

*State of Forest Genetic Resources
in the dry north of Nigeria*

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

Peter I. Oni



**A co-publication of FAO, IPGRI/SAFORGEN, DFSC and ICRAF
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Forest Genetic Resources Working Papers

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1. SOCIO-ECONOMIC AND ECOLOGICAL CHARACTERISTICS

1.1. Geographic position of the country

The dry region of Nigeria lies between Latitude 13°N and 11°S and Longitude 4°W and 14°E, covering a band of 342,158 km² or 85% total land area of Nigeria (Thulin, 1966; FAO, 1979). The land area occupied by the region is probably by far the largest single agricultural land use in Nigeria covering six states of the Federation.

1.2. Socio-economic information

The rural population in 1997 was 58.71% of a total population of 118.4 million inhabitants with an annual rate of change (1995-2000) of 2.8 % (FAO, 1999). The per capita income in 1995 was 260 dollars with an annual growth rate of GDP (1990-1995) of 1.6 % (FAO, 1999).

The major sectors of employment are agriculture, services and industrial concerns.

1.3. Ecological information

The region is characterized with lower precipitation than evapo-transpiration with an annual rainfall of about 400-1140 mm. There are only 2- 7 months with rainfall in excess of 50 mm in most parts of the region. The landscape is characterized by parklands with patchy grasslands dotted with naturally slow growing, drought tolerant and tire hardy indigenous woody tree.

The dry region is further sub-divided into three ecological zones (A, B, C) on the basis of rainfall and vegetation:

- Zone A (southern) consists of Kaduna north - Zaria (11°10'N, 7° 38'E). It is a Guinea savanna zone with 1200-1600 mm of annual rainfall.
- Zone B (central) consists of Kano-Jigawa (12°03'N, 8°32'E), a Sudan savanna zone with 1000 – 1300 mm of annual rainfall.
- Zone C (Northern) is made up (Katsina, 13°01'N, 7° 41'E) and Sokoto (13° 04'N, 05° 16' W) Jigawa and Bornu State 12° 30'N, 13° 05'E and Yobe state (11° 42'N, 11° 02'E). It is a Semi Arid region with less than 1000 mm annual rainfall.

2. STATE OF FOREST GENETIC RESOURCES

2.1. Phytogeography of the country

According to FAO/UNEP (1981), wood and shrub-lands occur on the largest part of the Guinea, Sudan and Sahel zones of Nigeria. Tree vegetation is generally rare in the Sudan and Sahel zones while it is more common in the Guinea and the derived savanna zones. The vegetation of these two latter zones is cursively presented as follows: “ In the Guinea zone, *Acacia spp.* are relatively rare, and trees which are completely bare in the dry season are rare. Large areas in the northern and median Guinea zones are dominated by *Isobertia doka*, and one distinction between the northern and the median guinea zones is the association of *Uapaca togoensis* and *Bridelia ferruginea* in the latter but not in the former. In the southern Guinea zones *Isobertia doka* is much rarer, and *Daniellia oliveri* is a very abundant tree (though it occurs in the others zones). The tree vegetation of the derived savanna zone is broadly similar to that of the southern Guinea zone, though the grass composition differs”.

The broadleaved woodland is mainly composed of *Annona senegalensis*, *Vitellaria paradoxa*, *Cussonia barteri*, *Daniellia oliveri*, *Isobertia doka*, *Lannea acida*, *Monotes kerstingii*, *Prosopis africana*, *Terminalia avicennioides*, *Uapaca togoensis*.

The Sahel zone is characterized by small, widely dispersed, small-leaved trees, particularly *Acacia* species such as *Acacia tortilis* subsp. *raddiana*, *Acacia seyal*, *Acacia nilotica* and in the northern parts *Acacia Senegal*. A fairly high proportion of the trees are deciduous in the dry season. Some characteristic species (through not confined to this zone) are *Anogeissus leiocarpus*, *Sclerocarya birrea*, *Combretum micranthum* and *Guiera senegalensis*.

