The Gabon Biodiversity Program
Forum sur le Biocarbone et les Reserves de la Biosphere

Complexe d’Aires Protegees de Gamba, Gabon
Smithsonian Institution
*Conservation Biology Institute at NZP*
*Center for Conservation Education & Sustainability*
The Gamba Complex of Protected Areas

- A vast mosaic of habitat types
- Highest biodiversity (species diversity and abundance) of all priority landscapes in the Congo Basin
- Location of two of Gabon’s three Ramsar Wetlands of International Importance – Loango and Setté Cama
The Gamba Complex of Protected Areas

- 1,550,000 hectares of land including a 550,000-ha. forest concession with FSC certification
- The country’s largest discovered onshore oil and natural gas reserves operated by 5 oil companies
- Home to two National Parks covering 600,000 ha.: Loango and Moukalaba Doudou NPs.
The Gamba Complex of Protected Areas

- Center of research / monitoring activities for 4 NGO’s, 3 scientific research institutes and one university.
- Home base for 5 tourist operators.
- Comprises 2 towns (Gamba, Mandjii) and 30+ villages with 15,000 inhabitants engaged in farming, fishing, hunting, logging, industrial labor and micro-enterprises (artisanal).
Coastal Scrub
Savanna – Forest Mosaic
Mangrove
Wetland Forest
Mature Forest
Smithsonian / Shell partnership

Established in 2000

Initiated activities in Gabon 2001

WORKING TOGETHER FOR BIODIVERSITY

Shell Foundation

Shell Gabon

Smithsonian National Zoo
Gamba Complex of Protected Areas

- Moukalaba-Doudou NP
- Loango NP
- Rabi - Ndogo Protected Area (Industrial corridor)
- National Parks
- Roads
- Shell oil fields

Map showing the Gamba Complex of Protected Areas with locations of Moukalaba-Doudou NP, Loango NP, Rabi - Ndogo Protected Area, and Shell oil fields.
Partnership Launched in the year 2000

- Consultation revealed a lack of knowledge / undervaluation of biodiversity, and desire to improve and apply new knowledge

- Defined program **OBJECTIVES:**
  - Increase biodiversity knowledge through basic and applied research.
  - Build local capacity through technical training.
  - Promote links among stakeholders in Gabon.
  - Spread information generated to a wide audience.
  - Advance the research-industry model to reduce impacts on biodiversity from Shell Gabon operations based on scientific recommendations.
Biodiversity Baseline

The first step was to conduct a biodiversity baseline inventory in oil-impacted and pristine sites.

Study sites
- Gamba oil field & environs – coastal human-use zone
- Loango National Park – coastal pristine zone
- Rabi and Toucan oil fields – inland human-use zone
- Moukalaba-Doudou National Park – inland pristine zone

Study groups
- Vegetation – trees & orchids
- Mammals – small terrestrial, bats, large, marine
- Herpetiles – amphibians & reptiles
- Birds
- Fish
- Arthropods
Vegetation
• 75 monitoring plots established
• 6600 trees measured
• 73 orchid species recorded
• New species under investigation

Amphibians
• 78 species – highest in Gabon
• Increased Gabon’s amphibian list by 25%
• Rabi oil field particularly rich

Reptiles
• 86 species – highest in Gabon
• Important sea turtle nesting area
Biodiversity Baseline

Small mammals
• 21 mice & shrew species
• 13 bat species

Large mammals
• 42 species – many protected

Fish
• 67 species Rabi – very rich
• 85 coastal species
• Several spp new to Science
• Indicators of water quality
Biodiversity Baseline

Arthropods
- Sampled 4 areas affected by oil
- 440,000 specimens examined
- 20,000 professionally prepared specimens in 200+ families
- Gabon’s 1st natural history collections

Birds
- 455 species recorded
- Bird monitoring baseline begun
Institutional Collaborations

- 11 Gabonese institutions
- 49 international scientific institutions in 13 other countries
- 110 scientific publications (64 peer reviewed)
- more than 2000 visitors since 2002
- 4 biodiversity posters
- 2 books
- 3 animal checklists
Ecological Connectivity: To examine ecological connectivity between oil zones and national parks. To assess elephant populations in a protected area.

Methods:
- Satellite collars installed in oil fields (dots on maps are GPS data from elephants in the Rabi concession)
- Patch occupancy
- Genetic analysis of population structure
Ecological Connectivity

Between two national parks
To assess elephant populations in a protected area
Ecological Monitoring of Impacts on the Gamba Complex

1) We have learned that the Gamba Complex of Protected Areas is an important site for biodiversity.

2) We have begun investigation into several key issues at the interface between oil operations and biodiversity.

3) We are now taking the next logical step: Integration of findings into an ecological monitoring plan. Monitoring will follow selected impacts on biodiversity.
Eight Impact Indicators

1. Habitat degradation and species of special conservation concern
2. Spread of invasive species in industrial areas
3. Incidence of bushmeat hunting in Shell Gabon concessions
4. Ecological connectivity of protected areas
5. Spread of forest fragmentation due to Shell Gabon operations
6. Coastal oil pollution
7. Aquatic system changes due to industrial activity
8. Impact of pollution on wildlife
A new 25-ha forest dynamics plot (FDP) was established in a mature forest at Rabi, located in the Gamba Complex of Protected Areas in southwestern Gabon. The plot follows CTFS protocols and adds a third site to the existing African plots at Ituri (Congo) and Korup (Cameroon).

