

Annex

USAID/Benin FAA 118/119 Environmental Analysis

USAID Benin: Initial Biodiversity and Natural Forest Conservation Assessment for Current Strategic Planning – December 2005

Overview

This report represents the first part of a two step process aimed at completing a full environmental assessment for USAID Benin. The current report provides a preliminary summary of the status of Benin's biodiversity and natural forest resources, including principle threats. It also contains a brief analysis of how current Mission programs in the new strategic plan could address some of these threats. The second part of this study will involve a comprehensive analysis of the sector and will include interviews and field work. That work will build on this report and will be completed during the first six months of 2006.

Much of the information used for this report was taken from, "Strategie Nationale et Plan d'Action pour la conservation de la Diversite Biologique du Benin" which was completed in 2002. The document is very useful, but some of the information is incomplete or vague; other information is missing all together (including the status of amphibians and butterflies – both groups recognized as key indicators of habitat health). These shortcomings should be taken into consideration when completing the second part of this study.

In addition to the summary, this report is divided into three sections:

1. Background (contains basic biophysical and socio-economic information);
2. Forest and Biodiversity Conservation, including threats;
3. USAID Benin

Summary

Benin contains key pockets of biodiversity and a limited number of important forest types; however, its importance as a haven for biodiverse areas and natural forests is less than most of its regional neighbors because of two key factors. First, the most biodiverse terrestrial ecosystems are the humid tropical forests, and Benin contains very few of those forest types. Second, the most biodiverse marine ecosystems are the coral reefs; again, Benin (as well as the rest of the West African states) is lacking that key ecosystem. The humid forest zone, which runs from Guinea to Cameroon, is missing in Benin due to a regional climatic feature known as the "Dahomey Gap." Cold water currents in the Gulf of Guinea (from central Ghana, east to Nigeria) which reduce the levels of evaporation along the coast, and a general slope that runs northeast to southwest (and captures less moist air arriving from the east) combine to create a "Sahelian" type climate along the coast. In this "gap" rainfall averages about 800 mm/year. Dense tropical forests need a minimum of 1500 mm/year to thrive. As a result, most of the coastal vegetation associated with the Dahomey Gap is savannah-like, and only about 2 percent of Benin is covered by dense forests (in the south). These forests are also associated with some of the more fertile soils, and as a result they are located in areas of high population densities. Other threats to biodiverse areas includes cotton production zones (central and northern Benin) from land conversion and pesticide use, energy demands for fuelwood (including charcoal), a high population growth rate (3.2 percent), low literacy rates and low income levels. Current biodiversity inventories are far from complete; the lack of good baseline information is noted as a major constraint to developing sound conservation strategies. USAID Benin has not targeted biodiverse or natural forest areas for specific activities under their health, education and governance programs.

I. Background

Benin is located between latitudes, 6 degrees, 30 minutes north and 12 degrees, 30 minutes north, and longitudes 1 degree east, and 3 degrees, 40 minutes east. The western border is

shared with Togo, the northwestern border with Burkina Faso, the northeastern border with Niger, and the western border with Nigeria. To the south, Benin adjoins the Gulf of Guinea along a 125 kilometer coastline.

Benin sits on the West African craton or shield, a geological feature characterized by precambrian parent basement rock (from 4.5 billion to .5 billion years old) with more recent sedimentary layers. Within Benin there are four distinct zones that include: 1) Mountainous region (associated with the Atakora mountain range) located in the northwest Benin – the range that runs northwest by southeast and continues into Togo and Ghana. This area is the main watershed for Benin, and it is the source for the Oueme, Pendjari and Mekrou rivers; 2) The Coastal zone, which is a relatively narrow strip of land that contains all of the lagoons and some of the most important lakes in Benin; 3) The Plateau region made up of clay and sand deposits that is found just north of the coastal zone and continues about 100 kilometers inland; and 4) The peneplain of Benin (large plateau) that increases in elevation very slowly from south to north. Elevation ranges from 0 to 800 meters except in the Atakora mountains and a few other areas.

