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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 TUNISIA
COUNTRY CASE STUDY***

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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.

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List of Acronyms

AFIC	Association Forestière d'Intérêt Collectif
API	Approche participative intégrée
ASAD	Association de Soutien à l'Auto Développement
AVFA	Agence de Vulgarisation et de Formation Agricole
BV	Bassin Versant
CES	Conservation des Eaux et du Sol
CNDD	Commission Nationale de Développement Durable
CRDA	Commissariat Régional de Développement Agricole
DCES	Direction de la Conservation des Eaux et du Sol
DGF	Direction Générale des Forêts
DPP	Diagnostic et Planification Participatif
DT	Dinar Tunisien
FAO	Organisation des Nations Unies pour l'Alimentation e l'Agriculture
GCES	Groupement pour la Conservation des Eaux et du Sol
GDA	Groupement de Développement Agricole
GFIC	Groupement Forestier d'Intérêt Collectif
IBRD	International Bank for Reconstruction and Development
IFPN	Inventaire Forestier et Pastoral National
INGREF	Institut National de Recherche en Génie Rural, Eaux et Forêts
INS	Institut National de la Statistique
JT	Journées de Travail
MARP	Méthode Accélérée de Recherche Participative
MdA	Minis tère de l'Agriculture
MEAT	Ministère de l'Environnement et de l'Aménagement du Territoire
NU	Nations Unies
ODESYANO	Office de Développement Sylvo-Pastoral du Nord-ouest
OEP	Office de l'Élevage et des Pâturages
ONG	Organisation Non Gouvernementale
OPDI	Opération Pilote de Développement Intégré
PDF	Projet de Développement Forestier
PDNDFP	Plan Directeur National de Développement Forestier et Pastoral
PDRI	Programme de Développement Régional Intégré
PDZF	Projet de Développement des Zones Forestières
PDZMNO	Projet de Développement des Zones Montagneuses du Nord-ouest
PFCF	Pays à Faible Couvert Forestier
PGRN	Projet de Gestion des Ressources Naturelles
PNUD	Programme des Nations Unies pour le Développement
PSPK	Projet Sylvo-Pastoral de Kairouan
PFN	Politique Forestière Nationale
PDES	Plan de Développement Economique et Social
PIB	Produit Intérieur Brut
REF	Régie d'Exploitation Forestière
SWC	Soil and Water Conservation
USF	Unité Socio-Forestière (Terroir Forestier)

Executive Summary

Preamble

This case study was carried out under the FAO-Netherlands Partnership Programme to support Sustainable Forest Management in LFCCs in the Near East Region. It is one of three carried out in Tunisia, Oman and Iran to form the basis for the Teheran Workshop (28-31/10/02). The focus is on enhancing the role of planted forests and TOFs in supporting sustainable forest management and complementing management of diminishing natural forest, range and woodland resources.

Located in the centre of the Mediterranean Basin, Tunisia covers 162 155 km²; its mostly urban (62 %) population of 9,4 million (1999) has stabilized its growth at 1,15 %. The country's environmental features include: (i) five bio-climatic¹ levels going from humid to arid, according to a north-south aridity gradient, (ii) a succession of soils (brown soil, regosols, lithosols etc.) that match this gradient (iii) dense/rich forests (north) to open, low forests (centre), and fragile, scattered formations (south), (iv) significant biological resources being degraded, (v) limited, unevenly distributed land and water resources with. The main land use groups are: (i) fertile land (2,9 million ha), (ii) rangeland (6,5 million ha), (iii) wasteland (71 million ha).

The economy sustains 2,7 % inflation and performs 5,4 % growth of GNP, to which agriculture contributes 11-16 %. The total labour force amounts to 3,3 million of which 15 % are unemployed and 22 % work in the agricultural sector. Five major production systems exist, i.e. cereal, fodder and cash crop farming, arboriculture and gardening. Despite a reduction of its part in the GNP, the agriculture receives significant public investments and contributes 9 % of exports (2000). Forest production is about 150 million MT of wood, while NWFPs make up 30 % of users' annual income. Woodlands continue to play a decisive role in satisfying domestic energy needs, particularly in rural areas.

Natural vegetation covers 5 744 000 ha, of which 743 000 ha is in esparto grass, and 4 031 000 ha is in rangelands. The forest estate amounts to 970 000 ha of which 51,8 % are productive. It includes coniferous stands (457 000 ha), deciduous forests (179 000 ha) and scrubland² (194 000 ha). Man-made forests cover over 400 000 ha. They require the production of 70 million seedlings/year, of which a growing number are multipurpose species. From 1920 to 1964, forests and esparto grass have decreased from 2,9 million ha to 1 433 000 ha. There is at present a positive balance trend of 30 000 ha (1997) resulting from man-made forest and pastoral plantations. The TOFs essentially consist of urban forests, windbreaks, multiple-use forests, roadside trees, rangeland, and soil and water conservation plantations. The role, production, and economic importance of these resources are under-evaluated, making them a hidden resource.

About 500 000 ha of forests are managed. Participation constitutes the administration's strategic option. 50 private forest industrial companies exist. The production of industrial and sawn timber is weak. The supply of wood fuels is 2 626 MT and the demand is stabilized at 2 650 MT (1997). Annual cork production earns over DT 9 million. NWFPs' exports bring in

¹ Mediterranean

² Maquis-garrigues.

some US \$ 4 250 000 and contribute about 28 % of the household annual revenue. Forests are a source of income for 900 000 forest side residents (10 % national population). Forestry contributes 7 million work days/year (35 000 permanent jobs) and provides 70 work days/year to 100 000 households who derive each a mean annual income of 340 DT. Forests are a major source of energy, food, fodder and incomes for neighbouring households.

The MEAT³ (policy formulation) and the MdA⁴ (managing/developing resources) share responsibilities with regard to the environment. The Forestry Directorate General (FDG) is in charge of implementing forest legislation and protecting/managing the 2 793 million ha of the national forest estate (1 055 million ha State ownership, 1 691 million ha community rangelands and 47 000 ha private forests). Other institutions are in charge of sylvo-pastoral development, livestock husbandry and training, and extension. Up to 1987, forestry activities were planned/designed/implemented by the administration. At present, private companies invest in forestry development actions and FDG supervises inventories, approves/implements management plans. Research under INGREF integrates the social dimension to development. Training technicians takes place in Tunisia and that of management staff in Tunisia and abroad. A system of continued and refresher course training is in place. Though still strongly biased towards conservation, the Forest Code emphasizes the promotion of forest users⁵. Technical assistance is provided by FAO and GTZ. Financial cooperation is supplied by WB, IRBD, EC, FAO and UNDP. Bilateral support is provided by 9 countries⁶. Tunisia is a signatory to 8 international conventions.

The physical objectives of the national strategy of reforestation and desertification control (1990-2001) were overestimated, particularly for private and community lands. The national development strategy (2002-2011) has taken into consideration the former constraints and planned more realistic reforestation and afforestation objectives. The forestry and rangeland development master plan proposes new forestry development orientations, which aim at: (i) increasing forest resources' economic role and promoting forest industries, (ii) enhancing participatory planning and job creation.

The national forest estate endures deforestation and forest degradation processes particularly in areas under pressure for wood and rangeland resources and areas undergoing agricultural land and urban expansion. The causes reside in (i) anthropogenic pressure exercised on natural environments, (ii) unclear and restrictive land ownership and tenure rights, (iii) poverty, (iv) limited empowerment and participation of users, (v) various forms of forest misuse, (vi) adverse climatic conditions etc.

Conclusions

The main concluding statements include: (i) Environmental, social and economic dimensions in forest planning are still at their infancy, (ii) without commitment to cross-sector integration/coordination and to participation, forestry and range policy, planning and legislation cannot address sustainable livelihoods and land use, (iii) afforestation of private land requires new and tailored social, legal contexts and more incentives, (iv) forest/rangeland estates ownership remains confusing and settlement issues are complex, (v) forest/range milieus are disadvantaged, (vi) foresters are reticent about participatory approaches, (vii) definitions, concepts, data, responsibilities and stakeholders for sustainable management

³ Ministry of Environment and Territorial Management

⁴ Ministry of Agriculture

⁵ By authorizing the creation of Collective Interest Forestry Groups

⁶ Germany, Canada, Spain, France, G.B., Japan, Holland and Sweden.

of planted forests, trees outside forests and agroforestry are causing debate and the way ahead is unclear, (viii) knowledge/technology transfer to the main stakeholders remains weak, (ix) wood products and NWFPs are underused and poorly developed; and (x) water resources mobilization for the benefit of forest and pastoral villages remains weak.

Recommendations

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

- Support participatory partnership and integrated sustainable management of forest resources;
- Develop and disseminate participatory planning, management and monitoring tools;
- Define roles of public and private stakeholders and ensure that appropriate policy, legal, planning and institutional frameworks are established consequently;
- Empower and engage traditional land users by addressing their needs and providing them with land and tenure security, appropriate technology, access to credit/markets etc.

Recommendations for rational use of water resources in the future include the need to:

- Implement a policy for sustainable and cost-effective water resources' management;
- Develop soil and water conservation and water harvesting programmes and preserve water quality;
- Preserve groundwater by artificial recharge and promote re-use of treated sewage effluent, etc.

In terms of poverty alleviation, it is recommended to:

- Create diversified and sustainable job and income opportunities;
- Increase NGO participation to support local communities and traditional land-users; and
- Resolve forestland conflicting and ambiguous tenure and user's rights related issues.

Recommendations relating to strengthening institutional frameworks include:

- Reform institutions and strengthen capacity for integrated land-use and participatory approaches in sustaining forest management and development and improving people's livelihoods;
- Enhance research on conservation/valorisation/development/delineation of forest/range resources;
- Improve awareness and technology transfer by strengthening extension, participatory planning, gender analysis and communications in natural resources management;
- Target youth and teachers before aiming at the various social levels of rural/urban populations;
- Instil awareness in policy/decision-makers to achieve commitment and reforms towards sustainable, participatory, integrated, multi-stakeholder and sectoral forest/range management;
- Strengthen training/extension for managers, ensuring applying new technologies and participatory approaches into field applications on a progressive upgrade training basis.

In terms of changes in resource use, it is recommended to:

1. Monitor and report status and trends in forest cover, deforestation, degradation and desertification
2. Implement policy and organizational plans to support sustainable forest resource management.

Recommendations to enhance the role of planted forests and trees outside forests include:

- Clarify the concept and definition of planted forests, trees outside forests;
- Evaluate/classify man-made forests consistent with purpose and ownership and derive and implement management plans accordingly
- Target suitable ecological zones and priority sites for developing future planted forests and TOFs;
- Define their main objectives and encourage demonstrations and communication of success stories;
- Provide the necessary technical support systems to increase the quantity and quality of nursery management and reforestation; increase productivity, and reduce costs.

Recommendations relating to support to the Tehran Process include:

- Promoting exchanges, experiences and knowledge among LFCCs and setting up common networks, projects and development programmes;
- Improving knowledge of causes to deforestation and forest degradation and identifying appropriate solutions, taking into account the specific characteristics prevailing within the LFCCs;
- Incorporating the proposed actions of the Teheran Process into the forestry policy of LFCCs;
- Adopting policies, strategies and plans to enhance planted forests and trees outside forests within the overall national forestry programmes in LFCCs;
- Promoting exchanges of knowledge, know-how and experience and developing collaborative research, and bilateral and multilateral cooperation among LFCCs;
- Establishing a monitoring/reporting system to gauge and follow up actions of the Tehran process;
- Supporting and strengthening the Secretariat to LFCCs based in Tehran.

Introduction

According to FRA⁷ 2000, seventy-one countries, (most of which are developing countries), have a forest cover of less than 10 % of their land area. Their total population amounts to 800 million persons, of which 55 % are rural people. These exert strong pressures on the still available forest resources, as a result of widespread and growing poverty, which leads to alarming rates of deforestation and forest degradation.

An open-ended international expert meeting on special needs and requirements of low forest cover countries (LFCCs) and unique types of forests was held in Teheran in October 1999. There, it was agreed to prepare proposals to secure international support to sustainable forest management in LFCCs. The Netherlands approved support to targeted outputs and activities as a follow up to the "Teheran Process". Country studies for Africa and the Near-East regions were selected to outline the causes and effects of deforestation and degradation together with lessons learned. The Tunisia case study is one of three carried out in the Near-East Region to form the basis for a subsequent Teheran Workshop (28-31/10/02). The focus is on enhancing the role of planted forests and TOFs in supporting sustainable forest management and complementing management of diminishing forest, range and woodland resources.

This short mission took place between 27 February and 26 March 2002. The TORs, itinerary of the mission and persons met are presented in Annexes 1, 2 and 3 respectively. A misinterpretation resulted in the delayed recruitment of the national consultant, which took place after the departure of the FAO expert. Nevertheless, the FAO expert benefited from the support of his counterpart who spared no effort in his free time to fulfil a significant share of the workload and participate to the report's finalization.

1. General Overview

1.1 *Background setting*

1.1.1 **Brief geographical and historical country description**

Tunisia, the most northern African country occupies a strategic position in the Mediterranean Sea. It belongs to North Africa and is located at the centre of the Mediterranean basin between the 30th and the 37th degree latitude north. It covers an area of 162 155 km², limited by the north and the east by the Mediterranean Sea on 1 250 km, to the west by Algeria on 1 050 km, and from the south by Libya on 480 km.

1.1.2 **Economic and demographic characteristics**

Its mostly urban (62 %) population of 9,4 million (1999) has stabilized its growth at 1,15 %. The rural population seems to have reached its peak and should progressively decrease to represent less than 24 % of the total population in 2025.

⁷ Forest Resources' Assessment.

According to its 9th Economic Plan⁸, Tunisia has achieved significant progress towards macro-economic stability. The economy sustains 2,7 % inflation, performs 5,4 % GNP growth and benefits from a steady progress in investment at the annual rate of 13,5 %. It has achieved external and internal financial stability by lowering its foreign debt and its budget deficit. The agricultural and fisheries sector, whose performances have allowed it to achieve self-sufficiency for most products, contributes 13,5 % of the GNP, within the reasonable range of 11-16 %.

1.1.3 Governance and administration

Tunisia was declared an Independent State in 1957 and its first Constitution was adopted in 1959.

The Ministry of Agriculture is in charge of implementing the national agricultural development policy, which entails natural resources' sustainable management. The Regional Agricultural Development Authorities⁹ (CRDA) are the main operational structures at governorate (decentralized) level.

The Ministry of Environment and Territorial Management¹⁰ (MEAT) is in charge of formulating and implementing, in collaboration with other concerned ministerial departments, the State policy on environmental protection, livelihood improvement and territorial management.

1.1.4 Policy and legal framework

Tunisia's 10th Social and Economic Development Plan¹¹ is underway and within the agricultural strategy, it is aimed at: (i) reducing inequality between urban and rural areas, (ii) promoting social development, and (iii) improving agricultural productivity and environmental conditions.

From 1959 forest areas were subjected to the first forest legislation, commonly termed Forest Code¹², which was complemented by the 1975 legislation on rangelands. Both laws are strongly biased towards conservation through coercion: they need to face up to social realities in the forestry and pastoral contexts and be more oriented towards social development.

1.1.5 Planning framework–Development plans

Tunisia inherited economic disparity from its colonial past. So it chose the planning approach to undertake its development. Regional development is the fundamental approach of its social and economic development policy. It consists in distributing as evenly as possible the fruits of

⁸ 1997-2001

⁹ Commissariats Régionaux de Développement Agricole

¹⁰ Ministère de l'Environnement et de l'Aménagement du Territoire.

¹¹ 2002-2006

¹² Code Forestier

economic growth to all regions, in order to reduce regional inequalities. Regional development has gone through 4 major periods, namely:

The 1962-71 period marked by: (i) the adoption of centralism (planning), (ii) setting up special decentralised development zones, (iii) the creation of Agricultural Development Offices¹³ and the CRDAs, (iv) the collectivising of agricultural lands.

The 1972-80 period, during which a free-market economy was adopted, dominated by the need to reduce regional disparities through Rural Development Programmes (PDR) aiming to create jobs, improve rural livelihoods and involve local authorities in promoting regional planning.

The third period during the eighties adopted rural and agricultural development as the fundamental strategy to achieving regional development. Planning instruments are improved through regional priority mapping and setting up in 1984 the Integrated Rural Development Programme (PDRI). Priority is given to productive investments, integrating activities, participation of beneficiaries, improvement of rural revenues, natural resources' development, strengthening of research and extension and reinforcement of communal equipment.

The fourth period stressed enhancing private investment by creating favourable conditions to private enterprise. Regions are to mobilize their capacities and potential by giving incentives to the private sector to play a more decisive role in national development efforts.

1.2 Environmental Characteristics

1.2.1 Geology

Tunisia has a folded structure to the North and a monocline structure in the South where generally sedimentary formations prevail, except for Galite where they are of volcanic origin.

1.2.2 Physiography and soils: there are three large natural regions

Northern Tunisia

It encompasses 10 governorates, includes mountain chains in the northwest, the Medjerda valley and the Cap Bon in the northeast. The Kroumirie-Mogods is a forest region par excellence forming a 300 000 ha northwestern strip between 400-1 200 m altitude. More to the south, and to the north of the Dorsale, is the High Tell, which is composed of medium altitude plateaux (500-800 m), with peaks reaching 1 000 m. The northeastern part encompasses the alluvial plains and low hills of the low Medjerda valley and the Maritime Tell, which are drained by the Joumine, Tine and Meliane rivers. The Cap Bon peninsula is hilly.

Central Tunisia

It encompasses 7 governorates. The Dorsale, a 30 km wide mountain range of medium altitudes (400-600 m) oriented southeast-northeast is dominated by high peaks as Jebel Serj (1 357 m), Jebel Béréno (1 419 m) and Chaambi (1 544 m). To the south are vast rangeland areas, which include: (i) eastern low steppes (Kairouan and Sfax North) with scattered

¹³ Offices de Mise en Valeur Agricole

sebkh¹⁴ drained by the Merguellil and Zroud rivers, (ii) the agricultural Sahel, and (iii) high western steppes (300-700 m altitude), which are a vast plateau bearing high peaks such as Djebel Selloum (1 248 m) and the Mghila (1 387 m).

Southern Tunisia

It is a transitional region towards the Sahara. It includes low plains spreading south of the high steppes, from the Algerian border to the Gulf of Gabès. The Matmatas are small ranges reaching up to 600 m in elevation, enclosed in vast flat stretches of land. The Jeffara-El Ouara region bordered by Libya is the most southern pastoral region, while the Dahars region is partly uninhabited.

1.2.3 Climate and soils

The climate is Mediterranean mild with mean temperatures ranging from 11 °C in winter to 29 °C in summer. It consists of five bio-climatic¹⁵ levels going from humid to arid, according to a north-south aridity gradient. The pedological cover also shows a succession of soils following the same gradient. The humid zone (MAR¹⁶ 1 000-1 500 mm) in the north favours the forming of brown soils, rich in organic matter, colonized by cork oak (*Quercus suber*) and zeen oak (*Quercus mirbeckii*). The sub-humid region (MAR 700-1 000 mm) is more to the south and is characterised by clayey soils (vertisols), while the semi-arid zone of Central Tunisia (MAR 500-700 mm) is dominated by calcareous soils. Saline soils (Kairouan), brown steppe soils and skeletal soils (regosols and lithosols) form the basic essentials of the soils complex in arid milieus (MAR 300-500 mm) in southern Tunisia. In the extreme south, the Saharan zone with M.A.R. under 300 mm is covered with soils paved with calcareous and gypsum crusts. Precipitations are irregular and unequally distributed according to seasons and regions.

