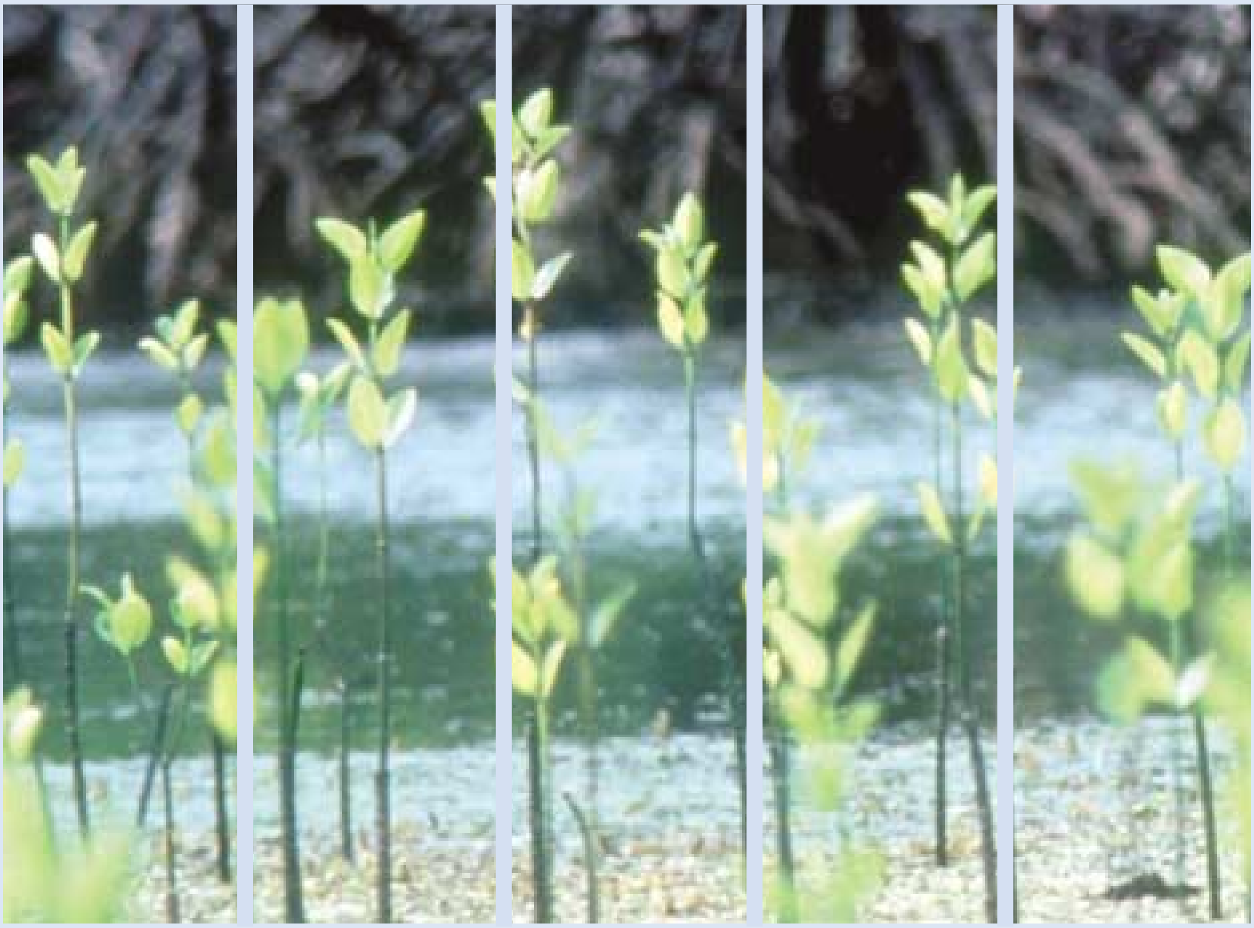
UNEP WCMC GPA

Mangroves



# of East Africa

Michelle Taylor, Corinna Ravilious, Edmund P. Green

UNEP

UNEP WCMC GPA

Mangroves

# of East Africa

Michelle Taylor, Corinna Ravilious, Edmund P. Green

UNEP World Conservation Monitoring Centre
219 Huntingdon Road
Cambridge
CB3 0DL
United Kingdom
Tel: +44 (0) 1223 277314
Fax: +44 (0) 1223 277136
E-mail: info@unep-wcmc.org
Website: www.unep-wcmc.org

