# NIGERIA
# ENVIRONMENTAL ANALYSIS
# FINAL REPORT

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## Acknowledgements

Nigeria is a tremendous varied and complex country with a significant endowment of natural resources. Attempting to describe the "state of the environment" and to provide an informed analysis of the threats to the nation's natural resources is a Herculean task. The Environmental Analysis (EA) Team believes that it has made a contribution in this regard and provided at least a snapshot of what the major environmental issues and threats are today.

This contribution has relied heavily on the assistance of others—public servants, private institutions and companies, NGOs, a multitude of individuals—from across the country. We were greatly encouraged by the spirit in which we were received and the help and guidance provided by so many.

We are especially indebted to the staff of USAID/Nigeria who provided us with assistance at every step while we were in Nigeria. We would especially like to thank Dr. Ravi Aulakh, the Program Economist and SO2 Team Leader for her guidance and assistance with all phases of our assignment; Mssrs. Nduka Okaro and Abdulkadir Gudugi who accompanied us on our field visits and provided invaluable networking assistance and background on the agricultural sector; Mr. John Brodman for not only tolerating us while we shared his office space, but also provided valuable insights about the energy sector and critical editorial comment; and also to Ms. Happiness Enere and Ms. Sherifat Somotun for their logistical and administrative assistance whenever we were at the USAID office. We are also grateful for the time spent and the commentary provided on drafts of this report by all of the reviewers in USAID/Nigeria and USAID/Washington.

On our visits to the field we came in contact with more than one hundred people who assisted us with our task. With are especially grateful to Dyno Keatinge at IITA, Dr. Festus Akindele and Dr. Wilson Eedy of Geomatics who provided us with some of the maps used in this report as well as access to recent environmental reports, to Tony Bassey of NCF in Calabar for unselfish assistance beyond the call of duty, and to Mr. Tim Adkins of Savanna Conservation who contributed generously with his time, insights, and knowledge of Nigeria's natural environment.

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# Table of Contents

# List of Tables, Figures and Boxes

**PART I**

**Tables**



**Figures**



**Boxes**

**PART II**

**Tables**



**Boxes**

## Acronyms and Abbreviations

| | |
|---|---|
| ADS | Automated Directives System (USAID) |
| AGFA | Associated Gas Framework Agreement |
| AGO | Automotive Gas Oil |
| AIDS | Acquired Immune Deficiency Syndrome |
| API | American Petroleum Institute |
| bbl/d | barrels per day |
| Bcf | billion cubic feet |
| CASSAD | Center for African Settlement Studies and Development |
| CBD | Convention on Biological Diversity |
| CBNRM | Community-Based Natural Resources Management |
| CBO | Community-Based Organization |
| CD | Convention on Desertification or Canadian Dollars |
| CDA | Community Development Association |
| CEDA | Center for Environment and Development in Africa |
| CERASE | Center for Environmental Resources and Sustainable Ecosystems |
| CGIAR | Consultative Group on International Agricultural Research |
| CIDA | Canadian International Development Agency |
| CITES | Convention on International Trade in Endangered Species |
| CNL | Chevron Nigeria Limited |
| CO | Carbon Monoxide |
| $CO_2$ | Carbon Dioxide |
| CSO | Community Service Organization |
| D&DA | Department of Drought and Desertification Amelioration |
| DDT | Dichlorodiphenyltrichloroethane |
| DFID | Department for International Development (UK) |
| D/G | Democracy and Governance |
| DOE | Department of Energy (U.S.) |
| DOS | Department of State (U.S.) |
| DPK | Dual Purpose Kerosene |
| DPR | Department of Petroleum Resources |
| EA | Environmental Analysis or Assessment |
| EC | Department of Environmental Conservation |
| ECN | Electric Corporation of Nigeria |
| EF&CZM | Department of Erosion, Flood Coastal Zone Management |
| EIA | Environmental Impact Assessment |
| EIS | Environmental Information System |
| EMP | Environmental Management Project (World Bank) |
| EPA | Environmental Protection Agency (U.S.) |
| FAA | Foreign Assistance Act |
| FAO | Food and Agricultural Organization |
| FCCC | Framework Convention on Climate Change |
| FCT | Federal Capital Territory |
| FEPA | Federal Environmental Protection Agency (now FMoE) |
| FMoA | Federal Ministry of Agriculture |

| | |
|---|---|
| FMoE | Federal Ministry of Environment |
| FORMECU | Forestry Management, Evaluation and Coordinating Unit |
| FRIN | Forest Research Institute |
| GAP | Gum Arabic Activity |
| GDP | Gross Domestic Product |
| GEF | Global Environment Facility |
| GFRN | Government of the Federal Republic of Nigeria |
| GIS | Geographic Information System |
| GMO | Genetically Modified Organism |
| GMP | General Management Plan |
| GNP | Gross National Product |
| GPS | Global Positioning System |
| HDI | Human Development Index |
| HIV | Human Immunodeficiency Virus |
| HPFO | High Pour Fuel Oil |
| IBA | Important Bird Area |
| ICBP | International Council for Bird Preservation |
| ICJ | International Court of Justice |
| IFDC | International Fertilizer Development Center |
| IITA | International Institute of Tropical Agriculture |
| IPP | Independent Power Producers |
| IUCN | International Union for the Conservation of Nature |
| JV | Joint Venture |
| KEPA | Kaduna Environmental Protection Agency |
| LG | Local Government |
| LGA | Local Government Association |
| LEEMP | Local Empowerment and Environmental Management Program |
| LNG | Liquefied Natural Gas |
| LPG | Liquefied Petroleum Gas |
| LRFO | Low Pour Fuel Oil |
| LSWC | Lagos State Water Corporation |
| MoE | Ministry of Environment |
| MoWR | Ministry of Water Resources |
| NACGRAB | National Center for Genetic Resources and Biotechnology |
| NAPIMS | National Petroleum Investment Management Services |
| NCE | National Council on the Environment |
| NCF | Nigerian Conservation Foundation |
| NCSC | National Center for State Courts |
| NDDC | Niger Delta Development Commission |
| NDI | National Democratic Institute |
| NEPA | National Electric Power Authority |
| NEST | Nigerian Environmental Action/Study Team |
| NGO | Nongovernmental Organization |
| $NH_3$ | Ammonia |
| NNPC | Nigerian National Petroleum Corporation |
| $NO_2$ | Nitrogen Dioxide |

| | |
|---|---|
| NPS | National Park Service |
| NTFP | Non-Timber Forest Product |
| ODA | Overseas Development Assistance (Philippines) |
| OECD | Organization for Economic Cooperation and Development |
| OP | Overall Priority |
| OPEC | Organization of Petroleum Exporting Countries |
| PC&EH | Department of Pollution Control and Environmental Health |
| PCB | polychlorinated bi-phenyl |
| ppm | parts per million |
| PR&S | Department of Drought and Desertification and Statistics |
| PSC | Production Service Contract |
| PTA | Parent-Teacher Association |
| RECLED | Response, Compensation and Liability for Environmental Damage |
| RSPB | Royal Society for the Protection of Birds |
| RUSEP | Rural Sector Enhancement Program |
| SAFGRAD | Semi-Arid Food Grain Research and Development |
| SCF | standard cubic foot |
| SEPA | State Environmental Protection Agency |
| SG | State Government |
| SO | Strategic Objective |
| $SO_2$ | Sulfur Dioxide |
| SPM | Suspended Particulate Matter |
| STCP | Sustainable Tree Crops Project |
| STD | Sexually Transmitted Disease |
| SWL | Soil and Water Conservation |
| Tcf | trillion cubic feet |
| TCP | Technical Cooperation Program |
| TDGE | Thematic Donor Group on the Environment |
| TSP | Total Suspended Particulates |
| UNCCD | United Nations Convention to Combat Desertification |
| UNDP | United Nations Development Program |
| UNEP | United Nations Environmental Program |
| UNESCO | United Nations Educational, Scientific, and Cultural Organization |
| UNICEF | United Nations International Children's Fund |
| USAID | US Agency for International Development |
| UTF | Unilateral Trust Fund |
| WAGP | West Africa Gas Pipeline |
| WCS | Wildlife Conservation Society |
| WHO | World Health Organization |
| WRI | World Resources Institute |
| WWF | World Wildlife Fund |

# Part I

## Nigeria
## Environmental Analysis

# 1.0 Background

This environmental analysis presents an overview of the environment sector in Nigeria and provides a threats and opportunities assessment that is a formal requirement of the United States Agency for International Development (USAID) strategic planning process. This analysis is designed to support the priority-setting process of USAID/Nigeria as it develops its future programming for the next three to five years.

The formal requirement stems from U.S. Congress' 1986 amendments to the Foreign Assistance Act (FAA), namely Sections 118 and 119 (see Annex A). Its intent was to alert USAID and the foreign assistance community to strong congressional interest in the wise and prudent management of environmental resources in countries where the U.S. provides assistance (Russo, 1994). Sections 118 "Tropical Forests" and 119 "Endangered Species" of the FAA codify the more specific U.S. interests in forests and biological diversity. These two provisions require that all country plans include (a) an analysis of the actions necessary in that country to conserve biological diversity and tropical forests; and (b) the extent to which current or proposed USAID actions meet those needs. Section 118/119 analyses are specific legal requirements of all USAID operating unit strategic plans. It should be noted that ADS 22 CFR 216.5 requires USAID to conduct their assistance programs in a manner that is sensitive to the protection of endangered or threatened species and their critical habitats. These regulations are also in place to help Missions make the best use of current scientific and social research on environment in their decision-making processes.

In 1999, the Africa Bureau approved the USAID/Nigeria two-year Transition Country Strategic Objective. This was approved without adherence to the Automated Directives System (ADS) environmental assessment requirements due to its short timeframe. An extension, until December 2003, of the Transition Strategic Plan was approved in May 2001, with the condition that an environmental assessment now be completed due to the longer term (two to four years) nature of the strategy. This document supports that process by providing a broad overview of threats facing the environment in Nigeria, based on available data and interviews with expert informants within and outside the Mission. Although this document presents the relative severity of the threats facing each sector, these need not necessarily dictate environmental priorities and assistance strategies. Similarly, the opportunities section of this assessment is provided for a broad range of parties who might be interested in addressing "environmental threats in Nigeria."

As noted above, this document is in two parts. Part I is an overall assessment of the environment and environmental quality issues, problems and opportunities in Nigeria. Part II is the direct response to FAA Sections 118/119 and provides the Tropical Forestry and Biodiversity assessment for USAID/Nigeria. Annexes at the end of the document provide additional supporting material. Annex B contains the documents and sources consulted in the course of the analysis exercise and Annex C lists the persons and institutions interviewed and visited throughout the course of the analysis. Annex D is the Scope of Work provided by USAID.

# 2.0 Executive Summary

## 2.1 Purpose

This environmental analysis was conducted to:

- Provide an overall state of the environment report examining the general status, issues, problems and opportunities related to Nigeria's environment sector;
- Identify the primary causes of environmental degradation in Nigeria and suggest options to address them;
- Describe current and successful approaches of interventions in the environmental sector by private interests, bi- and multilateral donors, nongovernmental organizations (NGOs) and other institutions;
- Analyze opportunities and constraints associated with the major elements (forests, land, wildlife, coastal and marine resources, air, water) of the environment;
- Provide recommendations as to how USAID/Nigeria can best integrate special targets of opportunity into its Strategic Objective 2 (SO2) program;
- Provide recommendations as to how USAID/Nigeria might be able to integrate "environment" into its current and future portfolio;
- Provide a concise evaluation of Nigeria's biodiversity and tropical forest resources; and
- Identify the extent to which required actions for conservation are satisfied by current or proposed USAID/Nigeria programs.

## 2.2 Findings

Nigeria's natural environmental resources and the quality of its air, water, and soils are severely threatened. Increasing poverty, high population growth and migration, especially into urban areas, and political/institutional constraints are the underlying causes for environmental degradation in the country.

Nigeria is Africa's most populous nation; one out of every five people in sub-Saharan Africa lives here. Its population growth rate is above three percent and rural to urban migration is making the country's cities some of the largest in the world. Although Nigeria receives considerable revenue from its large multinational oil industry sector, this money rarely trickles down to the populace who are generally poor and growing poorer. This combination of expanding population and increasing poverty puts increasingly severe demands upon the natural environment, the institutional structures and the resources available to manage them. The technical capacity to deal with the enormity of the problem is generally weak and the lack of enforcement of (and compliance with) existing regulations make for huge institutional obstacles when trying to effectively tackle environmental issues.

These causes lead to the major threats of unsustainable use of renewable natural resources, unplanned urban development and oil industry operations that confound sound community practices to manage natural resources for their mutual benefit.

Nigeria presently contains considerable biodiversity as well as some very important tracts of fairly undisturbed tropical forests. Its diversity of natural ecosystems ranges from semi-arid savanna to montane forests, rich seasonal floodplain environments, rainforests, vast freshwater swamp forests and diverse coastal vegetation. Nigeria, in the Niger Delta region, contains the largest remaining tract of mangroves in Africa—the third largest in the world. But all of this is threatened.

Most of the land in Nigeria has been converted to agricultural or pastoral uses and agricultural encroachment threatens the natural areas that remain. Desertification, the loss of soil fertility, insufficient quantities and quality of water and enormous erosion problems have followed in the wake of overuse and mismanagement of the country's resources. Environmental problems that stem from large unplanned urban centers with inadequate solid and municipal waste disposal practices and the impacts of the oil, mining and manufacturing industries are taking their toil on water and air quality in many areas. Add to this the escalating practices of overfishing, uncontrolled logging, and many other unsustainable uses of the natural resources that remain, and threats to the survival of significant components of Nigeria's biodiversity is very real. There is, however, still some hope.

Since the return to democracy in 1999, there has been a renewed interest in environmental management and protection. The newly created Federal Ministry of the Environment (FMoE) is pushing an agenda that makes priority issues of gas flaring, marine and coastal resources degradation, desertification, and industrial and urban pollution. The recently formed Niger Delta Development Commission has a transparent mandate and dynamic leadership to help that unique and resource-rich region seek and develop community-based solutions to the social and environmental problems that have been growing for decades. In many states across the country, there are encouraging signs that public leaders, NGOs and community-based organizations (CBOs) are focusing actively on threats to the environment and donors are moving to help implement environmental activities that result in improved livelihoods for the people of Nigeria.

USAID/Nigeria currently supports vigorous programs in health, democracy and governance, agriculture, education, and energy and infrastructure. While the Mission does not support an environment program, per se, it is worthwhile to note most USAID/Nigeria programming areas could be leveraged to impact positively on environmental management. Conversely, it is also true that improved environmental management would impact positively upon most of USAID/Nigeria's current programming areas.

## 2.3 Conclusions and Recommendations

This analysis identified three major threats to effectively managing Nigeria's environment:

- The unsustainable use of renewable natural resources,
- Unplanned urban development, and
- Petroleum industry operations.

To plan for effective activities and to manage the environment in a more sustainable manner, the GFRN needs to address and mitigate these threats—and the underlying causes of environmental degradation already mentioned: increasing poverty, population growth and migration, and political and institutional constraints. The environmental analysis (EA) team noted that there is not a lack of awareness about the problems and threats to environmental quality or conservation. But there is often a general lack of political will to tackle these issues and problems head-on and with a manner that is organized, consistent, and integrated across sectors. In order to facilitate a discussion and to help improve environmental management and governance, the EA team aggregated what it saw as priority actions into the general areas of:

- Legal and policy reform
- Economic incentives
- Research
- Educational awareness
- Institutional strengthening
- Regulation and enforcement

***Legal and Policy Reform***

Although the federal framework needs work in some areas, it is the states, due to the highly varied nature of the most pressing environmental threats they face, that need to be empowered to develop and enforce legislation promoting sustainable use of environmental resources. Sectoral policies are highly centralized and also suffer from lack of coordination. There needs to be an integrated, multisectoral approach to policy development and implementation at both the national and state levels.

USAID/Nigeria is continuing to gain valuable experience though its democracy and governance programming. Its work with the National Assembly, where members have ranked environment as an important thematic, might be an opportunity for expanded activity. Being aware of elected officials' sensitivity to environmental issues with their constituents and providing support to House and Senate Environment Committees are new places to focus attention. USAID programming has already been involved with the development and implementation of constituency outreach programs in other sectors. Assisting outreach programs grappling with pressing environmental issues such as gully erosion, water use and management, urban sanitation and pollution would be a logical step.

***Economic Incentives***

In Nigeria, the lack of effective resource valuation has strong negative impacts on the management of renewable natural resources and on the sustainable use of water and soils that effect overall quality and production potential. More complete knowledge of markets, better access to markets and use options for resources and their associated risks are unknown, or incomplete. There is considerable room for improvement in just about every economic activity that depends on clean and abundant sources of water, fertile soil, protection of infrastructure and populations from erosion, construction material from trees, food from plants and animals, etc.

Through a variety of programming, USAID/Nigeria is working with partner institutions, researchers, and other donors to improve agricultural practices, expand technologies available to farmers and improve their access to and knowledge of local and international markets for their

production. The recent start of the gum arabic program provides a solid linkage between rural livelihoods and environmental products. There are similar opportunities that can be captured with other high-value or specialty product in other regions of the country, building on the training and management experience being gained with local producer associations. The benefits already being realized under SO2 could be expanded by strengthening ties with the Sustainable Tree Crops Program, exploring additional options for non-timber forest product (NTFP) markets with the International Institute of Tropical Agriculture (IITA) and other partners, and looking at incentives to leverage opportunities with other donor programs/activities in the area of soil fertility and soil and water conservation.

***Research***

Overuse and poor management of existing resources have created enormous problems and substantial holes in Nigeria's natural resource base. Public records at the federal and state levels are poor, and too often out of date. They are nonexistent at the local and community levels, except for the indigenous knowledge of local land stewards. There is a definite need for more information, better science and solid monitoring of environmental change.

Working with IITA, the International Fertilizer Development Center (IFDC), Semi-Arid Food Grain Research and Development (SAFGRAD) and others, USAID/Nigeria has developed a good reputation for providing valuable financial and technical assistance backed with good science. The reputation and assistance associated with these programs is almost exclusively within the domain of the agricultural sector. A slight movement into the greater environmental arena to include water use and water quality, soil and water conservation, gene pools of wild/traditional crops and the management of tree crops and NTFPs could provide added benefits for ongoing programs and count considerably towards increasing conservation and environmental awareness.

***Educational Awareness***

Environmental education and awareness can be part of critical long-term strategies focused on promoting behavioral change to support sustainable environmental management. Programs can be developed to target all audiences ranging from the general populace (through various social marketing actions), to children in schools, to public servants in government, to private institutions.

The focus of USAID/Nigeria's education programming is literacy and the development of interactive radio teaching tools. These actions can easily accommodate environmental messages without drawing significantly on additional resources. By simply "weaving" in topics about environmental quality, actions being taken by Nigerians (farmers, private companies, other land stewards) at the local level related to conservation, and drawing on the growing NGO community can be conscious steps that will lead to increased awareness. State universities and NGOs have already developed "awareness" materials that may, with little or no adaptation, be easily integrated into the literacy function and training of teachers and others.

### *Institutional Strengthening*

The capacity to integrate environmental concerns into economic development planning and activities is extremely weak in Nigeria. Unfortunately in many instances, there is also the lack of political will to even attempt do so. The capacity is greatest at the federal level, but there are usually no "flow-down" mechanisms to the state, and certainly not to the local government levels where environmental threats need to be directly addressed. NGOs and CBOs are numerous, and to their credit, pooling resources and gathering strength in many areas of the country. Many of these latter groups address environmental issues or conflict resolution around environmental degradation problems. Several have direct ties to international groups.

USAID/Nigeria is presently working with producer associations, local traders and exporters to strengthen access to and knowledge about gum arabic markets. Training in marketing techniques as well as management techniques to grow trees and improve yields are examples of activities that will, over time, improve environmental conditions and environmental awareness in areas where the activities take place. Similar institutional strengthening could also occur with producers of other natural/environment products with high or niche value. There are also potential opportunities to assist or leverage programs and institutions in the Niger Delta region in particular. Oil companies are developing broad programs that provide assistance to NGOs and other local institutions that seek to mitigate environmental degradation.

A number of Nigerian NGOs are also actively engaged in environmental education, community conservation and other environmental initiatives. USAID/Nigeria should continue to examine ways to work with international foundations that support NGOs and CBOs operating in Nigeria (e.g., the MacArthur Foundation, the Ford Foundation) that work to empower communities to effectively manage natural resources.

In education, USAID/Nigeria is focusing on literacy training. Using materials that provide an environment and natural history focus would improve environmental awareness at a very basic level and help instill an environmental ethic that is only beginning to show itself in some areas of the country. Additionally, where the attention is on working with civic society entities, such as Parent-Teacher Associations (PTAs) and the like, work could also be done to include related efforts of environmental educational NGOs, such as the Nigerian Conservation Foundation's (NCF) Conservation Club initiatives that are being developed in various locales around the country.

### *Regulation and Enforcement*

Legal and political frameworks for environmental management require further work; considerable gains in improved environmental management could be made by effectively enforcing existing regulations, both in regards to pollution control and biodiversity conservation. Any credible change in Nigeria's enforcement of environmental regulations will require more than simple "capacity building," it will require building the political support or "the political will" to see the regulations enforced. These types of changes are long term and require raising the awareness of a wide range of stakeholders (e.g., resource users, judges, etc.) as to the interrelated nature of environment, economics and health.

One area that could use immediate focus is access to the Ecological Fund. Making the management of the Ecological Fund more transparent, and holding its users more accountable, could go a long way to promoting improved environmental management in Nigeria. Again, USAID/Nigeria's democracy and governance program could provide the most direct link to addressing regulatory issues such as the transparency of this Fund.

Another regulatory area (as well as an institutional one) that would benefit from additional assistance would be in strengthening the court system at the state level. This might first involve raising environmental awareness among court officials, both in a general sense and vis-à-vis the existing legislative framework. This might serve to help strengthen the application of environmental legislation among the judiciary.

Nigeria's environmental problems are extensive. Reversing these trends will require significant political and popular will, not to mention huge amounts of financial and human capital. The process has started and each small step has to be seen only as positive. Within this framework, USAID and other donors and institutions need to work in a coordinated effort to ensure that the scale of their efforts is as large as possible.

## 3.0 Purpose and Approach

This analysis of environment and natural resources in Nigeria was conducted for the purposes of:

- Providing an overall state of the environment report that would examine the general status, issues, problems and opportunities related to Nigeria's environment sector. This assessment reviewed the status and threats to the nation's forest resources, inland waters, and coastal and marine habitats and evaluated them in terms of their biodiversity, their use for subsistence and commercial purposes, governance issues related to their management, and how natural resources and agriculture are related to rural livelihoods and poverty. Urban and energy issues related to the environmental quality of air, water and land resources were also addressed for this nation where almost one-half of the population resides in, or in close proximity to, large cities;
- Identifying the primary causes of environmental degradation and suggesting options to address them;
- Describing current and successful approaches in interventions in the environmental sector by private interests, bilateral and multilateral donors, NGOs and other institutions;
- Analyzing opportunities and constraints associated with the major elements (forests, land, wildlife, coastal and marine resources, air, water) of the environment;
- Providing recommendations as to how USAID/Nigeria can best integrate special targets of opportunity into its SO2 program;
- Providing a concise evaluation of Nigeria's biodiversity and tropical forest resources; and
- Identifying the extent to which required actions for conservation are satisfied by current or proposed USAID/Nigeria programs.

The analysis was conducted by an ARD team of four expatriate specialists with expertise in biodiversity, natural resources management and governance, natural resources policy and energy/urban environmental planning. Key support was also provided by local specialists from the Ibadan-based Center for African Settlement Studies and Development (CASSAD) in the areas of urban planning, water resources, energy, forestry, sociology, agriculture and natural resources. Administrative and logistical support was provided via the Lagos and Abuja offices of Support Management Services, Ltd. A complete list of the team specialists is found in Table 3.1.

The analysis was conducted over a six-week period that began with consultations and a scoping exercise with USAID's Africa Bureau and Global Bureau staff in Washington, DC. Following an intensive period of interviews and documentation review in Abuja, the team traveled to cities and field sites in seven of Nigeria's 36 states reviewing environmental threats, issues and opportunities in five of the nation's six geopolitical regions. Visits, interviews and discussions were held in the field based on the scoping exercise, consultations with USAID/Nigeria staff, discussions with Nigerian government officials, research and other key contacts made by ARD's EA team members. USAID/Nigeria SO2 staff also accompanied the EA team to a majority of the sites visited outside of Abuja.

Additional time was allotted to revising the report based on comments to the draft report by USAID/Nigeria and Africa Bureau. Oral briefings were given at the mid-point and at the end of the in-country visit to USAID/Nigeria staff and the U.S. Ambassador to Nigeria in Abuja. Another briefing was given to Africa Bureau and Global Bureau staff following the submission of the final report document to USAID/Nigeria.

**Table 3.1. Nigeria Environmental Analysis Team**

| Specialist | Specialty Area |
|---|---|
| Steve Dennison, Ph.D. | Team Leader/Natural Resource Economics/Policy |
| Patricia Foster-Turley, Ph.D. | Biodiversity |
| Ramzy Kanaan | Natural Resources Governance |
| Davinder Sood, Ph.D. | Urban Environmental Management and Energy |
| Prof. Nurudeen Adedipe, Ph.D. | Agriculture and Natural Resource Policy |
| Adebayo Alao | Urban Planning |
| Fatai Balogun, Ph.D. | Energy |
| Nicolas Dosumu | Data Collection Specialist |
| Prof. L.K. Jeje, Ph.D. | Water Resources |
| Prof. Bunyamin Ola-Adams, Ph.D. | Biodiversity and Forestry |
| Prof. Adepoju Onibokun, Ph.D. | Sociology and Urban Planning |

# 4.0 The Nigerian Context

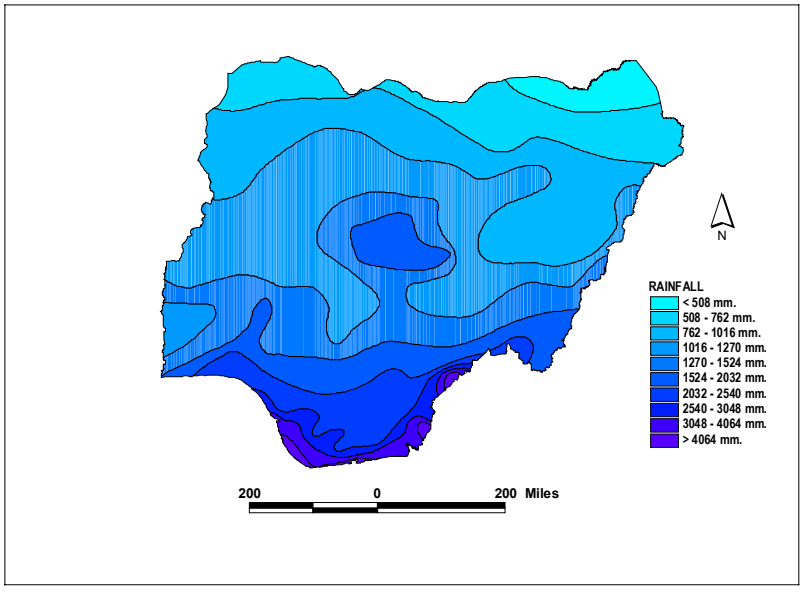
## 4.1 Biophysical

Although not a large country in the general context of Africa, Nigeria's 923,769 km² is quite variable ecologically and physically. Located roughly ten degrees north of the equator and eight degrees east of the Greenwich meridian, this West African country shares its 4,047-km international border with four Francophone nations—Benin, Niger, Chad and Cameroon. Its southern border is the Atlantic Ocean's Gulf of Guinea.

The country is characterized by a strong climatological gradient north to south with definitive dry and wet seasons. It is this gradient that defines Nigeria's ecological zones. Beginning along the northern border with Niger and moving south, the country can be classed into six ecological zones: savanna, lowland rainforest, freshwater swamp forest, mangrove forest and coastal vegetation, and along the eastern border with Cameroon, a montane forest zone. The savanna zone can be further divided into Sahel, Sudan, Guinea and derived savanna zones. The Jos Plateau, in the middle of the country and in the savanna zone, is often given a separate designation due to its higher elevation and vegetation that occurs there but nowhere else in West Africa. Details on these classifications are found elsewhere in this report.

Rainfall in the north rarely exceeds 600 mm annually, and most of this falls during the June to July period. Some regions of the south, in contrast, have as much as 4,000 mm of rain annually and the rainy season is much longer, lasting from February to October. Figure 4.1 provides a general estimate of rainfall regimes in the country.

**Figure 4.1. Rainfall Regime Map of Nigeria**



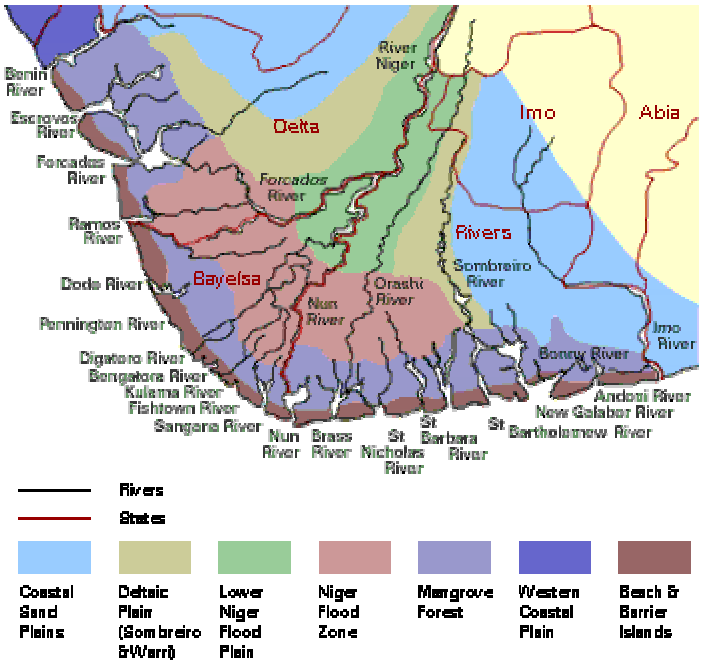

*Source: Beak Consultants et al., 1999.*

Topography in Nigeria is, for the most part, gentle and rolling, punctuated in several areas in the north by low escarpments bordering stream valleys and in the south by broad peneplains formed by the country's river systems. As noted above, the Jos Plateau in the central portion of the country is characterized by rugged terrain and elevations that exceed 5,000 feet above sea level. Along the eastern border with Cameroon, the terrain is mountainous with elevations ranging from over 7,000 feet in the south to peaks of volcanic plugs that have spires greater than 4,000 feet above sea level. Volcanic plugs are also scattered across much of the central part of the country, providing striking contrasts to the savanna vegetation surrounding them. The Yourobaland Plateau, entering from the western border with Benin, points like a long finger running southeast for about 200 km in the southwest portion of the country.

Nigeria is drained by three major river systems. In the north, the Komadougou-Yobe with headwaters formed by the Hadejia, Jama'are and Misau Rivers flows northeast from the north-central portion of the country, eventually forming the border with Niger before it empties into Lake Chad in the extreme northeast corner. This system also comprises the Hadejia-Nguru wetlands, an important freshwater estuary for wildlife.

The Niger River system consists of the Niger itself flowing into the country across its western border juncture with Benin and Niger and southeasterly to the south central part of the country. There it is joined by its major tributary, the Benue River, which flows southwesterly from its headwaters in the mountainous border with Cameroon. From this juncture at Lokoja, it flows almost due south emptying into the Atlantic through the Niger Delta (see Figure 4.2). The Niger River is the third largest in Africa and sixth largest in the world.

**Figure 4.2. The Niger Delta**




*Source: Shell Petroleum Development Company of Nigeria, Ltd.*

Other smaller rivers form the coastal drainage system and are simply classed as east or west depending on their orientation to the Niger Delta.

There are only two water bodies of significance in Nigeria: Lake Chad in the northeast, and Kainji Lake that was formed by damming the Niger River in the west central part of the country. The latter has a surface area of about 127,000 ha. Lake Chad is shared by four countries: Nigeria, Niger, Chad and Cameroon. Nigeria's sector encompasses about 550,000 ha.

Hydrologically, the country is influenced by geologic structure. Areas of igneous structure (primarily the Jos Plateau, the central and southern sections of the country) are dominated by surface runoff while the areas of sedimentary formation are characterized by groundwater retention. The Chad Basin and the Sokoto-Rima Basin in the north are more associated with groundwater than surface water (GFRN, 2000).

The coast and the Niger Delta are comprised of an extensive system of lagoons, barrier beaches, and mangrove swamps stretching along the 853-km coastline from Benin to Cameroon. Much of the western end of the coastline has been degraded due to anthropogenic factors (26% of Nigeria's population lives within 100 km of the coast), and many of the barrier islands on the outer reaches of the Niger Delta are being battered by erosion. But due to inaccessibility by the population at large, portions of the outer Delta and eastern coastline remain in a good natural state.

## 4.2 Socioeconomic

Nigeria is home for the continent's most populous nation, estimated at more than 120 million people. Almost half live in urban areas, the majority of them in large, sprawling cities in the south like Lagos, Ibadan, Warri, Benin City and Port Harcourt. Cities of over 1 million people like Kano, Kaduna and Sokoto also exist in the north. The population is characterized by a strong rural to urban migration. Although the last census was in 1991, annual growth rate estimates are over 3%. Population densities, even in rural areas, especially in the southeast part of the country, are often above 200 persons/km² (NEST, 1991).

Nigeria's people are tremendously diverse, composed of more than 250 ethic groups. Historically this has been a source of civil strife and conflict that continues today. The most populous and politically influential among them are the Hausa and Fulani (30%), Yoruba (20%), Igbo [Ibo] (18%), Ijaw (10%), Kanuri (4%), Ibibio (4%) and Tiv (2%) (Atlapedia, 2000). About half of Nigeria's population are Muslim, forty percent are Christian and the remaining ten percent follow indigenous beliefs.

Following the discovery of oil in the Niger Delta in the 1950s and the rapid development associated with that, significant economic progress was made in the 1970s and 1980s. By the 1990s, the economy was becoming severely hobbled by political instability, corruption and poor macroeconomic mismanagement. Coupled with the continuously increasing population that exerts increasing pressure on urban and rural land and water resources, serious consequences have ensued. One of the most serious is the large number of people who now live under conditions of extreme poverty and deprivation. Nigeria ranks among the low human

development countries of the world. Its Human Development Index (HDI) is 0.439, placing it in the 151st position among the 1,174 nations on the 1998 HDI ranking (UNDP, 2000). Life expectancy at birth is low (56 years) as is gross domestic product (GDP) per capita (US$300) (U.S. DOS, 2000).

Nigeria's economy is dominated by petroleum. It is extremely overdependent on the capital-intensive oil sector, which provides an estimated 80% of the nation's government revenues (GDP), 90 to 95% of its export earnings and over 90% of the foreign exchange earnings (U.S.DOE, 2002). Other sectors pale beside oil. The largely subsistence agriculture sector has not kept pace with rapid population growth and now Nigeria is a food importer, where once it was a net exporter to other countries in the region. According to the World Bank (2001), agriculture's share of the GDP has declined from 33% in 1990 to less than 28% today.

In addition to oil, other industries process coal, tin, palm oil, rubber, hides and skins, textiles, cement, footwear, chemicals, fertilizers and ceramics. Major agricultural production includes cocoa, peanuts, palm oil, corn, rice, sorghum, millet, cassava, yams, rubber, cattle, sheep, goats, pigs, timber and fish (Mapscom, 2001).

## 4.3 Legal/Political

Nigeria is comprised of 36 states and a Federal Capital Territory (FCT) that are grouped in six geopolitical zones. Table 4.1 shows how the states are grouped by zone and Figure 4.3 presents the geographic distribution of the states. The nation's capital, Abuja, was officially moved from Lagos in 1991. The transition to the new capital is still very evident both in terms of physical infrastructure and a transient government population that all but vacates the FCT on weekends.

**Table 4.1. Nigeria's Geopolitical Zones**

| Zone | Constituent States |
|---|---|
| North West | Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto, Zamfara |
| North East | Adamawa, Bauchi, Borno, Gombe, Taraba, Yobe |
| North Central | Benue, Kogi, Kwara, Nassarawa, Niger, Plateau |
| South West | Ekiti, Lagos, Ogun, Ondo, Osun, Oyo |
| South East | Abia, Anambra, Ebonyi, Enugu, Imo |
| South South | Akwa-Ibom, Bayelsa, Cross-River, Delta, Edo, Rivers |
| Federal Capital Territory | Abuja |

The current constitution was adopted in 1999 and the present government represents the first democratically elected body in more than thirty years. The executive branch consists of the president, who is both chief of state and the head of government, elected by popular vote for no more than two four-year terms. (The next presidential election is scheduled for 2003.) The Federal Executive Council, an appointed body, functions as a cabinet within the executive branch.

The legislature is bicameral consisting of a Senate (with 103 seats, three from each state, one from the FCT) elected by popular vote to serve four-year terms, and a House of Representatives, also elected by popular vote to serve four-year terms. The next election period is scheduled for 2003. Because both the executive branch and the legislature will be popularly elected in 2003,

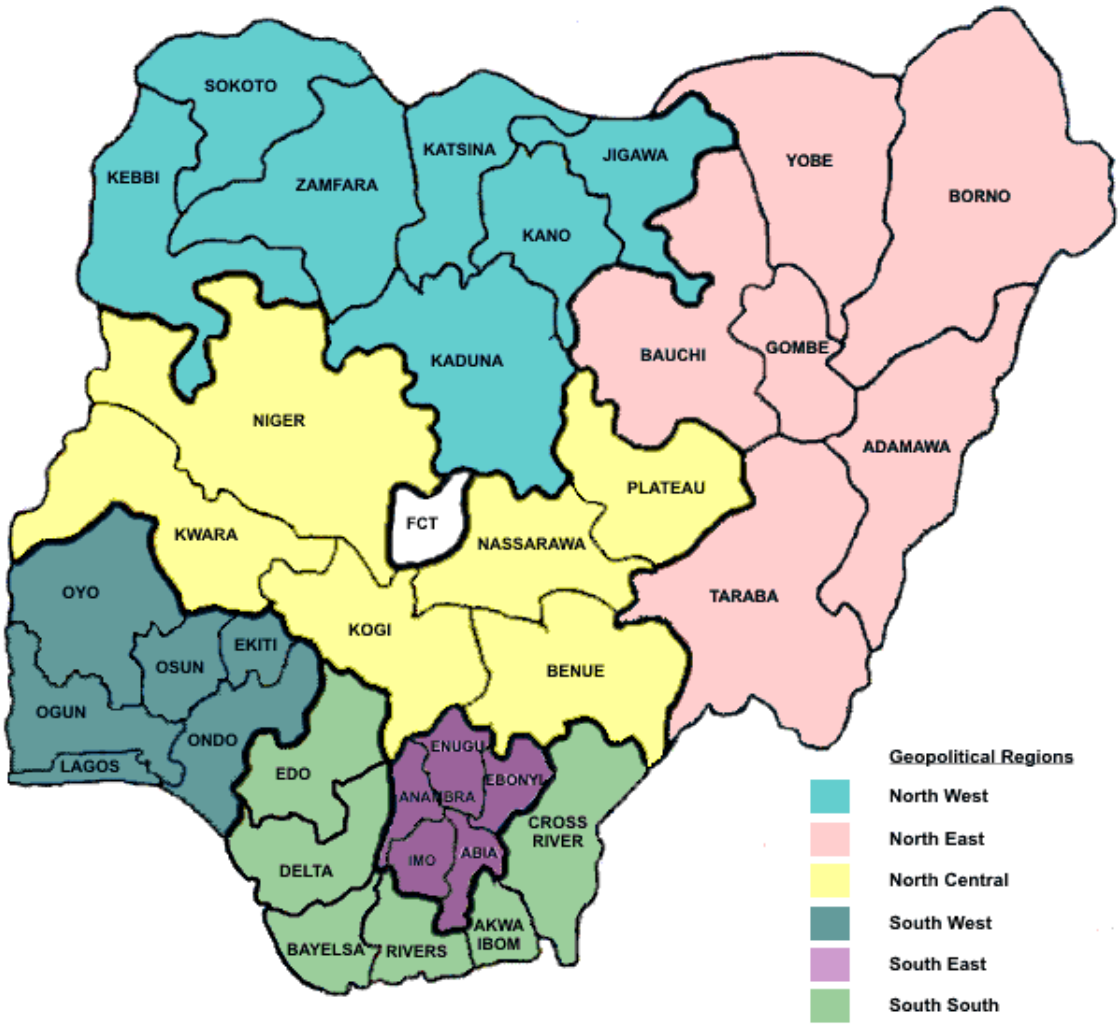



**Figure 4.3. The States and Federal Capital Territory of Nigeria**

the political and economic agendas in the period leading up to the vote are apt to be the only focus of action for the country.

The judicial branch is made up of the Supreme Court with judges appointed by the Provisional Ruling Council and the Federal Court of Appeals with judges appointed by the federal government on the advice of an Advisory Judicial Committee.

State governments are headed by a governor who appoints commissioners to oversee various state ministries. It is noteworthy that state ministry structure varies between states and does not necessarily follow the federal model. Local government associations (LGAs) function as the main supporting bodies for activities within each state.

The next section provides a broad overview of the constitutional and legislative, and institutional and policy frameworks for environmental management and protection.

# 5.0 Constitutional and Legislative Framework for Environmental Management

The Constitution of the Government of the Federal Republic of Nigeria (GFRN-1999) provides for a three-tiered governmental structure, that consists of the federal government (GFRN), the state governments (SGs), and the local governments (LGs). The Constitution specifies the roles and jurisdictions of the three tiers of government and describes the powers vested in the three arms of government—the executive, the legislative and the judicial—at each tier. The legislative and judicial arms of government are highlighted in this section, vis-à-vis their roles in environmental management. The executive arm of government, including the federal ministries, state ministries and the service departments of LGs, are discussed in Section 6, Nigeria's Institutional and Policy Framework for Environmental Management.

## 5.1 Constitutional Framework for Environmental Management

The Environmental Objectives and Directive of State Policy on the Environment contained in the Constitution state that, "the State shall protect and improve the environment and safeguard the water, air and land, forest and wildlife of Nigeria" (Constitution, Chapter 2, Article 28). In an effort to develop a framework within which the goals of protecting and improving the environment can be realized, the Constitution allocates certain legislative competencies to each of the three tiers of government. The responsibility for applying the legislation falls to the judiciary. The specific competencies of the National Assembly, the state assemblies and the local government councils are discussed below.

***The Executive Legislative List***

Part I of the Second Schedule to the Constitution contains the Exclusive Legislative List, which documents the realms over which the National Assembly of the GFRN is solely empowered to make, amend and repeal legislation. From the perspective of environmental management and protection these realms include, but are not limited to coastal and marine fisheries; mines and minerals—including oil fields and oil mining, national parks, and water—from sources affecting more than one state.

***The Concurrent Legislative List***

Part II of the Second Schedule to the Constitution, the Concurrent Legislative List, describes the realms over which both the National Assembly of the GFRN and the House of Assembly of any state, are empowered to act. From an environmental perspective these realms include the generation, transmission and distribution of electricity to areas not covered by the national grid system; the establishment of research centers for agricultural studies; the regulation and coordination of scientific research; industrial, commercial and agricultural development.

***The Functions of Local Government Councils***

Part I of the Fourth Schedule to the Constitution, the Functions of Local Government Councils, describe the roles and jurisdictions of local government councils. Again, from the perspective of

environmental management and protection these realms include the consideration and making of recommendations to a state commission on economic planning and development; the development of agriculture and natural resources—other than the exploitation of minerals; and the establishment and maintenance of infrastructure, public markets, etc.

As a whole, the constitutional framework for environmental management remains highly centralized. The result is a system in which the federal and state governments are given the primary responsibility for developing and applying the legislative framework for environmental management, including the provision of supervisory and regulatory functions, while the primary responsibility for economic planning and development resides with LGs. In addition to increasing the capacity of LGs to integrate environmental planning and management into their day-to-day activities, decentralizing certain supervisory and regulatory functions to institutions at the local level—institutions with some incentive and capacity to carry out regular activities on-the-ground—could go a long way toward supporting improved environmental management

## 5.2 The Federal, State and Local Government Legislative Framework for Environmental Management

The legislative framework for environmental management by the federal government, state and local governments are discussed below.

### 5.2.1 The Federal Legislative Framework for Environmental Management

The legislative arm of the GFRN, the National Assembly, is a bicameral legislative body comprised of the Senate and the House of Representatives. In addition to participating in the general activities of the House and Senate, members are also assigned to topical committees. The House and Senate Committees on the Environment are given primary responsibility for the review and oversight of the existing environmental legislation, the collection and analysis of relevant information, and the development of informed draft legislation designed to strengthen the legal framework for environmental management. These committees are each comprised of five sub-committees: Biodiversity Conservation, Desertification, Erosion and Flood Control, Industrial Waste Management, and Pollution Control. It is the responsibility of these sub-committees to focus on strengthening the legislative framework relevant to their assigned technical areas.

