



Forestry Department

Food and Agriculture Organization of the United Nations

Planted Forests and Trees Working Papers

**THE NETHERLANDS TRUST FUND SUPPORT TO SUSTAINABLE
FOREST MANAGEMENT IN LOW FOREST COVER COUNTRIES**

***ROLE OF PLANTED FORESTS AND TREES OUTSIDE
FORESTS IN SUSTAINABLE FOREST MANAGEMENT:***

***REPUBLIC OF MALI
COUNTRY CASE STUDY***

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October 2003

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Forestry Department**

**Working Paper FP/28E
FAO, Rome (Italy)**

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For quotation:

FAO (2003). Role of Planted Forests and Trees Outside Forests in Sustainable Forest Management in the Republic of Mali, by I. Thomas and S. Samassekou. Planted Forests and Trees Working Papers, Working Paper 28. Forest Resources Development Service, Forest Resources Division. FAO, Rome (*unpublished*).

Foreword

People of developing countries facing desertification and severe land degradation, particularly in arid and semi-arid areas, can experience extreme food insecurity and abject poverty. In most countries, their relationships with forests and trees are inseparably interlinked and interdependent. Poor people recognize that forests and trees protect soil, water and biological diversity, provide shelter and shade for their villages as well as havens for cultural customs and help to combat desertification. To meet their basic food, fuel-wood, fodder, medicine and construction materials from the meagre resources available, they adopt survival attitudes, overexploit forests and rangelands, and provoke alarming rates of deforestation and forest degradation, which further erode their livelihoods.

Decentralized, participatory, intersectoral and multidisciplinary approaches to policy, planning, implementation and monitoring are new to many developing low forest cover countries. They require new institutional frameworks as well as training and skills in forest planning and management. The voice of the forestry sector, which has generally been marginalized, needs to be mainstreamed in intersectoral planning committees and working groups to derive national development priorities and national forest development strategies. In so doing, it should examine the real value and potential roles of natural forests, planted forests and trees outside forests in supporting landscape restoration and sustainable livelihoods in urban and rural landscapes.

It is critical to integrate planted trees and forests in more holistic approaches to provide environmental services, biodiversity benefits and meet people's short and long-term needs. It is also necessary to make modern technology and traditional knowledge available in more people oriented approaches to be shared through national and international networks, and sound extension and technical support systems and demonstrations.

This case study was carried out under the FAO-Netherlands Partnership Programme to support Sustainable Forest Management in Low Forest Cover Countries in the Near East and African Regions. It is one in a series of six carried out in Iran, Oman, and Tunisia in the Near-East Region to form the basis of the Teheran Workshop, 28-31 October 2002 and Mali, Ethiopia and Namibia in the African Region to form the basis for the Nairobi Workshop 26-29 November 2002.

The case studies, chosen to represent the uniquely different ecological, social, cultural, environmental and economic conditions prevailing in the regions, were conducted to evaluate the role of planted forests and trees outside forests in supporting sustainable forest management and landscape restoration in low forest cover countries. Natural forests, rangelands, woodland resources, trees outside forests, agroforestry, urban and peri-urban forestry all play important roles in supporting the social, cultural, environmental and economic landscapes, particularly in low forest cover countries.

This case study focuses on the major issues, the policy/legal/institutional contexts, status of forests and rangelands, constraints, opportunities, gaps in knowledge, lessons learned and the proposed actions for the way forward. This is a first step in translating policies and proposed actions towards implementation.

Acknowledgements

This case study was carried out under the FAO-Netherlands Partnership Programme to support Sustainable Forest Management in Low Forest Cover Countries in the Near East and African Regions. It is one in a series of three carried out in Mali, Ethiopia and Namibia in the African region to form the basis for the Nairobi Workshop 26-29 November 2002. The focus is on enhancing the role of planted forests and trees outside forests in supporting sustainable forest management and complementing management of diminishing natural forest, range and woodland resources.

Information gained from the case study was collected from collaborative work between the FAO and national consultants, Government authorities and other collaborating national stakeholders. The authors are thankful to FAO for its valuable assistance, particularly Messrs. Pape Kone of the Regional Office for Africa, Accra (Ghana), and Jim Carle and Syaka Sadio of the FAO Forest Resources Division, Rome (Italy) for the remarkable efforts they have put in preparing and starting up the mission. We extend our thanks to all FAO personnel met at headquarters that provided useful assistance during the briefing sessions.

Our thanks go also to Messrs. Aguilnado, L. Ramos, FAO Representative in Mali and Bathily, C. Bougadary, FAO Programme Officer, for their constant solicitude throughout our presence in Mali. We wish to extend our appreciation to Mr. Yaya Tamboura, Head of the Nature Conservation National Directorate, for the valuable logistic provided to the mission during its field visits in Mali.

Finally we are grateful to all persons who have extended their cordial hospitality to the mission and contributed to its efforts by sharing their experience in forestry and providing annual reports and other useful documentation.

TABLE OF CONTENTS

LIST OF ACRONYMS.....	1
EXECUTIVE SUMMARY.....	3
INTRODUCTION.....	7
1. GENERAL OVERVIEW.....	8
1.1 BACKGROUND SETTING.....	8
1.1.1 Brief geographical and historical country description	8
1.1.2 Economic and demographic characteristics.....	9
1.1.3 Governance and administration	9
1.1.4 Policy, Institutions, National Development plans	10
1.2 ENVIRONMENTAL CHARACTERISTICS	10
1.2.1 Geology and soil.....	10
1.2.2 Climate	11
1.2.3 Biological resources.....	12
1.2.4 Water and land resources.....	13
1.3 HUMAN FACTORS: SOCIO-ECONOMIC CHARACTERISTICS.....	14
1.3.1 Population, Demography.....	14
1.3.2 Economic overview	15
2. FOREST RESOURCES: CURRENT STATUS AND MANAGEMENT.....	18
2.1 FOREST INVENTORY AND INFORMATION SYSTEMS.....	18
2.2 CHARACTERISTICS OF THE FOREST ESTATE.....	19
2.2.1 Total forest estate.....	19
2.2.2 Natural forests.....	19
2.2.3 Planted forests.....	19
2.2.4 Trees outside forests.....	21
2.3 TOOL BOX FOR SUSTAINABLE FOREST MANAGEMENT	24
2.3.1 Criteria and indicators for sustainable management	24
2.3.2 Management and Planning	24
2.4 FOREST PRODUCTION.....	25
2.4.1 Wood products	25
2.4.2 Non-Wood Forest Products.....	28
2.4.3 Marketing.....	29
2.5 STATUS OF FOREST INDUSTRIES	30
2.5.1 Wood processing	30
2.5.2 NWFP's processing	30
2.6 ECONOMIC AND SOCIAL SIGNIFICANCE OF FORESTS.....	30
2.7 ENVIRONMENTAL VALUES OF FORESTS.....	31
3. THE FORESTRY SECTOR.....	31
3.1 INSTITUTIONAL FRAMEWORK OF FORESTRY	31
3.1.1 State institution related to forestry.....	31
3.1.2 Private forestry.....	34
3.1.3 Forestry research.....	34
3.1.4 Forestry training	34
3.2 FORESTRY PLANNING, POLICY AND LEGAL FRAMEWORK.....	35
3.2.1 Forestry sector's evolution	35
3.2.2 Forestry policy and strategies.....	36
3.2.3 Forestry planning	37
3.2.4 Forestry Legislation	38
3.3 EXTERNAL ASSISTANCE.....	40
3.3.1 International multilateral support	40

3.3.2	Bilateral support	40
3.3.3	Other International support	40
3.4	NATIONAL PERSPECTIVES	41
4.	THE CAUSES AND EFFECTS OF DEFORESTATION AND FOREST DEGRADATION.....	42
4.1	INDIRECT CAUSES	43
4.1.1	Land tenure and user rights	43
4.1.2	Population growth.....	43
4.1.3	Poverty	43
4.1.4	Strategies to increase grain crops production.....	43
4.1.5	Profound transformations of the agrarian sector	44
4.1.6	Perception of trees	44
4.2	DIRECT CAUSES	44
4.2.1	Natural causes	44
4.2.2	Causes linked to human activity	45
4.3	EFFECTS OF DEFORESTATION AND OF FOREST AND RANGE DEGRADATION	46
4.3.1	Loss of land productivity	46
4.3.2	Biomass and species' diversity reduction	46
4.3.3	Reduction of groundwater resources.....	47
4.3.4	Increase in erosion phenomena and atmospheric pollution	47
4.4	EXTENT OF DEFORESTATION AND FOREST DEGRADATION	47
5.	STATUS OF KNOWLEDGE.....	48
5.1	LESSONS LEARNED	48
5.2	GAPS IN KNOWLEDGE.....	49
6.	CONCLUSIONS AND RECOMMENDATIONS.....	50
6.1	CONCLUSIONS	50
6.2	RECOMMENDED ACTIONS	51
6.2.1	Development choices and issues	51
6.2.2	Inter-sectoral collaboration	51
6.2.3	Institutional and legal aspects	51
6.2.4	Ecosystems' monitoring and evaluation.....	52
6.2.5	Improvement of resources utilization and management.....	52
6.2.6	Research	52
6.2.7	Training	53
	REFERENCES.....	54
	ANNEXES	56

List of Acronyms

AGEFORE	Aménagement pour la Gestion de la Forêt et de l'Environnement
AFD	Agence Française de Développement
AHF	Arbres Hors Forêts
AOPP	Association des Organisations Professionnelles Paysannes
APCAM	Assemblée Permanente des Chambres d'Agriculture du Mali
ASDAP	Association de Soutien au Développement des Activités de Populations
ASFD	Appui au Service Forestier Déconcentré
BM	Banque Mondiale
BAD	Banque Africaine de Développement
BCEAO	Banque Centrale des Etats de l'Afrique de l'Ouest
BDIC	Bureau Documentation Information Communication
BEAGGES	Bureau d'Experts pour l'Auto Gouvernance et la Gestion de l'Environnement au Sahel
BIT	Bureau International du Travail
BSSE	Bureau Statistiques Suivi - Evaluation
CARE	Cooperative for Assistance and Relief Everywhere, Inc.
CCL	Cellule Combustibles Ligneux
CED	Centre d'Education pour le Développement
CEEMA	Centre d'Etudes et d'Expérimentation du Machinisme Agricole
CESAO	Centre d'études économiques et sociales de l'Afrique de l'Ouest
CIDA	Canadian International Development Agency
CILSS	Comité Inter Etat de lutte contre la Sécheresse au Sahel
CITES	Convention sur le Commerce International des Espèces de Faune et de Flore Sauvages Menacées d'Extinction
CMDT	Compagnie Malienne de Développement des Textiles
CNC	Comité National de Coordination
CNRST	Centre National de Recherche Scientifique et Technique
CNUED	Conférence des Nations Unies sur l'Environnement et le Développement
CPS	Cellule de Planification et de Statistiques
CRA	Centre de Recherche Agronomique
CTA	Centre Technique Agricole
CTD	Collectivité Territoriale Décentralisée
DAGR	Division Aménagement et Gestion des Ressources Naturelles
DEA	Diplôme d'Etudes Approfondies
DED	Agence de Coopération Allemande pour le Développement
DEF	Diplôme Etudes Fondamentales
DEP	Division Etudes et Planification
DER	Département d'Etudes et de Recherches
DEUG	Diplôme d'Etudes Universitaires Générales
DGRC	Direction Générale de la Réglementation et du Contrôle du Secteur Développement Rural.
DIER	Division Infrastructures et Equipement Rural
DNACPN	Direction Nationale de l'Assainissement et du Contrôle des Pollutions et Nuisances
DNAER	Direction Nationale de l'Aménagement et de l'Equipement Rural
DNAMR	Direction Nationale de l'Appui au Monde Rural
DNCN	Direction Nationale de la Conservation de la Nature
DNE	Direction Nationale de l'Elevage
DNEF	Direction Nationale de l'Enseignement Fondamental
DNEF	Direction Nationale des Eaux et Forêts
DNGR	Direction Nationale du Génie Rural
DNRFFH	Direction Nationale des Ressources Forestières Fauniques et Halieutiques
DNSI	Direction Nationale Statistiques et Informatique
DRCN	Direction Régionale de Conservation de la Nature
EE	Education Environnementale
E et F	Eaux et Forêts
ECOFIL	Economie des Filières
EDP	Environnement et Développement Paysan
ENA	Ecole Nationale d'Administration

ENATEF	Ecole Nationale des Agents Techniques des Eaux et Forêts
ENGREF	Ecole Nationale du Génie Rural et des Eaux et Forêts
ENI	Ecole Nationale d'Ingénieurs
ENSEC	Ecole Normale Secondaire
ESGRN	Equipe Système Programme de Gestion des Ressources Naturelles
EVF/EMP	Education Vie Familiale et en Matière de Population
FC	Forêts Classées
FCFA	Franc de la Communauté Financière Africaine
FAFPA	Fond d'Appui à la Formation Professionnelle et à l'Apprentissage
FAO	Food and Agriculture Organization of the United Nations
FAS	Facilitation d'Ajustement Structurel
FDS	Fonds de Développement Social
FED	Fonds Européen de Développement
FIDA	Fonds International pour le Développement Agricole
FMI	Fonds Monétaire International
GDRN	Gestion Durable des Ressources Naturelles
GIE	Groupement d'Intérêt Economique
GTZ	Agence Allemande de Développement
HUICOMA	Huilerie Cotonnière du Mali
ICRAF	International Centre for Research in Agroforestry
IEF	Ingénieur des Eaux et Forêts
IER	Institut d'Economie Rurale
IFF	Forum Intergouvernemental sur les Forêts
IPEG	Institut Pédagogique d'Enseignement Général
IPF	Groupe Intergouvernemental sur les Forêts
IPR/IFRA	Institut Polytechnique Rural / Institution de Formation et de Recherche Appliquée.
MDRE	Ministère du Développement Rural et de l'Environnement
ME	Ministère de L'Environnement
MEATEU	Ministère de l'Equipement, de l'Aménagement du Territoire, de l'Environnement et de l'Urbanisme
MEPI	Ministère Economie Plan et Intégration
MESSRS	Ministère Enseignement Secondaire Supérieur et Recherche Scientifique
ON	Office du Niger
OP	Organisation Paysanne
OHVN	Office de la Haute Vallée du Niger
ONG	Organisation non Gouvernementale
PAN	Plan d'Action National
PASAOP	Programme d'Appui au Secteur Agricole et aux Organisations Paysannes
PASR	Programme d'Appui au Secteur Rural
PFNL	Produits Forestiers Non Ligneux
PGRN	Programme de Gestion des Ressources Naturelles
PIB	Produit Intérieur Brut
PIRL	Projet d'Inventaires des Ressources Ligneuses
PNAE	Plan National d'Action Environnementale
PNIR	Programme National d'Infrastructures Rurales
PNUD	Programme des Nations Unies pour le Développement
SDR	Secteur Développement Rural
SDDR	Schéma Directeur du Secteur Développement Rural
SERNES	Services Experts Ressource Naturelle du Sahel
SNLP	Stratégie Nationale de Lutte contre la Pauvreté
UICN	Union Internationale de Conservation de la Nature
UNESCO	Organisation des Nations Unies pour l'Education la Science et la Culture
UNFF	Forum des Nations sur les Forêts
UNSO	Bureau des Nations Unies pour la Région Soudano-Sahélienne

Executive Summary

Preamble

This case study was carried out under the FAO-Netherlands Partnership Programme to support Sustainable Forest Management in Low Forest Cover Countries in the Near East and African Regions. It is one in a series of three carried out in Mali, Ethiopia and Namibia in the African region to form the basis for the Nairobi Workshop 26-29 November 2002. The focus is on enhancing the role of planted forests and trees outside forests in supporting sustainable forest management and complementing management of diminishing natural forest, range and woodland resources.

Covering 1 240 192 km², the Republic of Mali is deeply landlocked within Western Africa. The population of 9,2 million (1996) has one of the highest demographic growths in the world (3,2 %). The country's environmental features include: (i) poor and fragile soils highly deficient in phosphate and organic matter, (ii) harsh climates with tropical arid and semi-arid conditions prevailing over a large part of the country, (iii) rich and varied biological resources, which suffer from degradation due mainly to a host of man made factors and extremes in climate.

The economy mainly relies on the rural sector dominated by agriculture (and livestock breeding), which employs 8 % of the working population and contributes 42 % of GNP, coming in second place after services. Two major production systems prevail, i.e. pastoral and agro-pastoral. Rangeland systems are based on extensive livestock breeding which represents less than 30 % of agricultural production. The forestry sector is fundamental to the national economy. It satisfies 93 % of the country's domestic energy needs and contributes 8,5 % to the agricultural added value (1994-1998). The main forest raw materials processed are wood, shea butter, Arabic gum, African black locust and baobab leaves. Mali aims at 7 % economic growth in the upcoming years.

The Republic of Mali established its national forest policy in 1982 and is committed to sustainable forest resources management. It became involved in formulating the UNCCD and is now implementing it. The objective of the forestry sector is to elaborate programmes which favour local development and promotion of real partnerships at local, provincial, national and international levels. Decentralization plans began in 1992. Aiming at reinforcing the democratisation process, they have resulted in profound changes supported by legislation. Next decentralization steps include setting the High Council of Collectives, transferring expertise and authority and working out management plans.

Mali's forest cover has not been assessed reliably, which explains the great disparity in forest cover estimations [15,5 million ha according to FAO; 32,3 million ha for 5 regions according to PIRL]. According to the law¹ the forest estate is divided into: (i) State owned forests, which include reserved forests, protected forests and manmade forests, (ii) forest estate of decentralized territorial communities, (iii) and private forest estate (Art. 60). The same law specifies the limits within which, private owners may exert ownership rights.

¹ Article 24 of law No 95004 of 18/01/1995.

Productive forests occur mainly south and west of the country (Sudano-Guinean, Guinean zones). They consist of open woodland, riparian forests, tree/shrub savannahs. Standing volumes range from 10-100 m³/ha from north to south. Mean annual increments/ha vary from 0,3-0,4 m³ in the Sahelian zone, to 0,5-1,0 m³ in the Sudanese zone, and 1-2 m³/ in the Guinean zone. Man-made village forests amount to 40 000 ha and 4 000 km of linear plantings. Trees outside forests contribute non-wood forest products; they are found in agroforestry parklands, fruit orchards and village and urban forests.

The first State institution in charge of forestry, the “Direction Nationale des Eaux et Forêts” was established in 1972. The 1991 national events have led to deep changes, with the strengthening of the forestry sector and the creation in 1995 of the “Direction Nationale des Ressources Forestières, Fauniques et Halieutiques” to put into operation the new forest policy. This was upset in 1997 when drastic institutional changes occurred that established the “Direction Nationale de Conservation de la Nature” to operate and administer the forestry sector. The private forestry sector was stimulated from 1995, when the forest policy began favouring private initiatives and partnerships between the State and private operators in the framework of participative forest development. The Institute of Rural Economy under MDR conducts forest research, for which, a long-term strategy was adopted and financed by many partners under bilateral and multilateral assistance. Mali benefits from international and bilateral support for its forestry programmes.

