

## **Final Report to USAID/CARPE**

### **Building Capacity for Science-Based Conservation Management across the Congo Basin**

**Smithsonian Institution**

(January 2007)

#### **1.- Introduction**

Central Africa contains the second largest contiguous tropical forest in the world, following after the forests of the Amazon basin. As in the rest of the world, forests in Central Africa are under threat because of their potential use by humans in a non-sustainable way that could lead to their destruction. Once the forest is fragmented or damaged severely, it is almost impossible to bring it back to a state that can serve future human generations and thus affecting the overall health of the ecosystem.

The Smithsonian Institution (SI) has worked to reduce the loss of biodiversity in Central Africa for many years. The approach has been strategic. It has provided training, baseline information for long-term management, and has partnerships with multiple collaborators. Activities in the region have been supported by several grants and for the last three years from the Central Africa Regional Program for the Environment (CARPE). All field activities matched to the best of our capacity CARPE's main strategic objective to "reduce the rate of forest degradation and loss of biodiversity through increased local, national, and regional natural resource management capacity." This report summarizes the major accomplishments and findings of the baseline studies supported financially by CARPE.

SI worked together with Missouri Botanical Garden (MBG) to achieve the mutual goals of training and sustainable development. In addition, during the first two years the two organizations focused on creating "demand" among the CARPE partners for the biological/scientific information that the group produces. The project was very successful in this regard as, by the third year as all activities undertaken were requested by CARPE partners. SI and MOBOT were able to secure funding directly from CARPE for the third year since CARPE partners recognized the importance of acquiring the needed field data and having their personnel trained on biodiversity monitoring and management issues;

activities that were complimentary to their own objectives but for which funding was limited. Examples of our on-the-ground collaborations include the Wildlife Conservation Society – Gabon, Wildlife Conservation Society – Democratic Republic of Congo, and the World Wildlife Fund – Cameroon.

The main objectives of our activities focused on gathering scientific information to be used when creating management plans for protected and non-protected areas (CARPE IRs 1.1 and 1.2) and on increasing technical and management capacity (CARPE IR 3.2) for the long term conservation of the biodiversity of the region.

## **2.- Major Findings (IRs 1.1 and 1.2)**

Appropriate sustainable forest management is one of the most important challenges that conservationists are facing around the world. Industrialized countries are searching for places where they can obtain crucial primary resources for their development in the way of timber, minerals and oil. More important than ever, it is to work with the companies and with government officials that manage those resources on how best utilize them without destroying them. Showing local people the benefits of having a well managed land for the conservation of biodiversity is also a major focus of attention.

When conducting the studies, we had as an objective the long term sustainable use of the flora and fauna of the managed areas for the benefit of the local communities and the nations where they are found. Below we present the findings of our baseline studies as requested by several landscape managers to find information on impacts from different present and future threats on the biodiversity in different landscapes. Some areas are threatened from logging or mining developments, while others have poaching on the large mammals as their primary concern, and others are using our information to promote sustainable forest management practices. Sustainable timber management necessarily requires inventory of initial forest conditions and long-term monitoring of logging impacts on a variety of parameters (particularly forest structure and forest diversity), as well as on the regeneration and growth of desired timber species.

- At the Sangha Tri-national Landscape, Lac Lobeke area Cameroon, SI has a productive partnership with the University of Buea, the World Wide Fund for Nature-Cameroon, and the Groupe Decolvenaere timber company to jointly

monitor the impacts of logging on forest structure and regeneration in the WWF Jengi project area. Our results show that opening large gaps in the forest canopy through logging did not result in increased regeneration of the canopy species, suggesting that in the future, stocks of these species will need to be maintained through intensive silviculture. These results suggest that conditions for regeneration in the forest were very different in the past (probably a few hundred years ago) when the present canopy was establishing itself as seedlings and saplings. Results also imply that as commercial trees in the canopy die or are harvested they will be replaced by a different species. These results support previous findings that the semi-deciduous forest of the landscape are secondary and represent a successional stage between an earlier, more open forest or even grassland and a more mature closed-canopy forest. Sustainable timber harvest is a key to reducing the rate of forest degradation and loss of biodiversity, both by placing timber exploitation on a sustainable basis, and by stabilizing land use around protected areas. Several landscape lead organizations are actively seeking to promote sustainable forest management practices, and particularly to promote mid-term efforts to certify some Congo Basin timber concessions as sustainably managed according to the Forest Stewardship Council (FSC) or other credible international standards.

