

# THE CATEGORIZATION OF LAND AND GROUND-WATER RESOURCES IN PART OF GHOGHA, DISTRICT BHAVNAGAR [PENINSULAR GUJARAT]

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## Abstract

The part of Ghogha area, of district Bhavnagar belonging to peninsular Gujarat, has been studied for its two prevailing resources namely: Land and Ground-water under non-renewable & renewable category respectively. The adapted methodology includes: Conventional, Field Observation and Modern-as digital analysis of Resourcesat-1 satellite data. The objective of study has been for scientific evaluation of local two important resources for regional development and economic boost -up of the society. The study advocates for utilization of latest available satellite data and comprehensive assessment of deeper aquifer for better appreciation of Land and Ground-water resources under judicious cum conservative way.

## Introduction

Land and Ground-water resources of coastal area possess vulnerable system, on account of fluctuation of tidal cum sedimentation influx within gulf portion and stream/estuary of coastal watershed interface. Such interface on the coastal strip has varied cum large dimension impact on life and living-hood of local society and related aspects like: salinity ingress, brackish water aquaculture and shrimp farming.[3]

The conventional cultivation of most commonly used kitchen salt has been practiced traditionally through accumulation of gulf water in adjacent pond of tidal area with it's large evaporation and subsequently collection- with proven commercial asset. Brackish water aquaculture has been one of the modern avenue to meet growing demand for sea food with it's great economic potential. The gulf areas have strategic importance, presently for petroleum exploration- as it is common for Persian of gulf.

The tremendous to enormous sedimentation rate through the big rivers of main inland namely: Sabarmati, Mahi & Narmada into gulf of Cambay has virtually destroyed the- once well developed Port and related Harbour activities of Bhavnagar [earlier one of the richest Princely ruled state in India], before the invasion of British ruler during 18th century to India. The gulf of Cambay has been lime lighted during May 2013 for Kalpasar project- world's largest man made fresh water reservoir, & became abandoned later on.[4]

## Area under study

Ghogha is small coastal developing village in district Bhavnagar [Peninsular Gujarat]. It has distance of 25 Km only, as bird's eye view via gulf of Cambay to mainland [Bharuch]. It has ship breaking industry of small scale, as compared to large one located at Alang, about 100 km further in south direction. Ghogha has administrative control over an island in gulf of Cambay, having IMD Observatory [1]. The geographic area of 54 Sq. Km for Ghogha has been selected as area under study and is illustrated as Fig.1.



**Fig.1 Location map for area under study**

The area under study is surrounded by Vallabhpur taluka in north-west, Sihor taluka in west, Taleya taluka in south and gulf of Cambay in east direction respectively. It is about 30 Km in south of Bhavnagar city, which is well connected with rest of country through Air, Rail & Road link.

The gulf portion at present has average draft of 4.0 m only with irregular cum punctilious bottom surface. It does not allow for sailing of big cargo ship, but local country made commercial boat do transport Bentonite- quarried from surrounding area up to sailable point for big cargo ship at the mouth of gulf of Cambay and Arabian sea. Bentonite is an important export quality raw material used as drilling mud in Petroleum industry for oil exploration by gulf countries.

### **Methodology & Objectives**

The adapted methodology includes three approaches namely: Conventional, Field Observation & Modern. The conventional has been based upon- collection of auxiliary data & review of literature. The field observation includes the interaction with local people, field checks with collection of field photographs. The modern has digital analysis of Resources - at 1 satellite data of 03 March 2004 as Remote Sensing.

The objective of study has-[a] classification of land resource for area of study into useful versus waste with further sub-classification of land-use. [b] hydro-geological classification of aquifer disposition and qualitative interpretation of ground-water [2].

### **Result & Discussion**

The land is most important non-renewable resource for living purpose of human, habitats and related activities. The land-use study has been focused with execution of Modern approach in conjunction with relevant field checks through Field Observation. The digital analysis of Resource-sat 1 [LISS IV] satellite data of 03 March 2004 has been carried out through supervised classification with use of maximum likely hood classifier. The geographic area of 54 Sq. Km. has been categorized into 8 sub-class including land waste as barren land. The geographic distribution of area-for each sub-class is summarised as Table 1.

