SIERRA LEONE:

COUNTRY REPORT TO THE FAO INTERNATIONAL TECHNICAL CONFERENCEON PLANT GENETIC RESOURCE

(Leipzig, 1996)

Compiled by:

Department of Agriculture and Forestery

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Note by FAO

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CHAPTER 1
Introduction To Sierra Leone and its Agricultural Sector

1.1 BASIC INFORMATION

a) Size, Location and Physiographic Features.

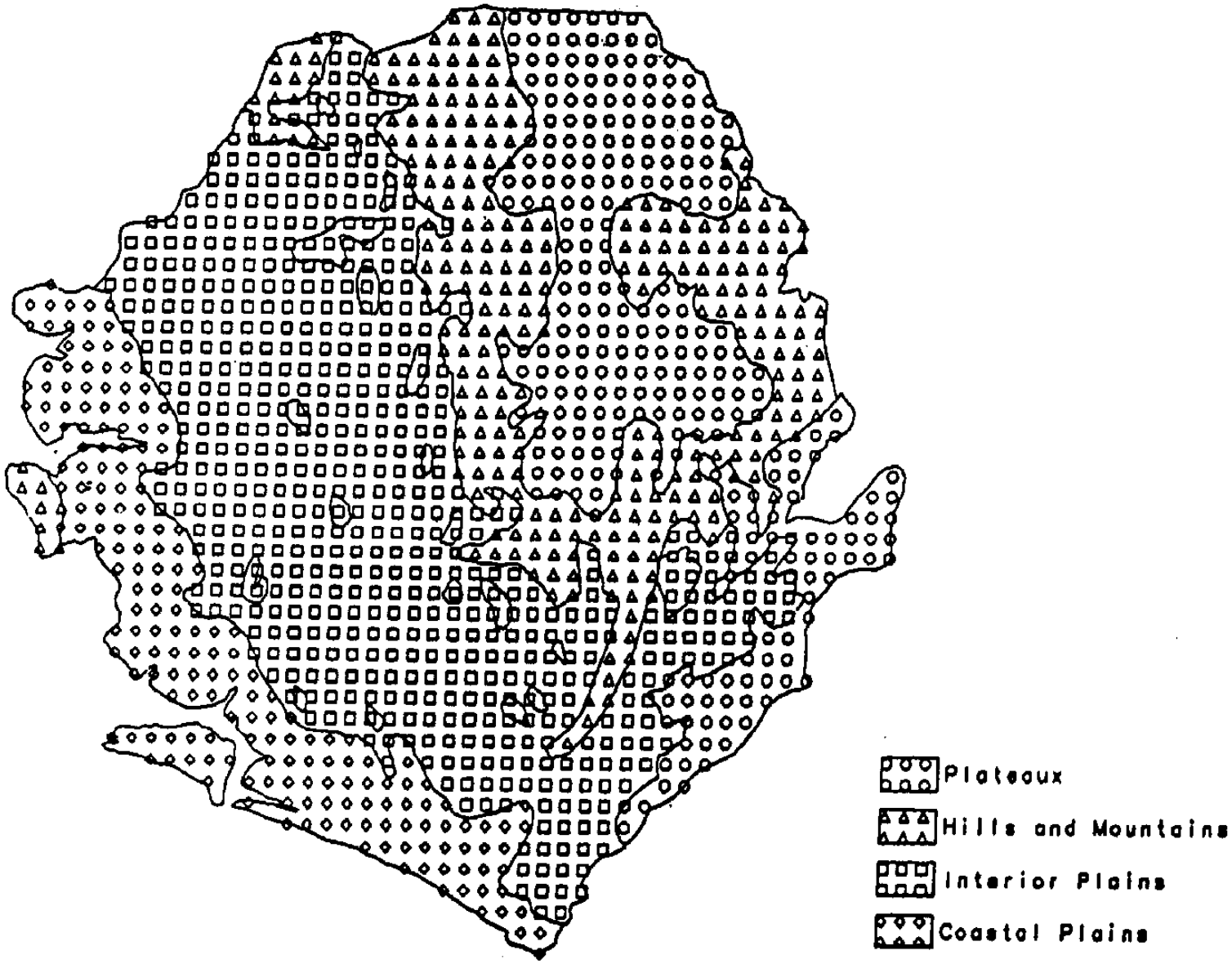
Sierra Leone is located on the West African coast between 7 and 10^0 N Latitude and 10 and 14^0 W Longitude. The country occupies a land area of 72,300 km^2. There are four main physiographic regions in Sierra Leone: the peninsular mountains, the coastal plain, the interior plain and the interior plateau and hill region (300m to 3,000m above mean sea level) (See Figure on page 2).

The Freetown peninsular mountains are the result of a large basic intrusive body of gabbro with mountain ranges rising almost up to 900 metres above mean sea level. The coastal plain is a strip about 40 kilometres wide adjoining the coast and running parallel to it. Most of it is less than 15 metres above sea level and is built up of recent marine deltaic deposits of the Bullom series. The topography is nearly flat with subdivisions including sandy beach ridges and lagoons, mangrove swamps, alluvial grassland flood plains, raised beaches and coastal terraces.

The interior plain is about 100 kilometres wide running parallel to the east of the coastal plain. It has an elevation of 15 metres in the west and about 150 metres in the east. Different types of rocks which are mainly granite and acid gneiss underlie the interior plains; such as: crystalline schist and gneiss of the Kasila series; sandstone, siltstone and mudstone of the Rokel river series; schist and quartzite of the Marampa series; granite and acid gneiss. All these rocks are of pre-Cambrian age. The interior plain contains many swamps especially in the boliland region which is underlain by sedimentary rocks of the Rokel river series.

The interior plateau and hill region cover the north- eastern half of Sierra Leone, and is part of the Guinean Highlands. It consists mainly of elevated plateau country, between elevations of 300 and 600 metres above sea level. In the central area and near the Guinea border, the Tingi Hills and Loma mountains rise far above the main plateau region with peaks around 1900 metres above mean sea level. Farther south-east in the upper Moa river basin, the elevations decrease to only about 150 and 300 metres. Most of this area is underlain by granite and acid genesis.

PHISICAL REGIONS OF SIERRA LEONE



b) Climate

Sierra Leone has a hot tropical climate with two pronounced seasons: a rainy season from May to November, and a dry season from December to April. The rainy season has weather patterns occurring in the following order: thunderstorms and squalls for some months, steady rains then thunderstorms and squalls again.

The thunderstorms and squalls occur at the beginning and end of the rainy season with high intensity and frequency in May-June and October-November. Steady rains occur in the middle of the rainy season from July to September. Rainfall is frequent and often heavy and about 80 to 85 percent of the annual rainfall occurs during this period.

The sky is mostly overcast and sunshine less frequent with relative humidity between 95 and 100 percent. Temperatures are at their lowest between 20° to 25°C and the diurnal range of temperature is small. Rainfall is highest in the coastal areas and the total ranges from 3,048 to 5,080 mm. This decreases to between 2,032 to 2,540 mm in the north of the country.

Natural rainfall supplies water to cultivate crops such as rice, maize, cassava and plantation tree crops in the rainfed production system in the uplands. The prevalent cloud cover during the rainy season reduces the number of sunshine hours and effective solar radiation and thus adversely affects crop yield.

The dry season is characterized by dry weather with high humidity, a short period of dry weather with low humidity (Harmattan) and then dry weather with high humidity again. The mean monthly ambient temperatures range from 27°C to 33°C. The relative humidity is high with the mean monthly figures exceeding 80 per cent for most of the year.

c) Population

The population of Sierra Leone is approximately 4.5 million (1994 estimate) growing at about 2.6 percent per annum with higher population densities in the mining areas and urban centres. The infant mortality rate of 153 per 1,000 is one of the highest in the world. Life expectancy at birth is 42 years and adult literacy level was 8 per cent for females and 22 per cent for males in 1990.

