

***State of Forest Genetic Resources  
in The Gambia***

*Prepared for*

**The sub- regional workshop FAO/IPGRI/ICRAF on the conservation,  
management, sustainable utilization and enhancement of forest genetic  
resources in Sahelian and North-Sudanian Africa  
(Ouagadougou, Burkina Faso, 22-24 September 1998)**

*By*

**Abdoulie A. Danso**



**A co-publication of FAO, IPGRI/SAFORGEN, DFSC and ICRAF  
December 2001**



# Forest Genetic Resources Working Papers

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**Food and Agriculture Organization of the United Nations (FAO)**  
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The current publication « *State of the Forest Genetic Resources in The Gambia* » is issue of country national report presented at *The Sub- Regional Workshop FAO/IPGRI/ICRAF on the conservation, management, sustainable utilization and enhancement of forest genetic resources in Sahelian and North-Sudanian Africa* (Ouagadougou, Burkina Faso, 22-24 September 1998). It is published with the collaboration of FAO, IPGRI/SAFORGEN, DFSC and ICRAF, as one of the country and regional series which deals with the assessment of genetic resources of tree species in the Sahelian and North-Sudanian Africa and identification of priority actions for their Conservation and Sustainable Utilization.

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Quantitative information regarding the status of forest and tree resources, including genetic resources, has been compiled according to sources, methodologies and protocols identified and selected by the author. Data comparison between countries using different recording methodologies and sources may not be possible. For standardized methodologies and data on forest resources, please refer to *FAO, 2001. State of the World's Forests 2001*; and to *State of Forest Genetic Resources in Sahelian and North-Sudanian Africa & Regional Action Plan for their Conservation and Sustainable Use*. Working papers FGR/2E, FAO, IPGRI & ICRAF. FAO, Rome, 2001. Official information can also be found at the FAO Internet site (<http://www.fao.org/forestry/Forestry.asp>).

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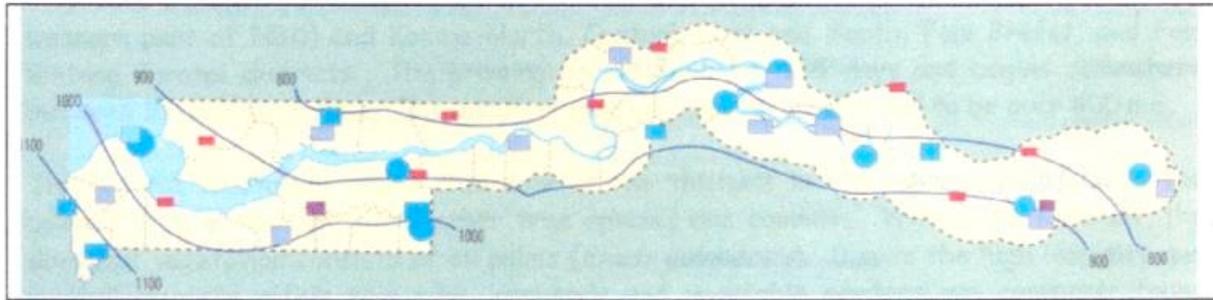
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country's land area (505,300 ha) is under forest cover with woodland accounting for 10%. The remaining 67 000 hectares are savannah woodland and mangrove forests (Bojang, 1999).



(SERTG 1997).

**Fig.2:** Rainfall distribution pattern in The Gambia (SERTG, 1997 in Bojang, 2000)

The vegetation type is strongly associated with edaphic factors. One hundred and fifty (150) plant species have been identified in The Gambia (Bojang, 1999).

In the woodland areas, particularly in the western division, the following species are common: *Daniellia oliveri*, *Khaya senegalensis*, (restricted to moist areas), *Pterocarpus erinaceus*, *Terminalia albida*, *Parkia biglobosa*, *Prosopis africana*, *Piliostigma thonningii*, *Combretum micranthum* and *Bombax buonopozense*.

For the riparian woodland, the vegetation is generally denser due to the increase in available moisture (higher water table). Trees on these sites would normally grow to large sizes and include *Khaya senegalensis*, *Detarium senegalensis*, *Pterocarpus erinaceus*, *Parinari excelsa*, *Dialium guineense*, *Parkia biglobosa*, *Erythrophleum guineense*, *Elaeis guineensis*, *Terminalia albida*, *Cassia sieberiana* and *Lanea velutina*. Also present are common climbers and creepers, including *Landdolphia heudelotii* and *Saba senegalense*.

Disturbed woodlands with shrub understorey is typically fairly open with trees seldom 15 m tall. The common tree species are: *Combretum micranthum*, *Terminalia albida*, *Cordyla africana*, *Cassia sieberiana*, *Oxytenanthera abyssinica* and *Sterculia setigera*. *S. setigera* is however dominant in the eastern part of the country.

Mangrove swamps are found on the banks of the River Gambia and its tributaries. The common species are *Rhizophora racemosa* and *Avicennia africana*. Most of the mangroves are used as fuel wood and by small-scale artisans. The mangroves are home to a variety of fish species.

## 2.2. Utilization patterns of forest species

Forests are important natural resources containing numerous species of flora providing food and medicine, habitat for numerous species of fauna with great potential for honey and wax production (Bojang, 1999). They also contribute to an integrated live-support system to many Gambians for the upland and coastal forest.

