



The Global Conservation Program

Achievements and Lessons Learned from 10 Years of Support for Threats-based Conservation at a Landscape and Seascape Scale

**Greater Yasuní-Napo Moist Forest Landscape Conservation Area
(Ecuador)**

WILDLIFE CONSERVATION SOCIETY

Greater Yasuní-Napo Moist Forest Landscape Conservation Area

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Key Achievements, Impacts and Lessons Learned Attained with GCP Funding

Since the inception of GCP-I funding, one of the main objectives of the WCS Biodiversity Conservation at a Landscape Scale (BCLS) program has been the development and piloting of the Landscape Species Approach in the Yasuní-Napo Conservation Area. Following preliminary community socio-economic, natural resource use, and wildlife distribution surveys, scientific review of over 20 candidate species resulted in an initial selection of the five Landscape Species (tapir, white-lipped peccary, giant river otter, woolly monkeys and black caiman). After gathering basic information on these species (e.g., local distribution and natural history), and following the framework of the Landscape Species Approach, maps were constructed which model the geographical distribution of each species, based on information on the climatic patterns, vegetation type, and altitude of each geographical record of the selected Landscape Species within the Yasuní National Park (YNP) and its buffer zone. These maps were then combined with human land-use (threats) maps developed during a participatory threats

ranking and mapping workshop. Combined, this information helped guide where conservation efforts needed to be targeted within the landscape.

Greater Yasuní-Napo Moist Forest Landscape Conservation Area, Project Highlights

- **Community Surveys and Mapping.** Through a cooperative relationship with EcoCiencia, a national NGO, community mapping exercises were conducted and communities surveyed on their wildlife use and knowledge. This work eventually led to the formalization of an agreement with EcoCiencia to facilitate community mapping at 14 Amerindian and colonist villages to determine the spatial distribution of the main hunting, fishing, and gardening sites, as well as the approximate sizes of the areas used by villagers. Under the same agreement, EcoCiencia facilitated wildlife use and knowledge surveys at 14 villages to determine the general distribution of 10 birds and mammals (the Landscape Species candidates), as well as information about these species' ecology and behavior. EcoCiencia researchers, with

assistance (e.g., technical guidance and financial support) from WCS BCLS Program staff, conducted these studies, as well as a third study to assess subsistence hunting patterns. The results of these studies provided the foundation of knowledge necessary to develop a resource management alternatives plan for the Waorani Ethnic Territory, under the CARE/SUBIR-III Project.

- **Landscape Species Selection.** The Yasuní Landscape Species Selection process was completed between April and September 2001. The initial suite included 5 species: lowland tapir (*Tapirus terrestris*), giant river otter (*Pteronura brasiliensis*), black caiman (*Melanosuchus niger*), scarlet macaw (*Ara macao*) and white-lipped peccary (*Tayassu pecari*). During the second selection process, the scarlet macaw was replaced with the woolly monkey (*Lagothrix lagothricha*) because of logistical and monitoring constraints. In addition, two “species of special interest” were chosen: jaguar (*Panthera onca*) and paiche (*Arapaima gigas*).
- **Biological Monitoring.** Systematic terrestrial and aquatic surveys were started to establish wildlife baselines and trends over time within the Yasuní National Park. Three aquatic surveys were conducted between October 2000 and March 2001, with a total sampling area of 319 km of river for aquatic mammals and 295 km for reptiles. Surveys located and identified 259 river turtles (*Podocnemis unifilis*), 238 caimans (65 *Melanosuchus niger*, 124 *Caiman crocodilus*, 44 *Paleosuchus palpebrosus*, 5 *P. trigonatus*), 48 river dolphins (*Inia geoffrensis*), 32 giant river otters (*Pteronura brasiliensis*), 2 Neotropical river otters (*Lontra longicaudis*), 4 gray river dolphins (*Sotalia fluvialis*), and 1 manatee (*Trichechus inunguis*). Yasuní BCLS Program staff designed and tested biological assessment protocols to determine the distribution and relative abundance of Landscape Species, and initiated these protocols at eight sites in or adjacent to the Yasuní National Park and the Waorani Ethnic Reserve. In FY03, threats were monitored at 10 sites (and at 12 sites in FY04) to compile baseline data on the distribution and relative abundance of the five Landscape Species and the two “species of special interest”. Additional ecological research was conducted on three Landscape Species: giant

river otter (*Pteronura brasiliensis*), black caiman (*Melanosuchus niger*) and scarlet macaw (*Ara macao*). Information on the historic commercial giant otter trade was also compiled. These studies provided the first complete description of the nesting behavior of the black caiman in western Amazonia, detailed characterizations of the diet and feeding behavior of the giant river otter and estimations of its seasonal movements and potential rainy season home-range size.

- **Yasuní Workshops.** A highly successful, well-attended workshop was conducted between January 16 and 19, 2001. This was the first time a diverse set of local and national stakeholders were provided the opportunity to come together, on-site, to voice their respective interests in the sustainable management of the Yasuní Biosphere Reserve, and to assess, collaboratively, the primary threats to sustainable resource use and conservation across the landscape. The workshop proceedings were published and distributed to BCLS (WCS GCP-I) Program sites in Bolivia and Congo, as well as to libraries and research centers in the US, England, and Mexico. The Yasuní Biosphere Reserve Management Committee, formed at this Workshop, includes 15 conservation and development NGOs and is coordinated by the Ministry of the Environment. The WCS Ecuador Program provided technical and administrative support to this Committee, and developed the Committee’s bylaws. In coordination with the Ministry of the Environment, UNESCO and FEPP (Fondo Ecuatoriano Populorum Progressio), the WCS Yasuní-BCLS program conducted the second Yasuní Biosphere Reserve Workshop October 23-26, 2001 and the third workshop on May 30, 2002. There were 126 participants in the second workshop, representing approximately 25 different institutions and organizations. An interim working group was established during this workshop to develop a proposal for the consolidation of the Yasuní Biosphere Reserve Management Committee. There were 45 participants in the third workshop, representing approximately 15 different institutions and organizations. An interim Directorate and a Technical Advisory Group (Grupo Asesor Técnico) were established at this third meeting.

- **Partnership with FEPP.** A working agreement was finalized with Fondo Ecuatoriano Populorum Progreso (FEPP), to work with the Ministry of Environment to strengthen the management capacity of Yasuní National Park officials and to monitor human activities along Vía Auca and Vía Maxus and the Yasuní and Tiputini Rivers. A complete analysis and synthesis of the current social and economic context of Yasuní was conducted in conjunction with FEPP, and WCS staff completed a draft report on the institutional context of the Yasuní landscape with collaboration from FEPP/DARE.
- **Review of Legal Environmental Framework.** WCS BCLS staff worked with EcoLex (an Ecuadorian environmental legislation NGO), Monica Rivadeneira (an environmental lawyer), and Luis Suárez from EcoCiencia to review the environmental legal framework in Ecuador and assess the need for a practical manual of environmental laws for use by Yasuní stakeholders and for park staff training. Working with EcoLex, WCS Yasuní staff completed draft reports on land use and tenure conflicts in the Yasuní landscape.
- **Maps.** A map of vegetation and land uses that highlights spatially-explicit conservation threats was completed and subsequently updated as new information became available. Additionally, community resource use at 10 Kichwa communities along the Vía Auca and the Napo and Tiputini Rivers was monitored and mapped.
- **Management Effectiveness Study.** A study on the effectiveness of Management Committees for Protected Areas in Latin America was initiated, to provide recommendations for the establishment of the Yasuní Biosphere Reserve Management Committee. The Committee was to serve as a participatory forum where all the local stakeholders with interest and/or mandate in the Yasuní Landscape have opportunities to receive information, share their visions and express their concerns about the conservation and development of the Yasuní region. Multiple successful efforts to promote this forum were undertaken and a number of workshops were facilitated to ensure continuous communications among the variety of local institutions, indigenous groups, campesinos, and local government representatives. These efforts led the Committee towards a more clear definition of an integrated vision of the overall Yasuní landscape. In 2008, the Yasuní Management Committee was officially recognized by the Ministry of Environment (Acuerdo Ministerial N° 168, 13 November 2008) and, as a result, it gained the institutional power to support the conservation initiatives within the Yasuní Biosphere Reserve.
- **Financial Strategy.** With the technical assistance of Carlos Quintela and Fernando Loayza (WCS Conservation Finance), Yasuní BCLS Program staff worked with the Ministry of Environment and the Environmental Fund (Fondo Ambiental) of Ecuador to develop a financial strategy to prevent, control and mitigate indirect impacts caused by the oil industry on protected areas and forests in the Amazon region of Ecuador, based on a strategic environmental assessment of such impacts. During FY03, BCLS Program staff raised \$170K to conduct a Strategic Environmental Assessment, to serve as the basis for the Long-term Conservation Finance Strategy. Beginning in 2003, WCS has worked with Ecuadorian government agencies to develop and implement appropriate policies based on the Strategic Environmental Assessment to avoid or mitigate socio-economic and ecological impacts of the planned expansion of the oil industry in the Amazon Region of Ecuador.
- **Integration of Activities Planning with Local Partners.** Between October 2001 and March 2002, BCLS had two productive planning meetings with park officials, FEPP and Fondo Ambiental. During these meetings, all of the activities that each organization (Ministry of the Environment, FEPP, and WCS) was conducting in the park and biosphere reserve were identified, in matrix format, as were the gaps and redundancies in the three annual workplans. The purpose of this initiative was the eventual revision of the management plan, a training program for park staff, and a biosphere reserve implementation strategy to be undertaken with the management committee. Indeed, as a result of these meetings, WCS BCLS Program staff, in coordination with park officials, FEPP, San Francisco University of Quito and Fondo Ambiental Nacional, reviewed and modified the YNP Management Plan to produce a shorter, more efficient and more effective plan. In FY04, a program was developed, based on the Yasuní National Park management plan, to

strengthen the managerial and technical capacity of YNP staff and to ensure the long-term conservation of the protected area. WCS Yasuní project staff also provided technical support to the Ministry of the Environment to effect a resolution of the conflict over the new Kichwa Indian settlements and commercial activities within Yasuní National Park. In addition, BCLS Program staff sponsored a 2-week “Black Caiman Field Research Methods” training course for park officials, university students, and Añangu community members.

- **Building Relationships with Government and NGO Partners.** WCS BCLS worked to establish closer relationships with key local Ecuadorian government and non-government organizations, with the purpose of promoting conservation and natural resource research in the Yasuní area. Specifically, Yasuní stakeholders (such as Alcaldía de Orellana, Honorable Consejo Provincial de Orellana, Vicariato de Aguarico, FICCKAE¹ [Inter-provincial Federation of Kichwa Communes and Communities of the Ecuadorian Amazon], FOCAO [Mestizo Farmer Federation, Napo River Region], CONFENIAE [Federation of Amazonian Indigenous Federations], OPIP [Organization of Indigenous People of Pastanza], and NAWÉ² [Waorani Nation of Ecuador]) have been engaged. WCS staff in the Yasuní-Napo Conservation Area have also continually worked to grow and improve their institutional relationships with the Tiputini Biodiversity Station and Yasuní Scientific Station. Relationships with both stations facilitate and foster important biological monitoring and research (i.e. on Landscape Species), heighten BCLS’s presence in the field, and are important links in the training of young Ecuadorian students. Furthermore, community coordination meetings were conducted to strengthen inter-institutional relationships with several Ecuadorian organizations; and, in FY 2003, the WCS Yasuní BCLS Program became a member of the National Network of Biosphere Reserves. As GCP-I funding wrapped up, the Yasuní BCLS program continued to strengthen inter-institutional relationships with several Ecuadorian

organizations, including the continuation of work begun with other members of the National Network of Biosphere Reserves.