Interpretation of radar imagery distinguishes the following (predominantly) shrub vegetation types:

- “Dense shrub grassland” and “shrub grassland” which offer a woody cover of shrub like *Combretum spp.*, *Guiera senegalensis*, *Acacia* species, *Calotropis senegalensis* and *Boscia senegalensis*, sufficient to classify them as wooded formations;
- “Thorny”, “non-thorny” and “mixed” “shrubland and thicket” with the same species as indicated above for the shrub grassland formations;
- “Wooded shrub grassland” (in the Guinea zone) with *Combretum spp.*, *Terminalia spp.*, *Anacardium occidentale*, *Lophira lanceolata*, *Afrormosia laxiflora* and scattered trees of the guinean savanna.

2.2. Utilization patterns of forest species

Within the Northern dry region of Nigeria dietary habits are similar with slight variations influenced by cultural backgrounds. All the trees selectively protected in the parklands provide one or combinations of the following tangible and intangible services: food items (edible fruits, nuts, leaves, flowers, livestock fodder, fuel wood, medicine, aesthetics, shade, agricultural tools and cooking utensils, avenues, and other services such as ropes, fibres, tannin, manure, latex gums and oils. Patterns of utilization are quite similar for the entire region and fall within various headings mentioned above. However more trees are protected for their medicinal values and food.. Fuel wood (fuel energy and heating) are equally of importance. With the exception of *Adansonia digitata* and *Calotropis procera*, all species are utilized as fuel wood obtained from prunings, complete felling or pollarding. All the component parts of the tree featured daily and regularly in the food security and dietary habits of the people with some quantity for market as income. Many of the cattle farmers still rely substantially on these trees for lopped fodder, while the fruits, shells are also fed to the livestock. Shade provision is unique with *Parkia biglobosa*, *Adansonia digitata* and *Tamarindus indica* along side with *Mangifera indica* due to their broad canopies. Currently, income from the sales of fruits of *Parkia biglobosa*, *Vitellaria paradoxa*, *Adansonia digitata*, *Tamarindus indica* and *Balanites aegyptiaca* and *Acacia seyal* account for 30 - 45% of the farmers income. Commonly known exotics including *Mangifera indica*, *Anacardium occidentale* and *Azadirachta indica* are on a par with most the indigenous trees and are equally protected. Soil fertility sustenance is secondary role from some of these trees through litter falls.

Table 1: Different uses of forest species

Ecological zone	Item	Percentage representation (%)
Zone A (Zaria) southern. Guinea savanna zone	Medicine	50
	Food	35
	Fuelwood	20
	Industrial	<5
	Soil conservation	1-3
Zone B (Kano-Jigawa) central. Northern Sudan zone	Medicine	45-50
	Food	35-40
	Fuelwood	10-15
	Industrial	<5
	Soil conservation	1-2
Zone C (Sokoto-Bornu) Northern. Semi arid region.	Medicine	45-50
	Food	25-40
	Fuelwood	10-15
	Industrial	5-8
	Soil conservation	1-3

2.3. Threats

Inadequate fuel wood supply, low precipitation, and desertification encroachments from the Sahel the conservation of forest genetic resources in the Northern semi-arid region of Nigeria. Demographic pressures and rapid urbanization are not perceived as major culprits. The increasing rate of uncontrolled over-exploitation of many of the woody trees species in the region particularly for fuel wood energy is becoming an area of major concern. The demand for poles and small timber and shifting cultivation are minor sources of threats. The presence of *Azadirachta indica*, *Anogeissus leiocarpus* and *Piliostigma thonningii* in most of the parklands is significant in meeting fuel wood supply along with the exotics. Low income levels of most inhabitants predispose them from having access to alternative sources of energy (kerosene and domestic gas). Generally, the parklands are ageing and are less dense compared to what they were two decades ago. In some cases certain size classes for these woody tree species are difficult to assess due to poor regeneration. Other recognizable threats to forest genetic resources within the region include over-grazing, which encourages sand dunes, and wind erosion. In many areas within the region, the absence of enrichment planting is visible for most indigenous woody trees species.

