BACKGROUND CONTEXT AND OBSERVATION RECORDING

1. PROJECT BACKGROUND

Community forests dedicated to one or more deities worshipped by the community and therefore are termed sacred groves or forests. These are one of the most valuable, primitive practices of nature conservation. Sacred groves are the relict climax communities preserved by the local people for certain beliefs. Such forests are rich in biological diversity and harbor many rare and endangered plant and animal species. An inextricable link between present society and past in terms of biodiversity, culture, religious and ethnic heritage exists in these sacred groves (Khurana, 1998). Sacred groves are distributed across the globe, and diverse cultures recognize them in different ways encoding various rules for their protection. These have been a source of natural wealth like fodder, fuel, timber, berries, roots and herbs and are regarded as a 'symbol of prosperity' for the community that owned it. Moreover, sacred groves play an important role in promoting a flourishing livestock based economy and growth of livestock rearing communities.

Cultural aspects such as religion, faith and traditions bring people closer to nature and the natural environment. Memorial Parks and Sacred Groves are examples of two such cultural landscapes that exist today also (Pruthi and Burch, 2009). There are examples from Asia, Africa and Europe (WWF, 2005), where natural phenomenon have been termed as 'sacred' and worshipped. These are types of natural sites like rivers, lakes, forests, gardens, groves or even a tree, that have been institutionalized by attachment of sacred values with intensions to make a collective management easy and sustainable. In India, Hinduism has grown out of the merger of local traditions that have been intertwined with nature (Chandra and Gadgil, 1998). Deep religious reverence for nature, rather than resource scarcity is the basis for longstanding commitment for preserving these community forests (Ramakrishnan, 1998).

Sacred groves existed in India since time immemorial and are scattered all over the country, but do not enjoy protection via a federal legislation. Total number of sacred groves in India is more than 1,00,000, but the numbers of documented sacred groves is relatively less, i.e., 14272. The situation in Rajasthan state is even worst with highest estimated number (i.e., 25000 sacred groves covering an area of about 6 lakhs ha and rang between <1 ha and as larger as 15,000 ha

Bhadariyaji Oran in Jaisalmer) in India (Pandey, 2004). Of these, nearly 5370 square kilometers area under Orans is in the Thar Desert. Some may be as small as a few square metres. This indicates a wide variation in reporting on number of 'Orans' exists not only in Rajasthan, but in a district too. Available literatures on sacred groves are also meager related to Rajasthan, i.e. less than 1% particularly for western Rajasthan. Highest available literatures are from North-East (30%), Western Ghat (26%), Eastern Ghats (24%), central India, Western Himalayas (10%) and Gangetic plain (9%) regions.

The present status of sacred groves everywhere is a matter of deep concern as they are fast disappearing from the countryside. These are currently facing threats like submergence, clear felling, mining, quarry, encroachment and other depletive factors (Nair et al., 1997, Pandey, np). Their presence in the agricultural lands, unauthorized and unregulated cutting of plants, grazing, erosion of social and cultural values are the many reasons of its degradation. In view of this, and due to failure of pure legal machinery to conserve biodiversity, it has become increasingly necessary to formulate policies based on local people's traditional knowledge. Therefore, there is an urgent need not only to protect sacred forests, but also to revive and reinvent such traditional ways of nature conservation and biodiversity management. Several encroachments have taken place, and worse, and have been regularized by the Governments. Lack of effective legislation promotes illegal activities of the offenders. Further, lack of faith in the younger generation is a major problem to loss of this valuable land resource and the biological diversity resides in it (Patnaik and Pandey, 1998; Vinothkumar et al., 2011).

There is need to reverse this trend in benefits of the local population. There is lack of documentation and inventorisation of the sacred groves of Rajasthan, whereas the available data are scanty and sporadic, whereas United Nations Convention on Biological Diversity (UNCBD) emphasizes on the development of inventory of organisms within each country for their proper use and sharing benefits arise out from it. In view of the above facts it is beneficial to inventories the biological diversity of the sacred groves Rajasthan for development of management strategies based on the importance of the species types exists in a particular sacred grove or region. Realizing the fact and need of the day Rajasthan Forest Department funded a project entitled "**Documentation of Sacred Groves of Rajasthan and Assessment of Biological Diversity in**

some of them for Improved Management and People Livelihoods' with a total outlay of Rs. 9.99 Lacs for a period of one year (2013-14) was given to Arid Forest Research Institute , Jodhpur to inventories biological diversity and the status of some sacred groves of Rajasthan and develop an effective management plan for revival of these sacred groves.