The migration of young men to urban areas has contributed to an aging farming population.

d) Vegetation

The country exhibits a wide variety of vegetation types including high forests, farm bush in the upland ecology. The lowland ecology comprises inland valley swamps, bolilands, riverain grasslands and mangrove swamps (Table 1).

The high forest is characterized by tall, mostly evergreen trees with a closed canopy at about 30 metres with occasional emergent trees. Remnant high forests are now found on steep and often inaccessible ranges of hills such as the Kambui, Nimini, Dodo, Kangari and Tama-Tonkoli hills. Other places with existing high forests include: Forest reserves, chiefdom protected forests and village sacred bushes. Their principal uses for logging timber and for farming have contributed to the drastic reduction in the area under high forest in Sierra Leone. Two types of high forest exist: the tropical rain forest and the moist semi-deciduous forest.

The tropical rain forest is characterized by trees with drip-tip leaves; numerically species-rich forest trees that grow in intimate mixtures; abundant rainfall of at least 3,000 mm concentrated into seven months of the year. Tropical rain forests are found mainly in forest reserves in the Eastern Province and in the Western Area.

The moist semi-deciduous forest has similar characteristics to the rain forest, but with a greater proportion of deciduous forest trees. They are concentrated in the central and south western parts of the country. The two main types of semi-deciduous forests are the Tama-Tonkolili and Kasewe types. These forests are used mainly for logging and farming activities.

Only about 5 per cent of the land area is now covered by closed forest. The rest has been converted to Secondary forest regrowth sometimes seen as thickets and fast-growing forest trees and farm bush *stricto sensu*. The local farmers generally refer to whole secondary regrowth as "farmbush". Due to population pressure on the land, "farmbush" replaces high forests after clearing for use in farming and as a source of firewood. Farming is done in the cleared site for 2 to 3 years before it is abandoned for a short fallow period of less than 10 years.

A further shortening of the fallow period leads to loss in soil productivity, decrease in tree species, and increase in the number of oil palms and herbaceous plants. This leads to a change from the farm bush state to predominantly grass/shrub or grass/herb mixture referred to as derived savanna. Guinea savanna vegetation exists in three forms: savanna woodland found in the south of the savanna zone consists of fire tolerant tree species with closed canopy in a tall grassy cover with the dominant cane grasses being *Andropogon* and *Chasmopodium* species. In the open savanna, the trees are more widely spaced and in L*ophira* savanna, *Lophira alata* is the dominant tree species among tall (3 to 5m) cane grasses. The savannas are found in the central and northern half of the country and are used for farming and cattle grazing.

Table 1 Diversity of plant communities within major ecosystems in Sierra Leone

Vegetation type	Plant community	Percent Of Country*
		(71,740 Km^2)
A. Tropical	-Rain Forestry	50.0%
Closed	-Moist Evergreen	protected as
Forest	-Moist Semi-deciduous	forest reserves
	-Secondary forests	3.6%
	-Forest Regrowth	52.2%
B. Swamp	-Mangrove Swamp	2.4%
Forests	-Inland Valley Swamp	1.5%
(Wet lands)	-Fringing forests	0.4%
	-Raphia swamp	0.5%
	-Gallery forests	0.1%
C. Savanna	-Moist, closed, Guinea	
Woodlands	Sav. Woodland	8.6%
	-Mixed-tree, open Sudan	
	Sav. woodland	10.1%
	-Lophira tree savanna	3.7%
	-Coastal park savanna	
	Woodland	1.5%
	-Tall grass (3m)	3.5%
	savanna	3.5%
D. Seasonally Flooded	-Riverain grassland (1-3m tall)	2.5%
Grasslands (wetlands)	-Boliland swamp + grassland (1m tall)	?
	-Lateritic pan grassland (very short)	?
	-Montane grassland (1m, short)	0.1%
E. Plantations	-Rubber	?
(+Farmland &	-Oil Palm	0.1%
wasteland)	-Coffee & Cacao	2.3%
	-Fuelwood	?
	-Forest trees	?

(ex Cole, 1968, Gordon et al (1979)

The closed forest, "farmbush" and savanna vegetation make up the upland ecology which is the largest single ecology with 4,200,000 hectares and accounting for 78.4 per cent of the total land area. These uplands are less fertile and less

suitable for cultivation on a sustainable basis. They are however suitable for tree crop cultivation. The lowland ecology comprises of inland valley swamps, bolilands, riverain grasslands and mangrove swamps. They are more fertile than the upland ecology with considerable potential for intensive cultivation under good management.

The inland valley swamps are generally narrow, flat bottomed, seasonally flooded valleys, varying in size from 10 to 200 hectares. Typically, the swamp is drained only by a sluggish stream and floods for several months during the rainy season. These swamps cover an area of 690,000 hectares making 12.9 per cent of the total land area and are found all over the country. They are relatively fertile and ideal for flooded rice cultivation in the rainy season and vegetable production in the dry season.

Bolilands are seasonally flooded saucer - shaped depressions found in the interior plains in the north of the country covering an area of 145,000 hectares and making up to 2.7 per cent of the land area. Their drainage is very poor and most of the soils are highly acidic. They are used principally for rice cultivation.

The mangrove swamp area extends along the coast, where tidal action causes an overflow of seawater at high tide and the draining of the area at low tide. During the dry season, the soil becomes very acid through oxidation of sulphides. The crop is subject to various depths of flooding. Serious diseases are absent, but weeds are a major problem as well as damage by crabs. Mangrove swamps cover an area of 200,000 hectares covering 3.6 per cent of the land area.

The riverain grasslands cover an area of 130,000 hectares representing 2.4 per cent of the land area. They are located in the Southern Province on the alluvial flood plains of the Waanje and Sewa rivers. They are used mostly for rice cultivation.

e) Farming System

Traditional shifting cultivation is by far the predominant system of farming in the country. Most farmers produce a wide range of crops under rainfed conditions. These include rice which is usually the main crop, cassava, sweet potato, maize, sorghum, yams, groundnut, benniseed (sesame) millet, okra, garden eggs, pepper and a host of leafy vegetables.

Crop yields are quite low with farmers hardly producing enough for home consumption with little or nothing for the market. They are generally constrained by a lack of necessary resources except perhaps land. Low yielding crop varieties are widely grown and fertilizers and other inputs rarely used.

Due to the growing population and increasing pressure on the land, the fallow and cropping cycles have been drastically reduced in many areas which has resulted in declining soil fertility and crop yields. A system of land management that allows intensive use of the land but at the same time maintains a relatively stable level of agricultural production is urgently needed.

1.2 PROFILE OF THE AGRICULTURAL SECTOR

Agriculture is the dominant sector in the Sierra Leone economy accounting for nearly 48 per cent of the Gross Domestic Product (GDP) and employing 65 per cent of the population. It accounts for nearly 10 per cent of recorded export earnings. Out of 5.4 million hectares (75%) of arable land area, about 600,000 hectares are cultivated by an estimated 400,000 small holder families with an average annual cultivated area of 1.5 hectares per household. Large scale farming is rare but cash crops such as coffee and cacao are exported. Total rice production for 1986 was 525,000 mt. Net rice imports increased from 4,100 mt in 1961 to 265,000 mt in 1971 and presently about 231000 mt of rice is imported into the country each year.

The livestock sector consists of 6 million poultry, 330,000 each of cattle and sheep, 180,000 goats and 500,000 pigs. Cattle are concentrated in the Northern Province. Livestock contribution to the agricultural gross domestic product is about 12 per cent.