During the 1990s, the federal government took substantial steps toward integrating environmental concerns into the developmental planning and implementation process. As part of this effort some of the major steps taken by the GFRN include:

- The enactment of the EIA Decree (1992), to integrate environmental concerns into all major activities throughout the country. Procedural and Sectoral Guidelines for Agriculture and Rural Development, Oil and Gas, Infrastructural Manufacturing and Mining activities in the country were also put in place.
- The establishment of Guidelines and Standards for Environmental Pollution Control, Regulations on Effluent Limitations, Pollution Abatement in Industries, as well as Regulations for the Management of Solid and Hazardous Wastes.

- The enactment of the National Parks Decree (1991; revised in 1999), establishing the National Park Service as a parastatal (paramilitary) organization under the Federal Ministry of Environment (FMoE), responsible for the planning and management of the National Park System, and its constituent National Parks.

Since the return to democracy, and in light of the changing times and changing environ-mental, economic and social priorities, the House and Senate Committees on the Environment have recently started to review existing environmental legislation. Stemming in part from this review, but more so from the pressing environmental concerns of their constituents, the House and Senate Committees on the Environment have already developed pieces of draft environmental legislation (e.g., a bill, drafted by the House Committee on the Environment, to study and mitigate the effects of gully erosion is currently pending approval of the Senate.

In spite of recent legislative developments, there remains a pressing need to comprehensively review and evaluate the applicability and efficacy of the existing legal framework for environmental management and protection. Many of the existing environmental laws date back to the colonial era, and in some cases these laws are outdated or even irrelevant (Caldecott, J. & A. Babatunde Morakinyo, 1996). In other cases, gaps exist in the legal framework, or in the legal-institutional linkages that must be addressed if the framework is going to serve as an effective tool for promoting improved environmental management and protection (Olaniran, O., 2000). The National Assembly and its constituent committees are very new institutions. And while their capacity for legislative review and development continues to increase, the technical understanding of "what makes good environmental legislation" is largely lacking. In order to bridge this gap, additional technical resources will be needed to assist the National Assembly.

### 5.2.2 The State Legislative Framework for Environmental Management

The SG legislative arm is comprised of a unicameral legislative body, the House of Assembly, headed by the Speaker. At present, state assemblies vary in terms of their capacity to review and develop quality legislation (Wayne Propst, 2002). Many of the state assemblies, as yet, do not have environment committees; even in those state assemblies that have established environment committees, most committee members lack both general experience in the legislative review and development process, and the technical capacity necessary to effectively inform the legislative review and development process.

As with federal legislation, many of the existing state environmental laws are remnants from the colonial era. However, the incidence in the development of new state-level environmental legislation appears to be increasing. In most cases, the development of new legislation is targeted to curtail the degradation or promote the improved management of those natural resources that are particularly important to a state's economy.

**Box 5.1. Examples of State-Level Environmental Legislation**

***In Cross River State:*** A heavily forested state located in the very southeast of Nigeria (in the South South Geopolitical Zone) with important coastal, wetland and riverine areas.

- A new Forestry Commission Bill was signed into law in late 1999 that established the Forestry Commission as an independent institution separate from the Commission for Agriculture.
- A draft fisheries/aquaculture is currently before the State Assembly for approval that is designed to further protect important local fish species and establish guidelines for aquaculture development.

***In Kaduna State:*** An important agricultural state located in the Geopolitical North West, is home to large tracts of savanna and plantation forests. The state capital is also a large industrial base.

- A bush burning law has been passed, in an attempt to stop the practice of burning savanna to clear new land for agriculture.
- In recognition of the Kaduna River's importance for both agricultural and human uses, regulations were passed in the late 1990s targeting the control of industrial sources of water pollution.

In both cases, the legislation and regulations target the conservation and/or improved management of natural resources that are vital to the livelihoods of the local populations.

### 5.2.3 The Local Government Legislative Framework for Environmental Management

Nigeria's 36 states and the FCT are comprised of 774 LGAs. The LG legislative arm is the legislative council. Unlike their federal and state government counterparts, LGs are not empowered to enact, repeal or revise legislation (although they do have the some latitude to develop and enforce local by-laws). Instead their role, in general terms, is twofold: to make recommendations to state institutions regarding economic planning and development, and to serve as the basic vehicle (of the state) for development at the LGA level (GFRN, Report of the Presidential Committee on the Review of the 1999 Constitution, Fourth Schedule, Part 1, 2001).

Within the current environmental management and protection framework, LGs are by and large excluded from participating in the legislative review, revision and redrafting process. This not only limits local-level inputs into the legislative process, but also serves to decrease local-level institutions awareness of and ownership over environmental management and protection. In order to effectively build local-level capacity for environmental management and protection key local-level institutions will need to become actively involved in the legislative process.

## 5.3 The Judicial Framework for Environmental Protection

The judiciary arm of the government is responsible for applying the legal framework at the federal, state and local government levels. At the federal government level, the judiciary is comprised of the Supreme Court and the Federal Court of Appeals. At the state level, the judiciary is comprised of the Federal High Courts. There is no judiciary flow-down to LGs. Instead, state courts are responsible for applying the legal framework at the LG level. Also operating at the local level, but not under the control of the judiciary, are both traditional courts

and Sharia courts, which are empowered to rule on a variety of civil issues—some of which impact access to renewable natural resources (e.g., inheritance).

**Box 5.2. Land Tenure and Land Use**

Land tenure and land use in Nigeria are governed by a combination of statutory and customary laws. Land tenure rules provide for the right to own or possess land, while land use rules provide for the right to use land in a certain way; land tenure rights normally include use rights, and are therefore more comprehensive in scope (Gunding, 2000).

The *Federal Land Use Decree of 1978* was designed to regulate ownership of land, the principles of land tenure, rents and rights of occupancy (Federal Land Use Decree, Sec.1). The motivation behind the establishment of the decree was fourfold: to make land more easily available for development, to reduce the cost of acquiring land for development, to facilitate planned development of settlements, and to eliminate land speculation—especially in urban and peri-urban areas. Essentially, the decree allowed for the transfer of land tenure from traditional rulers, village heads, heads of family, etc. to the state, and according to the decree, overall responsibility for the control and management of land in urban areas, including land allocation, was to become the responsibility of the governor of each state. Responsibility for land allocation in rural areas was to fall to local government. In practice, however, the decree has failed to supersede customary law for communal ownership of land resources and has never been fully enforced.

There are three basic, *de facto*, tenural systems in force in Nigeria. These are:

- **State Tenure** — **Under this system, land estates are put under the management of the state (either federal or state government; e.g., National Parks, State Forest Reserves, etc.), to be held in trust and administered for the use and benefit of the local—and larger—Nigerian population.**
- **Communal Tenure** — **Here, members of a community hold customary rights to land within the area controlled by that community. Within this system families, special interest groups and individuals may be granted usufruct rights over certain parcels of land and associated resources. Traditional rulers or village heads are generally responsible for exercising control over the management of unallocated community holdings. Generally, communal lands are not alienable.**
- **Private Tenure** — **In this case, property acquired through purchase, inheritance, gift or exchange, is held exclusively by an individual or a corporate entity.**

While in many parts of Nigeria land tenure continues to be a contentious point and a source of conflict—between communities and the state; among communities; and among individuals—environmental degradation seems to be less directly tied to any one land tenure system, and more directly to:

- conflict between land tenure systems (especially between state and communal systems), and
- resource management practices associated with certain land use systems.

Currently no land use policy exists in Nigeria. Instead, states are encouraged to derive their legislation from the Federal legislative framework. While some states have taken steps to develop legislation to improve (from an environmental perspective) resource management through decrees against bush burning, agricultural expansion into forest lands, etc., major impediments to sustainable environmental management still exist. Two key land tenure and land use issues that require future consideration include how to mediate/resolve problems that arise between tenure systems; and how, within the various tenure systems, to support policy/institutional frameworks that are capable of promoting the sustainable use of natural resources.

To date, the application of existing environmental laws by the judiciary has been largely inconsistent and ineffective. The problems in applying the legal framework seem to stem from a

combination of the lack of the necessary political will, and a general lack of awareness of the interrelated nature of environment, economics and health. To overcome these constraints, environmental awareness and capacity-building activities will need to be developed that target the judiciary as a key stakeholder in the environmental management process.

## 5.4 International Conventions and Treaties

In addition to Nigeria's federal environmental law framework, the country is also party to various international environmental conventions and treaties designed to promote environmental management and protection. A summary list of the environmental conventions and treaties signed by the GFRN are included in Table 5.1. Following the table in Box 5.3 is a summary of specific steps taken by the GFRN toward the implementation of two of these conventions and treaties: the Convention on Biological Diversity, and the Framework Convention on Climate Change.

**Table 5.1. Environmental Conventions and Treaties Ratified by GFRN**

| Convention/Treaty | Date Ratified by GFRN |
|---|---|
| Convention on the Protection of the World Cultural and Natural Heritage | 1974 |
| Convention on the Prevention of Marine Pollution by the Dumping of Wastes | TBD |
| Convention on International Trade in Endangered Species (CITES) | 1974 |
| Convention on the Conservation of Migratory Species of Wild Animals | 1987 (Signatory only) |
| Convention on the Law of the Sea | 1986 |
| Vienne Convention on the Protection of the Ozone Layer | 2001 |
| Montreal Protocol on Substance that Deplete the Ozone Layer | 1988 |
| Basel Convention on the Transboundary Movement of Hazardous Wastes and their Disposal | 1991 |
| Framework Convention of Climate Change (FCCC) | 1994 |
| Convention on Biological Diversity (CBD) | 1994 |
| Convention on Desertification (CD) | 1997 |

**Box 5.3. GFRN Steps Toward Implementation of CBD and FCCC**

***Convention on Biological Diversity*** – In implementing the CBD the GFRN has taken some important steps, including the preparation of the first National Report for the Conference of Parties, the development of the National Biodiversity Strategy and Action Plan (which is presently under revision and is expected to be completed in June 2002). Equally important, the GFRN has also taken important steps toward integrating biodiversity concerns into the development process, including the formulation of policies on conservation and sustainable use of biological diversity, and the development of national guidelines for biosafety, assessment of biodiversity status and the EIA process.

***Framework Convention to Climate Change*** – Since ratifying the FCCC, the GFRN has packaged a Climate Change Mitigation Program that includes taking an inventory of the greenhouse gases in the country's atmosphere. In addition, the Climate Change Mitigation Program is undertaking field studies in various locations throughout the country, which are vulnerable to the impact of climate change—including the Niger Delta. Presently the GFRN, with the assistance of CIDA and other donors, is working to strengthen the capacity of governmental institutions to comply with the FCCC requirements. This activity works with federal and local governments as well as with NGO and media communities to raise awareness and focus attention on issues related to climate change. A national action plan to mitigate the causes and effects of climate change in Nigeria is currently under preparation.

# 6.0 Institutional and Policy Framework for Environmental Management

Historically, the institutional framework for environmental management in Nigeria has been inconsistent and the policy framework has lacked an integrated approach, both at the federal level of policy development, and at the state and local government agency level of policy implementation. These problems have been compounded by an extended period of political instability, during which time environment management has, by and large, lacked the support of government. The result has been an often changing, yet highly centralized institutional and policy framework, that suffers from problems of institutional overlaps—and associated problems, such as lack of adequate resources.

## 6.1 Federal Institutional and Policy Framework

The federal institutional framework for environmental management has been in a state of almost constant flux for the past quarter century. During this time, primary responsibility for environmental management by federal government has shifted numerous times—from the Ministry of Economic Development in 1975, to the Ministry of Works and Housing in 1979, to the Federal Environmental Protection Agency (FEPA) in 1988, and to the Ministry of Environment (FMoE) in 1999. This flux in national-level institutions has resulted in an inconsistent approach toward policy development at the federal level, and has led to an even more inconsistent approach toward policy implementation at the levels of state and local government.

Primary responsibility for the development of policies, strategies and action plans resides with the sectoral federal government agencies. Over the past ten years, several sound policies, such as the Policy on the Environment and the National Urban Development Policy, have been developed through participatory processes that have solicited broad stakeholder input from the various levels of government, civil society organizations and the private sector. However, the majority of sectoral policies, strategies and action plans have been developed with little or no input from stakeholders outside of the centralized lead sectoral GFRN agency (Onibokun, 2002)—the result of which has been policies that lack input vital to successful implementation at the state and local government levels.

On another level, the overall policy framework for environmental management lacks intersectoral coordination. Environmental management is, by its very nature, cross-sectoral. However, to date very little cross-sectoral coordination in policy development has been attempted (the Interim Poverty Reduction Strategy and the Green Agenda 2010 are two notable exceptions—both of which were developed under the office of the Vice President with broad stakeholder input). The result has been the development of a series of sectoral policies, strategies and action plans, with conflicting goals and more so, conflicting guidance on approaches for the utilization of environmental resources. These conflicting national-level policies, strategies and action plans "flow down" to state and local governments for implementation, further decreasing the possibility of sound environmental management at the local level.

This section will begin with an overview of the structure and policy of the FMoE. This will be followed by a brief discussion of other national-level agencies with a hand in environmental management in Nigeria.

### 6.1.1 Federal Ministry of Environment/Policy on the Environment

In June 1999, the newly elected democratic government, in an effort to ensure that environmental issues receive priority attention in the Nigeria's development agenda, created the FMoE. To consolidate the primary responsibility for environmental management in one institution, the FMoE absorbed FEPA and accepted the transfer of relevant departments and units from various other federal ministries (e.g., Forestry Department from the Federal Ministry of Agriculture [FMoA], Soil Erosion and Flood Control Department from the Ministry of Water Resources [MoWR]). The broad mandate of the FMoE, as elaborated in the revised 1999 National Policy on the Environment, is to coordinate environmental protection and natural resource conservation for sustainable development, and specifically to:

- Secure a quality of environment adequate for good health and well being,
- Promote the sustainable use of natural resources,
- Restore and maintain the ecosystem and ecological processes and preserve biodiversity,
- Raise public awareness and promote understanding of linkages between environment and development, and
- Cooperate with government bodies and other countries and international organizations on environmental matters (GFRN, 2000).

FMoE's structure is comprised of eight departments (seven technical and one administrative), four supporting services units, and two parastatals. As one can imagine with a new ministry, comprised primarily of departments and units absorbed from other federal agencies, the organization is undergoing some "growing pains." But overall, the division of responsibilities for environmental management and protection among the seven technical departments and the two parastatals are fairly clear (with a few exceptions). A summary of the primary responsibilities of the seven technical departments and two parastatals follows:

- Department of Planning Research & Statistics (PR&S) – PR&S is comprised of three divisions, and assumes overall responsibility for FMoE coordination. Planning is responsible for the development of rolling plans, and the coordination of State Ministries of Environment (MoEs). Council Affairs is the responsible arm of the Ministry for the coordination of international affairs (Global Environment Facility [GEF], United Nations Development Program [UNDP], etc.), and for liaison with the National Council on Environment. Research and Statistics is charged with a range of tasks related to operational, organizational and management research, as well as development and maintenance of the Ministry's library services and publications.

- Department of Drought and Desertification Amelioration (D&DA) – D&DA operates through two divisions. Drought & Desertification Forecasting and Preparedness is responsible for identifying vulnerable areas, developing early warning systems and preparedness contingency plans, and monitoring the impact of global climate change on

drought and desertification. Drought & Desertification Management is responsible for a range of renewable natural resource planning and management activities (including rangeland management, fuelwood management, etc.), in addition to targeted interventions (e.g., dune fixation, soil and water management, etc.), in areas at risk from drought and desertification.

- Department of Environmental Assessment (EA) – EA consists of three divisions. Environmental Standards and Monitoring is responsible for the development and management of reference laboratories, analytical services and environmental studies. Oil and Gas Pollution Control is charged with developing and enforcing guidelines and standards for the oil and gas industry. EIA is primarily responsible for EIA guideline development and EIA processing.

- Department of Environmental Conservation (EC) – EC is comprised of two divisions. Biodiversity and Endangered Species Conservation is responsible for zoological and botanical surveys, wildlife inventory and monitoring, exotic and invasive species control, and management and enforcement of CITES. Nature Conservation and Watershed Management is responsible for protection of biosphere and nature reserves, registration, documentation and operations of protected areas, management of wetlands of national and international importance, and delineation and characterization of major watersheds and fadamas.

- Department of Erosion and Flood Coastal Zone Management (EF&CZM) – EF&CZM is comprised of three divisions. Soil Erosion Monitoring and Control is responsible for land degradation hazard assessment and monitoring and assessment of gully erosion areas. Flood Forecasting Monitoring and Control is charged with flood plain mapping and monitoring and maintenance of flood control infrastructure. Coastal Zone Management is responsible for monitoring and controlling coastal and river bank erosion, coastal land management, and dredging and reclamation of affected areas.

- Department of Forestry (F) – the Forestry Department is comprised of three divisions. Forest Resources Survey and Products Utilization is responsible for, among other things, the utilization, processing, promotion and marketing of certain non-timber forest products (NTFPs - e.g., gum arabic). Agro-Forestry Support Services and Extension is charged with agroforestry and communal forestry development, and the development of nurseries. Forest Management is charged with forest reserve management, forest fire prevention and control, and forest pest and disease monitoring and control.

- Department of Pollution Control and Environmental Health (PC&EH) – PC&EH consists of three divisions. Environmental Health and Sanitation is responsible for establishing guidelines and monitoring domestic waste management facilities (and eventually sewerage management and treatment plants). Pollution Abatement and Waste Management is primarily responsible for the oversight of industrial treatment facilities. Industrial Compliance and Chemical Management is responsible for ensuring compliance with regulations and standards governing pollution from industrial and chemical sources.

- National Parks Service (NPS) – NPS, a parastatal (paramilitary) under the FMoE responsible for the planning and management of the National Park System, and its constituent National Parks.

- Forest Research Institute of Nigeria (FRIN) – FRIN, a parastatal under the FMoE that is primarily responsible forest research, including the inventory of Nigeria's forests and forest resources.

While still a young organization, the FMoE shows promise. The organization is staffed by a cadre of professionals trained in and aware of the intricacies of environmental management, who appear to be tackling many of the in-house requirements of the Ministry. That being said, the Ministry's inability to effectively integrate (both horizontally—to the various sectoral federal government agencies whose activities impact upon the environment; and vertically—to the state and local government levels) environmental concerns into the planning and development activities of other governmental agencies, especially those in the productive sectors, very seriously impacts upon the potential for improving environmental management. In order to affect any real change will require the full support of the government to establish effective linkages and lines of communication between the FMoE and the various federal, state and local government agencies responsible for planning and development activities on the ground.

### 6.1.2 Other Federal Institutions Playing Important Roles in Environmental Management

***The National Council on the Environment***

The National Council on the Environment (NCE) was established in 1990 to provide a forum for the consultation and harmonization of environmental management throughout the federation. Membership includes the commissioners of environment from all 36 states, as well as the secretaries to the state governments. Officially, the role of the NCE is twofold: to advise the presidency on environmental matters, and to assist in the development of sound environmental policies.

***The Ecological Fund***

The Ecological Fund was established as a financing mechanism to support a wide range of initiatives that promote improved environmental management. The Fund is supported by an annual earmark of 2% of the Federal Account. The organization of the Ecological Fund is comprised of four committees: Desertification, Erosion, Gas and Oil, and General Environmental Matters. Any federal or state government agency can, in theory, apply for funds to address pressing environmental problems that fall under any of these four categories. For those activities selected to receive support from the Fund, allocations are made directly from the Fund to the state government (through the governor) in which the activity is to be implemented. While the annual earmark is sufficient to simultaneously address a wide range of environmental activities, mismanagement of funds—and in particular the "misdirection" of funds by governors to support other priorities (e.g., state employee salaries, education and health initiatives, etc.)—drastically impacts the functionality and efficacy of the Ecological Fund.

### 6.1.3 Sectoral GFRN Agencies and Policies

There are a large number of sectoral GFRN agencies whose policies and activities have a direct impact on the environment. These include:

- The Ministry of Water Resources (freshwater resources),
- The Ministry of Health (environmental health),
- The Ministry of Agriculture (land use, agriculture, livestock & fisheries),
- The Ministry of Transport & National Maritime Authority (coastal & marine resources management),
- The Ministry of Education (environmental education),
- The Ministry of Works and Housing (infrastructure development),
- The Ministry of Solid Minerals (non-oil mineral resources),
- The Ministry of Power and Steel (energy production),
- The Ministry of Culture and Tourism (tourism), and
- The Nigerian National Petroleum Corporation (NNPC-petroleum).

Between (and often times within) these ministries, the division of roles and responsibilities over natural resources and other aspects of the environment are unclear, and overlaps in institutional mandates are the norm, rather than the exception. In the case of freshwater resources, the MoWR is considered the lead institution. However, the Ministries of Health, Agriculture and Works and Housing all contain departments, units or parastatals that focus on aspects of water resource management. This, in and of itself, is not a problem but the lack of interministerial coordination and collaboration—and the cascading effects this situation has at the state and local government levels, results in considerable inefficiency.

## 6.2 State and Local Government Institutional and Policy Frameworks to Support Environmental Management and Protection

### 6.2.1 State Government Institutional and Policy Framework for Environmental Management and Protection

The institutional and policy framework for environmental management at the state level is variable from one state to another. Prior to the establishment of the FMoE, the responsibility for environmental protection resided with the State Environmental Protection Agency. Stemming from the creation of the FMoE, each state is expected to establish a state MoE to assume primary responsibility for implementation of the National Policy on the Environment at the state level. However, in reality many states have yet to establish MoEs, and in those states where they have been established, the institutional structure—and the staff skills contained therein—are inconsistent. While many states, such as Kaduna and Lagos, have established state MoEs which can be supported in their capacity to promote improved environmental management and regulate enforcement at the state level; other states such as Cross River have yet to establish a MoE. In such cases, the lack of an established institutional presence capable of serving as the "champion" for environmental management and protection at the state level is one of the first obstacles that needs to be overcome for environmental management to truly take hold.

### 6.2.2 Local Government Institutional and Policy Framework for Environmental Management and Protection

As already stated, local governments are charged with the responsibility for economic planning and development at the local level. While still quite weak, there is a general sense that the functional capacity of local governments is increasing. That being said, the current ability to local governments to integrate environmental management and protection into their economic development plans is still extremely weak. One major cause is the lack of an institutional flow down from the federal and state MoEs to the local government level, which severely impacts the ability of local governments to incorporate environmental concerns and priorities into their work. Typically, local governments are comprised of six departments: Administration, Finance, Works, Agriculture, Health, and Education and Social Services. While the technical skill contained in these six departments continues to increase, there is generally no local government official aware of existing environmental legislation and regulations, let alone conversant in environmental management. This lack of capacity at the local level is one of the most critical issues to be addressed if effective environmental management and protection is to be realized.

## 6.3 Civil Society Organizations Supporting Environmental Management

A growing number of civil society organizations are becoming active partners in Nigeria's environment sector. Currently, NGOs are working to improve various aspects of environmental management and protection, from conservation to urban environmental management. The roles played by these civil society organizations include advocacy, education, community development, training and the provision of financial and techncial assistance. A brief summary of the environmental NGOs follows.

The Nigerian Conservation Foundation (NCF) formed partnerships with the World Wildlife Fund (WWF)-UK, and Birdlife International has grown into Nigeria's largest and most active conservation NGO. A range of other conservation NGOs have become well established over the past 15 years. These include the Nigerian Environmental Action/Study Team (NEST), Savanna Conservation Nigeria, the Center for Environmental Resources and Sustainable Ecosystems (CERASE), Delta Environmental Network, the Niger Delta Wetlands Center, the NGO Coalition for Environment, Cercopan and Pandrillus. Although the GFRN is not a member of the Union for Conservation for Nature (IUCN), four Nigerian NGOs are members: NCF, NEST, CERASE and Savanna Conservation. Various international NGOs, including Wetlands International, the Wildlife Conservation Society (WCS) and others also have ongoing programs within Nigeria.

## 6.4 Private Sector Organizations Supporting Environmental Management

Private sector investment in environmental management in Nigeria continues to increase. The private sector organizations supporting environmental management range from oil companies and technical assistance firms to international foundations. Brief summaries of the types of initiatives supported by these organizations are provided below.

***Private Foundations***

- ***The A.G. Leventis Foundation*** is a private charitable foundation that supports a wide range of development activities around the world. The Leventis Foundation Nigeria supports activities in West Africa and is very active in the fields of agriculture, education and environmental conservation. The Leventis Foundation Nigeria has established and continues to support three agricultural schools specializing in innovative ways of training small farmers to improve productivity, efficiency and environmental sensitivity that take advantage of the latest research at the IITA and elsewhere. The trainees spend a year at the schools, and then returning to their farms and communities, are advised and supported by the schools' extension programs. By their example, they transfer their skills to other farmers in their area, while the schools also organize shorter training courses and farmers' days for the surrounding communities. In the field of environmental conservation, the Foundation provides support to a number of environmental NGOs including the NCF and Pro-Natura International. A major contribution in this field involves the construction of a Resources Center at Okomu, in a government-protected high rainfall forest area in Edo State; and the setting up of an agroforestry conservation program for local farmers.

- ***The Ford Foundation*** is a private grant making institution whose goals are to strengthen democratic values, reduce poverty and injustice, promote international cooperation, and advance human achievement. The Ford Foundation has been supported activities in Nigeria for more than 40 years. Through the Foundation's Community and Resource Development Program it has provided support to community development associations (CDAs) and action-research NGOs that work to reduce poverty and improve natural resources management. The Community Resource Development Program also provides support for micro-finance projects that target women's groups and poor communities, and is helping to build and strengthen sustainable sources of asset building. A special emphasis is placed on supporting community-based projects that enhance livelihoods while preserving the environment.

- ***The John D. and Catherine T. MacArthur Foundation*** is a private, independent grant making institution that supports research, policy development, information dissemination, and education and training in four programming areas. The Foundation's environmental activities are primarily supported through the Program on Global Security and Sustainability. The Foundation has five overseas offices, one of which is located in Nigeria. In Nigeria, the MacArthur Foundation provides support to a number of organizations involved in the promotion of improved environmental management, many of which are focused on issues related to the Niger Delta, including The Niger Delta Wetlands Center in Port Harcourt, and Pro-Natura International in Iddo. In addition, the MacArthur Foundation also supports conservation initiatives based in the U.S. that focus on activities in Africa, including the Africa Biodiversity Collaborative Group—supporting collaborative work for biodiversity conservation in Africa, and the American Zoo and Aquarium Association—supporting an international planning meeting about the bushmeat crisis in Africa.

### *Oil Companies*

While the oil companies and their operations continue to be a source of environmental degradation—especially in the Delta—they are also increasingly providing support for community development activities. While the commitment of these companies to community development and environmental management are highly variable, certain companies appear to be making genuine efforts to engage local stakeholders and to provide support for local-level priorities. Shell (2000b) reports spending more than US$ 60 million in the five-year period, 1996-2000, on community activities ranging from healthcare to schools to agriculture to water and sanitation. Chevron Nigeria Limited (CNL) reports to have invested more than $30 million over the past five years to support a range of development activities. Two examples of CNL-supported activities are provided below.

- ***The Western Niger Delta Development Program.*** Beginning in 2000, CNL's Nigeria Business Unit committed to this five-year, $1 million per year project which seeks to address critical social, economic and developmental problems in the Delta by initiating skills acquisition training, micro-credits for establishment of small businesses, basic education and teacher training, and health education. The goal of this expanded project is to train and educate a total of 1,000 people in Delta communities.

- ***Benikrukru Fish Farm and Poultry Project.*** In association with Enterprise for Development International, this project was developed with the Abiteye community—which is located near one of CNL's out flow stations—and was designed to improve local livelihoods through improved fish farming and poultry raising.

### *Consulting/Technical Assistance Firms*

The capacity of Nigerian firms and organizations to provide quality environmental technical services is highly variable from one firm to the next, although some well-qualified firms exist. The range of services offered by these firms include, but are not limited to geographic information system (GIS), global positioning system (GPS) and digital image interpretation; natural resource inventories; and EIA. There are also a considerable number of NGOs that provide advisory and technical assistance services in the environmental sector, many of which possess the capability to design and carry out social research.

## 6.5 Universities

Universities also have a role to play in improving environmental management. Faculty members at many Nigerian universities have long been involved in academic studies of natural resources in various areas of the country. The foci of theses studies is widely scattered and the data and results are often difficult to access. Recently, as part of Nigeria's activities on behalf of the CBD, a number of "Linkage Centers" have been established in Nigerian universities and institutes to consolidate and disseminate this information. One such center, the Linkage Center for Forests, Conservation and Biodiversity at the University of Agriculture in Abeokuta is focusing entirely

on coordinating data and research relevant to biodiversity conservation. Other such nodes in the country include Linkage Centers for Arid Environments (in Maiduguri), for Freshwater Environments (in Minna), for Highlands/Montane Environments (in Jos), for Delta Environments (in Port Harcourt) and for Marine and Coastal Environments, in conjunction with the Nigerian Institute for Oceanography and Marine Biology in Lagos. Another sister Oceanography Institute also exists within the University of Calabar. As a rule, most of these programs are underfunded and could use added resources before they can be successful in their various missions.

**Box 6.1. Resource Allocation In Nigeria**

**Background**
Current discussions over the proper formula for allocating revenue from the federal government to individual states, continues a debate that started under colonial rule. Early revenue allocation formulas were based on the principle of derivation—which channeled from 50 to 100% of selected federally collected revenues back into the region of origin. This, combined with a state's independent authority to generate revenue, created relatively strong regions and a relatively weak center. Under the derivation principle, the general tendency was for the rich to get richer, and the poor, poorer.

Pressure to redistribute wealth grew as political competition among regions, and later states, intensified following Independence. Nigerian officials revisited the revenue allocation formula several times in the following decades, reducing the weight accorded derivation at each rendition. New factors added to counterbalance derivation included a given state's need, population, and even progress in development. After the civil war, the federal government increased states' dependency on revenue allocations, thereby increasing competition for it by cutting states' tax authority. Thus, Geopolitical South South states saw their allocation of oil wealth based on derivation shrink from 50% in the 1960s to 30%, then to 3%—before finally rising again to its current allocation of 13%. At the same time that South South states have received smaller shares of oil revenue by derivation, other decisions threaten to shrink still further the amount of oil they can claim as derived from their jurisdictions. The Obasanjo administration is seeking Supreme Court clarification of states' rights to count offshore resources as part of their resource base. The current formula declares these resources to be federal, cutting the South South states' claim to oil revenue by almost half.

**Current Allocations**
Revenue from the Federal Account is currently allocated as follows:

- 45% to the federal government,
- 25% to the 27 non-oil producing state governments,
- 13% to 9 oil-producing state governments,
- 15% to 774 local governments, and
- 2% to the Ecological Fund.

**Main Problems with Resource Allocation vis-à-vis Environmental Management**
The analysis conducted by the EA Team identified two problems with the resource allocation system that heavily impact upon the capacity for environmental management and protection. These are:

1. Limited allocations to local governments – the limited revenue allocations to local governments is a constraint to the integration of environmental management and protection into local government economic planning and development activities.
2. Misuse of the Ecological Fund – the Ecological Fund, which as stated above is allocated 2% of the Federal Account annually, was established as a financing mechanism to support a wide range of environmental activities throughout Nigeria. In its current state, the GFRN allocates money from the fund to state governments, through the state governors. While these monies are intended to exclusively support environmental activities at the state level, this is rarely the case—monies received by the state from the Ecological Fund are diverted for other uses (*This Day*, 2002).

Adapted from: ARD, 2001.

# 7.0 Environmental Status and Threats

This section of the report documents the status and threats to natural environmental components, environmental quality and a series of integrated problems affecting Nigeria's environment. The components are organized, for purposes of discussion, under the large, loosely defined categories of Blue, Brown and Green. Each component is presented within a general framework that provides first an overview of its current status followed by a discussion of what the EA team views as the major threats to its sustainability. The FMoE's priorities (see Box 7.1) as outlined by the Honorable Minister of State for Environment (Okopido, 2002) also figured into this

**Box 7.1. Nigeria Ministry of Environment's Priority Action List**

During its initial round of discussions and interviews with government officials and key environment sector stakeholders, the EA team and USAID/Nigeria SO2 staff met with the Honorable Minister of State for the Federal Ministry of Environment, Dr. Imeh T. Okopido. In an engaging session of give-and-take and sharing of information about environmental issues, Dr. Okopido outlined ten areas that the Government of the Federal Republic of Nigeria see as needing immediate attention. In no particular order of priority, these included:

| | |
|---|---|
| • Decrease gas flaring | The private sector, with appropriate economic incentives, could capitalize on opportunities aimed especially at the energy and agricultural sectors |
| • Protect marine and coastal resources | Nigeria should proactively pursue a cohesive process with other sub-Sahara Africa countries to address the transboundary issues that threaten these resources |
| • Halt desertification | In the northern and central states, coordinated physical, biological, educational and political actions are needed to stop this threat |
| • Mitigate industrial and urban pollution | The health and quality of life of almost half of the nation's population are threatened by the decreasing quality of water, air and soil resources in urban areas |
| • Reduce land-based sources of pollution of the marine environment | Vegetative and fishery resources along Nigeria's 879 km of coastline are increasingly threatened by pollutants entering the country's air and watersheds |
| • Protect against the detrimental effects of exotic species | Invasive species such as Nypa palm and water hyacinth are effectively undercutting the economic activities and compromising the ecological systems associated with native species |
| • Stop gully erosion and provide shoreline protection | Erosion is widespread throughout the country. Management of mine tailings, streambanks and floodplains, coastal shorelines, and agricultural lands require immediate and more aggressive attention |
| • Conserve biodiversity | Sustainable resource management practices need to be more carefully adhered to in order to conserve and protect the nation's diminishing flora and fauna diversity |
| • Ensure food security | Nigeria's diminishing agricultural land base needs to be aggressively conserved and programs promoting biotechnology carefully scrutinized for potential negative impacts |
| • Improve management of protected areas and national parks | Human encroachment should be prevented in Nigeria's protected areas and these areas need to be managed cooperatively with local populations in order for them to yield their maximum benefit to the nation and the region |

analysis. Additional information about illustrative activities pertaining to alleviating the degradation or stress is also introduced. Later, Section 8 highlights specific programs by a variety of institutions that address environmental issues confronted by Nigeria. Section 9 lists a number of priority areas where the EA team believes additional improvements in environmental management and governance can be made to diminish and mitigate the threats discussed in this analysis. Section 10 concludes the state of the environment section of the report by pointing out linkages with current USAID programming and making recommendations for discrete actions for environmental improvement.

## BLUE

### 7.1 Freshwater Resources

Nigeria is blessed with a vast expanse of inland freshwater and brackish ecosystems. Their full extent has never been accurately measured due to seasonal variations that occur depending on rainfall. The Niger-Benue and the Chad (Hadejia/Komadugu/Yobe) systems predominate the hydrological landscape of the country. A few other minor systems flow directly into the Atlantic along the south coast of the country. The Niger River, the third longest river in Africa, begins in the Founta Djallon highlands of Guinea near the western coast of West Africa. The Niger is already more than four-fifths of the way to its terminus when it enters Nigeria. But the waters of the Benue, which begin in the mountains of Cameroon on Nigeria's eastern border, almost double the volume of the Niger when they join in the south central part of the country. From there they represent a major force, especially in flood stage, as they flow southward and empty into the Gulf of Guinea through the Niger Delta.

An inventory of inland water resources, completed in 1985 by Ita et al, provides a good illustration of what does exist. Table 7.1 presents these data. The total surface area of water bodies in Nigeria, excluding deltas, estuaries and miscellaneous wetlands suitable for rice cultivation is estimated to be about 148,869 km², or almost 16% of the total area of Nigeria (Ita, 1993).

The floodplains are included in these estimates even though they are the most variable in extent. They represent a major resource as they expand with seasonal rains. In the northern reaches of the country in the Sahel and Sudan savanna zones, they are critical for the livelihoods of human and wildlife populations. The Hadejia-Nguru wetlands (about 62,000 km²), a Ramsar site in Yobe State, world-renowned for its waterfowl and migratory bird populations, is an excellent example of these types of resources. A good resource and summary by state of wetlands in Nigeria has recently been completed (NCF, 2002), using Ramsar criteria for inclusion, it presents a quick inventory of these areas.

Soil erosion, siltation, salinization, irrigation, saltwater incursion and pollution from urban and municipal sources each pose grave threats to Nigeria's freshwater resources. In times of drought, and/or with areas confronted with desertification (see Section 7.11) these threats are even more exacerbated. In the dryland areas of the north, human habitation relies heavily of groundwater resources that are recharged from freshwater percolation and runoff during the rainy season.

Anything that upsets this balance threatens the livelihoods and economy of the people who live there.

The irrigation projects, dams and pumps in the Lake Chad Basin have seriously altered the natural flows of freshwater. Drought and desertification factors have placed an additional cost and burden on obtaining potable water in this area. Risks to human health are likewise increased. Flora and fauna are becoming more endangered because water regimes and flows have been permanently altered with consequences that lead to a direct loss to biodiversity in the region.

**Table 7.1. Major Inland Water Resources (including brackish and freshwater floodplains) of Nigeria**

| Water body | Surface area (ha) |
|---|---|
| **Major rivers:** | |
| Anambra River | 1,401,000 |
| Benue River | 129,000 |
| Cross River | 3,900,000 |
| Imo River | 910,000 |
| Kwa Iboe River | 500,200 |
| Niger River (less Kainji & Jebba lakes) | 169,800 |
| Ogun River | 2,237,000 |
| Oshun River | 1,565,400 |
| Subtotal | 10,812,400 |
| Major lakes and reservoirs: | |
| Lake Chad | 550,000 |
| Kainji Lake (man-made) | 127,000 |
| Jebba Lake (man-made) | 35,000 |
| Shiroro Lake (man-made) | 31,200 |
| Goronyo Lake (man-made) | 20,000 |
| 8 others (man-made) | 90,400 |
| Subtotal | 853,000 |
| Floodplains | 3,221,500 |
| Total, major freshwater resources | 14,886,900 |
| **Other fresh water bodies:** | |
| Delta and estuaries, brackish | 858,000 |
| Other (minor reservoirs, fishponds) | 104,400 |
| Miscellaneous wetlands suitable for rice | 4,108,100 |
| Total, all inland water bodies | 19,958,000 |

*Adapted from: Ita et al, 1985 and Ita, 1993*

In the areas surrounding the central plateau, siltation from upstream erosion seriously degrades freshwater resources. Hazardous wastes from mine tailings also threaten water and soil quality at sites considerably downstream from the pollution's source. In the South East, erosion has severely limited the population's access to clean water and threatened freshwater fish populations. Also in the South East and in all the urban areas of the south, industrial and municipal wastes foul fresh water systems to the degree that local populations can no longer rely on them for their daily needs. At extreme costs to society, potable water has to be trucked in, further hampering the environmental quality of the region. Nigeria's wetlands and other freshwater habitats are important reservoirs of fish and other aquatic food items for people, as a habitat for a myriad of other diverse species, and for the water resources themselves. Both water

quality and quantity are important to all the species that depend upon these resources. Various studies in Nigeria have shown high levels of heavy metals in some rivers where industrial wastes are discharged, high levels of siltation in areas with extensive logging and farming, and other disturbances, too (Ita, 1994). Inland fisheries in rivers are depleted due to these factors, although the fisheries in lakes and reservoirs are thought to be relatively stable due to restocking with hatchery fish and better controls (Shimang, 2002). Depending on the type of fish introduced—native vs. non-native, this might also present a problem for native species. One non-native, the water hyacinth, has invaded a number of waterways with deleterious effects on fishing access for people and competition with native aquatic species. Wildlife associated with wetlands is largely in a decline.

The next section (7.2), as well as Section 7.4, address additional water-related issues that threaten Nigeria's environment.

## 7.2 Coastal and Marine Resources

The coastline of Nigeria is approximately 853 km long stretching from the western border with the Republic of Benin to the eastern border with Cameroon. The coastal shore consists of barrier islands, sandy beaches, lagoons, estuaries, mud beaches, and creeks and includes the Niger Delta (see Figure 4.1). Mangroves and estuaries extend from 10 to 150 km inland. Further inland are freshwater swamp forests and other low-lying habitats, which are all considered to be part of the coast. The coastal area is heavily populated with about 20% of Nigeria's residents living in one of the nine coastal states. Offshore, the continental shelf occurs from 15 km off Lagos to more than 85 km off Calabar. The Exclusive Economic Zone, established in 1978, extends to 200 nautical miles offshore (CIDA, 1997).

The marine and coastal environment of Nigeria is rich in resources and species diversity. The mangroves found here are the largest remaining tract in Africa, and the third largest in the world, covering an area of about 9,723 km². The mangrove ecosystem provides a nursery and breeding ground for many of the commercial fishery species taken in the Gulf of Guinea. Nigeria's coast is said to have about 199 species of finfish and shellfish, a number of which are taken commercially. The Nigerian shrimp fishery is especially strong, and shrimp are now being exported to other countries, including the U.S. About 80% of the fisheries resources in coastal areas, however, are harvested by local residents (Ajao, 2001). Artisanal fisherfolk harvest a large variety of fish, crustaceans and mollusks from the estuaries and channels, and utilize mangrove and swamp forest products for a variety of domestic uses. A variety of birds, mammals and reptiles inhabit the mangroves and swamp forests of the coast, including a few endemic species like the Sclater's guenon and the Nile Delta red colobus monkey. Although a few species of sea turtles lay eggs on Nigerian beaches, they are rare and under threat from human predation.

The coastal area is greatly impacted by the activities of oil companies, including the destruction of mangroves to provide areas for drilling activities and staff housing, improper waste and sewage disposal, intrusion of saltwater further into freshwater areas as a result of the construction of navigable canals, the occasional oil spill, the establishment of exotic Nypa palm and other factors. As of now, there are still no officially protected areas in the mangrove belt.

Many marine resources are also harvested unsustainably both commercially and by local fisherfolk with virtually no controls.

***Niger Delta***

Although the Niger Delta has not been singled out for global attention as a Ramsar site, or a Biosphere Reserve, it is a world-renowned area with extraordinary biodiversity and natural resources potential. In physical terms, the Niger Delta is one of the world's largest wetlands, covering more than 20,000 km² where the Niger and Benue Rivers split into a network of channels before entering the sea. The Niger Delta portion of the coast covers about 500 km of the coastline and encompasses a total of 21 estuaries. Four distinct ecological zones comprise the Delta: barrier islands, mangroves, freshwater swamp forests and lowland rainforests. The barrier islands rim the shore and consist of sandy beaches and coastal forests, which represent a unique habitat containing much biodiversity, and is still largely intact (Moffat and Linden, 1995).

In terms of natural resources, the Niger Delta is the richest part of Nigeria. It has large oil and gas deposits, extensive forests, good agricultural land and abundant fish resources. The Delta's mangrove belt is about 30 to 40 km wide and has not yet been commercially harvested for timber; aside from localized cutting, it is still relatively undisturbed. Further inland are the seasonal and permanent freshwater swamps and swamp forests that are also still fairly intact. The ecological zone under most pressure in the Delta is the lowland rainforest, which is rapidly being degraded to derived savanna through logging and agricultural expansion. These diverse habitats and the wet tropical climate have led to a diversity of species. For instance, there are more freshwater fish species here (197) than in any other coastal system in West Africa, including 16 endemics. Some species listed in the IUCN Red Data book (Hilton-Taylor, 2000) such as the spotted-neck otter (*Hydrictis maculocolis*) and the white-throated guenon are said to be locally common in the Delta.

The Niger Delta is most well know as the repository for oil and gas and related commercial extraction activities (see Section 7.6) that make up Nigeria's largest source of foreign exchange. The development surrounding oil operations, and the heavy concentrations of people on the higher elevations, have led to localized disturbances, pollution, oil spills and other environmental problems. The abundant fishery resources are, in many cases, being harvested unsustainably. Despite these problems, biologists and conservationists in Nigeria and elsewhere consider the Niger Delta to be a global natural resource and one that needs more conservation attention while it is still in fairly good shape. The region, like the rest of the country, has abundant environmental threats. Box 7.2 illustrates one proxy ranking of the major environmental problems that exist in the Niger Delta. Overall priorities are assigned based on their environmental significance of the issue and the present value of a projected future benefit stream assuming the problem is mitigated.

