

Ecology And Environmental Assessment In Barmer, Rajasthan (India)

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Abstract

The ecological and environment resources is a per-requisite for mulating effective land use plan for various regions of Barmer. Mapping of the ecological regions will help in indentifying suitable situation for a particular regions.

Barmer exhibits a variety of landscapes and ecological conditions which are noticeable in the types of soils and vegetation. While preparing for land use plan or a cropping pattern or agricultural or animal husbandry system we should keep in mind the combine effect of climate,soil,land information and topography.

This study has been carrid out through critical survey and inter actions with the local people and available regional basis namely block Barmer specific details have been provided where ever relevant.

KEYWORDS:- Ecological, Environmental, Human population, Economic infrastructure, Agriculture, Animal species.

1.1 INTRODUCTION:-

Man has been relaying on the natural resources to meet the basic requirements since time immemorial. With the unprecedented increase in the population during the last few decades, clearly mankind faces formidable problem to ensure food and nutritional security for all, considering reduced per capita land, reduced availability of water, depleting biodiversity and need to preserve ecology and environment. The physical and biological environment of the earth is so rich in its potential that is can support the need of its inhabitants for a long time to come. However, the man's greed rather than his needs is putting enormous pressure in the capacity of the biosphere resulting in over-exploitation of the natural resources, as the demand is not within the paradigm set by ecological constraints.

The natural resource management at most places in the world including India is inappropriate, exploitative and unscientifically planned. Even today, land and water are being exploited without restraint considering them inexhaustible, and wastes are discharged freely into air and water assuming that these have unlimited assimilative and carrying capacities. As a result, very disturbing trends of natural resource degradation have emerged. Human activities inflict harsh and often irreversible damage on the environment and on the critical natural resources. If not checked, many of our current practices will put, at serious risk, the future that we wish for human Society and the plant and animal kingdom.

1.2 LOCATION OF THE REGION

The located in Barmer districts of the southwestern Rajasthan i.e., within the Indian Thar. The Thar Desert can be understood as a unique natural ecosystem having the following attributes:

- Low and extremely uncertain rainfall,
- Considerable diurnal and seasonal temperature variation,
- Soil deficient in organic matter and nutrients (NPK ratio)
- Soil prone to salinization,
- Shifting sand dunes,

Despite the adversities, The Thar is not devoid of bountiful life supporting systems with abundance of animal and plant species making it a unique biodiversity region in the world.

1.3 OBJECTIVE

1. Based on recent environment assessment evaluations and studies conducted in Barmer, the following is a summary of key environment concerns which account for the macro, meso and micro level impact on livelihood.

2. At the provincial level, which is a meso - level link in the policy implementation chain, there have been posts for trained officers with responsibility for environment issues, as well as others for forestry, agriculture, livestock, energy, mines and other relevant sectors.

3. Although environment issues may be addressed through support of decentralization process- such as being funded by the Barmer (Raj.) this may not be assumed.

4. Moreover, environment concerns are included throughout the document, and a separate sector deals exclusively with "Management of Natural Resources and Environment".

1.4 RESEARCH METHODOLOGY

1. Reviews and analysis of various studies and documents on ecology in Barmer, as well as review of district and sectoral policies and strategies, planning responsible for environment.

2. The field work involved assessment collection during focus and individual questionnaires of local policy planning processes.

3. Such issues as local environment awareness, interministerial relationship and their implications for local livelihood were emphasized.

4. In conducting this study holistic approach considers the interlinkages between society and environment, and distinguished between the micro, meso and macro levels.

1.5 DISSUCTION

- 1.This paper has demonstrated that although environmental considerations were indeed factored into the interim PRSP and the PRSP itself , there were few specific objectives and targets .
- 2.As the tourism sector rapidly expands ,guidelines for environmentally sound business practices should be adopted .The promotion and development of community based ecotourism could significantly improve livelihood .
- 3.Sometimes ,environmentally -friendly policies have unintended repercussions .In 2009, in order to protect land from use of fuel - wood ,legislation on wetland led to the closure of natural marking activities in ecology .
4. Finally , research findings are ecology in a comprehensive assessment intended to guide the development of the Barmer district (Raj.) .

