Nurseries of the Seas

Mangroves

Text by Tyge Dahl Hermansen

Mangrove forests are significant habitats that exist throughout the tropical belt across the globe. Mangroves are adapted to the specific terms that exist in intertidal marine zones.

In America, New Zealand and Australia mangroves extend to the subtropical zone, and they have their range limits at the most southern point of Australia.[1] Eighty-four species of mangrove trees have been identified across the world of which 70 (including 12 varieties) are true mangroves, while 14 are semi-mangroves.[2]

A wide diversity of animals is found in mangrove swamps. Since these estuarine swamps are constantly replenished with nutrients transported by fresh water runoff from the land and flushed by the ebb and flow of the tides, they support a bursting population of bacteria and other decomposers and filter feeders. ■

Mangroves are obligate to mangrove forests and adapted to the specific conditions that exist in intertidal marine zones.[3] Dependent on the tides, mangroves grow in soft mud or sand and have adapted by localizing approximately half of their weight in the roots.[4]

Mangroves have a complex ecology because of their interaction with physical forces such as tides, surface sediment runoff, river and groundwater discharge, waves, and varying amounts of sediments, nutrients and saltwater.[5] They live in coastal settings with freshwater runoff, multiple substrate conditions, prolonged hyper periods, varying salinity, anoxic conditions, accumulation of toxic substrates, perpetually changing temperatures and changing oxygen concentrations.[6]

But throughout geological time,[7] they have proved very suitable for adaptations to these conditions, which is why they have survived until today. But it is hard to predict how suitable mangroves are for survival in the future because, as pointed out in a paper by Berger et al. in 2008: "When coastal landscapes become fragmented by urban transformation of regional and coastal settings, mangroves are [becoming] less self-maintaining as coastal processes are modified."

All these factors together with the pressure of global warming,[8] makes the conditions for the survival of mangroves in the future very difficult and a world without mangroves realistic.[9] They are one of the most threatened ecosystems in the world today, suffering from conversion, over-exploitation and pollution.[10]

For example, in the Mexican LaPaz region, 23 percent of the mangroves were "wiped out" in the years from 1973 and 1981,[11] and in Asia, 26 percent of the mangrove forests in the six countries that were most influenced by the tsunami on 26 December 2004 have been destroyed during the last 20 years.[12]

Furthermore, many people think that mangrove forests are negative ecosystems plaguing urban areas with swamps that act as hatching places for mosquitoes, beetles, wasps and other insects, which are unwanted in the human community, and it is thought that mangroves


NOAA

Grass shrimp


PETER SYMES

These mangroves in Florida are important ecosystems, which provide breeding grounds and nurseries for marine life

SCOTT BENNETT

Exposed roots of mangrove trees reach into nutrient rich waters

Mangroves

JOHN E RANDALL / USGS

Mangrove goby

produce poisonous bacteria, gases and bad smelling substances, which pollute the surrounding areas. Therefore, it seems that the common perception of the local community is that mangrove forests and trees should be erased from locations near areas under urban development or agriculturally important areas. Nothing could be further from the truth.

Why is it important to conserve the world's mangrove populations?

The importance of mangroves is obvious if one looks at the fact that they provide a variety of other ecosystems with a broad array of service functions[13] such as grounds for spawning, breeding, nurseries and hatching areas for many different marine species[14] including support of a range of economically and biota important to conservation.[15]

They protect coastlines against sediment movements[16] and promote sedimentation.[??] They protect people and coastlines against extreme weather conditions[17]—for instance, by reducing the height of waves, which protects fragile marine life against stormy weather of all kinds.[18]

Many people who died in the 2004 tsunami catastrophe in Asia might have survived if the mangrove population along the coast had been intact, which provides food supply for fishes, crabs, prawns and humans,[19] and regulates the air and water quality,[20] climate, soil formation, as well as the primary production and the circulation of nutrients and water.[21]

Mangrove systems belong to the most productive ecosystems in the world. For example, each hectare of the mangrove forests of Sumatra contribute approximately 500kg of shrimp and fish each year,[22] and in Mexico, within 13 selected marine regions during 2001-2005, around 10,5000 tons of fish and crab worth US$19 million were harvested. About a third of these fisheries have species that rely on mangrove habitats.

