

Participatory natural resources mapping: A case study of Bhitara Panchayat in Banni grassland, Kachchh (Gujarat)

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SUMMARY

The information of this paper is based on nine months field survey at Bhitara Panchayat villages *i.e.* Bhitara Mota, Bhitara Nana and Udhma. Organization of series of meetings were held at various levels with local stakeholders and data were collected on natural resources like existing natural resources and their distribution, grassland status with salinity classes, participatory restoration methods and socio-economic status of each family. Based on participatory exercise (or participatory rural appraisal) with various groups, The conclusion was drawn to recommend site specific strategies for conservation and sustainable utilization of natural resources. Overall findings revealed that *Jat* muslims is the most dominant community in selected Panchayat villages with livestock rearing activities as the main occupation. In addition, local inhabitants were using charcoal as main source of energy to fulfill their daily requirement as well as had also adopted *Prosopis*-based charcoal making as business to earn surplus money for their livelihood. Natural habitats have been lost through invasion of *Prosopis juliflora* (locally called *Ganda Bavar*) and had resulted in significant loss of wetland area, degradation of remaining natural resources and a consequent decrease in the diversity of native land use type and species. People admitted that they did not have adequate knowledge of government developmental schemes and programmes so they were not able to avail the full benefits of such programmes. Participatory natural resources mapping supports the sustainable management of natural resources in an ecologically sound and socially sensitive manner. However, the resource use potential of local people has not been planned scientifically for sustainable development of the Banni region. The present study was planned and carried-out in one Panchayat of Banni region to develop an innovative management practice, which supports sustainable use and multiple natural resources benefits.

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The Banni has an area of 2,617 km² and has 48 villages, which are regulated by 19 Panchayats (local governor's body) under the state administration. Natural resources in Banni areas and particular in selected Panchayat (Bhitara) are multidimensional with cross-boundary resources within adjoining villages. These resources provide a range of interrelated environmental functions and socio-economic 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*, 4 for medicine and 22 for

livestock fodder. Today, *Prosopis juliflora* has become a wide spread species in many parts of Kachchh district especially in the Banni area. Further, *Prosopis* spread may not be severe when whole Kachchh is considered, but the rate of increase of spread in Banni area was very high. Further, in Kachchh, pressure on existing grasslands are high because an Adult Cattle Unit (ACU) requires 3-4 ha good condition grasslands. However, the available grazing lands in Kachchh district, which includes all categories *viz.*, good, fair, medium and poor condition class is 0.6 ha per ACU suggesting tremendous pressure on grazing lands. 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

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(Perrings and Walker, 1995). A total of 45% of the permanent pastures are available in the state and are also to be found in the Banni areas. Since the Banni areas are not well studied from this point of view, such data will serve as benchmark for the future. The said study will be a pilot study in this kind and will be the base model which will be replicable for other Panchayats of Banni. Thus, the present study was undertaken with the following objectives: to demonstrate the integration of field data and remotely sensed data under GIS domain, identify natural resources (land and water) and infrastructure facilities in and around the selected villages, to assess the land use and land cover of Bhitara Panchayat using people's participation methods and to understand the dependence of the local people on the surrounding natural resources for various requirements such as fodder, fuel, water, etc. and their accessibility.

Study area:

Gujarat State encompasses an arid area of 62,180 km², of which 73 per cent (45652 km²) is located in Kachchh district of the State. The district is poorly endowed in terms of its land quality, as about 23,310 km² (51 per cent) area is covered by saline deserts (Greater and Little Ranns). Banni is situated at 23° 19' to 23° 52' north latitude and 68° 56' to 70° 32' east longitude and is a western most end of Gujarat state as well as India and located 60 km from Bhuj-district headquarter. 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, accounts for approximately 45 per cent state of the permanent pasture and 10 percent grazing ground available in the state (Reddy *et al.*, 1997). 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 *i.e.* Dhordo, Gorewali, Hodako, Dumado, Sadai, Luna, Chachhala- Bhagadia, Bhirandiyara, Mithadi, Sarada, Shervo, Bhitara, Raiyada, Berdo, Bhojardo, Udai, Sargu, Dadhhar and Misariyado (Fig. 1).

