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Forest Genetic Resources Working Papers

State of Forest Genetic Resources in Sahelian and North-Sudanian Africa & Sub-Regional Action Plan for their Conservation and Sustainable Use

Based on the work of

Pierre Sigaud, Oscar Eyog Matig and national consultants

and in collaboration with

IPGRI and ICRAF

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Comments and feedback are welcome.

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In memory of Mr Abdou Salam, a dear colleague and friend who will be dearly missed.

State of forest genetic resources in Sahelian and North-Sudanian Africa and sub-regional action plan

EXECUTIVE SUMMARY

This first edition of a synthesis document, compiling a status of forest genetic resources in the Sahelian and North-Sudanian zone of Africa and a sub-regional action plan for the sustainable management of these resources, is the fruit of a process undertaken at the initiative of countries in the sub-region, towards a better consideration of the important but complex issues linked to forest genetic resources.

The synthesis and the action plan were prepared by the representatives of 15 countries assembled during a sub-regional workshop on the conservation, management, sustainable management and enhancement of forest genetic resources in Sahelian Africa, which was held from 22 to 24 September 1998 in Ouagadougou, Burkina Faso. The drafting of the documents also benefited from the active participation of 8 international, regional and bilateral institutions, the work of resource persons, as well as various national actors in Burkina Faso.

The aim of the synthesis is to supply foresters, researchers, scientists, managers and political and economic decision makers with elements of evaluation of the state of forest tree genetic resources, and appreciation of the relative values and level of importance attached to them at country and sub-regional level, on the basis of national preferences. Knowledge gaps on the diversity, availability and use of these resources are identified, and subsequent proposals for action in an informed manner are hierarchized. The action plan describes the action areas, objectives and priority activities identified by countries at sub-regional level. For the first time, it puts forward the scientific, socio-economic and political basis, as well as the framework and necessary incentives, with a view to promoting targeted, well founded and equitable cooperative activities to the benefit of states, national institutions and actors. Finally, by its nature, the plan contributes significantly to implementing the Convention on Biological Diversity in the area regarding forest tree and shrub species.

This country-led initiative represents an important step in the improvement of general knowledge related to forest genetic resources in the Sahelian and North-Sudanian region of Africa and in the dissemination of this information. The document itself should not remain frozen but should be updated at regular intervals, for example by taking into account the evolution of the status of forest genetic resources, changes in the scale of priorities, and progress in knowledge on ecosystems, species and genetic diversity. In its current state, it is aimed to act as a leading channel for targeted but flexible and evolutionary activities. As the action plan will be implemented by different actors in very diverse conditions, a pragmatic and concrete approach is put forward for its development, using the identification of priority species as the key approach. Based on these elements, more precise proposals, such as project proposals for example, could be formulated with the aim of presenting them for funding and implementation to various partners.

The plan sets ambitious but realistic and practicable goals. In order to reach them and produce tangible results, the plan will require voluntary actions from national actors in order to ensure solid implementation. Current international, regional and bilateral organizations, mechanisms and instruments, will be invited to contribute to its success.

INTRODUCTION

General overview

Forest genetic resources, which represent the value of hereditary variation between and within species, are a necessary and essential value to forest permanence and the maintenance of their productivity. They constitute an essential component of the biological diversity of forest ecosystems.

Forests in Sahelian and North-Sudanian Africa include closed and open forests, plantations, parklands, savannah and steppe formations. They supply a wide range of goods and services essential to the life of rural communities as well as to the development of local and national economies. Trees and shrubs contribute to the production of building timber, fuelwood, forage, foods, essential oils, gums, resins and rubber, medicines, and provide shade. They also encourage soil protection and regulate water flows, and represent living receptacles for fundamental values regarding aesthetics, ethics, culture and religion.

These forests are located in areas dominated by subsistence agriculture and numerous herds. Forestry and agroforestry systems have frequently been disrupted by changes in land use, particularly over the last 20 to 30 years, together with a succession of drought years and considerable population growth. In many places, the growth of agriculture, increased fuelwood harvesting, and intensification of grazing, have brought about strong pressures on forests.

The genetic resources of forest trees and shrubs are most commonly stored in living trees, in contrast to most agricultural crops for which genetic diversity can be relatively easily stored and conserved in seed banks. Variations in forest cover, quality and composition have therefore direct impacts on the extent and patterns of genetic variation of forest trees and shrubs.

Background to this document

The consequences of man-made pressures and climatic fluctuations on the integrity of forest genetic resources in the Sahelian area have been only partly documented and analysed in a systematic way but are worrying enough to be the object of growing concern both for national and international institutions.

Given the urgency of the problem in Sahelian Africa and in other regions of the world, FAO brought up the issue of forest genetic resources in order to discuss it in greater depth with representatives of Member States during the thirteenth session of the FAO Committee on Forestry (COFO) in March 1997[1].

[1] See also FAO. 1997b; FA0. 1997c; FAO. 1998a.

After discussion, the Committee on Forestry decided that "*there was an urgent need for concerted action to strengthen national, regional and international activities in the conservation and sustainable use of forest genetic resources, to help enhance country capacities and to support the exchange of information, experiences and know-how*"(extracts of the report of the Thirteenth Session of the Committee[2]). "*Efforts in this regard, which rested on the principles of national sovereignty over natural resources, as set out in the Forest Principles and the Rio Declaration, should be country-driven in recognition of the fact that the most appropriate action varied according to environmental, social and economic circumstances, institutional and legal frameworks, and prevailing needs and priorities of countries concerned*". Finally COFO added that "*FAO, in conjunction with Regional Forestry Commissions and countries that request it, could convene regional and sub-regional forest genetic workshops complementary to those already held in 1995 for boreal and temperate zones*[3]".

Following up on these recommendations, FAO adopted a certain number of provisions to help countries which so wish to prepare sub-regional and regional action plans for the sustainable utilization and conservation of forest genetic resources, through the convening of regional workshops.

In September 1997, FAO, the International Plant Genetic Resource Institute (IPGRI) and the International Centre for Research in Agroforestry (ICRAF) united their efforts to assist national institutions in Sahelian and North-Sudanian Africa to organize a sub-regional workshop on the conservation, management, sustainable development and valorization of forest genetic resources.

Two consultants, Messrs. B. N. Kigomo[4] and A. Nikiéma[5], released from institutions in the sub-region, visited several countries to discuss the process in 1997 and 1998. It was agreed that each country willing to take part in the initiative would prepare a national report beforehand summarizing the status of forest genetic resources. The form and contents of these reports were decided in close collaboration with the countries and harmonized so that all aspects associated with forest genetic resources be studied and in order to develop a regional synthesis at a later date[6]. Based on 12 reports received in mid August 1998, a synthesis project was drafted by Dr O. Eyog Matig (Cameroon), IPGRI consultant, for presentation to participants to the workshop.

The sub-regional workshop was held at the National Forest Seed Centre in Ouagodougou (Burkina Faso), 22-24 September 1998[7]. Participants examined and commented on the regional synthesis project and put forward a number of observations. They also debated and adopted a project for a sub-regional action plan on forest genetic resources, and discussed the ways and instruments for its implementation. The current document summarizes the results of these efforts.

[2] Report of the Thirteenth Session of the Committee on Forestry, Rome, Italy, 10 – 13 March 1997. Document COFO-97/REP. FAO, Rome.
[3] See Canadian Forest Service and FAO. 1996; Rodgers, D.L. and Ledig F.T., 1996.
[4] Kigomo, B.N. 1998b.
[5] Nikiéma, A. 1998.
[6] See Appendix 12 for details on the format recommended for drafting national reports
[7] See Summary Report of the Workshop in § II.7 and in Sigaud *et al*. 1998.

The sub-regional workshop had also been prepared during a training session on forest genetic resources organized by IPGRI in collaboration with FAO, ICRAF and other international, regional and bilateral partners, for French-speaking countries in sub-Saharan Africa. This training session[8], the first of its kind in the region, gathered nearly all the national focal points responsible for drafting the national report in francophone Sahelian Africa. A proposal to launch a research programme on forest genetic resources in sub-Saharan Africa (SAFORGEN) was made by participants and later developed in Ouagadougou in September 1998.

Composition of this document

This document comprises two parts:

- a part describing the *State of forest genetic resources in Sahelian and North-Sudanian Africa.* The technical information was provided by countries through the national reports on forest genetic resources prepared before the workshop. A first draft synthesis prepared by Dr O. Eyog Matig was reviewed and complemented by the national experts during the meeting. The contributions of workshop participants, and data from national reports received after the workshop, are included in this final version. General data on forests and trees in dry-zone Sahelian Africa, used especially in the first part of the work, were taken from *State of the World's Forests*[9] and other publications mentioned in the bibliographic references.

- a part devoted to the compilation at sub-regional level of tree and shrub species considered priority at national level, and to outlining action identified as priority in the regional context by participants at the Ouagadougou workshop. This part makes up the *Sub-regional action plan on forest genetic resources in Sahelian and North-Sudanian Africa*.

Limits of the zone considered

For better harmonization of current or forecast initiatives concerning forest genetic resources, action has focused on an eco-geographic zone within which natural, social and economic conditions are likely to bear certain similarities. This approach was expected to facilitate the identification of issues and opportunities that are common to several countries in the given zone. The initiative outlined in this document only considered data from areas with annual average rainfall higher or equal to 300 mm and lower or equal to 1 000 mm. Information on the Guinean, Sudano-Guinean and Saharan forest areas has not been included.

[8] The report of the training workshop is available in the publication *"Vers une approche régionale des ressources génétiques forestières en Afrique sub-saharienne*", A.S. Ouédraogo and J.M. Boffa, editors. IPGRI, 1999.
[9] *State of the world's forests*, FAO, 1999.

This document concerns those countries which are fully integrated into the western Sahelian zone (Burkina Faso, Cape Verde, Gambia, Guinea-Bissau, Mali, Mauritania, Niger, Senegal, Chad) and the eastern Sahelian zone (Djibouti, Eritrea, Ethiopia, Kenya, Somalia and Sudan)[10]. In addition, a certain number of countries bordering the Gulf of Guinea with a considerable proportion of dryland forests were included in the analysis. In particular, this was the case with Benin, Cameroon, Côte d'Ivoire, Ghana, Guinea, Nigeria and Togo, where forest formations in northern areas offer similar aspects to those in the Sahelo-Sudanian or North-Sudanian areas.

The map in Appendix 3 depicts the dry tropical forests of Sahelian and North Sudanian Africa and the limits of the zone considered in this document.

Lexicological and taxonomic conventions

Scientific names of certain species which lacked consensus in national reports had to harmonized on a case-by-case basis. This is the case with *Acacia albida* or *Faidherbia albida* (called *Faidherbia albida* in this report*), Butyrospermum paradoxum* subsp. *parkii* or *Vitellaria paradoxa* (the name used is *Vitellaria paradoxa*) and *Cassia siamea* or *Senna siamea* (here referred to as *Senna siamea)*. The verification work for species scientific names did not extend to all taxa, and a certain number of species might thus be described by several names. A short index of Latin, French and English names is provided in Appendix 2.

[10] Due to fragmentary information and the lack of updated national reports, four countries (Cape Verde, Djibouti, Guinea-Bissau and Somalia) are not included in the tables of data on genetic resources.

PART I: STATE OF FOREST GENETIC RESOURCES IN SAHELIAN AND NORTH-SOUDANIAN AFRICA

Background

The following synthesis is based on information supplied in the national reports and from the participants in the *Sub-regional workshop on the conservation, management, sustainable utilization and enhancement of forest genetic resources in sub-Saharan (Sahelian) Africa* (Ouagadougou, 22 – 24 September 1998), for the following eighteen countries: Benin, Burkina Faso, Cameroon, Côte d'Ivoire, Eritrea, Ethiopia, Gambia, Ghana, Guinea, Kenya, Mali, Mauritania, Niger, Nigeria, Senegal, Sudan, Chad and Togo. Cape-Verde also provided general information. The list of national reports considered in the synthesis is given in appendix 13. Contributions were also considered from Messrs B. N. Kigomo and A. Nikiéma, who on behalf of FAO, IPGRI and ICRAF visited several countries in the sub-region to discuss the preparation of national reports in 1997 and 1998. In order to ensure consistency between information sources, basic country data (including population, forest cover, forest cover change) available in FAO's publications *State of the world's forests 1997* and *State of the world's forests 1999* have been used.

General outline

The outline of the *State of forest genetic resources in Sahelian and North-Sudanian Africa* is structured in line with the plan recommended for the national reports (see Appendix 12). The first chapter presents the general ecological and socio-economic features of countries in the zone. The following chapter describes the state of forest resources, especially the threats these resources face from non-sustainable utilization. The third chapter presents activities related to the utilization and conservation of forest genetic resources. The fourth chapter refers to the institutional framework relating to forest genetic resources. The fifth chapter assesses support capacities for research and training. Finally the sixth chapter outlines the state of bilateral, regional and international cooperation.

I.1. Ecological and socio-economic characteristics

I.1.1. Climate and relief in the Sahelian and North-Sudanian sub-region

Whether the sub-region is traversed from north to south or east to west, climatic or typographical homogeneity is difficult to find. Low temperatures (10°C annual average in the mountainous zones of East Africa) and very high temperatures (more than 30°C in the plains of central and West Africa) can be experienced.

Rainfall is just as heterogeneous. Annual average rainfall varies from less than 300 mm to more than 1 000 mm. Maritime influence to the west and east accentuates this heterogeneity. Pagney (1994) explains these important differences by the fact that the fringes of the Sahel are contact zones between arid climates (desert-like in their most extreme form) and humid climates (equatorial). These influences foster many local climatic nuances.

The climate of the study zone is a tropical climate with a marked, very marked dry season. The intensity of this season is modified by altitude and the influence of the Gulf of Guinea. Climatic heterogeneity has visible consequences on the distribution of flora, in which interwoven Sahelian, Sudanian and Guinean components can be distinguished.

I.1.2. Eco-geographic typologies

Certain authors (Le Houérou, 1989; Donfack, 1998) distinguish several eco-climatic zones distributed along a rainfall gradient. The zones are relatively regular to the west where they trace the isohyets which are roughly parallel with the Gulf of Guinea; to the east, the zones depend primarily on relief. Taking into account the various phytogeographical areas mentioned in the national reports, this gradient can be summarized thus:

- Average annual rainfall above 1,200 mm: Guinean area;
- Rainfall of between 1 000 and 1 200 mm: Sudanian-Guinean area;
- Rainfall of between 800 and 1 000 mm: Sudanian area;
- Rainfall of between 600 and 800 mm: Sahelo-Sudanian area;
- Rainfall of between 350 and 600 mm: Sudano-Sahelian area;
- Rainfall of between 350 and 200 mm: Sahelian area.

The Saharan area is characterized by fewer than 10 days of rain per year. Annual rainfall rarely exceeds 150 mm (Pagney, 1994).

This classification presents advantages but also drawbacks associated with the gradual transition between extreme conditions. As the objectives of this document do not require such precise classification and with a concern for clarity, we preferred to adopt Menaut's (1983) simplified classification, which distinguishes three broad phytogeographical areas in the region:

- the Sahelian area, characterized by average annual rainfall of between 300 and 650 mm. From west to east, this area covers (see map in appendix 3) the south of Mauritania, the far north of Senegal, the central coastline of Mali, central Niger, the far north of Cameroon, central Chad and central Sudan;

- the Sudanian zone, where annual rainfall averages between 650 and 1 000 mm. This area covers from west to east the rest of Senegal, all of Gambia, Guinea Bissau, Guinea, southern Mali, northern Côte d'Ivoire, Burkina Faso, Ghana, Togo, Benin, Nigeria, northern Cameroon, southern Chad, the north of the Central African Republic, southern Sudan, and northern Uganda;

- the eastern zone, where annual average rainfall is between 150 and 350 mm (highly arid zones), 300 to 500 mm for arid areas, and 450 to 900 mm (semi-arid zone assimilated here to the Sudanian area). East Africa is the subject of special classification owing to its strong altitudinal gradient and the appearance of mountain flora mixing with Sudanian and Sahelian elements from the west. This area includes the following countries: Djibouti, Eritrea, Ethiopia, Somalia, Kenya, and Tanzania.

I.1.3. Country socio-economic characteristics

Summary tables of basic country data are given in Appendix 4. They can be summarized as follows:

- Population: apart from Nigeria and Ethiopia, where there are more than 60 million inhabitants (FAO, 1999), most other countries have populations of less than 28 million inhabitants. The average of the 21 countries listed in appendix 4 is 18 million inhabitants, including the moist regions of countries around the Gulf of Guinea. Cameroon, Côte d'Ivoire, Ghana, Kenya, Mali, Somalia and Sudan have more than 10 million inhabitants. All these countries are characterized by high population growth above 2%.

- Economic activities: For several countries in the zone (Cameroon, Ghana, Kenya, Mauritania and Senegal), the contribution of agriculture to GDP ranges from 20 to 29%. This figure is more than 30% in the other countries (World Bank, 1991).

I.2. State of forest resources

I.2.1. Plant formations

The term dry tropical forest often used in contrast with moist tropical forests can lead to ambiguity as it encompasses extremely different formations. The plant formations covered in this study include:

- Dry dense forests
- Open forests
- Savannah
- Wooded steppe
- Tree steppe
- Shrub steppe

According to FAO terminology, «forests» include plant formations with raised cover of over 10% and a surface area of more than 0.5 ha[11]. This standardized definition has been employed in the tables of general country data and the surface area of forest cover (Appendixes 4 and 5). Everywhere else, the quantitative information on genetic resources taken from national reports refer to the specific definitions of each country.

I.2.2. Wooded surface areas

The surface area of forest cover is given by country in Appendix 5. Western Sahelian countries total approximately 41 000 ha of wooded formations (using the FAO definition) and eastern Sahelian countries approximately 59 000 hectares. The surface area of dryland forest in countries bordering the Gulf of Guinea is guestimated at approximately 26 000 hectares.

[11] FAO, Forestry Department. *FRA 2000 - Terms and Definitions.* Forest Resources Assessment Programme, Working Paper 1, Rome, 18 November 1998. http://www.fao.org/FORESTRY/FOR/FRA/docs/FRA_WP1eng.PDF

The distribution of the main forest species by eco-geographical zone is presented in the following paragraph.

I.2.3. Main forest species

In the Sahelian area, the flora is made up of about 1,200 species, 40 of which being strictly endemic (Kigomo, 1998a). The Sahelian area is the privileged domain of *Acacia*. The main woody species found are[12]:

Acacia nilotica, A. raddiana, A. senegal, A. seyal, A. tortilis, Balanites aegyptiaca, Borassus aethiopum, Boscia senegalensis, Calotropis procera, Combretum glutinosum, Commiphora africana, Dalbergia melanoxylon, Faidherbia albida, Hyphaene thebaica, Phoenix dactylifera.

Introduced species include *Azadirachta indica* (neem tree), *Eucalyptus camaldulensis, Prosopis juliflora, P. chilensis* and *Senna siamea*.

In the Sudanian area there are about 2,750 species, a third of which are endemic. The main woody species include:

Adansonia digitata, Acacia sieberana, Anogeissus leiocarpus, Ceiba pentandra, Daniella oliveri, Ficus sycomorus, Isoberlinia doka, Khaya senegalensis, Parkia biglobosa, Piliostigma thonningii, Prosopis africana, Pterocarpus erinaceus, Sclerocarya birrea, Strichnos spinosa, Tamarindus indica, Vittelaria paradoxa, Ziziphus mauritiana, Ziziphus mucronata

The most widely used exotic species in reforestation programmes include *Anacardium occidentale, Azadirachta indica, Casuarina equisetifolia, Dalbergia sissoo, Eucalyptus camaldulensis, Jatropha currcas, Senna siamea* and *Thevetia nervifoli.*

In the eastern area, flora is made up of about 2,500 species, with about a half being endemic. The woody species vary according to the humidity of the macroclimate:

- in the arid and semi-arid zones, *Acacia* and *Commiphora* are prevalent. The main tree species include:

Casipourea malosana, Combretum molle, Diospyros abyssinica, Juniperus procera,, Lawsonia inermis, Olea africana, O. hochstetteri, Podocarpus gracilior and *Teclea simplicifolia.*

- in semi-humid zones, the following can be found:

Acacia mellifera, Acacia etbaica, A. reficiens, A. senegal, A. tortilis, Dodonaea angustifolia, Euphorbia sp., Faidherbia albida and *Pappea capensis.*

[12] See also FAO. 1996.

The following species have been introduced: *Azadirachta indica, Eucalyptus camaldulensis, E.tereticornis, Jatropha curcas, Leucaena leucocephala, Parkisonia aculeata, Pinus caribaea, Prosopis cineraria, Prosopis juliflora* and *Senna siamea*.

I.2.4. Utilization patterns for forest trees

General utilization features of Sahelian and North-Sudanian trees

While most dryland forests have relatively low potential for timber production, compared to humid lowland forest, they provide a wide range of wood and non-wood products which are vital for local people, not to mention their many important environmental functions(see Figure 1). These products are harvested for household use or for sale on local markets and their significance is often underestimated in statistics, national policy and programmes.

Dryland trees and forests provide fuelwood and small roundwood for poles, carpentry or tool handles, and a whole range of non-wood products, including human foods or game, forage for domestic animals, medicinal products or raw material for craftsmen (oils, tannins, gums, etc.). Among their environmental services, the most important is soil conservation against erosion and the preservation of fertility, not to mention shelter from wind and sun.

Sahel trees are multi-usage. Of more than 310 species mentioned in the national reports, all have more than one type of use. The 114 woody species of the Sahelian zone listed by Von Maydell all have multiple uses[13]. The uses of the various parts of forest trees vary from one country to another (see in particular Appendix 9). In the same country, the species can have various types of use.

The various use patterns are grouped thereafter in 7 categories:

(1) Species producing timber and service wood

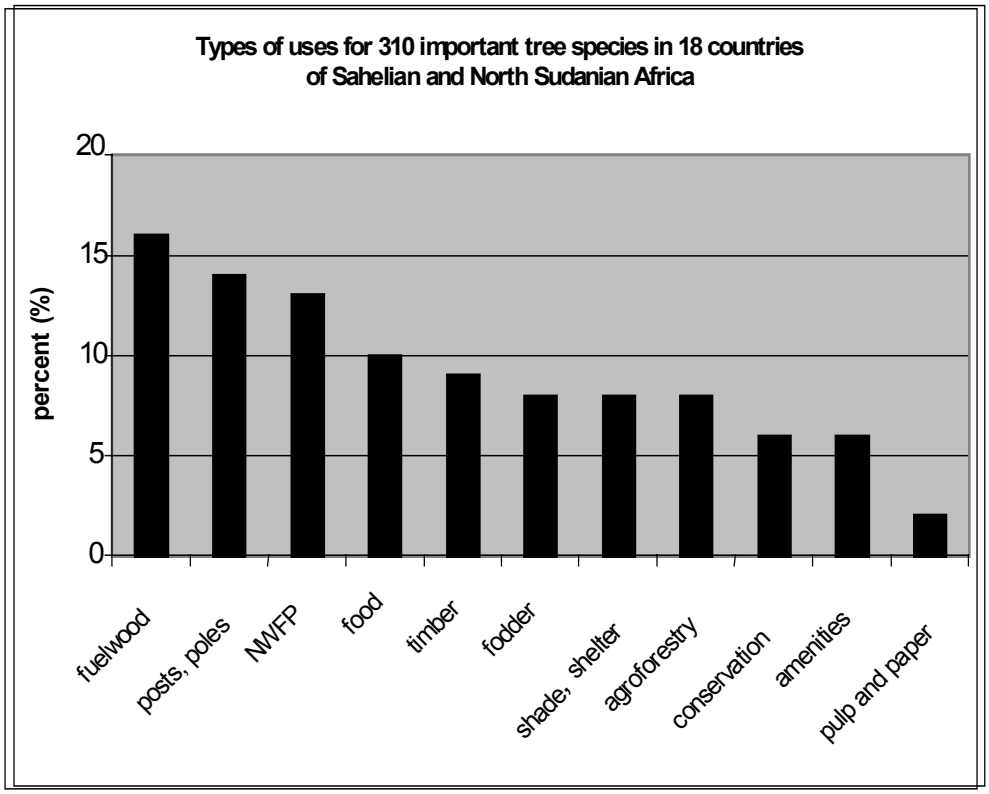
Most of the Sahelian population have only few raw materials, among which wood occupies a privileged place. The trees, shrubs and bushes of drylands provide small diameter roundwood used for making posts, frames or tool handles:

Anogeissus leiocarpus, Azadirachta indica, Balanites aegyptiaca, Commiphora africana, Dalbergia melanoxylon, Daniella oliveri, Eucalyptus camaldulensis, Hyphaene thebaïca, Isoberlina doka, Khaya senegalensis, Melia volkensii, Prosopis africana, Prosopis juliflora, Pterocarpus erinaceus, Sclerocarya birrea, Terminalia brownii.

[13] Von Maydell, H.J., 1986.

FIGURE 1: DISTRIBUTION OF TYPES OF USE FOR DRY-ZONE TREE SPECIES CITED IN COUNTRY REPORTS

Source: country reports (1998)



Use types include: fuelwood, charcoal; posts, poles, roundwood; non-wood products (gums, resins, oils, tannins, medicines, dyes...); food; timber production; fodder; shade, shelter; agroforestry systems; soil and water conservation; amenity, esthetic, ethical values; pulp and paper.

(2) Forage species

The pastoral economy is one of the population's main resources in the Sahel, especially in the northern part. Fodder from trees and shrubs on the rangelands of arid and semi-arid zones is essential for cattle, particularly during the dry season. Pastoral communities also draw an important benefit as milk represents one of their most important basic foodstuffs.

Acacia holosericea, Acacia senegal, Adansonia digitata, Anacardium occidentale, Annona senegalensis, Balanites aegyptiaca, Borassus aethiopum, Boscia senegalensis, Bauhinia rufescens, Detarium senegalensis, Diospyros mespiliformis, Faidherbia albida, Ficus sp., Grewia bicolor, Hyphaene thebaica, Moringa oleifera, Parkia biglobosa, Prosopis juliflora, Sclerocarya birrea, Spondias mombin, Sterculia setigera, Tamarindus indica, Terminalia brownii, Vitellaria paradoxa, Ziziphus mauritiana.

(3) Food species

Whether in the form of plants or animals, forest products play a critical part in food security in Africa, directly and indirectly. In addition to products used frequently in foods and directly contributing to nutritional well-being, forests and trees outside forests are an income source for purchasing food products and provide fuelwood to cook food. They also supply products which are sometimes less appetising but which can be essential food complements during bad harvests[14].