Director: Mark Collins

THE UNEP WORLD CONSERVATION MONITORING CENTRE is the biodiversity assessment and policy implementation arm of the United Nations Environment Programme (UNEP), the world's foremost intergovernmental environmental organization. UNEP-WCMC aims to help decision-makers recognize the value of biodiversity to people everywhere, and to apply this knowledge to all that they do. The Centre's challenge is to transform complex data into policy-relevant information, to build tools and systems for analysis and integration, and to support the needs of nations and the international community as they engage in joint programmes of action.

Sponsor

UNEP gratefully acknowledges the financial contribution of the Government of Ireland (Project Number IAL3010-02-16) for the production of this publication.

THE GLOBAL PROGRAMME OF ACTION FOR THE PROTECTION OF THE MARINE ENVIRONMENT FROM LAND-BASED ACTIVITIES aims to facilitate the realization of the duty of States to preserve and protect the marine environment. GPA assists States in taking actions individually or jointly within their respective policies, priorities and resources, which will lead to the prevention, reduction, control and/or elimination of the degradation of the marine environment, as well as its recovery from the impacts of land-based activities.

Acknowledgements

The following people have been key in the completion of this publication. Their help, papers, data and communications have been essential and we would like to send our heartiest thanks and best wishes to all: Janine Adams, Jared Bakuza, Salomao Bandeira, Rich Beilfuss and Dorn Moore (International Crane Foundation), François Blasco, Ian Bryceson, Neil Burgess, Stefano Cannicci, Caterina Contini, Mary Cordiner, Farid Dahdouh-Guebas (Mangrove Management Group), Arthur Dahl, Jennifer D'Amico, Will Darwell, Stephanie Duvail, Paul Erftemeijer, Kairo Gitundu, Olivier Hemerlynck (Rufiji Environment Management Project), Jacques Iltis, Claire Kremen, Ghislaine Llewellyn, Vedast Makota, Justin Moat (Royal Botanic Gardens), Nyawira Muthiga (Kenya Wildlife Service), Amani Ngusaru, Judy Oglethorpe, Harrison Onganda (Kenya Marine and Fisheries Research Institute), Rolph Payet, Jean Pascal Quod, Sware Semesi, Jude P. Shunulla, Mark Spalding, Jerker Tamelander, Kristian Teleki, Mike Traber, Caroline Turnbull, Rudy van der Elst, Mike van Keulen, Colette Wabnitz, Y.Q. Wang, WIOMSA staff and Tris Wooldridge.

A **Banson** production

Contents

Sources of figures provided in country tables (unless otherwise stated)

Land area (km²)	FAOSTAT, 2000	**Annual population growth rate (%) 2000-2005**	As above
Coastline (km)	Earthtrends, 2001		
Population (2000)	Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, 2002	**Mangrove area on map (km²)**	From GIS data stored and compiled at UNEP-WCMC and stated sources
		Mangrove area (alternative estimate) (km²)	Relevant country-specific reference
Population density (per km²)	As above	**Number of nationally protected areas containing mangroves**	World Database of Protected Areas, UNEP-WCMC

Photos: SECA/CML (left and centre); Stefano Cannicci (right)

Regional overview

Living in two worlds at once, mangroves protect coastlines from wave energy and protect offshore ecosystems from terrestrial sediments flowing downstream. Throughout the tropics mangroves exist in intertidal areas and are utilized as a habitat by thousands of animal species and as fuel, medicine, food and timber by human coastal populations.

As East African human populations have grown over recent decades, increasing pressure has been placed on mangrove resources. Simultaneously, mangrove research has boomed, unveiling the importance of the ecological, economic and protective role that mangroves fulfil. Governments, non-governmental organizations and local communities have made concerted efforts to protect and regenerate remaining stands. However, overwhelming pressures continue to take their toll.