The fisheries sub-sector contributes about 20 per cent to the agricultural gross domestic product and accounts for about 75 per cent of the animal protein consumed in the country. The marine resources are exploited by two groups: the large scale deep water industrial fishery operating within the 200 miles territorial water limit and the artisanal fishery operating within 5 miles of the coast using canoes and other small craft. The artisanal fishing operations employ 17,000 fishermen with over 34,000 people engaged in processing, transporting and trading. The inland fishery activity produces between 10,000 and 20,000 tonnes per annum.

The forestry sector contributes between 9.0 and 13.1 per cent to the agricultural gross domestic product. Over 80 per cent of domestic energy needs (excluding electricity generation and vehicle transportation) comes from burning wood biomass. About 400 km^2 of forest land are under nominal protection.

1.3 SEED SUPPLY SYSTEM

There are presently no commercial seed companies in the country. However there is a GTZ - supported Seed Multiplication Project that multiplies and sells mainly improved rice seeds to farmers. Less than 10 per cent of farmers' seed needs are met by this organisation. Limited amounts of maize and groundnut seeds are also multiplied by the Project which also imports and sells assorted vegetable seeds.

The Rice Research Station has over the years produced breeders, foundation and certified seeds for local use. The Institute of Agricultural Research multiplies and sells improved seeds of maize, cowpeas and groundnuts and also supplies vegetative stems of cassava and sweet potato. However, the seed production capacity of the Research Institutes is limited and they could meet only a very small percentage of the demand. There is therefore an urgent need to substantially increase the seed production capacity of the Institutes.

1.4 TRENDS IN PLANT PRODUCTION AND FORESTRY

Recent trends in rice production reveal a decrease in total paddy rice from 562,000 tonnes in the late seventies to 420,000 tonnes in 1993/94. This general trend was observed for most of the other crops, e.g. ginger production declined from 1,000 metric tonnes in the early 1980s to 9 tonnes by 1986/87.

The reasons for these trends are many. These include the increase in the age of the farming population; soils becoming less fertile because of frequent use due to short fallow periods; farming profession becoming less economically attractive to young farmers who migrate to cities leaving the arduous task of crop production to aging farmers. The low adoption rate of improved varieties because farmers cannot afford some of the recommended inputs and the weak national extension service are also contributory factors.

CHAPTER 2
Indigenous Plant Genetic Resources

2.1 INTRODUCTION

Naturally occurring plant genetic resources in Sierra Leone are found as wild species of under-exploited, lesser-known economic plants growing in the major vegetation types in the country. The wild species of economic plants occur in the tropical moist and rain forest, the savanna woodlands and the various types of grassland communities. Due to the high rate of deforestation of these natural vegetation in West Africa as a result of the traditional system of shifting cultivation, lumbering for timber, frequent bush fires over the past century, only 4 percent of the original closed forest vegetation remains in Sierra Leone.

Most of the country is now dominated by secondary forests and their regrowth stages - farm bush and thickets - which are also being devegetated due to the impacts of economic development activities. More recently over the past two to three decades, additional causes of deforestation have resulted from domestic energy demand for firewood and charcoal, rapid urbanisation with increased urban population density, and widespread alluvial mining for precious mineral (Cole and Karim, 1994).

One of the most serious negative impacts of deforestation on the natural vegetation, is the loss of species, some of which may be unknown to science in terms of economic potential and usefulness to mankind. Genetic erosion of wild indigenous plant species through deforestation deprives any country of the sustainable management of its natural biological resources. These resources form the basis for sectoral development of human activities in agriculture, horticulture, forestry, medicines for maintaining good health, and in environmental management. Because of the current threat of deforestation on indigenous biological resources, Cole and Macfoy (1992) carried out an inventory of about a thousand under-exploited economic plants in West African plant communities. The study showed that 65 percent of these economic plants were still growing in the wild compared to the commonly used domesticated plant species.

Of the five categories of uses mentioned above, 42 percent of the economic plants inventoried were medicinal plants, 21 percent were food and cash crops used in agriculture, about 20 percent were timber trees and other species used in cottage industries, 15 percent were ornamentals used in horticulture, and the rest

(2 percent) can be used for environmental management. This last group of plant species are being increasingly used for managing the environment through supply of biomass for renewable energy sources, pollution control in rivers using aquatic weeds to extract heavy metal nutrients, and in the use of sand-binding creepers to control soil erosion and to stabilize sand beaches undergoing coastal erosion by wave action.

This study will concentrate on the indigenous plant genetic resources used in forestry, agriculture, horticulture and medicine.

2.2 FOREST GENETIC RESOURCES

The majority of merchantable/commercial forest tree species of socio-economic importance are managed by the Division of Forestry in the Department of Agriculture and Forestry remnant protected natural closed forest, now forming only 4 percent of the country. The forest estate in Sierra Leone comprises the main forest reserves (the Golas, Kambui, Tama-Tonkoli, Western Area); the protected strip forests belonging to chiefdoms; the game reserves Qutamba-Kilimi, Mamunta-Myosa); and, forest plantations of mainly exotic timber species (*Gmelina arborea, Tectona grandis, Pinus caribeae, Eucalyptus* and *Melaleuca species*).

Logging in the closed moist or rain forests for timber species was widespread up to half a century ago, but is now concentrated only to the Gola Forest Reserves, the Kambui Hills and the Tama- Tonkoli Forest Reserves. Management of forest reserves after logging for timber, is based on the tropical shelter-wood system and on selective silvicultural enhancement with commercial species in forest gaps.

The conservation of the forest genetic resources is enhanced by programmes and management plans being carried out by NGOs such as Sierra Leone Conservation Society and the Gola Rain Forest Conservation Programme of the Royal Society for the Protection of Birds (RSPB), United Kingdom.

a) Construction Timber

The most important timber species being logged in Sierra Leone for the building construction and furniture trade are: the *mahogany Khaya anthotheca*, Entandrophragma utile*, E. angolensi*, E. cylindricum*,* the African walnut *Plakenetia conophora** = *Tetracarpidium conophorum*, African cedar - *Afzelia africana*, African oak - *Oldfieldia africana**, African teak - *Chlorophora excelsa*, *Terminalia ivorensis, T. superba, Piptadeniastrum africanum, Daniellia thurifera, Klainedoxa gabonensis, Brachystegia leonensis, Albizia ferruginea, Parkia biolor, Xylia evansii, Ricinodendron heudelotii, Hannoa klaineana, Erythrophleum*

ivorense, Irvingia gabonensis, Mimusops heckelii, Cathormion altissimum, Amphimas pterocarpoides, Cynometra leonensis, Tieghemella heckelii*, Heritiera utilis, Lophira procera, Sacoglottis gabonensis*, Triplochiton scleroxylon*, Parinari excelsa, Bussea occidentalis, Pentaclethra microphylla* and others (see Savill and Fox, 1967, Cole 1968, and Deighton, 1957). Cole (1993) gives the conservation status of forest timber species, especially those in the Gola Forest Reserve complex.

Other components of forest genetic resources besides timber tree species are namely: plant species supplying building poles, native roofing materials, piassava for the export broom trade, and mats which are more related to indigenous building construction. For example, slender poles for the rafters and framework of mid houses are obtained from fast-growing tree species in secondary forest regrowth. The tropical pines and eucalyptus plantations can supply poles for electricity and telephone lines, whilst the common oil palm tree trunk is laid across small rivers and streams as bridges for vehicles.