Acacia holosericea, Acacia senegal, Adansonia digitata, Anacardium occidentale, Annona senegalensis, Balanites aegyptiaca, Borassus aethiopum, Boscia senegalensis, Cordia pinnata, Detarium microcarpum, Detarium senegalensis, Diospyros mespiliformis, Faidherbia albida, Ficus sp, Grewia bicolor, Hyphaene thebaica, Lannea microcarpa, Maerua crassifolia, Mangifera indica, Moringa oleifera, Parinari macrophylla, Parkia biglobosa, Phoenix dactilifera, Prosopis juliflora, Saba senegalensis, Sclerocarya birrea, Tamarindus indica, Vitellaria paradoxa, Vitex doniana, Ximenia americana, Ziziphus mauritiana.

(4) Species yielding non-wood forest products

Populations in dry Africa depend heavily on non-wood forest products (various drugs, raw materials, chemicals). Thus medicinal products from forests are highly important, especially for village communities, and play a fundamental role in rural production systems.

Acacia holosericea, Acacia laeta, Acacia nilotica, Acacia raddiana, Acacia senegal, Acacia seyal, Adansonia digitata, Anacardium occidentale, Anogeissus leiocarpus, Azadirachta indica, Balanites aegyptiaca, Borassus aethiopum, Cassia singueana, Ceiba pentandra, Combretum micrantum, Combretum microcarpum, Commiphora africana, Diospyros mespiliformis, Faidherbia albida, Guiera senegalensis, Hyphaene thebaica, Hyphaene compressa, Khaya senegalensis, Lannea microcarpa, Lannea acida, Lawsonia inermis, Mangifera indica, Moringa oleifera, Moringa stenopetala, Moringa volkensii, Parinari macrophylla, Parkia biglobosa, Piliostigma thoningii, Pistia strastiotes, Pterocarpus erinaceus, Rottbellia exaltata, Salvadora perica, Sterculia setigera, Tamarindus indica, Vitellaria paradoxa, Vitex doniana, Ziziphus mauritiana.

(5) Energy source (fuelwood and charcoal)

The high rate of population growth in Sahelian zone countries and the relatively low revenue have contributed to an important increase in fuelwood and charcoal consumption. Popular dependence on this fuel threatens resource sustainability in some cases and therefore supplies. Supply problems in rural settings are restricted to isolated cases, while in some large urban conurbations or metropolises, problems are already reaching catastrophic proportions. In theory, almost all trees and shrubs can be used for fuel if they are dry enough; however, their calorific properties vary considerably. The most sought after burn without unpleasant smoke or sparks or provide an excellent charcoal (certain acacias*, Anogeissus, Balanites, Eucalyptus, Prosopis*); others are used only as a last resort. The species mentioned in the national reports include:

[14] See also FAO. 1984

Acacia holosericea, Acacia laeta, Acacia nilotica, Acacia raddiana, Acacia senegal, Acacia seyal, Acacia tortilis, Afzelia africana, Annona senegalensis, Anogeissus leiocarpus, Azadirachta indica, Balanites aegyptiaca, Bauhinia rufesens, Boscia senegalensis, Cassia sieberiana, Combretum microcarpum, Dalbergia melanoxylon, Daniella oliveri, Detarium microcarpum, Diospyros mespiliformis, Eucalyptus camaldulensis, Eucalyptus tereticornis, Faidherbia albida, Ficus sp., Grewia bicolor, Grewia tenax, Isoberlinia doka, Khaya senegalensis, Lannea acida, Leptadenia pyrotechnica, Leucaena leucocephalla, Moringa oleifera, Mangifera indica, Parinari macrophylla, Parkia biglobosa, Piliostigma thonningii, Prosopis africana, Prosopis juliflora, Pterocarpus erinaceus, Sclerocarya birrea, Sterculia setigera, Tamarindus brownii, Tamarindus indica, Vitex doniana, Ziziphus mauritiana.

(6) Species used in agroforestry systems

The paramount contribution of forests and trees to food security is indirect: it resides in their protection of essential natural resources for agricultural production[15]. The following species are closely associated with agroforestry systems, which confirms their economic importance:

Acacia mellifera, Acacia nilotica, Acacia senegal, Acacia sieberiana, Acacia tortilis, Adansonia digitata, Anogeissus leiocarpus, Azadirachta indica, Anacardium occidentale, Balanites aegyptiaca, Borassus aethiopum, Ceiba pentandra, Combretum microcarpum, Cordyla pinnata, Diospyros mespiliformis, Faidherbia albida, Gmelina arborea, Guiera senegalensis, Hyphaene thebaica, Lannea acida, Lawsonia inermis, Leucaena leucocephala, Moringa oleifera, Mangifera indica, Moringa volkensii, Parkia biglobosa, Pinus spp , Pterocarpus erinaceus, Salvadora perica, Tamarindus indica, Thevetia nervifolia, Vitellaria paradoxa, Vitex doniana, Ziziphus mauritiana.

(7) Species used for protection, cultural or ornamental purposes

The most obvious protective effect is the shade trees produce. Many species are appreciated and planted close to rural dwellings, localities, along roads and riverbanks.

In an area where arborescent vegetation is generally small in size, giant trees stand out all the more and often the object of veneration and religious or artistic demonstrations. It is not surprising that the baobab tree, which figures among the largest and oldest representatives of the Sahel plant kingdom, earns much respect. Few species rival them in size, but under favourable conditions, the following species are recognized for their protective, cultural or ornamental value:

Acacia macrostachya, Acacia nilotica, Acacia senegal, Adansonia digitata, Anacardium occidentale Anogeissus leiocarpus Azadirachta indica, Balanites aegyptiaca, Borassus aethiopum, Casuarina equisetifolia, Ceiba pentandra, Combretum microcarpum, Diospyros mespiliformis Eucalyptus camaldulensis, Faidherbia albida, Gmelina arborea, Lawsonia inermis, Leptadenia pyrotechnica, Khaya senegalensis, Mangifera indica, Moringa oleifera, Parkia biglobosa, Parkinsonia aculeata, Prosopis africana, Prosopis juliflora, Piliostigma thonningii, Senna siamea, Pterocarpus erinaceus, Vitellaria paradoxa.

[15] For more information, see also Boffa, J.M. 1999.

I.2.5. Pressures exerted on forest resources and forest genetic resources

The forest resources of the Sahelian and North-Sudanian zone are subject to strong pressures which contribute to their embrittlement and, gradually, to their reduction and marginalization. These pressures can be climatic or man-made in origin.

I.2.5.1. Pressures of climatic origin

Since 1965, the curve of annual variations in rainfall (Catinot, 1988) demonstrates that the zone has experienced successive droughts. Of particular note are the droughts at the beginning of the 1970s and above all in the 1980s. One of the long-term results of these droughts was the alteration of grassland flora. In some regions, perennial species (*Andropogon gayanus*) were replaced by mixed composition flora and introduced annual species such as *Cenchrus biflorus* and *Sida cordifolia*.

The resistance of woody species to these successive droughts varied from species to species. In Chad, the drought caused considerable loss among stands of *Acacia senegal*, *Anogeissus leiocarpus* and *Khaya senegalensis*.

Threats from climatic fluctuations spring not so much from the drought itself as from uncontrolled human intervention in already fragile environments. Consequences for a given species can consist of localized destruction of several individuals or the whole population. In extreme circumstances, the whole functioning forest ecosystem can be threatened. In countries such as Cameroon and Senegal, annual destruction of dry savannah is estimated at nearly 100 000 ha. The most vulnerable species are *Acacia nilotica, Acacia senegal, Pterocarpus lucens, Sclerocarya birrea, Prosopis africana, Lannea microcarpa* and *Dalbergia melanoxylon*.

In addition to climatic drought, edaphic drought can occur from an increase in soil salt content. This is the case with the "*tannes"* or salted soils in Senegal, as well as the "*harde*" or sterile soils in Cameroon. In Senegal, this combination of drought and soil salinity has led to the disappearance of certain forests in Cavor area and palm groves in Casamance.

I.2.5.2. Pressures of man-made origin

These are linked to numerous uncontrolled human interventions on forests and trees. The unmanaged exploitation of soils, forests and water reserves is manifested in the uncontrolled spread of agriculture, over-development of aerial grazing, sporadic multiplication of brush fires, anarchic exploitation of fuelwood, timber and service wood and finally the unsustainable utilization of non-wood forest products.

Agriculture: two types of agriculture can be distinguished: (i) shifting agriculture, which is practised particularly during the rainy season on sandier soils that are fairly poor in mineral content; and (ii) counter-season agriculture, which is carried out at the end of the rainy season within temporarily flooded areas on relatively hydromorphic soils.

Species threatened by shifting agriculture are: *Faidherbia albida, Acacia senegal, Cordyla pinnata, Sterculia setigera, Parkia biglobosa* and *Tamarindus indica.* These species occupy mostly light soils (clayey-sand to sandy), with poor water reserves available. The joint action of drought and continuous clearing contribute to their disappearance.

Species associated with heavier soils (vertic soils) which are subjected to counter-season cropping like sorghum are the most threatened. In effect, counter-season crops grow when there are weak soil reserves and consequently cannot withstand any competition from woody species left in the cultivated areas. Therefore trees are systematically felled in cropped areas with low water reserves. The most threatened species are: *Acacia seya* and *Acacia nilotica*.

Grazing: Certain species are used as food sources for cattle grazing. This is the case for: *Acacia raddiana, Acacia senegal*, *Commiphora africana* and numerous *Ficus.* Every year, these species are subject to mutilations, from leaves to the whole tree.

Industrial wood: The most widely sought after species for house building, boat building, and the manufacture of mortars and other cooking implements, are: *Khaya senegalensis, Pterocarpus erinaceus, Daniella olliveri, Borassus aethiopum, Diospyros mespiliformis, Eucalyptus camaldulensis, Azadirachta indica* and *Dalbergia sissoo*.

Fuelwood harvesting: When concern started to mount regarding dryland forests at the beginning of the 1970s, the main issue was focused on fuelwood supply. The fear of shortages hitting both rural and urban people led many countries to establish fuelwood plantations, notably using recently introduced or sub-spontaneous species. During this time, large-scale exploitation of local resources continued in order to meet the energy requirements of an ever-increasing population. Despite considerable efforts made by countries to increase fuelwood supplies and reduce consumption (in particular using improved wood stoves), results did not live up to expectations. Furthermore, statistics show that both rural and urban demand for wood-based energy has increased and should continue to increase owing to demographic growth (see Appendix 6) and to macro-economic evolution (as an indirect result of structural adjustment programmes). Hence progress achieved towards reducing pressure on natural forests and local genetic resources has been nullified. Today, the species *Acacia nilotica, Anogeissus leiocarpus, Diospyros mespiliformis* and *Vitellaria paradoxa* and certain *Combretacea* are particularly sought after.

Harvesting of non-wood forest products: The impact on genetic resources can be direct or indirect.

- Direct consequences, when reproductive organs (flowers, fruits and seeds) are removed. This is the case with most *Acacia,* where cattle eat the flowers and cloves. Also worthy of mention are the seeds of *Khaya senegalensis, Parkia biglobosa* and *Vitellaria parkii,* used to produce multiple-use oils. Finally there are species bearing edible fruits, such as *Sclerocarya birrea* and *Ximenia americana*. We should also mention *Acacia nilotica;* the extracts of its cloves are used as tannins.

- Indirect consequences include disfigurements to trees from the extraction of particular organs (bark, cambium, roots, leaves, etc.). Such damage can impact flowering or fructification of individuals and hence reduce the number of mating individuals.

In both cases, resource exploitation, too often combined with the action of brush fires, can lower the number of individuals participating in reproduction and reduce possibilities for natural regeneration, aggravating the risk of genetic erosion.

I.2.5.3. Species and populations considered under threat

National experts have provided lists of species of national significance with their degree of security and alleged threats. The result of the compilation of individual country reports is given in Table 1, Figures 2 and 3. More details on the nature of the threats, orders of magnitude by populations by country and ecological zone (when available), are given for 16 top priority species in Appendix 11

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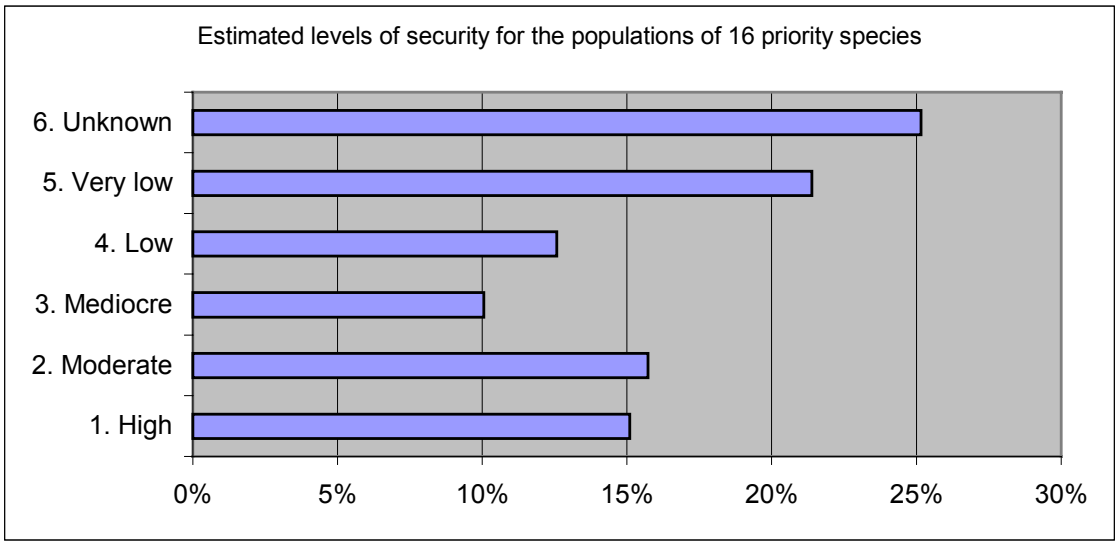
TABLE 1: SPECIES AND POPULATIONS CONSIDERED UNDER THREAT

Countries	Threats at species level	Threats at population level
Benin	*Afzelia africana, Khaya senegalensis, Pterocarpus erinaceus*	
Burkina Faso		*Acacia senegal, A. seyal, Anogeissus leiocarpus* *Adansonia digitata, Bombax costatum* *Faidherbia albida, Khaya senegalensis* *Parkia biglobosa, Vitellaria paradoxa* *Pterocarpus erinaceus, P. lucens*
Cameroon	*Azadirachta indica* *Dalbergia melanoxylon*	*Acacia nilotica, Acacia seyal* *Anogeissus leiocarpus, Khaya senegalensis*
Chad	*Azadirachta indica*	*Acacia senegal, Anogeissus leiocarpus* *Balanites aegyptiaca, Khaya senegalensis* *Parkia biglobosa, Vittelaria paradoxa* *Ziziphus mauritiana*
Côte d'Ivoire	*Cassia sieberiana, Ceiba pentandra* *Diospyros mespiliformis* *Ficus capensis, Khaya senegalensis* *Pterocarpus erinaceus*	*Anogeissus leiocarpus*
Eritrea	*Acacia etbaica, Adansonia digitata* *Boswellia papyrifera*	*Balanites aegyptiaca, Dodonaea angustifolia* *Juniperus procera, Olea africana* *Tamarindus indica, Ximenia americana*
Gambia	*Bombax buonopozence, Khaya senegalensis* *Oxytenanttera abyssinica, Parkia biglobosa* *Prosopis africana, Pterocarpus erinaceus* *Raphia spp*	*Afzelia africana, Borassus aethiopum* *Diospyros mespiliformis, Erythrophleum guineense* *Mitragyna inermis, Parinari macrophylla* *Rhizophora racemosa, Vitex doniana*
Kenya	*Acacia tortilis, Balanites aegyptiaca, Faidherbia albida*	*Tamarindus indica, Ziziphus mauritiana*
Mali		*Gilbertiodendron glaudolosum, Guibourtia copallifera*
Mauritania		*Acacia nilotica, Acacia senegal, Adansonia digitata, Ziziphus mauritiana* *Boscia senegalensis, Borassus flabelifer* *Combretum micrantum, Commiphora africana, Hyphaene thebaica* *Faidherbia albida, Grewia bicolor,* *Khaya senegalensis, Pterocarpus erinaceus* *Raphia soudannica, Tamarindus indica*
Niger	*Acacia senegal, Diospyros mespiliformis* *Lannea microcarpa, Prosopis africana* *Sclerocarya birrea*	*Acacia nilotica, Acacia seyal* *Acacia raddiana, Commiphora africana* *Pterocarpus lucens*
Nigeria	*Bombax costatum, Guiera senegalensis* *Pterocarpus erinaceus*	*Acacia nilotica, Acacia senegal* *Annona senegalensis, Anogeissus leiocarpus* *Balanites aegyptiaca, Borassus aethiopum* *Carrisa edulis, Hyphaene thebaica* *Lannea bacteri, Phoenix dactylifera* *Piliostigma thonningii , Ximenia americana* *Ziziphus spina christii*
Senegal	*Faidherbia albida* *Pterocarpus erinaceus*	*Acacia nilotica, Acacia senegal* *Borassus aethiopum, Cordyla pinnata* *Dalbergia melanoxylon, Parkia biglobosa* *Pterocarpus lucens, Saba senegalensis* *Sclerocarya birrea, Sterculia setigera* *Tamarindus indica*
Sudan		*Acacia mellifera, Acacia seyal, Acacia tortilis* *Adansonia digitata, Albizia amara, Albizia aylmeri* *Anogeissus leiocarpus, Balanites aegyptiaca* *Borassus aethiopum, Dalbergia melanoxylon* *Diospyros mespiliformis* *Faidherbia albida, Hyphaene thebaica* *Lannea fructicosa, Sclerocarya birrea*
Togo	*Anogeissus leiocarpus, Botrichium chamaeconium* *Daniellia oliveri, Dorstenia walleri, Faidherbia albida* *Garcinia afzelia, Garcinia Kola* *Khaya senegalensis, Parinari sp* *Polyscia pulva, Prosopis africana* *Pterocarpus erinaceus*	*Borassus aethiopum* *Diospyros mespiliformis*

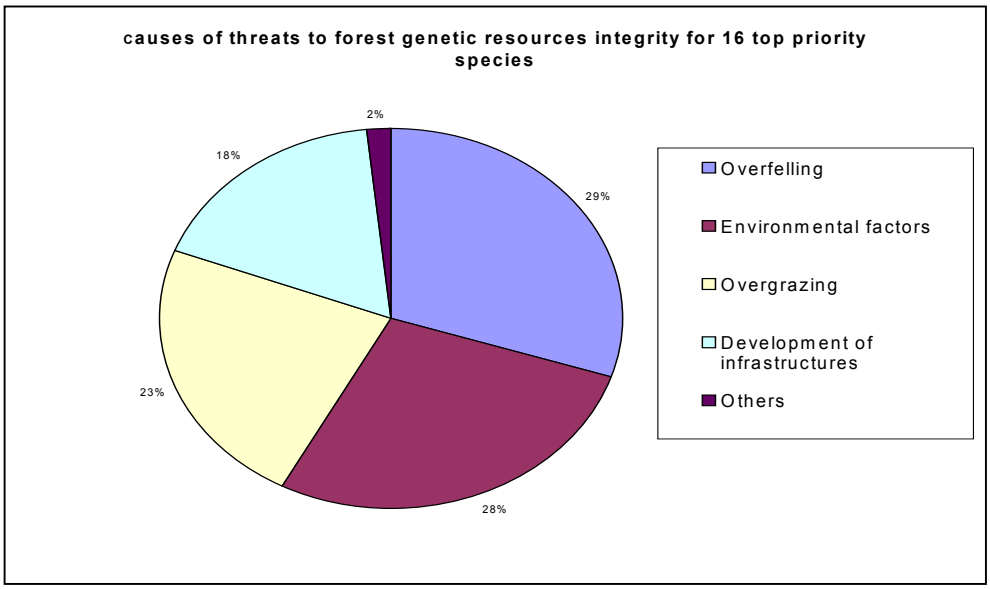
Source: country reports (1998)

FIGURE 2: ESTIMATED LEVELS OF SECURITY OF 16 TOP PRIORITY SPECIES*



Total number of populations considered: 159, representing 16 top priority species in 18 countries. The degree of security of each population has been ranked according to the following scale:
1.: implementation / enforcement of protection/conservation regulations probable, and regulations scientifically sound; or threat mild/occasional; 5: implementation/ enforcement of regulations unlikely; or threat severe with high probability of genetic degradation or loss; 2 to 3: intermediate between 1 and 5. 16 species considered top priorities in the region by country experts include: *Faidherbia albida, Tamarindus indica, Khaya senegalensis, Acacia nilotica, Adansonia digitata, Anogeissus leiocarpus, Parkia biglobosa, Acacia senegal, Azadirachta indica, Borassus aethiopum, Diospyros mespiliformis, Pterocarpus erinaceus, Balanites aegyptiaca, Eucalyptus camaldulensis, Vitellaria paradoxa* and *Ziziphus mauritiana.* See II 2.3 for more details.

FIGURE 3: NATURE AND IMPORTANCE OF THREATS RELATED TO 16 TOP PRIORITY SPECIES



Nature and importance of threats related to 16 species and their populations in Sahelian and North Sudanian Africa. Information provided in country reports for each species' population regarding its level of security and the nature of possible threats has been compiled. Number of species studied: 16; number of populations: 159. "Others" include vegetal, insect or disease pests, and fire. The relative low importance given to bush fires may be linked to the fact that it is not considered as a primary factor of threat, but associated with human activities such as agricultural extension and (over)grazing. See Figure 2 for the list of species.

I.3. Management of forest genetic resources

In operational terms, action relating to the genetic resources of forest trees and shrubs translates into three types of technical activities:

- conservation, for maintaining the adaptability of tree species and populations;
- utilization, for drawing benefit from genetic variation through tree selection and improvement;
- identification and supply of reproductive material (seeds, cuttings, etc.).

These actions are interdependent. Thus, genetic improvement programmes supply superior reproductive materials for planting and afforestation; to be pursued sustainably, these programmes require a broad base of genetic material which has to be conserved and maintained.

There is more and more tendency to take into account interactions between the objectives of conservation and sustainable utilization through the concept of sustainable management of genetic resources, thereby underlining that the conservation of forests and their genetic pools is generally compatible with their managed utilization to meet human requirements. In turn, efforts are under way to integrate forest genetic resources conservation concepts into wider frameworks, such as national forestry programmes, sustainable forest management plans, forest biological diversity status and action plans, and protected areas establishment and maintenance initiatives.

In countries of Sahelian and North-Sudanian Africa, several phases of forest policies and environmental regulations have influenced activities regarding forest genetic resources:

- protection measures, which led to the creation of parks and reserves for the protection of wildlife or wild flora, or of exceptional sites;
- large-scale plantation programmes, which aimed to water conservation, soil erosion and desertification control, particularly following the first droughts of the 1970s;
- efforts towards the sustainable management of natural forests. In the 1980s, policy measures started to address the issue of the management of natural forests in African drylands, promoting multi-disciplinary and participatory approaches.

I.3.1. Conservation programmes and activities

Technical programmes to conserve genetic variation between and within species (populations, individuals, genes) can use two basic strategies: *in situ* conservation (on the spot), i.e., in the natural or original habitat; or *ex situ* conservation (outside the natural habitat), i.e., in gene banks (seeds, tissue, pollen, stocks), or collections of individuals (botanical gardens, arboreta, *ex situ* conservation stands, tree improvement trials).

I.3.1.1. Location of forest genetic resources

Forest genetic resources in Sahelian and North-Sudanian Africa are distributed in various types of sites and areas, including forest stands and woodlands, either managed or unmanaged, trees outside forests, classified (gazetted) forest systems, natural reserves and protected areas. Information from national reports show that, the tree populations of 16 priority species are located in forests or wooded lands with some kind of control or management (either for soil or water conservation, for the production of wood and non wood products, or as grazing lands). Sites offering some kind of protection (reserve, protected area, gene conservation stand, parks) only retain 15% of these tree populations (Table 2). It should be noted however that no specific information is provided on the effectiveness of control, management, or protection systems.

TABLE 2: MANAGEMENT SYSTEMS AND POPULATION SIZES OF 16 SELECTED TREE SPECIES IN COUNTRIES OF SAHELIAN AND NORTH SUDANIAN AFRICA*

Management type/ population size	Protected site	Managed for			Not managed		
		soil/ water	wood	grazing	Uncontrolled felling	Uncontrolled grazing	Total by size
< 100 trees	3%	5%	2%	4%	4%	4%	**22%**
100 to 500 trees	2%	2%	3%	2%	3%	3%	**16%**
500 to 1 000 trees	5%	6%	7%	2%	6%	3%	**29%**
> 1 000 trees	2%	1%	4%	1%	3%	1%	**12%**
unknown size	4%	3%	6%	3%	3%	2%	**21%**
Total by type	**15%**	**16%**	**23%**	**13%**	**20%**	**13%**	
TOTAL	**15%**	**51%**			**33%**		

* The species have been considered top priorities in the region by country experts and include: *Faidherbia albida, Tamarindus indica, Khaya senegalensis, Acacia nilotica, Adansonia digitata, Anogeissus leiocarpus, Parkia biglobosa, Acacia senegal, Azadirachta indica, Borassus aethiopum, Diospyros mespiliformis, Pterocarpus erinaceus, Balanites aegyptiaca, Eucalyptus camaldulensis, Vitellaria paradoxa and Ziziphus mauritiana. See II 2.3 for more details.*

I.3.1.2. In situ conservation

The protection afforded by natural reserves, national parks, or other protected systems, theoretically guarantees the maintenance of the functioning of whole ecosystems (see Table 3). This does not necessarily ensure the conservation of a given species or tree population, supposing that forest ecosystems are included in the reserve. Considerations behind the decisions relating to the delimitations of classified forests, natural reserves or protected areas generally did not take into account the genetic variation of forest species.

In reality, it is rare to find national protected area systems which are sufficiently comprehensive to encompass all of the country's ecosystems, not to mention species and their variation. More alarming is the fact that some national parks established to protect wildlife are now characterized by animal overpopulation, causing damage to plants and jeopardizing tree regeneration.

Concerning the conservation of forest genetic resources, total protection measures today appear as a temporary, emergency solution which should be used with moderation in special cases only (for very rare and high value species, populations or individuals which face numerous threats, and for which reproduction and silvicultural techniques are still poorly known).