S N	Land-use sub-class	Geographic area [Sq. Km.]	Remark
1	Agricultural	25.00	Confirmed in Field by Fig.3
2	Barren land	6.81	Confirmed in Field by Fig.4
3	Bentonite quarry	0.74	Confirmed in Field by Fig.5
4	Fallow land	17.06	
5	Riverine sand	2.21	
6	Shrub	0.85	Confirmed in Field by Fig.6
7	Tidal flat	0.74	
8	Surface water body	0.44	
	Total	53.85 = 54.00	

Table 1: Different Land-use classes in area of study.

The various land-use categories as obtained through resource-sat 1 for area of study is illustrated as Fig.2

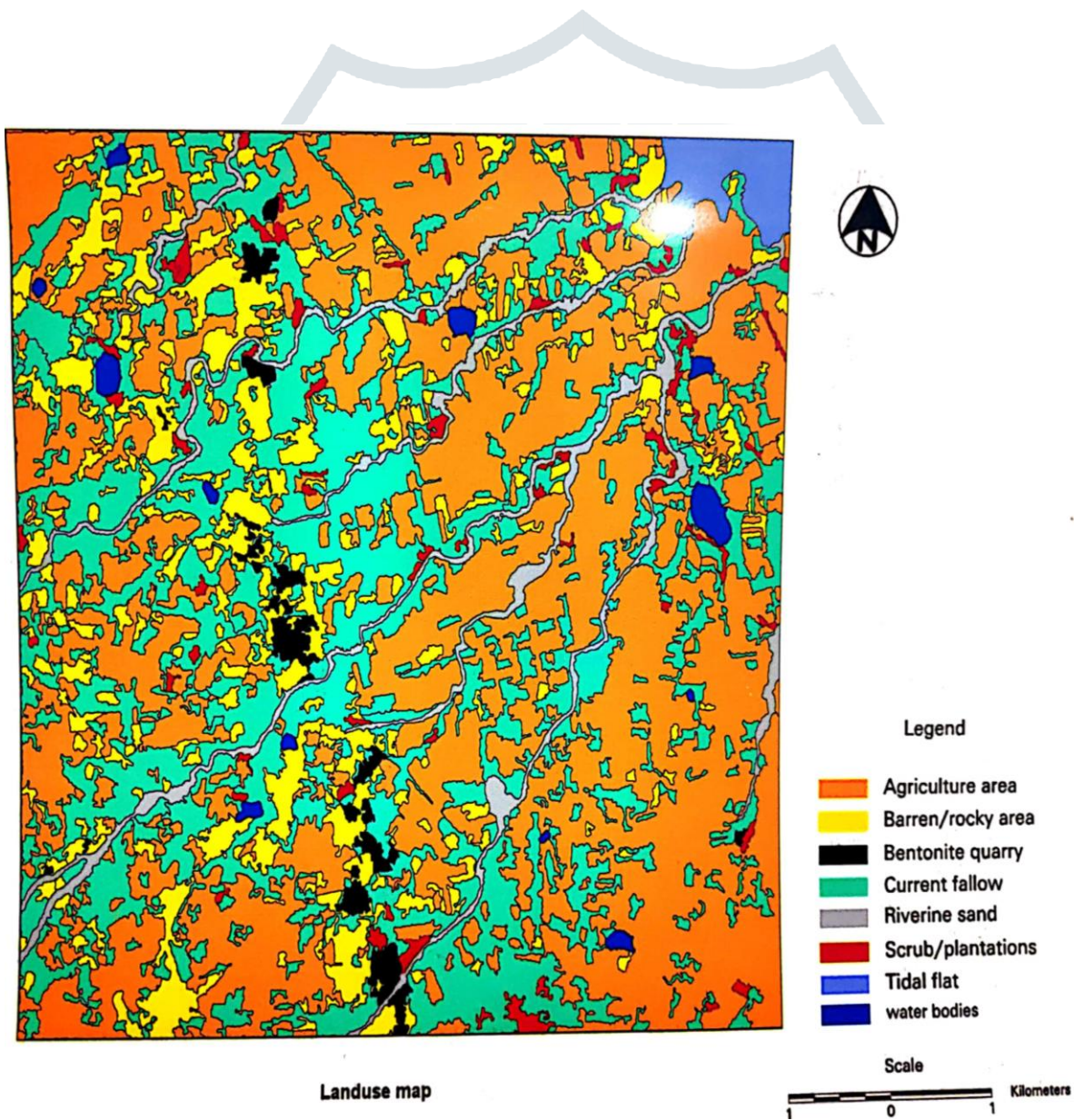


Fig. 2: Various land-use categories as obtained through resource-sat 1 for area of study