Benin's soils are highly variable, but in general there are 5 major soil types that include: 1) Ultisols (also known as Ferrisols or Luvisols), among the most common soils found in the tropics (and in Benin – represents about 80 percent of the country's soils), which are heavily weathered, low in nutrients and not optimal for agriculture; 2) "Terre de Barre" (Alfisols) that are good agricultural soils found on the southern plateau - although this soil group covers about 5 percent of the country, almost half of Benin's population reside there; 3) Fluvisols, deposits found in valleys and plains (5 percent); 4) Vertisols (black cotton soils) that are relatively fertile but difficult to manage/work because of their "swelling and shrinking" nature (5 percent); and 5) Sandy mineral soils of the coastal area which are low in fertility (5 percent).

In all, Benin is covered by about 333km² of lakes and lagoons. The river system is extensive and in total is 3050 kilometers long. The network of rivers forms the boundaries of a number of ecosystems, and their associated riverine forests enhance levels of biodiversity. Benin has three climatic zones. The southern zone has an average rainfall of 900-1500 mm/year; it is humid and has four seasons (two wet, two dry). This zone contains the best soils, vegetative growth and the highest levels of biodiversity. The central zone has similar annual rainfall level but only two seasons. The central zone also is known for larger temperature fluctuations than the southern zone. Finally, the northern zone is the driest and averages 900 mm/year with two seasons. The northern zone has the highest evapotranspiration deficit.

Benin has six main vegetation zones largely derived from the climate and the soils. They include: the coastal zone, which contain grasses and some intermittent forest areas, the swamp forests of southern Benin, the dense humid forest associated with the southern plateau and located between the coastal zone and the inner plateau region (these forests are highly fragmented with well conserved pockets), the dry forest transition zone, which contains some of the more valuable timber species (*Khaya sp.*, *Pterocarpus sp.*, *Azelia africana*, *Diospyros sp.*), the riverine forests, and the wooded savannah.

The population of Benin is estimated at about 6.9 million people. More than half of the population live in the southern part of the country, which represents only about 10 percent of the total land area. As in many West African countries, a large percentage of the population is young; 45 percent of Benin's population is 15 years old or younger. The average population growth rate is a relatively high 3.2 percent. Illiteracy rates are also high, at about 70 percent. There are three major religious groups in Benin: Christianity (about 36 percent), Animism (35 percent) and Islam (20 percent).

Benin has been liberalizing its economy and actively pursuing democratic political reform during the past 15 years; this reform also includes a recently launched national decentralization program. Benin has also undertaken a nation poverty reduction strategy. Despite Benin's reform efforts, it still remains a very impoverished nation. It ranks 131 out of 174 countries in terms of

average annual income per capita. About two-thirds of the population is located in rural areas, and some of these groups suffer regularly from food insecurity. These areas are also where population pressure is high on biodiversity.

In 1991 Benin initiated a National Environmental Action Plan process that was 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 that developed the "Convention on Biodiversity (CBD)" (held at Rio de Janeiro), and Benin is a signatory to the convention. This was completed by 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" by 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.

II. Forest and Biodiversity Conservation, including threats.

Forested Areas

Benin contains about 26,500 km² of forest area¹, with about 98 percent of this being natural forest and the rest plantations. Forests cover about 24 percent of the total land area in Benin. Within the 24 percent however, the overwhelming majority of forest cover has a crown closure of less than 50% (i.e., the ground area covered by tree crowns is less than 50 percent). This means that most of Benin's remaining forests are either sparsely stocked dry forests or wooded savannas. Only 2 percent of Benin is covered by a closed canopy forest where the tree crowns cover 75 percent or more of the ground area (typically associated with dense humid forests or deciduous forests found in the southern part of Benin). These are also the forests that harbor the highest levels of biodiversity.

