

reductions in productivity and yield have been observed, though mud-banks persisted as a recurrent feature.

During low-tide, mud deposits collected from beaches serve as good land-filling material, and this can affect local conditions and topography. Another major influence on landscape is the protection rendered to the coastal belt and the tendency for the shore to grow on either side of a mud-bank. Thus whereas high waves during the monsoon period have a devastating effect on the coastal belt by way of beach erosion, in mud-bank region the sea is calm, though this may adversely affect beach resorts and recreational activities. One of the physical aspects noted is the enhanced upward and shoreward extension of the oxygen minimum layer in mud-bank regions during upwelling.*

With regard to marine engineering, the Cochin harbour area maintains a channel 10 to 12 m deep for naviga-

tional purposes within the bay and extending outwards into the sea for about 5 km. This is achieved by periodic dredging operations and disposal of clay material out to sea. Recently the operations in the outer bay were hampered due to a mud-bank formation just south of the bar's mouth and its tendency to shift northwards, so that the channel had to be dredged with a northward inclination instead of the practised westward orientation (cf. Fig. 2).

Extensive studies will be required before there can be any conclusive understanding of this natural coastal phenomenon, though recently the State Fisheries Department has advanced schemes in this connection which is a welcome step. Equally interested are the Port Trust authorities in studying the mud-banks or 'Chakara' and the conduction and effect of dredging operations.

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*In answer to our query the Author explained: 'During upwelling, the thermocline and oxygen minimum layers are raised to subsurface levels. The presence of mud-banks enhances this phenomenon'.—Ed.

Importance and Status of Mangroves

The continued supply of shrimps and fish to innumerable outlets ranging from street barrows to the super-market chains of the West, is in danger. Over-fishing is one reason, while a far less known cause is the continuing destruction of mangroves, estuaries, and other coastal wetlands and shallows, which provide food and shelter for an estimated two-thirds of the world's fish-catch.

A recent survey carried out in Indonesia determined that when a mangrove swamp (a highly-adapted tropical coastal forest) was destroyed, the local shrimp fishery quickly perished with it. The explanation is that young shrimps feed on the dead leaves and other litter falling from the mangroves into the water below. Mullet and snapper are among the many commercially valuable fish species which also rely on the mangroves.

The World Conservation Strategy has stressed the valuable role which mangroves and other coastal wetlands play in the world economy, for as well as fish breeding-grounds they provide barriers to erosion and habitat for waterfowl and other wildlife. Recently in Singapore, a group of experts on mangrove forests met and finalized a 'Global Status Report' which draws the attention of governments and aid agencies to the plight of the mangrove forests that are being destroyed at an unprecedented rate practically throughout their tropical and subtropical range. Covering all aspects of mangrove ecology, the Global Status Report makes a series of recommendations for their long-term management.

Mangrove forests are a biological phenomenon which can survive waterlogging, poor soils, salinity, high humidity, hurricane-force winds—indeed everything, it seems, except Man. Today, ill-planned urban and tourist development, unchecked firewood gathering, herbicide pollution, and so on, are all contributing to their rapid destruction. In India alone an estimated 16,000 square kilometres of mangroves—an area larger than the US State of Connecticut—have disappeared since the turn of the century.

Traditionally looked upon as worthless mosquito-infested areas, mangrove swamps—if properly managed

—could provide a supply of firewood to meet the energy needs of tropical countries that are now reeling from the oil-price hikes. In places as far apart as Bangkok and Puerto Rico mangrove charcoal, which burns almost as well as coal, sells at twice the price of other kinds of charcoal. In Africa and West Asia, particularly, mangrove wood is highly prized as a building material—both for its strength and because its high tannin-content makes it resistant to termites.

As barriers to the sea along the Pacific coasts of Colombia and Ecuador, mangroves shelter coastal waterways that are important for internal transport, while rapid land-formation around the mangrove forests at the mouths of the Ganges and Brahmaputra Rivers is dramatic evidence that mangroves can help Man to reclaim fertile land from the sea.

Where Man has attempted to reclaim land from mangroves, he has not been so successful. Thus along the Gulf of Thailand and the coast of El Salvador, once-dense stands of mangrove forest have been replaced by barren, saline wastelands. It also seems clear that the widespread destruction of mangroves in Southern Asia has contributed to the catastrophic flooding of parts of that region in the past.

Fortunately, the situation is far from hopeless, as an estimated 20 million hectares of mangroves still remain practically throughout the Tropics, while the above-mentioned special meeting of the working group on Mangrove Ecosystems of the IUCN Commission on Ecology and its Global Status Report, together with a series of UNEP-inspired marine environment Action Plans, are together serving to focus the attention of governments on the need for conservation of mangroves, estuaries, and other aspects of the world's waterfront.

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