

The Mangroves of Bhitarkanika

the habitat of global importance

There are many reasons why it is critical that we act to preserve the fragile coastal ecosystem of the Orissan Coast found at Bhitarkanika. Not only is the natural wonder of the sanctuary worth protecting of its own right, but it provides critical cultural and economic services to the people of the region as well as the people of Orissa and India in general. In fact, Bhitarkanika is a habitat of global importance.

For biologists too, with their own kind of religion, this place represents a sacred trust. Of the approximately eighty species of mangroves in the world, Bhitarkanika harbors about sixty-two of them. It is also home to over 215 species of migratory birds, which are critical to ecosystems far removed (and part of the reason why Bhitarkanika is listed as a Ramsar site) and an amazing 8 species of kingfisher. Fish and crab species too are abundant, as are reptiles. These include the marvelous estuarine crocodile, which can grow to be between seven and eight meters in length, and for which Bhitarkanika serves as a sanctuary; and the Olive Ridley Sea Turtle, which makes its annual migration to these sandy shores to lay its eggs. It is the largest turtle-nesting site in the world. Bhitarkanika is also the hatching ground for many fish and shrimp species, critical both to coral and marine ecosystems and commercial fishery. Rare estuarine dolphins also inhabit the murky waters. These intelligent mammals are at risk due to motorboat traffic and noise pollution in rivers around the world, and Bhitarkanika hosts several such species.

But to a biologist, Bhitarkanika doesn't just represent one of the last places to find many of these rare specimens or a biodiversity hotspot, but a great mystery waiting to be unraveled. There's much we still don't know about mangrove ecosystems, including their true importance. Exactly what species are spawned among the mangrove roots? How do mangroves manage to survive in such harsh conditions of heat, UV radiation, fresh water scarcity, and ever-changing tide and salinity? Can these traits be used in commercial crops to increase food-security? How do crocodiles contribute to the marine population? What about crab populations cycling

If you have had a chance to gaze into the dark depths of a mangrove grove, or watch the tide flow up to kiss the bright green leaves of a tree; if you have seen fiddler crabs seeming to play in some silent string or chestra as they feed or deer dancing along the muddy banks at low tide; if you have seen a gigantic crocodile sunning itself like some ancient wonder transporting you back to the time of the dinosaurs or watched a mudskipper grip the roots of a tree with the beginnings of limbs like the first creature to crawl out of the sea millions of years ago; you could not help but be filled with a sense of wonder.

You know that this environment is worth preserving because of its beauty, its history, and its spirituality. Earth, water, wind, fire, and space are all present here in all their glory. You can feel the footprints of Gods that must walk among these trees and their twisted network of roots, whistling with every voice in the forest, from the red-breasted kingfisher to the loud squawk of herons nesting on the magnificent island of Bagagahan.

the nutrients and increasing the surface area of the soil? And those fireflies that light up whole trees with a simultaneous flash? And what of the medical mysteries of the horseshoe crab, whose blue blood appears so promising for research? There are so many questions and so many possible discoveries. Within a 10 square centimeters of mud alone there are thousands of microfauic organisms, many without names and whose roll is not well understood. How can a biologist not both wonder and be covetous of such a rich biological treat, a web of complex ecological interactions?

Even if you never get a chance to see this pristine environment and the wonders harbored within the Bhitarkanika sanctuary, you can feel content that such a place still exists in a world that sometimes feels strangled by concrete and industrial fumes. Nature remains in these isolated pockets in all its wonder. Gods and naturalists alike can still walk there, and that, in the very least makes it worth conserving.

But the value of Bhitarkanika does not end with the intangible aesthetic benefits or the joy that it will bring to biologists and naturalists. Bhitarkanika is a source of food security and cultural heritage for the people living in villages nearby or even within the sanctuary itself. The local people exploit the mangroves for fish/crabs and firewood. They have little choice because they depend on only one source of income: a type of rice that grows in the salty coastal soil (and a harvest that will also be in

danger should climate change effect the duration and intensity of the monsoon). Their income consists of the 70 Rupees (under 2 US \$) a day -- they earn during harvest time. The rest of the year they depend on the forest. Even when the Department of Forest & Environment in Orissa banned harvesting from the sanctuary, the people risked jail time and sometimes even resorted to organized crime out of desperation.