### **Medicinal plant species**

Trees and shrubs are commonly used in traditional treatments and for other uses. With the cultural belief that “Every plant grown on the surface of the earth has a medical property/use”, it is impossible to provide a complete list of the uses to which most of these plants may be put (Bojang, 1999). Over 28 plant families contain species used for medicinal purposes in The Gambia. Species locally known for their medicinal uses include: *Annona senegalensis*, *Moringa oleifera*, *Securidaca longepedunculata*, *Lophira lanceolata*, *Combretum spp.* *Guiera senegalensis*, *Terminalia macroptera*, *Waltheria lanceolata*, *Sterculia setigera*, *Bridelia micrantha*, *Cordyla pinnata*, *Azelia africana*, *Cassia sieberiana*, *Tamarindus indica*, *Ficus spp.*, *Khaya senegalensis*, *Lannea acida*, *Voacanga africana*, *Nauclea latifolia*, *Vernonia spp.*, *Kigelia africana*.

### **Food tree species**

A majority of women, particularly those in the Western Division, rely on the natural forests for their subsistence. Wild fruits and leaves from trees and shrubs, many of which are under exploited from a variety of plants (some of which are either supplementary or primary food source), provide good nutritious supplements to diet such as protein, vitamins and roughage and also medicinal values at certain times of their growing period. Bojang (1999) recorded 24 plant species in the forests widely in use as food by the local people. Principal species are *Adansonia digitata*, *Anacardium occidentale*, *Annona senegalensis*, *Balanites aegyptiaca*, *Bombax costatum*, *Borassus aethiopum*, *Ceiba pentandra*, *Detarium senegalensis*, *Detarium microcarpum*, *Dialium guineense*, *Elaeis guineensis*, *Ficus gnaphalocarpa*, *Moringa oleifera*, *Parinari excelsa*, *Parinari macrophylla*, *Parkia biglobosa*, *Sclerocarya birrea*, *Spondias mombin*, *Tamarindus indica*, *Ziziphus mauritiana*. The author has also recorded 24 less widely used ones.

### **Wood products**

The natural forests provide 80 to 85 % of the primary domestic energy for more than 84 percent of the total population in the form of fuel wood.

The total sawn timber volume in The Gambia was 4,630,000 cm<sup>3</sup> or 5.5 cm<sup>3</sup>/ha (National Forest Inventory of The Gambia, 1983 quoted by Bojang, 2000). The major contributory species are shown in Table 1. With the exception of the mangrove species, *Rhizophora* and *Avicennia*, which are not “popular timber species”, total sawn timber volume was 2.482 million cm<sup>3</sup> in 1983.

**Table 1:** Most common tree species in terms of sawntimber volumes

<b>Species</b>	<b>Volumes</b>
<i>Pterocarpus erinaceus</i>	569,000 cm <sup>3</sup> (23%)
<i>Daniella oliveri</i>	314,000 cm <sup>3</sup> (13%)
<i>Cordyla africana</i>	312,000 cm <sup>3</sup> (13%)
<i>Borassus aethiopum</i>	280,000 cm <sup>3</sup> (11%)
<i>Khaya senegalensis</i>	269,000 cm <sup>3</sup> (11%)

Source: National Forest inventory, 1983 in Bojang (2000)

### ***Other uses***

From the environmental point of view, forest cover contributes among many other benefits, to the protection of soil against desiccation, wind erosion, to the improvement of rainfall percolation, rainfall distribution and temperature moderation. The existence of mangrove forests on either side of the river banks up to 250 kilometers upstream, play significant role in maintaining stability of these river banks and provide habitat for many migratory birds and a life support system to many other plants, mammals and animals.

The upland forests continue to provide energy, construction and building material, food and local medicine to both rural and urban settlements. As such, it significantly contributes to the socio-economic development of the people of these areas in providing resources, job opportunities and income. However, the local commercialisation of forest products, such as fuel wood, timber, fruits etc., contributes to the unsustainable exploitation of the resources.

The coastal forests, including the mangrove forests, also provide the local communities with wood products for construction and energy as well as the needed protection against erosion of the riverbanks as well as breeding grounds for the many varieties of fish and oyster. The mangroves, which provide natural habitat for oysters, also provide many Gambians, mostly women, with some source of subsistence. However, the results of the coastal resources assessments under the climate change scenarios indicate a possible inundation of most of the mangroves on the coastal areas. This is probably due to a rise in the sea level. The Gambia would be adversely affected.

### **2.3. Threats**

Forest resource endowment of Gambia has been fairly distributed but seriously degraded, mainly through human influence (illegal felling and frequent bush fires) and to a limited extent by climate variations (drought, stress, precipitation and rainfall distribution). However, the unsustainable local commercialisation of forest products (both wood and non-wood products), are the main destructive activities of our forest resources.

Prior to independence from Britain, The Gambia was endowed with dense forests. However, with the increase in human and livestock population, the equilibrium that had existed between man and nature started to decline at a rate faster than it could be regained. Unsustainable forms of exploitation by man, such as the extraction of wood and non-wood products, were the cause. The expansion of agricultural activities and frequent incidence of bush fires and grazing pressure also affected the conditions of the forest. As a result, most of the forest lands have undergone changes, more often to secondary succession, resulting to less dense forests, poor regeneration potential, lower growth, incidence of undesirable grass species and lower plant species diversity.

### ***Agriculture impact on forest lands***

Approximately 33% of The Gambian territory, excluding fallow lands, is put into active agricultural use. While crop rotation, and to some extent intercropping, still is widely practiced throughout The Gambia, long fallow periods are coming to an end. For instance, in 1983, the previously practiced or traditional 20-year fallow period after 4 years of cropping, was observed to have dropped to one or two years in some parts of The Gambia. Reduced soil fertility has been the result. Indeed several fields no longer experience fallow periods at all.

Consequently, there has been severe pressure on forestlands leading to fast disappearance of forest resources from the high rate of deforestation. This rate of deforestation is now estimated at 3.11% annually (Bojang, 1999).

The 1983 forest inventory gave indications of some significant changes in the forest situation in respect of forest types, area and land use, but with no significant change in total forest area. The open and closed forest types declined in quality by more than 80% between 1968 and 1983 (Table 2).