- **Supporting Education.** Between April 2001 and September 2002, two Pontificia Universidad Católica del Ecuador (Catholic University of Ecuador) thesis students (Paola Guerra and Geovanna Lasso) completed fieldwork on two ecological studies on habitat use and diet of the giant river otter in Jatuncocha and Tambococha (eastern portion of Yasuní National Park). Lasso presented the results of her study at an international marine mammal congress in Chile. Additionally, two young investigators working under the BCLS Program were awarded Fulbright scholarships during 2003 due, in part, to their studies on Landscape Species in Yasuní; Paola Carrera and José Fabara then submitted proposals to conduct their Master’s research in the Yasuní landscape.
- **The Yasuní Meta-Database.** During FY03 and FY04, a bibliography of approximately 400 documents, that will serve as the basis for the Yasuní Meta-database, was compiled and distributed (100 documents compiled in FY03, and 300 in FY04).
- **Programmatic Expansion.** Between April and September 2002, the Yasuní BCLS Program worked to establish a WCS office in the town of El Coca, and hired Oscar Delgado as the local representative and coordinator.
- **Engaging Oil Corporations in Conservation.** In coordination with Petroecuador’s Office of Environmental Protection, (Gerencia de Protección Ambiental), the Ministry of the Environment, Flacso (Facultad Latinoamericana de Ciencias Sociales Sede Ecuador), and Environment and Society Foundation (Fundación Ambiente y Sociedad), the WCS Yasuní BCLS Program coordinated an international Petroecuador-financed workshop on environment and oil in the context of the new environmental and social legislation, a significant first step in promoting the engagement of oil companies in conservation. Later, Petrobras Energia Ecuador agreed to donate US \$3,500,000 to Yasuní National Park, out of which \$1,800,000 was supposed to be designated to establish a trust fund. However, because of political disagreements between Petrobras and the Government, this money has never been donated.

¹ Changed name from FCUNAE [Kichwa Indigenous Federation, Napo River Region].

² Changed name from ONHAE [Organization of the Waorani Nation of the Ecuadorian Amazon].

- **Natural Resource Management Plans.** During FY03, Yasuní BCLS staff developed a Natural Resource Management Plan for the Waorani Ethnic Reserve, in close collaboration with ONHAE officials. During FY04, staff worked with the CAIMAN Project and USAID-Ecuador officials to promote the implementation of the Management Plan. WCS also provided technical support to the Ministry of the Environment and six Kichwa communities living within Yasuní National Park to help them in the development of their natural resource management plans.
- **Establishment of a New Protected Area.** WCS Ecuador helped establish and have officially delimited the Taromenane-Tagaeri Intangible Zone, working with the Ministry of the Environment, ONHAE and CAIMAN Project. The Intangible Zone is an important area for two Waorani groups (the Tagaeri and Taromenane) that do not want to be contacted by outsiders. Today, both logging and oil extraction are forbidden within the zone. The Presidential Decree to protect this area was officially signed in January 2007³.

GCP Program Background

The goal of the Wildlife Conservation Society's Biodiversity Conservation at the Landscape Scale (BCLS) Program is to ensure conservation of biological diversity in regions of global importance, using a landscape- (or seascape-) and species-based approach. For the past 10 years, the WCS Living Landscapes Program (LLP) has been developing and testing wildlife-focused strategies to resolve the conflicts between people and wildlife that threaten biodiversity found in these important wild places. The LLP-developed Landscape/Seascape Species Approach (LSA) is threats-based and highly participatory; it promotes conservation of landscapes (and seascapes) by focusing efforts on key animal species found within that landscape/seascape. The conservation of these Landscape Species offers a focused and cost-effective way to retain a full complement of biodiversity and overall ecological integrity.

While WCS recognizes the integral role that protected areas play within national biodiversity conservation plans, we also realize that parks and reserves are seldom sacrosanct and are always embedded in larger, human-dominated landscapes. Regardless of how large or small a protected area may be, the plants and animals it contains are often threatened by human resource use, whether directly or indirectly. Therefore, the management of parks and reserves cannot occur in isolation from the surrounding landscape; rather, management plans must take into account where and how human activities conflict with biodiversity conservation as well as where conservation activities might adversely impact human welfare. As human populations continue to expand, the incentive for over-exploiting natural resources within and outside protected areas will increase and, therefore, the need for biodiversity conservation tools that address human-wildlife conflict will become even more important. In our efforts to conserve Landscape Species that frequently move beyond protected area boundaries, we recognize that parks and reserves must be integrated into the broader landscape, a landscape in which, realistically, people will continue to exploit natural areas and wild species to meet their socio-economic needs.

The Wildlife Conservation Society's BCLS Program was designed to ensure biodiversity conservation in a selection of globally significant sites, by identifying actions to conserve Landscape Species and by increasing the capacity of local and national organizations to implement such actions. Over the course of Cooperative Agreement LAG-A-00-99-00047-00, the WCS GCP/II/USAID portfolio has included 7 sites:

- **Glover's Reef Living Seascape** (Belize)
- **Greater Madidi Landscape Conservation Area** (Bolivia)
- **Ndoki-Likouala Landscape Conservation Area** (Republic of Congo)
- **Greater Yasuní-Napo Moist Forest Landscape Conservation Area** (Ecuador)
- **Maya Biosphere Reserve Living Landscape** (Guatemala)
- **The Eastern Steppe Living Landscape** (Mongolia)
- **Southern Sudan Transboundary Living Landscape** (Southern Sudan)

³ ENS-Newswire.com. 2007. Ecuador Bars Oil Extraction, Logging from Indigenous Zone. From: <http://www.ens-newswire.com/ens/jan2007/2007-01-12-04.asp> (viewed on 10/27/2009).

Location, Global Importance and Key Threats to this Landscape

The Yasuní landscape (i.e. Yasuní National Park and the surrounding Waorani Ethnic Reserve) covers approximately 2,800,000 ha (ca. 1770 square miles) of land in the northern Ecuadorian Province of Napo, and includes the lower Napo and Yasuní rivers. Because of their exceptional cultural and biological value, the YNP and Waorani Ethnic Reserve were designated by UNESCO as a Biosphere Reserve in 1989 and have received substantial national and international attention. Yasuní Biosphere Reserve (YBR) protects the core of one of the richest biodiversity hotspots on the planet and one of the last tracts of pristine, continuous tropical forests in eastern Ecuador. This tropical moist forest system contains some 4,000 species of plants and at least 70 species of mammals, among them 13 species of primates including woolly monkeys (*Lagothrix poeppigii*), red howlers (*Alouatta seniculus*), spider monkey (*Ateles belzebuth*) and monk saki (*Pithecia monachus*). Other non-primate mammals are lowland tapirs (*Tapirus terrestris*), white-lipped peccary (*Tayassu pecari*), jaguar (*Panthera onca*), the two Amazon freshwater dolphin species (*Inia geoffrensis* and *Sotalia fluviatilis*) and giant river otter (*Ptenoura brasiliensis*). There are well over 500 species of birds and more than 400 fish species. Plant diversity is astounding; research carried out by scientists indicates that a single hectare of upland forest harbors between 190 and 300 tree species. Moreover, YBR is home to some of the last remaining uncontacted indigenous peoples in the Amazon (the Tagaeri and Taromenane clans of the Waorani).

In this region, it is imperative that conservation interventions are sensitive to the needs of both wildlife and humans, as the park and its buffer zone encompass one of the world's richest areas for biodiversity and are the traditional home of indigenous communities whose long-term survival is threatened by unplanned development, unregulated oil industry, acculturation, and the unsustainable use of wildlife. With little national ability to effect rule-of-law, the landscape is fraught with tension and frequent conflicts as a complex network of stakeholders and powerful economic forces jockey for access to the area's renewable and petroleum resources. In this context, careful planning of land and resource use

within the landscape is critical if the extraordinary biota of this region is to be preserved, and the legitimate rights of local people secured.

The threats faced by the Yasuní landscape are numerous, and include: invasion by indigenous and non-indigenous colonists; illegal timber harvesting; illegal hunting and fishing; unsustainable subsistence hunting close to settlements and adjacent to roads; road construction; and oil exploration and extraction. To respond more effectively to these threats and set priorities for our interventions within the park, we developed a simple grid-based GIS model⁴ for assessing the location, extent and intensity of these threats within the Yasuní Biosphere Reserve. The resulting Yasuní Biosphere Reserve human activities/threats map (Figure 1) indicates that a large proportion (79.84% of the total area) of the landscape remains largely outside the influence and impact of human activities (i.e. 0 – 1 threats) and that this represents an important core-forest area for wildlife conservation. Much of the forest outside of this area is relatively highly disturbed (threat levels 3 – 6, 9.68% of the total area) with wildlife populations largely depleted (Figure 2).

By far the greatest threat to the area, however, is forest clearing by immigrant farmers moving along roads constructed by oil companies to facilitate petroleum exploration and extraction. As Figure 3 shows clearly, the direct impact of road construction on forest loss is small relative to the indirect impact associated with anarchic colonization and forest clearing to plant crops and graze cattle. A second indirect impact of road construction deep into the Yasuní landscape is facilitation of the illegal trade in wildlife as food.

⁴ The study area was divided into a ~1574 x 2260 cell grid with a 0.1 km² pixel resolution. A grid-based Geographic Information System (GIS) was used to develop a threats index and map, which included data layers about the distribution of roads, human settlements, large-scale deforestation, illegal hunting camps, oil wells, and areas where selective logging occurs. Distance buffers were calculated for each layer based on their expected impact on the surrounding forest. Once the buffers were created, each layer was reclassified in a 0 – 1 binary layer, where pixels with a value of “1” represented areas affected by a given threat, and pixels with a value of “0” represented areas free of that human activity. The final step was to overlay all the spatial layers and add their value. A threat index ranging from 0 to 6 was obtained, where a value of zero represents areas “free” from human activities, and values of six characterize areas where all of the human impacts that were included in the analysis were present.

