118/119 Biodiversity and Tropical Forest Assessment for Benin

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ACRONYMS

AVIGREF	Village Associations for the Management of Wildlife Reserves
CBD	Convention on Biological Diversity
CEDA	Center for Environment and Development in Africa
CENAGREF	National Center for the Management of Wildlife Reserves
DDEPN	Departmental Directorate for the Environment and the Protection of Nature
DGFRN	General Directorate for Forestry and Natural Resources
EFL	Environmental Framework Law
FAO	Food and Agriculture Organization
GEF	Global Environment Facility
GOB	Government of Benin
IUCN	World Conservation Union
MAEP	Ministry of Agriculture, Livestock, and Fisheries
MCA	Millenium Challenge Account
MCC	Millenium Challenge Corporation
MEPN	Ministry of Environment and Protection of Nature
POPs Convention	Stockholm Convention on Persistent Organic Pollutants
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

EXECUTIVE SUMMARY

Section 118 of the Foreign Assistance Act (FAA) requires that every USAID country development strategy statement or country plan includes 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 by the agency meet the needs thus identified." Section 119 dictates that every country strategic plan developed by USAID shall include: "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." USAID/Benin is in the process of developing its strategy. This report meets the strategic planning requirements set out in Sections 118 and 199 of the FAA. The objectives are to:

1. Assess the current state of biodiversity conservation and forest management in Benin
2. Identify the actions necessary in Benin to better conserve tropical forests and biological diversity
3. Judge the extent to which the actions proposed for support by USAID/Benin meet the needs thus identified

An expatriate environmental specialist (team leader) and a Beninese geographer conducted this analysis. The assignment allocated 19 days of LOE for the team leader, including travel and writing time, and 11 days of LOE for the local geographer. Both have more than 25 years of experience in conservation and development. The analysis process included a review of literature available through the internet and obtained while in Benin, a 1,800 km field trip, interviews with 23 professionals, and talks with with local residents.

Benin is situated between Togo on the west, Nigeria on the east, Burkina-Faso and Niger to the north, and the Atlantic Ocean to the south. It falls between 6°12' and 12°30' north latitudes and 1°0' and 3°40' east longitudes. The country measures 700 km in length and ranges in width from 125 km on the coast to 325 km at its widest point, at about 10°10' north latitude. Benin's boundary with Niger is defined by the Niger River, the most important waterway in the region.

Average annual precipitation ranges from 1,300 mm in the extreme southwest and elevated areas to 900 mm in the extreme north of the country. The bimodal rainfall distribution in the extreme south becomes unimodal as one moves north.

Benin's topography is subdued. Most of the country lies below 600 m, and its most prominent topographic feature is the Atacora Highlands chain in the northwest.

The dominant soils, derived primarily from granitic and gneissic rocks, include ferralsols, plinthosols, alisols, lixisols, and luvisols. The first three tend to be infertile and acidic to slightly acidic. Laeteritic crusts and nodules are common.

The rivers in the northern quarter of the country feed into the Niger while those in the south flow north to south into coastal lagoons and lakes before reaching the Atlantic

Ocean. The network of perennial rivers extends for 3,048 km, and lakes and lagoons cover 333 sq km, the latter concentrated in the coastal zone.

Benin is virtually devoid of dense tropical forests. To some extent this is because of the "Dahomey Gap," a climatic abnormality associated with less rainfall than would be expected at that latitude.

Semi-deciduous forests occupy an estimated 1 to 2 percent of the surface and are present as isolated patches in the southern portion of the country. The largest patch of semi-deciduous forest is the Lama Forest, which only covers 1,900 ha. Woodlands and savannas cover an estimated 30 to 50 percent of the country. Cultivated wooded and shrub savanna occupy between 15 and 25 percent of the country. Another 15 to 25 percent of the land cover consists of fallow fields intermingled with cultivated fields. Seasonally inundated vegetation occupies 2 to 3 percent of the country's land surface.

Administratively and politically, Benin is divided into 12 *departments* (states) and 77 *communes* (municipalities). The *communes* are sub-divided into *arrondisements* and these in turn into *villages*. The *villages* are sub-divided into *quartier de villes*. Under the set of decentralization laws, enacted in 1999, the *communes* have financial autonomy and assume responsibilities related to the environment. The process of decentralization is of utmost importance to Benin's environment and the conservation of tropical forests and biodiversity.

Estimates put Benin's population at 6.9 to 8.0 million;45 percent are less than 15 years old. More than 50 percent of the population is concentrated in the southernmost sixth of the country. Population growth rate estimates range from 2.8 to 3.2 percent.

Benin is among the least developed countries in the world, ranking 163rd out of 177 countries according to the UN Development Programme's (UNDP) 2006 Human Development Index. Adult literacy, at 33.6 percent, and life expectancy, at 55.9 years, are the 7th and 38th lowest, respectively, in the world. According to the World Economic Forum 2004 Competitive Index, Benin ranks 114th out of 117 countries assessed. The World Bank's Ease of Doing Business Index ranks the country 129th out of 155. Benin's trade deficit of 8.1 percent of GDP is the 26th highest in the world.

Benin is a signatory to seven international conventions: the Convention on International Trade in Endangered Species, United Nations Convention to Combat Desertification, Ramsar Convention on Wetlands, Stockholm Convention on Persistent Organic Pollutants, Convention on Biological Diversity, United Nations Framework Convention on Climate Change, and the Convention for the Conservation of Migratory Species of Wild Animals. Benin is also a signatory to the Kyoto and Montreal protocols.

Article 27 of the Benin Constitution establishes the right of every person to a healthy environment and the obligation to protect it. The Environmental Framework Law (EFL) of 1993 defines the general framework and the legal basis for government actions related to the environment. The EFL establishes the National Commission for Sustainable Development and the Beninese Agency for the Environment (ABE); the latter is responsible for implementing government policy on the environment.

A number of sectoral laws pertaining to water, forests, and wildlife complete the regulatory framework related to the environment. Some laws are outdated and subtended by a command and control philosophy, while more modern legal instruments espouse an empowerment and accountability doctrine. Some degree of regulatory overlap and contradictions exists. The Government of Benin (GOB) has enlisted donor agencies to help review the legal framework pertaining to the environment and identify problem areas. If adhered to, Benin's laws could result in the conservation of biodiversity and tropical forests; however, there is little enforcement capacity and much of the legislation is incongruent with Beninese reality. For example, Article 52 of the Water Code states that: "Whoever throws or spills or lets run into water courses, lakes, or dams, directly or indirectly, substances which directly or indirectly destroy fisheries or other domestic or wild animal species, or damages their food sources or reproduction and compromises the quality of water will be punished with imprisonment of between two and five years and fined." It is difficult to envision this provision being enforced when the bulk of households in Benin have no access to either waste water or solid waste disposal or management services.

In 1999, Benin embarked on a decentralization process subtended by a set of five laws. The decentralization process has serious implications for the environment. It involves three sub-processes: 1) the re-drawing of administrative units), 2) delegation of authority, and 3) decentralization.At the central government level, the Ministry of Environment and Protection of Nature (MEPN) has the primary role for managing and protecting the environment. However, the Ministry of Agriculture, Livestock, and Fisheries (MAEP) is also important, particularly with respect to the management and conservation of fisheries resources and water bodies. Other central government institutions that have a bearing on the environment include the ministries of Mines, Energy, and Water. Additionally, Ministry of Interior, Public Security, and Local Collectives (MISPCL) assumes a certain importance in light of its leadership role in the decentralization process.

Within the MEPN, the key sub-units concerned with forestry and biodiversity are the General Directorate for Forestry and Natural Resources (DGFRN); National Center for the Management of Wildlife Reserves (CENAGREF), Beninese Agency for the Environment, National Forest Office (ONAB), Permanent Secretary of the Commission for Sustainable Development (SN-CNDD), General Directorate for the Environment (DGE), Departmental Directorate for the Environment and the Protection of Nature (DDEPN), and the Directorate for Territorial Management. In the MAEP the relevant institutions are the Fisheries and the Agricultural directorates. At times overlaps in function and mandates generate confusion and inter-institutional rivalries. The ability of public institutions to support and regulate environmental management is limited due to a chronic shortage of resources. Their effectiveness hinges to a large extent on foreign assistance.

The German government, through its technical development agency GTZ, is the most important donor to Benin pertaining to the environment. Its environmental priorities are conservation and sustainable management of natural resources in rural regions; decentralization and municipal development; and integrated water resource management and potable water supply. Other contributors include the European Union as a single entity and, in addition to Germany, its member states France, Belgium, Denmark, and the Netherlands. The UNDP provides assistance for the decentralization of

environmental responsibilities and helps Benin meet commitments assumed under international agreements, such as compliance with the United Nations Framework Convention on Climate Change.

Nearly 20 percent of Benin's surface area is under some category of legal protection. There are two national parks (Pendjari and "W"), three multiple use zones adjacent to the national parks, 38 classified forests, and two Ramsar sites (the riparian areas in the "W" and Pendjari national parks). The national parks and multiple use zones cover more than 1,250,000 ha, nearly 10 percent of Benin's surface area.

The Pendjari National Park and buffer zones have been the focus of donor (GTZ) programs for more than 20 years. This protracted effort is beginning to bear fruit. A participatory management process has led to a drastic reduction in poaching and increased numbers of important species including a doubling of the elephant populations to 1,600 in the last five years. GTZ will continue to support the park for at least another three years. The Pendjari houses one of the last remaining populations of African wild dogs in the world and one of the last populations of elephants and cheetahs in West Africa.

In addition to the national parks, Benin has 44 units of classified forests covering a total of 1,019,179 ha[1] ranging in size from 50 to 259,000 ha. Most of them are in an advanced stage of degradation. The Lama Forest (1,900 ha) is the most important remaining patch of dense semi-deciduous forest. From 1978 to 1998 Benin lost 84 percent of its dense forests and more than 30 percent of its natural vegetation cover.

Benin's coastal lakes and lagoons are among the the most productive fishries in the country. It is reported that in the year 2000 they were the primary means of livelihood for an estimated 300,000 people. These water bodies cover 333 sq km and are show signs of stress in terms of productivity, biodiversity, and overall ecosystem chemistry and structure. Fishermen report the disappearance of certain fish species, and 48 percent of those interviewed declared their intention to abandon fishing because it is no longer profitable.

Acadjas is a fish husbandry system that involves the erection of fish corrals fenced with branches and fishing nets. The corrals create a favorable environment for fish growth and reproduction and can be used to turn a free-access resource into private property. The number of *acadjas* has increased precipitously over the past few decades reducing the space available for non-*acadja* fish and fishermen. Porto Novo lagoon is illustrative of this trend: from 1981 to 1996, the number of *acadjas* increased from 589 to 9,078. There is no reason to believe that this trend has changed; however, *acadja* productivity is reportedly decreasing.

Fishermen around some coastal lakes and rivers have witnessed the reduction of mangroves. The decrease in mangrove cover has serious implications to the productivity and diversity of these coastal ecosystems.

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[1] Legally the national parks are "classified forests." Nonetheless, in this document they are discussed separately since they are subjected to a distinct management models by a distinct government institution.

Coastal lakes and lagoons tend to have high biological oxygen demand, and coliforms, phosphates, and sulfates indicate that these systems are undergoing a process of eutrophication. Highly toxic and organically persistent pesticide (DDT, Heptachlor, Chlordane, Lindane) residues are also present in lake sediments. These bio-accumulate in animal tissue.

Benin's territory plays an important role in the life cycle of eight species listed by the World Conservation Union (IUCN) as "endangered" or "critically endangered." Of these, two are mammals (African wild dog and red-bellied monkey), three are fish (goliath grouper, dusky grouper, African wedge fish), and three are reptiles (leather back turtle, green turtle, hawksbill turtle). The African wild dog has been the center of conservation efforts for more than 20 years and its situation may be described as stable but tenuous; the red-bellied monkey inhabits the remaining patches of Benin's southern forests, which is under siege. The conservation status of "endangered" or "critically endangered" fish species that use Benin's brackish water coastal lakes and lagoons (goliath grouper, dusky grouper, African wedge fish) is worrisome as the ecosystems on which they depend are severely threatened.

One serious form of environmental degradation present in Benin is the high rate of vegetation cover loss, which has three principal causes. First, food-crop and cotton cultivation has expanded. For example, between 1986 and 1997 the area dedicated to cotton and manioc increased by 265 percent and 79 percent, respectively. Second, firewood extraction and charcoal production is estimated to be equivalent to a deforestation rate of 30,000 ha per annum. Third, the extraction of wood for the erection of *acadjas* requires 1.5 million branches for each hectare enclosure.

Overfishing, contamination, and poorly designed and operated infrastructure are the three principal threats to Benin's coastal lakes and lagoons. More than 300,000 people derive their living from these fisheries. Solid waste and waste water from urban centers and rural households, and pesticides, primarily from cotton cultivation, contaminate these ecosystems. And poorly planned and operated infrastructure such as the Nangbeto Dam in Togo and the port at Cotonou have severely altered ecosystem dynamics and ecology.

Habitat disappearance and degradation, and direct anthropogenic pressures are the principal threats to the eight "endangered" or "critically endangered" species that either live in Benin or use its territory during a critical stage in their life cycle. The red-bellied monkey is threatened by the loss of forest cover in southern Benin, fish species by the degradation and overuse of Benin's coastal lagoons and lakes, and marine turtles by the capture of adult and juvenile individuals and nest raiding.

Any action that helps Benin escape the underdevelopment trap should help the country avoid the slippery slope of environmental degradation. Actions that tackle the proximate causes, such as slowing down the expansion of the agricultural frontier and improving the management of pesticides, can help slow the pace of environmental decline. But such actions will not reverse it.

This document does not pretend to propose a development agenda for Benin. However, it recognizes Beninese initiatives that are steps in the right direction, chief among them

the decentralization process. The implementation of this policy is difficult and requires significant donor support. It requires institutional changes, strengthening of national and local-level government institutions, and the enactment of local level bylaws to complement national level environmental legislation, which itself will need to be reviewed and modified.

Some of Benin's environmental problems can be temporarily mitigated by actions that address proximate root causes. Others require the country to escape the under-development trap.The adaptation of improved agricultural technologies, such as proven agroforestry practices that improve soil fertility, can reduce the pressure that shifting agriculture places on the country's remaining natural vegetation by spatially fixing cultivation. A side benefit would be the extraction of firewood from agroforestry plots, which would help reduce the pressure on natural vegetation patches and tree plantations while creating an alternative source of income for rural families.

The pressure on marine turtles may be reduced by implementing a community-based turtle conservation program that includes education, economic alternatives, and enforcement.

Protecting the red-bellied monkey from extinction hinges on conserving the few remaining patches of this species' habitat. Setting up a breeding program, under complete captivity or partial captivity, may also be necessary. The former is the preferred alternative as the forest patches used as habitat by the Benin red-bellied monkey are remnants of the most biodiverse vegetation type in the country.
The Lama forest is a logical candidate for such conservation efforts.

The National Plan for the Implementation of the Stockholm Convention on Persistent Organic Pollutants recognizes that Benin's farmers are ignorant about the dangers and application methods for pesticides. A program to teach farmers how to manage and either diminish or avoid the use of pesticides could help reduce the level of contamination and health risks associated with pesticides. The cultivation of organic cotton could give Benin a competitive advantage in the highly distorted global cotton market.

USAID/Benin's Strategy Statement, dated February 13, 2006, specifies two strategic objectives — one in support of basic education and the other family health. USAID/Benin's strategy contributes to Benin's development by implicitly addressing the root causes of tropical forest and biodiversity losses. The scale of USAID/Benin's program, however, is too small in relation to Benin's environmental problems to address them in a substantial manner. The linkage between the mission's health component and the environment could be strengthened if an environmental health focus were chosen.