- In Collaboration with WCS-DRC, SI and partners worked at the Ituri Epulu Aru Landscape, D.R. Congo. The main objectives were to train ENRA's forestry team (only timber company recognized by the DRC government as legitimate in eastern DRC), and to determine forest structure and composition of an area that has not been logged with the purpose of comparing those results with logged areas. Botanical surveys revealed that the forest in the area is very diverse (a total of 170 species was recorded for trees with diameter at breast height of 10 cm or above). Fifteen timber species were recorded, among which Gilbertiodendron dewevrei and Julbernardia seretti were particularly abundant. The major timber species currently harvested by ENRA showed relatively low abundances. The low abundance of major timber species call for a prompt diversification of timber harvesting that includes less-known but more common timber species such as the

two mentioned above in order to promote sustainable management of forest for timber production in the region. While knowing the standing volume of a logging concession is a precursor to profitable logging, it does not necessarily follow that inventories will lead to ecologically sustainable management. Because there are few properly trained foresters/silviculturalists associated with forest management in the sub-region, a wide range of inventories aimed at economic efficiency are passing for inventories that will eventually only lead to unsustainable forest management. This is a critical distinction that is lost on many of the CARPE partners ostensibly working towards this goal.

- At the Dzanga Sangha protected Area Complex, in the Central African Republic, the impact of logging on vegetation was evaluated. We found that the forest responded well to disturbance from timber exploitation. As a result, a larger number of species were found on average and all diversity indicators were found to increase with the number of logging rotations that the area underwent. We also found that the diversity indicators decreased as time of recuperation increased. These results are very important for forest management for the following reason: logging practices can increase the number of species found in an area but close attention needs to be paid to the type of species that colonize the site. Pioneer species tend to be not popular for commercial purposes. Some of those incoming species can be of use for ethnobotanical purposes. It is also important to determine if the species that become established and that reach the canopy have a commercial interest and have an important ecological role in the system by providing fruits and shelter to animals.
- Large extensions of forest that seem to be in “good shape” using satellite images and aerial photography result to be either “empty” (i.e. mega fauna is not found in the forest due to hunting and poaching) or having the trees species composition and structure virtually different after some economic activity, such as logging. Our results show a good example of the latter in the Nouabale-Ndoki National Park and support zone in the Republic of Congo. There we undertook surveys of unexploited and exploited forests within the National Park and compared this information with subsequent assessments of the support zone currently under

lease to a major logging company in the area (CIB). Using exploitation plans, we placed sampling plots in logged forest of varying ages and compared with the control plots in unlogged mixed forest. Our results suggest that whilst species diversity is relatively unaffected, the structure of logged forest changes significantly. This is due to the fact that forest that has been exploited possesses a greater number of lower diameter stems per hectare, due to increased disturbance and subsequent regeneration, and a lower total basal area than unlogged forest due to removal of the median and larger sized trees. In addition, the species composition also changed in logged forest with a distinct shift from high concentrations of commercially valuable species such as the mahoganies (Entandrophragma spp.), to a higher proportion of species of lesser commercial value. These results indicate that logged forests remain commercially viable for a second or third rotation and that, if managed well, can maintain their ecological functions. However, our findings also suggest that recurrent exploitation must target a wider range of timber species other than those harvested during the first cut.