The climate of Banni is arid therefore, the temperature remains high during most of the time and it reaches a maximum of 48-49°C during May-June (the hottest months). The winter temperature goes down to 10°C with January and February being the coldest months. The total annual rainfall, occurring through south-west monsoon between June and September, is very low with an average of 317 mm per year. Earlier in Banni *viz.*, *Dichanthium annulatum* (Jinjvo), *Cenchrus ciliaris* (Dhaman), *Sporobolus fertilis* (Khevai), *Chloris barbata*

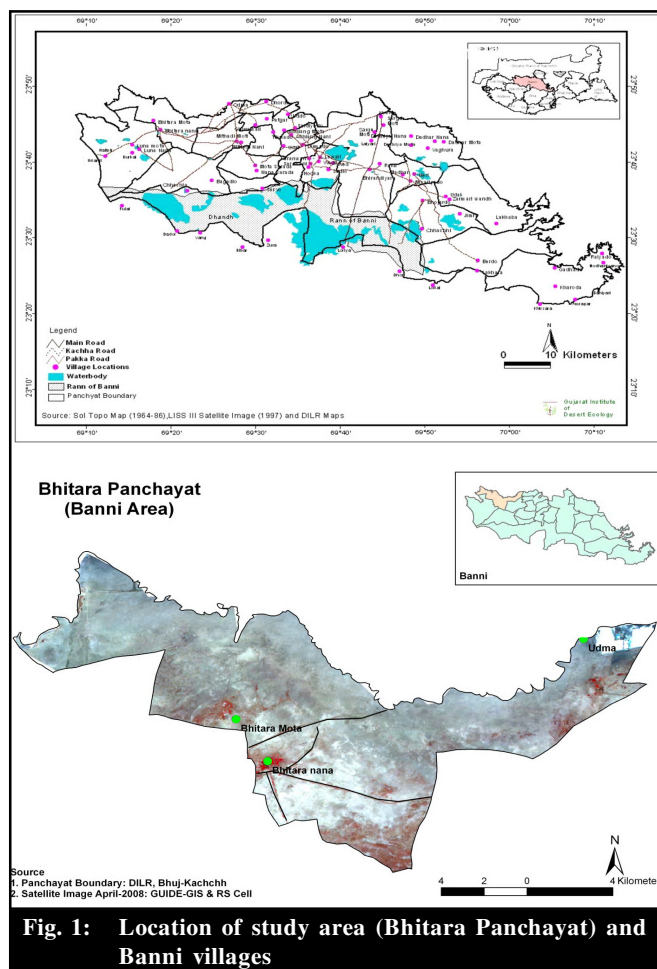


Fig. 1: Location of study area (Bhitara Panchayat) and Banni villages

(Siyarpuchha), *Dactyloctenium aegypticum* (Madhanu), *Desmostachya bipinnata* (Dhrab), *Aeluropus lagopoides* (Khariyu), *Cynodon dactylon* (Chhabar) were highly dense which has come down significantly in the recent years. The human population is about 17,000 and the livestock population is about 50,000. The Banni supports a large number of different pastoralist groups, collectively known as *Maldhari*. The *Maldhari* herd camels, sheep, goats, cattle, and buffaloes; they produce ghee (clarified butter), wool, and handicrafts. Since the land is not suitable for agriculture, the region was bypassed by conventional development. Livestock is the main stay of the livelihood (Joshi *et al.*, 2009; GUIDE, 2010).

