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SATELLITE DATA BASED NATURAL RESOURCES MAPPING OF BANNI GRASS LAND, KACHCHH DISTRICT, GUJARAT, INDIA.

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Abstract:

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. Banni Grasslands Reserve form a belt of arid grassland ecosystem, located in northern part of Kachchh district. This area is known for rich wildlife and biodiversity and is spread across an area of 2,617 square kilometers. Different types of flora and fauna species present in this region. It's a very important to observe & monitoring this region applying advanced technology such as Geographical Information Science with various remotely sensed data. With respect to Banni region, soils are moderate to strongly saline and are subject to flooding/inundation. Due to this inundation factor there is variation of vegetation also. The invasion species as *Prosopis juliflora* has taken a significant role for damaging the ecosystem through decreasing the grass areas. This region is totally dependent on livestock farming. This region has the Pastoralist community and they are locally called Maldhari who has camels, sheep, goats, cattle, and buffaloes. Besides these natural resources; long coast line is also contributing major portions in district economies. The natural resource map has been prepared with the advance Remote sensing technology for the Pastoral community to find out suitable vegetation for their grazing animals. Increasing of grazing pressure is also a major problem to

this region. So, using of space technology in this region will be a great achievement for the development of pastoral community as well as its ecosystem conservation plan also.

Key words: Natural Resources, Maldhari, conservation, Participatory, GPS.

Introduction:

We all are aware that there is no place on our earth where any habitat in case of flora or fauna grows without a proper environment. The Rann is flat, largely composed of salt and mud (Tiwari, C.B, et al, 1994). The increase in grazing pressure implies a reduction in the production of palatable species and increase the proportion of unpalatable as well as woody species (Perrings and Walker, 1995). Livestock is the main stay of the livelihood (Joshi et al., 2009; GUIDE, 2010). In addition, the socio-economic survey carried-out by Joshi et al., (2009) showed that the Banni communities are highly dependent on the natural grassland for various purposes. 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). Local Perceptions of grassland change and priorities for conservation of natural resources in Banni, Gujarat, India shows the dynamic change of biodiversity. “Biodiversity threat through exotic species monitoring and management using Remotely Sensed data and GIS techniques- A Case Study of Banni (Kachchh) Gujarat, India” written by K.L.N. Sastry et al, 2003. The threatening species due to influencing several factors mentioned by Joshi, P.N et al 2009. The Banni has an area of 2,617 km² and has 48 villages, which are regulating by 19 panchayats (local governor’s body) under the state administration. The Banni was derived from a Kachchhi word “Bani” which means “Banni hui” in Gujarat (made up); signifying that the land has been formed by detritus. Banni grassland once referred as Asia’s finest Grassland, accounted for approximately 45 per cent state of the permanent pasture and 10 percent grazing ground available in the state (Reddy et. al., 1997). Total grazing animals are 18,68,290 and they are directly dependent on natural vegetation. 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. In addition, the socio-economic survey carried-out by Joshi et al., (2009) showed that the Banni communities are highly dependent on the natural grassland for various purposes. In particular, nine woody species were useful for construction of traditional house called Bhunga, for medicine and 22 for livestock fodder. Today *Prosopis juliflora* (here after *Prosopis*)

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- I. Demonstrate the integration of field data and remotely sensed data under GIS domain for the preparation of Natural Vegetation Map.
- II. To identify the fresh waterbody location of Banni Grass Land.

Figure 2: Vegetation and Agricultural field pattern in Banni Grass Land, Kachchh

Methodology:

This study has followed the several methods to fulfill the objectives.

Figure 3: Methodology for Natuaraal Vegetation Map of Banni Grass Land

Some major steps has been taken for preparation of the vegetation map of Banni region. These are as follows-

- I. Satellite imagery LISS -III Resources Sat-2 data (October & November 2012) down loaded from the Bhuvan website, NRSC (National Remote Sensing Centre), Department of Space, Govt. of India with the help of Sahjeevan organization.
- II. After raw data downloaded from NRSC few more steps applied for the preparation of False color Composite (FCC) image (Band : R=3, G=2, B=1) from the satellite data of the Banni region with the help of ARC GIS 10.4 and. Through the ENVI 5.1 software

these steps has done i.e. Georectification, Layer stacking, Mosaicking and finally extracted the complete FCC image by Banni region boundary.

Used Data Details

Satellite Data Details:

A) For this Study area Resource Sat-2 satellite data has been used. Data details are given bellow in the table no (2-1). This satellite has LISS-III sensor with 23.5 mts. Spatial Resolution, Spectral resolution 4 band (B2: 0.52-0.59, (green), B3: 0.62-0.68 (red) B4: 0.77-0.86, (NIR) B5: 1.55-1.70 (SWIR). swath is 141 km. For temporal variation in the region Google Earth satellite data has been taken to visualize the different objects of Banni grass land.