2. ENVIRONMENTAL SET UP IN BARMER

2.1 CLIMATIC CONDITIONS

The region is characterized by low and uneven distribution of rainfall causing high soil water stress throughout the year. High potential evaporation and strong wind also add adversity to the area. The summer is the most dominant season characterized by high temperature spreading over March to mid of July, coupled with high wind velocity and drifting sands. Three seasons that can be distinguished in this region are long dry season from March to mid of July; a short monsoon season from mid July to September receiving most of the rainfall and a winter season from November to February. The long dry season is generally pronounced and predictable, while the short rainy seasons are unreliable both in time and amount of rainfall.

2.2 TEMPERATURE

The most characteristic feature of the climate is the wide variation in the temperature. The maximum temperature rises to 50 °C in summer and drops down to 0 °C in winter. Highest mean maximum temperatures are generally recorded during May to June; however, at times maximum temperature has also been observed in April. The lowest minimum temperature is generally, during the month of January. It increases during the dry season to above 23°C, and oscillate at a slight lower level throughout the remainder of the year. The diurnal temperature variation is high, both in winter and premonsoon summer month and least during the monsoon months.

2.3 WIND VELOCITY

Wind velocity is strongest during the months of May to July. Average wind speed varies from 6-18 m h⁻¹, which influences wind erosion and sand drift. But wind speed as high as 35 to 40 km h⁻¹ is also observed during summer causing sandstorm in

the some parts of the region. The wind direction is east to north westerly in winter and west to south westerly in summer.

2.4 RELATIVE HUMIDITY

Relative humidity of the area is low with very high variation in maximum and minimum value. Mean maximum relative humidity (RH) ranged from 43 to 93% and minimum ranged from 7 to 50%. Maximum RH is generally observed during winters (92% in December) followed by monsoon period whereas the minimum RH is observed in summer.

3. WATER AVAILABILITY

3.1 RAINFALL

Rain is the main source of water for drinking and for the irrigation of agricultural crops in the region. Annual average rainfall in Barmer region ranges from 200 to 350 mm whereas in Jalore region it ranges from 300 to 450 mm. Thus there is vast variation in rainfall both in quantity and number of rainy days indicating highest co-efficient of variation. July and September are the months when a few shower takes place. The southwest monsoon begins in the last week of June and lasts till middle of the September. In the winter season also, there is sometime a little rainfall. However, due to limited vegetation, the rain results in run-off losses in most of the areas.

4.2 WATER RESOURCES IN BARMER

There surface water and six ground water sources were examined for physico-chemical, heavy metals and bacteriological parameters in order to assess the effect of industrial and other activities on surface and ground water. The samples were analyzed as per the procedures specified in 'Standard Methods for the Examination of water and Wastewater' published by American Public Health Association (APHA).

4.2.1 SURFACE WATER

There is not a single perennial river in the region. All the rivers existing in the region carry water only during the rainy season and get dried up after the monsoon is over. Luni is the main river, which rises about 7 Km. north of Ajmer in the Aravalli ranges and passes through the Pachpadra and Guda-Malani tehsils of Barmer and Sanchor tehsil of Jalore divisions. It flows for 482 kms before draining into the Arabian Sea at the Rann of Kutch in Gujrat. The Luni River is seasonal, and comparatively shallow, although at places it is over 2 km. wide. Its main tributaries are the Lilri, Raipur Sukri, Bandi, Mitri, Jawai Khari, Sagi and Johari, which all rises in the Aravalli. River Sagi originates from the Sunda hills of Bhinmal Tehsil. Region falls in the Luni river basin. There are a number of less important seasonal streams and rivulets, which passes through the region.

The area remains dry throughout the year except few days rain during July to September. To sustain in the region, people have adopted various traditional methods of rainwater harvesting. To meet the day-to-day need of drinking water rainwater is stored in Kachha Tanka, Kui, Khadeen, small ponds etc. (Fig 1).



Fig 1. Traditional methods of rainwater harvesting for drinking purposes in dry region.

Except few of the villages in Barmer, which receive water of the India Gandhi Canal, originating from the Himalayan region, the rest of the region depends on groundwater for its drinking and irrigation needs. The Indira Gandhi canal has been extended up to Gadra Road in Barmer district. This is likely to provide adequate quantity of not only drinking water but also to irrigate about 0.1 million hectares of agriculture land. The flow of the canal would also improve water level of the wells in the area covered by the flow. About 131 villages in Barmer districts of Rajasthan would get drinking water from the Narmada project.