EAST AFRICAN MANGROVES

Mangrove areas have a high level of productivity as they receive nutrients from both sea and land. Detritus is the primary energy source in tropical estuaries and mangroves are often the producer of this organic litter. Sixty per cent of leaf material in tropical estuaries originates from mangroves. Gross primary production in East African mangroves is seasonally variable but generally comparable to seagrasses and more than coral reefs (see Table 1). Unfortunately little work has centred on energy transfer in mangrove ecosystems and consequently we do not have a complete understanding of trophic relationships and food webs.

In East Africa *Sonneratia alba* is very common, typically occurring in muddy soils where salinity is close to sea water. It is a hardy primary colonizer and resistant to physical disturbance so is often found along outer margins. *Rhizophora mucronata* dominates on muddy soil and is commonly found in large homogeneous stands on upper river banks. *Bruguiera gymnorrhiza* occurs between *Rhizophora mucronata* and *Ceriops tagal* zones, or interspersed throughout them. *Ceriops tagal* has a weaker root system and is less capable of withstanding strong waves and currents; it grows in upper intertidal areas where

Table 1: Mean gross primary production of biotopes in Gazi Bay, Kenya

	Wet season mgC/m^3/day	Dry season mgC/m^3/day
Mangroves	540.41±222.63	377.67±159.70
Seagrass	552.22±291.36	230.84±84.75
Coral reefs	388.88±247.12	240.27±115.29

Table 2: Mangrove species distribution throughout East Africa

Species	South Africa	Mozambique	Madagascar	Tanzania	Seychelles	Kenya	Somalia
Rhizophora mucronata	✓	✓	✓	✓	✓	✓	✓
Ceriops tagal	✓	✓	✓	✓	✓	✓	✓
Bruguiera gymnorrhiza	✓	✓	✓	✓	✓	✓	✓
Avicennia marina	✓	✓	✓	✓	✓	✓	✓
Sonneratia alba		✓	✓	✓	✓	✓	✓
Heritiera littoralis		✓	✓	✓		✓	
Xylocarpus granatum	✓	✓	✓	✓	✓	✓	
Lumnitzera racemosa	✓	✓	✓	✓	✓	✓	✓
Avicennia officinalis			✓				
Total number of species	6	8	9	8	7	8	6

sediments are thicker. *Heritiera littoralis* is found on river banks and in estuary mouths where salinity is low and in inland areas usually flooded only by spring high tides. *Xylocarpus granatum* grows scattered on higher ground in *Avicennia marina* stands where sea water flooding occurs only a few days each month and where freshwater has more influence. *Avicennia marina* is euryhaline and tolerates a variety of flooding regimes and substrates but is most commonly found on firm sandy soils. It is a widely distributed species and often a primary colonizer of exposed seaward areas. *Lumnitzera racemosa* is associated with *B. gymnorrhiza* and *Xylocarpus moluccensis* along river banks. Patterns of zonation can be altered by disturbance because heavily used species may not regenerate first and newly disturbed areas may be colonized by pioneer species.

From 1950 to 2000 265 papers were published focusing on mangrove research in East Africa, 92 per cent of which centred on Kenya. Few were experimental or comparative with 80 per cent descriptive in approach. The mangrove ecosystems of eastern Africa are well studied, but even the baseline information needed for environmental impact assessments and management plans is still not available. A major problem is that available information is often not disseminated. Numerous different national languages further hinder dissemination as findings are often confined to their countries of origin.

The physical three-dimensional complexity of mangrove forests creates a wide diversity of niches suitable for breeding, spawning and hatching of sedentary and migratory species. Mangroves are an important nursery habitat, particularly for fish and crustaceans.

Both terrestrial and aquatic biodiversity within mangroves are high. However, if areas are deforested densities of epifaunal species such as *Littorina scabra*, *Uca* spp., *Sesarma* spp. and *Cerithidea decollata* are greatly reduced. Populations of infaunal species, nematodes, bivalves, copepods and many molluscs are still recorded in similar densities in deforested and natural mangrove areas.

