



Forestry Assessment and Programme Planning
Maldives

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Forestry Assessment and Programme Planning, Maldives

Executive Summary

In the aftermath of the Tsunami at the end of 2004, a needs assessment and programming mission under the project funded by the Government of Finland, “Forestry Programme for Early Rehabilitation in Asian Tsunami Affected Countries” (OSRO/GLO/502/FIN) in the Maldives from 15th August to 19th September 2005. The broad objectives were: to evaluate the extent of damage to mangroves and other coastal forests; assess the role of mangroves and other coastal vegetation in mitigating the impacts of tsunamis, tidal surges and storms; identify forest sector interventions that would contribute to rehabilitation and linking to livelihoods; identify opportunities for community plantings, home gardens, agro-forestry, fruit trees and shade trees to restore and improve livelihoods; identify the physical and technical inputs required to support the proposed forest rehabilitation, including needs for forest nurseries and seedling distribution systems; determine the education, training and capacity building needs to strengthen the Government and community capacity to implement the rehabilitation of mangrove forests, coastal trees, nursery management and mobilization of communities and farmers to participate in integrated coastal area management; assess whether there are any issues to be addressed regarding of supply of wood and wood products for rehabilitation and reconstruction.

The major conclusions are that the main type of forests occurring in Maldives is littoral and mangroves. The littoral forests are dominated by *Scaveola* group, which are saline tolerant. The mangroves exist only in some of the islands. The mangrove vegetation is dominated by the *Rhizophoraceae* specie. Regarding the extent of forests, although forest cover in the Maldives is estimated at 1000 hectares, a thorough assessment of forests is needed to develop long-term management plan. It was clear from the aerial observation made that the area of the forest is more extensive than that of the reported 3 per cent of the total geographical area. The damage to coastal forests and mangroves could not be quantified due to lack of baseline data. Observations and interactions with the community during the mission indicate that, a) littoral forests and mangroves played a role in mitigating the impact of the tsunami and wherever these forests are disturbed, the impact of a tsunami increases; b) communities, policy makers and administrators understanding the value of littoral and mangroves forests as green shields has increased; c) degradation of forest and tree resources due to land use changes and over exploitation of resources is evident in many areas, but in some places the problems have been exacerbated by the tsunami. However, in many of the uninhabited islands the forests are intact and undisturbed. The littoral and the mangrove forests are used by the local communities for boat building and other needs, but in many places the level of use is not sustainable. With reference to the impact of the tsunami, although the damage to littoral forests was not extensive, inundation of seawater from the tsunami and subsequent stagnation has damaged inland fruit gardens and avenue trees. Communities clearly indicated that there is a demand for boat building wood. There are some local initiatives by communities to cultivate tree species used for boat building.

In the light of above observations, the following are recommended as short-term interventions to be supported by the project OSRO/GLO/502/FIN: i) restoration and rehabilitation of tsunami affected littoral and mangrove forests with the participation of the local community; ii) strengthening the management of existing and rehabilitated littoral and mangrove forests as green shields against natural calamities including Tsunami; iii) promoting agro-forestry using multiple value trees and avenue trees in tsunami affected islands for sustainable livelihoods; iv) raising timber species used in boat building and for firewood to reduce the current pressure on

forest resources; and v) training and capacity building of stakeholders in sustainable forest management.

There is a need for developing guidelines for Integrated Island Area Management, and for constituting Integrated Island Area Management Authority, which could be developed as a long-term initiative. GOM may seek funding through its country framework and bilateral and multilateral donor facilities for this.

1.0 Introduction

The Indian Ocean tsunami that occurred on 26 December 2004 caused serious damage and loss of lives and livelihoods in coastal communities and ecosystems in India, Indonesia, Malaysia, Maldives, Myanmar, Seychelles, Somalia, Sri Lanka and Thailand. In Maldives, the degree of damage varies throughout the island, as does the capacity and capability to respond to the rehabilitation and reconstruction of livelihoods and restoration of the coastal landscape. Out of 199 inhabited islands, 53 suffered severe damage and 20 islands were totally destroyed. Nearly one third of the total population of Maldives was severely affected. The Tsunami waves reached a maximum of three to four meters.

In Maldives, mangroves and other natural coastal vegetation, coastal plantings, agro forestry, home gardens and fruit and amenity trees were damaged to varying degrees by the tsunami, according to the back ground information available. Preliminary information suggested that in some places mangroves provided a buffer and protection from the major impact of the tsunami, but in other places some mangrove areas were destroyed. The full extent of the damage was still not clear, particularly the longer term effects on soils and trees, of inundation of salt water. Dieback of *Terminalia*, *Guettarda*, *Hibiscus* and *Cordia* were reported, but recovery of some species will occur with the onset of rains. Much of the infrastructure and civil buildings destroyed by the tsunami were made of wood, including wooden boats, piers, houses and other buildings. Many of the communities affected by the tsunami rely on fuel-wood for cooking. Almost all construction wood is imported from overseas. An assessment of whether there are any issues to be addressed regarding the supply of wood and wood products for rehabilitation and reconstruction was needed.

2. 0. Context of the mission

This mission was carried out under a project funded by the Government of Finland, "Forestry Programme for Early Rehabilitation in Asian Tsunami Affected Countries" (OSRO/GLO/502/FIN). The project will constitute a part of FAO's support to the Maldives for post-tsunami rehabilitation, including also assistance in the agriculture and fisheries sectors. The forestry assessment and programme planning assignment was carried out in the Maldives from 15 August to 19 September 2005. The consultant visited 30 islands (Annex: Travel itinerary) covering seven atolls namely Haa Alifu (North Thiladhunmathee), Haa Dhaalu (South Thiladhunmathee), Kaafu (Male), Hadhdhunmathee (Laamu), Gaafu Dhaalu (South Huvadhoo), Gnaviyani (Foamullah) and Seenu (Addu) distributed in north, middle and southern parts covering a wide geographical area to have a balanced view of assessing the damage and to identify areas for rehabilitation, focused on restoring and improving livelihoods. The purpose of the mission was to assess needs and prepare a preliminary plan of operation for the project's work in the Maldives.

3. 0. Objectives of the mission

The objectives of the mission were to:

- assess the areas of and evaluate the extent of damage to mangroves and other coastal forests destroyed or damaged by the tsunami;
- assess the status of information and knowledge available in the country on the role of mangroves and other coastal vegetation (including coastal scrub and trees) in mitigating the impacts of tsunami, tidal surges and storms;
- identify the forest sector interventions that would contribute to rehabilitation and reconstruction in the affected areas so as to improve the livelihoods of the local people and make them less vulnerable to such disasters in future;
- identify opportunities for community plantings, home gardens, agro-forestry, fruit trees, and trees for amenity and/or shade to restore and improve livelihoods;
- identify the physical and technical inputs required to support the proposed forest rehabilitation and reforestation activities, including needs for forest nurseries and seedling distribution systems;
- identify opportunities for small-scale forest-based enterprises (micro-enterprises) and the actions needed to develop them;
- determine the education, training and extension support necessary to strengthen the Government and community capacity to implement the rehabilitation of mangrove forests, coastal trees, nursery management and mobilization of communities and farmers to participate in integrated coastal area management;
- assess whether there are any issues to be addressed regarding supply of wood and wood products for rehabilitation and reconstruction.

4. 0. Approach

Initial discussions were held with officials associated with the assessment in FAO offices in Bangkok and Maldives. In Maldives, discussions were held with Ministry of Fisheries, Agriculture and Marine Resources (MFAMR) officials to collect necessary secondary data on the status of forests and related details. The field itinerary was made based on the suggestions and information provided by the staff at the different ministries and in consultation with the FAO office, Maldives. The MFAMR provided a counterpart who rendered necessary and excellent support in organizing visits to different islands for conducting the needs assessment.

Assessment of forestry damage with reference to Tsunami was undertaken in 30 islands with balanced selection of islands from south, North and Middle Atolls of Maldives. A survey was done in each island to look at the distribution of vegetation zones and the state of damage and recovery. Individual and group interviews were conducted on the role of the status of forests over the last fifty years, protection if any rendered by coastal forest and usage of forests in the lives and livelihoods of the islanders.

It is mandatory in the working system of Maldives that any visitor to the island should get prior permission from the Island and Atoll chief as the case may be before undertaking any work. The MFAMR made the necessary arrangements by writing to the Atoll offices of the FAO mission. In every Island, as soon as reaching the Island, the island chief was met and was explained about the mission and sought the logistical help to carry out the mission and provide details about the island and enable meetings with individuals or family or community members as a group.

Informal and formal discussions were held with island chiefs, atoll chiefs, boat builders, women and elderly people and group discussions were held with fishermen in order to collect primary data on the status of forest and the role the forests have played during Tsunami. Details on role of forests in protecting the islands from sea erosion, monsoon winds and by mitigating Tsunami floods or waves were collected.

Discussions were held with International agencies on the need and possibilities of collaboration in joint implementation of forestry and livelihood related programs. Resort Island was visited and discussions were held with resort managers on the possibilities of linking forestry with tourism. Possibilities of long term community based coastal forest management were discussed with NGO's. Based on the above, the following assessment report was prepared.

5. 0. General introduction of 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), Fig. 1.

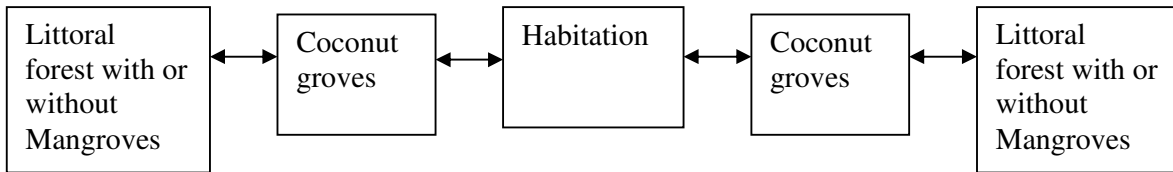
Administratively, the nation is divided into different Atolls, the names starting with the Dhivehi alphabet in the north and continuing to the south. Each Atoll has an Atoll chief, under which come all the islands in that Atoll. Each island has an island chief. Nearly 95 percent of the islands are fishing islands. Agriculture is practiced in the other islands and at times both fishing and agriculture are practiced, if there is space for agriculture in the island. The resort islands are maintained by resorts, which are the main source of tourism. Facing rising sea levels and climate change, the Tsunami has proven once again the extreme vulnerability of this island. It was reported that 35 percent of the inhabited islands had been subject to the high or very high impact by the tsunami with damage to buildings, infrastructure, crops and natural vegetation, emphasizing the need for coastal littoral forest development, protection and sustainable management.

