Forest Genetic Resources Working Papers

State of Forest Genetic Resources in Ghana

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

Daniel E.K.A. Siaw

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

December 2001

Forest Resources Division
FAO, Rome, Italy

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Disclaimer

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1. SOCIO-ECONOMIC AND ECOLOGICAL CHARACTERISTICS

1.1. Geographic position of the country

Ghana is almost centrally placed among the West African countries that lie along the shores of the Gulf of Guinea. It lies between latitudes 5° N and 11° N and between longitudes 1° E and 3° N, with the Port of Tema lying on the Greenwich Meridian. It is bounded on the West by Cote d'Ivoire, on the north by Burkina Faso, on the east by the Republic of Togo, and on the South by the Atlantic Ocean. Ghana covers an area of 23 million ha (239, 000 km^2).

Fig. 1: Administrative region of Ghana

1.2. Socio-economic information

The rural population in 1997 was 63.1% of a total population of 18.3 million with an annual rate of change (1995-2000) of 2.3 % (FAO, 1999). The major employment sectors in Ghana are agriculture, services and industrial sectors. About 40 % of total income for all Ghanaians is derived from agriculture.

Per capita income was US $390 in 1995 with an annual growth rate of GDP (1990-1995) of 4.3% (FAO, 1999).

1.3. Ecological information

Ecological information on the northern regions of the country are provided by Kranjac-Berisavljevic' et *al.* (1999). The climate in this area (which extends from approximately 8° N, to lat. 11° N) is characterized generally as tropical continental, or savanna, with a single rainy season, from May to October, followed by a prolonged dry season.

The rainfall distribution and amount controls two distinct ecologies, which can be distinguished within the interior savanna environment of northern Ghana, namely the Guinea and the Sudan savanna.

Most of Northern Ghana falls within the Guinea Savanna Ecological Zone, which is associated with total annual rainfall of about 1000–1300 mm/annum. The rainy season is 140–190 days in duration, while the estimated reference evaporation (ETo Penman) is about 2000 mm/annum, creating a great seasonal deficit every dry season. The peak rainfall period is usually late August or early September. About 60% of the rainfall occurs within the three months (July to September), with torrential rains creating serious drainage problems. In most cases, absorptive capacity of the soil cannot withstand the intensity of the rain, thus creating high amounts of runoff, with erosion being one of the most significant agricultural constraints in the area. Precipitation, however, considerably outstrips evapotranspiration during the main period of the growing season (July–October).

The vegetation cover typical of Northern Ghana consists of mixed formations of fire resistant trees and shrubs. Moving northwards, within the savanna region, there is at first densely wooded and vigorous grassland (*Andropogon, spp.)* with fire resistant shrubs, often referred to as woodland savanna. Further north, at the transition between the Guinea and Sudan savanna, woodland savanna gradually gives way to less wooded tree savanna. Still further, in an increasingly arid environment, grass savanna is formed, with trees and shrubs either absent or very sparse.

2. STATE OF FOREST GENETIC RESOURCES

2.1. Phytogeography of the country

Ghana's total forest zone is estimated at 81,342 km^2 out of which about 17,845 km^2 are known to be under reservations. The savanna woodland zone, located to the northern portion of the country occupies about 65.5% of the country's total land area. Only about 15% of the savanna woodland is under some form of forest reservation.

The following description of the vegetation types of the open broadleaved forest of the country could be given according to FAO/UNEP (1981):

The Guinea savanna woodland

It's extends over the area north of the closed forest and reaches the southeast of the country. This woodland is typically composed of short statured trees, usually not forming a closed canopy and often very widely spaced. Most of the areas lie within the "one-peak" rainfall zone. The true Guinea savanna woodland is a climatic climax. Though this is the case in the centre and north of this zone, there is a very large area in the south where this type of savanna woodland is considered to be a "derived savanna" brought about by human interference. Periodic grass fire-in many localities these are annual- sweep across the country during January to April. Many of the trees are fire resistant and have thick bark.