4.2.2 GROUND WATER

Ground water potential is very limited. Wells are the main irrigation facilities in the district. Therefore, due to heavy extraction of ground water in some of the region and its limited recharge, the ground water is getting depleted at a fast rate. The dependable sources of water in the region are rivers, streams, tanks, dug wells and springs. In Sanchor region, people used to excavate shallow dug well to irrigate their agricultural crops and when the water of the dug well became brackish or saline they would shift to another location. The block can be classified into four hydrogeological zones. The zones are presented in Table 1. Block is mostly characterized under Zone III and V. The aquifers in the study area are mostly brackish with pockets of sweet water in confined aquifers. Groundwater in many parts of the block especially in the northwestern portion of the Barmer district is saline and has very limited suitability for drinking or agricultural use. However, in southwestern region of the block, people use to irrigate agricultural crop through dugwells.

Table 1. Various Hydrogeological Zones (Source: Central Ground Water Board)

Hydro-geological zones	Type
Zone I	Covers the foothill and valley floors; Dugwell and complete aquifer thickness
Zone II	Covers deep valley floor areas, unconfined and semi-confined aquifer
Zone III	Covers western and northwestern and central part of the district. The aquifer depth varies from 3 to 30 m. the alluvial thickness varies up to
Zone IV	Occurs along the river flowing in the area. The alluvial thickness is shallow water table, zone suitable for dug well.

5. PHYSIOGRAPHY

The region is characterized by arid landscape like level rocky structural plains, rock-cut pediments, gravelly pavements, shallow colluvial plains, other sandy plain with alluvial underneath, sandy hummocks and low sand streaks, sand dunes of various kinds and interdunal plains. Dunes are the dominant landform in the west of isohyet of 25 cm. Transverse, longitudinal and compound parabolic dunes are the major types of dunes in the region (Figure 2).



Figure 2. Sand Dune area near Bandra (left) and riverbed of Sukri with isolated trees of *P. juliflora* providing shed to livestock during summer (right).

The other zone is Luni-Jawai/ Sukri plain (Fig 2). The dominant landforms are the younger alluvial plains along the major streams where cultivation is more secured because of ground water. The occasional isolated hills with fringing pediments and buried pediments and some sand dunes with interdunal plains also occur in the region. Sandy undulating plains occur along the margins of the dune-covered areas.

6. SOCIO – ECONOMIC PROFILE IN BARMER

6.1 HUMAN POPULATION

The Thar is the most populous desert in the world. As per the census 2001, population density in the arid districts is 103 km⁻². Population growth is high as compared to the whole country. Population density in Barmer division is 69 persons km⁻². Which occurs in Barmer District, wherein villages such as Thakron Ki Dhani, Fakiron Ki Dhani, Jinja Ki Dhani, Chokla, Bhikanyon Ki Dhani, Bothiya, Kapurdi etc are situated. The highest density is in the southern portion of the block. Around 80% or more human population is still living in rural areas but urbanization is increasing day by day in different pockets. Agriculture and cattle rearing are the main occupation in the region.

Table 2. Socio-economic profile of Barmer and Jalor divisions.

Variables	Unit	Barmer
Human population (2001)	Individuals	19,63,758
Human density	km ⁻²	69
Livestock population (1997)	Individuals	41,76,661
Livestock density	km ⁻²	147
Literacy	Per cent	59.65

(Source: Envis 2003).

6.2 LIVESTOCK POPULATION

A major portion of the Thar is occupied either by dry open grassland or by grassland interspersed with tree and thorny bushes (Gupta 1975). Thus, cattle rearing or animal husbandry is one of the main occupations of the people in the region resulting in high livestock population. Animal husbandry is the one of the most important sources of livelihood in these villages. Cows, camels and buffaloes are more important for richer people while goats, sheep and donkeys are the most important animals for the poorest families. Livestock densities are higher in Barmer region (Table 2). However, the ratio of livestock to human densities in these districts indicated 2.13 in Barmer district. Small ruminants like goat and sheep represent about 50% of the total livestock population. Such high load of livestock results in overgrazing of the existing vegetation. The grazier is used to pollard or debranch the trees for their cattles (Fig 3). Most of the communities and castes in the region including 'Rebaries' (the main grazier) and other pastoral group lopp *P. cineraria* (Khejri) tree for fodder and fuel wood (Fig 3). Whereas in the Bishnoi community residing areas, this tree remain unlopped.