The reduction in forest area did not result in any increase in savanna but in increase of cultivated area from 274,100 ha in 1980 to 336,000 ha in 1988. Based on the information available from the 1980 aerial photographs and 1988 satellite imagery, indications are that, no changes occurred in areas of high and low mangrove forest types. However, more up to date information may be available after the analyses of currently obtained forestry inventory data.

**Table 2:** Changes in forest types in The Gambia between 1980 and 1988.

Forest types	Years		Percentage Change (%)
	1980	1988	
Open forest	62,700	52,300	- 16.6
Closed forest	28,000	16,200	- 42.1
Low Mangrove	51,900	51,900	0
High mangrove	15,000	15,000	0
Savanna	369,900	369,900	0
Cultivated area	274,100	336,000	+22.6

*Source:* Forestry Department. GGFP report based on aerial photographs of 1980 and satellite imagery of 1988.

No data is available to indicate how many plant species are extinct or near extinction (Bojang, 1999). It is however known that several species of high economic value are threatened. Due to the transformation of the ecosystems, some species might have been replaced by the more tolerant.

### ***Livestock (grazing) impact on forest tree species or populations***

Livestock production system is reported to be predominantly and traditionally based upon seasonal transhumance, utilizing communal lands and any other unmanaged forestlands. Large cattle herds graze in the plateau bush in the wet season, while the wetlands provide additional fodder resources in the dry season ([www.afrol.com](http://www.afrol.com)). The dry season represents a bottleneck for animal husbandry, especially because of the low nutritional value of the dried grasses. However, the pasture is normally sufficient for Gambian herds, in the absence of bushfires. Grazing and trampling of large livestock herds causes substantial stress on the geo-ecological environment.

### ***Forest exploitation (timber and non timber products)***

The following species are currently over-exploited: *Pterocarpus erinaceus*, *Khaya senegalensis*, *Prosopis africana*, *Borassus aethiopum* and *Milicia regia*.

### ***Other types of threats***

Due to frequent bush fires and stress from drought, many species even in their natural habitats, are subjected to threats of reduction in species diversity, from being endangered and total extinction.

## **3. MANAGEMENT OF FGR**

### **3.1. *In situ* conservation activities**

#### ***Protected areas***

Approximately 32,729 hectares, representing about 7 %, constitute the 66 gazetted forest parks located in different parts of the country. These are mainly on poor soils.

In the early 1950s, the colonial administration placed particular emphasis on *Borassus aethiopum* (Rhun palm) and *Bambusa spp.* (Bamboo) areas in recognition of anticipated future dependency on these species for improved housing. Other major timber tree species such as *Khaya senegalensis* (mahogany) and *Milicia regia* (Iroko) and others were equally protected in natural stands. Until 1983 no forest management plans were established for the individual forest parks or plant species, with the exception of the *Gmelina* plantations.

Following the 1983 inventory results, 7 of the gazetted national forest parks were brought under management. There have been 10 others since 1996. Most of these parks are within the Western, Lower River and Central River Divisions. The management plan for each of these parks makes provision for the conservation of indigenous (especially when threatened) plant species common in the area. More emphasis is placed on in-situ natural regeneration, than artificial and ex-situ regeneration.

#### ***Traditional agroforestry parklands systems***

Little or no woodland cover characterizes areas of intensive cultivation. These areas are noted for large and widely spaced tree species such as *Parkia biglobosa*, *Bombax buonopozense*, *Khaya senegalensis*, *Acacia albida*, and *Adansonia digitata*. *Cordyla africana* (Bush mango) and *Elaeis guineensis* (oil palm) provide lots of by-products (fruits, palm oil, palm wine) than the primary use of the wood. Such species are most often found on farmlands and are protected by local farming communities. *Combretum sp.*, *Pterocarpus erinaceus* and *Terminalia macroptera* are less suitable or are otherwise more adaptive and tolerant to annual bush fires. They are therefore found in all areas including farmlands.

#### ***Forest enrichment***

The conservation of some economically valuable timber tree species is promoted through enrichment planting. The seedlings are often raised in the nursery and include *Antiaris africana*, *Azelia africana*, *Albizia ferruginea*, *Anacardium occidentale*, *Ceiba pentandra*, *Cordylla africana*, *Daniellia oliveri*, *Eucalyptus camaldulensis*, *Khaya senegalensis*,

*Leucaena leucocephala*, *Lophira lanceolata*, *Parkia biglobosa*, *Prosopis africana* (provenances of The Gambia and Senegal), *Pterocarpus erinaceus* and *Tectona grandis*.

### **3.2. Ex situ conservation activities**

Currently there is no ex-situ conservation collection programme for forest tree species. Seeds of both exotic and indigenous species, when acquired are often stored in an open wood shelf under normal temperature conditions before sowing. There are no nationally recognized seed sources; the managed forest parks could serve as seed sources. Some of the unmanaged parks with relatively good stands in respect of species diversity and population could equally be potential sources for seed production and supply without treatment. Seed collection in most cases is contracted to unprofessional individuals in the villages with little or no control of the provenances, collection process, seed handling and storage for quality production. Nursery attendants are also engaged in seed collection. There is need for improvement in the mechanism for seed collection, and in the training of seed collectors in situ and ex-situ conservation.