The compact signed between the GOB and the Millenium Challenge Corporation addresses pressing development problems and, therefore, the root cause of environmental degradation. Nonetheless, some of the activities contemplated, such as land titling and the inevitable emergence of a land market, may leave poor rural inhabitants without access to land. This could increase migration towards southern towns and fisheries, increasing the pressure on these areas.

SECTION A. INTRODUCTION

A1. Legal Requirement

Section 118 of the Foreign Assistance Act (FAA) of 1961 requires that every USAID country development strategy statement or country plan 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 by the agency meet the needs thus identified." Section 119 dictates that every country strategic plan developed by USAID shall include: "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." Further legal requirements for an environmental assessment is provided by Section 117 which states that: "Special efforts shall be made to maintain and, where possible, restore the land, vegetation, water, wildlife and other resources upon which depend the economic growth and human well being, especially of the poor." Hence, the use of the 118/119 report to assist the development of country level plans or strategies is a legal requirement.

In February 2006 USAID/Benin prepared a five-year (2006-2010) strategy statement that was released in April 2006. The environment and tropical forests are not currently among USAID/Benin's strategic priorities, but the mission is interested in the linkages between these two themes and its two stated strategic priorities: basic education and family health.

Annex I of the February 2006 strategy statement is an initial biodiversity and forest conservation assessment that helps meet the legal requirements of Section 118 and 119. This preliminary assessment provided the mission with the necessary information about the status of biodiversity and tropical forests in the country to allow it to initiate the development of its five-year strategy. A more comprehensive and in-depth analysis followed.

This document contains the findings of the follow-up in-depth analysis. It is organized into five sections. This introduction lays out the purpose and objectives of the analysis, and a country profile provides information on the physical environment, social conditions, and institutional and legal framework that have a bearing on the status of forest resources and biodiversity. The third section of the document is the assessment of the status of biodiversity and tropical forest resources. This is followed by a discussion of the root causes for the environmental problems identified. The document ends with an assessment of the linkages between the USAID/Benin strategy and the environment.

A2. Purpose and Objectives

This purpose of this assessment is to ensure compliance with Sections 118 and 119 of the FFA, as amended, and to inform USAID/Benin's strategic planning exercise as per the Strategic Framework for Foreign Assistance and country strategy guidelines under ADS 201.3.4.11 and ADS 204.5. The objectives are the following:

1. Assess the current state of biodiversity conservation and forest management in Benin

2. Identify the actions necessary in Benin to better conserve tropical forests and biological diversity
3. Judge the extent to which the actions proposed for support by USAID/Benin meet the needs thus identified

A3. Methods

A3a. Team Composition

This assessment was conducted by team leader Dr. Joao S. de Queiroz and local counterpart Professor Kolawolé Sikirou Adam. Dr. Queiroz holds a Ph.D in range ecology, a M.Sc. in soil genesis, and a B.Sc. in soil science. He has more than 20 years of post-Ph.D experience with natural resources and environmental issues, 10 of those years in Africa. He worked with USAID for seven years and has extensive experience managing, designing, and evaluating biodiversity conservation projects. Professor Adam holds a *Diplôme d'Ingénieur Cartographe Géographe* degree from *Université de Paris VII*, and is one of the best known geographers in Benin. Professor Adam is the founder and executive secretary for the Benin-based Center for Environment and Development in Africa (CEDA). He wrote the seminal geography book for Benin *Le Benin*. Under Professor Adam's guidance, CEDA has conducted numerous environmental studies in the country. The two team members worked in tandem. Professor Adam's knowledge of the environmental community and institutional framework guaranteed access to a broad range of actors.

A3b. Meetings and Interviews

The team met with more than 24 key individuals (Annex I), including political appointees in high-level positions in the Ministry of Environment and the Protection of Nature (MEPN), Ministry of Interior, Security and Local Collectives, Ministry of Agriculture, Livestock and Fisheries (MAEP), and Ministry of Health. The team also interviewed technical advisors working under the GTZ-funded Natural Resources Conservation and Management Program, Bioversity International, technical and administrative personnel responsible for the management of Pendjari National Park, and independent consultants. The interviews were open ended.

In addition to formal interviews, the team conversed informally with fishermen, medicinal plant sellers, charcoal sellers, and market stall owners.

A3c. Literature Review and the Internet

The team reviewed several key documents, focusing on original documents that contained original data. Key documents included the *National Plan for the Implementation of the Stockholm Convention on Persistent Organic Pollutants* (MEPN 2007), the *National Strategy and Action Plan for the Conservation of Biological Diversity* (MEPN 2002),[2] several volumes of the *Project Study for the Management of Water Bodies in Southern Benin* (Roche International 2000), the *Monografie Nationale*

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[2] At the time of publication the Ministry of Environment and Protection of Nature was called The Ministry of Environment, Habitat, and Urbanism.

de la Diversité Biologique (Republique du Benin, undated), and *Repertoire des Texts Sur le Foncier et les Resources Naturelles Renouvables* (Programme de Gestion de Terroirs et des Resources Naturelles/MAEP 2003).

Websites consulted included USAID/Benin (http://www.usaid.gov/bj/), the GOB (http://www.gouv.bj), the Convention of Biodiversity (http://www.cbd.int), the Millennium Challenge Corporation (http://www.mcc.gov), the World Conservation Union (http://www.iucn.org), GTZ (http://www.gtz.de), and Earth Trends (http://www.earthtrends.wri.org).

A3d. Field Trip

In a country where data on the environment is deficient or outdated, valuable insights can be gained through field observations and conversations with local people. To this effect, the team undertook an 1,800 km field trip, divided into three distinct segments:

1. North to the Pendjari National Park on Interstate Routes 2 and 3 passing through Bohicon, Dassa, Savalou, Bassila, Djougou, and Nattintigou. The team toured the park in the company of park personnel and a group of primary and secondary school teachers and students on a field trip. The return trip took a different trajectory to the south of Djougou along Interstate Routes 6 and 2, passing through Parakou, Tchaourou, and Save. The team covered approximately 1,400 km.
2. Fifty kilometers along the coastal sand track from Cotonou to the community of Daho. The team made several stops at traditional salt producing sites and fishing villages.
3. From Cotonou to the coastal town of Agoué, passing Ouidah and the lower reaches of Lake Ahéme, for a total of 200 km.

SECTION B. COUNTRY PROFILE

A general knowledge of Benin's physical and social environments is a prerequisite to understanding the distribution of biodiversity, the forces and trends that are obliterating the country's renewable natural resources, and the magnitude of the effort needed to reverse these negative trends.

B1. Physiography

B1a. Location

Benin is situated between Togo on the west, Nigeria on the east, Burkina-Faso and Niger to the north, and the Atlantic Ocean to the south. It falls roughly between 6°12' and 12°30' north latitudes and 1°0' and 3°40' east longitudes. It measures 700 km in length and ranges in width from 125 km on the coast to 325 km at its widest point, about 10°10' north latitude. Benin's boundary with Niger is defined by the Niger River, the most important waterway in the region.

B1b. Climate

Average annual precipitation ranges from 1,300 mm in the extreme southeast and the relatively elevated areas between the 10° and 11° north parallels, to 900 mm in the extreme north of the country (Exhibit 1). Rainfall distribution, perhaps as important as average precipitation as a determinant of agricultural potential, changes as one moves north from the coast.

In the southern sixth of the country, precipitation is concentrated in two wet seasons: a long one from March through July and a shorter one from September through November. These are separated by a short (August) and long (December through March) dry season. Precipitation assumes a unimodal distribution pattern as one moves inland, becoming most evenly distributed throughout the year at about 8° latitude. North of this line, the wet season tends to get progressively concentrated between the months of May and October, to the point where, in the northern third of the country, a protracted November to May dry season compromises crop production.

B1c. Topography

With the exception of a few isolated peaks, Benin lies below 600 meters (Exhibit 2). Its most prominent topographic feature, and origin of the Pendjari River, is the Atacora Highlands, which traverse the northwestern portion of the country on a northeasterly direction. The highest peaks are also found in the northwestern region near the border with Togo, the highest being Mount Sagabarao at 658 m above sea level. A mostly undulating topography etched on an erosional surface (peneplain) gives way to a flatter depositional surface in the southernmost reaches of the country.

From an elevational "bulge" that falls roughly between 9°30' and 10°30' north latitude, the elevation decreases gradually from 600 m to sea level, with the southernmost sixth of the country lying below 50 m. The elevation also decreases toward the Niger River on the north and the Pendjari River along the border with Burkina Faso.

B1d. Geology

The majority of the country is underlain mostly by pre-Cambrian igneous intrusive and metamorphic rocks of the basement complex, composed largely of granites, gneisses, quartzite, mica schist, and migmatite. In the southernmost sixth of the country, the basement complex is overlain by a layer of sedimentary rocks of the tertiary period, including limestone, shales, argillaceous sandstones, and quaternary alluvial deposits in depressions and along waterways.

Benin's geology is important to this document because granitic and gneissic rocks tend to yield relatively infertile, coarse soils. Medium-textured sedimentary rocks and recent alluvial deposits, on the other hand, yield finer soils, which generally have better agricultural properties. Other factors, such as climate, topography, drainage, biota, and age, determine soil characteristics.

Exhibit 1. Precipitation Map of Benin and Selected Rainfall Distribution Graphs
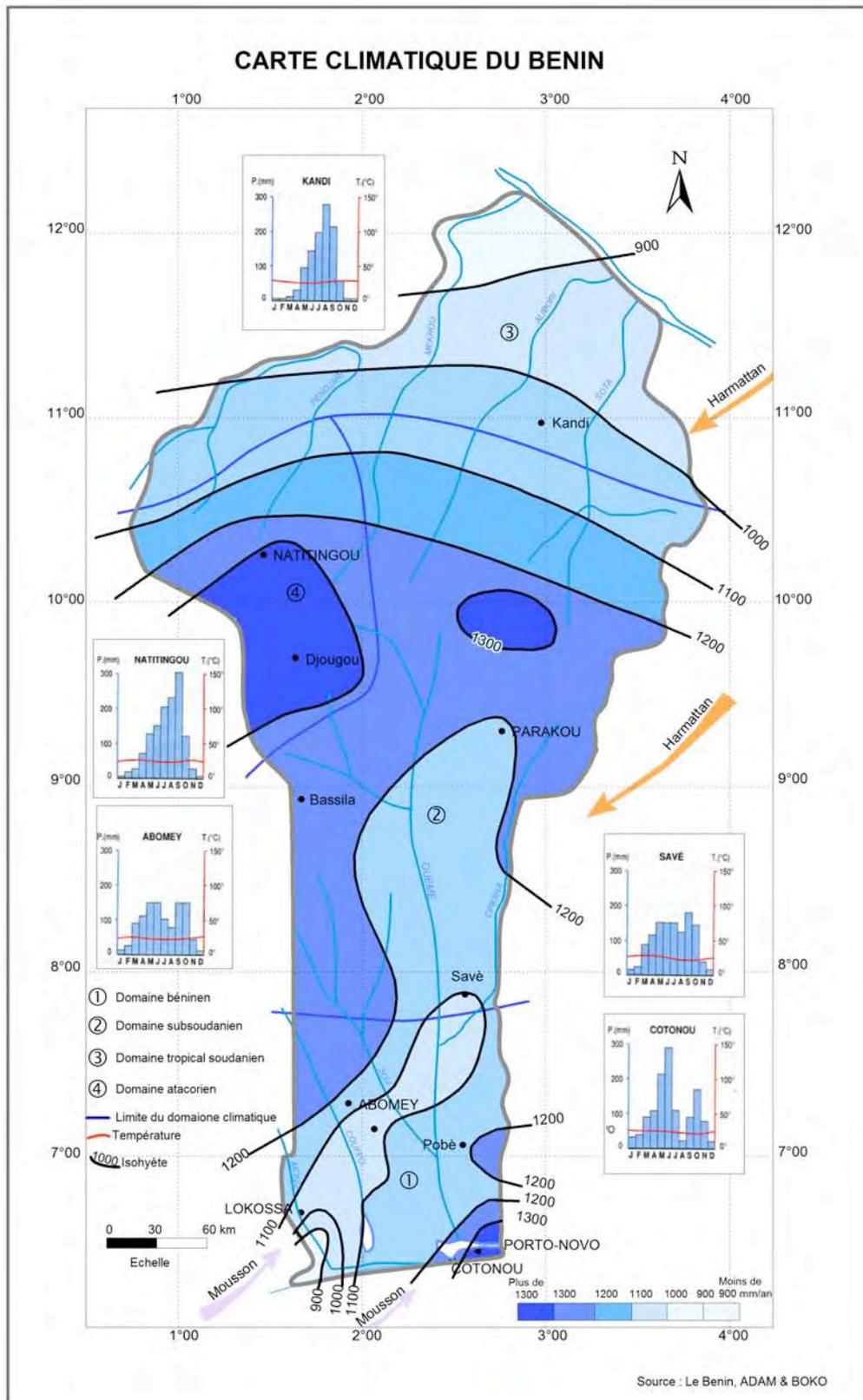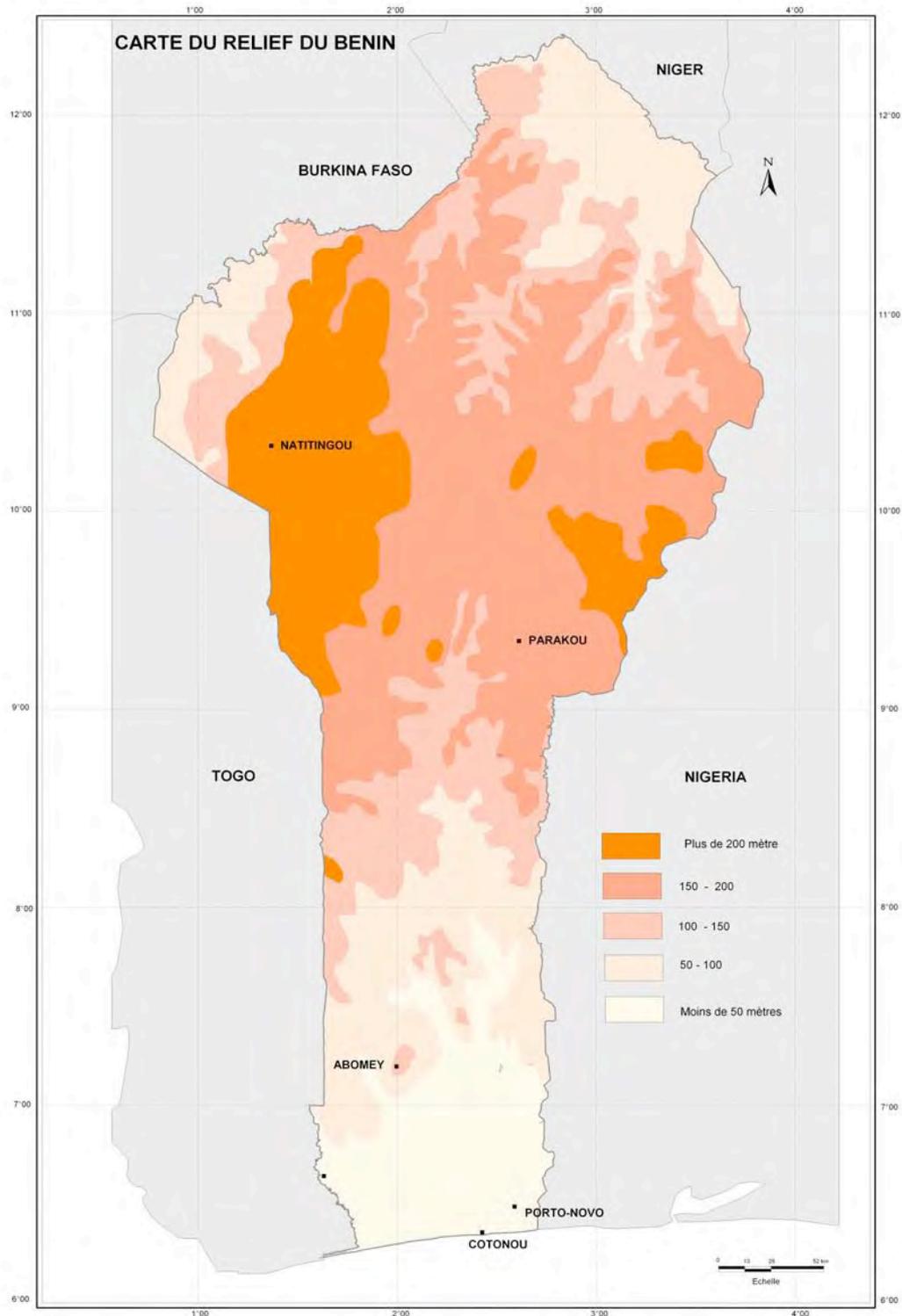
Exhibit 2. Benin's Topography

The Atacora Highlands run through the elevated massif along the northeastern portion of the country, to the east of Natitingou.

