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# Ethnoecological Study of Mangroves along the Estuaries of Rajapur and Devgad Tehsils, Coastal Maharashtra

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**Abstract**

Mangroves along the coast of Rajapur and Devgad tehsils have well developed ecological and economical potentials, therefore an attempt have been made to evaluate the diverse exploitation patterns of mangroves by the local population in Devgad and Rajapur. The present paper also highlights the relationship between mangrove environment and human in terms of ethnoecology (i.e. knowledge about mangroves; fuel wood and mangroves; fishing and mangroves). Coastal households have very limited knowledge about the ecological and economical importance or benefits of mangroves. About 15% of respondents are practicing agriculture in the mangrove area due to scarcity of agricultural land. Questionnaire based results indicates that the use of mangroves as fuel wood is common in the coastal areas, about 51.83% respondents depends on mangroves for fuel wood, but at the same time 64.92% respondents reveals that mangroves are not at all important for their livelihood. Tourism is alternative source of income in coastal area so about 52.60% respondents are positive towards tourism. According to 95.26% of the respondents their waste water is mixed in the estuary. Anthropogenic activities often causes to degradation of mangroves. The increasing population in the

areas of coastal Maharashtra with increased demands of resources especially natural resources has forcefully reducing the area of mangroves. To protect such type of natural resource conservation is the easiest solution. That's why the study of man and mangrove relationship i.e. ethnoecological study is most important.

**Keywords:** Mangroves, Ethnoecology, Ecology, Exploitation, oysters, mussels, Degradation of mangroves.

## INTRODUCTION

Mangrove is large tropical evergreen tree/forest that grows on muddy tidal flats and along the shorelines. Mangroves produce from their trunks aerial roots that become embedded in the mud and form a tangled network; this serves as a support for the tree root system (Encyclopedia, 2014). Such roots also form a base for the deposit of silt and other material carried by the tides or water discharge, and thus land is built up which is gradually invaded by other vegetation (Encyclopedia). So, mangrove forests are very rich in nutrients and acts as shelters for fish, crabs and other marine mammals. Mangroves play vital role in coastal areas than the inland areas or estuary. Because tsunami, cyclones, wind are firstly attack on coast. In this context, mangroves protect coastline from tsunami, tidal waves, cyclones, flash floods and they also act as a wind breaker. There are different depositional coastal features which continuously interact with tidal waves. Sand dunes are depositional feature which protects landward ecosystems like mangroves (Sapkale, 2014). Simultaneously, these both are significantly reduces the impact of coastal catastrophes.