What is difficult for the largely uneducated population of villages like Gupti to see is that the mangroves provide many other valuable services for which they should be preserved. The trees provide a home to many of the crabs that the people eat and spawning grounds for the very commercially important Tiger Prawn, Ilisha, Khainga, Bhekti, Kantia, and Kokill. The forest also helps to regulate the tide and prevent coastal erosion that would threaten to sink whole villages into the sea.

Additionally, a large swath of mangroves keep human beings and cattle safe from crocodile attack, because these large reptiles rarely chase prey terrestrially. The crocodiles themselves also provide a valuable resource. They attract ecotourists and biologists to the region, allowing the people an alternate source of income ferrying travellers up and down the rivers and in giving tours and providing food and accommodation. The crocodiles also help populations of commercial fish species because their main prey generally consists of the species of fish that, if they became overabundant, would eat the commercial fish. Moving the water with their gigantic bodies, the crocodiles contribute to primary and secondary productivity by stirring the suspension of detritus on which many macrofaunal and meiofaunal life depends, increasing the rate of nutrient cycling.

Mangroves are known as 'soil builders' though it is not just the mangroves themselves that do the job, but the rich ecosystem and habitat that they support. Mangrove roots trap sediment as well as help to create it with the leaf-litter and detritus that they produce. The way their roots break up and slow the current creates eddies that allow sediment to float to the bottom and accumulate. The mangroves also make the soil richer in elements such as oxygen and play a key part in the nitrogen and phosphorous cycles. Certain photosynthetic algae and bacterium that live among the mud produce secretions that help to trap soil and bind it together like glue. Crabs also play a large part. Fiddler crabs, which sift the mud for food in their mouths cycle a large part of the nutrients, process a large part of the soil when they spit out pseudofecal pellets. Other species of crab oxygenate the soil with their burrows (as well as increase the soil's surface area) and add organic matter by taking leaves for storage in those burrows.

The trapping of the sediment and the process of soil formation also protects coastal waters from organic contaminants and sedimentation, providing a key service in water purification.

But the mangrove trees themselves do much more than protect from coastal erosion and the creation of soil. They have been shown to reduce the impacts of tropical storms, tsunamis and

other violent acts of nature that are occurring with increasing frequency due to the effects of climate change. This is a valuable service for all the people of Orissa as well as for the people of India as a whole (they are spared the immense costs, both human and economic, of disaster relief).

Unfortunately, mangroves are vulnerable to climate change as well. They are specially adapted to coastal condition in the tropics, a region in danger should ocean level rise and the delicate balance of fresh and salt water in which they live shift. Their simple proximity to the coastline and the narrow band which they generally inhabit, also possess a risk. Added to these stressors is the threat of the human population living near these forests.

The Sandhan Foundation of Bhubaneswar, in conjunction with the UNEP-GPA, NC-IUCN-TRP and the Government of Orissa, has begun an innovative project: the Coastal Community Resource Center (CCRC), located at Gupti. The Center's objective is to educate the local population about the importance of wise management of the mangrove forest both for their own health, protection from the effects of climate change, and for sustainable development. The CCRC is working to provide alternatives to exploitation of the mangrove forest, including research into alternative crops and firewood able to grow in saline conditions, aquaculture in tidal ponds outside the sanctuary, collection of cow-patties or the purchase of biomass/solar cooking equipment as an alternative to mangrove wood and leaves, green fencing, and increased education and development of artistry to provide flexible sources of income and increase human capital.

The Center also serves as a rest house for scientists and tourists as part of a promotion of ecotourism to the region, providing the local people with yet another possible source of income, as well as increasing the demand for a well-developed transportation network.

As India's population continues to expand along with the demand for development, scarcity of water resources (also possibly exacerbated by climate change) for industry, human consumption and agriculture represents a threat to the Brahmani watershed, which supplies the freshwater inflow to the sanctuary. The efforts of the CCRC, especially in training local people to replant mangroves (which have a surprisingly slow natural re-growth rate) shows hope that those living in or near the sanctuary will at least have the tools at their disposal to adapt and to develop in harmony with the natural resources that will protect them from some of the worse effects of climate change as well as help to preserve them for humanity as a whole.