6. 0. Forest status and dependence of people

Maldives has a long coast with littoral forests, mangroves, coconut groves (which look like forests), ponds and lagoons. The littoral and mangrove forests are performing multiple functions like acting as shelterbelts and windbreakers, preventing soil and beach erosion and lessening the effect of floods during the recent Tsunami. Coconut groves are distributed in large areas taking care of the livelihood security of the islanders. It is observed that in all the islands, there is a tapering beach on the one side and abrupt coral beach on the other side. The

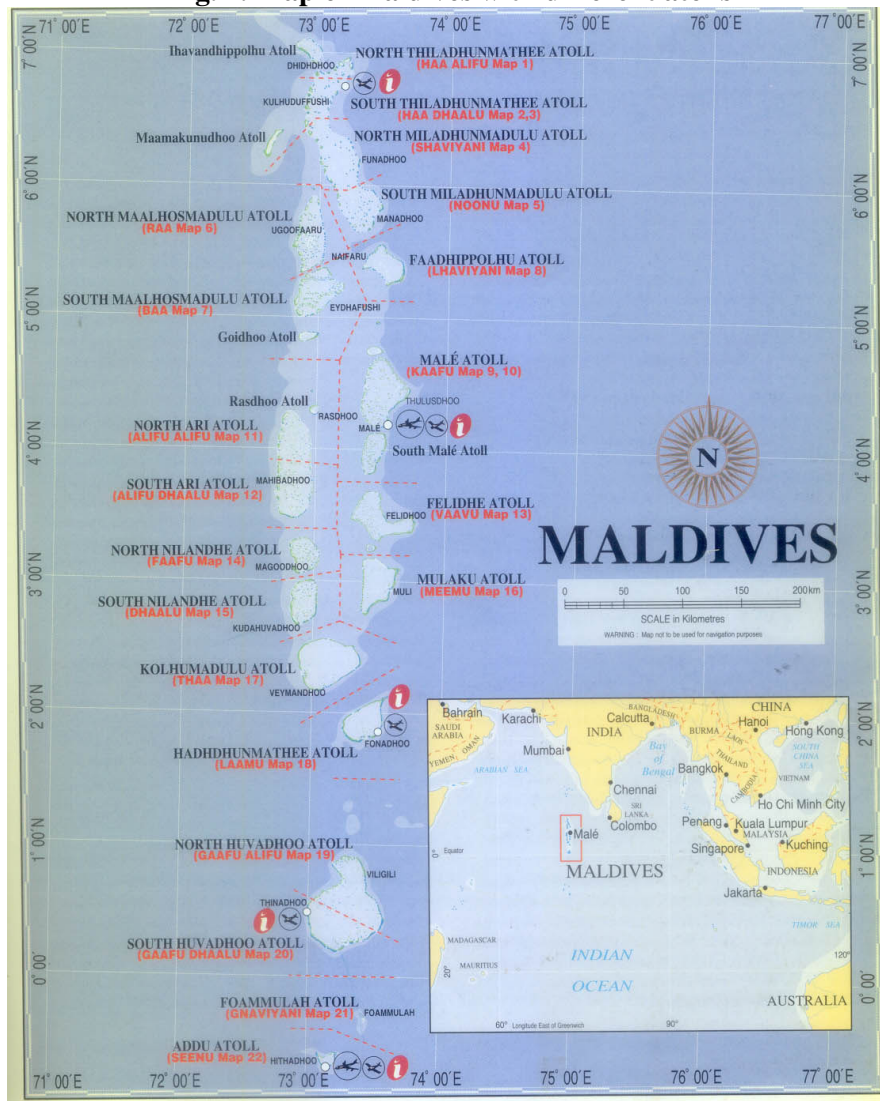
vegetation pattern is distributed largely as described in the figure below. Mangroves are not found on all the islands.

Pattern of forests distribution in the islands



As per the available information, approximately 3 percent of the land area is covered with forests. However, as per this assessment, qualitatively the area of forest appears more than the stated figures. Though the extent of forest may appear relatively low, the coastal forests in Maldives played a significant role in mitigating the Tsunami damage, representing value through ecological capital rather than economic capital.

Fig. 1. Map of Maldives with different atolls



On the islands, there is a clear-cut zonation of species from pioneers that colonize littoral forests to much dense vegetation with larger and long-lived tree species towards the land ward side. In the case of islands with larger land area, there is a thick and dense growth of forests with a succession of shrubby vegetation starting on the coast to tall trees towards the inland forming good humus. The littoral forests consists of species namely *Scaveola taccada* (Magoo), *Pandanus tectorus* (Boa Kashikeyo), *Thespesia populnaea* (Hirundhu), *Hibiscus tiliaceus* (Dhigga), *Suriana maritima* (Halaveli), *Guettarda speciosa* (Uni) etc. The Pandanus has dense growth in some islands from seaward side into the landward side. The mangrove forests consist of species namely *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 have provided the necessary buffer by playing the second line of defense particularly in Filladhoo. Patches of tree species *Barringtonia asiatica* (Kinbi) of 8 m girth at breast height (GBH) has been observed in Hithadhoo Island in Seenu atoll and Gan in Laamu atoll.

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

No baseline data on forests are available against which the damage of the tsunami can be assessed. FAO is the first organization to undertake forestry damage and mitigation assessment after the Tsunami. It is observed that in the inhabited islands, 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 available in Maldives, which is yet to be assessed, may contribute for the well being of the human kind in future. In this connection, there is a need for capacity enhancement by training the personnel in the respective Ministry to document the data on distribution of forests and its sustainable management. Also, the role of coastal forests as shelterbelts becomes much more important as the Government of Maldives is planning to double its GDP through agriculture interventions which may lead to a disturbance to the standing forest vegetation

6.1. 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 the 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 Maldives. There is a dense growth of forest vegetation along the coasts with clear zonation in the distribution of different species. *Scaveola taccada* (Magoo) is a common and dense thicket forming plant species, which is widely distributed. *Pemphis acidula* (Kuredhi), *Thespesia populnaea* (Hirundhu), *Pandanus tectorus*, Nit pitcha- *Guettarda speciosa* (Uni), *Calophyllum inophyllum* (Funa), Tassel plant- *Suriana maritima* (Halaveli) together form a dense shield protecting the islands from storms, monsoon winds and beach erosion and played a critical role in subsiding the Tsunami damage. In some areas, *Pandanus* forms a thick network with *Guettarda speciosa* (Uni), *Calophyllum inophyllum* (Funa) into the landward side. Coconut groves are distributed like forest with dense growth across the islands. Mangroves are confined to second line in the coast distributed in small swampy areas.

In Kaashidhoo island of Kaafu – Maale Atoll, the littoral vegetation is represented with Pandanus, *Ficus benghlensis* (Nika), *Adenanthera pavoniana* (Madhoshi). The littoral vegetation in Maradhoo consists chiefly of species namely *Suriana maritima* (Halaveli) and *Scaevola taccada* (Magoo). The other species observed in this long island are *Calophyllum inophyllum* (Funa) along with *Guettarda speciosa* (Uni), Pandanus, *Hibiscus tiliaceus* (Dhigga) and Coconut. In Gan Island, near Kashiganandu-vau, plant species like cone wood, *Syzygium cumini* (Dhanbu) etc., form thick vegetation between the airport and the beach on the eastern side of the atoll. In Fomullah atoll, *Scaevola taccada* (Magoo), Pandanus and Coconut are commonly distributed. Individuals of *Calophyllum inophyllum* (Funa) form dense vegetation and grow 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* (Magoo), *Suriana maritima* (Tassel plant; Halaveli) and *Thespesia populnaea* (Tulip; Hirundhi) towards the land ward side and thereafter coconut. In Hoededhoo, the plant species namely *Muntingia calabura* (Jeymu), Tulip, Magoo, Coconut, Pandanus, *Terminalia catappa* (Midhili) *Hibiscus tiliaceus* (Dhigga) and banyan are distributed across the island. Kaadedhoo is an uninhabited island meant for Airport. This island has a thick forest with plant species namely *Guettarda speciosa* (Nit Pitcha; Uni), Tulip, Magoo, Pandanus, *Terminalia catappa* (Country almond; Midhili), Coconut, are distributed in this forested area.

Baarah of Haa Alifu – Noth Thiladunmathee Atoll has a large area under forest cover with littoral forests distributed all along the island. The coconut trees are growing like forest, as the locals do not practice cultivation of coconuts as the case in all other islands visited. There are two varieties of Pandanus observed; one is small and the other large. The large one is edible. The small one is used as firewood like charcoal particularly by the black smiths as the fruits keep burning for a long time like coal balls. In Filladhoo Island of the same Atoll, which has a large area under forest cover and a long coastline, the littoral forest has Pandanus, *Calophyllum inophyllum*, Magoo, Tulip, *Hibiscus tiliaceus* (Dhigga), *Cordia subcordata* (Kaani), *Suriana maritima* (Halaveli), country almond and coconut.

In Nolhivaranfaru, also of the same atoll, there is a good gradation of forest with Magoo, Tassel plant, Pandanus, Tulip and Coconut which is wide spread. The species distributed in the dense zone between the sea and the inhabited part are *Barringtonia asiatica* (Kinbi) Pandanus, Tulip, *Cordia subcordata* (Kaani), *Syzygium cumini* (Jambolan; Dhanbu), *Morinda citrifolia* (Cheese fruit; Ahi), country almond, Banyan, etc.

In almost all the islands in Laamu atoll, commonly observed species were *Thespesia populnaea*, *Cordia subcordata* (Sea trumpet; Kaani) and *Guettarda speciosa* (Nit pitcha) and evenly distributed. In L. Hithadhoo, littoral forests consist of Tulip, Hibiscus, Pandanus, Coconut, *Calophyllum inophyllum* including breadfruit are observed. In Gan and Fonadhoo, *Barringtonia asiatica* of nearly 4 to 8 meters GBH were observed. In Maandhoo Island, Tassel plant, Hibiscus, Nit pitcha, Pandanus, *Morinda citrifolia* are the other species observed in this island. In Huraah, the coastal forest consists of Tulip, banyan, tassel, coconut, etc. Magoo is common on the beaches. In all the islands, as to their profession of fishing, the dwelling places are located facing beachfront. In the islands, where there is Tsunami damage to lives and material, the floodwater has entered from the harbor or jetty opening which has been constructed by clearing the vegetation.

Invasive species: Obnoxious weed species of *Cuscuta* and *Ageratum* are invading the island, which poses a concern for the standing forest vegetation.

6.1.1. Causes and issues for littoral forest erosion

Causes: Coral and sand mining for urbanization and house construction are causes observed for coastal area / beach erosion. This is disturbing the littoral vegetation. The 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 go for sand mining.

Issues: In Fomullah atoll, beach erosion is taking place all over the island. The Atoll chief said that fortification of the beach with quadra pods needs to be tried. In Raasge Fannu area hard structures have been constructed on the beach. The local people feel that such hard structures could be erected all along the island. According to Mr. Abdullah Rasheed, Assistant Island Chief, the beach in Meedhu of Addu Atoll, has eroded nearly 50 feet in the past 20 years. The beach was extending up to 50 meters from the present water line, which was rocky with vegetation. The coastal areas need a combination of fortification by either soft (green shields) or hard structures and in some places together with soft and hard structures. This has to be decided by means of thorough assessment of the local conditions.

In Thinadhoo of Gaadu Dhallu – South Huvadho Atoll, as the reclaimed area is not properly managed, it is eroding. According to local officials the reclamation should be followed with strengthening of bunds of the reclaimed areas. In Kaadedhdhoo of the same atoll, the beach area is eroding at various points ranging from 30 to 60 feet. According to airport authorities, the pace of erosion is severe within the last few years.

6.1.2. Usage and issues in availability and supply of wood for boat building

There is high demand for boat building wood, particularly in the northern islands. Species namely *Hibiscus tiliaceus* (Sea hibiscus; Dhigga) – *Ochrasia barbonica* (Cork wood; Dhunburi) *Calophyllum inophyllum* (Alexander laurel; Funa), *Diospyros ebenum* (Ebony; Kalhuvakaru), and *Tectona grandis* (Teak; Haivakaru) are used in boat building. In addition to harvesting wood from the forests, wood is also imported from Male. The fishermen in the north said it is expensive to own Fiber Reinforced Plastic (FRP) boats. There is less demand for boat building wood in the southern islands, as the islanders prefer FRP boats. However, even for building FRP boats, wood from the forests is used. Plant species namely *Hibiscus tiliaceus* and *Calophyllum inophyllum* are chiefly used. It is observed in Fomullah, that the trees are cut for boat building purposes.

The general issues the boat builders feel are that the price of wood is escalating exorbitantly and they find it difficult to continue the business. They feel that the MFAMR should help the fishing industry in capacity building of local fishers in fisheries and providing soft or interest free loan to small fishers. The local fishermen said that to build a boat they need to borrow at 11.2 percent, which they feel is high for them and many are moving out of fishery business. They also felt that the MFAMR should focus on developing fishing gears that are used by the fishermen and for a centralized retail place for fishing gears. They want the present customs and excise duty regime to become fishermen friendly. These issues become important in the community mobilization for developing green shields for Tsunami proofing and its sustainable management.

In Baarah, Mr. Abdullah Latif Mohamed, Boat builder, informed that he has been building boats for the past 40 years and uses species namely *Calophyllum inophyllum*, *Thespesia populnaea* and *Hibiscus tiliaceus*. He said that there is good demand for wooden boats and there is a need for more wood for making boats. He said that due to lack of wood at times work is to be stopped till the supply comes from elsewhere. He said that when a tree is cut for boat building, they plant two stem cuttings as saplings. He also felt that if more number of trees were grown, the import would come down. He said that he is cultivating these species in an area of approximately 100x50 foot area, and also selling them to other islanders for boat building.