1.2.4 Biological resources

The basic landscaping factors are ecosystems' fragility, inter-annual climatic variability, proximity to the Sahara and the existence of a large population in the forest environment constitute the basic landscape shaping factors. Natural vegetation is closely related to bio-climatic zoning and soil types. It varies in composition, structure, density and height, according to a north-south gradient. Just as important is man's influence, as he contributes in changing vegetation's physiognomy and wildlife's habitat and distribution. New vegetation compositions replace forests devastated by human activity as they are converted to "maquis" (brush) in the North and "garrigues" in the Centre and the South.

The dense and rich forests of the north give way to open and low formations in the centre, while they are rare, fragile and scattered in the south. There are 5 500 species and sub-species of flora, 20 of which are endemic, 240 are rare and 103 are very rare. Fauna includes 75 species of reptiles, batrachians and fish, 45 of which are endangered (26 mammals, 10 reptiles and 9 amphibians).

¹⁴ Saline depressions.

¹⁵ Mediterranean

¹⁶ Mean annual rainfall

1.2.5 Water and land resources

Presently well known, the reserves of natural resources are limited, fragile and unevenly distributed. The main land use categories of Tunisia are:

Land types, distribution and uses

The national territory covers 16,5 million ha, with: (i) 2,9 million ha of fertile lands (570 000 ha irrigable), (ii) 6,5 million ha of weak-medium potential land rangelands, and (iii) 7,1 million ha wasteland, of which:

- 3,2 million ha of sandy accumulations (Grand Erg);
- 2 million ha of saline lands (chotts and sebkhas);
- 1,9 million ha of rock outcrops.

Land use is as follows: (i) 5 781 000 ha of agricultural land, (ii) 840 000 ha of forest land, (iii) 4 606 000 ha of rangeland, and (iv) 6 297 000 wasteland. Agricultural land is distributed as follows:

- | | |
|---------------------|--------------|
| • Cereal farming | 2 100 000 ha |
| • Olive growing | 1 476 000 ha |
| • Fruit orchards | 576 448 ha |
| • Fodder farming | 300 000 ha |
| • Market gardening | 120 000 ha |
| • Fallow and others | 65 000 ha |

The areas sown to annual crops vary considerably from year to year, according to rainfall levels. Irrigated crops cover 340 000 ha (7 % total cultivated area) and contribute one third of the agricultural production. Forests, natural rangelands and esparto grass cover 5 674 million ha, while dunes, chotts and sebkhas constitute one third of the country land area.

Uncontrolled urban development results in the loss of 4 000 ha of agricultural lands annually (Source: Rapport de l'Environnement 1997).

State and characteristics of water resources

Of an annual rainfall 36 Mm³ water equivalent, 4 540 Mm³ could be potentially mobilized, of which 3 844 Mm³ can be used. These are divided into 2 700 Mm³ (60 %) of surface water and 1 840 Mm³ (40 %) of subsurface water. The latter includes shallow groundwater (664 Mm³) and low water table (1 176 Mm³/year).

Surface water is distributed as follows: (i) 2 185 Mm³/year in the North, (ii) 290 Mm³/year in the Centre, and (iii) 225 Mm³/year in the South. Taking into account the annual surface water variability, the quantities available are distributed as follows: (i) 2 230 Mm³ one in two years, (ii) 1 500 Mm³ on in five years, and (iii) 1 250 Mm³ one in ten years.

Underground water is distributed as follows: (i) 828 Mm³/year partly in fossil form in the South, (ii) 549 Mm³/year in the North, and (iii) 463 Mm³/year in the Centre.

The volume of water liable to be used without restriction represents just 50 % of the available resources. Together with the increase in drinking water consumption, population growth represents a challenge to water resources management, particularly in arid zones. The strategy

implemented since 1990 includes a decennial plan, whose objective is to mobilize water resources through the construction of 21 dams, 203 small earthen dams, 1000 lakes and water reservoirs, 1 760 boreholes and 98 water filtering and purification stations.

1.3 Human Factors: Socio-economic Characteristics

1.3.1 Population, Demography

Demographic parameters

Since the late 1980s, the rate of population growth has rapidly diminished to equal 1,7 % in the period 1994-2000. The projections of population increase made by the National Statistics Institute are as follows: 1,4 % between 2000 and 2010 and 1,0% between 2010 and 2025. The population changed from 8 785 364 to 9 730 000 between 1994 and 2 000. It is projected to be 11 200 000 in 2010 and 11 300 000 in 2025.

The rural population seems to have reached a maximum and should decrease progressively in the future. This should affect rural development in the future as well as the utilization of natural resources.

Population's spatial and temporal mobility

The "Internal Migration and Regional Development" study has showed: (i) a rising inter-communal and inter-regional mobility, (ii) a positive correlation between the size of cities and their appealing power, (iii) an inferior growth rate of urban populations as compared to that of rural populations. According to recent projections, the rural population's present ratio of 39 % should change to 29 % of the total population in 2010 and 24 % in 2025.

The gender issue

Basic rights for women, which have been achieved since Independence, have been reinforced during the Seventh and Ninth Plans (1992-2001) following the creation of the Ministry of Family and Women's Affairs in 1992. Since then, the Eighth (1992-1996) and Ninth (1997-2001) Plans have given a particular importance to consolidating women's social benefits and developing programmes for their further promotion.

A rural women's promotion Strategy and Action Plan was elaborated in 1998; their orientations are to:

- Create a gender statistical database;
- Formulate and implement projects targeting mountain rural women;
- Improve mountain rural women's socio-economic and cultural contexts;
- Involve women in professional associations and assist in the accessing of resources, services and productions factors.

Employment

The National Statistics Institute (INS) has undertaken successive census operations from 1966 to 1994 and employment investigations from 1989 to 2001. The results indicate that at present: (i) the labour force amounts to 3,3 million persons, (ii) trade and services sectors

employ 44,1 % of the working population, (iii) unemployment rate is 15%, and (vi) agriculture employs 22 % of the working population.

1.3.2 Economic overview

Production systems

The main agricultural, pastoral and forestry production systems are as follows:

1- Agricultural production systems: There are five agricultural crop production systems:

- *Cereal farming*: The average annual sown surface is 1 598 million ha. This system generates a great deal of erosion due to mechanized labour on slopes and to the destruction of the forest vegetation;
- *Fodder farming*: covers 270 000 ha and produces 900 M FU¹⁷/year, i.e. 14 % of the livestock needs. The rest coming from concentrated foods (13,5 %) and from natural grazing (72,5 %);
- *Cash crop farming*: Sugar beet and tobacco make up 5 730 ha/year ha and 4 072 ha/year, respectively during the Eighth Plan. The mean annual sugar beet production was 269 000 tons during this period;
- *Arboriculture*: The area is reserved for tree cultivation covers 50 % of cultivated areas: it is greater than 2 million ha, with olive trees as the chief crop (1,5 million ha);
- *Market gardening*: accounts for 148 300 ha (13 000 ha rain-fed) and contributes to up to 15 % of the value of total agricultural production.

2- Animal breeding production systems: Animal breeding has always been an important social, economical and ecological activity in Tunisia. However, it has been drastically disrupted during the last decades. At present, two main management or production systems prevail:

- *Intensive livestock breeding*: this production system involves thoroughbred animals, mainly cattle and intensive fodder cropping;
- *Extensive traditional livestock breeding*: It is the most common breeding system among small and medium holders that use the local breeds of sheep and goat and make use, above all, of the natural vegetation without any form of management.

The role of the agricultural sector in the economy

Despite a gradual lowering of its contribution to the GNP, the agricultural sector continues to have a substantial place in the national economy, contributing 9 % of exports in 2002. This is down from 13,2 % in 2000 and 16,3 % in 1990. Despite strong inter-annual variations, agriculture has had a mean growth rate of 4 % since 1976. The sector receives significant public investments, particularly for dam construction (two-thirds of public investments). Food products represent 10 % of both imports and exports.

¹⁷ FU = Forage Units

The role of forestry in the national economy

Though not fully documented, the forestry sector's role in the national economy is an important one. This is due to a large number of products it provides, either for processing or for direct consumption, such as wood, cork, esparto grass, fodder, medicinal plants and other non-wood forest products (NWFPs).

Incomes from forest products have developed significantly from 1 to 2 million DT between 1970 and 1980, to reach 5 million DT in 1991 and 11,6 million DT in 1997. The huge quantities of fodder and fuel-wood harvested without dues (royalties) direct from the forest estate correspond respectively to 100 and 35 million DT. The overall forestry revenues are estimated at 149 million DT (4 million DT for wildlife exports), while the NWFPs make up 30 % of producers' annual income. The woodlands continue to play a decisive role in satisfying domestic energy needs, particularly in rural areas.

1.4 Food Security: Consumption Trends

1.4.1 Food security

Thanks to the agricultural sector's performances, self-sufficiency has been achieved for most food products. There remain however deficits in cereal crops, which fluctuate with levels of annual precipitation. Seasonal shortages in potato production are experienced.

1.4.2 Trends in food consumption

Seven investigations undertaken by INS between 1967 and 2000 on household expenses and food consumption show that: I) the average household expenses have been multiplied by 7 during the last 25 years as indicated in Table 2. Food consumption has always constituted the major source of expenses in Tunisian families as showed in Table 3.

Table 1: Mean annual expenses/household

Item/Year	1975	1980	1985	1990	1995	2000
Average expenses/household/year (in dinars)	874,00	1 469,00	2 665,00	4 033,00	5 115,00	6 505,00

Source: Institut National de la Statistique (INS)

Table 2: Structure of Tunisian households' expenses

Functions/Year	1975	1980	1985	1990	1995	2000
Food consumption	41,7 %	41,7 %	39,0 %	40,0 %	37,7 %	-
Housing	27,9 %	29,0 %	27,7 %	22,0 %	22,2 %	-
Clothing	8,8 %	8,5 %	6,0 %	10,2 %	11,9 %	-
Hygiene and medical care	5,4 %	5,7 %	7,0 %	8,7 %	9,6 %	-
Transport and telecommunications	4,7 %	4,9 %	9,0 %	8,2 %	8,7 %	-
Education, culture and leisure	8,0 %	7,7 %	8,9 %	8,5 %	8,9 %	-
Other expenses	3,5 %	2,5 %	2,4 %	2,4 %	1,0 %	-
Total	100,0 %	100,0 %	100,0 %	100,0 %	100,0 %	-

Source: Institut National de la Statistique (INS)

Food consumption has been multiplied by 7 in the last 25 years. This indicates a transition from a traditional society to a consumer society which is increasingly dependent on food imports. The production systems are not always suitable given the country's context.

1.4.3 Energy consumption trends and perspectives

Credited with 4 % mean annual growth, energy consumption amounted to 5,4 Mtep¹⁸ in 1996, of which 36 % was derived from natural gas. A study of strategic wood energy¹⁹ indicates that wood continues to play a decisive role in satisfying domestic energy needs in Tunisia, particularly among rural households.

2. Forest Resources: Current Status and Management

2.1 Forest Inventory and Information Systems

According to its first national forest and rangeland resources inventory (IFPN²⁰, 1989-1995), Tunisia's vegetation cover is 5 744 000 ha of which 970 000 are in natural and man-made forests, 743 000 ha are in esparto grass formations, and 4 031 000 ha are in natural rangelands. This inventory permitted the: (i) update the knowledge of forest and rangeland resources, (ii) set up statistical and cartographic databases for these resources, (iii) established a forest and rangeland information system, (iv) set up a computerized forest planning system (SIPF²¹), and (v) acquired equipment and tools, which contribute in improving forest and rangeland management.

A programme to update the inventory is started in order to assess changes occurring in vegetation cover, particularly as a result of forest fires, clearings, reforestation and forest exploitation.

2.2 Characteristics of the Forest Estate

2.2.1 Global forest estate and tenure²²

The forestry administration is responsible for 2 793 million ha of lands, including:
 (i) 1 055 million ha under the State forest estate, of which 287 000 ha are man-made forests,
 (ii) 1 691 million ha communal rangelands, and (iii) 47 000 ha private forests, of which 30 000 ha are man-made forests.

The forest and rangeland land ownership status has not been yet settled. The State lands registration process has not operated for some time. According to the information available at the DGF, the situation is as follows: (i) 532 363 ha definitely registered as State land property,

¹⁸ Million tons petroleum equivalent

¹⁹ Wood Energy balance analysis and identification of an action Plan for Tunisia - DGF, Avril 1999.

²⁰ National Forest and Range Survey (IFPN - Inventaire Forestier et Pastoral National)

²¹ Informatic Forest Management System

²² From the National Forest and Range Development Master Plan (Plan Directeur National de Développement Forestier et Pastoral)

(ii) 188 627 ha in the process of being registered as State owned land and, (iii) 204 746 ha of land registration definitely turned down.

2.2.2 The National Forest Estate

According to the IFPN statistical data, 51,8 % of the forest estate is considered productive. Scrubland (maquis and garrigues) represents 33,8 % of the forest area, while the firebreaks and the forest clearings amount to 14,4 % of the forest estate. Table 4 gives Tunisia's main vegetation types, in detail.

Tunisia's natural vegetation cover (excluding the desert and Saharan zones) is estimated at 11,6 %. In the Saharan region (50 % of the national territory), natural vegetation cover is lower than 1 %. The percentage of vegetation cover of the North, Centre and South (Saharan zone) of the country are 15 %, 10 % and 1 %, respectively. The Saharan, Central and Northern zones represent respectively 50 %, 25 % and 25 % of the area surveyed. Table 5 lists the main plant associations found in the country.

Table 4: Tunisia's Main vegetation groups

Vegetation type	Area (ha)	Ratio
Forests	500 826	3,02%
Forest clumps	2 164	0,01%
Tree maquis and garrigues	132 898	0,80%
Shrub maquis and garrigues	194 849	1,18%
Total forests	830 737	5,02%
Grassland and short grass prairie	3 687	0,02%
Esparto grass	743 306	4,49%
Other pastoral vegetation types	3 338 965	20,16%
Riparian vegetation	45 788	0,28%
Complex steppe/agriculture	528 055	3,19%
Other vegetation groups	46 228	0,28%
Total rangelands	4 706 029	28,42%
Other forest lands	12 974	0,08%
Other lands	128 006	0,77%
Cultivated lands	4 774 023	28,83%
Waters and humid zones	393 421	2,38%
Built-up (developed) lands	179 639	1,08%
Overall total	16 561 595	100,00%

Table 5: Tunisia's main sylvo-pastoral plant associations

Main associations	Area (ha)	Comments	Utilization
Aleppo pine series	400 000	50% forest and 50% garrigues	Wood, Grazing, NWFPs, Erosion control
Cork oak series	90 379	60 379 ha of forest and 30 000 ha maquis	Cork, NWFPs, Grazing
Thuya de Berbérie series	33 000	Medium high forests and garrigues	Wood, Grazing, Erosion control
Kermès oak series	10 000	Often mixed with introduced species	Wood, NWFPs, Dune stabilization, Tourism
Zéen oak series	6 414	At high elevations in Kroumirie	Wood, NWFPs, Grazing, Tourism
<i>Quercus illex</i> series	5 000	Mountain peaks of the Dorsale & the Haut Tell	Wood, NWFPs, Grazing, Charcoal
Maritime pine series	3 930	Very localised (west of Tabarka)	Wood, NWFPs, Grazing,
<i>Artrophytum sp.</i> rangelands	869 100		NWFPs, Grazing, Erosion control
Esparto grass steppe	743 300	Very degraded less than 250 000 ha productive	Fodder, NWFPs, Erosion control
<i>Artemisia</i> steppe complex	446 000	Very degraded: less than 300 000 ha residuals	Fodder, NWFPs, Erosion control
<i>Anthyllis sericea</i> srteppes	417 200		Fodder, NWFPs, Erosion control

2.2.3 Natural forests

The national forest inventory does not distinguish between natural and planted forests. The following Table 6 lists the areas occupied by different plant associations.

The main species found in natural forests include among others: *Pinus halepensis*; *Quercus suber*; *Quercus merbekii*; *Juniperus oxycedrus*; *Cupressus sempervirens*; *Tetraclinis quadrivalvis*; *Quercus afares*; *Pinus pinaster*, *Quercus ilex*, etc. These are found either in pure or mixed species' stands.

The *Quercus suber*, *Quercus merbekii* and *Pinus pinaster* natural forests are located in northern Tunisia (Kroumirie-Mogods). The *Pinus halepensis* natural forests are located in central and southern parts of Tunisia, essentially in the vicinity of the "Dorsale" and in the high steppes. Coniferous natural forests cover 457 000 ha, or 55 % of the national forest estate. Deciduous natural forests occupy 179 000 ha (about 22 % of total forest area) and the maquis-garrigues cover 194 000 ha or 23 % of the forest area.

Table 6: Distribution of forest species in Tunisia

Main species	Area	Ratio	Main species	Areas	Ratio
Broadleaved species	178 986 ha	22 %	Coniferous species	456 902 ha	55%
Acacias	12 624 ha	7 %	<i>Pinus halepensis</i>	296 571 ha	65 %
<i>Quercus suber</i>	45 461 ha	25 %	<i>Pinus pinaster</i>	3 811 ha	1 %
<i>Quercus merbekii</i>	6 414 ha	4 %	<i>Tetraclinis quadrivalvis</i>	21 786 ha	5 %
Other oak species	1 452 ha	1 %	Various conifers	35 713 ha	8 %
Various Eucalyptus	28 360 ha	16 %			
Mixed broadleaved stands	29 643 ha	17 %	Mixed coniferous stands	11 186 ha	2 %
Broadleaved tree Maquis/garrigues	45 064 ha	5 %	Coniferous tree Maquis/garrigues	87 834 ha	19 %
Maquis and/or Garrigues	189 849 ha	23 %			

Source: National Forest and Range Survey (IFPN).

2.2.4 Man-made forest estate

Before 1990, forest plantations were roughly estimated at 285 000 ha²³. From 1990 to 2000 they covered 123 240 ha (Table 7). Forest plantations are carried out on lands of variable legal ownership. They occur in most cases on bare lands as well as coastal and continental sand dunes of the national forest estate. The distribution of forest plantations per Governorate is presented in the following table.