The national forest estate endures deforestation and degradation processes, particularly in areas under pressure for wood and rangeland resources, areas providing urban centres with wood fuels and areas undergoing agricultural land extension. The causes reside in rapid population growth, precarious living conditions, increased poverty, misuse of forest resources, agricultural land extension and road infrastructure development, extensive livestock breeding (overgrazing), mining etc. Natural causes include climatic conditions, fragile vegetative cover, and erosion-prone soils. Brittle means literally fragile!

Conclusions

The main concluding statements made by the mission include: (i) the relationship between people and the forestry service underwent a traumatic crisis from numerous conflicts of interests in terms of natural resource use, (ii) the forestry sector has not been integrated enough into the national economy nor has sufficient investment in forest products been made, (iii) despite the increasing recognition of the benefits from forests, strong human pressure has continued to cause deforestation and forest degradation at alarming rates; (iv) the Government has reviewed the forest law to define a new national forest policy and to implement a strategy of domestic energy, (v) Mali must rely on international cooperation, financial support and technical expertise of its partners to support its efforts to develop the forestry sector, (vi) a form of collaboration with those responsible in the decentralized communities guarantees their interests in the framework of a better management of natural resources, (vii) there is a need to improve tenure security and identify simple intervention techniques that are operational, inexpensive and transferable in the context of decentralization, (viii) participatory methods of planning, managing and monitoring of forest resources have been insufficiently embraced so there is only limited engagement of rural communities striving to achieve sustainable forest management.

Recommended actions

With regard to development issues and choices the mission recommends to:

- Adopt participatory planning approaches and combine a top down and bottom up decentralized strategy to forest management;
- Identify the sector's needs in human resources, budgets, equipment and strategies;
- Implement participatory forestry-related village demonstration and/or test sites.

In terms of inter-sectoral collaboration it is recommended to:

- Set up networks of systematic knowledge/ideas exchange with the main stakeholder groups;
- Widen multi-disciplinary and inter-sectoral dialogue across the public service and State projects and include community representatives;
- Strengthen forums of communication to guide planning and evaluation.

In terms of institutional and legal aspects it is necessary to:

- Review the legal, policy, regulatory and planning framework of the forestry sector;
- Analyse the ongoing decentralization process and strive to reach a balance of central and local administrative planning, management and monitoring supported with the necessary delegation of authority, responsibility and resources (budgets, personnel, equipment, vehicles etc);
- Review the role of the public service, private sector, NGOs, IGOs, donors, communities and other stakeholders in the management of forests;
- Improve efficiency in delivering public services reaching priority groups and areas;
- Conduct a human resource development (professionals, scientists, artisans etc.) programme;
- Correct omissions/gaps in forest texts where afforestation or reforestation is practically ignored.

The mission recommends improving ecosystems monitoring and evaluation by:

- Conducting a national forest assessment as reference for a viable analysis of forest cover status;
- Creating a computer network to facilitate exchanges between the country's operating structures;
- Developing a reliable statistical database to improve forest planning, management and development;
- Providing the forestry sector with the necessary computer science and information technology.

The main recommendations for improving resources' management and utilization are to:

- Evaluate the most appropriate mechanisms of forest management;
- Select successful species/varieties according to different agro-ecological conditions and purposes;
- Share knowledge with stakeholders by incorporating it in operation guidelines and codes of practice;

- Pay greater attention to cultural diversity and rights and traditional knowledge of tree culture;
- Collect data/information on NWFPs, at different times, according to socio-professional categories;
- Strengthen organizational capacities of traditional medicines and develop mechanisms to establish credibility with their relationship with modern medicine.

In terms of research it is recommended to:

- Stimulate the frameworks and networks of dialogue between forest researchers, professional foresters, local communities and other stakeholders in the forestry sector;
- Install a network of permanent sample plots in all forest types to improve the understanding of the dynamics of tree increment and growth of various types of forest settlement;
- Introduce modern forest equipment and associated training for the treatment of statistical data;
- Build the technical systems of reference on methods of pruning of wood fodder trees;
- Develop tools to relate management of selected trees on selected sites with the quantity and quality of fruit or fodder production;
- Conduct research on high-performance forest species/varieties to reach the national production and protection objectives under variable agro-ecological conditions.

With regard to training it is essential to:

- Design multi-level education/training programmes to upgrade training/graduation of needed qualified professional, scientist, technician, artisan and other support staff for the sector;
- Strengthen the experience acquired from the environmental education programme and extend it to all other sectors of activities.

Introduction

Mali's vast natural resources' potential is rich and diversified, but confronted with strongly marked degradation processes that translate into desertification, particularly over 75 % of the national territory, namely in the Saharan and Sahelian zones.

Faced with the situation's gravity, the Government of the Republic of Mali, taking into consideration article 15 of the constitution² is committed, together with its partners, to undertaking various actions, namely the:

- Implementation of the National Desertification Control Plan developed in 1985;
- Commitments made at the United Nations Conference on Environment and Development (UNCED) in 1992, at Rio de Janeiro (Brazil);
- Signature and ratification of the United Nations Convention on Desertification³ (1995); and
- Development of the National Environmental Action Plan (PNAE) and of National Programmes of Action.

Mali considers environmental management and desertification control as inseparable and has based the development of the PNAE/PAN-CID on:

- Participatory approach;
- Reform of legal and regulatory texts;
- Poverty eradication.

Despite promising results, rural development in Mali needs to take up the following challenges to become sustainable:

- Base its sustainable development on efficient production systems able to face up to food insecurity and desertification issues;
- Achieve decentralization with the necessary transfer of responsibilities, particularly with regard to natural resources' management;
- Take into account the specific conditions of women and marginal groups in formulating and implementing the natural resources' management training policy.

This study was carried out as part of implementing the IPF proposals for action related to sustainable forest management in the Low Forest Cover Countries (LFCCs), consistent with the FAO Strategic Framework and Medium Term Planning of the "Teheran Process". Its objectives as defined at the IPF meeting⁴ in Teheran that reviewed the main constraints to sustainable forest management are:

² Article 15 states that "all persons are entitled to a healthy environment and that environmental protection and quality life promotion are duties for all citizens as well as for the State".

³ The list of the main U.N. conventions signed and ratified by the Republic of Mali is given in Annex IV

⁴ October 1999.

- Enhance the role of planted forests, trees outside forests (TOFs) and non-wood forest products (NWFPs) in integrated landscape management in LFCCs, within the framework of the national forest programmes; and
- Foster multi-disciplinary and inter-sectoral collaboration at the national, regional and international levels.

This case study carried out in the Republic of Mali is a contribution to achieving the above objectives. It synthesises information related to the forestry sector and reviews the main geographic, demographic and economic characteristics of Mali, as related to food security, forestland tenure and users' rights, natural and man-made forest resources, deforestation, forest degradation, desertification and afforestation.

The case study then introduces the policy, legal and planning frameworks and analyses the government's commitment to sustainable management of forest ecosystems for the benefit of rural populations. It also describes the inter-sectoral relations and conflicts related to policy development options and land utilization and analyses their possible impacts on the forestry sector.

The case study also details data and information related to the significance of man-made forests, TOFs and wood and non-wood forest products, stating their role in providing goods and services. The paper reports on the perception that beneficiaries and partners have with regard to the priority policy options in terms of sustainable forest management, and outlines the causes and effects of deforestation and degradation together with lessons learned and the priority needs, and formulates recommendations to enhance the role of planted trees.

1. General Overview

1.1 Background setting

1.1.1 Brief geographical and historical country description

The Republic of Mali is situated in the centre of the Sahel, between 10⁰ and 24⁰ N latitudes, covering a vast area of 1 240 192 km². It is deeply landlocked within Western Africa, bordered in the Northeast by Algeria, in the East by Niger and in the South by Burkina Faso, the Ivory Coast, Guinea, and to the west by Senegal and Mauritania.

The country's land relief is dominated by a vast peneplain ranging between 200-400 meters above sea level⁵ characterized by:

- Sandstone plateaux, south of 14th parallel. These are frequently interrupted by cliffs and rocky escarpments 700 m and higher in the south-west, near the border with Guinea at Mount Mandingues, east of the Dogon Plateau up to Mount Hombori, where the country's highest elevation reaches 1 153 m;
- Flat and hilly watersheds of Senegal and Niger rivers at the Centre;
- Sandy and rocky pediplains respectively to the north and northeast;
- The eroded mountains of Adrar des Iforas, at the border with Algeria.

⁵ Altitudes will be indicated in meters (m) throughout the rest of the text.

1.1.2 Economic and demographic characteristics

The agricultural sector dominates the economy of the country, employing 80 percent of the working population (MEPI, 1998). With 42% of GDP, it comes in second place after the service sector (44 % of GDP). Revenue from country exports are mainly from cotton, livestock and recently, gold. The dominant imports are energy products and capital goods (UNICEF, 1995).

A great deal of work has been undertaken lately, aimed at promising economic perspectives, despite socio-demographic indicators showing the existence of a massive and rather worrisome poverty situation (MEPI, 1998).

The population was estimated at 9,2 million in 1996. Mali has one of the highest demographic growth rates in the world with an average natural growth rate of 3,2 %. Despite a relatively low population density (about 7 inhabitants/km²), its capacity to protect the environment is rather limited due to severe agro-climatic conditions. There is high urbanization, and one in five persons live in Bamako. About 46 % of the population is less than 15 years old. Life expectancy is 58 years.

1.1.3 Governance and administration

Governed under the 12 February 1992 Constitution, the Republic of Mali is divided up into eight administrative regions (Kayes, Koulikoro, Sikasso, Ségou, Mopti, Tombouctou, Gao and Kidal) and the capital district of Bamako, each of which is under the authority of an appointed governor. The regions are divided into 51 Circles (districts), which are divided into rural communes.

Decentralization is aimed at giving people greater control over their own affairs in terms of administration and other economic, social and cultural issues. It has been speeded up with the advent of the “Third Republic” in June 1992. There have already been profound changes in the services of State, notably in rural affairs. These changes have been supported by legal texts and regulations, including the Code of the Territorial Communities, the laws on taxing communes and communal personnel.

The “Etats Généraux” held in 1992 defined new orientations granting much importance to developing the private sector. It proposed new distributions of tasks between the State, Civil Society and the Communes. At present, the Regional Assemblies, the Communal Councils and the Councils of Circles are established and benefit from funding.

Despite people’s motivation and the corroboration of the process, decentralization is taking place slowly, following the pace of legal and regulatory texts and that of human resources’ development. The next steps of the decentralization process include implementing a High Council of Collectives, transferring expertise, accelerating the division of areas of collectives, and working out management and development plans.

1.1.4 Policy, Institutions, National Development plans

The first structural adjustment programme was implemented in 1982. It leaned toward a liberal policy in economic development and undertook reforms aimed at ensuring economic growth in a favourable socio-economic and political environment that centred on the market.

The Economic and Financial Programmes (1992–1996), funded through the Triennial Public Investment Programme (1997–1999) have shown these positive results:

- Increased livestock exports, recovery of industrial production and rise in export level, especially for cotton and gold;
- Inflation kept down from 33 % during the 1994 deflation to 12,7 percent in 1995, and 6,5 % in 1996. It is expected to lead to an inflation rate of less than 3 % in 1999; and
- Reduction of global deficit from 13,7 % in 1994 to 10,5 % in 1995 and then to 7,9 % in 1996, finally reaching under 7 % in 1999.

There is a genuine political commitment to establishing mechanisms aimed at inducing high performances and competitiveness of the Malian economy in a context of people-friendly economic reforms. The economic recovery will have to translate into financial viability in the mid-term and poverty alleviation and into improved living conditions in the long-term. This necessitates getting rid of environmental constraints, making use of the following policies and strategies:

- Decentralization and country planning that aim at reinforcing the democratising process and adapting the government missions to promote local initiatives;
- Poverty alleviation policy that takes account of people's specific needs and aims at improving the environment;
- Action plans aiming at the promotion of women;
- Communication for Development policy to establish a dialogue among decision-makers and communities regarding the stakes of development;
- Sectoral policies, such as the General Plan for Rural Development, the General Plan for Water Resources' Development, the Domestic Energy Strategy, and the Urban, Transport, Public Health and Hygiene, Mining, and Commercial and Handicrafts' policies.

Generally speaking, environmental issues are of major concern to the government, even when tackled partially or sectorally.

1.2 *Environmental characteristics*

1.2.1 Geology and soil

The platform is composed of metamorphic rocks, quartz, schist, gneiss and old eruptive rocks. This platform was initially covered with primitive sediments, especially sandstones and other

more recent ones that formed the sands of the Saharan part and those found in the alluvial system of the rivers.

The main soils encountered are generally characterized by strong deficiencies in phosphate and a great spatial variability thereby providing a mosaic of soil units, even at the scale of small surface areas. The most widespread soils are arid brown forest soils and ferruginous soils on sandy material. The deep sandy soils, either hydromorphic or consolidated, are found in the Delta.

1.2.2 Climate

Mali's climate is characterized by:

- High temperatures (average annual of 26°C) with strong discrepancies (12 to 16°C) in the North and more moderate variations in the South (3 to 4°C); Modest minimum temperatures are observed in December and July;
- A rainy season controlled by the Inter-tropical Front displacement. It lasts for 7 to 8 months in the South and only 3 months in the Sahelian area; and
- A dry season (during which the hot dry Harmattan wind blow from the desert) aggravates the moisture deficits.

During the past three decades the climate has been marked by recurrent droughts, which have resulted in the displacement of the isohyets some 200 km southwards (PNAE, 1998) and lead to the decline and dying out of many forest stands and severe environmental degradation.

The various climatic types of Mali alternate and follow strips which are somewhat parallel to the latitudes. They are defined by a growing precipitation gradient from North to South. The country's ecologic zoning is based on the mean annual rainfall criterion. It allows the distinction of the following climatic domains which are well adjusted to vegetation and human activity (PIRT, 1986).

The Saharan zone

This zone (rainfall under 200 mm) covers 632 000 km², i.e. 51% of the country surface area. This zone is desert-like and covers the Kidal region and most of Timbuktu and Gao regions. Highly degraded following influences due to human activity and climatic factors, the vegetation is made of short-cycled grasses and spiny shrubs (*Acacia raddiana*) located on fresh sites (wadi beds, depressions, oases). This zone encompasses 4 260 ha of forest and reserved woodlands, where endangered fauna (gazelle, peregrine falcon, bustard, dabrah, and ostrich) and fauna threatened of extinction (giraffe, big horn, and addax). Notwithstanding a fodder/forage productivity of 0,1 ton/dry matter/ha/year and a range stocking rate of 1 TLU⁶/44 ha, extensive livestock breeding is the main production system.

The North Sahelian zone

This zone (Sahelo-Saharan zone) with mean annual rainfall ranging between 200-350 mm characterized by the presence of dwarf and spiny-shrub steppes is the nomadic zone where livestock breeding is the main activity.

⁶ TLU = Tropical Livestock Unit.

The South Sahelian zone

This zone (Sahelo-Soudanian zone) with mean annual rainfall ranging between 350- 550 mm is characterized by spiny-shrub steppes.

Together, zones 2 and 3 cover a surface area of 285 000 km², representing 31 % of the national territory and encompass tropical ferruginous and erosion prone soils, whose development is restricted by a low to medium fertility, an arid climate and irregular rainfall. Highly degraded soils and vegetation are the habitat to wildlife species threatened of extinction, namely gazelles, damah, dorcas and “rufifrons”, “hyppotragues” ostriches and a herd of about 600 elephants (MDR, 2000).

The northern Soudanian Zone

With a mean annual precipitation ranging between 550-750 mm is the shrub savannah and *Combretum spp.* zone.

The southern Soudanian zone

It occupies 215 000 km² (17,5 % of national territory). Mean annual rainfall ranges between 750-1 100 mm. This is the tree savannah zone. The most common soils are the erosion-prone immature soils (superficial on platform) and the tropical ferruginous soils, which are more fertile and less sensitive to water erosion. The forest resources are rich and diverse and include such species as *Isobertina doka*, *Anogeissus leiocarpus*, *Vitellaria paradoxa*, *Detarium microcarpum*, *Pericopsis laxiflora* and *Pterocarpus erinaceus*. Large mammals include the “Guib harnaché”, warthog, “Hyppotrague”, “Cob de Buffon”, lion, Hippopotamus and manatee.

The northern Guinean zone

It covers 75 000 km² (6 % of the country). It is located at the extreme South, where mean annual rainfall exceeds 1 100 mm. It includes open forests (woodlands) and riparian forests along watercourses, where *Daniella oliveri*, *Detarium senegalensis*, *Detarium microcarpum*, *Vitellaria paradoxa*, *Pericopsis laxiflora*, *Pterocarpus erinaceus* and numerous vines (*Saba senegalensis*, *Landolphia heudelotii*) are dominant. It is home to a wildlife population of primates (green monkeys, Patas and baboons), antelope, lions, elk, derby and dwarf buffalos which are threatened by extinction.

1.2.3 Biological resources

There are varied biological resources due to the diversity in the ecosystems and the variable ecological conditions fashioned by a mean annual rainfall gradient ranging from less than 100 mm in the north, to more than 1 300 mm in the south, and by the existence of a vast network of rivers, lakes and mountain ranges. These resources include:

- Flora: there are 1 739 species of woody species belonging to 687 genders distributed in 155 families; eight species are considered to be endemic (MEATEU, 1989);
- Terrestrial fauna: It includes a wide diversity of species with reduced individuals. There are 136 mammal species, 70 of which are large mammals (UICN, 1989);

- Avian fauna: There are at least 640 species of birds 15 of which are considered to be rare. The central delta of the Niger river constitutes a valuable reproduction habitat for migratory birds;
- Ichthyologic fauna number 143 species of fish belonging to 67 genders and 26 families.

These indispensable biological resources provide food, fuel-wood, medicine, feed, and a large source of income in rural areas, where they play a major social, cultural and environmental role. However, despite the important policy, legal, regulatory and institutional measures initiated, Mali's biological resources are victim of degradation, due mainly to a host of manmade factors (deforestation, overgrazing, poaching, illegal fishing, bushfires, and agronomic pesticide use) and extremes in climate (drought).

1.2.4 Water and land resources

Water resources

Mali's hydrographical network is characterized by:

- An important fossil network north of the 16th parallel that benefits from rare, reviving rainfalls;
- Mali's division in the southwest by the Senegal River basin, and in the Centre and the East, by the vast Niger River basin. Both rivers originate in the Fouta Djallon in Guinea.

Born at the confluence of the Bafing and Bakoyé watercourses, the 1 700 km long Senegal River drains Mali over 800 km, providing an average flow of 669 m³/second. The Niger, a 4 200 km long river, which runs 1 700 km within Mali, has an average flow at Koulikoro of 1 550 m³/second. It forms within the Macina, between Timbuktu and Mopti, a vast network of lakes and swamps. Its inner delta watershed occupies 30 000 km², of which two-thirds are flooded in normal rainy years. The delta is of great economic importance, particularly downstream, at the "Niger Loop", where most human activities are punctuated by the river's floods.

Land resources

Mali's forested zones are used as valuable agricultural land banks for the extension of subsistence and cash crops. While this "land bank" function has a large economic significance, it is difficult to reconcile with the necessity to preserve and improve the multiple protective functions derived from the existence of forests. This is an important, but conflicting requirement and a major challenge to sustainable development in Mali.

