ASIA-PACIFIC FORESTRY SECTOR OUTLOOK STUDY II

WORKING PAPER SERIES

Working Paper No. APFSOS II/WP/2009/03

MALDIVES FORESTRY OUTLOOK STUDY

by

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
REGIONAL OFFICE FOR ASIA AND THE PACIFIC

Bangkok, 2009

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INFORMATION NOTE ON THE ASIA-PACIFIC FORESTRY SECTOR OUTLOOK STUDY

The Asia-Pacific Forestry Sector Outlook Study (APFSOS) is a wide-ranging initiative to gather information on, and examine, the evolution of key forestry issues as well as to review important trends in forests and forestry. The main purpose of the study is to provide a better understanding of the changing relationships between society and forests and thus to facilitate timely policy reviews and reforms in national forest sectors. The specific objectives are to:

1. Identify emerging socio-economic changes impacting on forest and forestry
2. Analyze probable scenarios for forestry developments to 2020
3. Identify priorities and strategies to address emerging opportunities and challenges

The first APFSOS was completed in 1998, with an outlook horizon to 2010. During its twenty-first session, held in Dehradun, India, in April 2006, the Asia-Pacific Forestry Commission (APFC) resolved to update the outlook extending the horizon to 2020. The study commenced in October 2006 and is expected to be completed by September 2009.

The study has been coordinated by the Food and Agriculture Organization of the United Nations (FAO), through its regional office in Bangkok and its headquarters in Rome, and implemented in close partnership with APFC member countries with support from a number of international and regional agencies. The Asian Development Bank (ADB), the International Tropical Timber Organization (ITTO), and the United Kingdom's Department for International Development (DFID) provided substantial financial support to implement the study. Partnerships with the Asia-Pacific Association of Forest Research Institutes (APAFRI) and the Secretariat of the Pacific Community (SPC) supported the organizing and implementing of national focal points' workshops and other activities, which have been crucial to the success of this initiative. The contributions of many other individuals and institutions are gratefully acknowledged in the main APFSOS report.

Working papers have been contributed or commissioned on a wide range of topics. These fall under the following categories: country profiles, sub-regional studies and thematic studies. Working papers have been prepared by individual authors or groups of authors and represent their personal views and perspectives; therefore, opinions expressed do not necessarily reflect the views of their employers, the governments of the APFC member countries or of FAO. Material from these working papers has been extracted and combined with information from a wide range of additional sources to produce the main regional outlook report.

Working papers are moderately edited for style and clarity and are formatted to provide a measure of uniformity, but otherwise remain the work of the authors. Copies of these working papers, as well as more information on the Asia-Pacific Forestry Sector Study, can be obtained from:

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EXECUTIVE SUMMARY

The key factors impacting forests and forestry in the Maldives are increasing demand on land area with or without forest. The land in demand is mainly for agricultural expansion, industrial growth and for housing. The increasing rate of population growth is creating a demand on the available land area. The expanding tourism sector, resulting in economic growth, increases demand for space on uninhabited islands. However this can be turned into a positive dimension by allotting one uninhabited island to each resort island for maintenance of forest biodiversity under eco tourism.

In the past the timber requirement was relatively low given the low population and less demand on the material needs of the community. This was complemented by the planting and cultivation of more trees. Modernization and high demand on material needs have created a greater demand for timber. The tourism sector requires large quantities of timber to construct the resorts using traditional methods.

Forest resources are likely to be affected given the industrial and other infrastructure growth plans envisaged by the Government of Maldives. Legalization of forest policy with sound implementation guidelines will be a key factor in the positive growth of forest resources.

Timber demand needs to be met by imports as there is no domestic means to meet it. Forest biomass is used as fire wood by collecting coconut refuse and cutting the trees in the nearby forests. There is an institutional arrangement through which women are permitted by the authorities to cut and store large quantities of fire wood on a stipulated day.

The December 2004 tsunami acted as an eye opener for protecting coastal vegetation. Even in the past there was a local practice of growing trees along the beaches for protection. Fruit trees and some medicinal herbs are used in the traditional medicine of the Maldives. Carving wooden toys and souvenirs is a small cottage industry.

Given the climate change threat that the Maldives faces, the safe islands' policy and fortifying the islands with coastal vegetation to protect the islands from salt spray and monsoon winds need to be strengthened.

Eco-tourism is an opportunity for linking forestry with tourism as the Maldives is a venue for international tourism.

Another threat is posed by the traditional use of locally available material being rapidly replaced by non-biodegradable material that affects coastal zones. Awareness on the role and value of forests needs to be created and enhanced by involving national and international NGOs in the protection of the islands from waste disposal that affects not only the coasts and coastal vegetation but also the coral reefs that the Maldives depends on heavily for tourism and economic growth.

1. INTRODUCTION

Background

Countries in Asia and the Pacific are undergoing rapid social and economic transformation. This has important implications on forests and consequently on societal welfare. What happens to forests and biodiversity will be largely determined by what happens outside the forests - within the country, the region and at the global level. The demand for forest products is increasing rapidly, and notwithstanding ongoing efforts to manage forests sustainably, deforestation and degradation persist in most countries. Changes in demography and economic performance including structural changes and environmental changes within countries and outside will have a collective impact on forests and forestry. Understanding what may happen under different scenarios is critical to design appropriate interventions to improve the situation and to address the emerging opportunities and challenges.

In this context the Asia Pacific Forestry Commission (APFC) of the Food and Agriculture Organization (FAO), in partnership with member countries and several institutions, has initiated the Asia-Pacific Forestry Sector Outlook Study (APFSOS II), updating the previous study (completed in 1998) to assess probable scenarios for forests and forestry to the year 2020.

This document outlines the status and the emerging scenarios of forests and forestry in the Maldives and how they affect forestry as well as recommended possible interventions.

The 21st session of the APFC, held in April 2006, agreed that the Asia-Pacific Forestry Sector Outlook Study (APFPOS) study should be undertaken with emphasis on the full involvement of countries in the region and with the participation of all key stakeholders. The study plans to build its analysis on the basis of comprehensive country reports and in-depth thematic studies, as well as making use of the wealth of existing information.

This will help in making a thorough assessment of the future outlook for forests and forestry in Asia-Pacific countries taking into account the impact of the various driving forces and the overall changes in societal and natural resources interaction. Detailed scenario analysis is necessary to assess the probable paths of development, taking into account the emerging changes at regional and global levels. This assists in identifying alternative scenarios and priorities and strategies to help improve the situation, especially to conserve forests and biodiversity. This document has been prepared to:

- Analyze the main trends as regards forests in the Maldives in the context of changing societal-nature relationships;
- Assess critical driving forces and identify probable development scenarios indicating the situation that may emerge by 2020;
- Identify options at national and regional levels to improve the situation including the priorities and strategies appropriate to the different scenarios that may develop in the region; and
- Strengthen country capacities in undertaking long-term outlook studies and strategic planning.

Scope and coverage

This study addresses the forestry sector and the situation up to 2020 given changing trends and their impact on the forest resources of the Maldives. Changing scenarios and cross-sectoral implications on forestry, policy implications as well as conclusions and recommendations are documented.

The process

Available information on forests and forestry development and management was reviewed, including reports developed during the FAO-implemented forestry project in the Maldives – OSRO/GLO/502/FIN: in particular, (1) forestry damage assessment and programme planning; (2) the forestry sector review; and (3) the forest policy document. In addition the 7th National Development Plan and the Agricultural Master Plan were analyzed. This input was complemented by the experience of the CTA of the Maldives component of the aforesaid FAO forestry project, observations made and interviews held during the forestry damage assessment consultancy, as well as the deliberations of project steering committee meetings.

2. WHERE ARE WE NOW? CURRENT STATE OF FORESTS AND FORESTRY IN THE COUNTRY

Trends in forest resources

General introduction to the islands

The Maldives are a chain of islands in the Indian Ocean; spread over a distance of 868 km in a north-south direction covering an area of 90,000 sq. km. Estimates regarding the number of islands differ, depending on the definition of an island. Officially there are 1190 islands having some form of vegetation on them whether grass or bushes or trees. Of this, 199 are inhabited with a total population of 327,135 and the rest are uninhabited. There are currently 88 resorts with another 11 to be built. The islands and reefs are divided into 26 geographic atolls but for convenience, these atolls are broken into 20 administrative groups (Atlas of the Maldives, 2004) (Figure 2).

