

COMPOSITION OF COASTAL VEGETATION IN AND AROUND THE TRADITIONAL GRAZING ROUTES OF CAMELS IN KACHCHH, GUJARAT-INDIA

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ABSTRACT

Natural resources provide a range of interrelated environmental interaction and socioeconomic benefits, which support a diversity of livelihood policies for different stakeholders of the local community. The Pastoralist community locally called *Maldharis* who is sifting one place to another place for their survival. Since the land is not suitable for agriculture, conventional development by-passed the region. Some Part of Landscape in Kachchh is considered as a biosphere reserve for its wildlife and plant ecosystem. The nomads tend to migrate with their economic betterment and better livelihood. Both food crops and multipurpose crops are being grown together with livestock management. The people lighting their hopes with the migration process. This region is rich in natural resources and livestock resources. The existing natural resources and the long coastline is also contributing a major part in the district economies. The grazing animals depended on natural vegetation, so need to prepare a cluster level seasonal Grazing route map of Camel pastoralist with the help of a participatory approach. Through the natural resource map, the community will easily find out the areas which are rich in natural vegetation and nearest safe water bodies for the animals on their grazing route. The participatory method helped a lot for this study to identify their temporal grazing location as well as the grazing routes around the largest district (Kachchh) of India. The shrubs and scrubs apart from the *Prosopis juliflora* are not in strength to protect erosions and since considered as an invasive species, should be remove from native habitats of Kachchh. The sweeping high wind velocity and high-temperature increase evaporation both from the soil and all living flora and fauna. Saving land and

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maintaining it for better agricultural use in a planned way for eco-system development retaining agrobiodiversity is a need. Wherever the environment is suitable (not affecting the soil water relationships and efficiency) keeping in view rainfed system agro-ecology needs to be developed.

Keywords: Natural Resources, Pastoralist, conservation, Participatory, GIS, Wetland.

1. INTRODUCTION

Kachchh district has the highest wetland (51.72%) area including seasonal and saline marshy area of RANN among all districts of the Gujarat state. The Kachchh Peninsula located between 22° 44' to 24° 41' North latitude and 68° 10' and 71° 43' East, forms the westernmost part of India and constitutes the Kachchh district of Gujarat State. This district has wide coverage as 45652 sq. km area of the Gujarat state. This district has 10 talukas such as Bhuj, Gandhidham, Anjar, Rapar, Mandvi, Bhachau, Mundra, Nakhtrana, Abdasa, Lakhpat. The total population is 2,092371 and the population density is 46 people /sq. km. The average literacy rate of this area is 70.59%. The western part of the Gujarat state of India is surrounded by the Arabian sea and the other three parts of this state are covered by the dynamic landmasses. The geographical extension of this state is Latitude 20° 06' N to 24° 41' N and Longitude 68° 10' E to 74° 28' E. This region is under the subtropical climate zone and over the whole region, there are several sub climate regions. The monsoon season starts from June and stays up to October, similarly winter months are November to February, summer months are March to June. Few wetlands have safe drinking water but after March due to extreme heat and the regional location, the normal water is converted into the saline water. Eastern and northern part of the region is covered by Greater Rann of Kachchh (GRK) and Little Rann of Kachchh (LRK). Kachchh peninsula has four ephemeral rivers as Khari, Pur, Kanaka Vati, and Gjansar (ORG, 1999; CWC, 1997, and Planning Atlas of Gujarat). The Pastoralist community, locally called *Maldharis* who are sifting one place to another place for their survival, has camels, sheep, goats, cattle, and buffaloes; they produce ghee (clarified butter), wool, and handicrafts. The water veins and groundwater flow according to the regional slope aspect. Two types of camels identified in Kachchh district i.e. the Kharai Camels, the unique breed of camels that swim in the sea in search of mangroves, and the other one is Kachhi camel, a breed of the camel that can't swim in the sea, mostly depended on inland grazing. The ecological barriers on the west are the river estuaries and marshy lands. Vegetation in the marshy land and immediate inland is on the verge of collapsing. The north of the middle ridge, a large spread of Banni land, is traditionally devoid of agriculture and suitable only for grasses.

However, people's lifestyles and occupations are predominantly interwoven with the Banni livestock and monsoon grasses. Handicrafts and embroidery of the Banni *Maldharis* are world acclaimed. Cattle largely Kankrej breeds, Sindhi buffalo, camel, sheep, and goat are the domesticated animals. In every aspect of their day to day life, these animals are involved. A strong emphasis is made here for agro-biodiversity and cultivated agriculture development in Kachchh.

1.1 Need conservation for Biodiversity development

Kachchh is considered as a biosphere reserve for its unique wildlife and plant ecosystem. Domestication of animals and livestock rearing, using the plant resources, and natural grasses is a way of life. The nomads tend to migrate with their economic betterment and better livelihood. The availability of groundwater and rains has led to a stable life, which, together brought in agriculture. Both food crops and multipurpose crops are being grown together with livestock management.

Kachchh was and continues to be a major livestock rearing center. When an agricultural ecosystem must be interwoven with it the ecosystem needs to be protected, maintained, and further developed. In the present scenario, there is a significant amount of soil erosion both by wind and water. The available land needs to be saved from salinity and desertification. In the mainland undulating hilly part of the district, vegetation of five major composition types can be identified. They are open scrub, dense scrub, grasslands, shrub savannah and tree savannah. Large parts of the landscape support the last remaining patches of natural tropical thorn forests and savannah of the country. Common plant species recorded from the landscape includes; *Acacia nilotica* subsp. *Indica* (Desi bavar), *Acacia senegal* (Kher, Gorad), *Capparis decidua* (Ker), *Euphorbia caducifolia* (Thuar), *Prosopis juliflora* (Gando bavar), *Salvadora oleoides* (Mithi jar), *S. persica* (Khari jar), *Prosopis cineraria* (Kandho), *Zizyphus mauritiana* (Bor), and *Z. nummularia* (Chani bor) in the top canopy, while *Maytenus emarginata* (Vikaro), *Premna resinosa* (Kundheri), *Corida perrottetii* (Liyar), *Grewia tenax* (Gangni), *G. villosa* (Luska) etc. constituted the under story. As tall trees with high canopy except for Neem, Banyan, and Peepal in small scattered standings, there is no windshield of natural source. The shrubs and scrubs apart from the *Prosopis juliflora* are not in strength to protect erosions. The sweeping high wind velocity and high-temperature increase evaporation both from the soil and all living flora and fauna. Saving land and maintaining it for better agricultural use in a planned way for eco-system development retaining agrobiodiversity is a need. Irresponsible or thoughtless use of technological applications needs to be given up. Fortunately, Kachchh is not much polluted with green revolution setups and a package of practices. Wherever the