## Box 7.2. A Proxy Ranking of Major Environmental Problems in the Niger Delta Region

| Problem type | Problem or source | Current environmental significance | Current health significance | Potential intervention benefits | Intervention costs | Overall priority |
|---|---|---|---|---|---|---|
| **Land resource degradation** | Erosion | | | | | |
| | coastal | High | Low | High | High | Moderate |
| | riverbank | High | Low | High | High | Moderate |
| | Flooding | Low | High | High | High | Moderate-High |
| | Sea level rise | Low | Low | Moderate | High | Low |
| | Agricultural land degradation | High | Moderate | High | Moderate | High |
| **Renewable resource degradation** | Fisheries | | | | | |
| | stock depletion | Low | Moderate | High | Low | High |
| | habitat degradation | Moderate | Moderate | Moderate | Moderate | Moderate |
| | Forestry | | | | | |
| | deforestation | High | Moderate | High | Low | High |
| | mangrove deforestation | Low | Low | Low | Low | Low |
| | freshwater forest | High | Low | High | Low | High |
| | barrier island | High | Low | High | Low | High |
| | Biodiversity loss | High | Moderate | High | Low | High |
| | Exotic species invasion | | | | | |
| | Nypa palm | Low | Low | Low | Moderate | Low |
| | Water hyacinth | Moderate | Moderate | High | Moderate | High |
| **Environmental pollution** | Water contamination | Low | Low | Moderate | Low | Moderate |
| | Oil | | | | | |
| | industrial | Low | Moderate | Moderate | Moderate | Moderate |
| | toxic & hazardous | Moderate | Moderate | Moderate | Low | High |
| | sewage | Moderate | High | High | Moderate | High |
| | Air pollution | | | | | |
| | gas flaring | Low | Low | Low | High | Low |
| | industrial | Low | Moderate | Moderate | Low | Moderate |
| | vehicular | Low | High | Moderate | Moderate | High |
| | Solid wastes | | | | | |
| | industrial | Low | Moderate | Moderate | Moderate | Moderate |
| | municipal | Moderate | High | High | Moderate | High |

**Notes on the ranking significance used in prioritizing environmental problems in the Niger Delta:**

For the environmental significance, long-term, large-scale and severely disruptive environmental problems are ranked higher than short-term, local, and moderately disruptive anthropogenic activities. Health significance is similarly ranked, with stressors that impact large populations or cause substantial direct health impacts ranked higher than those with smaller scale or indirect health effects. The effect on economic productivity is included in the evaluation for both health and environment.

Potential future environmental benefits are an estimate of the present value of all future benefits of mitigating the problem. Consequently, interventions with short-term benefits (e.g., within five years) are ranked higher than interventions which require longer periods for benefits to manifest themselves (e.g., more than five years). The benefits are compared with the present value of intervention costs to derive an estimate of the net present value of addressing the issue.

In establishing the overall priorities, equal weight is given to each of the criteria. Depending on the magnitude of the issue it is given a rating of High (3), Moderate (2), or Low (1) FOR EACH CRITERION. The overall priority assessment follows this ranking as well. To determine the overall priority, the sum of rankings of the environmental and health parameters is added to the net intervention benefits (benefits-costs). From this calculation, the overall priority (OP) is rated as High (OP 5), Moderate (2<OP<5) or Low (OP 2). A Low ranking does not mean that the problem is unimportant, only that it is a less significant problem than the higher ranked issues. The ranking provides a critical initial step for formulating policies and programs to address the most important environmental problems. Given the weak information base, the framework and the priorities should be refined as additional information and values are incorporated.

A further note: Water contamination from oil activities includes only oil pollution and other aquatic impacts. Other significant concerns associated with oil activities, including deforestation, forest degradation, loss of biodiversity, gas flaring emission, and solid wastes are incorporated into other categories.

*Adapted from: Moffat, D. and O. Linden. 1995. Perception and reality: assessing priorities for sustainable development in the Niger River Delta. Ambio 24(7-8):527-538.*

## 7.3 Air Quality

In Nigeria, ambient air pollution emanates from three major sources—energy generation, industry, and transportation—all of which increase with population and economic growth.

Rapid urbanization is major contributing factor to all three sources. Increasing urban populations have required more roads to accommodate an ever growing number of vehicles, thereby creating sprawling metropolises. This situation in Nigeria, given the lack of effective urban planning, has caused severe degradation of air quality.

In key urban centers, such as Lagos, heavy dependence on oil-dominated transportation is the major contributor to degraded air quality. Motor vehicles produce more air pollution than any other single human activity (World Resources, 1996). Transportation requires huge amounts of energy. Globally, 20% of all energy produced is used for transportation. Of this, between 60 and 70% goes toward transporting people, and the rest toward moving freight (World Energy, 1993).

Air (and marine pollution) problems in Nigeria are further exacerbated by Nigeria's lack of an effective pollution control policy. Sporadic enforcement of environmental laws is ineffective. Overall, there is no great incentive for industrial facilities to implement pollution abatement strategies. This is particularly true for the oil industry even though the GFRN has indicated that it is no longer willing to tolerate their avoidance of taking responsibility for reducing pollution.

### 7.3.1 Transportation-Related Air Pollution

Transportation-related air pollution in Nigeria is primarily a problem in large cities such as Lagos, Port Harcourt, Kano and Kaduna. Additional threats to air quality include power plants, factories, and other stationary sources including the thousands of privately owned diesel generators used for backup power.

Increasing vehicle ownership, especially among the middle and upper classes, has meant more travel. Thus, automobile-related pollution is the fastest growing source of degrading air quality. The situation is compounded by poor urban transportation planning as manifested by congestion in both large and small cities of Nigeria. Clogged city streets exact a major toll on economic productivity and exacerbate air (and noise) pollution.

In highly congested city centers, traffic can be responsible for as much as 90 to 95% of the ambient carbon monoxide levels, 80 to 90% of the nitrogen oxides and hydrocarbons and a large portion of the particulates, all posing a significant threat to human health and natural resources (World Resources, 1996). Nigeria's current use of leaded gasoline contributes to the high levels of lead in the ambient air. While unleaded gasoline has been introduced in many developing countries, there are no plans to do so at this time in Nigeria, even though two of its oil refineries are producing unleaded gas.

### *Air Quality Impact of Used Vehicles*

Nigeria has lagged behind in reducing or averting overreliance on privately owned vehicles, a situation particularly true for urban centers. Since a majority of these vehicles are older and pre-owned (used), they are generally heavier polluters than newer ones and present a serious air pollution problem. While a number of these are legally imported and generally documented, others stay unregistered. The total number of these vehicles in Nigeria could not be ascertained. Reducing the imports of these vehichles or placing stringent conditions on them has been politically difficult.

Poorly maintained vehicles can emit 100 times the pollutants of a properly maintained modern vehicle (Callahan, 1995). In Nigeria, air quality is further compromised by the lack of automotive emission standards. Logical actions to decrease pollution from vehicles range from simple idle checks of carbon monoxide and hydrocarbon emissions from gasoline-powered vehicles or a visible smoke check on diesel-powered vehicles, to programs that retrofit vehicles with pollution control devices to an accelerated retirement (scrapping) program of pre-owned vehicles. Any of these actions would help to significantly improve air quality, especially in congested cities like Lagos. But they also require significant political will and enforcement capabilities, both of which are lacking in Nigeria's current environmental quality arena.

## 7.3.2 Air Pollution from Stationary Sources

High urban and industrial demand for energy has contributed to both ambient air pollution and greenhouse warming. Studies indicate that good housekeeping can save a substantial amount of energy in Nigeria (UNDP, 2001). Industrial air pollution can be significantly reduced by preventing it in the first place—at the source, followed by recycling and reuse of the pollutants (e.g., industrial [air], heat [or waste] to the extent technically and economically feasible). This can be followed by treatment, detoxification or destruction of what is left, and finally, release to the atmosphere.

During the field study, two major industrial contributors—coal-fired power plants and gas flaring from oil drilling were identified as the air pollutant culprits, but the extent of the pollution and its contribution could not be gauged. Based on the available data and discussions with various individuals in FEPA and other federal and state agencies, carbon dioxide ($CO_2$) and particulates were identified as two key pollutants.

### *Industrial and Coal-fired Power Plants*

Reducing emissions from coal and oil-fired power plants can come via three routes:

- Upgrading or cleaning coal,
- Reducing demand for power through energy efficiency measures, or
- Minimizing or removing subsidies.

None of these measures are under consideration in Nigeria. Use of alternative energy sources, such as methanol from sugarcane or industrial energy solar systems—although technically (and economically in similar economies) feasible—is generally nonexistent.

No specific air pollution data was available from the power plants. However, coal being the major feedstock for most power produced in Nigeria, and given the poor state of environmental compliance, it can be safely assumed that these facilities are significant source of $CO_2$, $SO_2$ and other pollutants. $CO_2$ is also a major contributor to global climate change.

As an illustrative case, Table 7.2 provides summary data of ambient air quality at selected sites in two of Nigeria's states. The data was collected from a variety of sites ranging from a freshwater swamp to rural and urban residential areas to areas adjacent and inside a variety of industrial areas. Given increased environmental degradation, increased poverty and population levels and continued lack of environmental compliance, it is quite likely that the levels shown in this table have increased, even though the original data is old.

**Table 7.2. Ambient Air Quality, in µg/m3, at Selected Sites in the Rivers and Bayelsa States**

| Sr. No. | Location | SPM | $SO_2$ | $NO_2$ | CO | $NH_3$ | $CO_2$ |
|---|---|---|---|---|---|---|---|
| 1. | Clean Swamp | 15.9 | <25.0 | <10.9 | 1-2 | 33.9 | - |
| 2. | Industrial swamp/ambient | 1296.7 | 52 | 16.2 | 1-2 | <5.6 | - |
| 3. | Industrial upland/ambient | 160.3 | 96.0 | 13.3 | 2 | <5.6 | - |
| 4. | Construction site/asphalt | 1212.0 (24-hr.) | <25.0 | 15.0 | 2 | - | - |
| 5. | Urban residential | 24.4 | <25.0 | <20.0 | - | - | - |
| 6. | Rural Residential | 22.5 | 225 | 20.6 | 2 | - | - |
| 7. | pH/Industrial layout | 6.1 – 13.4 | - | - | - | - | 300 -500 |
| 8. | Chemical Plant (Industrial) | 208.00 | <25 | <15.0 | 2 | 174.9(One -hr.) | - |
| 9.0 | Rural Industrial | 4516 | - | - | 62 | 869.1 | - |
| Average Time | | 24 hr. | 8 hrs. | 2 hrs. | Spot | 1 hr. | |

*Pollutech Nigeria Limited. 1996, "Proceedings of the First Consensus Building Workshop on the Preparation of Rivers and Bayelsa States Environmental Action Plan. Port Harcourt. Organized by Nigerian Federal Environmental Protection Agency and World Bank.*

While the values for the other pollutants are not especially elevated when compared against recognized norms, the levels of suspended particulate matter (SPM) in the air measured in µg/m3 (which is also equivalent to parts per million, ppm) and the pH levels are extremely hazardous. (The high SPM levels are probably due somewhat to the fact that they were recorded during the harmattan season.) Shah et al. (1997) emphasizes that any level of SPM above zero is a dangerous condition for human health. Indoor urban values for this study were in the range of 153 to 260 µg/m3, while ambient values downstream of an industrial facility range from 1212.0 to 1295.7 µg/m3 inside an industrial facility (during harmattan season). These high particulate values come from natural and anthropogenic sources, but from an environmental and human health perspective, they are very dangerous.

During a visit to the Shell facility in Port Harcourt, an EIA submitted by Shell to FEPA as part of Nigerian regulatory requirements was briefly reviewed. Table 7.3 is indicative of the air quality at Shell's four fields. These data, taken in June by Shell contractors, indicate the presence of

unacceptable levels of CO, $CO_2$, $NO_2$, HC, $SO_2$, and SPM. Table 7.4 compares the figures in the EIA report with Nigeria's FEPA and the World Health Organization (WHO) standards. The health effects of these pollutants are discussed in Section 7.3.4.

**Table 7.3. Air Quality Data at Four Niger Delta Stations**

| Stations | CO (µg/m3) | $CO_2$ (µg/m3) | $NO_2$ (µg/m3) | $SO_2$ (µg/m3) | HC (µg/m3) | SPM (µg/m3) | Average Time |
|---|---|---|---|---|---|---|---|
| Soku | 2.25 | 414 | 0.125 | 0.5 | 134 | 246 | 3 hours |
| Buguma | 1.25 | 395 | 0.05 | 0.025 | 88 | 226 | 3 hours |
| Alakiri | 1.75 | 415 | 0.15 | 0.05 | 134 | 247 | 3 hours |
| Bonny | 1.75 | 431 | 0.175 | 0.75 | 144 | 248 | 3 hours |

*Shell Nigeria, 2001, "Limited Environmental Impact Assessment for Sokei-Buguma-Alakiri-Bonny Trunk Line Replacement." Shell Nigeria, Port Harcourt.*

**Table 7.4. Comparative Evaluation with Recommended Limits**

| Air Quality Parameter | FEPA standard | WHO standard |
|---|---|---|
| CO | 20 ug/m3 | 60 ug/m3 |
| $CO_2$ | 350 ug/m3 | - |
| $NO_2$ | 260 ug/m3 | 350 ug/m3 |
| $SO_2$ | 15 –113 ug/m3 | 150 ug/m3 |
| VOC/HC | 260 ug/m3 | 260 ug/m3 |
| SPM | 250 ug/m3 | 260 ug/m3 |

### *Gas Flaring*

The flaring of natural gas further exacerbates air pollution from the direct production and consumption of fossil fuels. Due to the lack of gas utilization infrastructure, Nigeria flares approximately 75% of the gas it produces and re-injects about 12% for enhanced oil recovery. Gas flaring contributes to both the production of the acid in acid rain and increased carbon emissions into the atmosphere.

Given the low combustion efficiency (80%) of gas flaring in Nigeria, a large portion of the gas is vented mainly as methane. This not only results in a significant economic loss but also contributes to environmental damage. The poorly combusted gas contains high concentrations of methane that trap 20 times more heat than $CO_2$ (World Energy, 1995), making it an important greenhouse gas that contributes significantly to global climate change.

One local study (Pollutech, 1996) estimated that 12 million tons of methane is released into the atmosphere every year in Rivers and Delta States. It also subjects plants to heat radiation, high temperatures and excessive light and gas deposits (dry and wet, depending on the season). In the Niger Delta, Pollutech (1996) also noted that affected plants show symptoms of chlorosis (leaf discoloration): scorching, browning and desiccation, stunting and death after prolonged exposure. All types of plant species are affected to some degree and their susceptibility seems to vary from species to species. The same study also noted that the gas flares attracted yam tuber beetles and grasshoppers that destroy crops.

In terms of human impact, a NEST study (1991) observed "discomfort and misery" in local populations living near flared gas areas due to fumes, heat and combustion gases, as well as increased incidences of illness.

***Indoor Air Pollution***

For many urban residents in Nigeria, air pollution from indoor smoke (usually from use of wood fuels for cooking) poses a greater threat than outdoor air pollution. Smoke is widely recognized as an eye irritant. It also contains numerous toxic and carcinogenic chemicals damaging to human health and the environment over prolonged exposure.

No data was available on the extent of wood use in Nigeria. However, from various discussions and observations, it is still the most prevalent energy source in the country (see Section 7.6.2) and in many urban centers as well. One observes large quantities of wood for sale along major transportation arteries at the entrance to most cities.

Programs to design and disseminate cleaner burning wood (or charcoal) cookstoves have been underway in many developing countries. China, India, Nepal and Kenya have made significant progress. Most of these programs are designed to improve efficiency, not reduce air pollution. One cookstove (described in Box 7.3) has made significant inroads in achieving both. This, or similar technologies, could be explored for Nigeria in so long as wood remains a primary source of fuel for cooking. It would help to reduce the health risks from indoor pollutants and also decrease overall demand on the nation's woodstocks.

**Box 7.3. Energy Efficient Cooking in Rural Africa**

The Kenya Ceramic Jiko initiative is one of the most successful urban cookstove projects in Africa. The initiative promotes a charcoal-based cookstove with an energy efficiency of about 30%. The stove is made of local ceramic and metal components. Since the mid-1980s, more than 500,000 stoves have been produced and distributed in Kenya. The stove is not a radical departure from the traditional all-metal stove. Rather, it is an incremental development. On the other hand, the stove requires that charcoal be produced and transported.

The improved stove is fabricated and distributed by the same people who manufacture and sell traditional stoves. From its beginning, the stove received no subsidies—a decision that had tremendous impact on its development, encouraging the private sector to work hard and recover its capital. The situation also assured self-sustained production, marketing and commercialization. The same stove design has been successfully replicated in Malawi, Rwanda, Senegal, Sudan, Tanzania and Uganda (UNDP, 2001).

### 7.3.3 Air Quality Monitoring

In Nigeria, the data on air quality is outdated and unreliable. Given the adverse health and environmental impacts of air quality, it is very important to develop and monitor appropriate data. The impact of air pollutants needs to be elevated to a higher profile in the eyes of the Nigerian public. This should be complemented with a greater capacity and political will to particularly enforce regulatory compliance to improvements of urban air quality. This requires recognition of legislated air quality standards backed by solid studies with good science, and establishing monitoring systems. Such systems are generally nonexistent in Nigeria.

**Box 7.4. Monitoring Limitations**

The limitations of monitoring must be recognized. In many circumstances, measurements alone may be insufficient—or impractical—for the purpose of fully defining population exposure in a city or country. No monitoring program, however well funded and designed, can hope to comprehensively quantify patterns of air pollution in both space and time. Monitoring should be used in conjunction with other objective assessment techniques, including modeling, emission measurement and inventories, interpolation and mapping. In addition, it is important to recognize the limitations of each of these tools in the context of a particular location. A complete inventory for a city may need to include emissions from point, area and mobile sources; in some circumstances assessment of pollutants transported into the area under study may also need to be considered.

Equipment for air quality monitoring includes automatic, portable high-resolution analyzers capable of collecting data continuously, and personal monitors. These can be quite costly. If budgets are tight, it may be possible to consider a limited number of pollutants. Portable continuous monitors for particulate matter 10 microns in aerodynamic diameter ($PM_{10}$) are available for US $3,000. The cost of setting up and operating one continuous station monitoring six 'classical' pollutants (see below), supported by several satellites sites monitoring only $PM_{10}$ and lead for three years, may be on the order of US $1.5 million to $2.5 million (World Bank, 1993).

### 7.3.4 Health Effects of Air Quality Pollutants

The six most important pollutants to monitor regularly for better air quality are what the WHO calls the "classical" pollutants:

- Lead;
- $PM_{2.5}/PM_{10}$ (particulate matter smaller than 2.5 and 10 microns in aerodynamic diameter, respectively);
- Carbon monoxide (CO);
- Sulfur dioxide ($SO_2$);
- Nitrogen dioxide ($NO_2$); and
- Ozone.

Particulate matter is the general term for the mixture of solid particles and liquid droplets found in the air. Scientific studies show that deleterious health effects include breathing and respiratory diseases, cardiovascular diseases, alterations in the body's defense systems against foreign materials, damage to lung tissues, carcinogenesis and premature mortality.

Motor vehicle particle emissions and the particles formed by the transformation of motor vehicle gaseous emissions tend to be in the fine particle range. Fine particles (those less than 2.5 micrometers in diameter) are of serious concern because they can easily reach the deepest recesses of the lungs, causing significant health problems.

A suggested high priority for Nigeria is to reduce lead content in gasoline. Transitions in a number of developing countries have been made in a year or less (Bailey, 2002). In Thailand,

this process has been accomplished through a tax subsidy, making it cost-effective for refineries to produce unleaded gasoline. In addition, leaded gasoline prevents the use of catalytic converters on gas-burning engines; catalytic converters help limit vehicle emissions of hydrocarbons, carbon monoxide and nitrogen oxides.

At present, two of Nigeria's four refineries are currently producing unleaded gasoline and distributing it in southeastern Nigeria. Within the limitations of supply and needed infrastructure, the use of unleaded gasoline can be increased in Nigeria. Also, the risk of using unleaded gasoline in older vehicles is minimal and any repairs, if needed, are easy and inexpensive. An international gathering has called for a complete phase-out of leaded gasoline in sub-Sahara Africa by 2005, and has recommended intermediate reductions in lead content (currently 0.8 gm/lt) to an average 0.4 gm/lt by 2002 and to 0.2 gm/lt by 2003 (U.S. EPA, 2001).

Health problems due to air pollution have typically been associated with airborne particulates, which include total suspended particulates (TSP) and particulate matter of 10 microns or less in diameter ($PM_{10}$ is the more damaging, smaller particles), and ambient lead. Damage to structures, forests and agricultural crops tend to be primarily linked with $SO_2$ and with ground-level ozone.

### 7.3.5 Suggested Actions to Improve Air Quality

Improving air quality, especially in Nigeria's urban areas, can best be achieved by reducing vehicle pollution. Motor vehicles emit large quantities of $CO_2$, hydrocarbon, nitrogen oxides and other toxic substances. Each of these, along with their secondary by-products (such as ozone), can cause adverse effects on health and the environment.

Achieving any air quality improvement goal will require a comprehensive strategy. The object is to bring the quality to a healthy level, or alternatively to the limits of effective technological, economic and social feasibility. It will require emission standards for new vehicles, clean fuels, programs designed to ensure vehicles are maintained in a manner that minimizes emissions, and traffic and demand management and constraints. The emission reduction goals should be achieved in the least costly manner.

Alternative fuels are also recommended to reduce air pollution. These fuels include methanol (made from natural gas, coal or biomass), ethanol (made from grain or sugar), vegetable oils, methane, liquefied petroleum gas (LPG) composed of propane and butane, electricity, hydrogen, synthetic liquid fuels derived from hydrogenation of coal, and various blends such as gasohol (gasoline and alcohol). LPG is widely used. For example, 94% of Japan's 260,000 taxis use LPG (OECD, 2001). LPG is produced in the extraction of heavier liquids from natural gas and as a byproduct in petroleum refining. One plant has just come on line in the Niger Delta and another is due to start production soon.

In the course of their visits the EA team's attention was called several times to the fact that exporting countries do not have any export restrictions on pre-owned automobiles. In general, the prevailing attitude seems to be that it is up to the importing country to determine its own environmental priorities and to decide whether the social benefits of used vehicles outweigh the environmental costs. The following three approaches in other countries have proved successful.

- Ban/minimize (e.g., through taxes) imports of certain types of used vehicles or engines.
- Place a high tax on imported used vehicles or engines.
- Require imports to pass stringent emissions requirements as a condition of registration.

Nigerian policymakers can review these (and other) options for relevance and use.

In the industrial sector, enforcement of the existing regulations is needed. Capacity at various enforcement levels should be increased. NGOs and other institutions can help to raise the consciousness about air quality issues while the federal, state and local governments should work to muster the political will to enforce compliance.

## 7.4 Urban Water Resources

Nigeria is blessed with abundant water resources, both underground and surface. The distribution of these resources varies between regions—the south, with about 3,000 mm/year, has markedly higher rainfall than the drier north (about 500 mm/year). In Nigeria, drinking water sources include rivers, lakes and reservoirs. Boreholes are drilled in many areas all across the country into aquifers for water. In many rural riverine communities, river water is the main source. In communities close to the Atlantic Ocean, high salinity in the river water makes it unfit for consumption.

A fundamental problem affecting urban Nigerians is the lack of safe drinking water, even though their access is often better than rural areas in Nigeria. Overall, the water supply both from public and private sources has not kept pace with the growing urban population. Existing water supply systems are plagued by poor maintenance, poor management and the inability to generate sufficient revenue. There have been some unsuccessful attempts though multilateral loan projects to increase capacity of these systems in several urban areas.

In most major towns, a state utility is responsible for water supply. However, these utilities only serve a small portion of the population. For example, according to one study, in 1997, the Lagos State Water Corporation (LSWC) only served 20% of the urban households in Lagos. Other city water sources (see Table 7.5) such as tankers, yard-wells, public standpipes and water vendors met the rest of the needs (CASSAD, 2001).

**Table 7.5. Sources of Water in Urban Lagos, 1997**

| Source of Urban Water Supply | % Households Receiving Water |
|---|---|
| Water Seller | 37 |
| Yard Well | 30 |
| Yard Standpipe | 14 |
| Public Standpipe | 10 |
| House Connection/Piped Water | 6 |
| Water Tanker | 3 |

*Source: CASSAD. 2001. Situation Analysis Report. Center for African Settlement Studies and Development. p.143.*

Inadequate treatment, runoff, discharges, and organic and inorganic matter are serious threats to drinking water quality in Nigeria. Although wastewater effluent standards regulate discharges from industries into surface water, monitoring to ensure compliance in Nigeria appears to be an impossible task, given numerous technical constraints and political interference.

Untreated discharge of industrial pollutants has degraded the surface water quality in many areas such as Kaduna. These areas depend upon the local streams and rivers as a source of drinking water. Such discharges have also increased biological oxygen demand, reduced the waters dissolved oxygen and increased the treatment costs or the health risks for the population using raw river water. In another state capital, Maidugari, sufficient clean and treated water exists in the local reservoir but frequent disruptions and insufficient power with the electricity supposedly supplied by the Nigeria Electric Power Authority means that pumps usually don't run. Private vendors are selling water by tapping uncontrolled boreholes to fill the supply gap. This increases the health risk, draws down (and possibly pollutes) the water supply in the aquifer, and pollutes the air because small, private diesel-powered generators are used to pump the water.

The most immediate impact of reduced accessibility and affordability of water is on women and children. When water becomes more expensive and less accessible, women and children, who bear most of the burden of daily household chores, must travel farther and work harder to collect water—often resorting to water from polluted streams and rivers.

***Drinking Water in Ibadan***

An in-house water connection is no guarantee of regular water supply. One study indicated that 34.3%, 26.8 percent, and 25.8 percent of households in Ibadan, Kaduna, and Enugu respectively had no piped potable water, even when a connection for such water existed (Streen, 1989).

To illustrate the status of drinking water supply, the situation in Ibadan is typical of most Nigerian urban areas. Problems of water shortage cut across social classes in Ibadan. A substantial amount of productive man-hours are lost daily as a result of workers searching for potable water in the city. Even on the University of Ibadan campus, potable water is a scarce commodity, causing a waste of time at the expense of official duties.

Moreover, the quality of water is not always guaranteed because occasionally, the water is either not clear, has sediments, or a bad taste. The incidence of cholera, typhoid fever, and dysentery is common, according to the University. Many people buy commercially processed bottled drinking water.

On the whole, the reliability of the water supply to households improves as one moves from the core areas to newer suburban areas. Nevertheless, rapidly emerging suburban slums in Ibadan and Kaduna seldom have water in their taps, whether they are illegally or legally connected.

### 7.4.1 Water Quality Measurement

There are two broad measures of water quality: measuring oxygen levels or demands in the water and measuring the concentration of heavy metals. Water sampling methods vary according to the water body. Timing of measurements is often an issue, since concentrations can vary

substantially as the flow varies. A given pressure may cause a few problems when flow is at its peak but may have a major impact at times of low flow.

Prior to the arrival of FEPA, Nigeria public water supply standards were based on U.S. standards published in *Standard Methods*. Current laws and regulations require enhancing and maintaining water quality to protect public health. However, these are rarely enforced. And given the lack of the state-of-the art equipment for determining levels of contaminants in water samples, set standards are probably not often met.

### 7.4.2 Drinking Water Treatment

Raw water is treated to remove undesirable contaminants. The most commonly used processes include filtration, flocculation and sedimentation and disinfection. Advanced systems include ion exchange and adsorption. Actual treatment steps are based on contaminants in the source water used by the facility.

**Box 7.5. Key Steps to a Safe Drinking Water Supply Treatment**

**Flocculation/Sedimentation** combines small particles with larger particles, which settle out of the water as sediment. Alum and iron salts or synthetic organic polymers (alone or in combination with metal salts) are generally used to promote coagulation. Settling or sedimentation is simply a gravity process that removes flocculated particles from the water.

**Filtration** is used by many water treatment facilities to remove the remaining particles from the water supply. These particles include clays and silts, natural organic matter, precipitants from other treatment processes in the facility, iron and manganese and microorganisms.

**Ion Exchange** removes inorganic constituents if they are not removed adequately by filtration or sedimentation. Ion exchange can be used to treat hard water. It can also be used to remove arsenic, chromium, excess fluoride, nitrates, radium and uranium.

**Adsorption:** Organic contaminants, color, and taste- and odor-causing compounds can stick to the surface of granular or powdered activated carbon.

**Disinfection** (Chlorination, Ozonation): Water is often disinfected before it enters the distribution system to kill dangerous microbes. Chlorine, chloramines, or chlorine dioxide are used most often because they are very effective disinfectants.

In the U.S., treatment costs are approximately $2 per 1,000 gallons, although costs tend to be lower for larger systems (U.S. EPA, 1997).

Nigerian LGAs in charge of water supply face multidimensional problems to supply safe drinking water, including inadequate funding, poor planning and a lack of cost recovery mechanisms, as well as trained staff. The fact that management responsibilities overlap and are scattered across a number of participating organizations presents another barrier. Privatization is often presented as a panacea for these ills, but in fact needs to be carefully reviewed for each city's context. Experience has shown that in some cases, rather than contributing to poverty reduction, water privatization and greater cost recovery make water less accessible and less affordable to the low-income communities that make up the majority of the population in developing countries.

Finally, the state of the environment generally can be a telling sign of the quality of water. Since comprehensive water quality monitoring in Nigeria is still in its infancy, a clear picture of the status of water pollution and the extent to which water quality has been impaired from different uses is not available. However, the contamination of ground water and lakes can quickly devastate ecosystems to the detriment of biological diversity. Such visible indicators are very conclusive. While technological improvements are helpful, political, institutional and social constraints are the crux of the problem. This makes an integrated, interdisciplinary approach to water management necessary.

## 7.5 Urban and Municipal Environmental Management

In its narrowest sense, sanitation refers to the disposal and management of human waste or excreta, sometimes diluted with water as sewage. Environmental sanitation includes proper hygienic behavior.

One of the fundamental problems affecting urban residents in Nigeria is the lack of adequate and safe sanitation systems. Compounding this situation is the unhygienic behavior resulting from inadequate awareness of information on disease transmission on the part of urban residents. Practices such as defecating or urinating on side streets (or in the bush) and infrequent washing of hands are common, contributing to unhealthy personal hygiene.

### 7.5.1 Management of Sanitation Systems in Nigeria

From the discussions during the field visits, it appears that only a fraction of the urban sewage is treated in Nigeria. The percentage of households covered by sanitary means of disposal has been slowly increasing, especially in urban areas.

These include urban populations served by connection to public sewers or household systems such as ‘soak–away pit latrines’, pit privies, pour-flush latrines, conventional septic tanks, communal toilets, and other such facilities. The urban city cores, especially the wealthier neighborhoods, are covered with a centralized system. The poorer neighborhoods have no such facilities.

A ‘Soak-Away’ system is a modified version of a conventional septic tank. Biosolids separate out in one chamber, unlike the septic tanks, where the liquid portion is not removed and percolates in to the ground. In areas where the water table is high and soil conditions favorable, this can cause groundwater contamination. Many neighborhoods rely on groundwater for their water supplies. This system is common in middle class urban neighborhoods.

In most cities, management of the urban services including sanitation is in the hands of LGAs. However, there are other agencies that participate in the program in one way or the other, including federal, state, and local agencies responsible for health, water and public works. The weak coordination and overlapping responsibilities do not create synergy and fail to meet the systems requirements. It reflects a serious policy void., in spite of the federal government’s policy that sanitation service providers should enjoy autonomy and freedom from political influence.

However, in spite of the poor sanitation systems, the LGAs visited have not moved beyond the rhetoric to implementation. Several factors seem to contribute to this situation. Key among these are the lack of funds (such as for equipment purchases) and absence of a strong institutional capacity (including adequate funding, efficient organization, clear lines of authority, and qualified personnel), which has further exacerbated the urban degradation. In some cities such as Lagos, local government mandates have been expanded, adding new responsibilities such as industrial pollution controls to the traditional responsibilities of urban management. The relentless pace of urban growth further exacerbate these problems, far outstripping the capacity of the government to manage and respond to demands for urban services. The political needs have prevented implementing adequate user charges for sanitation services.

The revenue base of the LGA is small as compared to their growing needs. Low revenues have resulted for many reasons—least of which is the lack of funds from the federal government. A key problem, however, is the weak local revenue generation. Often, political will has been lacking to implement measures such raising property taxes in richer neighborhoods. LGA leaders find it easier to ignore the needs of the poor than raise taxes of richer constituents. If LGAs are to meet the needs of their jurisdiction, they must stand on firm footing and raise revenues through (increased) property taxes, special taxes such as business taxes, motor vehicle registration taxes, user fees, local surcharge on national taxes or other measures.

### 7.5.2 Municipal Solid Waste

Municipal solid waste management is an essential public service that benefits all urban residents. These are defined to include refuse from households, non-hazardous solid (not sludge or semisolid) waste from industrial and commercial establishments, refuse from institutions) including non-pathogenic waste from hospitals), market waste, yard waste and street sweepings. Sometimes, construction and demolition debris is also included. However, for the purpose of this review, such wastes are excluded from consideration.

In Nigeria, the scale of urban consumption and waste generation—and the negative impacts associated with them—varies dramatically from city to city, depending in a large part on a city's wealth and size. Wealthier neighborhoods and cities have the highest level of resource use and waste generation. By contrast, per capita resource use and levels of waste generation tend to be quite low among the urban poor. Thus, poorer cities are less of a threat to the environment. However, their local impacts can be severe. The urban poor often find settlements in ecologically poor neighborhoods.

Regardless of the level of income, it is not feasible (or desirable) to exclude service from poorer neighborhoods unable to pay for services since public cleanliness and environmental waste disposal are essential elements of a clean city.

In Nigeria, there is no clear and effective framework for waste management. The existing framework does not seem to work, given the littering and piling of trash along city streets and medians in most urban centers. Previously, municipalities under the oversight of states were responsible for solid waste management. The states subsequently transferred this responsibility to LGAs, whose total number in Nigeria grew by leaps and bounds—at present totaling 774. LGAs are responsible for all city services including water, sanitation, health and solid waste

management. Overall, these LGAs are poorly equipped with funding and institutional capabilities.

In addition, during discussions with relevant officials, a conspicuous lack of delegation of relevant powers to lower levels of government that are typically responsible for implementation was evident. There also seems to be a lack of a clear and broadly accepted long-term policy, and a predictable and flexible regulatory regime targeting economic incentives and cost recovery. These efforts need to be strengthened by an increased awareness and education—with the long-term objective of changing the behavior of manufacturers and consumers in the direction of minimizing waste generation.

***Current Practices***

Waste disposal problems are typically associated with non-biodegradable or bio-accumulative substances such as solvents, heavy metals and chemical sludges. These are often industrial wastes but can also arise from poor consumer behavior such as improperly disposing waste oil on the ground by numerous small auto repair facilities in Nigeria.

Municipal waste collection and disposal in Nigeria's urban centers overall appears to be in a dismal state, as evidenced by field visits to various urban centers. It also seems waste is currently collected on an intermittent basis in the poorer neighborhoods, while regular pick ups occur in selected localities; wealthier urban neighborhoods seem to indicate this. This was evidenced by trash strewn along medians, roadside piles and in many other places. In addition to the health and environmental impacts, the trash piles create health hazards and a breeding ground for mosquitoes. Clogged drains were a common occurrence in Lagos, Port Harcourt, Calabar and Kaduna. The cities of Ibadan and Aba seem to lead the pack. In addition to the trash, hundreds of junked motor vehicles—cars, trucks, buses etc. were seen all along major arteries in Ibadan and Aba. In other cities less junked vehicles were in evidence— seen in dozens, rather than hundreds. The vast number of junked vehicles and the visible signs of rusting and rotting indicated that these have been sitting for very long periods—perhaps years. Obviously, none of the LGAs (the organization responsible for removal and environmental disposal, including recycling) has taken any action. There is no incentive for better performance or conversely, no penalty for poor performance.

In all cities visited, open fires on trash dumps were seen; these provide an (unhealthy) means of disposal of accumulated piles. In Lagos, the Lagos Waste Management Authority experimented with incineration. However, for unknown reasons, the practice was abandoned.

The team also observed a number of disabled hauling trucks waiting for repair for weeks, according to the facility manager. Given the limited equipment, the situation has deteriorated rapidly. In some places, limited composting is also practiced. None of the cities visited has any formal waste separation. Recycling and reuse is left to city scavengers. In general, LGAs are badly strapped for cash, the major limiting factor to a wider and more effective solid waste collection. Other constraints include lack of technical staff, institutional organization and lack of public sensitivity.

The most common method bordering environmental disposal is disposal in open dumps. This also involves the use of transfer stations. However, transfer stations observed in the cities visited were generally in disarray; it seems trash pick-ups have not been made for several days. In a few locations, in addition to scavengers, animals were seen feeding on the trash.

Open dumps are an inexpensive option in land disposal of solid wastes. Open dumps have the lowest initial capital investment and operating cost. LGAs with a lack of equipment and expertise often go for open dumps.

Open dumps, however, pose significant risks to human health and the environment, especially as municipal solid waste becomes more complex. In addition, the cost of remediating these sites can easily exceed their total lifetime capital and operating costs. Contaminated groundwater may never be returned to usable condition and other environmental impacts may take many decades to ameliorate. Open dumps also attract numerous birds that feed on the waste, which can make them more serious disease vectors than flies or rodents.

The other two types of landfill disposal—controlled dumps and sanitary landfills in the true sense did not exist in the cities the EA team visited. Controlled dumps have planned capacity, partial leachate management, regular (not usually daily) cover, basic record keeping and are sited with respect to site's geology and hydrology.

***Recycle and Reuse in Nigeria***

A sound waste management program involves recycle and reuse along with other elements indicated below:

- Available baseline data and information
- Collection and safe disposal
- Recycling and biogas generation
- Sewage treatment plants
- Lack of private sector participation
- Screening type of industry
- Land-use zoning/development control
- Legislative reforms
- Public toilets

As part of recycle and reuse activities, a few modest composting operations exist. In addition, some planning to recycle waste seems to have been initiated as indicated by the following feasibility studies.

***Ibadan Plastic-waste Recycling Plant***. Ibadan generates significant quantities of plastic wastes including nylon, polythene, broken/discarded plastic products such as jerry cans, bottles, bowls and balls. CASSAD (2001b), under the sponsorship of UNICEF, conducted a feasibility study for a modest (undefined size) pilot plastic-waste recycling project in the communities of Ayeye and Elta, in Ibadan on a cost-sharing arrangement. To gain useful information, the study also reviewed the operations of a plastic recycling facility at Idi-Ayunre in Oluyole LG. All projected equipment will be supplied by a Nigerian company.

The total estimated cost as well as cost sharing is indicated in Table 7.6.

**Table 7.6. Estimated Costs of a Plastic Waste Recycling Facility in Ibadan**

| Sr. No. | Items | Cost-sharing/Agency | Cost (N) |
|---|---|---|---|
| 1. | Machinery and Equipment | UNICEF | 1,975,000 |
| 2. | Personnel | Community | 535,000 |
| 3. | Capacity Building/Monitoring | UNICEF | 860,000 |
| 4. | Land | Community | 100,000 |
| 5. | Super Structure. | LGA | 500,000 |
| | **TOTAL COST** | | **3,970,000** |

The concept of the facility is based on local community participation and involvement. Participating communities have an institutional structure to sustain the community-based venture. Other participants include representatives from the state, LGAs and NGOs. This participation significantly increases the viability of the project.

***Slaughterhouse Waste Recycling Project.*** CASSAD also conducted a feasibility study for a slaughterhouse waste-recycling project based in Port Harcourt. The proposed project will use bone and blood from slaughterhouses to produce poultry feed supplement, phosphate fertilizer, bone powder and blood meal for pharmaceutical use. At production rates of four tons per day, a gross income of N3 million and a net profit of N675,00 per year was projected. The total cost of the plant including equipment, land, installation and labor was estimated at N5.4 million (CASSAD, 2001b).

***Organic Waste Recycling in Kaduna***. Another assessment under UNICEF/CASSAD evaluated the feasibility of installing an biodegradable organic wastes facility processing 20 tons of organic wastes per day. A similar plant based on local technology and manpower is in operation in Ibadan in Oyo State. Kaduna produces significant quantities of organic wastes, including animal wastes from cows, poultry droppings, piggery wastes, crop residues and some suitable industrial wastes—the city is home to the large Nigerian brewery and a few smaller ones.

Table 7.7 itemizes the project's costs.

**Table 7.7. Kaduna Organic Waste Recycling Facility**

| Sr. No. | Item | Cost-Sharing | Cost (N) |
|---|---|---|---|
| 1. | Machinery and Equipment | UNICEF | 5,316,710 |
| 2. | Capacity Building for Project Staff | UNICEF | 350,000 |
| 3. | Project Monitoring | UNICEF | 500,000 |
| 4. | Personnel (3-month costs) | State Government/LGA/Community | 428,000 |
| 5. | Super-structure/Buildings. | Community/LGA | 1,000,000 |
| 6. | Land | State Government | 100,000 |
| | **TOTAL PROJECTED COSTS** | | 7,719,710 |

In addition to cost sharing, the proposed plant includes key participation and management control by LGA, the state, and in addition to CASSAD, the Poverty Alleviation and Development Center, a local NGO. The project cost can be recovered in four to six years, and in addition, it will generate local employment opportunities. No formal cost-benefit analysis was provided.

***Private Sector Participation***

Local or metropolitan governments typically have handled solid waste management. In Nigeria, local governments are usually involved. However, LGAs are poorly funded, inadequately staffed and do not have the overall capacity to manage urban wastes. The EA team's site visits to Ibadan, Lagos, Calabar and other cities confirms this viewpoint.

Given this situation and the growing urban waste, private sector participation is desirable. Such participation may involve one or more aspects of solid waste management including collection, transfer, recycling, resource recovery and disposal of municipal wastes. The types of private sector participation most common to solid waste management are contracting, concession, franchise and open competition. Each option offers relative advantages and disadvantages and has been successfully used to varying degrees in developing countries. For example, Thailand has used private sector participation for operation and maintenance of equipment.

Open competition is a more common option. In open competition, the government freely allows qualified private firms to compete for refuse collection, recycling, or disposal services. Also, individual households and establishments make private arrangement with individual firms for refuse collection and/or recycling. In addition, the government grants a license to qualified individual firms for private provision of disposal services. The government's role in open competition is to license, monitor, and, as needed, sanction private firms. Costs are directly billed by private firms to their customers. Collusion can be a cause of concern in open competition.

For private sector participation, a number of contextual issues need to be carefully researched, including those of cost recovery, efficiency, accountability, management, finance, economics of scale, legislation, institutional management and cost.

In the Nigerian context, this will require review and overhaul, as needed, of applicable policy and legislative infrastructure and will require building institutional capacity to draft, implement and manage private sector participation. It will require generation of much needed baseline information, including reliable characterization of urban municipal wastes from various localities, socially acceptable approaches to city slums and community involvement and participation, as well transparency and competitive procurement.

Currently, in Nigeria, there are associations of private refuse companies in the states of Lagos and Oyo, and agreements on prices are made among companies. In situations where private companies can be relied on to not be excessively greedy, such price fixing practices might be tolerable. However, where profits are disproportionately high, price fixing is clearly unacceptable.

Despite conditions of open competition and unrestricted entry into the refuse collection business in various cities within Nigeria, it seems that the private sector has waxed and waned in response to general economic conditions, providing service when the economy is good and retreating from service delivery when bad. Only a handful of the private firms operating in Nigeria (no more

than 10 out of more than 100 firms) have made an investment in appropriately designed refuse vehicles. The remainder use depreciated equipment from construction (open tipper trucks), which they can readily use for other business activity when the profit potential of refuse collection business is down. At this juncture, it is interesting to observe that the one argument most often used for privatizing refuse collection (no barriers to entry) is essentially the same as one reason for private sector failure in Nigeria (no barriers to exit).

With significant growth in economic activity, a business as usual scenario will lead to significant damage to human health and environment. Limited monitoring can lead to unreliably measured results.

### 7.5.3 Industrial Waste

Waste is generally referred to as a material from a manufacturing process that has no value to the manufacturer and that has to be disposed of in some manner.

With rising economic standards and with many imported consumer goods (particularly food items), Nigerians increasingly have access to packaged goods, often using plastics, which makes waste disposal difficult. The development and widespread use of new packaging substances such as plastics have improved the standards of living for millions, but they have also introduced new threats to the environment, as typified by the histories of dichlorodiphenyltrichloroethane (DDT) and polychlorinated bi-phenyls (PCBs). Thus, industrial development also brings in its wake problems of environmental pollution that often need abatement. In Nigeria, the four most industrialized states are Lagos (home to approximately 60% of the Nigerian industries), Rivers, Kaduna and Kano. Collectively, these states share approximately 80% of the Nigerian industry.

Cleanup of industrial waste is costlier than prevention. The lowest level in the hierarchy (avoidance, utilization, minimization, recycle, reuse etc.) and the one that all other levels strive to eliminate, is remediation of the impacts of waste discharged to the environment.

The key industries in Nigeria are cement and asbestos, fertilizer and agro-chemicals, metallurgy and mining, tanneries, textiles and petroleum and petro-chemicals. At present, the petroleum industry contributes over 85% annually to Nigeria's foreign exchange revenues. Environmental pollution from these industries is regulated by FEPA and various state and other regulatory agencies. Between these agencies, the relationships are overlapping and not harmonized for regulatory environmental enforcement.