Traditional roofing material is the bamboo thatch made from the leaves of Raphia palm (*R. gracilis)* and that of the climbing Rattan palms (*Ancistrophyllum secundiflorum, Eremospatha maorocacpa* and *Calamus deeratus*), which also provides Piassava fibres. The 3-5m tall savanna cane grass (*Andropogon, Chasmopodium, Pennisetum species*) serve as roofing thatch in northern Sierra Leone. Mats (pokah and lokoh) for spreading on mud floors or to serve as ceiling cover or dividers of rooms, are made from the stems of *Marantochloa* species and from various large sedges *(Cyperus, Papyrus, Mariscus, Hypolytrum* species) growing in inland valley swamps.

b) Cottage Industries

Forest genetic resources are also concentrated in a wide range of closed forest species (some trees, lianes, shrubs and herbs) used for the cottage industries. Indigenous plant species provides natural dyes for gara-making, latex, gums, fibres, carving woods, cosmetic, alkali for soap making, sponges and gourds, which provide a wide base for the cottage industries. Indigenous plant species producing dyes from the leaves or bark are: *Lonchocarpus cyanescens* and *Indigofera suffructiosa* (Blue-indigo dye), *Bixa orellana, Baphia nitida, Harungana madagascariensis* (orange-red dyes); *Cola nitida, Anacardium occidentale* (brown dye) and *Alchornia cordifolia* and *Mucuna pruriens* (Black dye). The alum tree (*Craterispermum laurinum*) provides a mordant for the tie-dye gara-industry. Latex is produced from several plant families (*Apocynaceae, Asclepiadaceae, Solanaceae, Euphorbiaceae* and *Moraceae*) but the African rubber tree (*Funtumia elastica and F. africana*) have potential for commercial latex like the para-rubber

* Threatened species deserving conservation

tree (*Hevea brasiliensis*), an exotic in this country. Gum producing tree species are mainly the *Albizias (A. zygia, A. gummifera, A. andianthifolia)* and a few other species in the closed forests and savanna woodlands.

c) Fibres

Fibres produced in Sierra Leone can be either the fine cotton floss from *Ceiba pentandra, Bombax buonopozense, Gossypium hirsutum*, *Funtumia* species, *Calotropis procera*, used for weaving country cloth or for stuffing pillows. The other kind of fibre used for rope making comes from the bark of shrubs (*Clapertonia ficifolia, Urena lobata, Corchorus olitorius* and *Triumfetta cordifolia*), or the fleshy leaves of the sisal plant (*Agave sisalana*). Raffia fibre for making twines or art-work is peeled off the fronds of young palm leaves (oil palm, coco nut, raffia palms). Local brooms for sweeping are also made from the midribs of the pinnae of the above-mentioned palm fronds, whilst hard brushes and brooms are made from the bristles of piassava obtained from the climbing palms (rattan and raffia).

d) Wood Carvings

Wood carving is another cottage industry directed towards tourism and production of household utensils which are dependent on forest tree species. Either hardwood are used for carving e.g. mortar and pestles, walking sticks, handles for axes, hoes, shovels, or soft woods for carving mask heads, miniature forms of wildlife, and other wooden curios of touristic values. The hardwood species used are the Africa ebony (*Diospyros spp., Dalbergia melanoxylon*), *Albizia gummifera, Afrormosia laxiflora*, *Pterocarpus erinaceus* and *Dichostachys glomerata*. For soft wood carvings, indigenous species used are *Mitragyna stipulosa, Baphia nitida, Spondias purpurea* (Gambia plum) and *S. mombin* (fits plum), as well as the common exotic softwoods, *Gmelina arborea* and pines. In recent times, graphic artists are creating common village scenes using the dried up fibres of banana stem *(Musa sapientum*), fallen leaves on forest floors, variously coloured seeds and dried floral parts.

e) Cosmetics and Household Utensils

African women play an important role in making use of forest products in traditional societies for use as cosmetics, for house hold and kitchen utensils, and for making soap in the home. Some of the dyes described above are used by African women to adorn their bodies in red/purple or to blacken their gums permanently. Various species produce neck laces and beads worn by women e.g. the red seeds from *Erythrina senagalensis, Abrus precatorius* and variegated white-grey-brown seeds of the swamps grass Coix *lachryma-Jobi* (the tears of Job). Before the advent of Europeans, African traditional societies produced black soap from the caustic ashes of burnt dried up banana stem or from burnt barks of *Carthomion altissimum* or fruits of *Tetrapleura tetraptera,* which are common forest timber trees. Kitchen utensils used as gourds for collecting water or palm wine are

obtained from *Lagenaria siceraria* and calabashes of various sizes from *Strychnos spinosa* and *Crescentia cujete*. Wooden spoons are generally carved from soft wood forest species. Natural sponges obtained from the loofah gourd (*Luffa aegyptica and L. acutangula)*, are used as bathing sponge or for washing plates.

2.3 WILD SPECIES AND WILD RELATIVES OF CROP PLANTS

Wild species of economic crops which are important commercially in agriculture, horticulture and in traditional medicine will be dealt with in this section, as the first section has covered indigenous economic forest species and their commercially related forest products. The indigenous plant genetic resources of agricultural cash and food crops, of ornamental plant species used in horticulture, and of medicinal plants were reviewed by Cole and Macfoy (1992).

2.3.1 Agricultural wild species

From the study of the 142 economic crop species used in traditional agriculture, eight groups were recognized as follows:- (a) Legumes (4.9%), (b) cereals (6.3%), (c) edible fruits (29.6%), (d) nuts and oils (6.3%), (e) vegetables (15.5%) (f) pot-herbs (14.8%), g) root crops (9.9%) and h) beverages (12.7%). Of these groups 55% to 65% of the species of edible fruits, legumes, cereals and nuts were under-exploited and still growing in the wild. Similarly, 35% to 45% of beverages, vegetables and root crop species occur as wild species, whilst only 9.5% (i.e. 19 out of 21 species) of pot-herbs or leafy vegetables were still wild species, as most of them are being domesticated in backyard gardens of town houses and in villages for daily use.

a) Wild Edible Fruits

The group of 42 species of tropical fruits eaten raw, such as mangoes and banana, 64 percent are still mainly found as wild species in closed forests, forest regrowth and savanna woodlands. Some of the wild fruits are: *Tamarindus indica* (sour tumbler), *Tarrietia utilis* (African almond), *Detarium senegalense* (dita), *Dacryoides trimera* (damzon), *Vitex doniana* (black plum), *Anisophyllea laurinia* (monkey apple), *Spondias mombin* (fits plum), *Flacourtia vogelii* (black berry), *Omphalocarpum pachysteloides* (botlem), *Chrysophyllum cainita* (bobby water), *Erythrococca anomala* (bush lime), *Mammea americana* (mammy supporter), *Passiflora foetida* (passion fruit), *Uvaria chamae* (finger fruit), *Salacia senegalensis* (malombo), *Uvaria afzelii* (monkey finger), *Citropsis articulata*, a wild citrus relative. It is to be noted that some of the wild fruits are collected for making wines, jam and fruit juices as well.

b) Tropical Cereals

Of the 9 species of cereal crops, five belong to the staple food crop - rice - *Oryza sativa* (white) and *O. glaberrima* (brown rice native to Sierra Leone). Three wild relatives of brown rice found growing as weeds of cultivation are *O. brachyantha* in upland rice farms, *O. barthii* and *O. longistaminata* in riverain grasslands. Other cereals growing in this country are maize, (*Zea mais*), Kus-Kus (*Sorghum magaritiferum*), bulrush millet (*Pennisetum americanum*) and fundi (*Digitaria exilis*).