environment is suitable (not affecting the soil water relationships and efficiency) keeping in view rainfed system agro-ecology needs to be developed.

1.2 The literature of the study

The broad objectives of this study are as follows-

- I. A mapping exercise of Natural Resources with Pastoral Community within a 25 kilometers buffer zone from the coastline.
- II. Existence Status and Dependency on Natural Resources using GI (Geographic Information) Science technology.
- III. Participatory Conservation Management plan through the GIS tools. Based on these objectives we had focused on the resources and information available on a different website, published and unpublished research reports, articles, etc.

1.2.1 International aspect

Kachchh district and its surrounding area have unique biodiversity, there is no proportion between one taluka to another taluka. They all are different with their flora and fauna distribution. There are many research works have been done at the global level, here we had taken some recent research findings as references. The increase in grazing pressure implies a reduction in the production of palatable species and increases the proportion of unpalatable as well as woody species (Perrings and Walker, 1995). As per (Anteneh Belayneh et al., 2012) that the traditional medicinal plant species are relevant for human health care as well as for the people living in Ethiopia. Fifty systematically selected informants including fifteen traditional herbalists (as key informants) participated in the study. Semi-structured interviews, discussions, and guided field walk constituted the main data collection methods. The species like *Aloe pirottae*, *Azadirachta indica*, and *Hydnora johannis* were the most cited and preferred species. *Aloe pirottae*, a species endemic to Ethiopia, is valued as a remedy for malaria, tropical ulcer, gastro-intestinal parasites, gallstone, eye diseases, and snakebite. The gel extracted from dried and ground plant material, called SIBRI (Oromo language), was acclaimed as a cleaner of the human colon. A concoction made from leaf, seed, and flower of *Azadirachta indica* was given for the treatment of malaria, fungal infections, and intestinal worms. Root preparations from *Hydnora johannis* were prescribed as a remedy for diarrhea, hemorrhage, wound, and painful body swelling, locally called GOFLA (Oromo language). (Kristine B. Garcia et al., 2014) discussed the potential of the resource for development for the protection of the associated indigenous medical experience as well as the development and effective use of the medicinal plant resource. The status of the Philippines' mangroves, its

current and future threats, and analyzes the mechanisms on how various stakeholders put efforts to address those threats. The similarities in issues around wetland conservation and sustainability in three developing countries using case studies of internationally significant wetlands in Tanzania, Colombia, and Papua New Guinea. Planning processes, socio-economic inequities, and conflicts are significant risks to some wetland values. Mechanisms such as the Ramsar Convention provide a framework to assist in addressing global wetland loss, but implementation at these sites needs to be supported by effective, integrative approaches involving natural resource regulation, conservation, and the development needs of local communities by (Jasmyn J. Lynch et al. 2016). According to (Kathiresan Kandasamy 2017) in the last two decades, mangroves in India have been well maintained without any drastic changes, because of effective conservation measures being implemented in mangrove areas along with the country, despite growing threats by man and natural calamities. (Anna C. Treydte et al. 2017) said that the Afar pastoralists of Ethiopia mainly depend on natural rangeland resources for their livestock. In times of severe drought, migrating with livestock was most common. Participatory land-use mapping and vegetation assessment has been done to identify the most important rangeland locations and their condition in Afar. The average herbaceous cover of rangelands was <25%. Afar pastoralists applied little conservation and mitigation methods, most commonly they removed livestock pressure to allow the pasture to recover. Afar pastoralists applied little rangeland conservation and mitigation effort.

1.2.2 National aspect

When we are focusing on the national level study some people continue to depend on locally available bio-resources for their livelihoods. Such population who are directly dependent on local biological resources. Through their keen sense of observation, practices, and experimentation developed and established a body of knowledge that is passed on from generation to generation. Some are widespread traditional knowledge like cultivation practices by the (National Biodiversity of India, 2009). Defining the spatial limits of biodiversity has evolved a further group of terms; α (alpha), β (beta), and γ (gamma) diversity. This group of terms differentiates between local species richness (α diversity, the number of species at a location), the regional species pool (γ diversity, the number of different species that could be at a location) and vary between localities (β diversity), (Thompson et al. 2007). (Joshi et al, 2015) suggested that the total population of the golden jackal, about half of the golden jackals were mostly found in the *Prosopis juliflora* dominated habitat with an occurrence of 46.90%. This was further followed by grassland, mixed thorn forest, and open scrubland