2. OBJECTIVES OF THE STUDY

- To document and assess floral diversity of the important 'sacred groves' in different districts of Rajasthan;
- To identify and record faunal diversity countered in the above-mention 'sacred groves'
- To suggest suitable management strategies to increased diversity and productivity for improved local benefits and climate change adaptation.

3. GEOGRAPHICAL LOCATION OF STUDY SITE

Located in the north-west of India, Rajasthan is the country's largest state covering about 10.4 % of the total geographical area of the country. It lies between latitudes 23º 3' and 30º 12' North and longitudes 69º 30' N and 78º 17' E. Rajasthan is bound on the west and northwest by Pakistan, on the north and northeast by the States of Punjab, Haryana and Uttar Pradesh, on the east and southeast by the States of Uttar Pradesh and Madhya Pradesh, and on the southwest by the State of Gujarat. It covers about 3, 42,239 sq km area (Table 1.1).

3.1 Physiography of the region

The main physiographic feature of Rajasthan is the Aravalli Range, which runs across the state from southwest (Mount Abu) with peak height of 1,722 m to Khetri in Jhunjhunu district situated in the northeast running for almost more than 850 km. This range divides Rajasthan into 60% in the North West of the lines and 40% in the southeast. The northwest tract is sandy and unproductive with little water but improves gradually from desert land in the far west and northwest to comparatively fertile and habitable land towards the east. The western area includes the Great Indian (Thar) Desert, which is generally sandy and dry and extends into adjoining portions of Pakistan. The Aravalli Range intercepts the moisture-giving southwest monsoon winds off the Arabian Sea, leaving the northwestern region in a rain shadow.

Table 1.1 Total geographical area and district-wise distribution of population, forest area and rainfall in Rajasthan.

SNo.	District	TGA (km^2)	Population (Nos)	Forest area (km^2)	% of TGA	Rainfall (mm)	
						Normal	2003-2012
1	Ajmer	8,481	2,584,913	61310	7.23	601.8	493.85
2	Alwar	8,720	3,671,999	178495	21.30	657.3	666.28
3	Banswara	4,536	1,798,194	123667	24.55	950.3	976.88
4	Baran	6,955	1,223,921	223962	32.20	873.8	814.88
5	Barmer	28,387	2,604,453	62722	2.21	265.7	342.63
6	Bharatpur	5,044	2,549,121	43494	8.59	663.9	641.81
7	Bhilwara	10,455	2,410,459	77876	7.45	683.2	630.43
8	Bikaner	30,382	2,367,745	124906	4.58	243.0	286.14
9	Bundi	5,500	1,113,725	156678	28.23	773.4	613.73
10	Chittorgarh	7,880	1,544,392	182019	16.77	841.5	829.16
11	Churu	13,792	2,041,172	7122	0.42	354.7	413.17
12	Dausa	3,420	1,637,226	28263	8.24	561.0	644.22
13	Dholpur	3,009	1,207,293	63845	21.05	744.5	633.88
14	Dungarpur	3,770	1,388,906	69273	18.37	728.9	772.59
15	Hanumangarh	9,580	6,663,971	94566	6.72	273.5	296.57
16	Jaipur	11,061	672,008	58129	1.51	563.8	554.1
17	Jaisalmer	38,401	1,830,151	45261	4.25	185.5	225.81
18	Jalore	10,640	1,411,327	134979	21.70	370.0	496.14
19	Jhalawar	6,219	2,139,658	40535	6.84	844.3	822.48
20	Jhunjhunu	5,928	3,685,681	24303	1.06	405.1	483.72
21	Jodhpur	22,250	1,458,459	180206	32.59	313.7	302.19
22	Karauli	5,039	1,950,491	131082	24.07	670.7	647.61
23	Kota	5,204	3,309,234	24093	1.36	732.4	736.47
24	Nagaur	17,718	2,038,533	96358	7.78	311.7	370.52
25	Pali	12,357	868,231	140704	34.18	424.4	491.96
26	Pratapgarh	4,360	1,158,283	39658	8.32	-	-
27	Rajsamand	4,636	1,338,114	93772	8.91	567.8	599.51
28	Sawaimadhopur	5,221	2,677,737	63935	8.27	873.4	673.26
29	Sikar	7,881	1,037,185	163865	31.91	440.3	469.82
30	Sirohi	5,136	1,969,520	63344	7.93	591.2	883.05
31	SriGanganagar	11,604	1,779,650	23946	1.89	226.4	254.78
32	Tonk	7,200	1,421,711	33597	4.67	668.3	590.35
33	Udaipur	11,761	3,067,549	414170	29.83	645.0	763.54
	State	342,327	68,621,012	3270135	9.56	575.1	663.26

(Sources: Directorate of Economics and Statistics, Government of Rajasthan, Jaipur).

