

Guidelines on Mangrove Ecosystem Restoration for the Western Indian Ocean Region

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UNEP, Nairobi Convention

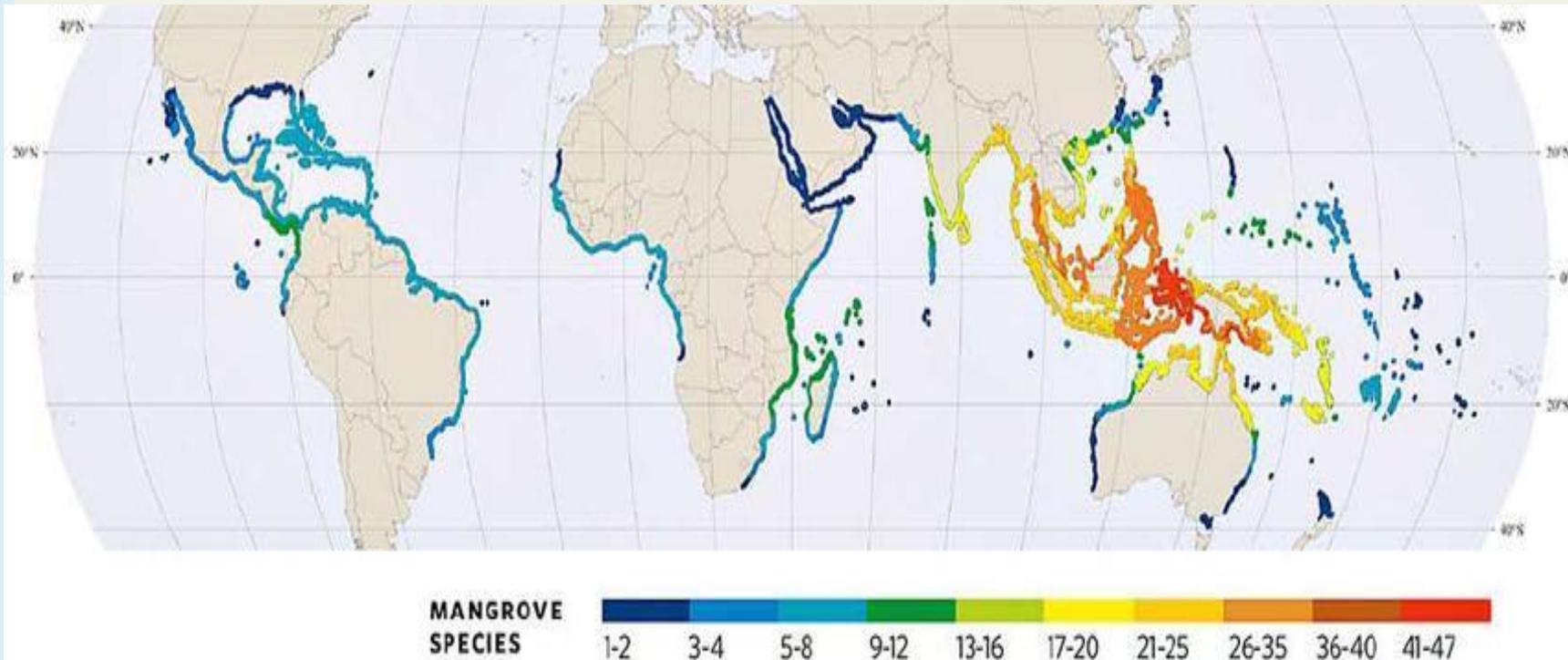
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Session: Validation of WIOSAP Guidelines/Toolkits

