

Conservation and management of mangrove forests in Kenya

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1.0 Introduction

Broadly, mangrove forests can be divided into two regions: Indo-West Pacific (IWP) or the Old world mangroves that comprises Eastern Africa, Australasia, southern Japan and the West Pacific Islands; and the Atlantic-East Pacific (AEP) also referred to as the New world mangroves that includes the mangroves of Americas and West Africa. The total area of mangroves in the world has been estimated at 15 million hectares.

In Kenya, mangroves cover approximately 54,000 ha, most of which are in Lamu and Tana River districts (Doute *et al.*, 1981). There are 9 mangrove species in Kenya, with the dominant species *Rhizophora mucronata* and *Ceriops tagal* making 70% of the formation. Mangroves in Kenya display typical zonation patterns of the mangroves in Eastern Africa (Fig. 2). The seaward side is occupied by *Sonneratia-Rhizophora*-giant *Avicennia* community. This is followed by *Rhizophora-Bruguiera-Ceriops* in the mid zone and dwarf *Avicennia-Lumnitzera-Xylocarpus* complex on the landward side. Other plant species associated with mangroves include *Pemphis acidula* and *Barringtonia racemosa*, which have mistakenly been referred to mangroves in some countries in the region.

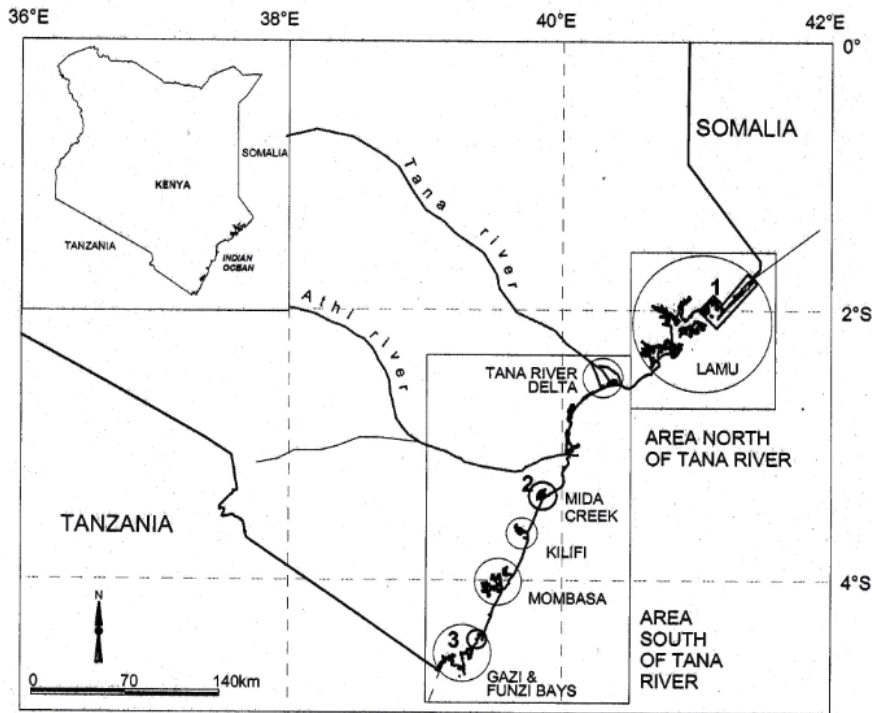


Figure 1. Map of Kenya coastline showing major mangrove areas

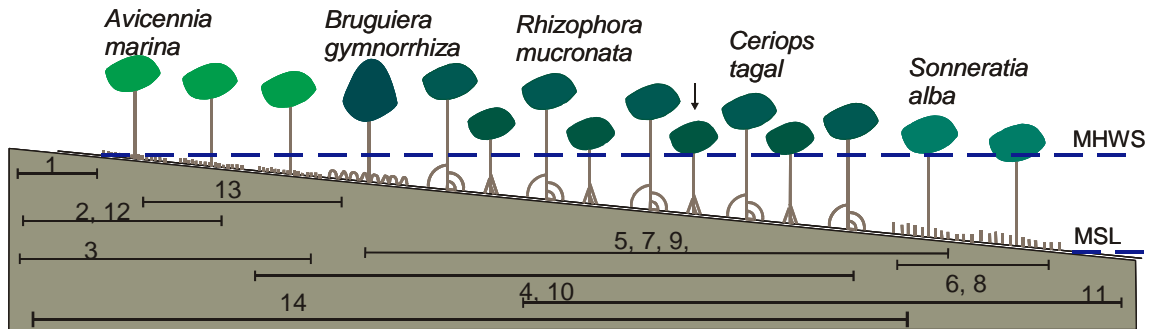


Figure 2. Zonation of mangroves along the land-sea interface

Mangroves provide good and services that are of ecological, economic and environmental importance to the people. At the ecosystem level, mangroves are classified as the 3rd in productivity after tropical rain forests and coral reefs. Mangroves serve as important habitat and breeding grounds for fish and other fauna. This is in addition to the important role mangrove play in shoreline protection, waste assimilation, and carbon sequestration. Mangrove forests have been found to have up to 700 t/ha of plant biomass; half of which is carbon. Reforested mangroves in Kenya have been estimated to have biomass of 131 t/ha, thus indicating more than 65 tonnes of carbon per hectare is stored up in these forests.

2.0 Value of mangrove in Kenya

Mangrove forests in Kenya provide many direct products – both timber and non-timber. Timber products include firewood, building poles and charcoal used in urban and rural areas. Poles used in construction are normally graded into different utilization classes depending on their uses (Table 1). Other uses of mangrove poles include boat masts and fish traps/stakes. Larger logs of mangroves, especially of *A. marina*, are used in traditional boat construction. Aerial roots of *S. alba* are also used as floaters for fishing nets. Mangrove wood is also utilized by the local communities for furniture. Among the non-timber products derived from mangrove forests include honey harvesting, medicinal values, crabs and fish caught inside the forest.



Plate 1. Mangrove poles ready for transport to market (*Photo; J. Lang'at*)



Plate 2. Traditional house, composed virtually of mangrove poles, under construction