Figure 3. Debranching of *Azadirachta indica* for feeding the livestock (left) and lopping of *P. cineraria* for fodder and fuel wood (right).

6.3 ECONOMIC INFRASTRUCTURE

Agriculture and animal husbandry is the main source of income. Other economic sources are mines (Fig 4), Bentonite grinding, cement bricks, embroidery and tailoring, flour mills, granite cutting and polishing, guar gum, non-edible oil, oil mills, plaster of Paris, stone crushing, textile dyeing and printing, wooden furniture. Export Items from Barmer are Guar gum, Handicraft items, Hand embroidered items, Woollen carpets, etc

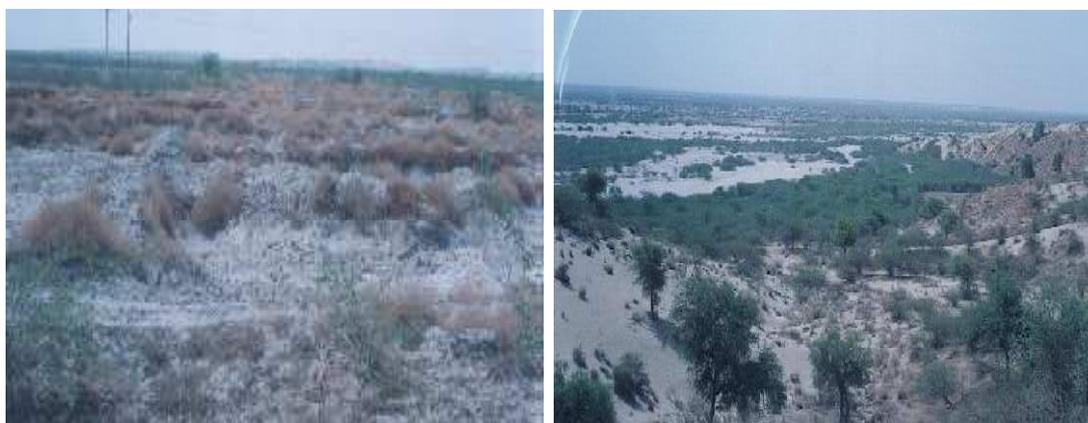


Fig 4. Gypsum mining area near Kawas (left) and Luni river basin infested with *P. juliflora* as the dominant species.

7. LAND USE

The Major share of the land in the study area is barren land and consists of about 59.1% 25.5% of the study area comprises of sand dunes. Agricultural land covers about 13.3% of the total area. The settlements in the study area are termed as built-up land covering about 0.5% of the total study area. However, no Major population concentration has been found and its is dispersed in pockets throughout the study area.

7.1 Agriculture practices

Agriculture is the main source of livelihood other than the livestock rearing. Rainwater is the main source for irrigation and drinking water in the region, tubewells also supplement as a source of water for irrigational purposes, sprinkler systems are utilized for irrigating crops through tubewells.

During the monsoon people prefer to grow pearl millet, commonly called as Bajra (*Pennisetum typhoides*). The other main crops are mungbean (*Vigna radiata*), moth (*Vigna aconitifolia*), til (*Sesamum indicum*) and the cash crop gaur (*Cyamopsis tetragonoloba*). In most of the region, a single crop is harvested, i.e the rainfed. Both irrigated and rain fed crops are taken by the farmer in some tehsils of the region like Guda Malani tehsil in Barmer division.

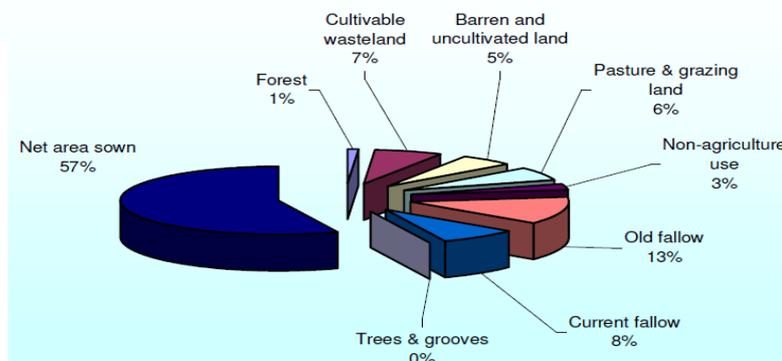
Under irrigated conditions wheat (*Triticum aestivum*), bajra (*Penisetum glaucum*), zeera (*Cuminum cymium*), Isabgol (*Plantago ovata*) are the common crops sown. Irrigation from Narmada project includes 73000 hectares in the arid areas of Barmer region.