Administratively, the nation is divided into different Atolls, the names starting with the Dhivehi alphabet in the north and continuing to the south. Each Atoll has an Atoll chief, under whom come all the islands in that Atoll. Each island has an island chief. Fishing is the main activity in nearly 95 percent of the islands. Agriculture is practiced in the other islands and at times both fishing and agriculture are practiced, if there is space for cultivation. Island resorts are the main source of tourist revenue. The December 2004 tsunami proved the extreme vulnerability of the islands, 35 percent of the inhabited islands being subject to high or very high impact with damage to buildings, infrastructure, crops and natural vegetation; it emphasized the need for coastal littoral forest development, protection and sustainable management.

Forest status and dependence of people

The forest area of the Maldives is not known. The Global Forest Resources Assessment of 2005[1] estimated the forest area at 1000 ha, and the Agricultural Development Master Plan (2006-2020)[2] of the Maldives estimates 3716 ha of forests. These estimates do not apparently include coconut groves that are by far the most common formations of woody vegetation. Coconut groves in the Maldives are typically mixed formations of various trees and bushes dominated by coconut palms.

Maldives forests, although not distributed extensively given the limited land area, comprise littoral forests along with mangroves, coconut groves, ponds and lagoons. The littoral and mangrove forests perform multiple functions by acting as shelterbelts and windbreaks, preventing soil and beach erosion and lessening the effect of flooding during tsunamis and storm surges. Extensive coconut groves provide livelihood security for islanders. All the islands have a tapering beach on one flank and an abrupt coral beach on the other. The vegetation pattern is described in Figure 1. Mangroves are not found on all the islands.

[1] FAO 2005. Global Forest Resources Assessment 2005: progress towards sustainable forest management. Rome, FAO.

[2] Ministry of Fisheries, Agriculture and Marine Resources. 2006. Agricultural Development Master Plan (2006-2020). Volume I: main document. Prepared with assistance of FAO, Malé, December 2006.

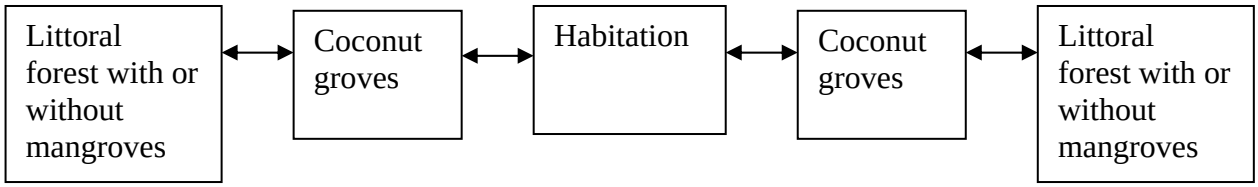

Figure 1. Pattern of forest distribution in the islands

Approximately 3% of the land area is covered with forests. However, qualitatively the area of forest appears to be more than the stated figures. Though the extent of forest may appear relatively low, the coastal forests in the Maldives play a significant role in mitigating the effects of salt spray and monsoon winds in addition to tsunami damage; they represent ecological rather than economic capital.

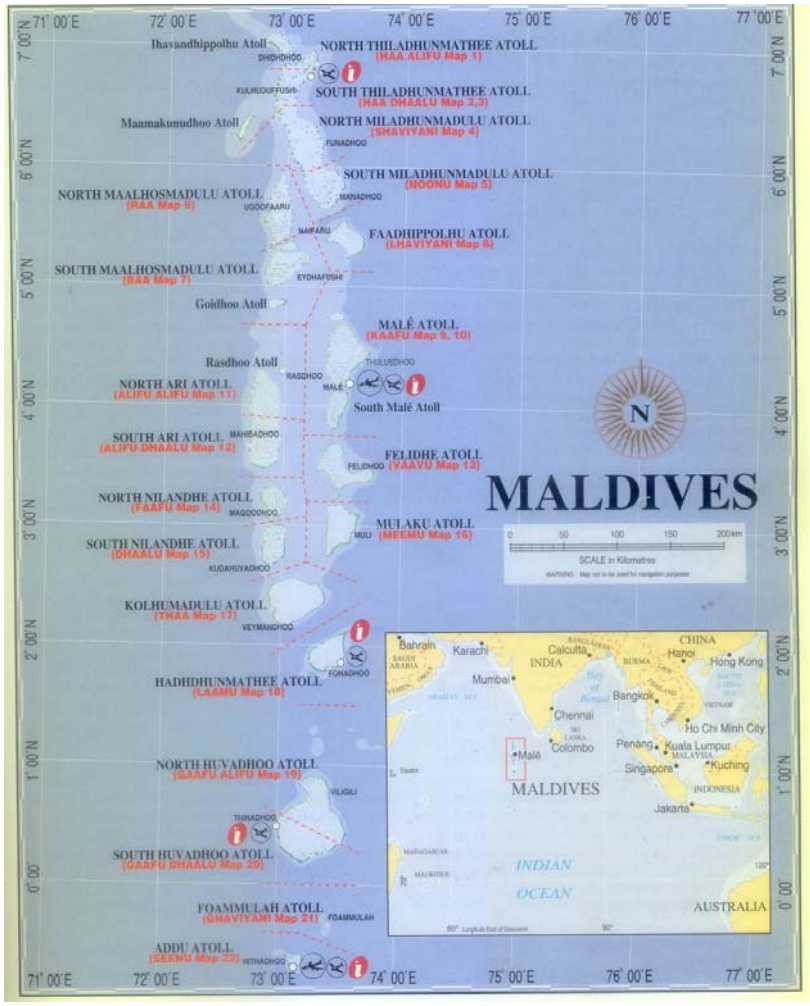

Figure 2. Map of the Maldives with different atolls

There is a clear-cut zonation of species from pioneers that colonize littoral forests to much denser vegetation with large trees occurring towards the landward side. In the case of islands with larger land area, there is a thick and dense growth of forests with a succession of shrub vegetation starting on the coast to tall trees towards the inland, forming good humus. The littoral forests consists of *Scaevola taccada* (Magoo), *Pandanus tectorus* (Boa Kashikeyo), *Thespesia populnaea* (Hirundhu), *Hibiscus tiliaceus* (Dhigga), *Suriana maritima* (Halaveli), *Guettarda speciosa* (Uni) etc. Pandanus has dense growth in some islands from the seaward side to landward. The mangrove forests consist of *Lumnitzera racemosa* (Burevi), *Bruguiera*

gymnorhiza (Bodavaki), *Bruguiera cylindrica* (Kandoo), *Rhizophora apiculata* (Randoo), *Rhizophora mucronata* (Thakaphati), *Ceriops tagal* (Karamana), *Sonneratia caseolaris* (Kulhlhavah) and *Excoecaria agallocha* (Thela). Mangroves provide a buffer by playing the second line of defence. Patches of the tree species *Barringtonia asiatica* (Kinbi) of 8 m girth at breast height (GBH) have been observed in Hithadhoo Island in Seenu Atoll and Gan in Laamu Atoll.

The Maldives has a geographical area of 30 000 ha, of which forests cover an area of 1 000 ha. As there is no inventory data available with regard to the extent and location of forests, the number of species available, and the status of rare, endangered or endemic *taxa*, there is a need for a thorough inventory of the forest and wooded vegetation of the Maldives.

Forest areas, including mangroves and pond areas, are encroached for housing, infrastructure development and agriculture. Land reclamation is affecting the natural forests on the inhabited islands. The uninhabited islands that have not been disturbed have patches of pristine forests. The genetic pool particularly the coconuts available in the Maldives, which is yet to be assessed, may contribute to human well-being in future. In this connection, there is a need for capacity enhancement by training personnel in the respective Ministry to document the data on distribution of forests and their sustainable management. Also, the role of coastal forests as shelterbelts is becoming much more important as the Government of Maldives is planning to expand agricultural interventions which may lead to a demand on the standing forest.

Coastal forests

The island vegetation is characterized by the presence of littoral forest for a width of 15 to 20 meters followed by small-scale mangroves on a few islands and coconut forests and home gardens. However, depending on the width of the island, these profiles differ. If the island is wider, the protection by forests is also relatively greater.

