

**Where areas of mangrove forest have been damaged (by natural or human causes) there may be opportunity for active restoration in which the MPA can take a leading role. Mangrove restoration is generally inexpensive, has a high degree of success, and is being undertaken in many parts of the WIO. It is however labour intensive and requires a certain level of skill, at least for some species. This sheet provides general guidelines and sources of information on this topic.**

Most mangroves in the WIO are under some form of pressure but mangrove forests are being successfully managed in some places, and there are sites that can still be considered pristine. Many of the MPAs on mainland East Africa and in Madagascar contain mangroves which are either totally protected or under some form of regulated exploitation, usually for subsistence use only. However, in many areas, protection alone is insufficient to reverse the trends in mangrove forest destruction. Even when disturbance is reduced, the altered soil conditions and limited natural dispersal mean that natural recovery can be very slow. Mangrove restoration aims to return an area to a condition more closely resembling its original state, including restoring the full range of biological diversity and all the essential ecological processes.

Most mangrove species produce propagules that are relatively easy to collect and plant and, in the right conditions, growth is fast. Propagules may be planted directly which is generally adequate (particularly for *Rhizophora* spp.), although seedlings and saplings can be grown to a height of 0.3-1.2m beforehand. Partly because of the ease with which they can be re-planted, there have been many attempts at mangrove restoration, undertaken often as a forestry management initiative though also for conservation of the ecosystem. Replanting mangroves as a forest is a useful first step but to restore the full biodiversity values, the following need consideration:

- Determining what the “natural” forest resembled originally. This requires deciding what the restored ecosystem should be like, including the abundance and distribution of other plants and animals in the community. Literature on the area before deforestation (if available) and studies from nearby intact systems will assist, and it is important to find out how the mangrove was destroyed.



M. Richmond

Planting of mangrove propagules is simple and can involve schools and other local community members.

- Deciding on the techniques to use which will depend on: whether the soils needs treatment (e.g. to reduce acidity) or physical re-working to attain suitable grain size; the species to be used; and the seasonal timing, seedling preparation, field support and developmental stage of the propagules. It is particularly important to determine the correct tidal height needed for each species.
- Developing a monitoring programme to measure the “success” of restoration. Ideally, the restored forest should be compared to forests that have been left to regenerate without intervention.



J. Turner

Young mangrove trees planted on Rodrigues Island as part of a large scale forestry programme in the late 1990 s to stabilise sediment movement and increase fish nursery areas.

One of the oldest examples of mangrove restoration in the WIO is in Kiunga in northern Kenya where, in the early 1900s *Rhizophora mucronata* was planted in a small clear-cut area and attained harvestable size within 50 years. Other small scale planting efforts include Kisakasaka (Zanzibar) where villagers began planting propagules in the early 1990s under guidance from the Forestry Department; Mbweni Creek near Dar es Salaam where in 1999 over 3,000 *R. mucronata* and *Avicennia marina* propagules were planted by villagers; and Tanga, northern Tanzania where the national Mangrove Management Project in collaboration with the Tanga Coastal Zone Conservation Programme has been replanting mangroves since 1997, with 107.4 ha of mangroves actively rehabilitated by 2004.

Larger scale programmes include Rodrigues Island (Mauritius), where in 1998 43,500 *R. mucronata* propagules were planted with the involvement of a private contractor. Similarly, on the main island of Mauritius a comprehensive programme was developed in 1995 (see

case study), while in Kenya at Gazi Bay, over 300,000 propagules were planted with the involvement of the local community. Some large-scale mangrove restoration efforts are also underway in Eritrea, using a technique that is considered controversial, as it involves adding nutrients to the planted propagules. This could potentially damage other ecosystems and communities (such as coral reefs) that require relatively low levels of nutrients, and so is not recommended. Although most mangrove restoration efforts are inexpensive, large scale programmes are labour intensive and may require donor assistance.

### KEY POINTS FOR THE MPA

- ❑ Endeavour to restore any degraded mangrove ecosystem within the MPA boundaries.
- ❑ Before starting seek advice from experts and discuss the ideas with the Forest Department or government agency responsible for mangrove management.
- ❑ Identify people willing to help, such as local communities, school children and teachers (mangrove restoration is a good environmental education activity), or other volunteers.
- ❑ Establish a monitoring programme to follow the success of the replanting.
- ❑ Do not consider introducing mangrove and other species that are not indigenous to the area.

### Sources of further information

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### CASE STUDY

## Restoration of mangroves in Mauritius - improving the habitat for juvenile fish

The MPAs in Mauritius include six Fishing Reserves, which have been established to ensure that the appropriate environmental conditions are maintained and appropriate fishing methods are used for sustainable fisheries management. Around 70% of commercial fish species depend on mangroves particularly in their juvenile stages. It is thus vitally important to maintain healthy mangroves in this country, but as in many WIO countries, forests have been damaged by a range of human activities as well as cyclones. Two species of mangroves are found: *Rhizophora mucronata* which is most common and is found along the north-east and east coast; and *Bruguiera gymnorhiza* which is found in only a few localities. In 1995, the Ministry of Fisheries started a Mangrove Propagation Programme with the aim of protecting and reforesting denuded areas and also sensitising the public about the importance of this ecosystem. The programme consisted of five phases. A mangrove nursery was set up at Mahebourg Fish Farm and mangrove propagules were collected, placed in small plastic bags with mud and kept in the nursery until they reached four-leaf stages. The seedlings were then planted at selected sites around the Island.

During the first phase (June 1995 - 1996), 12,400 seedlings were planted at nine sites around the island covering a total lagoonal area of 22,750m<sup>2</sup>, much of this in and adjacent to the MPAs including Black River, Poudre d'Or and Grand Port Fishing Reserves. An average survival rate of 65% was noted. The second phase (June 1997 - December 1998), involved four sites along the west coast, covering an area of 23,750 m<sup>2</sup> where 47,500 seedlings were planted. During the third phase (February 2000 - 2001), five sites along the north shore were selected and 40,000 seedlings were planted covering 20,000 m<sup>2</sup>. For the fourth phase, three sites in the east with an area of 29,000 m<sup>2</sup> were planted with 58,000 seedlings. The fifth phase, involved a mud flat of 23,000 m<sup>2</sup> on the western part of the island. No seedlings were planted at this site but 41,000 propagules were collected from mother trees and directly inserted in the mud to about one third their length, without prior development in the nursery. A year later, over 95% of the propagules had developed into healthy plants reaching four to six leaf stages, confirming the success of planting propagules without the need for the nursery and pre-culture facility.