Protected areas are subject to fairly systematic follow-up and monitoring by administrations. In particular, tourism in national parks generates significant revenue in some countries. Some reports suggest that tree genetic resources may be better conserved in protected areas and sacred forests than in classified forests.

TABLE 3: CLASSIFIED (GAZETTED) FORESTS AND NATURAL RESERVES IN SOME DRYLAND AFRICAN COUNTRIES

State	B.F.	Cam*	Chad *	CI*	Eth.	Ghan	Gnea	Maur	Nger	Ngria	Sen.	Sdan	Tgo
Classified forests	57 a		15 a 5,5 b	90 a 27,7b	- -	- 6,4b	156a 11,9b	30 a -	84 a 6b		242a 10,6b	12,8b	72a 2.2b
Protected areas	14 a	6 a 9,1b	7 a 116,5 b		21a 29,8b	- -	2 a 0.9b	5 a 42,2b	7 a 14,9b	6 a 3,3 b	18 to 9,7 b	85b	11a 5.8b

* Not all data make distinction between classified forests and protected areas

Legend:

a = Number of classified forests or protected areas

b = Surface area estimated in km^2 x 1000

B.F. = Burkina Faso; *Cam = Cameroon;* *CI = Côte d'Ivoire;* *Eth. = Ethiopia;*
Ghan = Ghana; *Gnea = Guinea;* *Maur = Mauritania;* *Nger = Niger;*
Ngria = Nigeria; *Sen. = Senegal;* *Sdan = Sudan;* *Tgo = Togo*

The effectiveness of the classification system for the protection of forest resources is variable and generally poor. Owing to the lack of human and material capacity, national public administrations have experienced and still experience difficulties in monitoring classified forests. In the 1960s and 70s, no dryland forest was actually managed in Sahelian and North-Sudanian Africa and a number of protected forests were in effect free access. Niger reports today that 50% of its classified forests are degraded. Only towards the middle of the 1980s did an approach towards more effective management emerge in the region. This in particular resulted in the adoption by several countries of new regulatory frameworks that provided incentives for rational exploitation with assistance from rural communities.

I.3.1.3. Ex situ conservation

Only a limited number of forest species can be preserved appropriately *ex situ*. Major technical difficulties refer to several species whose seeds are recalcitrant or intermediate (they cannot be dehydrated below a certain threshold, and cannot be preserved for a long time). The cost of installing and maintaining cold chambers and conservation stands can be crippling given the low final commercial value of forest trees. In forestry, at the difference of cultivated crops, *ex situ* conservation is conceived as a complementary, secondary method to *in situ* conservation.

The countries of Sahelian and North-Sudanian Africa use several *ex situ* conservation methods for their forest genetic material:

- storage of seeds, cuttings, and other reproductive materials;
- storage of *in vitro* organs or plants;
- maintenance of field trial areas, botanic gardens, arboreta and *ex situ* plots.

The conserved species vary from one country to another. However two criteria seem to have guided decisions at national level:

- The level of utility of the species in plantations programmes. The seed of the following trees are frequently stored for planting and afforestation purposes: *Acacia nilotica, Acacia senegal, Anacardium occidentale*, *Azadirachta indica, Balanites aegyptiaca, Eucalyptus camaldulensis, Faidherbia albida, Mangifera indica, Tectona gandis, Parkinsonia aculeata, Prosopis juliflora* and *Ziziphus mauritiana*. The list includes a significant number of introduced species.
- The progress of selection and genetic improvement programmes. The numerous genetic materials generated by the most advanced programs are available in field trials, conservation stands or arboreta. It is the case of *Anacardium occidentale, Eucalyptus camaldulensis, Eucalyptus microtheca,* and *Faidherbia albida.*

In vitro conservation of whole organs or plants is rarely used.

I.3.2. Plantations and forest seed demand and supply

I.3.2.1. Historical background to plantation efforts in the Sahel

Seed requirements followed the evolution of forest policy, particularly with respect to plantations. At the beginning of the 1970s, large-scale plantation operations were initiated, aimed at meeting wood energy requirements and at combating desertification. Fast-growing species *(Azadirachta indica, Eucalyptus camaldulensis, Senna siamea*) were used abundantly in afforestation programmes. Despite the enormous efforts by countries to increase fuelwood production, the results did not live up to expectations. The mediocre results gradually led authorities to scale down the afforestation programme and to try and improve the management of existing resources, particularly by encouraging natural or assisted regeneration of native species stands.

Since the 1990s, modest afforestation efforts has been carried out, particularly within the framework of community forestry. Forest seed demand is now oriented towards those trees consider useful by local people. In most countries, there has been a significant reduction in planted areas and a parallel increase in the use of local species.

I.3.2.2. National forest seed and germplasm demand

Forest seed demand as well as an assessment of quantities produced are difficult parameters to quantify in Sahelian and North-Sudanian Africa. The sources of seed supply are diversified (often consisting of simply harvesting fruits at the foot of a tree) and are not always documented. There is no regulatory obligation for forest seed user to purchase seed through a national forest seed centre (when such a centre exists).

However, seed demand can be estimated when planted areas are known. Estimates have been provided for a number of countries and species and are available in Appendix 8. Apart from Burkina Faso and Senegal, which provided recent data on forest seed demand, countries provided global data only (all species together) which are uneasy to compare because of large differences in forest tree seed size and weigh. Annual requirements for Ghana are given at 10 tons, while those for Mali are at between one and two tons per year, and those for Niger are estimated at 2 tons.

National forest seed centres and warehouses exist in the sub-region. They are unequally distributed, East Africa being the best covered region (Table 4).

TABLE 4: DISTRIBUTION OF FOREST SEED AND STORAGE CENTRES IN SAHELIAN AND NORTH-SUDANIAN AFRICA

Country	Existence of a forest seed centre or a forest seed storage facility	Status of the seed centre or the forest seed storage facility
Benin	No	-
Burkina Faso	Yes	Governmental (CNSF)
Cameroon	No	-
Chad	No	-
Côte d'Ivoire	No	-
Eritrea	Yes	Governmental (Research)
Ethiopia	No	-
Gambia	No	-
Ghana	no	-
Guinea	yes	Gov.(CNSF) and private
Kenya	Yes	Governement (KFSC): Res., training
Mali	no	-
Mauritania	yes	Gov.(res..) and private
Niger	no	-
Nigeria	yes	Gov. (res.)
Uganda	being set up (PRONASEF)	Gov.
Senegal	yes	Gov. (CNSF)
Sudan	yes	Gov.(res.)
Togo	yes	Gov. (CNSF)

I.3.3. Tree selection and improvement

In Sahelian and North-Sudanian Africa, exotic forest species were introduced as an attempt to increase forest production. Several introduced species and provenances were tested in comparative field trials. In the most advanced programmes, the best individuals (or families) were retained in order to establish seed orchards.

A number of native species have also been considered in tree selection and improvement programmes, although the methodology used for introduced species was not always followed. With the exception of some provenance tests for *Faidherbia albida* (*i.a.* in Burkina Faso and Cameroon), *Parkia biglobosa* (in Burkina Faso) and certain *Acacia* (see Box 1), few species have been the subject of systematic investigation with comparative testing of documented provenances. Intraspecific genetic diversity has more recently been investigated using enzymatic or molecular markers, sometimes complementing common garden experiments. Species investigated include *Parkia biglobosa* in Burkina Faso, *Acacia nilotica*, *A. senegal, Moringa oleifera* and *M. stenopetala* in Kenya, *Azadirachta indica* in Niger, *Casuarina equisetifolia* in Senegal, and *Faidherbia albida* in Cameroon.

As demonstrated in Table 5, numerous gaps remain to be filled as regards knowledge of intra-specific variability of most local species.

BOX 1: EVALUATION OF SEEDLOTS COLLECTED WITHIN THE FRAMEWORK OF THE FAO PROJECT ON GENETIC RESOURCES OF ARID AND SEMI-ARID ZONE ARBOREAL SPECIES

The project was initiated by FAO's Forestry Department in 1979 with financial support from IBPGR[16] and the United Nations Environment Programme (UNEP). The main purposes of the project were to act as a catalyst for gathering genetic materials and information on arid and semi-arid zone woody species, and to aid countries in the practical application of the results.

From 1983-1987 seeds of 281 provenances of 43 species (mainly of the genera *Acacia* and *Prosopis)* were under FAO coordination collected in 11 arid and semi-arid countries. Seeds from these collections were distributed for evaluation from 1983 to 1989. In this period, field trials of sub-sets of the seedlots were established by 40 institutes and projects in 22 countries, including Burkina Faso, Cape Verde, Kenya, Niger, Senegal and Sudan. The primary objective was to establish trials suited to national conditions and priorities.

An overall global evaluation of a selection of trials was initiated by FAO in 1989 in consultation with countries concerned, and in collaboration with DANIDA Forest Seed Centre (DFSC). This global evaluation complements the evaluations carried out at national level by countries concerned, since the establishment of the trials. During 1990-1994, 26 trials in 6 countries (Brazil, Burkina Faso, India, Pakistan, Senegal and Sudan) were assessed. An overall synthesis including the analyses of all the trials assessed will be prepared and is planned for publication in 2000/2001 as a joint effort between all national institutions involved, DFSC and FAO.

Progresses in the evaluation of field trials established within the framework of the FAO Project on Genetic Resources of Arid and Semi-arid Zone Arboreal Species have been reported in *Forest Genetic Resources No. 16* (FAO, 1988) and *Forest Genetic Resources No. 23* (FAO, 1995).

Lars Graudal, Danida Forest Seed Centre, 1999.

[16] Now the International Plant Genetic Resources Institute (IPGRI)

TABLE 5: LIST OF SPECIES SUBJECT TO SELECTION, EVALUATION AND IMPROVEMENT ACTIVITIES

Species	Species, provenance or progeny tests	Seed collection stands, seed orchards	Vegetative or sexual propagation	Molecular analyses	Countries involves in this research work
Acacia auriculiformis	V	V			CI, Mal
Acacia bevenosa	V				Maur
Acacia nilotica	V		V	V	Cm
Acacia senegal	V	V	V		BF, Cm, K, Mal, Ng, Sd
Acacia seyal	V	V			K, Ng, Sd
Acacia tortilis	V	V			S, K, Sd
Anacardium occidentalis	V	V			S
Anogeissus leiocarpus	V			V	BF, Be, Mal
Atriplex halumus	V				Maur
Atriplex numularia	V				Maur
Azadirachta indica	V		V	V	BF, Cm, Ng, S
Casuarina equisetum	V			V	S
Eucalyptus camaldulensis	V	V	V	V	BF, CI, Cm, K, Ng, Na, S, Sd, Tgo
Faidherbia albida	V	V		V	BF, CI, Cm, Ng, K, S, Sd
Khaya senegalensis	V		V	V	BF, Cm
Melia volkensii	V				K
Parkia biglobosa	V			V	BF, Cm, Na
Parkia biglobosa	V		V	V	BF
Prosopis africana	V				BF, Ng
Prosopis cineraria	V				Maur
Prosopis juliflora	V			V	BF, Ng, S
Pterocarpus erinaceus	V				Be, CI, Mal
Tamarindus indica	V			V	BF, Cm, K
Tectona grandis	V	V	V		CI, Tgo
Ziziphus lotus			V		Maur
Ziziphus mauritiana	V				BF, S

Source: country reports, 1998

Abbreviations:

BF= Burkina Faso Be= Benin CI= Côte d'Ivoire Cm= Cameroon
K= Kenya Mal= Mali Maur = Mauritania Ng= Niger
Nga= Nigeria S= Senegal Sd= Sudan Tgo= Togo.

I.4. Policy, planning and institutional mechanisms

I.4.1. General features of forestry policy

In most countries, forest legislation has been in place since the beginning of the 20th century, even though forest policies as such did not exist at that time. However, weaknesses in forestry laws and lack of enforcement have limited their effectiveness in protecting forests and genetic resources.

During the mid 1980s, the Tropical Forests Action Programme (TFAP) was adopted in almost all countries in order to improve planning in the forest sector (see Appendix 7). The ensuing forest action programmes recommended taking into account biological diversity conservation. During the period 1990-1995, the sub-region was characterized by a multiplicity of different planning frameworks which often overlapped, sometimes complemented each other and finally contradicted each other. This greatly hindered the formulation and implementation of good quality national forestry plans[17].

At international level, the economic context has been influenced since the 1970s by economic restructuring and the establishment of structural adjustment policies. These changes, strongly supported by the main international funding bodies, have considerably affected the forestry sector. In a number of countries, the vast majority of forest lands are owned by the state and public services and institutions are responsible for managing them. Within the framework of structural adjustment programmes, the budgets and manpower of national forest services and research institutions were generally reduced, sometimes considerably, and the role of these services has been scaled down.

Forest policy sought, and still seeks, to adapt to these new issues. It is now generally recognized that a balance should be found not only regarding the respective functions of governmental institutions and society (through NGOs for example), but also with respect to how authority and action is articulated between national and local levels. The decentralization of structures and devolution of responsibilities to provincial or local authorities underway in most countries on the one hand, and the privatization of estates and services on the other hand, have immediate implications for systems of ownership, management, conservation and utilization of forest genetic resources.

The major obstacles blocking the adoption and effective implementation of integrated and decentralized forest management policies are the same which limit the protection and conservation of forest genetic resources: inadequate security regarding tenure and usufruct of land and renewable resources, structural weaknesses of land use legislation and poor adjustment of policies for agroforestry and forestry activities.

[17] Source FAO, 1998b

TABLE 6: ADMINISTRATIVE AND LEGISLATIVE PROVISIONS REGARDING FOREST MANAGEMENT

Country	Forestry code updated in	Forestry code being updated	Institutions involved in forest genetic resources
Benin	1993	No	Min. env. habitat and urb.; Min. rural dev.; Min. plan, econ. restruct., and employment; Min.pub. works.; Min.educ.and sci, res.; Benin Centre Sust. Dev.
Burkina Faso	1997	No	Adm. eaux et forêts; Conseil nat. gestion env.; Research sector; Univ.; CNSF.
Cameroon	1994	No	Min. env. et for.; Developmt projets; IRAD; Universities; NGOs.
Chad	Various texts. National desertification control plan. Environmental law of 1998	Yes	Min. env. et eau; Min agric. ; Min elev.; Development projets; NGOs.
Côte d'Ivoire	1965	In progress	Min. env. & forêt. - Min. ens. sup. et rech. scie. - Assemblée Nat. Ecoles sup. agronomiq. NGOs and Private sector
Eritrea	1980	In progress	Ministère de l'Agriculture
Ethiopia	1980	Unknown	Min. Agriculture; Min. natur. & envir. protect.; Development projects
Gambia	1978	In progress	Dir. Forestry.; NGOs ; private
Ghana	1945	In progress	Min. For. and Land Use; Envir. protection agency; Savannah Agr. Rese. Inst; Forest Research Institute;
Guinea	1989	No	Min. agri. eaux et for.; Min. trav. publ.; Min. ress. nat. & energ.
Kenya	No	In progress	Direct. Forestry & wildlife; KEFRI; Nat. Env. Agency; Universities.
Mali	1995	No	Min. env.; Min. dév. rural et eau; Min. ens. sup. et rech.
Mauritania	1997	No	Min. dév. rur. env. rech.
Niger	1974	In progress	Min. hydrau. et env. ; rech.; Univ.; NGOs.
Nigeria	Forestry and Fauna policy of 1988	No	Min. Sc. & Techno.; Ins. Rech.
Senegal	1997	No	Min. env.et prot. Nat.; Devel. projets; PRONASEF; NGOs; rech.; Universities.
Sudan	Law of 1989	No	Min. agric. & for.; Off. nat. for.; Cent. rech.
Togo	Unknown	In progress	Min. env. & prod. for.; CNSF; Ins.rech. univ.

Source: country reports, 1998.

I.4.2. Policy and legislation regarding forest resources

Forest policies vary significantly among countries in the sub-region. Most policies now aim at reconciling an ever increasing number of interests and objectives, including resource conservation, forest product supply and devolution of managerial responsibilities to local people.

The majority of countries in Sahelian and North-Sudanian Africa have ratified the international frameworks and agreements adopted at the United Nations Convention on Environment and Development (UNCED), including the Convention on Biological Diversity[18] and the Convention to Combat Desertification. One of the main beneficial effects of these conventions has been the progressive incorporation in national legislative systems of considerations regarding the multiple functions of forests and the various actors in the forestry sector. A more integrated and decentralized approach to forest management was progressively mapped out, which is important in Sahelian and North-Sudanian Africa, where community forestry is traditionally well evolved. Other international initiatives and conventions of relevance to forest genetic resources include the African Convention for Conservation of Nature and Natural Resources, the Convention on the Protection of World Cultural and Natural Heritage, and the *Man and the Biosphere* programme of UNESCO.

In practice, difficulties have arisen in the implementation of the legislative and regulatory measures affecting forest resources in general and forest genetic resources in particular. In the past, the application of laws, regulations and management plans suffered from several limiting factors, including:

- lack of an appropriate legal framework for national and local conditions;
- the non-consideration in these texts of customary law;
- inadequate integration of rural people's grazing and forestry activities;
- complex and unsatisfactory land ownership structure ;
- lack of training among officers and rural people.

New political options have led a number of countries to start reformulating their legislation regarding forest resource management. This process of reformulation has concerned forest laws, environmental codes, and laws and regulations relating to land regimes (see Table 6). In the new legislative and regulatory texts on forests and nature protection, the technical focus tends to be at ecosystem level. The level concerning forest genetic resources is generally not given special attention, nor even mentioned.

[18] UNEP. 1992.

I.4.3. Forest management

Only in recent times has concern been raised about the sustainable management of natural dryland forests. In the Sahelian sub-region in the strict sense (excluding countries bordering the Gulf of Guinea), nearly 93% of the roundwood produced in 1996 (for a total of about 150 million m^3), was used for fuel[19] (see Appendix 6). The proportion of wood used as fuelwood in the same year was 88% in the countries bordering the Gulf of Guinea (Cameroon, Côte d'Ivoire, Ghana, Guinea, Nigeria), which is also significant. In western Sahelian Africa, the importance of fuelwood is such that cooperative management of natural forests for fuelwood is promoted and rural markets have been established for this product.

The mediocre results obtained by legislative and regulatory protection, and the disappointing outputs from plantations of introduced species, have helped change policy orientation towards improving the management of natural stands. Results from participatory models of forest management, along the lines of Burkina Faso, Gambia and Mali, have often been highlighted and some of them are being consolidated. These approaches are now being institutionalized in a number of cases, and several countries have strengthened the legal framework used for participatory management of dryland forests. Moreover, many countries have handed over, or are in the process of doing so, direct responsibility for forest management in favour of local people or private partners, while maintaining a supervisory role. In addition, the importance of stable land ownership regimes and access to open resources, have been acknowledged.

However these orientations are not without side effects at local level. The expansion of protected zones, decentralized management and the privatization of certain resources, have contributed to the development of numerous conflicts between stake holders regarding access to forest resources and their utilization.

I.4.4. National institutions and organizations concerned

No country in Sahelian and North-Sudanian Africa has a national institution that deals exclusively with forest genetic resources. Several national institutions contribute to defining policies and implementing management actions and resource conservation. In general, a particular institution plays the role of driving force and focal point.

At government level, forestry issues are generally supervised by a single ministry (ministry of forestry, ministry in charge of the environment, or ministry responsible for natural resources). This institution sets frameworks, planning and objectives through the country's forestry and/or environmental policy. The establishment of management and conservation regulations, the supervision of the execution of programmes and the monitoring of plans, may be carried out at national or sub-national levels, or a combination of both.

Research institutes: national agencies involves in research activities include research institutions *per se* (national agronomic or forestry research institutes), universities, and sometimes forest seed programmes or forest services.

[19] Source : *State of the World's Forests*, FAO, 1999

Public agencies: state agencies include organizations like *Office national de développement des forêts* (ONADEF, Cameroon), *Société de développement des forêts* (SODEFOR, Côte d'Ivoire) and *Forests National Corporation* (FNC, Sudan). These institutions are often placed under the authority of the ministry responsible for forestry and the environment. They operate on behalf of the ministry in carrying out and monitoring programmes and plans, and sometimes as executive agencies.

Cooperation and development projects: these projects associate one or more national agency or partner, one or several external technical or funding partners (donors, international cooperation agencies) and possibly an implementation agency. Several national forest tree seed centres in Sahelian and North-Sudanian Africa, including in Burkina Faso, in Senegal and in Togo, have been established through, or benefited from, a cooperation and development project.

NGOs: The number of both national and international non-government organizations operating in the forestry sector has grown rapidly. National NGOs involved in the field of forestry often participate in village-based rural development projects such as assistance to tree planting, environmental education, and technical extension. Some international NGOs have a more strategic and global approach regarding specific sectors: the World Conservation Union (IUCN) supports to the establishment and maintenance of natural reserves and protected areas; the International Union of Forest Research Organizations (IUFRO) has developed a Special Programme for Developing Countries aiming to expand and foster forestry research capacity in developing and economically disadvantaged countries (a regional coordinator has been appointed for Africa).

Several national institutions are reported suffering from a lack of financial means and trained staff to carry out stated policy.

I.5. Related and support activities

I.5.1. Forest genetic resources training

If the majority of countries in Sahelian and North-Sudanian Africa have training structures for technicians and forest engineers, only Kenya, Nigeria and Sudan have further training structures for forest genetic resources (Table 7). Most countries admit suffering from a lack of specialists in the area of forest genetic resources.

TABLE 7: NATIONAL CAPACITY FOR TRAINING AND RESEARCH (FORESTS AND FOREST GENETIC RESOURCES)

Country	Technical training	Higher education - forest and forest genetic resources		Forest research carried out at:	
		Engineer level	MSc and Ph.D.	Forest Research Institutes	Universities
Benin	Yes	Yes	No	INRAB	Yes
Burkina Faso	Yes	Yes	Yes	Inst.Env R.Ag.	Yes
Cameroon	Yes	Yes	No	IRAD	Yes
Chad	Yes	Unknown	No	Nn	No
Côte d'Ivoire	Yes	Yes	No	CNRA	Yes
Eritrea	Unknown	Unknown	Unknown	Unknown	Unknown
Ethiopia	Yes	Yes	Unknown	FRC	Yes
Gambia	Unknown	Unknown	Unknown	NARI	Unknown
Ghana	Unknown	Yes	Unknown	FORIG	Yes
Guinea	Yes	Yes	No	No	Yes
Kenya	Yes	Yes	Yes	KEFRI	Yes
Mali	Yes	Yes	No	CNRST	No
Mauritania	Unknown	Unknown	No	Centre de Boutilimitt	Unknown
Niger	Yes	Yes	No	INRAN	Unknown
Nigeria	Yes	Yes	Yes	For.Res.Ins.N	Yes
Senegal	Yes	Yes	No	ISRA	Yes
Sudan	Unknown	Yes	Yes	FRC	Yes
Togo	Yes	No	No	No	Yes

Source: Country reports, 1998 (list in Appendix 13).

I.5.2. Forest research[20]

Many countries in the sub-region are in the process of restructuring their national agricultural research system, of which forestry research is a component.[21] The general trend is towards the regionalization of agricultural research, with regional programmes carried out by multi-disciplinary research teams. While justified and positive from many points of view, this restructuring has sometimes weakened national forest research capacity by diluting expertise which in many cases is already below requirements. In some countries, the coordination of forestry research is inadequate at national and regional level as a result of this restructuring. In extreme cases, forest research is being marginalized.

Government and donor funding has considerably dropped in the last ten years. Forest research has generally not been attractive for the private sector and decision-makers owing to the lack of appreciation of the socio-economic benefits accruing from research activities. In Sahelian countries, sectoral and macro-economic policies contribute to an under-evaluation of the services and products supplied by forests and trees, particularly when rural people benefit from them within the framework of a non-monetary, or informal, economy. These distortion lead to an inadequate allocation of internal resources to the forestry sector. There is no effective legislative provision for funding allocation to support forest research. The restructuring and economic liberalization programmes underway in many African countries have a negative impact on the funding of forest programmes, especially forest research activities. At the same time, (often short-termed) funding opportunities from donors strongly orientates policy choices and forestry priorities at national level.

I.5.3. Research institutes

Research activities are carried out by specialized institutes, universities and sometimes by forest seed centres. Work essentially involves species elimination tests or comparative trials, provenance tests and progeny tests. Studies also concern plant propagation and *in vitro* cultivation (Kenya) and the study of seed conservation and manipulation, particularly seeds with recalcitrant behaviour. On the other hand, little work had been done (exceptions mentioned in Burkina Faso, Cameroon, and Kenya) on investigating intra specific variability.

A survey commissioned by CIFOR in 1999 sampled a number of countries in West Africa and assessed capacity for forestry research. Results of human resources survey are shown in Table 8.

[20] For further information, see also Carlson, L.W. and Shea, K.R. 1986.

[21] Source : *Summary Report, FAO-IUFRO Expert Consultation on Forestry Research*, Accra, Ghana, 30 September – 2 October 1997. Available at http://iufro.boku.ac.at/iufro/spdc/.

TABLE 8: HUMAN RESOURCES FROM THE SURVEY SAMPLE AGGREGATED BY COUNTRY

Country	Total	% female	Ph.D.	M.Sc.	B.Sc.	Expat.
Benin	4	25	0	4	0	0
Cameroon	25	4	14	9	0	2
Côte d'Ivoire	20	5	2	5	11	2
Ghana	47	19	20	17	10	0
Nigeria	55	7	18	36	1	0

Source: M.J. Spilsbury, G.S. Kowero and F. Tchala-Abina. 1999. Capacity for Forestry Research in Selected Countries of West and Central Africa. CIFOR Occasional Paper No 24, Nov. 1999.

I.6. Regional and international collaboration

Numerous networks and specialized mechanisms exist in Africa although most do not relate specifically to forest genetic resources. Many national reports reveal a strong desire to strengthen country cooperation in a concrete manner, using existing or new network facilities. In particular, these reports express the need to set up a facilitating mechanism for the exchange of thematic information and joint work on precise topics related to forest genetic resources.

I.6.1. Regional cooperation

The main sub-regional political and economic groups (see Table 9) include the Permanent Interstate Committee for Drought Control in the Sahel (CILSS), the Common Market for Eastern and Southern Africa (COMESA), the Economic Community of West African States (ECOWAS) , and the Intergovernmental Authority on Development (IGAD). Only the Organization of African Unity (OAU) reunites both western and eastern Sahelian and North-Sudanian countries in one structure.