### **3.3. Selection and genetic improvement**

#### ***Species trials***

Currently little is known about our indigenous tree species in respect of their characteristics particularly in their different locations. Trials had been established in 1959 and in the early sixties with exotics and indigenous tree species. However, there is little evidence that these trials were analysed. Consequently, a tree species trial with both indigenous and exotic species was conducted to identify the most suitable tree species for plantation. The species included *Tectona grandis*, *Khaya senegalensis*, *Albizia ferruginea*, *Milicia regia*, *Pterocarpus erinaceus*, *Prosopis africana*, *Parkia biglobosa* and *Eucalyptus camaldulensis*. The objective of the trial was to (1) test different indigenous and exotic species in different site conditions, (2) identify their nursery requirements, site and soil preparation and maintenance for their propagation and (3) to select the most suitable tree species for production of required products such as firewood, timber, fruits, fodder, medicine, ornaments and soil improvement. Criteria for selection included (a) demand and acceptability of the people, (b) legal restrictions, (c) experience and available information, (d) compatibility with other land use systems, (e) expected yields, (f) cost of establishment, (g) adaptability to site conditions, and (h) government policy.

### 3.4. National priority species

**Table 3:** List of species identified as high national priority

Indigenous species	Exotic species
<i>Acacia albida</i>	<i>Anacardium occidentale</i>
<i>Acacia seyal</i>	<i>Casuarina equisetifolia</i>
<i>Adansonia digitata</i>	<i>Cassia siamea</i>
<i>Afromosia laxiflora</i>	<i>Eucalyptus camaldulensis</i>
<i>Azelia africana</i>	<i>Gmelina arborea</i>
<i>Albizzia zygia</i>	<i>Leucnena leucocephalla</i>
<i>Alchornea cordifolia</i>	<i>Prosopis juliflora</i>
<i>Bombax buonopozense</i>	<i>Tectona grandis</i>
<i>Borassus aethiopum</i>	
<i>Ceiba pentandra</i>	
<i>Celtis integrifolia</i>	
<i>Milicia regia</i>	
<i>Cordia gharfle</i>	
<i>Cordyla africana</i>	
<i>Daniellia oliveri</i>	
<i>Detarium senegalensis</i>	
<i>Elaeis guineensis</i>	
<i>Erythrophleum guineensis</i>	
<i>Khaya senegalensis</i>	
<i>Parinari excelsa</i>	
<i>Parkia biglobosa</i>	
<i>Prosopis africana</i>	
<i>Pterocarpus erinaceus</i>	
<i>Rhizophora racemosa</i>	
<i>Sclerocarya birrea</i>	

## 4. POLICY, PLANNING AND INSTITUTIONAL MECHANISM

### 4.1. National forest policy

In the early 1950s during the colonial days, the mandates of the forestry services were limited mainly to the protection and utilization of the forests areas and their products as well as the development of plantations. The legislation was said to provide reservation of forest parks for regeneration, production, utilization and protection of forest resources.

The forest policy and legislation of 1976 and 1978 respectively, placed more emphasis on the role of the government for the protection, conservation and development of the state owned forest parks and all other forest resources. As a result, government's efforts at sustaining the

conservation role, controlled legal utilization and other functions of the forest parks including the communal forest areas (known as state forests), under the tenure of the communities, have registered limited success with the exception of the mangrove ecology.

The inadequacy of these policy objectives for the protection, sustainable management and utilization of forest resources has been realized. Thus recently much progress has been achieved in the revision of the forest policy giving due consideration to peoples' active participation in forest management and the country's policy objective in environmental and socio economic development. Unlike the previous policy, the new policy has also taken cognition of the nature of forestry problems as well as the role that forestry is expected to play in national economic development. It also identified the policy goals, orientations and requirements not only to effectively manage the resources but also to equally build the capacities of all stakeholders of the resources.

The current forest policy aims at increasing the number and area of managed forest parks and reducing the total area of unmanaged state forest through community involvement. The main current forestry policy goals are as stated:

- To reserve, maintain and develop forest resources covering at least 30 % of the total land area which is designated for environmental protection through: minimizing soil desiccation and erosion, improving and conserving biodiversity, managing river bank stability (mangroves) and protecting the swamp lands.
- To ensure that 75% of forest lands are managed and protected according to sustainable forest management principles in order to increase forest resource base.
- To ensure that sufficient supply of forest products needed by both urban and rural population is available through the rehabilitation of forestlands and the establishment of fast growing plantations and woodlots.

The draft Act and Regulations also take account of the policy objectives, strategies and farmers' right, social and physical factors that would affect forest development, as well as the relative and absolute area of forests, population density and existing land uses.

#### 4.2. Laws and others rules

**Table 4:** Laws, enforcement texts, Policy, Programs and actions on forest genetic resources management

<b>Laws, enforcement texts, Policy, Programs and actions</b>	<b>Year</b>
Land Act	1991
National Environmental Action Plan (1992-2001)	1992
Politique de population : grande priorité à la gestion environnementale	1992
National Environmental Management Act	1994
Définition d'une politique forestière. Goal : protection, gestion et exploitation des ressources forestières	1994
Convention on biological diversity	x

### 5. TRAINING AND RESEARCH CAPACITY BUILDING AND REINFORCEMENT

In 1983, a national forestry inventory was conducted through both the financial and technical support of the German government through GTZ. A land use classification was developed. A

stand description with respect to tree species per hectare, percentage of stand with regeneration, density of regeneration as well as their silvicultural treatments was elaborated. Prior to this inventory, forest tree species were identified and classified into three categories: timber tree species, firewood species and non-wood material species.

Currently the inadequacy of government funding and political support limited the number of trained and qualified staff and as well inhibited the department's involvement in research to provide basic information on tested silvicultural models and their treatments. Other areas for which research is desired are; studies on the impact of grazing and bush fire on natural regeneration and tree growth particularly the indigenous tree species; depleting rate of forest cover and its resources, as well as research in the areas of forest genetic resource conservation, utilization and marketing etc.