Table 7: Forest Plantations per Governorate from 1990 to 2000

Governorate	Area ha	% of total	Governorate	Area ha	% of Total
Béja	13 701	11,1%	Ariana	3 647	3,0%
Kairouan	11 565	9,4%	Ben Arous	3 055	2,5%
Siliana	11 303	9,2%	Sousse	2 811	2,3%
Jendouba	11 189	9,1%	Tataouine	2 708	2,2%
Nabeul	8 057	6,5%	Médenine	2 577	2,1%
Le Kef	7 295	5,9%	Sfax	2 178	1,8%
Bizerte	7 218	5,9%	Kébili	1 605	1,3%
Gafsa	6 971	5,7%	Tunis	1 589	1,3%
Kasserine	6 858	5,6%	Monastir	1 176	1,0%
Zaghuan	6 496	5,3%	Mahdia	875	0,7%
Gabes	5 631	4,6%	Tozeur	781	0,6%
Sidi Bouzid	3 958	3,2%			
Total 123 240 ha					

Source: Direction Générale des Forêts (DGF/DD).

Most species utilised for protection as well as production plantations are: *Eucalyptus camaldulensis*, *Eucalyptus astringens*, *Pinus pinea*, *Pinus pinaster*, and *Acacia spp.* At present, much importance is attached to planting native species (*Pinus halepensis*, *Cupressus*

²³ It is difficult to have reliable figures on the reforestation carried out before 1990, whereas one knows precisely what has been done since then – Source: *Mongi Ben M'Hamed Rapport de la Tunisie*, 5ème session du Comité de Forêts Méditerranéennes "Sylva Mediterranea" 16-20 Mars 1992.

sempervirens, *Quercus suber*) in their natural habitat, from where, the difficulty of differentiating natural from man-made forests in a forest survey based on remote sensing. The main species used in windbreaks are *Casuarina sp.*, *Cupressus spp.*, *Tamarix spp.*, and *Populus spp.* Eucalyptus species are used in road plantations.

Because the figures are so uncertain, it is urgent to carry out a periodic and consolidated evaluation of the plantations.

Forest nurseries

There are 94 forest nurseries, which produced 51 million high quality seedlings of different species, of which 42 % are forest species, 36 % rangeland species, 15 % for windbreak, 6,5 % ornamental plants and only 0,5 % for agroforestry species.

In view of the important needs of parklands and landscaping projects for ornamental plants, in 1990 it was decided to specialise a number of nurseries accordingly, and to use 5 % of the production capacity of the other nurseries to supply ornamental plants. The production of this category of seedlings has progressed rapidly, rising from 60 000 units in 1990 to 3,37 million seedlings in 1999. The multiple-use species category has also been strongly developed since 1995, with the production of olive, fig, carob, and nut trees.

At the same time, major efforts have been made to improve seedling production techniques. Off-soil seedling production was adapted successfully. It reduces the risk of root deformation, and uses forest compost as substratum and a programmable irrigation and fertilization system. Nine nurseries, each with a production capacity of 1 million seedlings have been specialized to off-soil seedling production. At the same time about 30 % of the forest nurseries will be abandoned. These are having difficulties and/or are not relevant to the programme.

In order to satisfy the needs resulting from the new afforestation strategy, 70 million seedlings will need to be produced annually, namely:

- 24 million forest seedlings to reforest 15 000 ha;
- 22 million rangeland plantlets to plant 22 000 ha;
- 9 million seedlings for beating-up operations;
- 5 million ornamental plants;
- 10 million saplings of windbreaks and linear plantings.

Plantations' contribution to National Forest Cover Extension

Colonization has brought about mechanized farming, confinement of native farmers to marginal and arid lands, population increase and other effects, all of which resulted in rapid forest and rangeland clearings. Settling the rural population through the distribution of collective land has intensified the process by converting occasional use of natural resources into permanent exploitation. From 1920 to 1964, the forest area decreased from 1,1 million ha to 690 500 ha and esparto grass steppes from 1,8 million ha to 743 000 ha.

This trend has been compensated for by reforestation and natural resources development. However, there is no systematic follow-up to forest cover change on the 1997-1998 database. It appears that the 1 490 ha forest loss resulting from forest fires (1 280 ha), and forest clearings (210 ha) was exceeded by the 31 513 ha of forest (14 539 ha) and pastoral

(16 974 ha) plantations carried out at the same time. This made a positive annual balance of 30 000 ha.

2.2.5 Trees outside forests

Functions, significance and stakes of Trees outside forests (TOF)

While all trees may have various uses, TOFs are potentially valuable because of their favoured location and accessibility. Their diversified utilization grants them a high socio-economic significance and a prominent environmental role. TOFs are part of everyone's daily life, as they provide some subsistence that improves many farmers' food security. They are also a source of wood, fodder, and fruit production and medical use; they provide services (shelter, shade, and fencing), protection (water, soils, and crops), habitats for wildlife, and they improve environments and landscapes.

TOF concept in Tunisian context

FAO's definition of trees outside forests (see Annex 4), calls for a number of observations with regard to the Tunisian context:

- a. The IFPN did neither identify or record forest and rangeland stands of less than 0,5 ha;
- b. Roadside plantations and windbreaks have not been assessed by the IFPN and all related data are derived from studies and investigations lead by the departments in charge;
- c. TOFs as defined by FAO are not taken into consideration in rural management strategies;
- d. Fruit orchards (table 8) cover about 2 million ha, of which: 1,5 million ha olive, 14 000 ha citrus fruit, 320 000 ha almonds, 23 334 ha date palm, and 42 500 ha peach tree. If one were to enter these areas in the forest cover, Tunisia would be not be a LFCC anymore;
- e. Several ministerial departments are in charge of TOFs each with many operators (Agriculture, Environment, Equipment, Interior), while municipalities are in charge of green-spaces;
- f. A large number of TOFs are nevertheless included in the national forest cover figures; these are plantations related to: Soil and Water Conservation and sylvo-pastoralism and other categories;
- g. Rural plantations are an old concept and include shade-tree clumps and trees in non-cultivated areas;
- h. Strip plantations are common in southern landscapes. They include roadside plantations (such as the 5-row eucalyptus tree strip planting on each side of the 20 km-long Tunis-Gafsa road) and tree strips delimiting household properties;
- i. If one were to list/record scattered rangeland tree formations sizeable steppe portions would be to the TOFS.

TOFs are a hidden resource and this is because of the lack of a particular TOF inventory, the confusion and the problems of definition, as well as under-valuation of TOFs' role, production and economic importance and management issues. It would therefore be desirable to add the TOFs' issue in agenda of the Nairobi and Teheran LFCC workshops.

Table 8: Fruit trees in Tunisia (1996)

Species	Area ha	Production (Tons)	Species	Area ha	Production (Tons)
Citrus trees	14 000	210 000	Olive trees	1 476 000	109 000
Almond trees	320 000	52 000	Pear trees	19 000	36 000
Apricot trees	19 000	27 000	Pistachio trees	50 000	900
Date palm trees	23 334	74 000	Medlar trees	500	3 600
Peach trees	42 500	66 000	Pomegranate trees	15 000	50 000
Prune trees	10 622	11 500	Quince trees	986	2 600
Fig trees	31 000	30 000	Cherry trees	1 506	3 000
Apple trees	29 000	61 000			
Total				2 052 448	739 600

Source: Ministère de l'Environnement et de l'Aménagement du Territoire (MEAT), 1996.

Considering the above, it is difficult to define the Tunisian TOFs with precision. Foresters there find it difficult to include fruit orchards in accounting for TOFs. The TOF estate consists of urban/peri-urban man-made forests, windbreak, agroforestry and rangeland plantations, as well as soil and water conservation, fruit tree, and roadside plantations, etc.

Urban and peri-urban forestry

The growing awareness of urban populations for environmental protection, and their growing need to live closer to nature explains their desire to be surrounded by vegetation, particularly trees. Furthermore, trees and ornamental plants contribute to the monetary value of their residences. These are all factors that have contributed to the development of urban forestry in Tunisia, and particularly around the capital city, where a greenbelt was initiated in the 1980s.

In 1992, MEAT initiated a national urban afforestation programme in association with partners, notably the Ministries of Agriculture (MdA) and of Interior (MdI). MEAT deals with monitoring and evaluation, MdA acts through the DGF, while the MdI operates through the "Direction Générale des Collectivité Publiques et Locales" and municipalities and local committees. The National Programmes include:

- *National afforestation monitoring and green spaces establishment programme:* Started in 1992, it aims at monitoring tree planting and at creating green spaces in urban environments. Investigations indicate that the average urban greening has increased from 4,4 m²/inhabitant in 1994 to 10 m²/inhabitant in 2001;
- *National Environmental Boulevards Programme:* This is a demonstration programme that aims at establishing a boulevard management approach by developing roadside plantations, and lighting;
- *National Urban Parks Programme:* Initiated in 1996, it anticipates the management of 100 parks in 10 years;

- *Green Itineraries National Programme*: Elaborated in 1995, its objective is to embellish the main town entrances and to improve the quality of roads linking airports to main tourist roads;
- *National Esplanades' Programme*: Started in 1996 and 80 %²⁴ complete, it aims at the management of 20 esplanades;
- *Roadside plantations*: Aims at implementing plantations beside highways with the participation of youth volunteers;
- *Hundred-Year Old Trees Programme*: Initiated in 1993, it aims at preserving hundred year old trees, considered as national historical, biological and ecological heritage, through:
 - ? Increasing ornamental plant production capacity;
 - ? Developing flower-growing and landscaping capacity;
 - ? Recruiting competent technical staff by municipalities;
 - ? Establishing plantation services within municipalities' technical sections;
 - ? Raising awareness and encouraging populations' participation to planting activities;
 - ? Developing protection schemes for plantations.

Windbreak plantations

Estimated at close to 12 000 km in 1998, linear windbreak plantations amounted to 17 000 km in 2000, which only covers 12,5 % of the irrigated perimeters needs. The objective of the 10th Development Plan is to cover 20 % of the country's needs in windbreaks by 2006 (Source: Direction Générale de la Production Végétale, rapport non publié, décembre 2000).

Agroforestry plantations

These relatively recent projects they cover vulnerable areas in mountain zones and forest clearings. Species of interest identified include: *Carya olivaeformis* (pecan nut tree), *Juglans regia* (walnut tree), *Pistachia vers* (pistachio tree), *Corylus avelana* (hazelnut tree), *Ceratonia siliqua* (caroub tree), *Capparis spinosa* (caper bush), *Olea europea* (olive tree), *Amygdalus communis* (almond tree), *Ficus carica* (fig tree) etc. The Tenth Plan anticipates the implementation of 25 000 ha of public and private agroforestry plantations.

Pastoral plantations

According to the national forest inventory pastoral plantations cover 208 000 ha, of which 91 000 ha are in forestlands and 117 000 are elsewhere. They are composed essentially of *Acacia sp.*, *Atriplex spp.*, and *Medicago arborea*.

Cactus plantations

These have not been included in the national forest inventory, even though they cover 198 000 ha, of which 82 000 ha in forestlands and 116 000 ha outside forests. In general, *Opuntia ficus indica* varieties are fit between forest trees or established as linear plantings on cropped fields to firm up soil and water conservation works. In central and southern Tunisia, they are used as live hedges to limit agricultural plots and traditional settlements. (Source: Stratégie Nationale de Développement et d'Amélioration des Exploitations Pastorales, MdA, document en Arabe, mars 2000).

²⁴ In 1997, at the time the report "L'Etat de l'Environnement 1997" was published.

Soil and Water Conservation (SWC) Plantations

The 1990-2000 SWC strategy planned for the management of 600 000 ha of watersheds with 230 000 ha of agro-pastoral plantations aimed at strengthening of the river basin control works. Up to 2001 the results reached 224 265 ha planted essentially with fodder-trees and cactus shrubs (70 %) and fruit trees (30%).

Road Plantations

Data on these plantations are almost absent. It is estimated that 16 000 ha equivalent of roadside and windbreak plantations have been established. Following a workshop held in 1992, a national road plantations commission was set up in 1993, which defined technical specifications for roadside planting. These plantations are under the State forest regime and are exploited under specific conditions with authorization granted by the DGF.

Riparian environments

The IPFN identified vegetation located along rivers, which are composed of phragmites, *Nerium oleander* and *Tamarix spp.* These natural vegetation associations cover 45 788 ha.

Box No. 1

Trees outside forests – multiple functions – ecological indicators

At Béja's main entrance, ash trees border the road, eucalypts are beside the river, storks have found shelter on tree tops, cypress windbreaks border the nursery's alleys, oleanders colonize river banks and wild olive trees are preserved in graveyards.

The main highway Tunis-Hammamet-Msaken is lined with a double row of oleander, bearing a series of white and pink flowers. Acacias blossom abundantly in yellow around Enfidha and atriplex bushes beautify Hergla's entrance. Palm, olive and fig trees adorn Tunis's exit route.

Tamarisk and cypress windbreaks protect Cap Bon's fruit orchards. Gardens give off scents of jasmine and various other flowers. Majestic eucalypts line the central and southern roads, up to the "Sahara Door", concealing olive, almond, fig, pomegranate and palm orchards.

Thus, trees outside forests vary according to use and the desired effect but also according to the ecological zone in which they are established.

TOFs = multiple functions = ecological indicators

2.2.6 Integration of trees in agrarian landscapes

Besides their utility as fruit and fodder providers, trees in agricultural systems have always had a protective role. Throughout agrarian landscapes they act as windbreaks, shelterbelts, and SWC dune stabilization plantations. The concept of multi-purpose trees is being developed, and in this context, the DGF distributes such trees free of charge to farmers on Tree Commemoration Day.

In the 1960s, without owners' consent, the State reforested some 30 000 ha of private agricultural lands. Another 9 000 ha were planted under contract signed with the owners.

Sand dune fixation perimeters cover 26 000 ha. Many landowners now demand that their land be returned or that they be granted a just compensation.

Instituting a legal incentive framework is not sufficient to bring farmers to integrate trees in their productions systems. The main constraints to this are: the weak rate of profit from forest plantings, the farmers` lack of long term vision, the lack of marketing prospects for wood products, a lack of extension, a strong bias against subjecting private land to the forestry regime, and the parcelling of land. (Source: Note de Synthèse du Séminaire National sur les Terrains Privés à Vocation Forestière, DGF, 1998)

2.3 Environmental Significance of Forests

Tunisian ecosystems are diverse and fragile because of the variety of climatic conditions prevailing from North to South. Economic, social and ecological issues are at the heart of the debate on sustainable development of forests and rangelands. “The root of forest and rangeland development issues lies in the necessary progressive conciliation of these roles²⁵”

2.3.1 Biodiversity conservation

Despite profound disruptions (loss of forest cover, shrinking of humid zones, decline of rangelands) of anthropogenic origin, the country has appreciable assets in terms of biological diversity. Wetlands are protected to shelter migratory birds, because of their universal importance. Others wetlands are used for fish farming and are economically important :

- The Ichkeul Lake is North Africa’s major refuge for birds; it shelters 200 000 - 400 000 birds of various species every winter, in particular: 50 000-180 000 coots, 20 000-12 000 “fuligules milouins”, 15 000-112 000 widgeons, up to 20 500 greylag goose and 9 100 “souchet” ducks, and 1 000-7 600 teal.
- The Kelbia Sebkhia is also a large winter refuge for up to 271 000 birds of various species;
- The littoral plateaux of the Kneiss shelters about 330 000 “limicoles” in winter;
- The Sejoumi Sebkhia is a winter refuge to 25 000 flamingos and 10 000 shelducks and sheldrakes;
- The lakes Garaet and Mabtouha shelter 38 000 birds and that of Tunis 35 000 in winter.

In order to preserve its biodiversity, Tunisia has 11 national parks, 20 natural reserves and 4 fauna reserves.

2.3.2 Soil and water conservation

The significance of the role of forests in SWC is endorsed by the National SWC Strategy. It calls for planting and managing significant watershed areas, in addition to constructing erosion and torrent control works, as follows:

²⁵ Source : Rapport national de prospective du secteur forestier en Tunisie: par Hamed Daly Hassan et Ghazi Gader.

- | | |
|--|-------------|
| • Integrated watershed management | 672 000 ha |
| • Creation of impoundment lakes | 1 000 units |
| • Creation of water spreading and water distribution works | 4 290 units |

Up to the present the level of implementation exceeds 50 % for construction works, and 108 % for watershed management.

2.4 Tool Box for Sustainable Forest Management

2.4.1 Criteria and indicators for sustainable management

In 1995 the National Commission for Sustainable Development (CNDD²⁶) adopted a priority actions programme and recommended using criteria and indicators to monitor the state of the environment. In 1998 some 134 sustainable development indicators elaborated by the CNDD were tested. A total of 121 indicators were judged relevant to the Tunisian context. Of these 21 indicators are used by the MdA to cover water, fish, soil, natural resources, desertification, pesticides, agricultural education and forestry. A workshop was called to discuss the indicators of the forestry sector.

Box No. 2 : Sustainable development indicators for the agricultural sector

- Underground and surface water uptake;
- Water consumption/inhabitant (for domestic needs);
- Wastewater treatments;
- Density of hydrological measurement networks;
- Sustainable maximal fish harvest;
- Development of utilization of soils;
- Soils' condition changes;
- Decentralized management of natural resources;
- Lands affected by desertification;
- Sustainable utilization of natural resources in mountain areas;
- Usage of agricultural pesticides;
- Fertilizer use
- Irrigated arable lands;
- Total energy consumption per ton of agricultural product;
- Arable land area per inhabitant;
- Soil degradation through salinization and waterlogging ;
- Expenditures devoted to agricultural education;
- Intensity of forest exploitation;
- Forests being maintained;
- Forest area under protection.

²⁶ Commission Nationale de Développement Durable.

2.4.2 Management of range and forest resources: Planning and Implementation

Management of forests and rangelands: The first forest management studies were initiated during the first Four-Year Plan 1965-1968. At present 500 000 ha are being managed representing 80 % of the productive natural and man-made forests. Forests not yet managed are either small, scattered and cut off stands, or young regeneration. They undergo protection and sivicultural treatments (sanitation and improvement cuttings), and are equipped with access roads and closely guarded.

Since the 1960s, three stages of management evolution have been observed:

First-generation plans

The first generation of forest management plans was initiated in 1964 were inspired from the French school of forestry. Only partially implemented, these plans reflected the concern for learning more about the forest stands and improving them, as well as procuring more employment. This was the time of the first plantations.

Second-generation plans: Sylvo-pastoral Management

Unevenly implemented, the 1st generation plans did little to halt degradation and forest clearing, essentially because they did not involve the local residents. Considering the social constraints, the revised management plans identified areas for exclusive pastoral use in order to compensate for the grazing exclusions implemented to gain forest protection and regeneration.

Third-generation plans: Integrated Management

In 1996 of the new Forestry Code called for the creation of common interest forest groups (GFIC²⁷) and the setting up of integrated development pilot operations (OPDI²⁸). The 3rd generation plans were based on a more global assessment of the situation to engage the villages in the negotiation process on integrated agro-sylvo-pastoral management of forestry resources. This type of management is aimed at improving all functions that forests fulfil from the ecological, social and economic perspectives.

2.4.3 Forest and range preservation, conservation and management

Rural development has not been granted the funds to reach out to rural populations and improve their livelihood and their impact on the environment. There is a dire need for promoting structures and mechanisms capable of removing the constraints to popular innovation and taking initiatives. There is a need for the creation of a favourable environment through:

- Setting up on-site development research taking into account farmers' situations and strategies;
- Giving priority and funds to promote training and small projects in all sectors of activity;

²⁷ "Groupes Forestiers d'Intérêts Communs"

²⁸ "Opérations Pilotes de développement Intégré"

- Keeping up livelihood improvement activities within local participatory frameworks involving GFICs.