with an occurrence of 31.25%, 9.91%, and 6.25% respectively. Minimum numbers of jackals were recorded in the wetland habitats (5.69%). The presence of a greater number of jackals in the *Prosopis* dominated area can be attributed to the availability of shelter and food which is also comprised of *Prosopis juliflora* pods and *Ziziphus* fruit. Habitats like *Euphorbia* scrubs, *Prosopis* scrubs, thorn mixed scrubs, open scrubs, thorn mixed forests with *Acacia Senegal*, *Acacia nilotica*, and *Salvadora* mixed considering the high floral diversity and unique vegetation assemblage of this range, it has been suggested that this tract and adjoining sites may be declared as Ecologically Sensitive Areas (ESA), (Joshi 2002). On the other side (Das et al. 2019) found the threatened habitat area of Kachchh district and suggested the suitable habitat areas for the wild animal with multi-criteria analysis. Some threatened floral species are identified in the region *Limonium stocks*, *Dipacdi erythraeum*, *Talinum portulacifolium*, *Indigofera caerulea var. monosperma* and *Ipomoea kotschyana*, *Commiphora wightii*, *Helicrysum cutchicum*, *Convolvulus stockii* and *Heliotropium rariflorum*, (Patel et al., 2018). As per the published report wetland habitat accepting only three threatened species i.e. *Ammania desertorum*, *Dipacdi erythraeum*, *Ipomoea kotschyana*, has high preservation substantial. Including this *Limonium stockii* and *Talinum portulacifolium* which were suggested preservation of their habitat for survival, (Patel et al. 2018). From this region, five species of mammals observed also i.e. *Canis lupus* (Indian Wolf), *Vulpes bengalensis* (Indian Fox), *Hyaena hyaena* (Striped Hyena), *Panthera pardus* (Common Leopard), *Felis silvestris* (Desert Cat), *Felis chaus* (Jungle Cat), *Viverricula indica* (Small Indian Civet), (Pardeshi et al. 2010). Wetlands consist of diversity according to their geographical location, nature, dominated by flora and fauna species, soil, and sediment physiognomies (Space Application Centre, 2010). According to (A. Rathore et al., 2013) the ecosystem mainly di-vided into few subsystems where desertification is expanding and the temperature making them drier and intolerable in terms of the threatened species. The risk of wildfire is increasing which could change the species biodiversity. Climate change is a threat to the diverse hotspots (Succulent Karoo, South Africa). Many species are very specific and endemic to this ecosystem and are rich natural reservoirs of goods. Based on (Nikunj B. Gajera et al. 2013), observation in this Kachchh region the bird species are widely distributed among various habitats around the western Kachchh region. Various factors associated with different habitat types had a distinct impact on bird species. Likewise, various land use activities especially opencast mining that is being done on a mass scale in the region also affect the bird populations considerably. According to (Nitin Bassi et al. 2014) observation of the wetland wealth of India in terms of their geographical location, the ecosystem benefitted but due to various stresses

like land-use changes in the catchment area, they went under the disturbed or threatened wetland ecosystem. Encroachment of reservoir area for industrialization, excessive diversion of water for agricultural practices is yet a major problem (Verma, 2001). Lack of good governance and management are also the main reason for the wetland ecosystem disturbance (Kumar et al. 2013). India, with its topographical variation, along with the climatic mobility supports unique wetland habitats (Prasad et.al. 2002). National Wetland Atlas 2011, prepared by SAC, is the latest inventory on Indian wetlands. In this report total of 201,503 wetlands were identified and mapped on a 1:50000 scale (SAC, 2010). According to the (SAC,2011) Wetland Atlas reports there are 69% inland wetlands, coastal wetlands 27%, and other wetlands (smaller than 2.25 ha) 4%. The aquatic vegetation in all types of wetlands put together, 1.32 m ha (9% of the total wetland area) in post-monsoon and in pre-monsoon 2.06 m ha (14% of total wetland area). The area under aquatic vegetation in Kachchh district is about 59132 ha in the post-monsoon season and slightly high in the pre-monsoon season (60381 ha). A total number of wetlands is 4659 (area 2360909 ha) in Kachchh district, (SAC, 2010).

Many research works have been done by the Govt. Departments as Gujarat Biodiversity Board, Gujarat Ecological Society, Geer Foundation, etc. Except for these organizations some private NGO organization as Sahjeevan, RAMBLE of Banni region, K-Link, Kachchh Unt Uchherak Maldhari Sangathan (KUUMS), Banni Breeders' Association, etc. They are working with the pastoral community and Biodiversity conservation and management sector. The soils of the Banni region are moderate to strongly saline and are subject to flooding/inundation. The Rann is flat, largely composed of salt and mud (Tiwari, C.B, et al. 1994). Due to this inundation factor, there is a variation of vegetation also. The invasion species as *Prosopis juliflora* has taken a major role to threaten the ecosystem through decreasing the grass areas. This region is dependent on livestock farming. Kachchh district support 1.4 million livestock, which yielded about 12% of milk and 21% wool production of the state during 1994-95 (GEC, 1996). Community based participatory natural resource management is being adopted widely as a possible solution to address complex problems. Also, participation and knowledge of local groups are understood to be a valuable resource in community-level natural resource management, decision making, and policy planning processes (Tripathi and Bhattacharya, 2004). However, regardless of its significant contribution to the economy of the district, the grazing requirements of the district could not be met with the existing resources. Increasing grazing pressure is also a major problem for this region so in that position needs a conservation plan. Livestock based income is the mainstay in Banni which was estimated as Rs. 7700/cattle/year and Rs.

13,400/buffalo/year (Geevan et al. 2003). Livestock is the mainstay of livelihood, (Joshi et al. 2009); (GUIDE, 2010). Besides, the socio-economic survey (Joshi et al. 2009) noted that the Banni communities are highly dependent on the natural grassland for various purposes. If this region suffers from the various ecological problem, then it will be very tough for their livelihood. Sahjeevan has tried to collaboration with Sardar Kushinagar Dantiwada Agriculture University (SDAU), Dept. of Animal Husbandry, Govt. of Gujarat for development of the Banni breed which was then registered as 11th Buffalo breed in the country, (Joshi, P.N et al. 2009). Local observations of grassland change and priorities for conservation of natural resources in Banni, Gujarat, India sows the dynamic change of biodiversity by (Das et al. 2018). Biodiversity threat through exotic species monitoring and management using Remotely Sensed data and GIS techniques- A Case Study of Banni (Kachchh) Gujarat, India (K.L.N. Sastry et al. 2003) also shows the threatening species due to influencing various factors. So, using space technology in this region will be a great achievement for the development of the pastoral community as well as its ecosystem also.