(Photo; J. Lang'at)

Table 1. Mangrove poles sizes and their uses

Local name for Utilization classes	Diameter class (cm)	Uses	Preferred species
<i>Fito</i>	2.5-3.5	Used to fill walls	Usually young <i>R. mucronata</i> and <i>C. tagal</i>
<i>Pau</i>	4.0-7.5	Used as roof frames	Usually young <i>R. mucronata</i> and <i>C. tagal</i>
<i>Mazio</i>	7.5-11.5	Used to build the main frame of house walls	Usually young <i>R. mucronata</i> and <i>C. tagal</i>
<i>Boriti</i>	11.5-13.5	Used to build fences, mainly for tourist developments	<i>R. mucronata</i>
<i>Nguzo</i>	14.0-20.0	Used at the corner of houses to support the roof	Mature <i>R. mucronata</i> and <i>B. gymnorrhiza</i>
<i>Vingigi</i>	20.5-35.0	For support of the main roof of larger tourist hotels	Mature <i>B. gymnorrhiza</i>

3.0 Threats to Kenyan Mangroves

Like in most parts of the world mangroves in Kenya are endangered. Overexploitation for wood products is the main agent of degradation. Lack of cutting plans escalates problems of mangrove management in Kenya. The government agencies vested with the responsibilities of managing mangroves and other forests in Kenya lacks adequate resources for implementing management guidelines. In most cases, therefore, selective removal of quality poles of suitable species has tended to leave out inferior species unsuitable for the market. Quality poles have been wiped out in most mangrove areas of Mombasa, Kwale and Kilifi districts where population density is highest along the coast.

Salt extraction has also led to loss of mangroves. Currently there are more than 6 salt works in Ngomeni where most of extraction is carried in Kenya; landing 71 400 tonnes of salt per year. Environmental impacts associated with salt extraction include hypersalinity in areas close to mangroves leading to their deaths.

Poor land use practices in the hinterland has increased sediment loads into mangrove leading to siltation of breathing roots of the trees and eventual death of the system. The situation was worsened during the 1997/98 El Nino rains that hit the country causing massive death of mangroves in many areas along the coast, most of which have experienced no recovery up to date. Another threat facing Kenyan mangroves is oil pollution. For instance, between 1983 and 1993 Mombasa port and surrounding waters experienced 391 680 tonnes of oil spills that affected mangroves of Port Ritz and Makupa creeks. A new threat to mangroves in Eastern Africa is the projected sea-level rise due to climate change. Climate change impacts are also associated with increased flooding/sedimentation and aridity. Since coastal area where mangroves occur is low lying land a small increase in sea level will mean that mangrove will be submerged unless they can migrate to new areas mainland. Looking at the Kenyan coast, most areas where mangroves could migrate to have already been occupied by human settlement and/or infrastructure. Evidence of death of mangroves due to climate change impacts has been observed in several areas along the coast such as Gazi bay, Mwache creek, Ngomeni, Tana River and Dodori creek.