The agricultural land with Cotton crop as confirmed in field is illustrated as Fig.3. The Bentonite quarry [abandoned, filled with pit water] is illustrated as Fig.4. The fallow land [earlier was associated with Ground-net crop, near Bhumali is illustrated as Fig.5. The occurrence of Shrub in field is illustrated as Fig. 6.



**Fig. 3: Agricultural land with cotton crop**



**Fig. 4: Bentonite quarry with pit water**



**Fig. 5: Barren land with Ground-net crop**



**Fig.6: Occurrence of Shrub**

The ground-water resource has been under renewable category and also essential for survival of living creature due to it's potable nature and related health aspects. It has been studied through Conventional

approach. The hydro-geological inference has been obtained through interpretation of Litho-logs- as available with Commission of Geology & Mining of Gujarat state. It has inferred three categories of aquifer disposition namely: Unconfined aquifer, Perched aquifer and Semi unconfined to confined aquifer towards increasing depth from ground surface.

Unconfined aquifer has been associated with alluvial deposit of Rampar ka nadi up-to 15-20 m depth from the ground surface. The quality of groundwater for unconfined aquifer has been assessed through two dug wells located at Bhuteswar and Rampar. Ten major hydro-geochemical parameters have been summarised in Table 2.

S N	Hydro-geological Parameter[mg/l]	Rampar	Bhuteswar	W H O Norm [mg/l]
1	EC [mhos/cm]	4700	27000	
2	Calcium	100	650	75
3	Magnesium	99	945	200
4	Chloride	1200	8400	200
5	Sodium	776	3651	
6	Bicarbonate	305	300	
7	Ph	7.8	6.7	6.5
8	Total Hardness	663	5563	
9	Total alkalinity	290	250	
10	Total Dissolved Solid	2870	15370	

Table 2: Groundwater quality for unconfined aquifer

The assessment of groundwater quality for unconfined aquifer reveals that Bhuteswar has higher value for hydro-geochemical parameters on account of its closeness to tidal flat, but still beyond and far from potable in nature.

The Perched aquifer is associated with clayey horizon among laterite in the depth range of 20-60 m. It is being confined to Bentonite quarry and related activity with higher salinity.

The semi unconfined to confined aquifer has been inferred with the occurrence of red boles in fractured basalt at the depth range of 85-90 m. It has sweet water, as per local version, which refers to be good potable in nature.

## Conclusion

The land resource of Ghogha area has full of economic potential in terms of existing as well as futuristic. The ship breaking, common kitchen salt cultivation, commercial crop growth and Bentonite quarrying belongs to existing economic venture. The shrimp farming, Lignite mining [GMDC] & Petroleum exploration are for futuristic category.

The groundwater resource of Ghogha area is limited presently due to more hardness, salinity including bitter taste. But it has full potential for prospect at higher depth sweet water exploration.

The conducted scientific study of the area has fulfilled the desired objectives at preliminary stage and more details are yet to be achieved through evolved methodology for both –non-renewable and renewable resources with use of latest satellite data and intensive groundwater sampling of deeper aquifer along-with geophysical prospecting. The area has another renewable resource of untapped nature namely; Solar energy, Wind energy and Tidal power.

The Government efforts are commendable for the area of study for Domestic cum potable water supply under NARMADA MAI WATER scheme. The potable nature of surface water is being brought by Narmada canal to the area and then pumped up in overhead tanks for its further supply through tapes during specific hours of demand daily- an outcome of nation's Sardar Sarovar dam project, as supplement for groundwater.

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