1.3 Study Area

The study area is the Kachchh district, (Figure no.1) the geographical extension is between latitude 23°13' N to 24°68' North and 68°10' East to 71°80' East longitude. Gujarat State has an arid area of 62,180 km², of which 73 percent is in the Kachchh district of the State. Kachchh District has an area of 45,692 sq.Km. Kachchh is the largest district in India. The administrative headquarters is in Bhuj which is geographically in the center of the district. Other main towns are Gandhidham, Rapar, Nakhatrana, Anjar, Mandvi, Madhapar, Mundra, and Vondh. Kachchh has 969 villages. The landscape of the area is amazing. A group of hills on the Pachchham outcrop are called Kala Dungar (Black Hill) is the highest point in Kachchh at 458 meters (1,503 ft).

Natural resources provide a range of interrelated environmental functions and socioeconomic benefits, which support a variety of livelihood strategies for different stakeholders of the local community. So the preparation of the Natural Resource map of Kachchh is necessary for the development of the Pastoral community. The Arabian Sea in the west; the Gulf of Kachchh in south and southeast and Rann of Kachchh in north and northeast. The border with Pakistan lies along the northern edge of the Rann of Kachchh, of the disputed Kori Creek. More loosely, the southern portion of the Rann is considered an island, with seawater inundating the land for most of the year.

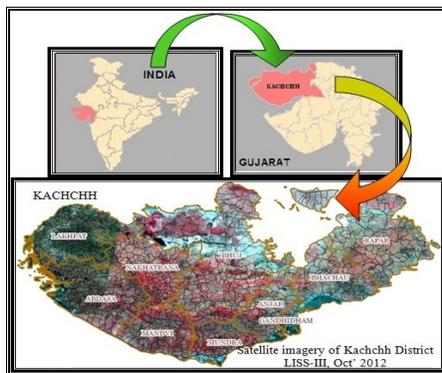


Figure 1: *The Study Area Location Map (not to scale)*

The soils are another main factor to develop the good and healthy vegetation of an area. It shows the heterogeneous character concerning their depth, morphological features, and physiochemical properties. As such a normal process of soil formation has led to the development of shallow to deep, light-colored, calcareous, and salt-rich soils. Kachchh district has a good variety of Natural vegetation distribution. Desert, Thorne forest, Open Grassland, Gorad forest, extensive mudflats, Mangroves in the coast, and numerous wetlands provide a variety of habitats for medium to small carnivores and water owl. The district had a population of 1,583,500 of which 30% were urban as of 2001. Major Crops being produced in Kachchh district are oilseed, bajra, jowar, cotton, pulses, date palms, and brinjal.

2. MATERIALS AND METHODS

2.1 Sampling

A participatory conservation management plan is defined in this study to manage the seasonal grazing route for the camel pastoral community. The Camel pastoral Community of the Kachchh region travels throughout the year from one cluster to another for grazing their animals. The main objective of this study is to find out the natural vegetation along the seasonal grazing route of camels to find out which cluster has what type of vegetation. How to manage the pastoralists to decrease a load of a specific cluster? because there are some common clusters where 3-4 groups of camel pastoralists gather in a single cluster within different seasons (Summer, Monsoon, and Winter). As per the Pastoralist of this region we got the information through focus group discussion (**Figure no. 4**) that basically they roaming for grazing their camels in and around 25 km from the coast line of the Arabian sea. So, we had taken the bench mark as 25 km buffer

(**Figure no. 9 and 10**) from the coastline to identify the availability of vegetation cover within that buffer zone specially with the help of Resource Sat-2 LISS-III satellite imagery.

2.2 Data Details:

Satellite imageries:

For this Study Resource Sat-1 and 2, satellite data (2012 and 2017) have been used for the identification of vegetation composition. The Resource Sat-2 LISS-III satellite data of October 2012 and 12th December 2017, collected from 'Sahjeevan' (NGO, Bhuj), and the rest of the data downloaded for free of cost from NRSC (National Remote Sensing Centre) website, Bhuvan portal, ISRO, Hyderabad of Govt. of India.

Data details are bellowed:

The Resource Sat-1 and 2 satellites have LISS-III sensor with 24 meters. of Spatial Resolution, Spectral resolution of 4 bands (B2: 0.52-0.59, (green), B3: 0.62-0.68 (red) B4: 0.77-0.86, (NIR) B5: 1.55-1.70 (SWIR) and the swath of 141 km. For the cloud-free post-monsoon data December month was selected. This data helped to identify the different natural objects of the earth's surface such as land, waterbody, drainage, forest, mangrove species, etc.

2.3 Processes for vegetation map (Figure 2):

This section has been discussed some major step by step procedure (**Figure no. 2**) for the preparation of two classified vegetation map of Kachchh district, one is for whole Kachchh district and another is for 25 km. Buffer zone from the coastline.

2.4 Processes for Cluster wise dependency map (Figure 2):

This exercise is mainly developed by applying participatory methods defined as manual GIS. For this exercise, ancillary data has been used and the availability of natural vegetation along the grazing route had used the satellite data. This exercise also follows some major steps to complete the grazing route map. The major steps are defined in **Figure no. 2**.

2.5 Participatory Conservation Management plan through the GIS tools.

A participatory conservation management plan is defined in this study to manage the seasonal grazing route for the camel pastoralist. Camel pastoralist Community (**Figure no. 4 and 5**) of the Kachchh region travels throughout the year from one cluster to another cluster for grazing their animals. The main objective of this study is to find out the natural vegetation along the seasonal grazing route of the camel. In which cluster, what type of

vegetation is available. How to manage pastoralists to decrease the dependency of a specific cluster because there have some common clusters where 3-4 groups of camel pastoralists gather in a single cluster for the different seasons (Summer, Monsoon, and Winter).