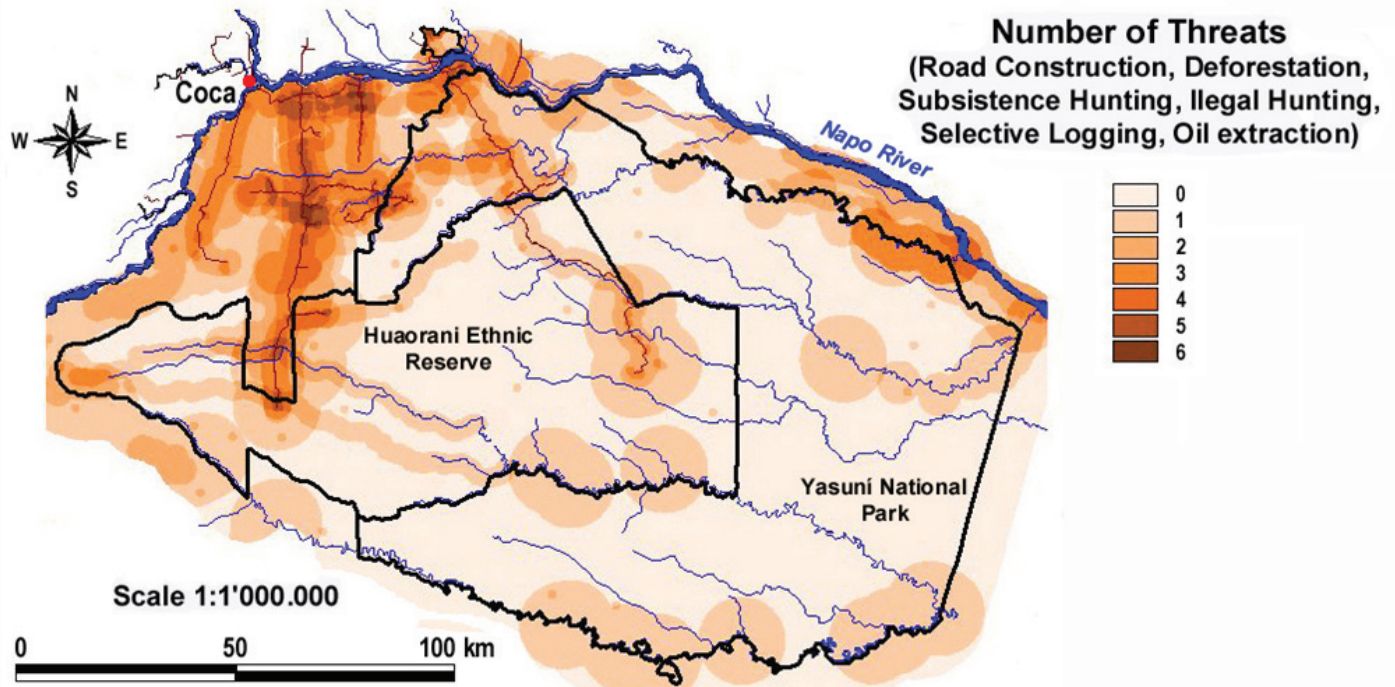


Figure 1. Threats map of the Yasuni National Park and its buffer zone. Pixels with values of 0 represent areas with low anthropogenic disturbance levels. Pixels with high values represent highly threatened areas.

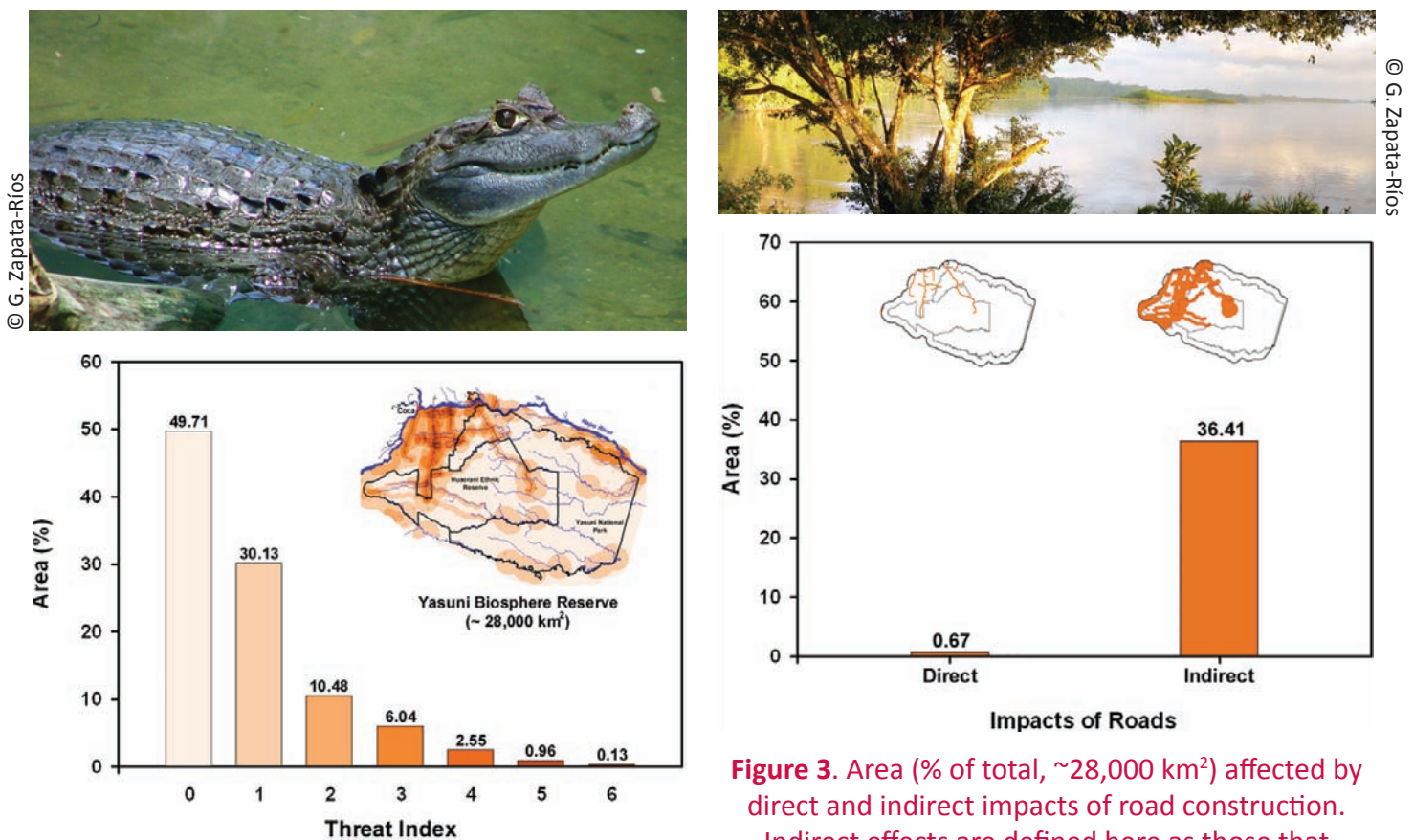


Figure 2. Area (% of total, ~28,000 km²) affected by human activities (road construction, large-scale deforestation, human settlements, selective logging, oil extraction). Highly threatened areas are located mainly in the northwestern section of the study area.

Figure 3. Area (% of total, ~28,000 km²) affected by direct and indirect impacts of road construction. Indirect effects are defined here as those that occur removed in distance or time from the actual construction of the road. Direct effects were mapped as a 100-m strip along the existing roads, only to include the removal of natural vegetation and topsoil for the actual construction of the road.

The Wildlife Conservation Society's Historic and Current Roles in this Landscape

In 2000, WCS embarked on a long-term commitment to the conservation of the Yasuní National Park and Waorani Ethnic Reserve. WCS's role in Yasuní was, and continues to be: 1) a trusted convener that can bring stakeholders with often divergent interests to the table; 2) a respected broker of credible environmental and socio-economic information; and 3) a provider of technical assistance in strategic planning, monitoring and adaptive management.

With USAID GCP support, WCS staff in Yasuní were able to demonstrate clearly the changes in land and resource use that followed the construction of two oil industry roads in the YNP and its buffer zone. This work showed that, when use of roads within oil concessions is not controlled by the oil companies, colonization occurs rapidly and intact forest is quickly converted to farms and pasture – as happened along the Vía Auca. On the other hand, when immigration into oil concessions is prohibited but transportation of natural resources by concession residents is not, deforestation associated with colonization does not occur, but unsustainable hunting of wildlife to sell meat rapidly depletes favored species within walking distance from settlements and the road – as happened along the Vía Maxus. The information gathered during this project is being used to develop participatory wildlife management plans for the YNP's local communities, and is being shared with park authorities to support their management and control programs. Administratively and politically, WCS's efforts to promote the conservation of the park have been directed via support of a Management Committee, which brings together representatives of all stakeholder groups in the region to discuss and advise on matters related to the conservation of the park and the rational use of the region's natural resources.

Since the conclusion of GCP-I funding, WCS has maintained its long-term commitment to the landscape and its people. Baseline and trend information continues to be gathered on the current suite of Landscape Species (jaguar, woolly monkey, tapir, giant otter and white-lipped peccary), and on the impact of human activities. WCS recognizes the importance of its continued work with local partners such as indigenous organizations, NGOs, universities, and government institutions. WCS

researchers have continued to reach out to local indigenous communities to recruit them as allies in conservation efforts. Currently, the main efforts of WCS's work in Yasuní are focused on increasing indigenous groups' capacity to protect their own lands. These capacity-building activities take many forms: from strengthening indigenous group organizations (to encourage them to promote conservation while securing tenure over their lands, developing economic alternatives and managing their resources sustainably to improve their quality of life), to encouraging their participation in managing the protected area, to supporting their role in governmental planning and management activities. For example, WCS has been promoting a number of small, community-based conservation projects such as a management program for freshwater turtles (*Podocnemis unifili*), locally known as "charapas." These projects demonstrate that the sustainable management of species is possible when an adequate response to threats is applied in close collaboration with communities, helping wildlife to recuperate while at the same time providing benefits to local people. WCS has also contributed to the consolidation of the Waorani territory by supporting its physical delimitation and actively promoting the strengthening of the monitoring and vigilance system within the YNP, hiring and training additional Kichwa and Waorani park guards. These types of activities are critical because, in spite of their strong connection to their ecosystem, Ecuadorian indigenous groups have traditionally been marginalized from the decision-making process. Collaboration with local partners helps to shore up the on-site protection and management of Yasuní and to develop national policies that will support conservation efforts both within the park itself, and beyond its borders.

WCS's Approach to Threats-based Conservation at a Landscape Scale

In order to conserve biodiversity and all other ecosystem services within an area, conservation interventions must be carried out at a spatial scale that matters to the species that rely on that area. To do this, one must first be explicit about what to conserve, while understanding clearly the habitat needs of these species and the threats to them. The Wildlife Conservation Society has developed a wildlife-focused approach to defining the spatial extent and configuration of landscapes and seascapes sufficient to ensure that functional ecological relationships

amongst species remain intact over the long-term, and by doing so conserve full assemblages of native plants and animals within an area. This Landscapes Species Approach focuses conservation actions on a suite of marine or terrestrial wildlife species that together rely on all primary habitats and are adversely affected by all key threats to biodiversity in the area. These Landscape and Seascape Species make explicit what we are holding ourselves to conserve and, by protecting their habitats and abating threats to them, we can create a conservation canopy that confers protection to most other plant and animal species in the landscape or seascape.

The Landscape Species Approach centers around the careful selection of a suite of focal species, called Landscape Species, defined by their ability to represent all major habitats, management zones and threats at a site, their use of large, heterogeneous areas, and their structural and functional impacts on natural ecosystems. The spatially-explicit steps of the Landscape Species Approach, for addressing where and how much of the landscape or seascape to conserve and how to prioritize areas for action, include procedures for: 1) mapping the attainable distribution (the Biological Landscape) of Landscape Species; 2) mapping varied human activities (Human Landscapes) and how those activities affect species; and 3) intersecting these Biological and Human Landscapes to create the Conservation Landscape, which in turn informs choices about conservation action relative to established goals.