The largest of the closed canopy forests is the Classified Forest of Lama, which covers an area of only 1900 hectares. In the same region there are numerous forest fragments that range in size from a few hectares to as much as 100 hectares or more; many of these are sacred/traditional forests. Some of the key tree species found in these forests include *Cieba pentadra* (Kaopok or cotton tree), *Triplochyton scleroxylon*, *Chlorophora excelsa* (iroko), *Terminalia superba*, *Holoptelea grandis* and *Piptadeniastrum africanum*. Wildlife associated with these forests includes a number of rare and threatened species including, the red-fronted monkey (*Cercopithecus erythrogaster*), the Mona monkey (*Cercopithecus mona*), the "magistrate" colobus (*Colobus vellerosus*), the olive colobus (*Colobus verus*). It is believed that the red-fronted monkey could be endemic to Benin; unfortunately, it is also seriously threatened and limited to the Lama forest and Oueme Valley. Other wildlife species found in these forests include the blue duiker (*Cephalophus monticola*), the tree hyrax (*Dendrohyrax aboreus*), the Seba python (*Python sebae*), black and green mambas (*Dendroaspis* spp.), guinea fowl (*Guttera edouardii*), civit cats, mongoose, and servals.

The dry forests and open forest (woodlands) are found to the north of the closed canopy forests and represent a transition zone between the coastal region and the savannah. This area also contains a number of riverine forests which are locally important refuges for biodiversity. The

¹ *Forests, as defined by the FAO, is a piece of land in excess of 5 hectares that has tree crown cover in excess of 10%.*

predominant dry forest tree components include two species of the genus *Isoberlinia* as well as the commercially important *Azelia africana* (lingue), *Khaya senegalensis* (mahogany), and *Pterocarpus erinaceus* (dark brown wood used for furniture and wood carvings). The riverine tree species include *Beerlinia grandiflora*, *Parinari congensis*, *Detarium senegalense*, *Diospyros mespiliformis*, *Dialium guineense*, *Khaya grandiflora* and *K. senegalensis* (both mahoganies), *Millettia thononii*, and *Erythrophleum saueolens*. The wildlife species found in the dry and riverine forest types are essentially the ones associated with savannah areas. Species include the several large antelope species (Roan antelope, hartebeest, Defassa's cob), bushpig, buffalo, vervet monkeys, and several reptile species. These are forests that are threatened each year by wildfire.

The wooded savannah is the largest of the forest cover types. While the number of tree species is relatively few, and dominated by two genera of the Combretum family (*Terminalia sp.* and *Combretum sp.*) and occasional baobabs (*Andansonnia digitata*), these forests contain the richest diversity of medium to large mammals, including lion, leopard, hyena, cheetah, elephants, as well as the species listed above for the dry and riverine forests. Birdlife is especially rich in the savannah zone as well, and includes species such as the crowned crane, marabou stork, ground hornbill, eagles, canaries, and others.

There are two other forest types that are mainly found in the south, the swamp forests and the mangroves. Swamp forests are imbedded in a mosaic of different vegetation types which include both moist and inundated grasslands, papyrus swamps, and other zones. The dominant tree species are *Mitragyna inermis*, *Cola laurifolia* and *Raphia palm*. Swamp forests are rich in fish and crustacean species, and they are key habitat for migratory birds. Other species found in the swamp forests include the "water antelope", the sitatunga (*Tragelaphus spekei*), the African clawless otter (*Aonyx capensis*), the spotted necked otter (*Lutra maculicollis*), monitor lizards (*Varanus niloticus*) and the crocodile. Mangroves cover about 6900 hectares and are dominated by two tree species: *Rhizophora racemosa* and *Avicennia germinans*. Wildlife associated with mangroves include fish and crustaceans (breeding and feeding grounds for both), reptiles, birds and the mona monkey.