## **6. REGIONAL AND INTERNATIONAL COOPERATION**

The department has had a number of development projects funded by either Gambia government or external donors for the establishment, protection and management of forest resources. In the past 15 - 20 years now, a number of bilateral and multilateral donors such as USAID, FAO/DADEA, EEC and the Federal Republic of Germany, and NGOs such as Action Aid The Gambia (AATG) and Catholic Relief Services (CRS) have significantly contributed in government's efforts for the protection and sustainable management of natural forest resources (plant genetic material).

Proposals for international, regional and sub-regional collaboration is presented as follows:

### ***International collaboration***

The following are proposed:

- A global financing mechanism should be set up for funding plant genetic material conservation especially in the tropics,
- A world centre to facilitate the coordination and preservation of genetic material of all known and existing plants for future reproduction if need be, must be established,
- The establishment of seed banks in tropical developing countries,
- Various institutions to collaborate and assist each other in designing and implementing natural forest resource management programs that are consistent with social and cultural and economic developments.

### ***Regional collaboration***

The following are proposed:

- Regional institutions must assist in the elaboration of the principles established in the conventions on Biodiversity and desertification to the expectations of the rural community and other plant genetic users,
- Need for an International Convention on Plant Genetic Resource preservation and development,
- Exchange of experiences in the field of conservation and plant genetic conservation,
- Aim at achieving regional integration in natural forest management.

### ***Sub-regional collaboration***

The following are proposed:

- Creation of awareness among all stakeholders through decentralization,
- Support private investment in forest plant genetic resource management and utilization through commercialisation,
- Prevention of national and trans-boundary social and land tenure conflicts,
- Integration of successful natural resources management strategies into economic development plans and
- Guaranteed food security and sustainable rural development.

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## **ANNEXES**

## Annex 1: Values and use of target, priority species

Name of priority species	Value code	Present, future or potential use											
		ti	po	wo	nw	pu	fo	fd	sh	ag	co	am	xx
<i>Acacia albida</i>	1			x	x			xx	x	x	x	x	
<i>Acacia seyal</i>	3							x	x	x	X		
<i>Adansonia digitata</i>	1				x		x	x	x			x	
<i>Afrormosia laxiflora</i>	2		x	x									
<i>Azelia africana</i>	1	x	x	x					x				
<i>Azelia zygia</i>	2	x	x					x					
<i>Alchornea cordifolia</i>	2	x	x					x					
<i>Anogeissus leiocarpus</i>	3			x	x				x				
<i>Antiaris africana</i>	1	x	x	x					x				
<i>Avicennia nitida</i>	1		x	x					x				
<i>Bombax buonopozense</i>	1	x		x	x				x				
<i>Borassus aethiopum</i>	1	x	x	x			x		x	x		x	
<i>Calotropis procera</i>	2				x			x					
<i>Cassia sieberiana</i>	1	x	x	x	x			x	x				
<i>Celtis integrifolia</i>	1		x	x			x	x	x			x	
<i>Milicia regia</i>	1	x	x	x					x				
<i>Cola cordifolia</i>	2						x		x			x	
<i>Combretum spp</i>													
<i>Cordia gharafle</i>	1		x	x	x				x				
<i>Cordyla africana</i>	2	x	x	x	x		x						
<i>Daniellia oliveri</i>	1	x	x	x			x		x	x	x		
<i>Detarium microcarpum</i>	1	x	x	x	x				x			x	
<i>Detarium senegalense</i>	3		x	x	x		x		x				
<i>Dialium guineensis</i>	1	x	x	x	x		x		x			x	
<i>Dichrostachys glomerata</i>	3		x	x			x						
<i>Diospyros mespiliformis</i>	3			x	x			x					
<i>Elaeis guineensis</i>	1		x	x	x		x						
<i>Entada africana</i>	2	x	x	x				x	x				
<i>Erythrophleum sp.</i>	1	x	x	x	x			x					
<i>Ficus spp</i>	3		x	x	x		x	x	x				
<i>Hannoa undulata</i>	3		x	x	x				x				
<i>Khaya senegalensis</i>	1	x	x	x	x				x	x		x	
<i>Lannea acida</i>	3		x	x	x								
<i>Mitragyna inermis</i>	3		x	x					x				
<i>Parinari excelsa</i>	1	x	x	x			x		x				
<i>P. macrophylla</i>	3		x	x	x		x		x				
<i>Parkia biglobosa</i>	1		x	x	x		x	x	x				
<i>Piliostigma thonningii</i>	3		x	x					x			x	
<i>Prosopis africana</i>	1		x	x	x			x	x		x		
<i>Pterocarpus erinaceus</i>	1	x	x	x	x			x	x			x	
<i>Rhizophora racemosa</i>	1		x	x				x					
<i>Sclerocarya birrea</i>	3			x			x	x	x				
<i>Spondias mombin</i>	2		x	x			x		x				
<i>Sterculia setigera</i>	3						x		x				
<i>Tamarindus indica</i>	1						x	x					
<i>Terminalia albida</i>	1	x	x	x					x				
<i>Vitex doniana</i>	1		x	x	x		x		x				
<i>Zizyphus jujuba</i>	1		x	x		x					x		

<i>Anacardium occidentale</i>	1		x	x			x		x	x			
<i>Cajanus cajan</i>	3						x		x	x			
<i>Casuarina equisetifolia</i>	1	x	x	x					x	x			
<i>Cassia siamea</i>	1		x	x					x	x		x	
<i>Delonix regia</i>	2		x	x				x				x	
<i>Eucalyptus camaldulensis</i>	1	x	x	x	x				x	x	x	x	
<i>Gmelina arborea</i>	1	x	x	x				x	x	x	x	x	
<i>Leucaena leucocephala</i>	1		x	x				x	x	x	x		
<i>Moringa oleifera</i>	2			x			x	x	x	x	x		
<i>Pakinsonia aculeata</i>	2			x					x			x	
<i>Prosopis juliflora</i>	2		x	x			x	x	x	x	x	x	

### Key

#### Value:

1. Species of current socio economic importance
2. Species with clear potential or future value
3. Species of unknown value given present knowledge and technology

#### Utilization:

- ti** timber production;
- po** posts, poles, round wood;
- pu** pulp and paper
- wo** fuelwood, charcoal;
- nw** non-wood products (gums, resins, oils, tannins, medicines, dyes...)
- Fo** food;
- fd** fodder;
- sh** shade, shelter;
- ag** agroforestry systems;
- co** soil and water conservation;
- am** amenity, aesthetic, ethical values;
- xx** other (specify).