Mr. Rameez Hasan and Mr. Abdullah Bari of Filladhoo in Haa Alifu – North Thildhunmathee Atoll, informed that *Thespesia populnaea* (Hirundhi) is the most preferred and also not aware of other species. They import the other wood from Male, which they feel is expensive. They are interested in cultivating plants of boat building value, but do not want to plant them near jetty areas, which they feel, will become a hindrance. They need hard structures for protecting the beaches near the boat building yards and fishing jettys. They are aware of the fact that the vegetation has protected the island by the presence of thick littoral forest. In Kelaa of the same atoll, also the boat builders use *Thespesia populnaea* (Hirundhi), but they prefer to use Balloo, which is imported from Indonesia. However, they feel that if the Balloo wood is cultivated, the imports will reduce and thus the cost.

In Nolvivanfaru of the same Atoll, there is a demand for small sized boats of the size of 18 feet by 6 feet. According to Mr. Mohamed Adam, the boat builder who came from Numerah Island, the boat will have a life span of 20 to 25 years and does not need regular maintenance. Mr. Abdul Samad, owner said that it would cost 12 000 MRf. He said that the wood for building the boat is met from local forest, which roughly means that by protection or cultivating boat building plant species, the local community can earn Rf. 12,000/- by selling wood for building a boat. Species namely Hirundi, Funa and Midhili are used and a mangrove species by name, *Bruguiera cylindrica* (Kandoo) is used for the bottom part of the boat.

Regarding the availability of wood for boat building, he felt that so far the wood from the local forest is able to meet the requirements of boat builders. Hence, at present no wood is imported from Male'. However, he felt that if more boats are made it will affect the tree population. Right now he said that they are planting the cuttings of the trees used for boat building and ensuring its regeneration. They are planting seeds for Funa and Midhili, which do not regenerate by cuttings. There are 15 wooden boats in this village. The reason for not shifting to FRP boats is the insufficient monetary position of the fishermen.

In Maamendhoo of Laamu Atoll, for making a FRP boat of size 104 ft length and 25 ft width, imported wood (Red merantine and Ballo) worth MRf 20,000/- is used. They also use *Thespesia populnaea* (Hirundi), *Calophyllum inophyllum* (Funa) and *Hibiscus tiliaceus* (Digga), which are plentiful. In Hithadhoo of Laamu atoll, species namely *Thespesia populnaea* (Hirundi), *Adenanthera pavoniana* (Madhoshi), Coconut, *Hibiscus tiliaceus* (Digga), Roo, *Cordia subcordata* (Kaani), *Calophyllum inophyllum* (Funa) and *Pemphis acidula* (Kuredi) are used in boat making and toy making. Due to over exploitation, a significant number of trees were felled and as the boat industry was shifted from wood to FRP, the decline in the population of these boat building tree species is not noticed. In this situation, there is a need for afforestation of these species. In order to address this issue, cultivation of boat building and fuel wood species is proposed as a short-term intervention.

6.1.3. Usage and issues in availability of wood for fuel wood.

Many families mentioned that they use kerosene and gas for cooking. As per the random information collected, the fuel wood requirement in Kaashidhoo Island in Kaafu-Maale atoll is very limited, as approximately 80 per cent are using butane gas for cooking. In Madaveli of South Huvadho, 20 percent of the population uses fuel wood, which is high when compared to other islands. They get fuel wood from the neighboring island Hoededhoo. However, it was noticed in many islands, women were collecting fuel wood from the forest areas and particularly from the coconut groves. Many houses had stacks of firewood in their back yard. Women interviewed in Foamullah, indicated that they spend nearly two hours every day to collect coconut palm refuse as firewood. For smoke drying fish, people in Guraidhoo of Maale atoll still prefer firewood.

The above observations indicate that there are a sizeable number of families, which still use firewood and there is a need for fuel wood in many of the islands. Another dimension to the issue is, that the kerosene and cooking gas has to come from Male', which at times gets delayed. A few women said that they use gas for cooking small dishes or for making coffee and tea instantly and for long cooking they prefer fuel wood. It was informed that the islanders meet their firewood, house and boat building needs from the fringe areas of village forests.

Therefore it is proposed for cultivation of fire wood species in the fruit tree gardens as well as in the project for raising boat building species. This would help save the time and energy of women that could be used in establishing livelihood-linked micro-enterprises.

The UNDP expressed interest in linking the cultivation of fuel wood species by developing tree nurseries to increase vegetation cover under its renewable energy project of Disaster Management Programme. It was suggested to UNDP that the same could be linked to the livelihood issues.

6.1.4. Use of drift and salvage wood for reconstruction

The driftwood after the Tsunami and the coconut trunks are being used for house construction and other building purposes. Coconut wood was used for constructing piers in some islands. An organized collection and storing of drift wood and damaged wood could meet the requirements of islanders in rehabilitation efforts. It may be appropriate to provide tools like portable saws to allow people to salvage and stack wood for future use. Technical inputs may be provided on treating the salvaged and stacked wood in order to safeguard from pest attack.

6.2. Mangrove forests

Mangroves were observed in G. Hithadhoo of Addu atoll in Eedhigali Kulhi, Hoededhoo in Gaafu Dhaalu – South Huvadho atoll and in Baarah, Filladhoo and in Nohlivaranfaru of Haa Alifu atoll and in Kulhudhiffushi of Haa Dhaalu – South Thiladhunmathee atoll and Isdhoo, Dabedhoo and L. Hithadhoo in Laamu atoll and Huraah in Maale atoll.

In Hoededhoo, three species of mangroves namely *Bruguiera gymnorhiza* (Bodovaki), *Bruguiera cylindrica* (Kandoo) and *Lumnitzera racemosa* (Burevi) are distributed in an area of approximately 100 meters by 50 meters. There is a small canal from the sea, facilitating tidal inundation to the mangrove swamp. Nevertheless, it was observed that many individuals are dying, as the tidal inundation is choked due to siltation of the small canal, which was facilitating the tidal inundation. The canal needs to be desilted by making trapezoidal canals,

which will reduce siltation and facilitate better inundation and natural regeneration. On the coast many wildlings are coming up, which can be maintained in a nursery and used for mangrove rehabilitation.

In Hithadhoo at Seenu Atoll, mangrove species *Lumnitzera racemosa* and a mangrove associate *Barringtonia asiatica* were recorded. *Barringtonia asiatica* of 20 to 25 mts tall were observed, as a dense patch along with mangroves and with a good growth of new individuals. These saplings could serve as planting material for the proposed green shields along the beaches in combination with tassel wood, Pandanus and magoo.

Excoecaria agallocha, *Bruguiera cylindrica* and *Ceriops tagal* are the mangrove species observed in Baarah. In Filladhoo, *Bruguiera gymnorhiza* and *Bruguiera cylindrica* were observed. According to local people mangroves were distributed in large areas in the past. They were eating fruits of *B. cylindrica* and the wood was used for house construction and boat building.

In Kulhudhuffushi, Mr. Ismail Ibrahim, Assistant Island Chief informed that there are five species of mangroves, namely *Ceriops tagal*, *Bruguiera gymnorhiza*, *Bruguiera cylindrica*, *Avicennia marina* and *R. apiculata* were occurring in the past. However, only *Lumnitzera racemosa* was observed plentiful during the assessment. In L. Gan, mangrove species, namely *Bruguiera gymnorhiza* (Kandoo) was found occurring in a small pond, which according to locals receive water through the ground water lens as the water in the pond increases as per the tide. In Huraah, there is a mangrove swamp with four species namely *Bruguiera cylindrica*, *Bruguiera gymnorhiza*, *Rhizophora apiculata* and *R. mucronata*. It was informed by the research personnel of the Environment Research Centre that *Rhizophora mucronata* is endemic to this island.

6.3. Fruit trees in home gardens

In home gardens, 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, – *Mentha spicata* (Mint) are cultivated. Fruit gardens are extensively cultivated in Addu atoll.

In Baarah, the islanders said that they raise vegetables and fruit crops; however, only perennial fruit crops are observed. Breadfruit, coconut, moringa, banana, sapota and citrus are some of the fruit trees being cultivated. 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 *Zizyphus*, Mango and *Mimusops elengi*, Tamarind, *Annona glabra* (Pond apple) and *Eugenia javanica* (Wax apple) were observed. Main plantation crops are coconut and banana. Coconut is managed like forest areas as they are not tendered like a plantation crop. It is observed in some islands that breadfruit and coconut are cultivated together forming zonations from seaward side to landward side.

7.0. Tsunami damage to forests, fruit trees and physical structures and recovery

It is observed that in general the damage to the coastal vegetation has been minimal and a few patches of the coastal forests were damaged by the tsunami. In Guraidhoo of Maale atoll, of the damaged vegetation, *Terminalia catappa* (country almond; Midhili),– *Cordia subcordata* (Sea trumpet; Kaani) are recovering. Species namely *Thespesia populnaea* (Tulip; Hirundhu), which were distributed towards the landward side of the islands was not affected. Coconut palms and the *Pemphis acidula* (Iron wood tree; Kuredhi) have not been damaged much. Houses facing the beach have been damaged and the necessary arrangements are being made to rebuild the houses.

The damage to fruit, timber yielding and shade trees vary from island to island. This is largely due to inundation of Tsunami water affecting the soil and ground water sources causing temporary, semi permanent and permanent damage depending on the age and size of the tree and its proximity to the coast and elevation of the area.

Damage to fruits trees particularly, Breadfruit, Guava and Stone apple were severe in Guraidhoo. *Annona reticulata* (Dhandi gandu atha), though recovery is showing yellowing and browning of leaves. It was observed that in limited areas in a few islands, vegetation is sprouting back after the monsoon rain. Banana has produced new individuals from suckers. Drum stick, is recovering after the monsoon.

In Foamullah, the harbor area was inundated. The Tsunami floods entered the land area through a gap between the hard boulders and the littoral forest, which reveals that the clearing of littoral vegetation was the reason for the tsunami damage in Foamullah.

Madaveli a fishing island in south Huvadhoo atoll, is at the reef mouth and hence there is continuous erosion and siltation. Being a low-lying island, it gets inundated during the normal high tide. On the beach side around the mouth area, the land has eroded for more than 40 meters where there is a need for strengthening the mouth area with littoral forest and coconut trees and fortification of beach with littoral vegetation and with concrete quadra pods in some places. During the tsunami, the harbor area was damaged.

In Kaashidhoo, the Tsunami damage to the habitat is severe as the floodwater entered the island through the inhabited area, which is devoid of forest vegetation as a shield. The coconut groves along the residential side of the island need to be fortified with coastal vegetation between the sea and the residential area.

In Baraah, a few patches of littoral forest, fruit trees and vegetables were damaged. Pandanus is damaged in the beachfront along with tassel plant. Breadfruit, which is the staple food of the islanders, has been severely damaged particularly close to the seaside. Though some breadfruit is recovering, much has died. A few of the salt tolerant species *Calophyllum inophyllum* (Funa) distributed close to the beach died due to Tsunami water inundation and stagnation for three days. The dead trees are being used for house and boat building. On this island, tsunami waves came in the form of floods to a height of 4 feet and the inundation lasted for three days. The trees on the coast died due to the force of the wave and the stagnated water; however, the trees inland died due to the stagnation of seawater. *Moringa oleifera* (Drumstick; Muranga) and *Morinda citrifolia* (Cheese fruit; Ahi) are recovering where as the Breadfruit in some areas is recovering and in some places died, depending on the proximity of the tree to the sea and the degree of inundation and age and size of the individual. In some areas the forest vegetation is

recovering after the monsoon; and as there is no problem of livestock eating away the saplings, the chances of natural regeneration are greater.

In Filladhoo, a few fruit trees are recovering. However, in some of the islands visited, the damage to fruit trees is very conspicuous by the presence of huge trees dried and without leaves. The damage to fruit trees affects the local people as they depend very much on the fruit trees for their food security. This is because of the reason that the transportation from one island to other and to Male' the Capital is very expensive and time consuming. In Filladhoo, six houses were completely destroyed and nearly 100 houses damaged. Compound walls of the school and Island office which were right on the beach and hardly 30 to 40 feet from the high tide line, were destroyed by the Tsunami wave.