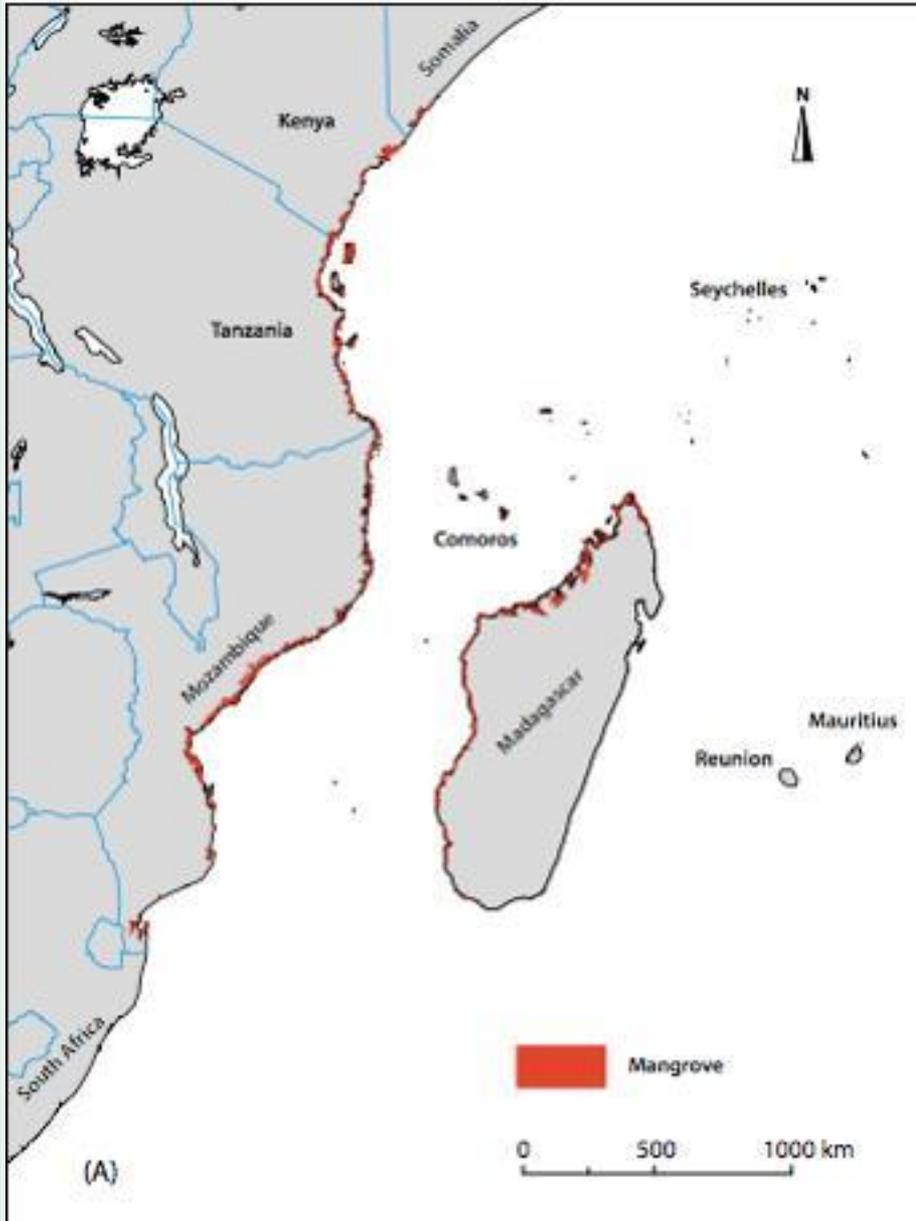


Global Mangrove Distribution



- Global extent- 13.7 million ha; 5% in WIO (Giri et al. 2011)
- WIO with 9-10 mangrove species

Mangroves of the WIO



Country	Mangrove area (ha)	No. of species
Somalia	3 000	6
Kenya	61000	9
Tanzania	181000	10
Mozambique	390,500	9
South Africa	1 921	4
Madagascar	314,000	8
Seychelles	1,900	7
Mauritius	145	2
Comoros	91	7
TOTAL (ha)	1.1m.	