The coastal forests are more or less uniform in their composition and structure throughout the Maldives. There is a dense growth of forest vegetation along the coasts with clear zonation in the distribution of different species. *Scaevola taccada* (Magoo) is a common and dense thicket-forming plant species, which is widely distributed. *Pemphis acidula* (Kuredhi), *Thespesia populnaea* (Hirundhu), *Pandanus tectorus*, *Guettarda speciosa* (Uni), *Calophyllum inophyllum* (Funa), and *Suriana maritima* (Halaveli) together form a dense shield protecting the islands from salt spray, storms, monsoon winds and beach erosion and played a critical role in mitigating the 2004 tsunami's damage. In some areas, pandanus forms a thick network with *Guettarda speciosa* and *Calophyllum inophyllum* to the landward side. Coconut groves are distributed like forest with dense growth across the islands. Mangroves are confined to a second line in the coast and are distributed in small swampy areas.

Distribution pattern of forest and tree species in representative islands

In Kaashidhoo Island of Kaafu – Maale Atoll, the littoral vegetation is represented by pandanus, *Ficus benghlensis* (Nika) and *Adenanthera pavoniana* (Madhoshi). The littoral vegetation in Maradhoo consists chiefly of *Suriana maritima* and *Scaevola taccada*. Other species observed in this long island are *Calophyllum inophyllum* along with *Guettarda speciosa*, pandanus, *Hibiscus tiliaceus* and coconut. In Gan Island, near Kashiganandu-vau, plant species like *Syzygium cumuni* (Dhanbu) form thick vegetation between the airport and the beach on the eastern side of the atoll. In Fomullah Atoll, *Scaevola taccada*, pandanus and coconut are commonly distributed. *Calophyllum inophyllum* forms dense vegetation and grows to a height of 20 to 30 m.

In Madaveli Island of Gaadu Dhaalu – South Huvadhoo Atoll, the coastal area is distributed with pandanus in the front line, followed by *Scaevola taccada*, *Suriana maritima* and *Thespesia populnaea* (Hirundhi) towards the landward side and thereafter coconut. In Hoededhoo, the plant species *Muntingia calabura* (Jeymu), *Thespesia populnaea*, *Scaevola taccada*, coconut, pandanus, *Terminalia catappa* (Midhili), *Hibiscus tiliaceus* and banyan are distributed across the island. Kaadedhoo is an uninhabited island for airport use. This island has thick vegetative cover of *Guettarda speciosa*, *Thespesia populnaea*, *Scaevola taccada*, pandanus, *Terminalia catappa*, and coconut distributed in the forested area.

Baarah of Haa Alifu – North Thiladunmathee Atoll has a large area under forest cover with littoral forests distributed all along the island. The coconut trees occur like forest, as the locals do not practice cultivation of coconuts as is the case in all other islands. There are two varieties of pandanus. The large one is edible and the small one is used as firewood/charcoal particularly by the blacksmiths as the fruits keep burning for a long time. In Filladhoo Island of the same atoll, which has a large area under forest cover and a long coastline, the littoral forest comprises pandanus, *Calophyllum inophyllum*, *Scaevola taccada*, *Thespesia populnaea*, *Hibiscus tiliaceus*, *Cordia subcordata*, *Suriana maritima*, country almond and coconut.

Invasive species and pest problem: Obnoxious weed species of *Cuscuta* and *Ageratum* are invading the island, which poses a concern for the standing forest vegetation. Pest attack on timber species affects the regeneration of certain species which warrants proper pest management.

Causes and issues for littoral forest erosion

Coral and sand mining for urbanization and house construction are the main causes of coastal area/beach erosion. This is disturbing littoral vegetation. Local people are aware of the consequences but the economic situation and the high cost of importing sand and lack of suitable low cost material forces them to practice sand mining.

Availability and supply of wood for boat building

There is high demand for boat building wood, particularly in the northern islands. *Hibiscus tiliaceous*, *Ochrasia barbonica*, (Dhunburi) *Calophyllum inophyllum* (Funa), *Diospyros ebenum* (Kalhuvakaru) and *Tectona grandis* (Haivakaru) are used. In addition to harvesting wood from locally available trees, wood demand, particularly for ebony and teak, is met from imported wood. There is less demand for boat building wood in the southern islands, as the islanders prefer Fibre Reinforced Plastic (FRP) boats. However, even for building FRP boats, wood from the forests is used. In Foamullah, trees are felled for boat building purposes.

Mangrove forests

Mangroves are distributed in Gaafu Hithadhoo of Addu Atoll in Eedhigali Kulhi, Hoededhoo in Gaafu Dhaalu – South Huvadhoo Atoll, Baarah, Filladhoo, Nohlivaranfaru of Haa Alifu Atoll, Kulhudhiffushi of Haa Dhaalu – South Thiladhunmathee Atoll and Isdhoo, Dabedhoo and L. Hithadhoo in Laamu Atoll and Huraah in Maale Atoll.

In Hoededhoo, the mangrove species *Bruguiera gymnorhiza* (Bodovaki), *Bruguiera cylindrica* (Kandoo) and *Lumnitzera racemosa* (Burevi) are distributed in an area of approximately 100 meters by 50 meters.

In Hithadhoo at Seenu Atoll, the mangrove species *Lumnitzera racemosa* and *Barringtonia asiatica* occur in a dense patch along with good growth of new individuals. These saplings should be used as planting material for green shields along the beaches in combination with tassel wood, pandanus and magoo.

Excoecaria agallocha, Bruguiera cylindrica and *Ceriops tagal* are the mangrove species occurring in Baarah. In Filladhoo, *Bruguiera gymnorrhiza* and *Bruguiera cylindrica* are found. According to local knowledge mangroves were distributed in large areas in the past. Fruits of *B. cylindrica* are edible and the wood is used for house construction and boat building.

Fruit trees in home gardens

In home garderns, fruit trees namely *Artocarpus altilis* (Bread fruit), *Phyllanthus distichus* (Star goose berry), *Cordia dichotoma* (Cordia plum), *Punica granatum* (Pomegranate), *Syzygium cumuni* (Jambolan), *Annona reticulata* (Bullock's heart), *Annona squamosa* (Custard apple), *Mimusops elengi* (Tangjong tree), *Zizyphus mauritiana* (Indian jujube), *Mangifera indica* (Mango), *Psidium guajava* (Guava), *Achras sapota* (Sapodilla plum), *Eugenia javanica* (Wax apple), *Muntingia calabura* (Japanese cherry), bananas, papaya, bamboo, coconut, citrus, moringa, pandanus, passiflora, tamarind, arecanut, taros, hibiscus , thespesia, and *Mentha spicata* (mint) are cultivated. Fruit gardens are extensively cultivated in Addu atoll.

In Baarah, the islanders raise vegetables and fruit crops such as breadfruit, coconut, moringa, banana, sapodilla and citrus. Another species of importance is kekura, a ground creeper that looks like a tiny watermelon, which is edible.

In the islands of Laamu Atoll, fruit trees namely Ziziphus, Mango and. *Mimusops elengi*, Tamarind, *Annona glabra* (Pond apple) and *Eugenia javanica* (Wax apple) are cultivated. The main plantation crops are coconut and banana. Coconut is distributed wild as it is not a plantation crop. In some islands breadfruit and coconut are cultivated in zones.

Wood and wood products

Wood production occurs in both inhabited and uninhabited islands. It is harvested according to the regulation that for every tree cut two new seedlings should be planted. Most of the non-timber products are supposedly domestic but there is no statistical evidence to this effect. A large proportion of timber used in the country is imported, primarily from Indonesia and Malaysia.

Sawnwood import statistics for 2000-2005 express annual import quantities in terms of metric tonnes. The 2005 imports amounted to 38 170 MT. Using an average density of 670 kg/m^3 for Meranti the estimated volume is ca. 57 000 m^3. Annual imports vary considerably, but an upward trend can be observed in Figure 3.