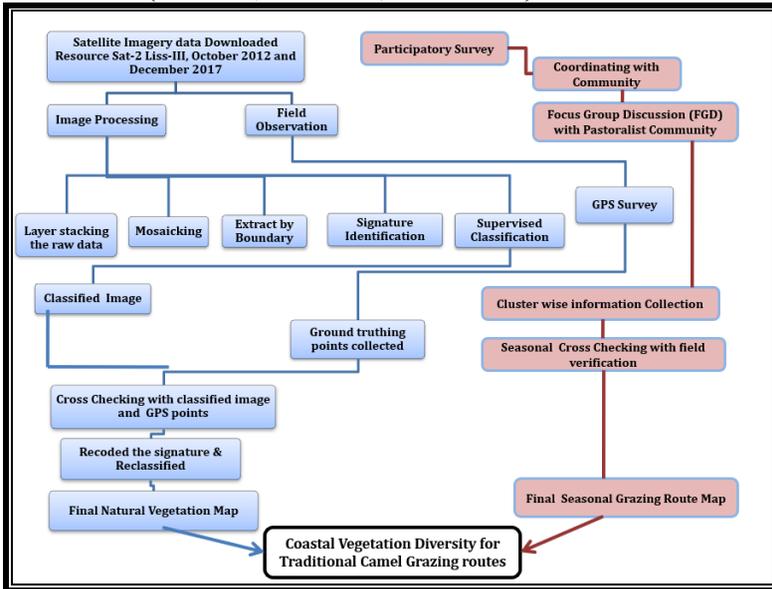


Figure 2: Methodology for Coastal Diversity vegetation mapping for traditional camel grazing routes.



Figure 3: Cross-checking with classified image, Kachchh District, Gujarat



Figure 4: Seasonal migration of a pastoralist family Sanosara cluster, Bachau, Kachchh (Source: Sahjeevan)



Figure 5: Discussion with camel Maldhari in a grazing camel.

2.6 Existence status and Dependency on Natural Resources using GI (Geographic Information) Science technology.

Kachchh district is rich in natural resources in the form of land resources and livestock resources. Besides these natural resources long coastline is also contributing a major part in district economies. Kachchh district has a good variety of Natural vegetation distribution which is controlled the Pastoral community’s growth and development. In Kachchh district according to the census 2011 by govt. of Gujarat total grazing animals are 18,68,290 including Cow, Buffalo, Sheep, Goat, Horse, Donkey, Camel, etc. (Figure no.7), and they fully indirectly depend on natural vegetation.

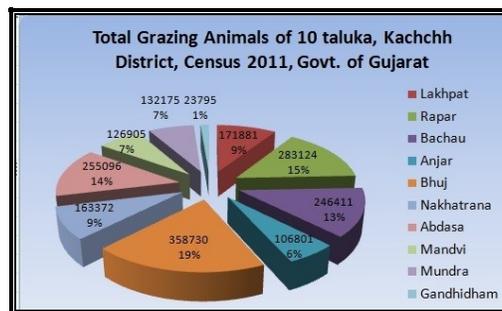


Figure 6: Total Grazing animals in Kachchh District (Source: Census 2011, Government of Gujarat, India)

So there is to be a need preparation of cluster-level seasonal Grazing route map of Camel pastoralist with the distribution of available natural resources

of the whole Kachchh region because when the pastoral community moves around the Kachchh district for grazing they don't have any idea regarding the vegetation types. Once the natural resource map will prepare with applying for the advance Remote sensing technology they can easily find out in which area has what types of vegetation on their grazing route. This is very difficult for a pastoralist to find out the actual grazing site or finalize the seasonal grazing route in the whole Kachchh region. Taluka wise grazing animal or livestock resource has been shown (Figure no.6 and 7).

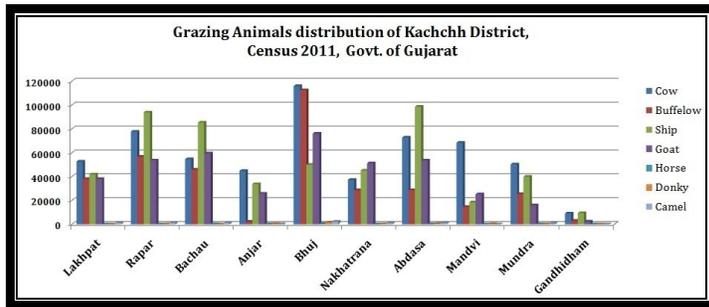


Figure 7: Taluka wise Grazing Animal distribution in Kachchh (Source: Census 2011, Govt.of Gujarat)

3. RESULT AND DISCUSSION

3.1. Preparation of Natural Resource map of Kachchh district, Gujarat.

Kachchh district broadly classified by four distinct regions i.e. (i) The Great Rann, or uninhabited wasteland in the north (< 5 mt.), (ii) The Grassland of Banni (5 to 10 mt), (iii) Main Land, consisting of planes, hills and dry river beds (10 to 465 mt), (iv) The Coastline along the Arabian Sea in the south (0 to 12 mt). More loosely, the southern portion of the Rann is considered an island, with seawater inundating the land for most of the year.

In this exercise, we have categories the vegetation type (**Figure no. 8**) into 8 broad categories (Dense thorn forest, Open *Prosopis juliflora*, Dense *Prosopis juliflora*, open scrub, Grass cover, Mangroves, Saline vegetation, and Agricultural crop/ Horticulture) with 5 other land use categories (Waterbody, Mining area, High Saline area, and Mudflat area). Based on the physiographic characteristic vegetation species also varied region to region. In Bhuj taluka Banni region has a large amount of dense *Prosopis juliflora* distribution in such panchayat as mota luna, Luna, southern Hodko, Northern