**Annex 2** : Management and location of genetic resources by natural site and species (*Zone A: Open forests, B: Closed forests, C: Low mangroves, D: High mangroves, E: Savannah, F: Cultivated areas*)

Species/area	Reserve, natural park	Stands in-situ ex-situ	Protected natural stands	Protected planted stands	Village fields, homesteads	Experimental fields, trials
<i>Adansonia digitata</i> ZONE A	<100		>1000		>10000	
ZONE B	<100		>1000		>10000	
ZONE C	<100		>1000		>10000	
ZONE E	<100		>1000		>10000	
<i>Afrormosia laxiflora</i> ZONE B	>100		?10000		>1000	
ZONE C	>100		>10000		>1000	
ZONE D	>100		>10000		>1000	
<i>Azelia africana</i> ZONE B	<100		>10000		>1000	
<i>Alchornea cordifolia</i> ZONE A	<100		>10000		>1000	
<i>Bombax buonopozense</i> ZONE A	>500		>10000		>1000	
ZONE B	>500		>10000		>1000	
ZONE C	>500		>10000		>1000	
ZONE D	>500		>10000		>1000	
ZONE E	>500		>10000		>1000	
<i>Borassus aethiopum</i> ZONE A	>1000		>10000		>1000	
ZONE C	>1000		>10000		>1000	
<i>Cassia sieberiana</i> ZONE A	>100		>10000		>100	
ZONE C	>100		>10000		>100	
ZONE D	>100		>10000		>100	
ZONE E	>100		>10000		>100	

Species/area	Reserve, natural park	Stands in-situ ex-situ	Protected natural stands	Protected planted stands	Village fields, homesteads	Experimental fields, trials
<i>Milicia regia</i> ZONE E	<100		>10000		>500	
<i>Cola cordifolia</i> ZONE A	>100		>10000		>1000	
<i>Cola cordifolia</i> ZONE E	>100		>10000		>1000	
<i>Combretum spp.</i> ZONE A	>500		>10000		>1000	
ZONE B	>500		>10000		>1000	
ZONE C	>500		>10000		>1000	
ZONE D	>500		>10000		>1000	
ZONE E	>500		>10000		>1000	
<i>Cordyla africana</i> ZONE A	>100		>10000		>1000	
ZONE B	>100		>10000		>1000	
ZONE C	>100		?10000		>1000	
ZONE D	>500		>10000		>1000	
ZONE E	>100		>10000		>1000	
<i>Detarium senegalense</i> ZONE E	<100		>10000		>500	
<i>Diopyros mespiliformis</i> ZONE A	>500		>10000		>10000	
ZONE E	>500		>10000		>10000	
<i>Erythrophleum guineense</i> ZONE A	>100		>10000		>500	
ZONE C	>100		>10000		>100	
<i>Ficus spp.</i> ZONE B	>100		>10000		>500	
ZONE C	>100		>10000		>500	
ZONE E	>100		>10000		>500	

Species/area	Reserve, natural park	Stands in-situ ex-situ	Protected natural stands	Protected planted stands	Village fields, homesteads	Experimental fields, trials
<i>Khaya senegalensis</i> ZONE A	>500		>10000		>1000	
ZONE B	>500		>10000		>100	
ZONE C	>500		>10000		>100	
ZONE D	>500		>10000		>100	
ZONE E	>500		>10000		>100	
<i>Mitragyna inermis</i> ZONE B	<100		>10000		>1000	
ZONE C	>500		>10000		>500	
ZONE D	>100		>10000		>500	
ZONE E	>100		>10000		>500	
<i>Parinari excelsa</i> ZONE A	>100		>10000		>1000	
<i>Parinari macrophylla</i> ZONE A	<100		>10000		>100	
ZONE D	<100		>10000		>1000	
<i>Parkia biglobosa</i> ZONE A	<500		>10000		>1000	
ZONE B	<500		>10000		>1000	
ZONE C	<500		>10000		>1000	
ZONE E	>500		?10000		>1000	
<i>Prosopis africana</i> ZONE A	>100		>10000		>1000	
ZONE B	>100		>10000		>1000	
ZONE C	<100		>10000		>1000	
ZONE D	<100		>10000		>1000	
ZONE E	>500		>10000		>1000	

Species/area	Reserve, natural park	Stands in-situ ex-situ	Protected natural stands	Protected planted stands	Village fields, homesteads	Experimental fields, trials
<i>Pterocarpus erinaceus</i> ZONE A	>500		>10000		>1000	
ZONE B	>500		>10000		>1000	
ZONE C	>500		>10000		>1000	
ZONE D	>500		>10000		>1000	
ZONE E	>500		>10000		>1000	
<i>Rhizophora racemosa</i> ZONE A	>100		>10000		<100	
ZONE B	>100		>10000		<100	
<i>Spondias mombin</i> ZONE A	>500		>10000		>1000	
ZONE C	>100		>10000		>1000	
ZONE D	>100		>10000		>1000	
ZONE E	<500		>10000		>1000	
<i>Tamarindus indica</i> ZONE C	>500		>10000		>1000	
<i>Terminalia albida</i> ZONE A	>10000		>10000		>1000	
ZONE B	>10000		>10000		>1000	
ZONE C	>10000		>10000		>1000	
ZONE D	>10000		>10000		>1000	
ZONE E	>10000		>10000		>1000	
<i>Vitex doniana</i> ZONE B	>500		>10000		>1000	
ZONE D	>500		>10000		>1000	
<i>Ziziphus jujuba</i> ZONE C	>500		>10000		>1000	
ZONE D	>500		? 10000		>1000	