Threats Map (“Human Landscape”)

The grid-based, landscape-scale GIS model mentioned previously represented a first step toward the establishment of a set of habitat conservation priorities which focus on the relationship of human activities (and impacts attributable to these activities) and wildlife distribution. In addition, the model provides information on wildlife habitat quality and extent, providing a measure of potential habitat for wildlife species (areas with threat levels of 0-1) in an area where little is known about the spatial distribution of wildlife or their relative abundance and population densities. Because there is little to no human activity in such a large area of the Yasuní landscape, it is an important area for the conservation of wildlife populations in the

western Amazon, including Landscape Species such as jaguars, tapirs and white-lipped peccaries. The Ecuadorian government, however, is planning to allow construction of additional roads inside the protected area to facilitate oil production, roads which would fragment an important part of the northern section of the core conservation area and are therefore predicted to have a large and lasting impact on the conservation of Yasuní’s important, and today, largely intact biological resources. Conservation priorities are currently focused on conserving the large core area within Yasuní National Park and the Waorani Ethnic Reserve, and to a far lesser extent reducing the impact of threats to wildlife in habitats that were originally ranked as suboptimal and/or degraded (areas with threat levels of 4-6). The threats map has been shared with many stakeholders in YNP and has been extremely helpful in terms of helping other organizations to set priorities for their own interventions in the region. Additionally, since the threats map is such an important communication tool, WCS has placed a lot of effort on ensuring that it contains the most recent information. As a result, since the conclusion of GCP-I funding, the threats map is improved on a regular basis with new data gathered during the course of programmatic field work, which will continue to keep it as a powerful and robust monitoring and communication tool into the future.

Conceptual Model

The threats assessment described above was one of the main assets used for the construction of the Conceptual Model for YNP and its buffer zone (Figure 4). As previously noted, this analysis showed the pre-eminence and urgency of the multiple threats related to the construction and operation of (oil-extraction) roads within the YNP and its buffer zone. In light of this information, WCS’s monitoring program was substantially modified to assess three specific impacts of the roads on the ecosystems and wildlife of YNP: 1) the effects of roads on land use change in YNP; 2) changes in wildlife communities as a result of road construction and operation; and 3) the development of illegal wildlife markets facilitated by the Maxus Road in YNP. Direct threats (Table 1) and Conservation Interventions (Table 2) are further described in relation to the IUCN-CMP standard typology.

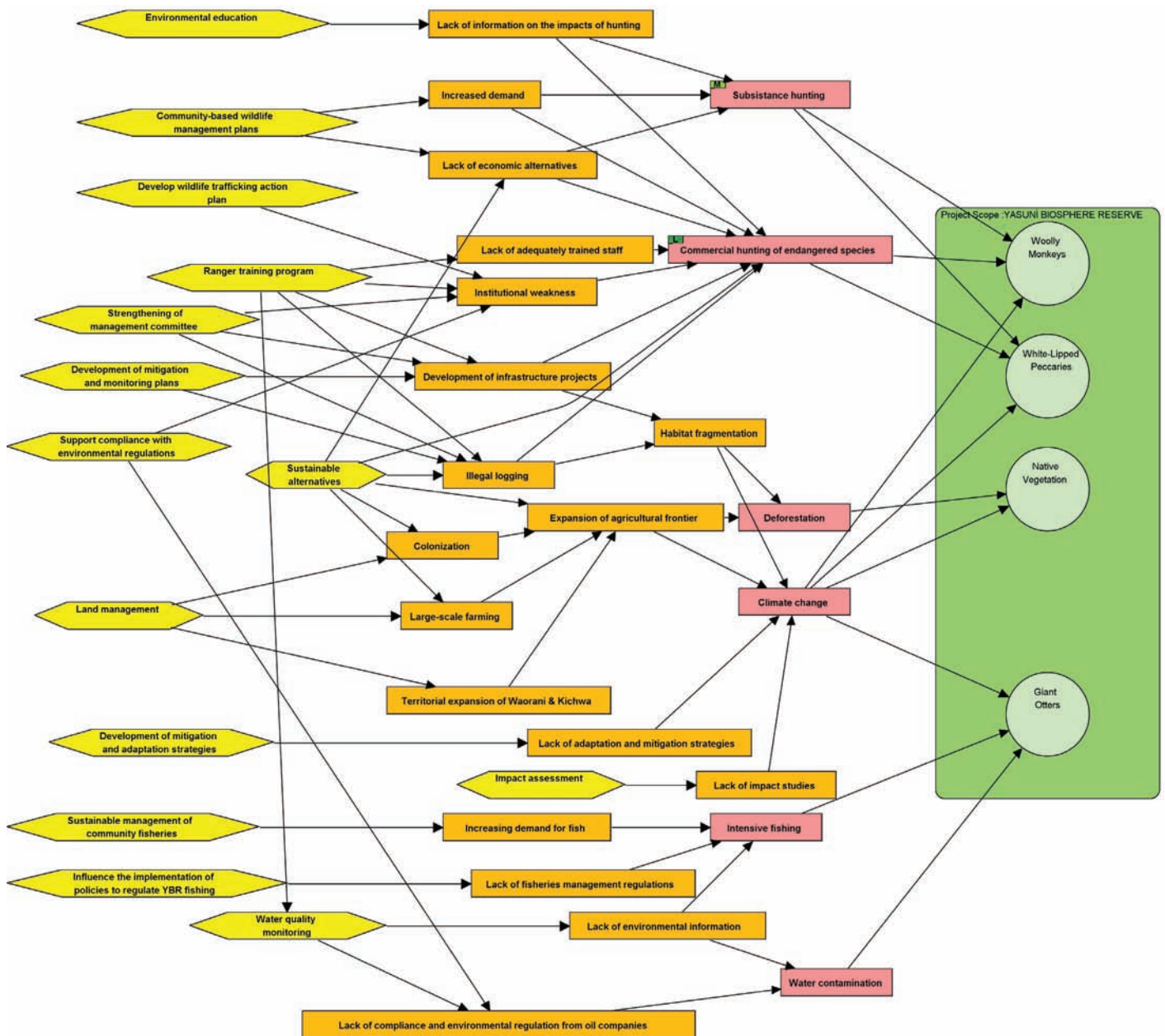


Figure 4. Conceptual Model for the Yasuní Biosphere Reserve, illustrating the links between strategies (in yellow), contributing factors (orange), direct threats (red) and conservation targets (in green).

Table 1. IUCN-CMP Unified Classification of Direct Threats (from the Conceptual Model shown in Figure 4).

IUCN Classification	Direct Threat(s)
1.1 Housing & Urban Areas	• Deforestation
2.1 Annual & Perennial Non-Timber Crops	• Deforestation
5.1 Hunting & Collecting Terrestrial Animals	• Commercial Hunting of Endangered Species • Subsistence Hunting
5.3 Logging & Wood Harvesting	• Deforestation
5.4 Fishing & Harvesting Aquatic Resources	• Intensive Fishing
9.2 Industrial & Military Effluents	• Water Contamination
11.1 Habitat Shifting & Alteration	• Climate Change

Table 2. IUCN-CMP Unified Classification of Conservation Actions (i.e. “strategies”) from Figure 4.

IUCN Classification	Interventions
2.1 <i>Site/Area Management</i>	Land Management
3.1 <i>Species Management</i>	- Sustainable Management of Community Fisheries - Community-based Wildlife Management Plans
3.2 <i>Species Recovery</i>	Development of Mitigation and Adaptation Strategies
4.2 <i>Training</i>	Ranger Training Program
4.3 <i>Awareness & Communications</i>	Environmental Education
5.2 <i>Policies & Regulations</i>	- Influence the Implementation of Policies to Regulate YBR Fishing - Develop Wildlife Trafficking Action Plan - Development of Mitigation and Adaptation Strategies
5.3 <i>Private Sector Standards & Codes</i>	- Development of Mitigation and Monitoring Plans - Water Quality Monitoring
5.4 <i>Compliance & Enforcement</i>	- Support Compliance with Environmental Regulations - Water Quality Monitoring
6.1 <i>Linked Enterprises & Livelihoods Alternatives</i>	Sustainable Alternatives
6.2 <i>Substitution</i>	Sustainable Alternatives
7.1 <i>Institutional & Civil Society Development</i>	Strengthening of Management Committee

Implementing Conservation at a Landscape Scale: Overcoming Challenges, Grasping Opportunities and Managing Adaptively

Studying Land-use Change along Roads

The conservation value of Yasuní has long been recognised even though the biodiversity value of the entire site remains only an estimate based on field surveys of just a small portion of the area. Comprehensive surveys of the area have been hindered by the size of the Yasuní landscape, the seasonal flooding of large areas and the restriction of access to boats moving along narrow rivers. Given this, it was logical to employ remote sensing⁵ to provide a baseline picture of the landscape. In Yasuní, remote sensing was applied to identify land-cover classes, detect changes in land-use/land-cover, and generate a high-resolution baseline image of an undisturbed area of the park where a new oil road was to be built. A supervised classification based on the data collected in the field was applied to the mosaic of Landsat TM5 satellite images to identify nine land-cover classes including natural vegetation,

⁵ Remote sensing provides a tool for monitoring an area with a large spatial extent, while providing detailed information about land-cover and land-use. Land-cover was studied over a 28,000 km² area, corresponding to the approximate limits of the Yasuní Biosphere Reserve. Data was obtained from a mosaic of four 2000 Landsat Thematic Mapper Images (TM5).

agriculture, water, and disturbed areas (see Figure 5). The results clearly indicate that disturbed areas are fairly concentrated in the northwest corner of the study region, near the foot of the Andes, from which much of the human population is migrating. The resulting map is the most detailed account ever made of the vegetation types in the Yasuní landscape. Still, however, the classification was based on the satellite imagery from the year 2000 and the Yasuní landscape has been undergoing continuous changes in its land-use/land-cover patterns ever since. As a result, as in the case of the threats map, WCS is currently updating the land-use/land-cover information for the region using more recent Aster and Landsat TM7 filled-gap imagery.

Since not all sites within a given region have the same risk of deforestation, a multi-temporal change detection analysis was carried out once the land-cover baseline map was developed. Because areas near roads are more likely to be deforested than areas further removed from human settlement, the analysis was focused on a 6,200 km² area divided into two polygons located in the northwestern section of Yasuní Biosphere Reserve. The two polygons included in the study covered the 30-year-old Auca Road and the 15-year-old Maxus Road, the two main roads in Yasuní (Figure 6). For the change detection analysis, five Landsat images, dating from 1986 to 2002, were used. Land-cover

