Mangrove restoration

Mangrove clearance for coastal development, fuel and timber is leading to high rates of degradation, particularly in urban and peri-urban settings. Mangrove loss can directly affect reef species reliant on the habitats for part of their lifecycle. Land use change can increase run-off, leading to chronic exposure to herbicides, increased turbidity, sedimentation and nutrient enrichment, which can affect coral health and increase mortality, cause reduced coral diversity and recruitment, replacement of coral by species such as macro-algae, and increase outbreaks of coral predators. The settlement of juvenile reef fish may also be impaired.

Current strategies: A number of initiatives are encouraging the replanting and protection of mangroves. Replanted mangroves act as a carbon sink, supporting climate change mitigation.

Assumptions for resilience: It is assumed that restored mangroves will a) trap run-off and provide habitat, increasing the health of the coral reef ecosystems and b) support resistance to pressures such as climate change and human activity allowing the continued provision of societally beneficial ecosystem services.

Ecological impacts

Positive

Documented examples have shown:

- Successful restoration of mangrove vegetation enhances the abundance and diversity in seabed-dwelling communities, improving functionality and supporting the delivery of ecosystem services
- Very large plantations (150,000 ha) in Asia led to significant sediment accretion, and even small plots affect soil composition and nutrient content. This suggests that plantations do fulfil their role of trapping sediment run off to at least some extent.
- Reef siltation rates following mangrove replanting do not appear to have been reported.

Negative

Documented examples have shown:

- Mangrove replanting often concentrates on a few preferred species so does not replicate the biodiversity of existing mangrove forests.
- The diversity and richness of fish and shrimp species can be lower in replanted stands, but results are mixed and the factors affecting this complex.
- Most attempts to restore mangroves fail completely or fail to achieve stated objectives.

Implications for ecological resilience

- The age, species and diversity of the trees is a factor in the functions and services provided by replanted mangroves.
- Mangroves behave as nursery grounds and refugia for coral reef species.
- Mangroves provide coastal protection against storms and sea-level rise.
- Mangroves can reduce siltation rates from land-use change, and assimilate pollution

Social impacts

Positive

Documented examples have shown:

- Mangrove restoration projects linked to carbon credit schemes can generate income for the community.
- They can also support alternative livelihoods (e.g. beekeeping, aquaculture, eco-tourism activities).
- Local communities perceive the benefits of mangrove plantations for the supply of ecosystem services. In most cases natural mangroves are valued more highly due to the range of products, but plantations can be particularly valued for the generation of better quality products (e.g. poles).

Negative

Documented examples have shown:

- Communities are not always informed before mangrove plantations schemes are initiated, and not always consulted on the species planted, so those chosen produced fewer benefits.
- Banning activities such as pole cutting, fuel collection and charcoal production as part of mangrove rehabilitation projects has negative effects on incomes and welfare, at least in the short term.

It has been suggested that:

- Community management could lead to conflicts around enforcement and corruption.

Implications for social resilience

- Short-term impacts on livelihoods can render households vulnerable to seasonal or sporadic shocks.
- Evidence for improvements to incomes from mangrove replanting is mixed in Africa.

Spatial scale: Generally local.

Temporal scale: New stands establish in 10-30 years.

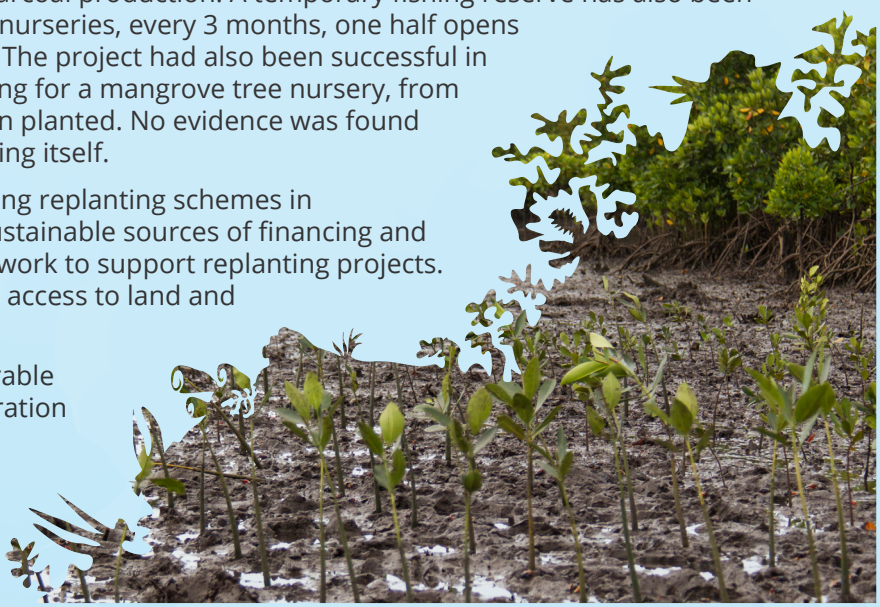
Case study: Mangrove restoration in the Ambondrolava mangrove complex, Madagascar

