Issues in mangrove management

The *ISME Mangrove action plan for the sustainable management of mangroves 2004–2009* (ISME and ITTO 2004) identified the key issues in need of management attention. These are set out below.

Overuse for forestry and fisheries. Many mangroves are subject to the over-extraction of timber and non-timber forest products as well as to unsustainable fishing and wildlife use, often driven by poverty and the meeting of daily needs. Such over-use leads to degradation of the mangrove resource and, in some cases, its complete removal. Even if pressures can be removed, natural regeneration is sometimes poor and rehabilitation can be difficult and costly.

Aquaculture. The conversion of mangroves to aquaculture is widespread, particularly in Southeast Asia and Latin America but also now in East Africa. Poor management of aquaculture operations can lead to pollution and disease, rendering ponds unusable within a few years. Because of the massive disturbance to tidal flows and the coastal profile caused by aquaculture development, restoration, even in abandoned sites, can be challenging and costly.

Pollution. Pollution—derived from single or multiple sources including industry, sewage, dredging, pond effluent and agricultural and urban runoff and involving pollutants such as solid wastes, toxic chemicals, hydrocarbons and persistent organic materials—can lead to the loss of biodiversity, declines in mangrove productivity and, in extreme cases, complete destruction.

Hydrological modifications. Upstream activities such as dam construction, water diversion and deforestation alter the flow regimes of freshwater into mangrove ecosystems, often causing marked reductions, especially in dry seasons and arid environments. This can lead to a build-up of salinity in water and soils and changes in sedimentation patterns that affect coastal configuration and the structure of navigational channels, with the potential to alter physiological processes and cause the loss of mangrove species or their substitution by other communities. Coastal modifications such as the construction of sea walls, ports and dredging can also alter tidal circulation patterns, which in turn can lead to structural and functional changes.

Conversion to other land uses. Conversion due to the development of infrastructure, residential areas and for agriculture, cattle-ranching, salt pans and mining causes the direct, irreversible loss of mangroves. Mangrove soils are often only marginally suitable for agriculture, yet the conversion of mangroves for this purpose is widespread. Conversion in one area can often lead to uncontrolled degradation and elimination in adjacent mangrove ecosystems.

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Concern about mangrove loss is highly variable, but a few countries—Guinea-Bissau, Cameroon and Gabon—have created networks of protected areas that include mangroves. In some cases considerable effort has been made to involve local communities and garner broad support, and ongoing but sustainable use of mangroves is encouraged. Other countries have paid little attention to the protection of mangroves, and wide areas, including in most of the Niger Delta, remain unprotected.

Table 10 Large mangrove extent countries in West and Central Africa

Country	Mangrove area (km^2)	Number of mangrove species	Number of mangrove protected areas	Number of international protected areas
Nigeria	7360	7	4	1
Guinea-Bissau	2980	6	4	1
Guinea	2030	7	-	5
Cameroon	1960	7	3	-
Gabon	1600	7	7	5
Senegal	1280	7	3	2
Sierra Leone	1050	6	-	1

Les Rivières du Sud, a vast complex of rivers and channels extending from Senegal to Liberia, is one of the largest areas of mangrove forest in the world.
Photo: © J.F. Hellio and N. Van Ingen

Lack of appropriate legislation and enforcement. In the absence of laws on the sustainable management and conservation of mangroves, decisions on mangroves are rarely made in the interest of local communities, tending instead to favor large-scale commercial interests such as oil extraction and shrimp-pond construction. Where they exist, legal and policy instruments for mangroves are often dispersed between institutions dealing with fisheries, forestry, planning, agriculture and the environment. Many laws are either inappropriate or rarely enforced, and little consideration is given to the socioeconomic needs of coastal people. Countries that share mangrove resources rarely coordinate their policies and management regimes.

Shortage of capacity, mangrove specialists, managers and technicians. There is a shortage of mangrove specialists in scientific and management institutions, law enforcement agencies and local communities. There is also a lack of exchange of knowledge and experience between professionals and coastal dwellers.

Inadequate communication, education, public awareness and participation. In most countries there is considerable scope for improving public understanding and appreciation of the value of mangrove resources and the benefits that can be derived from them. This awareness should form part of the formal educational system but should also be offered to the general public, decision-makers and local people.

Climate change and sea-level rise. Climate models predict future rises in temperature and sea levels as well as changes in precipitation and freshwater supply; most also predict changes in storm frequency and intensity. Although mangroves are highly opportunistic and might be expected to migrate landwards with rising seas, in many areas such landward migration is likely to be disrupted by human land-use.