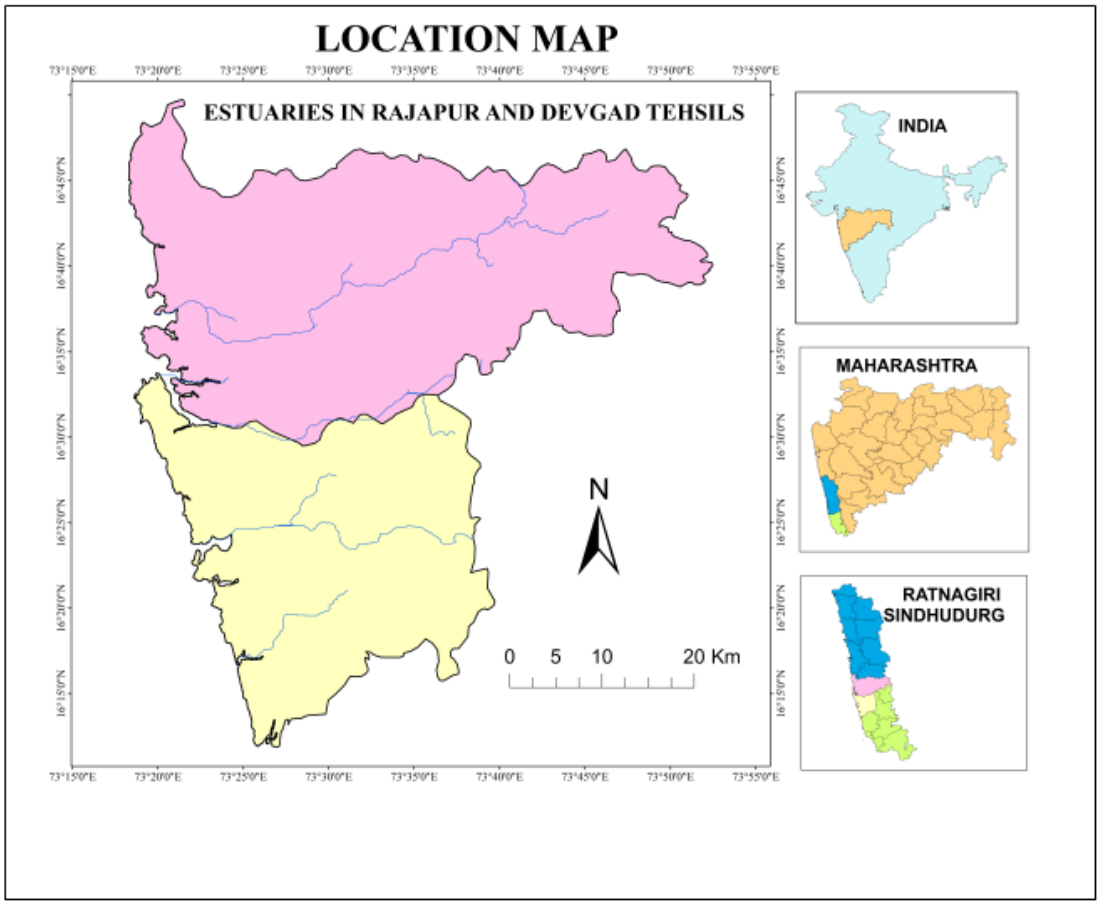
Moreover, mangrove forest also provides wood and non-wood forest products and benefits to native population (Bandaranayake, 1998; Ewel et al., 1998; Gilbert and Janssen, 1998; Dahdouh-Guebas and Koedam, 2006). Mangroves protect the coastline from destruction and maintain the ecosystem diversity and also provide lot of resources for the forestry, fisheries, food and agricultural industries (Miles et. al, 1999). The mangrove forest physically abused ecosystem because of several reasons of destruction like land recovery, pollution, disasters, and large exploitation of resources. At community level mangroves used for timber and firewood, fodder for animal and also used for medicine; at national level mangroves are used for timber and charcoal production; shrimp and crab production is also depends on mangroves (Kairo et. al, 2001). Consequently, human activities influenced on their surrounding environment. 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 key factor and much essential. Considering mangrove as a natural resource also needs some kind of conservation practice to reduce the degradation rates. The increasing population in the areas of coastal Maharashtra with increasing demands of resources especially natural resources has forcefully reducing the area of mangroves (Mugade and Sapkale, 2014; Rathod and Sapkale, 2015). That's why the study of man and mangrove relationship i.e. ethnoecological study has attempted in the present research work. 'Ethno' refers to human and 'ecology' means the interaction between physical environment and organisms (Encyclopedia). Ethnoecology is the study of cross cultures of people that how they manipulate and perceive their environments. Traditionally it has concentrated on linguistic analysis of terms for plants, animals, habitats and other ecological phenomena in attempts to understand the structure of human mind which influence human behavior (Casagrande, 2009). Ethnoecology is a way of looking that how people use their culture to accept the environmental transformation. The local people, whoever mostly depends upon the available natural resources are much more aware about every aspect of the resources. They are having more authentic ecological knowledge about the plants, animals and organism (Berlin, 1992). Ethnoecology gives great promise for linking anthropology with other fields of investigation (Nazarea, 1999). "Ethno ecology is the scientific study of how different groups of people living in different locations understand the ecosystems around them, and their relationships with surrounding environments" (Encyclopedia).