CARTE DU RELIEF DU BENIN

B1e. Soils

Existing soil maps for Benin are outdated. They are based on classification systems that are no longer used (ORSTOM) or have been modified (FAO/UNESCO). The discussion below is a generalized interpretation of maps developed using the old French system of soil classification and the 1988 FAO/UNESCO Soils Map Legend.

Exhibit 3 shows the soils of Benin according to the old French soil classification. More than 90 percent of the country is overlain by soils classified as *sols a sesquioxydes*, *sols ferrallitiques* or *soils a concretion et cuirasse*. These units would be somewhat encompassed under the ferralsol, plinthosols, alisols, lixisols and luvisols of the *World Reference Base for Soil Resources: A Framework for International Classification, Correlation and Communication* (FAO 2006). With the exception of the luvisols, these soils tend to be acidic to slightly acidic, be high in iron and aluminum oxides (sesquioxides), or contain laeteritic concretions or layer. Where the parent material is derived from the basement crystalline rocks, the soils tend to have coarse surface textures (personal observation).

In the southernmost sixth of the country, a northeasterly running strip of vertisols (poorly drained dark-cracking clay) and poorly drained alluvial soils intermingle with complexes of luvisols, and ferralsol. Textures tend to be finer and pHs higher because the parent material is derived from a variety of sedimentary rocks and quaternary alluvial deposits.

In practical terms this means that the other five-sixths of the country are covered by soils with limited agricultural potential. Soils high in sesquioxides tend to hold phosphorus in forms not available to plants, acid soils may have toxic levels of aluminum, and coarse surface textures have low nutrient and water retention capacity. In short, their fertility depends to a large extent on their organic matter content or the addition of chemical fertilizers. They are exhausted after a few crop cycles. Ferralsols and plinthosols may develop a hard laeteritic (ironstone) crust, which renders them useless for conventional agriculture.

Hence, unless chemical soil amendments or large quantities of organic matter are added, the bulk of the soils in Benin have to be abandoned after only two or three years of cultivation. Several years of fallow are required to restore some of their original fertility, forcing farmers to seek new areas to cultivate. Herein lays one of the biggest causes of forest and biodiversity loss in the country an points to the need for a comprehensive improved soil management program.

B1f. Hydrography

From a hydrologic perspective Benin may be divided into two large basins (Exhibit 4): one draining north to the Niger River, and the other draining south to the Atlantic Ocean. The divide between these two basins is located at about the 10°N parallel. The most important north-flowing rivers include the Mékrou, Alibori, and Sota. The Pendjari, crucial for the national park that bears its name, is a special case: It begins flowing north but takes a "U" turn to the south to form the boundary between Burkina Faso and Benin. The network of perennial rivers extends for 3,048 km, and lakes and lagoons cover 333 sq km, the latter concentrated in the coastal zone.

The most important rivers flowing to the Atlantic include the Ouéme, Okapara, Agbado, Kouffou, and Mono rivers. The last of these forms the boundary between Togo and Benin from the 7°N parallel to the Atlantic Ocean. The Nangbeto Dam on the Mono River in Togo is a primary source of electricity for Benin and has had a profound influence on the ecology of coastal lagoons and lakes.

North of the 7°N parallel, the south-flowing rivers, when not flooding, tend to remain confined to well-defined channels. On the other hand, once they enter the flatter southern portions of the country, the area dominated by sedimentary rocks, their behavior begins to change in response to a decrease in gradient. Hence, south of the 7°N parallel, the Ouéme River begins to meander creating a large periodically inundated flood plain. As it reaches the 6°N latitude it forms Lake Nokoué, the largest lake in Benin. The Kouffou River forms Lake Ahéme. Together with the Mono River and other minor rivers, the Kouffou gives rise to a system of coastal lagoons that extend for approximately 75 km along the coast, separated from the ocean by a thin strip of beach sand.

In a sense, Benin's coastal lakes and lagoons act as sumps for the basins drained by the rivers that feed them. Pesticides, organic wastes, and industrial waste all find their way to these economically and ecologically important systems.

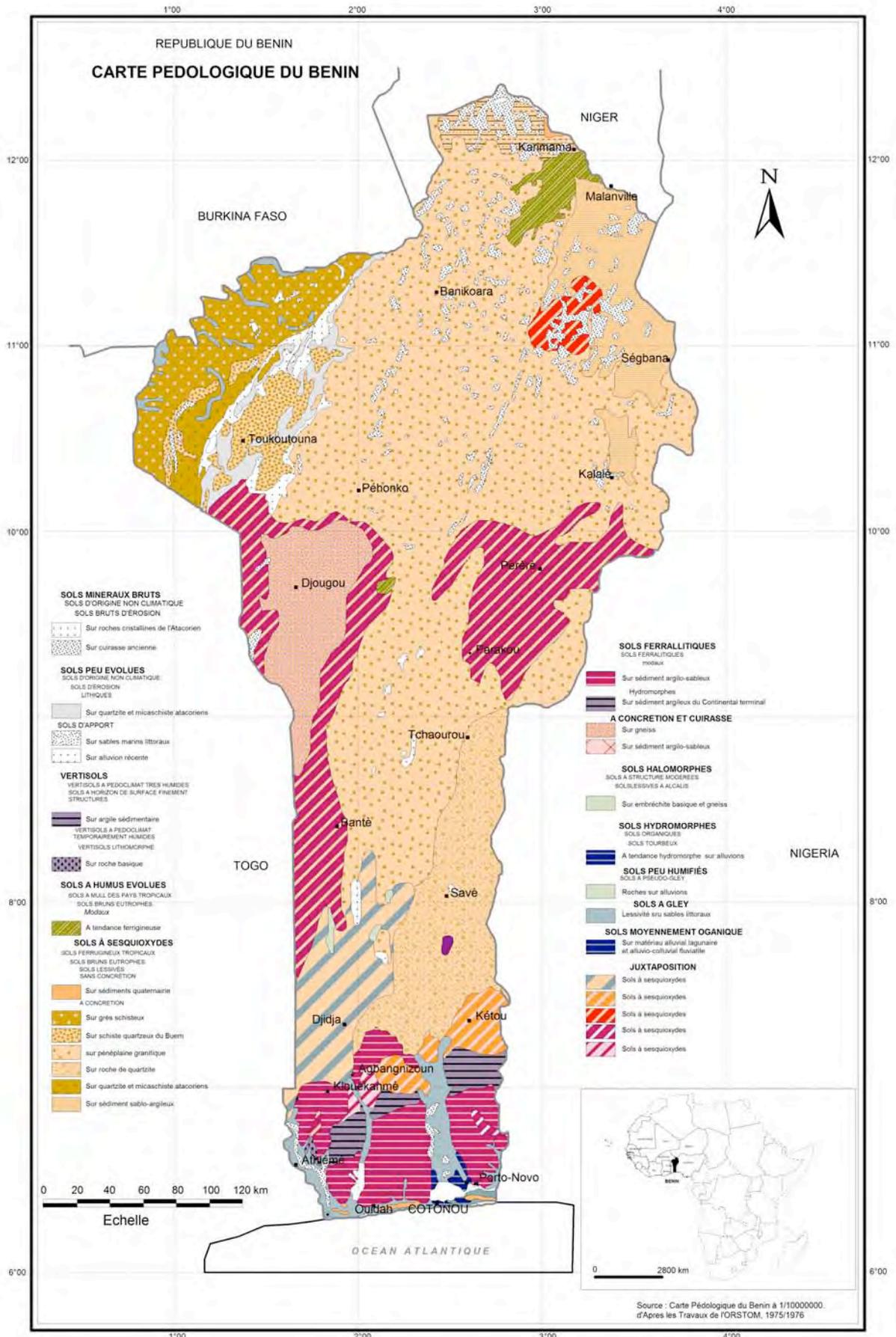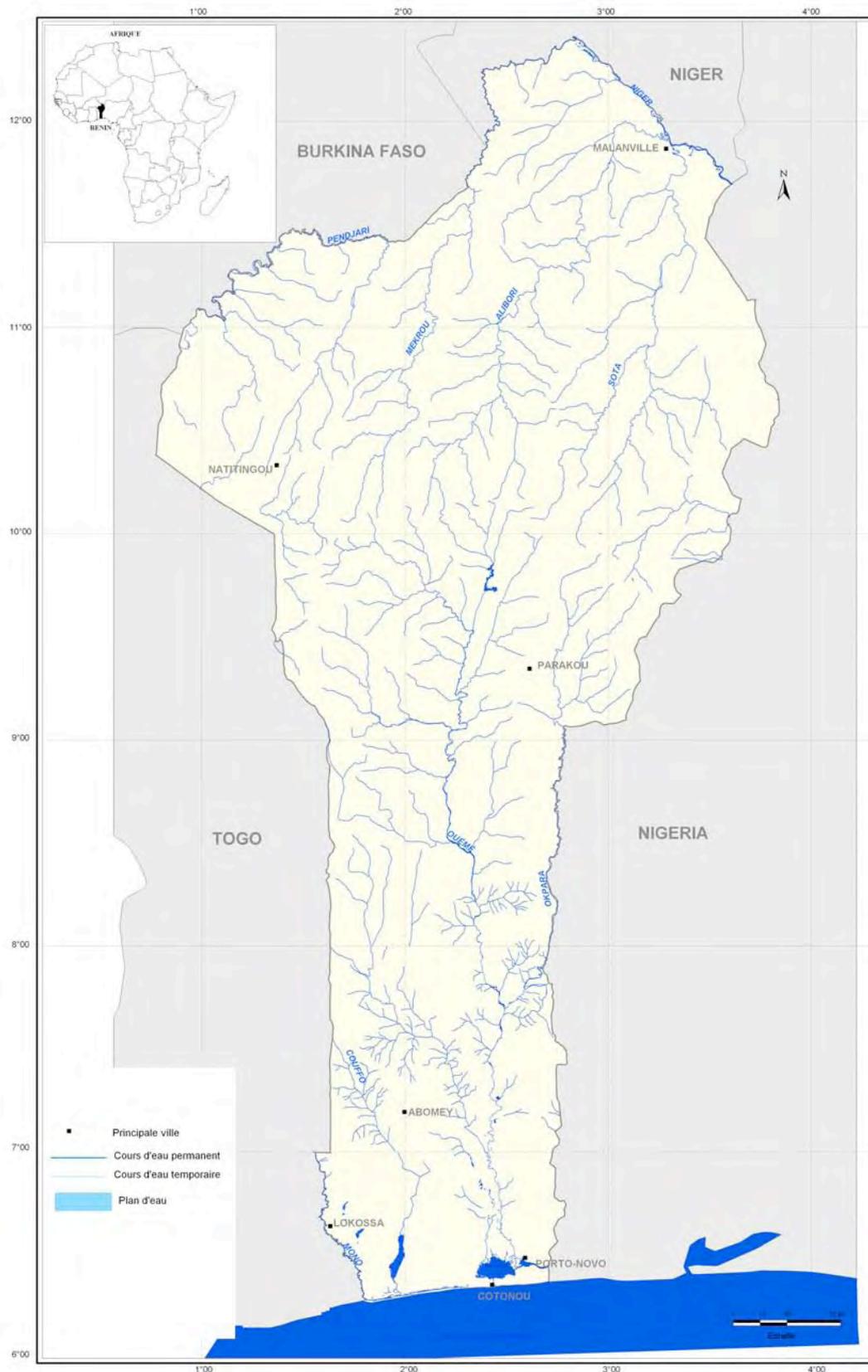**Exhibit 3. Soils Map of Benin According to Old French Soil Classification**

Exhibit 4. Benin's Major Rivers

B1g. Vegetation

Exhibit 5 presents land-cover types for Benin; Exhibit 6 translates the legend units used in Exhibit 5 into English, and provides estimates of broad cover types based on ocular estimates of the same map, but on a larger (1:1,000,000) scale, a review of literature, and the field trip.

Benin is virtually devoid of what could be considered dense tropical forests. To some extent this has to do with the existence of the "Dahomey Gap," a climatic feature whereby a combination of wind direction parallel to the coast, the absence of coastal highlands, and the influence of the Saharan high pressure zone result in less rainfall than would be expected at that latitude. It is believed, however, that during wet periods in the Holocene, the Dahomey gap was connected to the West African rainforest zone. Some of the species — *Berlinia grandiflora, Parinari congensis, Detarium senegalensis, Dyospirus melispiformis, Dialium guineense, Khaya grandifoliola, Milletia thonningii* — that were once widely distributed in the gap found refuge in the gallery forests, which now cover less than 1 percent of the country.

Semi-deciduous forests occupy an estimated 1 to 2 percent of the country's surface and dot the southern portion of the country in isolated patches. Typical species include *Triplochiton scleroxylon, Terminalia superba, Holoptelea grandis, Milicia Excelsa,*and *Piptadenisastrum africanun*. The largest patch of semi-deciduous forest is the Lama Forest, which covers a mere 1,900 ha. When classified in the 1940s, the Lama Forest covered 16,000 ha. This reduction in cover indicates the extent of deforestation that took place in southern Benin over the past few decades.

The extreme degree of fragmentation indicates that in Benin there are no ecologically viable patches of semi-deciduous forests. While still an important repository of biodiversity — providing refuge for 20 percent of Benin's plant species — these patches are probably no longer suitable habitat for many animal species that once inhabited Benin's semi-deciduous forests. Nonetheless, Nagel et al (2004) calls attention to the fact that the Lama Forest is one of the few remaining habitats for several "endangered" and "vulnerable" mammal species, such as the endemic red-bellied monkey sub-species (*Cercopithecus erythrogaster erythrogaster*), the sitatunga, (*Tragelaphus spekei*), the royal antelope (*Neotragus pygmaeus*), the black duiker, (*Cephalophus niger*) and the yellow-backed duiker (*C. silvicultor*). For Benin, this small patch of forest is clearly a conservation priority.

Woodlands and tree savannas cover an estimated 10 to 20 percent of the country. They are concentrated between the 8° and 10° parallels. Typical species include *Isoberlina doka, I. Tomentosa, Anogeissus leiocarpus, Afzelia africana, Khaya senegalensis,* and *Pterocarpus erinaceus*. This vegetation formation is dominated by fire tolerant species. Soils with limited agricultural potential and less than ideal rainfall could be deterring wholesale cultivation of these areas.