3. MANAGEMENT OF FGR

3.1. *In situ* conservation activities

Protected areas and sacred forests

Forest genetic resources of this region are traditionally protected and conserved on farm lands within the scattered agroforestry enclaves of the people. The total land area under forest reserve for the region is put at 342, 158 Km². While the Sahel savanna covers an area of 31,468 Km² (CFAD, 1979). Within the region some of the species are protected in parks and fetish grooves arising from mythological reasons, which forbids the cutting of some species such as *Adansonia digitata* and *Tamarindus indica*, *Acacia senegal* and *Faidherbia albida*. In the central part of this region (Kano) there is 'Falgore Game Reserve', which harbours many of

these trees including *Isoberlinia doka*, *Khaya senegalensis*, *Vitex doniana*, *Anogeissus leiocarpus*, *Tamarindus indica*, *Detarium microcarpum* and *Pterocarpus erinaceus*.

Table 2: Distribution pattern of threats to forest trees in the sub-Saharan zones

Ecological zone	Item	Percentage representation (%)
Zone A (Zaria) southern. Guinea savanna zone	Illegal felling	45-65
	Demographic	10-15
	Industrial	5
	Plantation forestry	15-20
	Drought	10-20
	Others (insects)	< 5
Zone B (Kano-Jigawa) central. Northern Sudan zone	Demographic	10-15
	Industrial	15-20
	Plantation forestry	25-35
	Illegal felling	40-55
	Drought	10
	Others (insects)	<2
Zone C (Sokoto-Bornu) Northern. Semi arid region.	Demographic	2-5
	Industrial	5-10
	Plantation forestry	20-35
	Illegal felling	35-45
	Drought	20-35
	Others (insects)	>3

For example, trees on farmland in Katsina state were put at 3, 915 km² in 1992. Ex-situ and in-situ conservation work started for *Parkia biglobosa* in 1993 and ninety-four accessions have been collected and conserved in the seed gene bank at the headquarters of the Forestry Research Institute of Nigeria (FRIN) with fifty-four accessions belonging to the rest of West Africa (Sarumi *et al.*, 1995). The distribution of forest reserves in 1983 in the region is indicated in Table 3.

Table 3: Areas of forest reserves as at 1983

State	Total land area (km ²)	Area of reserve (km ²)	% of Reserve forest to land area
Kaduna (now Kaduna and Katsina)	69,392.85	8,825.19	12.72
Kano	43,743.94	1,979.79	4.52
Sokoto	91,960.06	20,358.21	22.17
Borno	199,132.17	1,823.50	4.00

Source: Onochie 1983

Traditional agroforestry parklands systems

Most commonly observed agroforestry systems involve near pure stands of some of the following species especially *Parkia sp.* and *Vitellaria sp.* in south-central zone and *Tamarindus-Anogeissus-Parkia* in the northern zone. Most of these were derived from remnants of long time protective land use and manipulations of elements of the original vegetation in favour of the indigenous multipurpose trees in the farming systems.

Forest enrichment or plantation

Strict natural reserves or plantations for any of the indigenous tree species are rare across the region. However stands of these indigenous trees may be found within some of these plantations.