Table 3. Land use pattern (ha) of the district under consideration.

(Source: Envis 2003)

Land uses (ha)	Barmer
Forest cover	28523
Cultivable wasteland	231397
Barren and uncultivated land	128339
Pasture and grazing land	203560
Non-agriculture use	73624
Old Fallow	391769
Area under current fallow	207949
Tree and grooves	57.00
Net area sown	1552114
Total Area	2817332

Land use pattern in Barmer



7.2 FOREST RESOURCES

Considering the forestry importance, this region covers most of the area of Baitu, Dhorimanna and Sindhari Ranges in Barmer Forest Division. The little rain gets evaporates before it is transformed in to biomass or reaches to the underground aquifers. Data on forest resources have been reported based on land use pattern (Table 4)

Table 4
Forest resources in Barmer

District	Types of forest (ha)			Forest area
	Dense	Open	Scrub	
Barmer	0	5400	10300	59318

The ranges may not correspond directly with the district administrative units i.e., tehsils. The divisions cover 59318 ha area under forest (2.92 %) with the per capita availability of forest area being as low as 0.033 ha as against the national average of 0.08 ha, the average of 0.5 ha for developing countries and 0.64 ha for the world. The vegetative pattern changes with rainfall gradient from grassland with isolated trees in northwestern parts to open scrubland in the middle, and open-to-dense in pockets river basins. By legal status, reserved forest constitutes 37%, Protected Forest 53% and Unclassed forest 10%. The forest type is Tropical Thorn forest.

7.2.2 PROTECTED AREAS FOR WILDLIFE

In northwestern region, at a distance of 80 kms from the block boundary, there is Desert National Park known for Great Indian Bustard whereas Dhawa-Doli region of wildlife reserve and Pachpadra lake for migratory birds are situated in eastern region (Balotra

range), at a distance of more than 80 kms from the block boundary. In western and southwestern region lies the Dhorimanna of Barmer and Sanchores of Raniwada ranges, the famous region for Indian Gazelle. In addition, some of the areas are totally prohibited from shooting like Sanchores and the area dominated by Visnoi community (a community devoted to conserve wildlife and trees).

8. VEGETATION

A major portion of the Thar is occupied either by dry open grassland or by grassland interspersed with trees and thorny bushes (Gupta 1975). Most of the grasslands are *Dichanthium-Lasiurus-Cenchrus* type (Dabadghao & Shankarnarayan, 1975) and the vegetation consists of drought resistant stunted, thorny or prickly shrubs and perennial herbs. Vegetations of Thar are divided into following habitats.

8.1 SAND DUNES AND INTERDUNAL PLAINS

Nearly 58% of the Thar is covered with sand dunes and interdunal plains. Many shifting dunes are bare but stabilized dunes are generally covered with *Capparis deciduas* (Ker), *Calotropis procera* (Aak), *Calligonum polygonoides* (Phog), *Acacia Senegal* (Kumat), *Prosopis cineraria* (Khejri), *Aerva javanica*, *Aristida funiculata*, *Aristida adensionis*, *Dactyloctenium aegyptium*, *D. indicum* and other psammophytic species. At the base of the dunes and interdunal plains, which retain comparatively more moisture, the vegetation may consist of trees and shrubs such as *Acacia senegal*, *A. jacquemontii*, *P. cineraria*, *Tecomella undulata*, *Salvadora persica* and *Zizyphus nummularia*. *Citrus colosynthesis* and *C. lanatus* are the creepers.

8.2 SANDY PLAINS

Besides some of the trees and shrubs mentioned above sandy plains may also have herbs and shrubs like as *Arnebia*, *Crotalaria burhia*, *Farsetia hamiltonii*, *Helipterium*, *Indigofera cordifolia*, *Leptadenia pyrotechnica* and *Tephrosia purpurea*.