Wooded and shrub savannas cover an estimated 20 to 30 percent of the country and are concentrated to the north of the 8° parallel. The woody stratum is dominated by *Terminalia spp., Adansonia digitata,* and *Combretum spp*. and the herbaceous stratum

by *Andropogon gayanus, A. Schirensis, Hyparrhenia subplumosa, H. Smithiana,* and *H. involucrate*. Fire is a key factor in the maintenance of this vegetation formation.

Tree and shrub savanna on rocky slopes are usually associated with inselbergs and the rocky slopes of the Atacora Highlands. Typical woody species include *Afrotrilepsis pilosa* and *Hymenodictyon floribundum*. While classified in the reference map as savannas, their physiognomy are more akin to woodlands because tree and shrub cover often exceed 15 percent, and grass cover is sparse in light of the rock terrain. Trees and shrubs find rooting space in the gaps and fissures that occur on the exposed basement rocks.

Cultivated wooded and shrub savanna occupy between 15 and 25 percent of the country. This unit is made up of patches of savanna intermingled with cultivated plots where some of the woody plants are left. Another 15 to 25 percent of the country's land cover consists of fallow fields intermingled with cultivated fields.

Seasonally inundated vegetation covers two to three percent of the country. This land cover type is concentrated in the southernmost section of the country and characterized by plants tolerant of water logging. Often *Raphia* spp. and *Mytragina inermis* are prominent in the woody stratum while the herbaceous stratum is often dominated by *Paspalum distichum*, *Typha asutralis*, *Cyperus papyrus*, and *Echinochloa* spp. *Vetiveria nigritana*, *Nymphae lotu*, and *Eichhornia crassipes* are present in areas of open water.

Exhibit 5. Land Cover Map of Benin

Carte de vegetation du Benin

BURKINA FASO

KARIMAMA
PRC DU W
DU NIGER
MALANVILLE

PARC DE LA
PENDJARI

BANIKOARA

KANDI

SEGBANA

MATERI

TANGUIETA
KOBLI
TOUKOUNTOUNA

KEROU

GOGOUNOU

NATITINGOU
KOUANDE
SINENDE

KALALE

PEHONKO
BEMBEREKE

BOUKOUMBE

NIKKI

REPUBLIQUE

KOPARGO
N'DALI

FEDERALE

DJOUGOU
PERERE

DU NIGERIA

OUAKE

PARAKOU

BASSILA

REPUBLIQUE
TCHAOUROU

DU TOGO
QUESSE

BANTE

SAVE

GLAZOUE

SAVALOU

DASSA

DJIDJA
KETOU

COVE
ABOMEY
BOHICON
OUINHI

APLAHOUE
KLOUEKAME
POBE

SAKETE
LOKOSSA
ALLADA
ADJOHON

ATHIEME
BOPA

COME
OUIDAH
PORTO-NOVO

COTONOU
GRAND-
POPO

Galerie forestière
Forêt dense sèche ou forêt semi-décidue
Forêt claire et savane boisée
Savane arborée et savane arbustive
Savane arborée et arbustive saxicoles
Surface sans végétation
Savane arborée et arbustive à emprise agricole
Mosaïque de cultures et de jachères
Mosaïque de cultures et jachères sous palmier
Plantation
Formation marécageuse
Carrière et plage
Relique de forêt et savane en zones
Agglomération   saisonnièrement inondées
Plan d'eau
Cours d'eau permanent
Autoroute
Route revêtue
Chemin de fer
Limite d'aire protégée
Limite d'Etat
Limite de département
Limite de sous-préfecture

Echelle 1/3000000
0   20   40   60   80   100 Km

Source : Images LANDSAT TM et SPOT XS
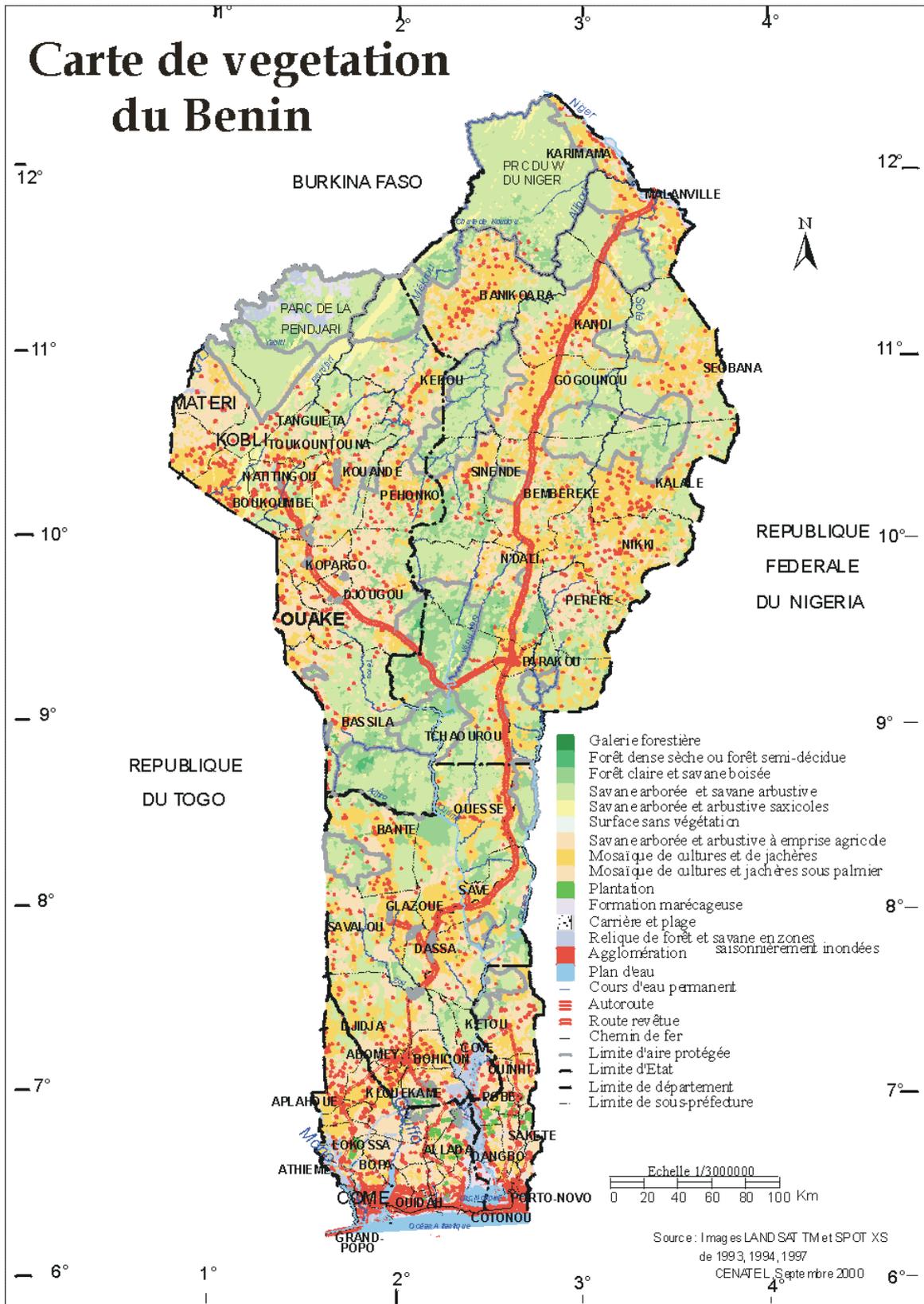de 1993, 1994, 1997
CENATEL Septembre 2000

Exhibit 6. Description of Vegetation Map Units and Cover Estimates

Legend Unit in French	Legend Unit translated to English	Estimated % Cover	Common Species and/or Comments
Galerie forestière	Gallery forests	<1%	Woody species: *Berlinia grandiflora, Parinari congensis, Detarium senegalensis, Dyospirus melispiformis, Dialium guineense, Khaya grandifoliola, Milletia thonningii*
Forêt dense sèche ou forêt semi décidue	Dense dry forest or semi - deciduous forest	1-2%	Woody species: *Triplochiton scleroxylon, Terminalia superba, Holoptelea grandis, Milicia Excelsa, Piptadenisastrum africanun*
Foret claire ou savane boisée	Woodland and tree savanna	10-20%	Woody species: *Isoberlina doka, I. Tomentosa, Anogeissus leiocarpus, Afzelia africana, Khaya senegalensis, Pterocarpus erinaceus*
Savane arborée et savane arbustive	Wooded and shrub savanna	20-30%	Woody species: *Terminalia spp., Adansonia digitata, Combretum spp.,* Grass species: *Andropogon gayanus, A. Schirensis, Hyparrhenia subplumosa, H. Smithiana, H. involucrata*
Savane arborée et arbustive saxicole	Tree and shrub savanna on rocky slopes	1-2%	Woody species: *Afrotrilepsis pilosa; Hymenodictyon floribundum*
Surface sans végétation	Bare soil	<1%	Self-explanatory
Savane arborée et arbustive á emprise agricole	Cultivated wooded and shrub savanna	15-25%	Same species as in tree and shrub savanna unit above plus annual/biannual crops, cassava, iñame, corn, peanuts, etc.
Mosaïque de culture et de jachéré	Mosaic of cultivated and fallow land	15-25%	Annual and biannual crops intermingled with fallow fields in early stages of succession
Mosaïque de culture et jachère sous palmier	Mosaic of cultivated and fallow land under African palm plantations	<1%	African palm stands (*Cypsiurus parvus*) are in poor condition. African palm is on its way out as an important economic activity
Plantation	Forest (teak) plantations	1%	Most poorly managed; some used for firewood
Formation marécageuse	Mangroves	1%	Woody species: *Rhizophora racemosa, Avicennia germinans*. In different state of conservation; degraded in areas of salt production; primary threat is from changes in salt levels and water levels, due to engineering works
Carrière et plage	Beaches and stony areas	<1%	Mostly beaches
Relique de foret et savane en zones saisonnièrement inondée	Relics of forests and savannas in seasonally flooded areas	2-3%	Woody species: *Raphia spp. Mitragyna inermis.* Herbaceous species: *Paspalum distichum; Typha asutralis; Cyperus papyrus; Echinochloa* spp. *Vetiveria nigritana.* Floating species: *Nymphae lotus; Eichhornia crassipes.*
Agglomération	High population densities	5-10%	Self-explanatory
Plan d'eau	Water bodies	2-3%	Self-explanatory

B2. The Human Environment

B2a. Administrative Units

Administratively and politically Benin is divided into 12 *départments* (states) and 77 *communes* (municipalities). The *communes* are sub-divided into *arrondisement*s and these in turn into *villages*. Finally the *villages* are sub-divided into *quartier de villes*. The maximum elected officials are the *préfet* at the departmental level and the *maire* at the *commune* level. Each *commune* has a communal council that is chaired by the *maire*. Under the set of decentralization laws, enacted in 1999, the c*ommunes* have financial autonomy and will assume a number of responsibilities related to the environment. The process of decentralization is of utmost importance to Benin's environment and the conservation of tropical forests and biodiversity.

B2b. Demographics and Quality of Life

Estimates of Benin's population range from 6.9 million to 8.0 million, of which approximately 45 percent are under the age of 15. Population growth rate estimates range from 2.8 to 3.2 percent. The average woman in Benin has 5.7 children, the 19th highest fertility rate in the world. Benin's population is expected to reach 9.4 million by 2015.

Nearly 45 percent of Benin's population lives in urban centers, a ratio that is twice that of 20 years ago. Nearly 50 percent is concentrated in the southernmost sixth of the country (Exhibit 7). This asymmetry is a result of not only the location of the capital Cotonou on the coast, but also the relatively more productive natural resources base. Several environmental problems, such as the declining productivity of coastal fisheries, are associated with this concentration of population. Women make up 51.5 percent of the population and head 21.3 percent of households. Cultural norms and practices severely limit their role in decision making. Violence against women and girls, including forced marriage, genital mutilation, and spousal abuse, is widely practiced and tolerated. Illiteracy among women is about 75 percent, compared to 47 percent among men.

Girls selling food in Parakou market. Benin's fast-growing population will place increasing pressure on the country's natural resources as employment opportunities are lacking.

According to the UNDP's Human Development Index, Benin ranks 163rd[nd] out of 177 countries. Adult literacy, at 33.6 percent, and life expectancy, of 55.9 years, are the 7th and the 38th lowest, respectively, in the world. The rate of HIV infection is reported to be 2 percent; however estimates put the figure as high as 6 percent.

B2c. Economics

Benin ranked 114 of 117 countries on the World Economic Forum 2004 Competitive Index, according to which "1" is the most competitive. The World Bank's Ease of Doing Business Index ranks the country 129 out of 155. Purchasing power is the 19th lowest in the world and equivalent to 2.7 percent of that in the United States. Benin's trade deficit, at 8.1 percent of GDP, is the 26th highest in the world. On the other hand, Benin's economy grew 4.9 percent per year between 1994 and 2004. Nearly all jobs are in the informal economy.

Nearly 40 percent of Benin's formal GDP is derived from agriculture. The main crops are corn, cotton, manioc, yams, African palm, and sorghum. Cotton production,

Exhibit 7. Benin's Population Distribution
Most people are concentrated in the southern sixth of the country as a result of a more productive resource base and the location of large cities.

and processing is the mainstay of the formal economy, contributing 13 percent to GDP and 40 percent to total export earnings. Cotton is the main source of cash income for about two million people. Low world cotton prices cast a shadow over the future of the cotton industry and Benin's short-term economic prospects.

Fish is the main source of animal protein consumed in the country. In 2000, an estimated 300,000 people derived their income from Benin's fisheries.

African palm, once a mainstay of Benin's economy, is losing its importance as a cash crop. Most plantations observed were under an advanced degree of degradation. The relatively low rainfall renders palm cultivation in Benin less competitive than in other wetter parts of the world.

B3. Legal instruments Related to the Environment

The GTZ recently commissioned an analysis of the legal and institutional framework related to the environment and natural resources management. Were it a matter of laws and number of institutions, Benin's environment would be one of the best conserved on the planet. The discussion herein is restricted to the legal instruments deemed most relevant to this analysis.

B3a. International Conventions

Benin is a signatory to seven international conventions: the Convention on International Trade in Endangered Species; United Nations Convention to Combat Desertification; Ramsar Convention on Wetlands; Stockholm Convention on Persistent Organic Pollutants (POPs Convention); Convention on Biological Diversity (CBD); UN Framework Convention on Climate Change (UNFCCC), and the Convention for the Conservation of Migratory Species of Wild Animals. Benin is also a signatory to the Kyoto and Montreal protocols. The country has produced its first National Communication as required by the UNFCCC and the Biodiversity Conservation Strategy and Action Plan as required by the CBD, and is finalizing its National Plan for the Implementation of the POPs Convention. These international commitments are legally binding.

B3b. Cross-Cutting Legal Instruments

Arcticle 27 of the constitution establishes the right of every person to a healthy environment and the obligation of every person and the State protect it.

The Environmental Framework Law (EFL) of 1993 defines the general framework and the legal basis for government actions related to the environment. It defines a number of principles, among them "the polluter pays," and re-states the constitutional provisions such as the right to a healthy environment. The EFL establishes the National Commission for Sustainable Development and the Beninese Agency for the Environment, the latter responsible for implementing government policy on the environment.

The ministerial decree of September 29, 1928, defines and regulates the use of the "public domain." It identifies all watercourses, natural and artificial, as part of the

public domain. It specifies that the rights of individual use and appropriation are prohibited in the following zones:
- 100 m from the highest tide line
- 25 m from the banks of rivers and streams
- 25 m from the edge of lakes and lagoons, including within islands and islets

The decree goes on to specify a series of penalties for the infringement of these provisions. Repeat offenders may be incarcerated for as many as five days.