Riverain woodland

This vegetation type established along the rivers in the northern area contains *Anogeissus schimperi, Celtis integrifolia, Cola laurifolia, Cynometra vogelii, Lannea spp.* and *Parinari polyandra.* Throughout the Guinea savanna woodland are *Anogeissus schiemperi, Vitellaria paradoxa, Detarium senegalense* and *Parkia filicoidea*. *Daniellia oliveri* is common in the South, and particularly so in the derived woodland savanna, where it is often associated with *Entada sudanica.* The *Acacia species* are more frequent in the north than in the south. *Combretum spp.* and *Terminalia spp.* are numerous and often indicate areas of poor drainage. The savanna mahogany, *Khaya senegalensis* is riparian. On worked out land, the vegetation consists of short shrub growth of *Bauhinia rufescens*, *Combretum spp.* and *Piliostigma thonningii*. Fires and grazing tend to restrict their height growth.

The Sudan savanna woodland

It is restricted to a small area in the extreme northeast of the country. It has the highest density of rural population, which has resulted in settled farming. This zone has very sparse tree cover. The arable land contains a sprinkling of *Vitellaria paradoxa*, *Parkia filicoidea*, and *Tamarindus indica*, all of which provide an extra source of food for the local population.

2.2. Utilization patterns of forest species

The main value of savanna forest is the supply of firewood, timber and grazing and non-wood products such as thatch, fruits etc. For trees on farmlands, the farmer usually has the right to fruits. *Vitellaria paradoxa* and *Parkia sp*. are cash sources. Women exclusively process the fruits. They are rarely planted. Young natural regenerated seedlings are protected during weeding.

The savanna zone is poor in indigenous timber resources for industrial use, and only a few species in this zone are of any commercial interest.

The area of unreserved forests is estimated at 63,446.77 km² occurring is small patches and therefore making it uneconomic to manage. A substantial volume of industrial raw materials in the form mostly of timber, however, comes from the unreserved forest areas to augment timber output from the forest reserves. Over 360 tree species have been recorded of which about 190 grow to timber size.

The economic value of Ghana's forest resources lies in the revenues derived mainly from exploitation of its wealth of commercial timbers and the considerable volume of commercial woods and other non-timber forest products (NTFPs). Ghana’s forestry sector contributes 6% of Ghana's energy requirements derive from its forest resources. This is because the majority of rural dwellers burn wood fuel for cooking.

2.3. Threats

The total conserved area is about 15 million hectares. It is estimated that 20,000 hectares per annum of the reserved area is lost to agriculture, or through bush fires and other human activities. In densely populated communities, the populace encroach the reserves to graze animals or obtain dead wood and fruits. Mining for minerals is threatening one of the reserves near Bolgatanga in the Upper East Region.

Agriculture impact on forest lands

As in most parts of Sub Saharan Africa, farming systems in the Northern Ghana are complex and often quite sophisticated systems of production, which have adjusted to external factors (Kranjac-Berisavljevic' *et al.,* 1999). According to these authors, the region of northern Ghana has two principal farm types: compound farms and bush farms. The farming systems prevalent in the region are mixed cropping, mixed farming, inter-cropping and mono-cropping. The crops cultivated in the compound farms include cereals (maize and sorghum), tobacco, yam and vegetable whereas those cultivated in bush farms include cowpea, groundnuts, bambara groundnuts, maize, sorghum, millet, yam and cassava. Cotton is cultivated as a cash crop.

The bush farms are based on the bush fallow system in which cropping and fallow periods are alternated. The fallow periods have been drastically reduced to between two and four years (Kranjac-Berisavljevic' *et al.,* 1999). According to Dwumfour (1994), increased demand for agriculture products and industrial raw materials, from rapid human population growth, has caused the fallowing period to be reduced. Recently with declining soil fertility of agricultural lands, pressure of demand for virgin lands for cocoa, oil palm and other cash crops, encroachment has been a scare to the forester, ecologist or environmentalist. This is only a local problem. These problems threaten the conservation of forest genetic resources (Peprah, 1999).