MATERIALS AND METHODS

Three villages in Bhitara Panchayat were selected for interview: Bhitara Mota, Bhitara Nana and Udhma. Participatory Rural Appraisal (PRA) and Focus Group Discussions (FGD) were employed to generate the socio-economic information. Primary data were collected by field observation, semi-structured and key-informant

interviews and group discussion. In this survey, the village leaders were asked to arrange meetings with at least three to five elderly inhabitants in each village. Thirty-five local people were interviewed independently of each other. The interviews, which spent 4-5 hours and three continues days, were semi structured and had four key sections: (a) personal or individual information, (b) grassland composition in adjoining sites, (c) salinity status and biomass availability, and (d) wishes for management and conservation of natural resources including grasslands, wetlands and biodiversity.

For present study the relevant information on livestock numbers, areas under each village and household details were also collected from available secondary sources. In addition, Participatory Appraisal of Natural Resources (PANR) technique with visualization and diagramming (Chambers, 1981, 1991, 1992, 1994; Collinson, 1981; Conway, 1985; Mukherjee, 1993) methods have been used to collect data on various natural resources. The participant observation method was also employed, especially while conducting group interviews, to observe the degree of response of participant respondents in a group. Interviews of individuals and groups with the social mapping exercise, the villagers were asked by PANR instructor to draw the natural resources around the village and other infrastructures. The maps were drawn by village leader, old age person or the people have knowledge about village land and water resources. Both men and women are also involved in this exercise. The participants were asked to use different colour of pens to differentiate resources. For example one village of Bhitara Nana line diagram map is presenting in Fig. 2.

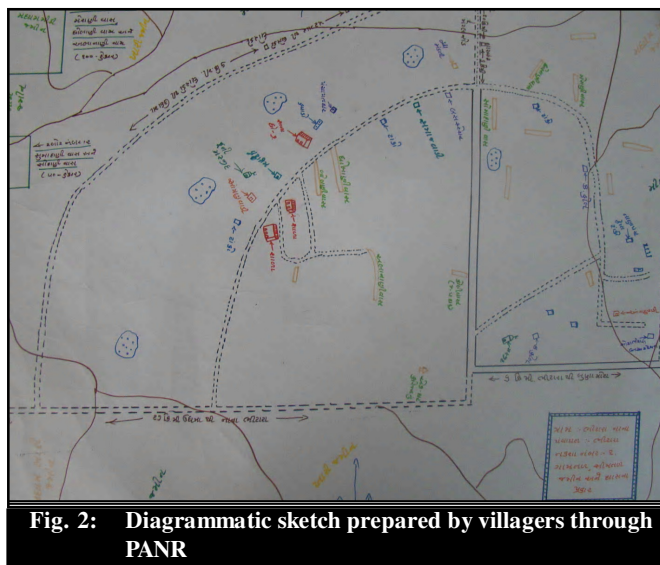


Fig. 2: Diagrammatic sketch prepared by villagers through PANR

Further, DILR (District Inspector of Land Records) non-geo referenced cadastral map was geo-referenced using GIS (Geographic Information System) points of field observation and prepared a subset of Bhitara Panchayat boundary. It is also well known that, GIS provides a framework to document and store indigenous knowledge meaningfully (Tripathi and Bhattarya, 2004). The Panchayat boundary map at 1: 50,000 scale was overlaid on this image and structures of each village with remote sensing data was then taken to and got verified with the help of field observations. Bhitara Panchayat northern boundary is sharing with Great Rann of Kachchh, southern part with Luna Panchayat and eastern part with Dhordo and Mithadi Panchayats. Fig. 1 shows satellite image overlapped with Panchayat boundary. On the basis of remote sensing data, total area covers Bhitara Panchayat is 772 ha. Approximately 15 km length and 4-5 km width covers the Bhitara Panchayat. According to the landuse data interpretation most of the land of selected villages are salt affected.

