ISSN (Print) : 0974-6846
Indian Journal of Science and Technology, *Vol 9(7), DOI: 10.17485/ijst/2016/v9i7/85604, February 2016* ISSN (Online) : 0974-5645

Perception based Study of Coastal Sand Dunes in the Areas of Ratnagiri Coasts, Maharashtra

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Abstract

Background/Objectives: The present research is the outcome of attitude and perception based study about the status of sand dune. The paper clarifies that, besides from the natural processes, human interventions also lead to decline the sand dunes. **Methods/Analysis:** Present research work is based on the questionnaire survey conducted in the Ganeshgule, Vare, Velneshwar, Kelashi villages in Ratnagiri district of Maharashtra. Perceptions of the villagers in view of the sand dunes have discussed. Utmost sand dunes in the study area are greatly under the influence of tidal sea-water and human activities. **Findings:** Anthropogenic impacts on coastal landforms are nowadays increasing rapidly. Sand dunes, sand bars and sand spits are the depositional features in the coastal areas which protects the coastal environments from natural calamities. Coastal sand dunes significantly protect the landward settlement and agriculture from sea waves and storms. **Applications/Improvements:** Therefore, it requires collecting the basic information and database about the sand dune as a coastal resource. Such collected basic information also helps for the proper management of resources.

Keywords: Coastal Sand Dune, Coastal Resource Management, Conservation of Sand Dune, Perception of Villagers, Sand Dune Degradation

1. Introduction

Coastal villages of Ratnagiri are reaching with differtiate coastal land scape. The coast is a zone with frequent erosional and depositional land forms like beaches, sand bars, sand spits, sand dunes, cliffs, rocky platforms that is the existing part between land and sea. Sea waves are the dominant agent of erosion and deposition in coastal areas. Wave energy and shoreline currents are responsible to develop erosional and depositional features in the coastal zones[1].

According to[2] the coastal tracts are the zones of energetic and vibrant activity that continuously transforming itself to maintain its equilibrium conditions. Coastal zone of India has diverse ecosystems like mangroves, sand dunes, corals, beaches, wetlands, estuaries, lagoons and backwaters harbouring. Fauna and flora with various landforms also serves as a barrier against many destructive natural hazards. "Coastal zones are currently experiencing intense and sustained environmental pressures from a range of driving forces"[3]. In view of the coastal resource protection, sustainable uses of available resources are the today's basic need. In[4] have applied the Zoning and grid method to separate protected areas for planning and sustainable management purposes in their study region. They tried to obtain potential zones in Boujagh national park within an area of 3266 ha, in Guilan province, Iran, by using grid method. The gridding of studied area was conducted by using satellite image of IRS 2007 and Arc GIS 9.3 software. They concluded that "coastal marine Boujagh national park zoning influences on sustainable coastal marine development in studied area"[4]. Therefore recent tools and techniques using first-hand information through questionnaire are required for the proper management of coastal resources.

Coastal sand dunes are the depositional landforms formed by wind action on the landward side of the

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beaches. Generally sand dunes are halted by vegetation that traps the sand[5].

Vegetation on sand dune maintains biodiversity, this also providing habitat for microorganism and animals. Therefore, various practices should also be starting to introduce new local plant species which can stabilize the dune. According to[6,7] there are some alternate names for dunes that are used in many other languages. In English word it is known to be "down"; in Holland recognized as "dun"; in Netherlands called as "dunum"; in Italy these dunes are referred as "duna"; in German, they used "dune" and in French the name is "dune"[6,7].

Coastal sand dune is a depositional landform, which is developed along the coast. It requires enough sand quantity, transported by wind and deposited beyond the berm line of the beach. Sand dunes are significantly natural protective landscapes, may be a very good hurdle that protects inland environment from damaging sea-waves, surges, tsunamis and storms. Also it reduces the wind velocity. These coastal sand dunes are continuously under the influence of erosional and depositional processes. These are the natural processes which constantly changes the extent of sand dune from time to time. Naturally, tidal waves and winds are more or less responsible for the sand dune degradation.



Figure 1. Location map.