B) Ancillary Data or Secondary data: Ancillary data are collected from Census of India (1997, 2011) and ‘Sahjeevan’ (NGO) organization, K-link (NGO) organization.

Table 1: Satellite data details (Source: NRSC, Hyderabad)

Satellite Name	Sensor	Sl. No.	Path/ Orbit	Row	Date of Pass
Resource Sat 2	LISS - III	1	089	055	20th Nov.2012
		2	090	055	8th Oct.2012
		3	090	056	8th Oct.2012
		4	091	055	13th Oct.2012
		5	091	056	13th Oct.2012
		6	092	055	18th Oct.2012
		7	092	056	18th Oct.2012

- III. Now the most important step is signature identification of the FCC satellite image, signature identification will depend on the image interpreter’s knowledge and his / her software expertness. So, the signature identification has been done with the proper vegetation classification of the entire Banni area based on the field verification knowledge and with the enormous research experience of mentor Pankaj N. Joshi.
- IV. After signature identification supervised classification process executes the signature values and generated the FCC satellite image (.img format) of Banni region.
- V. For cross checking the image processing result with the ground truth reliability, calculating the accuracy of the classified image is necessary.
- VI. So the classified image was taken and field survey was carried out with hand held GPS receiver along with other ‘Sahjeevan’ team member.

Figure 4: Ground truth verification in central Banni Grass Land, Kachchh

- VII. Completion of the field verification in some area was recoded and again executed the classified process. Finally we got better accuracy of the classified image and final layout was prepared through the Arc GIS 10.4 software as Natural vegetation map of Banni region.

Result and Discussion

Variation in Biodiversity has taken a major role in this region. The ecological barriers on the west are the river estuaries and marshy lands. Vegetation in the marshy land and immediate inland is at the verge of collapsing. The north of the middle ridge, a large spread of Banni land, is traditionally devoid of agriculture. In every aspect of their day to day life these animals are involved. Strong emphasis is made here for agro biodiversity and cultivated agriculture development in Kachchh. Banni region has a large amount of dense *Prosopis juliflora* an invasive species distribution in villages such as Mota luna , Luna, southern Hodko, Northern Sargu, eastern Moti Dhadhar, northern Misariyado, southern Sarado, eastern Shervo, northern Raiyada and some western Banni part also. This will be a major threat to future floral diversity of the region.

In the present scenario there is significant amount of soil erosion both by wind and water was observed. The available land needs to be saved from salinity and desertification. As tall trees with high canopy except Neem, Banyan and Peepal in small scattered standings, there is no wind shield 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 increases evaporation both from 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 agro-biodiversity is an immediate need. Irresponsible or thought less use of technological applications needs to be given-up. Remedial measures should be taken on invasive *prosopis juliflora* and the charcoal makers. Some peoples of Banni depends on charcoal making process for their economical growth. This process helps to decrease the rate of invasive species i.e. Ganda Babool (*prosopis juliflora*).

In central Banni region as Mithdi, Bhagadio, western Luna, central Bhirindiyara, Mono Sarado, Nano Sarado has the combination of Open *prosopis*, Grass and other vegetation as *salvadora*, *Tamerix* etc. These are available due to the physiographic landscape. Western Banni has dense *acacia nilotica* in Hajipir range and in Sarado, Mithadi, Hodka1, Central Bhiridiyara, Misariyado, Berdo Kharod area has sparse distribution of open *prosopis juliflora*. Southern Banni the little Rann (LRK) means Charidhandh area has the different types of saline grass species as the *Aluerops* with the open *prosopis juliflora*. This combination as *Aluerops* with the open *prosopis juliflora* is rich in percentage around the Banni region. Another combination is *Sueda*, *Kal* and Open *Prosopis juliflora* seen in the high to moderate saline area where the soil is also saline. Udai , Lakhabo, Rann of Banni, Bhitara, Gorewali, eastern Dhadhar and northern sargu has such kind of vegetation combination.

Figure 5 : Natural vegetation map o Banni Grass Land, Kachchh district , Gujarat

Figure 6: Near Bhojorado village dense Kal grasses spread over this region, eastern Banni grass land.