Guides for sustainable mangrove management

Given their considerable value, there is rarely any social or economic justification for the loss and degradation of mangroves; on the contrary there are powerful arguments for mangrove conservation and restoration. A critical challenge for those working in the fields of forestry, fisheries and the environment is to communicate these values and to ensure that public and political bodies are fully informed of the consequences of mangrove loss. In some places these lessons have already been learned and are being worked into legal and policy frameworks to protect and/or sustainably use mangroves and adjacent ecosystems.

A number of guides for the sustainable management of mangroves have been developed with the aim of assisting policymakers and practitioners. The following are authoritative manuals, guidebooks, work and action plans, guiding principles and codes of conduct and practice aimed at promoting the sustainable management and use of mangrove resources (extracts from four other relevant sources are provided in the boxes below):

- *Mangrove action plan for sustainable management of mangroves 2004–2009* (ISME and ITTO 2004)
- *Manual on guidelines for rehabilitation of coastal forests damaged by natural hazards in the Asia-Pacific region* (Chan and Baba 2009, published by ISME and ITTO)
- *Restoration of mangrove ecosystems* (Field 1996, published by ISME)
- *Mangrove guidebook for Southeast Asia* (Giesen et al. 2007, published by FAO and Wetlands International)
- *Coastal forest rehabilitation manual for Aceh Province and North Sumatra* (FAO 2008)
- *Mangrove rehabilitation guidebook* (GNF 2007)
- *After the tsunami: coastal ecosystem restoration: lessons learnt* (UNEP 2007)
- *Study of lessons learned from mangrove and coastal ecosystem restoration efforts in Aceh since the tsunami* (Wibisono and Suryadiputra 2006, published by Wetlands International)
- *Principles for a code of conduct for management and sustainable use of mangrove ecosystems* (The World Bank, ISME and cenTER Aarhus 2005)
- Several other ITTO publications also provide guidance for the sustainable management and conservation of mangroves:
- *ITTO action plan 2008–2011* (ITTO 2008)
- *ITTO/IUCN guidelines for the conservation and sustainable use of biodiversity in tropical timber production forests* (ITTO and IUCN 2009)
- *Revised ITTO criteria and indicators for sustainable management of tropical forests including reporting format* (ITTO 2005)
- *Guidelines for the establishment and sustainable management of planted tropical forests* (ITTO 1993)

ITTO mangrove workplan 2002–2006 (ITTO 2002)

Conservation and sustainable management
- Develop criteria and indicators for sustainable management of mangroves.
- Implement sustainable mangrove management and establish protected mangrove areas, including buffer zones.
- Prepare and implement mangrove management plans.
- Implement trans-boundary conservation and management areas.
- Rehabilitate degraded mangroves.

Mangrove information and awareness
- Maintain, expand and improve access to existing mangrove information databases in collaboration with other organizations.

Socioeconomic aspects
- Assess the contribution of mangroves and impacts of mangrove degradation.
- Document and promote use of traditional mangrove knowledge and management.
- Valuate wood and non-wood goods and services from mangrove areas.

Mangrove ecosystem functions and health
- Improve understanding of mangrove forest structure, growth and function.
- Evaluate the health of mangrove species and their habitat including the effects of climate change and sea-level rise.
- Assess the ecological impacts of wood harvesting and other human actions and develop innovative technologies for reducing such impacts.

Cooperation and capacity-building
- Establish national mangrove committees to coordinate all mangrove activities.
- Increase mangrove management capacity.
- Encourage and support cooperative relations between all stakeholders.

Policies and legislation
- Formulate appropriate laws and policies on mangroves with participation of all stakeholders and ensure their enforcement.
- Analyze existing laws and policies and their impacts on mangrove management.

Charter for mangroves (ISME 1991)

- Utilize mangrove resources so that their natural productivity is preserved.
- Avoid degradation of the mangrove ecosystems.
- Rehabilitate degraded mangrove areas.
- Avoid overexploitation of the natural resources produced by mangrove ecosystems.
- Avoid negative impacts on neighboring ecosystems.
- Recognize the social and economic welfare of indigenous mangrove dwellers.
- Control and restrict non-sustainable uses so that long-term productivity and benefits of the mangrove ecosystems are not lost.
- Introduce regulatory measures for the wise use of mangrove ecosystems.

Mangrove forest management guidelines (FAO 1994)

- Ensure that wood, non-wood and aquatic resources are managed in an integrated way which meets local, national or regional needs.
- Plans must be objective oriented and should achieve maximum benefits for the greatest number of people in the long run.
- The ecological carrying capacity should never be exceeded and resource sustainability should be given high priority.
- The need for conservation of biological diversity and wildlife should be recognized.
- Planning is an ongoing dynamic process and must provide for improvements in data and information accuracy.
- Planning functions and responsibilities should be clearly spelt out and the decision-making process must be visible and equitable.