3.2. *Ex situ* conservation activities

Seed banks

Most afforestation projects in the region are dominated by exotic species and seed supply and demand can be considered as relatively adequate. However seed supply for most of the indigenous tree species are grossly inadequate due to poorly managed seed orchards, intensive collections and utilization by farmers and in-adequate facilities for seed collections and storage by both the state and national forestry organizations. The interest of the farmers to plant indigenous trees is still low due to their slow growth, which had equally affected the replenishment of the old mother trees in the parklands. Most farmers prefer the cultivation of arable food crops to growing of indigenous fruit trees. In addition many of the woody species producing edible fruits are intensively harvested both for food and cash with very little quantity preserved for planting. In almost all parts of the region, supply of seedlings of indigenous woody trees are in limited supply. In recent times, following the report of Nigeria Environmental Study Action Team (NEST, 1990) and the advent of Federal Environmental Protection Agency (FEPA) and National Centre for Genetic Resources Conservation and Biotechnology (NACRAB), the trend is changing. In addition, a number of NGOs are now involved into *ex situ* and *in situ* conservation of the forest genetic resources. These organisations include the Nigeria Conservation Foundation (NCF), the Centre for Research and Development in Natural Resources and Environmental Development (CENRAD), and Plant Diversity Research Organization (PDRO).

Some orchards exist in state and federal Department of Forestry and Forestry Research stations in the region along with *ex-situ* conservation for some of the indigenous trees for seed collections and progeny trials. Species including *Parkia biglobosa*, *Vitellaria paradoxa*, *Adansonia digitata*, *Tamarindus indica*, *Entada africana*, *Moringa oleifera* and *Diospyros mespiliformis*. *Acacia senegal* and *Acacia nilotica* are receiving attention. Periodically, seeds collected are processed and distributed to the seed sections of the Agricultural Development Projects, which maintain direct contact with farmers (stakeholders). The National Agricultural Research Project (NARP, World Bank Assisted) of which the Forestry Research Institute of Nigeria (FRIN) is a part has recently embarked on 1 million seedlings production for afforestation and agroforestry projects and some indigenous trees are included to meet up this region seedlings supply.

Table 4: Seedlings production in the semi-arid region year 1992

State	Seedlings production in 1992
Borno	649,400
Kaduna	2,078,100
Kano	2,800,000
Sokoto	2,020,000
Katsina	3,478,940

Source: The Green light magazine 1992

Ex-situ conservation work started for *Parkia biglobosa* in 1993 and ninety four accessions have been collected and conserved in the seed gene bank in FRIN with fifty four accessions belonging to the rest of West Africa (Sarumi *et al.*, 1995).

The major problem in conservation work has been funding and under-maintenance of storage facilities. Currently the country has two properly equipped seed centres with professional and trained support staff. These centres are the main sources of seed collection, storage and handling for all user groups. More sophisticated equipment are required for seed harvesting, cleaning, handling, processing, sorting, drying and storage. Information documentation is inadequate, old-fashioned, cumbersome and often not standardized. Gene bank management, exploration methodologies and computer skills are also the priorities.

Forest plantation

Except for *Acacia senegal* commercially exploited for gum arabic with plantations existing in Yobe and Domo states, other plantations are mainly for afforestation and shelterbelts planted up with exotics including *Pinus spp.*, *Eucalyptus spp.*, *Gmelina arborea*, *Azadirachta indica* and *Senna siamea*.

3.3. Selection and genetic improvement

Few trial plots exist for *Parkia biglobosa*, *Vitellaria paradoxa* and *Tamarindus indica* in both the southern (Zaria) and northern (Katsina and Sokoto) zones. The Savanna Forestry Research Station of FRIN established these plots. In the northern zone (Katsina and Sokoto) trial plots are in place for *Moringa oleifera*, *Parkia biglobosa*, *Acacia nilotica*, *Tamarindus indica*, and *Vitex doniana*. They were established through the EEC/ Katsina state Arid Zone Project. Some form of deliberate plantings exist for a number of these species by both the farmers (seedlings supplied by local and state Forestry Departments) and direct planting by the State Forestry as demonstration plots or woodlots while the local governments have established small afforestation projects and enrichment plantings either as monoculture on the farmers plots or around homesteads. Instances of some of these trees forming a component of avenues along the major roads are also in practice. Most of the forestry sector, pre World Bank assisted NARP Project were not adequately funded by the national government. However, since the onset of NARP, many areas have been cultivated with indigenous fruit trees, including the establishment and evaluation of provenance trials. Small-scale seedlings establishment are also in existence. The impact of NARP as it relates to indigenous fruits trees in the Northern Sub-Saharan region is however yet to be fully felt.

