A Review of Mangrove Conservation Studies in Maharashtra, India

Nisha R. Mugade, Jagdish B. Sapkale

***Abstract*— Maharashtra state is having a variety of resources and is one of the developed state in India. Maharashtra state lies in the western and central part of country. The western part of Maharashtra is bordered by Arabian Sea and having a coastline of 720 kms. Coastline of Maharashtra consists of wetlands in terms of marshes and mangroves, which provides food and shelters to the Aquatic Organisms and also protect the coastal settlement and agricultural land from natural calamities. Now a day's mangrove vegetation is more vulnerable due to human interferences and at time vulnerable to natural Climatic Changes too. Authors have highlighted the status and conservation of mangroves in Maharashtra.**

***Index Terms*— Mangrove conservation, Climate change, Human intervention, Mangrove degradation.**

I. INTRODUCTION

The coast is narrow overlap zone between the land and sea, where the erosional and depositional processes taken place. Numerous erosional and depositional coastal features come into the existence between land and sea [1], [2]. Cliffs, rocky platform, beaches, sand bars, sand dunes and wetlands are associated with the coasts. Coastal wetlands i.e. marshes and mangroves are economically significant ecosystem on the earth. [3] . These valuable ecosystems are under the threat of increasing population. Coastal tract of Maharashtra is more vulnerable to mangrove degradation. Most of the mangroves patches have been degraded as a result of transforming the wetlands into agricultural fields and prawns' farming [4]. Violations of coastal regulation zone have seen in the coastal areas of Maharashtra. Therefore, mangroves are more prone to degradation in future. The saline water from sea enters through estuaries and small tidal inlets at the time of high tide and inundated most of the mud flats and agricultural land. Under the scheme of kharland (saline land) development, generally earthen bunds are constructing to mitigate from the salinity problem. But in view of the mangrove conservation practices, construction of bunds under the scheme of kharland development may not be suggested at or near to opening of the estuaries, wherever sea water enters into estuary or tidal inlets. There may be a threat to mangrove destruction due to such construction activities. The pioneer works of distinguished researchers revealed that the mangrove vegetation requires continuous monitoring in view of its conservation.

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II. MANGROVE VEGETATION

Mangrove is a tree or shrub which grows in tidal, chiefly tropical, coastal swamps, having numerous tangled roots that grow above ground and form dense thickets [5]. "Mangrove is large tropical evergreen tree/forest, genus Rhizophora that grows on muddy tidal flats and along protected ocean shorelines. Mangroves produce from their trunks aerial roots that become embedded in the mud and form a tangled network; this serves both as a support for the tree and as a means of aerating the root system. Such roots also form a base for the deposit of silt and other material carried by the tides, and thus land is built up which is gradually invaded by other vegetation.

The mangrove forests also can protect inland coastal areas by absorbing the effects of storm and some tsunami waves, but many mangroves have been harvested destructively on a large scale" [6]. Mangroves are notably tropical plants that grow with their roots relatively submerged in sea water. They are economically significant because the mangroves are a source of timber wood (used mainly as firewood). Mangroves also protect shorelines from wave damage and disastrous events and provide shelters for fishes [7].

Differentiate investigations revealed that mangrove growth and its area is decreasing due to change in climate and human interventions. Global warming is one of the dominant events of climate change which causes sea level rises and tends to reduce the mangrove swamps. Future models and predictions also indicates that sea level is increasing day by day and influences on the growth and health of mangroves [8], [9], [10], [11], [12] [13].

III. MAJOR AREAS OF MANGROVES IN MAHARASHTRA

The mangrove ecosystem in south konkan playing significant role, provide various benefits to the local people. This ecosystem is more or less protected in the wetlands of Mithbav creek. The coastal native do plantation of *Rhizophora*, spp. *Sonneratia* spp. *Avicennia* spp. regularly. *Excoecaria agallocha* can grow naturally all over the coastal line [14]. The various species of mangrove are identified along the coasts of Maharashtra. Table no. 1 shows the major sites of mangroves along the major estuaries and tidal inlets of coastal Maharashtra. Karivane estuary is having various species of mangroves with uneven size (Fig. 1).