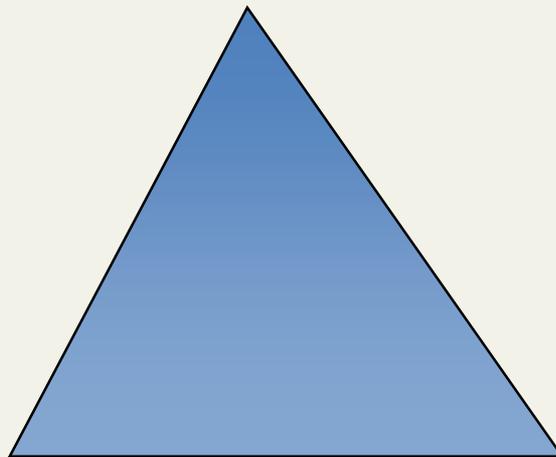
Represents 5% of the global mangroves

An old growth *Avicennia* stand, Rufiji, Tanzania



Mangroves and SDG/NDC

Economy



Ecology

Environment

 **SUSTAINABLE DEVELOPMENT GOALS**



- Mangroves contributes upto 10% of annual organic carbon sequestration to the coastal zone (Sademe et al., 2019; Nature)
- 70% of coastal fisheries depend one way or another on mangrove ecosystem (Barbier et al., 2011, Ecological monographs)





...direct use values of mangroves



Regional and global benefits



Ecosystem services estimated at 220,000 US\$/ha/yr



Drivers of Change

- Over- exploitation
- Conversion pressure
- Pollution effects
- Climate change

Root causes

- Population pressure
- Poverty
- Governance/corruption/legislations



Socio-economic impacts of mangrove degradation

- Loss of harvestable resources
- Reduced mangrove resiliency.
- Increased poverty
- Loss of life and property
- Reduced revenue from fisheries
- Reduced touristic and aesthetic value
- Reduced food security
- Loss of cultural heritage
- Reduced land value in coastal areas



Why restore mangroves?

To enhance **productivity, stability** as well as **functional integrity** of mangroves and ecosystem service they provide

- **Coastal protection** and stability
- Enhance **biodiversity and fisheries**
- **Resource sustainability** e.g. wood products
- **Water purification**
- **Carbon capture** and storage
- Aesthetic values
- Creation of employment



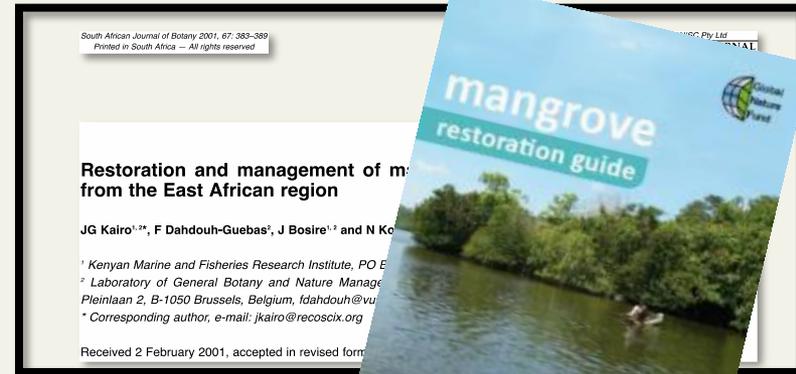
Objectives of the WIO mangrove restoration guidelines

- Highlights **status and conditions of mangroves**,.... and need to restore them
- Serve as **documentation of previous mangrove restoration activities**
- **Outline best practices** from previous mangrove restoration activities
- Help users in the region to **focus on what is most likely to work** for them
- Assist users to better plan and match available tools to their situation



Approaches used in developing the guidelines

- Peer reviewed publications/other guidelines
- Country expert knowledge and contributions
- Field site visits and observations
- Stakeholder surveys and consultations
- Community best practices



Structure of the Guideline

Chapter 1. Background information

Chapter 2. A review of mangrove ecosystem.