This calls for a three-dimensional approach characterized by:

- A favourable environment that brings about the desired behavioural changes among individuals and communities;
- Local communities being given a sense of responsibility;
- Adapted techniques, knowledge and know-how that result in revenue diversification and productivity improvement.

2.4.4 Support to participation and partnership in integrated and sustainable forest and range resources management

At present participatory forest and rangeland resources management constitutes a strategic option of the forest administration, “concerned about involving populations with a sense of responsibility in durably managing the resources available to them²⁹”. Forest management is strongly biased towards industrial wood production. At the same time as the local populations’ rights are restrict, which maintains them in a state of extreme poverty.

Finally in 1998, the promotion of users’ rights was taken into account in the forest law (Art. 43 and 44). To preserve forest resources, the Ninth Five-Year Plan (1997-2001) dedicated a significant forest management role to local populations. The 1996 decrees affecting the application of the law resulted in the actual setting up of effective common interest forest associations (AFIC³⁰). Furthermore a decree issued in 1999 instituted the agricultural development groups (GDA³¹) in order to broaden the range of activities of small farmers and to bring more flexibility and range of intervention to the GFICs.

The Forest zones silvo-pastoral projects (PZDF³²) and the Kairouan silvo-pastoral project (PSPK³³) have laid the foundation of participatory forest development. Through the second forest development project (2^{ème} PDF), the government has initiated the 10 pilot operations (OPDI) with the aim of perfecting and adapting participatory approaches and community interventions in sustained forest management, through:

- Sustaining reinforced local forest services’ intervention capacity;
- Organizing rural populations and strengthening their self-promotion capacity;
- Promoting forest and other activities for the benefit of local forest populations.

²⁹ Source: “Expérience des opérations pilotes de développement intégré dans la gestion participative des ressources forestières ” par Ghazi GADER.

³⁰ “Associations Forestières d’Intérêt Collectif”

³¹ “Groupements de Développement Agricole”

³² “Projet de Développement des Zones Forestières”

³³ “Projet Sylvo-Pastoral Kairouan”

2.5 Forest Production and Forest Industries

The forest exploitation corporation (REF³⁴) is an autonomous State-owned enterprise of commercial nature. It is in charge of forest products' extraction and commercialisation. The sector counts 50 private forest products industries (cork, chipboard and saw mills, shipbuilding) as well as wood extraction agents and charcoal producers.

Because of the differences over the legislation on forest products' extraction, collaboration between forest products' processors and the administration is difficult. Aiming at discouraging the extraction of forest products, the regulation is poorly adapted to the economic development of forests and forest products. The average annual wood production is estimated to be 400 000 m³. It is divided up into: 70 % extracted by private buyers, 10 % extracted by small jobbers, and 20 % extracted in timework.

2.5.1 Wood products

Sawn timber remains weak as the deficit is estimated to be more than 650 000 m³. Fuel-wood represents over 50 % of Tunisia's total wood production. The small volumes of round wood available are processed at 20 on-site, under-utilized saw mills. Plywood production has been increasing. The demand for construction wood by the agricultural sector has also increased.

2.5.2 Fuel-wood and charcoal

The 1997 wood energy supply/demand ratio was balanced at national level. The renewable supply of wood energy was 2 626 MT and the demand was stabilized at 2 650 MT. This analysis hides large differences in regional wood energy balance, particularly in the north of the country (see Table 9). Indeed, despite possessing the most important forest resources, this region's supply/demand ratio is more imbalanced than in the rest of the country. The demand for fuel-wood there is larger than that of charcoal (82 % vs. 18 %).

Table 9: Wood energy supply/demand balance, according to regions for year 1997

Item	AAS ³⁵ (tons)	Demand (tons)	BS/D ³⁶ (tons)	Index S/D ³⁷
Northeast	438 500	708 600	- 270 100	0,65
Northwest	479 800	669 800	- 190 100	0,72
Centre	1 502 600	923 400	+ 579 200	1,63
South	205 600	347 700	- 142 000	0,59
Total Tunisia	2 626 500	2 649 500	- 23 000	0,99

Source: Etude bois énergie, DGF, 1998

³⁴ "Régie d'Exploitation Forestière" established by decree No. 87 of 31/12/1972.

³⁵ AAS = Actual Available Supply (Offre Réalisée Disponible)

³⁶ BSD= Balance Supply/Demand (Bilan Offre/Demande)

³⁷ S/D = Supply/Demand

The projection for 2010 foresees a slight improvement in the national energy wood balance sheet, without eliminating regional differences. The surplus balance sheet of the Centre becomes more marked, thanks to the contribution of fruit tree pruning and cutting back, particularly in olive orchards. Despite an increase in renewable supply in the North, deficits keep progressing.

2.5.3 Non-Wood Forest Products

Non-wood forest products (NWFPs) as defined by FAO³⁸ are “all products of biological origin as well as services provided by forests or lands of similar use, excluding wood in all its forms”. According to a recent study³⁹ there is a diversified range of NWFPs in Tunisia (essential oils, food, craft products etc.) processed primarily by traditional gatherers and semi-industrial extraction enterprises.

Importance of NWFPs as export goods⁴⁰

NWFPs’ exports earn the country some DT 6 195 296 equivalent to USD 4 243 353⁴¹ per year. The exported products are:

- **Essential oils:** Several oils (wild mint, thyme, sagebrush, myrtle, lavender, citrus etc.) are produced which represented DT 3 253 100 export earnings in 1996 (Chemli, 1997)⁴². The most important are oils extracted from rosemary and myrtle. The rapidly degrading myrtle formations, which covered 80 000 ha in 1975, are very heterogeneous in terms of productivity. The productive rosemary formations have decreased from 360 000 ha in 1973, to 65 000 in the 1981-1985 period. Cumulated export earnings from myrtle and rosemary essential oils amount to DT 1 313 260 (average for period 1995-98). This provided DT 224 860 /year income for the forest administration and 91 800 working days to 2 300 families.
- **Food products:** The main forest food products earning export revenue are in decreasing order of importance:
 - ? **Game:** Game products include mainly game and snails. They provide DT 4 700 000. Game export is estimated at DT 46 565 per year, remains weak, as it concerns only 26,5 tons out of a mean annual production of 400 tons (period 1995-98). According to El Adab (1993)⁴³ the value of shot game is put at DT 598 385, while the exports of wildlife provide DT 537 982. The mean annual volume of snails exported during the same period is estimated at 688 531 tons, equivalent to DT 3 649 866 of export earnings (equivalent to US \$2 500 000).

³⁸ Cited by JAAKKO PÖVRY Consulting, Finland and ExA Consult Tunisia.

³⁹ JAAKKO PÖVRY Consulting, Finland and ExA Consult Tunisia: “Etude sur le développement des produits forestiers non ligneux – Rapport de la 1^{ère} phase : Recensement et valorisation des produits forestiers non ligneux”.

⁴⁰ Unless indicated differently, the source of the statistical data is from: JAAKKO PÖVRY Consulting, Finland and ExA Consult Tunisia: “Etude sur le développement des produits forestiers non ligneux – Rapport de la 1^{ère} phase : Recensement et valorisation des produits forestiers non ligneux”.

⁴¹ At the average rate of DT 1.460 for US \$ 1 000

⁴² Essential oils (Chemli, 1997) in “Etude sur le développement des produits forestiers non ligneux, Direction Générale des Forêts, 2000” by Engineering association JAAKKO/POYRY.

⁴³ El Adab, 1993, 1997 in “Stratégie Nationale de Développement Forestier et Pastoral, Direction Générale des Forêts” project FAO UTF/TUN/027/TUN.

According to DGF, 40 % of snail volume exports originate from forests with an estimated value of DT 1 460 000.

- ? **Mushrooms:** Truffles, chanterelles, cèpes and edible boletus etc. provide a mean annual revenue of DT 971 818, equivalent to US \$ 670 000 (1995-98). The administration's mean annual income derived from mushroom extraction was DT 56 500 in 1998-99. Extraction and trading of truffles, occupy 1 120 families to whom it provides a mean annual revenue of DT 421 per household.
- ? **Carobs:** Carob pods (*Ceratonia siliqua*) are used in the pharmaceutical and food industries, as well as fodder ingredients. The mean amount exported annually in the 1997-98 period was 113 435 tons for a value of DT 251 901.
- ? **Stone pine⁴⁴ kernel:** Non-husked stone pine seeds mean annual production of 42 tons (1997-98) was valued at DT 119 112, equivalent to US \$ 81 583.
- ? **Honey:** Tunisia's forests are traditional beekeeping sites. In 1993, about 3 500 apiculturists raised 35 000 bee swarms and produced 200 tons of honey and 50 tons of bee-wax. Exported honey originates from forestland as well agricultural and. Thanks to its high quality, honey of forest⁴⁵ origin is easily sold on foreign markets. The amount of honey exported in 1997-98 remains modest compared to the country's potential. It amounted to 1 214 kg, providing DT 21 913, equivalent to US \$ 15 000.
- ? **Capers:** *Capparis spinosa* natural formations cover 27 511 ha, of which, only 6 347 ha are in state to be used for caper extraction. In 1997 capers exports amounted to 4 717 kg and generated DT 11 345 revenues. Following the successful tuning of the species' nursery reproduction technique, productive areas should be increased in the near future.
- **Craft products:** Esparto grass products and basketwork⁴⁶ constitute the bulk of crafts exported. Though they only earned a modest DT 16 170 the significant progress in exports indicates a high potential for these products on the international market. Wooden handiwork is entirely sold on the internal market.

Importance of NWFPs in terms of administration income

Thirty-six articles provide substantial revenues to the local forest services. Thirty-four "minor forest products" provide DT 209 591 in income, while 14 NWFPs release DT 209 591 of annual revenues. This comes from the rights of use given to companies. Direct annual incomes from hunting amount to US \$ 934 961 (Source: Total Economic and Environmental Value of Forest Resources in Tunisia in 2002: By Hamed Daly-Hassan and Ameer Ben Mansoura (INGREF)).

Importance of NWFPs at community and family level

The extraction and processing of NWFPs is essentially a household activity in which all family members take part. NWFPs have a positive impact on the structure of community revenues. They contribute 28 % of the annual revenue of the 620 families surveyed (DT 580/family/year). These incomes represent up to 46 % of the mean annual revenue for

⁴⁴ *Pinus pinea*

⁴⁵ Honeys from rosemary (*Rosemarinus officinalis*), Thyme (*Thymus sp.*), arbutus (*Arbutus unedo*) and heathers (*Erica spp.*) have been renowned since ancient times and have been granted quality labels.

⁴⁶ Essentially based on 3 species: *Stipa tenacissima*, *Chamaerops humilis* and *Juncus maritimus*.

households without other activities. For those that carry out agricultural or agroforestry activities, the share of NWFPs is equivalent to 23 % of their mean annual revenue.

Forest fodder is a highly strategic NWFP for local, regional and national economies, given that it amounts to 44 % of the national goat and sheep population's feed requirements. El Adab (1997)⁴⁷ evaluates it at 651 million Fodder Units (FU) distributed as follows:

(i) National Domain and esparto grass formations: 375 million FUs, (ii) State and collective rangelands: 150 million FUs, Improved pastures: 126 million FUs.

Carobs processed industrially as animal feed concentrates also provide substantial revenues. Excluding forage harvest from forests, the most economically interesting products for producers are in decreasing order of importance: Aleppo pine seeds, walnut roots, stone pine seeds, mushrooms, rosemary, honey, capers, snails, bay tree leaves, oak acorns, lentisk oil, thyme and carob.

2.5.4 Status of wood industries

The facts relating to the main industrial operators are not reliable for the following reasons:

1. Industrial operators: There is no exhaustive listing of industrial operators involved in the primary processing of wood. Many combine these activities with commercial ones, or carry them out in a very unofficial manner;
2. Wood extraction operators: These do not constitute structured enterprises, but rather family groups sharing activities without any form of record keeping. They usually do not disclose information regarding products' selling prices, volumes extracted, and sold. Given their lack of organization, it is difficult to manage these rather traditional enterprises. They do lack:
 - The equipment to manufacture quality products required by wood industries;
 - Qualified labour for optimal (qualitative and quantitative) wood extraction;
 - A system of activity planning, being unable to evaluate correctly the quantities and quality of wood available on extraction sites. For instance high quality wood is often destined to charcoal production, making wood industries do without precious quantities of local high quality wood.

2.5.5 Status of supply/demand of forest products

The following table compares the country's supply and demand with regard to all wood categories.

⁴⁷ El Adab, 1993, 1997, in Stratégie Nationale de Développement Forestier et Pastoral, Direction Générale des Forêts, Projet FAO UTF/TUN/027/TUN

Table 10: Wood supply and demand

Item	Fuel-wood	Saw timber	Pulpwood	Mine timber	Total
Needs	4 725 000 m ³	740 000 m ³	75 000 m ³	140 000 m ³	5 680 000 m ³
Available	4 680 000 m ³	88 500 m ³	88 500 m ³	166 000 m ³	5 023 000 m ³
Balance	- 45 000 m ³	- 651 500 m ³	+ 13 500 m ³	+ 26 000 m ³	- 657 000 m ³

It appears from this table that deficits are very significant for saw timber (615 500 m³). Much saw timber is imported. In 2000, the earnings of the REF amounted to DT 13,9 million, of which DT 9,2 million was from cork and DT 3,1 million for wood. Cork and wood constituted respectively 66 % and 22 % of REF's incomes.

2.6 Economic and Social Significance of Forestry

Though forests growth and regeneration are slow processes, forest cover still plays a very important role in erosion and desertification protection. Forests are also considered a valuable national asset as well as a source of income and revenue to the neighbouring local populations. Forests contribute also in developing local and national economies, boosting processing industries and providing employment.

The forest is a source of income for 900 000 neighbouring farmers who live directly or indirectly from available local forest resources. They are engaged in the following activities: livestock breeding, household agriculture, forest use and fruit harvesting, as well as work associated with forest sites (extraction, management, infrastructure, reforestation, SWC etc.).

2.6.1 Forest populations

These represent almost 10 % of the Tunisian population and 23 % of the rural population. They encompass 150 000 households (90 inhabitants/km²) living in douars⁴⁸ that group 10-60 families. Forest populations often live in mountainous areas without private property. Therefore they depend heavily on limited natural resources. Their annual incomes are weak in comparison to the national average.

Policy views:

These fast growing populations have steadily rising needs in terms of pastures, agricultural land, forest products etc. As a consequence they exert a considerable pressure on the forest estate. That is why the new forest policy aims at sustaining the development of this living space, rationalizing its utilization, and satisfying people's need and requirements according to the following principles:

- Settling people in their environment and involving them in managing their living space. Winning them over to become agents of participatory development, protection and preservation agents;

⁴⁸ Rural villages

- Reinforcing the socio-economic development projects that target forest populations and aim at establishing an environmental equilibrium;
- Organizing and sensitizing forest populations as to their true partnership role in protecting and developing the forest domain, within a participatory and integrated approach to development.

Common interest forest groups (GFIC)

In 1998, the action plan was initiated aiming at the creation of 33 GFICs. At present, 15 such groups have been officially established and 18 others are in the final stages of their organization. The objective of the new strategy is to set up 300 forest and pastoral GFICs at the rate of 30 groups/year, in the central and northern governorates, at the projected cost of DT 600 000. The funds are mainly for training and supervision.

2.6.2 Economic contribution of forestry

Because of the main products it provides, the forestry sector contributes substantially to the national economy's development. Indeed, products such as esparto grass, cork, fodder, medicinal plants, forest seeds, mushrooms, snails and other NWFPs processed locally contribute an estimated 30 % of the annual incomes of forest and rangeland users.

Direct incomes from forest production have increased from DT 1,0 million in the seventies to DT 11,6 million in 1997. Indirect revenues from fodder are in the order of DT 100 million, while wood products extracted directly by users have an estimated value of DT 35 million. The total incomes from forest production amount therefore to DT 149 million, equivalent to US \$ 102 million.

Wood production

The annual wood extraction potential of the country is evaluated at 400 000 m³. The volume actually extracted has increased substantially. It grew from 85 000 m³ in 1970 to 200 000 m³ in 1990, with a peak of 350 000 m³ in 1997-98. Under-exploitation of wood products is essentially due to lack of funds, difficulties met in tree marking (lack of qualified agents), insufficient road infrastructure, and slumps in the market.

Cork

About 80 000-100 000 quintals of cork are extracted annually, generating over DT 9 million to the REF (Régie d'Exploitation Forestière).

Other important forest products

Other products of importance include:

- Rosemary exploited over 37 000 ha;
- Myrtle extracted over some 8 000 ha;
- Esparto grass with 40 000 tons extracted annually;
- Various quarry products from forest lands evaluated at 440 000 m³/year.

2.6.3 Contribution to employment and revenue generation

Employment contributed by the forestry sector has increased steadily growing from 5,9 million working days (WD) in 1992 to 8,3 million WD in 1999. The annual average is 7 million WD, equivalent to 35 000 permanent jobs⁴⁹. An estimated 100 000 households have received revenues from forest works sites at the rate of 70 WD in average per year and beneficiary. This equates to DT 340/houshold⁵⁰ for year 2000. While they may provide substantial revenues to the destitute forest zones, the forest work sites are still not profitable.

2.6.4 Forestry and food security

Forestry's contribution to food security happens at 2 levels:

1. Informal level with indirect financial revenues provided to households, that support their agricultural activities and direct consumption of forest foodstuffs;
2. Formal level with the commercial products provided by forests and rangelands, that contribute to the local and national economies, thus to local and national food security.

Forests are essential to neighbouring communities, particularly to poor and marginal groups, because it is their main source of energy, food, fodder, construction materials and income from forest products.

3. The Forestry Sector

3.1 *Institutional Framework of Forestry*

Two Ministries share the main responsibilities regarding environmental administration. The Ministry of Agriculture in charge of the forestry sector, manages the natural resources. The Ministry of Environment and Territorial Management (MEAT) is responsible for national environmental protection policy formulation and the coordination of the policy implementation by the diverse partners which are involved the protection, management and development of the environment.

3.1.1 State institution related to forestry

Ministry of Agriculture (Mda)

Within the Ministry of Agriculture, the organizations active in forest and pastoral domains include:

⁴⁹ At the rate of 200 working days/job/year.

⁵⁰ Income on forest sites is slightly inferior to the national legal minimum wages. This is partly due to the fact that low wages in the 60s and 70s were compensated for, by "food for work" distribution. The present under payment explains also the low productivity that prevails on forest works sites.

1- The Forestry Directorate General (DGF⁵¹): The first forestry service was created in 1883. Positioned within the Directorate of Public Works, it was later transferred (1895) to the Agriculture Directorate, where it started the business of training agents, evaluating forest resources and initiating erosion control and sand dune stabilization-related activities. With the enlarging of its responsibilities, it became first Central Directorate of Forestry before growing to be the present DGF.