c) Vegetables

Wild vegetables include *Lagenaria siceraria* (white pumpkin, bottle gourd), *Solanum macrocarpon* (wild jakato) and *S. dasyphyllum*, both wild relatives of the tomato, squash and jakato. *Trichosanthes cucumerina* (snake tomato) is a good tomato substitute whilst *Beilshmielda mannia* (tola is a substitute for dried powdered okra, and *Luffa acutangula* is fluted okra. It is also well known in this country that seeds of water melon (*Citrullus lunatus*), and pumpkin (*Cucurbito pepo*) are ground into egusi powder for thickening leafy vegetable soups. However, recent substitutes are castor oil seeds (*Ricinus communis*) and groundnut (*Arachis hypogea).*

d) Leafy Vegetables

The leafy vegetables (pot-herbs) form a wide large of protein-supplemented palm oil sauces to accompany starchy staple foods (rice, yam, cassava, fundi) in West African diets. 21 species of pot-herbs commonly used are now being domesticated but over 70 percent are still found as weeds in farmbush e.g. *Celosia argentea* (shokotoh-yokotoh), *C. leptostachya* (ajefawo), *Bidens pilosa* (bush needle), *Portulaca oleracea* (rat's ear), *Solanum nigrum (*ogamoh and efo-odu), *Crassocephalum biafrae* (bologi), *Basella alba* (broad bologi), *Talinum triangulare* (Lagos bologi), *Emilia coccinea* and *E. praetermissa* (efonyori), *Ocimum basilicum* (patmenji) and *Struchuim sparganophora* (water bitters).

e) Beverages

The beverages farm another important group in Sierra Leone. Two indigenous wild species of coffee are: *Coffea stenophylla* and *C. liberica* found in neighbouring wild Gola -Gofa rain forest with Liberia. Another substitute for colanut chewing is bitter Kola (*Garcinia kola*) which is chewed instead and is becoming more popular due to its medicinal effects (anticongestant, diuretic and antipyretic). Fragrant teas are brewed from dried leaves of *Cymbopogon citratus* (lemon grass), *Lippia chevalier* (Gambia tea bush), *Ocimum gratissimum* (tea bush) or *Hyptis suaveolens* (bush tea bush). Within the beverage group are the natural protein sweeteners, two of which occur in Sierra Leone, namely *Thaumatococcus daniellii*

(Ketenfe) and *Dioscoreophyllum cumminsii* (serendipity berry). One must not forget the beverages "drunk straight from the tree" namely palm wine - tokpoi from *Elaeis giuneensis* (oil palm) and duvui from *Raphia vinifera* (raffia palm).

f) Legumes, Oily Nuts and Root Crops

Of minor importance are very few wild species and relatives of the tropical spices, legumes, nuts producing oils and the root crops growing in the country. For instance spicy wild species *Mentha spicata* (mint), *Cinnamonum zeylanicum* (cinamon), *Xylopia aethiopica* (symingi) and the local farmer's tobacco (*Nicotiana rustica*). Wild legumes are rare - *Physiogstigma venosum* (calabar beans), *Parkia biglobosa* (kenda, locust beans) and *Voandzeia subterranea* (bambara groundnut). For wild species of nuts producing edible oil are: *Diospyros heudelotii* (bush palm kernels), *Telfairea occidentalis* (oyster nuts), *Cassia bicapsularis* (fula butter), *Butyrospermum paradoxum* (shea butter) and *Pentaclethra macrophylla* (fawei). *Pentadesma butyracea* (sodei) also produce a pleasant edible oil from its large fatty seeds. Finally as far as the tropical root crops are concerned, wild relatives are common only for the yam of which there are also five species under cultivation. The wild relatives of yams are *Dioscorea bulbifera, D. hirtiflora and D. minutiflora*.

2.3.2 Horticultural wild species

About 102 species of tropical ornamental plants, either with showy flowers or with conspicuous variegated leaves, were inventoried by Cole and Macfoy (1992). About half of the species are still growing in the wild as components of natural closed forests floor flora, savanna woodlands or grassland vegetation types. Some of these wild indigenous potential ornamental species in this country are shrubs (57%), forest or savanna trees (18%) or monocot herbs (25%). Ornamental wild trees are: *Newbouldia laevis* (purple flowers), *Spathodea companulata* (flame of the forest), *Markhamia tomentosa* (yellow flower with purple etreaks), *Milletia sanagana* (pink flowers) and *Canthium subcordatum* (with fragrant flowers).

The wild ornamental shrubs are: *Jasminum pauciflora, J. dichotomum, Abrus precatoruis, Clerodendron splendens, Ruspolia hypocrateriformis, Justicia flava, Acanthus guineensis, Cassia alata, Ixora brachypoda, I. hiernii, Mussaenda afzelii, M. erythrophylla, Rothmannia longiflora, Monechma depauperatum, Erythrina senegalense, Crotalaria mucronata and Coreopsis asperata*. The herbaecous wild ornamentals are mainly found in montane grasslands at Tingi and Loma, e.g. *Acidanthera acquinoctialis, Helychrysum nodiflorum, Sonchus elliotianus, Gladiolus psittacinus* and *G. klattianus. Others in forest and savanna are: Habernaria genuflexa, Eulophia gracilis, Nelsonia canescens, Asystacia scandens, Ipomoea mauritiana and Merremia umbellata*.

2.3.3 Medicinal plants

Local drug plants used in traditional medicine in this country are either curative or highly poisonous and used for ritual murders. The majority (70%) of medicinal plants are wild species and various studies have been made about these plants in West Africa (Dalziel 1937, Oliver-Bever 1986, Burkill, 1985 & 1994). Cole (1994) studied the ecology-habitats of over 450 medicinal plant species in the various West African plant communities, and provided a comprehensive list of such drug plants by habitats, hence there is no need to repeat this list here as most of them occur in similar plant communities in this country. The report showed that about 30% of drug plants are exotics already in cultivation locally as food crops or ornamentals. 40% of the wild species of drug plants are found in the closed forests including regrowth vegetation, 20% in savanna woodlands, 7% in the aridlands and 3% in wetlands.

Some of the common drug plants in closed forests are highly poisonous: *Dichapetalum toxicarium* (broke-back), *Erythrophleum guineense, Strophanthus hispidus, Rauvolfia vomitoria, Voacanga africana, Allophyllus africana, Paullina pinnata, Adenia cissampeloides, Strychnos usambarensis, Cnestis ferruginea, Alafia multiflora, Dichrostachys glomerata, Carapa procera, Alchornea cordifolia Craterispernum laurimum, Blighia sapida, Mareya micrantha, Mucuna pruriens* and *Adenia lobata* and *Tephrosia vogelii,* as fish poising. In the savanna woodlands and grasslands, the common drug plants are *Cassia sieberiana, Phyllanthus discoideus, Terminalia macroptera, Butyrospermum paradoxum = Vitellaria paradoxa, Hymenocardia acida, Anthocleista procera, Grewia carpinofolia, Dioscorea dumetorum* and the lily *Urginea indica.*

Weedy medicinal plants growing in wasteland communities are common in this country as in the rest of West Africa, such weedy species are: *Ageratum conyzoides, Cassia absus , Solanum nigrum, Euphorbia hirta, Phyllanthus amarus, Centella asiatica, Borreria verticilata Biden pilosa, Spigelia anthelmia*, *Desmondium gangeticum*, *Boerhavia diffusa*, and *Gynandropsis gynandra*. Some farmbush shrubs are also drug plants such as: *Cassia alata, C. tora, C. podocarpa, C. occidentalis* (stinking weed) and *Corchorus olitorius* (pot-herb kren-kren).

2.4 LANDRACES (FARMERS' VARIETIES) AND OLD CULTIVARS

Old cultivars or landraces of crops held by local farmers and maintained from one cropping season to another, were still in use in this country up to the end of the 1980s. But due to the disruption of the farming system, burning of villages and forced migration of the rural population to the larger urban centres by the rebel incursions (1991 to now), there is no guarantee for the wildspread existence

of old cultivars and landraces. Although limited information is available on the use of traditional varieties of food crops, yet some agriculturists in this country are knowledgeable of important landraces of staple food and cash crops, maintained by farmers in specific areas in the country. Within the past few years, a Community Biodiversity Development and Conservation (CBDC) Programme funded by the Centre for Genetic Resources in the Netherlands, was being implemented by the Rice Research Station at Rokupr, Sierra Leone, not only for landraces of rice and other grains but also for important root crops, vegetables and fruits locally used.