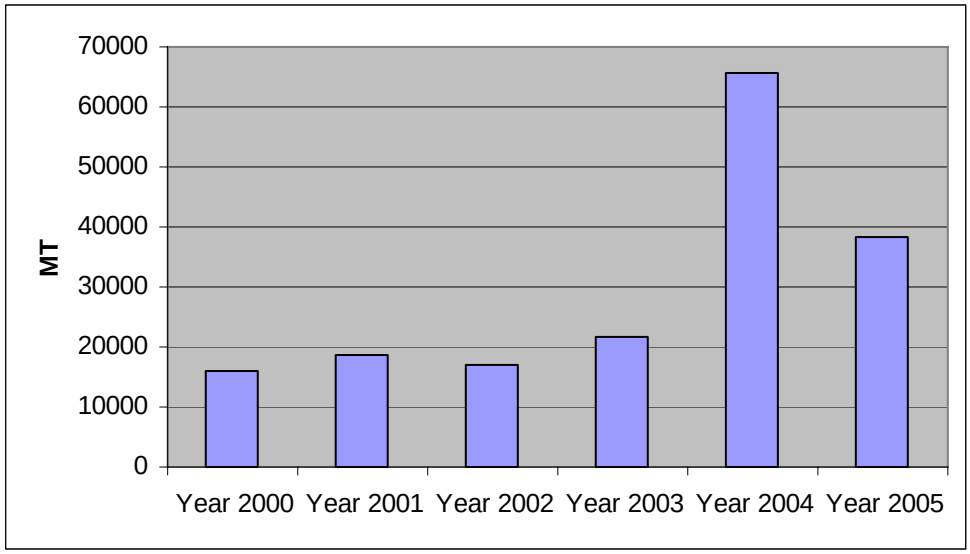

Figure 3. Sawnwood imports to Maldives during 2000-2005

Imported wood is increasingly being used for boat building, housing and construction purposes. Tourist resorts import most of their timber-based material. In view of the current level of sawn wood imports it can be concluded that there is no realistic prospect for the the Maldives to become self-sufficient in timber products. Wood-based panels and paper products are supplied entirely through imports.

In the absence of better yield data a rule-of-thumb could be applied: 1 cubic metre per hectare per annum could represent a conservative annual allowable cut from forest land. This would mean that 2800-3700 m^3 could be sustainably harvested from the existing forest land on uninhabited islands, provided that forest management is conducted sustainably.

Wood as a source of energy and issues in availability of wood fuel

Considerable amounts of wood and non-wood materials are being harvested on the inhabited islands. Harvested volumes and the sustainability of harvesting regimes are not known. The cumulative effects of this exploitation combined with the amount of wooded areas cleared for house construction and agriculture will be a problem in future.

Brush wood is used for cooking; it is collected by the islanders with the permission of the island chief. The island authorities permit the locals to collect fire wood on a stipulated day. Although firewood consumption is declining, wood can be seen piled up in houses for domestic use. Wood consumption seems to be higher during the *Ramazan.*

Firewood is slowly being replaced by kerosene and gas in domestic cooking. However, in rural areas a considerable percentage of households still cook their food with firewood. Another important use of firewood is in fish smoking. Traditionally smoking of fish was the main way to preserve perishable products for distant markets. However fishermen now sell their catches directly to the ships provided by industrial processing companies. Accordingly, the need for firewood for fish smoking is also declining.

LPG is also being used by households for cooking but has to be transported from Male'. There is a likelihood of delay in transportation of refills given slow and expensive sea transport in the country. It has been reported that women use LPG for brief cooking events and prefer firewood for longer cooking periods.

Other forest products

Other forest products are mainly firewood, coconuts, country almond, bread fruit, mango and other fruit species. These are mostly used for domestic consumption. Gum extracted from breadfruit and mangroves is used for caulking boats. Oil is extracted from coconuts and the palm leaves are used in roofing of tourist resort buildings. Coconut, banana and mango are used in dying clothes and mats. Coconut and breadfruit fibre is used in the rope industry. Coconuts are an important element in the daily diet of the rural population and a considerable source of income. The same applies to breadfruit and country almond. No quantitative information of the use of these forest products is available.

The service functions of forests

Forest vegetation is vital for the Maldives as tourism contributes greatly to the GDP. Wooded vegetation provides much needed recreation to the islanders particularly to children given the isolated and tiny nature of the islands. The Land Use Planning Department allocates land for developing parks with vegetation for recreation purposes. Mangroves provide a tourist attraction.

Mitigating role of forests: Intact littoral forests provide the best protection from salt spray, monsoon winds, tidal waves and storm surges. Areas that were either disturbed or altered bore the brunt of the 2004 tsunami, for example Gan, Foamullah, Baarah and L. Gan and other islands of Laamu Atoll.

According to local people, for a long time coastal forests known as *Heylhi* in the *Dhivehi* language protected the islands from erosion and monsoon wind and also during the recent tsunami. Senior citizens felt that littoral forests are degrading and said that they are important as a protective shield for the coast.

Urban forestry: Trees are being planted in urban areas (e.g. Male, Villingili and Hulhumale which are urbanized islands) and in residential areas on other islands for shade and amenities. In the tourist resorts the trees are maintained for aesthetic and tourism value. Beautiful urban landscapes are also attractive to tourists. In the inhabited islands shade trees are highly valued by pedestrians. Keeping in mind the importance of the tourism industry for the country, investment in decorative urban plants is profitable.

In principle trees should be a part of every residential environment. The principle of urban forestry is stipulated in the guidelines of the Ministry of Housing and Urban Development (MoHUD).

Conservation of biodiversity

Contribution of forests to biodiversity: The First National Report to the Conference of the Convention on Biological Diversity gives an account of the Maldives biodiversity situation. The southern islands, particularly Fuvahmulah (Gnaviyani Atoll) and Hithadhoo (Seenu atoll) demonstrate a richer diversity of plants than the northern islands. The mangrove distribution is greater in northern atolls than in southern atolls. There are 13 mangrove species in the islands. The report reveals that there are 100 indigenous terrestrial plant species and two endemic subspecies of fruit bats. A 1991 study indicated that six species of other plants and 37 species of fungi are associated with mangrove habitats. There are linkages between maritime and terrestrial ecosystems. For example breeding grounds of sea turtles may suffer from disturbance of littoral vegetation cover.

National biodiversity strategy and action plan of the Maldives

Environmental policy: Section 3.8 of the National Biodiversity Strategy and Action Plan defines the vision and guiding principles for the environment sector, whose elements can be interpreted as an expression of forestry sector policy. The vision states that the Maldives is a nation which appreciates the true value of the natural environment, utilizing its natural resources in a sustainable manner for national development. Conservation of biodiversity, equitable sharing of the benefits, and building capacity for learning from the environment are also aspects of the vision. The guiding principles realize the dependence of the people on the nation's biological resources and the need to conserve them; the necessity to share the benefits equitably; economic cost-benefit assessment; the need to integrate environmental considerations as cross-cutting issues in the economic development policies and plans; and appreciation of community participation, accountability and transparency in plan implementation. Further, the principles state that ecological sustainability should be a major goal in national development; efficient and prudent management of natural resources is fundamental; an integrated ecological approach is needed; and finally, the action plan will be a part of an interactive process to be monitored and reviewed regularly. All the above principles appear to be conducive for sustaining forest cover.

Forests and climate change

The 7th National Development Plan has addressed the issue of climate change and the predicted sea level rise which is of grave importance to the Maldives. The estimated predicted sea level rise of 0.09 m to 0.88 m in the period between 1990 and 2100, combined with increased extreme weather events, including the recent tidal wave and storm surges that affected large numbers of islands, makes the Maldives one of the most vulnerable countries to climate change and sea level rise. The small size of the islands forces human settlements and vital infrastructure to be located near the coast and thus existing at high risk. There is a need to include climate change prediction in future land use planning and community development plans.

Also, their small size and low lying nature make the Maldives islands very vulnerable to environmental threats. At the same time the coastal environment is very sensitive to changes in the coastal area from any development activity.

The Maldives is a party to the United Nations Framework Convention on Climate Change (UNFCCC) and is the first country to sign the Kyoto Protocol. The Maldives submitted the First National Communication to the UNFCCC in 2001. However as a non-Annex 1 party to the UNFCCCC the Maldives is not obliged to implement mitigation measures. But there is a need for the Maldives to be exemplary in implementing mitigation measures.