Urbanization is one of the important factors which influenced on natural resources. In view of mangrove ecosystem, the urban areas and its growths effects on the mangrove health. Waste water and sediment discharge from urban areas directly or indirectly added to mangrove swamps through river and estuaries. Therefore, the present research work focused ethnoecological relationship of man & mangrove in the coastal tehsils-Rajapur and Devgad of Maharashtra.

## STUDY AREA

The present study forms a part of mangroves, located in southern coastal region of Maharashtra along Arabian Sea. It consists of the coast of Rajapur and Devgad Tehsils from Ratnagiri and Sindhudurg districts respectively. It is also known as Konkan tract. Rajapur coast comprises Rajapur and Karivane estuaries whereas Vijaydurg, Phanase, Devgad, Mithbav and Mithmumbri estuaries are the part of Devgad coast (fig 1).




*Source : www.diva-gis.org/gdata and Survey of India Toposheets*

**Figure 1**: Geographical Location of the study area

## MATERIALS AND METHOD

In view of man and mangrove relationship and the exploitation of mangroves, the questionnaire survey was conducted in the study area. Along the right and left bank of seven estuaries, 23 villages (table no. 1) are selected for collecting primary data. Questionnaires are formulated on account of all the relevant aspects in terms of interaction between man and mangroves. The methodology also includes: individual household case study and institutional analysis. For the collection of large data/ information, random stratified sampling method was used. Estuary is divided into three part i.e. mouth, middle and upstream part. Comparatively middle zone of estuaries are having dense mangrove cover as compare to mouth of the estuaries (towards the seaward side). Out of 23 villages Devgad is headquarter of tehsil and Vijaydurg is semi urban area and both are historical places. Urban or semi urban area of the study area is more developed due to the availability of the infrastructural and educational facilities.

Data were obtained in April 2015 through 211 interviews/questionnaire. Each interview was conducted individually in the residential area of the interviewer where mangrove fields are presents. The questionnaire was split into the following categories: 1) Knowledge about Mangroves, 2) Fishing and Mangroves, 3) Fuel wood and Mangroves, (Côrtes et. Al, 2014). This questionnaire were adopted questionnaire designed by the Mangrove Management group at VUB and IFP , Wgeningen, also used by Hirani and Maniatis in 2005 (Guebas et. Al (2000) and Maniatis, Hirani, 2005).

**Table No. 1:** Villages for Ethnoecological survey

| TEHSIL | ESTUARY | VILLAGE NAME |
|---|---|---|
| Rajapur | Rajapur Estuary (Arjuna River) | Nate |
| | | Sakhri Nate |
| | | Jaitapur |
| | | Devache Ghotane |
| | | Karel |
| | Karivane Estuary | Dandewadi |
| | | Shirse |
| | | Ansure |
| | | Sagave |
| Devgad | Vijaydurg Estuary (Waghotan River) | Vijaydurg |
| | | Jambhari (Sagave) |
| | | Thakurvadi |
| | | Navanagar |
| | Phanase Estuary | Phanase |
| | | Kelayewadi |
| | Devgad Estuary | Malai |
| | | Madhaliwadi |
| | | Virwadi |
| | Mithbav Estuary | Morve |
| | | Tambaldeg |
| | | Hindle |
| | | Aagonwadi |
| | Mithmumbri | Mithmumbri |

## RESULTS AND DISCUSSION

KNOWLEDGE ABOUT MANGROVE:

Most of the people from all 23 villages acquainted with mangroves as a vegetation cover that is about 82.46% respondents. About 10.42% respondents know mangrove as wood and 1.89% of the villagers' responded mangrove as an Ecosystem. Poor knowledge about mangroves as an ecosystem is more serious in terms of the future degradation of the mangroves. Very few respondents have mixed responses about mangroves. They understand mangrove as a vegetation + ecosystem or Vegetation + wood + ecosystem.