3.4. National priority species

All stakeholders showed consistent preference for the following species: *Adansonia digitata*, *Acacia seyal*, *Acacia nilotica*, *Acacia Senegal*, *Anogeissus leiocarpus*, *Azadirachta indica*, *Anacardium occidentale*, *Balanites aegyptiaca*, *Borassus aethiopum*, *Ceiba pentandra*, *Combretum microcarpum*, *Eucalyptus camaldulensis*, *Diospyros mespiliformis*, *Faidherbia albida*, *Guiera senegalensis*, *Gmelina arborea*, *Hyphaene thebaica*, *Lawsonia inermis*, *Lannea acida*, *Khaya senegalensis*, *Moringa oleifera*, *Mangifera indica*, *Parkia biglobosa*, *Piliostigma thonningii*, *Pterocarpus erinaceus*, *Pinus spp.*, *Salvadora perica*, *Senna siamea*, *Tamarindus indica*, *Vitellaria paradoxa*, *Vitex doniana*. Highly valued naturalised exotic fruits trees including *Mangifera indica*, *Psidium guajava*, *Anacardium occidentals*, *Azadirachta indica* and *Citrus spp.*, were however not included in the list.

4. POLICY, PLANNING AND INSTITUTIONAL MECHANISM

4.1. National forest policy

The country has a well-guided policy towards forestry conservation and management especially on sustainable resources utilization. However, like in other countries, many policies are characterized with ambiguity and inconsistency in execution. The policy recognizes that forests should be reserved for the purpose of improved water supply, maintenance of soil stability, provision of grazing and recreational use in addition to the vital purpose of wood production (Omiyale, 1990). In the region policies on fuel wood production, shelterbelt and windbreaks, desertification control, agro-silvo-pastoral and production of building poles and small timber are in place.

4.2. Laws and other rules

Nigeria has been a part of the global effort on plant genetic resources conservation. This situation has been clearly demonstrated by its involvement in the various international treaties signed since 1968 (OAU) and the recent Convention on biological diversity in 1992 (Sarumi *et al.*, 1995). Laws forbid indiscriminate bush burning, illegal felling, over-exploitation, overgrazing and planting of another tree where one mature one is removed. However insincerity and bureaucratic procedures affect their proper implementation and monitoring. Farmers are aware of the law against illegal felling and over-exploitation and the consequences of such action, but do not seem worried.

Adequate education and proper orientation of the farmers are major hindrance to the implementation of relevant legislation. Appropriate agencies exist in overseeing and supervising land clearing operations, but the legal framework is defective of many execution procedures. Nigeria had also being a party to many other initiatives towards the conservation of forest genetic resources at the international and national levels. International treaties relating to conservation of plants in which Nigeria is a party include:

- African Convention for the Conservation of Nature and Natural Resources (Came into force in 1974)
- Convention concerning the Protection of the World Cultural and Natural Heritage; Paris 1972
- UNESCO
- Convention on international Trade in endangered species of Wild Flora (CITES) Washington 1973
- Convention on Biological Diversity 1992 -F AO

4.3. Institutions involved in FGR

The genetic resources programme of the country is under the Ministry of Science and Technology. In the last ten years the Forestry Research Institute of Nigeria (FRIN), State afforestation stations, Federal Department Forestry, State and local forestry stations and selected Universities and voluntary organisations in the region have embarked on various research efforts to conserve genetic resources, through appropriate agroforestry systems compatible with fruit trees for the Northern Sub-Saharan region. However, due to the desertification problems, attention continue to be given to the afforestation and shelterbelts using exotics species.