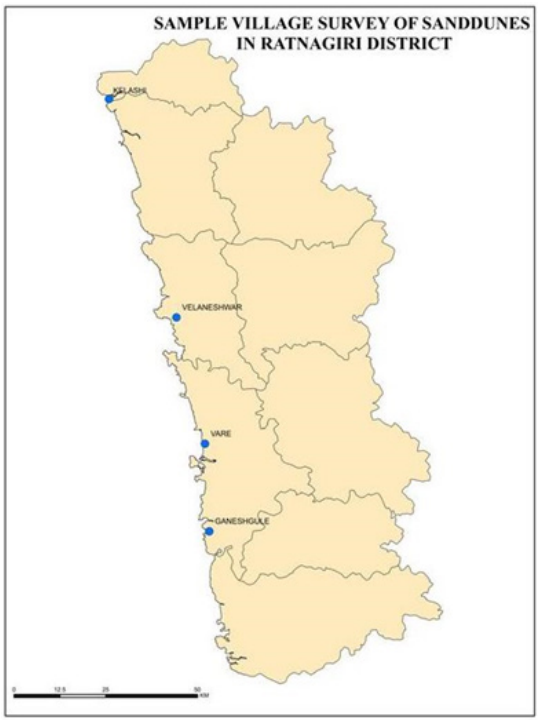


Figure 2. Village locations on map.

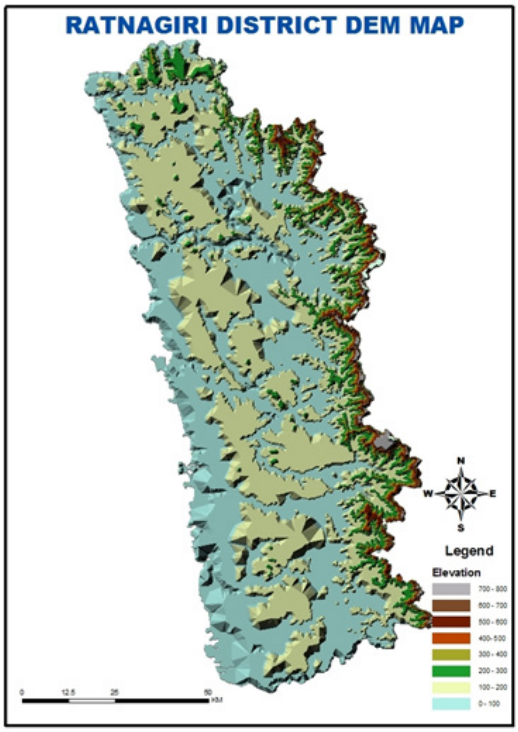


Figure 3. DEM of Ratnagiri district.



Figure 4. Degradation of sand dune at Vare.



Figure 5. Degradation of sand dune and casuarina plantation at Kajir Bhati.

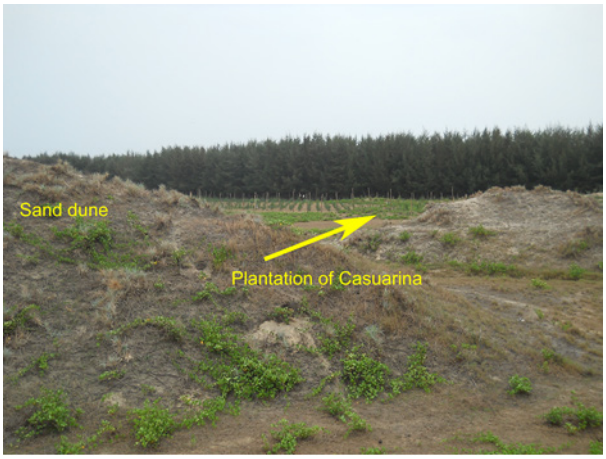


Figure 6. Plantation of casuarina at Aare.

Therefore, the present investigation has attempted to make an in depth study of four sample villages i.e., Ganeshgule, Vare, Velneshwar, Kelashi in Ratnagiri District (Figure 1, 2, 3). Apart from the natural processes, human interventions also lead to decline the sand dunes. Near the coastal tract of Vare, Kajir Bhati and Aare (Figure 4, 5, 6), some sites are more prone to sand dune erosion due to sea wave attack. At these sites sand dunes and casuarina vegetation is damaged by tidal water during high tide. At the same sites tidal water passes the dune and reaching up to the road. Therefore, this site should be protected immediately by constructing concrete wall at berm line. Hence, for collecting authentic data, some villagers were interviewed for questionnaire survey. Perceptions of local villagers regarding awareness and significance of sand dunes in the study area were analyzed and discussed for their proper management.

2. Methods

The data meant for sand dunes is collected from the four villages and tehsil revenue department. The data collected, was converted into percentage. The primary data is collected through 29 questionnaires survey. Questionnaire is consisting of family information, sand dune, use of sand dunes, function of sand dunes, importance of sand dunes, economical importance, and changes in sand dunes, legal commercial use, selling of sand dunes. Conservation and management, impact of agriculture, impact of tourism etc. The data collected through Primary and Secondary sources have been processed and represented by GIS and Remote Sensing Software[8].