The Government of Maldives has taken steps by introducing the Safe Island concept for islands vulnerable to calamities like storm surges and monsoon winds and rare events like tsunamis.

Policy and institutional framework

The Ministry of Fisheries Agriculture and Marine Resources (MoFAMR) is the national custodian of forests and the coconut trees on the inhabited and uninhabited islands in the Maldives including their management. However the protection and management of mangroves and marine parks is under the mandate of the Ministry of Environment, Energy and Water (MoEEW).

The MoFAMR is responsible for technical matters and advice regarding forests and trees. Presently, the MoFAMR does not have a forestry unit. The ministry has only one person with

a diploma in forestry, and another person presently under similar training. The agricultural extension section has two Agriculture Research Centres located in Mendhoo in the north and another in Hanimaadhoo in the south, the former was seriously damaged by the 2004 tsunami and is being rehabilitated with the support of the Asian Development Bank (ADB) and 12 staff members. These centers and the extension staff are also providing extension services on fruit trees.

The forest policy has been developed recently by the FAO forestry project implemented with the support of the Government of Finland. The policy is under the process of consultation with all stakeholders. FAO's support in legalizing the policy with a TCP facility should be considered for linking forest management in the Maldives under the NFP.

Timber use and harvesting mechanism

Timber exploitation is not conducted sustainably. There is a common perception that domestic timber is becoming increasingly scarce. Timber cutting licences are supposed to work as a tool for regulating commercial timber cutting. By law the MoFAMR is authorized to issue permits for cutting trees on uninhabited islands and the Island Office should have the authority to issue permits for minor timber cutting on inhabited islands. According to the existing mechanism, the Island Office forwards the cutting proposals to the MoFAMR, which grants the cutting permit. Permits are issued for construction and repair of boats, for production of lime and for house building. The person using the timber cutting permit is obliged to plant 2 trees for every felled tree. This rule is written in the Regulations of the MoFAMR governing uninhabited islands made under Law No. 20/98 (9), but it applies to the inhabited islands as well.

Timber cutting is driven by market demand. Applicants for the timber cutting licences have a need for certain species, and MoFAMR is issuing permits accordingly. The recently concluded forestry project OSRO/GLO/502/FIN supported the government with developing Island Forest Management Plans for Fuvammulah and H.A. Kela. The government is planning to undertake similar plans for potential islands in the future.

One constraint for intensification of tree planting is limited nursery capacity. In the absence of sufficient domestic seedling production capacity, the individuals and institutions concerned with tree planting have few options: to establish their own nurseries, to search for transplantable seedlings on the islands or to import seedlings. Nursery establishment requires a suitable site, capital, time and skills. For ensuring high survival of seedlings decentralised nurseries would be preferred. Importation of seedlings contains the risk of importing pests and diseases. The foreign seedling supplier may provide a certificate of good health for products, but the MoFAMR does not have the capacity to verify the quality of the certificate. The nursery established at H.A. Utheem with the support of the forestry project caters to the needs of tree planting in the project islands as well as in the nearby islands of Utheem.

Forest protection

The MoEEW has the mandate to define and manage the protected areas in the Maldives. Most of the existing protected areas were established for protecting maritime ecosystems. There are two terrestrial sites designated as protected areas. The MoEEW intends to manage mangrove sites as protection areas.

Key issues and an overview of the overall state of forests and forestry

Land use management in the islands covered with vegetation is a key issue given the expansion of agriculture and urbanization. The forests distributed in the inhabited and uninhabited islands should be brought under conservation and sustainable use regimes with a policy framework in place.

3. WHAT WILL INFLUENCE THE FUTURE STATE OF FORESTS AND FORESTRY?

Demographic changes

Population growth and an improving standard of living have resulted in increasing demand for wood-based products. The population of the Maldives in 2003 was estimated by the United Nations at 318,000. In that year approximately 4% of the population was over 65 years of age, with another 41% of the population under 15 years of age. There were 105 males for every 100 females in the country in 2003. According to the UN, the annual population growth rate for 2000–2005 was 2.98%, with a projected population for 2015 at 447,000. The population density in 2002 was 937 per square kilometre.

Urban development and expansion of agriculture require clearing of forest land. Sand and coral mining and subsequent coastal erosion are a threat to littoral forests. These activities combined with no professional forest management contribute to forest degradation. Given the increasing population scenario there is a need for construction of houses. Land with standing trees is being cleared for house construction. Male' municipality, which includes Hulumale and Villingili islands, has undertaken tree planting and the Atoll's administration is likewise involved in islands where seedlings are being imported. Seedlings are cultivated to a limited extent in the Male' nursery including nurseries in the two agricultural research centres.

Population migration from islands to Male' is high, however this has no impact on forest cover as Male' has minimal tree cover. Although in general Maldivian youth, particularly males, are not very interested in forestry activities, members of the Women Development Committee (WDC) and interested male youths could be involved in forestry development activities.

The political and institutional environment

In the mandate of the MoFAMR the following points are relevant for rural land-use development:

- To protect and conserve the marine and terrestrial biodiversity of the nation
- To collect, catalogue and maintain samples of the marine and terrestrial biodiversity of the nation
- To undertake timber rehabilitation, management and development
- To control the import of exotic trees and the export of indigenous tree species
- To manage and oversee the lease and sustainable use of uninhabited islands

All the essential functions for sustainable management of forests resources are vested with the MoFAMR. In forestry terms there is a need for extension, organisation and further research work. The only timber rehabilitation effort contained in the rule is if you cut a tree you have to plant two seedlings. The capacity of the ministry should be increased to verify the origin of imported exotic trees.

The Agricultural Development Master Plan (2006-2020)[3] promotes agricultural expansion, which is likely to occur in many places at the expense of forests. The Agricultural Master Plan includes one priority programme that addresses forest issues: "Judicious Harnessing and Stewardship of Natural Resources", with the following strategies and activities:

[3] Ministry of Fisheries, Agriculture and Marine Resources. 2006. Agricultural Development Master Plan (2006-2020). Volume I: main document. Prepared with assistance of FAO, Malé, December 2006.

- Periodic assessment of the status of natural resources on a regular basis (preferably every five years) by geographical area
- Internalisation of the ten-point action plan for the agriculture sector mentioned in the NBSAP
- Synergy with the National Forestry Policy and Fisheries
- Inter-agency coordination, by establishing and promoting functional mechanisms and coordination at both policy and implementation levels amongst the key government agencies, local administrations, the private sector and civil society
-

Urbanisation and the development of the tourism industry also result in clearing of forests. The 'One Million Trees' campaign, Fruit Tree Programme and the FAO-supported Forestry Programme have contributed positively to tree planting and awareness creation.

The 7th National Development Plan (2006-2010),[4] with regard to the agriculture sector, identifies six policies, the first of which is "To implement a forestry and natural resource management framework to promote sustainable agriculture development". The respective strategies are:

- Assess land, water and forestry assets and resources and develop mechanisms for regularly monitoring the condition and consumption of natural resources
- Develop a legal framework to regulate the use of natural resources
- Optimize the use of land and water resources

These strategies address the present lack of (i) resource data (e.g. a forest resource inventory), (ii) a coherent legal framework that would support sustainable resource management, and (iii) an overall macro-level land-use plan providing security e.g. for longer term investments[5] in sustainable and more productive agricultural and forestry production particularly in some of the uninhabited islands.

The National Biodiversity Strategy and Action Plan of the Maldives presents the objectives and broadly defined actions for the conservation, sustainable use and the equitable sharing of the benefits of biodiversity. The Regional Development Plan in its current first phase will emphasise economic development in the northern and southern regions.

Land tenancy in the Maldives can be separated into three categories:[6] (i) land held under *waqf* (trust principles under *Shari'ah* [Islamic law]); (ii) land owned by private individuals; and (iii) land owned by the state that is granted to individuals for residential, commercial or other purposes. By far the vast majority of the land is held under the last category, while land under the second category, though very limited in extent, has been increasing, particularly in Male' and the other urban areas. New tenancies under the first category have all but stopped. The state-owned land is leased and sub-leased to local communities and people through various arrangements: the *goi*[7] lands are managed and leased to residents by the Ministry of Atolls Development and *varuvaa*[8] lease is used to allow communities or individuals to "take care" of uninhabited islands. In principle both men and women have equal rights to land. It is important to note that there are also privately owned trees on public lands.