This region receives less than 400 mm of rain in an average year. The Godwar, Marwar, and Shekhawati regions lie in the northern region of the state and constitute major part of Thar Desert. The hilly Vangad region lies in southernmost Rajasthan and bordering Gujarat. With the

exception of Mount Abu in Sirohi district, Vangad is the wettest region in the state, and is the most heavily forested. North of the Vangad lies the Mewar region, home to the cities of Udaipur and Chittaurgarh in Rajasthan. The Hadoti region lies to the southeast, on the border with Madhya Pradesh covering Bundi, Kota, Baran and Jhalawar districts. North of Hadoti and Mewar is the Dhundhar region, the home to the capital city Jaipur. Mewat is the easternmost region of Rajasthan, bordering Haryana and Uttar Pradesh and relatively better in climate and vegetation. To understand implications and role of climatic and edaphic resources in agricultural and allied sectors, Rajasthan has been divided into ten agro-climatic zones covering following threes agro-ecological regions (Sehgal and Abrol, 1994; ICAR, 2010), which are further divided into 10 agro-climatic zones (Fig 1.1, Table 1.2).

Fig 1.1. Different agro climatic zones and the related districts of Rajasthan.

Table 1.2. Agroclimatic zone and their distribution in Rajasthan (Source: http://agropedia.iitk.ac.in/content/agro-climatic-zone-rajasthan).

SNo	Agro-climatic Zones	Rainfall (mm) range	Districts
1	IA-Arid Western plain	200-370	Barmer, Jodhpur
2	IB-Irrigated North Western plain	100-350	Sriganganagar, Hanumangarh
3	IC-Hyper-arid partly Irrigated Zone	100-350	Bikaner, Jaisalmer, Churu
4	IIA-Internal Drainage Dry Zone	300-500	Nagaur, Sikar, Jhunjhunu
5	IIB-Transitional Plain of Luni Basin	300-500	Jalore, Pali, Sirohi
6	IIIA-Semi arid Eastern Plain	500-700	Jaipur, Ajmer, Dausa, Tonk
7	IIIB-Flood Prone Eastern Plain	500-700	Alwar, Dholpur, Bharatpur, Karauli and S. Madhopur
8	IVA-Sub humid Southern Plain	500-900	Bhilwara, Rajsamand, Chittorgarh
9	IVB-Humid Southern plain	500-1100	Dungarpur, Udaipur, Banswara and Pratapgarh
10	V-Humid Southern Eastern Plain	650-1000	Bundi, Kota, Baran, Jhalawar

3.2 Climate of Rajasthan

Because of its location in the western part of India and varying topography, Rajasthan exhibits varying climate. For example, the rocky Aravali, the western arid plains, the eastern fertile plains etc experiences different climatic conditions. The weather pattern in the state can be divided into pre-monsoon, monsoon, post-Monsoon and winter. **Pre-monsoon is** summer and the most parched and hot season of the year and is actually the hot season that precedes the monsoon and extends from April to June. The temperature ranges from 32° C to 45 °C. The desert lies in the west and the north west of the Aravali region becomes drier due to the scorching heat of the sun and the highest temperature is recorded sometime about 47-48 °C during April/May. The single hill station of the state – the Mount Abu records the lowest temperature. Temperature however falls steeply at night in the arid regions. Heavy winds blow from the south-western boundary and bring dust storms, which are generally known as 'Andhi' or 'Kali-Pili Andhi'. **Monsoon** brings relief to the sultry and sun-baked terrain of this state during the month of June in the eastern region and mid- July in the western arid regions. The temperature drops from 40 to 35 degree. With the fall in temperature, humidity increases. The state receives 80 to 90 per cent rainfall during this period. There is a second phase of monsoon that continues from July to September. **Post-Monsoon** season is followed by the monsoon that commences from mid-September and

continues till November. This season is once again characterized by increased air temperature, when average maximum temperature ranged between 33 °C and 38 °C. The average minimum temperature is between 18 °C and 20 °C. **Winter** in Rajasthan extends from December to March and January is the coldest month of the year. Temperature varies throughout the state and the lowest temperature recorded even below 0 °C especially in the Churu district. There is slight rainfall in the north and north eastern region of the state. During this period, relative humidity ranges from 50% to 60% in the morning and 25% to 35% during noon time. On the average basis, winter temperatures range from 8 °C to 28 °C.