Forest exploitation (timber and non timber products)

Charcoal and firewood are major income earners for members of communities. Those who cut the trees and shrubs do not consider replacing them. This leads to environmental degradation and loss of genetic resources. Economic trees, shrubs and grasses continue to go up in flames every year due to bushfires. If the present trend continues unchecked, most parts of Northern Ghana will easily become desert.

For centuries, forest product gathering, which is for a subsistence society, has been a major form of land use. This has become significantly commercialised since demand for these items has risen sharply with the increase in population and growing scarcity of produce. Therefore, Ghana experiences levels of resources utilization that far exceeds the productive capacities of the exploited species to sustain exploitation. A number of mushroom species and African snail, *Anachna sp*., which used to constitute a major protein source in the past, have become increasingly scarce. Rattan and cane species (*Calamus deerratus, Raphia hooker, Ancistrophyllum secondiflorum, Ancistrophyllum opacum* and *Eremospatha spp.*) used in the rattan/cane craft are becoming rare (Dwumfour, 1994).

Other types of threats

Bush fires pose serious threats to the environment and forest genetic resources conservation. Ghana experienced over 40 fires in the closed forest areas during the dry years of 1982/83.

Assessment by FAO indicated that about 50% of Ghana's vegetation cover fell victim to the bush fires. 35% of standing crops (cocoa, oil palm etc.) and cereals (sorghum, millet, maize) were also destroyed in the same year (Dwumfour, 1994). Since then bush fires have become frequent, consequently forests bordering the savannah have been seriously degraded.

3. MANAGEMENT OF FGR

3.1. *In situ* conservation activities

Protected areas

The forest reserves have been places where most species can be found, particularly medicinal plant species. Within the high forest zone, this is considered to be more than the minimum requirements for the purposes of environmental protection. The reserved forest is made up of 11, 590 km² of production forests, 4,323 km² of protection forests and about 1,980 km² of game production reserves. Table 1 shows the distribution of reserve areas within the three upper region of the country.

Table 1. Distribution of reserve in the dry region of Ghana

	Upper East Region	**Upper West Region**	**Northern Region**	**Total**
Total land area (km²)	8,8421	-	70,384	-
Reserve area (km²)	1,536	1,295	3,557	6,388
Plantation area (km²)	20	-	-	-

A stock survey of reserves in the savanna region is required to estimate the populations of the species; however there will be greater than a thousand trees of each of the priority species. The Wildlife Department administers the largest area of protected woodlands (i.e. The Mole National Park).

Arboreta

In Ghana there are arboreta at three forest reserves namely, Subri Forest Reserve (Moist evergreen), Pra-Anum Forest Reserve (Moist semi-deciduous) and Bobiri Forest Reserve (Moist Semi-deciduous) (Peprah, 1999). According to the author, the construction of a road through the Subri forest reserve has partly destroyed the arboretum. Fire in 1983 destroyed the arboretum at Pra-Anum Forest Reserve but it has fully regenerated. Presently, the most functional arboretum is the one at Bobiri Forest Reserve. There are about 102 species found in this arboretum.

Sacred forests

Sacred groves are believed to be the habitats for the gods and ancestors of the local communities. As such, these groves are believed to provide protection for the people. The groves are protected, conserved and maintained through a mechanism of beliefs, taboos, prohibitions and restrictions. Burning, cutting of grass and fuelwood are prohibited in these areas.

The conservation of sacred groves by traditional beliefs has led to the preservation of numerous tree and shrub species in the numerous sacred groves scattered over the country.