The DGF is responsible for applying the forest code and for managing, protecting and developing the State forests and the lands under forest regime. It is also responsible for:

- Improving sand dune stabilization techniques;
- Formulating silvo-pastoral management plans for forests and collective lands;
- Organizing the sustainable exploitation of wildlife and organizing and developing hunting, particularly tourist hunting;
- Protecting nature and creating national parks and natural reserves.

Following its reorganization decided by decree (13/02/2001) the DGF includes 4 directorates, 8 divisions and 7 services as listed below:

- Forest Conservation Directorate: composed of:
 - ? Division: Hunting, National Parks and Natural Reserves;
 - Service: Hunting, National Parks and Natural Reserves;
 - ? Division: Forest Protection;
 - Service: Forest Protection and Forestry Equipments Maintenance;
 - Service: Land Registry and Delimitation.
- Silvo-Pastoral Development Directorate: composed of
 - ? Division: Forest and Rangeland Afforestation;
 - Service of Forest and Rangeland Afforestation;
 - Service of Inventory and Evaluation;
 - ? Division of Rangelands and Sand Dune Stabilization;
 - Service of Rangeland and Esparto Grass Formations, Organization and Utilization;
 - Service: Combating Sand Encroachment.
- Directorate: Forest Population's Socio-Economic Development: composed of:
 - ? Division: Integrated Forest Management Studies;
 - ? Division: Economy and Population Training and Supervision.
- Forest Control and Regulations Directorate: composed of:
 - ? Division: Legislation and Regulation;
 - ? Division: Supervision of State Forests' Management.

⁵¹ Direction Générale des Forêts

The Forest Population's Socio-Economic Development Directorate was recently created and constitutes a major innovation taken by the forest administration to promote participatory sustainable forest management in partnership with forest populations. Its tasks consist of:

- Rationalizing the rural workers' rights exercise, training, organizing and integrating local populations in forest development programmes;
- Following up, in collaboration with regional services, documentation pertaining to users' rights authorizations;
- Taking into consideration local populations in formulating integrated forest and rangeland management studies and ensuring their control and monitoring over the execution of the studies;
- Promoting the establishment of GFICs.

At regional level, administrating forests is carried out within the Agricultural Development Regional Commissions (CRDA⁵²) and the 26 Forest Districts they cover. Each district is divided in forest Subdivisions and 292 Guard Units which cover dense forest and rangeland zones.

2- The "Sylvo-pastoral Development Office for the North West (ODYSEPANO⁵³):

Established in 1981, it is a flexible, well organized and supervised public institution in charge of promoting agro-sylvo-pastoral development in 5 regions of the North-West. Its activities encompass: (i) organizing the rural space in "*terroirs*" (village land) of participatory, integrated community development, (ii) developing basic infrastructure, (iii) promoting agriculture and soil and water conservation, (iv) implementing forest and agroforestry plantations, (v) developing demonstration agricultural units, (vi) providing technical and project management training to communities etc.

3- The Office of Livestock and Grazing (OEP⁵⁴): it is a public institution, whose mission consists of: (i) improving livestock breeding productivity, (ii) promoting fodder improvement, (iii) developing animal breeding and fodder production techniques, (iv) monitoring and evaluating the animal husbandry sector and its contribution to economic development. OEP's present activities include: developing animal feed resources, backing livestock breeders, extension, genetic improvement, and organizing the sector.

4- The Agency of Agricultural Training and Extension (AVFA⁵⁵): It is a public administrative institution which: (i) implements and applies the national policy of extension and professional training in the sectors of agriculture, forestry and fisheries, (ii) coordinates and supports regional extension programmes, (iii) produces and distributes audio-visual aids etc.

Ministry of Environment and Territorial Management (MEAT)

MEAT's functions are specified in the Decree No 93-303 of February 1, 1993, which details its responsibilities which consist essentially of coordinating interventions of diverse partners

⁵² Commissariats Régionaux de Développement Agricole.

⁵³ Office du Développement Sylvo-Pastoral du Nord-Ouest.

⁵⁴ Office de l'Élevage et des Pâturages.

⁵⁵ Agence de Vulgarisation et de Formation Agricole.

in the field of environmental protection. MEAT supervises the following institutions responsible for environment affairs:

- a. National Hygiene Office established in 1974 to combat pollution and protect water resources. It aims at improving hygiene conditions in urban, tourist and industrial zones;
- b. National Environmental Protection Agency was established in 1998. It is specialized in protection against pollution, particularly of industrial origin. It approves environmental impact studies and supervises the national solid waste management programme;
- c. The National Agency for Coastal Shore Protection established in 1995 aims at protecting, improving and organizing coastal areas and preventing them from abuse;
- d. The Tunis International Centre for Environmental Technology was created in 1996 to promote the transfer of environmental knowledge and technology;
- e. The National Agency for Renewable Energy Sources was brought under MEAT in 1998 to promote and apply strategies for the promotion of renewable energy sources.

3.1.2 Global forestland tenure

The forest legislation distinguishes between lands subjected to the forest regime and those, which are not. Lands subjected to the forest regime are administered by the DGF on the basis of the forest legislation (forestry code). Submission to the forest regime concerns: (i) Lands with forests which are registered or not registered in the name of the State (State-owned lands), (ii) State-owned land dedicated to forestry, (iii) some forests owned by legal entities or private owners; (iv) esparto steppes, whatever their ownership status, (v) State-owned rangelands, (vi) demarcated collective rangelands, (vii) national parks and natural reserves.

National forests may be found either on lands registered by the State, or on land which is in the process of registration (requisition). In any case, national forests are administered and managed following the same rules. National forests, national esparto steppes and the national forest estate occupy 925 736 ha, of which: (i) 532 363 ha are registered lands, (ii) 188 627 ha are requisitioned lands in the hands of the real estate's tribunal, and (iii) 204 746 ha, for which the demand for requisition has been refused.

3.1.3 Resources under responsibility of the Directorate General of Forestry

The forestry administration administers 2 708 000 ha, of which 970 000 ha is under state ownership, 1 691 million ha under community rangelands and 47 000 ha as private forests. The situation of the forestry land of the State is not always audited since 188 627 ha are in process of registration, while there still needs a registration of 204 746 ha.

The forest estate corresponds more or less to the State forest domain, with the exception of esparto grass steppe lands. It includes the following categories: (i) forests proper, whether natural or man-made, (ii) the maquis and garrigues, (iii) degraded lands, with or without vegetation that are maintained in the forest domain by vocation (dedication).

Lands not owned by the State, but subjected to the forest regulations are detailed in the following table.

Table 11: Lands not owned by the State, but subjected to the forest regime (regulations)

Category	Total
Reforestation on private lands (SWC, public utility)	9 524 ha
Contractual reforestation on private lands	23 739 ha
Private lands destined to combating sand encroachment	21 229 ha
State-owned rangelands (State agricultural estate)	67 881 ha
Collective rangelands	537 828 ha
Collective esparto steppes	350 120 ha
Total	1 010 321 ha

Source: DGF

3.1.4 Main forestry tasks: Study and work Projects

Up until 1987, all forest works were achieved under State control, with foresters in charge of planning, project preparation, recruiting and supervising workers and approving the work. Since the start of the PDF, the tendency has been to encourage private companies to participate in forest works through invitation to tender. The first private enterprises took part to mechanical soil preparation, forest and fodder tree plantings, tracts opening and maintenance, manual planting, wood extraction/harvesting etc.

At present the DGF's forestry activities are still more often implemented under State control and not under private forestry enterprises. It is primarily the national and international educational institutes that carry out forest management studies. The General Directorate of Forestry and the forestry districts supervise inventories, control forest plot delimitation, contribute to the definition of the management's objectives etc. They examine and approve management plans, carry out tree marking operations prior to forest exploitation, and implement management plans.

3.1.5 Forestry research

The National Research and Superior Education Institute (IRESA⁵⁶) is an administrative establishment of the MdA. It supervises several education and research institutions including the National Agricultural Engineering and Forestry Research Institute (INRGREF⁵⁷). The institute is equipped with 2 laboratories for: (i) marginal waters utilization and irrigation systems management, (ii) ecology and silvo-pastoral improvement. It also has three research units in: (i) silviculture, protection and development of forest resources, (ii) improvement and development of agro-silvo-pastoral systems, and (iii) agricultural mechanization.

⁵⁶ Institut National de la Recherche et de l'Éducation Supérieure Agricole.

⁵⁷ Institut National de Recherches en Génie Rural, Eaux et Forêts

Forest research has gone through an initial stage essentially oriented towards species introduction (arboretums) and planting techniques development. Subsequently emphasis was placed on more diversified research themes, in particular: (i) selection of species, (ii) salinity resistance in fodder species, (iii) soil science, (iv) *Pinus halepensis*, (v) nursery techniques, (vi) natural vegetation conservation, (vii) growing of *Capparis spinosa*, (viii) forest plant protection, (ix) charcoal production, (x) participation.

Since the intervention of the second PDF, the real problems of development have been taken into consideration in terms of human as well as forestry and rangeland aspects. Although the private sector seems to stand out in terms of improved communication, there remains much to do to disseminate the research results more effectively.

3.1.6 Forestry training

The Silvo-Pastoral Institute of Tabarka (ISPT⁵⁸) was created in 1970. It is responsible for the training of specialized technicians in silviculture and rangelands. Senior forestry officers have also been trained at the National Agriculture Engineering and Forestry School (l'ENGREF⁵⁹ - France), the International Forestry School (ENFI) in Morocco, and recently at the National Agronomic Institute of Tunisia (INAT⁶⁰).

With regard to continued training and fresher courses training, between 1994 and 2000 the DGF has had an agreement with the Institut Polytechnique de Toulouse (France). DGF is presently in discussion with a Japanese-Tunisian engineering association to pursue the continued training and refresher courses for the benefit of forest technicians and engineers. Tunisia also has a training programme lasting 12-24 months in a higher education establishment that aims to have technicians and engineers to advance to senior public service positions.

3.2 Forestry Legal Framework

3.2.1 Legislation on forests and rangelands

Forestry legislation

The forestry code (FC) that governs the forest estate was first promulgated in 1959, and despite successive amendments, it remains strongly biased towards conservation and less oriented to social development. Indeed the redrafting of tenure and users rights remains very restrictive.

Since 1988, the country's policy and economic orientations have leaned more towards liberalism and free enterprise. For the first time, in 1988, the DFC put emphasis on the promotion of forest users (Articles 43 and 44) by resorting to the creation of Collective Interest Forest Associations (AFIC), which since have become the Collective Interest Forest

⁵⁸ Institut Sylvo-Pastoral

⁵⁹ Ecole Nationale du Génie Rural des Eaux et des Forêts

⁶⁰ Institut National d'Agronomie de Tunisie

Groups (GFIC). The articles referring to the GFICs include the following in explicit terms: rangeland development, integrated management, participatory approach to resource management, and a positive role for forest workers and populations. Furthermore, private appropriation of forestlands is seen in a more positive perspective. In addition, it is seen that outdated articles of the law should be removed from the legal texts.

The state ownership of the forests is not always sufficient to guarantee the preservation of the National Forest Estate. Private appropriation in certain cases and partnership management of forest and pastoral areas should be seen favourably. It is now fundamental to promote individual responsibility in place of collective responsibility when managing the preservation of forests.

Legislation on rangelands

This dates from the 1975 inclusion of community and state-owned rangelands in the State forestry system. The 1998 Code took up the 1975 measures again, but with minor changes. The aim remained mainly at conserving rangelands through tight State control. There was resistance by communities to the prevalent State ownership, which incorporated in legal texts precluding their formal rights and functions in management and administration of rangelands.

The texts do not anticipate any form of incentive to motivate owners of collective rangelands. Article 60 does not refer to people's participation in designing and implementing rangeland management plans. Communities are in fact excluded from any form of control or right over range management.

3.2.2 Legislation on agricultural land protection

The Law 83-87 of 11 November 1983 deals with agricultural lands protection. It recognizes three zones, namely: prohibitive, safeguarding and authoritative zones. The state-owned forests and those subjected to the forestry legislation are in the prohibitive zones. Olive groves, fruit orchards, forests not subjected to the forestry regime, and managed rangelands are included in the safeguarded zones

3.2.3 Environment code

Tunisia possesses a diversified legal environmental framework, consisting of numerous legal and regulatory texts on environmental management and natural resources. These texts are regularly enriched as international conventions/agreements are signed and approved. This legislation is mainly consolidated through:

- Law relating to Soil and Water the Conservation;
- Code of territorial management and urbanisation;
- Law on industrial zones management and maintenance;
- Decree 91/362 relating to environmental impact assessment.

3.2.4 Soil & Water Conservation (SWC) legal and strategic framework

Having stated the general erosion issues, the SWC strategy aims at strengthening the capacity to implement regular programmes. Besides the need for integration and research, the strategy insists on the progressive involvement of local populations in sustainable SWC. The inter-regional project GCP/INT/542/ITA⁶¹ was set up to test putting the participatory planning methodology into practise, under real conditions.

At the national level, law 95-70, relating to SWC, offers a framework for relevant participatory planning. At local level however, it meets with resistance from technicians who see the potential for slowing down or even curbing the rhythm of activities the implementation of which is the main criterion for measuring the institution's performance.

3.3 Planning Framework

3.3.1 Central planning mechanism

Planning at the national level is ensured through national strategies, plans, and action plans. Sector-based orientations are identified within the five-year economic and social development plans, prepared by the regional and national commissions after evaluating the former plan. There are also master plans prepared in the framework of five-year plans or on the occasion of particular large-scale missions. This was the case with the Forestry and Rangeland Development Master Plan formulated after completing the national forest and rangeland inventory.

3.3.2 Decentralized planning

At the regional level, planning is ensured through forest and range management plans. Programming regional and local interventions is done according to these plans, which determine the relevant activities to be undertaken in a given space and time framework.

Forest management plans concern the majority of State-owned forest stands, which are divided into "Series" (working circles) or a set of variable surfaces⁶² where planning and detailed programming of forestry and/or pastoral activities are implemented. Besides the traditional management execution plans, the administration resorts more and more to contractual programmes "Contrats-programmes" prepared in collaboration with development committees and other local social organizations, following the participatory approach.

3.3.3 Inter-sectoral planning

The Economic Development Ministry secures inter-sectoral coordination through inter-ministerial committees, such as those that bring together the MdA and MEAT with regard to

⁶¹ Projet Inter-Régional pour la Conservation et le Développement à Caractère Participatif des Hautes Terres.

⁶² Total dimension ranging between 1 550 ha and 7 000 ha.

such matters as: (i) reforestation and pastoral plantations, (ii) urban plantations, (iii) protection of nature, (iv) updating the green spaces ratio in urban spaces etc. Moreover, the National Sustainable Development Commission (CNDD⁶³) was created in 1993, to make sure that the environment is part of development and to promote sustainable development.

3.4 External Assistance

The technical assistance granted to Tunisia has primarily benefited project and programme formulation and execution. Special development programmes promoting the participatory approach and the development of silvicultural treatments have been targeted, primarily by the FAO and the GTZ⁶⁴. These programmes aim at developing sound natural resources utilization, increasing production and improving forest population livelihoods and revenues. They have given rise to a number of projects such as:

- Forest clearings development projects in mountainous areas of the North West;
- Forest clearings development projects in the Governorate of Siliana;
- Natural resources management project (Kasserine, Jendouba and Mednine Governorates);
- Integrated development pilot operations (OPDI) in the framework of the second PDF, in the Governorates of Nabeul, Zaghouan, Kasserine, Siliana, Jendouba, Kairouan, Ain Draham, Bizerte, Béja and Le Kef;
- Inter-regional soil and water conservation project of the Oued Sbaihya' watershed;
- Project 26-26 of revenue generation for the benefit of underprivileged areas.

About 585 000 persons (58,5 % of the population depending on forests) have benefited from the support of development projects, in particular with regard to: (i) rangeland and fodder tree plantations' improvement, (ii) planting of walnut, hazelnut, pecan nut, olive trees, (iii) development of forest tracks, (iv) human resources promotion through training, extension and GFICs' establishment, (v) development of revenue opportunities through livestock husbandry, fruit tree cultivation, beekeeping etc., (vi) creating small forest works' enterprises.

New and future model projects to become widely developed in the future include:

- The integrated forest management project initiated in 2001 by DGF under bilateral funding (DT 5,2 million) of the Tunisian Government and the Japan Bank of International Cooperation;
- The forest development project in the north-western mountain zone prepared by ODESYPANO with FAO's assistance.

DGF is presently studying the possibility of initiating a third integrated forest development project to promote the GFICs to be created between 2002-2011. This is in order to improve the social and economic situation of mountain zones communities.

⁶³ Commission Nationale de Développement Durable.

⁶⁴ Direction Générale des Forêts – Plan National de Développement Forestier et Pastoral.

3.4.1 International multilateral assistance

The Tunisian Government channels the more important part of the support to the fields of conservation and development of natural and forest resources. Financial cooperation is also present through investments and donations of organizations such as the IBRD, European Community (EC), FAO, UNDP also exist in country.

3.4.2 Bilateral assistance

Several bilateral cooperation programmes and projects have been launched particularly with the support of Germany (GTZ and KfW), Canada, Spain, France, Great Britain, Italy, Japan, Holland and Sweden. Since 1992 the Netherlands and Sweden have agreed to recycle the Tunisian debt into environmental protection projects.

3.4.3 Other forms of assistance

Tunisia is also active in the League of Arab Countries, the Arab Maghreb Union, as well as with Mediterranean countries under the Barcelona Convention and the Action Plan for the Mediterranean (PAM).

3.4.4 International conventions

Tunisia is a signatory to several international conventions, among which the following are related to forestry:

- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which was ratified by Law 74-12 of 11/5/74;
- RAMSAR convention for the protection of wetlands of international significance as bird habitats. Tunisia ratified this convention in 1979;
- Rio de Janeiro Convention on Biological Diversity signed on 13/6/1992, ratified on 3/5/1993;
- U.N. Convention to Combat Desertification ;
- African convention for conservation of nature and natural resources ratified on 4/11/1976;
- Convention for the protection of the world cultural and natural heritage ratified 11/12/1974;
- Convention on conservation of migratory species of wild animals signed on 27/5/1987;
- Protocol on specially protected areas in the Mediterranean signed on 3/4/1982.

3.5 Forestry Development Policy, Strategy and Perspectives

Tunisia's forests have endured human and animal pressure and numerous natural calamities, which have significantly reduced their surface area. At the beginning of the Christian era there were 3 million ha. At independence, forests only covered 400 000. Since then measures have been taken to ensure the conservation of the forest estate and increase the forest cover of the country.

3.5.1 Forest policy evolution

Since independence, the forestry policy in Tunisia went through three significant stages⁶⁵:

First stage 1956/70

During this period priority was given to water erosion control through the implementation of watershed management policies. The objective was to protect dams against sedimentation, and to protect settlements and infrastructures against flood damage. This phase aimed as well at delimiting the forest estate through a property audit and at defining the economic, social and environmental roles of forests.

Second stage 1971/87

During this phase, the forest policy's main orientations remained unchanged. However, in order to safeguard collective rangelands, these were brought under the forestry system (1974). This substantially increased the area managed by the forest administration. Much importance was given to the development of forestry potential, encouraging employment, creating natural reserves and national parks, training management staff and developing forest research.