Chapter 3.0 Mangrove restoration-What is it and when to use it

Chapter 4.0 Identification of restoration sites

Chapter 5.0 Principles of best practice – a restoration protocol

Chapter 6.0 Implementing a mangrove restoration monitoring plan

Chapter 7.0 How it has worked, lessons learn and recommendations

1. **Mangrove reforestation at Gazi bay, Kenya**
2. **Mangrove reforestation in Tanzania**
3. **Mangrove reforestation in Mozambique**
4. **Mangrove reforestation in Madagascar**
5. **Mangrove afforestation in Mauritius**

Annex 1: Key Methods for Site Assessment: -



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Typology of mangrove restoration

Natural regeneration

- Uses natural successional process mediated by biophysical factors
- Cheap to establish
- Saplings establish more vigorous
- Limited by absence of mother trees

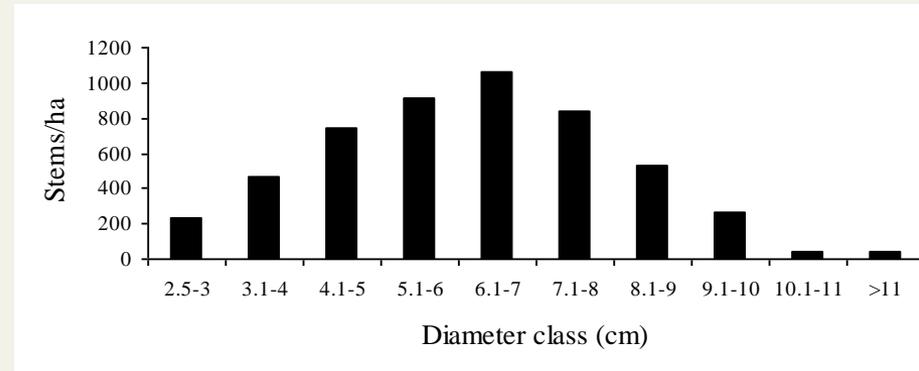
Artificial regeneration

- Use of direct planting (propagules/saplings/wildings)
- Species composition can be controlled
- It can be expensive
- Establishes simple systems



A successful mangrove restoration- Gazi bay

- Stand density 5130 stems/ha
- 86% of the wood of the required quality and size (>5cm dbh)
- Biomass = 106.6t/ha
- Even aged forest



(Kairo et al 2008. *Forest Ecology and Management*)



Wasted effort!



- Failed restoration project in Vanga, Kenya

Causes of restoration failures

- Poor **species-site** matching
- Poor understanding of **species ecology** and **hydrological requirements**
- **Changes in site** conditions
- Lack of **monitoring plan and post planting care**
- Inadequate **financing**
- Lack of **community participation**
- Limited **extension services**



Steps in Planning, Implementation and Monitoring restoration projects

Project Planning Phase

Step 1: Problem realization

Step 2: Defining the purpose of restoration

Step 3: Understanding governance

Step 4: Stakeholder analysis

Step 5: Community



Project Implementation Phase

Step 6: Site assessment and preparation

Step 7: Planting

Project Monitoring and Evaluation Phase

Step 8: Monitoring and Evaluation

Step 9: Feedback and Adjustment



Collection, transportation and sorting propagules

Species	Planting material	Peak availability of propagules*	Indicator of maturity	Size of maturity	Storage (max days)	Treatment
<i>Avicennia marina</i>	Seedling	April-May	Seed-coat turns light yellow, wrinkly	Weight of seeds >150g	5	Soak in fresh water (>12hrs)
<i>Bruguiera gymnorhiza</i>	Propagule	April-July	Reddish brown body	Propagule length >15cm	10	Cool wet conditions
<i>Ceriops tagal</i>	Propagule	February-March	Light yellow collar, brown/green body	Propagule length >20cm	15	Cool wet conditions
<i>Rhizophora mucronata</i>	Propagule	March-June	Yellow collar, green body	Propagule length >40cm	30	Cool wet conditions



?