Traditional agroforestry parklands

In Northern Ghana, farmers maintain and manage different tree species on croplands. The species usually maintained include *Parkia biglobosa*, *Faidherbia albida* and sheanut (*Vitellaria paradoxa Gaerntan*) (Kranjac-Berisavljevic' *et al.*1999). According to these authors, intercropping on arable lands of sheanut and dawadawa (*Parkia filicoides*) is

common in all regions of Northern Ghana. These two tree species are generally not cut and are used as a regular source of fuelwood or other timber products; they therefore form the common speci[illegible]rs in the community selectively pres

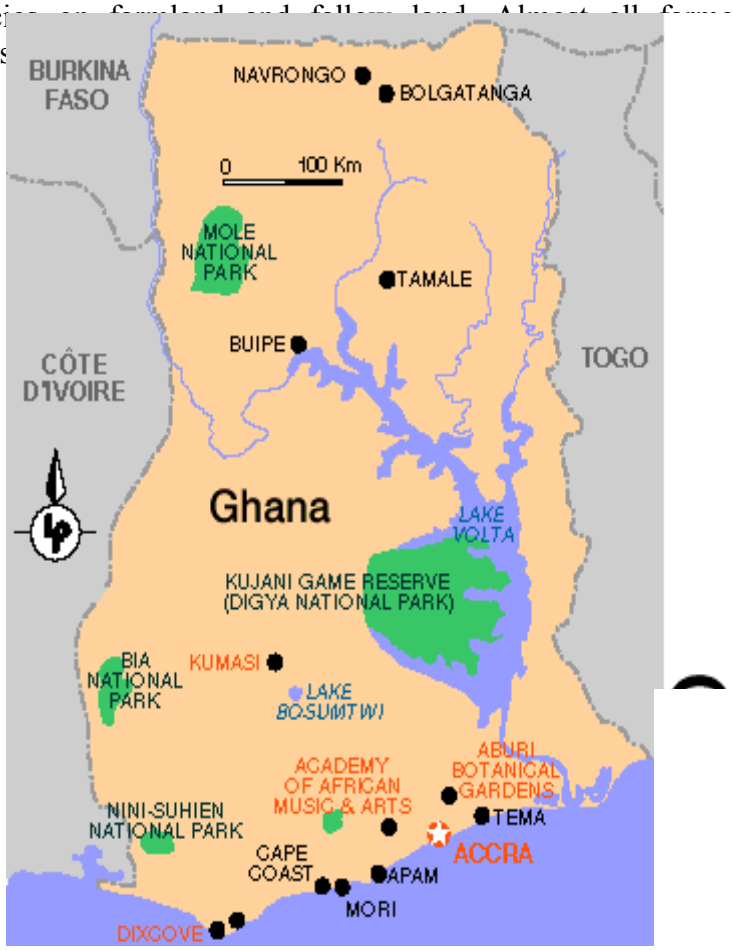

Fig.2: Map showing few National parks of Ghana

3.2. *Ex situ* conservation activities

Seed banks

In Ghana storage of seeds as means of conserving forest genetic resources is not a common practice. A small cold room was built under the Silviculture Branch of the Forestry Department (Forest Services Division) in 1971 but it broke down after 3 years and has since not been rehabilitated. Deep freezers have been used thereafter but they cannot provide the optimum conditions necessary for prolonged storage (Peprah, 1994).

Currently there are no forest tree seeds under storage but plans are well ahead to build a National Seed Centre with cold rooms where at least the orthodox species could be stored as a mean of conservation.

In Ghana the present demand for forest tree seed is estimated at 10,000 kg per annum. Projected demand is even higher because of the intensification of afforestation, reforestation, agroforestry and community forestry programmes.
Currently, some institutions and organisations such as the Forestry Service Division (formerly Forestry Department) and the Agroforestry Unit do their own seed collection from the natural

forest reserves and existing plantations. Others depend on the Forestry Research Institute of Ghana (FORIG) for their seed supply. Request to FORIG for seeds keep increasing year by year from both local and foreign users, but the problem is that FORIG cannot meet the demand. This is because FORIG has not got the facilities to collect and store seeds on a large scale (Peprah, 1994).

Enrichment planting

The aim of enrichment planting is to increase the stock of valuable species. It is in effect an artificial regeneration method being used to supplement natural regeneration.