Third stage 1988/96

Following the "1987 declaration" emphasis was placed on the forestry sector particularly in mountain and rural areas, as well as urban and peri-urban areas. Important measures were taken in favour of forestry such as: (i) promulgating the new forest code (1988), which promotes the socio-economic role of forests, (ii) formulating the national reforestation and soil protection strategy, (iii) creating the MEAT and of the national environmental protection agency⁶⁶, (iv) formulating the national strategy to combat sand encroachment, (v) designing the national plan to protect forests against fires, (vi) adhering to many international conventions, (vii) implementing the national forest inventory.

The national social and economic policy encourages the development of forestry according to a participatory approach, expressing a firm political commitment towards promoting social and economic development in a healthy and sustainable natural environment.

⁶⁵ Source: Direction Générale des Forêts – Plan National de Développement Forestier et Pastoral.

⁶⁶ Agence Nationale de Protection de l'Environnement.

3.5.2 An assessment of the National afforestation & desertification control strategy (1990-2001)

Objectives

Besides desertification control, the strategy aimed at increasing the forest cover as well as at improving range management at the global financial cost of DT 1 280 million. It included:

- 320 000 ha of forest plantations (cost DT 320 million) distributed as follows:
 - ? 130 000 ha on State-owned land (cost DT 130 million);
 - ? 170 000 ha on private lands (cost DT 170 million);
 - ? 20 000 ha equivalent of roadside and windbreak plantations (cost DT 20 million).
- 600 000 ha of fodder tree and spineless cactus plantations (cost DT 600 million) divided as follows:
 - ? 130 000 ha on State-owned land (cost DT 130 million);
 - ? 270 000 ha on collective land (cost DT 270 million);
 - ? 200 000 ha on privately owned land (cost DT 200 million).
- Range management over 2 200 000 ha (cost DT 360 million) distributed as follows:
 - ? 1 200 000 ha of collective rangelands (cost DT 196 million);
 - ? 1 000 000 ha of privately owned rangeland (cost DT 164 million).

Assessment of achievements

The achievements for the period 1990-2001 include:

- Forest plantations: The total area planted (186 000 ha) amounts to a modest global implementation rate of 58 %. There are large variations as indicated below:
 - ? 120 000 ha forest plantations on State-owned land (implementation rate: 92 %);
 - ? 46 000 ha of plantations⁶⁷ on private land (implementation rate: 27 %);
 - ? 5 700 ha of roadside and windbreak plantations (implementation rate: 28,5 %).

It is clear that the results achieved in the private sector have been below expectations for 2 major reasons: (i) forest investments do not provide immediate returns, (ii) the forestry legal system does not offer freedom of tenure and users rights. This performance reflects also a lack of extension and sensitisation targeting private landowners. However, on State-owned land, the execution rates are remarkable.

- Fodder tree and spineless cactus plantations: Out of 600 000 ha projected, 356 000 ha were planted, amounting to an implementation rate of 59,3 % broken down as follows:
 - ? 100 000 ha planted on State-owned land (implementation rate: 77 %);
 - ? 62 000 ha planted on collective lands (implementation rate 23 %);
 - ? 194 000 ha on private lands (implementation rate 97 %).

⁶⁷ Of which, 20 000 ha of forest plantations and 26 000 ha of multipurpose agro-silvo-pastoral plantations.

Despite the fact that a mere DT 60 million were allocated to spineless cactus⁶⁸ plantation instead of the DT 200 million projected, the rate of execution in the private sector has been outstanding, reaching 194 000 ha, of which 126 000 of *Opuntia ficus indica*, var. *inermis* plantations. This is explained by the fact that: (i) cactus plantations provide sustained and immediate revenue, (ii) landlords are granted financial compensation for closing-off planted lands to grazing.

The rather weak level of achievements observed on collective lands results from the beneficiaries' lack of conviction as to the usefulness of the administration's intervention, as well as from the broad community opposition to subjecting the treated collective lands to the forestry legal system.

- Range management: This activity has been applied over 236 000 ha amounting to an implementation rate of only 11 % .
 - ? 155 000 ha on collective rangelands (implementation rate: 13 %);
 - ? 81 000 ha on privately owned rangeland (implementation rate: 8 %).

The low level of implementation on collective rangelands results from community opposition to their submission to the forest system. It is also explained by people's wish to privatise collective lands. The causes of the low results on private pasturelands are the lack of interest shown by the private beneficiaries and the excessive parcelling out of smallholdings.

Desertification control achievements

The achievements in terms of desertification control for the period 1990-1999 are given in Table 12. It is important to note that sand dune stabilization, roadside and windbreaks' plantations have already been accounted for in forest plantations. They are repeated here to better give an idea of the scope of desertification control achievements.

Table 12: National desertification control programme (period 1990-1999).

Actions	Projections	Achievements		Costs
		Quantities	%	
Tabias construction	4 000 km	3 982 km	99,6	DT 16 millions
Raising of tabias	8 000 km	6 766 km	84,6	DT 17 millions
Biological dune fixation	24 000 ha	17 200 ha	71,7	DT 26 millions
Roadside & windbreak plantations	20 000 ha	5 700 ha	28,5	DT 9 millions
Total cost				DT 68 million

Source: DGF

The rates of implementation are generally satisfactory, except for roadside and windbreak plantations, which are most often on private lands.

Conclusions on the 1990-2001 forestation and desertification control achievements

The levels and rhythms of implementation in afforestation and desertification control activities were higher in the period 1990-2001 than they were in the 1980-1989 period. Mean annual achievements have improved from: (i) 4 500-12 000 ha for afforestation, (ii) 6 400-14 000 ha

⁶⁸ Spineless cactus plantations are grown for the most part on private estates.

for fodder tree plantings, (iii) 5 500–14 000 ha for spineless cactus plantations, and (iv) 6 600–18 000 ha for rangeland management. However, despite this commendable progress, the level of implementation of some activities has remained inferior to the expectations because:

- Projections were overestimated, particularly with regard to rangeland management. This suggests that all elements of the file were not completely thought out, particularly those dealing with socio-economic and tenure aspects;
- External assistance in rangeland management was weak;
- Rural communities are opposed to subjecting collective rangelands to the forest legislation;
- Investments in forestry activities do not provide immediate returns;
- Subsidies are insufficient, as are incentives to promote investments in forest activities;
- Tenure issues persist;
- These activities still meet some resistance from private landlords;
- The funds allocated were smaller than those projected.

3.5.3 National forestry development strategy (2002-2011)

The new development strategy (2002-2011) for the forestry sector includes:

Forest and pastoral reforestation operations

It include: (i) forest plantations, (ii) fodder tree or pastoral plantations, (iii) rangeland management, (iv) combating sand encroachment and desertification, and (v) restoring nurseries.

Improvement of the management of forest ecosystems

It comprises: (i) updating forests and rangelands databases, (ii) integrated forest management, (iii) socio-economic development of forest populations, (iv) promotion of non-wood forest products, and (v) developing the cork production and industry sector.

Conservation of the flora and fauna

It consists of: (i) protecting forests against fire and diseases, (ii) organizing hunting and preserving protected areas.

Constitutional, legal and organizational considerations

It encompasses: (i) forestry research, extension and training, (ii) constitutional considerations, (iii) legal aspects. Taking into account former constraints, the strategy is more realistic in terms of activity projections, as the levels and rhythms of implementation anticipated are scarcely higher than those of the period 1990-2001. Considering the persisting tenure and users right issues as well as the lack of incentives, it would be wrong to pretend that recalcitrant private and collective land owners can be won over to the to the administrations' cause. The detail of the projected implementations is given in table 13. Compared with the achievements of the period 1990-2001, the projections for the period 2002-2011 are as follows:

Activity	Achievements 1990-2001	Projections 2002-2011
Forest plantations	180 000 ha	190 000 ha
Pastoral plantations ⁶⁹	356 000 ha	375 000 ha
Rangeland management	276 000 ha	275 000 ha

Table 13: Forest and pastoral plantations and rangeland management strategy (2002-2011).

Diverse plantations: 565 000 ha equivalent	Objectives
Forest plantation: 190 000 ha	
– Plantations on State-owned land	50 000 ha
– Plantations on private land ⁷⁰ , with forest dedication	20 000 ha
– Forest strips and roadside plantations	20 000 ha
– Windbreaks in irrigated perimeters (equivalent area)	30 000 ha
– River bank and hydraulic works protection plantations	20 000 ha
– Multipurpose plantations and afforestation of private lands	50 000 ha
Fodder tree and pastoral plantations: 210 000 ha	
– Fodder tree plantations on State-owned land	100 000 ha
– Fodder tree plantations on collective rangelands	40 000 ha
– Fodder tree plantations on private land	70 000 ha
Spineless cactus plantations: 165 000 ha	
– Spineless cactus plantation on State forest estate	20 000 ha
– Spineless cactus plantations on collective rangelands	40 000 ha
– Spineless cactus plantations on private land	105 000 ha
Range management: 275 000 ha	Objectives
– Collective rangelands' management	150 000 ha
– Rangeland management on private lands	125 000 ha

Source: DGF

The following remarks are made with regard to the degree of realism with which the projections for some activities have been made:

⁶⁹ This category includes fodder tree plantations as well as spineless cactus bush plantations.

⁷⁰ Within the new organization of State-owned agricultural land, 60 000 ha of land with forest dedication have been transferred to the private estate, of which 20 000 ha will be planted as part of this new strategy.

- Considering the steady increase of demand by farmers for multipurpose species (walnut, fig, olive, pistachio etc.) it has seemed important and at the same time feasible to increase the level of implementation from 4 000-5 000 ha/year;
- Taking account of the need to establish forage/fodder reserves on State-owned rangelands, and considering the high national implementation capacity (timework and private enterprise) it seems feasible to augment the implementation rhythm for fodder tree and pastoral plantations from 5 900 ha to 10 000 ha/year. Plantation projections for collective rangelands are more cautious, rising from 2 600 ha to 4 000 ha/year;
- Considering the good results achieved in terms of spineless cactus plantations on private land, particularly in central Tunisia, it is proposed to increase the implementation from 14 000-16 500 ha/year.

Desertification control

Sand dune biological fixation is included in the reforestation strategy presented above. In addition to the desertification component includes the construction of 4 000 km of tabias and raising an additional 8 000 km of tabias.

3.5.4 Forestry and range development master plan (PDNDFP⁷¹): Main orientations⁷²

A PDNDFP prepared by DGF proposes new development options for the forestry sector, which imply its reorganization and the definition of new objectives to:

- Increase its economic role and:
 - ? Better cater to national forest products needs, particularly wood and cork;
 - ? Better contribute to the development of the agricultural sector and the national economy; and
 - ? Promote the industrial base of forest products.
- Increase its social role through:
 - ? The involvement and active participation of rural populations in initiating activities leading to improved revenues and livelihoods on top of sustaining resources' development;
 - ? Creating through development and conservation programmes sustained employment sources for the benefit of forest populations.
- Develop the forestry sector through intensified efforts in reforestation, management of resources and protection of the environment;
- Reaching a balance with regard to demand and supply of wood products.

⁷¹ Plan Directeur National de Développement Forestier et Pastoral.

⁷² Source: DGF – Plan Directeur National de Développement Forestier et Pastoral.

A number of outputs are expected of the PDNDFP, such as:

- Forest administration reorganized and more efficient in implementing the forest legislation and in executing its various development and conservation missions;
- Natural and man-made forests managed and their wood, cork, fodder and NWFPs potential identified, quantified and put under sound utilization;
- Local people's role in managing forest resources enhanced;
- Forest legislation reviewed to encourage private investment in reforestation and integrated forest management interventions;
- The promotion of the role of the private sector in the management and sound exploitation of national forest, rangeland and wildlife resources promoted;
- Organization of private forest products' extraction enterprises and strengthened structures in the REF and forest regional organizations:
- The creation of an environment and desertification information system, periodically supplied with field data exploited to adjust political choices, development approaches and planning activities;
- An operational national observatory on desertification and soil degradation;
- National plan to combat desertification prepared and implemented in close coordination with stakeholders.

4. The Causes and Effects of Deforestation and Forest Degradation

4.1 *Indirect Causes*

4.1.1 Tenure and user rights

Competing for land occupation and constraints on natural environments:

The fundamental cause behind land degradation is the excessive exploitation of resources at levels which exceed their reproductive capacity. Human pressure on natural environments has multiplied five-fold over the past 100 years owing to population growth. This has resulted in a huge increase in demand for land. The outcome was additional land occupation and excessive pressure on forests and natural resources. Despite attempts to preserve, manage and develop forests and rangelands, degradation continues unabated.

Land occupation is not optimal anymore, as urban settlements take over the best agricultural lands, and agriculture encroaches to the detriment of forests and rangelands. These issues are deepened by the increase of mechanized and intensified agriculture on marginal and fragile lands. The agro-silvo-pastoral balance is upset due to the steady extension of fields sown with cereal crops at the cost of rangelands, and to the extension of pasturelands to the detriment of forests.

Box No. 3**Pressure exerted on lands**

During the 20th century, cultivated lands took over very substantial areas of natural vegetation. Steppe areas put under cultivation between 1890 and 1975 are estimated at 27 million ha, while fires are believed to have caused the loss of 320 000 ha⁷³.

Overgrazing is still a major plague that leads to the conversion of rangelands into croplands in arid regions, exposing them to high desertification risks. Land clearing takes place as soon as the pastoral functions are brought to a stop. Land appropriation leads to people's adoption of sedentary lifestyles. This process is still ongoing at the cost of fragile steppe ecosystems, mostly in the form of economically and ecologically hazardous grain or olive monoculture.

The other form of pressure exerted on lands lies in the spread of intensive farming techniques on all soils, such as irrigation, excessive soil preparation, ill-advised use of chemical fertilizers and pesticides.

Constraints and challenges in water use

Agriculture uses 80 % of the 2 Mm³ of water exploited annually. In some regions the quantities of water operated by government services is largely superior to the actual needs, resulting in an estimated 30-40 % waste of irrigation water that is perpetuated through low water costs. This is aggravated by a weak the agricultural infrastructure and efficiency of irrigation techniques. Water extraction and utilization for irrigation by private landlords with consequent lowering of the water table.

Land ownership rights

Though estate audit procedures have been going on for a long time, 188 627 ha are still in the process of being registered as State land with little progress in view. Many problems remain that are linked to the application of the judgements of courts on the illegal occupation of State Forestry property. In either case, the conditions remain favourable to natural resources' overexploitation. The feeling of mistrust towards the forest administration is very serious as it perpetuates the excessive extraction and abuse of natural resources.

State incentives and land resources' allotment

Despite the specific investment incentives (50 %) granted for SWC interventions and tree fodder plantations, the incentives that encourage agricultural development continue to result in a substantial and steady expansion of croplands at the expense of forests and pastoral lands.

Support/constraints in forests and rangelands utilization

Financial incentives are granted in the form of bonuses for studies and for mobilizing investments to carry out arboriculture projects in steppe lands with forest and pastoral dedication. They often have negative impacts, particularly when they are carried out in areas of adverse climatic conditions. This results in some accelerated, severe and irreversible deforestation and degradation.

The main constraints to the promotion of investments in forest and pastoral activities on private estates comes from the obligation to submit these lands to the forest legislation and from the fact that any product harvesting/extraction requires an authorization delivered by the

⁷³ Source: Saoud. 1983. cited by: Rapport National – L'Etat de l'Environnement 1997 (MEAT).

forest administration. SWC works have proven and despite their acknowledged effectiveness but the constraint to their widespread utilization lies in the fact that level terraces and stone cordons hinder considerably the undertaking of agricultural activities.

Box No. 4

Forestland cultivation

Until recently, the group of forests located between the Governorates of Kef and Siliana formed an entity with the surrounding mountains, vegetation and rivers that was hardly disturbed by human activity.

In the early eighties, the region became the centre of an impressive development process resulting from the keen interest and support for apple orchards. In a first phase, farmers cultivated forest clearings, and with successes there, they soon looked for other lands to farm.

It is then that the “revolution des pommiers⁷⁴” began generating negative effects. Forests were cleared on a large scale and the groundwater was polluted following excessive use of fertilizers and pesticides. At the same time, the roads divided the forest and altered landscapes, and interrupted the free movement of wildlife.

4.1.2 Poverty

Combating rural poverty is a major element of the national social and economic policy. However, despite an improvement of revenues and a reduction of a per centage of the population living under the poverty line (Table 14), poverty persists in forest and pastoral regions disadvantaged by high population densities, over-exploitation of lands, deteriorating productive potential and meagre local income and investment capacity.

Table 14: Reduction of poverty rate in rural Tunisia (1975-2000).

Year	1975	1980	1985	1990	1995	2000
Proportion of the poor in rural Tunisia	22,0 %	12,9 %	7,7 %	6,7 %	6,2 %	4,2 %

Source: Institut National des Statistiques (INS)

Population increase versus resource availability

The importance of the human pressure is clearly indicated by the fact that the population living in and off of the 900 000 ha of forestlands is estimated at between 800 000-1 000 000 people⁷⁵. The population density is in the order of 80-100 persons/km². Besides periodic forest jobs, these forest folks live from extensive animal husbandry on forest pastures, subsistence agriculture, fuel-wood and NWFPs’ extraction, charcoal production, all of which add to soil and land degradation. Population increase results in a steady reduction of the resources available and in increased poverty as illustrated below.

⁷⁴ Apple trees’ revolution.

⁷⁵ Source: DGF – Plan National de Développement Forestier et Pastoral.

Increase in resource demand → overexploitation (vegetation, soils, waters) → imbalance between extraction and production capacity → soil degradation (through erosion and loss of fertility) → loss of productivity → population impoverishment → extension of cultivated lands at the cost of forests and rangelands → overexploitation → .

The populations living on and off forests may be broadly distinguished in three main categories, namely:

- A majority, for which the utilization of the forest is vital, given that they barely survive;
- A minority, for which forests represent an investment opportunity, either in the form of animal husbandry, or charcoal production;
- Another minority group made up of those who own neither livestock, nor land⁷⁶ and depend mostly on forestry for periodic employment.

Rural populations have therefore always utilized forests and rangelands for farming, animal husbandry, wood and non-wood forest products' extraction, utilization and marketing, etc., all of which form the basis of their local socio-economic systems. These are not always compatible with a sound management of the resources, which is why the forest legislation has a rather restrictive interpretation of tenure rights and users' rights. This explains why the forestry economic and social environments remain too complex and difficult to easily eliminate the causes of degradation and reverse the process.

4.1.3 The capacity to respond on a timely basis to misuse issues leading to deforestation

Financial context: dependence on external aid

Assessing the national reforestation and desertification control strategy brought out the funding difficulties encountered in implementing the targeted objectives. Though Tunisia has significant capacity and competence in natural resource management, this does not always result in addressing of environmental problems in a timely way. There is a strong dependence on external assistance, which does not always address priority needs. The need to achieve minimum investment returns often precludes support to rehabilitation of degraded forest and pastoral lands.