3. Discussion

On the basis of questionnaire survey the perceptions and opinions of the villagers regarding sand dunes have displayed by using graphs and tables. Figure 7 shows the perceptions of villagers about the particular functions of sand dune. Regarding, function of sand dunes most of the respondents distinguished it as it is important with respect to wave break. In Ganeshgule, Vare, Velneshwar and Kelashi villages the responses for wave break have shown 41.66%, 37.5%, 40%, and 33.33% respectively. Very few people think that the function of sand dune is barrier as shown in Ganeshgule and Vare villages i.e., 16.66% and 13.33% respectively. Some respondent answered as the function of sand dune is Wind break.

The comments of respondents regarding economical value of sand dune have shown in Figure 8. Near about 57.15% people from Ganeshgule village and 45.45% people from Velaneshwar village think that sand dunes are very beneficial for personal use. But some respondents i.e., 42.85% from Ganeshgule and 36.36% from Velaneshwar think that they are useful to the village as a whole. In Vare village, 80% respondents were not answered for their comments on economic value of sand dune.

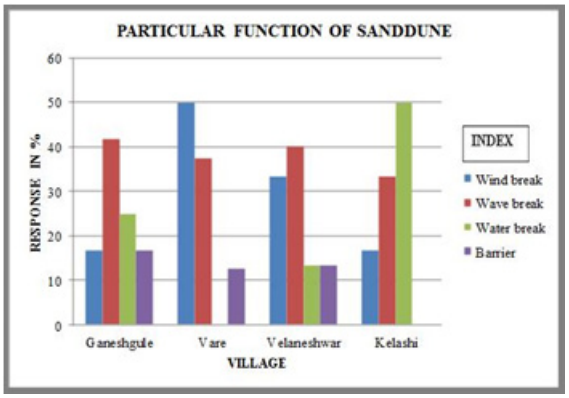


Figure 7. Perceptions of villagers regarding functions of sand dunes.

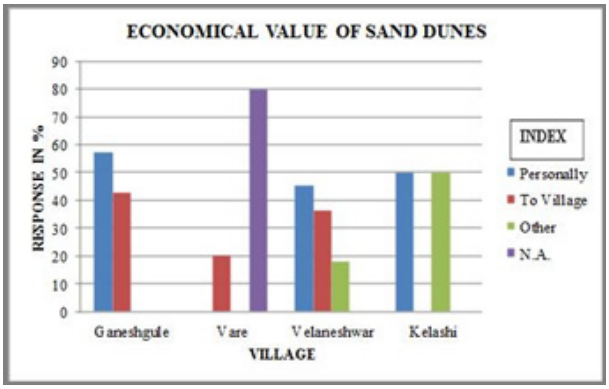


Figure 8. Economic value of sand dunes.

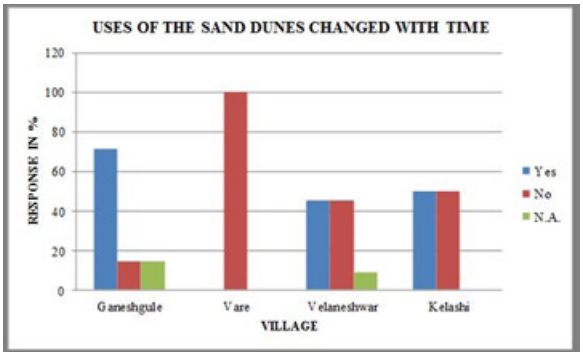


Figure 9. Use of sand dunes.

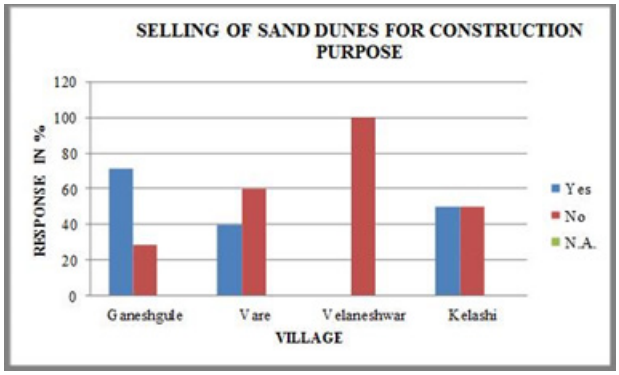


Figure 10. Selling of sand from sand dune sites.