Enrichment planting plots were established in the Asenanyo (Moist Semi-deciduous), Bia Tano (Moist Semi-deciduous), Nueng Forest Reserves (Moist Evergreen) between 1975 and 1978 (Peprah, 1999). The plantings were done to increase the stock of the heavily exploited or to increase the economic potential of the species in the forest reserves. *Pericopsis elata, Entandrophragma utile, Entandrophragma angolense, Entandrophragma cylindricum, Khaya anthotheca, Khaya invorensis, Nauclea diderrichii, Terminalia ivorensis and Triplochiton scleroxylon* were the species planted.

3.3. Selection and genetic improvement

With a wide array of species that are economically important and widely used, it might be expected that a sufficient diversity of tree improvement programmes will be generated. However, this is not so because of financial difficulties which had affected the Forestry Research Institute of Ghana in the mid 1970's and brought most of the field trials to a virtual standstill.

Several years have been spent collecting important germplasm and their consequent establishment in field trials. There is therefore need to build on this resource. Some of the provenance trials have reached their half rotation and others have passed, again almost all the seed orchards are flowering and fruiting regularly.

Provenance trials

In Ghana a number of provenance trials have been established with the aim of conserving gene pool, providing information on the nature and extent of genetic variation within and between provenances throughout the species native ranges and providing a basis for selection of species for afforestation (Gyimah, 1994 cited by Peprah, 1999). The following species were concerned by these provenances trials (Peprah, 1999): *Terminalia ivorensis* (10 provenances), *Pericopsis elata* (12 provenances) and *Triplochiton scleroxylon* (7 provenances), *Tectona grandis* (13 provenances), *Gmelina arborea* (11 provenances), *Cordia alliodora*.

Clonal trials

Vegetative propagation techniques that would have allowed the establishment of clonal trials to identify the extent of genotypic variation in any of the species mentioned above were not fully utilized (Peprah, 1999). The only exception is *Triplochiton scleroxylon*, where a trial was planted at Afram Headwaters Research Centre in 1963 to compare the performance of rooted cuttings with stumps and striplings. The results showed that up to 12 years old there were no differences between these different types of planting stock. It needs emphasizing,

though, that the cuttings were of unselected clones. This experiment has been destroyed completely by fire. Similar experiment with rooted cuttings of *Pinus caribaea* were compared with seedlings. The results also showed that there was no significant difference between the two types of plants. According to Leakey (1991), this indicates that cuttings are in no way inferior to seedlings. Therefore great benefits of clonal selection could be utilized to maximise genetic gains in yield and other parameters.

Clonal testing on teak is presently going on. Open pollinated seedlings are being used. The materials are from the clonal seed orchards of teak. The clonal seed orchard of teak is also being managed. Half of the plot established in 1978 has been top pruned since 1997.

Vegetative propagation by stem cuttings is being used to propagate some indigenous species to determine their potential capability in rooting if the need be. Species being tried are *Terminalia spp., Khaya ivorensis, Ceiba pentandra, Entandrophragma angolense, Triplochiton scleroxylon* and *Milicia sp.*

Forestry in Ghana has not yet taken advantage of biotechnology methods in afforestation. This is due to lack of facilities and personnel. Presently, interest has been on the use of tissue culture plantlets in plantations, for species, which fruit irregularly, like *Triplochiton scleroxylon.* A biotechnology laboratory is being built at FORIG to facilitate progress in afforestation programmes with some indigenous species.

Genetic resistance in Milicia species

This is an important component of International Tropical Timber Organisation (ITTO) project, which involves an examination of genetic resistance in *Milicia spp*. to the very serious attacks of the psylid *Phytolyma lata*. This insect prevents the establishment of plantations to produce the timber (Iroko or Odum) of these important tree species. It has been thought that mature shoots are tolerant or less susceptible to attack and some trees may be more resistant than others. The project has quantified both these possible sources of resistance. The susceptible and resistant trees have been cloned using stem cuttings and replicates tested for their susceptibility. Results have indicated that resistant clones are less frequently attacked and that insects in any galls formed do not develop to maturity.