B3c. Water

Article 51 of the law 87-016 of September 21, 1987 (Water Code), states that: "Whoever shall throw drugs or natural poisons to stun fishes or all other wild or domestic species, or to destroy and compromise water quality will be punished with imprisonment from two to five years and fined…the penalty will be doubled in case of repeat offenders." Article 52 goes on to state that: "Whoever throws or spills or lets run into water courses, lakes, or dams, directly or indirectly, substances which directly or indirectly destroy fisheries or other domestic or wild animal species, or damages their food sources or reproduction and compromises the quality of water will be punished with imprisonment of between 2 and 5 years and fined …"

B3d. Forests

Law 93-009 of 1993 (forestry law) addresses forest management and conservation. It divides forest resources into state forests and those owned by the individuals or cooperatives. State forests are divided into classified forests and protected forests.

Classified forests may be used by neighboring communities under a strict set of rules that excludes forest exploitation for commercial purposes. Nonetheless, commercial exploitation can take place if contemplated in an approved management plan. This flexibility is in stark contrast to previous legislation that prescribed strict protection of forests and exclusion of local inhabitants. While the clearing of classified forests is prohibited, forest cover may be enriched by tree planting contemplated in management plans. Grazing of domestic animals is allowed in classified forests, provided an authorization is granted by the National Forestry Office.

Protected forests, on the other hand, are those that have not been declared classified forests and do not belong to individuals or associations. Use rights are free but may be regulated, suspended, or prohibited by decree issued by the council of ministers under advice of the minister in charge of forest resources. Article 57 of the forestry law prohibits uncontrolled or "late" fires in any forest category. The law prescribes a number of penalties:

- CFA 5,000 to 50,000 for infractions such as illegal logging, cutting, burning, and overall illegal exploitation of forest products, and between 15 months and 6 years imprisonment
- In the case of protected species, illegal actions may carry fines ranging from CFA 50,000 to 500,000 and imprisonment from two months to two years.
- If permit quotas are exceeded, fines may range from CFA 50,000 to CFA 500,000, and the period of incarceration between three months and three years.

B3e. Wildlife

Law 2002/16 of October 2002 (wildlife law) regulates the management and use of wildlife. The law reverses previous legal instruments by opening the door for participatory management of wildlife. Article 3 states: "the management of wildlife and its habitat must be made in partnership with neighboring communities in order to maintain and develop for the long-term their value and biological, ecological, socio-economic, nutritional, scientific, cultural, aesthetic, and recreational functions." The law distinguishes the following categories of protected areas:

- *Integral Nature Reserves*, where all activities are prohibited, including tourism or even low-level flying
- *Wildlife Reserves*, where the hunting and capture of wild animals and other human activities are prohibited or strictly limited and exercised only under the control of the reserve authorities
- *Special Reserves*, where all activities are subordinate to the specific objectives for which they were created
- *National Parks*, where the fauna and flora are conserved to ensure their perpetuation
- *Cynegetic Zones*, where wildlife and its habitat are conserved and the rational exploitation of wildlife for recreational, economic, and scientific purposes is permitted

All the categories outlined above belong to the classified forest category under the forestry law (law 93-009) described above.

Article 25 of the wildlife law opens the possibility for the creation of zones where economic activities compatible with the purposes of protected areas may be exercised by neighboring communities. Article 30 places all wild animals, including migratory ones, under the tutelage of the state. Article 31 classifies the wild animals into integrally protected, partially protected, and other species. The capture or harvest of the eggs of integrally protected animals is prohibited. The law allows for the issuance of concessions for privately-run wildlife ranches and the development of management plans for protected areas, among other provisions. It also establishes penalties, including fines from CFA 300,000 to 800,000 and/or incarceration for six months to five years for various infractions:

- Killing or capturing wild animals without a permit
- Hunting females in gestation or nursing
- Harvesting eggs or destroying nests
- Commercializing wild animals or trophies without the appropriate permits

Article 67 of the wildlife law creates an incentive for park guards to enforce the law by assigning 20 percent of the receipts derived from fines to the individuals involved in the capture and conviction of lawbreakers.

Classified forests are used for purposes including cattle grazing. Absentee herd ownership is common.

B3f. Decentralization

In 1999 Benin embarked on a decentralization process that has serious implications for the environment. The process is at once an opportunity and a challenge of mammoth proportions. The decentralization is subtended by a set of four laws:

1. Law 97-028 about the organization of territorial administration
2. Law 97-029 about the organization of municipalities
3. Law 98-005 about the particulars of municipal organization
4. Law 98-007 about the financial regime of municipalities

The decentralization process involves three sub-processes: 1) the re-drawing of administrative units, 2) delegation of authority, and 3) decentralization. The re-drawing of administrative boundaries resulted in the creation of six new departments, primarily through the sub-division of departments in the southern portions of the country where most of the people reside. The roles and responsibilities under the new model of decentralized government are discussed below.

The focus on penalties of some sectoral laws are incompatible with Benin's reality; not only are Benin's government agencies unable to apply the legal provisions, but current economic circumstances leaves the rural population with no options but to break the law.

B4. Institutional Framework

At the central government level, the Ministry of Environment and Protection of Nature (MEPN) has the primary role for managing and protecting the environment. However, the Ministry of Agriculture, Livestock, and Fisheries (MAEP) is also an important player, particularly with respect to the management and conservation of fisheries resources and water bodies. Other central government institutions that have a bearing on the environment include the ministries of Mines, Energy, and Water through the General Water Directorate. Exhibit 8 summarizes the roles of the key institutions relevant to the conservation and management of forests and biodiversity. In addition to the MEPN and MAEP, the Ministry of Interior, Public Security and Local Collectives assumes a certain importance in light of its leadership role in the decentralization process.

Within the MEPN the key sub-units as far as forestry and biodiversity are concerned are the General Directorate for Forestry and Natural Resources (DGFRN), the National Center for the Management of Wildlife Reserves (CENAGREF), the Beninese Agency for the Environment, the National Forest Office, the Permanent Secretary of the Commission for Sustainable Development, the General Directorate for the Environment, the Departmental Directorate for the Environment and the Protection of Nature, and the Directorate for Territorial Management. In the MAEP the relevant institutions are the Fisheries and the Agricultural directorates.

Exhibit 8. Government Departments with a Role in Forests and Biodiversity

Organization/ Institution	Ministry	Functions
DGFRN	MEPN	• Define forestry policy and develop sustainable management strategies for forests, wildlife, and other renewable resources • Apply the law in matters related to forestry and wildlife in protected areas in consultation with local communities • Participate in the elaboration and implementation of international conventions and accords related to wildlife and forests • Define management policy for surface water within state forests • Participate in the elaboration and implementation of international conventions and accords related to surface water in protected areas • Collaborate with other agencies in the management of surface water
ONAB	MEPN	• Add value and commercialize forest resources • Develop forest management plans and protect forest plantations under its jurisdiction against fire and illegal exploitation
Fisheries Directorate	MAEP	• Define policies related to fisheries and oversee their application • Enforce fisheries and surface water management regulations for sustainable fisheries production • Participate in the elaboration of international conventions and accords related to the management of water resources
Agricultural Directorate	MAEP	• Monitor and control the contamination of agricultural lands • Organize and control the quality and distribution of agricultural inputs to avoid pollution
DGE	MEPN	• Develop policies and strategies related to the environment and renewable natural resources • Implement and monitor environmental policies • Develop and monitor the application of environmental legislation • Control and monitor development activities with environmental impact • Implement international conventions and accords related to the environment
ABE	MEPN	• Implement with the participation of all relevant institutions the national environmental protection policies
DDEPN	MEPN	• Advise municipalities in matters related to territorial management • Monitor adherence of municipal environmental management schemes to existing legislation
Municipalities	N/A	• Protect local natural resources • Define local-level policies for natural resources management • Ensure that policies and plans adhere to national level laws • Develop local-level environmental management plans
DAT	MEPN	• Develop and coordinate the implementation of national policy for territorial management
CENAGREF	MEPN	• Manage wildlife reserves, in particular the national parks

A perusal of Exhibit 8 reveals some overlap in function that generates confusion and rivalries. For example, the DGFRN is responsible for developing sustainable management strategies for wildlife, and CENAGREF has the mandate to manage wildlife reserves. The DGE has a broad mandate to develop policies and strategies related to the environment and renewable natural resources. Where does its mandate stop, and where do the mandates of other entities begin?

The GOB has recognized that its institutional framework related to the environment is in need of adjustments, and has asked the GTZ to analyze it. The outcome of this analysis should provide the basis for a clarification of functions.

Nonetheless, even with clear mandates, the government institutions' ability to support and regulate environmental management is limited due to a chronic shortage of resources. Their effectiveness hinges to a large extent on foreign assistance, which tends to be limited in duration and scope. The outcome of this dependency is evident. Fleets

of rusting vehicles in need of spare parts from previous projects are parked beside new ones from ongoing projects; divisions that are the current beneficiaries sport new computers, furniture, and equipment, while those without a sponsor lack these amenities.

B5. International Cooperation

The European Union and five of its members provide environment-related assistance to Benin (Exhibit 9).

Exhibit 9. Development Assistance Provided by the European Union and Member States

Theme	EU	Germany	Belgium	Denmark	France	Netherlands
Infrastructure, energy, water	X	X	X	X	X	X
Agriculture, rural development, environment	X	X	X	X	X	X
Democracy, decentralization	X	X	X	X	X	X

Under the Conservation and Management of Natural Resources Program, GTZ helps Benin comply with the responsibilities acquired through the signing of international conventions related to the environment, such as the Convention on Biodiversity, the POPs Convention, and the Ramsar convention. One of its geographic focus areas is the Pendjari National Park where it has helped develop a participatory management system, helped implement a hunting system, and helped resolve conflicts with local communities. Other collaborators include the French Fund for the Global Environment, and the Netherlands Embassy and SNV. The European Union provides assistance for the management of the W National Park as part of a regional effort to conserve this trans-border park.

The UNDP supports the GOB to strengthen its capacity for natural resources management through its Program for National Environmental Management. The program has two major objectives: 1) decentralization of natural resources management and 2) strengthening national capacity to implement the National Action Plan Against Desertification. UNDP also provided assistance through the GEF for the elaboration of Benin's first National Communication to the UNFCCC. GEF funds also supported the preparation of the National Biodiversity Strategy and Action Plan and will be used to support a community-based coastal zone management program.

While not explicitly linked with tropical forests or biodiversity conservation, the Millennium Challenge Corporation is likely to play an important role in reversing some of the negative trends affecting Benin's environment. The compact for a total value of $307 million signed between the MCA and the GOB will help 115,000 rural and urban households obtain more secure and useful titles to land.

SECTION C. THE STATUS AND ECOLOGICAL TREND OF TROPICAL FORESTS AND BIODIVERSITY

C1. National Parks and Buffer Zones

Nearly 20 percent of Benin's surface area is under some category of protection. There are two national parks (Pendjari and W), three multiple use zones adjacent to the national parks, 38 classified forests and two Ramsar sites (the riparian areas in the W and Pendjari national parks).

The Pendjari National Park, created in 1961, is located on the northwest of the country along the border with Burkina Faso. It forms a complex with three buffer zones covering 563,442 ha and is part of UNESCO's global network of biosphere reserves. W National Park and its buffer zones cover 762, 438 ha. Together, these two complexes of protected areas and multiple use zones form a continuous arc along the border between Benin, and Niger and Burkina Faso that covers over 1,250,000 ha, nearly 10 percent of Benin's surface area.

Cape Buffalo in the Pendajari National Park. The Pendjari is the best conserved protected area in Benin and perhaps West Africa. Sustained international support and locally derived initiatives have promoted effective conservation alliances among government, foreign donors, and local communities.

The Pendjari National Park and buffer zones have been the focus of donor programs for more than 20 years. This protracted effort is beginning to bear fruit. Declared by the central government without local-level consultation, Pendjari National Park faced strong opposition by local communities. Poaching was rampant as was grazing by domestic livestock. Over time the management model evolved from "command and control" to a participatory approach where local communities benefit from the park. The 20 villages (30,000 people) around the park have been organized into Village

Associations for the Management of Wildlife Reserves (AVIGREFs). These associations negotiate with the CENAGREF and participate in decisions made about park management. Neighboring communities can now make use of natural resources within the park such as firewood and water.

Furthermore, 30 percent of revenue derived from hunting licenses in the multiple use zones and the game meat from trophy hunting revert to the AVIGREFs. Soon, villages will be able to sell hunting rights and practice subsistence hunting. These measures, plus the employment of locals as park rangers, biological monitors, and research assistants, have helped change the attitude of local people toward the park. Poaching has been nearly eradicated, and the elephant population doubled between 2002 and 2007 from 800 to 1,600. Some of the increase in animal numbers may be a result of immigration from neighboring countries.

In the next three years GTZ, the Pendjari's principal financial supporter, will focus on three subject areas: 1) tourism promotion, 2) community organization, and 3) the creation of a fiduciary fund to help finance recurrent costs. One of the principal threats to the park is the expansion of cotton cultivation. GTZ would welcome assistance in helping stabilize the spatial distribution of cotton cultivation through the development of improved cultivation techniques. The situation of the Pendjari can be described as stable but tenuous — stable because the park enjoys the support of local communities, but tenuous because the support depends to some extent on the benefits the communities derive from the park, which in turn hinge on the support of international donors.

Pendjari National Park is of extreme importance to the conservation of the African wild dog (*Lycaon pictus*), a "critically endangered" mammal species. It is also crucial habitat for populations of the following vulnerable species: African elephant (*Loxodonta Africana*), cheetah *(Acinonyx jubatus*), African dwarf crocodile (*Osteolaemus tetraspis*), lion, (*Panthera leo)* and hippopotamus *(Hippopotamus amphibious*). Some of these species have healthy populations elsewhere in Africa, but in West Africa their status is precarious.

W National Park is supported primarily by the European Union and the UNDP through the GEF. Its management status is precarious due to its location along a transhumance pastoral route and the lack of controls along the border with Niger. Furthermore, donor support for W National Park has been more recent and sporadic.

Poorly managed teak plantations are common in Benin. They are often used as a source of firewood for sale and local consumption.

C2. Forests and Savannas

Benin has 44 units of classified forests covering a total of 1,019,179 ha.[3] These range in size from 50 to 259,000 ha.

Out of 26 units of classified forests evaluated as part of the analysis to develop Benin's National Biodiversity Conservation Strategy and Action Plan, 15 had at least a portion of its area under plantation either of teak, cashew, or other species used as firewood; six were found to be severely degraded. The only two sites that were deemed to be in good conditions were either far from population centers or situated in areas entirely unsuitable for cultivation.

Exhibit 10 provides figures, albeit dated, that illustrate a worrisome trend affecting the vegetation cover in Benin. In 20 years, on average, Benin lost 34 percent of its natural vegetation and forest plantation cover. The situation is most critical for the most biodiverse vegetation types in southern Benin: the semi-deciduous, deciduous, and gallery forests. In 20 years the country lost 84 percent of these vegetation types. Today, the Lama Forest with its 1,900 ha is the largest remaining patch of forest in southern Benin. When declared a protected area in the 1940s the area encompassed 16,000 ha of pristine forest.

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[3] Legally the national parks are "classified forests." Nonetheless, in this document they are discussed separately since they are subjected to a distinct management models by a distinct government institution.