The land-use situation is characterized by:

- Potentially arable lands cover 30 million ha (24 % of the country). Some 2,2 million ha potentially irrigable land are located south of the Saharan zone. Lands actually exploited (crop and fallow) amount to only 11,4 million ha, due to restrictions from river blindness epidemics and inaccessibility of the southern and south-western areas that lack road infrastructures (PIRL, 1991);

- Land cultivated annually ranges from 3,0 - 3,5 million ha. The area has increased at the annual rate of 15 % since 1970 (DNSI, 1997);
- The transhumant livestock breeding Sahelian zone occupy 24% of the national territory. It has undergone desertification as a result of decennia of recurrent droughts;
- Half of Mali's land area (51 %) is made up of deserts and arid areas where economic activity is almost impossible.

Table 1 presents the types and mode of occupation and utilization of forestlands in Mali, according to a national classification (Maïga 1999).

Table 1: Occupation of forest lands following bioclimatic zones of Mali

National classes	Areas
Desert	37 200 000 ha
Desert steppe	26 000 000 ha
Dwarf-spiny-shrub steppe	9 900 000 ha
Steppe of savannah with <i>Balanites</i> , <i>Euphorbia</i> , <i>Acacia</i> and Doum	19 800 000ha
Shrub and tree savannahs with "Borassus", "Balanza" and <i>Acacia</i>	9 300 000 ha
Guinean savannah, dry-dense and open forests	7 500 000 ha
Soudanian savannah woodland with <i>Combretum</i> , "Karité" and "Néré"	7 500 000 ha
Soudanian savannah	6 800 000 ha
Total	124 000 000 ha

Source: Maïga, 1999

1.3 Human Factors: Socio-economic Characteristics

1.3.1 Population, Demography

The 1998 general census estimated the population of Mali to be 9,8 million (80 % living in rural areas), compared to 7,7 million in 1987. The average growth rate of 2,2 % is variable according to regions: It is 0,1 % in Timbuktu, 1,2-1,2 % in Mopti and Gao, 2,1 % in Ségou, 2,5-2,8 % in Koulikoro and Sikasso and 4 % in Bamako. More than 91 percent of the population live on 30 percent of the country⁷. Population densities vary from 0-1/inhabitants/km² in the North to more than 30/inhabitants/km² in the South. Fifty percent of the population is less than 15 years old, as opposed to 3 % being more than 65 years old. Women count for approximately 51% of the population (MDR/CPS, 2000).

Unemployment prevails throughout the country, particularly in urban areas. In rural areas, lack of employment seems less important because people cultivate crops if weather permits. However, disguised under-employment and unemployment are more striking in rural areas, where they constitute the main causes of poverty.

⁷ Particularly in the regions of Kayes, Koulikoro, Sikasso, Ségou, Mopti and the District of Bamako.

1.3.2 Economic overview

The economy mainly relies on the rural sector dominated by agriculture and livestock breeding, contributing (between 1994 and 1998) an average of 45 % of GDP. The mean annual growth rate of 3,6 % is mainly due to an increase in cereal (especially rice), cotton, fruit, animal husbandry products and vegetable production. These contribute 75 % of the export earnings, with almost 50 % for cotton and 20-30 % for animal husbandry exports (meat and leather).

Table 2 displays the diverse rural development sectors' contribution to the value added by agriculture for the 1994-1998 period. It shows that forest products have experienced a growth rate comparable to the agricultural sector's mean growth rate. This contribution to the agricultural value added is twice as large as that of animal husbandry.

Table 2: Contribution of the diverse rural development sectors to agricultural added value

Rural development sectors	Growth rate*	Growth impact**	Contribution to AV***
- Non-rice subsistence agriculture	+ 3,3 %	+ 0,8 %	51,7 %
- Consolidated rice branch	+ 12,7 %	+ 0,8 %	2,7 %
- Industrial agriculture outside cotton	- 1,0 %	- 0,1 %	7,8 %
- Consolidated cotton branch	+ 9,4 %	+ 0,9 %	28,8 %
- Animal husbandry	+ 1,6 %	+ 1,6 %	4,2 %
- Fisheries	+ 1,4 %	+ 1,4 %	1,7 %
- Silviculture, gathering of forest products	+ 3,5 %	+ 3,5 %	8,5 %
Total agriculture	-	+ 3,5 %	100 %

Source: MDR/CPS, 2000

*Agricultural sector's growth rate;** Impact on the agricultural sector's growth;***Added value of the agricultural sector

Agricultural sector

The main agricultural production systems are extensive and therefore reflect producers' adjustment mechanisms and strategies as imposed by the soil, climatic and socio-economic conditions of their environment. Production systems are grouped into two major systems - pastoral and agro-pastoral, according to the importance of livestock breeding or agriculture. There are also specialized peri-urban, semi-intensive and intensive systems that appear in the big cities.

Pastoral systems

Rangeland systems are based on extensive livestock breeding by nomadic herders looking for grazing and water, contributing to degradation of resources following prolonged concentration of herds around watering places. These systems are divided into:

- Purely nomadic Touareg and Moorish systems applied in the Saharan zone, which are characterized by a high human and animal mobility, according to pre-organized routes;
- Systems associated with rain-fed subsistence crop cultivation and locally with gardening and date palm cultivation as put into practice by the Moorish at Kayes and Koulikoro,

the Peuhls in the Nioro and Nara areas. Family units are sedentary, transhumant herding being left to herders;

- Systems associated to spate farming carried out by Peuhl livestock breeders in the flooded plains of the Niger inner delta around Timbuktu and Gao. The herds are moved in the winter crop season⁸ and return to feed on crop residues.

Agro-pastoral systems

Crop cultivation is the chief activity and livestock breeding represents less than 30 % of agricultural revenues. Being largely extensive, these low-equipment systems make little use of either mineral or organic fertilization. They are differentiated in terms of agro-ecological and socio-economic conditions as well as farming types as follows:

- Systems based on rain-fed food crops⁹ that prevail in all regions (except Kidal) and on which 30% and 20 % respectively of Mali's human and animal populations depend;
- Agro-pastoral systems based on rice crops are in areas flooded by the Niger, Bani and Senegal Rivers. The surfaces concerned and the yields according to irrigation, management, hydro-agriculture and control of water are:
 - 150 000 ha of traditional irrigation producing rice are weak through free flooding; rice yields are low (700 kg/ha) and depend on rain and/or rises in water level;
 - 50 000 ha of irrigation by controlled flooding in the flooded plains of the Niger and of Bani. The yield is also low (1 T to 1,7 T/ha) due in part to lack of fertilization;
 - 8 000 ha rice in small irrigated areas of the village where, with support of the Rice Services, are from 4,5 to more than 5 T/ha); and
 - 50 000 ha with total control of water (by gravity) in hydro-agricultural areas according to the model of the Niger Office, with obtained yields of more than 5 T/ha.
- Systems based on cotton cultivation in the CMDT zone that covers the Sikasso region and part of the Koulikoro and Ségou regions. While they contribute significantly to the country's agricultural production, these systems are also blamed for soil degradation and fertility exhaustion as well as for deforestation, given that their area has increased threefold since 1989;
- Specialized peri-urban systems found around large cities in the Soudanian zone, where consumers' markets induce a socio-economic environment favourable to diversifying and intensifying production (poultry farming, fattening up, milk, market gardening, fruit tree cultivation, flower-growing).

The main constraints to intensifying these farming systems include:

- Low levels of agricultural inputs (mineral and organic fertilizers, pesticides, herbicides) and equipment (animal and mechanic traction), which are linked to low revenues and difficulty to gain access to credit
- Conflicts and excessive tenure and animal pressure that result in overexploitation and degradation of natural resources;

⁸ Specific to tropical regions: Hivernage in French.

⁹ Bread millet, sorghum, beans (Niébé), peanut, fonio

- Isolation of some production zones, which are devoid of road infrastructure¹⁰.

Forestry sector

The forestry sector is fundamental to the national economy. It satisfies 93 % of the country's domestic energy needs and contributes 8,5 % to the agricultural added value (1994-1998) and has a satisfactory global production/consumption balance. However regional disparities exist. The production in the southern zones exceed local requirements, while the northern regions and the zones around large urban centres are in deficit and tend to see their deficits grow with time.

Wood fuels

Bamako's 1994 wood fuel consumption¹¹ reached 600 000 tons wood equivalent (330 000 tons fuel-wood and 40 000 tons charcoal) and generated FCFA 10 billion, generating many jobs in rural as well as in urban areas. It has increased drastically to reach 750 000 tons wood equivalent with 75 000 tons of charcoal in 1997.

Wood fuel requirements come to 0,9 m³/inhabitant/year (SED, 1996). Considering the population increase, the requirements should amount to 7 million tons by 2010. It will be a serious challenge to meet this target.

Other wood resources

The forestry sector provides some 60 000 m³ of industrial wood annually (MDRE/CPS, 1998 cited by Yossi and Kouyaté, 2001), which represents 5-10 % of the supposed national requirements (MEATEU, 2000).

Non-wood forest products (NWFPs)

Forests provide other products including medicinal plants, forest fruits and diverse raw materials that contribute to the handicrafts industry and to improving rural livelihood conditions. Other NWFPs are:

- “Karité (shea) butter” derived from *Vitellaria paradoxa* and whose production reaches 80 000 tons/year;
- Gum Arabic whose production amounts to 2 100 tons annually;
- Honey, with a traditional production of 190 tons/year;
- The “Néré” (*Parkia biglobosa*) fruits, the baobab (*Adansonia digitata*) leaves, doum palm etc.
- Forage and fodder.

Food security

Forestry contributes also to food security through hunting and fishing, which satisfy a good deal of the animal protein needs. Fishing in particular is very important to the national economy, as it generates 70 000 direct jobs and creates indirect employment for 500 000, i.e. the equivalent of 7 % of the total working population (MEATEU, 2000). Activities related to hunting seem to hold potential, particularly with regard to the development of hunting tourism.

¹⁰ Mali has only 0,9 km of practicable tracks per 100 km².

¹¹ As estimated by the “Stratégie Energie Domestique/Bolet Offre” (SED)

2. Forest Resources: current status and management

Mali's forestry sector is confronted with the relentless degradation of its vegetation, wildlife and fisheries resources. The national forest estate endures local deforestation processes, particularly in:

- The Sahelian zone, victim of excessive animal pressure on woody rangeland resources;
- Areas providing urban centres with wood fuels; and
- Areas under strong pressure for agricultural land extension, particularly in the South.

This situation is due in part to the deteriorated relationships that have prevailed between the forestry administration and the forest resident population which is the victim of traumatic repressive experiences. It is aggravated by the many conflicts of interest and disputes that exist between various users of natural resources. Moreover, the lack forestry integration to the national economy and of investment in the various forest products' options has also contributed significantly to forest resources' degradation.

The forestry sector aims at a 7 % economic growth in the coming years. However the development of the agro-sylvo-pastoral sector may jeopardise the forest assets, unless sustainable management measures replace the prevalent predatory practices (MEATEU/DNCN, 2000).

Commendable efforts have been undertaken the last two decades resulting in the drafting of the National Forestry Policy in 1982, the development of numerous forestry projects, and the introduction of new forest development approaches supporting greater community participation. The outcomes of these efforts have been used in formulating a new forest policy.

2.1 Forest Inventory and Information Systems

As with other dry tropic African countries the status of forest resources and trends in development are not well known in terms of quantity, quality and variability. The only projects attempting to fill in these gaps were carried out in the centre of the country. They were too localized. They are now obsolete because of the damage studied. Mali requires a national forestry inventory and regular follow-up to quantify all features of its forest vegetation to support future sustainable management.

There is great disparity in the estimate of forest cover. The first study that evaluated wood resources was carried out in a 1982 regional study by FAO. It was estimated that the total forest cover was 15,5 million ha. Studies were carried out between 1985 and 1991 under the framework of an inventory and surveillance project on forest and woodland resources (PIRL¹²). It was estimated that the total surface of forest formations on five regions as 32,4

¹² Projet Inventaire des Ressources Ligneuses et Occupation Agricole des Terres au Mali.

million ha with a standing volume of roughly 516 million m³ and a very low productivity of about 0,86m³/ha/year (Touré, 2000).

2.2 Characteristics of the Forest Estate

2.2.1 Total forest estate

According to the law¹³ that sets conditions of forest resource management, the forest estate covers 91 % of the national territory and is divided into:

- State owned forest estate, forest estate (Art. 33), which includes: reserved forests, afforestation, reforestation and 16 protected zones (MEATEU/DNCN, 2000, a);
- Forest estate of decentralized territorial communities, which includes afforestation and protected zones (Art. 51); and
- Private forest estate (Art. 60), which includes natural and planted forests transfers. The same law specifies in its Art. 61 the limits within which these private owners may exert ownership rights.

2.2.2 Natural forests

Natural forests are believed to cover almost 33 million ha. Table 3 presents the main administrative forest categories, south of the Saharan zone.

Table 3: Administrative forest categories

Categories	Number	Area	Total
Reserved forests	119	1 300 000 ha	4 %
Protected areas - National parks - wildlife reserves - Ramsar sites		3 900 000 ha	12 %
Protected Forests		11 400 000 ha	36 %
Agroforestry Parks - fallow lands		15 700 000 ha	49 %
Total		32 300 000 ha	100 %

Source: (PIRL 85, 91 - DNRFFH, 95).

2.2.3 Planted forests

Planted forests consist of trees deliberately planted or seeded for afforestation or reforestation, and composed of local or exotic (one or two) species, with even age class and regular spacing. The first plantations in Mali were carried out prior to independence over 500 ha¹⁴ in the forest

¹³ Article 24 of law No 95004 of 18/01/1995.

¹⁴ Source: The compilation of annual forest reports allowed to the extraction of all data relating to plantations.

reserves in Kayes, Faya and Mount Mandingues regions. In 1981 they were continued in a vast afforestation/reforestation project.

Table 4 details the areas of industrial forest plantations carried out in Mali as extracted from various annual campaign reports and other documents provided to the mission.

Table 4: Summary of industrial forest plantations in Mali¹⁵

Years	Locations	Areas
1960	Faya, Monts Mandingues, Kayes	500,00 ha
1974	Faya	21,00 ha
1976	Faya	14,00 ha
1977	Faya	110,00 ha
1978	Faya	201,00 ha
1979	Faya et Monts Mandingues	216,00 ha
1980	Faya et Monts Mandingues	216,00 ha
1981	Faya, Monts Mandingues, Kayes	578,50 ha
1982	Faya, Monts Mandingues, Sikasso (F, M ^{ls} M, Si)	538,42 ha
1983	F, M ^{ls} M, S, Ségou, Koulikoro, Kayes, Gao, Mopti (Se, Ko, Ga, Mo)	844,89 ha
1984	F, M ^{ls} M, S, Se, Ko, Kayes, Ga, Mo	1145,40 ha
1985	F, M ^{ls} M, S, Se, Ko, Kayes, Ga, Mo, Tombouctou, Bamako	1 026,08 ha
1986	F, M ^{ls} M, Si, Ko	737,98 ha
1987	F, M ^{ls} M, Si	634,00 ha
1988	F, M ^{ls} M, Si, Kayes	917,57 ha
1989	F, M ^{ls} M	601,45 ha
1995	Ségou	105,26 ha
1996	Ségou et Kita	53,50 ha
1997	Ségou et Akita	57,21 ha
1998	Ségou et Kita	81,85 ha
1999	Ségou et Kita	133,58 ha
2000	Ségou et Kita	213,19 ha
2001	Ségou et Kita	249,44 ha
Total		9 196,32 ha

Source: Several annual reports

Types of plantations

Industrial plantations established since 1974 cover about 8 700 ha. Lately, they have been established in Bamako's suburbs by the ex-OAPF (present UGF) and around Sikasso in the framework of the "Opération Aménagement et Reboisement de Sikasso (OARS) et autour de Kayes" (ceinture verte). The Niger Office establishes other demonstration and experimental rain-fed or irrigated plantations, as part of the nurseries and village afforestation projects of the Mopti and Koulikoro regions. Village afforestation expanded from 1981 for one decade up until 1991 and achieved 40 000 ha and almost 4 000 kilometres of linear plantings.

Constraints

The substantial successes achieved by the "Opération pour un Mali Vert" programme, have attracted both public and decision-makers attention, despite difficulties encountered in

¹⁵ These are industrial plantations. The absence of information for the period 1990 – 1994 is supposed to be related to the disturbances that occurred following the 1991 crisis.

mobilizing resources and in conciliating planting and agricultural calendars. The main constraints to forestation are:

- Climatic, particularly vis-à-vis the bad spatial and temporal rainfall distribution, which result in 10 – 15 day-long droughts in the middle of the planting season;
- Socio-economic, in particular the difficulty of mobilizing communities in good time for the planting operations, straying animals, and difficulties in distribution of forest products;
- Difficulties in meeting qualitative and quantitative seed gathering requirements;
- Mobilizing nursery activities funds on a timely basis.

2.2.4 Trees outside forests

Trees outside forests (TOFs) here contribute positively to food security and poverty alleviation in providing various consumed products (fruit, leaves, tubers, “aliments¹⁶” fodder and wood) that contribute to improving household income. Additionally TOFs enhance agricultural productivity (shelter/shade/fertility), soil conservation, crop protection, aesthetics and recreation in and around cities and fulfil spiritual functions (sacred woods and places of worship).

TOFs in Mali include trees on village lands’ (terroirs)¹⁷ that contribute to soil fixation and fertility, crop protection against winds, aesthetics and recreation, shading, as well as fruit, fodder, medicinal products and wood production (Yossi and Mallé, 2001). The main systems related to this new concept¹⁸ include fruit orchards, shade and linear plantations, live hedges, village plantations and forests, urban trees, parks and gardens.

Agroforestry parklands

These cover 39 percent of the country and constitute the dominant system where various agro-ecological features according to the agro-ecological areas where they make up about 90 percent of agricultural land (PIRL, 1998. cited by Boffa, 2000).

The Institute for Rural Economy (IER) and the International Agroforestry Research Centre (ICRAF) have identified 20 types of “karité” (*Vitellaria paradoxa*) parks covering 415 700 ha in the Medium Bani Niger zone, and 17 *Faidherbia albida* parks covering 397 700 ha in the Gondo plain (Boffa, 2000, and Yossi and Kouyaté, 2001)

As well, there are *Parkia biglobosa* agroforestry parks associated with “karité” in the South, and *Acacia Senegal* parks that cover one sixth of the Malian territory, and have a potential Gum Arabic production capacity of 100 000 tons (FAO, 2000). Agroforestry parks of *Sclerocarya birrea*, *Adansonia digitata*, *Tamarindus indica*, *Sterculia setigera* and *Cordia pinnata* are also found.

¹⁶ In French: natural food stuffs with therapeutic properties for some illnesses (FAO, 2001 b).

¹⁷ Woody multipurpose trees outside the forest ambience.

¹⁸ The Trees Outside Forests concept appeared in 1995.

Fruit orchards

These are essentially mango and orange trees, primarily located in four main production zones, namely: the “Opération Haute Vallée du Niger” zone (Koulikoro, Banguinéda, Bamako District and Kati Circle), the Sikasso region, the Kinéba Circle (Yossi and Kouaté, 2001). Vast plantations of *Anacardium occidentale* and *Parkia biglibosa* exist in the southern Guinean zone.