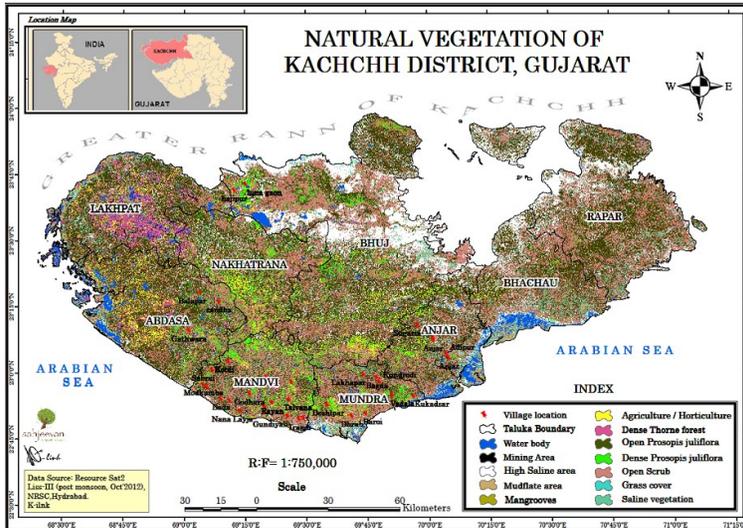


Figure 8: Natural vegetation map of Kachchh District, Gujarat.

Shervo, northern Raiyada, and some western part also. In Bachau and Rapar taluka most of the area is covered by the open *Prosopis juliflora* and open scrub due to the physiographic landscape. Only in the Lakhpata taluka has a large area of thorne forest. Another vegetation category found in this region is open *Prosopis* and open scrub rather than in the western part of this taluka has little bit Agricultural / Horticulture activity. Some of the areas are also covered by the Dense *Prosopis juliflora* which is not good for biodiversity conservation because it comes under the invasive species. The southern part of the Kachchh district has found agriculture/horticulture activity largely. In the southwestern part of Mundra taluka, the southeastern part of Mandvi taluka, the southern part of Bhuj taluka, the southwestern and central part of Nakhtrana taluka, southwestern part of Abdasa taluka are very rich in agriculture or horticultural activity. The Eastern and Northern part of Kachchh district is less agricultural activity due to the presence of the Rann area which is very saline.

3.2. Preparation of Natural Resource map with 25 km. Buffer zone from the coastline of Kachchh district, Gujarat.

Kachchh district has a huge variety of flora and fauna species and their distribution is also remarkable in the Asian continent. As per the Pastoralist of this region we got the information through focus group discussion that basically they roaming for grazing their camels in and around 25 km from

the coast line of the Arabian sea. So, we had taken the bench mark as 25 km buffer from the coastline to identify the availability of vegetation cover within that buffer zone specially with the help of Resource Sat-2 LISS-III satellite imagery.

In this exercise, we have categorized the vegetation type (**Figure no. 9**) into 8 broad categories as Land without scrub, Open *Prosopis juliflora*, Dense *Prosopis juliflora*, open scrub (*Acacia senegal*, *Acacia nilotica*, *Euphorbia*, *Capparis decidua*, *Salvadora persica*), Dense Mangroves (*Avicennia marina*), Sparse Mangroves (*Salvadora oleoides*, *Prosopis juliflora*, *Suaeda* spp.) and Agricultural land and crop/ Horticulture land with 5 other land use categories (Builtup area, Limestone dominated area,

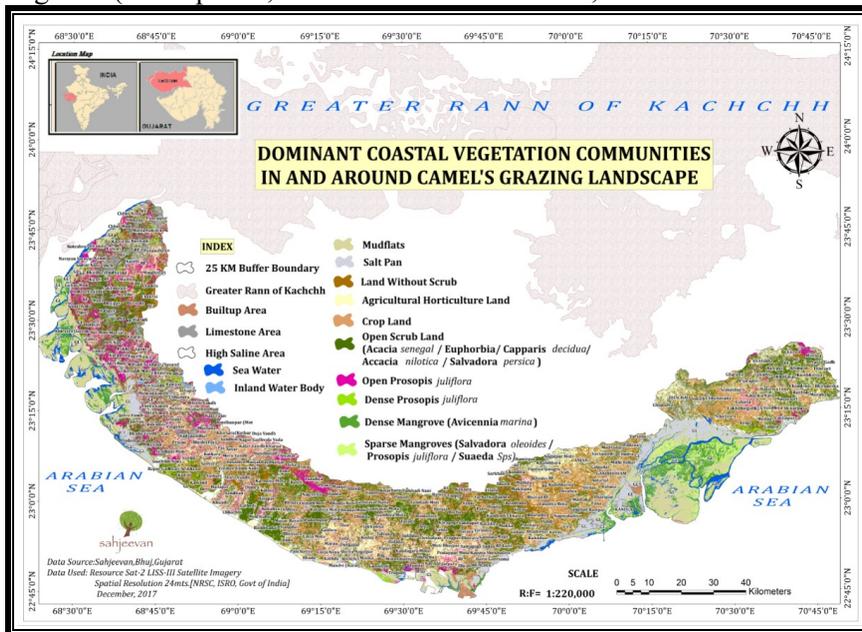


Figure 9: Natural vegetation map of Kachchh District, Gujarat

High saline area, inland water body, Salt pan, and Mudflat area). Based on the physiographic characteristic vegetation species also varied region to region. This map is showing the vegetation species distribution along the coastline. There are six clusters (**Figure no. 10**) located within the 25kms buffer zone from the coastline of Kachchi district. They are (**Figure no. 11**) Tundra wandh cluster, Jangi Amliyara cluster, Pipar Jadva cluster, Mohadi cluster, Bhadresar cluster, and Ashari wandh cluster. The cluster-based vegetation map is showing the composition of different types of vegetation species with spatial location.