Institutional considerations

Organisational issues affecting the forestry sector are:

- There is no suitable and well coordinated strategic framework to promote the involvement of multiple stakeholders, particularly resources users;
- While a number of objectives of various administrations may be synergetic and complementary, many remain conflicting and result in antagonistic relationships;
- Because of the lack of integrated, multidisciplinary approach and given the conflicting link between utilization and protection of natural resources, there is no appropriate rural development and planning concept;

⁷⁶ Less than 20 % of the population.

- Some regulatory and institutional measures are inadequate for the existing agro-systems and are difficult to enforce.

Environmental information systems

Since the creation of MEAT in 1992, reports on the state of the environment are prepared on a regular basis. They consist of 9 chapters, i.e.: (i) territorial management, (ii) land degradation and desertification control, (iii) sustainable water resources management, (iv) preservation of continental marine diversity, (v) urban and peri-urban forestry, (vi) sustainable coastal tourism, (vii) urban and rural hygiene, (viii) urban and industrial solid wastes, and (ix) environmental education, and public awareness. However, despite the existence of a reliable and relatively exhaustive and updated database, Tunisia is not able to respond on a timely basis to all of the issues on forestry and rangelands that are related environmental and socio-economic issues.

Limited empowerment and participation of people

The evaluation of the first integrated development projects shows that farmers and forest users respond positively to direct, short term and personal benefits derived from their projected participation in project interventions. However they reject the more indirect and long-term collective benefits. Although a new generation of projects based on the concept of integrated land-use are implemented using participatory approaches, the degree of participation among the people remains insufficient to curb the rate of forest and range degradation.

4.1.4 Policy related issues

Problems linked to forestry policy

The processes of bringing people to adopt sedentary lifestyles and of land privatisation for agricultural development at the expense of forest and rangeland often resulted in encroachment and abuses on natural resources. They were accompanied by break up of the family units and community structures. As well, forest entrepreneurs look after short-term benefits from their activities, without concern over the longer-term consequences of the land, which they do not own.

4.2 Direct Causes

4.2.1 Natural causes

Climate

Erosion results from the conjunction of natural factors. Tunisia's Mediterranean climate is characterized by strong storms that may deliver up to 200 mm rain per hour. Its irregular and highly variable rainfall regime made of recurrent and prolonged droughts, particularly towards the Saharan zone. Droughts negatively affect the resilience of vegetation formations and are hostile to their rehabilitation processes.

Soils

Tunisia possesses a significant area of good quality soils, the productivity of which is only hindered by adverse climatic conditions. Nevertheless, soils do have edaphic constraints that are conducive to various kinds of degradation. Examples are: (i) erosion-prone soils on slopes,

which concern 13 % of the northern Tunisia, (ii) stony or hardpan superficial soils that hinder rainwater infiltration and cause strong runoffs, (iii) alkaline soils, (iv) hydromorphic soils, etc.

Forest soils are generally calcareous and skeletal, except in Kroumirie-Mogods, where we have relatively deep grey brown podzolic soils. Fertility transfers benefiting lower watershed farmlands occur through erosion and washing out. Rangeland soils are generally marginal. The marl soils that are rather widespread in the country are problematic as they are very much prone to erosion and landslides.

Steep topography

Steep topography zones (above 300 m elevation) concern about 2 million ha in Tunisia. They harbour vital resources such as water, forests and rangelands and benefit from favourable climatic conditions explain their rich biological diversity. They are nevertheless the most endangered zones on account of this steep topography and a multiplicity of production systems there.

Natural calamities

Some 1 400 ha of natural vegetation formations are burned every year as a result of their high sensitivity to fire. Despite the existence of fire prevention systems, the forest road⁷⁷ and firebreak⁷⁸ infrastructure is below the norm developed for the Mediterranean region.

A number of parasites affect natural and man-made forests. They are the pine processionary caterpillar, the *Phoracanta semi-punctata* of the eucalypts, the *Lymantria dispar* of cork oak and the *Blastophagus pinperda* of the maritime pine. The areas affected vary from year to year. The means for combating pests are limited.

4.2.2 Causes linked to human activity

Since ancient times, Tunisian forests and rangelands have been subjected to clearing, overgrazing, illegal use, and fires. Today we see deforestation and degradation and conversion for the benefit of land cultivation. At independence, the forest area was 400 000 ha, which corresponded to the lowest national forest cover (2,25%) among the Mediterranean countries.

Infrastructures

Roads have been developed to improve transport, communications, access to markets, commercialisation, and protection against fires. They are a serious cause of erosion, landslides, and degradation of forest and rangeland resources. This is a result of:

- Natural resources over-exploitation requiring more transport facilities and from the introduction of mechanization equipment to intensify the traditional production systems;
- Tourism management;
- Urban development pressure and, particularly, the construction of second homes and summer quarters.

⁷⁷ 0,8 km/100 ha

⁷⁸ 0,7 ha/100 ha

Man-made catastrophes

Shoreline bare sand dunes arise as a result of fires, overgrazing, clearings, etc. that affect coastal natural vegetation. In spite of the commendable efforts undertaken to stabilize 26 000 ha of dunes, these are still being degraded in different ways, particularly in the form of clearings for urbanization. Many sand dune areas have been transferred to municipalities for the development of tourism.

Ninety six percent of forest fires are of human origin. They affect 1 400 ha/year. Despite the measures taken to limit the fire damage risks, the vulnerability is deep rooted due to the Mediterranean climate.

Abusive utilization of natural resources

The transition from a pastoral use, to agro-pastoral use, and finally to an agricultural society has been greatly accelerated since colonial times. The fertile plains of the North were subjected to mechanized dry-farming agriculture. The rangeland area was therefore drastically reduced and consequently overgrazed. The extension of olive-crop-growing has affected many regions, reducing even further the rangeland area remaining.

The parcelling of farmlands and the reduction of individual estates work against sustainable land use. In addition, Tunisian forests have been losing about 1 % of their area every year⁷⁹. Likewise, esparto grass steppes, which covered 1,1 million ha prior to 1885, were reduced to 612 000 ha in 1961, and only cover 250 000 ha at present. The potential natural range of oak species covers 150 000 ha, but given the various abuses (cork over-extraction, overgrazing, fires etc.) there remain only 60 000 ha of productive stands. The rest has degraded to maquis formations.

The production of natural rangelands and forest pastures varies greatly from year to year. In the acutely dry year of 1987-1988, fodder production from rangelands and forest pastures amounted to 302 million FUs, while in the favourable year 1985-1986 it reached 642 million FUs (OEP, 1994). Following the very low forage crop productions in dry years, natural rangelands and forest pastures are open without restriction to all herds, causing more overgrazing and degradation.

The uncontrolled livestock husbandry practised in natural rangelands and forest pastures is alarming. Herders are neither identified, nor organized. Their grazing rights are not clearly defined as to the volumes of fodder they may extract or the territories they may exploit. In collective and State rangelands, herders shepherd without restriction. Severe ecological degradation is the outcome of this form of natural resources overuse. The reduction of rangelands surface area in the last 20 years is estimated at 614 000 ha, equivalent to 29 200 ha/year.

At present, 78 % of the renewable water resources potential are used, while 873 Mm³ have yet to be developed. With regard to surface water, 67 % of the volumes are used (1 400 Mm³), while 93 % of the groundwater realizable volume is exploited (1 631 Mm³). Between 35 000 and 40 000 ha are irrigated by over-tapping groundwater reserves and 10 % of the total area under irrigation risks severe salt build-up. Water resources' quality is degrading under excessive

⁷⁹ Gerkens. 1976. El Afsa. 1978. Le Houérou. 1980. Gerkens estimates that it has been ongoing since 1910.

extraction, evaporation and pollution. Pollution from urban, industrial or agricultural origins constitutes a major risk by drastically diminishing the limited water resources available.

Unsustainable agricultural practices

Soil and water conservation interventions on private and collective lands, were never popular, despite their absolute necessity. Traditional farmers see in them a form of State interventionism and complain about the fact that they can cultivate less land (- 15 %) and often with greater difficulty. Ploughing along the slope is therefore still a common practice that causes severe erosion and soil impoverishment. In the south, disk ploughs have triggered very severe wind erosion on vast cultivated areas of steppes.

In good rainfall years, farmers increase drastically the rain-fed cultivated lands, at the cost of rangelands. These low productivity marginal lands are often abandoned following the exhaustion of soil and are subsequently re-listed as rangelands, even though they have become less useful for livestock husbandry. The same may be said about thousands of hectares of fruit orchards planted without success under state subsidy on marginal lands of the Centre and the South. They have triggered more rangeland degradation and subsequent land abandonment followed by excessive erosion and desertification.

4.3 Effects of Deforestation and of Forest & Range Degradation

4.3.1 Loss of land productivity

Three main effects linked to degradation processes are recognized; they are: (i) the physical processes (loss of soil particles, compaction, and reduction of rainwater infiltration), (ii) chemical processes (loss of minerals, salinization and chemical pollution); (iii) biological processes (loss of soil organic constituents and microbiological imbalance). These combined effects result in loss of soil fertility and productivity, as well as regeneration capacity.

4.3.2 Biomass and species' diversity reduction

Biomass and diversity reduction in forest species

Excessive extraction of forest products accelerates the process of forest destruction. For instance forest regions in the North sustain extreme pressures for wood fuels. Annual deficits noted are 2,4 MT and 1,0 MT respectively for the northeast and the northwest. As extraction concerns specific tree species, the process of destruction occurs in a selective manner, targeting some species before others. The exhaustion of eucalyptus stumps as a result of successive coppice cuttings, the ageing of oak formations, the lack of regeneration of *Quercus mirbecki*, the stunted appearance of overgrazed *Quercus ilex* stands are all clear indicators of biomass decline, followed by the reduction of diversity.

Livestock breeding is becoming more and more intensive under forest stands, and is responsible for the lack of regeneration of many tree species.

Biomass and diversity reduction in rangeland species

Husbandry practices and cyclic natural and man-made catastrophes have gradually impoverished the flora and reduced the vegetative cover as well as the surface area of rangelands in the steppe region, paving the way to desertification. This results in a very

substantial drop in rangelands productivity, as well as a high sensitivity to overgrazing and soil compaction. Esparto grass formations and steppes are particularly vulnerable to any form of degradation. The first IPFN (1995) highlighted the predominance of rangelands low cover rates (less than 25 %), the degradation of palatable species and the low biomass often inferior to 50 FUs/ha.

4.3.3 Increase in erosion & degradation phenomena and atmospheric pollution

Water and wind erosion

The absence of relevant indicators on cropped lands and production systems development makes any assessment of land evolution trends subjective. The national report on the environment (1997) mentions that water erosion degrades the equivalent of 9 200 ha annually. The loss of arable land resulting from water erosion is estimated at 10 000 ha (71 % in the North, 23 % in the high central steppes and 6 % in the southern steppes).

Wind erosion

The annual loss of rangelands through degradation and desertification processes (wind erosion) in semi-arid, arid and desert regions is believed to be 8 000 ha. More than two-thirds of the national territory is subject to wind erosion, whose maximum intensity occurs in Central Tunisia, where sand transports by wind are estimated between 50 and 200 tons/ha. Between Kairouan and the extreme south of the country, sand transports are evaluated at 10-50 tons/ha.

Salt build-up in soils

Some 3 000 ha are lost through water-logging and secondary salinization as a result of poor irrigation practices. Between 1881 and 1987, central and northern Tunisia's natural humid zones have lost 19 014 ha, from 130 219 ha to 111 205 ha. This corresponds to the loss of very important flora and fauna habitats. In the same period the artificial humid zones (dams, artificial lakes etc.) have increased by 22 400 ha.

Air quality and carbon sequestration

Natural forests, man-made forests and trees outside forests are very important in safeguarding air quality, particularly in urban and industrial zones. Any reduction of their surface area or biomass results in lesser air quality.

Vegetation is one of the most efficient means of carbon sequestration. It is estimated that 1 ha of cork oak forest absorbs about 22 tons of carbon dioxide and produces 16 tons of oxygen annually. Therefore, any form of degradation of vegetation limits the level of carbon sequestration.

4.3.4 Populations affected by poverty

Deforestation and reduction of silvo-pastoral resources affect diverse populations groups in varying degrees and in different ways.. For instance women are obliged to travel longer distances to fetch water and fuel-wood. Herders move their animals over larger territories and invest in complementary feeds to maintain their herds. Some traditional forest users can no

longer generate revenues from forest products. Farmers are affected by loss of land and land productivity following erosion processes. Thus degradation progressively affects all categories of natural resources users. It affects also the young and the jobless that leave their native land. Moreover, as resources become rare, poverty affects more people and social conflicts become more intense.

5. Status of Knowledge

5.1 State of Knowledge

5.1.1 Extent of deforestation and forest and range degradation:

There is recognition that the accuracy and reliability of the national forest inventory data need to be improved to reflect the situation on the ground and the trends in forest cover change. The national forest and rangeland cover data and trends do not readily reflect the severe losses due to deforestation and degradation in some areas. Some losses may be compensated by reforestation in other areas. Furthermore, it is only through revising the national forest and rangeland inventory that vegetation changes can be appraised on forests which become maquis or garrigues.

Box No. 5

Potential and basic indicators in forestry

Tunisia experiences a growing discrepancy between its natural resources potential and a steadily rising demand for products. Projections of production and consumption of forest products at national level need further data collection and analysis. For the time being, the main indicators affecting the quantity and the quality of natural forest and range resources are as follows:

- Low forest cover (11,6 % for northern Tunisia);
- Scarcity of dense forests, which represent not more than 16 % of the forest area;
- Low mean wood annual increments ranging from 0,5-2 m³/ha for forests and less than 0,5 m³/ha for the tree maquis and garrigues;
- Negative balance in terms of wood supply and demand, difficulties linked to forest products extraction and marketing, and illegal wood harvesting;
- High levels of degradation and lack of natural regeneration affecting the main natural forest stands of *Pinus halepensis* and *Quercus suber*;
- Sensitivity of forest to fire and parasites;
- Lack of economic appraisals of forestry interventions and frequent technical choices which are inappropriate;
- Lack of State lands for reforestation, and of incentives to promote sustainable reforestation of private lands;
- 900 000 people living in forests and benefiting from users rights;
- Local populations not sufficiently involved in the sustainable management of forests and rangelands;
- Lack of economic assessment of forest products, particularly NWFPs and of their impact on the rural population's economy;
- Absence of inventory and management of "trees outside forests".

5.1.2 Consequences of deforestation and forest and range degradation

Degradation of vegetation formations affects the ecosystem, resources, habitats and infrastructures, as well as the economy and well being of local people. There has not been sufficient recognition of the value of the forests and rangelands and of the uses of traditional wood and NWFPs', to the quality of life.

5.2 *Experience gained, Lessons earned*

The Tunisian forestry sector has entered a mature phase of its existence after having accumulated knowledge, know-how and experience at national and international levels. These are valuable assets and advantages as follows:

- Good command of soil and water conservation and forest and rangeland management techniques finely developed, demonstrated and documented;
- Positive disposition towards international financial and technical assistance;
- Legislation favourable to positive changes through the establishment of GFICs, a socio-economic directorate, an environmental observatory, the adoption of integrated management concepts etc.
- Quality education and training of personnel to impart knowledge and technology;
- Growing awareness and commitment of decision-makers on social and environmental issues previously not focused upon;
- Recognizing the need for sound and consistent policy, legislation and planning promoting partnerships, participatory and integrated approaches, and the need to encompass wider land-use management issues.

Technical initiatives recognized as being valuable in future forest and rangeland management include:

Production of improved quality forest seedlings

The off-soil seedling production technique is well established and gaining use in Tunisia. It concerns not only forest, but also fruit and ornamental tree nurseries. It is simple, efficient, economic and environmentally friendly. Tunisia could become the focal point to disseminate this valuable technique within LFCCs.

Development of networks for collection and treatment of data and information for planning of resources and forest and pastoral activities

In the framework of its national forest and rangeland inventory, Tunisia has set up a geographic information system. It has also created a cartographic and statistical database named Forest and Pastoral Information System (SIFOP⁸⁰). A new Forest Information and Planning System (SIPF⁸¹) has been recently developed, which allows dynamic information exchange with the

⁸⁰ Système d'information Forestier et Pastoral.

⁸¹ Système d'Information et de Planification Forestière.

database. It is valuable for national planning purposes as well as for management and decision-making at the level of local forest working circles.

Integrated management of forest and rangeland ecosystems

A new, integrated and participatory forest management model has been adopted, in which forest zoning is done according to socio-spatial units. Populations take part to all stages of the management process, from socio-economic and environmental studies, up to the formulation of the plan in partnership with the administration. This approach recognizes that management cannot be based solely on forestry technical criteria, but ought to be integrated in a wider “*terroir*”, which populations belong to and for which they feel responsible in their own interest.

Regeneration of the caper shrub

The recent development of a technique for the propagation of *Capparis decidua* at the nursery is a very important step forward with regard to the conservation of eroded marl soils. It should result in substantial increase of revenues from caper production.

Strategic studies

DGF has undertaken three strategic studies on non-wood forest products, wood energy and wood industrial sector, which aim at improving the knowledge about resources and identifying the issues as prerequisites for formulating relevant action plans.

5.3 Gaps in Knowledge and Know-How

5.3.1 Backing forest/range resources participatory management

Deficiencies in the fields of participation and partnerships for the sustainable and integrated management of forest and rangeland resources include:

- Weak processes of sustainable integrated managements of forest and pastoral ecosystems and weak involvement and organization of populations;
- Weak knowledge and dissemination of the nascent participatory planning, management and monitoring procedures and practices;
- Limited experience in the demonstration and documentation of success stories of various mechanisms of forest and range land use and limited dissemination of information related to these; and
- Limited awareness, and understanding of the dynamics of forest and rangeland deforestation and degradation with traditional users.

5.3.2 Other shortcomings

There are acknowledged deficiencies in the knowledge of:

- The ways in which Non-wood forest products are developed and utilized;
- Share of forest products in local people’s economic revenues;

- Genetic tree improvement in tree species;
- Improved techniques for regeneration (nursery and field) of forests and rangelands;
- Management of private lands ,and
- Information on the concepts and the technical data on the subjects of trees outside of forests and of agroforestry.

6. Conclusions and Recommended Actions

6.1 *Conclusions*

6.1.1 Development choices

Policy, legal, planning and socio-economic considerations

- In its infancy, the incorporation of the environmental, social and economic dimensions into forest and range land planning, management and monitoring remains a challenge that requires more resources, much time and management flexibility, backed by a suitable legal and regulatory environment;
- Forestry and rangeland policies, legislation and planning alone cannot address sustainable land-use and sustainable livelihoods as these need to be integrated across other sectors including agriculture, industries, transport and communication etc;
- Problems relating to reforestation of private lands intended for forestry are difficult to resolve in the social, legislative, statutory contexts and current policy incentives;
- The forest and rangeland estate and ownership remains confusing and settlement issues are complex, resulting in perpetuating conflicts and conditions of abusive exploitation of resources;
- Forest and steppe environments remain disadvantaged (illiteracy, poverty, lack of economic and investment opportunities etc.);
- Foresters remain reticent about the participatory approaches, considering them to increase costs and slow completion of their work without clear benefit to them personally.