3.3 Rainfall Pattern

Rainfall is very low highly erratic and variable throughout the Rajasthan plain mean Annual Rainfall is from 100 mm to 400 mm on eastern edge of Indo-Pak border. Rainfall decreases from East to West and from South West to North East. There is a very rapid and marked decrease in rainfall west of the Aravalli range making the western Rajasthan arid. The average annual rainfall in western part of Aravalli ranges from less than 100 mm in north-west part of Jaisalmer to 200-300 mm in Ganganagar, Bikaner and Barmer regions, 300-400 mm in Nagaur, Jodhpur, Churu and Jalore regions and more than 400 mm in Sikar, Jhunjhunu and Pali regions and along the western fringes of the Aravalli range. On the eastern side of the Aravalli range, the rainfall ranges from 550 mm in Ajmer to 1020 mm in Jhalawar regions. In plains, Banswara (920 mm) and Jhalawar (950 mm) districts receive the maximum annual rain. However, highest rainfall in the state, i.e. 1638 mm occurs in Mount Abu in Sirohi district.

However, rainfall varies widely across districts and for the same district it varies widely from year to year. But over a 16 year period, the rainfall shows a declining trend for all the districts with the fall being the steepest for Jaipur and Jodhpur (Fig 1.2). Trends in annual rainfall of 1901-1935 vs 1971-2005 indicates a decrease by 14.3% at Jaisalmer but no change in Jodhpur (Khaladkar et al., 2009). Extreme northwest region of India, the Thar Desert received record rainfall of 55 cm during August 16-25, 2006 (Jayanthi et al, 2006). Rainfall pattern during 2003 to 2012 indicated an increasing trend in IB, IC, IIA, IIA and V bioclimatic zone, whereas a decreasing trend has been observed in IIB, IVA and IVB zones. Others zones did not show almost constant rainfall during this period (Fig 1.2).