RESULTS AND DISCUSSION

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 is understood to be a valuable resource in community level natural resource management, decision making and policy planning processes (Tripathi and Bhattarya, 2004). In this direction, local knowledge in the Bhitara Panchayat has often been dismissed or overlooked in scientific grassland management, land use planning, and research. This pilot appraisal shows the potential for local knowledge to inform extension and technical assistance efforts, provide insight into sustainable grassland management. Research is needed to understand the best way to elicit pastoralist community's knowledge and quality of knowledge claims in order that selected villages landscapes can get benefit from a more complete understanding of natural systems and management motivations.

General socioeconomics and demography: An overview:

Of the 35 respondents, all the respondents were Muslims and belonged to the tribal Muslims group of Jat from three villages. Age ranged from 18 to over 80 years, with an average of 58, and most respondents had lived around the animals herds all the years. All informants, except for the oldest, frequently visited most parts of the Banni during the dry season, for free grazing their animals. In addition, most of the respondents had quite good

Table 1: Demographic composition of Bhitara Panchayat

Particular	Bhitara nana (No.)	Bhitara mota (No.)	Udhama (No.)	Total Bhitara Panchayat
Total household	225	74	41	340
<i>Kachha</i> house (Semi permanent)	25	24	31	80
<i>Pakka</i> house (Permanent)	200	50	10	260
Total population	780	268	181	1229
Male population	420	161	110	691
Female population	360	107	71	538
Community houses	7	3	2	12

knowledge on grazing route to each respective season with traditional understanding on availability and quantity of fodder species on particular grazing way. This information helped in identifying various problems and perception of local people about the natural resources.

Jat, Harijan, Koli and Sikh community are dominated in the selected Panchayat, Hindu and Islam as their religion. As discussed with local inhabitants, the main occupation of selected Panchayat is livestock rearing, but after constitute drought years, few of them were also being working with industries as well as collecting minor forest produce like gum, honey etc. As per discussed with elder *Maldharie's* group, the working pattern are also changing season to season for said Panchayat. Villages use charcoal as main source of energy to fulfill their daily requirement as well as have adopted *Prosopis*-based charcoal making as supporting business to earn money for their livelihood. The details on other demographic data are presented in Table 1.

Average family size as revealed through household survey was 5-7 individuals/family. The finding revealed that status of education was poor in selected villages. The main problems faced by people residing into Bhitara Panchayat were lack of basic facilities for education, primary health-care and local employment, which lead to the greater degree of poverty among them. State transport facility was not available, only local and private transports are available for Taluka head quarter- Nakhtarana village (65 kms.).

Livestock-based economy:

In Bhitara area primary economic sector is pastoralism. Livestock is the most sought livelihood option due to availability of open grasslands such as grasslands, savannahs, and *Prosopis* forest. In fact, in the Bhitara the population of livestock is higher than the human.

Total livestock population in 3 villages is 4055 with minimum 360 in Udhama village and maximum is 2918 in Bhitara Nana village. Village wise livestock result showing that buffalos are representing with higher (77-82%) in all the villages and sheep with less than 3% Table 2.

Livestock based income was the mainstay in Banni which was estimated as Rs.7700/cattle/year and Rs. 13,400/buffalo/year (Geevan *et al.*, 2003). Livestock based income was also the mainstay in selected villages (Bhitara Mota, Bhitara Nana and Udhama) *i.e.* 1456/cattle/day, 6629/cattle/day and 2025/cattle/day as per survey. To meet the need of livestock fodder, an Adult Cattle Unit (ACU) requirement for livestock in Bhitara Panchayat was calculated. It's mainly depending on the palatable grass species available in and around the village area. The PRA data and analysis showed that proportion of buffaloes was higher than goat and sheep. Detailed analysis on livestock proportion in various cattle's is given in Table 3. Livestock need more water in summer (4 times) compared to winter (one time). For Bhitara Panchayat, ACU 4465 kg and average need 7.5 kg per cattle was required. Daily requirement for total cattle of Bhitara Panchayat was 33489 kg and yearly (4 months) requirement was 4018671 kg (Table 3).