On the whole, landraces or old cultivars of major crops in this country show distinct morphological features in their seeds, fruits or propagating storage organs. For example, there are several landraces of rice, some of which have undergone breeding experiments at the RRS, Rokupr to give the series of ROK 1 to ROK 33 as improved varieties in terms of yield, cooking qualities, palatability. For the root crops, there are the white, yellow, pink coloured tissue or skin cover of sweet potato.

Also, cassava tubers with varying quantities of prussic acid from the bitter cotton tree variety to the sweet coco-cassava with very little poison which is hydrolysed on cooking. The common kus-kus cereal exists as creamy, grey, light to dark brown grains in the market. Also, some edible fruits like pawpaw, mango and bananas show distinct differences in sizes, shapes colour of tissue and skin, palatability, sweetness and keeping qualities (shelf life).

These are surely different landraces occurring in different parts of the country but no systemic survey or inventory has been done recently by any Government Department or local Research Institute. Besides the different features shown in the seeds, fruits and vegetative organs of landraces, differences are also common in the physiognomy or form and size of the cultivated plants. Some local farmers can tell the variety of mango from the form of the growing tree, whether the fruit will be a cherry, ropey, common, damzin, granny or sheep-tone variety of mangoes.

It is hoped that at the end of the Rebel War, the CBDC Programme will enhance the study of landraces and old cultivars which are fast disappearing in Sierra Leone. However, landraces do spread through population migration coupled with dispersal of fruits and seeds or through hybridization where varieties naturally occur in the same habitat. Land use policy in this country is not yet clearly defined, hence its impact on the conservation of landraces of important crops in the country is ill-defined at present.

CHAPTER 3
National Conservation Activities

3.1 CONSERVATION ACTIVITIES

Germplasm collection is a major part of the crop improvement activities in Sierra Leone. Crop scientists at the two agricultural research centres, Rice Research Station, Rokupr and the Institute of Agricultural Research at Njala, do embark on a systematic collection of local crop varieties of rice, maize, sorghum, millet, cassava, sweet potatoes, cowpeas and groundnut. The main objective of this exercise is to preserve the genetic diversity of useful crop plants that could be used in crop improvement programmes.

Conservation activities at the research stations are mainly *ex situ*. Collections are grown on-station for both maintenance and regeneration. The National Herbarium at Njala University College has over 21,000 plant specimens. The National Forestry Division maintains their germplasm *in situ*. These are in the form of protected natural areas which include the Outamba Kilimi National Park; the Tiwai Island Wildlife Sanctuary and Forest Reserves such as the Gola, Loma Mountains, Tingi Hills and Western Area Forest Reserves. The Botanical Reserve at Fourah Bay College is another form of *in situ* conservation.

There is also an herboratum based in Kenema. *In situ* conservation sites are managed by skilled forestry officers who are supposed to enforce laws for the conservation of the protected areas.

However, the protected areas of Sierra Leone are faced with a lack of management capacity and threats from agricultural encroachment and hunting pressures. The Forestry Division of the Department of Agriculture and Forestry has little funding to manage the protected areas. Also, failure to enforce the management objectives of protected areas in Sierra Leone often undermines their status as conservation areas.

The forest reserve system, established in 1910, is the most institutionalized form of land management and protection in Sierra Leone. Forest reserves cover 3.9 percent of Sierra Leone's land area, a total of 294,700 hectares and includes all the country's remaining mature closed canopy forests. Very few of the forest

reserves have management plans and only 27 per cent have been inventoried. Management and protection of forest reserves are inadequate and all are subject to agricultural encroachment and illegal hunting.

3.2 STORAGE FACILITIES

The collected materials are stored on laboratory and office shelves under ambient conditions with temperatures ranging from 28-35^{0}C and humidity from 50-95 per cent depending on the season. There are no facilities for long term storage.

Seeds are regenerated usually under field conditions. Very important materials are stored in gene banks outside Sierra Leone such as the International Institute of Tropical Agriculture (IITA) in Nigeria, the West African Rice Development Association (WARDA) Cote d'Ivoire, The International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) Sahelian Centre in Niger Republic; the International Rice Research Institute (IRRI) in the Philippines and the International Potato Centre (CIP) in Peru.

There is need to establish a national gene bank with sufficient capacity for all crop species including cereals, root and tubers and forest species. It should have the responsibility for preserving and maintaining the country's plant genetic resources and should collaborate with regional and international institutions.

3.3 EVALUATION AND CHARACTERIZATION

The characterization and evaluation of materials using recommended IPGRI descriptors are undertaken for any material collected. Locally accepted criteria are incorporated in the evaluation process. Farmers are involved in the evaluation exercise by participating in On-Farm trials and demonstrations. Evaluation generally includes observations on general adaptability, disease and pest susceptibility and general consumer acceptability. No genetic finger printing is presently done, but there are plans to commence such work in the near future.

Upon the establishment of a National gene bank, international collaboration would help achieve better evaluation results. A crop based approach on regional basis could also help obtain better results.

3.4 DOCUMENTATION

Most of the collections are documented by the use of index cards and in the case of cassava there is a partially computerised database. Each sample collected carries passport characterization and evaluation data. Dissemination of information to users is primarily by letters and personal communication with farmers.

CHAPTER 4
In-Country Uses of Plant Genetic Resources

4.1 USE OF PLANT GENETIC RESOURCES COLLECTIONS

Plant genetic resources obtained from local and foreign sources are used to a large extent in varietal improvement programmes. As pointed out in Chapter 3, the main external sources are IITA in Nigeria, IRRI in the Philippines, WARDA in Cote d'Ivoire, ICRISAT Sahelian Centre in Niger and CIP in Peru.

New cultivars of various crops mainly rice with superior plant characteristics and performance have been developed. Local farmers and those in the sub-region including Guinea, Guinea-Bissau, Senegal, Liberia and the Gambia have benefited from improved varieties of rice, cassava and sweet potato emanating from Sierra Leone.

The types of crop species, external seed sources, number of in-country users, approximate per cent accessions used in the past three years and number of scientists using the genetic resources are presented in Table 2.

Table 2 Types of crop species, external seed sources, number of in-country users, approximate percent plant accessions used in past three years and number of scientists using genetic resources in Sierra Leone

Crop / species	External seed source	No of different in-country users.	Approx. % Accessions used in past 3 years.	No of National Scientists using *species*.
Rice *(Oryza sp)*	IRRI, IITA, WARDA.	Variable but high	30-40 %	30
Cassava *(Manihot sp)*	IITA	"	80%	10
Sweet potato *(Ipomoea sp)*	IITA, CIP	"	70%	10
Maize *(Zea mays)*	CIMMYT, IITA	"	90%	15
Sorghum *(Sorghum sp)*	ICRISAT	"	30%	12

Crop / species	External seed source	No of different in-country users.	Approx. % Accessions used in past 3 years.	No of National Scientists using *species*.
Cowpea *(Vigna sp)*	IITA	"	80%	10
Groundnuts *(Arachis sp)*	ICRISAT	"	0%	10
Pearl millet *(Pennisetum sp)*	ICRISAT	"	15%	12

Apart from the use of local crop collections in national crop improvement programmes, local varieties of some crops such as rice that are very productive have been multiplied and distributed to farmers across the country. Local varieties are used as checks in regional and international trials.

Genetic materials from outside sources especially the International Agricultural Research Centres (IARCs) are routinely evaluated in association with local varieties on-station and if found to be desirable are further evaluated in multi-locational trials. Thereafter, the promising materials are used in on-farm trials and demonstrations for further evaluation and possible adoption by farmers.