Workshops, seminars and conferences and campaigns have been part of major afforestation strategies.

5. TRAINING AND RESEARCH CAPACITY BUILDING AND REINFORCEMENT

5.1. Research on forest genetic resources

Provenance evaluation trials of exotic species and establishment of seed orchards started in 1960s. Work has been completed for provenance studies and evaluation of native species e.g. *Acacia senegal* and *Acacia nilotica*. Research is also been completed on phenology, fruit characteristics, seeds problems and nursery techniques for some multipurpose trees including *Adansonia digitata*, *Parkia biglobosa* and *Moringa oleifera*. There is an on-going research programme on shelterbelts, wind breaks, sand dunes, fixation and amelioration of micro-climate for agricultural production within the region. Research work is currently in progress in some of the research stations and institutions and within and outside the region on provenance selections, evaluation, vegetative propagation, clonal and progeny studies while aspects of population distribution and phenology have been completed for *Parkia biglobosa* under EEC (European Economic Community) fund. Extensive work has been done on variability of *Acacia sp.* and *Parkia biglobosa*.

5.2. Training

As a result of the activities of IUFRO 1987, training in aspects of breeding including species biology, vegetative propagation, clonal and progeny studies and orchard management have been given to some field staff. Presently the region has several Strict Natural Reserves. Most of the research stations are also equipped with storage facilities for forest genetic materials. As indicated earlier, what remains are funds for maintenance and repairs. Many institutions also exist within the region where staff can be trained in various aspects of forest genetic conservation including tissue culture while the Centre for Genetic Conservation (NACGRAB) also enjoys some training facilities in this field.

6. REGIONAL AND INTERNATIONAL COOPERATION

Within the last fifties years various International organizations and institutions have assisted in the afforestation programme of the Northern Sub-Saharan region of Nigeria especially with the coming of UNDP/FAO in 1964 when the Savanna Forestry Research Station was established. The institutes have put many areas of unproductive forest reserves to productive plantations of exotics species including *Pinus spp.*, *Eucalyptus spp.*, *Tectona grandis*, *Gmelina sp.*, *Acacias spp.* and *Azadirachta indica*. The European Economic Community (EEC) and Japan International Co-operation Agency (JICA) have played various roles in tree nurseries' establishment, training of field extension staff, planting of fruit trees on a variety of sites, establishment of shelter belts and village woodlots in rural areas. It is worth noting, however, that, the activities of some of the organizations have indirectly promoted the erosion of genetic resources of several indigenous species through use of exotic species and monoculture plantations. On the part of the Federal Government of Nigeria, efforts are being made to complement the efforts of these agencies through the setting up different community forestry programmes, education of the masses on the dangers of deforestation, regulations of grazing habit of livestock, promotion of tree planting campaigns and legislation back their activities. Renewed efforts on extension services geared towards the conservation of forest genetic resources of this region also in motion.