CLASIFICACIÓN DE COBERTURA VEGETAL EN EL PARQUE NACIONAL YASUNÍ Y EL TERRITORIO HUAORANI

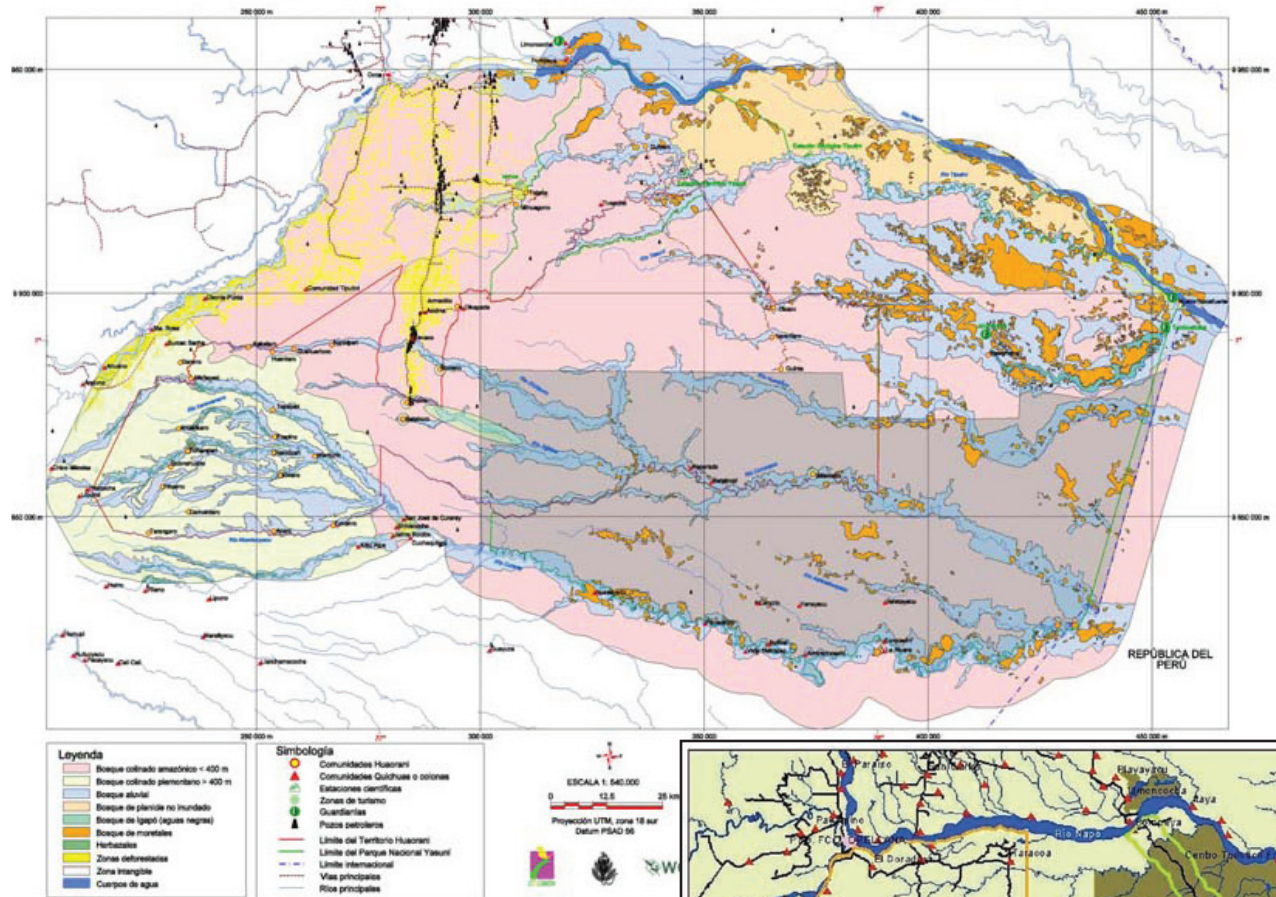


Figure 5. Land-cover map of the Yasuní Biosphere Reserve. The main categories include natural vegetation, disturbed areas, and water bodies.

change data show that between 1986 and 2002, there was a significant difference in the deforestation rates of the two polygons: the deforested area in the Auca Road polygon reached 4,828 km² (23%; see Figure 7); in the Maxus polygon, on the other hand, the extent of the deforested area only reached 12.63 km² (4%; see Figure 8). The much older Auca Road has suffered extensive impact from colonization during the last three decades, whereas oil companies, controlling access to the Maxus Road area, have managed to keep non-indigenous colonists out of that oil concession. However, Waorani settlers in the area are increasing their market integration (see following sections), and it would be expected that, as their farms increase in size, more rapid changes in deforestation and wildlife extraction rates will be observed in the short term. This analysis spanned 16 years of satellite data and provided a baseline for a deeper understanding of the socio-economic dynamics at work in the Yasuní landscape.

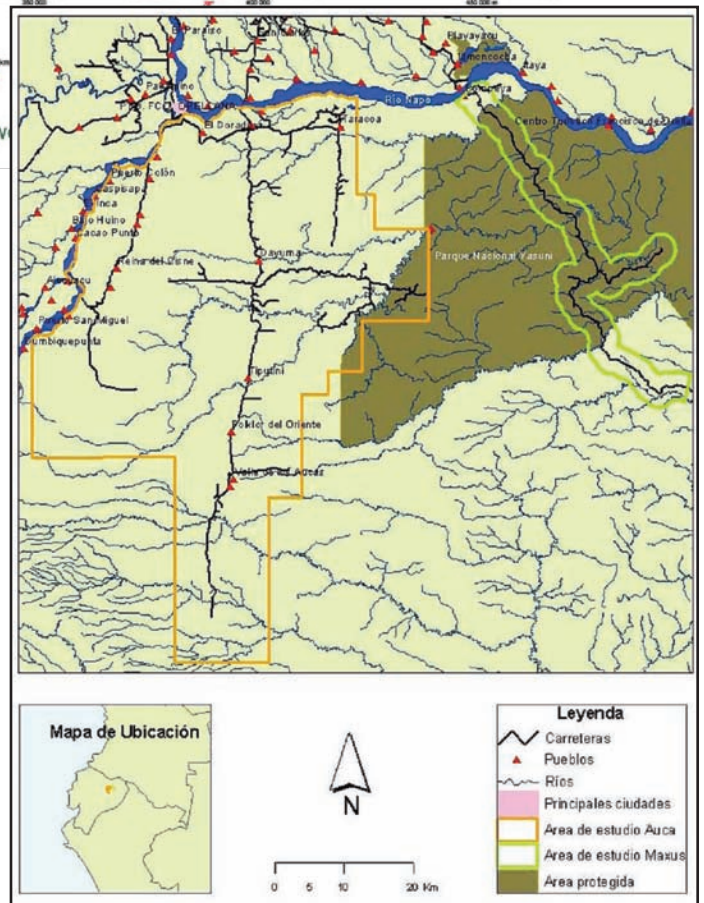


Figure 6. Location of the two polygons where the change detection analysis was carried out. The orange line corresponds to the 30 year-old Auca Road, and the green one to the 15 year-old Maxus Road. Both polygons cover an area of 6,200 km².

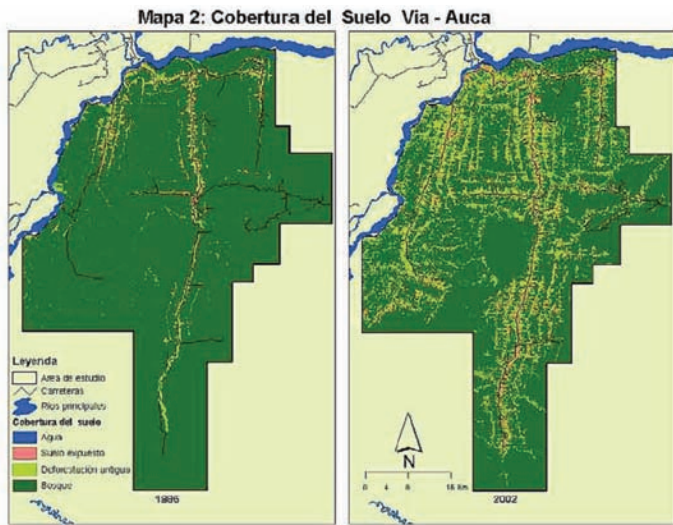


Figure 7. In the Auca Road study area, between 1986 and 2002, the percentage of forest converted to other uses reaches 23% of the total polygon area.

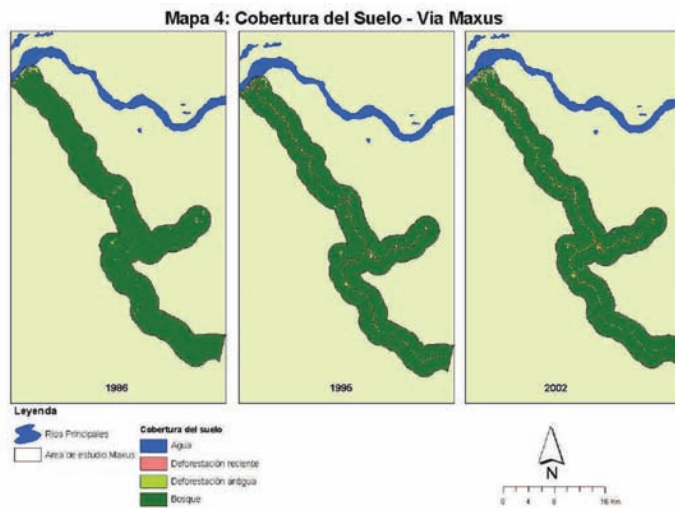


Figure 8. In the Maxus Road study area, between 1986 and 2002, the percentage of forest converted to other uses reaches 4% of the total polygon area.

An emergent threat to the Yasuní landscape in 2004 (at the end of the project's GCP-I funding) was the 40-km road that the Brazilian oil company Petrobras was beginning to build in its oil concession, located in the undisturbed core zone of the National Park. Up to that point, few to no remote sensing data existed for studying this type of event (an event that is very local in nature). The direct impacts of road construction and selective logging, for example, occur at scales of approximately 10-10,000 m². Since the cost of using high-resolution satellite images (e.g., IKONOS and Quickbird) to study the impact of the new road was prohibitive, it was decided that the most feasible alternative was the use of digital aerial videography. In collaboration with

Rodrigo Sierra (from the University of Texas at Austin), WCS staff flew a Cessna 206 that filmed the terrain directly below and tagged it with geographic coordinates (using a GPS device connected to a high-resolution video camera). An additional 8-megapixel digital camera shot photographs every four seconds. The resulting geo-referenced digital video was later used for tracing the locations of important features against the digital pictures. The final high-resolution mosaics cover a 14 km² area that encompasses the area of the road (Figure 9). This baseline information was intended to be used to help identify very subtle impacts that road construction may have on forest structure, dynamics, and demography of canopy trees into the future.

Wildlife Monitoring along Roads in YNP

As noted before, the analysis of a temporal series of satellite images showed that the extent of the deforestation that occurred historically along the 30-year-old Auca Road greatly exceeded that occurring along the Maxus Road, a difference that can be attributed to the intense control of external colonization implemented by the oil companies that have been operating on the Maxus Road (MAXUS and then REPSOL-YPF). Despite this encouraging finding, the Maxus Road has nonetheless introduced dramatic transformations in the socio-economic and cultural dynamics of the Waorani and Kichwa communities that live within its area of influence (i.e. aculturation and increased hunting pressure). In this context, WCS decided to evaluate if the integrity of the vegetation along the Maxus Road was also related to healthy wildlife communities, information that is critical in terms of informing decisions that the government will have to make regarding future oil exploitation and related activities in YNP (for example, the Yasuní-ITT initiative mentioned later).

To meet this objective, a wildlife monitoring system was established along the Maxus and Auca Roads, to be compared to a control site in an undisturbed area near the Tiputini River. These sites are being continuously surveyed on a bi-monthly basis to assess the species composition and density of their wildlife communities. Specifically, the goal was to gather reliable estimates of the density of medium- and large-sized mammals, and assess which species have responded positively or negatively to the operation of oil activities and to the changes that they have brought into the area.