In view of the differentiate function of the mangroves as a barrier in the coastal area, the native people are having very less knowledge about the particular functions of mangroves. The study reveals that, 33.64% respondents don't know the function of mangroves. About 32.70% respondent know only one function of mangroves i.e. Wind Breaker. Respondent in the area of sand dunes told that mangroves act as a wind breaker. In Tambaldeg village and Mithmumbri there are large size Sand dunes along the coast and mangroves along the estuary don't allow the sand from the beach area to move towards the inner part of the estuary or towards the inland areas of the coastal villages. Overall 9.47 and 11.37 percent respondents given their opinion that, mangrove also works as a Wave and Wind Breaker respectively. Very few respondents are known all the function of mangroves they had given mixed responses like wind, wave and water breaker or wave and water or wind and wave etc.
(table no. 2).

**Table No. 2:** Function of Mangroves

| Sr. No. | Response | % of response |
|---|---|---|
| 1 | Wind break | 32.70142 |
| 2 | Wave break | 9.478673 |
| 3 | Water break | 11.37441 |
| 4 | Barrier | 7.109005 |
| 5 | Wind break + Wave break | 0.947867 |
| 6 | Wind break + Water break | 2.843602 |
| 7 | Wave break + Water break | 0.473934 |
| 8 | Wind break + Wave break + Water break | 1.421801 |
| 9 | Do Not know | 33.64929 |
| Total | | 100 |

Most of the people are positive towards mangrove ecosystem in view of their role for reducing land degradation, but at the same time they also think that mangrove is an obstacle for boating and fishing. A mangrove helps in the process for the production of fish, as they provide oxygen to fish and marine animals. Crabs are growing in the shadow area of mangroves and under the knee roots of mangroves. Because of mangrove's knee roots, silt is almost trapping by mangroves. Knee roots hold the silt that is very rich in nutrients and also useful for fish and other organisms. Leaves of the mangrove are used as an organic fertilizer in farm lands.

Jaitapur is well known for proposed nuclear power plant which is under construction. Residential population of Jaitapur and surrounding area are opposing this power plant, because they think that the plant may affect on mangroves, fish and mango plantation. Water, which will be used for cooling system in nuclear plant will be poured out in sea for 20 to 25 km from the coastline. But people think that, water may come back to the estuary during the high tide and this will disturb the estuarine ecosystem.

Mangroves are known by different local names in different locations. Chipi, kandal, khajan, hurshi, hurra, tivar, bhidshi these are different local names of mangroves. According to 64.92% respondents “Mangroves are not at all important for livelihood”. People think that mangroves are obstacle for boating and that grows rapidly in estuary. Rapid growth along the estuary convert agricultural field into mangroves patches. To protect the agricultural cultivable land Kharland Department of Government of Maharashtra constructed the bunds along the estuary or river bank. But, due to poor and non maintenance, these bunds are broken and saline water entered in the agricultural field and resulting for the conversion of agricultural land into kharlands. Moreover, 22.27% of respondents think that mangroves are little important for livelihood, 5.68% respondents are not answered on that and only 7.10% of the respondents think that mangroves are very important for livelihood. Mangroves flowers are rich in honey so, these acts as a nest for honeybees. Some of the mangroves species are used for fodder for animals. Flowering in some of the mangrove species is a sign of onset of monsoon. Various birds are migrating in mangroves area in specific season, mostly during October and November (Fig 2).