[4] Republic of Maldives. 2006. Seventh National Development Plan (2006-2010). Volume I, Policies and Strategies. First working draft. 5 January 2006.
[5] Presently the widely used *Varuvaa* lease system does not encourage investments nor does it provide any security for investments in increasing land-use productivity.
[6] According to Republic of Maldives 2006.
[7] Areas where there are many coconut palms are known as *goi.*
[8] *Varuvaa* is traditional form of lease, the amount of which is based on the number of coconut palms in the area.

The responsibility for the management of land has recently been transferred to the MoHUD. The responsibility for the micro planning and management of land depends on its primary-use designation, usually at the island level and is managed accordingly by one of the five ministries: (i) the MoHUD (urban areas); (ii) the Ministry of Atolls Development; (other inhabited islands) (iii) the Ministry of Home Affairs; (iv) the Ministry of Tourism and Civil Aviation (islands leased for resort development); and (v) the MoFAMR (uninhabited islands). These five ministries often apply different and uncoordinated policies, directives and guidelines when allocating land for various purposes. This has led to a lack in consistency and some confusion regarding what is government-sanctioned and acceptable land allocation and tenurial policies and arrangements.

Economic changes

There is an increase in the growth rates in income however it is concentrated in the capital city:

- GDP (2006 est): US$907 million.
- GDP growth rate (2006 est.): 18.5%.
- Per capita GDP (2006 est): US$3,000.
- Inflation (2006): 2.8%.
- Percentages of GDP (2006 est): *Tourism*-28%; *transport and communications*-17%; *government*-15%; *manufacturing*-7%; *real estate*-6%; *fishing*-7%; *construction*-6%; *agriculture*-2%; *other*-12%.
- Trade (2006 est): *Exports*-US$147 million-fish products. *Major markets*-USA, Thailand, EU, Sri Lanka, Japan (source: Maldives Customs Service). *Imports*-US$832 million: oil, construction material, prepared foodstuffs, vegetables, animal products, electrical appliances, wood products, computers, transport equipment. *Major suppliers*-Singapore, Sri Lanka, EU, India, Malaysia, United Arab Emirates.

The ongoing trend to lease out islands for commercial agriculture and tourism is likely to increase the GDP. However these developments are likely to have implications on the forestry sector as land allotted for other interventions will have an impact on the forestry sector.

Home gardens play an important role in the traditional lifestyle of the Maldivians. Breadfruit and other fruit trees are grown in home gardens. The envisaged agricultural expansion should design agroforestry models given the rainfall pattern in the Maldives. Moreover soil-enriching nitrogen-fixing tree species will curtail expenses for fertilizers. The ADB-initiated tsunami project is developing agroforestry models in selected islands on a pilot scale that can be practiced under the proposed agricultural extension plan.

The government is planning to increase the number of commercial islands and tourist resorts. This will generate employment and increased income levels. This will in turn create demand for more space for house construction with the expanding economy.

Industrial growth, particularly in the fishing sector and tourism and agriculture, will have a direct impact on the standing forest vegetation when the land area is cleared for establishing industries.

At present there is a demand for biomass energy where one can observe that in addition to coconut refuse, brushwood is collected from forest areas to be used as fuelwood. Although overall cross-sectoral development will enhance the usage of alternative sources of energy for cooking, island communities with poor economies will depend on forest resources that are available cost free.

The Maldives is not self-sufficient in energy resources and imports are necessary with highly fluctuating prices depending on the international market. If wind and solar energy and energy from the ocean are tapped, dependence on forests is less likely to decrease.

Forests and trees have several important functions in the economy of the Maldives. Direct benefits are becoming relatively less important than the increasingly important indirect benefits for the economy.

No quantitative estimates are available on the value of forest and tree products and services to the economy in the Maldives. Only descriptive assessment can be given.

As regards direct benefits, the most obvious and measurable are wood for (i) boat building (mainly the structural frames of wooden boats and ships, outriggers are normally made of imported timber nowadays), (ii) poles (for house building, fencing, etc.), (iii) local carpenters for furniture, window frames and door making, (iv) for woodcarving and woodturning in handicraft production, mainly for souvenir items, and (v) firewood in cooking and smoking fish (although in decreasing volumes as kerosene, gas and electricity have gained in importance). Secondly, and probably economically still more important are the non-timber forest and tree products such as coconuts and various products, including souvenir items; other fruits and nuts; mats used for roofing, walls and other covering (produced from coconut palm and screw pine leaves); gums and resins used in boat building etc.; and various traditional medicinal products that are still widely used.

The indirect benefits that have major economic importance include (i) coastal protection; (ii) amenities and scenic beauty that are absolutely vital for the success of the tourist industry, and (iii) the provision of shade, thus diminishing excessive electricity consumption for cooling purposes. Forests and other vegetation also act as carbon sinks.

Apart from the limited land area available for growing forest and tree products, the high transport cost, from production sites to potential markets, is one of the main bottlenecks that hinders increased forest and tree-based production. Consequently, high value added and high unit value products must be targeted, instead of producing bulk products.

The state has gained some revenue from licence fees and from *Varuvaa* leases.

Environmental issues and policies and their impact on the forestry sector

The MoEEW has the mandate to provide clearance for new establishments following environmental impact assessment (EIA) recommendations. However the technical capacity of the concerned authorities undertaking and verifying EIA needs to be increased. The strength of the institutions dealing with EIA and a sound policy regime to allocate land for such establishments will have an impact on the forestry sector presently as well as in the future.

The 2004 tsunami exposed the vulnerability the Maldives faces. The National Disaster Management Centre is insisting on establishing coastal shelterbelts as a component in disaster mitigation projects (personal communication, Ms. Zaha Waheed, Director, National Disaster Management Centre, Maldives).

Soils and water

Soils are generally poor sandy soils of coralline origin. The organic soil layer is normally shallow. The water table is often at a high level, 1-2 metres below ground. Groundwater is normally fresh, but occasionally suffers from salt intrusion (e.g. after the 2004 tsunami).[9]

Summary of key factors that are likely to impact forestry in the next 20 years

Housing, agricultural and industrial expansion that creates demand on land is a key factor that is likely to impact forests and the forestry sector in the next 20 years. Tourism is another area which can have an impact on forests; however this can be a positive impact if the tree cover in the proposed resort islands as well as in the neighbouring/adjoining islands of the resort islands is managed properly.

[9] Republic of Maldives 2005. Tsunami: impact and recovery. Joint needs assessment, World Bank, Asian Development Bank, UN System. p. 19: "The damage to land and groundwater resources is severe in 35 agricultural islands, and saline water intrusion has affected 112 inhabited islands."

4. PROBABLE SCENARIOS AND THEIR IMPLICATIONS

Agriculture: Home gardening is very common. Shifting cultivation is still practised by small-scale farmers, although the areas involved are very modest. Year-round cultivation and small-scale livestock production are other farming systems. Shifting cultivation is a threat to sustainable forest cover because the fallow season often is too short for natural vegetation to recover. Part of the increase in agricultural production comes from intensification of cultivation methods. Another part comes from the expansion of the cultivated area, which is most often achieved by clearing forest land. Often a forest area is considered as a reserve, waiting to be developed. Clearing for agriculture is the "development", even if the subsequent cultivation suffers from marketing problems, pests and diseases.

Urban expansion and construction of roads are part of national economic development, needing additional land, which is most often taken from agricultural and forest land. The Ministry of Urban Development is in charge of land-use planning for the islands. The land-use plan should establish zones for residential areas and "green areas" for environmental protection and recreation.

Tourism is a thriving and expanding industry, the cornerstone of Maldivian economic development. The Tourism Master Plan 1996-2005 indicates that: (a) the share of domestic labour must increase and (b) expansion must focus on new areas. The executive summary of the Plan sets the target for resort bed development: the expansion should be 20 000 beds during the planning period. According to the strategy the emphasis of expansion should be in the Southern and Northern regions, as the Central region is already near saturation level. The expansion target has not yet been fully met. New resorts are being established on uninhabited islands. The establishment of a very new resort means clearing a certain percentage of the forest land of the respective island.