Institutional aspects

- There is a lack of an integrated, multi-disciplinary vision, and a deficiency in inter-sectoral (energy, equipment, agriculture, eco-tourism etc.) and intra-sectoral (rural engineering, SWC, forestry, extension etc.) coordination of the diverse interventions in the forest and pastoral estate;
- The political commitment remains insufficient for implementing the integrated planning and participatory development programmes and ensuring that the facilitating policies, legislation and regulatory framework are in place.

Box No. 6**General conclusion on NWFPs**

On a nationwide basis NWFPs have substantial economic and social impacts and are of major importance in forest and agroforestry zones. Commercialised in national and international markets, they are obviously a vital source of income for the population and the forest administration.

NWFPs that play a major role in the development of the Tunisian forestry sector are:

(i) rosemary and myrtle essential oils, (ii) mushrooms, (iii) pine seeds, (iv) forest honey, (v) diverse tree and shrub fruits (carobs, capers, pistachios, cherries etc.), (vi) walnut roots, (vii) bay tree leaves, and (viii) handicrafts.

Cork is a strategic product and has an equally important social and economic role as a wood product. Incomes from raw cork (DT 11 million in 1998) exceed those of wood. The value of exported cork was in the order of DT 15 million in 2000, while incomes distributed in forest areas reached DT 2 million.

Technical views

- Definitions, concepts, data, responsibilities and stakeholders for sustainable management of planted forests, TOFs and agroforestry are causing debate and the way ahead is unclear;
- Transfer of knowledge and technology to the main stakeholders remains weak;
- While NWFPs are underused, both wood and non-wood forest products are poorly developed;
- Mobilization of water resources (small and medium hydraulics) assisting the forest and pastoral villages remains weak.

Box No. 7**General conclusion on wood fuels**

Past, present and future consumption trends indicate that wood fuels play and will continue to perform a major role in satisfying energy needs. The projection is that domestic and services' wood fuel demand should reach 2,8 MT in 2010, against 2,6 MT in 1997.

A comparative supply and demand review indicates that 11 out of 23 governorates show a deficit in wood energy. The shortages of southern provinces can easily be brought down by the surpluses of the central region. The deficits of the northern forest provinces such as Béja, Le Kef and Jendouba, on the other hand, are huge and alarming.

An action plan aiming to improve the wood energy supply/demand balance should by 2010 succeed in providing 9 governorates with a cumulated 596 999 additional tons of wood fuels annually and save 4 MT of wood during the period 2000-2010. The action plan is based on 4 main measures that aim to:

- Improve durably the livelihood of households targeted by the action plan;
- Reduce the demand for wood fuels in the northern and central-west regions;
- Improve the supply of wood fuels in the northern and central-west regions;
- Monitor, consult, communicate and sensitise.

6.2 Recommended Actions

6.2.1 Development choices and issues

Support to participation and partnership

Despite commitments towards, and some progress achieved in promoting forest users to develop their resource, much remains to be done. To support participation and partnership in the framework of integrated sustainable management of forest resources, it is thus recommended to:

- Develop and disseminate participatory planning, management and monitoring tools;
- Reform institutional frameworks and strengthen human resources capacity to adopt and apply integrated land-use and participatory approaches by:
 - ? Setting up local management counsels where all villages and/or GFICs concerned would be represented as full partners;
 - ? Involving GFICs, GDAs and local management counsels in formulating, implementing and monitoring forest and rangeland management plans;
 - ? Providing training to forest users and administration agents in the participatory approach to management and development;
 - ? Identifying and developing viable forestry, pastoral and SWC activities which are reproducible by traditional users.
- Define the key roles of the public and private sectors and of the other stakeholders, ensuring that the appropriate policy, legal, regulatory, planning and institutional frameworks are established to warrant that all stakeholders can play their part effectively;
- Empower and engage traditional land users by addressing their needs and aspirations, allocate appropriate lands, transfer technical knowledge and technologies, provide rural finances and access to markets for sustainable livelihoods, including sustainable forest management;
- Promote the establishment of local, autonomous participatory development units that gradually release the State from its centralizing approach and commitments to development; and
- Strengthen the financing and investment capacity of forest and rangeland users, by setting up small projects and enterprises and creating off-farm jobs able to generate revenues to be partly reinvested in local development.

Rational use of water resources

Even though it is limited, Tunisia's water resources are highly subsidised and used without restraint. This causes excessive waste. Properly managing water resources will be vital in the future. Recommendations for rational use of water resources include the need to:

- Develop and implement a sustainable water management policy that regard water as an economic asset to be used at the actual economic production cost;
- Monitor water demands and cancel all forms of subsidies that induce wastage;
- Develop SWC and hydraulics works and improve water-harvesting techniques;

- Preserve water quality;
- Preserve groundwater by improving natural recharge and/or by resorting to artificial recharge;
- Promote re-use of treated sewage effluent, etc.

Poverty reduction

To reduce poverty, it is recommended, among other options, to:

- Improve knowledge and know-how of poor and vulnerable groups and create sustainable job opportunities, diversified incomes and micro forest works as well as NWFPs processing ventures within profitable participation at all the stages of forest and pastoral resources' management;
- Increase NGO participation to support local communities and traditional land-users.

Forestland property

Resolve issues relating to uncertainty and conflict relating to forestland ownership.

6.2.2 Institutional and legal aspects

Recommendations relating to the strengthening of legal and institutional frameworks include:

Inter-sectoral coordination

The objective here is to strengthen coordination between participants and stakeholders, including NGOs, to harmonize and improve intervention approaches, organize populations and increase their capacity to make decisions, and ensure information exchanges etc. To this avail, it is recommended to:

- Adopt inter-sectoral, multi-disciplinary approaches and collaboration to respect and understand the needs and aspirations of the full spectrum of stakeholders including the different authorities of the State, the private sector, traditional land-users and NGOs;
- Integrate sustainable forest management to support sustainable land-use and livelihoods.

Research

The objectives defined by the national forest research strategy include the following:

- Contributing to natural and man-made forests' conservation;
- Developing biological reserves;
- Developing productive forestry systems; and
- Assessing traditional users' way of life and proposing means and activities liable to improve their incomes and well-being.

To achieve these forest research objectives, it is recommended to carry out the following interventions:

- Corroborate and implement research studies, enquiries and investigations regarding:
 - ? Ecological forest habitats and selection of reforestation/afforestation tree species to optimise the production capacity within specific environments;

- ? Forest protection and regeneration and the development of forest products.
- Improve, develop and delineate agro-silvo-pastoral systems and contribute to their productivity improvement by:
 - ? Resorting to fast-growing and multipurpose tree species;
 - ? Diversifying agricultural products by harvesting and processing multipurpose tree wood and non-wood products; and
 - ? Improving crop protection with adequate tree selection and distribution.

Training and extension

The beneficiaries of training and extension would be: forest and rangeland populations and users, decision makers, the public at large, managers and the private sector.

- Improve training and awareness of land-use and forestry issues, transfer knowledge and techniques through strengthened extension services to traditional users, participatory planning, gender analysis, communications and integrated approaches to natural resources management;
- Simultaneously target, youth, teachers and academics before affecting all the social levels of the rural and urban populations;
- Instil awareness and reform actions in policy and decision makers to durably manage the forest and pastoral estate through participatory approaches and inter-sectoral commitment to provide the key facilitating factors for a more clearly defined role of the private sector (corporate and smallholder); and
- Strengthen agricultural and forest training/extension for managers, ensuring application of new scientific research and participatory approaches into field applications on a progressive basis to upgrade training.

Common interest forest groups (GFIC)

To improve the organization and supervision of the GFICs, it is recommended to:

- Implement the new organization chart of GDFC and organize and revitalize the “Direction du Développement Socio-Economique de la Population Forestiere”;
- Review, reduce and simplify the legal measures related to the creation of GFICs;
- See to it that the 1991 Decree (No. 1656) is modified to allow GFICs to acquire the power to sell authorizations for products of the national forest estate; and
- Promulgate measures to enforce the law, authorizing GFICs to contract under mutual agreement with the administration the implementation of various forest works and interventions (afforestation, developing and maintaining basic forest infrastructures).

Trees outside forests

It is recommended to revitalise the work of the “Commission Nationale des Plantations Routières” and to define the basis for the sustainable management of the roadside plantations.

Institutional change

It is recommended to:

- Review the forest agents’ tasks towards a more development-oriented role;

- Promulgate a law that authorizes establishing a specific extension institution for the forestry sector; and
- Review the responsibilities of the “Commission Administrative Régionale des Zones Pastorales” and include the coordination and implementation of all of the management plan interventions.

6.2.3 Resource use and management

Recommendations relating to changes in resource use:

Ecosystems monitoring and evaluation

It is recommended to:

- Establish a permanent monitoring and evaluation structure, including permanent observation plots in forest, rangeland, steppe and desert ecosystems;
- Evaluate the impacts of forest, rangeland and SWC interventions and report on the status and trends in forest cover, deforestation, degradation and desertification;
- Every five years update the data on status and trends in forest cover, deforestation, degradation and desertification and add it to the IFPN and the “Rapport National sur l’Environnement” databases;

Improving the utilization and management of resources

To improve the utilization and the management of natural resources, the mission recommends to:

- Strengthen the forest policy and implement its organizational plans to go beyond traditional afforestation, desertification control, SWC and support sustainable management of natural and man-made forests and TOF resources, to cater for continuous supply of wood, fodder, fuel-wood, charcoal, non-wood forest products and conservation of local woodlands;
- Improve livestock husbandry and organize grazing and browsing in forestlands to enhance natural regeneration and put an end to resource degradation;
- Gain mastery over the economics of forestry interventions, production and productivity, populations’ incomes and revenues, non-wood forest products and wood fuels extraction and processing, animal husbandry, beekeeping etc. and propose alternative improvements.

Development of local wood resources

- Design and conduct sustainable wood products extraction programmes;
- Investigate and promote the best opportunities for developing economically sound processing technologies for all local wood products. Disseminate the information, and grant facilities for private and/or collective investment;
- Design a national forest resources development programme to achieve the goals, needs and requirements of the national economy.

Sustainable management of *Quercus suber* stands

To sustain the cork-oak stands, it is recommended to:

- Create a National Cork Centre (CNL⁸²) and:
 - ? Train forest technicians in the silviculture and management of *Quercus suber*;
 - ? Train workers in the process of cork extraction and field staking;
 - ? Develop a large and long-term programme of cork oak productive plantations;
 - ? Design a natural regeneration programme for ageing cork oak stands; and
 - ? Protect oak stands against pests and diseases;
- Develop the various products (cork, wood and non-wood forest products) of the oak formations;
- Develop operational research on oak multiplication, extension and silviculture, as well as on cork field conservation and industrial processing.

Development and sustainable management of NWFPs

Because there is much room for manoeuvre to improve NWFPs and increase substantially their share of the international market, the mission recommends to:

- Develop within the national sustainable forest management strategy, long term programmes that systematically and methodically integrate the extraction and development of NWFPs and aim to:
 - ? Increase the surface area occupied by NWFPs' species and associations;
 - ? Develop their productivity as well as the range of products extracted;
 - ? Meet the quality requirements of the international market, particularly for essential oils and honey;
 - ? Promote NWFPs for the national market;
 - ? Manage the resources to ensure a sustainable and economically viable extraction of NWFPs;
 - ? Consolidate NWFPs position on the present markets and gain on new ones;
 - ? Enhance the socio-economic role of hunting.

6.2.4 Enhancing/promoting the role of forests and planted trees

Recommendations to enhance the role of planted forests and trees outside forests include:

Trees outside forests

Given the huge TOF potential not yet developed, the mission recommends to:

- Clarify the concept and definition of trees outside forests and devise inventory and classification methods for TOFs' review and assessment at national level;
- Include TOFs in the discussions of the Teheran workshop on LFCCs to:
 - ? Normalize their definition;
 - ? Identify tools for their extension and sustainable management.

⁸² Centre National du Liège.

- Design an ambitious integrated and inter-sectoral TOFs development programme;
- Formulate attendant projects and interventions on (i) species diversification, (ii) vegetative reproduction techniques, (iii) genetic research etc.
- Promote TOFs on private and collective lands, within the framework of agroforestry and silvo-pastoralism.

It is also recommended to:

- Strengthen, extend parklands and recreation parks in large cities and district administrative centres;
- Extend the urban forestry operations to rural settlements, notably those equipped with market infrastructures.

Encouraging forest plantations

The mission recommends to:

- Clarify the concept and definition of planted forests;
- Evaluate and classify existing planted forests according to their condition, purpose and ownership and derive flexible plans for their sustainable management;
- Generalize the use of off-soil seedling production to all forest nurseries;
- Provide the necessary technical support systems to increase the quantity and quality of nurseries increase their productivity, reduce costs;
- Increase or at least maintain the present rates of afforestation and reforestation;
- Reduce the costs of tree planting;
- Integrate planting operations in a more global and participatory development framework;
- Target the most suitable ecological zones and priority sites for future development of planted forests and trees outside forests development and encourage investment in suitable areas.

6.2.5 Recommendation in the framework of the Teheran Process

Recommendations relating to support to the Tehran process include:

- Promote exchanges, experiences and knowledge among LFCCs as well as set up common networks, projects and programmes of development;
- Improve the knowledge of the causes of low forest cover and identify alternative solutions to overcome this situation, taking into account the unique political, social, economic, environmental, cultural and physical characteristics prevailing within the LFCCs;
- Incorporate the objectives and key components of action of the Teheran Process into the forestry policy of LFCCs;
- Incorporate policies, strategies and plans to enhance planted forests and trees outside forests within the overall national forestry programmes in LFCCs;
- Promote exchanges of knowledge and experiences, bilateral and multilateral cooperation among LFCCs;

- Developing collaborative research on LFCC priority issues (social, cultural, economic and environmental aspects);
- Develop demonstration projects and document success stories for sharing with other LFCCs;
- Establish a monitoring and reporting system to gauge follow up actions to the Tehran process; and
- Support and strengthen the Secretariat to LFCCs based in Tehran.

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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 Near East region in Iran, Tunisia (North African Mediterranean) and Oman (Gulf States) in readiness for the Regional Workshop for the Near East to be held in Iran in August/September, 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/Arabic in advance of the 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 NWFPs (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:

1. 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;
2. 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;
3. Related to 1 above, inter-sectoral linkages, conflicts in land-use policy and practice, incentives and subsidies which impact upon the forestry sector;
4. Appropriateness of current policies as reflected in alternative mechanisms and practices, programmes and projects for achievement of sustainable forest management;
5. 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;
6. Meet with all stakeholders (line ministries, Municipal Affairs; communities, rural families, NGOs, private sector, research and academic institutions and international agencies etc) to discuss and report 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

7. 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 review, translation to Arabic and dissemination to country participants prior to the regional workshops. A guide will be prepared for the format and content of the country case studies.

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 and outputs will be presented in English and Arabic.

Duration: 3 person months, between February - April 2002

Locations: Iran, Tunisia and Oman, brief and debrief for case studies in Rome prior to and after completion of field missions

Task Managers: Hassan Abdul Nour, Near East Regional Office, FAO supported by Jim Carle and Syaka Sadio, Forest Resources Division, FAO, HQ, Rome Italy and FAO representations in the instances of Tunisia and Iran.

TORs National Consultant

Tasks to be undertaken: The national consultant will provide support to the international consultant to 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:

1. 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;
2. 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;
3. 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;
4. Other tasks as identified during the case study

- Duration:** Full time, 1 person month, between February - April, 2002 (during fielding of international consultant)
- Locations:** One national consultant in each of Tunisia, Oman and Iran - field visits included
- Task Managers:** Hassan Abdul Nour, Near East 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 the instances of Tunisia and Iran.

ANNEX 2: ITINERARY OF THE MISSION

- 26/02/2002:** Arrival international consultant in Tunis
- 27/02/2002:** Briefing at FAO Representation,
Departure for Hammamet to take part to the Forum on the International
Year on Mountains
- 28/02/2002:** Back to Tunis – Bibliographic research and establishing contacts
- 114/03/2002:** Field visits: Tunis – Béja – Nefza – Tabarka - Ain Draham - Le Kef,
Tajerouine- Tunis.
- 26/03/2002:** Departure for Oman

ANNEX 3: PERSONS MET BY THE MISSION

Abdelaziz Laifa	Chef d'Arrondissement des Forêts au Kef
Ahmed Bouzid	Directeur du Développement Sylvo-pastoral à la DGF
Ahmed Ridha Fkih	Directeur Général des Forêts
Ameur Mokhtar	Chef de Service de Lutte contre la Désertification
Dadok Mahfoudi	Chef de Service des Forêts au Kef.
El Arbi Abid	Ex-Directeur du Projet Ceinture Verte Nord-Africaine
Fatine El Euch	Chef de Service des Parcours
Ghazi Gader	Chef de Service Economie Forestière à la DGF
Habib Kachouri	Chef d'Arrondissement des Forêts à Jendouba
Hedi Selmi	Chef de Service des Forêts à Nefza
Mohamed Ajroud	Officier de Programmation, FAO
Mohamed Jellali	Chef d'Arrondissement des Forêts à Ain Draham
Mongi Ben M'Hamed	Directeur projet gestion intégrée des forêts
Mouldi Ben Said	Sous Directeur du Développement à la DGF
Mustapha Sinaceur	Représentant Résidant de la FAO à Tunis
Nejib Seddik	Chef d'Arrondissement des Forêts à Béja
Rafik Aini	Chef de Service des Reboisements à la DGF
Said Gharbi	Directeur des Reboisements et de la Protection des Sols à Béja
Said Helal	Sous Directeur Aménagement des Forêts
Selmi Khemais	Chef de Service Inventaire Forestier et Pastoral à la DGF

ANNEX 4: DEFINITION OF TREES OUTSIDE FORESTS (TOF)

The term “trees outside forests” includes forest and non-forest trees and shrubs on land not defined as forest or other wooded land.

TOFs include among others:

- Trees on land that fulfils the requirements of forest and other wooded land, except that:
 - ? The area is less than 0,5 ha;
 - ? Trees are able to reach 5 m height at maturity *in situ*, but the crown cover remains below 5%;
 - ? Trees that do not reach 5 m in height at maturity *in situ*, where the stocking level is below 10%;
 - ? Trees in shelterbelts and river valleys of less than 20 m width and below 0,5 ha area.
- Scattered trees in permanent meadows and pastures;
- Permanent tree crops, orchards and “prés-vergers” such as industrial trees, coconut trees, palm trees;
- Trees of agroforestry systems such as coffee, cocoa, home gardens;
- Trees in urban settings (human settlements) and infrastructure environment such as parks and gardens, trees around buildings and in lines along streets, roads, railways, rivers, streams and canals.

The term tree refers to a woody perennial able to reach 5 m in height at maturity, with a single stem, or in the case of coppice, with several stems, having a more or less definite crown. This definition includes bamboos, palms and other woody plants meeting the above criterion. Shrubs and bushes are woody perennial plants, generally of more than 0,5 m and less than 5 m in height and without a definite crown.

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See also: FRA Working Paper No.18