**(a)** **(b)**

**Figure 2a and b**: Birds along the Karivane Estuary

Dengue and malaria are diseases caused by mosquito. These are mosquito born diseases, Overall 81.99% of respondents are thinking that, growth of the mosquito is not possible in saline water and most of the insects may not survive in the saline area and in mangroves. Fishes in mangrove habitat survive on them making a food chain. 10.42% of respondent are thinking that mosquito production is because of mangroves. Stagnated water in mangroves causes for the increasing number of mosquitoes. 7.58% of respondent not answered about the relationship of mangroves and mosquitoes. They are unknown to dengue and malaria cases because of mosquitoes. Most of the people who live near mangrove forest use mangrove as a fuel wood. Table no. 3 shows the rank wise responses for the use of mangrove. As per the perception of the villages fuel wood comes at a first rank after that fishing; then construction purpose comes at 3$^{rd}$ rank, food especially honey and animal feed, then other uses. Very rare species of mangroves are poisonous. These poisonous species are not used as a fodder for animal or fuel because it spread disease.

**Table No. 3:** Function of Mangroves

| Sr. No | Response | Rank |
|---|---|---|
| 1 | Fuel (wood, charcoal) | 1 |
| 2 | Fishing | 2 |
| 3 | Construction (House, fence, furniture) | 3 |
| 4 | Food (honey,alcohol,animal feed) | 4 |
| 5 | Other | 5 |
| 6 | Medicinal Chemical(dyes,poisons) | 6 |

For collecting mangrove woods the villagers may travel for a distance of 500 to 1000 meters from their houses. Besides, wood as a profitable product, the fishing is also used by the people in the mangroves. Mangrove ecosystem at the sites of study area is having differentiate species with is a thick/dense forest. Various animals like fox, bears, snakes, rabbits, pigs and some unknown animals (fig 3) survive in this mangroves area.

**Figure 3:** Animals in Mangroves area **(**Fox in Phanase estuary mangroves)

Pigs are destroying rice field, which are adjoining fields to the mangroves. Other animals are not dangerous or harmful to the people who lived in surrounding settlements area. Because of destruction of mangroves, the animals are losing their shelters and are migrating towards the human settlement. Perceptions of the people reveals that, the local people are not ready to give the exact information about the commercial use of mangroves, only 5% of respondents were agreed to admit information about commercial use of mangroves. In mangrove areas oysters, mussels, barnacles and shrimps are more. In Ansure village one project is going on, the local natives collect barnacle shells and supply to the factory for making powder of these shells. (fig 4a) They took permission from government for cutting mangroves in that area. Private owner in some area also cut mangroves for making shrimp farms. In mangrove patches there is company from Tamilnadu, started ‘Kurle’ project (crab farming-figure 4-b).

**(a)** **(b)**

**Figure 4: (a)** Collection of shells (kalva) at Ansure and **(b)** Crab farming project-Devgad estuary

According to the perceptions, 57.34% of the respondents are not willing for the participation in conservation and management scheme of mangrove. They have misunderstanding about the mangrove ecosystem and less knowledge about the importance of mangroves. The native people suggested that 'there should be some awareness programme from the government side' because some people don't know that, mangroves are protecting coast from tsunami, cyclones, flash floods and tidal waves. Only 30.80% of the respondents are aware about the conservation and management scheme of mangroves. They think that mangroves are protecting their settlement and bank of estuary.

FISHING AND MANGROVES:

Most of the local population depends on fishing for their daily bread and butter. Everyone has permission for fishing. Their daily food is fish. In monsoon season fishing in deep sea is totally banned due to heavy rainfall and cyclonic conditions, this is a period of fish breeding. Most of the fishing is carried out in estuaries during rainy season. They fish different type of fish-species for their subsistence use and also sell the remaining one for getting money. Crabs, shrimps, barnacles, oysters, mussels (fig 5) and other fish species are collected from fishing. During low tide, especially women's are going to collect oysters and mussels. Very few respondents are not engaged in fishing activity but they collect fish from others.