**Annex 3 :** Species and populations degree of management and security (*Zone A: Open forests, B: Closed forests, C: Low mangroves, D: High mangroves, E: Savannah, F: Cultivated areas*)

Species by ecological zone	Protected in parks	Managed			Unmanaged		Threatened by					
		Soil	Wood, non wood	Animal grazing	Used harvested	used and grazed	Environment	clearing	Over grazing	Infrastructure	other factors	Degree of security
<i>Adansonia digitata</i> ZONE A	<100	>1000	<100	<100	>10000	<100	>500	>500		>500	>1000	3
ZONE B	<100	>1000	<100	<100	>10000	<100	>500	>500		>500	>1000	3
ZONE C	<100	>1000	<100	<100	>10000	<100	>500	>500		>500	>1000	3
ZONE E	<100	>1000	<100	<100	>10000	<100	>500	>500		>500	>1000	3
<i>Afromosia laxiflora</i> ZONE B	>100	>500	>500	<100	>10000	<100	>1000	>1000		>1000	>1000	4
ZONE C	>100	>1000	>500	<100	>10000	<100	>1000	>1000		>1000	>1000	4
ZONE D	>100	>1000	>500	<100	>1000	<100	>1000	>1000		>1000	>1000	4
<i>Azelia africana</i> ZONE B	<100	>1000	>500	<100	>10000	<100	>1000	>1000		>1000	>1000	5
<i>Alchornea africana</i> ZONE A	<100	>1000	>500	<100	>10000	<100	>1000	>1000		>1000	>1000	3
<i>Bombax buonopozense</i> ZONE A	>500	>1000	>1000	<100	>10000	<100	>1000	>1000		>1000	>1000	5
ZONE B	>500	>1000	>1000	<100	>10000	<100	>1000	>1000		>1000	>1000	5
ZONE C	>500	>1000	>1000	<100	>10000	<100	>1000	>1000		>1000	>1000	5
ZONE D	>500	>1000	>1000	<100	>10000	<100	>1000	>1000		>1000	>1000	5
ZONE E	>500	>1000	>1000	<100	>10000	<100	>1000	>1000		>100	>1000	5
<i>Borassus aethiopum</i> ZONE A	>1000	>1000	>1000	<100	>1000	<100	>1000	>1000		>1000	>1000	5
ZONE C	>1000	>1000	>1000	<100	>1000	<100	>1000	>1000				5
<i>Cassia sieberiana</i> ZONE A	>100	>1000	>1000	<100	>500	<100	>10000	>1000		>10000	>1000	3
ZONE C	>100	>1000	>1000	<100	>500	<100	>10000	>1000		>10000	>1000	3
ZONE D	>100	>1000	>1000	<100	>500	<100	>10000	>1000		>10000	>1000	3
ZONE E	>100	>1000	>1000	<100	>500	<100	>10000	>1000		>10000	>1000	3

Species by ecological zone	Protect ed in parks	Managed			Unmanaged		Threatened by					
		soil	wood, non wood	anim al grazi ng	used harveste d	used and grased	Environ ment	over grazing	clearing	infrastru cter	other factors	degree-security
<i>Milicia regia</i> ZONE E	<100	>500	>1000		>1000		>1000	>500			>500	5
<i>Cola cordifolia</i> ZONE A	>100	>500	>500		>1000		>1000	>100			>500	2
<i>Cola cordifolia</i> ZONE E	>100	>500	>000		>1000		>1000	>500			>1000	2
<i>Combretum spp.</i> ZONE A	>500	>500	>500		>10000		>1000	>1000			>500	1
ZONE B	>500	>500	>500		>10000		>1000	>1000			>500	1
ZONE C	>500	>500	>500		>10000		>1000	>1000			>500	1
ZONE D	>500	>500	>500		>1000		>1000	>1000			>500	1
ZONE B	>100	>500	>500		>10000		>1000	>1000			>500	1
<i>Cordyla africana</i> ZONE A	>100	>500	>500		>10000		>1000	>1000			>500	3
ZONE B	>100	>500	>1000		>10000		>1000	>1000			>1000	3
ZONE C	>100	>500	>1000		>10000		>10000	>1000			>1000	3
ZONE D	>500	>500	>1000		>10000		>10000	>1000			>1000	3
ZONE E	>100	>500	>1000		>10000		>10000	>1000			>1000	3
<i>Detarium senegalense</i> ZONE E	<100	>500	>1000		>10000		>10000	>1000			>1000	4
<i>Diospyros mespiliformis</i> ZONE A	>500	>500	>1000		>1000		>10000	>1000			>1000	4
ZONE B	>500	>500	>500		>1000		>10000	>1000			>1000	4
ZONE E	>100	>500	>500		>5000		>1000	>1000			>1000	5
<i>Erythrophleum guineense</i> ZONE A	>100	>500	>1000		>5000		>10000	>1000			>1000	5
ZONE C	>100	>500	>1000		>5000		>10000	>1000			>1000	1
<i>Ficus spp.</i> ZONE B	>100	>500	>500		>5000		>10000	>100			>500	1
ZONE C	>100	>500	>500		>1000		>10000	100			>500	1
ZONE E	>100	>1000	>500	>500	>1000	<100	>10000	>500			>500	1