In this grass land, there are several grass species such as *Cenchrus ciliaris* (Dhaman), *Sporobolus marginatus* (Dhrabad), *Dichanthium annulatum* (Jinjvo), *Dactyloctenium indicum* (Madhanu), *Desmostachya bipinnata* (Dhrab), *Sporobolus fertilis* (Khevai), and *Chloris barbata* (Siyarpuchha); and sparsely distributed colonies of *Cynodon dactylon* (Chhabar), *Eleusine compressa* (Nanu Mandhanu); besides sedge like, *Cyperus rotundus* (Chiyo), *Scirpus affinis* (Kal), *Cyperus alopecuroides* (Kaluro), *Eleocharis* sp. (Nano Chiyo), *Fimbristylis miliacea* and coarse and pioneer. Colonising grasses like *Aeluropus lagopoides* (Khariyu) and *Cressa cretica* (Oin) occur extensively. Under shrub like *Suaeda maritimum* (Lano), *Suaeda fruticosa* (Unt

morar), Suaeda nudiflora (Lano), and Tamarix aphylla (Lai), these are specially seen in water logging areas.

Banni region has rich biodiversity and the remarkable fauna distribution comparison with the other Asiatic grass land. Banni Wildlife habitat fully depended in this grass land. We have to monitor through the proper conservation plan as establishment of drinking water site for the animal and also for the Banni pastoral communities. Scarcity of water generates a big problem to any community's development. The tragic phenomenon of this region is that there are many water bodies, but they are changed into saline water body after the changing season due to climatic variation in this region. For the Banni pastoral community, water problem is the most important chronicle to them. For their development and growth and also maintain their animal's growth status is also a big challenge for them due to scarcity of water.

So, in the following map we have shown the fresh water bodies over the Banni region with GPS survey. We have collected the secondary data that include- the ownership of these water bodies and their location.

Figure 7: Fresh waterbody location By GPS survey (Data Source:Sahjeevan, Bhuj).

Figure 8: Landscape and vegetation checked by GPS survey, North-Eastern Banni Grass Land region.

Figure 9: GPS point taken as per Maldhari's description, Charidhandh cluster, Banni Grass land

Table 2: Village wise total area distribution of Banni Grass Land (Source: Sahjeevan,Bhuj)

Name of the Villages of Banni Grass Land, Gujarat			
SLNo	NAME_ENG	TALUKA	Area in sq.Km
1	Daddhar	Bhuj	99.37
2	Misarivado	Bhuj	52.56
3	Berdo	Bhuj	213.61
4	Udai-Lakhabo	Bhuj	163.62
5	Bhagadio	Bhuj	166.96
6	Bhitara	Bhuj	126.33
7	Rann of Banni	Bhuj	544.42
8	Mithdi	Bhuj	67.44
9	Raiyada	Bhuj	176.44
10	Luna	Bhuj	291.53
11	Hodka-2	Bhuj	45.18
12	Gorewali	Bhuj	61.35
13	Shervo	Bhuj	30.80
14	Hodka-1	Bhuj	29.66
15	Dumado	Bhuj	29.19
16	Bhojardo	Bhuj	101.21
17	Dhordo	Bhuj	42.68
18	Sarado	Bhuj	55.81
19	Sadai	Bhuj	50.85
20	Sargu	Bhuj	15.24
21	Bhirandiyara	Bhuj	248.61

Figure 10: Source of drinking water for the animal of Pastoralist

Table 3: Water body location data of Banni Grass land

Water body Location data of Banni Grass Land						
Sl. No	Lat Y	Long X	Elevation in mts	Village Name	Name Zeel	Owner Name
1	23.753483	69.735083	16	Hodko	Hodko Zeel	Bijal Magu
2	23.493867	69.594433	8	Hodko	sheth vali	Salam bhai
3	23.659083	69.593617	4	Hodko	Nath vali	sale mamad
4	23.662000	69.592183	17	Hodko	Nath vali-2	Nur mamad
5	23.655083	69.604350	6	Hodko	sandhani-1	Fadhal
6	23.655733	69.599383	17	Hodko	sandhani-2	ghosu bhai
7	23.658467	69.601000	22	Hodko	sandhani-3	Rukaman bhai
8	23.662017	69.584883	11	Hodko	Ghadiyaro	ibrahim jumma
9	23.686533	69.609433	3	Hodko	Gul vali	Gul vaNi bhai
10	23.688567	69.616100	11	Hodko	ottare	Haji Rahet
11	23.686950	69.626217	13	Hodko	Gaffur vali	Gaffur bhai
12	23.681733	69.600050	6	Hodko	jaLa vali	sale ismail
13	23.670567	69.589017	2	Hodko	jaLa vali-2	jana ismail
14	23.670567	69.589017	2	Hodko	sheth vali-2	Hasam idrisha
15	23.659150	69.593400	1	Hodko	Raj vani	Masudh haji ala
16	23.452717	69.872467	11	Berdo	Berda peer	Gam loko
17	23.453183	69.874617	8	Berdo	vaiva sale judeja	vaiva sale judeja
18	23.453200	69.874267	7	Berdo	Lala Jamal Khasakeli	Lala Jamal Khasakeli