Village and urban man-made forests

These include roadside plantings, shade trees, green spaces (parks and gardens), and greenbelts.

Village plantations were started in 1981 to satisfy the overwhelming fuel-wood demands, which natural forests were no longer able to satisfy. They were also conceived as an alternative to the costly State-run afforestation projects. Incentives were provided with incentives and assistance by the forest service in the form of nurseries in each administrative circle.

At the start, the village works resulted in the establishment of 14 forest nurseries. In addition there were plantings of 22 ha and 7 700 shade seedlings in the Kayes region, 106 ha at Sikasso, 4 ha and 6 800 shade trees at Ségou as well as 5 000, 34 000 and 11 900 shade trees respectively at Mopti, Timbuktu and Gao.

Urban plantations in most of Mali’s large cities were established during the colonial period and roadside plantations using *Kaya senegalensis* were retained and protected. Later on, fruit orchards were established within home estates at the outskirts of large cities, especially Bamako. Protected by *Eucalyptus* windbreaks or live hedges, these orchards produce substantial volumes of wood and contribute significantly to satisfying Bamako’s wood fuel needs.

Trees and live hedges are established as roadside plantations, while shade trees are generally planted within private home estates or around houses. These plantations are common in Bamako, particularly in the administration district. They have not yet been assessed.

Agro-silvicultural plantings

These include windbreaks, live hedges and countryside plantings.

Protection plantations

They concern sand dune fixation, watershed plantations and greenbelts.

Silvo-pastoral afforestation

It aims at protecting water points and improving rangelands.

Table 5 presents the diverse plantation types (other than industrial afforestation) established over the entire country between 1986 and 2000.

Table 5: Area (ha) and length of diverse types of plantations in Mali between 1986 and 2000

Years	Types de plantations						Total	
	R & U* ha	D & E** ha	ASV***		S & P****			
			ha	km	ha	km	ha	Km
1986	8	NA ¹⁹	452	-	90	-	550	-
1987	14	NA	955	-	11	-	980	-
1988	1 531	216	1 233	-	256	-	3 236	-
1989	3 147	191	797	171	818	1	4 953	172
1990	1 832	181	840	303	844	-	3 697	303
1991	1 246	128	263	845	382	-	4 389	845
1992	1 035	90	345	6	223	-	1 693	6
1993	1 135	35	898	1	125	-	2 193	1
1994	1.417	177	1 351	390	579	-	3 524	390
1995	1 184	289	806	666	228	-	2 507	666
1996	2 365	29	1347	479	281	-	4 022	479
1997	NA	NA	NA	NA	NA	-	4 877	647
1998	1 118	2	232	1	386	-	173	1
2000	509	2	3028	1	601	-	4 140	1
Total areas and lengths of diverse plantation types							42 497	3 814

Source: Compilation of information found in annual reports of the DNRFFH and the DNCN (1986-2000 - year 1999 lacking). *Rural and Urban. **Demonstration/experimental.

Agro-sylvicultural.*Sylvo-pastoral and protection.

There is insufficient information on types of afforestation and reforestation due to variations in data in reports. The results obtained by the mission are somewhat inferior to those reported by Konaté and Gakou (cited by Maïga, 1999), who assess Mali's total of forest plantations up until 1999 to be 60 296 ha, and those recorded by Maïga (1999) who estimates them at 43 796 ha afforestation and 4 484 km of linear plantings.

Table 5 illustrates an increase in mass plantings established since 1998 followed by a slight reduction in 1992, probably as a result of the 1991 crisis. The same trend is observed with regard to line plantings, which increased since 1989, only to decrease as of 1998. A change in policy took place in 1996, offering afforestation better organizational and sustainability conditions in the framework of the "Opération pour un Mali Vert" programme. In order to better appreciate the potential of the plantations, it is urgent to undertake their assessment at national scale.

TOFs roles and importance in rural communities

Rural communities' livelihood is closely interlinked to the presence of trees on their lands, given their agronomical, pastoral, feeding, cultural and religious utility. "Trees illustrate and denote a given social and cultural organization" (Maïga, 1999 b).

The perception of trees in agrarian systems in Mali as in the whole Sahel revolves around mythical and religious representations shaped by ancestral traditions that venerate some trees and woodlots. Such plants as *Vitellaria paradoxa*, oil palms and sizeable *Azalia africana*, *Daniela*, *Isobertina* trees are highly protected and never cut or felled. Others are planted as garden hedges or around villages for their protective virtues against evil spirits. Farmers'

¹⁹ NA: The data are not disclosed in the documents examined.

perception of trees within agrarian systems varies according to ethnic groups and religious beliefs within a same group. Some rural communities consider trees as a divine gift, which they abuse to the point of decimating even the most useful ones. Others throw themselves heart and soul in private or collective village plantings and set up local communities to control and keep watch on the tree resources of their territory.

In the mind of rural communities, trees constitute a set of complex symbolisms, some of which are beneficent, while others are harmful. Trees are often worshiped in relation to their specific usefulness, particularly when they provide medicines, toxic (poisons) or malevolent products. Other species have a cultural significance passed on by legends and arts and which become manifest in religious rituals or in selecting graveyard sites. Other trees have a particular taboo status. This is often to mark historic events (war episodes, signing of pacts or treaties).

Agroforestry parks play fundamental socio-economic roles as they take part in satisfying the needs of people (food, herbal medicine, wood and diverse products contributing to household revenues) and animals (fodder and veterinary products). Mali's agroforestry network involves 2,5 million persons and generates substantial revenues, which need to be better documented. The main products provided by agroforestry systems are fruits, wood, gum and honey.

2.3 Tool box for Sustainable Forest Management

2.3.1 Criteria and indicators for sustainable management

The criteria and indicators for sustainable management of forests currently used in Mali were adopted in the United Nations Environment Programme UNEP/FAO/CILSS²⁰/CSE²¹ meeting which took place in Dakar, 14 to 17 December 1999. This continued the work on criteria and indicators for sustainable forest management in a meeting in Nairobi, Kenya, from 21 to 24 November 1995. With the help of FAO and Direction Nationale de la Conservation de la Nature (DNCN), the Government aims at validating these criteria and indicators and discussing and analysing available data regarding sustainable forest management.

2.3.2 Management and Planning

A National Forest Action Plan was elaborated, following a World Forest Congress in Mexico in July 1985. The purpose was to stop forest destruction and favour the use of sustainable resources to satisfy local and national needs. However, as of 1992, the socio-political context stemming from March 1991 events led the Forestry Directorate²² to work on a new national forestry policy. Then in 1995 four Orientation Laws defined the management conditions for forest, fisheries and wildlife resources. Law No 95-004 constitutes the reference framework for forest resources management, whose plans are given an institutional character.

²⁰ Permanent Interstate Committee for Drought Control in the Sahel

²¹ Centre de Suivi Ecologique

²² Direction des Eaux et Forêts

2.4 Forest Production

Natural productive forests are mainly found in south and west of the country, in the humid Sudano-Guinean and Guinean zones. They consist of open woodland, riparian forests²³ and tree and shrub savannahs, where *Isobertina doka*, *Detarium microcarpum*, *Parinari curatolefolia*, *Azelia africana*, *Pterocarpus erinaceus*, and *Khaya senegalensis* are dominant. These 32,3 million ha of forests contain the bulk of Mali's 516 million m³ commercial growing wood stock. The global mean annual increment of Mali's non-managed forests is very low, averaging roughly 0,86m³/ha/year (Touré, 2000). The western riparian forests hold more than 100 m³/standing volume/ha, while the Sudano-Guinean open woodlands and the shrub savannahs of the North contain respectively 50-80 m³/ha and less than 10 m³/ha. Stripped bush covers 25 % of the south, with mean standing volumes often reaching 20-40 m³/ha. Mean annual increments vary from 0,3-0,4 m³/ha/year in Sahelian zone, 0,5-1,0 m³/ha/year in Sudanese zone and 1-2 m³/ha/year in the Guinean zone.

Participatory approaches involving local communities in natural forest management in the regions of Kayes, Koulikoro (Faya reserved forests) Mandingues Mounts and Sikasso (Kaboila) have achieved mean annual increments of 1 017 m³/ha/year or 2,30 steres/ha/year and 7 195 m³/ha of deadwood in the region of Siby. These trials have been carried out under contracts involving the forest services and village communities (DNCN, 2000).

Most of the village and industrial man-made forests produce fuel and utility wood. However their contribution remains very low, if not negligible in comparison with the national global production, because of a lack of silvicultural follow-up. Their productivity is estimated at 3 m³/ha/year for *Gmelina* and 7m³/ha/year for eucalyptus.

Organizing wood production from urban plantations constitutes a priority to the government. In April, 2002, a national workshop was organized (April 2002) on green spaces that brought together local councillors, NGOs, and forest executives. The workshop recommended defining a national urban and peri-urban forest policy, setting up adapted institutional, legal and regulatory frameworks, improving human resources capacity and seeking funds. In this regard, the government has requested FAO's technical cooperation assistance.

2.4.1 Wood products

Fuel-wood and Charcoal

More than 90 % of fuel consumed comes from wood products, whose needs are estimated at 0,9 m³/person/year. It is estimated that about 7 million tons of wood fuel are consumed annually, of which less than 10 % are under forest services control. This significant energy wood consumption in Mali is believed to correspond to the deforestation of almost 600 000 ha/year.

Over 10 billion FCFA²⁴ are generated from wood energy consumption, of which 7 billion FCFA for fuel-wood and 3 billion FCFA for charcoal. Wood energy consumption is increasing constantly because of the rapid urbanization. Indeed, charcoal consumption increases steadily in urban centres. Northern regions show large wood deficits, particularly

²³ Forêts galleries.

²⁴ Franc de la Communauté Financière Africaine

around such towns as Mopti, Timbuktu, Djénné and Gao. Except for the North, wood prices in Mali are the lowest of the region. Some districts already in deficit see their forest resources overexploited (southern periphery of Bamako) to supply the capital city with charcoal. Other districts have mixed balances (northeast of Bamako), while others have surpluses, notably those distant from Bamako.

Exploiting wood fuels to supply urban centres undergoes some form of organization as rural markets are created and put under the responsibility of the local communities. A modern tax system that provides incentives and redistributes turnover taxes to benefit the rural sector is anticipated by the legal texts. This huge plan, which concerns Bamako and all of the medium-sized towns of Mali²⁵, is progressively being implemented under the aegis of the CCL (Cellule Combustible Ligneux). This is in spite of anarchic and insufficiently controlled exploitations still proliferate.

Table 6 presents the development of Mali's wood energy consumption (1990-1998). It reveals a fuel-wood and of charcoal consumption increase. Charcoal is totally sold in urban areas, where the quantities commercialised have increased by 85 % from 1990-1998. Fuel-wood consumption in rural as well as urban areas has increased by more than 60 % in the same period.

Table 6: Evolution of Mali's wood energy production/consumption (1990-1998)

Years	Fuel-wood ('000 m ³)			Charcoal ('000 of tons)		
	R-S-C.	U.C.	Total	R-S-C.	U.C.	Total
1990	4 706	1 446	6 152	-	68	68
1991	4 821	1 481	6 302	-	72	72
1992	4 939	1 528	6 467	-	74	74
1993	5 027	1 588	6 615	-	80	80
1994	5 176	1 635	6 811	-	90	90
1995	5 340	1 686	7 026	-	96	96
1996	5 488	1 733	7 221	-	103	103
1997	5 634	1 779	7 413	-	111	111
1998	5 746	1 820	7 566	-	116	116

Source: CCL/SED H. KONANDJI « L'évolution de la demande de bois-énergie au Mali. » Bamako 1998 (cited by TOURE, 2000). *Rural Self-consumption. **Urban Commercialisation

Table 7 indicates a general tendency towards an increase of firewood production and consumption within all sectors of activity. From 1990-1998, households' firewood consumption increased by 18%, which was equivalent to 98 % of the production. For the same period, the mean annual firewood consumption was respectively 7 725 m³, 27 873 m³ for the collective and informal sectors. Wood consumption by the industrial sector is limited, as is its growth rate.

²⁵ Ségou, Sikasso, Koutiala, Koulikoro, Kayes, Mopti and Timbuktu.

Table 7: Development of Mali's production/consumption firewood sector of activity (1990-1998)

Years	Firewood ('000 m ³)				
	Households	Collective entities ²⁶	Industry	Informal ²⁷	Total
1990	6 122	4,2	7,5	18,5	6 152,2
1991	6 270	4,4	8,2	19,7	6 302,3
1992	6 433	4,4	8,6	20,2	6 466,2
1993	6 579	6,2	8,2	21,5	6 615,0
1994	6 770	5,9	8,2	26,8	6 810,9
1995	6 980	6,9	7,2	32,2	7 026,0
1996	7 170	8,2	8	34,7	7 220,9
1997	7 360	8,9	7,2	37,2	7 413,3
1998	7 504	10,1	6,4	40,1	7 560,6
Average	6 799	6,6	7,7	27,9	6 841,2

Source: CCL/SED H. Konandji « L'évolution de la demande de bois-énergie au Mali. » Bamako 1998.

Table 8 shows that households consume most of the charcoal production. The average consumption for the period 1990-1997 has been of 80 500 tons/year, and the consumption increased steadily at the rate of 10 %. The rest of charcoal production consumed by the informal sector represents about 7 % of the mean annual production of charcoal, i.e. about 6 710 tons. It has experienced a sharp growth rate, tripling between 1990 and 1998. While charcoal is almost integrally commercialised in urban centres, its marketing in deficit areas such as Pondori (Niger Office) is gradually growing (Touré, 2000).

Table 8: Development of Mali's production/consumption of charcoal sector of activity (1990-1998)

Years	Charcoal ('000 of tons)				
	Households	Collective entities	Industry	Informal	Total
1990	64,87	-	-	2,93	67,8
1991	68,64	-	-	3,48	72,12
1992	70 01	-	-	3,83	73,84
1993	75,29	-	-	4,91	80,20
1994	83 01	-	-	6,55	89,56
1995	87,44	-	-	8,36	95,80
1996	93,99	-	-	9,12	103,11
1997	100,9	-	-	10,23	111,13
1998	-	-	-	10,97	116,4

Source: CCL/SED H. Konandji « L'évolution de la demande de bois-énergie au Mali. » Bamako 1998

Construction wood and industrial round wood

The country's needs in timber and utility wood are least well known. Industrial round wood is restricted to 60 000m³/year. Production of construction wood is not restricted but at full

²⁶ Collective organisations include army barracks, garrisons, schools, hospitals etc.

²⁷ This sector concerns activities linked to food business, dyeing, the craft industry etc. It utilizes firewood as well as charcoal.

capacity only represents 5-10% of sawn-wood consumption. Logging currently supplies needs of small sawmills and shopkeepers using mechanized woodcutters (cutting rough lumber with chain saws). About 75 percent of these wood products are self-consumed in rural areas and 25 percent are traded commercially in urban markets.

Traditional forest products are used in construction and in handicrafts. Rural villages have “round houses” and straw huts. The commercial trade of traditional forest products (domestic and export) are valued at about 10 to 15 billion FCFA in a normal year.

2.4.2 Non-Wood Forest Products

Important NWFPs include harvest crops, fruit, grains, tubers, flowers, fruit-bearing forest trees, leaves of food plants, gums and resins, honey, the bush-meat trade (hunting), fishing etc. Traditionally devoted to self-consumption by local populations, NWFPs are gradually being commercialised in national and international market places. Revenues from NWFPs cover 20-60 % of household budgets, depending on the season (MEATEU/DNCN, 2000, c). They represent a gross added value of over 37,5 billion FCFA divided up into: Shea kernel (5 billion FCFA), Gum Arabic (2,5 billion FCFA), wildlife (0,5 billion FCFA) and fishing (30 billion FCFA).

There are no statutory acts on NWFPs. Their exploitation by women and children is neither organized, nor documented through viable official statistical data, whether in terms of harvest or trade. Yet these products harvested for their leaves, fruits, seeds, tubers, flowers etc. hold a prominent place in the rural socio-economic and cultural contexts.

Forest fruits

The main harvested crops are for feeding the rural inhabitants. Primarily they include: the Shea tree (*Vitellaria paradoxa*), African locust bean (*Parkia biglobosa*), the tamarind tree (*Tamarindus indica*), and the baobab (*Adansonia digitata*). Wild date (*Balanites aegyptiaca*), jujube (*Zizyphus mauritiana*), borassus palm (*Borassus aethiopicum*) and doom palm (*Hyphaene thebaica*) are also harvested in the forest.

The shea butter tree, with a kernel production of 80 000 tons per year is the most important tree species in Mali. The fruit's pulp is eaten and the shea butter extracted is highly sought-after by cosmetic industries. The trade of shea butter kernel pays 1,1 billion FCFA/year, and represents 3,6 % of the total national exports (Maïga, 2000). The pulp of the African locust fruit is the source of an extracted edible powder. The fermented seeds provide the “soumbala” which is a very much appreciated condiment used to season almost any sauce. The tamarind, baobab, jujube, wild date, borassus and doum palm fruits are also very important in terms for healthy diets and revenue generation, particularly in rural areas. The edible fruit of *Detarium microcarpum* is exported in large quantities to Senegal²⁸. The almonds are used in manufacturing jewellery.

Besides fruits, there are also products useful in traditional medicine, raw materials for industry, housing, crafts as well as fodder. Among the important products, Arabic gum and honey are the most prominent with respective annual productions of 2 100 and 190 tons. Fodder contribution to animal feed, has not been assessed yet, but it represents a deciding

²⁸ Non-documented.

contribution to the survival of domestic herds, particularly during the long dry season, when pastures are meagre or non-existent.

Traditional medicine

Mali's population and in particular its rural communities resort to traditional medicine to cure or treat preventively 50-80 % of the diseases affecting them. Efforts were made lately by the "Institut de Recherche en Médecine et en Pharmacopée Traditionnelle" to organize traditional therapists in associations within large geographic entities.

Beekeeping

Developing rapidly, beekeeping has seen its contribution increase from 300 to 400 tons of honey per year from 1997 to 1999. Wax production in the same period has also increased from 3 to 6 tons per year. A good deal of honey is produced following traditional techniques, leaving much room for honey production improvement to reach international standards. Introducing modern beekeeping with the assistance of national and international NGOs, has contributed to improving the quality of both honey and wax.

Hunting and fishing

They provide rural populations with their basic animal protein.

Fishing directly employs 70 000 people and indirectly almost 500 000 jobs, roughly 7 percent of the working population. This is a vital sector for the economy, generating almost 30 billion FCFA/year. It also contributes a 1,7 % agricultural added value. Fishing products represent 3 % of GNP, that is, 8 % of exports, making it the 4th most important sector after cotton, peanuts and beef.

Hunting Products generate 0,5 billion FCFA annually and provide 20 to 50 % of local needs for animal proteins, especially in rural areas. Hunters are organized in associations with a traditional organization based on gerontocracy or influence. These associations protect hunting areas, safeguard activity and assure protection of the village against thieves and other criminals. The development of hunting tourism is among the priorities of the Malian Government.