The EA team visited four industries: oil in Port Harcourt, breweries and textile industries in Kaduna, and tanneries in Maiduguri. In addition, the team had major discussions with FEPA, State Environmental Protection Agencies (SEPAs) and a number of other representatives in the industry, government and NGOs (see Appendix C). A brief overview of the environmental aspects, followed by overall compliance is presented below:

### *Tanneries and Textiles*

Tanneries are mostly concentrated in the Kano and Kaduna industrial zone. Tanneries are notorious for polluting the environment. Key pollutants include heavy metal chromium, toxic dyes, suspended particulate matters and others. The textile industry extensively uses a number of dyes and chemicals during the manufacturing process, depending upon the type of raw (fiber) material used. The Nigerian textile industry specializes in the production of fiber—cotton, synthetics or knitted materials. Environmental pollutants are generated during the process of desizing, scouring, mercerizing, dyeing and bleaching. The key pollutants are toxic waste fumes and dust (cotton fluff), sulfur dioxide, carbon monoxide, heavy metals, color, total suspended solids and fabric wastes.

### *Oil Industry*

Oil drilling and exploration can generate significant environmental pollution. The Niger Delta region, where this industry is concentrated, highlights this situation. The situation is described in Section 7.7.

### *Status of Environmental Compliance*

Most of the industrial effluents are discharged with little or no treatment into nearby water bodies. For example, all three of Kano's major industry effluents are discharged into Jakar River. The river also supplies irrigation water for vegetables and is a fishing ground for the residents. No statistics on the volume of liquid or solid wastes generated was available.

Waste management efforts are closely linked with the income levels. However, it the poor, mostly urban poor, given the proximity of industries to urban areas are the biggest sufferers. Such proximity to industrial facilities, often the result of the desire of the poor to live near places of employment, poses health risks. The 1984 accident, the worst in the industrial history at the Union Carbide plant in Bhopal, India caused over 2900 deaths and at least 100,000 injuries, affecting mostly the shanty town dwellers.

There is an urgent need to enforce the current environmental regulations. It was not surprising to hear from the Nigerian brewery staff in Kaduna that the large brewery is not meeting environmental requirements. The chemical analysis provided by the distillery staff supported the contention. The status was similar with the area's large textile industry. The situation was apparent in terms of deep, dirty blue, greasy water at each outfall. The water ultimately is discharged to Kaduna River, home of the area's fishery and water needs.

The KEPA staff overall expressed their inability, given political pressures, to enforce the current regulations. In addition to inadequate laboratory facilities, the staff also is inadequately trained in compliance and enforcement matters.

It is also important to note that much of the industrial and product design is based on industrial country has been practices, and almost all of the fundamental science on which regulation is based as been carried out in more advanced economies than Nigeria. While some opportunities

to leapfrog may be available, policymakers should review the situation in their own Nigerian context, especially for affordable technologies and compliance systems.

Ongoing challenges faced by Nigeria's enforcement program include limited funding, lobbying from powerful groups and individuals, interagency conflicts and political instability. Changes have been proposed in the system for imposition and collection of fines, and to include negotiation between government and industry in the enforcement process. In Nigeria, the national consciousness of environmental problems is not high enough to support a large-scale national enforcement program or polluter-pays principle.

## 7.6 Energy

Nigeria has considerable energy resources—the major ones being wood, hydropower, petroleum, coal and gas. The GFRN exercises a major role in managing many of these resources; their development, however, is carried out either by individuals, private corporations, or government organizations. Although the potential for solar and wind energy appear to be abundant, they as yet remain untapped in commercial quantities.

### 7.6.1 Energy Demand

Given the population growth and economic development, energy demand in Nigeria has been on the rise. Petroleum products, including premium motor spirit, kerosene, automotive gas, oil and liquefied petroleum gas (LPG), dominate commercial energy consumption in Nigeria. That being said, commercial energy consumption in Nigeria remains low. The reasons for this low commercial demand for and consumption of energy include, but are not limited to rising levels of poverty; low industrialization levels; relatively low ownership and usage of automobiles (around 20 cars per 1,000 people); and, weak penetration of appliances such as refrigerators, freezers and air conditioning into the general population. (U.S. DOE, 2000).

In terms of household energy demand and consumption, while liquified gas and kerosene are becoming increasingly common sources of energy in urban areas, woodfuel and charcoal remain the primary sources for household energy in rural and peri-urban Nigeria. As with the commercial sector, per capita energy consumption is quite low, estimated at 8.3 million Btu — for comparative purposes: per capita consumption in the U.S. is estimated at 355. 9 million Btu (Bendi, 2001).

***Electricity***

The National Electric Power Authority (NEPA) was created by governmental decree in 1972, through the merger of the Electricity Corporation of Nigeria and the Niger Dams Authority. The decree gave NEPA the mandate to maintain and coordinate an efficient and effective system of electricity supply for all parts of the federation.

Nigeria houses approximately 5,900 megawatts (MW) of installed electricity-generating capacity, primarily from three hydro and five thermal stations. NEPA continues to maintain the lead role in managing the generation and distribution of electricity through the national grid,

linking the major cities and many of the large towns in the Federation. All in all, NEPA provides electricity to an estimated 40% of the population—the majority of whom are urban dwellers.

In rural areas, electrification rates are far lower, and it is estimated that only 10% of rural households have access to electricity. In some states, such as Jigawa, it is estimated that only 6.2% of the population has access to electricity—contributing to a situation that negatively impacts upon economic productivity, educational opportunities and healthcare (SELF, 2000).

Over the years NEPA has been victimized by mismanagement, weak institutional capacity, corruption and frequent political maneuverings. As a result, Nigeria is facing a serious power crisis due to declining electricity generation. The causes of this crisis are threefold:

- Poorly developed commercial energy infrastructure (including pipelines and electricity grids) to deliver commercial energy to customers
- Poor maintenance and neglect of the existng power generation and distribution infrastructure, and;
- Weak revenue streams stemming from a combination of low tariffs, poor evolved billing and collection systems, and rapidly increasing demand.

The result is a power sector that operates well below its estimated capacity, and that suffers from increasingly frequent power outages and load shedding. At the federal level, the government is attempting to remedy the situation by increasing NEPA's capacity for generation and distribution. In addition the GFRN is moving to increase foreign participation in the power sector and to improve the environment for the operation of independent power producers to generate and sell electricity. There is also a plan, as part of a larger effort to increase privatization, to privatize NEPA in the near future.

### 7.6.2 Energy Sources and Production

Following is a brief discussion of the potential of key energy sources in Nigeria, and the main threats to the sustained use of these energy resources.

***Hydropower***

Nigeria's hydropower production has increased fourfold over the past 25 years and contributes to nearly 38% of the country's electricity generation (DOE, 2001). Currently Nigeria's hydropower potential is estimated at approximately 8000 MW, with an annual energy generation potential of 36,000 gigawatts (GWh). The existing installed hydropower capacity from the three major hydropower stations—two located on the Niger River at the Kainji and Jebba dams, and the third on the Kaduna River at the Shiroro dam—is estimated to be 1,900 MW (CASSAD, 2002). NEPA currently has plans for a fourth hydropower station to be located at Zungeru, in Niger State.

Although hydropower is considered a relatively clean energy source of energy, it does carry with it certain environmental and social costs, many of which are felt downstream from the actual generating facility. These may include changes in the ecology of the river and on a larger scale changes in the ability of the riverine ecosystem to provide much needed ecological processes and

services. At the present time, due in large part to a lack of reliable scientific data, it is very difficult to estimate the effects Nigeria's hydropower industry has had, and continues to have on the environment. It should be noted, however, that flooding continues to be a serious problem for those living in close proximity to the dam—for example, a heavy flood in October 1998 swept away more than 15 settlements located around Kainji Dam and along the coast of the Niger River. Some reports lay blame the flooding on the lack of regular dam maintenance. There are also reports that as a result of recent flood episodes, the Kainji Dam has shifted. If true, this may pose not only critical environmental and social threats to the region, but also serious economic threats to Nigeria on the whole.

### *Oil*

Commercial energy consumption in Nigeria is predominantly dominated by petroleum products. These product include the premium motor spirit (PMS), dual purpose kerosene (DPK), automotive gas oil (AGO), LPG, low pour fuel oil (LPFO), high pour fuel (HPFO), bitumen, base oils, paraffin wax and sulfur. Consumption of these products in the economy accounts for over 70% of the total energy demand in various sectors. Transportation, household and industrial sectors are the major consumers of petroleum products in Nigeria. A discussion of the various environmental issues associated with the oil industry are presented in Section 7.7.

### *Natural Gas*

Nigeria has the ninth largest reserves of natural gas in the world. Proven reserves are estimated at 124 trillion cubic feet (Tcf), including more than 3.4 Tcf of reachable gas. Additional reserves are estimated at 25 Tcf (DOE, 2002).

Natural gas is an emerging fuel in Nigeria, with great potential. In 1970, natural gas consumption was below 3% of the total (commercial) primary energy consumption. Current estimates now place natural gas consumption at 25% of energy consumption in the commercial sector (Davies, 2001). Several projects are currently underway, in an effort to meet the increasing demand. For instance, in partnership with a private sector consortium, Nigeria recently completed a liquefied natural gas (LNG) project, estimated at a cost of $3.8 billion, to process natural gas at Bonny Island. The facility, not yet fully operational, is expected to process 252.4 billion cubic feet (Bcf) of LNG annually. A number of similar projects are currently in various stages of design – designed to meet both domestic needs and for export. One such project, the West Africa Gas Pipeline (WAGP) is planned to export gas to Benin, Togo and Ghana. Several distribution schemes are also planned to increase domestic use. The proposed $580 million Ajaokuta-Abuja-Kaduna pipeline is designed to supply natural gas to central and northern Nigeria, while the proposed Aba-Enugu-Gboko pipeline will deliver natural gas to portions of eastern Nigeria.

The Lagos State government and Gaslink Nigeria Limited (Gaslink), a local gas distribution company, are developing a pilot program to deliver natural gas to nine residential neighborhoods in the state. Gaslink, which supplies natural gas to nearly 30 industrial customers in Lagos' Ikeja industrial district, plans to expand operations to include 150 industrial customers, 250,000 residential/commercial customers and 25 independent power plants.

### *Coal*

Coal reserves in Nigeria have been estimated at 2.5 billion tons, lignite at 250 million tons, and limestone at 600 million tons, spread over fifteen states (Bendi, 2001). In addition, there is an estimated 50 million tons of coking coal (CASSAD, 2002), and a large deposit of bituminous coal exists in Ondo State that has yet to be exploited.

The parastatal Nigerian Coal Corporation is responsible for operation of most of the existing mines. Its current plans call for increasing production to meet or exceed the previous level of 900,000 tons, achieved in 1959. The Nigerian coal mining industry is slowly being privatized. A production-sharing agreement with Nordic Industries, a consortium of Danish, British and local firms was recently signed to develop the coal industry. The Okab/Odigbo mine district in the northern Kogi State has reserves estimated at 22 million tons and is due to be developed. The Enugu mine has a capacity to produce 150,000 tons per year.

Nigerian coal is considered of average quality in terms of sulfur contents. Coal production in Nigeria, so far, has been very low. Cumulatively, it is an insignificant fraction of the total reserves due to declining annual production. Outside consumption at the household level, it is used for industrial heat and limited thermal power generation. Use of coal for electricity production requires relatively expensive clean technologies, and treatment for liquefaction and gasification make it more versatile. Thus, relevance of these and other issues in the context of increasing coal utilization in Nigeria must be fully evaluated.

### *Fuelwood*

Given the widespread lack of access to modern fuels, fuelwood remains the most important source of domestic energy in the country. Unfortunately, reliable estimates of per capita fuelwood demands and potential fuelwood supplies are unavailable. However, even in the absence of reliable statistics it has become clear that there is a growing and alarming shortage of fuelwood which affects a very large number of rural Nigerians. Clearing land for agriculture and the legal and illegal harvesting of fuelwood, both for household consumption, but increasingly for sale at market, are two of the major driving forces behind deforestation in Nigeria.

While specific strategies for sustainable development are beyond the scope of this study, political leadership and policies to promote wood supplies are sorely needed. There will also be a need to close the gap between expanding mandate and reduced capacity of the public agencies. Previous autocratic, centralized policies may need a serious review to include a decentralized approach, participation and input from NGOs, the rural communities and the private sector. It is also important to decrease reliance on fuelwood through the provision of other suitable fuel sources.

### *Solar*

The sun, a source of unlimited energy, can potentially provide the equivalent of about 25,000 times the total amount of energy presently used from all other sources in the world. In Nigeria, the geographic and climatic conditions show a high potential for solar energy. Its geographic location within the tropics, between latitudes of 4° and 13° North coupled with its land expanse

(about 983.2 x $10^6 m^2$) allows it to receive abundant radiation (about 16.7 x $10^{15}$ kilojeules [KJ]) every clear day. Estimates indicate that solar electricity could provide 35 times the current electricity production (CASSAD, 2001). The economics of conversion are very high at this time, but research in many countries has shown increasingly lower costs in conversion and improved cost-competitiveness with grid-supplied electricity.

In Nigeria, at present, exploitation of solar power remains extremely limited. In the commercial sector, a few companies in Nigeria marketing and selling solar energy conversion systems such as solar electric power systems, packaged power systems, photovoltaic systems, solar-powered irrigation systems, and renewable energy system batteries. Some of these firms include Comfort Zone (Nig.) Limited in Ikeja-Lagos, Fleet and Cosy Ltd. in Lagos, Subrec Engineering Limited in Kaduna and Solarmate Engineering Limited in Lagos.

SELF, a private U.S. firm, supported by the U.S. Department of Energy (DOE) and the Jigawa State government, is involved in a solar rural electrification project providing solar home systems to several villages, and providing electricity to village schools and health clinics in Jigawa State. This project will install solar home systems in 300 rural homes, solar power to 30 water pumping systems, electricity to 45 village health clinics, and enhance educational opportunities for children by bringing solar power to three rural schools (Self, 2000).

## 7.7 Environmental Impacts of the Petroleum Industry

The first discovery of commercial quantities of oil in Nigeria was in 1956. Today, the country produces approximately two million bbl/d of crude oil. Nigeria is the largest oil producer in Africa, and the fifth largest in the Organization of Petroleum Exporting Countries (OPEC).

Estimates of Nigeria's oil reserves vary from sixteen to twenty-two billion barrels, mostly found in small fields in the coastal areas of the Niger Delta. According to the Nigerian constitution, all minerals, oil and gas belong to the GFRN, which negotiates the terms of oil production with international oil companies.

The discovery of oil has transformed Nigeria's political economy, and oil has for the past two decades provided approximately 90% of foreign exchange earnings, and 80% of federal revenue—over half of which is from Shell. Total revenues are projected at $16.6 billion (African Business, 2002). Nigeria also has huge reserves of natural gas, yet to be fully exploited. Most exploration and production activities in Nigeria are carried out by European and U.S. oil companies operating joint ventures (JVs) in which the Nigeria National Petroleum Corporation (NNPC), a parastatal, owns 55 or 60%. More recent contracts related to offshore fields have been structured rather as "production sharing contracts" in which the government is not a formal partner. Shell operates a JV that produces close to one-half of Nigeria's crude production; ExxonMobil, ChevronTexaco, Elf, and Agip operate other JVs, and a range of international and national oil companies operate smaller concessions.

Given the large role of oil in the Nigerian national economy, the policies and practices of the oil companies have been an important factor in the decision making of the Nigerian government. Because the oil companies are operating JVs with the government they also have opportunities to influence government policy. At present, the oil industry is going through several changes

initiated by the NNPC. For instance, the government recently announced the withdrawal of all subsidies on crude oil and refined petroleum products in January 2002, following two-year struggle to force the change. One side benefit is apt to be lesser corruption. Earlier, NNPC was paying a subsidized rate of $9 per barrel. It is privatizing the four (NNPC) refineries and a commission will be set up to regulate competition (African Business, 2002).

### 7.7.1 Oil Industry and Area Communities

The multinational oil companies operating in Nigeria face a difficult political and economic environment, both nationally and at the oil producing community level where their facilities are located. At the community level, companies are faced with increasing protests directed at oil company activities and the lack of development in the Delta; these have included incidents of hostage taking, closures of flow stations, sabotage and intimidation of staff.

Environmental degradation has contributed to ethnic unrest in the region, especially the Niger Delta. People in the region protest that the activities undertaken by foreign oil firms have contributed to the degradation the local environment and are the target of much of their ire. But the government is also quite at fault for the unrest and the environmental problems due to it own mismanagement of oil and gas activities and its very lax enforcement of environmental laws and regulations. These kinds of problems also surface in other sections of this report and represent one of the underlying causes of environmental degradation in the country.

The oil companies are also legitimately concerned with preventing damage to their facilities and to the environment and to protect their personnel. The problems become more convoluted with the inevitable security arrangements between the oil companies and the GFRN, as are the internal oil company provisions for security responses in the event of incidents of hostage taking, sabotage or intimidation.

At the same time, the companies are emphasizing their commitments to avoid violent confrontations between community members and security forces. Shell and Chevron also have very visible and successful community outreach and self-help programs that have the participation of large cross sections of the Niger Delta communities and NGOs and that are also supported in no small way by other private sector institutions. (SPDC, 2000a). These and other efforts to reduce the risks of environmental degradation through targeted socioeconomic activities, such as those being overseen by the Niger Delta Development Commission (NDDC, 2001) should also help improve the relationship between the Delta populations and the oil companies.

### 7.7.2 Environmental Impacts

The major environmental impact of the petroleum industry has been, without doubt, in the Niger Delta. The Delta is one of the world's largest wetlands, the largest in Africa. It encompasses over 20,000 km², of which an estimated 6,000 km² is mangrove forest. As described elsewhere (see Sections 7.2 and 7.10) it has high biodiversity typical of extensive swamp and forest areas, with many unique species of plants and animals.

The environmental damage is well documented. It has occurred in all three environmental media—soil, water and air. Only the extent of the damage is subject to dispute. The oil companies operating in Nigeria, however, maintain that their activities are conducted to the highest environmental standards; but Nigerian environmental laws, when compared to their international equivalents, are very poorly enforced.

Although major environmental damage has been caused by oil drilling-related infrastructure development, gas flaring and oil spills, not all the environmental problems are the direct responsibility of the oil industry (see Box 7.2). The remaining discussion in this section now deals directly with environmental impacts related to the petroleum industry.

***Land Degradation and Water Quality Impacts***

Undesirable, environmentally polluting discharges of liquid, solid and gaseous wastes accompany almost all stages of oil production. In addition, all drilling has associated drilling wastes. Key among these are drilling-waste fluids or muds, drilling waste solids, produced water, and volatile compounds. The drilling-waste muds may be freshwater gel, saltwater, or oil invert-based systems (e.g., oil invert mud systems may contain up to 50% [by volume] of diesel oil). Occasional chemical discharges, though of short duration during construction, hydrostatic testing, commissioning, pigging, and maintenance of the pipeline systems, usually contain corrosion and scale inhibitors, biocides, oxygen scavengers, and other environmentally damaging agents.

Produced waters, including injection waters and solutions of chemicals used to intensify hydrocarbon extraction and separation of the oil-water mixtures, are one of the main sources of oil pollution in offshore oil and gas production. Formation water and brine are extracted along with oil and gas. Injection water is pumped into the injection wells in hundreds of thousands of tons to maintain pressure in the system and push the hydrocarbons toward the producing wells. Oil, low-molecular weight hydrocarbons, inorganic salts and technological chemicals usually pollute these waters.

Another potential source of oil pollution is produced sand extracted with oil. The amount of produced sand coated by oil can vary in different areas, even during production in the same area. Most often, this sand is cleaned of oil and dumped overboard at the well site. Sometimes, it is baked or calcified and transported to the shore. These wastes have a regular and long-term impact on the marine environment. Table 7.8 shows average values of pollutants in the wastewater stream from crude oil processing.

Also, as a hydrocarbon reservoir is being depleted, the ratio between the water and oil fraction in the extracted product increases, and water becomes the prevailing phase. At the same time, both the volumes of discharged waters and the difficulties of their treatment increase. The cleaning of produced water is complicated and expensive, offering the temptation of poor or no treatment, especially under poor enforcement conditions in Nigeria.

**Table 7.8. Wastewater from Crude Oil Processing**

| Parameter | Average values (mg/liter) |
|---|---|
| Oil and grease | 7-1,300 (200 |
| Total organic carbon | 30-1,600 (400) |
| TSS | 20-400 (70) |
| Total dissolved solids/TDS | 30,000-200,000 (100,000) |
| BOD | 120-340 |
| COD | 180-580 |
| Phenol | 50 |
| Cadmium | 0.7 |
| Chromium | 2.3 |
| Copper | 0.4 |
| Lead | 0.2 |
| Mercury | 0.1 |
| Nickel | 0.4 |

*Source: World Bank. 2000.*

The main environmental challenges from on-shore activities result from oil spills, gas flaring and deforestation. In the Niger Delta, one of the most visible consequences of the numerous oil spills has been the loss of mangrove trees. The mangrove forests are a source of fuelwood for the local people and a habitat for the area's biodiversity.

Also on shore, poorly designed causeways and canals constructed and used by the oil industry affect the hydrology of the seasonally flooded freshwater swamp and the brackish water of the mangrove forest. This kills off crops, destroys fishing grounds, and damages drinking water supplies. Saltwater incursion, especially in the outer reaches of the Delta and along the major water thoroughfares is an increasing problem.

***Atmosphere Pollution by Oil and Gas Operations***

Atmospheric emissions accompany most oil and gas operations. Atmospheric pollution caused by oil and gas development includes gaseous products of hydrocarbon evaporation and burning as well as aerosol particles of unburned fuel. From the ecological perspective, the most hazardous components are nitrogen and sulfur oxides, carbon monoxide and products of the incomplete burning of hydrocarbons. These components interact with atmospheric moisture, transform under the influence of solar radiation, and precipitate onto the land and sea surfaces to form fields of local and regional pollution.

Technical means to rectify and prevent atmospheric pollution during offshore oil and gas production are practically identical to analogous methods that are widely and often effectively used on land and in other industries. However, offshore atmospheric emissions, thus far, have not received attention, probably due to the remoteness of these developments from densely populated places. No estimates of the extent of oil and gas-related atmospheric pollution in Nigeria are available.

The effects of gas flaring are discussed in a separate section (7.3.2) under air quality.

### *Oil Refining Operations*

Nigeria has four oil refineries at Kaduna, Warri and Port Harcourt I and II, with a total nominal refining capacity of 438,750 bbl/d, although production rarely reaches this figure due to frequent breakdowns and operating problems. In theory, Nigeria's refinery capacity is sufficient to meet its domestic consumption requirements. In practice, the refineries are poorly configured and inefficient, leading to frequent shortages of refined products, both for the domestic and foreign markets. Product prices are heavily subsidized, encouraging smuggling on a large scale to neighboring states for resale at higher prices. It has been estimated that smuggling amounts to over 32,000 bbl/d, largely to Benin, Niger, Chad and Cameroon. Nigeria has become a large importer of light petroleum products.

On the environmental side, the contaminants, sulfur, nitrogen and metals found in increasing proportion in heavy crude oil for refining, contribute to pollution, interfere with refinery operations and corrode equipment, adding to the cost of refining, increased expenses of regulatory compliance, reduced operating efficiency and diminished product yield.

Oil refineries maintain a flare system to provide safety pressure relief for the various process units in a refinery. During start-ups, shutdowns and routine operations, excess hydrocarbon gases are generated and diverted to the flare system. At the flare stack, the hydrocarbon gases are burned as a method of destruction. As a result, the flares are a major source of hydrocarbon losses. Minimizing flaring, therefore, must be a priority for both environmental and economic reasons.

### *Oil Spills*

Oil spills are a normal occurrence in the oil industry and are detrimental whether they occur on-shore or offshore. In every case it is important to minimize their occurrence. Spills kill fish and agricultural crops, and pollute water, with serious consequences on the communities and families affected, especially on dry land or in freshwater swamp zones where spills are contained in a small area. The long-term effect of these major pollution incidents, regular small spills, and effluents deliberately discharged to the environment, is largely unevaluated.

The frequency of oil spills has varied considerably and the volume associated with these accidents has also been high. Regardless of the cause the oil companies and the people of Nigeria have to work agressively to keep the incidents and the volumes silled at a minimum to protect their valuable surface respources, especially in the Niger Delta region with its unique natural inheritance.

## GREEN

## 7.8 Agricultural Land Uses

Agriculture in Nigeria involves four broad systems of land use: crop production, animal husbandry, fisheries and forestry/agroforestry. This section addresses the crop production and

livestock systems focusing on threats, current practices and opportunities to/for those aspects of land use. Fisheries and forest uses are discussed elsewhere in this report.

The soils in Nigeria are the critical base for agricultural land uses and in order to support any type of production need to be used wisely and conserved. The major soil types according to the FAO soil taxonomy classifications are listed in Table 7.9. Even though they vary in their potential for agricultural use, no soil type (at least for any extensive area) would contribute to high productivity anywhere in Nigeria. In fact, almost fifty percent of the soils found in the country fall into the two lowest classes of productivity. These latter types are alfisols, acrisols, ferrasols and arensols and they have low productivity due to poor soil moisture retention capacity and low organic matter. Except for the ferrasols, they are the most dominant types found in the northern dry parts of the country (Government of the Federal Republic of Nigeria [GFRN], 2000). With an agricultural resource base of this magnitude, Nigeria's farmers and herders begin with an immediate disadvantage. These facts only further underscore the fragility of the land and the need to always be vigilant to its conservation.

**Table 7.9. One Productivity Estimate of Nigeria's Soils**

| Productivity grade | Soil classes | % of land area |
|---|---|---|
| High | None found in Nigeria | --- |
| Good | Fluvisols, gleysols, regosols | 5.52 |
| Medium | Lixisols, cambisols, luvisols, nitosols | 46.45 |
| Low | Acrisols, ferralsols, alfisols, vertisols | 31.72 |
| Poor | Arenosols | 16.32 |

*Adapted from: Agboola, S.A. 1979. An Agricultural Atlas of Nigeria. Oxford University Press, Oxford.*

### 7.8.1 Crop Production and Farming

Crop production in Nigeria can be broadly classified into three types of farming: rotational fallow, semi-permanent or permanent cultivation, and mixed farming each with variations. Permanent cultivation may be under rain-fed or irrigated systems, or as is common in sparsely populated areas rotational fallow within a land rotation system may exist.

Rotational fallow is a traditional system that was widely practiced throughout West Africa (as well as other regions of the world). The cropping phase on a plot of land was farmed until yields decreased and then allowed to go fallow where grasses and other vegetation were allowed to return under a natural state. Grazing was also sometimes permitted. Under this system, soils and nutrients were built back up with very little if any other productive inputs. With increasing population and demand for more land fallow times decreased or ceased to exist altogether. Without proper stewardship of the soils and the water falling on these plots (protection from wind and water erosion, compaction, loss of nutrients) and little or no fallow period the land resources become very susceptible to the processes of desertification (see Section 7.11).

Permanent or semi-permanent cropping systems in Nigeria are used to refer to perennial tree crop-based farming systems. Long-term crops such as coffee and cocoa determine a plot's use for an extended period of time and secondary annual cropping is done by the farmer to support and reduce risks associated with his/her main cash crop. Agroforestry (and certain types of

intercropping) also sometimes fall under this rubric. In these instances, the farmer will also grow shrubs or trees interspersed with his/her main cover crop, again to reduce the overall risk that might be associated with the loss of one or more of the crops, provide soil protection or other environmental improvements in addition to eventually gaining income from the longer-term crop. Environmental risks with this type of system are definitely less, but the use of fire to (annually) clear the land or careless plowing techniques can significantly increase the risks, especially to erosion as in the fragile soil types of the South East states.

Mixed farming (crop and animal production) is also widely practiced in Nigeria. Traditionally this was a semi-permanent system whereby plots or areas of land where allowed to be fallow for several years and a rotational system of grazing and crop production was used. It is still widely practiced. Farmers with livestock need to use extra precautions to avoid over compaction of soils on fragile or marginal sites, and to be wary of overgrazing that will result in valuable soil loss.

Today these traditional systems are breaking down and the fragile balance between man-made/managed environments and the renewability of natural resource ecosystems is crumbling due to overuse. Yudelman (1987) noted that the accelerating deterioration of the resource base in the region is significantly reducing production. In the absence of appropriate or functional technical changes, producers are farming more intensively either by shortening the fallow period or extending production into less hospitable areas. Both are happening to alarming degrees in Nigeria.

A recent nationwide study (Geomatics International et al., 1998) on comparative land use over an 18-year period reported that an additional nine percent of the entire country (84,073 km²) had come under agricultural production. Most of this "new" land was derived from areas of less intensive use or unexploited land such as savanna, forest or swamp. Overall, (see Table 7.10) the report concluded that by 1995 slightly more than 60% of the total land area of Nigeria was classified for agricultural uses compared to 44% in 1978.

In several regions of the country, and particularly in the more arid portions of the north, large-scale mechanized agriculture is being promulgated and practiced. The fragility of the soils, particularly their low nutrient content, is more pronounced here. Often these large operations are complimented by large irrigation schemes to help provide the necessary water that allow the farms to produce the quantities of cash crops necessary to stimulate the regional and national economies and help pay back the loans taken out to finance the projects. Large areas adjacent to Lake Chad, in the Hadejia-Nguru basin, and in the North West in the Sokoto River basin, irrigated perimeters are operating. Quite often, boreholes and deep artesian wells have been dug to supplement the agricultural effort and also to help serve domestic needs.

All of these water resources are fragile and their sustainability for both quality and quantity needs to be assured. Knowledge about their reliability is relatively unknown. Current water management practices in these areas, and especially in those listed above is suspect. Waterlogging occurs in some cases and there is definite knowledge on the increasing salinity of the soils in many of these perimeters. This condition not only decreases agricultural yields but also harms the ability of the area to support birdlife and other wild fauna, thereby creating a negative impact on the country's biodiversity.

**Table 7.10. Area Summary of Dominant Vegetation and Landuse Classes for 1976/78 and 1993/95**

| Land Use Category | 1976/78 | | 1993/95 | | Change km$^2$ |
|---|---|---|---|---|---|
| | % of country | km$^2$ | % of country | km$^2$ | |
| Intensive (crop) agriculture | 35.5 | 322,794 | 40.2 | 365,491 | 42,697 |
| Extensive (grazing) agriculture | 18.3 | 166,326 | 20.6 | 187,236 | 20,910 |
| Sudan savanna | 12.5 | 113,880 | 9.0 | 81,694 | -32,186 |
| Guinea savanna | 16.6 | 151,293 | 9.0 | 81,386 | -69,907 |
| Floodplain agriculture | 1.0 | 9,451 | 2.3 | 20,918 | 11,467 |
| Disturbed forest | 1.6 | 14,573 | 2.1 | 18,990 | 4,417 |
| Gully erosion | 0.0 | 122 | 2.0 | 18,517 | 18,395 |
| Shrub swamp | 1.9 | 16,899 | 1.0 | 9,248 | -7,651 |
| Freshwater swamp | 2.0 | 18,316 | 1.8 | 16,499 | -1,817 |
| Undisturbed forest | 2.9 | 25,951 | 1.3 | 12,114 | -13,387 |
| Sahel savanna | 1.4 | 12,549 | 1.3 | 11,983 | -566 |
| Discontinuous grassland | 0.7 | 6,137 | 1.2 | 11,248 | 5,111 |
| Mangrove forest | 1.1 | 9,994 | 1.1 | 9,977 | -17 |
| Agriculture / denuded | 0.4 | 3,518 | 1.0 | 9,206 | 5,688 |
| Continuous grassland | 0.1 | 1,034 | 0.9 | 7,989 | 6,955 |
| Natural water | 0.7 | 6,591 | 0.9 | 7,851 | 1,260 |
| Montane forest | 0.7 | 6,762 | 0.7 | 6,759 | -3 |
| Urban (major + minor) | 0.2 | 2,083 | 0.6 | 5,444 | 3,361 |
| Riparian forest | 0.8 | 7,402 | 0.6 | 5,254 | -2,148 |
| Sand dunes | 0.1 | 812 | 0.5 | 4,829 | 4,017 |
| Montane grassland | 0.2 | 1,739 | 0.3 | 3,112 | 1,373 |
| Reservoir | 0.2 | 1,327 | 0.3 | 2,888 | 1,561 |
| Rock outcrop | 0.2 | 1,424 | 0.3 | 2,632 | 1,208 |
| Tree crop plantation | 0.1 | 830 | 0.2 | 1,641 | 811 |
| Forest plantation | 0.1 | 997 | 0.2 | 1,573 | 576 |
| Teak Plantation | 0.1 | 628 | 0.1 | 1,156 | 528 |
| Irrigation project | 0.0 | 147 | 0.1 | 988 | 841 |
| Grass marsh | 0.5 | 4,882 | 0.1 | 871 | -4,011 |
| Salt marsh / tidal flat | 0.0 | 4 | 0.1 | 545 | 541 |
| Agricultural project | 0.0 | 16 | 0.1 | 485 | 469 |
| Alluvial | 0.1 | 487 | 0.0 | 269 | -218 |
| Livestock project | 0.0 | 52 | 0.0 | 139 | 87 |
| Mining | na | na | 0.0 | 62 | 62 |
| Canal | 0.0 | 2 | 0.0 | 29 | 27 |

*Geomatics International Inc., Geomatics Nigeria Ltd. and Beak Consultants Ltd. 1998. The assessment of vegetation and land use changes in Nigeria between 1976/78 and 1993/95. Submitted to: Forest Management, Evaluation and Coordinating Unit (FORMECU), Nigerian Federal Department of Forestry under the World Bank Environmental Management Project (EMP).*

The dams created to impound the water are also deleterious to the environment, trapping sediment that would normally wash downstream and provide fresh, nutrient-loaded soils that vegetative cover could use to its benefit. Moffat and Linden (1995) also surmise that the dams on the Niger River are having a significant effect on the longevity of the Niger Delta. The sediment that washed downstream annually with the floodstage of the river no longer happens. It is trapped upstream behind the dams. This cannot contribute to the seaward building of the Delta, but rather the forces of the Atlantic are now winning and coastal erosion is becoming more severe and actually removing significant portions of the outer Delta's structure.

Overall, the fragile soils of Nigeria face two major threats from agricultural land use: declining soil fertility and erosion. Declining soil fertility has been identified in every part of the country and actions to alleviate it have been noted, especially in the South West (Akinwande, 2002) and the South East (Mbagwu, 2000). Fertilizer applications are often seen as the panacea for this type of degradation. Too often the costs of such inputs are beyond the means of subsistence and even if they can be applied, the effect is short-lived and carries other environmental and health risks. Properly addressing soil fertility issues requires a sustained effort with education, hands-on training, a great deal of patience, indigenous knowledge that only the landowner can provide, secure tenure and luck.

Intensified agricultural uses, including agricultural encroachment into forested areas and overexploitation of the land, has resulted in extreme erosion problems in many parts of Nigeria. Table 7.10 reports that the area impacted by gully erosion increased by 18,395 km² in the 18 years prior to 1995. This threat is most severe in the states of the South East and the North Central zones (see Box 7.6). Local and state governments are expending millions of Niara in attempts to alleviate the problem (Mbagwu, 2000). In the central portion of the country, the high plateau region around Jos has been denuded for decades. The extensive mining activities have also exacerbated gully and sheet erosion in Plateau State (Jones, 1975; Longtau and Gwaivangmin, 1999).

Although the alarm has been sounded, there is little evidence of activities being implemented on the ground to alleviate the problems. Policies at the national level are being promulgated but there appears to be little coordination among activities or with resources at the community level. NGOs and CBOs in the South East zone are helping to raise awareness and to educate farmers and communities about the causes of erosion in their region. And states are helping to finance activities aimed at repairing the damage done to the hardest hit areas (Mbagwu, 2000). But there is yet to be any strong national or local movements to take preventative action. There are pockets of successful interventions. In Borno and Yobe States successful pilot activities (Gadzama, 2002) have occurred where CBOs have been empowered to utilize resources effective to relieve degradation caused by declining soil fertility and erosion. Also across the north and in the central portion of the country, soil and water conservation measures such as terracing, vegetative bunds, ploughed ridges and micro-catchments have been constructed by local farmers with success on a small scale (Longtau and Gwaivangmin, 1999). In some cases, local NGOs provided assistance for these efforts. Despite future plans for some pilot site areas on *fadama* lands, no institution has stepped in to aggressively promote the simple technologies that have been used successfully (Ouedraogo and Swadogo, 2002; Taonda et al., 2002) for more than a decade in the surrounding region (Cameroon, Niger, Burkina Faso, Benin, Mali). Somebody needs to do something, and soon.

### 7.8.2 Animal Husbandry

Livestock production in Nigeria is predominantly (at least in terms of numbers) the pastoral type. Estimates include 16 million cattle, 13.5 million sheep, 26 million goats and 2.2 million pigs and 150 million poultry (GFRN, 2000). In the Sahelian and savanna zones of the country, animals are herded, usually by Fulanis with these zones hosting about 90% of the cattle and two-thirds of the sheep and goats. (Almost all of the donkeys, camels and horses are in these northern zones.)

**Box 7.6. Gully Erosion**

*The total length of active gullying on the Jos Plateau is 8,000,000 yards, or more than 4,500 miles, representing a volume of 100,000 tons of soil lost. Expressed topically that means that the gullies, if placed end to end, would stretch from Lagos to London and halfway back again. And that to transport by sea the amount of soil lost, one thousand 100,000-ton supertanker-type cargo vessels would be required to complete the task. Mechanical repair would have cost more than N30,000,000 …(and) is not practical because of the very high cost, and it does not remove the root cause of the erosion. It is recommended that existing but unenforced legislation be reactivated and operative legislation be tightened to curb the malpractices associated with mining, grazing, and cultivation, particularly with regard to the refilling, leveling, and general rehabilitation of mining excavations; the over-intensive grazing, indiscriminate burning of the trailing and trampling of stream and gully banks and hillslopes, streambanks and streamside cultivation.* - R. Jones, 1975 Report to the Ministry of Overseas Development, London.

An extreme example perhaps, but this citation in a recent ODI report (Longtau and Gwaivangmin, 1999) illustrates that gully erosion is certainly not new to Nigeria. It is also listed among the top ten environmental priorities of the Ministry of Environment (Okopido, 2002). The phenomenon is quite dramatic and makes agronomists, hydrologists, passers-by, journalists and politicians take notice (Anonymous, 1999) of the plight of many would-be land stewards and their families. Gully problems are particularly acute in Plateau, Adamawa and Cross River states as well as the five states in the South East geopolitical region where runoff from high-intensity rainfall events makes the problem widespread (Owuama, 1997).

Gully erosion is primarily the result of poor land management practices such as uncontrolled removal of covering vegetation (deforestation, overgrazing, burning), unsustainable farming practices, and poorly constructed drainage and road/trail systems. In the states listed above, population densities are high and agricultural land is scarce making land stewardship mistakes costly. Poor management practices are easily exacerbated; and when left unchecked the problem grows. The Federal Ministry of Agriculture indicated that by 1996 more than 35 millions tons of soil was being lost annually (Mbagwu, 2000) and as far back as 1990 the cost of gully erosion in Nigeria was estimated by the World Bank (1990) to exceed US $100,000,000 per year!

Numerous technologies that address soil and water conservation issues are available and have been applied successfully in Nigeria and throughout West Africa. In addition to effective and participatory extension education activities, Hudec etal. (1999) notes that careful crop management practices and physical adaptations such as contour and strip farming, terracing and the construction of ridges perpendicular to the slope are good preventative measures. Gullied lands can be rehabilitated and stabilized with outside (government and donor) assistance but communities must take the initiative and be an integral part of the solutions and preventative practices that follow the engineering works and replanting efforts. Each situation will demand a different solution, or combination of solutions often involving innovation with traditional knowledge. Land stewards/owners and local governments must work together, informing one another of what activities can work, and what won't work on a particular site.

Simpson et al. (1999) point out that the proper mix of technologies, monitoring and local governance can help rehabilitate degraded landscapes and prevent more gullies from occurring. Coordination with highway designers and road builders is particularly important to prevent runoff erosion problems on lands adjacent to transport routes. Planting crops and trees must be carefully planned in relation to water harvesting and water spreading initiatives to minimize exposure of soil to the impact of rain and runoff. Water collection techniques such as terrace-margin ridges (bunds), contour trenches, impoundment of runoff in reservoirs on the up-slope sides of check dams, the collection of spring waters in masonry tanks and the harvesting of rainwater from the roofs of dwellings and roads are also mitigating techniques that have been used successfully in southeastern Nigeria.

To avert further disasters in these states, prevention strategies are becoming very important. In villages and areas especially prone to erosion inventorying local site conditions, and their propensity for gully erosion, are important criteria. Monitoring land use practices and changes in vegetative cover are critical and being prepared to respond rapidly to unplanned conditions are also important prevention steps.

Local communities have pushed to make the national government take notice. It has. But the real solutions, the rehabilitation, and prevention of future erosion problems needs to happen and be maintained at the local level.

During the dry season, the Fulani herders move southward as far as the deciduous forest and northwards into the Sahel as far as the rains will allow for fresh grass and water during the rainy season. For Nigeria, this transhumance migration has transboundary ramifications because during the dry season many of the herders and their animals come from Chad, Cameroon and Niger.

There are two pastoral corridors in Nigeria through which these migrations pass. One is in the northwest running from Niger and Benin through the western states and ending in Oyo State. The second runs from the northeast corner moving animals from Niger and Chad southwesterly through the eastern states and terminating in the Benue/Niger river basins.

During drought years, this movement of large numbers of animals has a tremendous negative effect on the soils, rangeland and even the woody vegetation in the country, especially along these corridors. They are a serious cause of erosion and desertification. And water resources, which are always in short supply during the dry season in these areas, becomes even more threatened. Watering points, which are often used by the country's sedentary population in these regions, also become sources of conflict as water use is competed, or public health risks rise when animals and humans are forced to use the same water sources.

Conflict with farmers is also on the rise in and adjacent to these pastoral routes. Nigeria's growing population is being forced more frequently to farm more and more marginal lands, areas that before were used only for livestock. This not only causes conflict among users, but it also seriously degrades the soil and biological resources of the country.

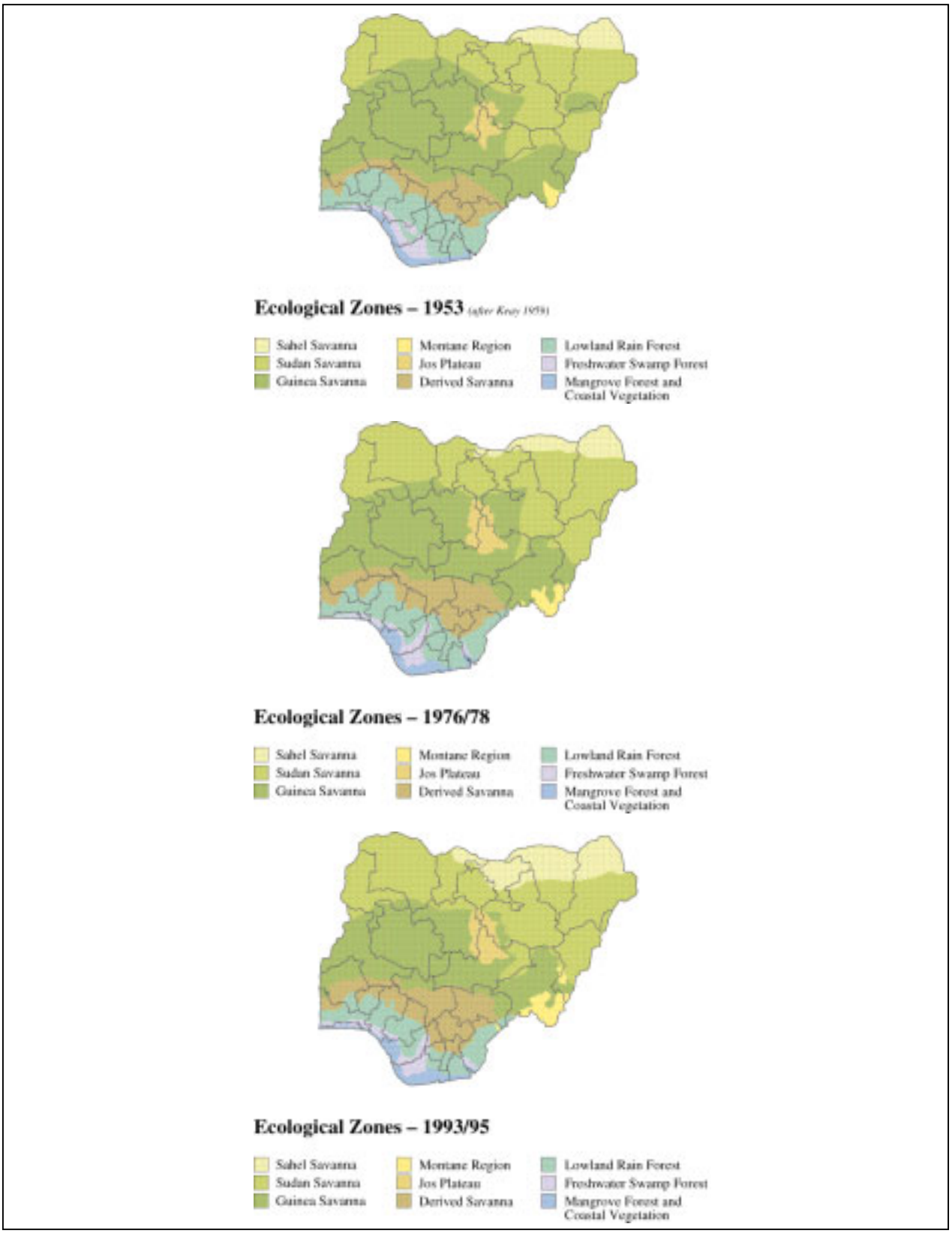
## 7.9 Savanna and Forest Ecosystems

Shrubs, trees and other woody vegetation is classified into seven major cover types in Nigeria. In the north four savanna types prevail, classed roughly by rainfall and moving from north to south, these are: Sahel, Sudan, Guinea, and derived. Figure 7.1 illustrates these zones and also shows the southward movement of the arid areas since 1953. The southern part of the country contains what remains of true forest cover types. These include rainforests, montane forests, freshwater swamp forests and mangrove (salt and fresh water) forests.