Farmers normally have access to genetic resources in the country through extension agents of the Department of Agriculture and Forestry, NGOs, direct contact with institutions and farmers through informal farmer-to-farmer exchange mechanisms. The varieties are made available to all levels of farmers - subsistence, commercial and semi-commercial. Farmers are very active in plant breeding and improvement programmes through on-farm research, visit to research stations, on-station selection processes and varietal exchange.

Rice varieties at the Rice Research Station that have been developed are used extensively in other countries. Two of these are WAR 77 and ROK 5 (salt tolerant) which are very popular in the subsavanna and savanna coastal countries like Senegal, the Gambia, Guinea Bissau and Guinea where salinity is a major constraint to rice production. Sierra Leone in turn benefits from getting other varieties from these countries and obtaining feedback on the performance of the rice varieties. Also, the country has exchanged cassava and sweet potato varieties with Guinea and sent cassava to the Gambia and Guinea-Bissau and sweet potato to Ghana. Recently Guinea sent white *Solanum* potato to Sierra Leone.

4.2 CROP IMPROVEMENT PROGRAMMES AND SEED DISTRIBUTION

The main objectives of the national breeding programmes are to develop high yielding crop varieties that have wide adaptability to local conditions with good pest and disease resistance and of acceptable quality to a large majority of consumers. To do this, local varieties and imported germplasm are evaluated constantly in line with these objectives. New materials are developed through hibridization programmes. The ultimate objectives are to increase production, and create a sustainable crop genetic base. The plant breeding programmes are primarily aimed at satisfying local food needs and enhancing export opportunities.

Our plant genetic resources are the greatest national plant assets. They are adapted to most of our local stresses and are the basis for crop improvement programmes in the country. However, the present scale of plant breeding is small due to lack of infrastructure including equipped laboratories, poor financial support and limited trained manpower. Presently, apart from the government research institutions, the GTZ is the only organization through the Seed Multiplication Project that produces and supplies seeds and other materials to farmers. The improved varieties produced reach only a small percentage of the farmers in the country. This is due to limited seed supply, weak extension services and other logistic problems such as mobility. There must be concerted national effort to provide seeds to reach all classes of farmers in the country. In order to achieve these goals, there is a need for strengthening the national capacity in genetic resources. This should include:

- Providing adequate infrastructure with facilities to carry out basic breeding work. This should include well equipped laboratories, green houses, modern genebanks and other storage facilities.
- Funding is needed for institutional support to finance every stage of the breeding programmes. Training manpower of high calibre will be indispensable to any successful breeding programme.
- To strengthen international linkages with CGIAR centres, the University and Research Institutions abroad, NGOs and the UN agencies through collaborative research efforts to solve problems of mutual importance.
- Also, it is envisaged that commercial producers will help fund certain activities which will be of direct interest to them. With the right facilities, logistic support, trained manpower and reasonable remuneration for staff, the immense genetic resources of this country will be preserved and exploited for the benefit of the country and the world.

Sierra Leone lays great emphasis on international collaboration both in the West African region and at global level. It is a member of the Food and Agricultural Organisation and it has strong collaboration with the CGIAR centres around the world.

CHAPTER 5
National Goals, Policies, Programmes and Legislation

5.1 NATIONAL PROGRAMME

In Sierra Leone there is no specific national programme responsible for organizing plant genetic resources activities. The national research centres (IAR, RRS), the University, NGO's (SAVE, Action Aid), farmer groups, individual farmers and government departments are individually involved in various aspects of plant genetic resources activities, including collection, multiplication and conservation. Coordination of these activities is within the mandate of the Government Departments of Agriculture and Forestry and Lands, Housing and the Environment.

There is no information available regarding the involvement of commercial firms in these activities. The Seed Multiplication Project, a joint venture between the Department of Agriculture and Forestry and GTZ, is involved in the collection, multiplication and sale of rice, maize and groundnut seeds to farmers. The activities of this project and the research centres have a great influence on the type of plant varieties available to farmers, but as pointed out in Chapter 1, the seed supply capacity of these institutions has to be strengthened and expanded.

Sierra Leone has made progress in recent years in building up its central capacity to manage its natural resources. It has established a Department of Lands, Housing and the Environment (DLHE) and has recently drawn up a National Environmental Action Plan (NEAP) and a National Forestry Action Plan (NFAP). The DLHE is entrusted with the mandate to prevent the irrational management of natural resources; forests etc. The Government has articulated a National Environmental Policy, to achieve sustainable development in Sierra Leone through sound environmental management, focussing on the conservation and use of natural resources for the benefit of present as well as future generations, restore, maintain and enhance ecosystems and preserve bio-diversity.

The NEAP includes strategies which incorporates the conservation of biological diversity. A number of key areas have been proposed for increased protection on the basis of biological richness, ecological sensitivity and representativeness.

Thus Government's policy objectives are directed towards:

a. the conserving and protecting of indigenous flora and fauna, in order to preserve bio-diversity;

b. raising the general level of conservation awareness, especially in rural areas through rural conservation and education programmes aimed at protecting forests from forest fires, poachers, trespassers and unauthorized grazers;

c. the formulation of environmental legislation;

d. establishment and strengthening of linkages with national NGO's and international organizations;

e. restoring and revitalizing the capacity of the Forestry Division to protect and manage the national forest estate;

f. encouraging the development of communal forest management;

g. expanding the area of reserved land, wherever possible, with priority to water sheds and unstable terrain;

h. restoring the guarded areas of existing reserves to productive forestry by the most cost effective means and wildlife conservation by developing national parks, game reserves and wilderness recreational facilities.

5.2 LEGISLATION

Sierra Leone has a number of sectoral laws relating to the protection of natural resources. However, much of the legislation was drafted several decades ago and is merely empowering and does not contain specific provisions and detailed criteria for the preservation and/or sustainable harvesting of particular biological resources. The enactment pertaining to forestry has recently been amended to reflect the need for conservation.

THE NEW FORESTRY ACT of June 1988 contains special protection provisions under which the Secretary of State is empowered to declare any area to be a "protected area for purposes of conservation of soil, water, flora or fauna." It empowers the Secretary of State to declare any type of tree as being protected. The legislation stipulates that no person may cut, burn, uproot or destroy trees that are in protected areas or trees that have been declared as being protected.

There are quarantine laws governing the movement or exchange of biological resources and or the sale and distribution of seeds but enforcement is generally weak. Thus Sierra Leone is in need of assistance on legal matters concerning plant genetic resources.

5.3 TRAINING

In the absence of a national programme to organize plant genetic resources activities, little attention has been paid to the establishment of facilities and training programmes in plant genetic resources. Undergraduate training programmes in general agriculture and biological sciences are available at Njala University College with in the University of Sierra Leone and these programmes incorporate some aspects of plant genetic resources (Statistical sampling, Agronomic Evaluation and Plant Breeding). The Seed Multiplication Project and the Research Centres periodically arrange for short-term training of its Scientific and technical staff externally. The establishment of a national programme for genetic resources will necessitate the establishment and strengthening of training programmes locally. Such programmes could be effectively started at Njala University College, with some international input.

CHAPTER 6
International Collaboration

6.1 INTERNATIONAL COLLABORATION

Sierra Leone has adopted and ratified the salient principles of the United Nations Conference for Environment and Development (UNCED)for the Convention of Biological Diversity. It is also highly supportive of the FAO initiative on Plant Genetic Resources development and conservation for the needs of the country and the world community.

In terms of active collaborative work, the National Agricultural Research System (NARS) in Sierra Leone is in constant communication with the CGIAR centres, for the exchange of genetic materials. Centres like WARDA and IRRI for rice, CIP for sweet potatoes, IITA for cassava, cowpeas and maize, CIMMYT for maize, ICRISAT for groundnut, sorghum and pearl millet, are very much involved in genetic resources work at various levels in Sierra Leone. Regional research centres like the gene bank in Ethiopia also provide useful linkages through the recently established collaboration in the Community Biodiversity and Conservation (CBDC) Programme of the Netherlands Government in selected African countries including Sierra Leone.