In Nollhivaranfaru, the shoreline that is gradually prograding towards the Island was affected by the Tsunami as the slope guided the Tsunami waves to the village. On the other side where there is a deep reef, the tsunami was dissipated. In many places, the beach has been eroding, which needs strengthening with green shield and also at places with hard structures. Tsunami water flooded the village and came up to three to four feet in height. In some places, trees were damaged along the shore but at a minimal scale. Fruit trees, particularly the breadfruit, were damaged along the beach ward side. The sand erosion and sand casting in the village is very severe, provoking a potential health hazard. Soil binding species like *Ipomoea biloba* should be planted. Edible creepers like watermelon, tiny watermelon and sweet potatoes could be cultivated.

In the islands of Laamu atoll, there is considerable damage to trees in home gardens and breadfruit trees were completely damaged; nevertheless, a few old trees with large buttress roots were not damaged. Unlike in other islands, there is no recovery after the monsoon and needs intervention like supply of fruit tree saplings.

8.0. Mitigating role of forests

The littoral forests along the coasts where they are intact provided the best protection to the islands. The areas, which are either disturbed or altered, have borne the brunt of Tsunami, which was observed in Gan, Foamullah, Baarah and L. Gan and other islands of Laamu atoll.

In all the islands visited, the littoral forest consisting of species namely Magoo, cordia, Pandanus, Barringtonia, Nit pitcha, Banyan, Hibiscus, Tassel, Tulip, *Calophyllum inophyllum* have provided a form of protection to the islands. Mangroves patches, which are on the coast, have provided the second line defense to the front line littoral forests. The well-established knee roots of the mangrove species have provided the necessary support to the mangroves in withstanding and mitigating the tsunami force.

In Kaashidhoo, the trees, which are older, have withstood the salt intrusion greater than the young trees. Moreover it was observed that particularly the breadfruit trees with larger buttress roots could recover well. The north facing side of the island has thick forest and the corals deposited in the form of rubbles to a height of 1 to 1.5 meters together with *Pandanus tectorius* (Wild Screw pine; *Boa Kashikeyo*) mitigated Tsunami effect and are safeguarding the shoreline from erosion.

In the islands of Laamu atoll, Magoo, which is present both in coral and sandy beaches, together with tulip and Pandanus, played an effective mitigating role. Coconut trees, which are tall and old, have been very tolerant to Tsunami and together with *Terminalia catappa* has

provided the necessary second line defense. The littoral forests along with coconut plantation, has saved many houses located behind the forest cover and also the type and quality of the construction played a role in withstanding the Tsunami effect. The school building is intact though it is close to the sea, due to the strong construction. It is very clear that on the beach side the tsunami damage and erosion is less where mangroves are distributed when compared to non-mangrove beaches.

In Gan island of Addu Atoll, the houses are constructed at the brim of the sea and some houses are constructed even below the high tide line. It was observed that, the thick green fences of the houses and offices remained unaffected, which will also allow the sea breeze to pass through, whereas at the same time the concrete compound walls have collapsed and also prevents sea breeze. Hence, it is proposed that wherever the concrete compound walls were damaged by Tsunami like in Filladhoo, green fences can be erected instead of concrete walls.

In Gan and Fonadhoo of Laamu atoll, houses facing the seaward side and most of the man made structures were damaged. It is usually the roads, which were laid across the islands by cutting the vegetation connecting the two ends of the islands, have provided a conduit for the tsunami floods to enter and thus caused the damage. It is observed that those structures and houses behind the vegetation though close to the beach, were saved and those facing the beach without any green shield between the residence and the coast were damaged, this is clearly evident in the islands visited in the Laamu atoll particularly in Gan island.

As per the information from the local people, for a long time the coastal forests that are known as *Heylhi* in *Dhivehi* language, protected the islands from erosion, monsoon wind and also during the recent Tsunami. Elderly in the community felt that the littoral forests are degrading and said that these littoral forests are important as a protective shield to the coast as a whole.

Mr. Abdullah Latif Mohamed, boat builder of Baarah, said that the littoral forest protected the island from the Tsunami and that the littoral forest should be strengthened, which he said, can be done by planting more trees by means of cuttings. He said that they are doing it through the youth clubs in the Island namely *Rehandi* Movement (named after Former Queen) and *Juaningha Dhirum* (Youthful life).

9.0. Action needed for rehabilitation

9.1. Coastal forests

The tsunami damage to coastal forests was noticed in small and narrow islands when compared to large islands with dense forest vegetation. The coastal forests of the small-uninhabited island adjacent to Nolvivaranfaru have been damaged.

Coastal green shields should be raised in the tsunami-affected islands on a priority basis and gradually in all the islands as a means of coastal protection from monsoon winds, beach erosion and Tsunamis. In the community meeting in Kaashidhoo, represented by Mr. Eesa Khaleel, Mr. Ibrahim Ahmed, Mr. Ibrahim Abdullah, Mr. Abookukusu Ali, Mr. Ibrahim Ahmed, Mr. Mohamed Haroon, Mr. Shafeez, Mr. Abdul Aslam, Mr. Hussain Zakir, the islanders felt that it is very important to grow more trees along the beach areas as a means of fortification.

All island chiefs agree that the forests protect the islands from winds and soil erosion. However, there are no concerted efforts to protect and save the forests as at present there are no

direct benefits in terms of monetary returns to the local communities or a means to get the same from the littoral forests. There is also no systematic plan for the sustainable management of these forest resources. There is lack of knowledge about biodiversity values of forests and no information is available about the mangroves. In this connection, there is a need for enhancing the capacity of concerned authorities to manage forests so to retain and enhance their ecological and functional values. The capacity building efforts should be started by training and skill building in selecting the salt tolerant species which has protected the islands during the Tsunami and in nursery raising, planting and caring of plantings as green shields. Multi-stakeholders namely the islanders and the staff of the Atoll office, personnel in MFAMR and Ministry of Environment, Energy and Water (MEEW) need to be trained in this movement right from the beginning.

Greater concentration and efforts are needed to enhance the density and beauty of the coastal forests, to safeguard the islands. In this connection, the potential of introducing into the Maldives the Andaman bullet tree – *Manilkara littoralis*, which has withstood the impact of Tsunami waves in Andaman and Nicobar islands, could be considered. This species could serve the dual purpose of protecting the coast and also adding aesthetic value with its huge size. If cultivated in resort islands, the Andaman Bullet tree will enhance the aesthetic value of the resort islands. However, this suggestion should be considered if there is no risk to the existing diversity in the context of species invasion, and any introduction should be done on an initial pilot scale.

Wild plants of edible value are observed in Baraah, which needs greater attention in the form of utilizing the germ-plasm available here. Collection, documentation and identification of the germ-plasm should be undertaken for greater understanding of the forest genetic resources of Maldives.

In Foamullah, the local people have adopted an innovative practice of controlling beach erosion. They cut the standing coconut trees on the edge of the beach, leaving half a meter of the tree trunk from the ground. As otherwise, if the entire tree falls due to erosion, it would remove the soil, further enhancing the erosion of the beach. This simple technique should be replicated in all the islands to prevent beach erosion wherever possible.

9. 2. Mangrove forests

The mangrove species *Lumnitzera racemosa* is distributed near the seacoast in Kulhudhuffushi. The marshland locally known as Kuda Kulhi was receiving seawater before the Tsunami. Due to Tsunami, the mouth, which was in the form of a small creek, has been closed and no sea water inundation is taking place now. In addition to this, right in the middle of the Kulhi, in between the marsh, a road has been laid bifurcating the marsh, thereby preventing the sea water inundation to the landward side of the marsh. According to local people and also as per this assessment, due to the road blockade the seawater inundation is prevented resulting in which, many plants are dying. The immediate step to be taken is to open the creek to facilitate seawater inundation during the high tide. Drainpipes should be installed to make water circulation across the road that has been laid. Otherwise due to stagnation of water, the mangroves will gradually die and the stagnant water will become a breeding ground for disease vectors like mosquitoes, like it is happening in Hithadoo in Addu atoll.

It was observed in Kulhudhuffushi, that *Sonneratia caseolaris* is cultivated in home gardens. According to local people, the fruits are edible and the fruit juice is a traditional drink. Large-

scale cultivation of *Sonneratia caseolaris* is recommended to revive the traditional practice of making juice out of these fruits, which can be promoted as a traditional drink.

The Atoll office has planted *Ceriops tagal* near the sea mouth. Propagules of *Ceriops tagal* has been brought from Kumundhoo Island and planted in 2004 by Magulas club with the help of a Japanese NGO.

In L. Hithadhoo of Laamu atoll, Mangrove species *Rhizophora mucronata* (Rando) were distributed in a large area of 1 to 1.5 sq. km. called Hithadhoo kulhi. This mangrove area is inundated by seawater regularly with a good opening. The proposed resort island “Olhuvelli” is close by. If this mangrove area is well protected and managed with board-walks it can generate revenue to the islanders through eco-tourism.

In Huraah of Maale atoll, the local community indicated that the mangrove swamp has comparatively reduced in area. The locals were getting revenue out of the mangrove swamp by selling the mangrove wood, which was used in boat building and boat-pushing poles. At present, the mangrove area is drying, as there is no regular tidal inundation to the interior of the mangrove swamp. It is recommended that, trapezoidal canals should be dug to facilitate tidal inundation. This will regenerate the mangroves and increase the vegetated area, which may otherwise gradually degenerate.

It is suggested that there should be a forestry person in each island, particularly in the islands in the northern part of the Maldives, where there are dense forests including mangroves. The ongoing practice of encroachment into mangrove forest may be stopped.

9.3. Fruit trees in home gardens

The damage to fruit trees in home gardens, particularly mango and breadfruit is severe and needs to be addressed. Mango is an income-generating crop and breadfruit is the staple food of the islanders. Breadfruit takes 15 years to yield fruits. Interventions like micro-propagation and mist chambers and nurseries for seedlings could be tried to reduce the gestation period and the mist-chambers could simultaneously be used for growing vegetables. There is a need for seed material and saplings of fruit, shade and avenue trees and ornamental trees. Seedlings of many fruit trees should be imported from neighboring countries to supply the affected families complementing the ongoing supply of seedlings by following adequate phyto-sanitary measures.

In Laamu atoll, seedlings of tree species like *Mimusops elengi*, *Syzygium cumuni*, *Annona reticulata*, *Annona squamosa*, *Tamarindus indica*, *Muntingia calabura*, *Terminalia catappa*, Jack fruit, Breadfruit, Clove, Wax apple, Great morinda, Mango and shade trees are to be supplied in the islands.

The Tsunami has acted as an eye opener for many Islanders. They are willing to cultivate fruit trees and trees for firewood and other uses in nearby islands if land is allotted, as there is no space available in the inhabited islands. They need saplings of Guava, mango, breadfruit and papaya. They are willing to raise nurseries for which the organic waste from the Islands could be used, which is right now, simply burnt out. It is proposed that, income generating species like *Sapindus emarginatus* (Soap nut tree) could be raised in the islands using tissue culture and mist propagation techniques. Fruit crops namely Pine apple, Rambutan, Jack fruit, Durians can be tried in addition to the crops that are being cultivated.

9.4. Local Area Initiatives as a starting point

The ongoing efforts of the island communities as local area initiatives could be used to start the suggested actions by initiating the process through the communities. During the discussions, the local people in the islands emphasized that the littoral forests need to be strengthened and developed to safeguard the dwellings in the island. As a local area initiative the islanders of Guraidhoo of Maale atoll, has started raising plants on the beach front with cuttings of magoo. In Madaveli, to strengthen the littoral forest the local community is planting wildlings of *Scaveola taccada* (Magoo) and *Pemphis acidula* (Iron wood tree).

In Baarah, there are three swampy areas with mangroves and survive by means of rainwater and the influx of salt water during high tides for which the locals have dug small channels. The locals have introduced a pipeline for facilitating seawater into one of these swamps. The islanders said that, otherwise the stagnant rainwater water becomes a breeding center for mosquitoes. The pipeline facilitating the seawater inundation was damaged by the tsunami and the mangroves are now surviving only on rainwater, hence could be threatened.