Other products

Other products are used in the construction of rural round cabins and straw huts, using such materials as borassus and doum palm leaves weaved into mats. These materials are also used to construct lofts and are sought after by craft industries, particularly basketry. They are traded in villages as well as in large cities such as Bamako, Sikasso, Ségou, and Kayes. The study carried out at Mount Mandingues in 1994 indicated that these products' exploitation occupies many men and women from January to May, and engenders 50-80 % of their annual income. Such species as *Vitivera nigricans* and *Comiphora africana* (incense) are commonly utilized as part of households' customs and habits and are commercialised at the local and regional level.

2.4.3 Marketing

Generally speaking, gatherers' products are marketed at local as well as national level, but the activities lack a form of gatherers' organization and remain unknown. Products that are of

interest to the exporters get bridging loans from foreign customers, allowing the former to establish their own collection and marketing circuit.

2.5 Status of Forest industries

Forest industries concern wood and non-wood forest products. The main raw materials processed are wood, shea butter, Arabic gum, African black locust and baobab leaves. The decline in standing wood stock following deforestation and forest degradation restrict the development of Mali's forest industries, particularly wood industries.

2.5.1 Wood processing

The main processing takes place in sawmills that provide planks and boards for pirogues' construction as well as beams, laths and rafters for joinery. Annual wood quantities needed to construct pirogues are estimated at 2 500 tons. Besides pirogues, other items produced with local species are not competitive against products manufactured with imported wood, particularly from Ivory Coast and Ghana, which account for 95 % of imported wood.

Mali's sawmill equipment is obsolete. It is not fully mechanized and automated and is highly dependent on the "Société Energie du Mali" for power. The sawmills are badly managed due to weak training and capacity of the entrepreneurs and the labour force. The equipment is basically obsolete (Konaté, 2000).

2.5.2 NWFP's processing

Dried shea kernels are processed into butter, using traditional, semi-industrial and industrial manufacturing processes. Traditionally produced shea butter (35 % of dried kernels) is used directly for human consumption in rural areas and traded in national markets. Cotton oil factories commercialise shea-cooking oil, shea butter destined to exportation, as well as soap. The maximum possible annual industrial capacity is 46 000 tons of shea kernels. This yields 17 037 tons of quality butter, the production costs of which are rather high.

Arabic gum is not transformed. The only treatment is hand sorting to select the hard gum produced by *Acacia Senegal* from the crumbly gum exuded by *Acacia seyal*, *Combretum nigricans* and *Commiphora africana*. The demand for Arabic gum is very high, notably for the sweets, candy and drinks industries and for the pharmaceutical and mining industries. The annual world demand for Arabic gum is 90 000 tons and the Malian contribution is about 2 000 tons. Investigations are underway to decide upon the establishment of a processing unit with 1 000 tons capacity.

2.6 Economic and social significance of forests

Forest resources satisfy fuel-wood needs, construction wood and various non-wood products such as fruit and animal fodder and medicinal plants, as well as diverse industrial and raw materials for crafts. Economic activities linked to domestic and commercial trade of forest

products generate more than 25 billion FCFA per year (MEATEU/DNCN, 2000 c). According to the same source, the economic and social contribution of forestry is increasing, especially in gathered products, the revenue of which has increased by more than 10 billion FCFA since 1999. In the same period, revenue from fuel-wood, utility wood and industrial wood reached 5 billion FCFA.

Income derived from natural forests is difficult to ascertain because of insufficient rural statistical data and because forest products commercial sales and marketing networks are not well monitored. Forest products revenues are important and come mainly from:

- Consumption of fuel-wood (over 10 billion FCFA in 1997 for Bamako city alone in 1997);
- Industrial wood sales where controlled (monitored) production is estimated at 60 000 m³; and
- The commercial trade of non-wood forest products for traditional medicine, a wide assortment of fruits and of handicrafts raw materials, all of which contribute in improving life conditions of the rural areas

2.7 Environmental values of forests

In general forests provide environmental protection, especially in improving and/or maintaining soil fertility, protecting soils against forms of water and/or wind erosion in the context of managing watersheds and combatting desertification.

Forest stands also provide habitats for many flora and fauna species and contribute thereby to biodiversity conservation. Some of these forest such the holy woods and the worshipping sites fulfil spiritual functions.

Forest trees contribute to the improvement of people's living environments by providing shade and beauty in residences, landscaped gardens, and in recreation.

3. The Forestry Sector

3.1 Institutional Framework of Forestry

3.1.1 State institution related to forestry

Established in 1972, during the severe droughts, the "Direction Nationale des Eaux et Forêts"²⁹ (DNEF) is the institution in charge of Mali's forestry sector. The missions assigned to this structure are concerned with:

- Supervising the national forest estate;
- Overseeing the use of forest resources; and

²⁹ National Water and Forests Directorate.

- Supervising forestry activities, such as afforestation, forest surveying and research and silvicultural treatments.

Between 1970 and 1980, the forest administration was substantially strengthened in terms of human resources (staff training), financial means (incomes from forest products and external funding of projects and forestry development operations), and also for logistics and infrastructure (offices, accommodations, over 4,5 million ha of reserved forests, equipment etc.).

The 1991 national events have led to deep changes that redefined environmental policies and induced supportive measures to the forestry sector. These include strengthening of institutions, information, extension and communication as well as adapting legislation, taxation, and research. The “Direction Nationale des Ressources Forestières, Fauniques et Halieutiques”³⁰ (DNRFFH) was set up by law No 95/002 AN-RM of 15 December 1995 to put into operation the new forest policy. The DNRFFH was in charge of designing forest, wildlife and fish resources management and exploitation schemes. Its mission included:

- Developing legal and regulatory texts pertaining to these resources and supervising their implementation;
- Desertification and deforestation control;
- Supervision and coordination of services in charge of executing of the national forest policy.

The enforcement of the new law was changed in 1997, when the Plan of Action of the “Ministère du Développement Rural”³¹ was put into effect, bringing about drastic institutional changes such as the merging of five Central Services (Agriculture, Animal Husbandry, Forestry, Cooperative Action and Plant Protection) in three national directorates, namely:

- The “Direction Nationale de l’Appui au Monde Rural” (DNAMR) in charge of counselling and supporting the rural world with regard to crop production;
- The “Direction Générale de la Réglementation et du Contrôle du Secteur Développement Rural” (DGRC) in charge of rural development legal and regulatory aspects; and
- The “Direction Nationale de l’Aménagement et de l’Équipement Rural” (DNAER) in charge of natural resources management and rural equipment.

More change occurred the same year when the Ministry of Environment was created (Decree No 97-290/PM-RM of 6/10/1997) and put in charge of:

- Developing and implementing the national environmental protection policy;
- Coordinating desertification control activities;
- Arousing people’s participation in combating environmental degradation with the objective of improving their living conditions;

³⁰ National Directorate of Forest, Faunal and Fish Resources.

³¹ Ministry of Rural Development.

- Designing and putting into operation legal and regulatory measures to protect the environment;
- Defining and putting into operation preventive measures against major technological or natural risks;
- Monitoring climatic changes and their environmental consequences (MEATEU/DNCN, 2000 b).

The MEATEU has two national technical directions available to complete its mission, namely: the “Direction Nationale de Conservation de la Nature”³² (DNCN) and the “Direction Nationale de l’Assainissement et du Contrôle des Pollutions et des Nuisances”³³ (DNACPN).

The DNCN is in charge of:

- Formulating the basic principles of the national environmental conservation policy;
- Implementing the environmental conservation policy by preparing forests, parks and reserves’ management and rehabilitation plans;
- Preparing and supervising the implementation of legal and regulatory texts related to fauna and forest resources conservation;
- Preparing and implementing desertification control programmes;
- Supporting territorial authorities in achieving the sustainable management of their wildlife and forest resources;
- Negotiating international legal transactions dealing with forest and wildlife conservation;
- Collecting, processing, and disseminating statistical data.

The DNCN has four divisions, namely: (i) Study and Planning; (ii) Management of Forests, Parks and Reserves; (iii) Environment Control and Protection; and (iv) Communication and Training. The DNCN comprises 9 Regional Environmental Protection Directorates, 52 Services (at the Circle level), 185 Units at the communal level, and 9 “Services Rattachés” and projects.

In a meeting held in Bamako in 1999, the DCNC proposed a number of projects to donors of the environmental sector. Four large projects are about to start that should give considerable impetus to its activities. These are:

- The Solidarity Fund;
- The Project in Support of Desertification Control for a Sustainable Development of Mali;
- The Gourma Biological Diversity Conservation Project;
- Consolidating the “Sustainable Development of Reserved Forests Around Bamako” project.

³² National Nature Conservation Directorate.

³³ National Pollution and Nuisance Purification Directorate.

The DNCN remains confronted with two major issues, i.e.: insufficient human resources and above all the lack of equipment, given that most equipment acquired earlier has remained with the “Direction Nationale de l’Aménagement et de l’Equipement Rural” of the Ministry of Rural Development. The working conditions of the DNCN need to be improved if it is to carry out its very important assignments.

3.1.2 Private forestry

The private sector is relatively recent as the State had exclusive management in the past. Not until 1995 did forest policy begin to favour private initiatives and partnership contracts between the Government and private operators in the framework of participative forest management with the:

- French Development Agency (AFD);
- “Bureau d'Experts pour l'Auto-Gouvernance et la Gestion de l'Environnement au Sahel”³⁴.

Other research institutes such as SERNES, “Aménagement pour la Gestion de la Forêt et de l’Environnement” (AGEFORE) and “Groupement d’Intérêt Economique” (GIE) became involved in creating and implementing domestic energy strategies and carrying out specific studies concerning forest management and environmental impacts.

3.1.3 Forestry research

Under the Ministry of Rural Development (MDR), the Rural Economy Institute (IER) is in charge of forest research, which is conducted under the “Ressources Forestières”³⁵ and the “Equipe Système Programme Gestion des Ressources Naturelles” programmes.

The IER was restructured early in the 1990s to provide a better support to users’ needs, based on improved relations between research and development. In 1994, a long-term strategic plan was adopted and funded by various partners, including the Netherlands, Switzerland and the World Bank.

3.1.4 Forestry training

Mali has a complete education and training programme at the following Forestry Institutions:

- The Rural Polytechnic Institute (IPR) of Katibougou to train managers (forest engineers: 5 years after high school, and qualified technicians: 2 years after high school);
- The Forestry Vocational Training Centre³⁶ (CFPF) for forest technicians.

³⁴ Experts Bureau for Self-Governing and Environmental Management in the Sahel (BEAGGES).

³⁵ Within the Centres de Recherche Agronomique (CRA) of Sikasso and Sotuba.

³⁶ Centre de Formation Pratique Forestier.

Following a diagnosis of the situation of human resources involved in sustainable natural resource management, Mali defined a new training policy in line with the sector's sustainable development. The decline and ageing of forestry staff were observed. Discrepancies between training institutions³⁷ were also noted in terms of their training capacity and aptitude to adapt to the needs born from the decentralization process and the growing importance of the civil society and farmers' organizations.

The training policy as formulated attempts to achieve a sustainable management of natural resources integrated within efficient and high-performing production systems, in response to food security and desertification control needs. It also aims at succeeding in implementing the decentralization and transfer of responsibilities, taking into consideration the status of women and marginal groups. It is also about initial professional training and adult continuing education as well as about environmental training for schools and populations. In this context it is expected to set up local and/or regional development funds specifically aimed at training activities targeting development agents at national, regional and local levels.

3.2 Forestry Planning, Policy and Legal Framework

3.2.1 Forestry sector's evolution

Five periods characterize the forestry sector's evolution in terms of legislation, policy and planning:

From 1935 to 1960

At its creation in 1935, the Forestry Service's responsibilities were to organize vast forest exploitation project sites to provide the Dakar-Niger railway and the Bamako-Koulikoro boat service with wood fuels. It was not until 1952, that 4 forest inspectorates were established by local decree to supervise the forest exploitation project sites.

From 1960 to 1970

The Forest Service operated under colonial legislation and was run by technicians in agriculture or war veterans. The Service was deemed repressive. In 1967, the National Forestry Foundation was created, and in the following year, the Forest Code, was promulgated. It constituted the basis to forest regulation (loi 688-AN-RM du 17 février 1968).

From 1970 to 1980

This period constituted a genuine turning point for Mali's forest administration as 91 % of national territory was declared State forest estate, of which 3,6 % were reserved forests. The 1972-1974 droughts and their repercussions in terms of forest degradation and agricultural land extension led to the creation of the National Forestry Directorate³⁸ (DNEF) in 1972.

The Five-year Development Plan from 1974 to 1978 defined a National Forestry Policy with objectives based on combating desertification and degradation of vegetative cover, and the improvement of living conditions of the populations in terms of food and energy needs.

³⁷ IPR of Katibougou and CPPF of Tabakoro.

³⁸ Direction Nationale des Eaux et Forêts.

From 1980 to 1991

The adoption of a new Forestry Code (law 86-42/AN-RM) modifying the basic forestry regulations³⁹ and of new legislations on forest fires (law 86-66/AN-RM), on fishing (law 86-44/AN-RM) and on hunting (law 86-43/AN-RM), all were events of particular importance.

During this period, the forest administration developed a programme aiming at the conservation and development of natural resources which were under heavy pressure due to:

- The shortage of wood fuels and the rapid exhaustion of the exploited stands
- The drying-up of ponds and watercourses and the reduction of fish stocks;
- The impoverishment of natural rangelands and the loss of wildlife.

The main activities consisted of: (i) combating bush fires, (ii) soil and water conservation and rehabilitation, (iii) establishing new reserves for forest, fauna and flora, (iv) increasing awareness of the public and decision-makers, (v) carrying out vast community and industrial afforestation programmes, (vi) managing silvo-pastoral formations and integrating trees in agrarian systems.

After 1991

In March 1991, profound changes commenced to redefine policy on the environment, rural development and territorial organization, especially within the framework of decentralization. The ministries of natural resources were involved in defining new policy toward efficient and sustainable management of natural resources.

3.2.2 Forestry policy and strategies

The main aim of the new national forest policy is the efficient and sustainable management of forest, wildlife and fishery resources. It identifies men and women in local communities as the designated managers of the natural resources in their territories. The policy is based on the following fundamental options:

- Social option: which grants sustainable management responsibilities and transfers competence and rights to village organizations upon request;
- Economic option: which promotes and guarantees investment in forestry, wildlife and fisheries' development, under State support (mobilizing national as well as international funds);
- Ecological option: which aims at preserving biological diversity and rehabilitating degraded ecosystems in the framework of desertification control.

In accordance with the declared political will to decentralize and target sustainable development, the strategic options of the national forest policy aim at (i) promoting private initiative and partnership, (ii) clarifying the forms of natural resources' management, (iii) improving partners implementing capacity through an efficient extension-training mechanism, (iv) preserving the biological diversity and rehabilitating degraded ecosystems.

³⁹ Law 58-8-AM-RM of 17 February 1968.

Within the framework of its global strategy to combat desertification and desert progression, the Government of Mali initiated in 1996 a large programme called “Opération pour un Mali Vert⁴⁰”, which lies within the implementation of the national afforestation policy. This programme is the best means for combating desertification. It is also an efficient strategy to achieve public awareness, mobilization and involvement.

3.2.3 Forestry planning

The 1996-2005 Action Plan includes 5 major programmes and 4 attendant measures in implementation of the new forest policy orientations. The programmes are:

- The “Natural Resources and Land Use” programme, which includes all projects related to agricultural land use planning and to natural forest resources management;
- The “Forests, Wildlife and Fisheries Management” programme;
- The “Environment Protection and Conservation and Ecosystems Rehabilitation” programme, which concerns all projects dealing with protected areas, with the MAB-UNESCO world heritage sites and with the follow-up of international conventions concerned with the safeguard of endangered species and rehabilitation of natural resources (forests, wildlife and fisheries);
- The “Training” programme, which includes all vocational training projects and refresher courses aimed at the various human resources of the sector;
- The “Développement des Filières” programme, which concerns projects promoting the various fields of activity in forest products.

The main forest management plan tools include:

- The simple management plan “Plan d’Aménagement Simple” for state reserved forests inspired from the classical management method, whose operations are simplified. It concerns forests with high commercial value that require important financial investments;
- The simplified management plan “Plan d’Aménagement simplifié” for community and private forests, which is prepared in response to the requirements and concerns of rural populations and according to their needs and revenues;

⁴⁰ Operation for a Green Mali.

- The “Plan de Gestion” (Activities and Means Scheduling) is an integral part of the Management Plan. It programmes all activities and means required throughout the duration of the management plan and carries out technical and financial planning;
- The “Contrat de Gestion” (Management or Business Contract) established by Article 38 of Law 95/004, concerning the implementation of management plans of reserved state forests, which includes private and public contracts.

3.2.4 Forestry Legislation

Since 1960, the legal and regulatory framework of forest resource management has undergone many changes. The first texts rested on resources protection and had a forbidding and repressive character. Forest resources’ management was governed by the 1968 Code (law 68-8/AN-RM of 17 February 1968).

The periods of drought between 1972 and 1974 led to a revision of the forest texts introducing an increase in penalties to better protect forest resources (law 86-42/AN-RM). This law granted the State ownership over the entire forest estate and included several restraining measures concerning people’s access to forest resources.

After the events of March 1991, the discrepancy was examined between a system conceived for a centralized approach to forest management and the new decentralization environment. This necessitated the review of the whole legislation to introduce appropriate measures to promote decentralized management. New acts laying down the basic principles for government action with regard to forest resources management were adopted in 1995. These are: (i) law 95-003 of 18/01/95 on the organization of wood exploitation, transport and marketing, (ii) law 95-004 of 18/01/95 setting the conditions for forest resources’ management, (iii) law 95-031 of 20/03/95 setting the conditions for the management of wildlife and wildlife habitats, (iv) law 95-032 of 20/03/95 defining the conditions for the management of fish resources and for fish farming, (v) law 96-050 on principles for the constitution and the management of community estates. These acts entail some technical, institutional and legal items of the following illustrate aspects of natural resources sustainable management:

Law 95-003: An *ad hoc* communal committee decides on quotas of annual allowable wood volumes to be harvested in any forest stand by rural management structures. Specific measures are outlined with regard to harvesting and transport conditions. Forestry officials together with community representatives control the harvest and transport operations, report any breach of the law and enforce penalties, as defined by decree 98-402/P-RM of 17/12/1998. The latter outlines revenue service distribution between the various partners, i.e. the State, Forest Management and Maintenance Fund, Control Fund, productivity bonuses for forest agents, and shares devolved on rural communes and regional chambers.

Law 95-004: Divides the national forest estate into: the State, communal (community) and private forest estates. Particular arrangements administer forest clearing operations, protected species, users’ rights, fires, forest management, law breaches and settlement of fines.

This law permits the State and territorial authorities and communities to jointly administer forest exploitation. The basic principles underlying the management of the forest estate are defined as follows:

- Partners in forest management must act to protect natural resources;
- Necessity to revoke acts stating reserved forests, afforestation and protected areas, prior to any property transfer;
- Reserved forests are subjected to management decisions approved by decree of the Minister in charge of Forests.

Law 96-050: defines the principles for the constitution and the management of community estates, including: forest, range, agricultural, wildlife, mining, settlement etc. estates. It defines them, outlines the conditions for their management and stresses the role and responsibilities of local authorities with regard to the forest estate.