Table 2: Livestock population with relative percentage

Villages	Bhitara nana	Relative %	Bhitara mota	Relative %	Udhama	Relative %
Buffalo	2304	78.96	639	82.24	276	76.66
Calf	474	16.24	79	10.17	74	20.55
Goat	114	3.90	54	6.95	10	2.77
Sheep	26	0.89	5	0.64	0	0
Total	2918	100	777	100	360	100

Table 3: Livestock adult cattle unit for Bhitara Panchayat

Sr. No.	Cattle	No. of cattle	Conversion unit	ACU	Average requirement of fodder (kg)	Daily (kg)	Monthly (kg)	Yearly (kg)
1.	Buffalo	3219	1.3	4281.3	7.5	32109.53	963285.75	3853143
2.	Calf	627	0.2	137.94	7.5	1034.55	31036.5	124146
3.	Goat	178	0.2	39.16	7.5	293.7	8811	35244
4.	Sheep	31	0.2	6.82	7.5	51.15	1534.5	6138
	Total	4055		4465.2		33488.93	1004667.8	4018671

Participatory natural resource mapping (PNRM):

As discussed above, PNRM was carried out using ground surveys and it translates into GIS domains with the help of remotely sensed data acquired for selected villages. Data on various aspects were collected and mapped on georeference images of each village. These resources included, wetland resources including drinking and domestic requirements for local inhabitants and livestock population, land resources with various land categories.

Detailed of land available in various categories as generated through participatory exercises are presented in Fig. 3.

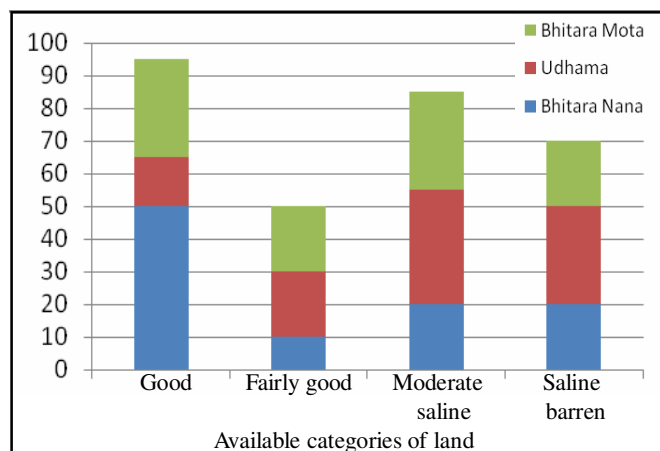


Fig. 3: Various land availability in selected villages

Wetland resources:

As per discussed with local inhabitants and *Maldharies*, a total of 11 small (appr.1-3 ha.) and medium (appr. 4-5 ha.) size open ponds (locally called *Jil*) were existing and were being used by local inhabitant in Bhitara Panchayat. All the *Jil* had local traditional water harvesting practices called “*Virda*”. This system is very useful even in severe drought condition as well as in extreme summer season. The distributions of various wetlands available in Panchayat are shown in Fig. 4.

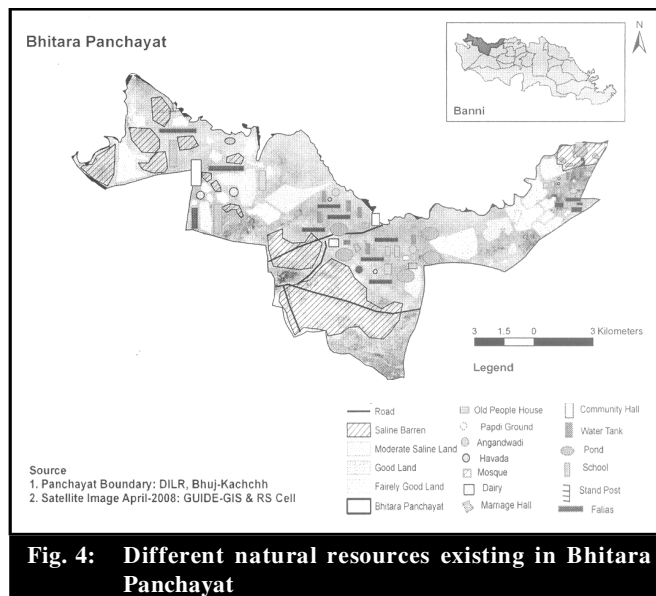


Fig. 4: Different natural resources existing in Bhitara Panchayat

Land resources and grazing system:

In focus group discussions participants indicated that, low rainfall and constitutive drought of the last 40 to 50 years were major reasons for vegetation and grassland changes, but since last couple of years (2007 to 2009) this area received average precipitation (>350mm) of district. According to informants, another main reason to decline or deteriorate the grasslands of this area is salinity increasing and spreading of *Prosopis*. A few respondents also mentioned that the earthen barrier in Rann, is also highly destructive to the native grasslands resources for this Panchayat. Therefore, grasslands of this Panchayat need special attention since this is extremely fragile ecosystems with threatened traditional pastoralist system.

Perception of local people for development:

Most respondents preferred the previously dense grasses with tree cover and would like it to be restored. They also suggested some preferred species including grass and trees to be restored at various degraded sites with few amendments techniques, but often without clear ideas about how that should be done. Better management practices and grazing systems were also proposed by few

respondents. People in general preferred their own grazing route as well as their traditional free grazing system between each adjoining villages, but they had difficulties agreeing on the stall feeding to their livestock. Some respondents stated that a good option would be to protect regeneration of grass species and other fodder tree species by cutting the surrounding *Prosopis*. According to them, charcoal making activities from this woody invasive species would also generate extra income or benefit to poorest in poor in each village. Although it was difficult for local inhabitants to give exact ideas about grassland management in selected Panchayat as overall but they have defined traditional strategies to manage their own grazing area, and that improves the status of grasslands and maintains fodder tree species diversity. The details on various types of land availability and existing resources are shown in Fig. 4.

Conclusion and future direction:

– Experience has shown that development efforts that ignore indigenous knowledge, local systems of knowledge, and the local environment, generally fail to achieve their desired objectives. This system is becoming extinct because of rapidly changing natural and social environment (Tripathi and Bhattarya, 2004). In recent, it is generally recognized that indigenous knowledge plays an important role in the sustainable management of natural resources and can also have an impact on issues of global concern.

– In view of above, data have been presented on various socio-economic attributes of each villages. The data (secondary, primary, PANR etc.) generated in the above villages would help in identifying important land and wetland areas and also representing a conservation and management plan for selected villages in Banni. Overall findings revealed that Jat muslims are most dominant community in selected villages whose main occupation is livestock rearing. Villages use charcoal as main source of energy to fulfill their daily requirement as well as have adopted *Prosopis*- based charcoal making as supporting business for earning money during drought periods. Basic amenities related to health, education, transportation are not adequate in all the studied villages where people have to travel long distances for getting basic medical and educational facilities.

– Natural habitats have been lost day by day through regeneration of invasive species. They have resulted in significant loss of wetland area, degradation of remaining natural resources and a consequent decreasing in the diversity of native land use type and species composition. In couple with the anthropogenic

pressure, the existing dry conditions adversely affected the grassland ecosystem function in selected villages. People also admitted that they did not have adequate knowledge of governmental developmental schemes and programmes so they were not able to avail the full benefits of such programmes.

– Besides supporting the regional economy, through animal husbandry sector, these grasslands also play an important role in performing various ecological services, including the maintenance of biodiversity.

– In future attempts will be made to analyze the soil condition level by collecting more soil and water samples from various locations; examine the geo-hydrology of area and identify biodiversity hotspots in view of existing threats; and to develop effective conservation strategies for sustainable development of the selected villages.

– Additionally, the landscape level mapping and development of spatial and non-spatial (plants, animals and socio-economic) database will be continued in order to achieve the objectives.

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