Table – 1 : Major Sites of Mangroves in Maharashtra

Sr. No	Name of District	Major areas of Mangroves: Name of Estuary/Creek/River/sites
1	Thane	Vasai, Vaitarna River, Dandi, Dahanu Creek
2	Mumbai	Thane Creek, Mahim, Malad Creek, Manori Creek
3	Raigad	Hareshwar, Shrivardhan, Murud Korlai, Uran
4	Ratnagiri	Vijaydurg , Purnagad, Bhatye, Mirya, Jaigad, Dabhol, Anjarle, Kelshi
5	Sindhudurg	Phanasewadi, Wadatar, Mith Mumbri, Mithbav, Achara, Kolamb, Karli, Vengurla, Kelus, Mochemad, Reddi, Terekhol

Source : Compiled by Authors.

IV. MANGROVE SPECIES IN MAHARASHTRA

Numerous Studies have been documented in view of the status, biodiversity and distribution of mangroves in south konkan estuaries like Mithbav, Mumbari and Devgad. In the study area few researchers have calculated relative density of Mangroves forest. As per their calculation relative density of *Exoecaria agallocha (L)* is highest in Mithbav estuary and lowest in Devgad estuary. They investigate about 12 genera and 20 species recorded in south konkan estuaries. The distributions of these mangroves were different from mouth of estuary towards inland water. Almost all the species were found in study area [14]. According to the Mangrove Cell [15], Forest Department of Maharashtra there are 20 species of Mangroves that have found in Coastal districts of Maharashtra (Table no. 2).

The new and rare species of mangrove that is Heritiera littoralis Dryand is studied along the coast of Maharashtra. Author's work highlighted on Heritira Littoralis Dryand's morpho-taxomomy, phenology, seedling morphology, habitat and regeneration [16].

Figure 1: Mangroves along Karivane Estuary

Table - 2 : Mangrove species in Maharashtra

Sr. No.	Scientific Name of Mangrove	Common Name	Distribution
1	*Avicennia marina*	Tivar	All over Maharashtra
2	*Avicennia officinalis*	Tivar	Widely distributed in Maharashtra but not as common as A. marina
3	*Rhizophora mucronata*	Kandal	Throughout Maharashtra
4	*Rhizophora apiculata*	Kandal	Raigad, Ratnagiri and Sindhudurg District
5	*Bruguiera cylindrica*	Kandal	Mumbai, Thane, Raigad and Sindhudurg rare in Ratnagiri
6	*Bruguiera gymnorhiza*	Kankar, Ekmane	Rare in Sindhudurg, Ratnagiri and Mumbai
7	*Kandelia candel*	Kandal-guriya	Sindhudurg and Ratnagiri district
8	*Ceriops tagal*	Kirkiri	All along Maharashtra coast
9	*Sonneratia alba*	Pandhari chipi	Found in all coastal districts of Maharashtra
10	*Sonneratia apetala*	Chipi	Thane, Mumbai and Raigad Districts rarely found in southern districts of Ratnagiri and Sindhudurg (south of Alibaug)
11	*Sonneratia caseolaris*	Chipi	Found in Sindhudurg district rare in Ratnagiri
12	*Lumnitzera racemosa*	_____	Mostly in Sindhudurg and Ratnagiri Districts
13	*Xylocarpus granatum*	Bhelanda, Samudraphal	Found only in a few estuaries in Sindhudurg and Ratnagiri Districts (Aachra, Vijaydurg, Purnagar and Jaitapur)
14	*Excoecaria agallocha*	Huri, Geva, Phungi	Coastal districts of Maharashtra
15	*Aegiceras corniculatum*	Kajala, Karti, Sugandha	Found in all coastal districts of Maharashtra
16	*Cynometra iripa*	Irapu	Very rare species found only in Sindhudurg District
17	*Heritiera littoralis*	Sundri	Sindhudurg district (recent report)
18	*Dolichandrone spathacea*	Gorshingiah	Sindhudurg district
19	*Acanthus ilicifolius*	Marandi, Kateri	Throughout Maharashtra
20	*Acrostichum aureum*	_____	Reported from Sindhudurg District, Maharashtra

V. CONSERVATION OF MANGROVES

Conservation of any natural resource means the proper management and systematic use of available resources. Natural resources full fill the human needs by different ways, but over exploitation of natural resources gives rise to ill effects on the resource and surrounding environments. To control over the degradation of resources , conservation is much essential. Considering mangrove as a natural resource also needs some kind of conservation practice to reduce the degradational rates. The increasing population in the areas of coastal Maharashtra has forcefully reducing the area of mangroves. Some areas of coastal Maharashtra reflect the deterioration of such wetlands.