### 7.9.1 Savanna Types

The Sahel savanna is found mainly in the northeast and along the northern border with Niger. In addition to grasses, shrub species (*Combretum spp*.) and acacias predominate. Forest cover rarely exceeds 10% except along season watercourses. The Sudan savanna contains similar species to the Sahel zone with a greater frequency of *Acacia albida*, *Tamarindus indica*, *Schelocarya birrea* and forest cover of up to 20% of the land area. The Guinea savanna is found in the middle belt of Nigeria, and is typified by open woodland with tall grasses and fire-resistant trees. African mahogany at one time was an indicative species of this zone. They have all but disappeared today, being a favorite species for local wood products like mortars. Tree cover here varies between 15 to 25% in undisturbed areas. The derived savanna is found further south and is a broad band that borders the remaining forest zone, and is continuing to spread south as more forestland is degraded into agricultural uses. Tree cover here is as much as 30%. Although savanna tree species are not as valuable for timber as those found in rainforests, a few species are

**Figure 7.1. Ecozones of Nigeria (1953-1995)**




*Source: Geomatics International et al., 1998.*

commercially harvested. Many other trees are cut for fuelwood by residents in these areas, or cleared to make room for agriculture (Beak Consultants et al., 1999).

Desertification (see Section 7.11) is also causing the borders of the drier savanna types to move southward. These lines of definition between all the various savanna types are vague and overlapping, and continually influenced by fire, drought and anthropogenic factors. Only a small amount of natural savanna has been protected in Nigeria, and the many large savanna animals often found elsewhere in Africa have become greatly reduced in numbers and range.

### 7.9.2 Natural Forest Types

Nigeria has six main types of natural forestland: lowland rainforest, freshwater swamp forest, savanna woodlands, riparian forests, mangrove forests and montane forests. The savanna woodlands mentioned in the previous section and riparian forests occurring in watercourses in the central and northern parts of the country also contribute to the nation's natural forest resource base. In addition, there are increasing areas under oil palm and rubber plantations. Planted agroforestry species also contribute to the resource, but not significantly. Table 7.11 presents one recent estimate of the natural forest area in the south of Nigeria.

**Table 7.11. Estimates of Natural Forest Cover in Southern Nigeria**

| Forest type | Estimated Area (ha) | % in Forest Reserves |
|---|---|---|
| Lowland forest | 1,700,147 | 20.7 |
| Freshwater swamp forest | 1,611,360 | 4.9 |
| Savanna woodland | 392,321 | 2.3 |
| Riparian woodland | 84,355 | 0.1 |
| Mangrove forest | 5,314 | -- |
| Montane forest | 3,847 | -- |
| Total | 3,797,344 | 28.0 |

*Adapted from: Beak Consultants et .al., 1999.*

#### *Lowland Rainforests*

Lowland rainforest once covered much of the southern terrestrial areas of Nigeria, where an abundant rainfall regime favors the development of this ecosystem type. Unfortunately, excessive exploitation of timber, agricultural encroachment and other anthropogenic changes has greatly reduced these forests in extent. Although rainforest patches still are found in a belt in southern Nigeria from the western to eastern borders of the country, the largest remaining tracts of rainforest are primarily found in Cross River, Bendel and Ondo States (FAO, 1981) contiguous with the rainforests in neighboring Cameroon.

Nigeria's lowland rainforests are characterized by a great variety of plant species arranged in a complex vertical structure of forest canopies. Some economically important rainforest trees include mahoganies, African walnut (Lovoa) and Mansonia and a number of others that are increasingly endangered by illegal and legal logging activities. Many NTFPd are extracted from these forests and have important values as food items, medicinals, and other domestic uses by local residents.

### *Freshwater Swamp Forests*

Freshwater swamp forests are found in southern Nigeria, on the landward side of the mangrove belt, where salinity decreases beyond the tolerance of mangrove species. Swamp forests are dominated by species *of Raphia, Pandanus, Calamus* and *Alchornea*, with a canopy that sometimes is as high as 15 meters tall (NEST, 1991). Those swamp forests the furthest inland are only seasonally flooded and are characterized by climbing palms (rattan) and a variety of other species that make the forest nearly impenetrable. Although some NTFPs are collected, large tracts have been relatively untouched by commercial ventures. A bigger threat to swamp forests is the intrusion of saltwater into many areas due to the development of navigational canals, primarily to enhance activities of the oil industry.

### *Riparian Forests*

Riparian forests consist of forest types found on narrow strips bordering water bodies. Many of these forests have been spared from agriculture influences due to difficult access and periodic flooding regimes (Beak Consultants et al., 1999). These forests are important to the protection of watersheds, and when they are destroyed, siltation and degradation of the watercourses becomes severe. These forests also have a role to play in the migration and movement of many animal species, forming corridors of connectivity between different forest patches. The riparian forests of the Jos Plateau are also known to contain a unique assemblage of species including a number of endemics plants and a few endemic birds and mammals. These forests are under intense threat and only small amounts still remain.

### *Mangrove Forests*

Mangrove forests in Nigeria range along 708 km of coastline with an extent of from 16 to 90 km from the shore inland, encompassing 5,591 km² of land (Isebor and Awosika, 1993). Mangroves survive in marine and brackish habitats and are replaced further inland by freshwater swamp forests. Nigerian mangroves are dominated by red mangroves (*Rhizoporaceae spp.*) and also include white mangroves (*Avicennia spp.*) and a few other mangrove species. The mangrove understory includes a thick undergrowth of other salt-tolerant plant species.

Local residents also use mangroves for firewood, for dying their fishing nets, and also collect a number of NTFPs from the understory. As mangroves are cut for firewood, or opened up for navigational canals, villages, and oil company operations, they are gradually being replaced by Nypa palms (*Nypa fructicans*), an exotic plant species that is a fast colonizer. Unfortunately, the Nypa palm but does not provide the same extensive ecological services provided by native mangroves.

### *Montane Forest*

In Nigeria, montane forests are found primarily on the highlands that form the southeastern border between Nigeria and Cameroon. Although some of this high altitude area consists of grassland, shrubs and rocky outcrops, there are some patches of montane forests along the

eastern, southern and western sections that merge gradually into lowland rainforest at the base. Due in large part to their geographical isolation and unique microclimate, they contain considerable biodiversity and many of the plant and animal species found here are endemic to these areas. Two types of montane forests can be discriminated, the mist forests with a diversity of moss and epiphyte species and uneven canopies, and drier forests higher up, where dwarf and stunted trees occur. The Jos Plateau is another highland area that once contained tracts of montane forests. This area has been highly modified by anthropogenic factors and now only remnant patches exist.

Major threats to Nigeria's forest resources are unsustainable uses and poor management of existing forested land, including lack of enforcement. The derived savanna zone described above is an excellent example of these effects. The primary forest is overexploited and gives way to agricultural land or secondary forest with species that are of lesser economic value and importance for biodiversity conservation. Lack of affordable access is the only reason today why the montane forests in the southeast and the freshwater swamps along the coast and in the Niger Delta still exist.

Management of existing forestland is nil or ineffective due to poor training, lack of enforcement and poor data (Beak Consultants et al., 1999). Even when concessions are granted legally for harvest they have no inventory data to back up the sale and licensing (Akindele, 2002). Unless local people are empowered to protect the remaining forest land outside of reserve areas most of Nigeria's remaining natural primary forest cover is sure to disappear.

## 7.10 Biodiversity

Nigeria is a tropical nation encompassing a variety of diverse habitats and ecosystems—features that lead to a large amount of biodiversity in terrestrial and aquatic species. Like many developing nations, the continued resources necessary to thoroughly catalogue these has been lacking and much of the diversity is relatively undocumented. The data that exists come from a number of studies of particular taxa and particular sites of interest to various researchers. Most of the information available concentrates on those species of particular economic or aesthetic importance to people. Most species, including many plants, terrestrial and aquatic invertebrates, small mammals, reptiles, amphibians, fish, etc. in much of the country remain undocumented.

As of 1992, Nigeria was said to have 274 mammal species and 839 bird species (FEPA, 1992). Since then more birds have been documented in Nigeria, bringing the latest total of Nigerian birds to 889 species (Ezealor, 2002). Nigeria is known as a global hotspot for primate species, with a great diversity found especially in the Gulf of Guinea forests of Cross River State and adjacent parts of Cameroon. Some important endemic birds and mammals include three monkey species, the white-throated monkey (*Cercopithecus erythrogaster*), Sclater's guenon (*Cercopithecus sclateri*) and the Niger Delta red colobus (*Procolobus pennantii epieni*) and three birds, the Anambra waxbill (*Estrilda poplipaia*), the Ibadan malimbe, (*Malimbus ibadanensis*) and the Jos indigo-bird (*Vidua maryae*) (Aminu-Kano, 2001). The most endangered gorilla subspecies on earth, the Cross River gorilla (*Gorilla diehli*) with an estimated population of less than 250 individuals is found only in a couple of protected areas near the Nigeria/Cameroon border (Bassey and Oates, 2001).

Nigerian reptiles, amphibians and fish are not nearly as well known as the birds and mammals. In the Nigeria country study on biological diversity (FEPA, 1992), Nigeria was said to harbor 135 reptile species, 109 amphibian species and 648 fish species but various other studies over the years quote widely differing numbers of these vertebrates. The forests along the southeastern border with Cameroon area known to be a hotspot for amphibian biodiversity. Invertebrates are even less known, but the tropical forests bordering Cameroon are also a hotspot for butterfly speciation, with an estimated 1000 species in Cross River National Park alone (Larson, 1977). The Biodiversity Country Study (FEPA, 1992) estimates that Nigeria has more than 20,000 insects, 77 mollusks, 5 echinoderms, etc. but these numbers are largely suspect.

Due to the diversity of habitats in Nigeria and the tropical climate, there is a great diversity of plant species found in the country. There have been many localized studies of plants in Nigeria, but few sources of consolidated information. According to the 1992 country study (FEPA, 1992), more than 848 algae species have been identified in the marine and freshwater habitats and over 5,103 higher plant species and less than 200 lower plant species have been identified, although the number of these plants is most definitely much higher. Nigeria's plants include many species with traditional value as food items, medicinals and for various domestic uses and a number of these plants have been catalogued in various specific areas of the country. Nigeria is also an epicenter for diversity of wild varieties of important crop plants, including cowpeas (*Vigna unguiculata*), West African rice (*Oryza sativa*), yams (*Dioscorea* spp.), Bambara groundnuts (*Vigna subterranea*), Kersting's groundnut (*Macrotyloma geocarpum*), African yam bean (*Sphenostylis stenocarpa*), and winged bean (*Psophocarpus tetragonobus*) (Dr. Ng, IITA, 2002). A number of these wild crop relatives are presently endangered.

The IUCN Red List of Threatened Species (Hilton-Taylor, 2000) of globally threatened species includes 148 animals and 146 plants that are found in Nigeria. Of these, 26 animals and 18 plants are classified as endangered and another three animals and 15 plants are critically endangered worldwide. Many more species are endangered or threatened in Nigeria alone, but viable populations still exist in other countries.

Nigeria's extraordinarily large human population includes one out of every five people living in sub-Saharan Africa. This population is growing rapidly and migrating to increasingly large urban centers that are among the largest cities in the world. Although Nigeria receives considerable revenue from its large multinational oil industry sector, this money rarely trickles down to the populace who are generally poor and growing poorer. This combination of expanding population and increasing poverty is putting increasingly severe demands upon the remaining biodiversity.

## 7.11 Desertification

**Box 7.7. Desertification is …**

*The reduction or destruction of the land's biological potential, finally resulting in the appearance of desert conditions. It is one aspect of the generalized degradation of ecosystems under common pressures of adverse and uncertain climatic conditions and over-exploitation. This overuse has reduced or destroyed the biological potential, that is to say the plant and animal production for multipurpose use, at the very moment when increased use was needed to meet the needs of growing populations aspiring to development.* - UN Conference on Desertification, Nairobi, 1977.

Desertification and persistent drought is common at this region's latitude of Africa and the eight northern-most states of Nigeria have experienced these conditions for quite some time (see Box 7.8. Today desertification is further exacerbated by a rapidly growing population and it constitutes a very serious environmental threat for the region. Although it most directly affects the northern tier of states it has dire economic consequences for the whole country. Some estimates place the southward advance of the desert conditions as high as 0.6 km per year. As noted earlier, the Minister of State for the Ministry of Environment (Okopido, 2002) lists it in the top three environmental problems that affect Nigeria.

**Box 7.8. Over fifty-five years ago …**

*In Northern Nigeria there are certain signs of encroachment of the Sahara … It arises from a variety of causes—overtaxing the land by demanding too much and giving little, over-population with inferior cattle, forest fires, unregulated tree-felling, inferior methods of agriculture, silting of waterways and the washing away of alluvial soil. These distressing circumstances can be seen in places like the road to Zaria, where even the main road itself is threatened … we see little evidence of it where traditional agricultural practices are maintained. Difficulties arise from new developments such as new methods of cultivation for cash crops, especially those involving mechanized equipment.* - Lord Ammon, 20 January 1945 (Longtau and Gwaivangmin, 1999).

The northern border shared with Niger is in the Sahelian/Sudan savanna ecological zone. Annual rainfall rarely exceeds 600 mm and usually occurs in the three-month period of June to August. Unpredictability and unreliability characterize the pattern of rainfall. Acacia trees and shrub species predominate here in open savanna grassland and a tree canopy cover that rarely exceeds 10%. The climate is harsh. Streambeds remain dry for most of the year and are prone to flashfloods and the accompanying erosion in the short rainy season. Soil surface temperatures often exceed 50º C at the peak of the dry season (April/May). Wind blown erosion is a common problem especially with Nigeria's burgeoning population seeking arable land is cultivating more and more marginal areas. Because of its low and variable biological production this savanna ecosystem is very sensitive to human and animal population pressure.

This zone is also home to the largest livestock population in the country and supports the bimodal movements of transhumance populations that follow the rains as they move north and then retreat southward as the rainy season ends. There are two pastoral corridors in Nigeria through which these animals pass. One is in the northwest running from Niger and Benin through the western states and ending in Oyo State. The second runs from the northeast corner moving animals from Niger and Chad southwesterly through the eastern states and terminating in the Benue/Niger river basins.

It has been estimated that upwards of 50% of the northern tier of states in the North West and North East geopolitical zones are affected by desertification. These states, with a population of about 30 million people, account for about 43% of the country's total land area (GFRN, 2000). And in the next line of buffer states 10 to 15% of the land area has been influenced by desertification (Gadzama, 2002).

Natural causes of desertification include the poor physical condition of soils, covering vegetation, topography as well as the inherent extreme climatic variability. This latter variable is the most important natural component of desertification in Nigeria.

Human activities disrupt ecological systems. Poor land use and population pressures erode the sustainability of natural resources. Over-exploitation (of water and biological resources), overgrazing, deforestation, wood extraction and poor irrigation practices are the main anthropogenic factors leading to desertification. Table 7.12 consolidates some of the issues related to desertification in the drylands of Nigeria.

**Table 7.12. Issues Related to Desertification in the Savanna Lands of Nigeria**

| Issues | Causes |
|---|---|
| Drought | • Climatic variations<br>• Low soil water holding capacity |
| Inherent low soil fertility/declining soil fertility | • Low soil organic matter levels in drylands<br>• Cultivation of marginal lands<br>• Population pressure resulting in reduced/eliminated fallow period<br>• Land tenure problems |
| Inadequate feed and fodder for livestock | • Livestock population in excess of carrying capacity of the rangelands<br>• Increasing migration of livestock from neighboring countries (Chad, Cameroon, Niger)<br>• Encroachment of crop cultivation into designated “livestock routes” and grazing reserves |
| Depletion of water resources (surface and groundwater) | • Damming of rivers (also deprives downstream users access to water)<br>• Increasing human and livestock populations<br>• Increasing demand caused by increased urbanization and industrialization |
| Low forest cover | • Excessive wood extraction for fuel and construction<br>• Bush burning<br>• Uncontrolled land clearing for agricultural purposes |
| Poor legislative framework | • Low level of education and public awareness<br>• Conflicting policies and regulations<br>• Poor enforcement of existing laws |
| Poor institutional framework | • Uncoordinated research efforts on problems relating to drought and desertification<br>• Obsolete research and meteorological equipment<br>• Low and/or erratic funding for early warning systems or anti-desertification projects<br>• Uncoordinated approaches to planning and implementation<br>• Insufficient involvement and empowerment of all stakeholders, especially resource-users in activity planning and implementation |

*Adapted from: Federal Republic of Nigeria. 2000. National Action Programme to Combat Desertification and Mitigate the Effects of Drought. Ministry of Environment. 58p.*

Impacts of desertification and drought on Nigeria are many. The socioeconomic impact could be disastrous. It has a severe impact on food security, livelihood, economic, social and cultural activities all resulting in a low food security index. It can also lead directly to migration from

rural to urban areas and probably also results in disruption to families as men abandon their households in search of employment elsewhere.

Desertification also directly affects available water sources, both above ground and underground. Reduced water resources not only affects vegetation and wildlife, but also local populations who rely on these for daily needs. Decreases in water supply leads directly to higher incidences of disease and greater health risks to human populations.

Drought and desertification has shown during the last quarter century in this Sahelian region and in the Horn of Africa that they can be the cause of extreme economic and social strife, especially in zones where natural resources are already heavily competed. The Lake Chad Basin, and also the region around Sokoto in the northwest has many types of rural land users, notably fisherfolk, herders, hunters and farmers.

Loss of biodiversity happens swiftly in times of drought or where desertification threatens the natural environment. In northern Nigeria, desertification continues to seriously threaten flora and fauna. Natural habitats have all but disappeared. The Hadejia-Nguru wetlands, a Ramsar site of global significance as a waterfowl habitat, is not only threatened by drought conditions and direct human influences but also by interrupted water flows caused by upstream dams and poor irrigation practices.

As a party to the United Nations Convention to Combat Desertification (UNCCD), Nigeria is working to develop programs and policies to slow down and hopefully stop the effects of desertification. Government and NGOs are beginning to develop policies and raise awareness of the issue, its causes and actions that need to be taken. A national policy has been developed (GFRN, 1999; GFRN, 2000; MoE, 2000). It is one that recognizes that it is not just an institutional issue, but also one that requires incentives to empower local people to guard their precious resources. It requires implementers to utilize indigenous knowledge (Longtau and Gwaivangmin, 1999), as well as to communicate among and between sectors and to utilize successful experiences within the country and from through the region. In addition, linkage centers such as the Center for Arid Land Studies can help to pool experiences and knowledge, and together with NGOs working in the threatened states, to raise awareness and assist local specialists and the local populations to work together (Gadzama, 2000; Folorunso, 2002). Table 7.13 provides illustrative actions that stakeholders in the battle against desertification could logically take on.

**Table 7.13. Illustrative Activities by Stakeholders in Controlling Desertification**

| Stakeholder | Illustrative roles |
|---|---|
| NGOs and CBOs | • Advocacy, environmental education, and public awareness<br>• Mobilization and management of resources and local participation<br>• Implementation and monitoring of activities |
| Private sector | • Activity identification<br>• Funder<br>• Social marketing |

| Stakeholder | Illustrative roles |
|---|---|
| Public sector | • Policy formulation<br>• Activity implementation, coordination and monitoring<br>• Funder<br>• Extension services<br>• Environmental education and public awareness<br>• Cross-sectoral mobilization and coordination |
| Academia | • Appropriate research to support desertification control<br>• Activity implementation assistance<br>• Information management and linkage centers |
| Development partners | • Information and technical assistance<br>• Incremental funding for activities; leveraging opportunities<br>• Capacity building |
| Resource users | • Activity identification<br>• Activity execution<br>• Monitoring |

*Adapted from: Federal Republic of Nigeria. 2000. National Action Programme to Combat Desertification and Mitigate the Effects of Drought. Ministry of Environment. 58p.*

# 8.0 Summary of Current Donor Activities in Relevant Programming Areas

Donor investment into Nigeria's environment began in earnest in the late 1980s. Many of these early donor investments focused on local-level environmental problems in high profile regions of Nigeria (e.g., the Niger Delta). Other initiatives sought to address the local effects of regional or global environmental problems (e.g., desertification). By the early-1990s a considerable number of multilateral and bilateral organizations were financing specific environment/environment-related initiatives. This level of assistance continued through the mid-1990s, until the establishment of military rule. Although many multilateral donor-funded programs remained in place during the military regime, the majority of the bilateral investment into the environment sector—along with investments into various other sectors—was tabled.

Since the Nigerian government's return to democracy, numerous multilateral and bilateral organizations have returned to the environment sector. In an effort to "coordinate" donor activities, a Thematic Donor Group on the Environment has been established. The Donor Group, which is co-chaired by the Canadian International Development Agency (CIDA) and UNDP, meets quarterly to share information on partner activities in an effort to allow funds to be leveraged and overlap reduced.

## 8.1 Multilateral Donor Organizations Active in the Environment Sector

The following is not an exhaustive list, but rather a brief summary that highlights the major multilateral organizations that are actively supporting improved environmental management in Nigeria. Where relevant, pipeline projects are discussed:

***World Bank***

The World Bank has historically been the most active multilateral organization in the environmental sector. During the 1990s, the World Bank supported numerous projects and activities (Environmental Management Project, Fadama I, etc.) in the environment and environment-related sectors, the large majority of which came to a close between 1996 and 1998. Currently the World Bank is developing a new programming cycle that will include two large credit projects in the environment sector. These projects are:

- ***Fadama II*** is being designed to support necessary infrastructure and institutions to expand small-scale irrigation in Nigeria. The project is also looking to provide support to the pastoral sector. Ultimately, Fadama II will strive to promote the development of linkages between farmer interest groups and the private sector. Fadama II will very likely have a GEF-financed component to address issues of biodiversity conservation and sustainable use of renewable natural resources. Currently the World Bank and GEF are working with the FMoE to develop the GEF component.

- ***Local Empowerment and Environmental Management Program (LEEMP)*** is a combination of two earlier planned projects (the Micro Watershed and Environmental Management Project, and the Community and Local Government Development Project),

LEEMP will channel considerable financial and technical resources to support natural resources governance and management at the community level. The project will very likely contain a GEF-financed component that will work with the NPS and NGOs to improve protected area and buffer zone management in and around Yankari and Kainji National Parks.

***Food and Agriculture Organization (FAO)***

In Nigeria, the FAO supports two types of initiatives: Technical Cooperation Programs (TCP) and Unilateral Trust Fund (UTF) Projects. TCPs are funded through the FAO investment center in Rome. UTFs are funded through a trust fund, paid into by the GFRN on an annual basis. In Nigeria, FAO activities focus "on-farm", and many are targeted at increasing food security. However, FAO also supports environmental activities; of particular interest is the planned TCP-funded Streamlining Environmental Law Project—while still under development, it is expected that this project will focus on aspects of biosafety and biotechnology.

***International Fund for Agricultural Development (IFAD)***

IFAD, with World Bank and FAO assistance, is implementing two large projects:

- The Root and Tuber Expansion Program – targeting 26 states in the mid-south, and
- The Community-Based Agriculture and Rural Development Program ($28.6 million) – targeting eight states in the north.

***United Nations Development Program (UNDP)***

In Nigeria, the UNDP is most active in the environment sector through its Sustainable Agriculture, Environment and Rural Development Program, which strives to improve food security and environmental management through work with poor smallholder farmers, fisherfolk and rural artisans. In this approach, the UNDP/Nigeria is working to provide an integrated framework to address the linked problems of poverty, food insecurity and environmental degradation. Specifically, Program activities strive to enhance the production, productivity and incomes of smallholder farmers, fisherfolk, and artisans, as well as to improve their access to credit and productive assets. As part of this effort, the UNDP is working to improve physical access to rural markets, and is focusing these activities on between eight and 15 communities per state.

***United Nations Children's Fund (UNICEF)***

UNICEF is currently supporting a range of activities in the urban sector, and has also been active in small-scale activities designed to increase the provision of safe drinking water in rural parts of Nigeria. One ongoing UNICEF-funded activity is the Urban Services Program, where UNICEF is seeking to enhance the provision of basic urban/municipal services; specifically, potable drinking water, electricity and waste disposal. This program stresses collaboration with communities, and works with a range of NGOs.

### *World Health Organization (WHO)*

While focused primarily on health issues, a number of WHO activity areas relate directly to environmental health. In Nigeria, the WHO activity that is may impact most heavily on the environment sector is the Health Cities Program. Through this program, WHO is conducting health surveillance studies, and helping the government to establish and monitor health standards, many of which are related to environmental health.

## 8.2 Bilateral Donor Organizations Active in the Environment Sector

While numerous bilateral donors have established programs in Nigeria, CIDA and the U.K.'s Department for International Development (DFID) currently appear to be the most active in terms of the support they provided to the environmental sector. The following section briefly highlights CIDA's and DFID's relevant programming in the environment sector.

### *Canadian International Development Agency (CIDA)*

CIDA is currently in the process of developing a long-term program in Nigeria. This new program will focus in two areas: health and environment. In environment, CIDA is particularly interested in focusing on land degradation and water resources management. CIDA is funding two projects in the environment area, one in Borno State (addressing desertification) and the other in Cross River State (addressing forest/natural resource management).

In Borno State, CIDA is funding a small project implemented through Pro-Natura. Through this project they have established two 4-ha tree plots, in three communities across the three distinct ecozones. The goal of Phase 1 has been: a) to plant the trees, and b) to derive a benefit-sharing scheme. Phase II of this project will focus on generating greater up-front support for the initiative and will provide additional capacity building to support community organization with state government, local government and civil society organizations—and possibly private sector involvement.

The overall size of the CIDA Mission is quite small (expected to be between $5-6 million, over five years—focused on both health and environment). However, in addition to supporting discrete activities through country-level programming, CIDA is also currently supporting two environmental initiatives in Nigeria through its $100 million (CD) Global Climate Change Program. One of these activities provides funding to NEST to strengthen the capacity of GFRN institutions to comply with the FCCC requirements. This activity works with federal and local governments as well as the NGO and media communities to raise awareness and focus attention on issues related to climate change. The second initiative works through IITA to develop and test drought-resistant maize varieties (focused mainly in the Kaduna region), as a means to increasing food security in drought-prone regions of the country.

### *Department for International Development (DFID)*

Following the return to democracy, DFID reactivated their Nigeria program. At this time, DFID looked initially to restart activities that had been suspended during military rule. One such DFID-

supported activity was the Community Forestry Project in Cross River State. This environmental activity focused Overseas Development Assistance (ODA) and DFID support on improving both community and state management of forest resources. Specifically, the activity focused on building the capacity of 15 communities to rationalize forest management, and worked with the Forestry Commission to reorganize and raise revenue. DFID funding for this initiative will expire in 2003, and currently CIDA is considering continuing/furthering aspects of this activity.

Based upon the new DFID Country Strategy, new programming activities will be focused on four states. Discrete activities are still in the planning stages. However, in the environment realm, one likely DFID-funded activity will focus on improved management of the Nguru Wetlands, an internationally recognized Important Bird Area (IBA) and a Ramsar site located in the northeast of Nigeria.

# 9.0 Priority Actions to Improve Environmental Management and Governance

This environmental analysis identified three major threats to environmental management in Nigeria:

- The unsustainable use of renewable natural resources,
- Unplanned urban development, and
- Petroleum industry operations.

In order to begin planning and managing the environment in a more sustainable manner, the GFRN will need to begin effectively addressing and mitigating these threats—and the underlying causes of environmental degradation in Nigeria: increasing poverty, population growth and migration, and political and institutional constraints. In this section, the EA team identifies the priority actions needed to improve environmental management and governance. The priorities are divided into five areas: Legal and Policy Reform, Institutional Strengthening, Economic Incentives, Regulation and Enforcement, and Research.

## 9.1 Legal and Policy Reform

The constitutional framework allows both the federal and state governments to develop legislation for the management and use of most renewable resources. While the federal framework needs some improvement, states—due to the highly varied nature of the most pressing environmental threats they face—will need to be empowered to develop **and** enforce legislation that promotes sustainable use, if environmental management is to improve. Currently, the status of the legislative framework at the state level is generally regarded as insufficient to support the goals of environmental management. Equally weak is the ability, at the state level, to enforce existing environmental legislation and regulations. In order to affectate any reasonable change, support will need to be targeted at both the National Assemblies and at the various state government (and local government) agencies responsible for enforcement. In the still nascent democratically elected State Assemblies, technical assistance will be required to ensure that environmental priorities are effectively addressed in the legislation review, revision and development process. Likewise, those agencies responsible for enforcement of environmental legislation and regulations will need assistance to ensure that they understand and are empowered to carry out their mandates.

Sectoral policies in Nigeria are highly centralized. They also suffer from lack of coordination. The results are conflicting sectoral approaches to renewable resources management that agencies at the levels of state government and local government are charged to implement. If the framework for environmental management and protection is to be improved, considerable efforts will be needed to institute an integrated, multisectoral approach to policy development **and** implementation.

## 9.2 Institutional Strengthening

The capacity of governmental institutions, especially those at the local and state government levels to integrate environmental concerns into economic development plans and activities is currently extremely weak. While the level of environmental awareness is high in the federal and state MoEs, this is not the case in the state and local government sectoral agencies (such as the state Ministries of Agriculture and local government Departments of Agriculture). These agencies typically lack the necessary expertise to integrate environmental concerns into their planning and development activities. The capacity of these institutions, especially at the level of local government—where no flow-down from the FMoE exists—will need to be increased if they are to be able to effectively integrate environmental concerns into their day-to-day activities. While all local government departments could benefit from environmental awareness training and capacity building, it is the opinion of the EA team that targeting the local government Departments of Agriculture, Works, Education and Social Services, and Finance—e.g., those local government departments whose activities most heavily impact upon the environment—could go a long way toward improving environmental management and the local level.

In addition, and as discussed below (under 9.4), there is also considerable need to strengthen the capacity of those institutions responsible for the enforcement of environmental legislation and regulations.

## 9.3 Economic Incentives

The lack of effective resource valuation has strong negative impacts on the management of renewable natural resources. This is true, for example, in the case of forest products (both wood and non-wood). Decreased value at the local level (due in part to lack of awareness and also to lack of access to markets), especially in areas where communities—and their resident individuals—have scant access to alternate sources of livelihood, promotes overharvesting (unsustainable use) of economically viable resources. The connection between economics and renewable natural resource use is clearly understood in the development community, but adequate economic incentives need to be established if sustainable, renewable natural resource use is to have a chance of succeeding.

## 9.4 Regulation and Enforcement

While the legal and political frameworks for environmental management require further work, considerable gains in improved environmental management could be made with pollution control and biodiversity conservation by effectively enforcing existing regulations. Currently the lack of enforcement of environmental regulations serves to undermine environmental management and protection. Regulations are put in place to "safeguard" the environment. Without enforcement these regulations are rendered useless. In most cases, this lack of enforcement stems from weak institutional capacities of the institutions ostensibly responsible for the enforcement efforts. Affecting any credible change in Nigeria's enforcement of environmental regulations will require more than just "capacity building;" it will require building the political support or "the political will" to see the regulations enforced. These types of changes are long term and require

raising the awareness of a wide range of stakeholders (e.g., resource users, judges, etc.) as to the interrelated nature of environment, economics and health.

## 9.5 Environmental Education and Awareness

Environmental education and awareness is a critical long-term strategy focused on promoting behavioral change to support sustainable environmental management. Programs can be developed to target all audiences, ranging from the general populace (through various social marketing strategies) to children in schools. The general public in Nigeria is often unaware of the environmental consequences of their actions and how these in turn effect affect them. Targeted social marketing with select environmental messages can go a long way toward beginning to address this gap. If truly sustainable environmental management is to be realized, considerable education and awareness efforts that promote behavioral change will need to be undertaken in Nigeria.

## 9.6 Research

Effective environmental management is predicated upon the ability to make informed decisions. This, in turn requires that targeted data be systematically collected and managed and made available to decision makers. Currently in Nigeria, there is a glaring lack of a systematized approach to environmental data collection and management. Although university faculty and other specialists have conducted a considerable number of research projects, the results of these studies are widely scattered, and often inaccessible. In addition, much faulty and incomplete information is gathered and cited in perpetuity, leading to an unrealistic assessment of the problems and the opportunities for addressing them in Nigeria. Targeted and coordinated applied research is needed to develop a credible baseline of information within all environmental sectors. Data on sources of pollutants, air and water quality and other environmental conditions need to be collected throughout the country. Similarly, flora and faunal surveys need to be conducted in all terrestrial, freshwater and coastal habitats and remaining natural areas need to be mapped in extent and quality. It is only with such baseline information that appropriate management regimes can be devised and implemented in Nigeria.

# 10.0 Recommendations for USAID/Nigeria

## 10.1 Potential Linkages Between Environment and Current Mission Programs

This section draws on findings discussed in the previous section and examines them in the context of where improved environmental management could most logically be linked to USAID/Nigeria's current programming. These potential linkages are discussed below, by USAID/Nigeria Strategic Objective.

***SO1: Sustain transition to democratic civilian governance***

1) Increase the transparency of the Ecological Fund

   Access to the Ecological Fund is highly problematic. While the Fund earmarks a substantial allotment of money (2% of the Federal Account) to support a range of environmental initiatives, current management of the Fund has resulted in considerable inefficiencies and in the misappropriation of funds. Making the management of the Fund more transparent, and holding its users more accountable could go a long way to promoting improved environmental management in Nigeria.

2) Strengthen the federal legislative framework to support environmental management

   Expand the National Democratic Initiative's (NDI) ongoing work with the National Assembly, to provide support to the House and Senate Environment Committees, to strengthen the federal legislative framework for environmental management and protection. To date, NDI has not provided support in the environmental arena, but Assembly members have ranked environment as an important thematic area where they would like to receive assistance. NDI is currently looking for ways to expand into "new" thematic areas.

3) Integrate key environmental concerns into the National Assembly Members Constituency Outreach Activity

   Through the NDI-implemented National Assembly Members Constituency Outreach Activity, support has already been provided to National Assembly members on the development and implementation of constituency outreach programs. To date, programs have focused on democracy and governance (D/G) and health (primarily HIV/AIDS) issues. Given the enormity of environmental problems, NDI and many National Assembly members are eager to expand the activity to focus on pressing environmental concerns. Initial focal areas may include erosion, water use and management and environmental sanitation.

4) Strengthen the capacity of state courts

   The National Center for State Courts (NCSC) is currently implementing an SO1 activity through which it is working to strengthen the capacity of courts at the state

level. Currently the program is working with courts in Lagos and Kaduna. Given the current weak application of environmental legislation by the judiciary—especially at the state level, it may prove beneficial to work through NCSC to raise environmental awareness among court officials, both in general environmental matters and vis-à-vis the existing legislative framework.

5) Strengthen civil society organizations that promote environmental management

A number of Nigerian NGOs are actively engaged in environmental education, community conservation and other environmental initiatives. Select NGOs can be strengthened in their work to empower communities to effectively manage natural resources. Nationally based NGOs could also be supported to develop stronger advocacy for environmental issues. USAID should also continue to examine ways to work with international foundations that support NGOs and CBOs operating in Nigeria (e.g., the MacArthur Foundation, the Ford Foundation) that also support aspects of this work.

6) Develop environmental awareness among governmental officials

Be aware of elected official's sensitivity to environmental issues and how they successfully respond to their constituents on these issues. And vice versa, share information about how elected officials are successful in promoting critical issue agendas both with their constituents and their fellow politicians. There may be good links to environment in these situations.

***SO2: Strengthen institutional capacity for economic reform and enhance capacity to revive agricultural growth***

Current programming by USAID/Nigeria under this SO is broad and has significant potential as Nigeria struggles to provide a greater and renewed focus on the agricultural sector. Despite its rush to urbanization, the majority of the population remains rural and very dependent on agriculture. Activities being undertaken under this SO are aimed at strengthening the growth in the sector and providing more transparent and better opportunities for a larger spectrum of farmers to participate in that process at less risk. There are several areas where current activities and future programming can intersect with opportunities to decrease threats to water and land (soil) resources, improve livelihoods of rural populations and enhance biodiversity conservation.

1) Examining crosscutting themes related to the environment

There are numerous crosscutting themes with environmental issues and agricultural activities. Water issues, especially in the northern Sahelian and savanna zones are critical. Opportunities for improving the availability and the quality of water resources for both rural and urban populations cannot be overlooked for any activities where water is a component. Impacts on desertification, soil fertility, and crop yield are all at stake. Related impacts like improved health measured by a reduction in risks posed by waterborne diseases, hazardous wastes or other pollutants are obvious ones.

Capitalizing on current linkages with IITA, or leveraging new ones such as the FAO's food security program or the World Bank's micro-watershed activities could increase funding efficiencies to improve impact. USAID's work with IITA in the Rural Sector Enhancement Program (RUSEP) seeks to make progressive linkages with researchers, farmers, processors and markets. Participating farmers could benefit from improved management and market links associated with products that are secondary to their primary production, but have important environmental impacts. (See also the NTFP discussion below.) This is certainly the case with the gum arabic activity where increased local incomes and improved environmental conditions are main objectives of improved management and planting of *Acacia senegal* trees in the northern states.

Because food security has been named as a top priority issue by the FMoE, the EA team also wants to point out that every precaution should be taken to keep gum arabic tree species (*Acacia senegal* and *A. seyal*) separate from areas of millet and sorghum production. These tree species are preferred resting, roosting and nesting environments for many of the birds that plague cereal crops. We recognize that this is a conundrum of sorts because farmers will want to plant the acacia trees in their fields to help improve both their cash flow and the environment. But there may also be reluctance on the part of some farmers to participate because of the bird risk, or farmers on adjacent lands may also protest acacias being planted so close to their fields.

Another opportunity with benefits similar to those of the gum arabic program also exists with the Agency's Sustainable Tree Crops Project (STCP). This project, which operates in Nigeria as well as 13 other African nations, works with the IITA based in Ibadan as well as other public, private and NGO partners. This program's emphasis on increased tree productivity and improved socioeconomic return for smallholder farmers can, through managed activities, help to improve degraded land, enhance and protect biodiversity and contribute to resource conservation.

By expanding traditional agricultural boundaries slightly, engaging farmers participating in USAID-funded programs to talk about their perspective on environmental risks (desertification, water quality and water quantity, wind- and water-caused erosion) small, but valuable changes can often be affected to either reduce risks associated with further environmental degradation, or actually improve microsite conditions on the farmers' lands. USAID's funding to the IFDC under the Developing Agricultural Input Markets in Nigeria Project and to the SAFGRAD project should also be examined through the lens of environmental improvement, especially at the microsite level as each farmer's situation is different. One of the greatest challenges facing Nigerian agriculture today is declining soil productivity. Using the resources of these projects to help keep one eye on the risks to the environment (soil and water) as traditional practices, improved technology/techniques, and greater market access are championed will help lessen the chances of degradation and improve the long-term livelihood of farmers.

2) Increasing the market potential and/or adding value to NTFPs

Throughout Nigeria, NTFPs are gathered for use as foodstuffs, building materials, medicinals, etc. Some of these products have very high market values. However, the local communities gathering these products rarely have access to larger markets. Instead, they tend to harvest products, which they in turn sell to a middleman (or a chain of middlemen). Based on information gathered during our site visits, it appears that between the harvest and the final sale (in Lagos or Kano, for example) the price of some products can increase by more than 1000%. Those harvesting the NTFPs, perhaps out of lack of awareness or more likely due to better access to markets, tend to receive "a pittance" for their harvest. As a result there is a strong tendency to increase the amount of product harvested to increase the overall economic yield. This pressure to harvest greater quantities for external markets has led to unsustainable levels of removal for many NTFPs. In the geopolitical South East region, where pressures on unique ecosystems of the tropical rainforests are already stressed due to increasing population growth, land clearing for agricultural uses and unsustainable harvesting of primary forest products, this is especially true. At current rates of removal, the rural livelihoods dependent upon many of these NTFPs is in serious jeopardy, not to mention the direct threats to biodiversity conservation from the overharvesting.

Given this scenario, the potential may exist to build upon the model of the gum arabic activity (GAP) that has just started in the north to support improved access to markets. USAID/ Nigeria can monitor this new experience for replication with other high-value niche crops that are collected, such as some of the NTFPs in the South East, for adding greater value locally. The products would not have to be those destined for export out of the country, but rather those where a large discrepancy exists between the value to the producer/collector and the value to the end consumer. Forming producer associations to improve market knowledge and to help self-regulate the resource, training producers to improve collection techniques to conserve the resource base, and incorporating techniques to improve yield quantity and/or quality are similar to the objectives of the GAP. A vigilant eye for opportunities with NTFPs could improve livelihoods and reduce threats to biodiversity conservation in the South East and possibly other geopolitical regions.

3) Supporting the conservation of wild crop relatives

Many of the same organizations that work to develop improved crop varieties are also involved in conserving wild crop relatives such as those that abound in many areas of Nigeria. The country is well known as the epicenter for diversity of a number of varieties including cowpeas, winged beans, yams and others. Existing partners such as the IITA could be supported to become more engaged in protecting wild crops (for their regional and/or genetic value), an important component in biodiversity conservation.

***SO3: Develop the foundation for education reform***

1) Expanding the use of environmental education concepts within the present Mission programming

   There are a number of synergies possible between the activities and contractors involved in SO3 and with activities that can relate to the conservation of forests and biodiversity. Environmental education in any form is a strong tool towards the development of a more environmentally conscious society. Where/when local opportunities exist, classroom teachers could be encouraged to engage local human and institutional resources such as specialists or NGOs for classroom visits or even a "walk around the block" to point out the natural environment and how we interact with it in positive and negative ways. Instruction should not just come from a manual or a book. Within this SO, for instance, although a strong focus is literacy, this can be taught in some cases using material with an environmental and natural history focus. Interactive radio teaching tools can easily relay environmental stories and material to students while also serving the primary literacy function. Additionally, where the attention is on working with civic society entities, such as PTAs and the like, work could also be done to include related efforts of environmental educational NGOs, such as the NCF's Conservation Club initiatives that are being developed in various locales around the country.

***SO4: Increase the use of family planning, maternal and child health, child survival, STD/HIV services and preventative measures within a supportive policy environment***

1) Strengthening family planning programs in environmentally sensitive areas

   Excessive population growth coupled with increased resource use and poor resource management are key elements driving the degradation of remaining forests and biodiversity in Nigeria. Family planning messages that illustrate overpopulation's impact on natural resources are valuable. Not only do large families require more time and labor inputs to provide basic food and shelter requirements, but larger families (taken collectively) also tend to have a larger negative impact on available natural resources. More marginal land needs to cultivated, more wood needs to be collected to help cook for the family and more water resources are required for basic needs and drinking. Large families make it more difficult to survive, or even maintain an acceptable quality of life. Where effective family planning programs are in place, these effects lessen. Strong synergies are possible between this SO and natural resources conservation, especially in areas of rich biodiversity. Environmental awareness activities could also be included as an expansion of the population awareness efforts under the health SO, using the same contractors and awareness techniques that have already been developed for targeted Nigerians but with different messages.

2) Increasing the attention to water quality issues

Issues related to water are the closest tie-ins to this USAID/Nigeria SO. Opportunities to leverage funds or experiences that improve/enhance water quality often have direct links to the environment and can improve child survival.

***SPO: Improve management of critical elements of the infrastructure and energy sector***

1) Developing alternate energy sources that have less destructive environmental impacts

There are numerous options with the development of alternate energy sources in rural populations, especially those that are found in and around forests where firewood is being unsustainably harvested, transported and marketed. Land stewards (including farmers) and forest managers could be provided with greater incentives (through chain-of-custody permitting, policy changes, permits, etc.) to manage their woodstocks more sustainably and thus ensure longer and improved access to this very important energy resource.