The Mexican mangrove areas are sold by the Mexican government for US$1,000 per hectare but produce a median value of $37,000 per hectare.[23] Mangroves also provide wood for timber and fuel.[24]

Furthermore, researchers have found that several towns described by Marco Polo as coastal towns in the 13th century, are actually located more than 100km from the coast today.[25] This phenomenon is partly caused by the deposit of sediments in the mangrove forests of Sumatra. The Millennium Ecosystem Assessment, 2005, classifies these ecosystem services into four groups—supporting, cultural, regulating and provisioning services.[26]

From this, one can see that the mangroves make up an extremely important habitat type that is decisive for the survival of the two other main coastal marine ecosystems: coral reefs and sea grass.[27] Because of this relationship and because mangroves and their inhabitants (as well as other species occupying coastal wetlands) are vulnerable to global warming,[28] urban and agricultural disturbances,[29] and because their capability to expand their range is restricted by the specificity of their habitats,[30] it is particularly important to intensify the research in mangroves' capability to survive in the future.

However, many of these problems have been faced by a number of countries that pay attention to induced or natural mangrove recovery.[31] Models that simulate management planes for protection, rehabilitation and restoration of mangroves have also been constructed.[32] These models could help governments through future planning of mangrove conservation, and further research in theoretical modelling is necessary to improve existing models or constructing new and even better models.

Furthermore, mangrove rehabilitation has been carried out or planned in several countrie. For example, the World Conservation Union (IUCN) and the United Nations development programme for the reestablishment of the mangrove populations in the 12 countries hit by the December 2004 tsunami—Mangroves For the Future (MFF)—will run over six years.[33] Such initiatives are mostly welcome and very helpful for the conservation of the world-wide mangrove population. ■

[1] GILL AND TOMLINSON, 1971; HOGARTH, 1999; DUKE, 2006
[2] WANG ET AL., 2003
[3] BALL, 1988; HOGARTH, 1999; DUKE, 2006; KRAUSS ET AL., 2008
[4] KOMIYAMA ET AL., 2008
[5] BERGER ET AL., 2008
[6] LUGO, 1980; BALL, 1996; HOGARTH, 1999; BERGER 2008; LAMBS ET AL, 2008
[7] ELLISON, 2008
[8] GILMAN ET AL., 2008
[9] DUKE ET AL., 2007
[10] FARNSWORTH AND ELLISON, 1997; DAHDOUH-GUEBAL AND KOEDAM, 2008; ELLISON, 2008
[11] DALTON, 2008
[12] DANIELSEN, 2005; FAO, 2003
[13] SEE ALSO: FAO, 2007AB
[14] BARAN, 1999; BARBIER, 2000; DAHLGREN ET AL., 2006; WALTON ET AL. 2006; DAHDOUH-GUEBAL AND KOEDAM, 2008; NAGELKERKEN ET AL., 2008; WALTERS ET AL., 2008; TSE ET AL., 2008
[15] DANIELSEN, 2005; CANNICCI ET AL., 2008; ELLISON, 2008; NAGELKERKEN ET AL., 2008
[16] MENDOZA AND ALURA, 2001; WALTON ET AL., 2006
[17] DAHDOUH-GUEBAS, 2005; DANIELSEN, 2005; WALTON ET AL., 2006; ELLISON, 2008
[18] DANIELSEN, 2005; ELLISON, 2008
[19] DANIELSEN, 2005; NAGELKERKEN ET AL., 2008
[20] WALTERS ET AL., 2008
[21] WALTERS ET AL., 2008
[22] DANIELSEN, 2005
[23] DALTON, 2008; UBERTO-OROPEZA ET AL, 2008
[24] ELLISON, 2008
[25] DANIELSEN, 2005
[26] WALTERS ET AL., 2008
[27] MOBERG AND RÖNNBÄCH, 2003; HARBORNE ET AL., 2006
[28] GILMAN ET AL., 2008
[29] HARTY AND CHENG, 2003
[30] THOMAS, 2006
[31] STEVENSON ET AL., 1999; LEVIS ET AL., 2005; BOSIRE ET AL., 2008; DAHDOUH-GUEBAL AND KOEDAM, 2008
[32] TWILLEY, 1997; FIELD, 1998, 1999; DOYLE ET AL., 2003; DUKE ET AL, 2005; TWILLEY AND RIVERA-MONROY, 2005
[33] STONE, 2006; IUCN-MFF; MFF