3.4. National priority species

List of priority species found in the savanna region of Ghana:

Vitellaria paradoxa (Shea)
Anogeissus leiocarpus
Azadirachta indica
Parkia biglobosa (dawadawa)
Adansonia digitata (Baobab)
Ceiba pentandra
Tamarindus indica
Diospyros mespiliformis
Senna siamea
Khaya senegalensis
Albizzia lebbeck
Faidherbia albida

Acacia nilotica
Acacia seyal
Acacia sieberiana
Acacia polyacantha
Combretum molle
Detarium senegalense
Terminalia glauscescens
Afzelia africana
Lannea acida
Mitragyna inermis

4. POLICY, PLANNING AND INSTITUTIONAL MECHANISM

4.1. National forest policy

In 1945 the Forestry Department published a forest policy for the northern regions and proposals for its implementation (Marshall, 1945).

The various functions of forestry in the Northern territories were indirect utility in the conservation of water supplies, prevention of erosion, shelterbelts and direct utility in the supply of fuelwood, poles and possibly the production of a limited amount of sawn timber (Marshall, 1945, 1947). Silvicultural research in support of improved forest management was prescribed:

- Investigation of the effects of no burning, early burning and late burning on regeneration and growth.
- The effects of pruning side branches and thinning coppice in existing forest: selective pole felling; formation of taungya plantations using leguminous food crops and fire resistant tree species (*Anogeissus sp*., *Bauhinia sp*.).
- Utilization research planned in preservation of roofing poles and pit sawing of comparatively small trees.

The policy framework for Savannah Woodland Management (SWM) has not been reviewed since 1945. The Forestry Department spends most of its energy protecting the reserves from the people who own them and for whom they were created. A new collaborative approach whereby the Forestry Department and the communities form working partnerships is needed.

A new and clear policy framework is needed to guide overall development of Savannah Woodland Management to encourage local participation:

- A new policy should clarify the overall purpose of SWM. Is it primarily an engine of local economic development and environmental protection or to supply charcoal to southern Ghana and protect the Volta Lake?
- The new policy should clarify whether the area under permanent protection is sufficient and if more protected areas are needed what strategy to employ
- The new policy should clarify the appropriate medium term and long-term role for the Forestry Department. In the short term there will be moved from a regulatory, exclusion, protection role to supporting the development of more participatory forestry management (with communities, NGO's, EPA).
- The new policy should clarify the purpose of revenue generation from SWM. As far as possible the revenue should be returned to the landowners, district assemblies and farmers

of these impoverished areas to support development and their own forest management efforts, environmental protection, farming systems, support, ecological maintenance e.g. Biodiversity.

- The policy on conversion needs to be reviewed such that poor sites where the cost of establishing plantations cannot be recouped are not converted since the Mean Annual Increment is low (Forestry Department Planning Branch, 1997).

4.2. Laws and others rules

Existing laws are either obsolete or are inadequate to deal with present environmental issues (Dwumfour, 1994). But two main bottlenecks have impeded the efficacy and effectiveness of environmental legal regulations in the country according to Dwumfour (1994): There is total lack of compliance with existing legal commitments and an inherent weakness of enforcement procedures. Thus, some specific, achievable actions are needed to provide practical basis direct action for improving the environment, implementation of national policies and programmes to reconcile social, economic and environmental objectives in development.

Many conventions related to forest genetic resources conservation and utilization have been signed /ratified by Ghana (Dwumfour, 1994):

- The African Convention on the Conservation of Natural Resources, Algiers, 1968.
- Convention on Wetlands of International Importance especially as Waterfowl Habitat, Ramsar, 1971.
- Convention concerning the Protection of the World Cultural and Natural Heritage, Paris, 1972.
- Convention on International Trade in Endangered Species of Wild flora and fauna, Washington, 1973.
- Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 1979.
- International Tropical Timber Agreement, Geneva, 1983.
- Convention on Biological Diversity, Rio de Janeiro, 1992.