2) Leverage opportunities currently underway for reducing environmental impacts and degradation associated with the oil industry

The petroleum industry companies operating in the Niger Delta area are working hard to improve their public relations with local populations. Each company has whole divisions working with local communities, NGOs and the public sector to affect programs that will improve local livelihoods and the overall socioeconomic condition of the area. Opportunities exist and are growing to leverage resources that will expand these activities so that they can reach greater numbers of people. USAID needs to be kept abreast of these programs to learn where it might have an impact. The "new kid on the block," the Niger Delta Development Commission (NDDC) is also aggressively examining alternatives to environmental, social, health, and infrastructure problems that have plagued the area for years. It appears to have dynamic leadership and a clear mandate to help affect change both through discrete activities and through working side by side with the region's states and municipalities to promulgate effective policy changes. There definitely should be opportunities here for USAID to assist with activities to mitigate environmental problems in this critical region of Nigeria.

## 10.2 Illustrative Stand-Alone Environmental Activities

During discussions with the U.S. Ambassador, USAID's Mission Director, the SO2 team and other Mission staff, the EA team learned that the Mission is currently seeking to support one, or potentially a few, discrete environmental activities. These would be in addition to seeking logical opportunities to link improved environmental management to current and future Mission programming areas (discussed in Section 10.1). From our discussions, it was very clear that any recommendations for stand-alone activities would need to meet five criteria. According to these criteria the activity must:

- Be implemented within a two-year timeframe,
- Stay within a budget of no more than $1.5 million,
- Yield demonstrable results within the two-year timeframe,
- Be implemented in an area where a supportive political and institutional environment exists, and
- Be implemented in an area that is considered to be a high priority to the Mission.

From the EA team's collective experiences, and based on discussions with a broad range of stakeholders, four potential activity areas that meet these criteria were identified (in addition, Section 10.2.5 presents two additional potential activity areas that warrant further examination against the five criteria). These activity areas were also selected, as much as possible, to help address the environmental priorities outlined by Nigeria's FMoE (see Box 7.1). It should, however, be noted that the application of the five criteria or filters (noted above) pose significant constraints to activities capable of addressing the many of the environmental priorities identified by the FMoE. Specifically, the EA team found the budget and the ability to have demonstrable results within a two-year timeframe, to be the two most difficult criteria to satisfy.

Brief discussions of each of the illustrative stand-alone activities follows.

### 10.2.1 Soil and Water Conservation

Desertification and gully erosion are two of the primary environmental threats named by the FMoE, and outlined in Box 7.1. There are numerous low technology soil and water conservation (SWC) activities that could be undertaken in targeted areas to help:

- Decrease erosion from water and wind,
- Increase agricultural yields of traditional crops,
- Increase water infiltration,
- Promote soil formation in the important humus and a-horizons, and
- Provide additional yields from grasses and woody vegetation that are commercially important.

Constructing small micro-catchments, terracing, creating earthen bunds and vegetative ridges are all labor-intensive activities that can be done with hand tools for local farmers. These are techniques that have been utilized for centuries in semi-arid and arid zones around the world, and successfully over the last twenty years in neighboring Sahelian countries. They also utilize indigenous knowledge, and have already been employed by some farmers in Nigeria (Gadzama, 2002; Longtau and Gwaivangmin, 1999).

Other donors (World Bank, DFID, etc.) have soil and water conservation components planned for upcoming projects in Nigeria. USAID/Nigeria could leverage some of the opportunities in certain areas, or could promote only one or two specific technologies, or decide to implement activities in separate areas. Success in other areas of the Sahel has been enhanced where NGOs and CBOs have already helped to increase environmental awareness in the region.

Examining SWC activities against the selection criteria noted earlier, the following points stand out:

1. The techniques can be employed in a single dry season, preferably on relatively flat terrain that is already being cultivated by farmers. The scale should be relatively small, perhaps working with only several hundred farmers in a small area. Employing the techniques on adjacent parcels increased the collective benefits. The main constraint is being able to engage sufficient labor to construct the water catchments well in advance of the rainy season so as to capture the full effect of the rains.

2. Overall cost per farmer is low, although farmers would be expected to provide in-kind labor on their own land. Simple implements/hand tools would need to be provided in most cases. Most of the cost would be in the initial training and information dissemination. Using Nigerian farmers who have already employed these techniques would provide more impetus to others. Many Hausa farmers in neighboring Niger have employed these techniques and may also be a resource. Engaging a local NGO or CBO with interests in agriculture and the environment would also make the effort more cost effective.

3. Results can be seen in the first year (assuming the SWC techniques are in place before the rainy season). Micro-catchments help increase water infiltration, making more moisture available to crops. As water from rain storms moves across a farmer's land, these tied ridges and bunds also help slow the movement of water, increase the buildup of silt and other nutrients that are normally carried away and create a richer micro-environment for planted crops. By the end of the second rainy season, additional benefits to participating farmers are usually even more tangible in terms of greater yields and less erosion and increased soil buildup, especially of the humus layer.

4. These techniques are most appropriate for the Sahel and Sudan savanna zones. USAID/Nigeria is already active with other programs in several states in the north. The EA team's visit to Kaduna and Borno States indicated that agricultural activities are a mainstay of local economies and that there is a high sensitivity to environmental problems like desertification. The EA team also learned that Bauchi State has dynamic leadership and ongoing environmental activities that would allow easier entry for activities such as these. Also, there is local experience with these techniques that would facilitate their expansion over a larger area.

5. Soil and water conservation falls within the domain of agriculture. These techniques would complement USAID/Nigeria programming under SO2. Participating farmers could realize gains in terms of crop yields, increased soil fertility, and presumably, better livelihood, not to mention an improvement of the productive capacity of their land. These activities could also complement the agroforestry component of the gum arabic activity currently being implemented under SO2. It has been the EA team's experience that farmers tend to shy away from planting *Acacia nilotica* and *Acacia senegalensis* because they are preferred by birds who also damage millet and sorghum crops. This fact may make tying the two activities more problematic in some areas.

The EA Team recognizes that SWC activities are not a "new" activity in Nigeria. But this should not make them less appealing. Having successful cases nearby is usually a very positive attribute. Carefully planned, strategic (in terms of both timing and location) activities can have (visually) dramatic results. Their low cost and relative simplicity also usually implies they can join easily with other planned or ongoing endeavors. Well-planned SWC activities can also help leverage funds and resources for similar or related activities.

### 10.2.2 Environmental Capacity Building for Local Government Associations

The capacity for the environmental management and protection at the local government level—the level at which most of Nigeria's economic planning and development activities occur—is virtually nonexistent. Typically, local governments are comprised of six departments: Administration; Finance; Works; Agriculture; Health; and, Education and Social Services. While the technical skills contained in these six departments continues to increase, there is generally no local government official aware of existing environmental legislation and regulations, let alone conversant in environmental management. This lack of basic capacity at the local level is one of the most critical issues to be addressed if effective environmental management and protection is to be realized.

Promoting environmental awareness at the local government level (general awareness on the interrelated nature of environmental management and economic development, and targeted awareness programs that highlight the existing legal and policy frameworks) and providing targeted training to individuals in the Agriculture, Works and Finance Departments (e.g., EIA, integration of environmental concerns into the planning and development process, etc.) that would allow them to better integrate environmental concerns into their routine activities, would go a long way toward addressing the need for improved environmental management at the local level. Likewise, focusing these activities on a series of adjacent LGAs would allow for both priority local problems and priority problems occurring across a landscape to be addressed. This approach could also build off of economies of scale.

Examining this activity using the five criteria identified earlier, the following points stand out:

1. The development and implementation of an environmental awareness campaign and training program that targets key stakeholders at the local government level would likely take between five and 12 months, which is well within the allowable timeframe. This would also allow ample time for follow-up and assessment, and for the roll-out of programs to other LGAs—if deemed appropriate.

2. The costs associated with both awareness and training activities developed and implemented in a series of adjacent LGAs would fit well within the available budget.

3. The range of demonstrable results from such an effort could include a more environmentally aware public, with a better understanding of the interaction between environment, agriculture, economics and health; more effective application of existing environmental regulations—including EIA; more effective application of environmental legislation; and local governments that are more capable of incorporating environmental concerns into their planning and development activities.

4. Through our field visits and consultations with stakeholders, we identified Borno, Kaduna and Lagos States as areas where capable State Ministries of Environment exist that could be easily be engaged as partners in the development and implementation of awareness and training programs—an important step in building state-level capacity. Equally as important, capable NGOs exist in all three states that could be engaged to liaise between communities and government.

5. Due to the relatively low costs associated with awareness and training activities, it would be possible to develop and implement activities across a series of LGAs in a number of states.

This activity, through awareness raising and training activities with would also contribute to addressing the need for capacity building raised by the Minister of State for Environment (Okopido, 2002).

### 10.2.3 Support to Protected Area Management

Protected areas planning and management are vital steps in the promotion of *in-situ* biodiversity conservation. Currently, not one of the eight Nigerian National Parks has an approved General Management Plan (GMP). A GMP is a most valuable tool in protected areas management. It contains the basic set of information needed to successfully manage the resources of the park—in the present and in the future.

Throughout the developing world, parks do not only serve the strategic purposes of conservation and recreation— they are often also strategic economic resources to those living in and around the park. These strategies, basically conservation and use, are often in conflict. Participatory protected area planning is a process by which the full range of stakeholders (NPS, communities, special interest groups—such groups of individuals engaged in herding, gathering, etc.) are actively engaged as partners in the conservation process—in order to secure stakeholder buy-in and support for the conservation initiative. The result of the process is a GMP, which lays the framework for the management and development of the park and its surrounding buffer zone for a set amount of time into the future (typically around 10 years).

In addition to strengthening the capacity of the NPS to conserve biodiversity in a given location, support to a protected area planning effort could also serve to:

- Reduce conflicts over renewable natural resources through the promotion of a collaborative environment for resource management, and
- Promote sustainable resource use/livelihoods for communities living in/around the park.

Examining this activity using the five criteria identified earlier, the following points stand out:

1. The development of a GMP generally requires six to15 months. This is within the allowable timeframe and it is conceivable that the GMP could be developed, and that certain aspects of the GMP could be implemented.

2. The resources required to develop a GMP (inclusive of technical expertise) could easily be covered within the available budget—leaving ample room in the budget for the implementation of key components of the GMP.

3. The range of demonstrable results from such an effort will likely include more effective conservation, decreased localized resource conflicts, and increased rural livelihoods.

4. Through our field visits and consultations with stakeholders, we identified Kumuku and Yankari National Parks as areas where the necessary political will exists to implement such an activity. Specifically, these locations possess the necessary support from federal, state and local government. Capable NGOs also exist and are already active on the ground. In addition, although our schedule did not allow us to visit and meet with stakeholders from around Gashaka-Gumpti National Park and Kainji National Parks, we feel that both locations would warrant further investigation as potential activity sites.

5. The Mission, as we understand, is inclined to divide resources equitably across the six geopolitical zones. However, the recommendation of the Ambassador and SO2 Team Leader indicated that with the relatively small amount of money available, distributing the money across the six geopolitical zones did not make sense. Assuming this approach is acceptable, the Mission would need to decide whether Kaduna or Bauchi—or Adamawa or Niger State should be the recipient of such an activity.

This activity would also contribute to addressing the biodiversity and protected areas management priorities outlined by the Minister of State for Environment (Okopido, 2002).

### 10.2.4 Biogas Pilot Project

Biogas is a useful source of decentralized energy that is produced via the digestion of animal, human and agricultural wastes, under anaerobic conditions.

Animal manure is a major feedstock for most of the digesters in the developing world. These wastes are a source of carbon as well as nitrogen required for successful operation of an anaerobic fermentation process. As much as 8 to 9 $ft^3$ of gas can be produced per pound of volatile solids added to the anaerobic digester when the organic matter is highly biodegradable (night soil, animal wastes). The overall conversion efficiency is, however, low—roughly 10 to 15%—and depends upon the type of feedstock. The process, in addition to providing energy, also converts raw manure into an environmentally safe enriched fertilizer with more available nutrients than raw manure. The technology, therefore, offers an integrated system that lends itself to a rural setting. Millions of biogas digesters are successfully operating in rural and semi-urban areas of China, India, Thailand and many other countries.

Nigeria's semi-urban and rural areas generate significant quantities of biodegradable wastes to support biogas operation. In the rural areas, livestock wastes and other feedstock is generally available. At the urban level, significant amounts of biodegradable municipal wastes are produced. Currently, these wastes are either uncollected or poorly collected and often poorly disposed. In addition, in cities such as Kaduna, large amounts of industrial (non-toxic) biodegradable wastes, such as wastes produced by the area's large breweries are also available.

Nigeria's rural as well as semi-rural areas also have significant amounts of uncollected or often poorly utilized wastes. These include animal manure, agricultural wastes and other organic residues.

For a selected area in Nigeria, depending upon the available feedstock, a few biogas digesters of suitable size can be installed. During the EA team's visit to Kaduna Environmental Protection Agency (KEPA), the Health Department indicated its desire and willingness to install a few digesters. The proposed installation(s) can be facilitated by local NGOs, and cost-shared by the industry since it can save waste disposal costs while also meeting the environmental regulations. Participation by NGOs allows opportunities for training local resources to generate needed management and organization to support participation with the local environmental ministry. In addition to Kaduna, other cities like Port Harcourt and Ibadan also expressed similar interest. Staff at the University of Miadugari also reported experience with biogas technologies.

Biogas is a proven technology. Its feasibility and economic viability is well established for a number of developing country rural and urban settings. A family-sized (2 $cu^3$/day or more) biogas digester costs approximately $3,200, excluding the cost of local labor. For the rural areas, the technology is easily adaptable and can use a number of locally available skills and a number of materials for construction. At present, a few biogas digesters are operating in Nigeria. One of these in Zaria provides gas for water heating for the prison laundry.

Introduction and use of biogas technology, based on a proper evaluation and backed by adequate management and organizational support, can provide the following benefits:

- The collection of animal and other wastes can provide employment opportunities, and can help to reduce health and social problems associated with lack of adequate sanitation services.
- The generated gas can be used as cooking fuel to decrease the dependence on firewood and charcoal or economically deployed to provide additional income-generating opportunities.
- The process's by-product is an environmentally stable nutrient-enhanced product providing potential for increased agricultural production and also income-generating opportunities.
- The process provides environmentally safe disposal of wastes.

Using the five filters named earlier, the following points are noted for a biogas option:

1. Installation of a family-sized (2 $cu^3$) biogas digester requires four to five months. During this time a feasibility study can be developed, and if acceptable, a biogas digester installed.

2. The resources required to install a biogas digester are generally locally available. The large gas steel holder for the Indian design, if required, may require importation of materials to be fabricated in Nigeria. The costs are within the projected total cost of $3200 as indicated above.

3. The demonstrable results, gas production (in less than a month of installation), and improved agricultural yields vary with the crop(s), but is usually less than six months. Similarly, potential income-generating opportunities, both for gas used and raw material (paid) collection could show results in less than a year.

4. Biogas has a wide range of proponents in Nigeria, including the city governments (primarily for biodegradable municipal waste), the agricultural community and industries such as Nigerian breweries with available, biodegradable wastes. The proposed site around Kaduna has additional support from KEPA.

5. If the available funding resources are to be divided among the six geopolitical zones, any of the zones is likely to welcome biogas. This is based on our field trip and overall knowledge of high USAID priorities related to rural development.

Implementing an activity to generate biogas for small-scale users would directly address the industrial and urban pollution priority listed by the FMoE by using waste materials that are currently collected and managed by municipal authorities at a considerable cost.

### 10.2.5 Other Potential Activity Areas

Other areas identified by the EA team that warrant further investigation for potential support by USAID/Nigeria include:

- **Adding value to timber and non-timber forest products:** Through consultations with stakeholders in the South South—especially in Cross River State—timber and non-timber forest products are undervalued. This is through a combination of the lack of access to markets and the lack of awareness as to the real market value of locally harvested and sold products. Developing activities that help to counter this trend could have a positive impact on the use pattern associated with many renewable natural resources.

- **Planning to support the development of a national-level Environmental Information System (EIS):** The link between data collection, data management and informed decision making is clear. Nigeria's current lack of planned, systematized data collection and management is a major factor affecting the present and future potential for environmental management. If this trend is to change a vertically and horizontally integrated, and transparent, approach to environmental data collection and management, proper incentives for data sharing must be developed. An activity that targets integrated planning for EIS as the first logical step in this process could be developed and supported.

# Part II

## Tropical Forests and Biodiversity in Nigeria: FAA 118/119 Assessment

# 1.0 Background

This Biodiversity and Tropical Forests Assessment has been produced for the United States Agency for International Development (USAID)/Nigeria in fulfillment of Sections 118 and 119 of the Foreign Assistance Act (FAA) guidelines for U.S. government agencies working abroad (see Annex A). This assessment was prepared as part of an overall Environmental Analysis Study conducted by ARD, Inc. from February to early April, 2002 for USAID/Nigeria under the Biodiversity and Sustainable Forestry (BIOFOR) Indefinite Quantity Contract (IQC) No. LAG-I-00-99-00013-00, Task Order No. 807.

The ARD Environmental Analysis (EA) Team (Table 1.1) spent five weeks in Nigeria researching and developing the contents of the Environmental Analysis Report and this Biodiversity and Tropical Forests Assessment. The team was joined by USAID Strategic Objective (SO) 2 team members on field trips to Lagos, Port Harcourt, Calabar, Kajuna, Maiduguri and Ibadan to meet with key officials and experts, and to visit various field sites.

**Table 1.1. Nigeria Environmental Analysis Team**

| Specialist | Specialty Area |
|---|---|
| Steve Dennison, Ph.D. | Team Leader/Natural Resource Economics/Policy |
| Patricia Foster-Turley, Ph.D. | Biodiversity |
| Ramzy Kanaan | Natural Resources Governance |
| Davinder Sood, Ph.D. | Urban Environmental Management and Energy |
| Prof. Nurudeen Adedipe, Ph.D. | Agriculture and Natural Resource Policy |
| Adebayo Alao | Urban Planning |
| Fatai Balogun, Ph.D. | Energy |
| Nicolas Dosumu | Data Collection Specialist |
| Prof. L.K. Jeje, Ph.D. | Water Resources |
| Prof. Bunyamin Ola-Adams, Ph.D. | Biodiversity and Forestry |
| Prof. Adepoju Onibokun, Ph.D. | Sociology and Urban Planning |

This Biodiversity and Tropical Forests Assessment was compiled largely by the EA Team's biodiversity specialists from an analysis of existing documents, and from interviews with relevant government, nongovernmental organization (NGO) and university representatives from around the country. An attempt was made to present this biodiversity assessment as a self-contained document, but some of the relevant information is covered in more detail in Part I of the Nigeria Environmental Analysis Report. Similarly, some sections of Part I contain material presented more fully in this biodiversity report. It is hoped that this Biodiversity and Tropical Forests Assessment will have utility within not only the USAID system, but elsewhere in Nigeria, where such an updated consolidation of available information could be most useful to those actively engaged in conservation of Nigeria's fragile, threatened, but globally important biodiversity and natural ecosystems.

## 2.0 Executive Summary

Nigeria is a biologically diverse country with an extraordinarily large human population that includes nearly one out of every five people living in sub-Saharan Africa (World Resources Institute, 2000). This population is growing rapidly and migrating to increasingly large urban centers that are among the largest cities in the world. Although Nigeria receives considerable revenue from its large multinational oil industry sector, this money rarely trickles down to the populace, who are generally poor and growing poorer. This combination of expanding population and increasing poverty is putting increasingly severe demands upon the few natural areas and significant biodiversity that remain.

Despite these negative pressures, Nigeria presently contains considerable biodiversity as well as some very important tracts of fairly undisturbed tropical forests. A diversity of natural ecosystems, including coastal areas, rivers, freshwater wetlands, lakes, savannas, plateaus, and mountains and a tropical climate with varying patterns of rainfall from north to south combine to form conditions ripe for the development of high levels of biodiversity. Nigeria has the largest remaining tract of mangroves in Africa and the third largest in the world, and despite oil company operations, much of this mangrove forest is still in good shape. The Niger Delta area of the coast contains not only mangroves but also unique swamp forests that are relatively pristine in many areas and harbor a number of endemic species and many non-timber forest products (NTFPs) that local communities rely upon. The lowland rainforests and adjacent montane areas along Nigeria's southeastern border with Cameroon are critically important habitats for a number of endangered and endemic species of primates, plants and other many other taxa and along with adjacent areas in Cameroon are known to be a biodiversity hotspot for primates, butterflies and amphibians. The most endangered subspecies of gorilla on earth, the Cross River gorilla (*Gorilla gorilla diehli*) is found in a restricted part of this habitat and holds on with 250 or less animals remaining in the population, broken into two separate, isolated groups. The Jos Plateau is another unique habitat that contains a number of endemic and endangered plant species and two endemic birds in the remaining small bits of habitat that have not been totally destroyed by anthropogenic factors. The protected savanna areas of Nigeria also contain some of those large mammals and birds that draw ecotourists to other parks around Africa.

For the most part, the remaining natural forestland and diverse species of international importance exist only in a few protected and/or otherwise inaccessible areas. The eight national parks of Nigeria, and the relatively small number of other areas that actually receive protection, harbor a number of rare, endangered and threatened plant and animal species. Many other notable species still remain in the Niger Delta swamp forests and mangroves that are unsuitable for farming and difficult to log. Aside from the localized activities of oil companies and various unsustainable hunting and fishing practices, there has been little timber extraction and other large-scale forms of habitat destruction in the Delta. There are, however, no protected areas in the Niger Delta, and this relatively secure situation is unlikely to remain so. Another important pocket of biodiversity is the Cameroon Forest Ecoregion along the Nigerian border with Cameroon, where many species still exist in the more inaccessible areas.

Most of the land in Nigeria has been converted to agricultural or pastoral uses and agricultural encroachment threatens the natural areas that remain. Environmental problems stemming from

large unplanned urban centers with inadequate solid and municipal waste disposal practices and the impacts of the oil, mining and manufacturing industries are also taking their toil on water and air quality in many areas. Add to this the escalating practices of overfishing, uncontrolled logging and many other unsustainable uses of the natural resources that remain, and the threats to the survival of significant components of Nigeria's biodiversity are increasingly severe.

Effective biodiversity and tropical forest conservation in Nigeria requires a careful juxtaposition between the needs of a large and growing human population today and the long-term sustainability of the natural resources the people ultimately depend upon for the future. A three-pronged approach is needed to recognize this dichotomy and to strike an acceptable balance between today's needs and tomorrow's quality of life for Nigerians:

1. **Sustainable agriculture**: In Nigeria, most of the original natural habitats have already been converted to agricultural use and agricultural conversion is continuing to eat away at the rest of the natural ecosystems and the diverse species contained therein. Continued efforts are needed to ensure the most effective utilization of existing farmland and to increase their productivity and sustainability while also working towards stemming agricultural conversion of the remaining natural areas.

2. **Sustainable use of remaining forest, wetland and savanna resources outside of protected areas**: Efforts are needed to develop, promote and expand upon economically viable and sustainable uses of those natural areas that have not yet been converted to agriculture, tree monoculture plantations and aquaculture projects. Many of these areas are already heavily used by local communities, and in some cases, by commercial enterprises that obtain various NTFPs from them. Much more work is needed to ensure that key natural products are harvested sustainably by all those involved in their extraction. Further value-added approaches also need to be developed to bring more revenue from such products into the communities in critical natural areas.

3. **Adequate protection of protected areas**: Finally, even with steps one and two in place, there is still a strong need to ensure the solid protection of key protected areas under federal, state and community jurisdictions. Such protected areas provide a reservoir for biodiversity and critical ecosystem components, and may one day in Nigeria, like elsewhere, become an attractive focal point for tourists and citizens alike. Nigeria's protected areas for the most part still sorely need on-the-ground protection before they can be effective in these roles.

In Section 8, this report outlines a number of general recommendations that may be effective in stemming the loss of forests and biodiversity in Nigeria and that address all elements of this three-pronged approach. A combination of efforts aimed at policy reform and implementation, law enforcement, environmental awareness and education, improved agricultural practices and expanded community involvement are all needed. Although USAID cannot undertake all of them, some activities would easily fall within the existing Mission strategic objectives, as described in Section 9.

Despite the complexities of biodiversity and tropical forest conservation in Nigeria, there is still some hope. The new recognition of democracy in Nigeria can also hold out hope for a new

appreciation of preserving some of the remaining natural world and the biodiversity within it. Nigerian governmental policies are already reflecting an interest in environmental conservation, and if the institutional weaknesses could be sorted out and more stringent enforcement practices put into play, the tide could turn. An increasing number of NGOs are also working towards environmental conservation and a few of these have implemented successful conservation approaches in some areas. It is up to the rest of the world to help these budding efforts by providing further capacity-building efforts and partnerships for not only local, but also global benefits gained from the conservation of the fragile natural world of Nigeria.

# 3.0 Major Natural Habitats of Nigeria

## 3.1 Overview

Nigeria is a diverse tropical country encompassing a variety of different natural habitats including savannas, tropical forests, wetlands, lakes, rivers and coastal areas. Rainfall in Nigeria is heaviest along the coast and in the southeast leading to the development of rainforest in this region. By contrast, the northern part of Nigeria receives much less rain and encompasses increasingly drier vegetation zones. Three different highland areas are found in Nigeria: the Yoruba highlands in the west, the Jos Plateau in the central part of the country, and the mountains bordering Cameroon in the east. The diversity of landscapes and climatic conditions results in a corresponding diversity of plants and animals.

A recent study (Geomatics International et al, 1998) has found that 40.2% of Nigeria has been converted to intensive (crop) agriculture, 20.6% to extensive (grazing) agriculture and another 0.6% to urban development. The remaining land (less than 39%) contains important biodiversity and natural ecosystems, and is the basis of this report.

**Table 3.1. The Land Area under Different Vegetation Types and Amount of Land Designated as Forest Reserves**

| S/N | Vegetation type | Total land ($km^2$) | Area of forest reserves ($km^2$) |
|---|---|---|---|
| 1. | Sahel savanna | 31,463 | 2,572 |
| 2. | Sudan savanna | 342,158 | 31,247 |
| 3. | Guinea savanna | 400,168 | 38,271 |
| 4. | Derived savanna | 75,707 | 3,208 |
| 5. | Rain forest | 95,653 | 19,986 |
| 6. | Fresh water swamp forest | 25,653 | 256 |
| 7. | Mangrove swamp and coastal vegetation | 12,782 | 522 |
| **Total** | | **983,584** | **96,062** |

## 3.2 Savanna and Grassland

About four-fifths of Nigeria was once savanna but much of this land has been converted to agriculture or grazing lands. The remaining savanna lands are found in the north and central areas of Nigeria, and are often classified into four different types based largely on rainfall amount and timing: the Sahel, Sudan, Guinea and derived savanna. The Sahel savanna is found in the northeast and is typified by grasses, open thorn scrub and scattered thorny trees. The Sudan savanna zone is found in the north and is covered by a drift of sand in many areas and dominated by grasses and some shrubs and trees, but it has been greatly modified by man for centuries. The Guinea savanna is found in the middle belt of Nigeria, and is typified by open woodland with tall grasses and fire-resistant trees. The derived savanna is found further south, bordering the remaining forest zone, and is continuing to spread south as more forestland is degraded into agricultural uses. Desertification is also causing the borders of the drier savanna

types to move southward. These lines of definition between all the various savanna types are vague and overlapping, and continually influenced by anthropogenic factors.

Only a small amount of natural savanna has been protected in Nigeria, and the many large savanna animals often found elsewhere in Africa have been greatly reduced in numbers and range. In Nigeria, attempts have been made to preserve savanna habitats and species. For instance, Yankari National Park in Bauchi State was initiated as a game reserve in the 1950s and later turned into a national park with the primary purpose of protecting the Sudan savanna ecosystem and the large game populations it harbored. Despite this protection, although elephants and lions still occur, a number of other large mammals including the African wild dogs, cheetah, giraffe and a few antelope species have been extirpated. Large mammal populations in other protected areas in Nigeria's savannas are in worse shape and those outside of protected areas are virtually nonexistent.

## 3.3 Forests

Tropical forests are just one category of the many ecosystems in Nigeria that are important for biodiversity conservation. Because these habitats are of special interest to the U.S. government, they are considered in more detail in the next section. In summary, Nigeria's forests fall into three basic categories: those in the drier middle and north latitudes, the lowland rainforest in the southern humid zone, and the coastal mangroves and freshwater swamp forests. Montane forests are also found on the border with Cameroon, but the Guinea woodlands that once occurred on the Jos Plateau have nearly disappeared. Most other forested habitats are similarly declining at a rapid rate. According to the changes in land use study (Geomatics International et al, 1998), undisturbed forest, including rainforests and savanna woodlands, made up 2.9% of the total area of Nigeria in 1976/1978 but only 1.3% in 1993/1995 while the extent of disturbed forests has similarly increased. Riparian forests also declined significantly. Only the coastal mangroves and swamp forests showed little loss in extent over the course of the study (see Figure 7.1 of Part I of this report).

Although the forests of Nigeria are small compared to other ecosystems, they harbor the bulk of the globally important biodiversity of the nation. The lowland rainforests in the south contain a great diversity of primates and butterflies, many NTFPs of regional and global importance and many valuable hardwood tree species. The mangroves along the coast provide spawning and nursery grounds for important fishery resources. The swamp forests further inland and the remaining patches of riparian forest on the Jos Plateau and the mountains bordering Cameroon contain a variety of endemic species of plants as well as animals. The threats to these forests are increasing, and the protective measures in place are sorely inadequate.

## 3.4 Freshwater Ecosystems

Nigeria is endowed with a diversity of freshwater resources including seasonal and permanent rivers, lakes, and wetlands but these are all under varying degrees of threat. Nigeria has two major rivers, the Niger and the Benue that meet in a series of tributaries and channels to form the Niger Delta. Further north, other rivers flow into the Niger and Benue Rivers and to Lake Chad. Rivers including the Cross, Imo, Ogun, Osun Benin, and others also flow into the Atlantic

Ocean. All told, there are eight main river basins in Nigeria (Ita, 1994). A number of these have been dammed, diverted, polluted or otherwise disturbed, along with their aquatic flora and fauna. Riparian marsh and swamps along river courses are also under threat. For instance, by 1990, the natural freshwater marsh and swamps along the Niger, Benue and Hadejia Rivers had nearly disappeared due to floodplain agriculture (Geomatics International et al, 1998). Freshwater swamp forests are extensive in the south, adjacent to mangrove areas. Two large lakes are found in Nigeria: Lake Chad in the northeast and manmade Kainji Lake in the west. Nigeria also has many natural and manmade lakes, reservoirs, fish ponds, abandoned mine pits and other freshwater sources throughout the country. Many of these water features provide important breeding and feeding habitats for a diversity of bird species (NCF, 2002). The Hadejia-Nguru wetlands in the northwest have been protected for many years and were recently declared a Ramsar site. Other wetlands throughout Nigeria are not so fortunate.

Wetlands and other freshwater habitats in Nigeria, as elsewhere, are important reservoirs of fish and other aquatic food items for people, as a habitat for a myriad of other diverse species, and for the water resources themselves. Both water quality and quantity are important to all the species that depend upon these resources. Various studies in Nigeria have shown high levels of heavy metals in some rivers where industrial wastes are discharged, high levels of siltation in areas with extensive logging and farming, and other disturbances (Ita, 1994). Inland fisheries in rivers are depleted due to these factors, although the fisheries in lakes and reservoirs are thought to be relatively stable due to restocking with hatchery fish and better controls (Shimang, 2002). Depending on the type of fish introduced—native vs. non-native, this might also present a problem for native species. One non-native, the water hyacinth (*Eichhornia crassipes*) has invaded a number of waterways with deleterious effects on fishing access for people and in competition with native species. Wildlife associated with wetlands is largely in decline, with aquatic birds becoming rarer, crocodiles and some turtles virtually nonexistent in many areas, and other less conspicuous species most likely declining as well.

## 3.5 Coastal Areas

The coastline of Nigeria is approximately 853 km long, stretching from the western border with the Republic of Benin to the eastern border with Cameroon. The coastal shore consists of barrier islands, sandy beaches, lagoons, estuaries, mud beaches, and creeks and includes the Niger Delta. Mangroves and estuaries extend from 10 to 150 km inland. Further inland are freshwater swamp forests and other low-lying habitats, which are considered part of the coast. The coastal area is heavily populated, with about 20% of Nigeria's residents living in one of the nine coastal states. Offshore, the continental shelf occurs from 15 km off Lagos to more than 85 km off Calabar. The Exclusive Economic Zone, extends 200 nautical miles offshore (CEDA, 1997).

The marine and coastal environment of Nigeria is rich in resources and species diversity. The mangroves found here are the largest remaining tract in Africa, and the third largest in the world, covering an area of about 9,723 km². The mangrove ecosystem provides a nursery and breeding ground for many of the commercial fishery species taken in the Gulf of Guinea. Nigeria's coast is said to have about 199 species of finfish and shellfish, a number of which are taken commercially. The Nigerian shrimp fishery is especially strong, and shrimp are now being exported to other countries, including the United States. About 80% of the fisheries resources in

coastal areas, however, are harvested by local residents (Ajao, 2001). Artisanal fisherfolk harvest a large variety of fish, crustaceans and mollusks from the estuaries and channels and utilize mangrove and swamp forest products for a number of domestic uses. A variety of birds, mammals, and reptiles inhabit the mangroves and swamp forests of the coast, including a few endemic species like the Sclater's guenon (*Cercopithecus sclateri*) and the Nile Delta red colobus monkey (*Procolobus pennantii epieni*). Although a few species of sea turtles lay eggs on Nigerian beaches, they are rare and under threat from human predation.

The coastal area is greatly impacted by the activities of oil companies, including the destruction of mangroves to provide areas for drilling activities and staff housing, improper waste and sewage disposal, intrusion of salt water further into freshwater areas as a result of the construction of navigable canals, the occasional oil spill, the establishment of exotic Nypa palm (*Nypa fruticans*) and other factors. As of now, there are still no officially protected areas in the mangrove belt. Many marine resources are also harvested unsustainably both commercially and by local fisherfolk with virtually no controls.

## 3.6 Habitats of International Importance

Nigeria has a number of globally important ecological areas, but few of these have yet to receive the international conservation attention they deserve. Only two sites have been included in international listings: one Ramsar site and one United Nations Educational, Scientific and Cultural Organization (UNESCO) Biosphere Reserve. Global conservationists are just now recognizing two other areas of extreme biodiversity importance in Nigeria: the Niger Delta and the Cameroon Highland Forests. Although parts of these areas are under heavy threat from anthropogenic factors, much viable habitat and diverse species still remain. Other areas in Nigeria, such as Lake Chad and the riparian forests of the Jos Plateau are important but these, sadly, are already heavily degraded.

***Niger Delta***

Although the Niger Delta has not been singled out for global attention as a Ramsar site or a Biosphere Reserve, it is a world-renowned area with extraordinary biodiversity and natural resources potential. The Niger Delta is one of the world's largest wetlands, covering more than 20,000 km², where the Niger and Benue Rivers split into a network of channels before entering the sea. The Niger Delta portion of the coast covers about 500 km of the coastline and encompasses a total of 21 estuaries (see Figure 4.1 in Part I of this report). Four distinct ecological zones comprise the Delta: barrier islands, mangroves, freshwater swamp forests and lowland rainforests. The barrier islands rim the shore and consist of sandy beaches and coastal forests, which represent a unique habitat containing much biodiversity, and are still largely intact (Moffat and Linden, 1995). The Niger Delta mangrove belt is about 30 to 40 km wide and not yet commercially harvested for timber, and aside from localized cutting it is still relatively undisturbed. Further inland are the seasonal and permanent freshwater swamps and swamp forests that are still fairly intact. The ecological zone under most pressure in the Delta is the lowland rainforest, which is rapidly being degraded to derived savanna through logging and agricultural expansion. These diverse habitats and the wet tropical climate have led to a diversity of species. For instance, there are more freshwater fish species here (197) than in any other coastal system in West Africa, including 16 endemics. Some species listed in the International

Union for the Conservation of Nature (IUCN) Red Data Book (World Resources Institute (WRI), 2000), such as the spotted-neck otter (*Hydrictis maculocolis*) and the white-throated guenon (*Cercopithecus erythrogaster*), are said to be locally common in the Delta (see Table 3.2).

The Niger Delta is best known as the repository for oil and gas and related commercial extraction activities that make up Nigeria's largest source of foreign exchange. The development surrounding oil operations and the heavy concentration of people in the areas of highest elevation have led to localized disturbances, pollution, oil spills and other environmental problems. The abundant fishery resources have in many cases been harvested unsustainably. Despite these problems, biologists and conservationists in Nigeria and elsewhere consider the Niger Delta to be a global natural resource and deserving of conservation attention.

***Cameroon Highlands Forest Ecoregion***

The World Wildlife Fund (WWF) Global 2000 listing of ecoregions of particular importance to biodiversity and ecosystem diversity has pinpointed the "Cameroon Highlands Forest Ecoregion" as an area of global significance. This area stretches along the border between Cameroon and southeast Nigeria and includes adjacent areas in both countries. Within this ecoregion, two different areas have been singled out for international conservation attention. The first area, at the northern edge of this ecoregion, combines the Gashaka Gumti National Park in Nigeria and adjacent Tchabal Mbabo National Park in Cameroon to form a transboundary project presently seeking Global Environment Facility (GEF) project development funds. This area includes montane forests and grasslands, lowland forests and savanna in a continuous transition, a rare occurrence in West Africa. This diversity of habitats has led to a variety of plant and animal species and the montane area in particular includes many endemics. The area is especially endowed with amphibians, with at least 60 endemic species found to date, and up to 18% of the plant species are also endemic to this area, although they may be found in both countries and are not "true endemics". Elephants and other species use this area as a corridor for migration. Due to the protected nature of these adjacent parks, the area is well situated for conservation action.

Another area within this ecoregion, but further south, has also been singled out. The "Gulf of Guinea Forests" include montane areas, lowland forest and coastal areas in Cross River State and adjacent areas of Cameroon, and the island of Bioko. This area is known to be a hotspot for primates (22 species), and for butterflies (which may have more than 1,000 species when survey work is completed). Of particular interest in this area is the Cross River gorilla (*Gorilla gorilla diehli*) with a population of less than 250 individuals broken up into two areas, and thus the most severely threatened of any gorilla subspecies in the world. Conserving aspects of the Gulf of Guinea Forest area has been an initiative of the Nigerian Conservation Foundation (NCF), Wildlife Conservation Society (WCS), and other partners for a number of years. A recent study on the area's biodiversity is presently in draft form, and will be distributed within a few months.

## Table 3.2. Select IUCN Red List Species Found in the Niger Delta

| Common Name | Scientific Name | IUCN 2000 Red List | Nigeria | Niger Delta |
|---|---|---|---|---|
| **Mammals: Primates** | | | | |
| Angwantibo | *Arctocebus calabarensis* | LR | I | Common |
| Red-capped mangabey | *Cercocebus torguatus* | LR | I | * |
| White-throated guenon | *Cercopithecus erythrogaster* | EN | | Common |
| Sclater's guenon | *Cercopithecus sclateri* | EN | | Common |
| Niger Delta red colobus | *Procolobus pennantii epieni* | EN | I | * |
| Olive colobus | *Procolobus verus* | LR | I | * |
| Chimpanzee | *Pan troglodytes* | EN | I | ** |
| **Mammals: Carnivores** | | | | |
| Cape clawless otter | *Aonyx capensis* | NL | I | ? |
| Crested genet | *Genatta cristata* | EN | I | Common |
| Spot-necked otter | *Lutra maculicollis* | VU | I | ? |
| Leopard | *Panthera pardus* | NL | I | ** |
| **Mammals: Ungulates** | | | | |
| Ogilby's duiker | *Cephalophus ogilbyi* | LR | | ** |
| Yellow-backed duiker | *Cephalophus sylvicultor* | LR | I | ** |
| Heslop's pygmy hippo | *Hexaprotodon liberiensis heslopi* | CR | I | *** |
| Water chevrotain | *Hyemoschus aquaticus* | DD | I | * |
| Bates' pygmy antelope | *Neotragus batesi* | LR | | * |
| Sitatunga | *Tragelaphus spekii* | LR | I | Common |
| **Mammals: Other** | | | | |
| Atlantic hump-backed dolphin | *Sousa teuszii* | DD | I | ? |
| Manatee | *Trichechus senegalensis* | VU | I | Common |
| Elephant | *Loxidonta africana* | EN | I | ** |
| Long-tailed pangolin | *Manus longicaudata* | NL | I | * |
| Tree pangolin | *Manus tricuspis* | NL | I | ? |
| Brush-tailed porcupine | *Atherurus africanus* | NL | I | Common |
| Rufous-nosed rat | *Oenomys hypoxanthus* | DD | | ? |
| **Birds** | | | | |
| Anambra Waxbill | *Estrilda poliopareia* | VU | | ? |
| Falcons | *Falconidae* | Varied | I | ? |
| Parrots | *Psittacidae* | Varied | I | ? |
| **Reptiles** | | | | |
| Nile monitor lizard | *Varanus niloticus* | NL | I | Common |
| Royal python | *Python regius* | NL | I | * |
| Rock python | *Python sebae* | NL | I | * |
| Serrate hinge-back tortoise | *Kinixys erosa* | DD | | * |
| Home's hinge-back tortoise | *Kinixys homeana* | DD | | * |
| Nile crocodile | *Crocodylus niloticus* | NL | I | ? |
| Slender-snout crocodile | *Crocodylus cataphractus* | DD | | ? |
| W. African dwarf crocodile | *Osteolaemus tetraspis* | VU | I | Common |

**Legend:**

IUCN 2000 Red List: CR = Critically Endangered, EN = Endangered, VU = Vulnerable, LR = Lower Risk, DD = Data Deficient, NL = Not Listed
Nigeria: I = Prohibited Species under the Federal Endangered Species Act of Nigeria
Niger Delta: Common = relatively common in delta in suitable habitat, * = reduced to small part of original range in delta, ** = reduced to relict populations in delta, *** = probably extinct (Status according to authors of the Niger Delta Environmental Survey Final Report

*Adapted from: Environmental Resources Managers Ltd., 1997, Niger Delta Environmental Survey Final Report, Phase I. Lagos, Nigeria, pp. 31-32, and Hilton-Taylor, C. 2000. 2000 IUCN Red List of Threatened Species. IUCN, Gland (Switz.) and Cambridge (UK,) 61 pp.*

### *Omo UNESCO Biosphere Reserve*

The Omo Forest Reserve was originally designated in 1925 and has gone through various degrees of protection since then. In 1977, the Strict Nature Reserve at its core was declared a UNESCO Biosphere Reserve, the only one in the country. This reserve is only a couple of hours drive from the metropolitan areas of Lagos, Ibadan and Abeokuta but has managed to preserve patches of mixed moist semi-evergreen rainforest and remnant populations of mammals including forest elephants and duikers, and a high degree of plant and animal biodiversity. Studies in the reserve include 26 one-hectare permanent plots that have been monitored since 1975, and various university-based projects. Enclaves within the buffer zone areas of the reserve include communities that farm, fish, hunt and collect forest products (Ola-Adams, 1999). The close proximity of this reserve to major universities, and the diversity of social and biological factors at play here make this an ideal conservation study area for Nigerian students and faculty alike.

### *Hadejia-Nguru Wetlands Ramsar Site*

The Hadejia-Nguru wetlands is a floodplain complex on the southern edge of the Sahel savanna in northeastern Nigeria. The Hadejia and Jama'are Rivers that supply this floodplain originate on the Jos Plateau and flow seasonally into Lake Chad. This area has long been noted for its importance to both breeding and wintering waterbirds and Paleartctic waterbirds passing through. It is also known to harbor at least 89 species of freshwater fish and many savanna animals. This area is under threat from water diversions and flooding due to dam construction, from grazing livestock, and from agricultural expansion. A number of NGOs, including NCF, the Royal Society for the Protection of Birds (RSPB) and IUCN have been collaborating with the state government and local communities to help conserve this area. Due in large part to this international attention, the Nguru Lake and Marma Channel complex in the Hadejia-Nguru Wetlands was designated as Nigeria's first Ramsar site in 2000. Other Ramsar sites are now being determined for possible inclusion, based on a report and study of wetlands conducted by the NCF for the Federal Ministry of Environment (FMoE, 2001).

# 4.0 Tropical Forests in Nigeria

## 4.1 Overview

Nigeria is largely an agricultural country with large urban centers, but despite this predominate use of land, important tracts of forest still remain. The major forest types were summarized in the previous section along with the rest of Nigeria's natural ecosystems, but are described in further detail here. The way forests are managed in Nigeria is of special conservation interest and is detailed separately in this section. This further information is provided here in recognition of the special attention tropical forests receive under the U.S. government's FAA 118 requirement. The threats to forests cannot be considered separately from the threats to the nation's biodiversity and habitats, however, and the conservation actions are intimately interrelated. For this reason, the threats to forests and biodiversity are considered together in Section 6 and organizations and actions involved in conserving these are considered together in Section 7. The recommendations at the close of this report likewise relate to forests and all the rest of the ecosystems and biodiversity in Nigeria.