Exhibit 10. Changes in Vegetation Cover between 1978 and 1998

Broad Vegetation Type	Area 1978 (hectares)	Area 1998 (hectares)	Change (hectares)	% Change
Semi-deciduous forests, deciduous forests, and gallery forests	393,139	63,125	-330,014	-84%
Woodlands and tree savannas	1,931,968	1,274,375	-657,593	-34%
Wooded and shrub savannas	6,095,625	4,150,488	-1,945,137	-32%
Wooded and shrub savannas on rocky slopes	235,000	220,770	-14,230	-6%
Relict forests in seasonally inundated areas	162,500	125,003	-37,497	-23%
Plantations	666,250	490,268	-175,982	-26%
TOTAL	9,484,482	6,324,029	-3,160,453	-34%

Data from the National Center for Remote Sensing

In terms of total area, the greatest loss between 1978 and 1998 (1,945,137 ha) occurred in the wooded and shrub savanna category. On the other hand, the smallest loss in terms of area (14,230 ha) and percentage (6 percent) occurred in the wooded and shrub savannas on rocky slopes. Apparently these areas were spared because they are not suitable for cultivation.

C3. Coastal Lakes, Lagoons, Mangroves, and Fisheries

Benin's coastal lakes and lagoons are the most productive ecosystems in the country. These bodies of water cover 333 sq km (Exhibit 11). These ecosystems are showing signs of stress in terms of their productivity, biodiversity, and overall ecosystem chemistry and structure.

ROCHE (2000) consulted over 1,800 people who live around Porto Novo Lagoon, Lake Ahemé, and Lake Nokoué. More than 75 percent of fishermen interviewed reported that catch sizes in terms of weight had declined; nearly 90 percent claim that the individual fish caught are smaller. The fishermen reported the disappearance of marine species such as *Epinephelus spp.* (grouper), *Caranx spp.* (jack), *Trachinotus* (pompano, jack), *Cephalopolis spp., Dasyatis* (stingray) *Selene spp.* (moon fish) as well as some freshwater species such as certain species of the *Polydactilus* (catfish)*, and Tetraodon* (puffer fish) genus. In another study (Atti-Mama 1998), 48 percent of the fishermen interviewed indicated that they are considering abandoning fishing because it is no longer profitable.

Exhibit 11. Lakes and Lagoons of Southern Benin

These water bodies collect the wastes and agrochemicals that enter the hydrographic network to the north with serious implications to the population and aquatic biodiversity.

Acadjas is a fish husbandry system that involves the erection of fish corrals fenced with branches and fishing nets. The enclosures create a favorable environment and protect the young from predators. They are known to increase fish productivity.

Because of their effectiveness and the option to turn a publicly owned resource into private property, *acadjas* have increased in number precipitously over the past few decades. For example, from 1981 to 1996, the number of *acadjas* in Porto Novo Lagoon increased from 589 to 9,078, an increase of 1,500 percent in 15 years. There is no reason to believe that this trend has changed.

In spite of the effectiveness of *acadjas* as a fisheries technology, their sheer number puts increased pressure on the fisheries resources. Hence, Laleye (2000) reported that while the number of *acadjas* has increased, their productivity decreased from 5,625 tons per hectare per year in 1959, to 1.92 tons per hectare per year in 1998.

The older fishermen around Lake Ahemé report that the 20 to 30 meter band of white mangrove that fringed the lake and the lower reaches of the Kouffo River delta disappeared. Mangrove coverage has also declined in the coastal lagoon that parallels Benin's western coast line. The decrease in mangrove cover has serious implications for the productivity and diversity of these coastal ecosystems.

At 20 measuring sites in Lake Nokoué, Porto Novo Lagoon, and the lower Ouemé River, ROCHE (2000) found high levels of biological oxygen demand — coliforms, phosphates, and sulfates. These are strong indicators that these water bodies are

undergoing a process of eutrophication. The coastal lagoon, however, did not present these problems.

ROCHE (2000) also found pesticide residues in lake and lagoon sediments such as hexachlorobenzene (HCB), Gamma BHC (Lindane), Heptachlor oxide, Gamma' Chlordane, DDE, DDD, and DDT. Copper, aluminum and lead were also found in levels that exceed established safe limits.

Hexachlorobenzene is moderately toxic to fish. Its concentration in the tissue of fish may reach 560 times that of the ambient water. Chlordane is highly toxic to fish and its capacity to bioaccumulate in tissue is 3,000 times its concentration in water. Lindane, highly toxic to fish, has a bioaccumulation potential 1,400 times the concentration in water. Heptachlor oxide is highly toxic to mollusks, and tissue concentration may reach 37,000 times the concentration in water. DDT, a pesticide that has been banned in most of the world, persists in the environment and its power of bioaccumulation in tissue is one million times its concentration in ambient water.

Several of the chemicals found in the water and sediments of Benin's coastal water are considered persistent organic pollutants (POPs) under the Stockholm Convention. These include Chlordane, DDT, Heptachlor, and hexachlorobenzene. Furthermore, Lindane has been proposed by Mexico for inclusion as one of the 12 POPs under the convention. In summary, Benin's coastal lakes and lagoons show serious signs of degradation, including a decrease in species diversity and fisheries productivity, a change in ecosystem structure, and worrisome levels of pollutants.

C4. Threatened Species

In this analysis, "threatened species" (Exhibit 12) are those listed as "critically endangered," "endangered," or "vulnerable" by the World Conservation Union (IUCN). A species that is "critically endangered" faces an extremely high risk of extinction in the wild, an "endangered" species faces a very high risk of extinction in the wild, and a "vulnerable" species faces a high risk of extinction in the wild. The determination of the risk of extinction as "extremely high," "very high," and "high," is based on a set of criteria developed by IUCN, such as population size, number of adults of reproductive age, generation length, fragmentation of population, and spatial distribution.

Benin has 44 species[4] in the IUCN Threatened Species List: 12 mammal species, 13 plant species, five reptile species, 11 fish species, and two bird species. In analyzing the significance of the information in Exhibit 12, it is important to consider that IUCN ranks the conservation status of the species from a global perspective. Some of the species considered "vulnerable" at the global level could be regionally "endangered" or even "critically endangered."

In Benin, seven species are globally "endangered" and four species are "critically endangered." The remaining 33 species are categorized as "vulnerable."

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[4] In fact the IUCN lists 45 species; however, the exhibit includes the chimpanzee. This species has not been observed in Benin for sometime and either it never existed there or it is locally extinct.

Exhibit 12. Species in Benin in IUCN's Threatened Species List

Common Name	Scientific Name	Status
Mammals		
Cheetah	*Acinonyx Jubatus*	VU
Red-bellied monkey	*Cercopithecus erythrogaster*	EN
Geoffroy's black-and-white colobus	*Colobus vellerosus*	VU
Red-fronted gazelle	*Gazella rufifrons*	VU
Hippopotamus	*Hippopotamus amphibius*	VU
African elephant	*Loxodonta africana*	VU
African wild dog	*Lycaon pictus*	EN
African lion	*Panthera leo*	VU
African golden cat	*Profelis aurata*	VU
African manatee	*Trichechus senegalensis*	VU
Humpback whale	*Megaptera novaeangliae*	VU
Plants		
Afzelia	*Afzela Africana*	VU
Albizia	*Albizia ferruginea*	VU
N/A	*Daniellia oblonga*	VU
West African cycad	*Encephalartos barteri*	VU
N/A	*Garcinia kola*	VU
N/A	*Homalium dalzielii*	VU
African mahogany	*Khaya grandifoliola*	VU
African mahogany	*K. senegalensis*	VU
N/A	*Milicia regia*	VU
N/A	*Nesogordonia papavifera*	VU
N/A	*Pierreodendron kerstingii*	VU
N/A	*Rutidea nigerica*	VU
N/A	*Turraeanthus africanus*	VU
Reptiles		
Green turtle	*Chelonia mydas*	EN
Leatherback turtle	*Dermochelys coriacea*	CR
Hawksbill turtle	*Eretmochelys imbricate*	CR
Home's hinged tortoise	*Kinixys homeana*	VU
African dwarf crocodile	*Osteolaemus tetraspis*	VU
Fishes		
White-tipped shark	*Carcharinus longimanus*	VU
Grey nurse shark	*C. Taurus*	VU
Great white shark	*Carcharodon carcharias*	VU
Goliath grouper	*Epinephelus itajara*	CR
Dusky grouper	*Epinephelus marginatus*	EN
Wide sawfish	*Pristis pectinata*	CR
Common sawfish	*P. pristis*	CR
Whale shark	*Rhincodon typus*	VU
African wedge fish	*Rhinchobatus luebberti*	EN
Bottlenose skate	*Rostroraja alba*	EN
Bigeye tuna	*Thunnus obesus*	VU
Birds		
Lesser kestrel	*Falco naumann*	VU
Lappet-faced vulture	*Torgos tracheliotos*	VU

CR = Critically Endangered, EN = Endangered, VU = Vulnerable

Two mammal species feature within the "endangered" category: the red-bellied monkey and the African wild dog. Nonetheless, it is likely that at the national level, the African manatee and hippopotamus are "endangered." The red-bellied monkey should be regarded as a priority species for conservation efforts since it inhabits the remaining patches of forest in southern Benin. The African wild dog, while globally "endangered," inhabits the Pendjari National Park where most of the donor-funded conservation efforts are focused. Its situation is precarious but may be considered stable in the short-term.

One liana, 14 species of plants, and 13 trees are listed as "vulnerable" by IUCN. They are threatened by high rates of deforestation and fires. In the case of the high-value timber species such as mahogany the threat stems from selective logging.

Among the 11 species of fish listed as threatened, six are either "endangered" or "critically endangered." Two of them (common sawfish, wide sawfish) are strictly marine species, whereas the other four make use of mangrove fringed brackish water lakes and lagoons during some part of their life cycle. Of special concern are the "critically endangered" goliath grouper, "endangered" dusky grouper, and the African wedge fish. Little can be done at the national level to conserve the strictly marine species, such as the four shark species, the humpback whale, the two species of sawfish, and the one species of tuna. The conservation of these species requires global collaboration; Benin's impact on their status is negligible.

Benin's beaches are used as nesting grounds for four species of sea-turtles; three of which feature in IUCN's list of threatened species. Two of those, the hawksbill and leatherback turtles, are "critically endangered," while the green turtle is classified as "endangered." Clearly this group of animals should be given the highest conservation priority.

SECTION D.CAUSES OF ENVIRONMENTAL DEGRADATION

D1. Immediate Causes and Contributing Factors

D1a. Loss of Vegetation Cover

Exhibit 14 illustrates the system of problems that leads to the accelerated loss of vegetation cover in Benin. Each of the direct causes of vegetation cover loss is discussed separately below.

D1a(1). Itinerant Agriculture

The lack of employment opportunities forces a large portion of the growing population to rely on agriculture. The problem is compounded because the soils in Benin are generally marginal for agriculture. Hence farmers practice "swidden" agriculture, whereby plots are cultivated for two to four years, after which new land has to be cleared and planted. With cotton, however, soil deficiencies may be compensated for by inputs of agro-chemicals.

The impact of agriculture on the vegetation cover is illustrated by the data provided in Exhibit 10 (above), which shows a decline of 84 percent in forest cover and more than 30 percent for different types of savannas and woodlands over a 20 year period. Exhibit 13 provides data on the increase of cultivated area that supports the causal linkage between the expansion of agriculture and loss in vegetation cover. In 11 years, the cultivated area increased by more than 30 percent for maize and sorghum, nearly 79 percent for manioc, 62 percent for ingñame, and 265 percent for cotton. Cotton exports bring in most of Benin's foreign currency.

Exhibit 13. Changes in Cultivated Area over an 11-Year Period for Selected Crops

Crop	1986 (hectares)	1997 (Hectares)	% Change
Maize	442,875	583,254	32%
Sorghum	110,674	149,086	34%
Manioc	103,216	185784	79%
Ingñame	80,210	130,488	62%
Cotton	102,708	375,218	265%
Total	839,683	1,423,830	69%

D1a(2). Charcoal and Firewood

An estimated 90 percent of household energy needs in Benin is met by charcoal and firewood. In fact, Benin produces only 30 percent of its electricity needs, importing the rest from neighboring countries. Electricity outages are a daily occurrence in urban centers.

ROCHE (2000) estimated that the consumption of firewood was approximately seven million cubic m per year, equivalent to 30,000 ha of forests. While the accuracy of these estimates is doubtful, it provides us with an idea of the dimensions of the problem. Besides being the principal source of fuel for cooking, firewood is used to smoke fish, make salt, and roast cassava to make flour.

But this environmental problem is an income opportunity for rural households. The roads into and out of Cotonou are lined with bags of charcoal and piles of firewood, some from forest plantations, for sale. Near the coast, where deforestation rates are most advanced, some people have to use the mid-rib of palm fronds as firewood.

Charcoal is one of the only sources of income for a significant segment of the rural population. Charcoal production is an important cause of deforestation.

Exhibit 14. Root Causes and Direct Causes for the Loss of Vegetation Cover in Benin

D1a(3). Wood for *Acadjas*

Under-development

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High population growth rates

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Lack of employment opportunities

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Exploitation of forest resources and agriculture

Charcoal and firewood   Itinerant agriculture   Wood for *acadja*

Loss of vegetation cover

Contributing factor: weak institutions unable to deliver services or regulate processes

As indicated previously, the number of *acadjas* has increased precipitously (1,500 percent in 15 years in Porto Novo Lagoon) over the past few decades. The amount of wood required for the construction and maintenance of *acadjas* is enormous. For example, Weinzierl and Vennemann (undated) calculated that 7,500 bundles are needed to fence one hectare of *acadja*. Each bundle is made up of 200 branches. Hence, a total of 1,500,000 branches are needed to fence-in one hectare. 5,000 bundles per hectare are needed to maintain the *acadja* in subsequent years.

Weinzierl and Vennemann reported that the quality of branches used has declined over time, and the distances covered to obtain branches have increased. Furthermore, the removal of branches from fallow fields, where most of the branches are harvested, results in the net movement of nutrients from agricultural areas to the lakes and lagoons. However, the sale of branches for *acadjas* is a source of income for farmers.

D1b. Degradation of Coastal Lagoons and Lakes

The ecological integrity and biodiversity in Benin's coastal lakes and lagoons are being compromised by three processes: 1) over-utilization, 2) contamination, and 3) anthropogenic changes in ecosystem structure and processes. Each of these processes has a distinct but related set of causes.