Aquaculture is an expanding industry in the East African region. The consequences of aquaculture projects for mangroves are well documented from Ecuador, Thailand, Indonesia, Malaysia, Vietnam, Bangladesh and India. If this industry develops vigorously in East Africa there is the potential for similar degradation of mangroves. This can be avoided through careful regulation of mangrove felling. Many small-scale, locally managed farms, of low intensity, would be economically and environmentally preferable to a few massive ventures such as the proposed Rufiji prawn project in Tanzania.

Mangrove timber is used locally in construction and for fuel. Mangroves have a range of branch sizes and the varying sizes have different uses and individual names in Swahili:

Fito (2.5-3.5cm): the smallest poles, used to fill walls (usually young *R. mucronata* and *C. tagal*).

Pau (4.0-7.5cm): small poles, used as roof frames (usually young *R. mucronata* and *C. tagal*).

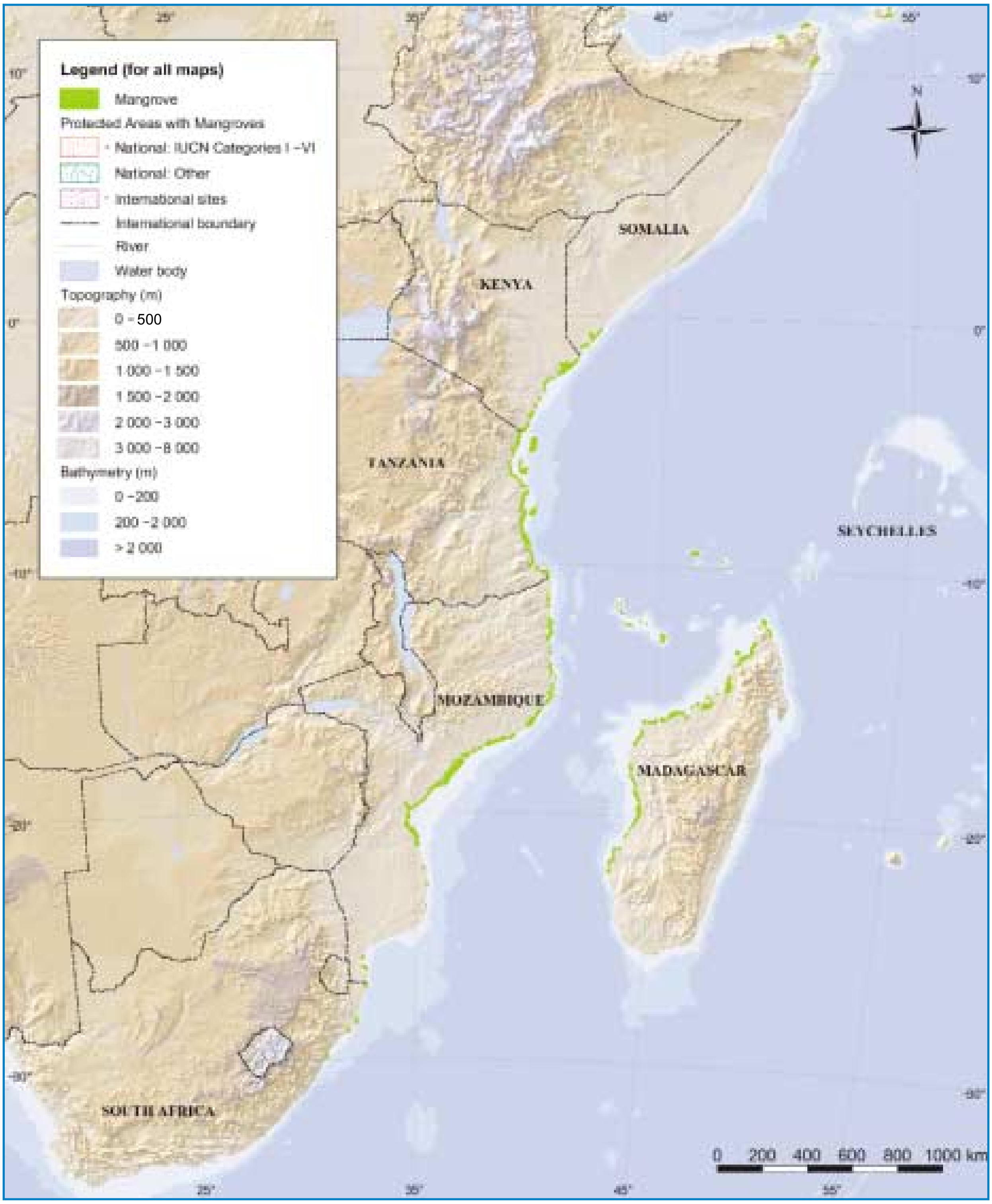
Mazio (7.5-11.5cm): a bit larger, and used to build the main frame of house walls (usually young *R. mucronata* and *C. tagal*), which is then packed with mud.