Figure 11: GPS point taken as per Maldhari's description, Charidhandh cluster, Banni Gras land

Table 3.1: Water body location data of Banni Grass land

Water body Location data of Banni Grass Land						
Sl. No	Lat. Y	Long. X	Elevation in mts	Village Name	Name Zeel	Owner Name
19	23.453483	69.874650	13	Berdo	Tamachi Khamisha	Tamachi Khamisha
20	23.453983	69.874550	14	Berdo	Ramjan Ramu	Ramjan Ramu
21	23.454083	69.874900	9	Berdo	Salar Namar	Salar Namar
22	23.454133	69.873100	11	Berdo	Bhuchu Ghodu	Bhuchu Ghodu
23	23.453567	69.874550	8	Berdo	siddhik Habib	siddhik Habib
24	23.456783	69.872267	12	Berdo	Long ibrahim	Long ibrahim
25	23.459050	69.870883	12	Berdo	Khamisha valu	Khamisha valu
26	23.459050	69.870883	9	Berdo	Masjid valu	Gam loko
27	23.480633	69.897717	8	Berdo	Haji mithu	Haji mithu
28	23.457083	69.875783	13	Berdo	Uras khamisha	Uras khamisha
29	23.654417	69.710617	10	Bhirandivara	Gam Zeel	Gam loko
30	23.671667	69.735717	12	Bhirandivara	Khir joke	Ali mamad
31	23.665283	69.714833	12	Bhirandivara	Udona Zeel	Amin kara
32	23.660733	69.713067	13	Bhirandivara	Takrada	din mamad
33	23.671850	69.687850	15	Bhirandivara	Sabu vandh	jusab ladharaysi
34	23.655800	69.700783	17	Bhirandivara	Makudi	mubark raysipotra
35	23.655133	69.717200	10	Bhirandivara	Udai	Ali mamad jan
36	23.651967	69.670550	6	Bhirandivara	Varoda	Ravasi marf
37	23.671650	69.694250	13	Bhirandivara	Sheru vali	sheru seva ravasi
38	23.676650	69.685700	21	Bhirandivara	Husen vali Udai	husen jakab raysi
39	23.739867	69.301800	15	Nana bhitara	Haji allah judiya	Haji allah judiya
40	23.741817	69.301800	11	Nana bhitara	mahbbat Khan desar	mahbbat Khan desar
41	23.741817	69.307200	10	Nana bhitara	Haji sai khan hasamnu	Haji sai khan hasamnu
42	23.744400	69.306900	22	Nana bhitara	Haji abaNa sumar	Haji abaNa sumar
43	23.745917	69.307183	17	Nana bhitara	Haji abdulla haji khan	Haji abdulla haji khan
44	23.746050	69.305667	13	Nana bhitara	sumar haji jan mamad	sumar haji jan mamad
45	23.745667	69.304033	10	Nana bhitara	nurmamad haji mutlif	nurmamad haji mutlif
46	23.746333	69.310200	16	Nana bhitara	Haji ayuf aduda	Haji ayuf aduda
47	23.745367	69.310017	12	Nana bhitara	Ramjan haji	Ramjan haji