Since 2007, the Reef Doctor Honko Project (formerly Honko Mangrove Conservation and Education) has worked with coastal communities to preserve and manage the mangroves within the Bay of Ranobe, a 120 ha site within the Ambondrolava mangrove complex. In 2010, VOI Mamelo Honko, a local community mangrove association was created with the aim of improving community based mangrove management, which in 2017 has approximately 700 members. The community obtained the management rights of the forest and VOI supported the creation of a local law (dina) governing the use of the mangroves. Mangrove restoration activities have been accompanied by an education and communication programme, support in mangrove fisheries management and the introduction of alternative livelihoods (e.g. beekeeping, aquaculture, artisanal products and ecotourism). A partnership with NGO Blue Ventures has been used to examine opportunities for sustainable financing through a payments for ecosystem services (PES) scheme (see report card 6) and carbon financing.

Has it been successful? Since 2009, 400,000 seedlings have been planted across 40 ha and enforcement of the dina has resulted in a ban on charcoal production. A temporary fishing reserve has also been generated to protect important fish nurseries, every 3 months, one half opens while the other half remains closed. The project had also been successful in acquiring additional funding, including for a mangrove tree nursery, from which over 1000 seedlings have been planted. No evidence was found indicating the success of the replanting itself.

Challenges: The main challenges facing replanting schemes in Madagascar are the availability of sustainable sources of financing and the absence of a government framework to support replanting projects. There are also challenges relating to access to land and land tenure.

Future application: There is considerable interest in effective mangrove restoration across Madagascar and community members are now regarded as experts on mangrove plantations. They are invited to share their expertise across the country.



Further reading

Andradi-Brown, D.A., Howe, C., Mace, G.M. and Knight, A.T. 2013. Do mangrove forest restoration or rehabilitation activities return biodiversity to pre-impact levels? *Environmental Evidence* 2(1): 20.

Blue Ventures. Accessed 2017. *Blue Forests Programme*. https://blueventures.org/conservation/blue-forests/.

Bosire, J.O., Dahdouh-Guebas, F., Walton, M., Crona, B.I., Lewis, R.R., Field, C., Kairo J.G. and Koedam, N. 2008. Functionality of restored mangroves: a review. *Aquatic Botany* 89(2): 251–259.

Bucht, K. 2015. Plantation projects in Madagascar: approaches, objectives and reflections for fuelwood production. *Tropical Resources* 34. http://tri.yale.edu/publications/tropical-resources-bulletin/tri-bulletin-archive/tropical-resources-vol-34/plantation

Gorman, D. and Turra, A. 2016. The role of mangrove revegetation as a means of restoring macrofaunal communities along degraded coasts. *Science of the Total Environment* 566: 223–229.

Jones, B. 2015. Communities leading the way to save Madagascar's mangroves. *National Geographic Ocean Views* 17 March 2015. https://voices.nationalgeographic.org/2015/03/17/communities-leading-the-way-to-save-madagascars-mangroves/

Kairo, J.G., Dahdouh-Guebas, F., Gwada, P.O., Ochieng, C. and Koedam, N. 2002. Regeneration status of mangrove forests in Mida Creek, Kenya: a compromised or secured future? *Ambio* 31(7–8): 562–568.

Kathiresan, K. and Rajendran, N. 2005. Mangrove ecosystems of the Indian Ocean. *Indian Journal of Marine Sciences* 34(1): 104–113.

Lewis, R.R. 2005. Ecological engineering for successful management and restoration of mangrove forests. E*cological Engineering* 24(4): 403–418.

Mikoko Pamoja Community Organization. 2017. *2015-2016 Plan Vivo Annual Report Mikoko Pamoja*, 46pp. http://www.planvivo.org/project-network/mikoko-pamoja-kenya/.

Reef Doctor. Websites accessed 2017. Honoko Project: Mangroves - management and restoration. https://www.reefdoctor.org/projects/conservation/mangroves/; https://www.reefdoctor.org/projects/conservation/mangroves/mangrove-management-restoration/

Rönnbäck, P., Crona, B. and Ingwall, L. 2007. The return of ecosystem goods and services in replanted mangrove forests: perspectives from local communities in Kenya. *Environmental Conservation* 34(4): 313–324.

Images courtesy of Samuel Stacey, Worldfish Centre.