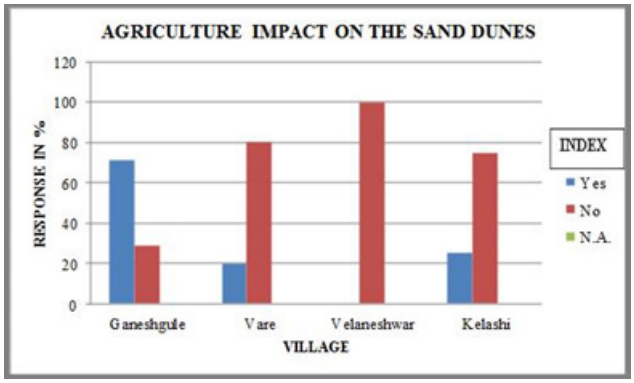


Figure 11. Opinion of villagers regarding impact of agriculture on sand dunes.

Figure 9, shows that in what way the people think that the uses of sand dunes have changed with the time. In Ganeshgule 71.42%, in Velneshwar 45.45%, and in Keleshi 50%, people answered as 'YES' that 'the uses of sand dunes have changed with time'. Some people in Kelashi (50%) and Ganeshgule (14.28%) answered as 'NO'. 100% people from Vare gave a negative response.

It has noticed that in the study area the "sand" from the coastal sand dune is used for construction purpose. In view of this, some questions have asked to the respondents, whether the villagers re selling the sand for construction purpose or not? In Ganeshgule 71.42% and in Kelashi 50% people answered positively (Figure 10). In Vare 60% and in Velanshwer 100% people answered 'NO'. Some respondents have not answered. In the coastal areas along the shoreline most of the sand dunes have been reclaimed for agricultural activities and used for coconut plantation. In view of this some questions have been asked about the impact of such activities on sand dunes. Figure 11 shows perceptions about the impact of agriculture on

the sand dunes. In Ganeshgule 71.42%, and in Kelashi 25%, people think that agriculture does have impact on sand dunes but 20% people from Vare answered as 'NO'. Some respondents did not answer for the same, as they are afraid of government rules.

Table 1 reveals the perceptions of respondents to know the problems that they are facing seasonally due to natural catastrophes. Natural disaster occurs in terms of cyclone, storms, and coastal floods in the study area. Cyclone acts as a disaster and raises serious problems in Ganeshgule and Kelashi villages according to the views of 30% and 25% respectively. Tsunami also occurs in some area of Ratnagiri, the disastrous effects have been documented in some villages i.e., Vare and Velaneshwar, and their villagers are agreed that Tsunami is also the natural hazards in their area (responses are 22.22% and 27.77% respectively). Tidal wave consistently occurs and destroyed the sand dunes in their villagers. The villagers (40-% to 45%) of Vare, Velanshwer and Ganeshgule villages agreed for the same.

Table 2 shows perception of the respondents about the importance of sand dunes for their livelihood. The respondents in villages Ganeshgule and Velaneshwar i.e., 85.15%, 45.45% respectively think that 'sand dunes are very important for livelihood', while 50% and 45.45% people from these villages think that they are of little importance for their livelihood. Only 33.33% and 9.09% of the respondents think that sand dunes are not important for livelihood. Some respondents did not respond. Overall, according to respondent, the sand dunes are very important for livelihood in the study region.

Table 3 is related with the legally commercial use

Table 1. Problem of natural disaster

Sr. No.	Particular/ Response	Ganeshgule	Vare	Velaneshwar	Kelashi
		Perceptions of villagers in Percentage (%) #			
1	Cyclone	30	-	5.55	25
2	Tsunami	-	22.22	27.77	25
3	Tidal wave	40	44.44	44.44	25
4	Flood	10	33.33	16.66	25
5	Any other	20	-	5.55	-
Total		**100**	**100**	**100**	**100**

Source – Field work (# Values/information is of Respondents that has considered for survey)

Table 2. Importance of the sand dunes for livelihood

Sr.No.	Particular/ Response	Ganeshgule	Vare	Velaneshwar	Kelashi
		Perceptions of villagers in Percentage (%) #			
1	Very	85.71	16.66	45.45	25
2	Little	14.28	50	45.45	75
3	Not at all	-	33.33	9.09	-
4	N. A.	-	-	-	-
Total		**100**	**100**	**100**	**100**

Source – Field work (# Values/information is of Respondents that has considered for survey)

Table 3. Legal commercial use of sand dunes

Sr.No.	Particular/ Response	Ganeshgule	Vare	Velaneshwar	Kelashi
		Perceptions of villagers in Percentage (%) #			
1	Yes	85.71	20	20	-
2	No	14.28	80	80	100
3	N.A.	-	-	-	-
Total		**100**	**100**	**100**	**100**