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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>Adansonia digitata</i>	1	-	-	-	-	X	X	X	X	X	X	-	X
<i>Acacia seyal</i>	1	-	-	-	X	X	-	X	-	-	-	-	X
<i>Acacia nilotica</i>	1	X	X	-	X	X	-	X	-	X	X	X	-
<i>Acacia senegal</i>	1	-	X	-	X	X	-	X	-	X	X	-	-
<i>Anogeissus leiocarpus</i>	1	X	X	-	X	X	-	-	X	X	X	-	-
<i>Allium saliva</i>	3	-	-	X	X	X	-	-	-	-	-	-	-
<i>Azadirachta indica</i>	1	-	X	-	-	X	-	-	X	X	X	X	-
<i>Anacardium occidentale</i>	1	-	-	-	X	X	X	X	X	X	X	X	-
<i>Balanites aegyptiaca</i>	1	-	-	-	X	X	X	-	X	X	-	-	-
<i>Borassus aethiopum</i>	2	X	X	-	-	X	X	-	-	-	-	X	-
<i>Ceiba pentandra</i>	2	-	X	X	-	X	-	-	X	X	X	-	X
<i>Crotalaria renaria</i>	3	-	-	-	-	X	-	-	-	-	-	-	-
<i>Calotropis procera</i>	3	-	-	-	-	X	-	-	-	-	-	-	-
<i>Combretum microcarpum</i>	2	-	-	-	X	X	-	-	-	X	-	X	-
<i>Eucalyptus camaldulensis</i>	1	X	X	-	X	-	-	-	-	-	X	-	-
<i>Diospyros mespiliformis</i>	2	-	X	X	X	X	X	-	X	X	X	-	-
<i>Faidherbia albida</i>	1	-	-	-	-	X	-	X	X	X	X	-	-
<i>Guiera senegalensis</i>	2	-	-	-	-	X	-	-	X	X	-	-	-
<i>Gmelina arborea</i>	1	X	X	X	-	-	-	-	X	X	X	X	-
<i>Hyphaene thebaica</i>	2	X	X	-	X	X	-	X	X	-	-	-	-
<i>Lawsonia inermis</i>	2	-	-	-	-	X	-	-	-	X	-	-	-
<i>Lannea acida</i>	2	-	-	-	X	X	-	-	-	X	-	X	X
<i>Khaya senegalensis</i>	1	X	X	-	X	-	-	-	X	-	X	-	X
<i>Moringa oleifera</i>	1	-	-	-	X	X	X	-	-	X	X	-	-
<i>Mangifera indica</i>	1	-	-	-	X	X	X	-	X	X	X	X	-
<i>Parkia biglobosa</i>	1	-	-	-	X	X	X	X	X	X	X	X	X
<i>Piliostigma thonningii</i>	2	-	X	-	X	X	-	-	-	-	-	X	X
<i>Pterocarpus erinaceus</i>	2	-	X	-	X	X	-	-	-	X	X	-	-
<i>Pistia stratiotes</i>	3	-	-	-	-	X	-	-	-	X	-	-	-
<i>Pinus spp</i>	1	X	X	-	-	-	-	-	-	X	X	-	-
<i>Salvadora perica</i>	2	-	-	-	X	X	-	-	-	X	-	-	-
<i>Senna siamea</i>	2	X	X	-	X	-	-	-	X	-	X	X	-
<i>Rottboellia exaltata</i>	3	-	-	-	-	X	-	-	-	-	X	-	-
<i>Tamarindus indica</i>	1	-	-	-	X	-	X	X	-	X	X	-	-
<i>Vitellaria paradoxa</i>	1	-	-	-	X	X	X	X	X	X	X	X	-
<i>Vitex doniana</i>	2	-	-	-	X	X	X	X	-	X	X	-	-
<i>Ziziphus mauritiana</i>	3	-	-	-	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