In theory, forest research forms part of the African sub-regional networks on agricultural research ASARECA[22], CORAF[23] and SACCAR[24], which were recently federated into an African Forum for Agricultural Research (FARA). However, forest research is not a priority of these networks, which remain traditionally focused on agricultural crops. As a result, the lack of a suitable mechanism means that information dissemination is inadequate and cooperation is under developed for forest research.

[22] Association of Agricultural Research in East and Central Africa
[23] Conference of Directors of Agronomic research in West and Central Africa
[24] Southern African Centre for Cooperation in Agricultural Research

TABLE 9: MAIN REGIONAL AND SUB-REGIONAL POLITICAL AND ECONOMIC GROUPS AND RESEARCH NETWORKS ACTUALLY OR POTENTIALLY ACTIVE IN THE FIELD OF FOREST GENETIC RESOURCES

Body	Name	Field of Action	Country or zone of operation
AFREA	Association of Forestry Research Institutions of Eastern Africa		Membership in 10 countries of East Africa
AFORNET	African Forestry Research Network	Extended area	All Africa
ASARECA	Association of Agricultural Research in East and Central Africa	Strengthening agricultural research	Eastern and central Africa
CACEU	Central African Customs and Economic Union	Broad area	Cameroon, Congo, Gabon, RCA, Guinea Eq., Chad
Club of Sahel		Mobilizing support	All Sahelian countries
CILSS/INSAH	Sahel Institute	Forestry research	Burkina Faso, Mali, Mauritania, Niger, Senegal, Chad
CORAF / WECARD	Conference of Directors of Agronomic Research in West and Central Africa / West and Central Africa Council for Agricultural Research and Development	Management, improvement, wood	All countries, particularly French-speaking
CORAF-Forêt	West and Central African Council for Agricultural Research and Development	Broad area	20 members institutions in West and Central Africa
EAC	East African Community	Extended area	Eastern African Community
ECOWAS	Economic Community of West African States	Extended area	Burkina Faso, Senegal, Mali, Mauritania, Niger, Côte d'Ivoire, Nigeria
FORNESSA	Forestry Research Network for Sub-Saharan Africa	Federation of forestry research institutions	41 countries, members of AFREA, SADC-FSTCU or CORAF-Forêt.
GFIS	Global Forestry Information Service	Information system, research	IUFRO project; all countries and territories in Africa
ICRAF/SALWA	International Centre for Research in Agroforestry	Agroforestry	Senegal, Mali, Burkina Faso, Niger, Chad, Mauritania
IGAD	Intergovernmental Authority on Development	Extended area	Eastern African countries
LCBC	Lake Chad Basin Commission	Extended area	Cameroon, Niger, Nigeria, Chad
NAPRECA	Natural products Research Network for Eastern and Central Africa	study, promotion, and development of the science of natural products	nine branches HQ in University of Dar es Salaam , Tanzania
OMVS	Senegal River Development Organization	Extended area of the Senegal river valley	Mauritania, Mali, Senegal
OSS	Observatoire du Sahara et du Sahel	Broad area	African countries in affected areas and northern countries
OAU - STRC	Scientific, Technical and Research Commission	Broad area	All African Countries
PRASAC		Agricultural research	Cameroun, Chad et RCA
Prog.Rég.Am.Bass.Vers.Haut Niger et Haute Gambie			Guinea, Guinea Biss.,Mali, Mauritania, Niger, Senegal.
Projet Jachères		Agroforestry	Burkina Faso, Senegal, Mali, Niger, Côte d'Ivoire
SADC-FSTCU	Forestry Sector Technical Coordination Unit of SADC	Broad area	Research institutions in 14 countries of the Southern Africa Development Community
SAFORGEN		Forest genetic resources	All sub-Saharan countries
UNSO	Office to Combat Desertification and Drought	Environment and energy	All member countries affected by desertification and drought

I.6.2. International cooperation

International cooperation is the area of partners such as UN agencies (FAO, UNEP, UNDP, the World Bank), the centres of the Consultative Group on International Agricultural Research (CGIAR), international NGOs (IUCN, IUFRO, WWF), bilateral cooperation and development agencies (see Table 10). There is no administrative, financial or technical coordination structure between the national, bilateral or international organizations. Many country reports mention the need for a better harmonization of the interventions of large international agencies at national level.

I.6.3. External funding of forest resource activity

Countries in the Sahelian and North-Sudanian sub-region depend heavily on outside sources for the funding of their forestry sector. Domestic funding comes primarily from the public sector.

A number of bilateral funding donors and other donors are increasingly turning away from funding individual projects in favour of a global approach (called programme approach), favouring an integrated vision and involving the national government in the administrative and technical management of support activities. Through the revision of forest action plans and other planning and legal texts, a certain number of Sahelian and North-Sudanian counties are oriented towards a new handling of forestry issues. As reported in national documents, these approaches might include a decentralization of natural resource management and the development of an integrated technical and operational framework. The programme approach in theory appears suitable if inter-sectoral links are important, which is the case with forest genetic resources (strong interaction with the agricultural, forestry, the environment and natural resources, and rural development sectors). It is not clear from country reports whether the programme approach can easily be translated into operational action in forest genetic resources.

At national level, the policy of state disengagement and decentralization discourages investments that are not directly related to the productive sector. Financial constraints reported by most countries in the sub-region seriously compromise domestic commitment and investment capacity in the field of forest genetic resources.

TABLE 10: SOME BODIES OPERATING IN INTERNATIONAL COLLABORATION

BODY	FIELD OF ACTION	COUNTRY OR ZONE OF OPERATION
African Development Bank	Broad mandate	African member countries
CFD/France	Broad funding	Especially developing French-speaking countries
CIRAD-Forêt/France	Forest research	All countries, especially French-speaking
CRDI/Canada	Forest research and protection	All countries
DANIDA/Denmark	Forest seeds	All countries
DGIS/Netherlands	Forest management and protection	None
European Union	Forest research and management	All developing countries
FAO	Forest Resources Division.	All member countries
Fondation Int. pour la Sc	Funding agricultural research	All developing countries
GTZ/Germany	Nature management and protection	All countries
ICRAF	Agroforestry	All countries
ICRISAT	Dryland agricultural research	All countries
IFAD	International Fund for Agricultural Development.	All countries
IITA	Regional tropical agricultural research	All countries
ILRI	Veterinary and zoological research	All countries
IPGRI	Forest genetic resources	All countries
IUCN	Nature conservation	Burkina Faso, Guinea Biss., Mali, Niger, Senegal
IUFRO	Forest research	All member countries
ODA/Great Britain	Nature research and protection	All countries, especially Commonwealth members
ORSTOM/France	Various research fields	All countries, especially French-speaking
UNDP	Development Funding	All developing countries
UNEP	Environment	All member countries
UNESCO	Protection and training (Prog.MaB)	All member countries
Univ. Wageningen/Netherlands	Forest and recalcitrant seed research	All countries
Univ.Toulouse/France	Brush fire	Burkina Faso
Univ.Leiden/Netherlands	Resource management	Burkina Faso and Cameroon
World Bank/GEF	World Fund for the Protection of Nature	All countries
WWF	Financial NGO for nature protection	All countries

I.7. Conclusion

The Sahelian and North-Sudanian eco-geographic zone of Africa identified in this document groups together 21 countries[25], covering a total surface area of 12 million km^2 and with a population of 365 million inhabitants[26]. The area groups together Sahelian countries in West Africa, dry zone countries in East Africa and countries with dry areas bordering the Gulf of Guinea. Rainfall in the area studied varies approximately between 300 and 1 000 mm and three main phytogeographical areas are represented: the Sahelian area, the North-Sudanian area and the western area.

The populations, mostly rural, live mainly from agriculture and livestock breeding. Industralization is limited, consisting essentially of primary processing units. The portion of fuel from harvested and used wood is close to 90%. Rural and urban people remain very dependent on the goods and services supplied by forests, trees and multiple use woody plants. The overexploitation of forest resources due to population growth and uncontrolled human activities (harvesting of wood and non-wood products, grazing, clearing, brush fires) represents the most serious threat to the maintenance and sustainable development of forest resources. The man-induced depletion of forests and woodlands is amplified by recurrent episodes of climatic drought.

Growing awareness of the excessive pressures on the environment and natural resources has led several countries in the sub-region to review or envisage the revision of legislative and regulatory texts regarding trees and forests. New forest policies tend towards better indirect protection of forest genetic resources. Nevertheless policies, including new ones, are not always implemented efficiently.

Forest plantations established in the framework of desertification control, albeit with varying degrees of success, have encouraged the production and supply of forest seeds and in some countries the creation of national forest seed centres. Attention and efforts have recently shifted to local species, mainly used for small-scale tree planting by rural communities and individuals. Although most genetic variability of woody species is located in forests and other non-managed formations, natural parks, reserves and classified forests represent important reservoirs.

Further education on forest genetics in the sub-region is provided by national bodies (schools and universities). In the past, much research work focussed on selection and genetic improvement in order to supply reproduction material for plantation efforts. Now the focus is more on knowledge of natural formations.

[25] Benin, Burkina Faso, Cameroon, Cape Verde, Chad, Côte d'Ivoire, Djibouti*, Eritrea, Ethiopia, Gambie, Ghana, Guinea, Kenya, Mali, Mauritania, Niger, Nigeria, Senegal, Somalia*, Sudan and Togo. No national report has been requested from countries with *.

[26] Source : *State of the World's Forests. FAO, 1999*. See Table in Appendix 4.

Despite efforts at country level, management of forest genetic resources is globally deficient in the sub-region, and the following reasons have been reported by national experts:

- legislation and regulations encompass a broad area (forest resources or biological diversity) and do not target genetic resources specifically. Moreover, many of these texts do not take enough account of the country's socio-economic context and are poorly implemented;

- overpopulation and the impact of macro-economic policies have led to changes in the way of life of certain rural groups, which are now sedentary and competing with other groups for access to resources and land use;

- the training of the agents, technicians, engineers and officers specialized in forest genetic resources remains inadequate and most countries have limited capacity;

- scarce applicable technical knowledge is available on local species and their variability;

- while remaining limited, scientific and technical information is poorly circulated and research results are publicized selectively;

- national institutions lack financial resources to be able to intervene actively in the conservation and sustainable management of forest genetic resources.

Nonetheless the new approaches to resource management brought to light at local, national and world level, and the experiments carried out in a number of countries, together with possible overall decreases in population growth, generate a certain optimism as to the possibilities of reducing pressures on forest genetic resources[27].

The writers of the national reports evaluated the state of forest genetic resources in their country and formulated a certain number of recommendations. The main recommendations reported by national experts concern the basic actions necessary for:

- sensitizing local people and all interested parties as to the importance of the conservation and sustainable utilization of the genetic resources of forest species and to the compatibility of these two themes;

- proposing clear and suitable policies and legislation, in compliance with country obligations with respect to the Convention on Biological Diversity;

- facilitating dialogue and joint and coordinated actions among all parties concerned by forest genetic resources at national level;

- facilitating the preparation of management and conservation plans for forest genetic resources and promoting their effective implementation;

- identifying the priorities and activities which could be treated in a coordinated way at regional level, in support of national efforts.

[27] See also Clément, J. 1997.

These recommendations were discussed, complemented, targeted and structured by participants of the workshop on the conservation, management, sustainable utilization, and enhancement of forest genetic resources, which was held in Ouagadougou in 1998. The genetic resources experts sent by 15 regional countries not only examined the plan of the sub-regional synthesis report, but also prepared the outline of a sub-regional action plan on forest genetic resources. The detail of this action plan forms the subject of the second part of this document.

Part II: SUB-REGIONAL ACTION PLAN ON FOREST GENETIC RESOURCES IN SAHELIAN AND NORTH-SUDANIAN AFRICA

II.1. Background

II.1.1. Justification for a sub-regional action plan on forest genetic resources

Dryland zones are among the most fragile ecosystems on the planet and become more so during periods of drought and desertification. As a result of their vulnerability and ecological limitations, these zones tend to be marginalized economically to such an extent that their inhabitants rely closely on local forests in order to obtain many goods and services. Sahelian and North-Sudanian Africa is no exception.

Despite their crucial importance, the forest resources are constantly being diminished in quality and quantity. Uncontrolled deforestation (mainly for land conversion to agriculture) and the overexploitation of wood and forests (by excessive harvesting of fuelwood and overgrazing) are the main sources of degradation for trees, forests, soils and the environment.

Forest goods and services closely depend on the quality of their genetic base, but genetic diversity is rarely taken into account in decisions regarding land use, forest planning and management or in resource utilization. It is however subject to growing attention in discussions concerning sustainable forestry and in the development of concepts related to biological diversity, of which it is an essential component.

Nevertheless, forest resources face very real, topical and immediate pressures. *The State of Forest Genetic Resources in the Sahelian and North-Sudanian zone* mention several species and populations facing threats from clearly identified causes. These threats are sometimes worrying enough to justify urgent action even in the absence of the scientific knowledge necessary for programmed conservation and management.

In a certain number of countries, there has been strategic consideration concerning the conservation of biological diversity, forest seed supplies, or with respect to prioritization in conservation or genetic breeding programmes. The formulation of national strategies for forest genetic resources is a way of integrating action proposals at national level, and of identifying the appropriate institutional mechanisms for implementing them.

National initiatives, strategies, action plans and programmes should remain the foundation of all efforts. The preamble to the Convention on Biological Diversity affirms that while the conservation of biological diversity is a concern for all of humanity, states have sovereign rights and obligations for the conservation and sustainable utilization of their own living resources.

Although necessary, national strategies do not always suffice. Many forest species are characterized by high genetic diversity and a vast distribution range, which often spills over national borders. Issues regarding ownership, access to resources and the rights and knowledge of local people, are raised more and more frequently in international discussions, as well as the equitable distribution of benefits drawn from the use of genetic resources. Regional and international cooperation have become an essential complement to national efforts.

II.1.2. Objectives and strategy of the sub-regional action plan

The appropriateness of preparing a sub-regional action plan on forest genetic resources, as well as its objectives and contents, were discussed by participants at the sub-regional workshop on forest genetic resources in Ouagadougou from 22 to 26 September, 1998. The participants agreed that a sub-regional action plan on genetic resources for Sahelian and North-Sudanian Africa would constitute an invaluable tool. They also agreed that the plan should initially be based on the scientific and technical information contained in the national reports, and on the ideas and proposals put forward at the workshop.

Participants unanimously stressed that the plan should be action-oriented, thereby confirming the recommendations of the Committee on Forestry. Since the plan would be used to guide inter-country cooperation in future years, the document should be founded on clear goals and principles, but stated succinctly in order to be flexible enough for the implementation and update of recommendations.

The format of the action plan was discussed at length. It was finally decided to articulate the plan in two parts: a part tackling priority species surveyed at sub-regional level on a hierarchical basis; and a second part describing the actions necessary to reduce the major constraints to these species. A list of priority species was drawn up from national reports, discussed during the workshop, and complemented with information from participants. National reports were also submitted after the workshop, such as the one from Ethiopia. Participants identified the main constraints during the workshop based on similar operations previously carried out nationally by forest tree seed centres in Burkina Faso and Senegal.

Three major constraints were identified by national experts. These constraints are not specific to one forest species or to a given category of trees, but encompass genetic resources of woody species in their broadest sense:

- knowledge of forest genetic resources in the sub-region is inadequate, both in terms of genetic variability as well as population numbers and risk evaluation;

- production of goods from forests cannot meet current and projected human requirements;

- forest resources in general and their genetic heritage in particular are not sufficiently taken into account at national level, despite information on their deteriorating status.

The long-term objectives assigned to the action plan are the following:

- ensuring the conservation of forest genetic resources of regional significance as a basis for sustainable forest management and the maintenance of forest biological diversity;

- promoting the sustainable utilization of forest genetic resources in order to encourage local and national development and contribute to poverty alleviation;

- promoting a fair and equitable distribution of the benefits from using forest genetic resources, while acknowledging that it is equally as desirable to share knowledge, innovations and traditional practices regarding the conservation of forest genetic resources and their sustainable utilization;

- developing, strengthening and harmonizing national policies and regulatory and legislative measures in line with circumstances, and promoting the incorporation of forest genetic resources in management schemes for territorial and rural management;

- promoting or strengthening national programmes for management, research and development, and the capacity of institutions in charge of developing and implementing such programmes. Particular attention should be given to the execution and follow up of national forest action plans and programmes, management plans for woodlands and trees outside forests, plans for conserving biological diversity, afforestation and desertification control plans, and programmes for the provision of improved forest tree seed.

Immediate objectives to be reached are summarized as:

- managing (using and conserving) forest genetic resources more efficiently;
- improving the performance of forest genetic resources;
- strengthening national capacities concerning forest genetic resources.

The following priority topics were identified as best suited to concerted and voluntary regional cooperation efforts:

- resource conservation and protection;
- more efficient resource utilization;
- better availability and diffusion of quality forest seeds;
- selection and improvement of priority species;
- awareness raising among actors and rightsholders;
- strengthening of institutional resources and capacity, especially for research and training;
- implementation or utilization of regional cooperation mechanisms.

The sub-regional action plan is based on the recognition that countries in Sahelian and North-Sudanian Africa enjoy sovereign rights over their forest genetic resources and are responsible for the conservation and sustainable utilization of these resources; and that well targeted sub-regional cooperation can be instrumental in strengthening national programmes.

II.1.3. Structure and organization of the sub-regional action plan

The first chapter describes the methodology used for hierarchizing important species and defining the lists of species considered priority by countries at sub-regional level, which could be the object of coordinated efforts. Mention is also made of identified activities related to conservation, sustainable utilization, new knowledge acquisition and the dissemination of this information.

The following chapters will follow the thematic divisions fixed by participants:

- Improving the management and utilization of forest genetic resources
- Strengthening the availability of quality reproduction material
- Strengthening institutional capacity

The last part regards plan implementation, and the identification of the structures, mechanisms and instruments which may promote its implementation.

Finally the recommendations made by participants at the Ouagadougou workshop (22–24 September 1998) are recalled.

The plan only mentions those actions recognized as important at sub-regional level, *i.e.*, for which participating countries at the Ouagadougou workshop reached agreement. The points raised are common to most Sahelian and North-Sudanian countries, but not necessarily to all of them. The priority subjects complement the list of priority species.

The plan is action oriented and promotes the initiation of operational activities. It was not judged feasible to consider activities in greater detail nor to identify potential actors. This work should be carried out during the identification, formulation and finalization stages of the programmes and projects by appropriate mechanisms participating in plan implementation.

II.2. Identification of sub-regional priority species

II.2.1. Rationale and issues

Taking into account the naturally limited financial and human resources allocated to activities addressing forest genetic resources, economic and political decision makers need to make choices to optimize resource utilization. Drafting a hierarchy of actions considered to be the most urgent and essential is naturally subjective, and mostly determined according to the main beneficiaries and where possible by them. It is obvious that all interested parties should be associated with the process and that the maintenance and development of forest genetic resources is of general interest.

Beyond the purely technical questions regarding genetic resources management, much greater reflection is required as to the value of these resources to the different actors, and thus on the contribution of the same actors; such reflection should take stock of the short, medium and long term, with a view to programme continuity, bearing in mind that this continuity will be better guaranteed if everybody's needs are taken into account in analysis and the final choices.

II.2.2. Methodology

The main object of the process described here is to assist decisions on those forest species likely to be considered in collaboration initiatives at sub-regional level. The result is a list of species considered priority by most countries, and hence with potential for targeted cooperation efforts.

Lists should answer the following question: "*When necessarily limited material, financial and human resources are available at sub-regional level for forest genetic resources, where could they be allocated with a view to optimal effectiveness*?"

Country priorities were set by weighing up the socio-economic, ecological, cultural or other value of the species vis-à-vis the potential risks of reduction or indeed extinction of their genetic components. Two types of data were thus required: data linked to species status (value, usage, distribution, current management and potential risks) and those linked to recommended actions for a restricted group (priority species).

Information, based on expert's opinion, was supplied from countries through the reports prepared for the Ouagadougou workshop and then synthesized by Dr O. Eyog Matig within the framework of a consultancy for the International Plant Genetic Resources Institute (IPGRI). During the hierarchization process, a certain number of assumptions were formulated (outlined below) to help understanding of the process's scope and limits:

- The higher level of biological complexity considered is the forest species. It is the best known level from a technical and scientific point of view, the easiest to learn in practice, and the level of most direct interest to rural people. Other levels of biological diversity, such as ecosystems, landscapes or molecular genetics, are thus not considered directly in the plan objectives.

- Sub-regional data are provided by information gathered at national level. In each country, a list of priority species was established by the person drafting the national report in line with a methodology developed by countries in the sub-region in collaboration with FAO. The writer was chosen by his/her country. The approach was deliberately empirical and used existing information without resorting to uniform quantitative data or to statistical analyses[28].

- The approach is openly utilitarian and strongly action-oriented; only species with proven value (whatever the type of value) were considered. The process tried to be holistic (all types of value attached to the species were considered) and neutral (there was no pre-set hierarchy among different types of value).

[28] For examples of scientific analyses and hierarchization, see Oldfield *et al*., 1998. *The World List of Threatened Trees,* and comments in the *Commonwealth Forestry Review* 77 (4), 1998, p 291-293.

- Countries decided priorities regarding forest species in line with their own scale of values and preferences. In order to have a broad range of preferences represented, the consultants Mrs A. Nikiéma and B. Kigomo, during their visits to 13 countries before the national reports were drafted, underlined the importance of consultations with all sectoral actors, particularly with representatives of local communities, professional organizations, agricultural, pastoral and forestry services, NGOs, private and public nurseries, nature conservation associations, as well as with scientists and researchers, rural development agents, etc. Similarly, the writer of the national report was recommended to take into account the opinions of various actors concerned by forest genetic resources.

- Species of interest to only one country were not considered despite considerable national or local interest.

The most obvious limitations of the applied methodology include the following:

- The number of species ranked as top priority at sub-regional level is naturally limited. Other initiatives exist that may, at least partly, cover those species which are not considered as most important (see box 2). Such initiatives include the development of national Biodiversity Status and Action Plans under the framework of the Convention of Biological Diversity; the establishment and maintenance of networks of protected areas and natural reserves; the updating of global lists of threatened or endangered trees species by IUCN and the World Conservation Monitoring Centre (WCMC); the maintenance of lists of important and priority tree species by the FAO Panel of Experts on Forest Gene Resources[29]; and the development of the FAO World-Wide Information System on Forest Genetic Resources (REFORGEN)[30].

- The most important species at sub-regional level may not have the same priority level for a given social group, or a village, or a particular rural community. Extensive experience has been gained on studies of rural social groups at different levels of social organization by ICRAF and ISNAR[31] in the Semi-Arid Lowlands of West Africa (SALWA)[32].

- Priority lists are not universal or definitive in nature. They will need to be revised and updated at regular periods. Nevertheless, they represent present options for decision makers and donors to focus their efforts on if they so wish.

[29] See FAO, 1997*c*
[30] For details, see FAO, 2000 or http://www.fao.org/forestry/FOR/FORM/FOGENRES/homepage/fogene-e.stm.
[31] International Service for National Agricultural Research, The Hague
[32] See Franzel *et al*., 1996, and SALWA's presentation at: http://www.cgiar.org/icraf/regional/region_3/region_3.htm

BOX 2: PRACTICAL APPROACH TO PRIORITY-SETTING PROCESSES FOR FOREST TREES

As a preliminary approach to selecting priority species, Namkoong[33] recommends classifying species into three groups:

1: species with recognised socio-economic value and currently utilized;
2: species with acknowledged potential or future value;
3: species with no particular value according to current knowledge.

The first group includes species which are already the object or will soon be the object of selection or breeding programmes, irregardless of the programme's stage.

The second group features species with as yet poorly known genetic diversity, but which hold actual or perceived potential according to current status of research and utilization.

Finally, most forest species are gathered in the third group. Given the current state of knowledge and projections, the utilization value attributed to these species cannot justify establishing specific strategies for their conservation and genetic improvement in order to meet human needs. The only management goal could be to conserve representative samples from the populations for future use. In this case, an *in situ* approach could be useful[34].

II.2.3. List of species requiring absolute priority

Sahelian and North-Sudanian African countries have numerous woody species that are of various degrees of importance to human communities. Von Maydell[35] lists 114 multipurpose trees and mention is made of a total of 310 tree and shrub species in national reports. Of the species quoted as priority in country reports, the final selection only retained those species (i) quoted as priority by at least 9 countries out of the 18 which supplied national reports, and (ii) species acknowledged by countries as having high current or potential value. There are 16 of these species (see Table 11).

By way of comparison, of the 26 forest fruit trees listed by the programme SALWA in four Sahelian countries (Burkina-Faso, Mali, Niger and Senegal) based on farmer preferences for fruit tree domestication, only 3 species do not figure in the list below: *Acacia senegal, Anogeissus leiocarpus* and *Eucalyptus camaldulensis,* which are not fruit trees.