- WCS-Gabon requested similar quantitative information as from Nouabale-Ndoki National Park from the logged and un-logged areas currently confined within the Waka National Park boundaries (Gabon). The park is part of the Massif du Chaillu mountain range, an extension of the Monts de Cristal Mountains coming from the north. A multi-national botanical team of six institutions conducted the studies in the park and results are helping park managers to evaluate the value of the exploited zones and decide whether the current management of those areas is appropriate for long term conservation or if changes are needed, such as defining if those areas are to remain within the park boundaries. In addition, one new plant genus in the Flacourtiaceae family was found (nowadays new genera are very seldom found), two species of palms endemic to Central Gabon were re-discovered that are used locally by the Mitshogo people. There are many ancient villages in the area, and the pre-European human populations appear to have been relatively large, as evidenced by the presence of oil palm plantations and atanga (Dacryodes edulis) trees. In recent history, the mountain chains that run through

- the park have served as a corridor for human migration as well as hunting and gathering expeditions by Babongo pygmies and Mitshogo people. These two groups still rely heavily on forest resources, both within and outside the park. Please see section below on training at the site that increases linkages between these people and the park. The re-discovery of the species originally described as Podococcus acaulis and Sclerosperma walkeri has considerable implications for not only understanding the patterns of plant endemism within the Massif du Chaillu landscape, but also for the evolution of the Palmae as a family on the African continent.
- The Mbé National Park (Monts de Cristal, Gabon) is currently under threat from mining interests beginning to operate within park the boundaries. The baseline biological information gathered during our studies was presented to government officials of the Conseil National des Parcs Nationaux at the invitation of WCS-Gabon, one of our partners in the country. Value was added to the national park through explicitly and quantitatively describing the diverse vegetation, one of the main objectives for the creation of such protected area. Our results support the notion that national park is very botanically diverse and may be the center of speciation for several groups of plants and animals.
  - At Ivindo National Park, Gabon, MBG led quantitative and qualitative vegetation surveys in Ivindo National Park, Gabon, in collaboration with the Herbarium National du Gabon and WCS-Gabon. The park covers an area of 3,300 km<sup>2</sup> and has been designated as an IUCN critical site for conservation. The plateau at Mont Kinguié, in the south west part of the park was the focus of the study. The plateau has a different rain fall and likely different soil properties than the surrounding areas. The objective of the assessment was to test the idea that the vegetation found in the plateau has a high degree of endemism and to use that information in future management plans and park activities. The park has recently been under threat from logging interests; some concessions are still licensed within park boundaries. The study showed a very high degree of endemism of the trees that had a diameter at breast height of 5 cm or above. More than 80% of the species found were restricted to a single transect. This is higher than what was recorded

both in Monts de Cristal and in Waka National Parks, Gabon. Total species richness and species richness per transect were however lower than the ones recorded for Monts de Cristal and in Waka National Parks. Species identifications continue both in Gabon and in Europe to have a complete list of the species found at Mont Kinguié. Future studies in Belinga Hills and in the Langoué Bai (recognized as a key resource for wildlife providing mineral-rich soil and plants for wildlife) will provide a larger scale comparison of the great botanical diversity found at Ivindo National Park.

- The conservator of the Lobeké National Park (Cameroon) welcomed the information provided by our studies. A particular concern is the quality of wildlife habitat, particularly in the logged and unlogged sections of the park. We showed that logging practices cause rapid changes in forest composition and structure and in some instances succession alters the suitability of the forest habitat and the availability of food plants. This is known thanks to the SI permanent monitoring plot established in the park. This information is very useful for the protection of the regional mega fauna, one of the main objectives for the creation of the park. Large mammals are currently affected by food quality and availability and threatened by poaching.
- Monte Alen NP (Equatorial Guinea). A multi-institutional and multi-disciplinary team confirmed that the biodiversity at Monte Mitra is one of the most important in the Congo Basin, supporting the idea that it is a Pleistocene refuge. The largest number of plant species per plot was recorded here, with new species of plants to science and several new records for the country. Significant observations of forest elephants and leopards were found, as well as new records of bird species for the country. All of these indicate that the forest is in good condition. Unfortunately, it was also recorded that a high level of uncontrolled hunting is taking place, including of protected species. Better management of human/elephant conflict which is affecting agriculture is much needed.