Boriti (11.5-13.5cm): larger poles, used to build fences, mainly for tourist developments (usually *R. mucronata*).

Nguso (14.0-20.0cm): used at the corner of houses to support the roof (usually mature *R. mucronata* and *B. gymnorrhiza*).

Vigingi (20.5-35.0cm): the largest poles, used to support the main roof of larger tourist hotels (usually *B. gymnorrhiza*).

Local mangrove markets are common as wood is used in so many aspects of everyday life. Fish traps made of mangrove are more robust in salt water than other types of wood. Seaweed farmers use mangrove stakes for the same reason. Boats, such as one-man canoes carved from heavy *Avicennia marina* logs, furniture, drums and serving dishes



East African mangrove distribution

Photo: GISE Unit/NEMC and TCMP/CRC

Mangrove area converted into coastal salt mining, Mikindani, Mtwara.

are all made from mangroves. Most villages around mangrove forests construct the majority of buildings from felled mangroves as they are an easily accessible resource.

Mangrove wood is often used as fuel. *Rhizophora* species are especially utilized as they are rich in tannin and burn almost smokelessly, imparting a pleasant taste to cooked food. Green *Avicennia marina* logs, however, are very smoky and slow burning so are often used by honey collectors and fishermen to keep away biting insects at night.

Many villagers produce salt by boiling brackish water in clay bowls over fire. Mangroves are heavily exploited as a fuel source using this technique. With seven tonnes of wood needed to produce one tonne of salt some coastal forests are now bare. On a larger scale salt is harvested from evaporation ponds, shallow brine-filled pits, usually built in cleared mangrove areas.

THREATS

Once common in sheltered bays and estuaries, mangrove forests in some areas of East Africa are now degraded. One of the major factors changing the characteristics of mangroves within the region is inland topsoil erosion, typically from agriculture and grazing land. Natural levels of erosion bring nutrients to coastal areas and build mangrove forests by replacing mud and sand lost by wave action. However, the extreme levels of soil being washed downstream in recent years is burying roots, asphyxiating mangroves.

If mangroves are felled, offshore coastal areas, such as coral reefs, receive even more sedimentation. Already the effects of excessive nutrient loads and sediment discharge can be seen as breaks forming in fringing reefs opposite river mouths. The central Mozambique coast (800km long) is devoid of coral due to discharge from the Lompopo and Zambezi Rivers.

Oil is a major pollution threat in the region as there are tanker routes along the East African coast linking the Gulf to the Atlantic Ocean. Many countries lack even basic effluents enter mangrove areas. In Somalia and Madagascar the concentration is more on livestock industries. However, industrial pollution is not a severe problem in the region as it is still small scale.

Eastern Africa is also undergoing an extraordinary rate of urbanization. The pressure on mangroves from human populations varies immensely across the region. In Madagascar over 90 per cent of households depend on fuelwood and charcoal (including mangroves). By contrast, only 8 per cent of people in the Seychelles depend on fuelwood, even as a supplementary source of energy.

The effects of climate change will be felt across the region as patterns of rainfall, coastal weather, atmospheric pressure and evaporation adjust. Anticipated effects of climate change are increased temperatures, changes in hydrology regimes, a rise in sea level, increased magnitude and frequency of storms and increased carbon dioxide concentration. There will be positive and negative affects on mangroves and it is highly uncertain exactly what the net outcome will be as local variability will be very high and effects site specific.

As temperatures rise mangroves may start to colonize higher latitudinal areas. A warmer climate may result in an increase in frequency and strength of tropical storms and previously sheltered areas, suitable for mangrove growth, may become exposed. Conversely, any