8.3 GRAVELLY PEDIMENTS

Besides the sandy plains and sand dunes, the most common feature of the Thar is gravelly pediments and low hills seen around Barmer. The dominant tree is *P. cineraria* and *Salvadora persica*. Dominant shrub species are of *Maytenus emarginata* (Hingot), *Calotropis procera*, *Euphorbia*, *Capparis decidua* and *Zizyphus nummularia*. Common grass is *Aristida funiculata*.

8.4 HILLY AND ROCKY OUTCROPS

This feature exists in some parts of Barmer. However, it spreads about 13,200 sq km areas in western Rajasthan, mainly near Barmer, Kailana- Jodhpur. The characteristic plants of these rocky outcrops are thorn (*Euphorbia caducifolia*), kumatha (*Acacia senegal*), dhok (*Anogeissus pendula*), ker (*Capparis decidua*), gugal

(*Commiphora wightii*), kankera (*Maytenus emarginata*) and dholken (*Grewia tenax*). There are a large number of shrubs, annual herbs and climbers recorded in the region.

8.5 SALINE FLATS AND DEPRESSIONS

There are many saline depressions in the Thar with their characteristic halophytic vegetation consisting of *Salsola baryosma*, *Chenopodium*, *Haloxylon salicornicum* and *Sueda fruticosa*. The major grasses and sedges are *Eleusine compressa*, *Eragrostis ciliaris*, *Dactyloctenium aegyptium*, *Cyperus rotundus* and *C. arenarius*. The most famous saline depressions are in Pachpadra Lake. The other depression is at Kawas and has tree species *Tamarix auriculata*, *Fagonia cretica*, *P. juliflora* etc (Fig 5).



Figure 5. Indian gazelle (left) and Blue Bull (right) in the southern portion .

8.6 RIVER BEDS

Luni and its tributaries flow only during the monsoon for three to four months, although pools remain for a much longer period. It enters into Pachpadra tehsil and after passing through Sinadhari and Guda-Malani region of Barmer . At Gadav in Barmer, this river receives water from Sukari flowing through the Bagoda . Most of the riverbed is covered with *P. juliflora* as the dominant species. *Tamarix ericoides* is also common in some of the places. The grasses are generally represented by *Desmostachya bipinnata* in association with *P. juliflora*, *Dactyloctenium aegyptium*, and *Eragrostis ciliaris*. The main sedge is *Cyperus rotundus*.

8.7 WETLANDS

Interestingly there are many tanks and ponds in the villages in the Thar Desert for storing and collecting rainwater. These smaller wetlands and village ponds have *Potentilla supine*, *Pullicaria crispa*, *Cyperus rotundus*, *Fimbristylis dichotoma* and *Scirpus roylei* species along the edge and *Ceratophyllum*, *Hydrilla verticillata*, *Ipomea aquatica*, *Nymphaea* and *Vallisneria spiralis* in the water.

9. MAJOR DIVERSITY IN THE BARMER REGION

9.1 FLORAL DIVERSITY

The Thar Desert of India exhibits 682 plant species (Khan 1997). Most of these species are common covering Barmer divisions. The predominant tree species in forest areas are *Prosopis juliflora* (bilayati babool), *Acacia senegal* (kumatha), *Salvadora oleoides* (mitha jal), *Salvadora persica* (khara jal), *Prosopis cineraria* (khezri), *Tecomella undulata* (rohida). *Capparis decidua* (ker), *Zizyphus nummularia* (jhar ber), *Acacia jacquemontii* (bhoo bavali), *Lycium barbarum* (murali), *Clerodendrum phlomoides* (irna) are the shrubs species (Table 5). Under shrubs includes *Leptadenia pyrotechnica* (khimp), *Crotalaria burhia* (sinia), *Aerva pseudotomentosa* (bui), *Tephrosia* species (bipni) etc. Grasses include *Cenchrus bidlorus* (bhurat), *Aristida* species (lapda), *Lasiurus sindicus* (sewan), *Dactyloctenium indicum* (ganthia), *Indigofera* species (beker), *Tribulus terrestris* (gokharu or kanti), *Boerhaavia hirta* (punarnva). The creepers are *Citrulus colosynthesis* (tumba) and *Citrulus allatus* (matira). The lianas *Cocculus pendulus* (pilwan) is mostly found in association with *P. cineraria* tree.