SI and collaborators have now created a region-wide network of almost 50 permanent sample plots (in six countries). This network allows for region-wide

comparisons of vegetation and provides a baseline for future monitoring and assessment of forest dynamics. A paper has been accepted for publication in the Journal of Ecology entitled The odd man out? Might climate explain the lower tree alpha diversity of African rain forests relative to Amazonian rain forests? It has the following co-authors Ingrid Parmentier, Yadvinder Malhi, Bruno Senterre, Robert J. Whittaker, A.T.D.N. Alfonso Alonso, Michael P.B. Balinga, Adama Bakayoko, Frans Bongers, Cyrille Chatelain, Jim Comiskey, Renaud Cortay, Marie-Noël Djuikouo Kamdem, Jean-Louis Doucet, Laurent Gautier, William D. Hawthorne, Yves A. Issembe, François N. Kouamé, Lazare A. Kouka, Miguel E. Leal, Jean Lejoly, Simon L. Lewis, Louis Nusbaumer, Marc P.E. Parren, Kelvin S.-H. Peh, Oliver L. Phillips, Lourens Poorter, Douglas Sheil, Bonaventure Sonké, Marc S.M. Sosef, Terry C.H. Sunderland, Juliana Stropp, Hans ter Steege, Mike D. Swaine, M.G.P. Tchouto, Barend S. van Gemerden, Johan L.C.H. van Valkenburg, and Hannsjörg Wöll.

### **3.- Capacity Building (IR 3.2)**

Baseline studies to obtain information to aid in better practices for managing forests have also contributed to building the capacity of in-country institutions by bringing their personnel to the field for on-site training. Those trained individuals will continue to measure and monitor forest resources in the future. In addition, capacity has been built in formal settings by professional presentations in regional training programs in the form of workshops.

#### **3a.- On-site Training**

- During the fieldwork at Ivindo National Park, Gabon, we conducted on-site training for Gabonese scientists and parataxonomists on vegetation inventories. Plant collection is one of the best ways to understand what plants are found within a protected area, which are rare or endemic or new to science. Plant collections add value to protected areas by providing information on what is found there in relation to local community use and how rare/common those plants are in the park, in the country and in the region. Training occurred in the field using MBG



protocol (<http://www.mobot.org/MOBOT/Research/Library/liesner/tpage.html>). Specimens and field book data was entered at Herbar National du Gabon and the data has been incorporated into the database of Gabon plants and MBG's publicly available plant database TROPICOS (<http://www.tropicos.org>), which contributes to the understanding and preservation of Gabon biodiversity. Collections have contributed to the plant lists for the park, documenting rare and endemic species. As this site remains largely unknown biologically, baseline information is essential for its continued protection.

- In Nouabale-Ndoki National Park, Republic of Congo, we undertook on-site training of forestry technicians currently employed by WCS who are, in turn, advising the Government of Congo in the management of the national park, in quantitative vegetation assessment techniques. These technicians included two senior female technicians, one of whom is now leading continued vegetation surveys within the park. In addition, on-site tree climbing training was provided at this site.
- In Waka National Park, during the vegetation assessment, the Herbar National du Gabon, MBG, and WCS-Gabon selected and trained technicians from a number of villages surrounding the park. Those selected during the training became MBG staff managed on-site by WCS in the park and by the Herbar National du Gabon and MBG in Libreville. With funds provided by the Beneficia Foundation, they now conduct independent field missions in the park to collect much needed botanical information on plant rarity and endemism. More importantly, they are providing a direct link between the park and the local communities, some where they come from and others, by working outside the park in areas nearby pygmy and Mitschogo villages to gather ethnobotanical information. It is anticipated that they will receive more training at the national forestry school to later return to work for the park. In addition, the Herbar National du Gabon has participated in numerous missions inside and outside the country. They have purchased their own equipment with the hope of continuing the monitoring efforts launched by this initiative. As their members participate in the data collection and analysis, it has built national capacity to monitor and manage forest resources. The herbarium

now links directly with the Conseil National des Parcs Nationaux. These records will contribute to future informed decisions for best practices in park management based on data gathered in the park. In addition, on-site tree climbing training was provided at this site.