Mangroves For Fiji

Text by Scott Bennett

In the Pacific, mangrove habitats have been decimated via a culmination of over harvesting, urban development, reclamation for tourist resorts and the proliferation of squatter settlements.

Holistic approach

Despite the seemingly incessant reports doom and gloom, there are glimmers of hope. In Fiji, one local dive operator is playing a vital role to halt the destruction. Situated on the island of Viti Levu, Beqa Adventure Divers has initiated a holistic conservation project aimed at protecting this besieged environment.

Long striving to minimize their environmental impact, the company had found it difficult to substantially minimize its carbon footprint. With vehicles, boats and compressors an integral part of its business, the company was disturbed but its resulting high emission. With global carbon trading on the increase, the company could have easily paid an intermediary to finance a forest or windmill in some far-flung destination. A homegrown solution was sought, but when no such initiative was found, the company decided to run a project themselves. Called "Mangroves for Fiji", the privately-funded scheme combines the advantages of planting mangroves while offsetting their own carbon footprint. To do so, the company is offsetting the entirety of its carbon emissions by planting a corresponding number of mangroves throughout Fiji.

Sustainable results

In order to achieve sustainable results, Beqa Adventure Divers engages directly with local communities, schools and grassroots initiatives whilst availing welcome mediation by various Government Departments. Heading up the project is resident marine scientist Arthur Sokimi. Having studied Marine Science at Fiji's University of the South Pacific, he has garnered a wealth of information about the subject and ironed out the initial kinks by co-running a pilot project in Galoa village. Sivorosi "Sivo" Naivua is the President of the Galoa Village Youth and one of the absolvents of the company's village youth sponsorship programs. Having worked for OISCA, a Fiji Agro-Forestry Development Project, he has had extensive experience in mangrove planting, having co-managed the successful pilot project. The heart and soul of the operation is Nanise "Nani" Ledua, Beqa Adventure Divers' Office Manager. she provides a wealth of networking and organizational skills and is likely to be the first point of contact when contacting the company.

Government support

The project is supported by a number of government departments, including Environment, Forestry and Fisheries as well as the Marine Ecology Consulting, is Fiji and the South Pacific's leading company for Coastal and Marine Ecology Assessments.

Conservation of mangroves and their associated ecosystems has been identified as a key natural adaptation strategy and mitigation measure to climate change. Protection of these vital ecosystems also safeguards and enhances the livelihoods of coastal communities. In the Pacific, mangrove habitats are acknowledged to be especially important to the traditional lifestyles of its people.

Apart from the physically protecting coastlines, they are a valuable food source, providing a myriad of fish, crabs, prawns and shellfish as well as seeds that are consumed in many parts of the Pacific. Furthermore, they provide are an important source of firewood and building material for housing.

Carbon sequestration

For this project, it is assumed that one hectare of Mangroves (= 10,000 Mangrove trees) sequesters one metric ton of Carbon every year. Planting will be effected in cooperation with local stakeholders that shall be paid FJD 1,000 for every hectare of restored Mangroves. Beqa Adventure Divers operate and pays for a small project team that will be on call for establishing and keeping all the necessary contacts, inspect sites, share information, disburse the funds and assist any partners in Fiji and abroad.

With projects underway in a number of villages throughout the country, the future looks brighter for one of Fiji's most endangered ecosystems.