Table 5 : Dominant species in forest, community and farmer lands of the region.

Name	Tree	Shrub	Grasses
Forest land	<i>P. juliflora</i>	<i>Capparis decidua</i> ,	<i>Aristida adsensionis</i> , <i>C.</i>
	<i>P. cineraria</i>	<i>Z. nummularia</i>	<i>ciliaris</i> , <i>C. biflorus</i> ,
	<i>A. senegal</i>	<i>Leptadenia pyrotechnica</i>	<i>Panicum turgidum</i> , <i>C.</i>
	<i>S. oleoides</i>	<i>Balanites aegyptiaca</i>	<i>ciliaris</i> , <i>L. sindicus</i>
Community land	<i>S. persica</i>	<i>Capparis decidua</i>	<i>C. biflorus</i> , <i>C. ciliaris</i> ,
	<i>S. oleoides</i>	<i>Z. nummularia</i>	<i>Aristida adsensionis</i>
	<i>P. juliflora</i>	<i>C. procera</i>	
	<i>A. nilotica</i>	<i>Crotalaria burhia</i>	
Farmers land	<i>P. cineraria</i>	<i>C. decidua</i>	<i>Aristida adscensionis</i> ,
	<i>T. undulata</i>	<i>M. emarginata</i>	<i>C. ciliaris</i> , <i>C. biflorus</i> ,
	<i>A. leucophloea</i>	<i>Balanites aegyptiaca</i>	<i>L. sindicus</i> , <i>Boerhaavia</i>
	<i>Ailanthus excelsa</i>	<i>C. procera</i>	<i>hirta</i> , <i>Tribulus</i>

(Source: Meena Survey 2004).

In 'Oran' and 'Gauchar' lands (community lands), the trees stand far apart singly or in groups in these lands. The vegetation in Oran and Gauchar is dominated by *Salvadora oleoides*, *P. cineraria*, *Acacia nilotica*, *Acacia jacquemontii*, *Acacia senegal*, *Acacia tortilis*, *Azadirachta indica*, *Prosopis juliflora*, *Salvadora persica*, *Sericostomma pauciflora*, *Vogelia indica*, *Balanites aegyptiaca*, *Calotropis procera*, *Capparis decidua*, *Cassia italica*, *Crotalaria burhia*, *Euphorbia caducifolia*, *Leptadenia pyrotechnica*, *Maytenus emarginata*, *Plumbago zeylanica*, *Rhus mysuriensis*, *Zizyphus nummularia*, *Aristida depressa*, *Aristida hystrix*, *Alysicarpus spp.*, *Arthraxon lensuratus*, *Blepharis linaefolia*, *Convolvulus microphyllous*, *Cymbopogon martini*, *Cyprus spp.*, *Dactyloctenium aegyptium* (makra), *Panicum turgidum* (murath), *Dichoma tomentosa*,

Elusine spp., *Eragrostris ciliaris*, *Indigofera cordifolia*, *Indigofera linaefolia*, *Merremia hederacea* and *Polycarpia coriambosa*..

9.2 FAUNAL DIVERSITY

Species of wild animals that can adapt to these harsh climatic and environmental conditions flourish in the area. About 390 species of animal have been recognized in Thar Desert of Indian. Amongst the mammals, chinkara (*Gazella bennetti*), Indian fox (*Vulpes bengalensis*), desert fox (*Vulpes vulpes pussila*), jackal (*Canis aureus*), desert cat (*Felis chaus*), jungle cat (*Felis lybia*), desert hare (*Lepus nigricollis dayanas*), nilgai (*Boselaphus tragocamelus*), wolf (*Canis lepus pallips*), black buck (*Antelope cervicaps*) and spotted deer (*Axis axis*) (Figure 6) wild boar (*Sus scrfa*) are the animals of the region.