In Filladhoo, at present as a local area initiative, the islanders are planting *Bruguiera cylindrica* but on a very small scale. Proper measures need to be taken in order to ensure the survival and revival of mangroves in this island. Mangrove rehabilitation and restoration is recommended as an immediate action under coastal green shields as tsunami rehabilitation.

9.5. Linking forestry to tourism

In Maldives, there is a potential to link forestry and tourism under the long term tourism program, to enhance the aesthetic value of the islands and generate livelihood options by means of employment. Forest based tourism is on the increase and it has great potential in Maldives given the well-developed infrastructure. The example of Mauritius where a hotel owner has restored mangrove forest and uses this ecosystem for guided walks can be replicated in Maldives. The Soneva Gili, Resort island in North Male Atoll is promoting eco tourism by linking environment, forestry and tourism. The same management has another resort island, which is called as Soneffushi. The resort managers are willing to link forestry with tourism by establishing mangrove thickets in the resort island with board walks.

It is recommended that - *Manilkara littoralis* (Andaman bullet tree), which is a gregarious tree could be introduced in resort islands, which can provide necessary Tsunami proofing and would also add aesthetics of the resorts. The resort islands are willing to fund this type of initiatives.

9.6. Plan of operations

It has been observed during the assessment that the littoral forests have provided the protection to the islands and reduced the effect of tsunami by acting as green shield. As described earlier it is clearly evident from this assessment that those habitations, which were behind the thick green shield of littoral forest were protected. This situation has brought in an atmosphere where the local people started viewing the forests as protective shields. It is also clear that, the human, economic and social capital of Maldives is not safe unless it has ecological capital in the form of littoral green shields to protect the life and assets of the islanders.

The Government of Maldives has expressed the need for and interest for the sustainable management of forest resources, which has proved to be a life and material saving shield

during the recent Tsunami. A preliminary plan of operation for by OSRO/GLO/502/FIN to support the rehabilitation and sustainable management of forest resources has been developed and included in this report.

Suggestions for long term actions are also provided, based on the discussions and the needs projected by the policy makers in the MFAMR, Government of Maldives. The Government of Maldives may seek funding to plan and implement these projects through its country frameworks and bilateral and multilateral donor agencies. In this connection guidelines may be developed for Integrated Island Area Management (IIAM) for sustainable and integrated management of land and marine resources of Maldives. In addition to this, training and capacity building of the personnel in respective ministries in remote sensing and GIS for the sustainable management of the land and marine resources is necessary and hence recommended here. It is also suggested that Integrated Island Area Management Authority is constituted to implement the IIAM plan for sustainable management of Island resources.

9.6.1. Preliminary plan of operations

PRELIMINARY PLAN OF OPERATIONS

MALDIVES COMPONENT

OF

**FORESTRY PROGRAMME FOR EARLY REHABILITATION
IN ASIAN TSUNAMI AFFECTED COUNTRIES**

OSRO/GLO/502/FIN

I. BACKGROUND AND JUSTIFICATION

The Maldives is a chain of Indian Ocean islands spread over a distance of 900 kilometers. It is located between 7° N and 0°42' S and between 72° and 74° E. The land area covers about 26 geographic atolls grouped into 20 administrative atolls. The altitude of most of the islands in the Maldives is very low, just above sea level with the average elevation of 1.5 meters above sea level. The population of the Maldives is about 327,135. The country faces two main geographic challenges: (a) the presence of a highly dispersed land mass of very small size, resulting in a highly dispersed population, and (b) the low elevation of the existing islands. The area of the country is about 30,000 hectares, spread over 1,190 islands, of which 199 were inhabited prior to the Tsunami. This extremely low population density makes the Maldives unique, even among small island archipelagic states. It also raises the cost of delivering social services and of public administration, as there is hardly any scope to generate economies of scale.

The Tsunami traveled at over 700 kilometers per hour and reached Maldives at 9:20 AM on 26 December 2004. The Tsunami was the worst disaster ever to hit the Maldives. Waves of 1 to 4 meters wiped out several islands and destroyed both housing and livelihoods, leaving behind 83 people dead and 5% of the population homeless. Maldives is among the countries worst affected by the Tsunami. Thirty-nine islands were significantly damaged and nearly a third of the Maldives' people were severely affected. The Government has declared a state of emergency and has appealed for international assistance (OCHA situation report no. 5, 28 December 04).

After the Tsunami, and in order to fully evaluate the magnitude of the disaster and propose emergency interventions, FAO together with the Ministry of Fisheries, Agriculture and Marine Resources (MOFAMR) carried out an assessment for forestry program development.

Regarding the forestry sector, the main types of forests present in Maldives are littoral forests and mangroves. The littoral forests are dominated by *Scaevola* group which are saline tolerant. The mangroves are occurring only in some of the islands and are dominated by *Rhizophoraceae* members. The area of forests in the country is reported 3 per cent of the total geographical area. (or about 1000 ha), but a national forest inventory has not been carried out, and the forest cover appears from air travel to be perhaps many fold more.

The littoral as well as the mangrove forests are used by the local communities for boat building and other needs, but sustainable management practices are often not followed. There is considerable demand for boat building wood, particularly in the northern islands. Species namely *Hibiscus tiliaceus* (Sea hibiscus; Dhigga), *Ochrasia barbonica* (Cork wood; Dhunburi) *Calophyllum inophyllum* (Alexander laurel; Funa), *Diospyros ebenum* (Ebony; Kalhuvakaru) and *Tectona grandis* (Teak; Haivakaru) are used in boat building. In addition wood harvested from local forests, wood imported from outside the Maldives is transported from Male. However in the southern islands there is less demand for boat building wood, as the islanders prefer Fiber Reinforced Plastic (FRP) boats. Even for building the FRP boats, some wood (sourced locally) is used, but the demand is lower than in the north. Demand for firewood is comparatively low, since coconut refuse is also widely used for fuel.

Degradation of littoral and mangrove forest has been going on for a long time, and the tsunami caused additional damage in some places. . In some islands *Pandanus* and tassel plant were severely affected due to salt-water intrusion caused by tsunami. In some places *Calophyllum inophyllum* distributed close to the beach died. Observations also indicated that mangroves are showing indications of degradation due to deposition of sediments in both man made and natural tidal creeks, which facilitate tidal flow. With reference to the inland fruit gardens and avenue

trees, inundation of seawater due to tsunami and subsequent stagnation caused degradation. An estimate indicates that about 700,000 fruit trees and 840,000 timber trees were damaged in the inhabited islands. These losses affected about 11,500 households.

II. PROJECT OBJECTIVES, RESULTS AND ACTIVITIES

Principal Objective

The principal objective of the project is to improve livelihoods of the people in the tsunami-affected areas of the Maldives and decrease the risk of future storm-related damage in these areas through forest protection, forest rehabilitation, reforestation and agro-forestry.

Specific Objective

The specific objective of the project is to enhance the capacity of the local community, government institutions, NGOs and community-based institutions in rehabilitating, protecting and sustainably using the littoral and mangrove forest and their resources through participatory analysis and action

Results

1. Tsunami affected littoral and mangroves forests are restored and rehabilitated with the participation of local communities
2. Agro-forestry using multiple value trees and avenue trees promoted in Tsunami affected islands for sustainable livelihoods
3. Timber species used in boat building and for firewood raised to reduce the pressure on forest resources
4. Capacity of the stakeholders to sustainably manage existing and rehabilitated littoral and mangroves forests of Maldives enhanced

Activities per result:

Result 1

- 1.1. Demarcating and quantifying the littoral and mangrove forests affected by the tsunami and estimate seedling requirement through PRA
- 1.2. Import of seedlings for immediate plantation
- 1.3. Identification of nursery sites and infrastructure development for nursery raising
- 1.4. Establish centralized nurseries for seedlings of littoral, mangroves, fruit, avenue and timber yielding trees in worst affected atolls
- 1.5. Establish mechanisms for collection of wildlings
- 1.6. Provide training to women, men and youth in nursery development, management, plantation technique and participatory management
- 1.7. Planting of seedlings in affected areas and post care

1.8. Mobilizing and organizing Community Based Institutions for forest management in collaboration with community leaders and island authorities

Result 2

- 2.1. Identify families to benefit from agro-forestry by participatory mechanisms
- 2.2. Ensure community participation in selection and establishment of agro-forestry species
- 2.3. Plant and tender the fruit and avenue trees
- 2.4. Develop livelihoods for women by linking with agro-forestry activities

Result 3

- 3.1. Assess demand and selection of sites for timber and fire wood species involving community
- 3.2. Plant and post care of seedlings for boat building and firewood
- 3.3. Develop mechanisms for sustainable harvest of timber and firewood species

Result 4

- 4.1. Needs assessment and selection of trainees from community, government agencies and NGOs in collaboration with GOM through PRA
- 4.2. Identification of resource institutions and experts for training programs
- 4.3. Developing resource materials in local languages, developing training plans and organizing trainings
- 4.4. Community Based Institutions organized for participatory management in selected islands
- 4.5. Render training on nursery development, planting and post care and management
School children and community are made aware of role of littoral and mangrove forests as green shields against tsunami through essential awareness programs in local languages

Beneficiaries

The project beneficiaries are the vulnerable fishing and farming communities in the five worst affected islands and government agencies and NGOs. 100 families will directly benefit from nursery development and management, and 500 families will get seasonal employment in nursery raising and plantation activities in restoration of littoral and mangrove forests.

III. PROJECT IMPLEMENTATION

The implementation process must contain a degree of flexibility in order to adequately adapt project activities to variations and developments in this rapidly changing emergency rehabilitation phase.

Coordination

The FAO Representative in Maldives will assume overall responsibility for the implementation of project activities and liaise with the other participating members of the Multilateral Group (i.e. ADB, World Bank, and UN agencies), the Ministry of Agriculture, Fisheries and Marine Resources; the Ministry of Atolls Administration, the Ministry of Planning and National Development, Atolls Development Units, Islands Development committees and Women Development Committees.

The FAO Representative will be supported by the TCEO Programme field officer and TCEO at HQs Rome for project operations. Technical responsibility for the project is under the Forestry Department, through the Regional Coordinator, Forestry Programme for Early Rehabilitation in Asian Tsunami Affected Countries, in conjunction with forestry officers in HQs and the Regional Office for Asia and the Pacific in Bangkok (RAP).

Coordination between this project and other FAO projects in agriculture and fisheries will be facilitated through FAO's in-country coordination mechanisms as well as through the Tsunami Task Force and Tsunami Coordination Unit in RAP.

Beneficiary Selection

The criteria for beneficiary selection (see comments in the accompanying file) will be identified in close collaboration with the Ministry of Fisheries, Agriculture and Marine Resources and Atoll and Island Chiefs.

The beneficiaries will be poor artisan fishers and agricultural families in affected regions who lost their production assets, as well as families who have lost their livelihoods through the loss of family members.

The beneficiaries will be selected among the most affected communities and on the basis of their most urgent needs, their level of vulnerability and their alternative income sources.

The selection of the beneficiaries will observe the following:

- Selection of most affected atolls.
- Selection of targets Islands within the most affected atolls
- Selection of beneficiaries according to vulnerability analysis

Monitoring and Evaluation

Regular monitoring of project activities will be ensured through project consultants. Project consultants will also be responsible for the implementation of an end-of-project impact assessment evaluation of project activities.

The donor is invited to monitor the project throughout its implementation.

Visibility

FAO will ensure full visibility to the donor through logos, boards, stickers and publications. At the same time, FAO will ensure the maximum visibility of project activities through both national and international media and its own web site and internal publications.

Documentation and Publications

FAO will ensure the preparation of the necessary documentation to highlight the progress and achievements of project activities.

Complementarities with other interventions

FAO Project activities will be closely coordinated with those of other FAO emergency tsunami interventions in the Maldives for the fishery and agriculture sector, such as FAO Technical Cooperation Project TCP/MDV/3002(E) “Emergency assistance to support the rehabilitation of sustainable agriculture in tsunami-affected areas in Maldives; OSRO project OSRO/MDV/501/BEL “Immediate provision of agricultural inputs to worst affected fisher and farmer groups in the Maldives”; OSRO project OSRO/MDV/502/JPN “Emergency Assistance to support affected coastal communities in Maldives”; OSRO project OSRO/MDV/503/JPN “Emergency Assistance to support affected rural communities in Maldives” and other new projects that could be operational during the life span of this project.