4.0 Conservation Measures

With the realization of the loss of inherent mangrove goods and services due to degradation a lot of measures have been undertaken in order to reverse the trend. The Kenya Marine and Fisheries Research Institute (KMFRI) initiated steps in 1991 to reforest degraded mangrove areas with suitable species. By 2007, more than 1 million trees had been planted. Survival rates range from less than 10 % in areas exposed to high energy levels to more than 70 % in newly harvested protected areas (Kairo *et al.* , 2001). Biomass accumulation rates in the reforested areas range from 11.0 tons/ha/yr in *Rhizophora* plantations (Kairo *et al.* , 2008) to 1.38 tons/ha/yr in *Bruguiera* plantations (*see* also Table 2). It is possible to conclude of these works that replanted mangroves in Kenya are growing to function as natural stands (Bosire *et al.* , 2008). In collaboration with Napier and Southampton Universities KMFRI is running experimental projects aimed at identifying the best restoration techniques in mangrove degraded areas. Preliminary results from these experiments have shown that mixed cropping of mangrove

species, especially with salt tolerant *Avicennia*, enhances survival and growth of mangrove seedlings (Kirui *et al.* , 2008).

Table 2. Stand table for 12 year-old reforested mangrove plantations in Kenya

Plantation	Variables	Diameter classes (cm)				Total
		≤ 4.0	4.1-6.0	6.1-9.0	9.1-13	
		<i>Fito</i>	<i>Pau</i>	<i>Mazio</i>	<i>Boriti</i>	
<i>Rhizophora</i>	Stems/ha	559	1586	2391	327	4864
	*Merchantable volume (m ³ /ha)	1.4	11.0	36.4	9.4	58.2
	Non-merchantable volume (m ³ /ha)					40.3
	Aboveground biomass (t/ha)	2.4	18.6	66.4	19.4	106.7
	Belowground biomass (t/ha)					24.9
<i>Bruguiera</i>	Stems/ha	3570	960	70	-	4600
	Merchantable volume (m ³ /ha)	8.5	5.1	1.2	-	14.8
	Aboveground biomass (t/ha)	10.1	5.6	1.0	-	16.7

*Merchantable wood refers to commercial timber; while non-merchantable refers to mangrove wood (mostly branches and, in case of *Rhizophora*, aerial roots) utilized by local community as firewood (Source; Kairo *et al.*, 2008).

Other activities initiated by KMFRI to enhance sustainable management of mangroves in Kenya include awareness creation of the importance of mangroves as well as capacity building in mangrove area restoration and management. In partnership with County Council of Oveljise in Belgium, the International Ocean Institute (IOI) and the UNDP-Small Grant Program, KMFRI has initiated community based mangrove management programs at Gazi bay, Mida and Wasini Island in order to promote multiple uses of mangrove environment. Main livelihood activities under this program include integrated aquaculture in the mangrove areas, ecotourism and bee-keeping.

The major problem facing the management of mangrove forests in Kenya is the lack of baseline data and information for the development of a comprehensive management plan and limited community participation in mangrove management. Unlike the terrestrial forestry little attention has been given to mangrove forestry. Mangrove harvesting is control by Kenya Forest Service (KFS) through licensing procedures and recommendation of mangrove poles to be harvested. However, these recommendations are based on wood demand rather than the actual resource base (Abuodha and Kairo, 2001). Secondly due to lack of resources there is limited monitoring of harvesting system used by mangrove cutters. Therefore, there is a need to step up sustainable management of this vital coastal ecosystem. This could be achieved by participatory management approach where all stakeholders, especially the local communities, are involved. The current Forest Act 2005 in Kenya provides for comprehensive community involvement in forest management and there is need to support communities along the coastline to have a defined management plan for these mangroves, which they will implement under the

guidance of KFS. This will ensure enforcement and compliance with forest management guidelines.

5.0 References

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