Deforestation rates in Benin from 1990 through 2000 are alarmingly high. During that decade it is estimated that the total natural forest area was reduced by 22 percent. The main reasons for deforestation are clearing for agriculture, overgrazing naturally regenerating areas, seasonal burning (especially threatening to dry forests and wooded savannah), and the overexploitation of wood fuel as an energy source – more than 90 percent of the population depend on fuel wood and charcoal for their domestic energy needs. In relation to agricultural expansion, the combination of low soil fertility and repeated wildfires increases the pressure to convert remaining forest lands.

Within the different forest types there is a considerable demand for certain forest species that provide both subsistence and commercial benefits (non-timber forest products like ropes, resins, medicinals, mushrooms, etc.). The consumption rates and methods are generally not well monitored, and some of these species are becoming rare in select locations. In cotton growing zones, natural systems are threatened by the misuse of pesticides. Seasonal livestock herding is a major threat to protected areas, especially in the northern regions. Natural regeneration is trampled and over browsed, which puts domestic herds in direct competition with the native wildlife for the same resource.

Poaching (for household consumption or the bush meat trade) is also a serious threat to biodiversity throughout the country. West Africa has the highest bush meat consumption levels on the continent. Fortunately, certain species in specific locales also have cultural and traditional value. They are often found in sanctuaries and are protected by residents. Other species have disappeared entirely. A few of the more noteworthy include the rhinoceros (*Rhinoceros bicornis*), and the Bongo (*Tragelaphus eurycerus*), which was last seen in the forest of Mount Kouffo in the 1970s. Other mammals that are listed as threatened or rare include: the olive colobus monkey,

the magistrate colobus, the cheetah, the leopard, hunting dogs, topi, the tree hyrax, the dugong, and the giant pangolin. In addition to poaching, habitat destruction is a major threat to biodiversity; this is especially true in the classified forest areas where wildlife protection is weak or non-existent.

Non-forest Zones

Highlands include the Atacora mountain range as well as the inselbergs (large and conspicuous rock outcroppings) found throughout the northern parts of Benin. Vegetation includes *Afrotrilepsis pilosa* and *Hymenodictyon floribundum*. Mammals found in these areas include the rock hyrax, baboons, patas and vervet monkeys, rabbits and rodents. Several species of bats are also found around the inselbergs.

Ocean diversity is associated with the continental shelf, which covers an area of about 3000km² off the coast of Benin. Marine fish species number about 450. Marine algae numbers about 123 species. Fish and crustaceans are heavily exploited both by artisanal and industrial means. Giant sea turtles also use the beaches of Benin for nesting. In the coastal areas vegetation is dominated by palms and grasses such as *Remirea maritima*, *Impomoea pes-caprae* and *Chrysobalanus icaco*. These areas are also the home to shore birds and crustaceans (mostly crabs). Coastal zones and waterways are threatened by pollution and sedimentation buildup.

Freshwater systems contain high levels of biodiversity. Large mammals include the hippopotamus (*Hippopotamus amphibious*) and the West African manatee (*Trychecus senegalensis*), both of which are found in internal waterways. These areas are also the home to the Nile Crocodile (*Crocodylus niloticus*). The main river basins are the Oueme, Couffo, Mono, Volta and Niger. The Oueme is the largest in Benin and contains a total of 110 aquatic species. Threats to freshwater systems include pesticide use for agriculture (especially in the Borgou and Zou regions); overfishing and destructive fishing techniques, destruction of aquatic species breeding grounds, dam construction/change in river bed and flood areas, and deforestation of the waters edge and side slopes of lakes and lagoons.

Summary of status and threats of different groups

Insects and other invertebrates. The study of Benin's insects is a work in progress (like most other groups). To date national insect collections are housed in several organizations and include 2592 species. As would be expected, much of the collecting has been made in relation to species that could be a threat to food crops. This is also the reason why insects receive a fair amount of attention compared to other taxonomic groups. Apart from agricultural pests, insects associated with natural ecosystems are not well studied (e.g., forest insects, wetland insects, etc.). An unknown number of insect species have disappeared after repeated wide spread application of pesticides during the establishment and management of agricultural industries.