Species/ecological zones	Reserve, natural park	Stands in situ, ex situ	Protected natural stands	Protected planted stands	Villages fields, homesteads	Experimental trials
<i>Acacia senegal</i>	>10,000 individuals	>10,000	>1000	>10,000	>1000	Over 100 provenances and 500 trial plots
<i>Acacia nilotica</i>	>1000 individuals	>10,000	>1000	>10,000	>1000	Over 50 provenances and 500 trial plots
<i>Adansonia digitata</i>	>100	>1000	>1000	>1000	>100	25 provenances and 60 trial plots, 10 clones
<i>Anogeissus leiocarpus</i>	>100	>1000	>1000	>1000	>500	10 provenances and 15 trial plots
<i>Annona senegalensis</i>	>100	>500	>1000	>500	>100	5 provenances
<i>Azadirachta indica</i>	>10,000	>10000	<500	>10000	>1000	Over 100 provenances and several trial plots more than 30 clones
<i>Anacardium occidentale</i>	>1000	>1000	<100	>1000	>500	10 provenances and 60 trial plots
<i>Albizia lebeck</i>	>1000	>10000	>100	>1000	>500	Data not available
<i>Balanites aegyptiaca</i>	>100	>1000	>1000	>1000	>500	60 provenances and over 100 trial plots, 15 clones
<i>Borassus aethiopum</i>	>100	>500	>100	>500	>100	Not available
<i>Bombax costatum</i>	>100	>500	>100	>1000	>100	15 provenances
<i>Ceiba pentandra</i>	>100	>1000	>500	>500	>100	Not available
<i>Calotropis procera</i>	<50	>500	<500	<50	<50	No worked done yet
<i>Carrisa edulis</i>	>50	>100	<100	<100	<50	Not available
<i>Diospyros mespiliformis</i>	>100	>1000	>1000	>500	<100	18 provenances, 10 trial plots and 5 clones
<i>Dododnea viscosa</i>	<50	<100	<500	>100	<50	Not available
<i>Delonix regia</i>	>500	>500	>500	>500	>1000	5 provenances
<i>Entada africana</i>	>100	>100	<1000	>100	>100	15 provenances and 12 trial plots
<i>Eucalyptus camaldulensis</i>	>10,000	>10,000	<500	>10,000	>100	Over 100 provenances and 300 trial plots
<i>Faidherbia albida</i>	>1000	>1000	>1000	>10,000	>100	Over 100 provenances and several trial plots
<i>Ficus platyphylla</i>	<100	>500	>500	>500	<100	10 provenances
<i>Ficus thonningii</i>	>500	>100	>500	>500	<100	Not available
<i>Ficus ingens</i>	<50	<100	>100	>100	<100	Not available
<i>Gmelina arborea</i>	>1000	>10,000	>100	>10,000	<100	Over 100 provenances and several trial plots, 25 clones
<i>Guiera senegalensis</i>	<500	<500	>500	>100	<100	15 provenances

						and 15 trial plots
<i>Hyphaene thebaica</i>	<100	>500	>100	>100	<50	Not available
<i>Khaya senegalensis</i>	>1000	>10,000	<500	>10,000	<100	30 provenances and 3 clones
<i>Leuceana leucocephalla</i>	>500	>1000	<100	>500	<100	10 provenances and 3 clones
<i>Lannea barteri</i>	>100	>500	>100	>100	>100	10 provenances and 3 clones
<i>Landolphia owariensis</i>	<50	<100	>100	>100	>100	Not available
<i>Nauclea esculentus</i>	>100	>500	>100	>100	<100	Not available
<i>Moringa oleifera</i>	>1000	>1000	<500	>10,000	>1000	30 provenances and 5 clones
<i>Mangifera indica</i>	>1000	>1000	>500	>1000	>1000	14 provenances and 3 clones
<i>Parkia biglobosa</i>	>500	>1000	>10,000	>1000	>1000	94 provenances and 43 clones
<i>Phoenix dactylifera</i>	<50	<500	>100	>100	<100	5 provenances and 2 clones
<i>Piliostigma thonningii</i>	<100	>500	>1000	>500	<100	10 provenances and 2 clones
<i>Prosopis africana</i>	<100	<500	>500	>100	<100	5 provenances
<i>Pterocarpus erinaceus</i>	>100	>500	>500	>500	<100	15 provenances
<i>Ximenia americana</i>	<100	>100	>100	>100	>100	Not available
<i>Tamarindus indica</i>	>100	>1000	>10,000	>1000	>1000	25 provenances and 8 clones
<i>Tectona grandis</i>	>1000	>1000	<500	>10,000	<500	Not available
<i>Vitellaria paradoxa</i>	>500	>1000	>10,000	>1000	>500	35 provenances and 5 clones
<i>Vitex doniana</i>	>500	>1000	>1000	>500	>100	15 provenances and 5 clones
<i>Ziziphus spina-christii</i>	>100	>100	>100	>100	<100	5 provenances

* Estimated Tree density