Figure 2: Mangrove destruction along Vaghotan estuary

Figure 3: Mangrove seedling in Anjanvel tarf- Guhagar

Degradational rate of coastal wetlands have increasing rapidly, more or less 25-50% of the world's coastal wetlands have been lost due to conversion of marshes and mangroves into agricultural lands aquaculture [3] [17], [18], [19] . Some degradational sites have been observed along some estuaries of Maharashtra (Fig 2). Such sites may be rehabilitating by re planting the mangroves seedling in the degraded areas, mostly such practices under conservation of mangroves are carried out through various Government scheme (Fig 3).

When attempted for the conservation of mangroves, "First priority should be given to conserving the remaining areas of natural mangrove forest, especially areas supporting mature, seedling-bearing trees. Particularly valuable wetland habitats from an ecological and biodiversity perspective, can be conserved most effectively by assigning to them special status which is clearly recognized nationally, or internationally. This would include a designation as e.g. a national park, nature reserve, gazetted forest at national level, or e.g. Biosphere Reserve, Ramsar site, or World Heritage Site at the international level" [20].

Some researchers have concluded that Ramsar has maintained its balanced ecosystem, by introducing the restoration of wetlands in public awareness [21], [22]. There is significant awareness of Ramsar and mangrove protection and rehabilitation efforts at multiple levels. The effectiveness of Ramsar depends not only on the raising of public awareness, but also in quantifiable results such as the health and status of mangroves and the well-being, employments , and occupations of the people who depend on the resource [22].

In Mumbai, about 37 sq km of area is covered by mangroves. Maharashtra Nature Park located at left bank of Mithi river near dharavi Slum area, Mumbai and it is surrounded by Mangroves. Before two decades Maharashtra Nature Park was a city garbage area. The park occupies about 0.14 sq. km that is 37 acres. Maharashtra Nature Park is great achievement for conservation of biodiversity in India. Acanthus ilicifolius, Thespesia populnea, Salvadora persica, Ipomoea sps, Avicennia marina, Avicennia officinalis these mangroves species found in Maharashtra Nature Park [23]. Periphery of the Maharashtra Nature Park supports a lush and evergreen mangrove forest. Surrounding mangrove area is resting spot for birds which migrate during winter season in Indian subcontinent therefore famous for bird watching [24]. Mangroves plantation in the Maharashtra has been reducing because of human interference. Industrial developments, including power plants have been taken place. Therefore it is essential to undertake assessment of mangrove habitat and aware about the conservation of mangroves. "Specific education programmes should be conducted. Similarly, meetings with stake holders and Village Governing Bodies should be conducted to create platform for sharing their experiences and problems encountered in conservation of mangroves"[25].

Urbanization is one of the important factor which influenced on all natural resources. In view of mangrove ecosystem, the urban areas and its growths affects on the mangrove health. Waste water and sediment discharge from urban areas directly or indirectly added to mangrove swamps through river and estuaries. Some studies have been documented in terms of mangrove conservation in Thane Creek and Ulhas River Estuary of Maharashtra. An approach towards conservation measures such as sewage treatment, urban drainage management; mangrove plantation and dredging have been attempted in same area [26]. A holistic approach must at the time of planning to minimize the direct or indirect of urbanization on mangroves. In respect of this, Thane Municipal Corporation has implemented various conservative measures to protect the mangroves from sewerage [26]. Therefore, it is necessary to take serious initiate to protect mangroves through proper management scheme and conservation programme.

VI. CONCLUSIONS

The Mangrove ecosystem is affected by climatic factors as

well as by human interferences. Directly or indirectly, climatic change influences on mangrove growth. Many studies determined that variations in sea level, storm, cyclones, uneven distribution of rainfall, temperature variations are the climatic factor that effects on mangrove. In context with the present status of mangroves, it is necessary to protect such natural resources by conducting the awareness programme; and implementing strict rules and regulation. Violations of coastal regulation zone have seen in the coastal areas of Maharashtra. Therefore, Government and stakeholders should attempt the continuous evaluation and monitoring of mangrove ecosystem at micro level.

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