Step-by- step – establishment and management of mangrove nurseries – *Avicennia marina*



Seed selection



potting



shade



6 weeks later



Monitoring of replanted mangroves

- Growth rates
- Sediment accretion
- Carbon content/biomass
- Nutrient cycling
- Environmental variables
- Survival/mortality rate
- Secondary succession



Monitoring schedule of mangrove restoration projects

Time (months)	Activity	Remarks/parameters to measure
0+3 months	<ul style="list-style-type: none"> Preparing report of nursery and ... 	<ul style="list-style-type: none"> survival %
6	i. Assessment of seedling survival and growth	<ul style="list-style-type: none"> Survival % Height...
9	1. Assessment of seedling survival and growth	<ul style="list-style-type: none"> Survival (%) Height, diameter...
12	<ul style="list-style-type: none"> Assessment of seedling survival Assessment for animal types and abundance Xx xx 	<ul style="list-style-type: none"> Survival (%) Height, diameter, no. of leaves for tagged individuals Xx Xx xx
5yrs	<ul style="list-style-type: none"> 	<ul style="list-style-type: none">



Case study 1: Mikoko Pamoja, Kenya

- Restoration and protection of mangroves through sale of carbon credits
- Community based payments for mangrove carbon project
- Certified under Plan Vivo Standard – a voluntary carbon market
- Income generated support local development programs
- Replication & up-scaling = from Gazi Bay to other areas...
- Successful model



Case study 1: Mikoko Pamoja, Kenya



- “Mangroves Together”
- The first community-led mangrove PES project in the world

Objective: Restoration and protection of mangroves through sale of **carbon credits**

- Verified 20yrs by **Plan Vivo standards**
- Carbon sold into voluntary market = 3,000 tCO₂
- Income support local development projects



Mikoko Pamoja results

- ❑ Job creation
- ❑ Livelihood support
 - Ecotourism
 - Energy – efficient stoves
- ❑ Community services
 - Education
 - Water & Sanitation
- ❑ Mangrove reforestation
- ❑ Replication/upscaling in Vanga Bay



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Case study 2: Rufiji Delta, Tanzania

- Local community groups of 8-10 men and woman are involved in reforestation practices on **hired basis**
- Restoration activities are facilitated by **donor agencies** (UNDP, UNEP)
- 1000 ha planted between 2014 and 2016
- **Sustainability is at stake**



Case study 3: Hydrological Restoration – Quelimane and Limpopo, Mozambique

- Opening of artificial channel to irrigate degraded mangrove areas to induce natural recolonization
- Labor **intensive/expensive**
- Mostly **community/government driven**



Case study 4: NGO – Community partnerships, SW Madagascar

- Voluntary participation in mangrove restoration through Education and Awareness campaign
- Two approaches
 - No cash remuneration - sometimes food for work...
 - Financial compensation for community labour – collection of propagule collection, nursery establishment, outplanting...
 - **NO FREE LABOUR/LUNCH**



Case study 5: Mangrove gardening... at Le Morne , Mauritius



- Largely government sponsored...
- Nature hate order
- Potential effects to other ecosystem services



Case study 6: Investing in future generations, Seychelles

- Use of school children ensures long term community commitment
- **Building a mangrove practitioners...**
- **Our future is now**



Recommendation and way forward

- Continued creation of awareness of **true value** of mangrove ecosystem at all levels
- Training staff on **ecological mangrove restoration**
- Understanding **hydrological restoration needs**
- Enhanced **partnership on mangrove restoration** and management
- Promote **incentive scheme** in mangrove restoration and management
- **Long-term monitoring** of reforestation projects
- Support alternative livelihood and income generating activities in communities adjacent the mangrove areas...
- Mainstream mangrove conservation with national **development and climate change agenda.**



The PSC requests the following:

1. Approve adoption of the Guideline for application within relevant demo projects supported under WIOSAP and also wider regional application.
2. Recommend testing of the Guideline across the region
3. Recommend revision of the Guideline as appropriate after testing
4. Recommend translation of the Guideline into key languages in the region as may be requested by any interested country



Acknowledgments



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