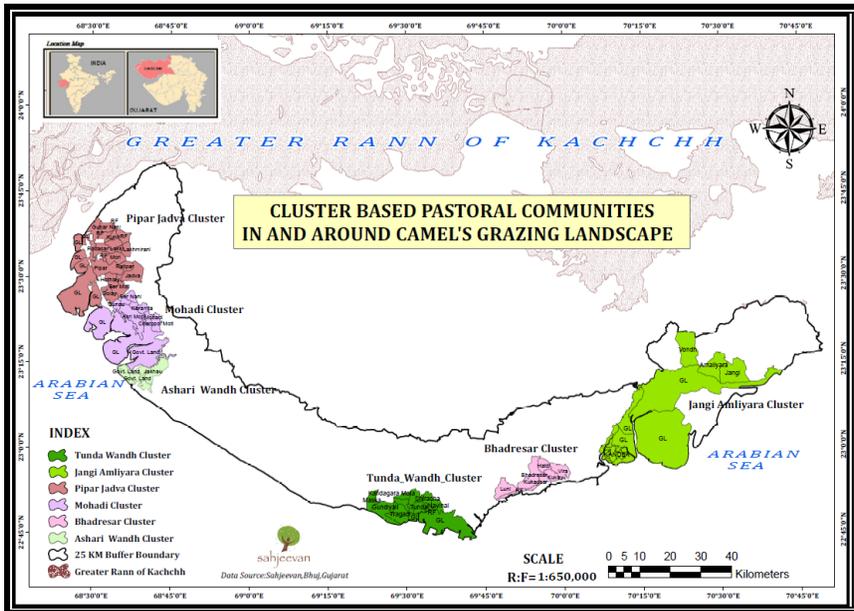


Figure 10: Different cluster locations within 25 km. Buffer zone from the coastline of Kachchh District, Gujarat

3.3. Preparation of Cluster level Seasonal Grazing Route Map of camel pastoralist with the distribution of available Natural Resources.

Does this exercise have an important value that is according to the summer route find out what type of vegetation is available on their grazing way? From the (Figure no. 12) we can easily say the available vegetation type. We can calculate the specific pressure of a cluster on it through how much area it has and How many animal grazing there on a specific season. So in this way, we can show the vegetation distribution and grazing pressure on the summer route through the secondary animal data of a specific cluster.

We had identified their location by phone call and visit their location to collect the information. This may not possible to realize their survival process without staying with them. The Summer season grazing route map is showing the grazing route direction of different cluster in summer season (Table no. 1). There are 11 different cluster named as Balasar (Rapar Taluka), Charidhandh (Bhuj and Nakhtrana Taluka), Jadv (Lakhpat Taluka), Jangi (Bachau Taluka), Jawhar Nagar (Mandvi Taluka), Mohari (Abdasa Taluka), Pachchham (Bhuj Taluka), Pippar (Lakhpat Taluka),

Sanosora (Rapar Taluka), Tundawandh (Manvi, Mundra and Anjar taluka), Vadva Bhopal (Mandvi Taluka).

The winter season grazing route map is showing the grazing routes of in Kachchh region. In this season there are 10 grazing cluster named as Balasar (Rapar Taluka), Charidhandh (Bhuj and Nakhtrana Taluka), Jadv (Lakhpat Taluka), Morgar (Lakhpat Taluka), Jawhar Nagar (Rapar Taluka), Mohari (Abdasa Taluka), Pippar (Lakhpat Taluka), Sanosora (Rapar Taluka), Tundawandh (Manvi, Mundra and Anjar taluka), Vadva Bhopal (Mandvi Taluka).

As per discussion (**Figure no. 13**) with camel maldhari of the Charidhandh cluster we know that how they grazing their animal around the Charidhandh area in the winter season because other maldhari of anther cluster has come for grazing also.

Now to find out which are the common regions for grazing in all three seasons. We must find out the common grazing cluster through GIS mapping. In the map (**Figure no. 12**) you will found the common cluster in all three seasons the camel pastoralists are available. Here in the bellow map overlapping area shows the common cluster and defined the pressure of grazing. As we have seen in the Charidhadh cluster we found more camel pastoralists come for grazing due to available grazing resources. So this cluster has to suffer more pressure on water, grazing vegetations.

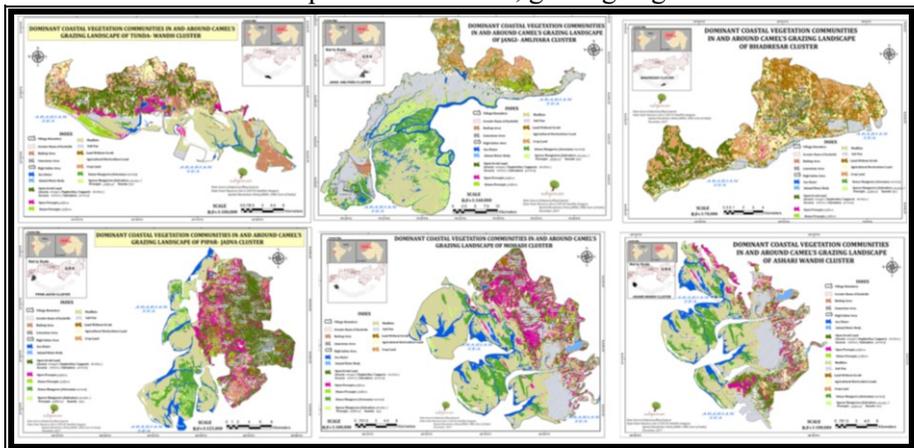


Figure 11: *Vegetation distribution of different clusters within 25 km. Buffer zone from the coastline of Kachchh District, Gujarat*

3.4. Proposed plan to develop natural process

The combination of all three season cluster maps (**Figure no. 12 and Table no. 1**) is showing the cluster load of the Kachchh region due to the grazing by camel. From the above map, we found that the Charidhandh cluster has

the maximum load in the overall three seasons. This cluster is for the kachhi camel pastoralist and this region is not suitable for monsoon season except some agricultural places due to the waterlogging. From other cluster's camel