Collaboration with NGOs and other international organizations.

FAO will discuss with the Ministry of Fisheries, Agriculture and Marine Resources the ways of collaborating with national and international NGOs in implementing the project activities in the islands.

Coordination and collaboration will also be sought with bilateral and international organizations in order to avoid duplication and to increase the synergies in project activities.

Procurement

Procurement will be implemented by FAO in accordance with FAO Procurement rules and regulations.

IV. WORK PLAN

Soon after project start-up, the FAO consultants will prepare a detailed project work plan, in consultation with national, atoll and island counterparts. The work plan will provide the basis for subsequent activities. It will review the proposed technical interventions and provide recommendations regarding the implementation.

Field level project activities will be executed in coordination with the concerned government departments, in particular the Departments of Fisheries and Atolls Development /Island development Committees, with assistance from the project staff.

At the end of activities, an impact assessment will be carried out by the FAO project consultants. The recommendations from the assessment will be incorporated into the action plan for a more comprehensive programme to be submitted to potential donors addressing the sustainable management of forest resources for sustainable livelihoods.

V. INPUTS FOR THE IMPLEMENTATION OF PROJECT ACTIVITIES

FAO will provide two types of inputs under this programme. The main input provided will be technical assistance and training of human resources within the MFAMR. The second input will be seedlings and material for nurseries establishment and planting.

Most of project activities requires a significant amount of community mobilization and involvement, which implies close, follow up and constant traveling among the islands where the forestry project will take place. This situation together with the high transport costs in the Maldives, calls for a significant allocation under the General Operating Expenses line.

The Technical assistance component of this forestry programme together with assessments, training, material preparation, community mobilization, running costs, transportation and logistic costs will constitute about 47% of the total budget. The expendable and non-expendable inputs provided by this programme under the 4 different projects will add up to about 53% of the total project budget.

Personnel Services

To ensure appropriate technical supervision and operational support from FAO headquarters, regional and field offices, and other standard supervisory functions.

International Consultants¹ (Forestry Specialist and Community Mobilization expert and Nursery and Afforestation specialist):

- Forestry Specialist and Community Mobilization expert (TORs in Annex II)
- Nursery and Afforestation specialist (TORs in Annex III)

Casual Labour

To cover the expenditures of office and administrative support and the expenses of casual labour for afforestation practices in public lands as well as small cash incentives for islanders and communities participating in the programme.

Travel

To cover the cost of travel and DSA for the FAO international experts, backstopping offices and cost of internal travel within the country to ensure adequate technical assistance, carry out the assessments and the different community mobilization activities.

Expendable Equipment

- nursery tools
- seedlings and planting material
- hand tools

Non- expendable Equipment

- nursery sheds
- irrigation equipment
- hand tools

Technical Support Services

For technical assistance, backstopping and monitoring of project operations by FAO headquarters/ regional offices.

General Operating Expenses

¹ The Terms of Reference as well as the international experts required are subject to changes by FAO as project activities and the emergency situation in the country evolve

This includes transport costs of inputs, superintendence, distribution costs for inputs, as well as monitoring and evaluation workshops, assessments, operational and maintenance costs and other miscellaneous running costs related to project implementation.

VI. REPORTING

A progress report will be prepared by the Forestry Specialist and Community Mobilization Expert project every two months. Based on these and other reports prepared by the consultants and by technical backstopping officers in the course of project implementation, a project final report in accordance with donors guidelines and procedures will be finalized by the Forestry Specialist and Community Mobilization Expert in consultation with TCEO at FAO headquarters and submitted to the Donor and to the Government of Maldives.

VIII. GOVERNMENT CONTRIBUTION AND SUPPORT ARRANGEMENTS

The Ministry of Agriculture Fisheries and Marine Resources will be the Government counterpart agency responsible for the project.

The Government of Maldives will:

- nominate a national project coordinator to liaise with the international and the national consultants on all aspects of project implementation;
- make available the services of qualified staff for the duration of the project as necessary;
- provide all necessary facilities for the efficient operation of the project including access to information, data, and storage space as required;
- assist in the transport of inputs to the beneficiaries free of charge,
- provide administrative and technical support that may be required for the successful completion of the project;
- allow the FAO Representative accredited to the country, or any other FAO official designated by him/her to visit the project sites to follow up the project implementation.

BUDGET
(FINLAND contribution in US\$)

MALDIVES BUDGET

Accts	Item	Sub/Child Account	Main/Parent Account
5013	Consultants		72300
5542	Consultants - Internationally recruited Community Forestry/Reforestation Expert 11 p/m @ US\$200/day)	66000	
	Nursery consultant (6 weeks @ \$150/day)	6300	
5014	Contracts		0
5650			
5020	Overtime		10000
5660	Locally contracted labour	10000	
5021	Travel		62500
5684	Travel - International consultants	62500	
5687	Travel - National consultant		
5023	Training		40000
	In-service training	40000	
5024	Expendable equipment		180,000
	Plants and seeds	150000	
	Other expendable equipment	30,000	
5025	Non-expendable equipment		50,000
	Communication equipment		
	Other non-expendable equipment	50000	
5027	Technical support services		
6111	Reporting		
6116	STS		
5028	General Operating Expenses		53200
	Other operating costs	53200	
5029	Support Costs		32000
6118	Direct Operating Costs 6.5%	32000	
	GRAND TOTAL		500,000

Work plan chart by activity and month
Draft work plan schedule:

Activities	Month											
	J	F	M	A	M	J	J	A	S	O	N	D
Activity 1												
1.9. Demarcating and quantifying the littoral and mangrove forests affected by the tsunami and estimate seedling requirement through PRA												
1.10. To import of seedlings for immediate plantation												
1.11. Identification of nursery sites and infrastructure development for nursery raising												
1.12. Establish centralized nurseries for seedlings of littoral, mangroves, fruit, avenue and timber yielding trees in worst affected atolls												
1.13. Establish mechanisms for collection of wildlings												
1.14. Training women, men and youth in nursery development, management, plantation technique and participatory management												
1.15. Planting of seedlings in affected areas and post care												
1.16. Mobilizing and organizing Community Based Institutions for forest management in collaboration with community leaders and island authorities												

Activity 2													
2.5.To identify families to benefit from agro-forestry													
2.6.Selection and establishment of agro-forestry species by involving community members													
2.7.Planting and tendering the fruit and avenue trees													
2.8.Livelihood activities for women by linking with agro-forestry activities													
Activity 3													
3.4.To assess demand and selection of sites for timber and fire wood species													
3.5.Planting and post care of seedlings for boat building and firewood													
3.6.Developing mechanisms for sustainable harvest of existing timber and firewood species													
Activity 4													
4.6.Needs assessment and selection of trainees from community, government agencies and NGOs in collaboration with GOM through PRA													
4.7.Identification of resource institutions and experts for training programs													
4.8.Developing resource materials in local languages, developing training													

plans and organizing trainings												
4.9.Organizing Community Based Institutions for participatory management in selected islands												
4.10. Training on nursery development, planting and post care and management												
4.11. Awareness programs in local languages to school children and community on the of role of littoral and mangrove forests as green shields against tsunami												
Reporting												

Logical Framework

	<i>Intervention Logic</i>	<i>Objectively Verifiable Indicators</i>	<i>Sources of Verification</i>	<i>Risks and Assumptions</i>
Principal Objective	To improve livelihoods of the people in the tsunami-affected areas of the Maldives and decrease the risk of future storm-related damage in these areas			
Specific Objective	To enhance the capacity of the local community, government institutions, NGOs and community-based institutions in rehabilitating, protecting and sustainably using the littoral and mangrove forest and their resources	<ul style="list-style-type: none"> • Number of hectares of littoral and mangrove forests restored and rehabilitated with community participation • Number of households obtaining benefits from sustainable agro-forestry activities in selected locations • Number of hectares of forest planted with boat building and firewood species • Number of initiatives involving community based institutions, NGOs and Government towards sustainable management of littoral and mangrove forests and agro-forestry 	<ul style="list-style-type: none"> • Ocular observation and measurements • Interactions with the community • Project document from inception to final 	Favorable weather conditions and policy environment.
Results	<ul style="list-style-type: none"> • Result 1 Tsunami affected littoral and mangroves forests are restored and rehabilitated with the participation of local communities • Result 2 Agro-forestry using multiple value trees and avenue trees promoted in Tsunami affected islands for sustainable livelihoods • Result 3 Timber species used in boat building and for firewood raised to reduce the pressure on forest resources • Result 4 Capacity of the stakeholders to sustainably manage existing and rehabilitated littoral and mangroves forests of Maldives enhanced 	<ol style="list-style-type: none"> 1.1. Establishment of centralized nurseries in worst affected atolls 1.2. Number of people trained in nursery development and management, plantation technique and post care 1.3. Number of hectares of affected area rehabilitated 2.1. Number of families benefiting from agro-forestry 2.2. Number of households established with agro-forestry species 2.3. Number women employed in agro-forestry activities 3.1. Number of hectares planted with boat building and firewood species 3.2. Existence of mechanisms for sustainable harvest of timber and firewood species 4.1. Number of people trained from Government, NGOs and the community 	<ul style="list-style-type: none"> • Project technical reports. • Monitoring/evaluation reports. • Physical verification and measurement • Group interviews of beneficiaries 	Favorable and essential support from the host government, community and civil society organizations No devastating natural or man made disaster occurs during project implementation

		<p>4.2. Availability of resources materials in local languages</p> <p>4.3. Existence of Community based management systems in selected islands</p>		
Activities	<p>Activities per result:</p> <p><u>Result 1</u></p> <p>1.1. Demarcating and quantifying the littoral and mangrove forests affected by the tsunami and estimate seedling requirement through PRA1.2. Import of seedlings for immediate plantation</p> <p>1.3. Identification of nursery sites and infrastructure development for nursery raising</p> <p>1.4. Establish centralized nurseries for seedlings of littoral, mangroves, fruit, avenue and timber yielding trees in worst affected atolls</p> <p>1.5. Establish mechanisms for collection of wildlings</p> <p>1.6. Provide training to women, men and youth in nursery development, management, plantation technique and participatory management</p> <p>1.7. Planting of seedlings in affected areas and post care</p> <p>1.8. Mobilizing and organizing Community Based Institutions for forest management in collaboration with community leaders and island authorities</p> <p><u>Result 2</u></p> <p>2.1. Identify families to benefit from agro-forestry by participatory mechanisms</p> <p>2.2. Ensure community participation in selection and establishment of agro-forestry species</p> <p>2.3. Plant and tender the fruit and avenue trees</p> <p>2.4. Develop livelihoods for women by linking with agro-forestry activities</p> <p><u>Result 3</u></p>	<p>Means</p> <p><i>Ultimately include Who & by, When for supervision and monitoring and evaluation</i></p>	<p>Costs</p> <p><i>Ultimately Include Physical Inputs to derive costs (work and productivity norms so that budget calculations can be justified and followed)</i></p>	

	<p>3.1. Assess demand and selection of sites for timber and fire wood species involving community</p> <p>3.2. Plant and post care of seedlings for boat building and firewood</p> <p>3.3. Develop mechanisms for sustainable harvest of existing timber and firewood species</p> <p><u>Result 4</u></p> <p>4.1. Needs assessment and selection of trainees from community, government agencies and NGOs in collaboration with GOM through PRA</p> <p>4.2. Identification of resource institutions and experts for training programs</p> <p>4.3. Developing resource materials in local languages, developing training plans and organizing trainings</p> <p>4.4. Community Based Institutions organized for participatory management in selected islands</p> <p>4.5. Render training on nursery development, planting and post care and management</p> <p>4.6. School children and community are made aware of role of littoral and mangrove forests as green shields against tsunami through essential awareness programs in local languages</p>			
				<p><i>Pre-conditions</i> Stable security situation and accessibility of the project area.</p>

