

# Traditional botanical gardens as a tool for preserving plant diversity, indigenous knowledge and threatened relic forest in Northern Benin.

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## Abstract

In developing countries, human activities (farming, grazing, logging, and bushfires) account for a big part of the causes of the deforestation of thousands of hectares of forests and natural vegetation each year. This deforestation is one of the major factors of loss of biodiversity and desertification especially in dry and subhumid savannas regions. In Benin, species such as *Kigelia africana*, *Azizah africana*, and *Khaya senegalensis* are threatened and becoming increasingly rare due to above mentioned human activities but also overexploitation for medicinal and food use. The conservation of these species can hardly be envisioned without the participation of local communities. To contribute to the conservation of biological diversity we created local botanical gardens. This new concept has been adopted by local communities which are increasingly requesting help with the establishment of their own gardens. The trend motivated CERGET (a Benin-based NGO) to set up three botanical gardens in Pehunco (Dakererou and Koungarou gardens) and Sinende (Gnaro garden) at the request of these communities. The botanical gardens which were initially made of degraded forests, have now been restored, delimited, reforested, and managed by the populations. Some follow up was also completed through the support given to individual farmers in setting up private plantations and raising awareness. These efforts should be pursued at current project sites and extended to other sites as well, so as to sustain biodiversity conservation and sustainable use. Key words: Medicinal plants, Threats, Biodiversity conservation, Botanical gardens, Local populations.

## 1- Background

Traditional approaches of conservation often assumed that nature must be protected through the promotion of the sustainable use of the resources by humans. Although this has been useful in some situations, it has not enabled us to effectively prevent the widespread degradation of our natural resources. The loss of biodiversity is increasing. Tens of thousands of plant species are threatened with extinction (IUCN, 2004; Walter & Gillett, 1998) and today we are seeing the greatest rate of species extinction in Earth's history (Wilson, 1992; Millennium Ecosystem Assessment, 2005).

In Benin, rural populations rely on the uses of medicinal plants for their health. Unfortunately most of concerned species are disappearing due to overexploitation. As a consequence, in 1999 an international workshop was held by IPGRI to establish a national priority list of endangered medicinal tree species (Eyog Matig *et al.*, 2001). The disappearance of these species that are always used by populations will be a

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great problem not only for biodiversity conservation but for population health and food. The conservation of threatened medicinal and food species will help to preserve and restore biodiversity and to fight against starvation and reduce poverty in local populations that rely for life on these resources.

It is now generally admitted that people are less likely to have an incentive to conserve natural resources if they do not appreciate their value (Adams *et al.*, 2004). Conservation actions which takes into account the sustainable use is likely to be most effective and avoid negative impacts on local communities, which in the past has been unfortunate victims of the “protectionist” approach to conservation (Colchester, 2002). If conservation is to succeed, it should take into account of human needs. To attend this goal, a project was conducted by CERGET NGO with the scientific collaboration of the Laboratory of Applied Ecology. Three traditional botanical gardens were created in Pehunco district (Dakererou and Koungarou gardens) and Sinende district (Gnaro garden): Figure. 1.

## **2- Objectives**

The new concept of traditional botanical gardens has been adopted and developed together with local communities in order to reconcile the need to conserve threatened medicinal plants and to use them to cure diseases and alleviate poverty effect. In this project, we seek to encourage the:

- Conservation of phytodiversity: through botanical inventory and monitoring; protection of threatened species, including the possibility to reintroduce rare or locally extinct species.
- Conservation of traditional knowledge by documenting of all kinds of traditional plant uses, especially medical and ethnoveterinary uses.
- Use of the garden as a tool and a resource for environmental education, i.e. for school children, students, non-governmental organisations (NGO), local, national and international public.
- Protection of natural resources by sustainable production of the plants used in traditional medicine.
- Creation of sources of new income for the local populations through nurseries and ecotourism activities.
- Establishment of permanent sites for research on sustainable use methods and the reintroduction of threatened species, at the same time raise awareness amongst the population.



**Figure 1: Localisation of gardens**

### **3- Establishment and management of botanical gardens**

The project was implemented for three years (2005 – 2007) and followed successional phases:

#### **- *Identification of project sites***

Possible villages of implantation of botanical gardens were identified by the Laboratory of Applied Ecology (LEA) and BIOTA (Biodiversity Analysis and Transect Monitoring in West Africa). Those sites were prospected by a team of CERGET NGO and meetings were organised with local communities and districts authorities of each pre-selected sites. During those meetings, it appeared that the local populations are aware of the degradation of their resources and the disappearance of many useful species, and they expressed a need to overcome resources degradation. Together with these village dwellers, the concept of several traditional botanical gardens was developed as a way to conserve species diversity as well as the traditional knowledge linked to numerous threatened species. To achieve this goal, populations identified some areas where such gardens could be set up and the team had prospected those sites.