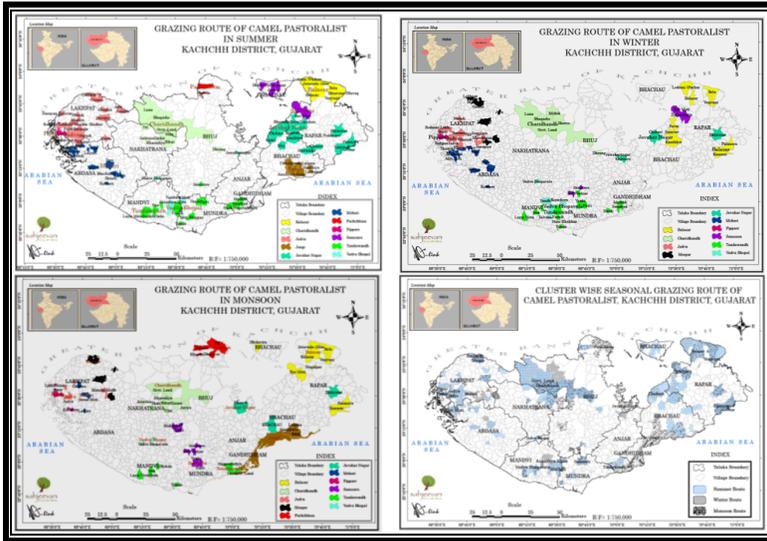


Figure 12: Grazing routes of Camel Pastoralists in and around Kachchh District.

Table 1: Taluka wise seasonal Cluster distribution

Name of Taluka	Name of Cluster		
	Summer	Winter	Monsoon
Lakhpat	Pippar, Jadva	Pippar, Jadva, Morgar, Mohari	Pippar, Jadva, Morgar, Mohari
Rapar	Balasar, Sanosora	Jawhar Nagar, Balasar, Sanosora	Jawhar Nagar, Balasar
Bachau	Jangi	—	Jangi
Anjar	Tundawandh	Jawhar Nagar	Jangi
Bhuj	Charidhandh, Pachchham	Charidhandh	Charidhandh, Pachchham
Nakhatrana	Charidhandh	Charidhandh	Vadva Bhopal,
Abdasa	Mohari	Mohari	—
Mandvi	Jawhar Nagar, Tundawandh, Vadva Bhopal	Tundawandh, Vadva Bhopal	Tundawandh
Mundra	Tundawandh	Tundawandh, Sanosara	Sanosara
Gandhidham	Tundawandh	Tundawandh	Jangi

pastoralists like Jangi, Jadva, Pachchham (in summer & winter) comes for grazing in the Charidhandh cluster. In monsoon season only the Charidhandh

cluster’s own Maldhari stay because this area is their residential area. In the Pachchham cluster, only two season grazing is done summer and winter season. There is no other cluster’s load. This cluster uses by the Kachchhi camel pastoralist.



Figure 13: Camel pastoralist in winter grazing site, collection of information through FGD (Focus Group Discussion)

Other low load clusters (**Table no. 2**) are Jangi, Mohari, Tundawandh, and Jawhar Nagar. These all clusters are using by the Kharai camel pastoralists. Kharai camel pastoralist travel along the coastline area means western Kachchh.

Table 2: Description of cluster load in all season

Name of Cluster	Seasonal Migrant Camel Pastoralist			Total Cluster Load
	Summer	Winter	Monsoon	
Charidhandh (Kachchhi)	Jangi, Charidhadh Jadva, Pachchham	Jangi, Charidhadh Jadva, Pachchham	Charidhadh	9
Pachchham (Kachchhi)	Pachchham	Nil	Pachchham	2
Balasar (Kachchhi)	Balasar, Sanosara	Balasar, Sanosara	Balasar	5
Sanosora (Kachchhi)	Sanosara	Sanosara	Sanosara	3
Jangi(Kharai)	Jangi, Jawhar Nagar	Nil	Jangi	3
Mohari (Kharai)	Mohari	Mohari	Mohari	3
Tundawandh (Kharai)	Tundawandh	Tundawandh	Tundawandh	3
Jawhar Nagar (Kachchhi)	Jawhar Nagar	Jawhar Nagar	Jawhar Nagar	3
Morgar (Kachchhi)	Morgar, Jadva	Morgar, Jadva	Morgar, Jadva, Charidhandh	7
Pippar(Kharai)	Pippar, Jadva	Pippar, Jadva	Pippar, Jadva	6
Jadva (Kachchhi)	Jadva, Pippar	Jadva, Pippar	Jadva, Pippar	6

Another heavy load cluster is Morgar cluster, here in all-season grass available, here two more cluster’s Kachchhi camel pastoralists come for

grazing their camel. The load has given weighted 7 after the Charidhandh cluster (9). Except for this region, one more cluster has been used by the Kachchi camel, Jadva cluster, and in this cluster one more cluster's camel pastoralist comes for grazing their camel. The load has given a weighted 6. On the other way, only one cluster used by the Kachchi and kharai camel pastoralist is Pippar and it has been used by other Kachchhi camel pastoralists as from the Jadva cluster.

This cluster has a weighted of 6 (**Table no. 2**). Among the entire cluster, this is clear that Charidhandh and Morgar cluster is to be needed more consciousness regarding conservation and management. The other three clusters also needed concentration for conservation and management as Pippar, Jadva, and Balasar.

4. CONCLUSION

Participatory conservation management plan defined in this study to manage the seasonal grazing route within the availability of vegetation for the camel pastoralist. This study is impossible without including the pastoral community. We heard from them about their problems during the seasonal grazing and What kind of problem they have faced. They told us that sometimes they do not get fresh drinking water due to the salinity then they have to travel more kilometers for water. Camel pastoralist Community of the Kachchh region travels throughout the year from one cluster to another cluster for grazing their animals. The main objective of this study is to find out the natural vegetation along the seasonal grazing route of the camel. In which cluster what types of vegetation are available. How to manage pastoralists to decrease a load of a specific cluster because there have some common clusters where 3-4 groups of camel pastoralists gather in a cluster in a different season (Summer, Monsoon, and Winter).

So, among all the clusters of this Kachchh region, Charidhandh and Morgar cluster is to be needed more consciousness regarding conservation and management. The other three clusters also needed concentration for conservation and management as Pippar, Jadva, and Balasar.

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