D1b(1). Over-Utilization of Coastal Lakes and Lagoons

As discussed above, the bulk of Benin's population is concentrated in the southern part of the country near the coastal lakes and lagoons. According to Roche (2000), in 2000 an estimated 300,000 people derived their living from the coastal lakes and lagoons fisheries. Six years hence, the number of people that depend on these fisheries is likely to be considerably higher. The causes of this situation are illustrated in Exhibit 15.
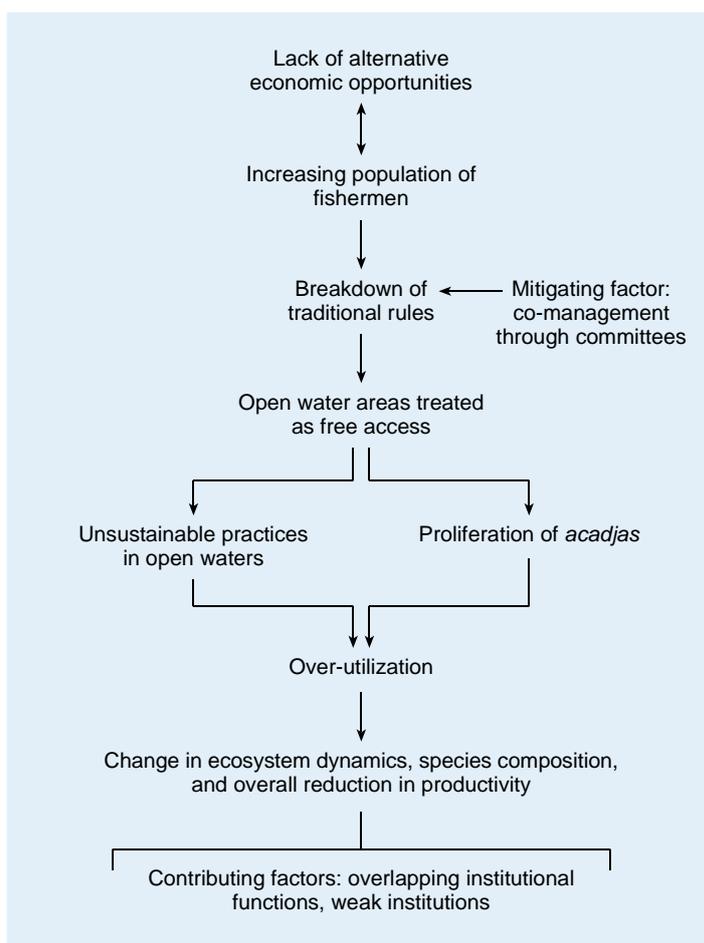
The fisheries resources are treated as a free access resource, except for areas enclosed in *acadjas*. Outside these enclosures, unrestricted fishing is conducted throughout the year. Traditional taboos and regulations that once limited fishing during certain times of the

year and in certain areas are now largely ignored. The use of illegal fine-mesh nets is widespread. Conflicts abound.

Fishing committees have been set-up with support from the Fisheries Department of the MAEP. The fisheries committees provide a local-level structure for the implementation of co-management agreements with the government. These committees have met with success in reducing illegal practices and resolving conflicts. They are considered a success by the fishermen.*Acadjas* are known to increase fish productivity by creating a favorable environment for fish growth and reproduction. This system involves the erection of corrals fenced by branches and fishing nets. The enclosure creates a favorable environment and protects the young from predators. Because of its effectiveness the number of *acadjas* has increased precipitously.

Despite the effectiveness of *acadjas* as a fisheries technology, the sheer number of them puts increased pressure on the fisheries resources. In fact their number is so large that it is changing the flow regime and tilting the balance in favor of non-migratory species such as *cichlids* that are favored by the environments created by the *acadjas*. This plus the practice of a number of unsustainable methods such as the use of fine-mesh (10 mm) nets, called *medokpokonou* installed as a funnel in small channels compromise the future of Benin's coastal fisheries. As stated above, productivity per hectare, even within *acadjas,* has declined.

Exhibit 15. Immediate Causes for Unsustainable Fishing of Benin's Coastal Lakes and Lagoons

Lack of alternative economic opportunities

Increasing population of fishermen

Breakdown of traditional rules ← Mitigating factor: co-management through committees

Open water areas treated as free access

Unsustainable practices in open waters   Proliferation of *acadjas*

Over-utilization

Change in ecosystem dynamics, species composition, and overall reduction in productivity

Contributing factors: overlapping institutional functions, weak institutions

D1b(2). Contamination

Fishing pressure is a likely contributor to the decline of Benin's coastal zone fisheries, but contamination is perhaps a more pervasive threat (Exhibit 16). There are three principal sources of contamination: household wastewater and solid waste, industrial waste, and pesticides (primarily from cotton cultivation).
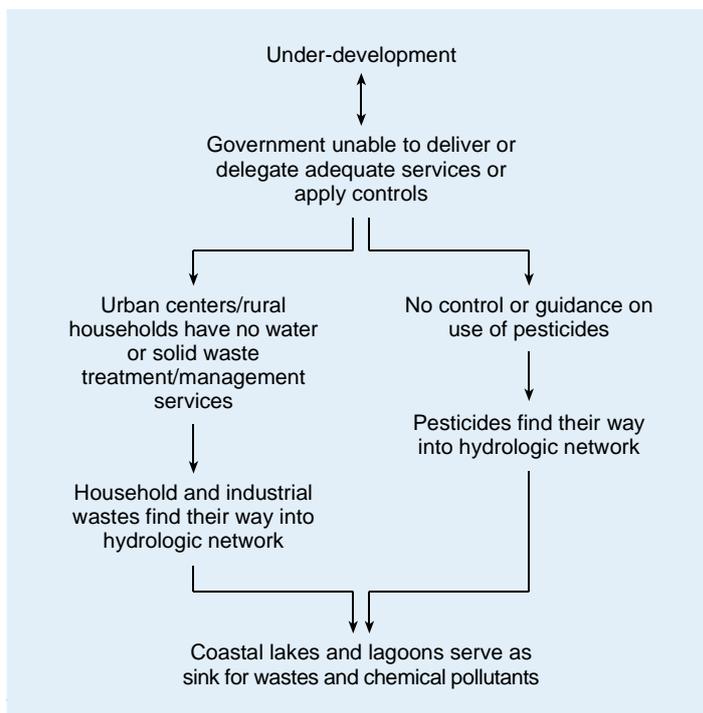
Only 15 percent of greater Cotonou households are served by garbage collection services. The remainder dumps their wastes in unoccupied spaces and in water bodies. Improperly disposed waste finds its way into rivers and streams. Nearly 3 percent of

households in greater Cotonou dump household waste directly into lakes and lagoons. An estimated one-third of industrial solid waste is discarded in rivers and streams that feed into Lake Nokoué. Only 35 percent of medical waste is incinerated; the remainder is treated as all other solid waste. In rural areas, households deal with solid waste by either dumping it straight into water bodies or disposing of it in pits, generally located adjacent to rivers streams and lagoons. Only 20 percent of households in Cotonou have septic tanks. The situation is likely to be even worse in upstream cities and towns.

Cotton accounts for 40 percent of Benin's export earnings. Conventional cotton cultivation uses a broad spectrum of pesticides including endosulfan and heptachlor. Pesticides destined for cotton are used in other crops as well. In a recent study the MEHU (2004) found that 22 percent of vegetable produce sampled were found to be contaminated with POPs including DDT, lindane, dieldrin, chlordane, and heptachlor. The MEHU (2004) study concludes that "the use of pesticides is abused particularly in cotton and for the protection of vegetable crops or the conservation of cereals." In 2000, 37 people associated with cotton farming died due to endosulfan poisoning. In 1999, 50 people died as a result of inhaling pesticides. In 1998 there was widespread contamination-related fish mortality in Lake Nokoué and Porto Novo Lagoon.

The National Plan for Implementation of the Stockholm Convention (MEPN 2007) identifies three related root causes for the misuse and abuse of banned and permitted pesticides: 1) the porosity of international borders, which allows for the importation of banned pesticides, 2) total ignorance on the part of agriculturalists and industrialists about the impact of pesticides on health and environment, and 3) chronic institutional weaknesses that compromise enforcement and information campaigns. We assume that strong institutions could reduce the misuse of pesticides by controlling imports, guiding farmers on pesticide management, and perhaps disseminating technology to reduce reliance on agrochemicals.

Exhibit 16. Cause and Effect Diagram for the Contamination of Benin's Coastal Lakes and Lagoons

Under-development

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Government unable to deliver or delegate adequate services or apply controls

Urban centers/rural households have no water or solid waste treatment/management services

No control or guidance on use of pesticides

Pesticides find their way into hydrologic network

Household and industrial wastes find their way into hydrologic network

Coastal lakes and lagoons serve as sink for wastes and chemical pollutants

D1b(3). Anthropogenic Changes in Ecosystem Structure and Processes

The dynamics of Benin's coastal lakes and lagoons have been severely altered by infrastructure projects, including the canalization of waterways and port expansion in the Cotonou/Porto Novo area, and the construction of the Nangbéto Dam on the Mono River in Togo.

The effect of the changes in the waterways in the vicinity of Cotonou and Porto Novo

on coastal lakes and lagoons is not well understood; however, ROCHE (2000) speculates that the infrastructure developments, particularly the construction of Cotonou's port, have altered the flow dynamics and salinity of Lake Nokoué. ROCHE (2000) and others (de la Vega-Leinert et al. 2000), report that the Nangbeto Dam built on the Mono River in Benin has had serious effects on the hydrochemical and hydrological conditions of downstream coastal systems and Lake Ahemé. Local fishermen maintain that marine species that once used these coastal ecosystems have disappeared. They also claim that dam construction was followed by the disappearance of a 30 to 40 m wide strip of mangroves that fringed large stretches of Lake Ahemé's shoreline. ROCHE (2000) reports that the effect of the Nangbeto Dam extends to Togo Lake in Togo. An estimated100 m³ of sediments are trapped annually by the dam. This change has resulted in serious changes in the morphology of the Mono River mouth (de la Vega et al. 2000).

D1c.   Exploitation of Endangered Species

Eight "endangered" or "critically endangered" species either live in Benin or use its territory during a critical stage in their life cycle.[5] The red-bellied monkey is threatened by the loss of forest cover in southern Benin. The reasons for forest cover losses were discussed above. The African wild dog resides in the Pendjari National Park, which receives considerable support from GTZ and other organizations. The other six "critically endangered" species are associated with the coastal ecosystems: three species of turtle and three species of fish.

The Pendajari hosts one of the last remaining elephant populations in West Africa.

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[5] These are exclusive of strictly marine fish species.

Threats to fish species are related to the degradation and overuse of Benin's coastal lagoons and lakes: overfishing, contamination, and change in ecosystem dynamics. Turtles face other threats related to the difficult economic situation of coastal populations and governance problems, such as the inability of government institutions to apply existing laws prohibiting the capture of turtles or harvesting of turtle eggs. Nature Tropicale, the Beninese NGO that works to conserve marine turtles in Benin, identifies the immediate threats to turtles that use Benin's coastal areas and beaches:

- Capture by fishermen in open water
- Capture of pregnant females on the beach
- The harvest of eggs and young turtles on the beach
- The anarchic development in coastal areas
- Predation of eggs and young turtles by domestic animals and wild predators
- Pollution of coastal areas and beaches

SECTION E. ACTIONS NECESSARY TO CONSERVE BIODIVERSITY AND TROPICAL FORESTS

E1. Decentralization: One Step toward Removing the Root Cause of Environmental Degradation

The colonial legacy of central government has proven to be a poor model of environmental governance for Benin. The resting of decision making locii from traditional local leaders and the transfer of environmental responsibilities to central government officers helped undermine time-tested cultural norms and practices. In many cases, the inability of central government to apply national laws and regulations at the local level transformed communal property into free-access resources.

Decentraliation is an important step towards the devolution of decision making to the local level. As such, it is more in line with traditional practice. Local level leaders and population are not only more cognizant of local environmental problems, but also better able to monitor the conditions on the ground. Hence, the decentralization of government functions and responsibilities could improve environmental management and conservation in Benin.

Nonetheless, the leap from the decision to decentralize to the implementation of the decentralization agenda is huge. While the national legal framework for decentralization is in place, much remains to be done at the local government level where new by-laws will have to be enacted. Furthermore, Benin's institutions have to be strengthened and transformed operationally, philosophically, and structurally in order to facilitate the implementation of the decentralization policy.

The time frame required for the full implementation of Benin's decentralization agenda is in the order of decades, well beyond the strategic planning horizon of most development agencies. There are, however, critical short-term actions that are needed if Benin is going to succeed in decentralizing government.

First, Benin's colonial and post-independence past left in place an institutional framework designed for centrally controlled decision making and implementation. To effectively support the implementation of the decentralization policy, Benin's central government institutions have to be transformed from entities that historically were used

to implement and enforce centrally made decisions, to institutions that work with local-level government and civil society institutions to help them develop and implement local-level environmental strategies and programs. This transformation can be achieved through a training program that emphasizes participatory planning and implementation methods. The institutional framework and legal mandates must also be reviewed and modified to answer the demands of a decentralized administration and minimize overlaps, duplications, and contradictions in mandates.

Second, Benin's local-level government institutions and civil society are unable to effectively assume their responsibilities. In order for them to be effective partners with central government institutions, donor agencies, and civil society organizations, their capacity has to be strengthened. They will require material and technical support for some time to come.

Third, the national-level decentralization policy is not matched by local-level by-laws. Furthermore, some sectoral legislation is incompatible with a decentralized government model and Benin's socio-economic realities. Hence, there is a need to help local–level governments develop by-laws related to the environment. However, this exercise must be preceded by a review and modification of sectoral legislation to make it compatible with a decentralized system of government. The emphasis on command and control should be shifted to an emphasis on empowerment and accountability.

Finally, without appropriate oversight and accountability decentralization could have undesirable outcomes. Local-level leaders must be held accountable to the local population through transparent and fair democratic processes.

E2. Priority Actions to Tackle Proximate Causes of Losses in Biodiversity and Tropical Forests

Biodiversity and tropical forest losses are serious problems in Benin and compromise the wellbeing of its population. The problems are too complex for Benin to tackle alone. Solutions for the immediate causes of biodiversity and tropical forest losses will only be sustainable if Benin can create alternatives to the unsustainable exploitation of the country's natural resources by a desperately poor population. Below we address those problems that could be within the management interest of development agencies, and the current capabilities of the GOB.

E2a. Slowing Down Loss of Vegetation Cover

The principal cause for the decline in forest cover is the expansion of cultivated areas, which will continue for as long as Benin remains a largely agricultural country and its population continues to grow. Nonetheless, the rate of expansion of cultivated areas may be reduced if improved agricultural practices are widely adopted.

Most cultivation in Benin is slash-and-burn. This is a result of the reduced fertility of most of the country's soils and the relatively high cost of chemical fertilizers. Under these conditions, farmers are only able to cultivate a given plot for a few years, after which they clear new areas. The abandoned areas are left fallow to allow recovery of soil fertility. This system is sustainable under low population pressure, but in Benin it is reaching its breaking point.

There are tested agroforestry technologies that help maintain soil fertility without the use of chemical fertilizers. These have been tested throughout Africa under conditions similar to those in Benin such as in certain areas of Malawi, Kenya, Burkina Faso, Mali, Senegal and a range of other African countries. The adaptation of these technologies to the Beninese context can help reduce the pressure that shifting agriculture places on the country's remaining natural vegetation. A side benefit would be the extraction of firewood from agroforestry plots that would help reduce the pressure on natural vegetation patches and tree plantations while creating an alternative source of income for rural families.

Besides agroforestry there exists a broad spectrum of improved agriuclutral technologies suitable to Benin, chief among them improved soil management through, increased use of legume in crop rotations, incorporation of organic matter, erosion control practices (vetiver grass), and the use hardy varieties that are better able to cope with reduced fertility and competition from weedy species. Other potential technologies include micro/drip irrigation, composting, and the approprtiaet integration of livestock into farming systems.

E2b. Reducing Pressure on "Endangered" and "Critically Endangered" Sea Turtles

As indicated above, three "endangered" or "critically endangered" species of marine turtles (green, leatherback, and hawksbill) use Benin's coastline for either foraging or laying their eggs. Poor households that populate the country's eastern coastline capture adult females and raid turtle nests. These practices severely impact the population of these migratory animals, and regional species are likely to face extinction.

The contribution of turtle eggs and meat to the nutrition of the local population is likely to be small in light of the short nesting season and the low volume of turtle meat harvested. Turtle products can be removed from the local diet without seriously affecting the nutritional status of coastal families. Hence, it is a problem that could be mitigated through education particularly of the local leadership. Nonetheless, it is unlikely that these populations will abandon the exploitation of a free-access resource without a replacement food source or an equivalent tangible benefit. Effective controls, a service the GOB is unable to carry out, will also be necessary.