[33] Namkoong, G. 1986
[34] for more references, see FAO, 1989
[35] Von Maydell, 1986

TABLE 11: RESULTS OF TREE SPECIES HIERARCHY ANALYSIS IN 18 COUNTRIES[36] - LIST OF 16 TOP PRIORITY SPECIES

Relative Ranking of priority species	Priority species	Total number of countries listing the species	Countries listing the species as a percentage of total countries	Main uses
1st	*Faidherbia albida*	15	83%	Fodder, shade, soil and water conservation, agroforestry, fuelwood
1st	*Tamarindus indica*	15	83%	Food, NWFP*, shade
3rd	*Khaya senegalensis*	14	78%	Timber, fuelwood, NWFP
4th	*Acacia nilotica*	12	67%	Fuelwood, NWFP
4th	*Adansonia digitata*	12	67%	Food, shade, NWFP
4th	*Anogeissus leiocarpus*	12	67%	Fuelwood, roundwood (poles etc)
4th	*Parkia biglobosa*	12	67%	Food, agroforestry
8th	*Acacia senegal*	11	61%	NWFP, fodder
8th	*Azadirachta indica*	11	61%	Roundwood, fuelwood, NWFP
8th	*Borassus aethiopum*	11	61%	Roundwood , food, timber
8th	*Diospyros mespiliformis*	11	61%	Food, timber, fuelwood
8th	*Pterocarpus erinaceus*	11	61%	Timber, fuelwood, NWFP
13th	*Balanites aegyptiaca*	10	56%	Food, NWFP
13th	*Eucalyptus camaldulensis*	10	56%	Roundwood (poles etc), fuelwood
13th	*Vitellaria paradoxa*	10	56%	Food, fuelwood, NWFP
13th	*Ziziphus mauritiana*	10	56%	Food, fodder

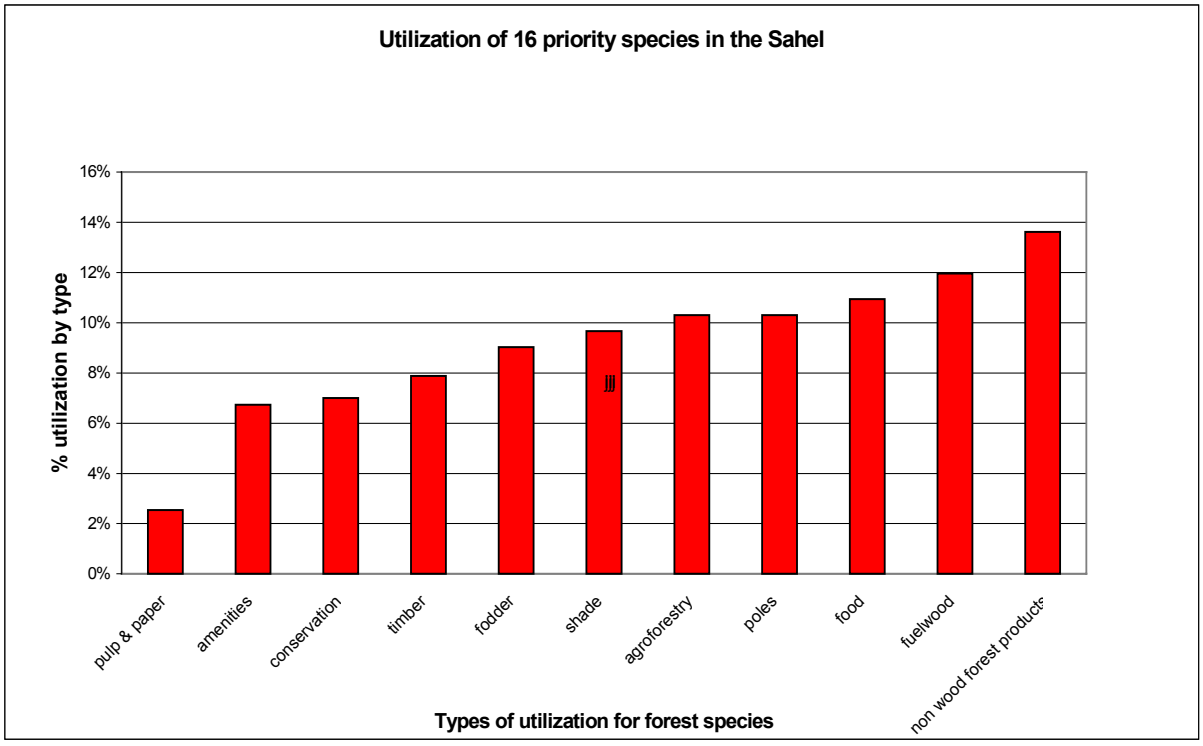
* NWFP: Non wood forest products

[36]As a reminder this process concerns the following countries: Benin, Burkina Faso, Cameroon, Côte d'Ivoire, Chad, Eritrea, Ethiopia, Gambia, Ghana, Guinea, Kenya, Mali, Mauritania, Niger, Nigeria, Senegal, Sudan, and Togo.

II.2.4. Utilization of priority species

Data on tree uses mentioned in national reports for each of the 16 priority species have been compiled and Figure 4 shows the distribution of these different uses. The main uses relate to (i) the production of non wood forest goods; (ii) provision of fuelwood; (iii) the provision of foodstuffs; and (iv) the production of small poles. Although the relative importance of each of these four main categories is not exactly the same as a similar ranking using 310 species (see paragraph I.2.4.), results do not appear significantly different at a level of reliability of 95%.

FIGURE 4: UTILIZATION PREFERENCES FOR 16 FOREST TREE SPECIES REQUIRING ABSOLUTE PRIORITY AT REGIONAL LEVEL
Tree uses have been recorded at national level first then compiled into regional level



II.2.5. Operational activities for priority species

Based on indications provided by national experts, technical activities relating to priority tree species have been compiled and harmonized. The result of this analysis is given in table 12. The table represents an average outline of the status of each species, and does not necessary represent any particular situation in individual countries.

TABLE 12: OPERATIONAL RECOMMENDATIONS FOR SPECIES REQUIRING ABSOLUTE PRIORITY AT REGIONAL LEVEL

Operation	**Exploration & collection**		**Evaluation**		**Conservation**		**use of germplasm**	
Species	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Acacia nilotica	1	2	1	1	2	2	1	1
Acacia senegal	1	1	1	1	1	1	1	2
Adansonia digitata	3	2	2	2	2	2	3	3
Anogeissus leiocarpus	1	2	2	2	2	2	2	3
Azadirachta indica	2	2	2	1	2	2	1	1
Balanites aegyptiaca	1	2	1	2	1	2	1	3
Borassus aethiopum	2	2	2	3	1	2	2	2
Diospyros mespiliformis	2	3	2	3	1	2	1	2
Eucalyptus camaldulensis	1	1	2	2	2	3	1	3
Faidherbia albida	2	2	2	2	1	2	1	2
Khaya senegalensis	1	1	1	1	1	2	2	2
Parkia biglobosa	2	2	2	1	1	2	2	1
Pterocarpus erinaceus	1	3	1	3	1	3	1	3
Tamarindus indica	1	1	1	2	1	1	2	3
Vitellaria paradoxa	1	1	1	1	1	1	2	2
Ziziphus mauritiana	2	2	1	2	2	2	1	2

Legend:
1: high priority
2: prompt action recommended
3: action is important but less urgent than for 1) and 2)
Exploration:
1. Biological information (natural distribution, taxonomy, genocology, phenology, etc.)
2. Harvesting of genetic material for assessment
Evaluation:
3. *In situ* (population study)
4. *Ex situ* (provenance and progeny trials)
Conservation:
5. *In situ*
6. *Ex situ*
Utilization of genetic material:
7. Seed production for plantations, reproductive material
8. Selection and breeding

II.3. OBJECTIVE 1: Improving the management (utilization and conservation) of forest genetic resources

The overall methodology for managing forest genetic can be summed up as a multi-stage programme depending on the chosen objectives and the degree of sophistication (see box 3). From a strategic point of view, activities will have a greater chance of being implemented effectively if they are formulated and decided under the impulse of, or with the active participation of, land owners, local decision makers and rightsholders.

BOX 3: TECHNICAL ACTIONS RELATING TO FOREST GENETIC RESOURCES

Actions related to the management (including conservation and utilization) of forest genetic resources generally cover one or several of the following technical stages:

- (a) botanical and taxonomic prospecting;
- (b) genecological prospecting;
- (c) harvest of material for testing;
- (d) trials and evaluation of provenances, families, progenies, clones;
- (e) the setting up of *in situ* conservation stands;
- (f) sampling and harvesting of material for *ex situ* conservation;
- (g) the setting up and management of *ex situ* stands;
- (h) starting up selection and genetic breeding programmes;
- (i) research into biology, phenology, reproduction;
- (j) research into silviculture and management.

Whatever deviations may occur in the above list in line with the desired objective - conservation or improvement -, the process is cumulative and some stages have to be crossed before others can be initiated. This is why knowledge on a species geographical and ecological distribution has to be gathered before its intraspecific variability can be studied.

Issues related to resource access and utilization should be solved at several levels: locally between communities and individuals, for example concerning the use of goods and services in a park or forest; at national level (for example, aspects connected to the transfer and utilization of selected reproduction material); and at international level (for example, on questions regarding inter-country exchange of reproduction material and the sharing of ensuing benefits).

II.3.1. Inventorying resources

Justification: In theory, any rational conservation or improvement programme begins by studying and inventorying existing resources. In order to develop policies and strategies related to the conservation and sustainable utilization of forest genetic resources, national programmes require information on country resources.

Countries that have ratified the Convention on Biological Diversity recognize certain requirements and responsibilities in this area. The report *State of forest genetic resources in the Sahelian and North-Sudanian zone* shows that, given the importance of woody plants in local and national economies, fairly few systematic activities have been carried out, even for highly important trees and shrubs. Out of 16 top priority species listed in Table 12, ten require urgent information gathering on biological features (natural distribution, taxonomy, genocology, phenology, etc.).

Concerning the subject of surveying and inventorying species distribution, and the delineation of possibly distinct populations by genecological zoning, the lack of a common forest ecological typology in regional countries impedes both comparisons between countries and standardized assessments. This constraint represents a considerable brake to regional studies on the scale and spatial distribution of intraspecific variability.

The study and inventory of genetic resources of priority species should be viewed as stages in a process for the better management of genetic diversity, and not as aims *per se*. That is why it is advisable to link them to specific action-oriented objectives, for example within a regional programme for the conservation or sustainable utilization of a given species. In this way, it will be easier to make decisions on the relevance of various methods for studying genetic diversity (provenance trials, biochemical analyses, genetic markers) according to the information sought and the projected cost.

Long-term objective: To identify, localize, survey and where possible assess the diversity of local priority species, sub-species, populations, varieties, ecotypes and breeds. To assess the importance of populations in intraspecific units, as well as the precise nature and degree of risk each may be facing.

Intermediate objectives: To develop common, useful and simple methodologies in order to study and survey tree and shrub resources as well as the extent and manner of their genetic diversity. To define the distribution of genetic resources by priority species.

Recommended activities:

- Proposing a series of common typological parameters to be used by different countries in inventories, descriptions and studies of the genetic diversity of species considered.

- Gathering available information on the distribution, biology, patterns and physiology of reproduction, and the modality and known extent of intraspecific variation among priority species.

- Identifying gaps in the above information and proposing studies or additional investigations by broad ecological zone.

- Updating the maps of distribution areas of priority species by country and ecological zone.

- Contributing to the inventory of pools of forest genetic resources such as natural reserves and national parks for priority species.

Technical options: Studies aimed at improving knowledge of a given specie's genetic diversity within a geographical region or between regions, can employ several methods, including morphological and biometrical studies in comparative tests; biochemical and molecular marker analyses in laboratory conditions; or the simple presumption of genetic diversity in view of the specie's geographical and ecological distribution. There is ample documentation on the choice of each of these methods, none of which is absolute and each contributing essential clarification[37].

II.3.2. Protecting and conserving resources

While protection denotes a series of measures aimed at sheltering certain resources from real or perceived threats (with the result of physical or regulatory protection, for example), conservation aims at maintaining these resources in "good condition", i.e., as far as possible at ensuring their evolution potential in order to meet the needs of future generations. Protection (preservation) is only one aspect of conservation in the broad sense.

> The conservation of forest genetic resources denotes all policies and acts «guiding human utilization of genetic resources in such a way that they may sustainably procure maximum benefits to current generations, while maintaining their capacity to meet the needs and aspirations of future generations». [38]

Justification:

The *State of forest genetic resources in the Sahelian and North-Sudanian zone* shows that many species and populations are subject to strong pressures. Levels of security and nature of threats recorded for 159 populations of 16 priority species in 18 countries are compiled in appendix 11.

The document also confirms that legislative or regulatory efforts to protect forest resources have generally had a mediocre impact unless accompanied by broader reflection that took into account the needs, rights and responsibilities of local people and the need for a balance between conservation and utilization through forest management.

Protection in the strict sense seems more and more to be a transitory measure, which should be used temporarily as a complement to other options. In general it can be observed that conservation efforts are to be preferred to protection, which is more limited in scope.

Before carrying out any action in this area, it is absolutely vital to define and identify the target elements of projected conservation measures. These elements may consist of: ecosystems, species, populations (variation between populations) or individuals (variation within populations). Genetic resource conservation can be carried out on site (*in situ*) or offsite (*ex situ*), in the case of seed orchards for example.

[37] Graudal, L. *et al*, 1997
[38] FAO, 1989

Finally, species and levels of intraspecific diversity can be found in several types of deposit (pools):

- forest (classified, managed or unmanaged);
- reserves, natural parks, protected areas (whatever the protection is effective or not);
- trees outside forests, agroforestry plantations, recreational parks, botanical gardens;
- breeding trials, seed orchards, agricultural or forest seed centres.

Experience shows that the conservation and regeneration of genetic heritage is best ensured when a combination of various pools is established. The recommended approach is to combine various places and different types of pool. A good start could be made by surveying the possibilities of *in situ* conservation in managed forest, then continue by inventorying the resources found in natural reserves and other protected areas, and finish if not successful by projecting the *ex situ* stocking of a representative sampling of variability. This process has the advantage of reconciling within a single approach conservation and sustainable utilization of resources in one place (managed forest).

The interest of a regional approach to preparing and implementing conservation strategies springs from the fact that large scale economies could be made while reducing the global risks of species or provenance extinction. If the goal is to conserve the main genetic pools, a reasonable number of stands should be conserved.

Long-term objectives: To ensure forest species capacity to adapt to environmental changes and to thus maintain the necessary genetic information for natural evolution and for future tree breeding programmes.

Intermediate objectives: For each priority species at sub-regional level, to define and implement a conservation strategy over its distribution range, taking into account the eco-geographical features of the specie's genetic diversity, the distribution and effectiveness of existing genetic pools, possible protection constraints and the complementary actions required.

Recommended activities:

- inventorying genetic resources of priority species which benefit from a protection system (natural reserve, protected area, classified forest)

- assessing the effectiveness of conservation of priority species/populations in the above systems;

- inventorying the seed-bearing stands used for each priority species;

- inventorying the pools of genetically distinct populations for each species;

- identifying the main centres ("hot spots") of genetic diversity as well as the marginal and peripheral populations;

- surveying particularly important stands of priority species (seed harvesting stands) which should be the priority objective of protection and conservation measures;

- inventorying genetic resources found in *ex situ* pools of the sub-region, (including domestication trials and trees conserved in non-forestry systems) for each priority species;

- surveying populations subject to severe pressures and possible options for vegetative propagation and *ex situ* conservation;

- promoting, with relevant authorities, information and extension campaigns for local people and villagers regarding brush fire control and prevention;

- researching and documenting management experiences and models for agroforestry parks taking account of *in situ* considerations for forest genetic resources;

- documenting traditional and current experiences concerning *in situ* conservation of forest genetic resources.

Technical options: The choice of available technical options should depend first and foremost on the nature of the material to be conserved and should be done case by case. The two main technical options regarding conservation of genetic resources, i.e., *in* and *ex situ* conservation, complement each other. *In situ* conservation foresees the ongoing maintenance of a stand within its community and in its original environment. *Ex situ* conservation includes both the conservation of seeds, pollen and tissue and the conservation of genetic materials in living collections, for example in arboreta and clone deposits, or in specially established *ex situ* conservation stands (see Table 13).

For forest species that are currently little exploited, it would be enough to delineate or set up a network of *in situ* conservation areas, including production forests and protected reserves subjected to varying degrees of management. These genetic conservation areas have to be extensive enough to avoid the negative effects of self pollination and genetic drift, and should encompass central and peripheral stands. For species subject to intensive exploitation, *in situ* conservation can be complemented by management of genetic diversity from forest stands and selection programmes.

TABLE 13: SUMMARY OF TECHNICAL OPTIONS AVAILABLE FOR GENETIC CONSERVATION ACTIVITIES IN CONNECTION WITH TYPES OF REPOSITORIES AVAILABLE

** Adapted from Palmberg, 1999.*

Type of repository	Main utilization for conservation activities
Protected areas, nature reserves	*Iin situ* Conservation
Managed natural forests, natural stands managed for seed production	*In situ* Conservation
Plantations, planted trees, botanical gardens	*Ex situ* conservation
Experimental stands, comparative tests, seed orchards, tree seed centre	*Ex situ* conservation

II.3.3. Utilizing resources sustainably

Justification:

Degradation of forest genetic resources in the Sahelian and North-Sudanian zone is mainly due to uncontrolled and unsustainable utilization. In many cases, both for forest resources and tree and shrub genetic resources, forest management for the supply of goods and services is compatible with the conservation of a given species if certain simple management and genetic principles are applied in silviculture.

In the search for a balance between resource conservation and utilization, management concepts occupy a central place. There is probably no universal solution to the problem, but a certain number of concepts, methodologies and case studies taking account of technical, socio-economic and cultural aspects, have been developed by several rural development actors in the Sahel. In particular, given that rural people in Sahelian and North-Sudanian Africa are, and will be for a long time yet, strongly dependent on forest goods and services, it is essential that they become involved in sustainable management efforts and processes. The limited effectiveness of existing forest reserves works in favour of systematic integration of current human constraints and needs in conservation strategies.

An analysis of constraints (utilization of forest genetic resources by product and service) could constitute an entry point to identifying actions to be undertaken at local level. The importance of fuelwood justifies alone developing energy strategies where all forms of production (natural forest and plantations) will be investigated. The development of better performing plantations near consumption areas is likely to relieve pressure on native resources considerably.

As regards the production of food products, various national and international institutions support domestication efforts for forest trees by farmers and support the conservation of genetic heritage in cropping systems.

Long-term objectives: To increase and improve sustainable and rational utilization of genetic resources of natural and introduced trees and shrubs. To promote innovations in the genetic improvement of trees and wild populations by domestication and conservation. To promote the diversification of goods and services by associating natural forests and plantations in a complementary way. To actively prevent desertification in the most vulnerable ecological zones.

Intermediate objectives: To encourage awareness raising among local people who use goods and services provided by trees and shrubs through targeted and localized programmes. To contribute to desertification control programmes.

Recommended activities:

- promoting productivity studies of natural formations and developing managing options for sustainable harvesting intensity;

- developing case studies to support experience and memory of traditional utilization and knowledge (taboos, bans, ...). Identifying new concerns and new cultural behaviour which could accompany sustainable management efforts;

- contributing to information and extension campaigns for local people and villagers with respect to economical resource utilization.

Technical options: promotion of forest management plans and land planning; strengthening community and individual planting programmes; stepping up improvement and domestication programmes for targeted species; underlining the importance of seed-bearing stands (see the following chapter).

II.4. OBJECTIVE 2: Strengthening availability of quality reproduction material

In recent years, forest plantations have attracted both positive attention and criticism, especially when they had resorted to introduced species whose adaptation to site conditions had not been properly established. In the future, plantations and planted trees are expected to play an increasingly important role in supplying vital goods and services.

This diversification assumes the availability of quality reproduction material in sufficient volumes for users. Seeds and plants must meet a triple quality requirement: (i) for genetic quality (species and provenances that are adapted and which perform well); (ii) phytosanitary quality (absence of insects and plant pests, and harmful diseases), and (iii) physiological quality (seeds and plants that meet standard criteria for size, state of conservation, moisture content, and germinative capacity).

The *State of Forest Genetic Resources in Sahelian and North Sudanian Africa* confirms the diversity of current and potential users of forest plants and seeds: public administrations, the cooperative sector, village communities, private actors. As these actors have different experiences regarding plantations and wood growing, considerable awareness raising and training efforts should be undertaken alongside the identification of local priority species and their utilization aims, the sources of seeds and plants, silvicultural requirements, and in order to set up protection and maintenance after planting. Too often in the past, dubious technical options were dictated by the limited number of seeds available and inadequate knowledge of the silviculture of local species.

A global and comprehensive Tree Seed Suppliers Directory is available from ICRAF in hard copy and in CD Rom forms[39]. In addition, updated information is also available on the Internet at ICRAF's homepage[40]

II.4.1. Managing seed supply and demand

Justification:

Changes in forestry policy have revealed a growing portion of plantations carried out by village communities with local species. All the same, the use of local materials can pose a certain number of technical questions, which are not all solved yet.

The irregular flowering of some species and stands still hinders regular supplies in both quality and quantity, all the more so since many seeds cannot be dried or partially dehydrated for conservation (intermediate and recalcitrant seeds). Sometimes considerable losses are incurred in nurseries as a result of cultivation practices for little known and documented plants. Public or private forest seed distribution companies sometimes find it difficult to supply provenances that are specifically suited to defined local conditions. Often, they cannot supply all species or seeds of secondary interest, requested in small quantities.

[39] Kindt *et al.*, 1997
[40] http://198.93.235.8/cfdocs/examples/treessd/treessd.htm

Special attention should be paid when material is issued from vegetal multiplication, which may be necessary when some species/populations are too few in number to ensure reproduction or when it is desirable to multiply exceptional phenotypes. It is also important in domestication programmes to have a strategy for utilizing these materials and sound knowledge of the technical propagation protocols.

The importance of quality reproductive material, which will determine the value of tomorrow's goods and services, has led some countries to develop national policies for forest seed production. Specialized national seed centres for dryland forest species exist in Burkina Faso, Senegal and in Togo. The degree of state intervention and regulation will vary according to whether certification or monitoring systems are established or not. Seed production for reforestation may in addition compete with other uses (derived products, medicines, cosmetics or food).

Long-term objectives: To improve the availability and utilization of quality forest tree seed (in terms of genetics, physiology, biosecurity), especially native species. To establish national forest seed policies, which should be articulated at sub-regional level if possible. To help maintain and develop biological diversity in forests and tree plantations outside of forests.

Intermediate objectives: To improve the structuring of activities and actors throughout the forest seed sector. To set out the objectives of reforestation and forest seed policies. To promote complementarity among the actions of public, cooperative, small-scale or commercial companies in seed production, stocking and distribution and plant breeding. To promote a regional approach in delineating seed stands, harvesting and seed supplies. To disseminate knowledge regarding species and provenances and publicizing techniques for seed harvesting, maintenance and stocking. To design and develop viable mechanisms for rural communities to participate in the management of seed stands, including the collection, treatment, stocking and marketing, according to circumstances. To contribute to awareness raising and training for users as to the importance of species adaptation to the site and to silvicultural maintenance techniques after planting. Finally raising awareness among actors as to the added value of selected and improved seed and among political decision makers with respect to the importance of selection and improvement programmes in national sustainable development initiatives.

Recommended activities:

- assessing local and national seed supply and demand in economic, technical and institutional terms;

- inventorying, delineating and carrying out activities to protect, conserve and utilize seed stands of priority species sustainably;

- registering, synthesizing, publicizing and disseminating acquired knowledge on the collection, temporary storage, transport, extraction and drying of priority species;

- developing methodologies for conserving the seeds of important species, promoting the development of simple handling protocols and methods;

- developing coordinated research on the seeds of recalcitrant or intermediate priority species;

- promoting the establishment of seed storage centres in user zones and regions;

- strengthening links with agricultural seed storage centres, with a view to facilitate local or national storage of orthodox forest seeds of priority species;

- contributing to the production and publication of technical guides to seed transfer and exchange: it could be useful to take account of technical, legal and commercial aspects;

- raising awareness among national and provincial decision makers in countries bordering the Gulf of Guinea (with dryland forests in their northern area) as to the specific requirements of these dryland zones in national reforestation and forest seed programmes – generally poor, these dry zones are easily neglected.

Technical options:

The strategy on forest seed supply can be implemented in the sub-region (exchanges and trade between countries), at national level (seed centres, seed supply and trade legislation) or at local level (collection by and for village communities). It is recommended to structure these three levels wisely.

II.4.2. Selecting and improving priority species

Justification:

Improving the productivity of forest stands in Sahelian and North-Sudanian Africa is essential to the development of both rural areas and national economies. Growing competition among actors for land and resource access will decide the future of many forests. As dryland forests are considered relatively unproductive, their conservation is not always considered an urgent requirement.

Through simple improvements in selecting seed trees, culling and raising nursery plants, and monitoring and maintaining plantations, it is easy to increase forest land productivity, i.e., obtain more products from the same surface area. These potential gains are all the more realistic since little effort has gone into improving local species. In fact, the diversity of ecological conditions in the natural range of many priority tree species, in addition to the magnitude of this range and the variety of traditional uses by different rural communities, means there could be important intraspecific variation and hence opportunities for genetic gains. Provenance and progeny trials underway for certain species tend to confirm this assumption.

The advantage of regional cooperation in setting up such programmes is obvious through the economies of scale gained in areas such as exploitation of the whole range of a species, the coherence of conservation areas systems based on existing pools of variability in countries, coordinated programmes of multi-site provenance trials, access to knowledge on a wide range of product and services.

The aims and intensity of selection and improvement programmes should be adapted to projected national plantation and domestication programmes, taking local and regional demands into consideration. These programmes should not systematically resort to sophisticated improvement strategies nor to latest technology. Very often, exceptional results can be obtained at low cost and in a decentralized way by paying attention to the quality of seed trees, seed handling techniques, and to plant raising practices. In all instances, selection and improvement programmes promote the conservation (*in situ* or *ex situ)* of representative samples of the variability of the species under consideration. In the long run, the success of an improvement programme is effectively determined by the magnitude and diversity of its basic collections.

Finally, attention should be paid to the genetic foundation of established plantations, particularly if introduced material has been used locally: accidental genetic pollution can lead to irreparable loss among surrounding natural stands, which can be important for local adaptation. Similarly, the long-term sustainability of clonal plantations or those from vegetal multiplication is determined by thorough monitoring of genetic material and its origin.

During domestication processes, especially on fruit trees (which are also subject to many other uses), it is important to maintain a broad range of diversity in those characteristics not submitted to selection. The very objectives of such a programme may be significantly different from breeding programmes for agricultural crops, where improved species are requested to be fixed, homogenous and homozygotic. In order to keep open the widest possible range of options regarding the future use of the final products, flexible and adaptable domestication programmes should be established.

Long-term objectives: To ensure ongoing availability of improved reproduction material adapted to local conditions for priority species. To observe and take account of changes in the end use of products by users.

Intermediate objectives: To assess the genetic diversity of priority tree species' reproductive materials. To initiate coordinated actions to conserve the specie's diversity. To finalize the degree of desirable selection and breeding for each priority species.

Recommended activities for priority species:

- identifying, delineating, and protecting seed sources (seed-bearing stands, plantations, isolated groups of trees);
- setting up networks for germplasm exchange with the aim of starting provenance trials;
- defining the legal conditions for the exchange of material in view of its use in experiment (putting forward conditions for access to genetic resources and if not possible forecasting the implications of their use);
- developing technical protocols for vegetative propagation techniques: rooting of green shoots, rejuvenalization of adult sections, grafts, hormone treatments;
- maintaining collections, experimental sites, elimination trials, provenance and progeny tests, seed orchards, even if priorities and end-users requirements change suddenly.