Figure 6. Peacock (*Pavo cristatus*) and Kabooter (*Columbia livia*) are the common birds of the region

The area provides suitable conditions for survival of a number of species of lizards, gerbils and snakes. The spiny tailed lizards with their prehistoric looks are quite common in many areas of the Barmer and Jalore. Among the snakes the saw scaled viper, the large rat snake and sand boa are noteworthy. Most of these animals can survive in the scarcity of water by adopting special mechanism so that life can go on without water. They reduce their physical activity considerably and avoid exposure to hot winds by keeping in shade of shrubs or by burrowing down in the sand. Earth act as an admirable insulator against heat and aridity, and an animal burrowing a few centimeters below the surface will comfortably survive the hottest day and coolest night. In the Desert National park the foxes, cats, lizards and snakes all enter the burrows to avoid the hot and desiccating air outside. Most of the animals are active in early morning or after the sunset, when the temperatures are much lower.

9.2.1 MAMMALIAN DIVERSITY

Chinkara (*Gazella benetti*), jackal (*Canis aurens*), hare (*Lapus nigricollis*), hedgehog (*Parachinus micropus*), jungle cat (*Felis caus*), mongoose (*Herpestes edwardis*) and wolf (*Canis lapus*) are animals in the region (Table 6). The chinkara,

which cannot enter a burrow, go under the shade of bushes. They can tolerate a rise in body temperature up to seven degrees above normal without serious injury to any vital organ. These animals can withstand considerable haemo-concentrations or blood thickening, which takes place. Chinkara for example can go without water for a number of days by feeding on green plants like Aak (*Calotropis procera*) and obtaining water from its leaves. Similarly, the gerbils, which serve as staple food for the desert fox and the desert cats, provide much of the water to these species.

Table 6. Distribution of dominant wild animal in the Barmer divisions.

Common name	Zoological Name	Distribution in forest ranges			
		Baitu	Barmer	Dhorimana	Sindari
Chinkara	<i>Gazella bennetti</i>	+	+	+	+
Desert Fox	<i>Vulpes vulps</i>	+	-	+	+
Indian fox	<i>Vulpes bengalensis</i>	+	+	-	-
Blue bull	<i>Boselaphus tragocamelus</i>	+	?	+	-
Mongoose	<i>Herpestes edwardis</i>	+	+	+	-
Hedge hog	<i>Parachinus micropus</i>	+	-	-	-
Hare	<i>Lepus nigricollis</i>	+	+	+	+
Jackal	<i>Canis aureus</i>	+	+	-	-
Wolf	<i>Canis lupus</i>	+	-	-	-
Jungle cat	<i>Felis chaus</i>	-	+	-	+
Porcupine	<i>Hystrix indica</i>	-	+	+	+
Desert cat	<i>Felis chaus</i>	-	-	-	-
Black buck	<i>Antelope cervicapra</i>	-	-	+	-
Spotted deer	<i>Axis axis</i>	-	-	+	-

(Source: survey report of State Forest department, 2004).

CONCLUSION :- Despite of the tough climatic conditions the region harbours variety of wild life and flora along with high human and livestock population. The region has important floral and faunal species and some of them have been endangered or are at a verge of extinction. The concentration of wild life is more in the northeastern, central eastern and southwestern parts of the particularly the Luni river basin of Sindari and Gudamalani and areas.

Ecological planning and management of environment (Agricultural, Animal, Forest and other natural Resources) it is highly advisable that we all have a fairly good understanding of ecology capability and various types of classifications. But this problem disappears if one remembers that the same reality can be viewed at different angles or studied under various aspects to get a better and holistic understanding of it.

REFERESNCE

- 1 Savitri, 2011, Human ecological analyses and enviromental management of Barmer. Ph.D, Thesis, UOR, Jaipur.
- 2 R.K. Gehlot, 2004, An Assessment of natural resources of the Indian desert, Madhu Publication.
- 3 B.B.S. Kapoor, 2002, Aduances in Resources Management of the Indian desert, Madhu Publications.
- 4 Environmental impact Assessment study, Barmer District, Rajasthan, 2006.
- 5 Environmental assessment report, Barmer district, Raj. 2008.
- 6 Central Ground water Board, Ministry of water resources Govt. of India, Barmer, Raj. 2008.
- 7 Forest survey of India (1999) State of forest Report ministry of environment & forest Dehradun, India.

External Links

- 8 <http://rajasthan .gov.in/rajgovresources/actnpolicies.html>
- 9 http://en.wikipedia.org/wiki/resources_classification.
- 10 <http://www.ipcc.ch/publication and data/sur/en/main.html>