Southeast Asian Fisheries Development Center's Code of practice for sustainable use of mangroves for aquaculture in Southeast Asia (Bagarinao and Primavera 2005)

- Recognize that mangrove ecosystems provide vital ecological services and valuable goods to coastal areas and communities.
- Protect and conserve mangroves to sustain vital ecological services and goods.
- Improve governance over mangrove conservation and sustainable use.
- Integrate aquaculture and mangrove conservation in coastal zone management.
- Assess and classify existing mangrove ecosystems for proper disposition.
- Retain a greenbelt or buffer zone along coasts and rivers where mangroves naturally occur and where replanting is technically feasible.
- Locate aquaculture farms outside of pristine mangroves.
- Prohibit conversion of pristine mangrove ecosystems into shrimp aquaculture farms.
- Rehabilitate abandoned aquaculture ponds back to mangroves.
- Resolve conflicts between aquaculture and other users of mangrove ecosystems.

Increasing incentives for sustainable use

While there is considerable knowledge on sustainable mangrove management, there is an urgent need to provide financial and social incentives for its implementation.

Building more holistic models for natural resource accounting is one avenue. New approaches are being encouraged through, for example, The Economics of Ecosystems and Biodiversity studies (Kumar et al. 2010), which highlight the need for comprehensive and cross-sectoral accounting of ecosystem services.

There may also be opportunities to encourage financial payments for ecosystem services, such as through the REDD+ mechanism being discussed within the United Nations Framework Convention on Climate Change, designed to encourage payments to developing countries for avoided forest loss and degradation (e.g. Pritchard 2009;

Sandbrook et al. 2010). Although the total area of mangroves is small compared to the size of the global forest estate, their importance is considerable, not only as living biomass but for their role in carbon sequestration and long-term storage in soils. This sequestration role has largely been ignored in REDD+ discussions, but it has been highlighted in recent reports on coastal wetlands and 'blue carbon'—the role of coastal ecosystems in carbon storage and sequestration (e.g. Crooks et al. 2011; Laffoley and Grimsditch 2009; Murray et al. 2010).

The role of mangroves in coastal defense deserves more attention in the preparation of climate-change adaptation plans. To date, many such plans have focused on hard engineering structures to prevent damage from sea-level rise. Such approaches are costly, however, and can lead to further losses of coastal ecosystems and other associated ecosystem services. The use of natural coastal protection, including mangrove restoration, should be encouraged, including through adaptation funding mechanisms (Gedan et al. 2011; Hale et al. 2009).

Information and communication

The decisions that are made on mangrove use, conservation, management and restoration in coming years will have a profound effect on millions and possibly billions of people worldwide. They must be made, therefore, on the best available information. The *World Atlas of Mangroves* is one contribution to improving understanding of the importance of mangrove ecosystems, their distribution and the pressures they face. There is no doubt that mangroves are better appreciated today than they have been in the past. But there is no time for complacency: the work of mangrove countries and the partner organizations that produced the Atlas is far from over.

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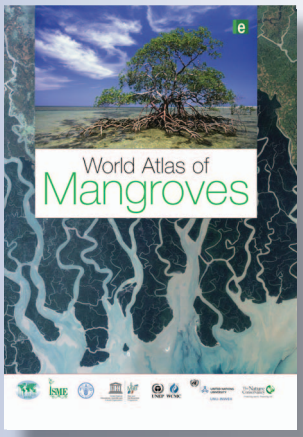
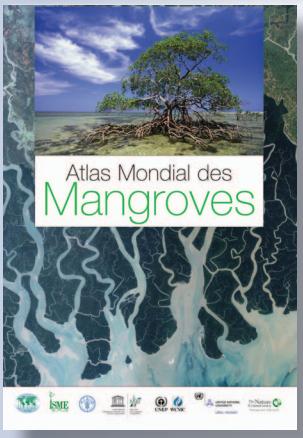
Partner organizations

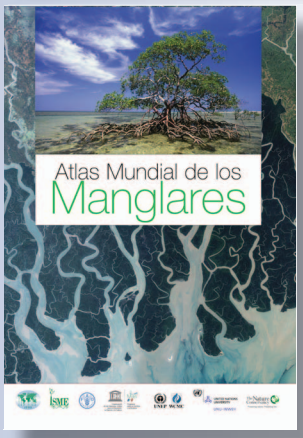
United Nations Educational, Scientific and Cultural Organization

Man and the Biosphere Programme

Supporting countries/ organizations







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