Fresh water fish and crustaceans: In all, there are about 180 species, which include: 58 species found in the coastal lagoons; 68 species found in Lake Nokoué; 72 species found in the lagoon of Porto Novo; 52 species found in Lake Ahémé; 22 species in the Toho lagoon; 60 species found in the Ouémé River; 30 species found in the Niger River. These species are overexploited in all locations: The use of illegal fish nets is the leading cause for the rapid depletion of existing stocks. Other threatening factors include, pollution from pesticides, industrial water discharge, discharge of petroleum products, invasive plants (e.g., water hyacinth), poisons illegally used for fishing, and non-enforcement of seasonal limits on activities.

Marine life: As noted above, there are about 450 species of marine fish for Benin. Of these, about 260 are exploited commercially and a select few are vital to resident fishing communities. Some (about 77) also have value for the sport fishing trade. There are roughly 3,000 artisanal fishermen who depend on marine fish stocks and about 20 local commercial fishermen. It is generally recognized that foreign fishing vessels are severely depleting marine fish stocks in West Africa (especially off the coast of Ghana). While it is assumed that this is also a problem for Benin, there is little available information at this time. Invertebrate species are estimated in the

hundreds of thousands but poorly studied. A number are economically important. Algae and phytoplankton are also not well studied.

Reptiles. Reptiles are not well studied in Benin. At this time it is believed that there are about 66 species of snakes, 5 species of lizards (2 of which are monitors), 2 species of chameleons, 2 species of crocodiles and 7 species of turtles (5 of which are marine). While most reptiles are eaten by local residents, the greatest threat to reptiles comes from their commercial exploitation for exportation to European markets. Individual animals and their eggs are collected for the pet and zoo trade. In addition to reductions in local species diversity, this is having a noticeable impact on agricultural production systems as many of the rodent populations that cause damage to food crops are expanding due to the decreasing numbers of their main predators, reptiles. Limits on the quantity of reptiles exported are not respected and many leave Benin illegally through the border with Togo where they are then shipped to Europe. .

Birds. Limited systematic inventory work has confirmed that there are 371 species of birds in Benin, but future estimates could place this figure as high as 600. Within that group there are: 250 species found in the national parks; 227 species in central Benin; 100 in the Lama forest and 185 in the area of Lake Nokoué. A number of species (including the francolins and guinea fowl) are highly regarded by the local population for food. There is also a relatively small but growing ecotourism industry centered around bird viewing. The main threat to Benin's avifauna comes from habitat destruction, including the felling of dominant forest trees that contain the nests of many species, and the pollution of waterways with toxic substances.

Other groups.

It is worth noting other groups that play important roles in the livelihoods of Benin's population. Benin appears to be exceptionally rich in fungal species, including mushrooms. To date, about 250 mushroom species have been described for Benin; some play an important role in rural areas. There are at least a dozen species that have had commercial commodity chains developed through the work of NGOs. Women are the target group since they have traditionally collected and handled mushrooms. Some mushrooms also contain medicinal properties. Others are critical to the viability of certain ecosystems given their symbiotic relations (mycorrhiza) with a number of higher plants. Threats to the known and valuable mushrooms mostly come from habitat destruction (removal of host plants) and mineral fertilizers, which can make soils unfavorable for mushroom production.

Natural grasslands are found throughout Benin, even as far south as the coastal zone. It is not yet known how many native grasses Benin has, but 70 have been described thus far. The grasses and other forage species are essential for ruminants and play an important role in households that maintain livestock. A prime threat to the natural grassland and other forage species comes from man-made changes to the vegetative cover.