**Figure 5:** Collection of oysters (kalva) and mussels: Phanase estuary

FUEL WOOD AND MANGROVES:

Table no. 4 shows that, more than half i.e. 51.83% of the respondent used mangroves as a fuel wood. Mangroves woods are very easily available to the natives, but for other wood, they have to pay cost (fig 6-a). Mangroves woods are growing in saline water that's why the proportion of sodium is more in this wood. If this wood use directly as fuel wood then sodium in that wood causes to break the aluminium pots during cooking. Therefore, this type of woods are stored in rainy season for getting the showers and then allow drying up in sunshine and after that it is ready for using as a fuel wood. But, if such mangrove wood remains for a longer time in fresh water then it may be decaying. About 48.16% of the respondents are not using mangrove as fuel wood. One of the respondents from Chinchadi village (i.e. from Karivane village) has quoted that "literally there is no use of these mangroves for villagers".

**Table No. 4:** Use of mangrove as fuel wood by villagers

| Sr. No | Response | % of responses |
|---|---|---|
| 1 | Yes | 51.83246 |
| 2 | No | 48.16754 |
| 3 | Not answered | 0 |
| Total | | 100 |

As per their perception they committed that they are not using the mangroves wood for fuel purpose and for the construction purpose. But at the same time, the present study found that, the people are not using cooking gas, kerosene or any other fuel for making the food. It has also observed physically that there are number of heaps of

mangroves wood in front of their houses (fig 6-b). So it is clear that, they are using mangrove as a fuel wood, but they are not selling the wood. Such types of destruction of mangroves are observed in other villages also. After that, 13.13% of the respondent used mangroves for heating purpose (i.e. to heat the water). Besides that 5% respondents are used for other purposes like construction, fishing etc.

**(a)** **(b)**

**Figure 6: (a)** Collecting mangroves for fuel at Mithmumbri and (b) Heaps of mangroves wood at Karel Village.

Some respondents i.e. 63.98% are agreed that, they are using different kind of forest wood for fuel purpose (for cooking and other purpose). Other than that, 19.43% of the respondent using gas. 10% of respondents are using other wood as well as gas. There is negligible use of charcoal and kerosene by the respondents. Other wood collected by the mango trees or brought by others. Most of the respondents (69.19%) are thinking that, there is no ill-effect due to cutting of mangroves for fuel. 20.85% of the respondent are not answered to this. Only 9.95% of the respondents think that, cutting mangroves for fuel has negative effect on mangroves ecosystem. As per the perception of the villagers the mangroves plant/tree can be alive up to 200 years. They have number of knee roots, that's why they grow rapidly.

## CONCLUSION

Mangroves can grow in inter tidal zones of coastal area, where saline water mixes with the fresh water. Mangroves are small shrubs or trees that grow in brackish water and need shallow tidal water for its healthier growth. It is found that, mangroves are concentrated in the mouth and middle zones along the estuary. There are different views and attitudes of the respondents about mangroves and it varies from village to village. Ethnoecological study reveals that people who are residing near to the

downstream part of the estuaries (mouth zone of the estuary) have more awareness about the significance of mangroves than the up-stream part of the estuaries/upper zones. Most of the respondent used mangroves as a fuel wood, fishing or construction purpose. Roots of the mangroves hold the silt and sediment, so that it protects the coastal area as well as the banks of the estuary. Mangrove forests are very useful for the fishing, especially for prawns and crab farming, because breeding of them takes place in the roots of the mangroves. Besides that, mangroves provide shelter for marine or aquatic animals, birds and provide fodder for animal. There is no correlation between mangroves and dengue/malaria. Mosquito's that may cause dengue and malaria are not able to grow in saline water; simultaneously, fish in the mangroves eat such type of insects so, there is no chance of spreading such type of diseases. Most of the females are collecting the oysters and mussels in the estuary during low tide. Now-a-days mangrove sites are used for commercial purposes like Crab farming (Kurle project), Shrimp farming. Shrimp and crabs need the available space between roots of mangrove for breeding purpose. Present study also concluded that, mangroves along the Rajapur estuary and Karivane estuary are more prone to its degradation.

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