In light of the above, the salvation of Benin's marine turtles requires an integrated approach that includes the following elements:

- Education at the elementary and secondary school levels
- A community-based patrolling system against nest raiders
- A community-based turtle reproduction program
- The provision of incentives for turtle protection and conservation
- Support of government agencies
- Development of a locally-manged ecotourism program centered on sea turtles.

These elements were part of a successful turtle conservation program in Honduras. First, teaching materials were developed using the turtle as the main theme. For example, the turtle life cycle was used to teach life-cycles in general and turtle ecology

was used to teach ecological principles. Second, community members were recruited to patrol beach segments during the nesting season. In exchange, participating families received food rations from the World Food Program. Third, the community established a communal turtle reproduction center. Turtle eggs could be transported there and guarded. Fourth, school children were involved in the release of baby turtles. The program's success was attributed to the pressure school children placed on the grown-ups.

In Benin, the government must legally recognize the authority of turtle conservation guards and provide enforcement support.

E2c. Saving the Red-Bellied Monkey from Extinction

The subpopulation of red-bellied monkey is reportedly endemic toBenin. Protecting this species from extinction hinges on protecting the few remaining patches of its habitat. It may also be necessary to set-up a breeding program under captivity or partial captivity. The first of these is the preferred alternative as the forest patches preferred by the Benin red-bellied monkey are remnants of the most biodiverse vegetation type in the country.

Among the few remaining options, the Lama Forest looms as one candidate for conservation efforts aimed at the red-bellied monkey. The patch has been the subject of a number of biological and sociological studies that provide a solid foundation upon which a participatory management and conservation plan could be developed.

E2d. Reducing Contamination of Aquatic Ecosystems by Agrochemicals

Cotton is Benin's most important cash crop. Understandably the surface area of cotton cultivation has increased over the years and with it the use of agrochemicals, most notably pesticides.

The National Plan for the Implementation of the POPs Convention recognizes that Benin's farmers are ignorant about the dangers and application methods for pesticides, therefore placing both their health and the ecosystem in danger. It is not surprising that pesticide residues are widespread in Benin's hydrological network. A program to teach farmers how to manage and either diminish or avoid the use of pesticides could help reduce the level of contamination and health risks associated with pesticides. Perhaps the cultivation of organic cotton could give Benin a competitive advantage in the highly distorted global cotton market.

SECTION F. LINKS TO USAID STRATEGY AND PROGRAM AND REFERENCE TO THE MILLENIUM CHALLENGE CORPORATION

F1. Links of Proposed Strategy with Biodiversity and Tropical Forests

USAID/Benin's Strategy Statement dated February 13, 2006, specifies two strategic objectives:

1. Ensure that a quality basic education is more widely available on an equitable and sustainable basis
2. Expand the use of family health services, products, and preventive measures within a supportive policy environment

Neither of these strategic objectives is explicitly linked to tropical forests or biodiversity; they are, however, two key components of development. People rely on agriculture and resource exploitation to try to meet household needs and a resource-starved government is unable to provide the services or apply the controls needed to mitigate the pressures exerted by the growing population.

From this perspective, one can assume that by addressing two critical components of development, USAID/Benin's strategy contributes to the reduction of threats to biodiversity and tropical forests over the long-term. If history repeats itself, improved family health care and reduced mortality will lead to a reduction in the growth rate of population. It is also true that a better educated society tends to have smaller families.

USAID Benin can also work to integrate environmental considerations (including environmental health, energy savings, etc.) into curriculum development and the provision of family health services. The links are clear and with simple modifications to the existing program, these important messages can help improve conditions within the target communities while helping to conserve the natural resource base.

F2. Suggestions for How to Strengthen Linkage between Environment and Proposed Strategy

Part of USAID/Benin's health activities will be directed at reducing malaria infection rates. Malaria prevention currently focuses on limiting contact between the vector (*Anopheles spp.*) and people through the distribution of bed nets. This strategy does achieve fast results but its impact is short-lived. Bed nets have a limited useful life, and many in rural areas do not have the resources to purchase new bed nets.

USAID/Benin should consider incorporating into its health strategy an environmental health component aimed at reducing the habitat for the *Anopheles spp.* larvae. This may include improving the management of household solid waste and perhaps waste water. USAID/Benin could also combine its interest in health and education by incorporating an educational element related to the dangers and manipulation of pesticides, especially since the use of pesticides is often part of malaria control programs.

USAID West Africa is supporting the West African Cottong Improvement Program (WACIP) in four countries; Benin is one of the four. WACIP aims to improve the productivity of cotton, promote institutional and policy changes in the cotton sector and

improve value-added through niche processing and marketing opportunities. WACIP will work through local organizations, institutions and farmers associations to achieve these objectives. WACIP will also be promoting Integrated Pest Management as a means of increasing production while reducing the environmental and economic costs associated with current pest control practices. In Benin, cotton farming is expanding in areas of high biodiversity value (eg. Pendjari National Park). USAID WA and USAID Benin should work with the WACIP grantee (International Fertilizer Development Center – IFDC) to target cotton growing areas proximate to key biodiversity zones.

F3. The Millenium Challenge Corporation

USAID's budget is small, but the Millenium Challenge Corporation (MCC) signed a $307,000,000 compact with Benin. These resources will be used to improve port facilities, help clarify and resolve land-tenure issues and improve access to micro-finance services.

Benin's port is used by landlocked countries, creating an income opportunity for the country. It is also true that the chaotic land-tenure situation serves as a deterrent to rural development. Access to micro credit may also catalyze economic activity in rural areas, thus spurring development.

If underdevelopment and its derivative population growth are the root causes of environmental degradation, one could assume that, by contributing to economic development, the MCC is implicitly helping Benin solve its environmental degradation problems. On the other hand, if the MCC provides funds without the proper environmental reviews and safeguards, those funds could accentuate certain negative trends. For example, port construction could further damage the ecology of coastal lakes and lagoons if micro credit were used to increase the use of pesticides.

Nonetheless, the change from a traditional system of allocating land to one based on formal titles and the creation of a rural real estate market may actually exclude rural people from access to land resources and a source of livelihood. This may compound the north-south migration trend and place further pressure on the already stressed coastal lagoons and lakes.

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APPENDIX A. LIST OF INDIVIDUALS INTERVIEWED AS PART OF BENIN'S FAA 118 AND 119 ANALYSIS

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APPENDIX B. SCOPE OF WORK

Team Leader, 118/119 Biodiversity and Tropical Forest Assessment, USAID/Benin

A. Purpose and Objective

The team leader will lead a two-person team (the team leader and a local technical specialist) to conduct an assessment of (1) the current state of biodiversity conservation and forest management in Benin, (2) the actions necessary in Benin to better conserve tropical forests and biological diversity, and (3) the extent to which the actions proposed for support by USAID/Benin meet the needs thus identified. This assessment is intended to serve as a planning tool to assist USAID/Benin in better understanding and considering conservation options in their proposed programs in the near term and medium term. The assessment is necessary to comply with sections 118 and 119 of the Foreign Assistance Act of 1961, as amended, as well as critical to inform the Strategic Framework for Foreign Assistance and country strategy guidelines under ADS 201.3.4.11 and ADS 204.5. Current guidance is included in the REFERENCES FOR USAID FY2007 OPERATIONAL PLANS dated January 10, 2007.

A previous 118/119 Biodiversity and Tropical Forest Assessment was completed in Benin in December 2005, as an annex to the 2006 Strategy Statement for Benin, and represented the first part of a two-step process aimed at completing a full environmental assessment for USAID Benin. This assessment provided a preliminary summary of the status of Benin's biodiversity and forest resources, including principal threats. The current assignment will build on this work and involve a more comprehensive analysis of the sector and will include interviews and field work to be conducted by a two-person team.

B. Background

Located in West Africa, Benin is bordered by Togo to the west, Burkina Faso to the northwest, Niger to the northeast, Nigeria to the east, and the Gulf of Guinea along a 125 km coastline to the south. Within Benin four distinct zones include 1) the mountainous region in the northwest, which is the main watershed for Benin; 2) coastal zone, which is a relatively narrow strip of land that contains all of the mangroves and estuaries, and some of the most important lakes in Benin; 3) plateau region, made up of clay and sand deposits, that is found just north of the coastal zone and continues about 100 km inland; and 4) Benin Peneplain (large plateau) that increases in elevation very slowly from south to north. Elevation ranges from 0 to 800 m, except in the Atacora Highlands and a few other areas. The population of Benin is estimated at about 7.8 million people (2006), with more than half of the population living in the southern 10 percent of the country.

In 1991 Benin initiated a National Environmental Action Plan process designed to critically review all sectors in relation to the environment and the management of natural resources. The Environmental Action Plan was completed and written into law in 1993. Concurrently, Benin participated in the 1992 International Conference (held at Rio de Janeiro) that developed the Convention on Biological Diversity (CBD), and Benin is a signatory to the convention. This was completed June 30, 1994. A directive

of the CBD is for each signatory country to develop a national strategy and action plan to conserve biodiversity through an iterative and participatory process. Benin began this process in 2000 and completed the National Strategy and Action Plan for the Conservation of Biodiversity in March 2002. In addition to the CBD, Benin is a signatory to the Cartagena Protocol on Biosafety, the Climate Change Convention and the Convention for the Fight against Draught and Desertification. Benin is also a signatory to the Ramsar Convention (conservation of wetlands) and the Bonn Convention (to protect migratory species). A stated objective of Benin's National Development Strategy is to fight environmental degradation and guarantee the protection of Benin's biodiversity resources. In this regard, the issue of sustainability is clearly a guiding principle, where the country will strive to achieve a balance between consumption and replenishment levels.

C. General Task

The team leader will lead a two-person team (the team leader and a local technical specialist) to conduct an assessment of biodiversity and tropical forest ecosystems, governing institutions, and policy framework in Benin. The focus of all activities taken under this assignment is threefold: 1) assess the conservation status of biodiversity and forests in Benin, 2) identify actions necessary to better conserve biodiversity and tropical forests, and 3) describe how and to what extent actions proposed in the country operational plans meet the biodiversity and tropical forest needs thus identified.

D. Specific Tasks

The team leader (coordinating with Chemonics' home office and local technical specialist) shall perform the following activities:

1. *Data Collection.*
   a. Prior to departure, meet or phone the Bureau Environmental Advisor, other Bureau for Africa technical staff, suggested Department of State interested parties, and other organizations to gather relevant information on regional programs and agency environmental regulations.
   b. Obtain, review, and analyze existing documentation on biodiversity conservation (and tropical forest conservation) in Benin, such as that prepared by government agencies, bilateral donors, and national and international NGOs. Available online materials will be gathered priory to the country visit (links to examples are shown in Section F).
   c. Meet with USAID/Benin to get an understanding of the Mission's ongoing sectoral assessments, program goals, and objectives under its proposed strategy. The Mission also may provide the team with advice and protocol on approaching USAID partners, diplomatic entities, and host country organizations with respect to this assignment. The team will discuss organizations to be contacted and any planned site visits with the Mission and coordinate as required.
   d. Meet with relevant ministries and agencies, donor organizations, international NGOs, and other organizations that are involved in forest and biodiversity conservation or cross-cutting issues, or which are implementing noteworthy projects, and gather relevant information.
   e. Conduct one to three priority site visits, if necessary, to supplement the understanding gained from interviews, literature, and other second-hand sources.

The preliminary itinerary includes a site visit to coastal ecosystems, which include mangroves, lagoons, estuaries, as well as to the Lama Forest (the only significant moist evergreen forest in Benin). Short side trips to local governments, agricultural lands, and protected areas will be incorporated as feasible.

2. *Analysis*. Summarize the status of biodiversity and tropical forests in Benin. Summarize the social, economic, institutional, legal, and policy context for their use and conservation, including actions being taken by government, other donors, NGOs, and the private sector. Identify the key direct and indirect threats to biodiversity and tropical forests. Identify the actions necessary to conserve and sustainably manage natural resources and biodiversity and tropical forests in Benin based on analysis of country donor and NGO responses currently in place to meet these needs.

3. *Report*. Prepare a report on the status of biodiversity conservation efforts in Benin and implications for USAID or other donor programming, which shall define the actions necessary for conservation. The team leader may divide the initial drafting of particular sections of the report with the local technical specialist but shall be ultimately responsible for a final report including elements. This report shall clearly meet the legal requirement of FAA Sec 118 and 119. An illustrative outline for the report is provided below:

   f. Introduction, describing the purpose of the analysis and methods used in conducting it, including the timing of the analysis in relation to the timing of USAID strategy development
   g. An overview of the social, economic, legislative, and political context for sustainable natural resources management and the conservation of biodiversity and forests in Benin
   h. An overview of the status of tropical forests and terrestrial and marine biodiversity in Benin, including ecosystem diversity, species diversity, threatened and "endangered" species, genetic diversity, agricultural biodiversity, ecosystem services, and protected areas. Economic importance and potential values of biodiversity will also be included
   i. A summary of government, NGO, and donor programs and activities that contribute to conservation and sustainable natural resources management, including a brief assessment of their effectiveness, strengths, and weaknesses.
   j. An assessment and analysis of the threats to tropical forests and biodiversity, including direct threats and indirect root causes of such threats
   k. A description of those programmatic actions necessary to conserve biodiversity and forests in Benin
   l. An assessment of how USAID/Benin's program currently addresses the key threats to biodiversity and forest conservation, including how activities may be modified to more effectively address these issues for future planning
   m. All references used and cited in the report, including web URLs
   n. Cartographic information; all primary refs should be included on CD
   o. Appendices will include the SOW for the analysis, biographical sketches of analysis team members, a list of persons contacted and their institutional affiliation, and other background or supporting material as needed, including maps and photographs

E. Deliverables

The primary deliverable under this assignment is the above referenced report with an assessment of 1) the status of biodiversity and forest conservation in Benin, 2) the actions necessary in Benin to conserve tropical forests and biological diversity, and 3) the extent to which the actions proposed for support by the USAID meet the needs thus identified in the assessment.

There shall be four deliverables under this activity:

1. *Preliminary Work Plan and Schedule*. The team leader shall work with the local technical specialist and Chemonics home office staff to provide USAID with a work plan and schedule prior to traveling to Benin.
2. *In-Country Mission Exit Briefings*. The team leader shall meet with USAID/Benin to provide a brief of the report findings. The exit brief shall be accompanied by a short written summary of initial key findings and recommendations.
3. *Draft Report*. The team leader shall submit a draft report to Chemonics no later than one week after the field assignment to Benin, and work with Chemonics to submit a draft to the USAID Environment Office no later than May 21, 2007. The draft report shall follow the generic outline discussed above, as refined during the course of the contract in consultation with USAID.
4. *Final Report*. The final report is due no later than two weeks after receiving USAID/ Benin comments on the first draft report.

F. Duration of Assignment and Estimated LOE

Meetings, phone calls, and preparatory research will take place mid to late April prior to departure for Benin. Work in Benin will take place from the end of April/beginning of May for a period of 8 workdays in Benin. Estimated LOE for this assignment is 16 days, composed of 2 days for preparatory work, 8 workdays in Benin, 2 days for follow-up and report writing, and 4 days for travel.

G. Supporting Documentation

Tropical forestry and biodiversity (FAA 118 and 119) analyses: lessons learned and best practices from recent USAID experience. (655 KB) Associates in Rural Development, Inc. (ARD); USAID. EGAT. Office of Environment and Natural Resources. Sept 2005. 74 p. PN-ADE-195

Best practices for biodiversity and tropical forest assessments. (508 KB) Chemonics International Inc.; USAID. EGAT. Office of Agriculture. Apr 2005. 28 p. PN-ADE-673

USAID/Benin FAA 118/119 Environmental Analysis. December 2005.

Convention for Biological Diversity Clearinghouse — Benin, including the National Biodiversity Strategy and Action Plan, and National Reports.