TERMS OF REFERENCE

Forestry Specialist and Community Mobilization Expert

MALDIVES

Under the general guidance of the Chief TCEO; the technical guidance of the Regional Coordinator, Forestry Programme for Early Rehabilitation in Asian Tsunami Affected Countries; operational guidance of TCE; supervision of the FAO Representative (FAOR) for Sri Lanka and the Maldives; direct supervision of the OiC FAO Maldives and the FAO Emergency and Rehabilitation Coordinator for the Maldives; and in close collaboration with government counterpart officials, national and provincial authorities and in coordination with other international and national actors, the Forestry Specialist and Community Mobilization Expert shall:

- Within one month of arrival, and in conjunction with national, atoll and island counterparts and communities, develop a detailed plan for the project activities in the Maldives, in line with the project document for OSRO/GLO/502/FIN and the preliminary plan of operation for the Maldives. This should include:
 - results and their indicators
 - activities
 - geographic location
 - information on the location, area extent of the littoral and mangrove forests needing protection and rehabilitation and areas for potential reforestation in the atolls chosen for project implementation
 - list of communities in which the project will work to support forest rehabilitation, home garden rehabilitation and agroforestry, etc.
 - criteria for beneficiary selection
 - estimation of number of beneficiaries
 - responsible organization and institutional implementation arrangements
 - list of implementing partners that will support the community-level forestry activities
 - list of Local Area Initiatives that the project could assist
 - a training plan for the project
 - timetable of project activities
 - technical specification of inputs to be purchased for the project
 - detailed project budget
- In collaboration with the Emergency Coordinator and Regional Programme Coordinator, establish an operational structure to plan, monitor and provide management support and technical backstopping for the project
- In collaboration with the Emergency Coordinator and Regional Programme Coordinator, coordinate and supervise the implementation of project activities
- Liaise closely with the Regional Coordinator on all technical aspects of project activities and assist in the organization and implementation of regional activities (workshops, training courses, studies, etc.) in order to facilitate coordination and a programme approach across the regional programme's components.
- Work in close collaboration with FAO's agriculture and fisheries staff working on tsunami rehabilitation in Sri Lanka to ensure close coordination and integration of forestry, fisheries and agriculture activities, particularly as regards support to integrated coastal area management.

- Liaise with and seek the co-operation of other UN organizations, regional organizations, donors, NGOs and civil society organizations involved in rehabilitation of forests and home gardens in the tsunami-affected areas;
- Provide technical assistance, as required, to concerned government bodies, FAO implementing partners and to operational units providing assistance for rehabilitation of forests and home gardens.
- Review available information and brief the FAO Office and UN Country Team on ongoing and planned activities and assessments related to forest sector.
- Prepare a strategy for coastal forest rehabilitation and management in the Maldives and outline a process by which a corresponding plan could be developed, building on the project experience but expanding to national level
- Prepare project profiles and project documents for submission to donors for forest rehabilitation and forest and livelihoods initiatives.
- Perform other related duties, as assigned.

Reporting: Provide inputs for the FAO Maldives office monthly progress reports and send a technical report every two months as well as an end-of-mission report, which will describe in detail activities undertaken, problems and achievements and impact, lessons learned, conclusions and recommendations for the possible continuation of FAO assistance. The final report should be submitted to the Regional Coordinator-Forestry and the Chief, TCEO no later than one week after the completion of the mission.

Qualifications: Masters degree in forestry or a related discipline, experience in coastal forest management and community forestry, project management experience in developing countries, and a minimum of ten years work experience in forest rehabilitation and reforestation.

Duration of the assignment: 11 months

TERMS OF REFERENCE

Nursery and Afforestation Specialist

MALDIVES

Under the overall supervision of TCEO, the direct supervision of the FAO Officer in Charge in Maldives, the technical guidance of the Coordinator, Regional Forestry Programme for Tsunami Rehabilitation and with technical supervision by the Forestry Expert and Community Mobilization Specialist (FECMS), and in close collaboration with other project experts and MFAMR staff, the Nursery and Afforestation Specialist will:

- undertake a rapid assessment of requirements for littoral, mangrove and fruit and avenue tree seedlings and other planting material for rehabilitation and afforestation in the affected islands (these will be subsequently adjusted once the results of participatory rural appraisals with the beneficiary communities are carried out).;
- inspect the plant nurseries in Maldives from which the project will buy seedlings and cuttings, and provide an assessment report of their ability to produce planting material, particularly given the required plant health conditions;
- review other potential sources (wildlings, imports) of planting material, as well as resources (facilities, equipment, materials and personnel), available to meet immediate needs as well as longer term needs ;
- Develop a plan for procuring planting material to meet immediate needs (including purchase of existing nursery stock, collection of wildlings, importation of seedlings) and for meeting longer-term needs (including through the expansion of existing nurseries or establishment of new nurseries), while meeting the appropriate level of plant health protection established by Maldives
- import seedlings to provide for immediate planting needs (while awaiting the nursery seedlings), following the required precautions and regulations for import, including quarantine

On the basis of the findings in the nurseries, prepare some practical guidelines on pest/disease control at the production level in nurseries (the guidelines will be a practical protocol with recommendations and specifications of material needed and actions required);

- provide training on nursery management to five selected MFAMR staff and for labourers hired to work in the nurseries;
- formulate proposals and recommendations for the management of plant material post planting;
- prepare a technical report at the end of the mission which will be provided in paper and electronic format on completion of the mission;

Qualifications:

University degree (if a national consultant) /Masters degree (if an international consultant) in forestry or a related subject, with at least 8 years experience in nursery development and management in Asia (in the Maldives a plus). Experience in carrying out training activities.

Language: English
Duty Station: Maldives

Duration: Six weeks in one visit

Security: before starting the mission/travel, the consultant must find out in what security phase is the country of assignment and what this implies for his own security. As soon as he arrives at the duty station, through the FAO Representation or directly he must contact the designated UN security officer to be briefed on all the recommended security measures. In case this procedure is not properly applied, the consultant may not be covered under the Malicious Acts Insurance Policy.

Health: all Consultants and staff members, on duty travel, must accept responsibility for their health and well being as part of their official duties and also on their return.

The following are the main responsibilities of the traveler:

- seek health advice, preferably four to six weeks before travel;
- comply with recommended vaccinations and other prescribed medication and health measures;
- ensure health precautions are taken before, during and after travel;
- obtain a physician's letter pertaining to any prescription medicines, syringes, etc., Being carried;
- precaution to avoid transmitting any infectious disease to others during and after travel;
- report any illness on return, including information about all recent travel; and respect the host country and its population

9.6.2. Suggestions for Long-term Actions

Development and implementation of Integrated Island Area Management plan

The Maldives being a signatory to the Agenda 21 Action plan has a commitment to develop an Integrated Coastal Zone Management. The purpose of ICZM is to address issues related to competing demands on the coastal zones, whilst enabling sustainable use. This assessment has not come across any progress in developing guidelines of ICZM. There is a need for such guidelines of ICZM as it can address issues related to management of coastal forests both for conservation and to ensure that the modifications in the coastal areas do not increase vulnerability to erosion or storm surges.

In addition to the above, in order to protect and manage the natural resources of the Maldives in a holistic manner there is a need for broad framework guidelines to achieve the above. However, to achieve the desired goals the ICZM should be worked in the mode of Integrated Island Area Management (IIAM), which includes a wider and holistic approach. These guidelines should address the issues related to assessment, data collection and sustainable management of natural resources of Maldives. In order to effectively implement the IIAM guidelines there is a need for an Island Area Management Authority (IAMA) to restore, reinforce or for the fortification of shore areas linking to Disaster management.

This unit could undertake the necessary study on shoreline changes through remote sensing and GIS data. Remote sensing and GIS information is very vital for a country like Maldives and essential in order to undertake sustainable shore area management, and also to develop island area management guidelines and implement island area management plan.

There is a need for such an authority, as there has been commendable work done by different international development and rehabilitation agencies, which lies scattered. This newly formed authority should maintain all documents prepared by the agencies and work on them by implementing the activities and recommendation made by them. This will also help to derive necessary inputs for any future work on island area management.

There is a well-established administrative system in place, in island office of each atoll. There is a need to turn this administrative system to a Result Based Management system for better management of the coastal and marine areas. At present details on land use management and Coastal Zone Management is not available at the Atoll office. Most of the islands have no details on the natural resources like littoral forests, coconut groves and mangrove forest and different land use patterns. Strengthening and mainstreaming the Island and Atoll level capacity in forest resources management can achieve this.

Suggested Basic principles to be taken into consideration while developing guidelines of Integrated Island Area Management*

Ecological, cultural and livelihood security should be the cornerstones of Integrated Island Area Management

* Adapted from report of the Dr. M. S. Swaminathan committee for ICAM, Ministry of Environment and Forests, Government of India, February, 2005

The entire island area including the marine part should be taken up for an integrated, holistic, multi-disciplinary management

Regulation, education and awareness and social mobilization should be components of a multi-stakeholder, participatory, sustainable management strategy

The conservation and sustainable development of the marine and coastal environment and resources should be in conformity with the international law, as laid down in 1982 UNCLOS, as well as with the suggestions contained in chapter 17 of Agenda 21. Every effort should be made towards ensuring an Integrated Marine and Coastal Area Management (IMCAM) as prescribed in the 1995 Jakarta Mandate under the CBD

Coastal regulation needs to be based on sound scientific and ecological principles and should safeguard both natural and island heritage. Areas of ecological and environmental significance such as biodiversity rich islands particularly the uninhabited and unexplored islands, islands of aesthetic value, turtle nesting places, breeding and feeding grounds of birds should be conserved and managed.

The precautionary approach should be used where there are potential threats of serious or irreversible damage to ecologically fragile and critical coastal and marine resources. Scientific uncertainty should not be used as an excuse for the unsustainable exploitation of coastal resources.

Irreversible risks and harm to human life, critical island systems and resources should be considered unacceptable. Ecological economics should underpin economic activities, so that present day interests are complementary to future prospects. Biological, cultural and natural assets should be considered invaluable and irreplaceable and should receive overriding priority in the allocation of resources for its conservation and sustainable management.

Every conscious effort should be made to promote sustainable fisheries, prevent loss of biological diversity, prevent all forms of marine pollution and ensure that island area development and urbanization are eco-friendly

The strengthening and rehabilitation of coastal forests including mangroves, coral reefs and sea grass beds should confer short and long term ecological and livelihood benefits. An important lesson taught by Tsunami is that the presence of littoral forests is a boon for the security of fragile islands like Maldives. Sustainable management of thick and continuous green shields will ensure both ecological and livelihood security. Green shield development and sustainable management should be undertaken for island prosperity coupling with employment generation.

The above should be coupled with Training and capacity building in assessment and sustainable management of coastal forests and coral reefs using remote sensing and GIS techniques.

Technical capacity of the personnel responsible for forestry is to be enhanced in order to undertake inventorization to planning to management. There is need for inter departmental role clarity.

Remote sensing data usage is one area where Maldives needs capacity building in acquiring data, processing the same and using.

At the atoll and island level, atoll chief is in-charge of the atoll and so is the island chief. The administrative staff under the atoll and island chief looks after the natural resources management of the respective atolls and islands. The atoll office does the administration and requires necessary technical and scientific expertise to manage the forest resources.

The different Ministries in charge of the overall management of forest resources of Maldives need to enhance their required expertise in the technical aspects of forest management. In this connection, there is a need for capacity building of staff of different departments and NGO's in the assessment and sustainable management of forests. Hence, Training and capacity building in assessment and sustainable management of coastal forests and coral reefs using remote sensing and GIS techniques, may be taken up for long term benefits.

The training could be done by means of Trainers of Training mode workshop wherein experts from Universities specialized in remote sensing and GSI, like Forest Research Institute, Dehradun, India and from Research, based development oriented NGOs' could organize the training courses in Maldives. The trainees can get practical training in the islands and for reorientation they could be sent to Australia and India for further refining of their skills.

9.7. General recommendations

Maldives being an atoll with low soil fertility, agro forestry with coconut as the main resource crop, will be a promising prospect as a sustainable land use system, which can emerge as a good micro enterprise with coconut oil industry. Coconut coir is available in plenty and products made out of coir and the other coconut tree products will have great market potential given the tourism the Maldives has. Training in coir doormats making, ornamental product making could be revenue earning for the people particularly women who live in far off islands. This would also reduce import of synthetic products of domestic need thereby reducing pollution.