#### **- *Creation of village botanical gardens committees***

In order to have a group which will be in permanent contact with the NGO staff and will have the responsibility of taking care of the garden, we organized in each selected village, a meeting with all stakeholders (healers, farmers, and stockbreeders) and genders. During this meeting local populations identified resource persons which could help for the gardens maintenance. The committee was composed by a president, a secretary, an accountant, two wise persons of each ethnic group and two guards. It was requested by the project staff the presence in the committee of one woman who will serve as a link between the NGO and the other women in order to gain their participation.

- **Identification and production of plants species**

We identified with communities, using a participatory approach, the main species they want to promote according to the extinction risks and their needs for traditional medicine. To this list, the project adds other species from the national priority list of endangered medicinal tree species established by Eyog Matig *et al.* (2001). We delineated and estimated with the committee the area in which reforestation need to be done for the current year. According to the area and the specificities of each selected plant species, we estimated the need in seedlings per garden.

To facilitate the availability of those species, nurseries were established for the production of seedlings of threatened medicinal tree species for planting in botanical gardens. We identified a nursery in Pehunco district and signed a contract with the responsible before the rainy season. This nursery was monitored and plants species were produced and bought by the project. To build local capacities in nurseries in each village where the botanical gardens sites were identified, we asked each committee to identify a volunteer to be trained by the responsible of the Pehunco nursery about techniques of production of plants in nursery. After the training, seeds were given to each committee to create their own nursery in each village. Three tree-nurseries were created in order to produce rare species for distribution and to reintroduce them into the garden (Figure 2).



**Fig. 2.** *Afraegle paniculata* in nursery

- **Management of gardens and private plantations**

After the production in nursery, the project facilitates the transport of seedlings from the nurseries to the botanical gardens. During the reforestation, the committee got support from many other villagers to help with the plantation. We delineated the edge of each garden with fast growing species such as *Gmelina arborea*, *Acacia polyacantha*, *Eucalyptus camaldulensis* and *Azadirachta indica* (Figure 3).



**Figure 3.** Delimitation of Niaro garden with *Gmelina arborea* (the situation at the 2<sup>nd</sup> year of plantation)

In the gardens, threatened medicinal species were planted: *Khaya senegalensis*, *Kigelia africana*, *Azizelia africana*, *Afraegle paniculata*, *Vitex doniana*, *Strophantus sarmentosus* and *Moringa oleifera*. Moreover we promoted private plantations by giving seedlings to villagers who were interested in creating their own plantations in their compounds or farms. This support was given especially to some healers and breeders who expressed the need.

A total of 12 468 seedlings were planted in gardens and private plantations during the three years of the project (Tables 1 a & 1b). The national day of tree was celebrated each 1<sup>st</sup> of June in Benin. The project availed itself of this opportunity to support the district authorities by giving them some seedlings for reforestation where they chose to celebrate this event.

**Table 1. Enrichment and reforestation records from 2005 to 2007**

(a) according to conservation options

Years	2005	2006	2007	TOTAL
Gardens	4918	3130	3160	11 208
Private plantations	585	120	205	910
Celebration of the national day of tree	100	100	150	350
<b>TOTAL</b>	5603	3350	3515	12 468

(b) according to species

Years	2005	2006	2007	Total
<b>Species</b>				
<b>In the gardens</b>				
<i>Khaya senegalensis</i>	1464	1365	865	3 694
<i>Kigelia africana</i>	970	735	350	2 055
<i>Afraegle paniculata</i>	310	700	500	1 510
<i>Vitex doniana</i>	38	-	-	38
<i>Azizelia africana</i>	118	-	250	368
<i>Strophantus hispidus</i>	367	-	500	867
<i>Moringa oleifera</i>	10	-	-	10
<i>Other species</i>	275	15	-	290
<b>Edge of gardens</b>				
<i>Gmelina arborea</i>	1051	225	400	1 676
<i>Eucalyptus camaldulensis</i>	400	115	-	515
<i>Acacia nilotica</i>	550	195	600	1 345
<i>Azadirachta indica</i>	50	-	-	50
<i>Lophira lanceolata</i>	-	-	50	50

Local committees are in charge of the protection of gardens against late bush fires. Before the dry season communities take care of the edge of gardens by establishing 2 – 3 meters firebreak around the garden (Figure 4). Annual early fires (at the end of the rainy season) were lit as a protection measure and help to avoid the more destructive accidental bush fires in the late dry season.



