联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Продовольственная и сельскохозяйственная организация Объединенных Наций | Organización de las Naciones Unidas para la Alimentación y la Agricultura | منظمة الأغذية والزراعة للأمم المتحدة

LATIN AMERICAN AND CARIBBEAN FORESTRY COMMISSION

THIRTY-FIRST SESSION

Montevideo, Uruguay, 2 - 6 September 2019

8.1.4 Conservation of Coastal Forest in Caribbean SIDS Countries

Secretariat Note

I. Mangrove forest in the Caribbean

1. Prior to human colonization, the islands of the Caribbean and the land areas around the Caribbean Sea were covered with forest. The forest cover extended to the coastal zones. Depending on the topography a variety of coastal forest types developed. Along steep coastlines forests transitioned abruptly from rocky shores, coastal cliffs or sandy beaches through coastal thickets, which varied depending on the precipitation regime between cactus and coastal scrub to tropical forest with Manhaniele (*Hippomane* sp.), Cocothrinax sp or Roystonea sp. palms, sea-grape (Cocoloba sp.).

2. Along the shallow coast lines mangrove forests developed. Mangroves are a transitional forest between the open sea and the hinterland. Mangrove forest are typical for low laying and shallow coastal plains around the Caribbean. Most of the volcanic islands of the southern Caribbean have a steep gradient from land to sea. Mangroves are rare on those coastlines and often limited to narrow band or isolated patches of mangroves. The larger islands of the Caribbean and the continental countries around the Caribbean Sea have extensive mangrove areas.

3. Only a few plant families (e.g. Rhizophoraceae, Avicenniaceae and Combretaceae) have developed physiological and structural adaptations to the brackish water habitat in which mangroves live. The exact number of species is still under discussion and ranges from 50 to 70 worldwide according to different classifications. At first sight, the most easily recognizable adaptation developed by mangroves to the tidal environment is the aerial rooting system, which is completely or partly exposed to the atmosphere at least part of the day but covered by water during high tide. Its main functions are the exchange of gases, anchorage of the tree in the muddy soil, absorption of nutrients and a first filter

of salt from the sea water. Processing excessive salt in the water absorbed is one of the biggest challenges in the salty environment in which mangroves live. These plants have developed several methods, according to the species, to desalinate ocean water. (FAO Forestry paper 153 "The worlds mangroves 1980-2005")

4. Mangrove forests are limited to tidal zones. Unlike most other trees mangroves can grew with salty or brackish water. It is not that mangroves like salt water, it is more that they are the only species which can tolerate a high level of salt as the plants have developed a mechanism to emit salt. Further inland the salt content in the soil water decreases and other faster and higher growing tree species take over. Therefore, mangrove forests are best described as transitional forest societies. Towards the sea side the trees are short, often less than 5 m high, further inland the tree height generally increases until the salt content in the ground is so low that other, not salt tolerant species, take over from mangroves.

II. Mangrove forests have many functions

5. Mangrove forest have a very special function in protecting the shoreline against erosion. Their root system holds the soil and absorbs the force of the waves. The dense root systems reduce the speed of the water movement. This lowers the likelihood of erosion and encourages sediment deposition. During high tide sediment laden waters flood the mangrove forest, the root system of the mangrove trees calms the movement of the water and enhances the sediment deposition.

6. In order to protect the hinterland the mangrove belt should be wide enough to absorb the wave energy. The example from Suriname shows that sea dikes without a protecting belt of mangroves are very vulnerable to erosion. Waves directly hitting the dike, reflect the energy of approaching waves which leads to erosion in front of the sea wall; this weakens the base of the dike. In order to be effective, man-made sea walls or dikes ideally require a belt of mangrove forest in front of them in order to be durable.

7. Mangrove forest are not only important for protecting the coastline against erosion: mangrove plantations in combination with other land reclamation techniques can also be used to restore eroded coastlines. Along the north coast of Suriname, the original mangrove forest was removed and consequently the coastal erosion increased. To restore the coastline sediment traps made of wood and bamboo were installed. The sediment traps decreased the speed of the water flow and increased deposition of the sediments. The pilot site in Suriname showed a raise of the sea bed of approx. 1.1 m in 3 years following the construction of the sediment trapping units.