The first year of this new monitoring program yielded important results. For example, the survey showed that the fragmented and isolated forests along the Auca Road harbor an impoverished wildlife community in which the number of species recorded is 2.6 times less than that recorded at the control site and 2.3 times less than that recorded at the Maxus Road (Table 3). Similarly, the encounter rates at the Auca Road (0.48 animals/km) were 2.6 and 1.6 times less than those at the control (0.99 animals/km) and Maxus Road (0.79 animals/km), respectively. The preliminary data analysis also suggests that, despite the relative integrity of the forest along the Maxus Road, the wildlife in this area is already adversely affected by hunting; the overall encounter rate at the Maxus Road is roughly 20% less

than at the control site. Four species commonly reported in other areas (*Ara ararauna*, *Agouti paca*, *Mitu salvini* and *Tayassu pecari*) were not recorded during the surveys in the area near the Maxus Road; these are all species intensively targeted by Kichwa and Waorani hunters. The same pattern was true for other hunted species like *Mazama americana*, *Penelope jacquacu* and *Pecari tajacu*, for which encounter rates at the control site were two times higher than at the Maxus Road. Together, these species represented 78% of the individuals and 85% of the biomass of bushmeat sold during the first eight months of 2005 in the bushmeat market that has started in the community of Pompeya, at the entrance of the Maxus Road. These results suggest that, in spite of fairly strict control of colonization

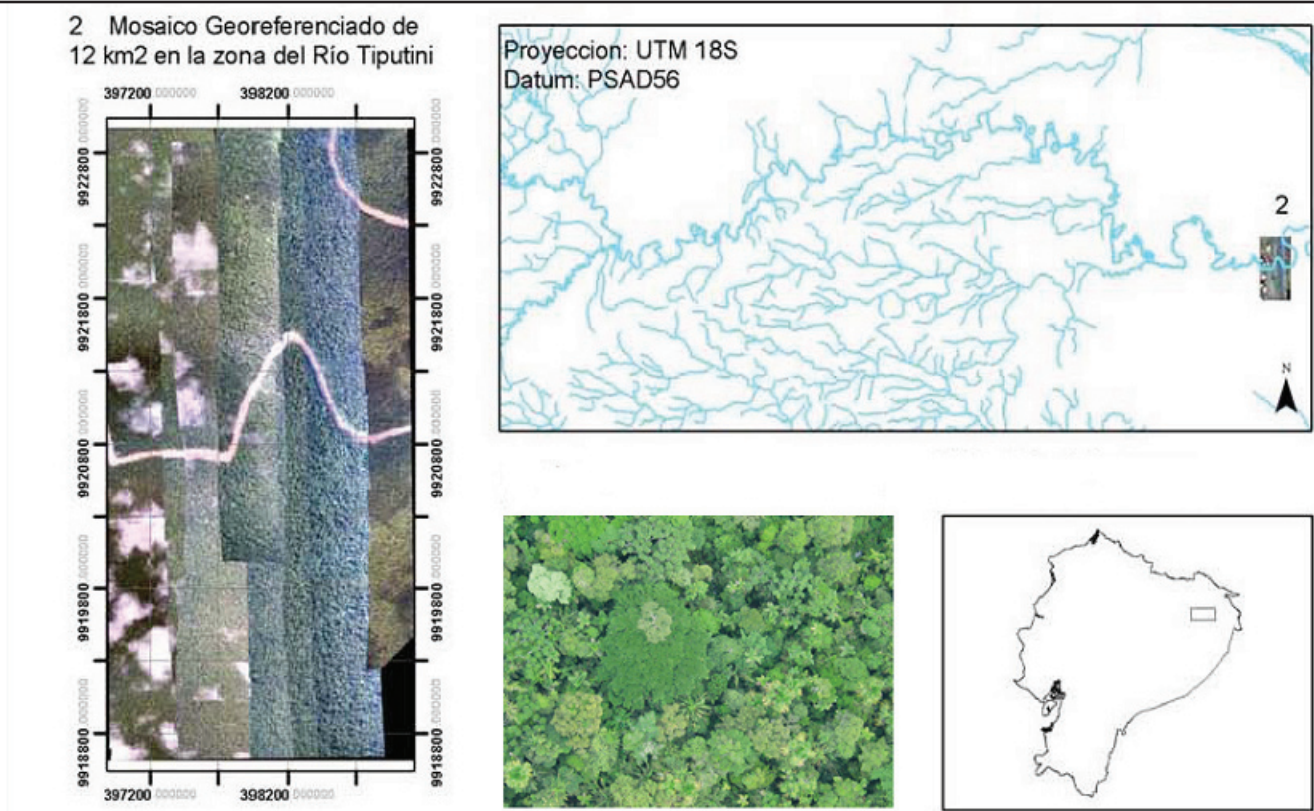


Figure 9. Georeferenced high-resolution mosaic encompassing 12 km² in the area where Petrobras is currently building a road. The inset photo (30 cm resolution) of the canopy shows one of the pictures that form the mosaic. The mosaic will be used as a baseline for studying the impact of the road.

Table 3. Species richness (number of species) and encounter rates (individuals/km) of medium- and large-sized wildlife recorded in Yasuní National Park during diurnal and nocturnal standardized surveys along the two roads and at a control undisturbed site.

	Diurnal		Nocturnal	
	Species Richness	Individuals/km	Species Richness	Individuals/km
Control	21	0.99	7	0.32
Maxus Road	19	0.79	7	0.58
Auca Road	8	0.48	7	0.58

and deforestation along the Maxus Road, wildlife is being negatively impacted by the road through hunting and the illegal wildlife trade.

The first phase of this study was completed in February 2006, and its results were shared during a series of local meetings organized by WCS and FLACSO. Even more importantly, they were used to inform the government about the potential impacts of oil exploration within the region. The results were, thus, discussed on several occasions during events organized by the Ministry of the Environment and were used as part of an inter-institutional campaign to stop the construction of a new road inside the park by the Brazilian petroleum company, Petrobras. Thanks to WCS's efforts, Petrobras road construction was stopped indefinitely in 2006.

The battle, however, continues; in 2007, the Ecuadorian government launched the Yasuní-ITT initiative, a proposal to keep Ecuador's largest oil reserve (~ 900 million barrels) underground if developed countries compensate Ecuador for the forgone revenue. WCS hopes to obtain additional funding to initiate new wildlife monitoring efforts in the area of ITT to better understand the potential impacts that this new oil exploitation initiative may have on local biodiversity.

Hunting Studies

A growing threat identified in the YNP landscape stems from the abrupt socioeconomic and cultural changes that have occurred as oil company roads have provided once isolated communities access to markets. With little else to sell, this nascent cash economy of the Waorani and Kichwa relies heavily on sales of bushmeat at the illegal bushmeat market which operates every Saturday in the community of Pompeya on the north bank of the Napo River, directly opposite the terminus of the Vía Maxus.

The Pompeya market sells wild meat and fish from the Waorani communities along the Maxus Road, and from Kichwa communities along the Napo River. In March 2005, Yasuní project staff started a study to assess the scale of sales at the Pompeya market and to track bushmeat along the market chain from hunter to consumer. WCS staff were present in 24 out of the 30 market days that occurred between March and September. In this period, 467 transactions of fish and wildlife (3,218 kg) were recorded, most of which occurred during the early morning hours. These transactions included 322 mammals (2,034 kg), 136 batches of fish (1,118 kg), 26 birds (44.8 kg) and four reptiles (21.34 kg).

There were strong differences in the species sold by hunters of different ethnic groups (Table 4). The biomass of wild meat and fish sold by Kichwa hunters was 1.6 times greater than the biomass sold by Waorani Indians, but the main difference between these two ethnic groups was the composition of the group of animals that they hunt and sell; while mammals represented nearly 97% of the biomass sold by the Waorani, Kichwa hunters sold a more diverse group of animals, with fish and mammals representing 50.1% and 48.2% of the biomass, respectively. Reptiles and birds represented a much smaller fraction of the biomass sold by either ethnic group. Recent colonists play only a minor role in the Pompeya bushmeat market at present (Table 4); while non-indigenous colonists do not play an important role as sellers in the market chain, the four dealers in the market are non-indigenous colonists.

All the fish and wild meat sold at Pompeya was bought by four dealers at prices that ranged from US\$0.92 to \$2.26/kg, with the exception of *Agouti paca* that was sold at an average price of US\$3.18/kg. Forty percent of the fish and wild meat recorded at the market was

Table 4. Biomass of wildlife and fish sold between March and September 2005 by each of the three ethnic groups (Kichwa, Waorani, and Colonist) at the Pompeya market in Yasuní National Park, Ecuador.

	Kichwa		Waorani		Colonist	
	biomass (kg)	%	biomass (kg)	%	biomass (kg)	%
Mammals	915.25	48.2	1097.91	96.9	21.11	11.2
Birds	12.93	0.7	31.95	2.8	0.00	0.0
Reptiles	18.62	1.0	2.72	0.2	0.00	0.0
Fish	951.50	50.1	0.00	0.0	166.55	88.8
Total	1898.30	100.0	1132.58	100.0	187.66	100.0

eventually sold at restaurants in Tena, a medium-sized city 146 km southwest of Pompeya. Other preferred destinations were Joya de los Sachas (31 km north of Pompeya) and the local restaurants at Pompeya itself, where dealers sold 20% and 11% of the wild meat, respectively.

The 2005 wild meat trade recorded at the Pompeya market was valued at US\$7,203.68; of this amount, 61% was paid to Kichwa hunters, and 32% was paid to Waorani. The final analysis was recently published⁶. In general, the study indicates that the transportation subsidy provided by the oil companies has had three important consequences: 1) it provided an access to a much larger hunting area along the road for the exploitation and killing of as many animals as possible; 2) it facilitated the transportation of the hunted animals; and 3) it considerably reduced the costs that the Waorani hunters would incur in order to bring the wild meat to the market. As a result, the transportation subsidy led to a significant intensification of the commercial hunting in the area by changing the pattern of hunting from subsistence to trade.

WCS staff incorporated the information gained from this study into work with three Kichwa communities along the Napo River (Nueva Providencia, Añangu and Sani Isla), to inform and facilitate the development of participatory wildlife management plans. The development of the management plan had three main goals: 1) effective zoning of community lands to reduce the hunting pressure over the northern portion of the YNP, which would also ensure a source area of wildlife for the Kichwa people's subsistence use; 2) effective and coordinated control of colonization from other parts of the country and illegal timber extraction along the Tiputini River; and 3) wildlife monitoring. On the basis of the studied spatial hunting patterns, WCS proposed the design of a communal reserve with prohibited hunting within an area of 5 km along the Tiputini River. After a number of participatory workshops where the community members had an opportunity to discuss the idea, the proposal was finally accepted during the general assembly of the Kichwa communities of Nueva Providencia, Añangu and Sani Isla. The 17,400 ha communal reserve was established within a 5-km-wide strip from

the northern Tiputini's riverbank, south of the three Kichwa communities. Recently, with the support of the community park guards, WCS finished the physical delimitation of the communal reserve, installing fourteen boundary signs at the northern Tiputini's riverbanks and at the boundaries between communities. These signs warn about the prohibition of the extraction of any natural resources in this area.

Finally, the hunting and market study work was extended to three main Waorani communities that are involved in the trade chain induced by the Pompeya market (Guiyero, Dikaro and Timpoka) where WCS has just finished a year-long study of hunting patterns. WCS intends to use these data to implement local management plans as it did with Kichwa. In addition, WCS is working with two Waorani communities (Guiyero and Timpoka) and four Kichwa communities (Nueva Providencia, Añangu, Sani Isla and San Roque) to raise an endangered species of river turtle, locally known as 'charapa,' that is subject to illegal trade (of both eggs and adults) in the Pompeya market. The goal is to allow the population to recover within the rivers of Napo and Tiputini, where local people have been intensively collecting the eggs over a long period of time.

Implementation of the Landscape Species Approach in YNP

The Landscape Species Approach was initiated in Yasuní with the completion of a Threats Map (or "Human Landscape" map), the selection of a suite of Landscape Species and the construction of a Conceptual Model, as described in the previous section. The Biological and Human Landscapes are two pillars of the Landscape Species Approach. By the end of 2004, BCLS Program staff members – including two young Ecuadorian biologists trained in monitoring techniques – had conducted 3 years of biological monitoring at 12 sites, primarily in the northern portion of the Yasuní landscape. Day and night surveys, conducted along terrestrial and aquatic transects, enabled the compilation of baseline information on the distribution and relative abundance of the five Landscape Species and two species of special interest, as well as approximately 50 other species of birds, mammals and reptiles. These studies showed that Landscape Species were generally less abundant in the northern portion of the landscape – as compared to the central or eastern areas – due to

⁶ See Suárez et al. (2009) Oil industry, wild meat trade and roads: indirect effects of oil extraction activities in a protected area in north-eastern Ecuador. *Animal Conservation* 12:364-373.

hunting and agriculture pressure. However, it is important to note that there were two main factors that precluded the complete implementation of the Landscape Species Approach in the Yasuní-Napo landscape by the conclusion of GCP-I funding.