There is a potential for agro-forestry in this island. The fruit and shade trees occurring on the low level areas were damaged. There is a need for developing fruit and shade trees in which possibilities of growing cashew could be looked into. If possible some spice crops like clove, could be cultivated which could become a good income and employment generating intervention. There is a priority need for human capacity building and tools for undertaking agriculture combined with agro-forestry. In this connection there is need for higher education and extension in collaboration with agriculture universities in nearby countries and under the over all guidance of IAC, Wageningen, The Netherlands. There should be a definite plan for sustainable agriculture using minimum land area available. Otherwise, the Maldives will loose its forest cover due to agriculture extension.

Declaring some islands, which are far from human interference as heritage islands to conserve the pristine biodiversity to use the genetic resources in future.

Terms of Reference

Background

The Indian Ocean tsunami that occurred on 26 December 2004 caused serious damage and loss of lives and livelihoods in coastal communities and ecosystems in India, Indonesia, Malaysia, Maldives, Myanmar, Seychelles, Somalia, Sri Lanka and Thailand. The degree of damage varies markedly throughout the area, as does the capacity and capability to respond to the rehabilitation and reconstruction livelihoods and restoration of the coastal landscape.

In the Maldives, mangroves and other natural coastal vegetation, coastal plantings, agroforestry, home gardens and fruit and amenity trees were damaged to varying degrees by the tsunami. Preliminary information suggests that in some places mangroves provided a buffer and protection from the major impact of the tsunami, but in other places some mangrove areas were destroyed. The full extent of the damage is still not clear, particularly the longer term effects on soils and trees, of inundation of salt water. Dieback of *Terminalia*, *Guettarda*, *Hibiscus* and *Cordia* were reported, but recovery of some species will occur with onset of rains.

Much of the infrastructure and civil buildings destroyed by the tsunami were made of wood, including wooden boats, piers, houses and other buildings. Many of the communities affected by the tsunami rely on fuel wood for cooking. Almost all construction wood is imported from overseas. An assessment of whether there are any issues to be addressed regarding the supply of wood and wood products for rehabilitation and reconstruction is needed.

FAO is implementing a programme financed by the Government of Finland that will support forest-related tsunami rehabilitation in the affected countries in Asia until the end of 2006. One component of this programme is a forestry project in the Maldives. A consultant is required to carry out a forest sector damage and needs assessment in the Maldives and to develop a draft project document and work plan. The consultant would: evaluate the extent of damage to mangrove forests and other coastal vegetation; identify the opportunities for forest sector interventions that would contribute to rehabilitation and reconstruction in the affected areas so as to improve the livelihoods of the local people and make them less vulnerable to future such disasters; and determine the needs to strengthen Government capacity in forestry, in particular for the reconstruction effort but also in policy, planning and management for long-term development of the country's forest sector.

Tasks to be Undertaken by the Consultant

This consultancy will be carried out under the operational leadership of FAOs Emergency Operations and Rehabilitation Division (TCE). TCE's mandate is "to enhance rural people's resilience and ability to recover from human and natural disasters". Within the context of the Asian Tsunami emergency response, TCE is working closely with the Governments of affected countries and with partner agencies to provide emergency assistance and rehabilitation of the agriculture, forestry and fisheries sectors. This includes extensive needs assessment, recovery planning, provision of substantial material inputs, and mobilization of communities to support recovery processes. Due to the rapidly evolving nature of the response, there is a requirement for flexibility in addressing these needs, and the Consultant may be called upon to support assessments, planning, project design and management of actual delivery of assistance as required by the circumstances

Under the general guidance of the Chief TCEO, the technical guidance of the Tsunami Technical Focal Point for Forestry and responsible forestry officer in the Regional Office for Asia and the Pacific; under the overall supervision of the FAO Emergency and Rehabilitation Coordinator/Representative in the Maldives; in close cooperation with Government of the Maldives (GOM) officials at various levels; and in coordination with representatives of other international organizations, donor countries and NGOs involved in the forestry sector, the main tasks of the consultant are as follows:

Assess the areas of mangroves and other coastal forests destroyed or damaged by the tsunami;
Meet with forestry and other relevant officials in the Ministries of Fisheries, Agriculture and Marine Resources to gather information on: the status of tsunami impact and needs assessments; opportunities for forest sector interventions that would enhance rehabilitation and reconstruction efforts; related activities of the GOM, IOs, NGOs, bilateral organizations, etc; and capacity building needs of the GOM related to forests;

Identify key players and contacts in rehabilitation, reconstruction and restoration activities related to forestry, environment, livelihoods and integrated coastal area management and meet with them to gather information on their respective activities;

Assess the status of information and knowledge in the country on the role of mangroves and other coastal vegetation (including coastal scrub and trees) in mitigating the impacts of tsunami, tidal surges and storms;

Determine the areas potentially suitable and available for rehabilitation or replanting of coastal vegetation and mangroves for coastal protection and environmental benefits, within the context of integrated coastal area management;

Identify opportunities for community plantings, home gardens, agroforestry, fruit trees, and trees for amenity and/or shade to restore and improve livelihoods;

Identify the physical and technical inputs required to support the proposed forest rehabilitation and reforestation activities, including needs for forest nurseries and seedling distribution systems;

Identify opportunities for small scale forest-based enterprises and the actions needed to develop them;

Through contacts with relevant GOM officials and organizations involved in reconstruction of housing, other infrastructure and fishing boats, assess whether there are any issues or difficulties to be overcome related to provisioning of wood for these purposes;

Determine the education, training and extension support necessary to strengthen the Government and community capacity to implement the rehabilitation of mangrove forests, coastal trees, nursery management and mobilization of communities and farmers to participate in integrated coastal area management.

Prepare a draft programme proposal and work plan for FAO's forestry-related programme to assist in the tsunami rehabilitation effort in the Maldives, outlining the various actions, requirements and terms of reference for technical inputs, financial inputs, institutional arrangements and potential partners.

Travel itinerary

Sl. No	Date	Name of the Atoll	Name of the island	Number of Days	Counter part
1.	24 th August	South Male	Guraidhoo	One day	Mr. Abdulla Asfal,
2.	25 th August	North Male	Kaashidhoo	One day	
3.	26 th August	Addu (South Maldives)	Feydhoo Maradhoo- Feydhoo Maradhoo and Gan	One day	Ministry of Fisheries, Agriculture and Marine Resources
4.	27 th		Meedhoo, Huludu and Hithadu	One day	
5.	28 th	Foammullah	Foammullah	One day	
6.	29 th			One day	
7.	30 th	South Huvadhoo	Madaveli, Hoadedhdhoo	One day	
8.	31 st		Thinadhoo and Khadedhoo	One day	
9.	1 st Sep	North Thiladhunmathee (North Maldives)	Baarah	One day	
10.	2 nd		Filladhoo, Kelaa	One day	
11.	3 rd	South Thiladhunmathee (North Maldives)	NolhivaranFaru and Kulhudhuffushi	One day	
12.	4 th		Hanimadhoo	One day	
13.	5 th Sep	Male	Briefing Meeting with the Hon. Minister, Mr. Abdulla Kamaaludheen, Ministry of Fisheries, Agriculture and Marine Resources	Afternoon 2.00 to 3.15	
14.	6 th Sep	Male	FAO office	One day	
15.	7 th Sep	Male	Soneva Gili Resort	One day	
16.	8 th Sep	Laamu	Atoll office visit at Gan		
17.	9 th Sep	Laamu	Isdhoo, Dhabidhoo, Maabaidhoo, Mundhoo and Hithadhoo		
18.	10 th Sep	Laamu	Gan, Maandhoo, Kaddhoo and Fonadhoo		
19.	11 th Sep	Male	Meeting with officials at MFAMR and MRC. Report writing		
20.	12 th Sep	Male	Meeting with officials and Report writing		
21.	13 th Sep	Bangkok	Debriefing		
22.	14 th and 15 th Sep	Bangkok	Debriefing and report writing		
23.	16 th to 19 th Sep	Chennai and Kakinada	Report writing		

The islands were selected in consultation with FAO office, Maldives, MFAMR, and MEEW and by reviewing the reports.

Meetings with personnel

Personnel met	Topic of discussions
Met Dr. Simmathiri Appanah, RAP, FAO, Bangkok	Status of forests and forestry in Maldives, what are the roles the mangroves are playing at present and what kind of interventions FAO can make in enhancing the role of coastal forests in proving multiple benefits. What the other agencies are doing right now and are they involved in above work and their willingness to collaborate with FAO.
Mr. Patrick Durst, RAP, FAO, Bangkok	Discussed the need for capacity building for NGO's and other agencies involved in developing shelterbelts. The need for an understanding on the ecology of mangroves and beach forest ecosystems for raising shelterbelts.
Met Mr. Masakazu Kashio, Forest Resources Officer, RAP, FAO, Bangkok	Protective and productive functions of mangroves like the role played by mangroves in preventing coastal erosion, filtering the pollutants. The other economic, ecological and livelihood functions. The role of NTFP in socio-cultural and religious aspects of mangroves. Ecological, sylvicultural aspects and scientific way of management. Ways and means of reducing the timber import, mainly for fuel wood and construction purposes.
Met Mr. Hiroyuki Konuma, Deputy Regional Representative, RAP, FAO, Bangkok	To interact with International Organisations on developing collaborative projects.
Peter A. C. Ooi, RAP, FAO, Bangkok	Need for participatory arrangement for sustainable management of resources and livelihoods
Mr. Yon Fernandez De Larrino Arcal of FAO, Maldives.	Discussions on the mission and assignments and logistics to undertake the field visits. Damage to coconuts because of beetle attack and the effect of this to tourism has a negative impact as the resorts loose their aesthetics with leafless coconut palms. Tsunami damage to mangoes.
Ms. Aminath Safia, Director, MFAMR	Discussed about the planning to visit different islands. Need for rehabilitation and management of forests and recommendations to the GOM.
Mr. Winston Rudder, FAO, Maldives	Issues related forestry cover in Maldives and value of timber and non timber resources. Multiple value trees species for sustainable livelihoods.
Mr. Mohammad Ali, Secretary Min. of Environment and Natural Resources, Government of Maldives	Mangrove forests distribution in Maldives. Forestry related laws and acts and policy issues in conservation and management of forest resources. Information on Coastal Zone Management.
Mr. Ibrahim Shareef, Project Manager and Mr. Abdullah Asfal, Agriculture officer, Ministry of Fisheries, Agriculture and Marine Resources, Government of Maldives	Distribution and status of forests including mangroves in different islands. Data available and the capacity of the personnel in the MFAMR in assessment and management of forest resources. Tsunami damage to forests in different islands
Mr. Mohamed Zuhair, Deputy Director, Protected Area Management, and Mr. Mohamed Zahir, Assistant Director, Biological Diversity from Ministry of Environment, Energy and water.	Protected Area management in Maldives. Possibilities of including mangroves under protected area management because of the multiple functions it plays.
Ms. Elbegzaya Batjargal, Environmental Specialist, UNDP and Ms. Shooza Aminath, Program Assistant, UNDP, Maldives	Linking UNDP programmes on disaster management with FAO programme on forestry development
Mr. Abdullah Kamaluddin, Hon. Minister, Ministry of Fisheries, Agriculture and Marine Resources, Mr. Mohammed Zuhair, Deputy Minister for Agriculture, Mr. Naseer, Executive Director for Agriculture and Fisheries.	Briefed about the mission and what has been accomplished so far and the plan of the report preparation. The minister wanted a national plan for forestry management. He also suggested that if need be there can be Department of Forestry and Agro-forestry. Discussions on Community participated forest management with NGO involvement. On the Need for Integrated Coastal Area Management
Mr. Ali Rilwan , Bluepeace, NGO Maldives	Status and degradation of mangroves in Maldives. Raising mangroves through community based approach. Institutional and policy issues in forestry management in Maldives
Dr. Shiham Adam, Director, Marine Research Centre, Government of Maldives	Regarding the coastal zone management regulations he said, "we would like to have one". He said that there is no conscious, consolidated, and committed effort in putting together the fragmented material available on forestry or coastal zone management.

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