Technical options:

- making decisions on (i) selection and improvement programmes or (ii) short-term strategies of vegetative propagation;
- domestication of fruit trees;
- finalizing analytical methods for genetic variability, with due consideration to the added value of additional information, and the cost necessary to obtain it;
- maintaining a balance between efforts devoted to local species and those afforded to introduced species.

II.5. OBJECTIVE 3: Strengthening institutional capacity

The sub-regional action plan aims at facilitating decision making and the implementation or development of national activities which can be coordinated at regional level. The plan will associate national actors and operators in its implementation. Its success thus closely depends on country institutional capacity to initiate and pursue commonly decided upon goals and actions. Strengthening institutional and country capacity is therefore a major topic for the implementation of the technical activities described previously and should accompany technical considerations regarding priority species, the management of forest genetic resources and seed supply.

II.5.1. Raising awareness of partners involved

Justification:

Activities regarding forest genetic resources are carried out by public and private institutions and companies, NGOs, communities, cooperatives and individuals from the agricultural, forestry, environmental and development sectors. Communication is not always an established fact between rights holders and local or national actors working in and using the same geographical area. Partner coexistence is sometimes made difficult by the wide variety of interests at stake coupled with each actor's fragmented knowledge of global problems. Public sector redefinition is resulting in the active or *de facto* transfer of responsibility and authority to private sector entities, NGOs and local authorities and organizations. While some of these trends may present challenges for sustainable management of forest genetic resources, they also present opportunities for improved management through capitalizing on the comparative strengths of these new structures.

Whatever form the process of setting priorities takes, and whatever the scientific importance of actions to promote forest genetic resources, results will only be successful if there is strong consensus among partners to make these actions succeed. The success of any conservation programme rests on its capacity to sensibilize the target public as to the impact of human activities on resources. To reach common objectives and to speak the same language, partners should benefit from information, training and sensibilization initiatives concerning the importance and fragility of forest genetic resources.

Foresters aside, awareness raising and training of focal points in rural communities on forest genetic resources issues is also a critical element for the success of resource conservation and protection measures.

Since the late 1970s, community forestry has been developing various tools and methods for involving communities more actively in planning and managing forest resources. When the effectiveness of those tools has been proven, they could be adapted and utilized to facilitate the management of genetic resources of native trees and shrubs.

Long-term objective: To fully integrate awareness raising of public opinion and interested partners in all programme activities at local, national and even international levels.

Intermediate objective: To support coordination mechanisms for awareness raising activities at all levels.

Recommended activities:

- identifying national awareness raising objectives and strategies, defining the target public, partners and mobilization tools;

- governments should recognize and promote the activities of NGOs and related sectors regarding awareness raising among farmer populations and village communities;

- allocating sufficient space to the production of awareness raising material in appropriate languages in order to promote wide scale use in countries;

- promoting the participation of villagers and women in decisions regarding the management of forest genetic resources;

- joning a wider campaign on forest resources and their conservation and rehabilitation when this is useful. Heightening awareness among rural people as to the dangers of brush fires and the consequences of uncontrolled resource exploitation.

Technical options:

- Integrating questions related to forest genetic resources in national and local activities and programmes on rural development and forest management;
- integration by forestry and rural development agents of notions related to forest genetic resources in their routine management work;
- maintaining a balance between awareness raising for decision-makers, foresters and rural communities.

II.5.2. Strengthening national institutions

Justification:

Since the United Nations Conference on Environment and Development, countries in Sahelian and North Sudanian Africa have attempted to make national forestry policy more consistent with the concepts of sustainability and environmental soundness. Workshop participants at Ouagadougou underlined the importance of national programmes and policies for sustainable resource management, fuelwood supply, forest seeds procurement, and more generally the importance of a holistic approach to issues related to forest genetic rescues. The preparation of national reports has catalysed a process for the gathering of information, discussions, prioritization and identification of needs and requirements.

If countries so wish, the Plan in its current form could be used to formulate national forest genetic resources strategies compatible with strategies of neighbouring countries which often have similar ecological and socio-economic conditions. The sub-regional plan could thus be utilized both as a starting point and framework for national consideration. National action could either be holistic (all aspects related to forest genetic resources could be considered), or more targeted (action could focus on resource conservation or protection, seed supply and procurement, etc.).

Long-term objective: to strengthen national institutional capacity in such a way that these bodies play an integral role in implementing the action plan.

Intermediate objective: to identify requirements at sub-regional level and to strengthen the effectiveness of information exchanges and multiple decision making between political, administrative, scientific and technical institutions. To promote dialogue and collaboration between national institutions concerned with forest genetic resources.

Recommended activities:

- identifying national capacities, inventorying facilities and research and management programmes regarding priority forestry species for each country, and collating the information at sub-regional level;

- with this information, establishing a list of potential partners for specialized actions;

- drafting a list of experts and resource persons on forest genetic resources in countries of the sub-region;

- proposing the incorporation of issues linked to dryland forest genetic resources into forestry programmes, laws and regulations, including in countries with both moist and dry forest areas.

II.5.3. Carrying out training activity

Justification:

Participants at the Ouagadougou workshop recognized the important role of training in the outcome of actions for the sustainable conservation and utilization of forest genetic resources. The importance of continuing professional training is also recognized by regional, bilateral and international institutions active in cooperation and development. A training workshop on the conservation and sustainable utilization of forest genetic resources in West Africa, Central Africa and Madagascar was organized by IPGRI in collaboration with FAO, ICRAF and many other partners, from 16 to 27 March in Ouagadougou, for forestry technicians and managers from 15 French-speaking countries.

At schools and universities, and even in forestry education, issues linked to forest genetic resources are not always properly taken into consideration. Moreover the structural adjustment programmes and financial doubts hanging over many programmes have reduced money allocated to training. Governments still do not monitor whether the few people who have received this kind of training are utilized and remunerated properly. Furthermore, there appears to be a lack of programmes which combine technical training in forest genetic resources with exposure to many related disciplines, including administrative, political and legal fields.

Long-term objectives: To make available to every country according to their capacity, needs and priorities, training in all the relevant functions of conservation, utilization, management and development of forest genetic resources, in addition to policies and management of these resources.

Intermediate objective: To develop sub-regional capacity for advanced training and to establish effective collaborative arrangements among relevant institutions in regional countries, and between the institutions of regional and developed countries.

Recommended activities:

- Identifying institutions capable of providing training programmes. Report on the provincial, national and sub-regional state of available capacity in line with the declared objectives of forest genetic resources programmes. Disseminating this information to potentially interested parties in the sub-region.

- Identifying research or management institutions likely to provide complementary and targeted professional training and to define operational details.

- Establish a hierarchy of sub-regional training priorities on a yearly basis, by balancing resources allocated to further training and those destined for basic training.

- Planning the training of trainers and extension staff with the aim of heightening awareness raising among the various rural partners. Evaluating the impact of these efforts.

- Preparing suitable short and long-term courses, and education modules on subjects which are annually identified as priority in the sub-region.

- Promoting the incorporation into university programmes of modules and sessions on the importance of the genetic heritage of trees and forests.

- Encouraging institutions to incorporate aspects related to dryland forest genetic resources into their courses and advanced training programmes.

II.5.4. Exchanging experiences, know-how and information

The information technological revolution and the advent of new ways of transmitting knowledge represent a vast area of challenges but also relatively unexplored opportunities for countries in Sahelian and North-Sudanian Africa. Participants at the Ouagadougou workshop emphasized the importance of communication exchange among partners concerned by forest genetic resources, but also noted that the content and the support of information should be relevant to each country and its institutional capacity.

Justification:

There are substantial cross-sectoral links between forest genetic resources and other activity sectors. Some countries have already revised their legislative, regulatory and operational apparatus, or are doing so, with the aim of reconciling diverse interests, including resource conservation and socio-economic equilibria, meeting requirements for forest products and making local people responsible for managing forest resources. Politicians and managers are now asking themselves how to make integrated planning operational.

The restricted number of skilled experts, foresters, professionals and individuals in the field of forest genetic resources in Sahelian and North-Sudanian Africa and the magnitude of the task make it necessary to circulate and obtain more information both within and outside of the community of technical professionals. It is well known that most rural people obtain information from neighbours and farmers and not necessarily from extension services, and that the private sector is also playing a greater role by supplying advice and reproduction material in many countries. Thus different communication media can be used according to the targeted public and the message. The most sophisticated technical media are not necessarily the most desirable nor the most efficient.

The Ouagadougou workshop also underlined the importance of information content. The establishment of a communication driving force (network or similar instrument) cannot be effective without appropriate participation from actors and the programmes of national institutions, complemented by the inputs and programmes of international institutions. Without a leading role from national institutions in Sahelian and North Sudanian African countries, forest genetic resources programmes of bilateral or international organizations will be limited in impact. Nearly without exception, countries in the zone do not possess the necessary capacity to take part in international research or conservation projects, nor to transfer research results or national decisions to local level. For a long time yet, it will be essential to strengthen national systems prior to and parallel with the development of types of international cooperation.

The sub-regional background presents clear benefits to the circulation and exchange of information and experiences:

(a) the global nature of problems can be considered since the distribution of woody species rarely conforms to political borders and multiple use trees are often employed differently from one genecological zone to another;
(b) cooperation efforts between professionals from neighbouring countries can be facilitated, leading to better joint knowledge;
(c) sub-regional cooperation on precise subjects and towards targeted goals should provide added value to overall programmes, enable economies of scale and a more efficient utilization of resources ;
(d) coordinated concentration of priority initiatives should reduce duplication and cover unexplored zones better;
(e) international cooperation brings prestige to national institutions and can help to obtain extra resources;
(f) cooperation can offer national institutions the chance to guide and/or coordinate sub-regional programmes;
(g) the importance of reasonably priced publications for the general public as a technical and strategic information vehicle.

Long-term objectives: To ensure ongoing dissemination of appropriate, neutral, updated and targeted information among people concerned by forest genetic resources issues.

Intermediate objectives: To strengthen the capacity of national institutions in such a way that these institutions fully fill their role as both national actors and messengers between the international community and local users of knowledge and information. To heighten awareness among partners at all levels regarding the importance of forest genetic resources in local and national development and also concerning the necessity of balanced and agreed upon solutions between conservation on one hand and sustainable utilization on the other.

Recommended activities:

- Promoting systematic integration of forest genetic resources considerations into inventories of, programmes and action plans on biological diversity;

- Surveying the mechanisms, instruments and networks that exist in the sub-region and assessing their area of action, impact, and possibilities for cooperation and collaboration;

- Facilitating the publication of simple and low-cost technical manuals for the general rural public;

- Assessing the impact of information campaigns.

II.6. Implementation and funding

Traditionally forest funding comes from three sources: allocation of national public resources, public development aid, and the private commercial sector. Sources of non-profit funding are also developed, mainly in support of environmental and conservation activities or community group activities.

The forest genetic resources sector is traditionally under-funded and heavily dependent on investments and public programmes. The action plan identifies important requirements but without giving figures. The initiative for this now falls to national and sub-regional actors who should identify a useful institution or mechanism to have a driving role in applying and implementing final action plan elements in the form of working programmes or projects. Participants at the Ouagadougou workshop recognized the difficulty of obtaining greater public funding due to the global structural adjustment policies implemented in many countries.

Considerations regarding forest genetic resources are still relatively poorly known in the public opinion of developed countries while the understanding of certain major concepts, such as genetic improvement or species or provenance selection, is sometimes negatively interpreted. Certain major topics could act as a general framework and support to the plan elements and may attract the attention of potential funding donors. Inter alia, these topics could include sustainable management of dry tropical forests, desertification control, and the conservation and development of biological diversity.

Actions concerning forest genetic resources are long-term operations, even if sometimes emergency measures are required. The continuity of these actions should thus be a concern examined at the beginning by the partners and adequate assurances should be obtained to follow up operations with time. This may require an initial limitation of ambitions when the response capacity and possibilities of national institutions are still limited. The plan should thus be applied progressively according to the capacities and priorities of countries and national institutions.

The activities mentioned in the action plan have a sub-regional vocation and thus presuppose the existence of an institution, a mechanism or a national or sub-regional entity with the capacity and will to ensure a driving force role in implementing certain activities. Although initially the technical objectives may appear limited, dependant on the response capacity at national levels, the scale of the coordination task should not be underestimated. It must be remembered that at the present time there is no cooperation programme regarding forest genetic resources common to all the countries in Sahelian and North-Sudanian Africa, and only a few rare forestry projects join together English-speaking and French-speaking countries.

The national experts gathered at Ouagadougou took note of IPGRI's efforts with respect to the implementation of the IPGRI Sub-Saharan Regional Programme on Forest Genetic Resources (SAFORGEN), an initiative that they strongly supported. They confirmed in this the conclusions and recommendations of the training workshop on forest genetic resources held in March 1998 in Ouagadougou, during which proposals were put forward on priority themes and the functionality of such a specialized cooperation network. At the workshop in September 1998, participants recommended that this regional programme, when it is implemented and operational, play a major role in the general coordination of forest research efforts in the sub-region.

The elements of the action plan identified by countries are not limited to research activities but encompass a vast area of concerns and issues. The implementation of the plan's elements therefore should involve numerous partners concerned by issues related to forest genetic resources, particularly national governments, local and regional authorities, regional and international organizations (both inter-governmental and non-governmental), the scientific community, the private sector, local communities and all foresters.

To mobilize as extensive participation and support as possible, it is planned to widely the distribute the *State of Forest Genetic Resources in Sahelian and North Sudanian Africa* and the *Sub-Regional Action Plan* to the main international, regional and national bodies that deal with forestry and biological diversity matters.

II.7. FAO/IPGRI/ICRAF Sub-regional workshop on the conservation, management, sustainable utilization and enhancement of forest genetic resources in dry zone sub-Saharian Africa. Ouagadougou, Burkina Faso, 22 - 24 September 1998 – Final statement

Objectives and outputs

The objective of the workshop, organized by FAO in collaboration with IPGRI and ICRAF, was to assist countries in the Sahelian sub-region to assess the status of their forest genetic resources, elaborate and propose priority actions, and make recommendations for immediate follow-up and implementation.

35 participants representing 15 countries and 9 international, regional, bi-lateral and national agencies (CIRAD-Forêt, DANIDA Forest Seed Centre, FAO, ICRAF, IPGRI, IRAD-Cameroon, UNEP, IUCN and IUFRO) took part in the workshop held at the *Centre National des Semences Forestières* 22 – 24 September 1998. National delegations presented country reports summarizing the status of forest genetic resources, underlining priority species and issues and making recommendations to tackle the major constraints identified. Many reports had been compiled beforehand in a draft regional synthesis, which was presented and discussed. This draft should be revised in the light of additional country reports received and recommendations formulated at the workshop. Delegations called for increased regional cooperation through integrated mechanisms, and elaborated on these priority species and operations amenable to coordinated action. Delegates identified the need for, and agreed to prepare, a Sub-Regional Plan of Action on forest genetic resources, for which the following three main objectives were specified with related activities:

1. Improved management and utilization of forest genetic resources.
    - Resource assessment
    - Conservation, including protection
    - Sustainable utilization
2. Enhancement of availability of superior germplasm
    - Seed supply and demand
    - Selection and improvement of priority species
3. Enhancement of institutional capacity
    - Awareness raising
    - Institutional strengthening
    - Training
    - Exchange of experience, know how and information

Recommendations

The delegates highly appreciated the country-driven initiative, facilitated by FAO following the recommendations of its Committee on Forestry, and carried out in collaboration with other institutions, to support the preparation and convening of a series of regional and sub-regional workshops on forest genetic resources. They recommended that similar workshops be planned in other sub-regions of Africa.

Delegates noted the coordinated efforts of FAO, IPGRI and ICRAF in the preparation of the workshop, and recommended that such collaboration be continued towards the implementation of the Sub-Regional Plan of Action elaborated during this workshop, through appropriate mechanisms.

Delegates expressed an urgent need for increased regional collaboration and coordination of efforts among countries and institutions of the Sahel following priority objectives and activities identified during the workshop.

Delegates noted and strongly supported the efforts made by IPGRI toward the establishment of a regional programme on forest genetic resources (SAFORGEN). They recommended that this programme, when implemented and operational, would play a major role in the overall coordination of forestry research efforts in the sub-region.

The delegates called for international organizations including FAO, UNEP, IPGRI, ICRAF, as well as other regional and bi-lateral agencies, to support countries in securing appropriate funding for actions relating to the conservation and sustainable use of forest genetic resources within the sub-region.

Delegates recommended that a reference document, incorporating country information on the status of forest genetic resources, the Sub-Regional Plan of Action and the recommendations of the workshop, be prepared and widely disseminated.

They stressed that efforts should be undertaken urgently to draw the attention of policy and decision makers to the role, function and importance of forest genetic resources to fulfil the needs and requirements of present and future generations. The development of integrated strategies on forest genetic resources should be promoted at national level.

Delegates recommended that efforts be strengthened to raise awareness at community level of the importance of conservation. In particular, the compatibility of conservation and managed use of forest genetic resources should be emphasized and demonstrated.

Ouagadougou, 24 September 1998.

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For the list of national reports, see Appendix 13.

APPENDICES

Appendix 1: List of Abbreviations

CBD	Convention on Biological Diversity, Montreal (Canada)
CGIAR	Consultative Group on International Agricultural Research, Washington (United States)
CIFOR	Centre for International Forestry Research, Jakarta (Indonesia)
CILSS	Permanent Interstate Committee for Drought Control in the Sahel, Ouagadougou (Burkina-Faso)
CIRAD-Forêt	Département forestier du Centre international en recherche agronomique pour le développement, Montpellier (France)
CSIRO	Commonwealth Scientific and Industrial Research Organization, Canberra (Australia)
DFSC	DANIDA Forest Seed Centre, Humlebaek (Denmark)
UNCED	United Nations Conference on the Environment and Development (Rio de Janeiro, Brazil, 1992)
FAO	Food and Agriculture Organization of the United Nations, Rome (Italy)
FORNESSA	Forestry Research Network for Sub-Saharan Africa, Nairobi (Kenya)
GTZ	German Technical Cooperation Agency, Eschborn (Germany)
ICRAF	International Centre for Research in Agroforestry, Nairobi (Kenya)
IGAD	Inter-Governmental Authority on Development, Djibouti (Djibouti)
IPGRI	International Plant Genetic Resources Institute, Rome (Italy)
ISNAR	International Service for National Agricultural Research, The Hage (The Netherlands)
IUCN	World Conservation Union, Gland (Switzerland)
IUFRO	International Union of Forestry Research Organizations, Vienna (Austria)
NGO	Non-government organization
UNDP	United Nations Development Programme, Washington (USA)
UNEP	United Nations Environment Programme, Nairobi (Kenya)
UNESCO	United Nations Educational, Scientific and Cultural Organization, Paris (France)
USDA-FS:	United States Department of Agriculture, Forestry Service
WCMC	World Conservation Monitoring Centre, Cambridge (U.K.)
WWF	World Wide Fund for Nature, Gland (Switzerland)

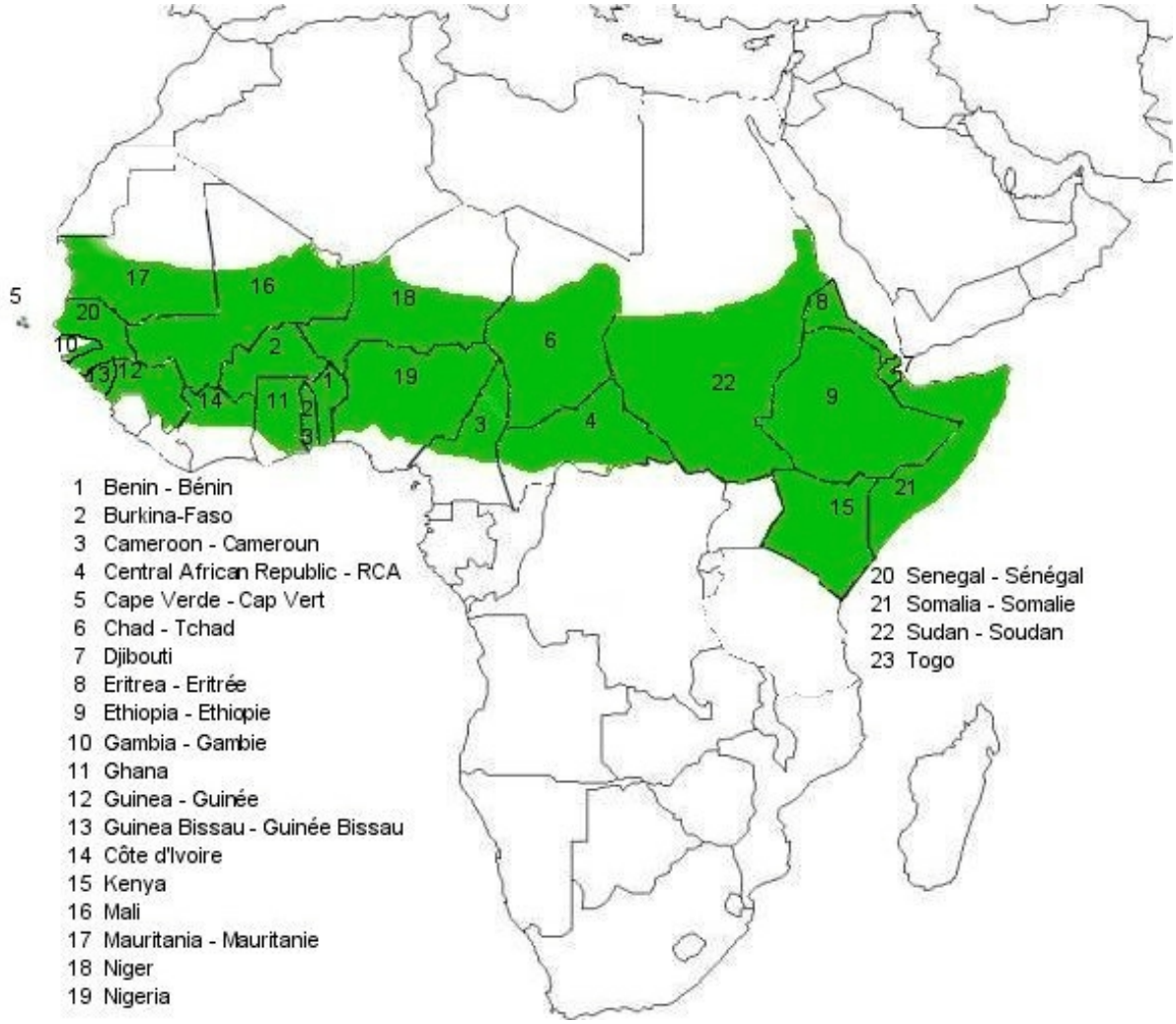
Appendix 2: Index of Latin, English and French Names of Priority Forest Trees

Latin name	English name	French name
Acacia nilotica Del.	Arabic Gum Tree, Babul	Acacia d'Arabie, Gommier rouge, gonakié
Acacia senegal Willd.	Gum Arabic Tree, Hashab	Acacia du Sénégal, Gommier blanc, vérek
Adansonia digitata L.	Baobab, Monkey Bread Tree	Baobab, Pain de singe
Anogeissus leiocarpus DC. Guill. et Perrott.		Bouleau d'Afrique
Azadirachta indica A. Juss.	Neem Tree, Indian Lilac	Nim, Lilas des Indes
Balanites aegyptiaca (L.) Del.	desert date	Dattier du désert, Dattier sauvage
Borassus aethiopum Mart.	Borassus Palm	Rônier, Borasse
Diospyros mespiliformis Hochst. ex. A. DC.	African Ebony	Ebénier de l'Ouest Africain, Faux ébénier
Eucalyptus camaldulensis Dehnhardt	Red River Gum	Eucalyptus rouge
Faidherbia albida Del. A. Chev.*(Acacia albida* Del.*)*	Apple ring Acacia, Winter-thorn	Cad, kade
Khaya senegalensis (Desr.) A. Juss.	African Mahogany	Acajou du Sénégal, Caïlcédrat
Parkia biglobosa Jacq. Benth.	Nitta Tree, African Locust Tree	Néré, Arbre à farine, Caroubier africain
Pterocarpus erinaceus Poir.	Senegal Rose Wood Tree	Véne, Palissandre du Sénégal
Tamarindus indica L.	Tamarind Tree	Tamarinier
Vitellaria paradoxa Gaertn. f. (*Butyrospermum parkii* (G.Don) Kotschy)	African Butter Tree, Sheanut Butter Tree	Karité, Arbre à beurre
Ziziphus mauritiana Lam.	Geb, Indian Jujube	Jujubier

Appendix 3: Map of Sahelian and North-Sudanian Africa

Map showing the approximate coverage of the state of forest genetic resources report and the limits of validity of the sub-regional action plan.

Based on climatic limits by Menaut, 1984 (*in FAO, 1997a*).