4.3. Institutions involved in FGR

Other agencies concerned with savanna woodland in management the Northern Regions:

- Environmental Protection Agency (EPA), Tamale. The EPA tries to raise awareness of destruction of the environment and the steps needed to restore it. Monitoring and education are the main activities. Inter-sectoral networks have been established.
- Savanna Agricultural Research Institute (SARI), Tamale. The main emphasis at SARI is on food crop production. Three farming systems research groups have been set up. One group targets each of the Upper West, Upper East and Northern Regions of Ghana. The groups include researchers in wildlife, socio-economists, entomology, soils and agronomy. Agroforestry research is conducted on the use of different tree species to improve soil fertility.
- University of Development Studies (UDS), Tamale, Faculty of Agriculture. The UDS was established in 1994. Its Department of Renewable Natural Resources included forestry, wildlife and grassland management. Teaching, research and extension activities are supported
- The Agroforestry Unit of the Ministry of Food and Agriculture has an office in each district. Their activities are mostly extension and supply of seedlings to farmers. Tree

species are distributed free but fruit tree seedlings are sold to farmers to plant on cropland, woodlots, boundaries, fodder banks and for soil conservation.

- The Forestry Research Institute of Ghana (FORIG) The Forest research institute has fourty research staff in various disciplines. FORIG has a sub-unit in Bolgatanga to support its savannah research programme (Ofosu-Asiedu and Nketiah, 1996).

There is poor relation between the Forestry Department and communities around the reserves. There should be a strategy of involving the landowning groups in the process of objectives set ting and policy formulation.

Better coordination is needed between the Forestry Department and other agencies and NGOs by establishing local working groups.

5. TRAINING AND RESEARCH CAPACITY BUILDING AND REINFORCEMENT

5.1. Research on FGR

In general it is difficult to find any mention in records of any formal savanna woodland research programme conducted by the Forestry Department after the late 1960's.

However from 1986 to 1988 a Forestry Department, Community Forestry Project in the Northern Region supported by ODA ran a programme of research into technical and sociological factors influencing the development of community forestry action in the Northern region. Trials included: Woodlot spacing trial, species screening trial, wet site trial, living fence experiment; planting material trial shelterbelt establishment, Combretum regrowth trial; agroforestry plots, field windbreak, boundary planting; lump side protection planting; enrichment planting of natural woodland, yield trials at Sinsangbleweni forest reserve designed to assess the volume of wood products produced under different site and management conditions.

The current thrust of savanna forest research is:

- Selection and cultivation of fast-growing savanna trees: identification of tree species that grow well in the savanna, the development of techniques for their cultivation and the study of the socio-economics of savanna afforestation.
- Utilization of selected savannah trees for industrial products aside from energy
- Management of existing savannah woodlands to take advantage of coppicing ability of savanna tree species and natural regeneration.
- Agroforestry Research: A survey of traditional agroforestry trees on farms, fallows and homesteads, the uses of these trees and the roles they play in sustainable management.
- Socio-economic studies of agroforestry systems to determine economic returns of trees.

5.2. Training capacity

The staff of the Forestry Department is hindered by lack of knowledge on the following: - sustainable productive potential of savanna woodlands, silviculture (phenology, rate of growth, coppicing ability, regeneration) of savanna species; community issues, anthropological studies, real effects of fire and grazing, coverage and extent of savanna

woodlands, role of trees and reserves in farming systems and local economies. Furthermore, the Forestry Department is hampered by lack of infrastructure, lack of transport, poor deployment of staff, general neglect of savanna by Forestry Department, minimal value attached to savanna woodland management, lack of mandate to work off-reserve, low morale, late release of funds, insufficient money for operations etc.

6. REGIONAL AND INTERNATIONAL COOPERATION

Funding should be sought to support regional cooperation schemes (networks) to look at some of the highlighted research topics.

Working groups should be formed in each country to implement the activities. Issues that could be addressed could include:

- Halting the decline of the Guinea Savannah Ecosystem;
- Technical Opportunities and Community Challenges.
- Survey of energy use requirements and strategies for meeting the need;
- Livestock production systems, labour allocation, livestock nutrition and marketing
- Survey of farming systems, role of tree, protected, wild, planted (sacred groves)
- Impact of season of migrant pastoralist on rangelands browse
- Description of existing institutions their present and future development strategies for better coordination.