8. Once the elevation of the deposited sediment has reached the level of the average high-water level during the spring tide, its growth slows down drastically. Further growth in height will only take place if the mudbank that is formed due to the construction of the sediment trapping units, is colonized with mangrove trees. On the pilot in Suriname mangrove seedlings were planted on the elevated mud beds. The planted mangrove seedings survived well and the newly planted mangroves continue to trap more sediment.

9. Mangrove will trap sediments, however, other factors such as the presence of the mudbank, the distance to the mudbank, the location of the site in relation to the prevailing current will also impact the rate of the sedimentation. The experiences from Suriname show that a mangrove plantation can increase the effectiveness of man-made coastal protection, (Naipal pers. communication).

10. Mangrove forest along the coastline also provide a belt of wind protection, providing reduced wind speed and absorbing the negative effect of sea-blast on agricultural fields adjacent to the shore line. Sea-blast and salt intrusion can be important stressors for agricultural plants and lead to the reduction of productivity, for coastal farms. Even against extreme weather events mangrove forest provide protection. A belt of mangroves breaks the force of the waves and even if damaged mangroves are very resilient and re-generate quickly. Their existence reinforces the man-made coastal protection systems.

11. Mangrove forests are a mosaic of different habitats for many bird and other animal species. Due to their transitional character, mangroves provide the unique conditions these species require. For example, the adult birds of the Scarlet Ibis (Eudocimus ruber) feed on the mud plains on the sea side of the mangrove, while their young chicks need insects from the freshwater of brackish water marches on the inland side of the mangrove forest. The example shows that it is not enough to protect only the center of the mangrove belt. As mangroves are transitional ecosystems, it is therefore important to protect all stages of the transition from the salty conditions on the sea side to the backwater habitant on the inland side of the mangrove forest. Different mangrove species are adapted and linked to specific salt content in the water and soil conditions, which needs to be taken into consideration when restoring and planting mangroves.

12. For the fishing industry mangroves are important reproduction sites. The calm and shallow waters in the mangrove forest are rich in nutrition and provide protection for many economically important fish species. A wide range of commercial and non-commercial fish and shellfish depend on these coastal forests. The role of mangroves in the marine food chain is crucial. When mangrove forests are destroyed, declines in local fish catches often result. Assessments of the links between mangrove forests and the fishery sector suggested that for every hectare of forest cleared, nearby coastal fisheries lose some 480 kg of fish per year (MacKinnon and MacKinnon, 1986).

13. In addition to the protective functions and the importance for the fish industry mangroves provide a wide range of forest and non-timber forest products. Because of the relative small size of most mangrove trees, the wood is used as round wood for poles, building of fish traps or used for firewood or charcoal. A traditional use in the past was the use of the bark to tan leather. Mangroves are not suitable for commercial forest operations, however they provide a wide range of locally consumed forest products, that are important at the local community level especially in small islands.

14. On average, mangrove forests are estimated to store 3 to 4 times more carbon than tropical forests by retaining carbon in biomass and locking it in marine mud (Donato, et al., 2011). Reducing carbon emissions by avoiding the deforestation or degradation of mangroves or accumulating carbon by restoring mangroves has a great potential for climate change mitigation. The inclusion of mangroves is now being promoted by a number of organisations and is being incorporated into national REDD+ programmes.

III. Threats to mangroves

15. Through their location mangrove forest are threatened. Coastlines and estuaries are preferred areas for human settlement. Large scale industrial and infrastructure development concentrates along the coastline and have replaced the original mangrove forest. In many places the biological protection the mangroves provided was replaced by marine and costal engineering work. In rural areas coastal swamp and mangrove forest was replaced by agricultural fields for the cultivation of rice and other large-scale plantation crops. Another threat to mangroves are the establishment of large scale shrimp or fish farms. The process of converting mangroves continues because their real value is not recognized, and wetland areas are often considered as idle land and too often seen only as a land reserve.