At present mangroves are not properly protected by communities as the mangroves are habitats for mosquitoes that plague the islands. Thus communities have little interest in mangrove preservation.

Tree planting: In 2000 the MoFAMR conducted a tree planting campaign for "One million trees". Accordingly one million seedlings were planted by local population on all islands. One of the objectives was to raise national consciousness of the value of trees.

There is a new ongoing MoFAMR-led tree planting campaign: The MoFAMR will import fruit tree seedlings and distribute them to selected agricultural islands on 11 atolls. Each household will receive one seedling, which the household will plant and maintain.

The most likely scenario depends on the development of a sound legal mechanism for the conservation, development and sustainable management of forest resources. Forest cover is likely to increase by 2020 given the increasing level of awareness that is being generated by national and international organizations, concentrating on youth groups and school children.

Agroforestry development complementing agriculture expansion could pave the way for maintaining forests and trees in the Maldives with increased tree plantation in uninhabited islands.

5. WHAT WE MAY SEE IN 2020

Forest resources in the next two decades

Forest cover situation in the context of alternative scenarios: The 7th National Development Plan stipulated pathways for the development of different sectors for national growth, which have a cross-sectoral impact on the forests and trees of the Maldives. However to evaluate the changing trend baseline data on the extent of forests and forest resources of the Maldives should be developed with the help of RS images and GIS.

Change in the area under production and protection: The Agricultural Master Plan has recommended expansion of agriculture in 3,000 ha of wooded area. However the status of the area to be cleared needs to be made explicitly clear. Areas with forests and trees desirable for the GDP should be set aside for conservation and sustainable management. This is essential or otherwise it will work against the interests of the proposed tree-planting campaign.

Extent of area under sustainable forest management: The area under forest cover in Maldives has been recorded as 1,000 ha. However the Agricultural Master Plan has stipulated an area of 3,000 ha of forest area to be cleared for extension of agriculture (data discrepancies have been mentioned earlier). The MoHUD in its plan for all the inhabited islands has earmarked zones in coastal areas to be protected and along island peripheries for roads that will have avenue plantations.

Future of non-wood forest products

Non-wood forest products in the form of edible fruits meet only domestic requirements and are not exploited on a commercial scale.

Forest-related services

Protective functions of the littoral forest: Undisturbed littoral forest along the coast provides essential shoreline protection. Mangroves patches on the coast provide the second line of defence.

Forest and soil erosion control: Forest cover is essential for soil erosion control. This forest cover consists of littoral forest and a mixture of coconut palms and other vegetation in the interior. Good forest cover minimizes rain-induced soil erosion. Without forest cover, rainwater run-off will cause siltation of sea grass beds and corals.

Shade and amenity trees in urban areas: Trees are being planted in urban areas (e.g. Male' and nearby urban islands) and in residential areas on other inhabited islands for shade and amenities. In the tropical heat shade trees are highly valued by pedestrians. Scenic urban landscapes are also attractive to tourists.

Forestry sector's contribution to the national economy

Forest and tree cover has an important role in environmental protection and urban landscaping, which can in turn positively influence the development of the important tourist industry. As the forestry sector does not exist as an independent sector or sub-sector, the national accounts do not provide any estimates of its sectoral contribution. Commercial domestic timber production currently has a modest and declining contribution to the national economy.

An overview of the future of the country's forests and forestry in 2020

Strengths and opportunities: Forestry in Maldives has potential for the growth of the national economy as islands with good forest cover attract tourists. The uninhabited islands located close to resort islands should be leased to the resorts for forest cover maintenance.

Weaknesses and threats: There is recognition now that forests play a critical role in protecting the islands from natural hazards. However there is a need for increasing awareness among students and the corporate sector to conserve and leverage support for the conservation of forest resources.

There is threat that ongoing land development, urbanization and agricultural expansion will affect the standing area of forests and trees. A coordinated approach among the different sectors would yield positive results.

6. HOW COULD WE CREATE A BETTER FUTURE?

Legalization of policy with clear implementation guidelines is the need of the hour to work for a better and coordinated regime for the forestry sector in the Maldives. Institutional arrangements should be made with forestry wing developed under the MOFAMR with island level extension workers would enable for a viable forest and tree resources management.

There is a need for establishing nurseries to provide the necessary nursery stock for the establishment of coastal shelterbelts and to replenish/enrich the island tree cover. Investment requirement should be arranged with national budget allocation for forestry sector. Provisions for sourcing funding from different international agencies and particularly under the UNDAP

7. SUMMARY AND CONCLUSIONS

At present the forestry sector is functioning as a sub-sector of agriculture in the Maldives. Low priority given to the sub-sector is evidenced by the absence of proper forest management and pertinent forest-related information. The concept of forest management plans is unknown to the authorities responsible for forest resource management. However, forest-based products and services have an important role in the economic development of the country.

The FAO-implemented forestry project, which was incidentally the first forestry project in the Maldives, supported the development of a Forest Policy. The recommendations covered preparation of a forestry sector strategic plan, pertinent organisational development, inter-sectoral coordination and forest management plans. The Forest Policy statement, once approved by the Maldivian authorities, should initiate a process with clear-cut implementation guidelines for the sustainable management of the country's forest resources.

Follow up to the outlook study: **The forest policy** which is under consultation among stakeholders should become a Forest Law for the sustainable management of forests and tree resources in the Maldives.

Development of Island Forest Management Plans should be taken up for islands with large areas of green cover.

Agroforestry islands for the cultivation of betel nut and betel leaves should be started on a pilot scale to meet the domestic requirement and to reduce imports.

Establishment of an organizational structure for forest resource management: An action plan for institutional development should be developed as a process under the policy implementation mechanism.

National level

The forestry-related functions of the restructured Agriculture and Forestry Service (AFS) Division should be coordinating forest and tree management on uninhabited and inhabited islands. This will cover commercial forest management and community-based forestry. In the current organisational structure there are vacant positions and a number of positions are filled with people who do not have the required qualifications. The AFS needs at least one graduate forest management expert with broad experience covering technical, economic, extension and administrative aspects. As there is no one with these qualifications in the organisation, an expatriate expert should be hired to fill the gap to begin with.

A human resource development plan should be made for the MoFAMR. In the plan provision should be made to allow on-the-job training to upgrade the skills of the personnel in charge of forestry issues.

Atoll and island levels

The draft Agricultural Master Plan recommends the establishment of a new division, called Community-based Agriculture Research and Extension Service (CERES). CERES is supposed to coordinate extension activities with the Agriculture, Research, Extension and Communication Stations, which will have services on all the atolls. Focal CERES extension agents should be trained to cover the basic forest extension services. If the establishment of CERES does not take place, alternative arrangements should aim at creating a minimum level of forestry extension on all atolls with significant forest resources.

On all islands with sufficient forest resources, trained personnel should be available to deal with issues related to forest management and extension. The forest extension services should be available on a commercial basis for commercial customers and free-of-charge or at a subsided price for communities.

Forest management

Concessions for commercial timber production: Forest management for timber production requires a long planning horizon. Long-term commercial lease for forestry on uninhabited islands would be in the Maldivian circumstances the most suitable land tenure instrument, provided that the lease period is long enough to motivate for investments in tree planting and in improvement of the existing forest stands. Duration of lease should be 30-50 years and renewable, if the lessees have managed the resource according to the lease conditions, which are elaborated in a compulsory forest management plan. Adequate monitoring systems would have to be developed and function properly in order to assess whether the lessees are implementing the management plans properly.

Community forestry and agroforestry: In large islands with considerable extent of forest vegetation initiatives for community forestry should be assessed and – when found feasible – further elaborated and implemented. Opportunities for forest-based income generation should be developed. Ensuring access to forest extension services on these islands will help support the above interventions. Agroforestry has a role in improving farmers' livelihoods. Boundary planting and wind shields can provide protection for agricultural crops. Appropriate tree species with nitrogen-fixing capacity can improve the soil. Certain agricultural crops need shade trees for maximum productivity. While improving the productivity of agricultural crops

the intercropped tree species can provide timber, leaves, fruits and fibre for various domestic and commercial end uses.

Forest management plans

The MoFAMR should prepare guidelines concerning the content of two kinds of forest management plans.