- In the Jengi Project Area in SE Cameroon, SI and WWF selected and trained a team of forest technicians in the establishment and measurement of long-term forest monitoring plots. We hope to expand the program of monitoring impacts of timber exploitation to other landscapes in the future, and to eventually establish this team as a permanent resource for monitoring the vegetation of the logging concessions and the National Park, and to conduct periodic re-measurements. The partnership also involved forest ecologists from the University of Buea to address timber management in secondary forests.
- During the Monte Mitra assessment, SI worked closely with INDEFOR for mentoring and supervision of students and field technicians learning monitoring field methods. As part of the training, the students contributed in the preparation of the reports and they progressed greatly in the writing skills. This is genuinely reflected in the authorship of a number of papers in the report.
- On site training also took place in the Monts de Cristal and at the Dzanga Sangha protected Area Complex, in the Central African Republic.

### **3b.- Regional Training Program**

Regional training programs are a major component of our capacity building initiative. Landscape leaders are informed of the contents and dates of the programs and they encourage their personnel to attend. Applications are received and a selection process is conducted.

In 2006, a regional workshop on methodologies was conducted entitled “Applied research for landscape management: an adaptive approach.” The workshop was held at Camp Saker, a mission on the edge of some of the last remaining lowland tropical forest found between Limbe and Douala, in Cameroon. After introductory days on concepts and techniques that lead into applied research for adaptive management, a series of complementary sessions followed with principles and practice of socio-economic surveys

and their importance. Special emphasis was given to issues related to landscape management and how to design and implement a successful project. Invited speakers also discussed these themes and provided practical examples. To reinforce the management planning approach, participants formed groups that and prepared a proposal to manage a community forest. The best project received an award. A total of 25 participants from eight countries representing 16 institutions attended this training. Two other regional trainings were conducted by our group in Limbe, Cameroon and Lope, Gabon. The total number of participants that received formal training from our group is 71. As they continue to work in their respective landscapes, conservation of natural resources is facilitated.

The regional training programs are only possible with the help of local organizations that in turn benefit as well from the training. Two examples include Forest Resources and People in Cameroon, and the Réseau des Botanistes d'Afrique Centrale (REBAC).

#### **4. Financial Report**

Please find report provided by the Office of Sponsors Project.

#### **5. Equipment with unit cost above \$5000.00**

There was no equipment purchased above \$5000 with funds from CARPE for activities performed during the last two years that relate to Agreement # 623-P-00-04-00076-04, Modification 1, dated September 09, 2005.

During the first year FY04, there was an agreement to purchase a vehicle with the assistance of WCS-Cameroon (please find attached letter). We propose that this vehicle be donated to Forest Resources and People, a local NGO in Cameroon. They have worked very closely with us and will continue promoting the long term conservation of natural resources in the area.

#### **Acknowledgements**

This work was possible thanks to the leadership and support from John Flynn (CARPE CTO) and his team. Many people have helped with the success of this project. F.

## Carpe Phase II A/SI/Reports/Final Report

Dallmeier, J. Comiskey and E. Losos were the initial Principal Investigators. M. Wishnie, D. Thomas, S. Davis, and J. Hall contributed from the Smithsonian Center for Tropical Forest Science. J. S. Miller, P. Lowry contributed from the Missouri Botanical Gardens. The program was brilliantly implemented in the field by T. Sunderland and G. Walters. M. Balinga, J.-R. Makana, M. Leal, and G. Chuyong provided additional assistance in the field. We also thank L. Ngok Banak, Director, Herbarium National du Gabon; Y. Issembe, Research Botanist, Herbarium National du Gabon; N. Orbell, WCS Technical Assistant to Ivindo National Park, R. Starkey, WCS Research Coordinator of Langoué Bai, L. Usongo, Director of the WWF Jengi Project; D. Kenfack and C. Ewango, REBAC, M. Sainge, SI field manager in Cameroon, and Michael Balinga, Coordinator of FOREP, Cameroon who provided support for the training workshop. Administration at the Smithsonian was supported greatly by T. Pacheco, V. McMahan and M. Diaz.

Alfonso Alonso, Washington DC

January 2007.