There are a number of select tree species that have good commercial value. The most sought after natural forest timber species (for furniture and other uses) include *Chlorophora excelsa* (iroko), *Azelia africana* (lingue) and *Pterocarpus erinaceous* (vene). While there are at least 50 other species that can serve the same purpose, the demand for these select few is leading to their local depletion; diversification of species through education campaigns and demonstration would greatly assist in this regard. There are roughly 130 plants and trees that provide fruit, most of them are native. Normally, the local fruits are consumed at the household level and not widely traded. There is however, the potential to expand the commercial production of a number of species.

Agriculture is the most important sector of Benin's economy since 55 percent of the population are engaged in agriculture. It is also the foundation for industrial development. Within the overall agricultural context, the number of native crops that are regionally cultivated is considerable and includes cereals, tubers, and legumes. There are literally thousands of native crop varieties, and the systematic screening of the more productive ones is not carried out nearly enough. As a

result, a considerable amount of productivity is lost. Moreover, at this time there is limited capacity within Benin to enhance productivity levels through plant breeding and biotechnology. Benin also contains a considerable number of livestock varieties, the most important of which are the 2 species (taurine and zebu) and 4 races of cattle. Sheep, goats, pigs and poultry all play important roles as well. Overall, livestock contributes about 10% to Benin's GDP. The greatest threat to domestic livestock comes from cross-breeding with introduced races; this is especially true for taurine cattle.

III. USAID Benin

The USAID program in Benin under the previous strategy focused on basic education, family health and governance. Under the new strategy, USAID's program focuses on primary education and family health. The strategic objective for governance is no longer included.

USAID Benin's program did not directly address issues related to biodiversity and natural forest conservation. Until recently, however, select small scale development activities have been financed through NGOs and Peace Corps, some of which may have had an indirect impact on biodiversity and natural forest conservation at the local level (e.g., development projects and micro-enterprise activities designed to increase household productivity and incomes and that offset traditional uses that could be destructive).

Under the previous strategy the education program included an activity with an explicit focus on environmental studies and environment themes were included in textbooks developed for primary schools. The primary education program under the current strategy continues training to equip teachers with skills in teaching core subjects, including French, math, science and technology. The only link between this program and forest and biodiversity conservation is through the Science and Technology Education focus. Within the context of training teachers the importance of biodiversity and forest conservation can be included as part of the overall training package. Beyond that, biodiversity and natural forest conservation threats are not related to the current program design.

The health program under the previous strategy at one time had a micro-project component known as the "Community Environment and Sanitation Health." Activities were not programmed or implemented with biodiversity or forest conservation in mind, but as with the education program, some of the micro-projects may have indirectly addressed some of the threats at the local level. The current health strategy will emphasize the delivery of family services to targeted populations. As currently envisioned, this program will not contain activities that support the conservation of biodiversity or natural forests.

Under the Governance program in the previous strategy USAID Benin has provided the most support to biodiversity and natural forest conservation. This included promoting the production and use of fuel efficient stoves (lower fuelwood demand = less deforestation), alternative agricultural strategies in the cotton growing regions including the promotion of integrated pest management (less land clearing and lower use of pesticides = habitat and biodiversity better conserved), reforestation of depleted cotton fields (habitat development), and agroforestry and tree production (reduces demand on native species). Some of these activities were conducted in the proximity of protected areas. Since the program explicitly focused on improved governance in productive sectors, links to biodiversity and natural forest conservation were not directly monitored.

Throughout the world, successful or promising decentralization programs are usually linked to natural resource access and ownership. Communities can exploit natural resources under eco-tourism or by cultivating and marketing "environmentally friendly" products. The revenues can be important in helping communities become more self-sufficient. Governance programs are not generally explicitly designed to address threats to biodiversity and natural forest conservation.

However, if select civil society groups are carefully chosen in relation to their proximity to natural areas, both the capacity of the targeted groups and the conservation of the local resource can be enhanced. Due to resource constraints, the governance strategic objective has been dropped from the new strategy, but USAID/Benin may explore possibilities for collaborating with the USAID West Africa Regional Program and other donors for establishing natural resource activities in transboundary areas.

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