The first factor that has worked against the completion of the Landscape Species Approach in this area was the lack of specific information about the habitat use patterns and needs of the suite of Landscape Species within the environmental matrix that is present at YNP. The Yasuní-Napo landscape is relatively homogeneous, containing only three major types of natural vegetation (terra-firme forest, flooded forest, and swamp) whose distribution depends mainly on topographical and hydrological patterns. But despite this apparent homogeneity, there are complex flooding dynamics that affect the quality and quantity of available habitat for both terrestrial and aquatic species over large areas of the Yasuní-Napo landscape. There is virtually no field information available (e.g., from landscapes similar to the Yasuní-Napo area) on how these types of hydrological dynamics may affect animal movements and habitat use/preferences, making it very difficult to build the sensitive distribution models necessary to guide the design of conservation strategies based on the needs of the Landscape Species⁷.

The second (and most important) factor that has precluded the completion of the full implementation of the Landscape Species Approach in the Yasuní-Napo area was the recognition of the overwhelming influence of threats related to the oil industry operating within YNP. The construction and operation of roads that facilitate the extraction of oil within YNP is affecting wildlife and ecosystems throughout the northern portion of the park, not only through direct impacts (e.g. deforestation, pollution, increased hunting pressure), but also through the stimulation of dramatic changes in the cultural and socio-economic matrix of the region. The urgency imposed by these threats forced WCS to revise its

priorities within the national park in order to respond adequately to the overriding and dramatic influence of oil industry impacts. As a consequence, WCS was forced to prioritize additional efforts aimed at understanding the effects of specific oil industry activities on local wildlife, at the expense of critical studies that would provide a better understanding of the habitat requirements and distribution of the suite of Landscape Species.

Sustainability

The information gathered in YNP and its buffer zone is critical in terms of understanding the complex effects of human activities on the wildlife and the forest of this area. Local monitoring activities continued after the conclusion of GCP-I funding; this monitoring continues to inform the design of interventions intended to curb some of the impacts that our studies identified. More specifically, during 2006, WCS worked to incorporate the information gathered during this project into participatory wildlife management plans for Kichwa and Waorani communities living in YNP (or its buffer zone), a process that had previously been started in six Kichwa communities along the Napo River (Indillama, Pompeya, Nueva Providencia, Añangu, Sani Isla and Nuevo Rocafuerte), where detailed evaluations were performed on their production systems, land-use schemes and wildlife perceptions. As of 2009, the communal reserve where hunting is completely illegal exists within three Kichwa communities of Nueva Providencia, Añangu, and Sani Isla. It is located within a 5-km-wide strip from the northern Tiputini's riverbank and covers 17,400 ha. WCS has also just finished a year-long study of hunting patterns within two Waorani communities to be used for designing the local wildlife plans. In the meantime, the river turtle conservation project was implemented with two Waorani and three Kichwa communities.

WCS continues to seek funds and to form strategic alliances with the aim of establishing a system to control illegal timber extraction from the western portion of the park. Observations in the area suggest that this is a growing problem, whose solution is further complicated by two main factors: 1) the insecure land tenure situation of the people living along the Auca Road and its branches; and 2) the presence of armed illegal timber dealers who bring Waorani people into the illegal exploitation of forest within the Park and do not

⁷ The importance of this dynamic was clearly exemplified by the project's estimations of seasonal home-range sizes of giant river otters. During the wet season, when the rivers flood adjacent forests along its banks, the home range of the giant otters was found to be as much as four to eleven times larger than during the dry season when the otters were restricted to the river channels. But, to what extent this affects the distribution and density of prey (fish), and the resulting movements of otter groups, is virtually unknown.

hesitate to fire upon park rangers if they try to control this activity. In 2006, WCS supported the Ministry of the Environment (MAE) in the development of a control system that involves trained community park rangers from critical communities in the area. A new initiative, funded by the Ecuadorian Environmental Fund (ECOFUND), to support conservation activities within the landscape allowed WCS to hire and train four Kichwa park guards to work jointly with the current four park guards from MAE. Due to the Ministry's economic difficulty in expanding the group of park guards within the Yasuní Landscape, this was a very important step forward. Having four new park guards incorporated into the Ministry increases the quality of control and monitoring efforts within the region and demonstrates the urgent necessity of strengthening the system in the future. At the same time, thanks to a USAID-funded project, during the period of 2007-2009 WCS has hired, through the Waorani Federation (NAWE), seven Waorani community park guards and three Waorani technicians. This is the first time that NAWE has consolidated its own technical team, now being incorporated into a control system and a variety of community-based projects. The technical team of Waorani has been already involved in: 1) the collection of data on current distribution of threats; 2) the first two community land-use zoning efforts that are helping to define the areas of conservation; and 3) the demarcation of the Waorani territory carried out by NAWE and completed in January 2009. Additionally, WCS continues to support the Management Committee of YNP with the creation of a sub-committee whose function will be to help local communities resolve their land tenure conflicts, thus improving the protection of the western portion of the YNP.

Depending on funding levels, WCS-Ecuador plans to initiate more detailed studies on both white-lipped peccaries and river otters, specifically directed at understanding the way in which the hydrologic dynamics of the area affect the habitat use of these two Landscape Species. For peccaries, the main objectives would be to understand how these animals use the large-scale mosaic of flooded and terra-firme forests that characterize YNP, and to relate flooding levels to their movement patterns. For otters, an evaluation of the real extent of flooded forest use during the wet season would be the desired outcome, with special attention paid to the availability of prey and the mobility of the otters when the local rivers inundate the riparian

habitat. These studies are critical steps in the design of proper management plans for these sensitive species, but are also hoped to increase the understanding of the other species that depend on the complex mosaic of forest in the Yasuní-Napo area. Meanwhile, one of the methods that WCS has been researching to tackle these questions is the application of remote sensing imagery and its derivatives – such as the Normalized Difference Vegetation Index (NDVI) and the Enhanced Vegetation Index (EVI) – in studying the interaction between the phenological dynamics of major forest/palm communities and the habitat distribution of species such as white-lipped peccaries. The preliminary models indicate that the species' habitat preferences are strongly influenced by the regional flooding dynamics and fruiting seasonality of the major palm species. These models have to be further tested in the field, but the application of remote sensing data to explore the relationships of peccary habitat use to palm fruiting and forest flooding in the Yasuní Landscape seems to have generated valuable results. The leverage provided by GCP-I funding helped WCS to obtain more funding to continue and strengthen conservation efforts such as these within the Yasuní Landscape.

The Gordon and Betty Moore Foundation (GBMF) provided WCS with support for FY04-FY09, funds that were used to continue the documentation of the impacts of road construction on wildlife and on the livelihoods of indigenous people living in the Yasuní Landscape as well as designing and implementing a community-based monitoring program for the control of illegal timber extraction and colonization in the Kichwa community lands overlapping the northern portion of YNP. In addition, these funds were used to continue to support local management initiatives, which included: 1) encouraging local authorities to exercise their jurisdictions to establish protection over critical areas around the park that are important for conservation and for helping protect the physical integrity of parts of Yasuní; and 2) continuing to strengthen Yasuní's management committee.

During the last half of FY06, the Yasuní BCLS team won support from the Overbrook Foundation to continue the strengthening of the YBR Management Committee. These funds were specifically used to support activities related to the promotion of the YBR Management Committee and to organize a technical forum for

the discussion of the impacts that the oil industry has on the environment and on the development of local communities in the YBR.

The evident results in improving resource management strategies and having a strong conservation impact allowed WCS to acquire additional funding from USAID for the period FY07-FY09 (with later extension to FY11) to implement “The Integrated Management of Indigenous Lands” initiative at the landscape scale. The main goal of this project is to contribute to the USAID mission strategy objectives of increasing areas under improved management for biodiversity and sustainable use and increasing the number of Ecuadorians benefiting from improved conservation. The main objectives are to: 1) support consolidation of indigenous territories; 2) build institutional capacity for conservation in indigenous territories; 3) increase economic benefits from conservation; 4) build greater financial sustainability into conservation and development initiatives within indigenous territories; and 5) assess impacts of infrastructure development and human displacement on indigenous territories. This USAID project has already expanded WCS’s conservation impact at the regional level. In particular, the project supports indigenous communities and organizations of the YBR in the development of sustainable land zoning frameworks and wildlife management plans and the consolidation and demarcation of indigenous lands. WCS has also positioned itself as the key organization contributing to the development of the institutional capacities needed to advance the sustainable use of natural resources in the region. By providing the necessary training to community and official park guards as well as supporting young professionals, WCS is addressing a number of challenges that the region faces as well as involving local people in the management of their territories. These initiatives have laid the basis for the effective protection of a significant portion of the YNP and the initiation of community-based conservation projects in the area. At the same time, additional communities are expressing interest in this initiative and new opportunities are arising to increase the area of the YNP under effective community-based protection.

Furthermore, WCS has received funding from the “oil revenues for conservation” managed by the Ecuadorian Environmental Fund. Thanks to ECOFUND funding

obtained in FY08, WCS was able to implement a project called “Strengthening the system of control and monitoring of the YNP and implementation of an Interpretative Center”. Thanks to this project, and with WCS logistical and technical support, one of the Kichwa communities, Nueva Providencia, completed the construction of the infrastructure needed for an Environmental Interpretative Center entitled “The world under the water”. This Center will provide the local community with a sustainable source of funding from education and tourism activities. The income generated from the visitors to the site will cover local staff salaries, with remaining resources going to a common community fund (to cover, for example, health, education and other community projects). In addition to the project’s goal of constructing the interpretative center, WCS was able to support the control and monitoring system within the Yasuní National Park by hiring and training four additional park guards to work jointly with the current four park guards from the Ministry of Environment. Having four new park guards incorporated into the Ministry of Environment increases the quality of control and monitoring efforts within the YNP.

As for the support of small community-based conservation projects, WCS received funding for one year from the Small Grants Program from UNDP (UNDP-PPD) in FY08, to implement a management program for river turtles (*Podocnemis unifilis*) in two Waorani communities along the Tiputini River and in three Kichwa communities along the Napo River. The goal of the project is to work with local indigenous groups in actively managing natural resources and to help recover a turtle population that has decreased considerably over the past decade mostly due to overexploitation of the eggs for subsistence consumption and commercial sale at local markets. Having the community involved in this local conservation project encourages them to improve conditions for harvested species and raises awareness about the need for conservation of natural resources. As of July 2009, there were two artificial beaches and four artificial pools, over 2000 collected eggs had hatched and hatchlings were transferred to the artificial ponds. In three Kichwa communities along the Napo River, there are three artificial beaches and three artificial pools, and approximately 820 eggs collected (100 *Podocnemis expansa*, the rest *P. unifilis*) had already hatched. This project demonstrates that, with an adequate approach and close collaboration with the

communities, it is possible to achieve the goals of sustainable management of species (helping their populations to recuperate and strengthening environmental education activities) while, at the same time, providing benefits to local people.