The designations employed and the presentation of material on this map do not imply the expression of any opinion whatsoever on the part of the authors of the document or the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Appendix 4: Basic country data

Country	Land Area	Population				Economic Indicators	
	Total	Total	Density	Annual Rate of Change	Rural	GNP per caput	Annual Growth Rate of GDP
	(1996)	(1997)	(1997)	(1995-2000)	(1997)	(1995)	(1990-1995)
	thousand ha	millions	#/km^2	percent	percent	US$	percent
Benin	11 062	5.7	52	2.8	60.1	370	4.1
Burkina Faso	27 360	11	40	2.8	83.1	230	2.6
Cameroon	46 540	13.9	30	2.7	53.6	650	-1.8
Cape Verde	403	0.4	99	2.5	42.9	960	n.a.
Chad	125 920	6.7	5	2.8	77.2	180	1.9
Côte d'Ivoire	31 800	14.3	45	2	55.3	660	0.67
Djibouti	2 318	0.6	26	2.7	17.5	n.a.	n.a.
Eritrea	10 100	3.4	34	3.7	82.3	n.a.	n.a.
Ethiopia	100 000	60.1	60	3.2	83.7	100	n.a.
Gambia	1 000	1.2	120	2.3	69.6	320	1.6
Ghana	22 754	18.3	80	2.8	63.1	390	4.3
Guinea	24 572	7.6	31	1.3	69.4	550	3.8
Kenya	56 914	28.4	50	2.2	69.7	280	1.4
Mali	122 019	11.5	9	3	71.9	250	2.5
Mauritania	102 522	2.4	2	2.5	46.3	460	4
Niger	126 670	9.8	8	3.3	80.9	220	0.5
Nigeria	91 077	118.4	130	2.8	58.7	260	1.6
Senegal	19 253	8.8	46	2.7	55	600	1.9
Somalia	62 734	10.2	16	3.9	73.6	n.a.	n.a.
Sudan	237 600	27.9	12	2.2	66.8	n.a.	6.8
Togo	5 439	4.3	79	2.7	68.3	310	-3.4
Total	**1 228 057**	**365**	*	*	*	*	*

Notes:
numbers may not tally due to rounding;
n.a. = not available;

Source: State of the World's Forests, FAO, 1999

Appendix 5: Forest Cover and Change 1990 – 1995 in Sahelian and North-Sudanian Africa

Country	Total Forest 1990 Thousand ha	Total Forest 1995 Thousand ha	Total Change 1990-95 Thousand ha	Annual Change Thousand ha	Annual Change rate (%)
Burkina Faso	4 431	4 271	-160	-32	-0.7
Cape Verde	16	47	31	6	24.0
Chad	11 496	11 025	-471	-94	-0.8
Gambia	95	91	-4	-1	-0.9
Guinea-Bissau	2 361	2 309	-52	-10	-0.4
Mali	12 154	11 585	-569	-114	-1.0
Mauritania	556	556	0	0	0.0
Niger	2 562	2 562	0	0	0.0
Senegal	7 629	7 381	-248	-50	-0.7
Total West Sahelian Africa	**41 300**	**39 827**	**-1 473**	**-295**	**-0.7**
Djibouti	22	22	0	0	0.0
Eritrea	282	282	0	0	0.0
Ethiopia	13 891	13 579	-312	-62	-0.5
Kenya	1 309	1 292	-17	-3	-0.3
Somalia	760	754	-6	-1	-0.2
Sudan	43 376	41 613	-1 763	-353	-0.8
Total East Sahelian Africa	**59 640**	**57 542**	**-2 098**	**-420**	**-0.7**
Benin	4 923	4 625	-298	-60	-1.2
Cameroon	20 244	19 598	-646	-129	-0.6
Côte d'Ivoire	5 623	5 469	-154	-31	-0.6
Ghana	9 608	9 022	-586	-117	-1.3
Guinea	6 741	6 367	-374	-75	-1.1
Nigeria	14 387	13 780	-607	-121	-0.9
Togo	1 338	1 245	-93	-19	-1.4
Total Gulf of Guinea States	**62 864**	**60 106**	**-2 758**	**-552**	**-0.9**

Notes: numbers may not tally due to rounding; the sub-regional breakdown reflects ecogeographic zones, not economic or political groupings.
FAO definitions of forest apply here
Source: State of the World's Forests, FAO, 1999

Appendix 6: Production, trade and consumption of forest products in Sahelian, North-Sudanian and Western Africa, 1996

Country	Fuelwood and Charcoal (1000 m^3)				Industrial Roundwood (1000 m^3)				Sawnwood (1000 m^3)				Total (1000 m^3)
	Production	Imports	Exports	Consumption	Production	Imports	Exports	Consumption	Production	Imports	Exports	Consumption	Production
Benin	5 753	0	0	5 753	329	0	0	329	24	0	2	22	6 106
Burkina Faso	9 835	0	0	9 835	466	0	0	466	2	0	0	2	10 303
Togo	2 189	0	0	2 189	245	3	3	245	14	3	0	18	2 448
Cape Verde	0	0	0	0	0	2	0	2	0	7	0	7	0
Chad	3 993	0	0	3 993	669	0	0	669	2	17	0	20	4 664
Djibouti	0	0	0	0	0	0	0	0	0	1	0	1	0
Eritrea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	0
Ethiopia	46 982	0	0	46 982	2 373	1	2	2 371	33	1	0	34	49 399
Gambia	1 120	0	0	1 120	113	0	0	113	1	1	0	2	1 234
Kenya	41 003	0	0	41 003	1 961	0	0	1 961	185	2	2	185	43 201
Mali	6 315	0	0	6 315	420	0	0	420	13	0	0	13	6 748
Mauritania	9	0	0	9	6	0	0	6	0	0	0	0	15
Niger	5 693	0	0	5 693	374	0	0	374	4	0	0	4	6 071
Senegal	4 457	0	0	4 457	737	25	0	761	23	30	0	53	5 217
Somalia	8 911	0	0	8 911	108	0	0	108	14	0	0	14	9 033
Sudan	14 600	1	0	14 601	2 274	14	0	2 287	45	70	0	115	16 920
Total Sahelian Countries	**150 860**			**3023**				**2920**					**161 360**

Appendix 6 (cont.): Production, trade and consumption of forest products in Sahelian, North-Sudanian and Western Africa, 1996

Country	Fuelwood and Charcoal (1000 m^3)				Industrial Roundwood (1000 m^3)				Sawnwood (1000 m^3)				Total (1000 m^3)
	Production	Imports	Exports	Consumption	Production	Imports	Exports	Consumption	Production	Imports	Exports	Consumption	Production
Cameroon*	12 692	0	0	12 692	3 364	0	1 307	2 057	1 400	0	316	1 084	17 530
Côte d'Ivoire*	11 974	0	6	11 968	3 008	0	332	2 676	706	0	501	206	15 960
Ghana*	25 190	0	0	25 190	1 255	0	150	1 105	604	0	240	364	27 154
Guinea*	4 273	0	0	4 273	651	0	31	620	85	3	1	87	5 009
Nigeria*	105 832	0	101	105 731	8 479	2	11	8 470	2 723	1	25	2 698	117 149
Total Gulf of Guinea* countries	**159 961**			**12 692**				**2 057**					**182 802**
Total Sahel & Golf/Guinea*	**310 821**			**15 715**				**4 977**					**344 162**

Source : State of the World's Forests, FAO. 1999. * Figures are only indicative. The sub-regional breakdown reflects geographic groupings. Figures are given by country and do not represent solely dry-zone areas, especially for countries bordering the Golf of Guinea where significant amount of humid zones are found. Table excludes wood-based panels, pulp for paper, and paper and paperboard.

Appendix 7: International Conventions and Agreements and National Forest Programmes

Country	Status of Ratification of UNCED Conventions			Members under ITTA 1994	Countries with National Forest Programmes	
	Convention on Biological Diversity	Framework Convention on Global Climate Change	International Convention to Combat Desertification		Programme starting date	Programme type
Benin	x	x	x		1993	NFAP
Burkina Faso	x	x	x		1986/91/92	NPCD/NFAP /NEAP
Cameroon	x	x	x	x	1986	NFAP
Cape Verde	x	x	x		1992	NFAP
Chad	x	x	x		1989	NPCD
Côte d'Ivoire	x	x	x	x		
Djibouti	x	x	x			
Eritrea	x	x	x		1997	NEAP
Ethiopia	x	x	x		1990	NFAP
Gambia	x	x	x		1991	NFAP
Ghana	x	x	x	x	1986/97	NFAP/MP
Guinea	x	x	x		1986/89	NFAP/PNAE
Kenya	x	x	x		1991	MP
Mali	x	x	x		1987/95	NFAP/NPCD /NEAP
Mauritania	x	x	x			
Niger	x	x	x		1985/1990	NPCD/NFAP
Nigeria	x	x	x		1990	NFAP
Senegal	x	x	x		1988/90	NPCD/NFAP
Somalia						
Sudan	x	x	x		1984/86	NFAP/FSR
Togo	x	x	x	x	1990	NFAP

* Planning process interrupted, not completed
FSR = Forestry Sector Review
MP = Forestry Sector Master Plan
NP = National Legal Policy or Planning Framework
NFAP = National Forestry Action Plan (including TFAP)
NEAP = National Environmental Action Plan
NEMS = National Environmental Management Strategy
NPCD = National Plan to Combat Desertification
Source: FAO, State of the World's Forests 1999

Appendix 8: Annual forest seed supply (in kg) presented by some countries in national reports and during FAO or Danida Forest Seed Centre missions

Species	Cameroon	Côte d'Ivoire	Senegal	Eritrea	Djibouti	Ethipia	Togo	Burkina Faso	Sudan
Acacia abyssinica				7.4					
Acacia aneura					0.4				
Acacia auriculiformis		100	20	0	1.5		101	100	6 097
Acacia cyanopylla					0.3				
Acacia decurrens					5	349			
Acacia etbaica				77.2					
Acacia maemsii				3.1					
Acacia mangium			3 020		0.1	13 944			
Acacia mellifera					0.1			0	3 093
Acacia occidentale		50 000							
Acacia nilotica			15					660	17 710
Acacia polyancantha		50		1.9				10	
Acacia raddiana			21	0	0.1			120	
Acacia salina				71.5	1				
Acacia senegal				7.5	1			700	64 488
Acacia sieberiana							2.5		
Adansonia digitata							4.7		
Albizia amara				4.7					
Albizia lebbeck						1 600	26		
Anacardium occidentale	1 000		2					600	
Anogeissus leiocarpus							14		
Atriplex nummularia							5.7		
Azadirachta indica	515			10.2					
Balanites aegyptiaca			22	52.8			26		
Bauhinia rufescens		50	127					100	4 240
Borassus aethiopum			33					70	
Cajanus cajan							14.2		
Casuarina spp						194			
Cordia africana			13				0.9		
Dalbergia sissoo							522		
Delonix regia	5.6				1		3		
Eucalyptus camaldulensis		5	16	0.6				40	
Eucalyptus cladocalyx	2.2		23	81.5	0.8		6	45	
Eucalyptus globulus				7.5					
Eucalyptus rudis				3.4		158			
Faidherbia albida		25	36						
Grevillea robusta				0.6	3.5				
Jacaranda mimosifolia				1.5		1 249			
Juniperus procera				11.4	0.4				
Khaya senegalensis		100			0.5	2 537			
Kochia sp	62		3	20.9	0.1		26	250	

Appendix 8 (cont.): Annual forest seed supply (in kg) presented by some countries in national reports and during FAO or Danida Forest Seed Centre missions

Species	Cameroon	Côte d'Ivoire	Senegal	Eritrea	Djibouti	Ethiopia	Togo	Burkina Faso	Sudan
Leucaena leucocephala				109.8					
Moringa oleifera			6 097		0.1				
Olea africana			57				215	100	
Parkia biglobosa				15.5					
Pterocarpus erinaceus		50							
Parkinsonia aculeata			3				15	300	
Prosopis africana			34				0.5	55	
Prosopis cineraria			20				7	60	
Prosopis tamarugo			128					300	
Schinus molle	7.6								
Senna siamea							52		
Tamarindus indica		5							
Senna siamea			5	27.1				25	
Tectona grandis			5	1	0.1	56			
Ziziphus mucronata		100 (decort.)	5	30.5				40	
Ziziphus mauritiana									
Ziziphus spina-christi			334					420	

The absence of data does not signify a lack of demand.

Source : Soudan: Danida Forest Seed Centre, 1996 ; Senegal: National report, 1998; Erithrea: Danida Forest Seed Centre, 1997; Djibouti: FAO, 1990; Ethiopia: Danida Forest Seed Centre, 1995; Cameroon: Catinot, 1988

Appendix 9: Value and utilization of 16 top priority species at regional level

Actual, potential or future value														
Species Name	**Country**	**Val.**	**ti**	**po**	**wo**	**nw**	**pu**	**fo**	**fd**	**sh**	**ag**	**co**	**am**	**xx**
Acacia nilotica	BEN	1				1								
	BF	1				1		1						
	CAM	1			1							1		
	CHAD	1			1	1								x
	ERIT	1		1	1	1			1		1	1		hedgerow, brush
	GHN	2		1	1	1							1	x
	KEN	2	1	1	1	1					1	1		
	MAL	1			1	1			1	1	1	1	1	
	MAUR	1			1	1			1	1	1	1		
	NGER	1		1	1	1			1	1		1		
	NGIA	1	1	1		1	1		1		1	1	1	
	SDA	1	1	1	1	1			1	1	1		1	
Acacia senegal	BF	1				1								
	CAM	1			1							1		
	CHAD	1				1								
	ERIT	1		1	1	1		1	1			1		
	KEN	1				1		1	1		1			
	MAL	1			1	1			1	1	1	1	1	
	MAUR	1			1	1			1		1	1		
	NGER	1		1	1	1			1		1	1		
	NGIA	1		1		1	1		1		1	1		
	SDA	1			1	1		1	1		1	1		
	SEN	1				1			1		1			
Adansonia digitata	BEN	2				1		1						
	BF	1						1						x
	CAM	2												
	ERIT	1		1	1	1		1	1	1	1		1	Rope
	GBIA	1				1		1	1	1			1	
	GHN	1			1	1		1						x
	MAL	1				1		1	1	1	1		1	Pottery
	MAUR	1						1		1				
	NGER	1				1		1	1	1	1		1	
	NGIA	1	-	-	-	-	1	1	1	1	1	1		x
	SDA	1				1		1		1		1		x
	SEN	1						1						
Anogeissus leiocarpus	BEN	2	1	1	1	1								
	BF	3			1							1		
	CAM	1	1											
	CHAD	1		1	1									
	CI	1	1	1	1	1					1			
	GBIA	3			1	1				1				
	GHN	1		1	1	1								x
	MAL	1	1	1	1	1				1			1	
	NGER	1		1	1	1								
	NGIA	1	1	1		1	1			1	1	1		
	SDA	2		1	1									
	TGO	1			1			1						

Appendix 9 (cont.): Value and utilization of 16 top priority species at regional level

Species Name	Country	Val.	ti	po	wo	nw	pu	fo	fd	sh	ag	co	am	xx
Azadirachta indica	BEN	1	1	1	1					1				
	CAM	1		1								1		Insecticide
	CHAD	1	1		1	1				1			1	x
	ERIT	2	1	1	1	1			1	1	1	1	1	Insecticide
	GHN	1	1	1	1	1		1					1	
	KEN	2	1			1							1	
	NGER	1		1	1	1				1	1		1	
	NGIA	1		1			1			1	1	1	1	
	SDA	1	1	1	1	1				1			1	x
	SEN	1		1	1									
Balanites aegyptiaca	BF	1						1						x
	CAM	2												
	CHAD	1				1								x
	ERIT	1	1	1	1	1		1	1	1	1			Poison, hedgerow
	GHN	3		1	1	1		1					1	
	KEN	1				1		1			1			
	NGER	1		1	1			1	1	1				
	NGIA	1					1	1	1		1	1		
	SDA	1	1		1	1			1	1	1	1		
	SEN	1				1		1	1					
Borassus aethiopum	BEN	2		1		1		1						
	CAM	1												
	CHAD	1		1				1			1		1	
	GBIA	1	1	1	1			1		1	1		1	
	GHN	2	1	1				1					1	
	GNEA	1	1	1			1	1		1	1			
	NGER	1	1	1		1		1	1		1		1	
	NGIA	2	1	1			1	1					1	
	SDA	1	1	1	1			1						
	SEN	1												
	TGO	1		1				1						
Diospyros mespiliformis	BEN	2	1	1	1									
	BF	2	1					1						
	CHAD	2				1		1						
	CI	1	1	1	1	1		1		1	1		1	
	ERIT	1	1	1	1	1		1	1	1				
	GBIA	3			1	1			1					
	GHN	1	1	1	1	1		1						x
	NGER	1						1		1	1			
	NGIA	2		1	1	1	1	1		1	1	1		
	SDA	2	1											
	TGO	1		1				1						

Appendix 9 (cont.): Value and utilization of 16 top priority species at regional level

Species Name	Country	Val.	ti	po	wo	nw	pu	fo	fd	sh	ag	co	am	xx
Eucalyptus camadulensis	BF	1	1	1	1									
	CAM	1		1							1			
	CHAD	1		1	1	1								x
	ERIT	1	1	1	1				1		1		1	
	GBIA	1	1	1	1	1				1	1	1	1	
	KEN	2		1	1									
	NGER	1	1	1	1					1		1	1	
	NGIA	1	1	1		1						1		
	SDA	1		1	1	1				1				
	SEN	1	1	1										
Faidherbia albida	BF	1							1		1	1		
	CAM	1							1	1	1			
	CHAD	1						1	1	1	1	1		
	CI	1			1	1			1	1	1	1		
	ERIT	1	1	1	1	1		1	1	1	1	1		Hedgerow
	GBIA	1			1	1			1	1	1	1	1	
	GHN	1			1	1				1			1	
	KEN	1		1					1		1			
	MAL	1			1	1			1	1	1	1	1	
	MAUR	2			1				1	1	1	1		
	NGER	1			1				1	1	1	1	1	
	NGIA	1					1		1	1	1	1		
	SDA	1							1	1	1			
	SEN	1							1		1	1		
	TGO	2							1		1			
Khaya senegalensis	BEN	1	1		1	1			1				1	
	BF	1	1		1					1				
	CHAD	1	1		1	1			1					x
	CI	1	1	1	1	1	1			1	1		1	
	GBIA	1	1	1	1	1				1	1		1	
	GHN	1		1				1						
	GNEA	1	1		1	1		1	1	1	1	1		
	MAL	1	1	1	1	1			1	1			1	
	MAUR	3	1	1								1		
	NGER	1	1	1	1	1				1			1	
	NGIA	1	1	1		1				1		1		x
	SDA	1	1	1		1				1			1	
	SEN	1	1											
	TGO	1	1	1									1	
Parkia biglobosa	BEN	1			1	1		1			1			
	BF	1					1	1			1			
	CAM	1												
	CHAD	1						1					1	
	CI	1	1	1	1	1		1	1	1	1			
	GBIA	1		1	1	1		1	1	1				
	MAL	1			1	1		1		1	1	1	1	
	NGER	2			1	1		1	1	1	1		1	
	SEN	1						1						
	TGO	1				1		1			1	1		

Appendix 9 (cont.): Value and utilization of 16 top priority species at regional level

Species Name	Country	Val.	ti	po	wo	nw	pu	fo	fd	sh	ag	co	am	xx
Pterocarpus erinaceus	BEN	1	1	1	1									
	CAM	2												
	CI	1	1	1	1	1		1	1	1	1	1	1	
	GBIA	1	1	1	1	1			1	1			1	
	GHN	1	1	1		1							1	
	GNEA	1	1		1	1	1	1		1	1	1		
	MAL	1	1	1	1	1			1	1	1		1	
	MAUR	3			1									
	NGIA	2		1		1	1				1	1		
	SEN	1	1						1					
	TGO	1	1						1					
Tamarindus indica	BEN	1				1								
	BF	1				1		1						
	CAM	2												
	CHAD	1				1		1		1				
	CI	1		1	1	1		1	1	1				
	ERIT	1	1	1	1	1		1	1	1	1	1		
	GBIA	1						1						
	GHN	1	1	1	1			1					1	x
	KEN	1			1			1			1			
	MAL	1				1		1	1	1	1		1	
	MAUR	1				1				1				
	NGER	1				1		1	1	1	1			
	NGIA	1				1		1	1		1	1		
	SDA	2			1			1		1		1		
	SEN	1						1			1			
Vitellaria paradoxa	BEN	1			1	1		1			1			
	BF	1			1	1		1						
	CHAD	1				1							1	x
	CI	1	1	1	1	1		1	1	1	1	1		
	GHN	2			1	1		1		1	1			x
	GNEA	1	1	1	1	1	1	1		1	1			
	MAL	1	1	1	1	1		1	1	1	1	1	1	
	NGIA	1				1	1	1	1	1	1	1	1	
	SEN	1						1						
	TGO	1						1						

Appendix 9 (cont.): Value and utilization of 16 top priority species at regional level

Species Name	Country	Val.	ti	po	wo	nw	pu	fo	fd	sh	ag	co	am	xx
Ziziphus mauritania	BF	1						1	1					
	CAM	1		1										
	CHAD	1						1						
	GHN	2			1									x
	KEN	1			1			1						
	MAL	1			1			1	1		1	1		
	MAUR	1				1	1	1	1	1	1		1	
	NGER	1						1	1			1		
	NGIA	3				1	1		1		1		1	
	SEN	1						1	1		1			

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, roundwood
- (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, esthetic, ethical values
- (xx) other

COUNTRY

BF	Burkina Faso	CAM	Cameroon	CHAD	Chad
CI	Côte d'Ivoire	GBIA	Gambia	GNEA	Guinea
KEN	Kenya	MAUR	Mauritania	NGER	Niger
NGIA	Nigeria	SEN	Senegal	SDA	Sudan
TGO	Togo				

Appendix 10: Genetic Management of 16 top priority species, by country and population

Species	Country	Ecological zones	Number of trees by population					
			Protected area	*In situ* & *ex situ* stands	Protected compartment, natural	Protected compartment, planted	Fields, home gardens	Experimental sites
Acacia nilotica	BF	SA		>1 000	<100	>100	<100	
	BF	SN	>1 000	>1 000	>1 000	>100	<100	15p
	BF	SS	>1 000	>1 000	>500		<500	
	CAM	SA	>1 000		>1 000		<100	
	CAM	SD	>100				<100	>100 (1p)
	ERIT	SD			>500			
	KEN	SD		>1 000				
	KEN	SA		>1 000				
	MAL	SA		x			x	x
	MAUR	SA			<1 000	<100		
	NGER	SA			<500	>1 000	<100	
	NGIA	SA	>1 000	>10 000	>1 000	>10 000	>1 000	>5p
	NGIA	SD	>1 000	>10 000	>1 000	>10 000	>1 000	>5p
	SEN	SA		x				
Acacia senegal	BF	SA	>10 000	>10 000		>1 000		8p
	BF	SD		>10 000		>1 000		7p
	CAM	SA	x	x		x		
	CH	SA		100				
	CH	SD		400				
	ERIT	SD			>1 000	>1 000		17p
	KEN	SA		>1 000				
	MAL	SA		x	x		x	x
	MAUR	SA			<100	<100		
	NGER	SA		<500	>10 000	>10 000	>100	5p
	NGIA	SA	>10 000	>10 000	>1 000	>10 000	>1 000	>100p
	NGIA	SD	>10 000	>10 000	>1 000	>10 000	>1 000	>100p
	SDAN	SA			>10 000	>10 000	>10 000	>1 000
	SDAN	SD			>10 000	>10 000	>10 000	>1 000
	SEN	SA		x	x	x		2p 2d 1c

Appendix 10 (cont.): Genetic Management of 16 top priority species, by country and population

Species	Country	Ecological zones	Number of trees by population					
			Protected area	*In situ* & *ex situ* stands	Protected compartment, natural	Protected compartment, planted	Fields, home gardens	Experimental sites
Adansonia digita	BF	SA					<100	5p
	BF	SD					<100	4p
	CAM	SA			>1 000	<100	<100	
	CAM	SD	<100				<100	1p
	ERIT	SD			<100	<100		
	GBIA	SD	<100		>1 000		>1 000	
	MAL	SA	x	x	x	x	x	x
	MAUR	SD			<100			
	NGER	SA	>100	<100			>100	
	NGER	SD	>100				>100	
	NGIA	SA	>100	>1 000	>1 000	>1 000	>100	25p
	NGIA	SD	>100	>1 000	>1 000	>1 000	>100	25p
	SDAN	SA			>1 000			
	SDAN	SD			>1 000			
	SEN	SD		x	x			
	SEN	SD		x	x		x	
Anogeissus leiocarpus	BEN	SD	x	x	x		x	
	BF	SA		<500				
	BF	SD		>1 000				7p
	CAM	SA	>1 000	>100			<100	
	CAM	SD	>10 000		>1 000			1p
	CI	SD		>100				
	ERIT	SD			<100			
	MAL	SD		x				x
	NGER	SD			>100			
	NGER	SA			<500			
	NGIA	SD	>100	>1 000	>1 000	>1 000	>500	10p
	SDAN	SA	>500		>10 000			
	TGO	SD	>100		>10 000	>1 000	>100	

Appendix 10 (cont.): Genetic Management of 16 top priority species, by country and population

Species	Country	Ecological zones	Number of trees by population					
			Protected area	*In situ* & *ex situ* stands	Protected compartment, natural	Protected compartment, planted	Fields, home gardens	Experimental sites
Azadirachta indica	BF	SA				>100		
	BF	SD				>1 000		
	CAM	SA	<100	>1 000		>100	>1 000	>500(1p)
	CAM	SD				>1 000	>1 000	>10 000 (1p)
	ERIT	SD					>1 000	
	KEN	SD			>1 000	>1 000		>500
	KEN	SA			>1 000	>1 000		>500
	NGER	SA				>1 000	>1 000	
	NGER	SD		>500		>10 000	>1 000	
	NGIA	SA	>10 000	>10 000	>500	>10 000	>1 000	>100p
	SDAN	SA				>1 000		
	SDAN	SD				>1 000		
	SEN	SD		x		x	x	2p
Balanites aegyptiaca	BF	SA		>1 000			>1 000	
	BF	SD	>100	>1 000			<500	
	CAM	SA	>100				>500	
	CAM	SD					<100	100 (1p)
	ERIT	SD			>500			
	KEN	SD		>1 000				
	MAL	SD	x	x			x	x
	MAUR	SA			<100			
	NGER	SD			<500		<100	
	NGER	SA			>1 000			
	NGIA	SA	>100	>1 000	>1 000	>1 000	>500	60p
	NGIA	SD	>100	>1 000	>1 000	>1 000	>500	60p
	SDAN	SA	>1 000		>10 000			
	SDAN	SD			>10 000			
	SEN	SA		x	x		x	
	SEN	SD		x	x			

Appendix 10 (cont.): Genetic Management of 16 top priority species, by country and population

Species	Country	Ecological zones	Number of trees by population					
			Protected area	*In situ* & *ex situ* stands	Protected compartment, natural	Protected compartment, planted	Fields, home gardens	Experimental sites
Borassus aethiopium	BF	SA						
	BF	SD		>500		<100	>500	
	CAM	SD	<100	x		<500	<100	1p
	GNEA	SD		*in situ*	>500			
	GNEA	SA	>10 000	*in-situ*	>10 000		>1 000	
	MAL	SA	x	x			x	x
	NGER	SD					<100	
	NGER	SA	<500	<10 000	>10 000	>1 000	>500	
	NGIA	SD	>100	>500	>100	>500	>100	
	SEN	SD		x				
Diospyros mespiliformis	CAM	SA	>500		>10 000			
	CAM	SD	>500					1p
	ERIT	SD			>100			
	GBIA	SD	>500		>10 000		>10 000	
	NGER	SD	<100					
	NGER	SA			<100		<100	
	NGIA	SD	>100	>1 000	>1 000	>500	<100	18p
	TGO	SD	<100		>100		<100	
Eucalyptus camaldulensis	BF	SA						150p
	BF	SD		>1 000		>1 000		113d+40c
	CAM	SA				>1 000	>1 000	>1 000 (20p)
	CAM	SD	>10 000			>1 000	>10 000	>10 000 (40p)
	KEN	SD				>10 000	>10 000	>1 000
	KEN	SA				>10 000	>10 000	>1 000
	NGER	SD		>1 000		>10 000	>500	p
	NGER	SA				>500	<100	p
	NGIA	SA	>10 000	>10 000	<500	>10 000	>100	>100p
	SDAN	SA				>10 000	>1 000	>1 000
	SEN	SD		x		x		5p