The project represents collaboration between the Smithsonian Institution’s Conservation Biology Institute, Shell Gabon, the Government of Gabon, CTFS/SIGEO and other stakeholders.
Rising CO₂

SIGEO Advances
Annualized global measurement of forest carbon dynamics

A five year, $8 million grant from the HSBC Bank Climate Partnership permits precise appraisal of above and below ground carbon in a subset of the SIGEO plots.

Empirical carbon measurement is fundamental to the development of improved models that predict the consequences of global climate change, and such measures are necessary to answer the following questions:

- How are forests responding to increases in atmospheric CO₂ (carbon fertilization) and global warming?

- Is climate change causing increases or decreases in forest biomass?

- How does the rate of carbon sequestered by forests vary with latitude?
SIGEO/CTFS Consortium
Training

- Field and lab research protocols
- Data analysis
- Biodiversity assessment and monitoring
- Scientific collections set-up
- GIS techniques
- Smithsonian Conservation Center collections´ use for educational and research purposes
The Industrial Corridor

• Among the highest biodiversity sites recorded in Central Africa
• Significant populations of species of global conservation concern
  • Forest elephants
  • Western lowland gorillas
  • Leatherback turtles
  • Hippopotamus
  • Long-snout, Dwarf and Nile crocodiles
• Gabon’s greatest species richness for amphibians and reptiles
How does the UNESCO/MAB concept fit into the Gamba Complex?

- Parallel tripartite objectives: conservation; sustainable socio-economic-cultural development; programs fostering research, monitoring, training and education;
- Parallel Benefits: development of local community projects that generate incomes and yet balance consumption with production; creation of multiple livelihoods and activities for diverse skill levels; establish technologies and practices the local population can afford to use; improvement of community living standards;
How does the UNESCO/MAB concept fit into the Gamba Complex?

• Parallel Opportunities: to minimize conflicts and maximize the talent of all stakeholders through self-governance; involvement by private industry, local communities and professional organisms to design projects that integrate nature and man; integration of small-scale projects and large-scale land and water management planning; capitalize on Biosphere Reserve status to seek funding from private and public sources, seek expert advice from UNESCO and maintain links with other BRs to pool resources and foster capacity-building.
The Gamba Complex as a Biosphere Reserve: Fulfillment of MAB’s three functions

1) Conservation of landscapes, ecosystems, species and genetic variation.

2) Development: Foster economic and human development that is socio-culturally and ecologically sustainable

3) Logistic Support: for research projects, education and training that relate to local, regional, national and global issues of conservation and sustainable development.
The Gamba Complex as a Biosphere Reserve: Fulfillment of MAB’s Seven Criteria

1) Encompass a mosaic of ecological systems representative of major biogeographic regions and human intervention.
2) Be of significance for biological diversity conservation.
3) Provide an opportunity to explore and demonstrate approaches to sustainable development.
4) Be of appropriate size to fulfill MAB’s 3 functions
5) Constitute zoning of a core area, buffer zones and a transition area
6) Design and application of MAB’s 3 functions by all stakeholders
7) Mechanisms for management and governance of the BR
Ecological Monitoring History

- Ecological Monitoring Loango NP 2005-2006 (WWF-WCS)
- Monitoring of Great Apes of Moukalaba Doudou NP 2005 (Max Planck, WWF, Kyoto)
- Ecological Monitoring southern part forestry concession, UFA Kivoro (CBG, WWF)

<table>
<thead>
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<th>Inventaire</th>
<th>Note de site</th>
<th>Date des inventaires</th>
<th>Organisation(s) en charge des inventaires</th>
<th>Nombre de transects</th>
<th>Nombre de km de transects</th>
<th>Méthodologie</th>
<th>Présence d'éléphants</th>
<th>Taux de rencontres d'éléphants (N/km)</th>
<th>Densité de groupes d'éléphants (N/km²)</th>
<th>Présence de groupes d'éléphants (N/km²)</th>
<th>Taux de rencontres de groupes d'éléphants (N/km²)</th>
<th>Densité de groupes ail de grands singes (N/km²)</th>
<th>Signe de présence humaine</th>
<th>Signe de présence d'éléphants (N/km²)</th>
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<td>336.84 ± 52.3</td>
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</tr>
</tbody>
</table>

1) Van Vroonen, 2008
2) WCS, rapport non publié
3) et 4) WCS & WWF, rapport non publié
5) Max Planck/WWF, non daté
5.1) Koulil et al., 2007
5.2) Koulil et al., en cours pour publication future
UNE NOUVELLE GENERATION DE RESERVE DE BIOSPHERE

SOUTIEN INTELLECTUEL DES PARTICIPANTS DU FORUM
Gabon National Park System established in 2002

- 13 parks covering 11% of landscape
- Created to protect biodiversity and promote ecotourism
Permis Pétrliers dans le Landscap
Gamba - Mayumba - Conkouati

(Gamba le 02 Novembre 2009)

Sources : WWF, WCS, Total Gabon, Shell Gabc
Impacts of Logging

To evaluate impacts on forests caused by logging via increased road access