Thanks to WCS efforts and commitments begun under GCP-I, a strong foundation was built for the project's continuation within the landscape and WCS has been successfully raising money to continue, support and expand the activities initiated with USAID GCP support. In Ecuador, WCS fills a niche as a technical group that generates scientific information to guide conservation processes. It is one of the few organizations that promotes community-based conservation of natural resources in the Yasuní landscape. While several local organizations conduct research in Ecuador, WCS is capable of generating the information and then using it to promote beneficial changes in Eastern Ecuador, a strength that has been recognized and appreciated by local partners. WCS will continue to work in this capacity in the future.

Measures of Success

WCS's long-term commitment and coherent efforts within the Yasuní landscape are yielding concrete and visible results that would not have been possible without the support of the USAID GCP funding. Despite many social, economical, political and institutional complexities that challenged WCS's activities within the Yasuní landscape, overall, the experience of the BCLS program in Yasuní was very positive. WCS staff were able to achieve a wide variety of goals, as described in greater detail in the previous sections. The conservation successes achieved during the 5 years of funding included: the implementation of the Landscape Species Approach, including the selection of a suite of Landscape Species, the construction of a Threats Map and the production of a Conceptual Model; the completion of Community Surveys and Biological Monitoring research within the landscape; the facilitation of three very successful "Yasuní Workshops"; the drafting of a financial strategy to address the threats caused by oil exploitation in the region; the formation and strengthening of meaningful relationships with a variety of stakeholders in the region (e.g., FEPP, Ministry of the Environment, various indigenous peoples' organizations); provision of support to

Master's students' fieldwork; completion of a review of the Ecuadorian environmental legal framework; the engagement of oil corporations in conservation work; the creation of the "Yasuní Meta-Database"; and the completion of several natural resource management plans. These achievements positioned WCS to face the threat of future development projects in a coherent and coordinated manner. More importantly, these achievements created a strong foundation for searching and receiving more funding from various sources to continue WCS's efforts in conserving this unique landscape.

There are many accomplishments that were achieved during the GCP-I funding period. A particular highlight of the program involved the establishment of the Taromenane-Tagaeri Intangible Zone, an important new protected area in the region. This Intangible Zone was originally established in 1999 to protect the Taromenane and Tagaeri (two uncontacted Waorani groups) from extractive activities, but at that time its boundaries were not officially established and the overlap between the Intangible Zone and existing Block 17 (an oil concession now owned by Andes Petroleum) was unresolved. To legally secure this protected area, it became necessary to: 1) establish the official boundaries; 2) resolve the conflict with the oil concession; and 3) issue the necessary legislation which would protect this area into the future. Thanks to the diligent work of Yasuní BCLS staff, WCS, the Ministry of the Environment, CAIMAN Project, and EnCanEcuador S.A. (the owner of the block at the time) agreed to work together to officially delimit the intangible zone and ensure its long-term protection. Built upon the groundwork laid by these organizations, the Presidential Decree to protect this area was officially signed in January 2007.



Collared Peccary (Tayassu tajacu)

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During the GCP funding period, WCS-Ecuador played a crucial role in carrying out an intense campaign to impede the construction of a new road proposed by the oil company Petrobras within the YNP. This was a highly publicized campaign, which drew the attention of the international scientific community and other conservation organizations. WCS is not intrinsically opposed to building roads that contribute to increasing economic opportunities and improving the quality of life of local people, so long as it is done in a way that is consistent with the conservation objectives for YNP; however, this new road, as conceived, constituted a grave threat to the integrity of YNP. In this context, WCS made several presentations to critical stakeholders within the Ministry of the Environment, and within other governmental and nongovernmental organizations, which highlighted scientific evidence suggesting the enormous threat that this new road constituted to the ecosystems and wildlife within the park. This campaign finally succeeded when, in early 2006, the Ministry of the Environment stopped the construction of the road and asked Petrobras to present an alternative proposal for harvesting the oil fields within the park without the construction of additional roads.

Another area of important progress, supported by additional funding sources, was WCS's promotion of a better governance framework centered on the YBR Management Committee. WCS worked with a diverse group of local stakeholders, including indigenous organizations, municipalities, the Ministry of the Environment, and oil companies, to establish and consolidate a YBR Management Committee that would play a crucial role in ensuring effective conservation and improved livelihoods in the area. Despite the heterogeneity of these institutions' interests and levels of involvement, WCS was able to promote intense and continuous communications among these institutions, leading the Committee towards a more clear definition of its role and development strategies for the conservation of the YBR. In 2008, after a long process that demanded intense dedication and long-term commitment from WCS, this Committee was officially recognized by the Ministry of Environment as a key and visible actor in the region, leading the creation of a national network of biosphere reserves and co-management initiatives intended to strengthen mechanisms of social participation in the management of protected areas in Ecuador in the

future. The Committee's official recognition was an historical event and important step toward increased involvement with local actors in the co-management of the area and the development of its long-term vision. Concurrently, WCS positioned itself as a respected and trusted institution with real influence in the area.

During nine years of working in the Yasuní Biosphere Reserve, WCS has struggled to create stronger alliances and consolidate a more regional conservation impact on an area of enormous socio-economic and cultural complexity. Despite the importance of the YBR, very few institutions are directly involved in its conservation and the area faces increasing threats mainly derived from the socio-economical changes that oil extraction activities have brought to the region (including illegal wildlife trade, population growth, inequity, market integration, political instability, and institutional weakness). The lack of a clear legal framework, the weak Ecuadorian state (due to constant political changes in the Ministry of Environment that delayed important processes) and the overwhelming presence of the oil companies have created a vulnerable situation for the Waorani and other groups in the area, who struggle with their changing relationship with the forests, the vulnerability of their territories and the difficulty in conserving their traditional lifestyles. Additionally, Waorani organizations lack the technical and administrative capabilities and the level of representation needed to effectively manage their territories. Local biodiversity resources are being exploited without understanding the long-term consequences of their depletion on local livelihoods and global biodiversity in general. However, WCS's long-term commitment and coherent efforts over many years have resulted in tangible and concrete improvements in the management of this area, both through the development and replication of community-based conservation projects and through the development and promotion of a better governance framework centered around the YBR Management Committee.

Value of the GCP Program

USAID's GCP-I funding was critical, enabling WCS staff and partners in Yasuní to achieve the conservation successes described throughout this report. Although the conservation challenges facing the Yasuní landscape continue to be numerous and serious, the program was able to make significant progress in addressing them, especially those related to oil-industry activities, weak institutional capacity to implement resource management strategies, and lack of local and national policies to support the landscape conservation approach. GCP funding helped WCS define the Landscape Species and initiate monitoring efforts to document and better understand the effects of roads on wildlife communities and wildlife use by local indigenous communities. The preliminary results from a study on the difference between wildlife communities along the two main oil extraction roads in YNP and in a control area with very little human intervention were critical components of a successful campaign to stop a Brazilian petroleum company's (Petrobras) construction of a new road inside the park. This study also supplied a baseline for future conversations with the Ministry of the Environment about exploring policy interventions to ensure that no more roads are constructed within Ecuadorian protected areas, and helped WCS secure more funding to continue its monitoring in the landscape and involve local people in designing sustainable resource management strategies. This was definitely one of the main accomplishments of WCS's Yasuní program, contributing to the overall goal of maintaining the ecological integrity of the Yasuní landscape.

Informed local participation, a key component of the Landscape Species Approach, has been encouraged in Yasuní through the formation of the Yasuní Biosphere Reserve Management Committee (with the participation of 25 institutions, including FEPP and WCS-Yasuní staff serving as permanent, non-voting advisors to the committee). At the May 2004 meeting of the group, members approved the bylaws of the committee and agreed on a mechanism to elect board members⁸. As a result of BCLSP program efforts, local Yasuní stakeholders

are increasingly working together to enhance the conservation status of this unique landscape, and a priority of this GCP-funded project was to strengthen the local, on-site capacity to protect and manage biological resources across the Yasuní landscape. Today the Committee, now legally recognized by the Ministry of Environment, plays a crucial role in promoting a landscape conservation vision.

Local participation has been strongly promoted at the community level, as a unique strategy to involve indigenous people in the management of their own territories. To this end, WCS-Yasuní and FEPP worked to design an integrated, regional management plan for the six Kichwa communities settled in the northwestern corner of the park. The WCS Ecuador program facilitated the development and consolidation of an agreement between these six communities and the Ministry of the Environment to encourage the rational use of territorial lands that overlap with YNP boundaries. During this process, WCS was directly involved in the analysis and resolution of persistent conflicts over the boundaries of three of the communities, a step that was crucial in advancing towards the signing of the agreement. WCS works with these communities to develop community-based programs for wildlife management that protect wildlife and reduce deforestation within their territories, under the conservation easement agreement completed in 2004.

Overall, the leverage provided by GCP-I funding allowed WCS to acquire additional funding that has expanded its conservation impact at the regional level. In particular, WCS supports YBR indigenous communities and organizations in the development of sustainable land zoning frameworks and wildlife management plans and with the consolidation and demarcation of indigenous lands. Efforts initiated with six Kichwa communities allowed WCS to focus on working more closely with three Kichwa communities settled along the Napo River (Sani Isla, Añangu, and Nueva Providencia) to design and implement community-based wildlife management strategies. This process led to the creation of the communal reserve located within 5 km of the northern Tiputini's riverbank and south of the three Kichwa communities. The reserve, in which hunting is completely illegal, is officially recognized by local communities and serves as a source area for wildlife to sustain hunting by the communities. As part of the developing community-based

⁸ The Board of Directors will be composed of 7 members: 3 from the indigenous and mestizo communities, 2 from the public sector, 1 from the private industry sector, and 1 from the non-profit sector.

monitoring program, WCS established a control and communication system in the three Kichwa communities that consists of: 1) hiring and training local park guards; 2) construction of a guard station along the Tiputini river; and 3) the establishment of the communication system to link the communities with the office of the YNP Ministry of Environment (MAE). The system strengthens the relationship between local communities and YNP staff and ensures that they can effectively cooperate to control colonization and manage the community lands adjacent to YNP, thus promoting more efficient conservation of the northern area of the park.

WCS also supported the NAWA and ECOLEX-led physical demarcation of the Waorani territory boundary. This process, initiated by NAWA and other partners over a decade ago, advanced significantly during the CAIMAN project and is now complete. With WCS (USAID) support, approximately 84.2 km were demarcated and 63 boundary signs were installed. This demarcation constitutes an important contribution to consolidating the indigenous territory.

WCS, with USAID support, was able to position itself as the key institution contributing to the development of the institutional capacities needed to advance the sustainable use of natural resources in the region. By

providing training to community and official park guards and supporting young professionals, with funding from USAID and ECOFUND, WCS addressed a number of challenges that regions face and involved local people in the management of their own territories. These initiatives laid the foundation for effective protection of a significant portion of the YNP and initiation of the first community-based conservation projects such as the river turtle initiative. Additional communities have expressed interest in this initiative, and new opportunities are opening to increase the amount of the YNP effectively protected by community-based management. For example, additional funds from ECOFUND have allowed WCS to complete construction of a new interpretative center for the YNP, and hire four additional park guards to work with the Ministry of Environment's park guards. The new park guards are responsible for the implementation of a new monitoring framework for wildlife in sensitive areas of the YBR that WCS is developing with the Ministry of the Environment.

Overall, GCP-I support helped WCS to establish a strong foundation for implementing and strengthening its conservation efforts within the Yasuní Landscape. There is also reason to be optimistic about the future of the Yasuní landscape due to the current level of interest and support generated from Yasuní stakeholders.

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