The new forest law puts an end to the excessively extensive interpretation of the forest estate⁴¹ and:

- Concerns the forest estate only and does not include urban and agricultural estates;
- Is consistent with the decentralization process and grants larger responsibilities to the new partners (communities and individuals) in the management and development of forest resources;
- Is confined to defining the major principles, and leaving it to territorial authorities to complete with the legal and regulatory measures and local conventions.

Moreover, the State is not the sole legal owner of natural resources anymore. Communities have also been granted estates on which they have full jurisdiction. Private propriety ownership rights have also been approved, together with access to forest exploitation.

Concerning technical aspects, the new laws aim to protect and guarantee the sustainable management of forest resources, and specify the rules that govern any form of forest utilization. Some examples follow:

- Obligation for any natural person or legal entity to take all necessary environmental protection measures prior to any intervention in any forest estate;
- Forest clearings are to be followed by soil and water conservation measures to reduce erosion risks;
- State reserved forests and protected estate, and community estates are to be managed;
- Management contracts may be established between resources owners and other natural persons or legal entities;
- Control burnings are authorized as management tools in State and community forest estates.

⁴¹ It included all the lands, with the exception of towns and cultivated lands.

3.3 External assistance

External collaboration in the forest sector revolves around institutional support to public services, government projects and community activities. Due to the numerous tasks assigned the Department, other ministerial department are responsible for planning and monitoring and evaluation. These include the CPS⁴², the STP⁴³, and the PGRN⁴⁴.

The Government of the Republic of Mali benefits from external support to accomplish its mission, as indicated by the commitments of its partners in development (table 9).

3.3.1 International multilateral support

Within the framework of ensuring sustainable natural resource management, Mali benefits from the support of the World Bank, UNICEF, UNESCO, United Nations Development Programme (UNDP), FAO, “Programme d'Appui à la Mise en oeuvre du Schéma Directeur de Développement Rural” (PAMOS), The European Union, IFAD, and the “Bureau International du Travail” (BIT).

3.3.2 Bilateral support

The Government also receives bilateral support in forestry from the Netherlands, France, Switzerland, Federal Republic of Germany as illustrated in table 9.

Table 9: Forestry projects being funded (Budget and State contribution in thousands of F CFA)

Project title	Funding	Budget	State Contribution
Progr. Nat. Lutte Contre l'Ensamblent (Tombouctou – Gao)	European Development Fund	5 189 220	Salaries
Gestion Durable des Forêts autour de Bamako	French Cooperation	1 200 000	156 000
Gestion Durable Ressources Naturelles en 3 ^e région	French Cooperation	3 000 000	Salaries
Cellule Combustibles Ligneux	W.B + Netherlands Cooperation	4 600 000	1 200 000
Gestion Participative des Forêts de Kita	UNDP	1 121 304	135 410

Source: MEATEU/DNCN, 2000 a

3.3.3 Other International support

Other associations and NGOs also grant their support to the forestry sector is directed from the regional organization - CILSS, West African Development Bank [BOAD], Institut Africain de Développement (BAD) and international NGOs such as IUCN, ICRAF, AGEFORE, SOS Sahel, WETLANDS, CARE, Club du Sahel, etc.

⁴² The Planning and Statistics Committee.

⁴³ Permanent Technical Secretariat

⁴⁴ Project of Natural Resources Management

New forestry programmes have been prepared and presented during the donors' roundtable on the funding of the environmental sector held in Bamako in May 1999. The government is mobilizing the resources expected from the partners commitments for the programmes detailed in table 10. Other projects have been presented for which France, FAO and other institutions (CCD, CILSS, UEMOA, BAD etc.) have shown an interest.

Table 10: Partners in development funding commitments to the environmental sector

Programmes/ Targeted projects	Donors	Amounts
1. Water resources' management programme Natural resources' management programme	FRG	10 000 000 DM
2. Environmental information management		
1. Natural resources' management 2. Water resources' management programme	UNDP	8 545 000 US \$
1. Nat. Res. Management programme (management of the biological diversity of the Bafing-Makan wildlife reserve. 2. Harnessing water resources through continuing the sand dune stabilization programme of the Timbuktu and Gao regions.	European Union	Being appraised
1. Drinking water and rural hydraulics in pastoral zones of the Kayes region ⁴⁵ 2. Implementation of the management plan of the RAMSAR ⁴⁶ sites 3. Drinking water and rural hydraulics (Gao-Kidal)	IFAD	8 million US \$
Assistance to the Natural Resources' Sustainable Management Programme of the Sikasso region	Swiss Cooperation	4,6 billion F CFA
Sustainable land management and environmental monitoring in CMDT and Office du Niger zones. Developing an environmental monitoring network in the CMDT zone. Implementation of the management plan of the RAMSAR sites. Institutional assistance to the Ministry of Environment and Sand Dune Stabilization.	The Netherlands	1,5 billion F CFA/year
Studies anticipated within the National Territorial Management Programmes and on Desertification Research ⁴⁷ Developing a National Environmental Information System.	FENUAP	60 million F CFA
1. Water Resources' Management in the Senegal River Basin Community natural resources' management and biodiversity conservation in the interior Niger delta 2. Integrated management project of the ecosystems scoured by the Gourma ⁴⁸ elephants.	World Bank	5 billion F CFA

Source: MEATEU/DNCN, 2000 a.

3.4 National Perspectives

Mali is fully committed to sustainable forest resources management. It has become actively involved in the formulation and follow-up in the signature and ratification of the United Nations Convention to Combat Desertification of the United Nations Conference on Environment and Development (UNCED). It then organized accordingly and started building up its institutional framework and introducing programmes. It intends to develop them further, giving priority to local development and the promotion of genuine partnerships at local, provincial, national and international levels.

⁴⁵ Under the Development Fund for the Sahel Region.

⁴⁶ Second supporting operation for Biodiversity Conservation in the interior Niger delta.

⁴⁷ National Programmes on Territorial Management and Desertification Research.

⁴⁸ Mali/Burkina-Faso

By putting these options into practice with the backing of regional and international cooperation, it would allow the country to take up future challenges related to desertification. At present this form of degradation translates from North to South, into severe water and wind erosion and degradation and even loss of a good portion of forest, range and water resources.

Combating desertification and protecting the environment will require multiplying initiatives related to soil conservation, forest and rangeland rehabilitation and management, and promotion of efficient production systems. As well, as rural investment, employment and revenues will need to be promoted to eradicate poverty. Mali aims at a 7 % economic growth in the upcoming years; and at developing its agro-silvo-pastoral sector at the same time. The Government has requested backing from FAO in preparing an action plan that would put in place institutional and legal reforms leading to the decentralization of natural resources management on a nationwide basis. This calls for:

- Drawing up an inventory of the present state of the decentralization process in natural resources management and analysing strengths, weaknesses and prospects, based on central level considerations and careful diagnosis at local level;
- Based on the above, formulating proposals and recommendations aimed at setting up some forest resources management schemes in a limited number test communes representative of the main contexts encountered within the country;
- Developing a compatible methodology for setting up institutional reforms aimed at decentralizing natural resources management nationwide;
- Identifying the human, budgetary, and equipment resources and strategies needed to put the institutional reforms into effect;
- Recognizing the additional needs in terms of forest policy, legislation and regulations;
- Making proposals to strengthen institutions in charge of natural resources at the level of the commune, circle and region, and improving the coordination with the central level, that is, at the department level.

4. The Causes and Effects of Deforestation and Forest Degradation

It is difficult to clearly ascertain the difference between direct and indirect causes for the phenomena because the issue of desertification, deforestation and forest degradation are very complex. However, it is possible to see that deforestation and forest degradation are principally due to a combination of anthropogenic factors (forest clearing, bush fires, poaching...), climatic factors (droughts, rainfall scarcity...), and edaphic factors. Other main factors include excessive pressure exercised on forests to supply urban centres with fuel-wood and charcoal, and the competition for agricultural soils. The factors that have caused desertification and degradation of natural resources for 30 years can be crudely classified as either manmade or natural causes.

4.1 Indirect Causes

4.1.1 Land tenure and user rights

While the indirect causes of deforestation and forest degradation vary according to regions, tenure and users rights constitute the principal bottleneck to rural development in Mali (MDR/CPS, 2000). The antagonistic coexistence between common law and modern legislation based on concepts irrelevant to the traditional land use systems is at the origin of widespread tenure insecurity, which maintains anarchic forms of natural resources management and utilization.

4.1.2 Population growth

With its 9,8 million inhabitants Mali stands among those countries with the highest population growth (3,2 %). The population is essentially rural (80 %) and is characterized by important internal migrations and high concentrations in some regions. This is notable in such regions as Sikasso, Koulikoro, Ségou and Mopti, which represent 24 % of the national territory but are home to 67 % of the country's population. This, explains why the strong pressure on ecosystems without any consideration of regeneration is a cause of deforestation and degradation.

4.1.3 Poverty

Low prices paid for farmers' crops, and high prices for agricultural inputs and agricultural credit burdens explain why rural populations become increasingly impoverished. This results in survival behaviours that generate widespread misuse of natural resources⁴⁹, where access is more or less easy and free. This poverty-induced social reaction is in all probability the factor that contributes most to deforestation and forest degradation in Mali.

4.1.4 Strategies to increase grain crops production

The strategy put in practice to increase grain and cash crops production often rests on increasing the cultivated areas as a result of farmer's incapacity to get into debt or have access to credit.

These circumstances are behind the severe degradation of natural forest resources occurring in the southern regions of Mali, particularly in the cotton belt (CMDT zone). This reaches alarming proportions around San, where almost half of the cropped land has been abandoned for not being able to sustain crop cultivation. Accession to land has become problematic, particularly for underprivileged groups (women, pastoralists) who fall back on marginal lands and thereby multiply the risks of erosion and degradation. This zone is also where disputes for natural resources are most severe and frequent.

⁴⁹ Soils, water, flora, fauna.

4.1.5 Profound transformations of the agrarian sector

The profound transformations that have occurred in the last decade have resulted in technical, social, cultural and religious upheavals that have translated into natural resources degradation and devastation. Some farmers blame the various agricultural policies (including the different forest policies). These have mostly been technically oriented, and insensitive to the social, cultural factors that govern natural resources utilization.

4.1.6 Perception of trees

Some populations perceive trees as a gift of God, which they can use unconditionally, without taking the slightest precaution, considering that God provides for their renewal. Unbelievable as this may seem, this harmful attitude is very topical as evidenced by the multitude of bush fires, clearings and tree mutilations that occur each year. In Sikasso for instance, people have indiscriminately decimated a good deal of their tree resources (even useful trees) following the 26 March 1991 events, while livestock breeders have devastated the thorn bush between Niono and Bamako (Maïga, 1999 b).

4.2 Direct Causes

Direct causes of deforestation and forest degradation may be grouped into natural and anthropogenic causes.

4.2.1 Natural causes

Climate

Drought, reduction and irregularity of rainfall have prevailed for more than 20 years and are among the causes of forests decline and of the continued degradation of natural resources.

Aridity combines high temperatures and scarce rainfall and affects 51 % of the national territory, especially in the Saharan zone. Limited (less than 200 mm) and irregularly distributed annual rainfall makes the natural ecosystem particularly vulnerable. These harsh climatic conditions concern in fact $\frac{3}{4}$ of the country, given that the Sahelian zone is also affected by low (200-550 mm), erratic and unevenly distributed rainfall. Notwithstanding the resilience developed by the flora and fauna under these difficult conditions, the balance of nature is too often severely disrupted as a result of excessive pressures applied on the environment, particularly on forest resources.

Soils

Generally speaking, the different soil types present similar constraints which include: (i) low to medium fertility levels with deficiencies in humus, phosphorous, potassium and sulphur as well as high wind and water erosion potential. Cultivating marginal lands without soil and water conservation measures constitutes a factor of accelerated erosion.

4.2.2 Causes linked to human activity

The extension of cultivated lands, industrial activities and development, unsuitable extensive production systems, abusive forest exploitation for the satisfaction of wood requirements, bush fires etc. are the main anthropogenic causes of forest degradation and deforestation and are discussed below.

Misuse of forests

Supplying an increasing number of urban centres characterized by rapidly growing populations exerts growing pressures on natural resources, particularly in the form of natural forest overexploitation. This results in their degradation or even their total destruction. Indeed, the quantities of wood produced in 2000 for the sole satisfaction of wood fuels (firewood and charcoal) has been estimated at 7 million tons harvested over 560 000 ha of forest stands. This intense pressure is exacerbated by the heavy demand for industrial round wood and various other forest products to generate income and improve the quality of life in rural areas.

Bush fires

All those involved in forest management acknowledge that bush fires are virtually an endemic disaster in Mali. They destroy thousands of hectares annually. Bush fires are among the most important factors of natural forest resources alteration (Maïga, 1999 c). Yet legislative aspects of forest fires are dealt with in only one decree (95-287/MDRE-SG) that determines the conditions for setting early prescribed burnings in State and communal forest estates (MEATEU/DNCN, 2000 c).

The main causes to bush fires are: (i) forest clearings as a means of preparing land for cultivation, (ii) bush fires started by herders to induce the regeneration of pastures, (iii) accidents occurring while gathering honey, (iv) social disputes, (v) flushing out game while hunting, and (vi) criminal negligence of variable origins.

Mining

This deals mainly with gold washing linked to mining gold, especially in the South where forest formations have the highest wood potential and succumb to the strongest pressures. Deforestation is caused by both the traditional and modern methods of mining gold. Gold mining is practised in about 10-15 locations, covering between 5 000 and 10 000 ha each year. Between 50 000 and 150 000 are now cleared or strongly degraded, adding damage to the surface due to human communities that live around or near the mining areas.

Irrigated agriculture development

The increase of irrigated crops, particularly rice crops, is a significant factor of deforestation. Rice production accounts for about 7 % of GNP and has priority in the country's agricultural development strategy. The Government has opted to increase rice production to 900 000 tons/year towards 2018. This calls for the management of 6 000 ha of new agricultural land areas annually at Manantali, Sélingué and Talo (MATEU/DNCN, 2000 c). Such cropland extension will necessarily encroach on the forest estate, which has already been severely reduced in these locations.

Herding methods

Estimated livestock in 1995 was in excess of 13 million sheep and goats, and nearly 6 million cattle. Livestock breeding occupies an important place in the economy. However, for the most

part, traditional herding methods consist of extensive livestock breeding systems that lead to degradation through overgrazing.

The perception of carrying capacity is discarded in present day herding methods, which consist of conducting the herds where fodder is available. Great animal concentrations over vulnerable pasturelands result in further pasture and rangeland degradation. The ultimate stage of this degradation process is to be seen in Mopti's highly compacted soils where natural regeneration no longer takes place.

Urbanization

Due to the erosion of rural livelihoods there has been a vast migration to large cities, particularly Bamako, which grew by a factor of 10 during the period 1972 to 2000. The extension of the city has strongly reduced the areas of forest stands in the proximity. All urban areas in Mali experience this phenomenon. This is particularly true in Timbuktu, where the 460 ha of the Kabara's reserved forest have been converted to settlements. Today it is estimated that the encroaching urbanization destroy about 50 000 ha of the national forest estate each year.

Road networks

The development of the road infrastructure network also contributes to the deforestation process. Construction works of national roads and opening of rural tracks destroy considerable portions of the forest estate. Each km of road affects an estimated 2,5 ha of forest area.

4.3 *Effects of deforestation and of forest and range degradation*

The strong pressures exerted on natural ecosystems, without consideration for their regeneration potential, are at the origin of forest degradation and deforestation. They have led to the loss of vegetative cover and forest species diversity. There has also been the attendant reduction of groundwater reserves, and an increase in water and wind erosion, as well as atmospheric pollution. The archaic and uncontrolled activities are responsible for the reduction of land productivity, the loss of forest biomass and biodiversity, the increase in poverty and erosion of livelihoods.

4.3.1 Loss of land productivity

This phenomenon is particularly serious in the cotton belt (CMDT zone), where it reaches alarming proportions and has compelled government authorities to initiate soil conservation and watershed management measures. The objective is to reduce and eventually stop degradation by maintaining and improving land fertility and productivity and thereby sustain the production systems. At the same time this would contribute to satisfying the needs and requirements of the population.

4.3.2 Biomass and species' diversity reduction

Significant clearings for the extension of crops, especially in areas of high population density, have incurred immediate deforestation and forest degradation. With this reduction, there is a

loss of biodiversity, biomass and carbon sequestration capacity. This also has serious impacts on the supply of wood fuel, industrial round wood, traditional wood and non-wood forest products.

Moreover, bush fires destroy significant volumes of organic matter, favouring thereby undesirable grass, shrub and tree species. Many microorganisms, insects and small mammals are also eradicated by fire and NWFPs are lost in large quantities. Fires also often extend to farms and villages, destroying crops and infrastructures, thereby exacerbating food insecurity and poverty.

4.3.3 Reduction of groundwater resources

Despite the fact that no investigation has been carried out in Mali, it is realistic to believe that because of significant deforestation and forest degradation, most rainwater tends to runoff, reducing the amount that infiltrates to the soil and which eventually recharges the groundwater

4.3.4 Increase in erosion phenomena and atmospheric pollution

Mali's forest resources face destruction and degradation at an unprecedented scale and are therefore less and less in the state needed to fulfil their protective role against wind and water erosion.

Increase of erosion

Because of severe deforestation and forest degradation, many northern cities and dams along the rivers of Senegal and Niger are threatened by sand encroachment as a result of steadily increasing wind erosion. At the same time, agricultural lands lose gigantic amounts of soils through this process. In the rest of the country excessive runoff on sun-exposed bare soils lead to their siltation and severe and widespread water erosion. However forest stands still play an important environmental protection role.

Pollution

Due to pollution of the Niger and Senegal Rivers and the atmospheric disturbances created by dust hazes coming from the Sahara, air pollution is notable in the big cities. The Government has started undertaking actions with the objective of increasing forests contribution to carbon sequestration and atmospheric purification. However, the costs are high and this remains a major constraint.

4.4 Extent of deforestation and forest degradation

According to FAO FRA - 2000, the forest cover has decreased about 100 000 ha/year due to the growing population's need for fuel-wood and agricultural soils, overgrazing and bush fires and severe climatic conditions as well as to the weaknesses in institutional capacity and capability. According to a study carried out by PIRL some 20 years ago, the rate of forest degradation was then estimated at 8,30 % (MEATEU/DNCN, 2000 a). Despite the lack of contemporary data, it is generally admitted that forest degradation and deforestation have intensified following population growth, poverty extension, the maintenance of unsuited

agricultural and animal husbandry strategies, the development of urban centres, and increased gold mining.

Clearing for crop cultivation

It is carried out most often on marginal soils and over 300 000-400 000 ha each year (Maïga, 1999 c). In the southern cotton belt (zone CMDT), the annual rate of increase in cultivated areas is estimated at 7 %. This results in a rate of ecosystem degradation ranging between 8 and 12 % annually (MEATEU/DNCN, 2000, c).

Gold mining

Traditional mining is carried out on 10-15 sites. Every year this affects between 5 000 – 10 000 ha at each site. Traditional mining is therefore responsible for 50 000 to 150 000 ha of forest clearing and degradation annually. To this, one must add the significant destruction caused by human settlements around gold mining sites. Open cast modern gold mining is carried out in Kalam, Fiaman and Sadiola, where vast stretches of forest areas are cleared and combed to the sub-soil, without any subsequent rehabilitation measures.