Source – Field work (# Values/information is of Respondents that has considered for survey)

Table 4. Conservation and management of sand dunes

Sr.No.	Particular/ Response	Ganeshgule	Vare	Velaneshwar	Kelashi
		Perceptions of villagers in Percentage (%) #			
1	Yes	100	-	27.27	75
2	No	-	100	72.72	25
3	N.A.	-	-	-	-
Total		**100**	**100**	**100**	**100**

Source – Field work (# Values/information is of Respondents that has considered for survey)

Table 5. Decrease in sand dune area and main cause

Sr. No.	Particular/ Response	Ganeshgule	Vare	Velaneshwar	Kelashi
		Perceptions of villagers in Percentage (%) #			
1	Excavated of dune by local people	44.44	28.57	29.41	33.33
2	Erosion by sea water	-	-	11.76	-
3	Wind action	22.22	42.85	23.52	50
4	Agricultural use	11.11	-	17.64	16.66
5	Tourism industries	11.11	28.57	11.76	-
6	Any other reason	11.11	-	5.88	-
Total		**100**	**100**	**100**	**100**

Source – Field work (# Values/information is of Respondents that has considered for survey)

of sand dune. Most of the people answered 'NO' i.e., they forcefully said that, "the sand dune is protected and there is no such legal and commercial use of sand dunes". Perceptions for the answered 'No' in the villages Vare, Velaneshwar, Kelashi is 80%, 80% and 100% respectively. Some respondents answered as 'YES' that means sand dunes are legally and commercially used. The percentage of the respondents who answered 'YES' is in Ganeshgule 85.71%, in Vare 20%, and in Velanshwar 20%, respectively. In view of the conservation of sand dunes in the study area, the respondents were asked about the participation and their willingness for the protection of sand dunes. Most of the people i.e., 75-100% are willing to take participation in the management practices of sand dunes (Table 4). During field work it has suggested to the villagers to protect the sand dunes, involving with self-participatory attitude. At some sites where erosion would be severe, there is a need of wooden fencing. Villagers may participate in the sand dune management processes, if government initially provides the proper guideline to them or bare some costs for installation of fencing and other protective measures.

Table 5 shows the important opinions of the respondents about the present status of sand dunes. Questions were asked whether sand dunes are increased or decreased in their area. Most of the people answered 'yes the sand dunes are decreasing day by day' because sand dune degradation takes place both naturally and artificially in the study region. At Ganeshgule and Velaneshwar most of the dunes are excavated by local people and also used for agriculture purpose while natural erosion by wind is observed in all villages. But erosion due to sea water is prominently seen at Velaneshwar village.

4. Inclusive Observations

It has noticed that, major area of stabled dune is protected by vegetation. As per the local people, the vegetation and various species should also be restored, that helps for the protection of sand dune from wind erosion. Wire fencing also one of the important options to protect the vegetation. Consequently it has also observed that, more than 70% of the villagers strongly pointed out that path or small-small walkway from the villages towards the beaches are the major causes of the sand dune disturbances. Tourists and local people used these paths; the direct interferences of the tourists should ban in the sand dune areas. Plantation of coconut trees and mining of sand was prominently seen in most of the villages. In view of the significant role of such natural land scape various methods must be

adopted to protect the coastal resources. Coastal resource management not only required in the coastal area of Ratnagiri of Maharashtra, but it is the primary and basic need to adopt the best practices that ever required for coastal resource management in the coastal countries. The processes, policies, different practices that may participate in the coastal resource management should properly examine for the development of coastal area.

5. Conclusion

The respondents of the study area agreed that sand dunes are degraded due to tidal waves and human activities. Sand mining and reclamation of sand dunes for agricultural purposes are the major threats in the coastal area of Ratnagiri. Tourism activities are also one of the reasons for sand dune degradation, as resort and recreation facilities are boosting on the sand dunes. Continuous monitoring of sand dunes with advanced technology is essential. Assessment of sand dune degradation in view of physical processes and human induced processes should be commenced. Violation of coastal regulation zone must be identified and mapped in the coastal areas. Training programs for awareness of coastal resources should be undertaken. Participatory involvement of local people must necessary to protect the sand dune as a sensitive coastal resource. On the basis of collected data through local people, clubbing the knowledge and perceptions of native villagers, the big data must be generating for proper management of sand dunes. Lastly it is strongly suggested that revegetation and rehabilitation of the disturbed sand dunes are very essential for their proper stabilization.

6. References

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