## 4.2 Importance of Nigerian Forests

Like elsewhere in the world, the forests of Nigeria are important for the ecosystem services they provide, including watershed protection, climate control, and as habitats for a diversity of other plant and animal species. In Nigeria, the forests also provide valuable commercial timber sources and other commercially harvested products such as resins, spices, rattans and many more. Local Nigerians also benefit largely from forest resources as a source for fuelwood and building materials; and for a myriad of NTFPs with various uses as food, flavorings, medicine, various domestic uses, and also in some cases, for their traditional values. Many of these products harvested by communities are also important for their trade and cash value. Bushmeat, for instance, is hunted widely by community residents, but has too great a value for personal consumption (see Box 6.2 in Section 6 for more on this subject). Instead, these animals are sold for a high price in markets in urban centers, and the local communities instead eat "ice fish" which is frozen, imported sea fish like mackerel and herring locally available at a lower price.

The biodiversity in Nigeria's remaining forests is an important reservoir for many rare and endangered species, and for many genetic strains of wild crop species that may ultimately have further agricultural uses. Much of the biodiversity in Nigerian forests remains unexplored and undocumented, and no doubt many new species will someday be found, especially in the montane and swamp forest areas where little work has been done to date. Unfortunately the forests are disappearing more rapidly than studies are being initiated and it is likely that many forest species will go extinct before they are even officially recognized.

## 4.3 Description of Nigeria's Natural Forests

A major study of forests in Nigeria was commissioned by the Forestry Management, Evaluation and Coordinating Unit (FORMECU) of the Federal Department of Forestry and completed in 1999 (Beak Consultants et al, 1999). This study covered 27 Nigerian states with significant forest resources, including about two-thirds of Nigeria's total land area. Seventeen of these states, in

southern Nigeria, were found to contain significant natural forest resources, and are termed "high forest states" in this report. It is within these states that nearly all of the important natural forests in Nigeria are found. The remaining ten states, further north, contain only patches of savanna woodland or riparian forests and are mainly included in the Forestry Management, Evaluation and Development in Africa (FORMECU) study for their plantation estates.

Nigeria has six main types of natural forestland, lowland rainforest, freshwater swamp forest, savanna woodlands, riparian forests, mangrove forest and montane forests. Within the high forest states, the extent of each forest area is represented in Table 4.1. In the drier parts of the country further north, there are some remaining natural savanna woodlands and riparian forests not included in this table, but these become scarcer further north as conditions are drier and conversion to agriculture and overharvesting of firewood has depleted them. In addition, there are an increasing number of tree monocultural plantations, such as rubber and oil palm, but these contribute nothing to conservation of natural biodiversity and are not discussed here.

**Table 4.1. Estimates of Natural Forest Types in the High Forest Zone (17 states) in Southern Nigeria**

| Natural Forest Type | Within Forest Reserves (ha) | Outside Forest Reserves (i.e., in Free Areas) (ha) | Total Forested Area in the State (ha) |
|---|---|---|---|
| Lowland rainforest | 788,053 | 912,094 | 1,700,147 |
| Freshwater swamp | 186,621 | 1,424,739 | 1,611,360 |
| Trees/woodlands/shrubs (savanna woodland) | 85,789 | 306,532 | 392,321 |
| Trees/woodlands/shrubs (riparian forests) | 4,018 | 80,337 | 84,355 |
| Mangrove with trees | 0 | 5,314 | 5,314 |
| Montane | 0 | 3,847 | 3847 |
| **TOTAL** | **1,064,481** | **2,732,863** | **3,797,344** |

*Source: Beak Consultants et al, 1999.*

### *Lowland Rainforests*

Lowland rainforest once covered much of the southern terrestrial areas of Nigeria, where an abundant rainfall regime favors the development of this ecosystem type. Unfortunately, excessive exploitation of timber, agricultural encroachment and other anthropogenic changes have greatly reduced these forests in extent and in biological diversity. Although rainforest patches still are found in a belt in southern Nigeria from the western to eastern borders of the country, the largest remaining tracts of rainforest are primarily found in Cross River, Bendel and Ondo States (FAO, 1981). The rainforest belt of Nigeria is contiguous with the rainforests in neighboring Cameroon, and many of the species are found in both countries. Although many species are endemic to these forests, since they occur in both countries, they cannot be considered "true endemics."

Lowland rainforests are characterized by a great variety of plant species arranged in a complex vertical structure of forest canopies. Some economically important rainforest trees include mahoganies, African walnut (*Lovoa*), *Mansonia* and a number of others that are increasingly endangered by illegal and legal logging activities. Many other NTFPs extracted from these forests are prized by local residents for their food and medicinal value, and for other domestic uses. A number of rare or endangered rainforest animal species, including primates, forest antelopes, rodents and birds are overharvested as bushmeat and are exceeding scarce and rarely seen. Increasingly monocultural plantations of rubber, cocoa, oil palm and the like are planted within former rainforest areas, with a resulting loss of habitat and biodiversity. Other forms of agriculture also abound, although crops can be grown on lowland forest soils, long fallow periods are necessary between plantings, leading to the destruction of ever more forest areas for future crops.

***Freshwater Swamp Forests***

Freshwater swamp forests are found in southern Nigeria, on the landward side of the mangrove belt, where the salinity decreases beyond the tolerance of mangrove species. Swamp forests are dominated by species of Raphia, Pandanus, Calamus and Alchornea, with a canopy sometimes as high as 15 meters (NEST, 1991). Those swamp forests furthest inland are only seasonally flooded and characterized by climbing palms and a variety of other species that make the forest nearly impenetrable. A number of rare and endangered species still thrive in these forests, due to their inaccessibility. A few species of endemic primates also thrive here in locally common numbers. Although NTFPs are collected from some areas of the swamp forest, large tracts have been relatively untouched by commercial ventures. A bigger threat to swamp forests is the intrusion of saltwater into many areas, due to the development of navigational canals, primarily to enhance activities of the oil industry.

***Savanna Woodlands***

North of the rainforest belt in Nigeria there is a large band of derived savanna, which has undergone large-scale anthropogenic modifications. Aside from extensive agricultural areas, this zone contains some relict forest patches with species indicative of the rainforests and others known throughout the middle savanna belt. Further north the conditions get drier, the woody vegetation gets sparser and the trees thornier. The Guinea savanna area includes areas of mixed deciduous and semi-deciduous woodlands. Further north, in the Sudan savannas, baobob trees (*Adansonia digitata*) are characteristic while the Sahel savanna is virtually treeless (NEST, 1991).

Although savanna tree species are not as valuable for timber as those found in rainforests, a few species are commercially harvested. Many other trees are cut for fuelwood by residents in these areas, or cleared to make room for agriculture (Beak Consultants, et al, 1999). The savanna habitats also support a good number of large mammals such as various antelopes, elephants, lions, etc., which are all characteristic of savannas found elsewhere in Africa. These animals are increasingly scarce in Nigeria, and nearly nonexistent in areas outside those few protected areas that actually receive protection.

### *Riparian Forests*

Riparian forests consist of lowland rainforest, freshwater swamp forests and other forest types found on narrow strips bordering water bodies. Many of these forests have been spared from agriculturization due to difficult access and periodic flooding regimes (Beak Consultants et al, 1999). These forests are important to the protection of watersheds, and when they are destroyed, siltation and degradation of the watercourses becomes severe. These forests also have a role to play in the migration and movement of many animal species, forming corridors of connectivity between different forest patches. The riparian forests of the Jos Plateau are also known to contain a unique assemblage of species, including a number of endemics plants and a few endemic birds and mammals. These forests are under intense threat, however, and only marginal amounts still remain.

### *Mangrove Forests*

Mangrove forests in Nigeria range along 708 km of coastline extending from 16 to 90 km from the shore inland, encompassing 5,591 km² of land (Isebor and Awosika, 1993). Mangroves survive in marine and brackish habitats and are replaced further inland by freshwater swamp forests. Nigerian mangroves are dominated by red mangroves (*Rhizoporaceae*) and also include white mangroves (*Avicennia*) and a few other mangrove species. The mangrove understory includes a thick undergrowth of other salt-tolerant plant species.

Mangroves provide a number of ecological services including the habitat and nursery ground for a productive range of fish, crustacean and mollusk species that are harvested locally and in offshore fisheries. Local residents also use mangroves for firewood, for dying their fishing nets, and collect a number of NTFPs from the understory. As mangroves are cut for firewood, or to enable the construction of navigational canals, villages and oil company operations, they are gradually being replaced by Nypa palms (*Nypa fructicans*), an exotic plant species that is a fast colonizer, but does not provide the extensive ecological services provided by native mangroves. As yet, there are no protected areas in Nigeria that include mangroves.

### *Montane Forests*

Montane forests contain considerable biodiversity, and due in large part to their geographical isolation and unique microclimate, many of the plant and animal species found here are endemic to these areas. In Nigeria, montane forests are found primarily on the highlands that form the southeastern border between Nigeria and Cameroon. Although some of this high altitude area consists of grassland, shrubs and rocky outcrops, there are some patches of montane forests along the eastern, southern and western sections that merge gradually into lowland rainforest at the base. Two types of montane forests can be discriminated: the mist forests with a diversity of moss and epiphyte species and uneven canopies; and drier forests higher up, where dwarf and stunted trees occur. The Jos Plateau is another highland area that once contained tracts of montane forests. This area has been highly modified by anthropogenic factors, and now only remnant patches exist.

## 4.4 Management of Nigerian Forests

Nigerian forests are managed by the Federal Department of Forestry, by State Departments of Forestry and by communities throughout the forest zones. Three management categories exist for those remaining tracts of natural forest: protected areas, forest reserves and nonconcession areas.

***Protected Areas***

Nigeria includes a number of different types of protected areas, under the auspices of authorities ranging from the federal to local levels. The eight national parks in Nigeria are managed by the Federal National Park Service and include some representative forest types, in some cases very large tracts of them. Although these national parks have quite a bit of paper protection, most do not have management plans and the staff is generally unequipped and untrained. Other areas, such as the OmoBiosphere Reserve and the many game reserves in the country, are often even less protected. Within many of these protected areas, however, are "strict nature reserves" that may receive more conservation attention that the larger areas. Probably the most protected of the protected areas in Nigeria are those that are considered by local communities to be sacred groves or juju shrines and are under local prohibitions. Another category that receives strong protection are those few reserves in private hands, such as the NCF Lekki Island swamp forest and the remnant forest within the International Institute of Tropical Agriculture (IITA).

***Forest Reserves***

Forest reserves are numerous around the country and are under various management regimes that vary widely from state to state. Forest reserves are administered under the Department of Forestry in the Ministry of Agriculture and Natural Resources in the various states. For the most part, these reserves are managed as a source of revenue and without a conservation mandate. Many of these forest reserves have been converted to plantations for rubber, pulpwood, oil palm and other monocultures. In the 17 high forest states in the Forest Resources Study (Beak Consultants et al, 1999), for instance, the ratio of forest reserves to total land area was found to be 10.25%. This number is deceptive, however. Although forest reserves cover nearly two million ha of land—1,976,586 ha to be exact—only 53.9% is occupied by natural forest types, and the rest consists of plantations or cropland.

Wild timber is also extracted from most of these reserves although few controls exist in the field to monitor such activities. On paper, some of these states, such as Cross River, manage the extraction of timber based on charging fees for stumpage, with more economically valuable species commanding a higher fee. In other states, further discriminatory charges are added based on the economic value of the trees. Some states also specify the size of tree that can be harvested. In some states particular tree species are under strict protection. In other states the permits are managed according to concession areas that are being harvested regardless of the size or number of trees. There is also a widespread amount of corruption in managing the forests and officials are often pressured or encouraged to offer more permits than are sustainable. There is very little monitoring of various activities on the ground, providing an easy track towards escalating deforestation practices.

### *Non-concession Areas*

The forestland that is not included in protected areas or in forest reserves (which includes the majority of forestland in Nigeria) is considered to be "free" forest, but "free-for-all" is a more apt phrase. Except in a few cases where communities are sustainably managing forests in their neighborhood, much of this forestland is rapidly becoming degraded or disappearing entirely. It is still a common practice in some communities in the south where anyone in the community can clear a patch of forest in their common area, sell the timber and turn it into cropland. This land then belongs to the individual, who will need to clear more land as the rainforest soil gives out and this land must go fallow. As more people inhabit these communities, the loss of free forests is exponentially increasing. Similarly, many of the forest products and wildlife in these free areas have been overexploited to near extinction. A few examples do exist, however, where communities have continued in sustainable, traditional extraction practices or have recently learned the practices of sustainability from NGOs, and are now working to actively manage their own forests. In Nigeria, many believe, it is this practice that holds the best hope for the important forests and biodiversity still remaining.

# 5.0 Status of Biodiversity in Nigeria

## 5.1 Overview

Nigeria is a tropical nation encompassing a variety of diverse habitats and ecosystems—features that lead to a large amount of biodiversity in terrestrial and aquatic species. Like many developing nations, the continued resources necessary to thoroughly catalogue these species has been lacking and much of the diversity is relatively undocumented. The data that exists comes from a number of studies of particular taxa and particular sites of interest to various researchers. Most of the information available concentrates on species of particular economic or aesthetic importance to people. Large mammals, birds and butterflies (Larson, 1997) with aesthetic appeal to expatriots have been well studied in certain regions. Economically and/or traditionally important fish, invertebrates, and plant species have been similarly focused on within Nigeria. Most species, including many plants, terrestrial and aquatic invertebrates, small mammals, reptiles, amphibians, fish, etc. in much of the country remain undocumented. In preparing papers for the Convention on Biological Diversity (FEPA 1992, FEPA 1996, etc.) an effort has been made to gather existing data into a single source, but this information is still sketchy and probably inaccurate. Some of the existing information is summarized here.

## 5.2 Birds and Mammals

As of 1992, Nigeria was said to have 274 mammal species and 839 bird species (FEPA, 1992). Since then more birds have been documented in Nigeria, bringing the latest total of Nigerian birds to 889 species (Ezealor, 2002). Most of Nigeria's birds and mammals are also found in other countries in Africa with similar habitats, but a few species, known as endemic species, only occur in Nigeria. Some important endemics include three monkey species: the white-throated monkey (*Cercopithecus erythrogaster*), Sclater's guenon (*Cercopithecus sclateri*) and the Niger Delta red colobus (*Procolobus pennantii epieni*); and three birds: the Anambra waxbill (*Estrilda poplipaia*), the Ibadan malimbe, (*Malimbus ibadanensis*) and the Jos indigo-bird (*Vidua maryae*) (Aminu-Kano, 2001). In addition, some birds and mammals are near endemics and found in some habitats shared with neighboring countries. The Gulf of Guinea forests of southeastern Nigeria, western Cameroon and Bioko Island of Equatorial Guinea are one such area with an exceptional number of near endemic primate species (Oates and Bergi, 2001).

Many of Nigeria's birds and mammals are at very low population levels and only found in a few protected areas, where they are still threatened due to lack of adequate protection. Some larger species such as giraffes, various antelopes, ostriches, vultures, etc. which may be common in other African countries, have all but disappeared in Nigeria due to a combination of habitat destruction and severe hunting pressures (FMoE, 2001).

## 5.3 Reptiles, Amphibians and Fish

Nigerian reptiles, amphibians and fish are not nearly as well known as the birds and mammals. In the Nigeria country study on biological diversity (FEPA, 1992), Nigeria was said to harbor 135 reptile species, 109 amphibian species and 648 fish species but various other studies over the years quote widely differing numbers of these vertebrates. Reptiles are the most studied and

those that are hunted for food, like turtles and tortoises, are known to be rapidly disappearing in Nigeria. Over 230 fish species are said to be found in inland waters (Shimang, 2002) and many more found in coastal and marine habitats. The best known fish species are those with commercial value, but many others that are less obvious, smaller and found in restricted and specialized habitats no doubt would be found, if anyone took an interest.

One snake (*Nahelya egbensis*) and five amphibians are endemic to Nigeria (Aminu-Kano, 2001) and undoubtedly a number of fish species as well, but there is little available information on these. As with the higher vertebrates, a number of these are considered near endemics and are found in neighboring countries with similar habitats.

## 5.4 Invertebrates

Aside from a few economically important invertebrates, such as various prawns and mollusks, little information is available on the diversity of this large group of organisms. Various insects including ants and butterflies have been studied in certain habitats, and new species are found wherever anyone looks. For instance, Larson has done some extensive butterfly collecting in the Gulf of Guinea forests and estimates that there are around 1,000 species in the Cross River National Park alone (Larson, 1997). A particularly significant collection of insects resides in the Department of Crop Protection and Environmental Biology at the University of Ibadan. The Biodiversity Country Study (FEPA, 1992) estimates that Nigeria has more than 20,000 insects, 77 mollusks, 5 echinoderms, etc., but these numbers are largely suspect.

## 5.5 Plants

Due to the diversity of habitats in Nigeria and the tropical climate, there is a great diversity of plant species found in the country. There have been many localized studies of plants in Nigeria, but few sources of consolidated information. According to the 1992 country study, more than 848 algae species have been identified in the marine and freshwater habitats and over 5,103 higher plant species have so far been identified and less than 200 lower plant species have been identified, although the number of these plants is definitely much higher (FEPA, 1992).

Due to the geographical isolation and the unusual climatic conditions of Nigeria's montane areas, many of the plants found here are endemic species, and some even represent monospecific endemics, with a single species found in the genus. Many of these montane plants are highly endangered, especially those found only in riparian habitats on the Jos Plateau. In a recent study of forest and forest products in 25 forest states in Nigeria (Beak Consultants et al, 1999), it was found that a total of 58 tree species, especially those that have been selectively harvested for economic value, were thought to be endangered in the study area.

Nigeria's plants include many species with traditional value as food items, medicinals and for various domestic uses, and a number of these plants have been catalogued in specific areas of the country. Nigeria is also an epicenter for diversity of wild varieties of important crop plants, including cowpeas (*Vigna unguiculata*), West African rice (*Oryza sativa*), yams (*Dioscorea spp.*), Bambara groundnuts (*Vigna subterranea*), Kersting's groundnut (*Macrotyloma*

*geocarpum*), African yam bean (*Sphenostylis stenocarpa*), and winged bean (*Psophocarpus tetragonobus*) (Ng, 2002). A number of these wild crop relatives are presently endangered.

## 5.6 Other Biodiversity

Microorganisms, bacteria, viruses, etc. are little known in Nigeria as well as almost everywhere else. The Biodiversity Country Study (FEPA, 1992) estimates that there are 3,423 fungi species in Nigeria, 134 "plankton" species, more than 500 virus species, 55 bacteria, etc. Aside from the fungi, these numbers most likely do not come close to the true situation of biodiversity of these taxa.

## 5.7 Significance of Nigeria's Biodiversity

The IUCN Red List of Threatened Species (Hilton-Taylor, 2000) of globally threatened species includes 148 animals and 146 plants that are found in Nigeria. Of these, 26 animals and 18 plants are classified as endangered and another 3 animals and 15 plants are critically endangered worldwide. Many more species are endangered or threatened in Nigeria alone, but viable populations still exist in other countries.

Nigeria is known as a global hotspot for primate species, with a great diversity found especially in the Gulf of Guinea forests of Cross River State and adjacent parts of Cameroon. The most endangered gorilla subspecies on earth, the Cross River gorilla (*Gorilla gorilla diehli*) with an estimated population of less than 250 individuals, is found only in a couple of protected areas near the Nigeria/Cameroon border (Bassey and Oates, 2001). The Gulf of Guinea forests are also a hotspot for butterfly speciation. Similarly, the forests further north along the Cameroon border are also known to be a hotspot for amphibians.

Nigeria's wild varieties of various crop species are also of global importance for the diversity they represent and the potential attributes that might make some of these plant varieties less susceptible to disease, more drought resistant, or other positive features that might enhance domesticated crop types.

# 6.0 Threats to Nigeria's Biodiversity and Tropical Forests

## 6.1 Overview

The threats to biodiversity, tropical forests and the rest of the many ecosystems and natural habitats in Nigeria are overwhelming and escalating. A key feature of Nigeria's ecology is its large and burgeoning human population and the increasing pressure this population growth is putting upon the natural environment. Urban areas are congested and growing, without adequate environmental safeguards. Population estimates vary, but the WRI approximations for 2000 (WRI, 2000) estimate at least 111 million people and others believe that Nigeria's population may be at least 120 million. No matter what the exact numbers are, Nigeria is known to be the most densely populated country in Africa. Although Nigeria has some very large urban centers, more than 70% of the people live in rural areas where they depend upon agriculture and other natural resources for their survival (FEPA, 1992). This growing rural population puts increasing demands upon the natural habitats and plant and animal species of Nigeria, which decrease in extent and numbers as the human population increases. Add to this the environmental contamination stemming from urban and industrial centers and the picture becomes clear. Nigeria's natural environment is rapidly becoming degraded—along with the quality of life that future Nigerians can expect.

The direct threats to biodiversity and ecosystems in Nigeria can be grouped into two conservation categories: habitat degradation and unsustainable use. Overriding all these threats, however, are the administrative and management conditions of the country that are allowing such conditions to continue.

## 6.2 Habitat Degradation

Habitat degradation is visible in all terrestrial and aquatic habitats throughout Nigeria. In terrestrial habitats, the major degradation factor is conversion of natural habitats to agricultural uses. In a study of land use changes in Nigeria (Beak Consultants et al, 1999) it was determined that agricultural lands, including crops and grazing land, in 1976/1978 made up 53.8% of the land in Nigeria. Similar data from 1993/1995 shows that another 84,073 km² have been converted to more cropland and grazing land, bringing the total to 60.8% of the land area of Nigeria. This land was obtained from natural habitats such as savannas, forests and swamps with resulting negative impacts on the diversity and populations of indigenous species. Since then, this trend towards further agricultural land conversion is continuing, to the detriment of the natural habitats that remain.

Often the conversion of natural areas to agricultural land happens in predictable sequences. In forest ecosystems, initially any remaining valuable timber is harvested and sold commercially. Already after such activities, the forests are degraded and some valuable biodiversity is lost. The remaining trees and shrubs are cleared using fire, until finally, land is opened up for crop planting. The forest soil cannot sustain sequential crops without long periods of fallow, so new areas are increasingly sought for more planting in future years. Making matters worse, often these set fires burn out of control and many more ha are lost. With more people in Nigeria every year, this process is escalating. Conversion to agriculture is occurring in many protected areas, in

community-owned land, and in state managed forests without serious control. Rainforest and savanna woodland areas are the most threatened from agricultural conversion at this time. Mangroves are not yet harvested commercially in Nigeria, and mangrove soil is not conducive to growing crops. If and when aquaculture projects take off in Nigeria, these forests also will be under threat of conversion. Swamp forests similarly are not yet widely converted to agricultural use, but if rice growing increases in scale in Nigeria, these areas too, will be threatened.

Terrestrial degradation of ecosystems can be less obvious than land conversion, but still damaging to biodiversity. In areas where particular species, such as hardwood trees, rattans, medicinal and food plants and other NTFPs are harvested unsustainably, not only are these species lost but also a myriad of associated plants, insects, fungi, etc. that require these specific hosts to meet their own ecological requirements for survival. The tree fall gaps in logged areas also lead to the establishment of secondary growth that often cannot fully replicate the old growth that was lost. There is also the case of genetic erosion, for instance, when the largest, straightest, most vigorous trees are selectively logged, leaving the puny behind to reproduce.

Aquatic degradation is often less visible but no less harmful to the species that depend on this environment. Many aquatic species have very particular requirements in water quality, flow, and seasonality, all factors that are undergoing anthropogenically induced changes in Nigeria. Pollution from urban centers, industrial areas, mining and agricultural runoffs are impacting the water quality of rivers and streams throughout the country. Clearing riparian forests for agriculture is changing the nearshore microhabitats for fish, amphibians and other species. Soil erosion is a rampant problem throughout Nigeria, and adds more than normal levels of silt to some bodies of water, such as Lake Chad, with predicted negative effects on some aquatic species. Damming and diversion of waterways block migratory routes of fish and other species and stem the flow of necessary nutrients and silt to the estuaries and deltas of the country, thus leading to lowered productivity, and loss of land in these areas.

Finally, in both terrestrial and aquatic habitats, the introduction of exotic species has been a factor in habitat degradation. In Nigeria, there has been recent attention to three introduced plants that are leading to habitat disturbances in various environments. One, the water hyacinth (*Eichhornia crassipes* ) causes worldwide problems in many major waterways and lakes. In Nigeria, this is also true, and a number of rivers are now nearly closed to navigation due to the proliferation of this surface floating plant, which tangles in boat engines and changes the character of the ecosystem by shading out some native species and displacing others. In coastal areas, the Nypa palm (*Nypa fruticans*) introduced in Calabar from Southeast Asia is also a problem. In areas where mangroves have been cut and otherwise disturbed, Nypa palm is the first to regrow, thus outcompeting the mangroves. Mangroves have an extensive root structure that provides sheltered habitats for many species of fish, mollusks and crustaceans, and the fallen leaves continually replenish the soil. In areas where mangroves have been replaced by Nypa palms, these nurturing features are lost to the ecosystem. Even terrestrial plants can become a problem. In Yankari National Park, for instance, the introduced Neem tree (*Azadirachta indica*), which was initially planted for its medicinal value and value as a shade tree, has proliferated to the detriment of less hardy native species that cannot compete with it, or grow in its understory. Although these examples are all plants, introduced animals too can be a problem. Governmental attempts to stock lakes and reservoirs with fish to be harvested often do not consider whether

these fish are native or not. In many places in the world such non-native species have totally crowded out native species to the point of extinction. Lake Victoria in East Africa is one such example, but no doubt there are other examples right in Nigeria. Species and strains that are produced through biotechnology and introduced to the country may also provide other threats to natural biodiversity unless appropriate safeguards are met (see Box 6.1).

**Box 6.1. Biosafety**

Advances in molecular genetics research have had a concomitant increase in the availability and use of biotechnology to produce living organisms with particular characteristics that are desired. Although for centuries man has manipulated species by breeding select individuals with one another, biotechnology has advanced much further. Now, it is possible to take genetic material from one species and add certain pieces of it to another entirely unrelated organism. These genetically modified organisms (GMOs) are already widely utilized in many products and agricultural commodities including various vaccines, drugs, food additives and various processed foods. One positive offshoot of this work is the development of various crop strains that are drought and/or disease resistant or otherwise more desirable than their progenitors, offering a new approach to improved agricultural productivity. Along with the benefits of such products, however, come possible threats that these GMOs may present to the natural ecosystems and biodiversity of the world. It is possible that GMOs may out-compete, exchange genes with, or otherwise negatively impact related species. In addition it is possible that these new life forms may have adverse impacts on other non-target species, such as beneficial insects, and may also become weedy and invasive with ultimate negative effects on entire ecosystems.

Producing and using GMOs is a new field but concerned scientists and citizens worldwide are already advocating a "precautionary approach" to the use and introduction of these organisms worldwide. The Cartagena Protocol on Biosafety to the Convention on Biological Diversity was adopted in January of 2000 to provide a global forum for addressing the concerns raised by biotechnology and to provide oversight in the safe transfer, handling and use of GMOs. Nigeria signed this protocol in May 2000, showing its commitment to ensuring the safety of biotechnology products utilized in the country. As a nation with a mandate to improve agricultural productivity for its large human population, the use of genetically modified crops is a useful approach. As this process becomes the norm, however, the precautionary approach mandates a careful look at the effects on the natural biodiversity and ecosystems of the nation.

## 6.3 Unsustainable Use

Nigeria is rife with examples of unsustainable use of many animal and plant species, both legally and illegally, but it is difficult to find hard data. Most rural Nigerians depend to some degree on food items and other products they can extract from the wild. As the population increases, so does the rate of extraction of key species. In addition, other species have an economic value and are overexploited for financial gain. Few controls are in place to make these activities sustainable over the long term.

One problem receiving international attention in Nigeria is the "bushmeat" trade (see Box 6.2). In most natural habitats in Nigeria, edible-sized animals have all but disappeared. Great apes, monkeys, duikers, rodents, birds, turtles, etc. are all hunted and consumed wherever they occur. Bushmeat has a high commercial value, and is often exported to urban centers where it commands a high price and is considered a delicacy. Unbelievably, communities living in forested areas in the southeast get most of their own protein from "ice fish" which is usually

mackerel and herring that is frozen and imported. These fish can be purchased by a villager at a cheap price, while he sells his bushmeat to supplement his income.

**Box 6.2. Bushmeat**

Conservationists assessing the threats to endangered, threatened and rare mammals in West and Central Africa are increasingly focusing on the problem of "bushmeat." One primate species, Miss Waldron's red colobus (*Procolobus badius waldroni*), is said to have become extinct due to the bushmeat trade, and populations of chimpanzees (*Pan troglodytes*), gorillas (*Gorilla gorilla*) and many smaller forest primates are all threatened by bushmeat hunting (Milner-Gulland, 2002). In Nigeria, as in much of the region, nearly every mammal that is encountered in the forest is hunted for consumption by the local community or for sale to others. Monkeys, great apes, duikers, rodents—all are valuable food commodities. In much of the remaining natural forests in Nigeria, such hunting pressures have reduced mammal populations to almost invisible numbers.

Nigerian bushmeat of all types make its way to city markets, where it is considered a delicacy and commands a high price. Once the meat is processed and cooked, it is difficult to ascertain the source of the meat, be it monkey or rodent. In southern Nigeria, local communities that hunt bushmeat do so for its commercial value, not for the protein it provides them. For their own protein needs, they buy "ice-fish," imported to Nigeria, that surprisingly is cheaper to purchase.

The human implications of the bushmeat trade are many and complicated. On the one hand, bushmeat provides an important source of revenue for many communities and hunting is an inherent part of the traditional lifestyle. On the other hand, bushmeat hunting is leading to the extinction of a number of mammal populations throughout the region. Conservationists are working to develop solutions to this dichotomy. One rodent, the grass-cutter (*Thryonomys swinderianus*), is an especially common source of meat, and efforts are underway to domesticate it, as an alternate income source for communities and to lessen the hunting pressure on wild mammals of all species. It remains to be seen if this species will be an economically viable candidate for husbandry in Nigerian communities, and if this will help the wild mammal populations.

The trade in endangered species is also said to be quite high in Nigeria. It is claimed that gorillas, monkeys, parrots, etc. are captured in neighboring Cameroon, trucked by land to Kano, and then flown out to various Middle Eastern and South Asian markets where they are considered to be status symbol pets. Every baby chimpanzee or monkey and every parrot that appears in this trade is representative of many others lost in the process.

Overfishing is also a problem in much of Nigeria. Although hard data is scarce, the Department of Fisheries suggests that a number of fish stocks have declined and they are looking towards aquaculture to provide the quantity of fish that Nigerians require. The amount of fish recorded commercially is only one aspect of the issue, however. Up to 70% of the production of fish and shellfish in Nigeria is taken by artisanal fisherman, with few catch records available. Studies at the University of Calabar's Institute of Oceanography, however, show that certain fish found in local markets have declined in quantity and size during a five-year period (Sieghard Holzloehner, 2002).

Unsustainable use of trees and other plant species is also a problem in Nigeria. Commercially valuable hardwoods have nearly disappeared from most forests in Nigeria, no matter what degree of protection these forests supposedly have. Certain NTFPs, such as rattans (for making

furniture); the vegetable delicacy afang (*Gnetum spp*.); and *Prunus* (a cure for prostate cancer) are being overharvested due to market demand. Most NTFPs are harvested using unsustainable techniques, like uprooting them, or peeling off all the bark, or cutting down a tree to get to the rattan vine, when more sustainable techniques would be possible.

## 6.4 Institutional and Management Threats

Overlaying the ecological threats to biodiversity and tropical forests in Nigeria are a host of institutional and management problems that do nothing to help a conservation agenda. The ineffectiveness of existing environmental policies, regulations, and enforcement is visible at all layers of government, beginning at the top and flowing down into the communities. One major problem is the lack of coordination of environmental policies and responsibilities among various government ministries. Ostensibly, the newly formed Ministry of the Environment (formerly FEPA, now FMoE) holds most of the power in environmental protection. However, other ministries such as the Ministry of Water Resources and the Ministry of Agriculture, also manage elements of the natural world. In some cases, the goals and policies of one ministry are in conflict with that of another. For instance, the Federal Department of Fisheries (under the Ministry of Agriculture) is under a mandate to "produce enough fish in a sustainable way to meet the needs of the populace and for export" (Shimang, 2002). Recognizing that the fishery stock in natural freshwater and coastal areas is already sorely depleted, this department is looking at aquaculture to meet their goals. Although at the moment aquaculture makes up only about 2.5% of the tonnage of the domestic fish production, the government is working to increase this to 71.2%. The Fisheries Department is eyeing the 1.6 million ha of natural land in Nigeria that they claim is suitable for aquaculture. This land consists of the very swamp forests, mangroves, wetlands and associated biodiversity that the FMoE is trying to conserve. Many other such examples exist in the government structure, and until the discrepancies are sorted out no one can go forward.

Nigeria has many good environmental laws and policies, but most of these are never enforced. There is an overall lack of knowledge of these laws even among those agencies entrusted with enforcing them. Even when the laws are known, there is little capability to enforce them. Throughout the entire system there is much room for entrepreneurial government officials to look the other way when, perhaps, more timber than permitted is being extracted, or large fishing trawlers are fishing in inshore waters. No one is out in the field to actually monitor these commercial activities and individuals who ignore the rules can make much money.

Even at the local level, existing laws are often not known, or if they are, they are widely ignored. The need for immediate sustenance and income in communities near natural areas overrules any interest in official laws set by others. In the best of conditions the communities themselves can work together to manage their resources sustainably. But the population pressures and immediate needs are in many cases overriding traditional management systems. As aquatic resources are being depleted, artisanal fisherfolk are using smaller mesh nets, and ignoring any seasonal fishing regulations, even those traditional ones formerly in place. In forest habitats, similarly, community forests are no longer boundless and full of resources that can be endlessly tapped. Various products with domestic or commercial use are often gone from these forests, and animals of any type are scarce beyond the markets. In some communities, the land tenure system

is also breaking down. Where once it made sense, in a time of plenty, for any individual to be able to clear a patch of community forest and plant crops and own the land individually, now this practice is leading to the loss of major forest areas with resources that were once the entire community's assets.

Protected area management is also a problem to biodiversity conservation in Nigeria. The eight national parks have (on paper) the highest degree of protection, especially the core areas and strict nature reserves within them. But the paramilitary National Park Service lacks the human resources and equipment to manage these resources in the field. Rangers rarely have guns, radios or other basic equipment and cannot compete with poachers who do. Some of the national park boundaries are still encroached upon by agriculture, and pockets of commercial activities take place within their cores. Forest reserves under state management are even worse off, and receive nominal protection. Scattered around the country are sacred groves, research plots, private reserves like the Lekki Conservation Center of NCF and the forest reserve within IITA, and other small plots of land that are tightly protected. But these areas are small in size, widely scattered and are the exception rather than the rule.

Finally, in order to effectively manage natural resources there must be accurate data on the distribution and abundance of the resources involved, the amount harvested from year to year, and the ecological parameters of sustainability for each. In Nigeria, such information is often lacking. Small studies have been done on a few NTFPs in some forests, or in artisanal fisheries in some coastal communities, or market surveys of various products but there is no overall body of data necessary for effective management. At the rate the resources are being depleted, such information is too late for many species already disappearing from Nigeria.

# 7.0 Tropical Forests and Biodiversity Conservation efforts in Nigeria

## 7.1 Background

Biodiversity conservation has had a long history in Nigeria stemming back to colonial days, but in the past couple of decades concern has slipped considerably in lieu of other more pressing problems facing the government and residents. A number of Nigerian NGOs and ex-patriot experts have continued to maintain an interest in wildlife conservation, but these efforts have, by and large, been localized and/or focused on particular taxa, such as birds and large mammals. The development of the multinational oil industry, while infusing the government with foreign exchange has also led to a disregard for adequate environmental controls that might interfere with profits. Today, with the initiation of the FMoE, however, governmental attention seems to again be focused on the natural environment, and the work of NGOs is becoming more visible. Some of the major players and conservation activities underway in Nigeria are summarized here.

## 7.2 Organizations Playing a Role

In Nigeria, biodiversity and tropical forest conservation activities are the mandate of various governmental entities, NGOs, university faculty and institutes, and supported in part by donors and private foundations. Aside from the contributions of the nonprofit arm of various oil companies, there is as of yet little conservation investment by the private sector. From the GFRN side, the primary environmental entity is the newly formed FMoE that has raised the role of the old Federal Environment Protection Agency (FEPA) to a ministerial level, while adding other responsibilities formerly situated elsewhere in the federal system. Other remaining ministries, however, still have federal environmental activities, some of which appear to be in conflict with an environmental conservation and protection mandate. The Ministry of Agriculture, for instance, includes the Fisheries Department and other more terrestrially based components, all striving to increase the production of food resources in Nigeria despite the environmental consequences. The Ministry of Water Resources has jurisdiction over water sources for people regardless of the deleterious effects water development activities may have on the diversity and abundance of natural fisheries that are crucial to many residents of Nigeria. Such conflicts among the policies and goals of these federal agencies still need to be reconciled. Other anomalies exist at the federal level as well. For instance, one federal entity with a strong biodiversity conservation role, the National Park Service, has been set up to function as an independent parastatal agency, with a mandate of protection, but without enough resources to do this effectively, and little chance of raising significant funding from tourism to accomplish its mission in tourist-scarce Nigeria.

Other government agencies at the state level, local government level and community level are also charged with aspects of biodiversity conservation. Often the administration of game and forest reserves is managed at the state level and most often the resources and capacity are not available to meet this task. Although the governmental system varies from state to state, some of the overlapping responsibilities evident at the federal level occur at this level as well in many states. In local government areas, similar nuances and conflicting roles also are widespread. In many areas, the communities themselves also have official ownership roles in managing forests and other natural areas in their midst. Traditional land tenure and extraction practices in some

cases can still help to sustainably manage these resources. As the population increases, and the land area and abundance of resources shrinks, however, these management regimes increasing fail to ensure the survival of key resources for the next generation.

A growing number of NGOs in Nigeria are tackling various aspects of biodiversity and tropical forest conservation initiatives (NCF, 2000). One of the longest standing has been the Nigerian Field Society, established in 1930, and known for the publication of the *Nigerian Field Journal*. In 1980, the NCF was formed and has grown with partnerships with the WWF and Birdlife International into Nigeria's strongest and most active conservation NGO. A number of other NGOs have proliferated since then throughout Nigeria. Among the most prominent are the Nigerian Environmental Action/Study Team (NEST), Savanna Conservation Nigeria, Center for Environmental Resources and Sustainable Ecosystems (CERASE), Delta Environmental Network, Niger Delta Wetlands Center, NGO Coalition for Environment, Cercopan and Pandrillus. Although the GFRN is not a member of the IUCN, four Nigerian NGOs are members: NCF, NEST, CERASE and Savanna Conservation. Various international NGOs, including Wetlands International, the Wildlife Conservation Society and others also have ongoing programs within Nigeria. Many other smaller local and regional NGOs have also proliferated around the country. Activities of these NGOs range from environmental education, to community development work, to species and habitat-focused programs, and most involve a myriad of stakeholders and partners. Together these NGOs have a major civil society role that may well turn out to be the most effective mechanism to ensure the sustainability of wildlife and ecological resources in Nigeria.

Universities also have a role to play in Nigeria's conservation efforts. Faculty members at many Nigerian universities have long been involved in academic studies of wildlife, plants and other natural resources in various areas of the country. The foci of theses studies is widely scattered and the data and results are often difficult to access. Recently, as part of Nigeria's activities on behalf of the Convention for Biological Diversity (CBD), a number of "Linkage Centers" have been established in Nigerian universities and institutes to consolidate and disseminate this information. One such center, the Linkage Center for Forests, Conservation and Biodiversity at the University of Agriculture in Abeokuta is focusing entirely on coordinating data and research relevant to biodiversity conservation. Other such nodes in the country include Linkage Centers for Arid Environments (in Maiduguri), for Freshwater Environments (in Minna), for Highlands/Montane Environments (in Jos), for Delta Environments (in Port Harcourt) and for Marine and Coastal Environments, in conjunction with the Nigerian Institute for Oceanography and Marine Biology (in Lagos). The Oceanography Institute resides within the University of Calabar. As a rule, most of these programs are underfunded and could use added resources before they can be successful in their various missions.

Many of the conservation entities and activities described here are funded in part by multilateral donors, like the World Bank and the UN Environmental Program (UNEP), and bilateral donors such as the UK Department for International Development (DFID) and the Canadian International Development Agency (CIDA). A variety of other foundations also play a role in supporting various conservation efforts. Some of these foundations are the nonprofit and public relations arm of various industrial giants, such as multinational oil companies. Shell, Chevron and Statoil are highly visible in this regard in the Niger Delta and beyond, but not as visible in

the conservation world as their extraction activities are on the natural horizon. Other private foundations in the U.S. and Europe also play a role in supporting conservation activities in Nigeria. The Laventis Foundation, for instance, is said to invest $600,000 in biodiversity conservation activities each year in Nigeria. The Ford and the MacArthur Foundations in the U.S. are visible in providing NGO support in various conservation activities throughout Nigeria.

## 7.3 Nigeria's Involvement in Global Conservation Agreements

The GFRN is a signatory to most of the major natural resources conventions and treaties including the following:

- Convention on the Protection of the World Cultural and Natural Heritage,
- Convention on the Prevention of Marine Pollution by the Dumping of Wastes,
- Convention on International Trade in Endangered Species (CITES),
- Convention on the Conservation of Migratory Species of Wild Animals,
- Convention for Cooperation in the Protection and Development of Marine and Coastal Environment of the West and Central Africa Region,
- African Convention on the Conservation of Nature and Natural Resources,
- Convention on the Law of the Sea,
- Vienne Convention on the Protection of the Ozone Layer,
- Montreal Protocol on Substance that Deplete the Ozone Layer,
- Basel Convention on the Transboundary Movement of Hazardous Wastes and their Disposal,
- Framework Convention of Climate Change (FCCC),
- Convention on Biological Diversity (CBD),
- Convention on Desertification (CD), and
- Ramsar Convention on Wetlands of International Importance.

Although this list is extensive, the compliance with the conditions of these treaties varies widely. For instance, it is only in the past few years, largely through the Akassa Project in the Niger Delta where community monitoring and protection of sea turtles had begun, that Nigeria was able to meet the conditions of the Convention on the Conservation of Migratory Species of Wild Animals from which it had previously been excluded. Similarly, it was only in February 2001 that Nigeria joined the Ramsar Convention and established its first Ramsar site in the Hadejia-Nguru wetlands. Such increasing conservation activities of the GFRN are an optimistic sign.

## 7.4 Conservation Approaches in Nigeria

### *Traditional Approaches*

There have long been traditional approaches to biodiversity conservation in many communities around the country. In some areas, certain trees are spared in the process of farming because of the usefulness of their products, for providing shade or for religious purposes. The types of trees that are protected vary from one community to another. In other areas, some natural forests are dedicated to deities, deemed to be sacred, and are therefore insulated from use and sometimes entry. The protection and management of these forest areas is based on regulations and taboos

that are stipulated and approved by custom and accepted by the local people. These anthropological reserves or sacred groves serve as important reservoirs of living collections of useful plants from which local people could obtain various items such as food, medicine and other materials. In some areas, local customs also protect various species from overharvesting within community land areas. Various rules and taboos regarding the timing and amount of collections of some plant species, taboos regarding catching fish with roe on their way upstream to spawn, and other traditional measures also serve a biological conservation role. Unfortunately, the human population pressures are increasing, and more and more such customs are being lost in the challenge of day-to-day survival of the increasingly resource-scarce communities.

Other biodiversity conservation measures are inherent in traditional agro-ecosystems that involve the maintenance of populations of viable and adaptable plant races as well as wild and weedy relatives of crops on farms or home gardens. This process allows for continued dynamic adaptation of plants to the environment and the exchange of genes between crops and wild relatives, thereby increasing genetic diversity. As more and more farmers turn to improved hybrid species, however, this practice is in decline and much of the natural variability is lost.

### *Protected Areas*

Official biodiversity conservation activities in Nigeria have had a strong focus on the establishment and maintenance of various types of protected areas. At present, there are eight national parks managed by the National Park Service, a parastatal federal government entity and often in conjunction with various NGOs like Savanna Conservation Nigeria and the NCF, and with support from the Leventis Foundation and other private sector entities. These parks include a number of key wildlife habitats and representative ecosystems throughout Nigeria and are among the better protected of Nigeria's protected areas. Unfortunately, most of these parks lack a master plan and all lack the human capacity and financial resources to adequately protect and maintain them. In addition to the national parks, on paper there is an extensive list of game and forest reserves that are managed by various state entities. Within some of the forest reserves and national parks are Strict Nature Reserves ("inviolate plots") that were set aside to preserve representative forest habitats in an untouched state for posterity. Game reserves were set up with the primary role of conservation of animal species. Although there are exceptions—such as those reserves that are working with NGO partners—for the most part these protected areas actually receive little protection and are continually being eroded away by logging, agricultural expansion and unlimited hunting and gathering activities. Scattered around Nigeria are also some small protected areas that are managed privately, such as the remnant forest plot at the IITA in Ibadan, and the coastal swamp forest plot in Lagos that was purchased by Chevron and now managed by the NCF. Although such reserves are often the most protected natural habitats in Nigeria, they are also the smallest in extent.