- Every commercial concession holder must prepare a comprehensive forest management plan, which contains an operational forest inventory, location and timing of harvesting operations and respective silvicultural activities.
- For community forestry, a simple format for a management plan should be prepared. It should cover the necessary activities for sustainable management of communal and/or individual forest plots. Forest/agricultural extension personnel should be skilled in advising on the optimal mix of agricultural and tree species for developing agroforestry models and their respective maintenance.

The MoEEW, in cooperation with the MoFAMR, should develop pertinent management plans for protected forest areas, of which mangrove forests constitute an important part.

Cooperation between inhabited and uninhabited islands

The inhabited islands in the Maldives are divided into agriculture islands and fishing islands based on the predominant occupation of the islanders. In the fishing islands boat building is more prevalent. While choosing uninhabited islands for commercial forest management, including forest plantations of species used in boat building, uninhabited islands close to the fishing islands would be more appropriate.

As better managed forests will enhance tourism, the uninhabited islands near tourist resorts could be developed with the support of resort islands and eventually managed by the tourist resorts like the existing picnic islands.

Mangrove forests on inhabited islands can be developed for tourism by building board walks and organizing *bokkuraa* (boat) rides as a collaborative effort of the resort islands and the local communities to generate revenue for local communities. Uninhabited islands with significant mangrove forests, constituting a part of the protected areas system, could be managed for conservation purposes

8. REFERENCES

Asia Development Outlook. 2006.

Atoll Editions. 1999. Atlas of the Maldives.

Bhaharthie, Sri K.P. March 1993. Report to the Government of the Republic of Maldives on support to community tree planting (FAO).

Bhaharthie, Sri K.P. September 1993. Final report to the Government of the Republic of Maldives on support to community tree planting, parts i and ii (FAO).

Brune, A. May 1984. Report to the Government of the Republic of Maldives on tropical woodlots (FAO).

Customs Office. 2006. Imports of Timber.

Deomampo, Narisco R. October 2005. Masterplan for sustainable food security, agriculture and regional development. Draft report of the ECDC expert/agriculturist (FAO).

FAO. 2005. Forest Resources Assessment 2005: progress towards sustainable forest management. Rome. FAO.

Jyrki Salmi. 2007. Forest Policy the Maldives (OSRO/GLO/502/FIN).

Koljonen. 2006a. End-of-Mission Report.

Koljonen. 2006b. Forest Policy of Maldives – draft.

Law No. 1/02. Maldives Land Law.

Law No. 20/98. Law on Uninhabited Island of Maldives (Translation).

Law No. 4/93. Environment Protection and Preservation Act of Maldives (Translation).

Maldives Housing and Urban Development Board. January 2005. Planning Guidelines for the Planning of the Built Environment (Translation).

Ministry of Environment and Construction. 2004. State of the Environment – Maldives 2004.

Ministry of Fisheries and Agriculture. Agricultural Statistics 1994 – 2003.

Ministry of Fisheries and Agriculture. October 1992. Catalogue of Plants.

Ministry of Fisheries and Agriculture.1996. Maldives: Country Report to the FAO International Technical Conference on Plant Genetic Resources.

Ministry of Fisheries, Agriculture and Marine Resources and FAO. March 2006. Agricultural Development Master Plan of the Maldives.

Ministry of Fisheries, Agriculture and Marine Resources. 2006. Timber Cutting Permits.

Ministry of Fisheries, Agriculture and Marine Resources: Agriculture & Forestry Services – organisation chart.

Ministry of Fisheries, Agriculture and Marine Resources: General Considerations /Guidelines use by the MoFAMR in Determining the Lessee of Islands for *Varuvaa* (Translation, combined with the document no. 9).

Ministry of Fisheries, Agriculture and Marine Resources: New Draft Guidelines for the Lease of Uninhabited Islands (translation, combined with the document no. 9).

Ministry of Fisheries, Agriculture and Marine Resources: Regulation of the MoFAMR Governing Uninhabited Islands Made under Law Number 20/98 (translation, combined with the document no. 9).

Ministry of Fisheries, Agriculture and Marine Resources: Terms in the Commercial Lease Agreement (translation, combined with the document no. 9).

Ministry of Home Affairs, Housing and Environment. 2002. First National Report to the Conference of the Parties to the Convention of Biological Diversity.

Ministry of Home Affairs, Housing and Environment. 2002. National Biodiversity Strategy and Action Plan of the Maldives.

Ministry of Home Affairs, Housing and Environment. December 1997. Environmental Impact Assessment in the Maldives; an Information Hand Book for Proponents and Government Agencies.

Ministry of Housing and Urban Development. Mandate of the Ministry.

Ministry of Planning and National Development. 2005. Republic of Maldives – Strategic Economic Plan.

Ministry of Tourism: Tourism Master Plan 1996 – 2005. Executive Summary and Chapter "Key Issues in Developing Tourism in Maldives".

Naseer, Abdulla and Bruce G. Hatcher. 2004. Inventory of the Maldive's Coral Reefs using Morphometrics Generated from Landsat ETM+imagery (Coral Reefs (2004) 23).

OSRO/GLO/502/FIN. 1 March 2006.

OSRO/GLO/502/FIN. 24 March 2005. Progress report, Maldives component of Forestry Programme for Early Rehabilitation in Asian Tsunami Affected Countries).

OSRO/GLO/502/FIN. May 2005. Forestry programme for early rehabilitation in Asian tsunami affected countries. Project Document.

Plan of Operations. Maldives component of forestry programme for early rehabilitation in Asian tsunami affected countries.

Seventh National Development Plan 2006 – 2010. Volume I; Policies and strategies. 5 January 2006. First working draft (Government of the Maldives).

Seventh National Development Plan 2006 – 2010. Volume II; Sector road maps. 5 January 2006. First working draft (Government of the Maldives).

TA No. 4337-ML. April 2005. Commercialization of Agriculture in the Maldives. Main report.

TA No. 4337-ML. April 2005. Commercialization of Agriculture in the Maldives. Annexes A – H.

TCP/MDV/3001 (A). April 2005. Preparation of a Ten-Year Master Plan for sustainable food security, agriculture and rural development; Project Initiation Mission Report.

TCP/MDV/3001 (A). April 2005. Preparation of a Ten-Year Master Plan for sustainable food security, agriculture and rural development; opportunities and major issues in agriculture sector development raised by government stakeholders during discussions.

Thupalli, Ravishankar. November 2005. Forestry Assessment and Programme Planning – Maldives (OSRO/GLO/502/FIN).

Untawale, A.G. and T.G. Jag tap. 1991. Scientific report on the status of atoll mangroves from the Republic of Maldives. National Institute of Oceanography. Dona Paula 403004. Goa. India.

9. Annex. Large uninhabited islands currently with partial forest cover

Name of atoll	Name of island	Area of island (ha)
Haa Alifu	Mulidhoo	62.5
Haa Alifu	Madulu	16.8
Haa Dhaalu	Keylakuna	83.7
Haa Dhaalu	Muiri	22.5
Shaviyani	Naruribudhoo	31.8
Shaviyani	Neyo	19.2
Shaviyani	Ekasdhoo	47.5
Shaviyani	Medhukurudhoo	44.4
Noonu	Raafushi	16.5
Noonu	Badaidhidhdhoo	24.4
Noonu	Karimmavattaru	36.6
Noonu	Kuramadhoo	15.3
Noonu	Kalaidhoo	27.5
Noonu	Minaavaru	30.2
Noonu	Maafunafaru	19.8
Noonu	Dhonaerikadoodhoo	18.7
Noonu	Dhigurah	40.0
Raa	Ufulandhoo	27.0
Raa	Vandhoo	37.5
Raa	Dhigali	16.4
Raa	Liboakandhoo	17.0
Baa	Maarikulu	24.3
Baa	Maamaduvvari	27.8
Baa	Finolhoss	20.5
Lhaviyani	Lhossalafushi	25.9
Lhaviyani	Maduvvari	19.5
Lhaviyani	Maidhoo	56.6
Gaafu Alifu	Funadhoo	22.2
Gaafu Alifu	Fenrehaa	42.6
Gaafu Dhaalu	Maavaarulaa	81.0
Gaafu Dhaalu	Gan	240.0
Total area		**1215.7**