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ANNEXES

Table 2: Values and use of target, important species

Name of species	Value code	Present, future or potential use											
		ti	po	wo	nw	pu	fo	fd	sh	ag	co	am	xx
Acacia nilotica	2		x	x	x							x	x
Acacia campylacantha	2		x	x	x								
Acacia dudgeonii	2		x	x	x								x
Acacia gourmaensis	2		x	x	x							x	
Acacia sieberiana	1		x	x	x							x	x
Acacia chariensis	2		x	x	x							x	x
Adansonia digitata	1			x	x		x						x
Afrormosia laxiflora	2		x	x									
Afzelia africana	1	x	x	x									x
Albizzia lebbeck	1		x	x								x	
Andira inermis	1	x	x	x									
Anogeissus leiocarpus	1		x	x	x								x
Annona senegalensis	1				x								
Azadirachta indica	1	x	x	x	x		x					x	
Balanites aegyptiaca	3		x	x	x		x					x	
Bauhinia refescens	1			x	x							x	
Bombax costatum	2		x	x			x						
Borassus aethiopum	2	x	x				x					x	
Boswellia dalzielii	2		x	x	x								
Bridelia ferruginea	2		x	x	x								
Bridelia micrantha	2			x	x								
Burkea africana	2	x		x	x								
Calotropis procera	2				x								
Ceiba pentandra	1	x		x	x							x	x
Celtis integrifolia	1		x	x	x		x					x	
Hexalobus monopetalus	2	x	x	x									
Hymenocardia acida	3	x	x										
Heeria insignis	2			x									
Isoberlinia dalzielii	3	x		x			x						
Isoberlinia doka	2		x	x			x						
Khaya senegalensis	1		x				x						
Kigelia africana	3				x		x						
Lannea acida	2			x	x		x						
Lannea afzelli	3		x		x								
Lannea barteri	3				x		x						
Lonchocarpus laxiflorus	2			x	x	x	x						
Mangifera indica	1		x	x	x		x						x
Manilkara multinervis	2	x		x								x	
Maytenus senegalensis	3		x	x	x							x	
Mitragyna inermis	2			x			x						

Name of species	Value code	Present, future or potential use											
		ti	**po**	**wo**	**nw**	**pu**	**fo**	**fd**	**sh**	**ag**	**co**	**am**	**xx**
Moringa oleifera	3		x		x								
Nauclea latifolia	2		x		x								
Ostryoderris chevalieri	2		x				x						x
Parinari curatellifolia			x		x								
Parkia clappertoniana	1		x		x								
Piliostigma reticulatum	3				x								
Piliostigma thonningii	2		x		x								
Poupartia birrea	2		x		x								
Prosopis africana	2		x				x						
Pseudocedrela kotschyi	1	x	x		x								x
Pteleopis suberosa					x							x	
Pterocarpus erinaceus	1	x	x		x							x	x
Quisqualis indica	3												
Sclerocarya birrea	2		x	x	x							x	
Securidaca longepedunculata	3			x	x					x	x		x
Securineaga virosa	3		x							x	x	x	
Senna siamea	1		x					x				x	x
Sesbania sesban	2				x		x					x	
Spondias monbin	2		x									x	
Sterculia setigera	3			x									
Stereospermum kunthianum	2		x		x							x	
Strophantus hispidus	3		x	x	x								
Strychnos triclisioides	2		x	x			x						
Swartia madagascariencis	3		x	x	x							x	x
Tamarindus indica	1		x	x								x	x
Tectona grandis	1	x	x	x	x				x	x			x
Terminalia avicenioides	2		x	x	x								
Terminalia macroptera	2	x		x	x								
Trichilia roka	2		x	x	x							x	x
Vitellaria paradoxa	1		x	x	x		x		x	x			x
Vitex doniana	2			x			x						
Vitex chrysocarpa	3												
Vitex simplicifolia	3			x			x					x	
Ximenia americana	2			x			x					x	
Ziziphus mauritania	2			x								x	
Ziziphus mucronata	2												

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).