Bush fires

There are very few statistical data on bush fires. According to Maïga (1999) it was estimated (using SPOT satellite images) that over 9 million ha are burned annually in the period 1987-1990, with the following approximate distribution:

- 2,5 million ha in the Sahelian zone;
- 2,6 million ha in the northern Soudanian zone;
- 2,4 million ha in the southern Soudanian zone; and
- 1,6 million ha in the Soudano-Guinean zone.

Urban and road infrastructure extension

The extension of urban centres encroaches on about 50 000 ha of forestland annually. Road construction is responsible for the destruction of vast land areas combed and/or cleared at the rate of 2,5 ha for each km of infrastructure developed. Supposing that only ½ of the area affected is composed of natural woody vegetation, the projected opening of 10 000 km of tracks by the year 2010, would claim the destruction of at least 15 000 ha of forest (MEATEU/DNCN, 2000, c).

5. Status of Knowledge

5.1 Lessons learned

The lessons learned include:

- Mali's substantial natural potential has been undergoing severe deforestation and degradation, which has led the Government to undertake a series of actions to curtail the process. This political will has translated into many documents detailing the protection of the environment and the struggle against desertification, and into implementing institutional organizations plans. This includes the responsibility for coordinating activities of the Environment National Action Plan;

- The approach closely ties the management of the environment with desertification issues and is based on the participation of all actors (rural populations, private producers, professionals, technical supervisors, etc.);
- There is a huge collection of legal and regulatory texts which all favour sustainable development of the natural ecosystems, including a national strategy to combat poverty, national programmes of rural development and support, and many projects in the management of natural resources and village lands;
- Mali has a rich potential in forestry technicians and experts with experience and good will, but human resources are dispersed in various state organizations or in NGOs. There is a lack of trained supervisors, and the necessary synergy for sustainable management;
- It is advisable to profit from these lessons by strengthening experience acquired in the silviculture and to take note of the mechanisms of applying new legal and regulatory texts. This is important in the current context of decentralization and local transfer of responsibilities. The logistic capacity of the DNCN would certainly contribute to highlighting the challenges concerning installing sustainable management of integrated natural resources and of efficient and successful production systems in response to issues of food security and desertification; and
- Marginal groups and women in particular are not yet sufficiently considered at the conception and implementation stage of policy formation in the management of natural resources.

5.2 Gaps in knowledge

The gaps in knowledge include:

- Information on the status and trends in forest resources are obsolete (more than 25 years old) and/or concern very limited geographical areas;
- Insufficient knowledge on land cover according to forest type (natural forest, planted forests, trees outside forests), standing volumes, dynamics of growth, response of different types of natural and planted forests, and “trees to improved management” (tree improvement programmes, use of modern silvicultural knowledge, forest protection, low impact/low intensity harvesting);
- The massive unauthorized and uncontrolled traditional/informal harvesting and utilization of wood and non-wood forest products in rural areas is not sufficiently taken into account;

- Knowledge is insufficient concerning the extent of deforestation and forest degradation and their impacts (social, cultural, environmental, economic), particularly on food security and poverty alleviation strategies is insufficient; and
- There is insufficient recognition of, and attention given to the immense richness of rural people's traditional knowledge and know-how of land use, tending and management.

6. Conclusions and recommendations

6.1 Conclusions

Analysis of the forestry sector reveals a constant degradation of forest and woodland flora and fauna. The relationship between people and the forestry service underwent a traumatic crisis from numerous conflicts of interests in terms of natural resource use. The forestry sector has not been integrated enough into the national economy nor has sufficient investment in forest products been made. As a consequence, major national issues include deforestation, forest degradation, loss of biological diversity, soil erosion, reduction of water resources and consequent lowering of income and increase in levels of poverty constitute still major national issues.

Despite the increasing recognition of the benefits from forests, strong human pressure has continued to cause deforestation and forest degradation at alarming rates. If corrective measures are not immediately applied, there is a risk of creating an irreversible social, cultural, environmental and economic catastrophe where the livelihoods of both rural and urban populations will be severely eroded.

In search of appropriate solutions, the Government has reviewed the forest law to define a new national forest policy and to implement a strategy of domestic energy. Still, it does not have the proper means to elaborate on the Action Plan for 117 Reserved Forests of the National Territory, the protected areas of the State and of the communities. Therefore, it must rely on international cooperation, financial support and technical expertise of its partners to support its efforts. It is with urgency that the laws, policies, regulations and plans have to be translated into targeted priority actions in the field through a more effective and efficient institutional framework.

The government is also considering a form of collaboration with those responsible in the decentralized communities, to guarantee their interests in the framework of a better management of natural resources. The Government authorities need to improve tenure security and identify simple intervention techniques that are operational, inexpensive and transferable in the context of decentralization. The current methods are lengthy and do not generate enough income for rural populations, thereby leading to misuse of natural resources.

Participatory methods of planning, managing and monitoring of forest resources have been insufficiently embraced so there is only limited engagement of rural communities striving to achieve sustainable forest management.

6.2 Recommended actions

6.2.1 Development choices and issues

- Adopt participatory planning approaches to determine the expertise, needs, vision and expectations of rural populations to combine a top down and bottom up decentralized strategy to forest management;
- Identify needs in human resources, budgets, equipment and strategies aimed at implementing development options of the sector; and
- Implement a series of village demonstration or test sites, representative of main contexts encountered that relate to natural resource managements (in particular, forestry).

6.2.2 Inter-sectoral collaboration

- Set up networks of systematic exchange of knowledge and new ideas with the full spectrum of main stakeholder groups;
- Widen multi-disciplinary and inter-sectoral dialogue across the public service and State projects and include community representatives; and
- Strengthen forums of communication to guide planning and evaluation.

6.2.3 Institutional and legal aspects

- Review the legal, policy, regulatory and planning framework to clarify the vision, key initiatives, major stakeholders and target areas, and the decentralization policies of the Government;
- Analyse the strengths, weaknesses and opportunities of decentralization concerning the management of natural resources and strive to reach a balance of central and local administrative planning, management and monitoring to suit the unique conditions prevailing. This needs to be supported with the necessary delegation of authority, responsibility and resources (budgets, personnel, equipment, vehicles etc);
- Review the role of the public service, private sector, NGOs, IGOs, donors, communities and other stakeholders in the management of forests;
- Establish an institutional structure in the public service and mechanisms of collaboration with other stakeholders which can effectively and efficiently deliver the necessary support services at all levels to apply the priority actions to the priority target groups and areas;
- Conduct a human resource development plan to quantify the needs of the public sector for professionals, scientists, technicians, artisans and support personnel and to identify the specialist expertise needed; and
- Correct omissions or gaps in re-examined forest texts where afforestation or reforestation is practically ignored.

6.2.4 Ecosystems' monitoring and evaluation

- Urgently conducting a realistic national forest assessment (survey) to be a reference for a viable analysis of status and trends in forest cover as well as monitoring and reporting of the criteria and indicators for sustainable forest management;
- Creating a computer network of DNCD with regional representations to facilitate exchanges between the operating structures in the country;
- Developing a reliable information and statistical database to improve forest planning, management and development;
- Providing the forestry sector with the necessary computer science and information technology and the training of forestry staff.

6.2.5 Improvement of resources utilization and management

- Evaluate the most appropriate mechanisms of forest management, select successful species and varieties according to different agro-ecological conditions and purposes, and document and share this knowledge with a wide range of stakeholders, whilst incorporating this information in implementation guidelines and codes of practice;
- Pay greater attention to cultural diversity as well as rights and traditional knowledge of tree culture and meld this knowledge with scientific knowledge in implementation of policy and plans in a prudent manner;
- Focus the methods of collecting quantitative information on non-wood forest products (NWFP), according to different times of the year and socio-professional categories for the purpose of obtaining reliable statistics; and
- Strengthen organizational capacities of traditional medicines and develop mechanisms to establish credibility with the relationship with modern medicine. Make regulations concerning pharmacopoeia certifications for the products.

6.2.6 Research

- Stimulate the frameworks and networks of dialogue between forest researchers, professional foresters, local communities and other stakeholders in the forestry sector;
- Install a network of permanent sample plots in all forest types for a better understanding of the dynamics of tree increments and growth of various types of forest settlement;
- Introduce modern forest equipment, including computers and associated training for the treatment of statistical data and install a system to motivate those responsible for statistics;
- Build the technical systems of reference on methods of pruning of wood fodder trees; and

- Develop tools to relate management of selected trees on selected sites with the quantity and quality of fruit or animal fodder production; and
- Conduct research on high-performance forest species/varieties to reach the national production and protection objectives under variable agro-ecological conditions.

6.2.7 Training

- Design a multi-level education and training programme to upgrade training and increase the graduation of the necessary qualified professional, scientist, technician, artisan and other support staff for the sector; and
- Strengthen the experience acquired from the environmental education programme and extend it to all other sectors of activities.

References

- BOFFA, J. M., 2000.** *Les parcs agroforestiers en Afrique subsaharienne*. ICRFA, FAO. Cahier FAO Conservation N°34. Rome.
- DNRFFH, 1995.** Rapport Annuel de la Direction Nationale des Ressources Forestières, Fauniques et Halieutiques. Direction Nationale des Eaux et Forêts. Bamako,
- FAO, 1999.** *Appui à la formulation du Plan National d'Action Environnementale et des Programmes d'Action Nationaux de Lutte contre la Désertification au Mali*. Compte rendu final du projet préparé pour le Gouvernement du Mali par la FAO. Rome,.
- FAO, 2000.** *Report of the open-ended international meeting of experts on special needs and requirements of developing countries with low forest cover and unique types of forest (Teheran, Islamic Republic of Iran, 4- 8 October 1999)*. Information Note FO:NEFC/2000/INF.5, Rome, March 2000.
- FAO, 2001a.** *ituation des Forêts du monde*. Rome.
- FAO, 2001b.** *Arbres Hors Forêts: Vers un aménagement intégré de l'écosystème rural et urbain*. Contribution au rapport sur l'évaluation des ressources forestières 2000. FAO, Rome.
- FAO, 2001c.** *Conflits et gestion des ressources naturelles*. Foresterie Communautaire/FTPP, Série Gestion des conflits, Rome.
- KONATE, Gaoussou, 2000.** *La revue et l'amélioration des données relatives aux produits forestiers au Mali*. Collecte et analyse de données pour l'aménagement durable des forêts –Joindre les efforts nationaux et internationaux. Programme Partenariat CE-FAO (1998-2001), Projet GCP/INT/679 EC. DNCN, Bamako, Mali, Août 2000.
- DNCN, 2000.** *Rapport National du Mali à l'Atelier Régional de Formation sur les "Programmes Forestiers Nationaux" (Dakar 12 – 21 juin 2000)*. MEATEU, Juin 2000, Bamako, République du Mali.
- MAIGA, A., 1999a.** Ressources forestières naturelles et plantations (*Cas du Mali*). CE-FAO Programme Partenariat (1998-2000) - Projet GCP/INT/679/EC. Septembre 1999.
- MAIGA, A., 1999b.** La perception des arbres dans les sociétés sahéliennes. *Rapport Provisoire Consultation FAO, Novembre 1999*.
- MAIGA, A., 1999c.** Stratégies d'atténuation des émissions de GES : Secteur de la foresterie. *Projet PNUD/GEF/MLI/97/G32. ME – MESSRS. Bamako*.
- MDR/CPS, 2000.** Schéma Directeur du Secteur du Développement Rural Vol. I : *Situation du Secteur du Développement Rural et Evaluation de la Mise en Œuvre du SDDR - Bamako, juin 2000*
- MEATEU /DNCN, 2000a.** Rapport National du Mali à l'Atelier Régional sur les « Programmes Forestiers Nationaux ». *Académie Africaine des Sciences, Dakar, Sénégal, juin, 2000*.
- MEATEU /DNCN, 2000b.** *Former pour une gestion durable des ressources naturelles au Mali. 1ère partie : Etats des lieux: Aspects environnementaux, institutionnels et ressources humaines*. Bamako, juillet 2000.
- MEATEU /DNCN, 2000c.** *Etude prospective du secteur forestier en Afrique (FOSA)*. Document National du Mali. Bamako, Octobre 2000.

M E/ Secrétariat Permanent PNAE/CID, 1998. *Plan National d'Action Environnementale et Programmes Nationaux de la Convention Contre la Désertification (PNAE/PAN-CID).*

Volume I: Diagnostic Environnemental.

Volume II: Politique Nationale de Protection de l'Environnement (PNPE). Mai 1998.

Volume III: Résumés des programmes d'Action Régionaux.

MEPI, 1998. Stratégie Nationale de Lutte contre la Pauvreté. Volume I. Février 1998.

TOURE, O., I., 2000. Collecte et analyse de données pour l'aménagement durable des forêts dans les pays ACP. Bois Energie – Cas du Mali. CE-FAO Programme Partenariat (1998-2000), Projet GCP/INT/679/TC. Bamako, Mali, Avril 2000.

IUCN 1989. *The IUCN Sahel Studies.* IUCN, Gland, Switzerland and Nairobi, Kenya. 152 pp.

UNICEF, 1995. *Analyse des indicateurs sur la situation des femmes et des enfants au Mali 1990 – 1995.*

Annexes

ANNEX 1: TERMS OF REFERENCE OF THE MISSION

TORs International Consultant

Background: It is proposed that country case studies will be prepared in the African region in Mali (CILSS), Namibia (SADC) and Ethiopia (IGAD) in advance of the Regional Workshop for Africa to be held in Nairobi, Kenya in May 2002. These case studies will outline the causes and effects of deforestation and forest degradation; lessons learned and priority needs strategies and methodologies to enhance the role of planted forests, trees outside forests in integrated landscape management and economic significance of NWFPs. The country study reports will be published in English and French in advance of a subsequent International Workshop together with guidelines for each participating country to prepare their inputs. The consultant will also assist in providing technical advice in preparation and conducting the workshops and co-ordinating and reporting outputs.

Tasks to be undertaken: With respect to enhancing the role of planted forests and trees outside forests for production of wood and non-wood forest products (including fuel-wood, wood products, food, livestock fodder, medicines, protection of soil and water values, shelter, shade etc) in individual country case studies the international consultant, assisted by a national consultant, under the supervision of task managers will consult stakeholders widely to evaluate and detail for each country case study:

Background highlights with direct or indirect impacts upon the forestry sector, including population pressure, food security, land access, land-use rights, availability of credits, market access, forest resources (natural and planted), deforestation, forest degradation, desertification, afforestation and other key indicators of the significance and state of the forestry sector.

Policy, legal, planning and institutional frameworks outlining the vision and commitment of the Government, detailing strengths and weaknesses in capacity and capability (technical, technology and financial) and awareness of the environmental, economic, social and cultural value of these forest resources and ecosystems for the livelihoods rural populations;

Related to the above, inter-sectoral linkages, conflicts in land-use policy and practice, incentives and subsidies, which impact upon the forestry sector.

Appropriateness of current policies as reflected in alternative mechanisms and practices, programmes and projects for achievement of sustainable forest management.

Information, data and reports on the extent (quantity and quality) of planted forest resources (forest plantations - rain-irrigated and/or with treated waste water and trees outside forests) and production of the main wood and non-wood forest products and their respective roles in provision of goods and services;

Meet with all stakeholders (line ministries e.g. Agriculture, Municipal Affairs; communities, rural families, NGOs, private sector, research and academic institutions and international

agencies etc) to discuss and report on the perceived appropriateness of current policies and priorities in planning and soundness of alternative mechanisms, practices, programmes and projects in achieving sustainable forest management and equitable sharing of opportunities, risks, costs and benefits; and

Formulate a list of the key issues, constraints, opportunities, lessons learned, success stories and recommended development proposals within the capacity and capability of each country to be presented as case studies at the regional workshops to represent different ecological zones, institutional and stakeholder circumstances.

The case study reports are to be prepared and presented to FAO in English within 1 month of completion of the fieldwork to allow time for translation into French and dissemination to country participants to the regional workshops. A guide will be prepared for the format and content of the case study report for each country.

The consultant will support the FAO task managers with technical advice and recommendations on the format, content, activities and outputs from the regional workshops, with potential (to be confirmed) to attend as facilitators for the working groups. The workshop will be conducted in English and the proceedings prepared in English and French.

Duration: 3 person months between February - April 2002

Locations: Case studies in Mali, Namibia and Ethiopia, brief and debrief for case studies in Rome prior to and after completion of field missions

Task managers: Pape Kone, Africa Regional Office, FAO supported by Jim Carle and Syaka Sadio, Forest Resources Division, FAO, HQ, Rome Italy and FAO representations in each country.

TORs National Consultant

Background: It is proposed that country case studies will be prepared by an international consultant with support from an in-country national consultant in each of Mali, Ethiopia, and Namibia in readiness for a Regional Workshop for the low forest cover countries in Africa to be held in Nairobi in June/July, 2002. These case studies will outline the causes and effects of deforestation and forest degradation, as well as lessons learned and priority needs strategies and methodologies to enhance the role of planted forests, and trees outside forests in integrated landscape management as well as the economic significance of NWFPs. The country study reports will be published in English/French in advance of a subsequent International Workshop together with guidelines for each participating country to prepare their inputs.

Tasks to be undertaken: With respect to enhancing the role of planted forests and trees outside forests for production of wood and non-wood forest products (including fuel-wood, wood products, food, livestock fodder, medicines, protection of soil and water values, shelter, shade etc) in individual country case studies the national consultant will provide support to the international consultant and facilitate effective and balanced in-country participation with stakeholders; ensure appropriate approvals, background resources and logistical support are available for meetings and field visitations; and to achieve a dispassionate and professional case study document. Specific tasks include:

Provide the link between the key stakeholders and the international consultant to identify key resource persons, organize meetings and stakeholder forums, contribute fully to discussions, arrange field visitations and provide logistical support as necessary;

Ensure that documentation and resources as detailed in the terms of reference for the international consultant (attached) are available in a timely manner and assist in interpretation;

Assist the international consultant to prepare and review the draft case study report to reflect the current status and key issues, constraints, opportunities, lessons learned, success stories and recommended development proposal priorities of the country.

Other tasks as identified during the case study.

Duration: Full time, 1 person month, between February and April 2002 (during fielding of international consultant)

Locations: One national consultant in each of Mali, Ethiopia, Namibia - field visits included

Task Managers: Pape Kone, Africa Regional Office, FAO supported by Jim Carle and Syaka Sadio, Forest Resources Division, FAO, HQ, Rome Italy; and in-country supervision and administrative support by FAO representations in each country.

ANNEX 2: ITINERARY, PLACES VISITED BY THE MISSION

Tuesday 5 May, 2002 : Bamako

- Fana (Projet de Gestion des Ressources Naturelles)
- Ségou (DRCN ; Office du Niger ; UER/ICRAF) ;

Wednesday 6 May, 2002 : San

- Service de la Conservation de la Nature ;
- Fondation pour le développement au Sahel ;
- Projet d'Appui à la communauté de Sono – Mopti (DRCN Mopti).

Thursday 7 May, 2002 : Mopti - Commune de Konna:

- Projet FED: Projet Valorisation des Ressources en Eau et du Sol à Konna ;
- Tradipraticien Kalidi Berthé.