**Figure 4. Fire break in Dakererou garden (Pehunco district)**

**- *Creation and redynamisation of district associations of healers***

An association of healers exists before the beginning of this project in Ouassa district. This association was established with BIOTA and the Laboratory of Applied Ecology and was in charge of the management of one of the first's botanical gardens in the district: The garden of Guson. This association had been reinforced and help in the creation of a similar association in Sinendé district. Those associations will be trained and traditional pharmacy will be created to improve traditional medicinal knowledge.

**- *Awareness and promotion of gardens***

The promotion of botanical gardens consisted of the realisation of boards for identification of gardens, for orientation and public awareness about “no fires, no pasture” (Figure 5) and for identification of main species in the gardens. We identified and built in each garden trails to facilitate the visit of gardens. Moreover, the project builds in 2007 one chair for ecotourists in each garden (Figure 6). Many leaflets were edited to promote the new concept of botanical gardens in the region.



**Fig. 5. Identification and sensitisation boards**



**Fig. 6. A chair built in a garden for tourists and for rest**

The project signed a contract with a local radio called NaanƆ Ouassa FM to raise awareness. As an additional and very effective tool for environmental sensitization, the association of healers in collaboration with gardens committees produced radio talk shows that focus on traditional knowledge, biodiversity and ecology, the importance of gardens which are broadcasted twice a week and reach a wide audience in the region.

**- Cooperation between the network member gardens**

Some other gardens existed before the start of this project in Northern Benin. Many examples were taken from the experience of the first village botanical gardens in the region: The Botanic Garden of Papatia established in 2001 (Krohmer *et al.*, 2006). An exchange visit of members of Ouassa and Sinendé gardens management committees to Papatia botanical garden was arranged in 2006 to share and train participants in new packaging, processing, and marketing methods.

**- Research**

Many gardens put a strong emphasis on research relevant to the development of useful plants, especially in the fields of agriculture and healthcare (Waylen, 2006). Many research activities are planned to be implement in the gardens. In 2007, a MSc student investigated the importance of those gardens in the preservation of most important ethno veterinary plants in the region. This topic will be defended in next August 2008.

## **5- Specificities of village botanical gardens**

Botanic gardens are a major force for the conservation of plants around the world and have the skills and expertise to study and manage plants in cultivation, and in the wild, as a major contribution to ecological and human well-being (Waylen, 2006). Village botanical gardens are a recent strategy to conserve medicinal and threatened plants in Benin. It has the same advantages of preservation of the genetic resources for therapeutic, phytochemical and pharmacological studies (Vieira 1999). The concept differs from classic botanical gardens which are a form of *ex situ* conservation contrary to the village botanical gardens which are a form of *circa situ* conservation (Hamilton, 2002). *Circa situ* conservation is intermediate between the conservation *ex situ* and that *in situ*. In the case of Benin, we followed plants production in nurseries to enrich spaces with original medicinal species which abundance was reduced in the past. As a result we obtained a stable and an



improved form of botanical gardens considering that species are planted in their natural habitat. The village botanical gardens are also a strategy to fight against desertification and to preserve medicinal plants from extinction. They are managed by local communities for the promotion of traditional medicine and ecotourism and could further generate new incomes (Sogbohossou and Akpona, 2006).

## **6- What future for traditional botanical gardens?**

Some constraints occur generally in the process of village botanical gardens establishment.

### **- Agriculture**

Some farmers plot at the edge of the gardens. This can especially facilitate the propagation of late fires to the gardens. To assure the sustainability of gardens, we need to create a buffer zone between the gardens and the fields which could be used for nurseries and other activities related to the conservation of natural resources. The project is discussing this possibility of extension of the limits of gardens with local authorities in each village.

### **- Cattle breeding**

Gardens shelter permanent water sources which attract cattle. Cattle herders often prune the fodder trees to feed their animals. The consequence is drastic because the fodder plants are the same with the same threatened trees used for traditional medicine. The involvement of cattle breeders in the gardens committees will help to mitigate such conflicts. The management of the gardens by the populations even makes them more responsible and it is noticed that they exert a good monitoring on their resources and do not hesitate to denounce destruction actions.

### **- Social considerations**

Generally when a new concept occur in a village, all the community can not be agree with the innovation. It is necessary to implement the innovation for a first phase (called pilot phase) and to show the direct positive impact on the livelihoods of those who had been involved. It is necessary to proceed to awareness in order to have the participation of those who reject the project during the pilot phase. However this could not be done without the financial and technical support of local, communal, national and international authorities.

Village botanical gardens are the most recent strategy we have to develop when we consider the implication of local communities in the management of such gardens. Sacred forests, classified forests, forests reserve and other forms of conservation have many constraints related to urbanisation and need lot of financial and technical resources.

Governmental institutions have to integrate this new concept in their priority and promote village botanical gardens in each village as a national conservation strategy which integrate directly communities.

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