Table 3.2: Water body location data of Banni Grass land

Water body Location data of Banni Grass Land						
Sl No	Lat_Y	Long_X	Elevation in mts	Village Name	Water Body Name	Owner Name
48	23.746583	69.307717	14	Nana bhitara	Gahi madanu	Gahi madanu
49	23.746533	69.307817	14	Nana bhitara	Khusi mamad Haji arab	Khusi mamad Haji arab
50	23.746333	69.310500	19	Nana bhitara	bhula haji fathal mamad	bhula haji fathal mamad
51	23.779083	69.355817	14	Nana bhitara	dhar vandh	mamad kasam haji
52	23.746250	69.307533	10	Nana bhitara	Udi Zeel	malik mamad
53	23.775067	69.444650	9	Udhama	kuvavali talav	Givan haji chama
54	23.778717	69.444400	7	Udhama	Udi zeel	Abdul Mirkhan
55	23.771717	69.442617	9	Udhama	zeel	Bhula haji Mamad
56	23.737050	69.297750	16	Mota Bhetara	Mota Bhetara zeel	Haji achar makhe
57	23.590367	69.818533	12	Bhojardo	Thebavali zeel	Ajim musha
58	23.593317	69.725350	14	Bhojardo	Ami mamad valu zeel	Ami mamad
59	23.589100	69.724833	15	Bhojardo	Godavali talav	Harun amad
60	23.589600	69.814950	13	Bhojardo	Faleli zeel	Hamad dina
61	23.588567	69.727283	12	Bhojardo	Sujavali zeel	Sedik Gulmamad
62	23.601083	69.795500	14	Bhojardo	Fat talav	korar Sakur
63	23.590167	69.795067	13	Bhojardo	Bhagadiya zeel	Rahem mtara
64	23.590200	69.805750	12	Bhojardo	Rajavali zeel	Haji umar
65	23.594433	69.814317	21	Bhojardo	Umar sar zeel	Haji Esamayl
66	23.594883	69.725600	13	Bhojardo	Haji nur zeel	Haji Hakem
67	23.575000	69.814400	12	Bhojardo	Kamalvati zeel	Pira kamal
68	23.584267	69.822367	14	Bhojardo	Junu zeel	Judeva samabha
69	23.592433	69.820383	13	Bhojardo	Udo zeel	Maluk latif
70	23.534900	69.820817	1	Chhachhi	dhodho	dhodho Zakam
71	23.536667	69.818133	9	Chhachhi	juma haji	juma haji
72	23.536333	69.818417	9	Chhachhi	haji ibrahim	haji ibrahim
73	23.539550	69.817583	18	Chhachhi	pat bharya	pat bharya Sulaman
74	23.539667	69.817667	18	Chhachhi	hasam lukaman	hasam lukaman
75	23.535950	69.817133	13	Chhachhi	haji mamad	haji mamad Rahim
76	23.539450	69.815217	25	Chhachhi	Usaman hasam	Usaman hasam
77	23.539450	69.815000	25	Chhachhi	Karim hasam	Karim hasam
78	23.539500	69.816333	25	Chhachhi	chanu bhai	chanu Kasam
79	23.539350	69.817750	22	Chhachhi	Mod Jusab	Mod Jusab
80	23.534800	69.818883	22	Chhachhi	Zakab dhodha	Zakab dhodha
81	23.633883	69.407833	17	Bhagadiya	Umarani	Karam Hasan

Table 3.3: Water body location data of Banni Grass land

Water body Location data of Banni Grass Land						
Sl No	Lat Y	Long X	Elevation in mts	Village Name	Name Zeel	Owner Name
82	23.634700	69.403950	8	Bhagadiya	Sakurani	Bhanuda ishak
83	23.636983	69.406883	8	Bhagadiya	Malirani	Mamad patel janu
84	23.636583	69.404133	9	Bhagadiya	Vasavani	Gam loko
85	23.637750	69.406767	10	Bhagadiya	Faruk Vandh	Khamisha jonga
86	23.635783	69.407467	13	Bhagadiya	Haji Soji Udi	Haji soji
87	23.635317	69.414717	11	Bhagadiya	Haji kulab	Haji kulab
88	23.628183	69.410183	6	Bhagadiya	Vado Zeel	Gam loko
89	23.635783	69.402517	11	Bhagadiya	Allahna mamdharim	Allahna
90	23.606017	69.354217	17	Shasala	Shasala zeel (alag-alag malik)	Gam loko
91	23.711117	69.833650	14	Ram Nagari	Saybanu zeel	Node, Sumara, Higo rja, Harijan
92	23.700317	69.729633	16	Vagura	Gam zeel	Gam loko
93	23.694550	69.807450	16	Vagura	Jam valo zeel	Jam namno malik
94	23.695450	69.809367	12	Vagura	Desi Baval zeel	Mitha Amad

Conclusion:

Banni region has one of the most important cluster as Charidhandh which is the maximum overloaded for grazing in two seasons (summer & winter). From this study we observed that the Charidhandh cluster has the maximum grazing pressure in overall three seasons because other cluster's camel pastoralist like Jangi, Jadvā, Pachchham (in summer & winter) comes for grazing in Charidhandh area. This cluster is for the kachhi camel pastoralist. This region is not suitable for monsoon season except some agricultural places due to the water logging for low slopes of land. Banni has other pastoral community other than camel, they are goat, sheep etc. but in this study we have focused on camel pastoralist because most of the peoples of Banni region chose their profession as camel pastoralist. That will be better to take any remedial measure for the biodiversity and community development. We can generate a layer with specific suitable wildlife habitat area or zone for the development of ecological Biodiversity through this technology in future.

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