Friday 8 March, 2002 : Mopti

- Koutiala (Région de Sikasso) : DRCN de Sikasso ;
- Direction Régionale de la Recherche Agronomique (Recherche Forestière).

Monday 11 March, 2002 : Institut d'Economie Rurale de Sotuba.

Tuesday 12 March, 2002 : Koulikoro (DRCN, Centre de Formation Continue de Katibougou).

Wednesday 12 March, 2002 : Kita

- Service de la Conservation de la Nature ;
- Projet PNUD/BIT 'Mise en valeur des forêts du Cercle de Kita par les Organisations Paysannes'.

Various meetings with officers in charge and actors involved in forestry

ANNEX 3: PERSONS MET BY THE MISSION

FAO – ROME (Forestry Department)

ALLARD, B. Gillian: Forestry Officer (Forest protection) –FRDS

ANDRADE, Graciela: FORM

MALAGNOUX, Michel: Forestry Officer (Arid Zone and Fuel-wood Production). Forest Conservation, Research and Education Service. Forest Resources Division.

CARLE, B. Jim: Senior Forestry Officer (Plantations and Protection) FORM

SADIO, Syaka: FORC

BLANCHEZ, Jean Louis: Ingénieur, Division des politiques et de la planification forestière.

NAIR, C. T. S.: Senior Forestry Officer. Forestry Policy and Planning Division

SO, H. , Patrick: Division des politiques et de la planification forestière.

ROUCHICHE, Salah :Consulting Forestry and Desertification Control Specialist. Diepenbrockstraat, 9 – 2625 XG, Delft, The Netherlands.

WALTER, Sven: Associate Professional Officer (NWFP). Forest Product Division

MALI

Bamako

AGUILNADO, L. Ramos: Représentant de la FAO au Mali- Bamako, Mali.

BATHILY, C. Bougadary: Chargé des Programmes, FAOR – Bamako, Mali.

SISSOKO, Marie B. Traoré: Assistante de Programme, Représentation FAO - Bamako, Mali.

SAMASSEKOU, Sory: Ingénieur des Eaux et Forêts, Responsable de la Division Documentation et Formation à la Direction Nationale de la Conservation de la Nature.
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BERTHE, Yafong: Conseiller Technique – Ministère du Développement Rural. Bamako – Rép. du Mali – yberthe@mdr.mali.org

DABO, Makan Fily: Ingénieur des Eaux et Forêts, Secrétaire Général – Ministère de l'Équipement, de l'Aménagement du Territoire, de l'Environnement et de l'Urbanisme.

TAMBOURA, Yaya: Directeur National , Direction Nationale de la Conservation de la Nature. B. P. 275 Bamako, Rép.Mali – conservationnature@datatech.net.ml

KONATE, Gaoussou: Ingénieur des Eaux et Forêts, DNCN, Chef Section Réglementation et Normes. Point Focal du FOSA. B. P. 275 Bamako, Rép.Mali.

DIARRA, Dramane: Ingénieur des Eaux et Forêts, DNCN, Adjoint à la Coordination.

KANOUTE, Salif: Secrétariat Technique Permanent de l'Environnement, Ministère de l'Équipement, de l'Aménagement du Territoire, de l'Environnement et de l'Urbanisme. Bamako, Rép. du Mali. – stp@ceflb.com

SANOUGHO, Nampaa Nangou: Administrateur GIE AGEFORE (Groupement pour l'Aménagement et la Gestion des Forêts et de l'Environnement). BP. E 2927.

HINDATOU LABO, M. Saidou: Coodinatrice de Programme. SNV – Mali. Organisation Néerlandaise de développement. B.P. 2220 Bamako, Rép.Mali – snv@snvmail.org

MAÏGA, Amadou: Docteur Ingénieur des Eaux et Forêts, Conseiller Technique, MEATEU, Bamako, Rép. du Mali.

MAÏGA, Pathé: Chef de la Division Administration Territoriale. Secrétariat Technique Permanent de l’Environnement, MEATEU, Bamako, Rép. du Mali.

DEMBELE, Moussa: Ingénieur des Eaux et Forêts, Secrétariat Technique Permanent de l’Environnement, MEATEU, Bamako, Rép. du Mali.

NIANG, Amadou Ibra: Directeur Régional ICRAF, Bamako, Rép. du Mali.

KARAMBE, Moussa: Ingénieur des Eaux et Forêts, Chercheur Pastoraliste à l’IER de Sotuba. Bamako, Rép. du Mali.

KAMISSOKO, D. Christophe: Ingénieur des Eaux et Forêts, Chercheur Aménagiste à l’IER de Sotuba. Bamako, Rép. du Mali.

DIARISSO, Dalla: Chercheur en Agro-pédologie à l’IER de Sotuba. Bamako, Rép. du Mali.

OUATTARA, Seydou: Ingénieur des Eaux et Forêts, Chercheur “Plantes Médecinales” à l’IER de Sotuba. Bamako, Rép. du Mali.

Koulikoro

KONE, Oumarou: Coordinateur Centre de formation continue IPR/IFRA de Katibougou. B.P. 06 Koulikoro, Rép. du Mali.

KEITA, Modibo: Ingénieur des Eaux et Forêts, Directeur Régional de la Conservation de la Nature à Koulikoro.

DEMBELE, Gabriel: Professeur Agro-Chimie. IPR/IFRA de Katibougou. B.P. 06 Koulikoro, Rép. du Mali.

DIARRA, Nguiti: Technicien des Eaux et Forêts, Chef Antenne Conservation de la Nature à Fana.

COULIBALY, Mamadou: Technicien Eaux et Forêts, Antenne Conservation de la Nature à Fana.

Région de Ségou

GOITA, Nafiengé: Ingénieur des Eaux et Forêts, Directeur Régional de la Conservation de la Nature à Ségou.

KALOGA, Kalidy: Ingénieur hydraulicien, Directeur de l’Office du Niger à Ségou.

SIDIBE, Souleymane: Ingénieur hydraulicien, Chef des Aménagements à l’Office du Niger à Ségou.

BORE, Mme: Spécialiste Femmes et Développement à l’Office du Niger à Ségou.

BOKARI, Kaya: Ingénieur des Eaux et Forêts, IER/ICRAF à Ségou.

TIMBELY, Donno: Ingénieur des Eaux et Forêts, IER/ICRAF à Ségou.

SAMAKE, Zan Moussa: Chef du Service de la Conservation de la Nature à San.

DRAME, Issa: Projet d’Appui à la Commune de Somo.

Région de Mopti

SANOGO Moumouni: Ingénieur des Eaux et Forêts, Chef de division Aménagement DRCN à Mopti.

BA, Mamadou: Ingénieur des Eaux et Forêts, Chef division Réglementation et Contrôle DRCN à Mopti.

MAIGA, Amadou : Projet Valorisation des ressources en eau et du sol à Konna.

BERTHE, Kalidi: Tradithérapeute à Konna.

Région de Sikasso

SISSOKO, Biramou; Ingénieur des Eaux et Forêts, Directeur Régional Conservation de la Nature à Sikasso et Directeur National du Projet GCP/RAF/303/ITA.

SISSOKO, Moussa: Ingénieur des Eaux et Forêts, Chef du Service de la Conservation de la Nature à Koutiala.

MAIGA, A. Ahmadou: Ingénieur Agronome, Directeur du Centre de Recherches Agricoles de Sikasso.

DIALLO, Oumar: Ingénieur des Eaux et Forêts, Chercheur à l'IER de Sikasso, B.P. 178 à Sikasso.

KAMISSOKO, Sayon: Ingénieur des Eaux et Forêts, Chercheur à l'IER de Sikasso, B.P. 178 à Sikasso.

KOUYATE, A., Malla: Ingénieur des Eaux et Forêts, Chercheur à l'IER de Sikasso, B.P. 178 à Sikasso.

Région de Kayes

KOKAINA, Mamary: Ingénieur des Eaux et Forêts, Chef Service Conservation de la Nature de Kita.

COULIBALY, Koulountan: Coordonnateur Projet "Mise en valeur des forêts du Cercle de Kita par les Organisations Paysannes".

ANNEX 4: MAIN CONVENTIONS RELATED TO ENVIRONMENTAL PROTECTION WITH A FORESTRY ASPECT RATIFIED BY THE REPUBLIC OF MALI

Title	Objective	Ratification
1. Convention for the protection of the world cultural and natural heritage (Paris, 16/11/1972)	To establish, on a permanent basis and by means of modern methods, an efficient collective system for the protection and preservation of the cultural and natural heritage considered to be outstanding value to humanity.	05/07/1977
2. Convention on Wetlands of international importance especially as Waterfowl Habitat (Ramsar, 02/02/1971)	To stem the progressive encroachment on and loss of wetlands given their fundamental ecological functions and their great economic, cultural, scientific, and recreational value.	25/09/1987
3. African Convention on the Conservation of Nature and Natural Resources (Alger, 15/09/1968).	To adopt the measures necessary to ensure conservation, utilization and development of soil, water, flora and faunal resources in accordance with scientific principles and with due regard to the best interests of the people.	20/06/1974
4. Convention on the Protection of Migratory Species of Wild Animals (Bonn 23/06/1979)	To preserve some migratory species from extinction, to regulate the production and management of such migratory species whose conservation status is unfavourable by taking individually, or in co-operation, appropriate and necessary steps to conserve such species and their habitat.	10/10/1987
5. United Nations Convention to combat desertification (Paris, 1974)	To combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification	31/10/1995
6. Framework Convention on Climate Change (Rio de Janeiro, 1992)	To achieve stabilization of greenhouse gas concentrations in the atmosphere.	28/12/1994
7. Convention on Biological Diversity (Rio de Janeiro, 1992)	To conserve biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.	29/03/1995
8. International Plant protection Convention (Rome, 1951)	To ensure and develop international co-operation in controlling pests and diseases of plants and plant products and in preventing their introduction and spread across national boundaries.	31/08/1987
9. Convention on International Trade in Endangered Species of Wild Fauna and Flora (Washington, DC, 30/03/1973)	To safeguard some endangered species from over-exploitation by regulating the international trade system.	18/07/1994

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<http://www.fao.org/DOCREP/004/AC121E/AC121E00.HTM>
- Working Paper FP/2 *Biological Sustainability of Productivity in Successive Rotations.*
Evans J. March 2001.
<http://www.fao.org/DOCREP/004/AC122E/AC122E00.HTM>
- Working Paper FP/3 *Plantation Productivity.* Libby W.J. March 2001.
<http://www.fao.org/DOCREP/005/AC601E/AC601E00.HTM>.
- Working Paper FP/4 *Promotion of Valuable Hardwood Plantations in the Tropics.*
A Global Overview. Odoom F.K. March 2001.
<http://www.fao.org/DOCREP/004/AC124E/AC124E00.HTM>
- Working Paper FP/5 *Plantations and Wood Energy.* Mead D.J. March 2001.
<http://www.fao.org/DOCREP/004/AC125E/AC125E00.HTM>
- Working Paper FP/6 *Non-Forest Tree Plantations.* Killmann W. March 2001.
<http://www.fao.org/DOCREP/004/AC126E/AC126E00.HTM>
- Working Paper FP/7 *Role of Plantations as Substitutes for Natural Forests in Wood*
Supply – Lessons learned from the Asia-Pacific Region.
Waggener T. March 2001.
<http://www.fao.org/DOCREP/004/AC127E/AC127E00.HTM>
- Working Paper FP/8 *Financial and Other Incentives for Plantation Establishment.*
Williams J. March 2001.
<http://www.fao.org/DOCREP/004/AC128E/AC128E00.HTM>
- Working Paper FP/9 *The Impact of Forest Policies and Legislation on Forest*
Plantations. Perley C.J.K. March 2001.
<http://www.fao.org/DOCREP/004/AC129/AC129E00.htm>
- Working Paper FP/10 *Protecting Plantations from Pests and Diseases.* Ciesla W.M.
March 2001.
<http://www.fao.org/DOCREP/004/AC131E/AC131E00.HTM>
- Working Paper FP/11 *Forestry Out-Grower Schemes: A Global View.* Race D. and
Desmond H. March 2001.
<http://www.fao.org/DOCREP/004/AC131E/AC131E00.HTM>
- Working Paper FP/12 *Plantations and Greenhouse Gas Mitigation: A Short Review.*
Moura-Costa P. and Auckland L. March 2001.
<http://www.fao.org/DOCREP/004/AC132E/AC132E00.HTM>
- Working Paper FP/13 *Future Production from Forest Plantations.* Brown C. March
2001.
<http://www.fao.org/DOCREP/004/AC133E/AC133E00.HTM>

- Working Paper FP/14 *Forest Plantation Resources, FAO Data Sets 1980, 1990, 1995 and 2000.* Del Lungo, A. December 2001.
<http://www.fao.org/DOCREP/004/AC134E/AC134E00.HTM>
- Working Paper FP/15 *Global Forest Plantation Development: Review for FRA 2000.* Vuorinen A.P. and Carle, J.B. April 2002.
- Working Paper FP/16S *Bibliografía Anotada Sobre los Efectos Ambientales, Sociales y Económicos de los Eucaliptos.* Compilación de documentos elaborados en inglés, francés y español entre 1985 y 1994. Marzo de 2002.
<http://www.fao.org/DOCREP/005/Y4016S/Y4016S00.HTM>
- Working Paper FP/16E *Annotated Bibliography on Environmental, Social and Economic Impacts of Eucalyptus.* Compilation from English, French and Spanish Literature, 1985 to 1994. Revised (Combined) Edition, March 2002.
- Working Paper FP/17S *Bibliografía Anotada Sobre los Efectos Ambientales, Sociales y Económicos de los Eucaliptos.* Compilación de documentos elaborados en inglés, francés y español entre 1995 y 1999. Palmberg C. Marzo de 2002.
<http://www.fao.org/DOCREP/005/Y7605S/Y7605S00.HTM>
- Working Paper FP/17E *Annotated Bibliography on Environmental, Social and Economic Impacts of Eucalyptus.* Compilation from English, French and Spanish Literature, 1995 to 1999. Palmberg C. March 2002.
- Working Paper FP/18 *Tropical forest plantation areas 1995 data set.* Pandey D. May 2002.
<http://www.fao.org/DOCREP/005/Y7204E/Y7204E00.HTM>
- Working Paper FP/19 *Teak (Tectona grandis) in Central America.* De Camino, R.V., Alfaro, M.M. and Sage, L.F.M. May 2002.
<http://www.fao.org/DOCREP/005/Y7205E/Y7205E00.HTM>
- Working Paper FP/20 *Melina (Gmelina arborea) in Central America.* Alfaro, M.M. and De Camino, R.V. May 2002.
<http://www.fao.org/DOCREP/005/Y7206E/Y7206E00.HTM>
- Working Paper FP/21 *Case study of hardwood programmes in Fiji, Solomon Islands and Papua New Guinea.* Hammond, D. May 2002.
<http://www.fao.org/DOCREP/005/Y7207E/Y7207E00.HTM>
- Working Paper FP/22 *Case study of long rotation eucalypt plantations in New South Wales.* Heathcote, R. June 2002.
<http://www.fao.org/DOCREP/005/Y7208E/Y7208E00.HTM>
- Working Paper FP/23 *Case study of the tropical forest plantations of Malaysia.* Krishnapillay, D.B. June 2002.
<http://www.fao.org/DOCREP/005/Y7209E/Y7209E00.HTM>

- Working Paper FP/24 *Hardwood plantations in Ghana*. Odoom, F. June 2002.
<http://www.fao.org/DOCREP/005/Y7210E/Y7210E00.HTM>
- Working Paper FP/25 *Planted Forests Database (PFDB): Structure and Contents*.
Varmola, M. and Del Lungo, A. July 2003.
- Working Paper FP/26 *Planted Forests Database: Analysis of Annual Planting Trends
and Silvicultural Parameters for Commonly Planted Species*.
Del Lungo, A. September 2003.
- Working Paper FP/27E *Role of Planted Forests and Trees Outside Forests in Sustainable
Forest Management: Republic of Tunisia - Country Case Study*.
Rouchiche, S. and Abid, H. October 2003.
- Working Paper FP/27F *Rôle des plantations forestières et des arbres hors forêts dans
l'aménagement forestier durable: République de Tunisie – Rapport
par pays*. Rouchiche, S. et Abid, H. Décembre 2003.
- Working Paper FP/28E *Role of Planted Forests and Trees Outside Forests in Sustainable
Forest Management: Republic of Mali - Country Case Study*.
Thomas, I. and Samassekou, S. October 2003.
- Working Paper FP/28F *Rôle des plantations forestières et des arbres hors forêts dans
l'aménagement forestier durable: République de Mali - Rapport
par pays*. Thomas, I. et Samassekou, S. Décembre 2003.
- Working Paper FP/29E *Role of Planted Forests and Trees Outside Forests in Sustainable
Forest Management: Republic of Ethiopia - Country Case Study*.
Thomas, I. and Bekele, M. October 2003.
- Working Paper FP/29F *Rôle des plantations forestières et des arbres hors forêts dans
l'aménagement forestier durable: République d'Ethiopie - Rapport
par pays*. Thomas, I. et Bekele, M. Décembre 2003.
- Working Paper FP/30E *Role of Planted Forests and Trees Outside Forests in Sustainable
Forest Management: Republic of Namibia - Country Case Study*.
Thomas, I. and Chakanga, M. October 2003.
- Working Paper FP/30F *Rôle des plantations forestières et des arbres hors forêts dans
l'aménagement forestier durable: République de Namibie -
Rapport par pays*. Thomas, I. et Chakanga, M. Décembre 2003.
- Working Paper FP/31E *Role of Planted Forests and Trees Outside Forests in Sustainable
Forest Management: Sultanate of Oman - Country Case Study*.
Rouchiche, S. October 2003.
- Working Paper FP/31F *Rôle des plantations forestières et des arbres hors forêts dans
l'aménagement forestier durable: Sultanat d'Oman - Rapport par
pays*. Rouchiche, S. Décembre 2003.
- Working Paper FP/32E *Role of Planted Forests and Trees Outside Forests in Sustainable
Forest Management: Islamic Republic of Iran - Country Case
Study*. Rouchiche, S. and Haji Mirsadeghi, M. A. October 2003.

Working Paper FP/32F

Rôle des plantations forestières et des arbres hors forêts dans l'aménagement forestier durable: République Islamique d'Iran - Rapport par pays. Rouchiche, S. et Haji Mirsadeghi, M. A. Décembre 2003.

International Poplar Commission - FAO Statutory Body (English, French, Spanish)

(<http://www.fao.org/forestry/FO/STATBOD/Technical/IpC/ipc-e.stm>)

Report on the 21st Session of the International Poplar Commission and the 40th Session of the Executive Committee, Portland, Oregon, USA, 24-28 September, 2000.

Report on the 41st Session of the Executive Committee of the International Poplar Commission, Rome, Italy, 2 September, 2002

Information Notes (English, French, Spanish)

Forest Plantations (<http://www.fao.org/forestry/FODA/Infonote/en/t-plantations-e-2000.stm>)

International Poplar Commission (<http://www.fao.org/forestry/FODA/Infonote/en/t-ipc-e.stm>)

See also: FRA Working Paper No.18