IV. Other coastal forest

16. Further inland, mangrove forests are followed by swamp forests or forests on mineral soils above the ground water level, depending on the gradient the landscape raises from the shoreline. As the elevation raises above the direct influence of the water table the rainfall pattern determines the forest type. On the windward side of the island, where the rainfall is higher, the mangroves are followed by low land tropical rainforest. On the leeward side common vegetation types are dryland scrub or dry forest vegetation. Most of the human settlements on the Caribbean Islands are located on the dryer,

leeward side of the island. Agriculture, villages, cities, tourism and other industrial development have replaced most of the original vegetation. This is the reason why dry forest ecosystems are the most threatened forest type in many of the Caribbean islands. Remaining are often only isolated patches for forest in a landscape dominated by built-up areas or agriculture. These islands of forest need to be preserved because they harbor the biodiversity of past and almost lost habitats. A typical example is a Grenada dove (*Leptotila wellsi*), a ground dwelling endemic bird which only lives in the dry coastal scrub forest of Grenada. This bird population is confined to 2 known sub-populations which live in an area of less than 94 ha. This is all what is left of this forest type, and these habitats are threatened by conversion to high-end residential properties with access to beaches and a marina. Like mangroves dryland forest ecosystems are often seen as unproductive land and only considered as land reserve for future urban and industrial development.

17. Even if it would be possible to preserve all these isolated patches of forest, these dryland forest formations are threatened by climate change. It is expected that with climate change the leeward sides of the islands will become dryer. In an undisturbed landscape the dryland forest formation could move upwards and further inland. However, with most of the dry forest occurring in isolated patches, surrounded by human development, there is little space for any upward movement of these forest types across the landscape in response to climate change. To preserve the remaining patches of the dryland forest formations it is important to preserve them by establishing protected areas across a vertical gradient. Just as the composition of the mangrove forest changes with the salinity, the composition of dry forest formation changes with elevation and increased humidity. If the dryland forests are understood as a transitional ecosystem between the shoreline and the submontane forest it becomes clear that to protect the multitude of habitats, a protection approach that takes a reef to ridge focus must be established.

V. Restoration of riverine forest

18. Riverine of gallery forests are important “conduit” systems, which are relative narrow strips of forest along waterways and rivers. Agriculture, urban and industrial development have almost eliminated these forest systems. But forest and trees along the river are especially important. They stabilize the river bank, they provide shade to the waterway and keep the water temperature and oxygen content in the water stable and finally they provide a corridor for wildlife to move across the landscape. Gallery forests can be the bridges between the isolated patches of coastal forest and the inland forest in the upper watersheds. To re-establish at least some kind of connectivity within the landscape the restoration and reforestation of gallery forest should be a priority.

VI. FAO’s cross sectorial approach to the management of mangroves and other coastal forest

19. The Food and Agriculture Organization of the United Nations (FAO) holds the premier UN mandate for forest and fisheries management and works on issues related to sustainable land and water management as well as climate change. In recent decades, FAO has prioritized addressing issues of unsustainable development and environmental degradation by promoting an integrated and cross-sectoral approach.

20. Since 2006, FAO has led 29 projects directly related to mangrove ecosystems worldwide; these include 6 publications, 1 toolbox, and 22 field projects. The field projects were established in 28 countries throughout South America, Africa and Asia. FAO has carried out considerable work on assessments and research connected to mangroves, using both local and international knowledge, to assess the condition of mangroves and their management. Sixteen of the 22 mangrove projects implemented by FAO since 2006 explicitly addressed *Livelihood opportunities and Food Security* as key areas of work.

21. Maintaining the premier UN mandate for forest and fisheries management, FAO promotes an integrated approach to sustainable mangrove management, mainstreaming ecosystem services to fisheries and aquaculture, and fostering supportive enabling environments. FAO is committed to establish collaborative partnerships in support of countries to achieve their international commitments through sustainable mangrove and fisheries management.

VII. Points for consideration

In view of the above, the Commission may wish to discuss and recommend members and request FAO's support to:

- The development of policies to provide special protection to the remaining areas of coastal forest and the development of programmes for the restoration of these forests.
- Specific measures to provide protection status to transitional forest from near shore forest to inland forest types.
- Specific measures to provide protection status to riverine forest from near shore forest to inland forest types.
- To integrate the concept of bio-engineering in the design of Green Climate Fund projects and investments in coastal protection by supporting the restoration and if needed the reforestation of mangrove forest.
- To provide FAO with a mandate to explore the development of international incentive schemes specifically designed for the management and restoration of coastal forests.