Appendix 10 (cont.): Genetic Management of 16 top priority species, by country and population

Species	Country	Ecological zones	Number of trees by population					
			Protected area	*In situ* & *ex situ* stands	Protected compartment, natural	Protected compartment, planted	Fields, home gardens	Experimental sites
Faidherbia albida	BF	SA		>100	>500		>100	70d
	BF	SD		>100			>100	10p
	CAM	SA	>100		<100		>1 000	
	CAM	SD	>100				>500	8p
	KEN	SD		>5000		>1 000		
	KEN	SA		>5000		>1 000		
	NGER	SA			<1 000			
	NGER	SD			<1 000			
	NGIA	SA	>1 000	>1 000	>1 000	>10 000	>100	>100p
	SDAN	SD	<100		>1 000			
	SDAN	SA			>1 000			
	SEN	SD	x	x	x		x	1p 1d
	TGO	SD			>10 000		>1 000	
Khaya senegalensis	BEN	SD	x	x	x		x	
	BF	SD	>100	>100				10p
	CAM	SA	<100			>100	>1 000	1p
	CAM	SD	>500	x	>100	>1 000	>100	1p
	GBIA	SD	>500		>1 000		>100	
	GNEA	SD	<500	*in-situ*	>1 000		<100	
	NGER	SD	>100	<100	<500	<500	<100	p
	NGIA	SD	>1 000	>10 000	<500	>10 000	<100	30p
	SEN	SD		x	x			1p 1d
	TGO	SD	<100		>10 000	>10 000	>100	

Appendix 10 (cont.): Genetic Management of 16 top priority species, by country and population

Species	Country	Ecological zones	Number of trees by population					
			Protected area	*In situ & ex situ* stands	Protected compartment, natural	Protected compartment, planted	Fields, home gardens	Experimental sites
Parkia biglobosa	BEN	SD	x	x	x		x	
	BF	SA		<100	>1 000		>500	
	BF	SD	<100	>1 000	>1 000	>1 000	>1 000	15p
	CAM	SD	>500			<100		1p
	GBIA	SD	>500		>1 000		>1 000	
	GNEA	SD	>500	*in-situ*	>1 000		>100	
	NGER	SD	>100	<100	<500		>100	
	NGIA	SD	>500	>1 000	>10 000	>1 000	>1 000	94p
	SEN	SD		x	x			
	TGO	SD	>100	>1 000	>10 000	>100	>10 000	
Pterocarpus erinaceus	GBIA	SD	>500		>10 000		>1 000	
	NGIA	SD	>100	>500	>500	>500	<100	5p
	TGO	SD	>100		>10 000		<100	
Tamarindus indica	BF	SA		<100				
	BF	SD	>100	>500			>1 000	13p
	CAM	SD	>100				>100	1p
	ERIT	SD			<100			
	GBIA	SD	>500		>1 000		<1 000	
	KEN	SD		>5,000	>1 000	>100	>100	
	KEN	SA		>5,000	>1 000	>100	>100	
	NGER	SA			<500		>100	
	NGER	SD			<100		<100	
	NGIA	SD	>100	>1 000	>10 000	>1 000	>1 000	25p
	SDAN	SA	> 100		>1 000			
	SEN	SD		x	x			

Appendix 10 (cont.): Genetic Management of 16 top priority species, by country and population

Species	Country	Ecological zones	Number of trees by population					
			Protected area	*In situ & ex situ* stands	Protected compart. Natural	Protected compartment, planted	Fields, home gardens	Experimental sites
Vitelaria paradoxa	BEN	SD	x	x	x			
	BF	SD	>500	>1 000	>1 000	c		8p
	CAM	SD	>500	>500			<100	
	GNEA	SD		<100*	*In situ*	<1 000	>500*	<100*
	NGER	SD			<1 000		<100	
	NGIA	SD	>500	>1 000	>10 000	>1 000	>500	35p
	TGO	SD	>1 000		>10 000		>10 000	
Ziyphus mauritiana	BF	SA		<100			<100	160d
	BF	SD	<100	>100	>100		>1 000	
	CAM	SD	>1 000	>1 000	X		<100	1p
	KEN	SD		>1 000	>1 000	>100	>100	
	KEN	SA		>1 000	>1 000	>100	>100	
	NGER	SA					<100	
	NGER	SD					<100	
	SEN	SA		x	x		x	
	SEN	SD		x	x			1p 1d

Countries:

BEN = Benin GNEA = Guinea SEN= Senegal BF= Burkina Faso KEN= Kenya SDAN= Sudan CAM= Cameroon
MAL=Mali TCH= Chad CI= Côte d'Ivoire MAUR= Mauritania TGO= Togo ERIT= Eritrea NGER= Niger
GBIE= Gambia NGIA= Nigeria SA = Sahelian zone SD = North Sudanian zone
p = Provenance d = Descendance c = Clone

The following repositories of genetic resources have been considered:

(a) Protected Areas, National Parks (managed with the principle of full protection and minimum intervention by man), in which the target species is a component of a protected ecosystem;
(b) Conservation Stands *in situ*, *ex situ* (managed for the explicit purpose of genetic conservation of specified target species). In case of *ex situ* conservation stands, number of provenances included in each separate stand should be specified.
(c) Forest Reserves, managed forests, in which special attention will be given to genetic conservation of target species in defined compartments
c.1 Naturally regenerated forests; c.2 Plantations;
(c) Village woodlots, farmers' fields, windbreaks, homesteads;
(d) Field experiments, selection and breeding programmes (with number of provenances, families, clones, as appropriate).

Estimates:

Factual information (f), or estimates (e), are given of the number of individuals in each category, per major ecological zone as follows:
<100 individuals >100 individuals >500 individuals >1 000 individuals >10 000 individuals
Details are not provided on the significance of ecological zones in each country (ecological classification systems are generally not compatible between neighbouring countries).

Appendix 11: Level of security and nature of threats to the integrity of genetic resources of 16 top priority species

Species	Country	Ecol. zone	Number of trees by population											
			(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
			Protected within parks	Managed for			Unmanaged		Threats and their causes					Level of security
				Soil and water protection	Timber Product.	Grazing	Harvested	Grazing land	Environ. Factors	Cuts, clearing	Cattle over-grazing	Infrastructure developm	Other	
Acacia nilotica	CAM	SA	x	x	x				drought				fire	5
	KEN	SD	>1 000		>500		>500		medium	mild	medium			
	KEN	SA	>1 000		>500		>500		medium	mild	medium			
	MAUR	SA		<100	<100		<100	<100	mild	mild	mild	mild		2
	NGER	SA		>1 000	>1 000	>1 000	<500	<500	mild	mild	mild			5
	NGIA	SD	>1 000	<1 000		>1 000	>1 000	>1 000	serious	very serious	mild	serious		2
	NGIA	SA	>10 000	<100	<1 000	>1 000	>10 000	>1 000	serious	medium	serious	serious		1
	SEN	SA	x	x	x				drought	x		x		5
Acacia senegal	CAM	SA			>10 000	>1 000		>1 000	drought				gum	4
	KEN	SA	>1,00		>100		>500	>500	medium	mild	medium			
	MAUR	SA		<100			<100	<100	mild	mild	mild	medium		2
	NGER	SA		>10 000	>10 000	>10 000	>100	>100	mild	mild	mild			5
	NGIA	SD	>100	<100	<10 000	>1 000	>10 000	<1 000	medium	serious	mild	serious		5
	NGIA	SA	<1 000	>100	>1 000	>1 000	<1 000	>10 000	serious	medium	serious	serious		2
	SDAN	SD			>10 000		>10 000							
	SEN	SA		x	x	x			drought	x				1

Appendix 11 (cont.): Level of security and nature of threats to the integrity of genetic resources of 16 top priority species

Species	Country	Ecol. zone	Number of trees by population											
			(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
			Protected within parks	Managed for			Unmanaged		Threats and their causes					Level of security
				Soil and water protection	Timber Product.	Grazing	Harvested	Grazing land	Environ. Factors	Cuts, clearing	Cattle over-grazing	Infrastructure developm	Other	
Adansonia digitata	CAM	SA	>1 000						drought				fire	4
	ERIT	SD		<100						mild				
	GBIE	SD	<100	>1 000	<100	<100	>10 000	<100	medium	medium		medium		3
	GNEE	SD					>500	>500	medium	mild	mild	mild		2
	MAUR	SD		<100		<100	<100	<100	mild	mild	mild	mild		2
	NGER	SD	<100								mild			1
	NGER	SA	<100		<1 000		>100		mild	mild				3
	NGIA	SD	<100	<100	>10 000	<1 000	>10 000	<1 000	mild	mild	mild	mild		1
	NGIA	SA	<1 000	<500	>10 000	<500	<10 000	<500	mild	mild	mild	mild		
	SDAN	SD					>1 000							
	SEN	SD		x	x				drought			x	overfelling	1
Anogeissus leiocarpus	BEN	SD					x			x				5
	CAM	SA			>10 000	>10 000	>10 000	>10 000	very serious	very serious				2
	CI	SD	x	x	x	x	x	x	mild	mild	medium	medium		
	NGER	SA					>100		mild	mild				5
	NGIA	SD	<1 000	<100	>10 000	<500	>1 000	<500	mild	serious	mild	mild		5
	NGIA	SA	<1 000	<100	>1 000	<100	>1 000	<100	medium	mild	serious	serious		
	SDAN	SD	>500/1				>10 000			>10 000				
	TGO	SD					x	x	x	x				

Appendix 11 (cont.): Level of security and nature of threats to the integrity of genetic resources of 16 top priority species

Species	Country	Ecol. zone	Number of trees by population											
			(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
			Protected within parks	Managed for			Unmanaged		Threats and their causes					Level of security
				Soil and water protection	Timber Product.	Grazing	Harvested	Grazing land	Environ. Factors	Cuts, clearing	Cattle over-grazing	Infrastructure dev	Other	
Azadirachta indica	CAM	SD			>10 000				drought				insects	1
	ERIT	SA			>1 000									
	ERIT	SD			>1 000									
	KEN	SA		>1 000	>100						mild			
	KEN	SD		>1 000	>100						mild			
	NGER	SA		>10 000	>1 000		>1 000		serious	serious		serious		1
	SDAN	SA			>1 000									
	SDAN	SD			>1 000									
Balanites aegyptiaca	CAM	SA		x	x				drought	x				3
	ERIT	SA								mild				
	ERIT	SD		<500						medium				
	KEN	SA	>1 000		>500	>100	>100	>100	serious	mild	serious			
	NGER	SA					<500	<500	medium	medium	medium	mild		4
	NGIA	SD	<500	>500	>1 000	>1 000	<100	>1 000	medium	mild	serious	mild		1
	NGIA	SA	>1 000	>1 000	>1 000	>1 000	>10 000	>500	very serious	serious	serious	mild		
	SDAN	SD	>1 000		>10 000		>10 000	>10 000			very serious			
	SEN	SA		x	x	x			drought	x		x		2

Appendix 11 (cont.): Level of security and nature of threats to the integrity of genetic resources of 16 top priority species

Species	Country	Ecol. zone	Number of trees by population											
			(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
			Protected within parks	Managed for			Unmanaged		Threats and their causes					Level of security
				Soil and water protection	Timber Product.	Grazing	Harvested	Grazing land	Environ. Factors	Cuts, clearing	Cattle over-grazing	Infrastructure developt	Other	
Borassus aethiopium	BEN	SD					x			x				5
	CAM	SD	x		x				drought	x				3
	GNEE	SD	>10 000	>10 000	<1 000	>1 000	>10 000	>10 000	very serious	serious	serious	mild		1
	NGER	SD	>500											1
	NGER	SA	>500	>500	>500		>500		mild	mild	mild			5
	NGIA	SD	<100	<100	<1 000	<100	>100	<100	mild	mild	mild	mild		5
	NGIA	SA	<100	<100	100	>500	<100	<100	mild	mild	mild	mild		
	TGO	SD	x		x		x		x					3
Diospyros mespiliformis	CAM	SA							drought				gum extr.	2
	CAM	SD							drought				fire	
	GBIE	SD	>100	>500	>500		>5000		serious	serious				5
	NGER	SA					<100		mild	mild				4
	NGIA	SD	<100	<100	<100	<100	<100	<100	mild	mild	mild	mild		1
	NGIA	SA	<100	<100	<100	<100	<100	<100	mild	mild	mild	mild		2
	TGO	SD	x					x			x			5
Eucaluptus camaldulensis	CAM	SD			>10 000	x			drought					2
	KEN	SA			>10 000						medium			
	NGER	SA		>1 000	>1 000				medium	medium				4
	NGER	SD		>1 000	>1 000				serious	serious				4
	NGIA	SD	>10 000	>1 000	>1 000	<100	>1 000	<1 000	medium	mild	mild	mild		1
	NGIA	SA	>1 000	>1 000	>1 000	<1 000	<1 000	<100	mild	mild	mild	mild		1
	SDAN	SA			>10 000									
	SDAN	SD			>10 000									
	TGO	SD			x					x	x			2

Appendix 11 (cont.): Level of security and nature of threats to the integrity of genetic resources of 16 top priority species

Species	Country	Ecol. zone	Number of trees by population											
			(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
			Protected within parks	Managed for			Unmanaged		Threats and their causes					Level of security
				Soil and water protection	Timber Product.	Grazing	Harvested	Grazing land	Environ. Factors	Cuts, clearing	Cattle over-grazing	Infrastructure dev	Other	
Eucalyptus camaldulensis	GBIE	SD	>1 000	>1 000	>1 000		>1 000		serious	serious		serious		5
Faidherbia albida	CAM	SD							drought					3
	CAM	SA			x	>10 000			drought				fire	5
	CI	SD	x	x	x	x	x	x	mild	mild	mild	medium		
	KEN	SD	>5 000	>1 000	>500				medium	mild	serious			
	KEN	SA	>5 000	>1 000	>500				medium	mild	serious			
	MAUR	SD		<100			<100	<100	mild	mild	mild	mild		2
	NGER	SD		>1 000	>1 000		>1 000	>1 000	medium	serious	serious	medium		3
	NGER	SA		>500	>500	>100	>100	>100		medium	medium	medium		3
	NGIA	SD	>1 000	>1 000	>10 000	>10 000	<100	<1 000	mild	mild	mild	mild		1
	NGIA	SA	>1 000	>1 000	>10 000	>10 000	>1 000	>1 000	medium	serious	serious	mild		1
	SDAN	SD	>100				>1 000				serious			
	SEN	SD	x	x	x	x			drought		x	x		5
	TGO	SD	x	x							x			1

Appendix 11 (cont.): Level of security and nature of threats to the integrity of genetic resources of 16 top priority species

Species	Country	Ecol. zone	Number of trees by population											
			(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
			Protected within parks	Managed for			Unmanaged		Threats and their causes					Level of security
				Soil and water protection	Timber Product.	Grazing	Harvested	Grazing land	Environ. Factors	Cuts, clearing	Cattle over-grazing	Infrastructure dev	Other	
Khaya senegalensis	BEN	SD					x			x			x	4
	CAM	SD							drought	x			overfelling	3
	CAM	SA			x	x			drought	serious			overfelling	5
	CI	SD	x	x	x	x		x	medium	mild	mild	medium		
	GBIE	SD	>500	>1 000	>1 000	<100	>1 000	<100	very serious	serious		serious		5
	GNEE	SD	>500	<500	<100	<100	>1 000	>1 000	serious	mild	mild	mild	x	2
	MAUR	SA		<100	<100		<100		mild	mild				2
	NGER	SD	<100											2
	NGER	SA			>100		<100		mild	mild				4
	NGIA	SD	>10 000	<1 000	>1 000	<100	>1 000	<1 000	mild	mild	mild	mild		1
	NGIA	SA	>1 000	<1 000	>100	<100	<100	<100	mild	mild	mild	mild		1
	TGO	SD	x		x		x			x				4
Parkia biglobosa	BEN	SD			x					x				5
	CAM	SD	x				>10 000		drought	x			fire	4
	CAM	SA	x	x	x					x				4
	CI	SD	x	x	x	x	x	x	mild	medium	medium	medium		
	GBIE	SD	>500	>1 000	>1 000	>500	>10 000	>1 000	serious	mild	mild	mild		5
	GNEE	SD	>500	>500	>500	<100	>100	>1 000	serious	mild	mild	mild		2
	NGER	SA			>500		>100			mild	mild			3
	NGER	SD	<100						mild		mild			1
	NGIA	SD	>10 000	<1 000	>10 000	<1 000	>10 000	>1 000	serious	serious	medium	medium		1
	NGIA	SA	>1 000	<100	>1 000	<1 000	<1 000	>100	mild	medium	mild	mild		1
	SEN	SD		x	x				drought	x		x		4
	TGO	SD	x	x	x				x		x			1

Appendix 11 (cont.): Level of security and nature of threats to the integrity of genetic resources of 16 top priority species

Species	Country	Ecol. zone	Number of trees by population											
			(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
			Protected within parks	Managed for			Unmanaged		Threats and their causes					Level of security
				Soil and water protection	Timber Product.	Grazing	Harvested	Grazing land	Environ. Factors	Cuts, clearing	Cattle over-grazing	Infrastructure dev	Other	
Pterocarpus erinaceus	BEN	SD			x		x				x			5
	CAM	SA	x				>10 000		drought	x			fire	4
	GBIE	SD	>500	>1 000	>1 000	>1 000	>10 000	>1 000	serious	very serious	serious	serious		5
	MAUR	SD	<100	<100	<100	<100	<100	<100	mild	mild	mild			2
	NGIA	SD	<100	<100	<100	<100	<100	<100	mild	mild	mild	mild		3
	NGIA	SA	<100	<100	<100	<100	<100	<100	mild	mild	mild	mild		5
	TGO	SD					x	x	x	x	x	x		4
Tamarindus indica	BEN	SD					x							4
	CAM	SD	x						drought					3
	CAM	SA			>10 000		>1 000		drought				fire	4
	CI	SD		x	x	x	x	x	medium	medium	mild	medium		
	KEN	SD	>5 000	>1 000	>100		>500		serious	mild	medium			
	KEN	SA	>5 000	>1 000	>100		>500		serious	mild	medium			
	MAUR	SD		<100	<100	<100	<100	<100	mild	mild	mild	mild		2
	NGER	SD			<500		>500	>500	mild	medium	medium			4
	NGER	SA			<100		<100	<100	mild	mild				4
	NGIA	SD	>10 000	<1 000	>10 000	<1 000	>1 000	<1 000	medium	medium	medium	medium		2
	NGIA	SA	<1 000	<100	>1 000	>1 000	<1 000	<1 000	mild	medium	mild	mild		2
	SDAN	SD	<100				>1 000							
Vitellaria paradoxa	BEN	SD			x									5
	CAM	SD	x		x		x		drought	serious				3
	CI	SD	x	x	x	x	x	x	medium	medium	medium	medium		
	GNEE	SD	>100	>100	>100	<100	>500	>500	serious	mild	mild	mild		2

Appendix 11 (cont.): Level of security and nature of threats to the integrity of genetic resources of 16 top priority species

Species	Country	Ecol. zone	Number of trees by population											
			(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
			Protected within parks	Managed for			Unmanaged		Threats and their causes					Level of security
				Soil and water protection	Timber Product.	Grazing	Harvested	Grazing land	Environ. Factors	Cuts, clearing	Cattle over-grazing	Infrastructure dev	Other	
Vitellaria paradoxa	NGER	SA					>100			mild				3
	NGER	SD												
	NGIA	SD	>10 000	<100	>10 000	<1 000	>1 000	<100	serious	mild	mild	mild		1
	NGIA	SA	<1 000	<100	>1 000	<100	>1 000	<100	serious	mild	mild	mild		2
	TGO	SD	x		x	x	x	x		x	x			3
Ziziphus mauritiana	CAM	SD	x			x			drought	x				2
	CAM	SA	x	x		x	>1 000		drought	x				4
	KEN	SA	>1 000	>500	>100		>500		medium	mild	medium			
	KEN	SD	>1 000	>500	>100		>500		medium	mild	medium			
	MAUR	SD		<100	<100	<100	<100	<100	mild	mild	mild	mild		2
	NGER	SA		>500	>500		<100	<100	mild	mild				3
	SEN	SA			x	x				x				1

Countries:

BEN = Benin GNEA = Guinea SEN= Senegal BF= Burkina Faso KEN= Kenya SDAN= Sudan CAM= Cameroon
MAL=Mali TCH= Chad CI= Côte d'Ivoire MAUR= Mauritania TGO= Togo ERIT= Eritrea NGER= Niger
GBIE= Gambia NGIA= Nigeria SA = Sahelian zone SD = North Sudanian zone

1.: implementation / enforcement of regulations probable, and regulations scientifically sound (for use/management categories 4.a-4.d above); or threat mild/occasional (categories 4.e-4.j above); 5 : implementation/ enforcement of regulations unlikely (categories 4.1-4.d); or threat severe with high probability of genetic degradation or loss (categories 4.e-4.j). 2-3 : intermediate between 1 and 5.

Appendix 12: Outline for country reports on forest genetic resources in Sahelian and North Sudanian Africa for the preparation of the Sub-regional Workshop on Forest Genetic Resources, Ouagadougou, Sept. 1998

1/ Social-economic conditions and issues related to the conservation, utilization and management of forest genetic resources.

* status of forest resources
* utilization of trees
* identification of threats, if any
* links between the forestry sector and forest genetic resources
* links between other activities : agriculture, agroforestry, animal husbandry, industry

2/ Past and present activities in the field of conservation, utilization and management of forest genetic resources.

* demand and supply of seed for agroforestry and afforestation programmes
* *in-situ* conservation (protected areas, forests, parks, ...)
* *ex-situ* conservation (seed, conservation stands, in-vitro cultivation, ...)
* tree improvement (provenance trials, progeny tests, seed orchards, ...)

3/ Institutional framework

* institutions : their role, responsibilities, capabilities.
* national legislation, policy, strategy on forest genetic resources
* links with other initiatives (Convention on Biological Diversity, Agenda 21 of UNCED, ...)

4/ Identification of national priorities
* list of priority species

5/ Side activities

* training and capacity building
* research
* national forestry policy and institutional issues

6/ Proposals for regional and international collaboration

* Regional cooperation schemes (networks, ...)
* international cooperation

Annexes

Any other useful information

Appendix 13: List of country reports prepared by national experts for the Sub-regional Workshop on the Conservation, Management, Sustainable Utilization and Enhancement of Forest Genetic Resources in Sub-Saharan Africa, Ouagadougou, Burkina Faso, 22 – 24 September 1998

Country	Title of report	Author(s)	Institution	Date
Benin	Rapport national sur les ressources phytogénétiques forestières	Agbahungba, Georges. Sokpon, N.	Institut national des recherches agricoles; Faculté des sciences agronomiques	September 1998
Burkina Faso	Conservation et utilisation des ressources génétiques forestières	Nikiéma, Albert Ouédraogo, Sibiri Boussim, Joseph	Centre national de semences forestières	August 1998
Cameroon	Rapport national du Cameroun	Fondoun, Jean Marie	Institut de la recherche agricole pour le développement; Direction des forêts	August 1998
Chad	Rapport national du Tchad	Tal, Mounlang	Direction des forêts et de la protection de l'environnement	Mai 1998
Côte d'Ivoire	Rapport national de Côte d'Ivoire (zone de savanes)	Ouattara, N'Klo	Centre national de recherche agronomique	August 1998
Eritrea	Conservation, Management, Sustainable Utilisation and Enhancement of Forest Genetic Resources in Eritrea	Araya Eman, Elias	Ministry of Agriculture	September 1998
Ethiopia	Status of Forest Genetic Resources in Ethiopia	Bekele, Million Berhanu, Leykun	Natural Resources Management and Regulatory Department	September 1998
Gambia	Review of Information on Forest Genetic Resources	Danso, Abdoulie	Forestry Department	August 1998
Ghana	National Document on Forest Genetic Resources of savannah in Ghana	Siaw, Daniel EKA	Forest Research Institute of Ghana	September 1998
Guinea	Rapport national de la République de Guinée sur les ressources génétiques forestières	Diawara, Djiramba	Direction nationale des eaux et forêts	June 1998
Kenya	The status of Forest Genetic Resources and Plan of Action for the Dry Zone Areas of Kenya	Kigomo, Bernard	Kenya Forestry Research Institute	June 1998
Mali	Situation des ressources phytogénétiques au Mali	Maiga, Alpha S.	Institut d'économie rurale	May 1998
Mauritania	Rapport national sur la conservation et l'utilisation durable des ressources génétiques forestières en Mauritanie	Ould M'Baré, Cheikhna	Direction de l'environnement et de l'aménagement rural	April 1998

Appendix 13 (cont.): List of country reports prepared by national experts for the Sub-regional Workshop on the Conservation, Management, Sustainable Utilization and Enhancement of Forest Genetic Resources in Sub-Saharan Africa, Ouagadougou, Burkina Faso, 22 – 24 September 1998

Country	Title of report	Author(s)	Institution	Date
Niger	Rapport national du Niger sur les ressources génétiques forestières	Laminou, Attaou M.	Ministère de l'hydraulique et de l'environnement	March 1998
Nigeria	Country Report on the Level of Conservation, Management, Sustainable Utilization and Enhancement of Forest Genetic Resources in Dry-Zone Sub-Saharan Region of Nigeria	Oni, Peter I.	Forestry Research Institute of Nigeria	July 1998
Senegal	Rapport national sur les ressources génétiques forestières	Boyé, Ababacar	Direction des eaux, forêts, chasses et conservation des sols; Direction des recherches sur les productions forestières	June 1998
Soudan	Status of Forest Genetic Resources in the Sudan	Gorashi, Abdel Rahman	Forests National Corporation	June 1998
Togo	Rapport national sur les ressources génétiques forestières du Togo	Ouro Djéri, Essowè Djagba, Tchéliaga Sewa Ouro-Landjo Albada	Centre national de semences forestières; Direction des productions forestières	August 1998

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