### *Community Conservation Work*

Many conservationists believe that the best hope in protecting and conserving natural resources is to involve communities in developing and implementing their own resource management strategies. In Nigeria, this work is strongly supported by a number of NGOs working in various habitats and with different communities throughout the country. Savanna Conservation Nigeria,

for instance, is working on various community development projects in areas around two national parks and one game reserve in the savanna belt of Nigeria. Depending on the location and the needs of the different communities, this work includes a number of aspects such as conflict resolution between communities and the park, self-managed hunter groups, and various poverty alleviation schemes. In the southern forest belt of Nigeria, the NCF, the NGO Coalition for the Environment, the DFID Community Forestry Project and other programs are working with selected communities in and around the remaining forest tracts using a variety of education, alternate sources of income and natural resource management strategies. The Akassa Project similarly works with fishing communities in the Niger Delta to empower them to manage and/or protect their fisheries, mangroves, sea turtles and other resources. The IUCN and NCF are likewise working with communities in the Hadejia-Nguru wetlands area. Many other NGOs around the country are working at the community level, with some success.

### *Environmental Education*

The NCF has long played a role in helping to shape and implement environmental education programs in Nigeria. In 1987, the NCF helped develop and draft a national conservation education strategy that, among other things, stipulates that this subject be integrated in the primary and secondary public school curricula. Unfortunately, despite this policy, resources and will are largely lacking to carry this out in most schools in the country. One environmental education approach that seems to be more effective is the development of Conservation Clubs in many schools. These clubs are an extracurricular activity taught by schoolteachers that have been trained and provided with appropriate educational material by NCF. Besides NCF, many other NGOs also include environmental education as one component of a fuller conservation-based program. There is now also an environmental education certificate and B.A. degree program at the University of Calabar and a couple of other universities, which are providing teachers with appropriate knowledge and skills to work with schools and NGOs as the demand for these programs increases.

### *Ex-situ Conservation Activities*

In many countries, *ex-situ* approaches, where plant and animal species and/or genetic materials are maintained and studied away from their natural habitats, are often widely used conservation strategies. In Nigeria, this is true for plant conservation activities, especially those that involve commercially important crop and tree species. Various *ex-situ* techniques include seed storage, pollen storage, meristem and tissue cultures, clonal seed orchards and others. In Nigeria, various such *ex-situ* biodiversity conservation projects are conducted at the Forestry Research Institute of Nigeria in Ibadan (which also does some *in-situ* conservation work*),* Cocoa Research Institute of Nigeria, Rubber Research Institute of Nigeria in Benin*,* Nigerian Institute for Oil Palm Research*,* National Cereals Research Institute in Badaggi*,* National Root Crop Research Institute, in Umudike*,* Institute for Agricultural Research in Samaru*,* Institute of Agricultural Research and Training, Moor Plantation in Ibadan, National Horticultural Research Institute in Ibadan*,* and the National Center for Genetic Resources and Biotechnology (NACGRAB). The IITA is a prominent international Consultative Group on International Agricultural Research (CGIAR) institution based in Ibadan that conducts various biodiversity initiatives focused on diverse African crop species, including some important to Nigeria. Nigeria also has a few botanic

gardens and arboreta, the most notable of which is the Murtala Mohammed Memorial Botanical Gardens in Lagos.

Although it is widely recognized as a useful tool for plant conservation, an *ex-situ* approach to conservation of animal species in Nigeria is not yet a viable option in Nigeria. Some Nigerian institutions are focusing on various domestic animal species, but not with an eye to biological diversity. A few projects are also now underway to "domesticate" the grass-cutter (*Thryonomys swinderianus*), a rodent with great value as "bushmeat" but so far this has not proven in most cases to be an economically viable approach to community conservation. Zoos and aquariums are, for the most part, nonexistent or in terrible disrepair. A few NGOs in Cross River with international support, are the strong exception and are doing a good job in rescuing and rehabilitating forest monkeys (*Cercopan*) and larger primates such as drills and chimps (*Pandrillas*).

### *Flora and Faunal Surveys*

Throughout the years, many surveys have been made of the flora and fauna of selected areas and reserves in the country by university professors and their students. Recently, in-depth surveys of the flora and fauna of the Cross River tropical forest area have been undertaken by the WCS and NCF, and various national parks and reserves are also receiving increased survey attention. For the most part, however, any survey information is largely scattered and difficult to access. As part of its mandate under the CBD, the GFRN is beginning to start to consolidate this information. Other countrywide initiatives, such as the Important Bird Areas survey by the International Council for Bird Preservation (ICBP), Birdlife and NCF, and the associated Wetlands Inventory by NCF and other partners, are attempts to help remedy this need. The Conservation Division of the FMoE is interested in developing a countrywide flora and fauna survey, if sufficient resources and capacity-building efforts become available.

### *Other Approaches*

Many other approaches to biodiversity conservation are also evident in Nigeria but to a much smaller extent than those major approaches described above. A few organizations are working to help shape various environmental policies. Some are engaged in research on particular species in particular locations. Others are working to remove exotic plant species, planting mangroves and other activities. Ecotourism efforts, where these exist, are in their infancy, due largely to the lack of tourists to this country despite the Nigerian National Park Service's and various NGOs' best attempts.

A few conservation approaches applied successfully elsewhere in the world have not yet become part of the Nigerian biodiversity scene. For instance, no one seems to be talking about reintroducing species that have become extirpated, and no large-scale zoos and aquariums are being planned. As the capacity of Nigeria improves and the will to conserve increases in strength, more than likely these initiatives too will appear one day in Nigeria.

## 8.0 Overall Recommendations for further Biodiversity and Tropical Forests Conservation Efforts in Nigeria

Effective biodiversity and tropical forest conservation in Nigeria requires a careful juxtaposition between the needs of a large and growing human population today and the long-term sustainability of the natural resources that people ultimately depend upon for the future. A three-pronged approach is needed to recognize this dichotomy and to strike an acceptable balance between today's needs and tomorrow's quality of life for Nigerians:

- **Sustainable agriculture**: In Nigeria, most of the original natural habitats have already been converted to agricultural uses and agricultural conversion is continuing to eat away at the rest of the natural ecosystems and the diversity of species contained therein. Continued efforts are needed to ensure the most effective utilization of existing farmlands and to increase their productivity and sustainability while working towards stemming agricultural conversion of the remaining natural areas.

- **Sustainable use of remaining forest, wetland and savanna resources outside of protected area**: Efforts are needed to develop, promote and expand upon economically viable and sustainable uses of those natural areas that have not yet been converted to agriculture, tree monoculture plantations and aquaculture projects. Many of these areas are already heavily used by local communities, and in some cases, by commercial enterprises that obtain various NTFPs from them. Much more work is needed to ensure that key natural products are harvested sustainably by all those involved in their extraction. Further value-added approaches also need to be developed to bring more revenue from such products into the communities in critical natural areas.

- **Adequate protection of protected areas**: Finally, even with steps one and two in place, there is still a strong need to ensure the solid protection of key protected areas under federal, state and community jurisdictions. Such protected areas provide a reservoir for biodiversity and critical ecosystem components, and may one day in Nigeria, like elsewhere, become an attractive focal point for tourists and citizens alike. Nigeria's protected areas for the most part still sorely need on-the-ground protection before they can be effective in these roles.

Within the framework of the status and threats to biodiversity and tropical forests in Nigeria, the players and activities presently underway to address them, and the inherent difficulties and challenges that have come to light during this study, eight general recommendations are made here. Many other interventions are also needed and possible, but under the present conditions in Nigeria, these seem to be the most needed in the short term, and the most likely to show positive results for any development and conservation investments that are made at this time. Specific recommendations include:

1. Agricultural practices need further improvement throughout Nigeria to increase crop yields on existing agricultural lands, while helping to stem the loss of further natural habitats to agricultural conversion. Where appropriate, this work should include the introduction of

sustainable forestry techniques and agroforestry practices that promote a diversity of useful native species.

2. A bottom-up approach involving work at the community level is crucial to developing adequate conservation mechanisms for forests and biodiversity. Communities and NGOs need strengthening in aspects of management of natural resources, sustainable harvesting of key resources like some NTFPs and fisheries, and other aspects of community-based natural resources management (CBNRM). These community activities are especially needed in and around areas with global biodiversity and natural resources importance, such as the Niger Delta and the southeastern forests.

3. From the top, overlapping and often conflicting environmental policies and institutional structures need to be sorted out in the GFRN. A clearinghouse for integration of environmental policies at the presidential level should be activated, empowered and supported to preclude conflicts among the mandates of different government agencies.

4. Where adequate natural resource laws and regulations do exist, these need to be better understood by the populace and by the agencies charged with their enforcement, and they need to be enforced. Constituency building efforts should be undertaken to encourage public support for these efforts, and to ensure appropriate implementation of improved environmental policies.

5. Existing protected areas need further strengthening and capacity building to ensure their adequate safeguarding. Master plans are still needed for most national parks, and virtually all of the game and forest reserves. Park officials, rangers and wardens need training in conservation, education, protection and community liaison work and they need to be better equipped to carry out their roles. The network of protected areas needs to be analyzed and expanded upon to include adequate representation of all major ecosystems in Nigeria, and to include corridors between them that protect the migratory routes of large mammals and other species.

6. Environmental awareness and advocacy activities need to be strengthened at all levels in Nigeria. Public awareness campaigns are strongly encouraged to help develop further advocacy efforts for improved biodiversity and forest conservation in Nigeria. Existing NGOs that already play environmental advocacy roles should be further helped in these efforts.

7. Environmental education needs to be strengthened and better integrated into primary and secondary school curricula, and better teaching materials need to be developed and more teachers trained in these subjects. The role of NGOs in environmental education activities also needs strengthening.

8. More work is needed to identify information gaps and to gather baseline information on the species and ecosystems of Nigeria. Nigeria-wide faunal and floral surveys by specialists that go out to the field, then scientifically document and preserve their findings are especially needed at this time. Linkage Centers and other clearinghouse institutions should be

strengthened in their roles of collecting, coordinating and analyzing biodiversity information and in disseminating this information to those who can use this information to make better natural resources management decisions.

## 9.0 The Relationship between USAID/Nigeria and the Conservation of Biodiversity and Tropical Forests

At present, USAID/Nigeria has no SO or program that is designed specifically with the conservation of biodiversity or tropical forests in mind and no expressed immediate interest in doing so. If and when sufficient environmental funds become available and sufficient political interest is aroused, the USAID mission might well create a niche for itself within one or more of the necessary conservation activities listed in Section 8 of this report.

From a global biodiversity and tropical forests perspective, two geographic areas of Nigeria are of particular concern: 1) the montane and lowland forests bordering Cameroon in the South South Geopolitical Zone and a bit further north; and 2) the mangrove and swamp forests in the Niger Delta region in the South South and South East Zones. The states in these zones might also be ones in which particular biodiversity and tropical forestry activities might have the most global impact. Depending on the political will and potential partnership base in these individual states and in the Local Government Associations (LGAs) and communities within them, some areas in these zones might be most advantageous for any planned focused biodiversity conservation activities by USAID.

In the meantime, in fulfillment of the FAA 118/119 U.S. Congressional mandate, some ideas are suggested that outline various synergies between existing SOs and possible biodiversity conservation activities, and a number of cautions that program managers should keep in mind when implementing their USAID programs in Nigeria. Moreover, whenever USAID is implementing programs in the geographic areas mentioned above, particular attention should be addressed to the potential global biodiversity consequences.

***SO1: Sustain transition to democratic civilian governance***

**Synergies**: Work with civil society organizations and NGOs can include various Nigerian groups that have an environmental perspective and work to empower communities to effectively manage their own natural resources. Nationally based NGOs could also be supported to develop stronger advocacy for environmental issues.

**Cautions**: None are evident.

***SO2: Strengthen institutional capacity for economic reform and enhance capacity to revive agricultural growth***

**Synergies**: SO2 is expected to be the home for any new environmental activities within USAID/Nigeria, and was so chosen for the many synergies possible between agricultural programming and other environmental objectives. One strong immediate synergy could be possible within the programmatic area of support for improved crop varieties. Many of the same organizations that work to develop improved crop varieties are also involved in conserving wild crop relatives such as those that abound in many areas of Nigeria, a known epicenter for diversity of a number of varieties, including cowpeas, winged beans, yams and a few others. Without necessitating new partners, existing partners such as the IITA could be supported more

fully to engage in such important biodiversity conservation work. Another area of synergy can occur at the policy level, with an effort to include among the development of improved agricultural policies, those that recognize the impact of agriculturization on other elements of the natural world and attempt to balance these.

**Cautions**: There are many potential conflicts between agriculture and natural environments in Nigeria and elsewhere. Agricultural encroachment upon natural lands is one of the major threats to forests and biodiversity in Nigeria. It is important that Mission-supported programs do not encourage further expansion of agricultural activities into forestland and other areas with rich natural biodiversity. This is especially important for programs such as the Rural Sector Enhancement Program (RUSEP) that in part aim to increase the area under cultivation for target crops. Environmental Impact Assessments (EIAs) are needed in specific locations before more land is cleared. In programs involving the development of new crops, such as the gum arabic work, it is important that only those trees known to be noninvasive are used in these projects to reduce the impacts on biodiversity of native species in and around target areas.

***SO3: Develop the foundation for education reform***

**Synergies**: There are a number of synergies possible between the activities and contractors involved in SO3 and with activities that can relate to the conservation of forests and biodiversity. Environmental education in any form is a strong tool towards the development of a more environmentally conscious society. Within this SO, for instance, although a strong focus is literacy, this can be taught in some cases using material with an environmental and natural history focus. Interactive radio teaching tools can easily relay environmental stories and material to students while also serving the primary literacy function. Additionally, where the attention is on working with civic society entities, such as Parent-Teacher Associations (PTAs) and the like, work could also be done to include related efforts of environmental educational NGOs, such as the NCF's Conservation Club initiatives that are being developed in various locales around the country.

**Cautions**: None are evident.

***SO4: Increase the use of family planning, maternal and child health, child survival, STD/HIV services and preventative measures within a supportive policy environment***

**Synergies**: Excessive population growth is a key element driving the degradation of remaining forests and biodiversity in Nigeria. Where effective family planning programs are in place, these effects lessen. Strong synergies are possible between this SO and natural resources conservation, especially in areas of rich biodiversity. Environmental awareness activities could also be included as an expansion of the population awareness efforts under the health SO, using the same contractors and awareness techniques that have already been developed for targeted Nigerians but with different messages.

**Cautions**: None are evident.

***SPO: Improve management of critical elements of the infrastructure and energy sector***

**Synergies**: There are few direct links between the activities in this SPO that involve privatization of railroads and ports and better aviation safety, with biodiversity and tropical forest conservation. There are possible synergies in the development of alternate energy sources in rural populations, however, especially those that are found in and around forests where firewood is being unsustainably harvested.

**Cautions**: Care should be taken in improving farm-to-market roads in order to ensure that these roads do not lead to increased logging and other natural resource extractive activities along the way. All site-specific activities should also be carefully guided to avoid undue additional stresses on key natural resources and areas.

# ANNEXES

# Annex A. FAA Sections 118/119

**Foreign Assistance Act, Part I, Section 118 - Tropical Forests**

Sec. 118.\73\ Tropical Forests.

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\73\ 22 U.S.C. 2151p-1. Sec. 118 was added by sec. 301(3) of Public Law 99-529 (100 Stat. 3014). See also footnote 71.

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(a) Importance of Forests and Tree Cover.--In enacting section 103(b)(3) of this Act the Congress recognized the importance of forests and tree cover to the developing countries. The Congress is particularly concerned about the continuing and accelerating alteration, destruction, and loss of tropical forests in developing countries, which pose a serious threat to development and the environment. Tropical forest destruction and loss--

(1) result in shortages of wood, especially wood for fuel; loss of biologically productive wetlands; siltation of lakes, reservoirs, and irrigation systems; floods; destruction of indigenous peoples; extinction of plant and animal species; reduced capacity for food production; and loss of genetic resources; and

(2) can result in desertification and destabilization of the earth's climate. Properly managed tropical forests provide a sustained flow of resources essential to the economic growth of developing countries, as well as genetic resources of value to developed and developing countries alike.

(b) Priorities.--The concerns expressed in subsection (a) and the recommendations of the United States Interagency Task Force on Tropical Forests shall be given high priority by the President--

(1) in formulating and carrying out programs and policies with respect to developing countries, including those relating to bilateral and multilateral assistance and those relating to private sector activities; and

(2) in seeking opportunities to coordinate public and private development and investment activities which affect forests in developing countries.

(c) Assistance to Developing Countries.--In providing assistance to developing countries, the President shall do the following:

(1) Place a high priority on conservation and sustainable management of tropical forests.

(2) To the fullest extent feasible, engage in dialogues and exchanges of information with recipient countries--

(A) which stress the importance of conserving and sustainably managing forest resources for the long-term economic benefit of those countries, as well as the irreversible losses associated with forest destruction, and

(B) which identify and focus on policies of those countries which directly or indirectly contribute to deforestation.

(3) To the fullest extent feasible, support projects and activities--

(A) which offer employment and income alternatives to those who otherwise would cause destruction and loss of forests, and

(B) which help developing countries identify and implement alternatives to colonizing forested areas.

(4) To the fullest extent feasible, support training programs, educational efforts, and the establishment or strengthening of institutions which increase the capacity of developing countries to formulate forest policies, engage in relevant land-use planning, and otherwise improve the management of their forests.

(5) To the fullest extent feasible, help end destructive slash-and-burn agriculture by supporting stable and productive farming practices in areas already cleared or degraded and on lands which inevitably will be settled, with special emphasis on demonstrating the feasibility of agroforestry and other techniques which use technologies and methods suited to the local environment and traditional agricultural techniques and feature close consultation with and involvement of local people.

(6) To the fullest extent feasible, help conserve forests which have not yet been degraded, by helping to increase production on lands already cleared or degraded through support of reforestation, fuelwood, and other sustainable forestry projects and practices, making sure that local people are involved at all stages of project design and implementation.

(7) To the fullest extent feasible, support projects and other activities to conserve forested watersheds and rehabilitate those which have been deforested, making sure that local people are involved at all stages of project design and implementation.

(8) To the fullest extent feasible, support training, research, and other actions which lead to sustainable and more environmentally sound practices for timber harvesting, removal, and processing, including reforestation, soil conservation, and other activities to rehabilitate degraded forest lands.

(9) To the fullest extent feasible, support research to expand knowledge of tropical forests and identify alternatives which will prevent forest destruction, loss, or degradation, including research in agroforestry, sustainable management of natural forests, small-scale farms and gardens, small-scale animal husbandry, wider application of adopted traditional practices, and suitable crops and crop combinations.

(10) To the fullest extent feasible, conserve biological diversity in forest areas by--

(A) supporting and cooperating with United States Government agencies, other donors (both bilateral and multilateral), and other appropriate governmental, intergovernmental, and nongovernmental organizations in efforts to identify, establish, and maintain a representative network of protected tropical forest ecosystems on a worldwide basis;

(B) whenever appropriate, making the establishment of protected areas a condition of support for activities involving forest clearance of degradation; and

(C) helping developing countries identify tropical forest ecosystems and species in need of protection and establish and maintain appropriate protected areas.

(11) To the fullest extent feasible, engage in efforts to increase the awareness of United States Government agencies and other donors, both bilateral and multilateral, of the immediate and long-term value of tropical forests.

(12) To the fullest extent feasible, utilize the resources and abilities of all relevant United States Government agencies.

(13) Require that any program or project under this chapter significantly affecting tropical forests (including projects involving the planting of exotic plant species)--

(A) be based upon careful analysis of the alternatives available to achieve the best sustainable use of the land, and

(B) take full account of the environmental impacts of the proposed activities on biological diversity, as provided for in the environmental procedures of the Agency for International Development.

(14) Deny assistance under this chapter for--

(A) the procurement or use of logging equipment, unless an environmental assessment indicates that all timber harvesting operations involved will be conducted in an environmentally sound manner which minimizes forest destruction and that the proposed activity will produce positive economic benefits and sustainable forest management systems; and

(B) actions which significantly degrade national parks or similar protected areas which contain tropical forests or introduce exotic plants or animals into such areas.

(15) Deny assistance under this chapter for the following activities unless an environmental assessment indicates that the proposed activity will contribute significantly and directly

to improving the livelihood of the rural poor and will be conducted in an environmentally sound manner which supports sustainable development:

(A) Activities which would result in the conversion of forest lands to the rearing of livestock.

(B) The construction, upgrading, or maintenance of roads (including temporary haul roads for logging or other extractive industries) which pass through relatively undegraded forest lands.

(C) The colonization of forest lands.

(D) The construction of dams or other water control structures which flood relatively undegraded forest lands.

(d) PVOs and Other Nongovernmental Organizations.--Whenever feasible, the President shall accomplish the objectives of this section through projects managed by private and voluntary organizations or international, regional, or national nongovernmental organizations which are active in the region or country where the project is located.

(e) Country Analysis Requirements.--Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of-

(1) the actions necessary in that country to achieve conservation and sustainable management of tropical forests, and

(2) the extent to which the actions proposed for support by the Agency meet the needs thus identified.

(f) Annual Report.--Each annual report required by section 634(a) of this Act shall include a report on the implementation of this section.

**Foreign Assistance Act, Part I, Section 119 - Endangered Species**

Sec. 119.\75\ Endangered Species.--

(a) The Congress finds the survival of many animal and plant species is endangered by overhunting, by the presence of toxic chemicals in water, air and soil, and by the destruction of habitats. The Congress further finds that the extinction of animal and plant species is an irreparable loss with potentially serious environmental and economic consequences for developing and developed countries alike. Accordingly, the preservation of animal and plant species through the regulation of the hunting and trade in endangered species, through limitations on the pollution of natural ecosystems, and through the protection of wildlife habitats should be an important objective of the United States development assistance.

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\75\ 22 U.S.C. 2151q. Sec. 119, pars. (a) and (b) were added by sec. 702 of the International Environment Protection Act of 1983 (title VII of the Department of State Authorization Act, Fiscal Years 1984 and 1985, Public Law 98-164; 97 Stat. 1045).

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(b) \75\ In order to preserve biological diversity, the President is authorized to furnish assistance under this part, notwithstanding section 660,\76\ to assist countries in protecting and maintaining wildlife habitats and in developing sound wildlife management and plant conservation programs. Special efforts should be made to establish and maintain wildlife sanctuaries, reserves, and parks; to enact and enforce anti-poaching measures; and to identify, study, and catalog animal and plant species, especially in tropical environments.

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\76\ Section 533(d)(4)(A) of the Foreign Operations, Export Financing, and Related Programs Appropriations Act, 1990 (Public Law 101-167; 103 Stat. 1227), added ``notwithstanding section 660" at this point.

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(c) \77\ Funding Level.--For fiscal year 1987, not less than $2,500,000 of the funds available to carry out this part (excluding funds made available to carry out section 104(c)(2), relating to the Child Survival Fund) shall be allocated for assistance pursuant to subsection (b) for activities which were not funded prior to fiscal year 1987. In addition, the Agency for International Development shall, to the fullest extent possible, continue and increase assistance pursuant to subsection (b) for activities for which assistance was provided in fiscal years prior to fiscal year 1987.

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\77\ Pars. (c) through (h) were added by sec. 302 of Public Law 99- 529 (100 Stat. 3017).

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(d) \77\ Country Analysis Requirements.--Each country development strategy statement or other country plan prepared by the Agency for International Development shall include an analysis of-

(1) the actions necessary in that country to conserve biological diversity, and

(2) the extent to which the actions proposed for support by the Agency meet the needs thus identified.

(e) \77\ Local Involvement.--To the fullest extent possible, projects supported under this section shall include close consultation with and involvement of local people at all stages of design and implementation.

(f) \77\ PVOs and Other Nongovernmental Organizations.-- Whenever feasible, the objectives of this section shall be accomplished through projects managed by appropriate private and voluntary organizations, or international, regional, or national nongovernmental organizations, which are active in the region or country where the project is located.

(g) \77\ Actions by AID.--The Administrator of the Agency for International Development shall-

(1) cooperate with appropriate international organizations, both governmental and nongovernmental;

(2) look to the World Conservation Strategy as an overall guide for actions to conserve biological diversity;

(3) engage in dialogues and exchanges of information with recipient countries which stress the importance of conserving biological diversity for the long-term economic benefit of those countries and which identify and focus on policies of those countries which directly or indirectly contribute to loss of biological diversity;

(4) support training and education efforts which improve the capacity of recipient countries to prevent loss of biological diversity;

(5) whenever possible, enter into long-term agreements in which the recipient country agrees to protect ecosystems or other wildlife habitats recommended for protection by relevant governmental or nongovernmental organizations or as a result of activities undertaken pursuant to paragraph (6), and the United States agrees to provide, subject to obtaining the necessary appropriations, additional assistance necessary for the establishment and maintenance of such protected areas;

(6) support, as necessary and in cooperation with the appropriate governmental and nongovernmental organizations, efforts to identify and survey ecosystems in recipient countries worthy of protection;

(7) cooperate with and support the relevant efforts of other agencies of the United States Government, including the United States Fish and Wildlife Service, the National Park Service, the Forest Service, and the Peace Corps;

(8) review the Agency's environmental regulations and revise them as necessary to ensure that ongoing and proposed actions by the Agency do not inadvertently endanger wildlife species or their critical habitats, harm protected areas, or have other adverse impacts on biological diversity (and shall report to the Congress within a year after the date of enactment of this paragraph on the actions taken pursuant to this paragraph);

(9) ensure that environmental profiles sponsored by the Agency include information needed for conservation of biological diversity; and

(10) deny any direct or indirect assistance under this chapter for actions which significantly degrade national parks or similar protected areas or introduce exotic plants or animals into such areas.

(h) \77\ Annual Reports.--Each annual report required by section 634(a) of this Act shall include, in a separate volume, a report on the implementation of this section.

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| | Director, Monitoring & Evaluation | | |
| | Director, Fadama | | |
| | Director, Institutions | | |
| **Borno State Water Corporation** | | | |
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| B.B. Offiong | Assistant Director | | |
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| A. Mantey | | | |
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| J.H. Malan | Honorable Commissioner of Environment | 062-211-963 | |
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## Annex D. Scope of Work

**Scope Of Work for the**
**Nigeria Environmental Analysis**

## A. Background

In August, 1999, the Africa Bureau approved the USAID/Nigeria two-year Transition Country Strategic Objective. The Transition Strategy was approved due to its short-timeframe, without adherence to the ADS requirements for an environmental assessment,

On May 8, 2001 the Africa Bureau approved a request from USAID/Nigeria for an extension of the Transition Strategic Plan until December 2003. During the R4 Review .the Global Bureau requested the Mission to adhere to the ADS requirement for an environmental assessment given the longer-term nature of the strategy from two to four years. As required under the ADS section 201.3.4.1l.b, all CSPs must include a biodiversity and tropical forest assessment. The assessment must be completed before CSP decisions are made so that the results can be incorporated into the long-term CSP that the Mission is planning to develop toward the end of the current transition strategy period. As required under the Foreign Assistance Act (Section 118 and 119), the assessment must include:

- A concise evaluation of the countrywide status of biodiversity and tropical forest resources, focusing on management issues and required actions for conservation; and
- A determination as to the extent to which these required actions for conservation are satisfied by the current or proposed Mission programs.

The ADS regulations also indicate that while not required, an Operating Unit "can save time and be more efficient by including all aspects of environment when undertaking the mandatory biodiversity and tropical forestry work." For example, these environmental aspects may include a wide variety of topics including water resources, urban environmental issues and desertification.

## B. USAID/Nigeria Program

The Nigeria Mission is not presently implementing an environmental program. Strategic Objective (SO) 2 is most closely linked to environmental issues. S02 is entitled "Strengthen Institutional Capacity For Economic Reform and Enhance Capacity to Revive Agricultural Growth."

As indicated in the Transition Strategy, S02 will focus on the economic management to lay the foundation for a longer-term more comprehensive program that will expand on current initiatives and focus more on industrial, service sector, and agricultural revitalization. The program will require preliminary studies and assessments, as well as close coordination with the rest of the donor community.

There are a number of existing and planned agricultural analyses. For example, a fertilizer marketing survey and rice studies are presently being conducted in Nigeria. Tree crops analyses are also being planned under the AFR/SD Tree Crops program (Refer to Attachment 2 of this sow for a schedule of studies).

While most of the efforts to date in S02 have focused on agriculture and economic growth, an interagency assessment that was conducted in November 1999 did identify some potential areas the environment sector. The sector assessment indicated that opportunities should be pursued for training in the areas of environment and forestry.

The subject environmental analysis will focus on identifying environment sector opportunities under the Strategic Objective 2. However, the environmental analysis will also identify opportunities for synergism under the Mission's three other Strategic Objectives:

- SO1-Sustain Transition to Democratic Civilian, Governance;
- SO3-Develop the Foundation for Education Reform;
- SO4-Increased use of Family Planning, Maternal and Child Health, Child Survival/Sexually Transmitted Disease/HIV Services, and Preventative Measures; and
- Improved Management of Critical Elements of the Infrastructure and Energy Sector.

## C. Nigeria's Environment

Nigeria maintains the largest human population of any country in Africa-120 million people. The Republics of Niger and Chad border the country to the north, Atlantic Ocean to the south, Cameroon to the east and the Republic of Benin to the west. Nigeria has a total land area of 923,773 square kilometers and a variety of climatic and ecological zones.

The oil sector dominates the Nigerian economy and accounts for ninety percent of its exports. However, most of the people in Nigeria make their living in the agriculture motor. The types of agricultural production are closely related to the main ecological zones. For example, the forest region supports tree crops such as cocoa and food crops including yams, cassava, maize and rice. On the other hand, in the drier savanna zones, grain crops such as millet and sorghum predominate.

The ecological zones range from tropical forest vegetation in the south to Guinea-savanna in the north. The five biogeographical zones in Nigeria are:

- Guinea-Congolian zone;
- Guinea-Congolion/Sudanian regional transition zone;
- Sudanian zone;
- Sahel transition zone; and
- Afromontane-like zone.

There is a wide range of environmental problems in Nigeria. Over population *(annual rate* Of Increase by 2.83 percent based on the current estimates by the Nigerian National Population Commission), inappropriate natural resources management (NRM) systems, poor environmental governance, weak enforcement of regulations are contributing to these problems. The most important of these problems are:

- Land degradation (including desertificition and soil erosion);
- Accelerated deforestation and loss of biodiversity;
- Unregulated chemical and industrial contamination and oil spillage;
- Water pollution; and
- Inadequate coastal zone management.

While the extent and severity of desertification has not been fully quantified, it has been estimated that the country is losing approximately 351,000 square kilometers of landmass to desert conditions annually. Desertification is affecting the ten northern States and is advancing southwards at a rate of 0.6 kilometers per year. Drought and desertification are the most important environmental problems affecting the ten northern states of the country. Erosion and desertification are catastrophic in five states and are adversely affecting approximately fifty million people.

While not yet fully quantified, desertification is said to be the most pressing environmental problem in Nigeria. Population pressure compounded by the influx of migrants from neighboring countries is resulting in overgrazing and over-exploitation of marginal lands. This influx of population from neighboring countries and drought has aggravated the desertification problem.

The large majority of Nigeria's population is dependent upon its natural resources for food, shelter and income. As a result, there are many areas in Nigeria that are suffering from degradation resulting from unsustainable environmental practices. For example, only ten percent of Nigeria's original tropical high forests remain. The conversion of forests to other land uses is primarily the result of unsustainable agricultural and intensive forestry practices.

As much of Nigeria's tropical forests have been destroyed, the Nigerian government must take urgent measures if representative portions of the forests are to be preserved. Deforestation has resulted from a combination of three processes: uncontrolled logging practices, an increase in the area used for subsistence farming, and the rapid spread of cash cropping by peasant farmers.

While the total land area of Nigeria is 923,768,000 ha, in 1992 forests accounted for only 9.61 percent (8,874,225 ha) of the total land area. During the period of 1980 to 1992, it is estimated that 43.48 percent of the total forest ecosystem had been converted to other uses as a result of human activities. Current estimates put the rate of rainforest depletion at three and one-half percent a year. Limited research suggests that deforestation has resulted from a combination of two processes:

- Uncontrolled logging practices and
- An increase in the area used for subsistence farming (Many Nigerians use wood as a primary fuel source).

The continued loss of Nigeria's tropical forests has taken its toll on the country's biodiversity resources. Nigeria has a diverse collection of flora and fauna, including 274 species of mammals, 830 species of birds and 5,081 plant species. Out of the animal species, 0.14 percent are threatened and 0.22 percent are endangered.

Nigeria maintains important biodiversity resources. One reason for its importance is that there is an overlap between several biogeographical zones including the biologically rich Guinea-Congolian forests. The diversity of Nigeria's wildlife resources is impressive. For example, the maintenance of 274 mammal species makes Nigeria the eighth most important country in Africa for mammal species. Of these mammals, two primates are endemic: the white-throated guenon (Cerecopithecus erythrogaster) and Sclater's guenon (C. sclateri). Both of these primates are endangered. There are also twenty-three primate species that include the chimpanzee (Pan troglodytes) and the gorilla (Gorilla g. diehli). Other important mammal species that are threatened include the African elephant (Loxodonta africana), black rhinoceros (Diceros bicornis).

The activities undertaken in Nigeria to conserve biodiversity conservation include the establishment of six National Parks, twenty-six Game Reserves, twenty-five Conservation plots, nine Strict Nature Reserves, one Biosphere Reserve and fourteen proposed Game Reserves. However, only 3.4 percent of Nigeria's land is included within protected areas and most of these protected areas are located within the savannah biome.

It is estimated that over 90% of Nigeria's total land area suffer from one form of erosion or the other. There are over 2000 active gully erosion spread across the country. Coastal erosion is also very prevalent along the 835 km coastline of Nigeria with over 50 erosion sites identified, and having an estimated mean shoreline retreats of 2 to 30 meters per year. Soil erosion generally poses threats to the people and their economic activities including depletion of farmlands, loss of forest resources and over all reduction in agriculture outputs. In addition to the severe coastal erosion problem, the other major erosion problems facing the marine environment in Nigeria include public health and ecosystem quality issues.

Nigeria also has substantial environmental pollution problems resulting from industrial, agricultural and urban mismanagement. For example, Lagos is the only city in Nigeria that maintains a sewage treatment facility. However, even that sewage treatment facility is inadequate to keep up with the growing population. As a result untreated sewage is still dumped directly into the lagoon. A 1979 survey indicated that the majority of the urban population relies on pit latrines or does not have any sanitary facilities.

In addition to untreated sewage pollution, pollution from textiles and food processing facilities is commonly dumped into nearby rivers. Eventually, these pollutants find their water to Nigeria's coastal environment where they cause damage to coastal ecosystems and endanger human health. Oil spillage is also a major problem in Nigeria. During the period of 1976-1983, there were an estimated 1360 oil spills in Nigeria with over 1.4 million tons of oil into the coastal wagers of Rivers State in eastern Nigeria.

The impact of pollution on the coastal environment as Nigeria maintains some of the most extensive and valuable coastal wetlands in West Africa. There are three primary wetland area along the coast of Nigeria:

- Lagos and Lekki lagoons and system;
- Niger Delta; and

- Cross River wetlands and delta.

These wetland area are characterized by the presence of mangroves and are important breeding and nursery grounds for fish and crustacean species. Other important wetland areas include the Benin River mangroves and Calabar Estuary. Nigeria maintains more than thirty-five percent of all West African mangroves (approximately 3.2 million of a total of approximately 9.7 million ha). These mangroves still maintain large stands. For example, the Niger Delta maintains 500,000 ha of mangroves.

However, there are no records indicating that any marine or coastal protected areas exist in Nigeria. The development of environment regulations and legislation has only recently begun. Some rare fish species are present and the fish fauna in general may be particularly diverse. While the marine environment of West Africa does not contain coral reef ecosystems, numerous coral communities are thought to exist in this region. Documentation of these potentially important communities specifically, and the broader marine environment, is lacking.

West Africa's coastal ecosystems are being rapidly degraded as a result of multiple human impacts, including over-fishing; sewage discharge; pollution from pesticides, fertilizers, and industrial waste; conversion of land for agriculture, fuel wood, oil and mineral extraction, land reclamation and freshwater diversion. All of the threats are connected in one way or another to rapid expansion of the human population in the coastal zone without benefit of coordinated comprehensive marine resources and coastal zone use plans.

Since much of the land degradation and loss of biodiversity in Nigeria is due to unsustainable agricultural practices, the integration of agriculture and environmental management is one of the country's important challenges.

## D. Specific Tasks

The assessment is first and foremost a tool to facilitate Mission planning and decision making. With this in mind, the report document should frame specific Mission program options which can address the:

- Environmental issues identified by the team for each of the environment sub-sectors (e.g., forestry, water resources); and
- Opportunities to integrate environmental issues into existing or planned Mission activities (e.g., agriculture, economic development, education, tree crops, micro-enterprise development) (Refer to Attachment 2 for a list of other planned S02 analyses).

The report should also serve as an educational tool, seeking to inform Mission staff and others on present trends and recent advances in the scientific study of tropical forests, biodiversity and their management.

The environmental advisors shall develop an environmental report composed of two distinct report sections as indicated below:

1). Overall state of the environment report; and
2) Tropical Forests and Biodiversity Report (Foreign Assistance Act Sections 118/119).

*Task Number 1: Overall State of the Environment Report*

The consultants will make use of the Report Outline in Attachment I as a basis for the development of the report.

The consultants will make use of the three pronged approach indicated below for the development of the report. This approach emphasizes the identification and description of successful interventions (and associated enabling conditions) over extensive descriptions of environmental problems.

1) Identify the underlying causes of environmental degradation in Nigeria and suggest strategic options to address them.
2) Identify and describe in detail successful approaches and interventions by all institutions (e.g., NG0s, government, private sector) and under what enabling conditions.
3) Analyze opportunities and constraints associated with all environmental elements (e.g., coastal management, forestry resources).

The consultants will provide information on each of the environmental elements listed in Attachment I using the three-pronged approach as a means to focus their collection of data. As an attachment to the written report, the consultants will develop an information matrix for each primary environmental element listed in Attachment I (e.g., urban, desertification, tropical forests and biodiversity, watershed management, water resources management).

For example, under tropical forests the matrix will contain information on forestry sector constraints, underlying causes of constraints, the identification of successful field interventions by USAID and other institutions (past and present as appropriate), the enabling conditions which were necessary in order to achieve success, lessons learned from the success, and suggestions for accelerating the success.

The consultants will conduct a comprehensive literature review on each of the topics listed in Attachment I and a list of references will be included in the report. The consultants will meet with representatives from selected institutions in Nigeria in order to gather information for the report. The consultants will also conduct targeted field visits to successful sites in order to collect the necessary information for the report and information matrix.

The consultants will identify opportunities to integrate environment opportunities within the Mission's current and planned program. For example, the consultants will examine planned activities under the Tree Crops Program, fertilizer marketing survey and the rice survey. The consultants will also identify opportunities for the Mission to address environment in the course of developing SO2 agro-business plans.

Finally, the consultants will provide recommendations as how the Mission can best integrate special political targets of opportunity (e.g., Gorilla earmark) into its SO2 program.

The intent of this scope of work is for the consultants to approach the gathering of information on tropical forests and biodiversity in the same way as the other environmental topics in the report. Treating tropical forests and biodiversity like the other environmental topics will encourage the team members to identify opportunities to integrate tropical forests and biodiversity into the Mission's rural development program.

However, there are special legal requirements (Foreign Assistance Act, Sections 118/119) for USAID to obtain specific information on tropical forests and biodiversity as part of the development of a CSP. Task 2 is included below for this reason. The challenge for the consultants is to gather information for the development of the Part I (State of the Environment Report) that can also be used in Part II (Actions Necessary and Planned to Conserve Tropical Forests and Biodiversity) in Attachment I.

> Task Number 2: Tropical Forests and Biodiversity Report (Foreign Assistance Act Sections 118/119)

As required under the Foreign Assistance Act (Section I 18 and 119), the assessment must include:

- A concise evaluation of the countrywide status of biodiversity and tropical forest resources, focusing on management issues and required actions for conservation; and
- Identification of the extent to which these required actions for conservation are satisfied by the current or proposed Mission programs.

The consultants will conduct the activities identified below in order to comply with the requirements stipulated above.

The consultants will make use of the Report Outline in Attachment I as a basis for the development of the report.

As required in the development of Task Number I above, the environmental consultants will make use of the three-pronged approach. This approach emphasizes the identification and description of successful interventions (and associated enabling conditions) over extensive descriptions of environmental problems.

As described in Task I above, the consultants will develop on information matrix for each of the elements listed under the Tropical Forests and Biodiversity section in Attachment I (e.g., Ecosystem Protection, Species Diversity). In the course of completing the Tropical Forests and Biodiversity section, the consultant report will provide additional information on the topics indicated below.

- Document tropical forest and biodiversity trends in Nigeria associated with its management, biophysical condition, productivity and diversity.

- Identify and analyze key threats to biodiversity (e.g., pollution, policy environment, bushmeat, unsustainable timber extraction).
- Describe the major ecosystem types and protected areas in Nigeria.
- Describe the relationship between biodiversity and agriculture-both as an opportunity to conserve biodiversity (e.g., tree crops) and as cause of biodiversity loss (e.g., agricultural expansion).
- Describe the relationship between biodiversity and other rural development activities underway or planned (e.g., agriculture, energy, infrastructure development, economic growth, policy reform). Identify opportunities to integrate biodiversity conservation into activities that the Mission is planning under its planned CSP.
- Provide information regarding threatened and endangered plant and wildlife species in Nigeria and activities underway and planned to protect these species.
- Identify and describe recent, current and planned conservation efforts in Nigeria.
- Identify the scope and effectiveness of existing and past conservation efforts. This information will be summarized in a matrix format.
- Provide information regarding the effectiveness of GON management authorities that are responsible for tropical forests and biodiversity in Nigeria.
- Identify USAID's comparative advantage to address biodiversity and tropical forestry issues.

Also per the description in Task I above, the environmental consultants will develop an information matrix for tropical forests and biodiversity (and the other environmental elements). The matrix will contain information on forestry sector constraints, underlying causes of constraints, the identification of successful field interventions (past and present as appropriate), the enabling conditions which were necessary in order to achieve success, lessons learned from the success, and suggestions for accelerating the success. The matrix will also include a description of other international donor and NGO tropical forestry and biodiversity activities.

## E. Organizational Responsibilities and Coordination

### USAID/Nigeria

USAID/Nigeria is the primary client for this activity. The Mission will be responsible for providing financial support and oversight. The Mission will also provide comments (along with AFR/SD) on the draft reports submitted by the contractor.

### AFR/SD

AFR/SD provides technical backstopping to USAID/Nigeria. As the scope of work will address both agriculture and environment, both ANRE agriculture and natural resources management staff will provide oversight to the contractor for the environmental analyzes. ANRE staff assistance may be in the form of providing technical information and/or staff for short-term assignments to USAID/Nigeria.

**G/ENV**

The Global Bureau provides USAID Missions and the regional Bureaus with technical assistance and information on environment and rural development. The Global Bureau will be responsible for working with ANRIS and the Mission staff to accomplish the environmental analyses. This assistance may be in the form of providing technical information and/or staff for short-term assignments to USAID/Nigeria.

## F. Technical Assistance Mechanisms

As discussed in Section C above, the scope of work will be accomplished using a combination of USAID/Washington technical staff and a private contractor. (A Rural Environment Advisor from the USAID Regional Urban Development (RUDO) Office in South Africa will also be contacted to determine the feasibility his/her availability to provide technical assistance to the Mission.)

The primary source of the technical assistance will come from the private contractor. An Indefinite Quantity Contract (IQC) will be selected by the Mission with assistance from the Global Bureau's Environment Team and ANRE staff. Proposals from the environment IQCs will be reviewed and selected by the Global Bureau and ANRE staff.

## G. Schedule

The final report will be completed by the end of February 2002 in order for the information to be used during the development of the CSP. With this in mind, the environmental analysis will be conducted during the period of December 2001 through February 2002.

## H. Level of Effort

A level of effort of two months in Nigeria will be required to accomplish this activity:

- 1 week initial scoping assessment (First week of December 2001);
- 3 weeks to conduct literature review and conduct field studies (January-February
- 2002); and
- 2 weeks to write the final report (February 2002).

## I. Deliverables

- One scoping assessment containing information on key contacts, existing projects, technical reports and suggested areas of focus by the team by December 7, 2001.
- Work plan and schedule within three days of arrival in Nigeria by the consultants preparing the report by January 7, 2002.
- On February 8, 2002, a draft report (Part I and Part II) based on the outline in Attachment I and the tasks identified above. USAID will provide comment back to contractor within one week for incorporation into the final report
- An oral debriefing to USAID/Nigeria upon submission of the report on February.8, 2002.

- Final report will be submitted to USAID/Nigeria on February 22, 2002 that addresses all comments from USAID. The report will be provided on one diskette along with six hard copies.

The final report should use the following format:

- Table of Contents
- List of Acronyms
- Executive Summary
- Background
- Findings (Underlying Causes/Successful Approaches)
- Recommendations
- Conclusion
- List of Contacts

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