The Institute of Agricultural Research at Njala and the Alley Farming Net-work for Tropical Africa (AFNETA) have collaborated in the development of sustainable cropping systems such as alley cropping using Nitrogen fixing trees. The Oxford Forestry Institute in the United Kingdom and Njala University College have collaborated in the evaluation of Nitrogen fixing tree species for use in agroforestry.

Scientists and technicians from the National Agricultural system have benefitted from higher degree training at the University of Birmingham, UK. IITA, CARE International and Action Aid have also provided short term training courses.

6.2 UNITED NATIONS INITIATIVES

Sierra Leone is one of the countries which has adopted and ratified Agenda 21. So far Sierra Leone has developed a national environmental policy and Action Plan which include the requirements on the conservation of biological diversity. The Convention on Bio-diversity forum and the role of FAO Commission can complement each other. The separate roles which the bio-diversity forum and the FAO can play will be at the level of implementation of national programmes on one hand and the monitoring and coordination of these programmes at regional and international levels on the other.

6.3 FAO GLOBAL SYSTEM

Sierra Leone joined the FAO Commission with the view to being an active participant in developing a sustainable global system for genetic resources conservation and utilization. The benefits gained so far have been negligible due to several problems associated with the weak economic position of the country over several years. At this point, it is important that the country gains from the Commission's facilities both in resources and manpower which will enable Sierra Leone to contribute significantly to the activities of the Commission. In the next decade, it is expected that the commission will assist to upgrade the capacity of the Sierra Leone national programme so that it could be strong enough to undertake much of its national responsibilities currently carried out by the FAO within the country.

Policy makers and professionals are now conscious of the importance of plant genetic resources conservation. In time, and with new developments in the agricultural sector and environmental programmes, Sierra Leone is likely to review these commitments with the view of making all concerned more responsive to the requirements of the undertaking.

An international fund should be set up to support programmes which would contribute profitably to those efforts. This will ensure that the needs of all member states are addressed properly. This will take into account the levels of expertise and development of bio-diversity work in these countries. Sierra Leone will possibly be a beneficiary as far as funds, materials and expertise are concerned. On the other hand, it could also be a donor of useful genetic materials and relevant genetic resource expertise. So far, Sierra Leone has no genetic resource collaboration at the programme level.

6.4 INTERNATIONAL AGRICULTURAL RESEARCH CENTRES (IARC)

The IARCs have contributed greatly to our national programme by providing genetic resources mainly in the form of improved crop varieties to scientists in Sierra Leone. These materials have come from staff based at headquarters of these centres and in a few cases in the region. Staff of the Research Institutes, the University and appropriate Government Departments have received training from CGIAR centres ranging from a few weeks for short term courses to three or more years for degree- related programmes.

CGIAR centres cannot however provide all the required assistance due to financial constraints and limitations imposed by differences in mandate. Besides, CGIAR centres are primarily engaged in doing more high level research in consonance with centres in the developed world. A good proportion of their resources are used in trying to sustain their competitive positions. Genetic resources work conducted by CGIAR centres should be more closely linked to national programmes like the collection and conservation of material for short and medium term conservation. The new initiatives in Plant Genetic Resources work which CGIAR centres should undertake are active training programmes to upgrade the quality of staff in various countries and to provide the support services which will enable the programmes to carry out their responsibilities effectively.

Communication with the CG centres is normally based on mutual needs. There is active collaboration with the CGIAR scientists and national programmes even though none is based in Sierra Leone. The most important function of IPGRI in the next decade is to help upgrade existing structures for plant genetic resources work in national programmes. It should invest in the training of national scientists at all levels and improve facilities for their work in their home countries.

6.5 REGIONAL RESEARCH COLLABORATION

Sierra Leone has special relationship with regional research organizations and other national research systems in the region, but on scales lower than the CGIAR centres. Most of these relationship are informal, flexible and fairly successful. For example, Ghana, Guinea Bissau, Republic of Gambia, Senegal and Liberia have been supplied seed rice by the Rice Research Station, Rokupr. The Institute of Agricultural Research has also supplied cassava to the Republic of Guinea, Gambia, Guinea Bissau and Liberia, and sweetpotato to Guinea, Liberia, the Gambia and Ghana.

The National Agricultural Research system in Sierra Leone has received maize, cassava and sweet potato from the Republic of Guinea. Training of manpower is also an active collaborative assignment.

6.6 REGIONAL INTER-GOVERNMENTAL INITIATIVES (RII)

Sierra Leone is actively participating in RII like CBDC in the Netherlands with regional headquarters in Ethiopia and the various CORAF Networks. Our national genetic resource programmes are participating in these collaborative arrangements which have so far been very advantageous in helping to elucidate our common problems and goals for plant genetic resources work. We also exchange ideas which help to greatly strengthen our activities.

CHAPTER 7
National Needs and Opportunities

Over the years in Sierra Leone, a considerable amount of plant habitats have been destroyed as a result of human and other activities resulting in a loss of some of the nation's genetic resources. There is therefore an urgent need to conserve the remaining material to ensure that future generations of scientists, farmers and other users will have access to useful plant materials regardless of deforestation, forest fires, droughts or other catastrophes.

Presently, there is not a central location in the country were genetic materials are stored. A national gene bank would provide a safe area for the conservation of genetic resources in case of any natural disaster or war which could lead to the loss of plant genetic materials in the field. There is therefore an urgent need to provide the infrastructure that will house a national gene bank and provide essential support facilities, such as coldroom, dehumidifiers, stand-by generators and voltage stabilizers, through project funding.

In addition to a central gene bank, the existing gene banks that are presently being maintained by the Research Institutes, University and Forestry Division should be upgraded and made to serve as satellite gene banks to the central gene bank. These satellite gene banks will be responsible mainly for the conservation of materials that are of primary interest to the institution, provide material to the central gene bank that ensure that genetic materials are located in more than one site in the country so as to avoid total loss in cases of disasters.

Since the central and satellite gene banks will most likely be inaccessible to farmers in the rural areas, there is the need to establish a programme in which farmers will participate in the selection and conservation plant genetic materials in the field.

There are many crop species which are not generally cultivated by farmers but are potentially important as food and export crops. These are susceptible to genetic erosion through human activities, such as bush burning, deforestation and road construction. There is therefore the need to expand and intensify research to properly identify and obtain information on the environmental conditions, culture and uses of these plants.

The successful implementation of a good plant conservation programme demands well trained and experienced workers. Presently, there is the need to upgrade the professional skills of the existing staff through training. Scientists and support staff should be provided with training opportunities in regional centres attached to Universities and Research Centres.

There is the need to fully document the existing information on genetic resources in the nation. Provision should be made for the procurement of modern tools for the acquisition of information related to genetic resources.

CHAPTER 8
Proposal for a Global Plan of Action

The following is a list of proposals on plant genetic resources work at both national and international levels as a component of an international effort at conservation and use of the world's genetic resources for the sustenance of life on earth:

1. Assessment of Bio-diversity: This will include exploratory surveys to assess species composition on under-exploited plants in the natural vegetation;
2. Assessment of genetic erosion and an estimate of indigenous species loss;
3. Sensitizing local communities on the relevance of genetic resources conservation for landraces and old cultivars towards the economic improvement and sustenance of life in the country.
4. Making available to a broader audience indigenous knowledge on plant genetic resources.
5. Training more plant taxonomists/bio-systematists for documentation of species composition of different ecosystems.
6. Enhancing the ability of countries to prepare proposals that are of regional benefit; in addition, to establish network facilities for regional collaborative research work.

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