Species by Ecological zone	Protected. in parks	Managed			Unmanaged		Threatened by					
		soil	wood, non wood	Animal grazing	Used harvested	Used and grased	environment	Clearing	Over Grazing	Infrastructure	Other factors	Degree-security
<i>Khaya senegalensis</i> ZONE A	>500	>1000	>1000	<100	>1000	<100	>10000	>1000		>10000	>1000	5
ZONE B	>500	>1000	>1000	<100	>1000	<100	>10000	>1000		>10000	>1000	5
ZONE C	>500	>1000	>1000	<100	>1000	<100	>10000	>1000		>1000	>1000	5
ZONE D	>500	>1000	>1000	<100	>1000	<100	>10000	>1000		>1000	>1000	5
ZONE E	>500	>1000	>1000	<100	>1000	<100	>10000	>1000		<1000	>1000	5
<i>Mitragyna inermis</i> ZONE B	>100	>1000	>500	<100	>100	<100	>500	>1000		<100	>500	1
ZONE C	>500	>10000	>500	<100	>500	<100	>500	>10000		>1000	>500	1
ZONE D	>100	>10000	>1000	<100	>500	<100	>500	>10000		>1000	>500	1
ZONE E	>100	>10000	>1000	<100	>500	<100	>500	>10000		>1000	>500	5
<i>Parinari excelsa</i> ZONE A	>100	>500	>1000	<100	>10000	<100	>10000	>1000		>1000	>500	5
<i>Parinari macrophylla</i> ZONE A	>100	>100	>100	<100	>1000	<100	>1000	>1000		>500	>1000	5
ZONE D	>100	>100	>100	<100	>1000	>1000	>1000	>500		>100	>500	5
<i>Parkia biglobosa</i> ZONE A	<500	>1000	>1000	>500	>10000	>1000	>1000	>500	>100	>100	>1000	5
ZONE B	>500	>1000	>1000	>500	>10000	>1000	>1000	>500	>100	>100	>1000	5
ZONE C	>500	>1000	>1000	>500	>10000	<100	>1000	>500	>100	>100	>1000	5
ZONE E	>500	>1000	>1000	>500	>10000	>1000	>1000	>500	>100	>100	>1000	5
<i>Prosopis africana</i> ZONE A	>100	>1000	>1000	<100	>10000	<100	>1000	>10000	<100	>1000	>1000	5
ZONE B	>100	>1000	>1000	<100	>10000	<100	>1000	>10000	<100	>500	>1000	5
ZONE C	>100	>1000	>1000	<100	>10000	<100	>1000	>10000	<100	>1000	>1000	5
ZONE D	>100	>1000	>1000	<100	>10000	<100	>1000	>10000	<100	>1000	>1000	5
<i>Prosopis africana</i> ZONE E	>100	>1000	>1000	<100	>10000	<100	>1000	>1000	<100	>1000	>1000	5

Species/ Ecological Zone	Protec ted in parks	Managed			Unmanaged		Threatened by					
		Soil	Wood , Non wood	Animal grazing	Used harveste d	Used and grazed	Environ -ment	clearing	Over grazing	Infrastr ucture	Other factors	Degree of security
<i>Pterocarpus erinaceus</i> ZONE A	>500	>1000	>1000	>1000	>1000	>1000	>1000	>10000	>1000	>1000	>1000	5
ZONE B	>500	>1000	>1000	>1000	>1000	>1000	>1000	>10000	>1000	>1000	>1000	5
ZONE C	>500	>1000	>1000	>1000	>10000	>1000	>1000	>10000	>1000	>1000	>1000	5
ZONE D	>500	>1000	>1000	>1000	>10000	>1000	>1000	>10000	>1000	>1000	>1000	5
ZONE E	>500	>1000	>1000	>1000	>10000	>1000	>1000	>10000	>1000	>1000	>1000	5
<i>Rhizophora racemosa</i> ZONE A	>100	>10000	>1000	>1000	>10000	<100	>10000	>1000	<100	>1000	>1000	5
ZONE B	>100	>10000	>1000	<100	>10000	<100	>10000	>1000	<100	>10000	>1000	5
<i>Spondias mombin</i> ZONE A	>500	>500	>500	<100	>1000	<100	>1000	>500			>500	1
ZONE C	>100	>500	>500	<100	>1000	<100	>1000	>500			>500	1
ZONE D	>100	>500	>500	<100	>1000	<100	>1000	>500			>500	1
ZONE E	>500	>500	>500	<100	>1000	<100	>1000	>1000			>1000	1
<i>Tamarindus indica</i> ZONE C	>500	>500	>500	<100	>1000							4
<i>Terminalia albida</i> ZONE A	<1000	>1000	>500	<100	>1000	>10000	>1000	>500	>10000		>1000	3
ZONE B	>1000	>1000	>500	>500	>1000	>10000	>1000	>500	>10000		>1000	3
ZONE C	>1000	>1000	>500	>500	>1000	>10000	>1000	>500	>10000		>1000	3
ZONE D	>1000	>1000	>500	>500	>1000	>10000	>1000	>500	>10000		>1000	3
ZONE E	>1000	>1000	>500	>500	>1000	>1000	>1000	>500	>10000		>1000	3
<i>Vitex doniana</i> ZONE B	>500	>1000	>1000	>500	>1000		>1000	>1000		>500	>1000	5
ZONE D	>500	>1000	>1000		>1000		>1000	>1000		>500	>1000	5
<i>Ziziphus juzuba</i> ZONE C	>500	>500	>1000	<100	>1000		>1000	1000			>1000	3

### Degree of security

- 1: Low risk of genetic erosion  
2,3,4: intermediate risk of genetic erosion  
5: High risk of genetic erosion