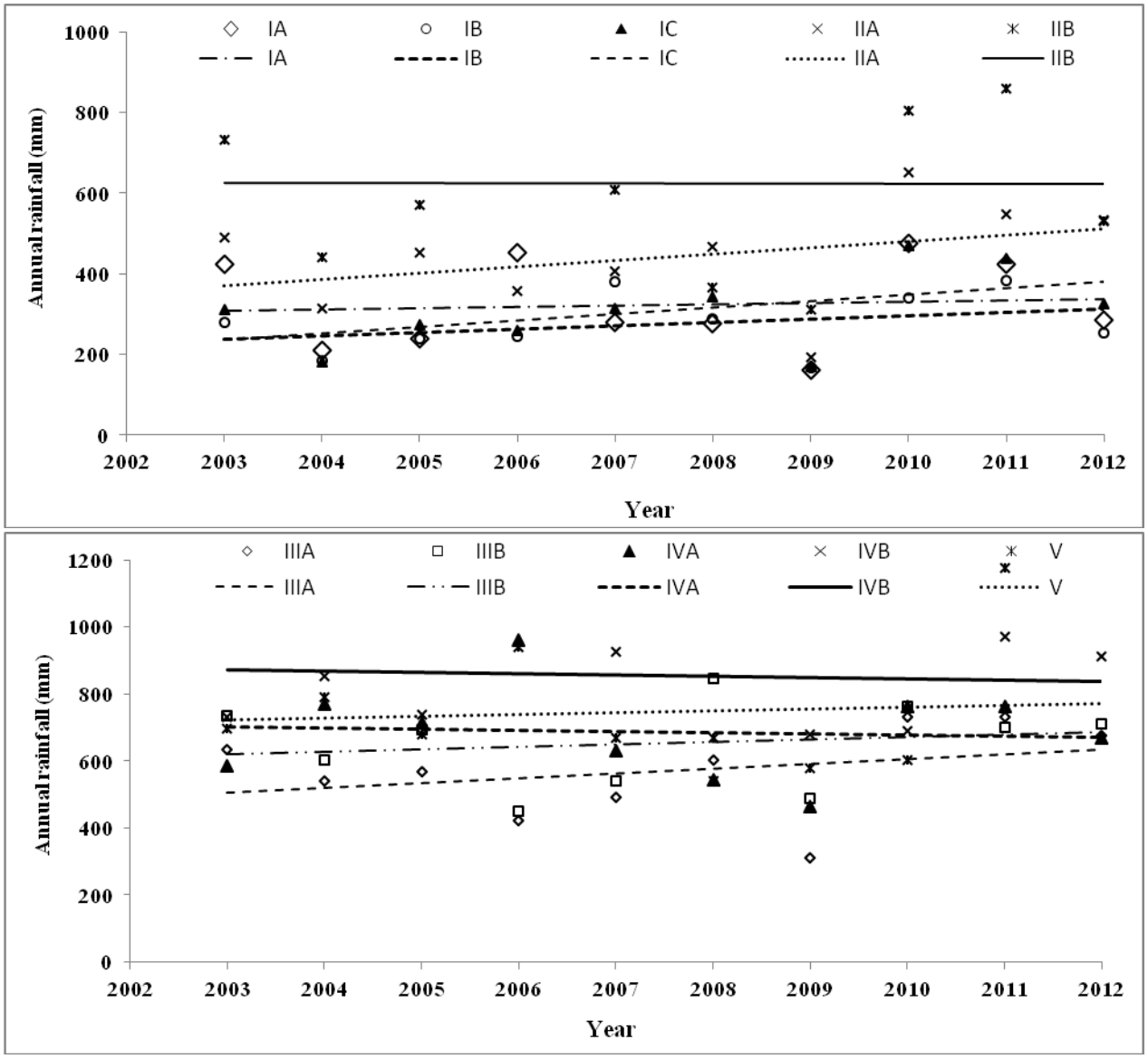


Fig 1.2. Pattern of rainfall in different agroclimatic zones during 2001-2012.

3.4 Land use pattern

Compared to Indian averages, Rajasthan has slightly better proportion of total cropped area and net shown area (Table 1.3).

Forest cover: Forests are an important part of any ecosystem and contribute by providing humans with food, fodder and fuel and by enriching and aiding the nutrients to the ecosystem too. In Rajasthan, coverage of forests is 9.54% of total geographic area as compared to the country's average of 20.6%. This is because nearly 13 districts of western Rajasthan are under desert conditions. There are only two zones namely, the Humid Southern and the Humid

Southern Eastern Plain that is endowed with substantial proportion under forests, i.e. one-fourth of the total reporting area is under forests. In rest of the zones it varies from 6 to 15 percent.

Table 1.3. Land used statistics in India and Rajasthan.

Land use	**India**	**Rajasthan**
Reporting area for land utilization statistics	305611	34270
Forests	70042	2735
Not available for cultivation	42954	4268
Permanent pastures & other grazing lands	10149	1697
Land under misc. tree crops & groves	3351	17
Culturable waste	12857	4475
Fallow lands other than current fallows	10484	2048
Current fallows	15753	2055
Net area sown	140022	16974
Total cropped area	192197	21745
Area sown more than once	52175	4770

Source: GoI (2011-12; http://data.gov.in/dataset-export-tool?nid=5914) (in $x10^3$ ha)

***Natural Vegetation*:** In the western region, sparse vegetal cover comprises mainly xerophytic plants, which are thorny and have stunted growth. The dominant species are *Acacias* and *Prosopis* spp. In depressions particularly in saline areas, halophytes are available. The eastern region has vegetation ranging from mixed deciduous forests to subtropical evergreen forests, but it has been adversely affected by reckless cutting and grazing. Forest in the eastern sector comprise *Anogeissus* spp. (Dhav), *Tectona grandis* (teak). *Boswellia serrata* (Salar), *Lanea comandelica* (Gurjan), *Cassia auriculata* (Aunwal), *Diospyros melanoxylan* (tendu), *Acacia catechu* (khair), *Aadirachta indic* (Neem), *Madhuca indica* (Mahuva), *Sizigium spp.* (Jamun), *Acacia nilotica* (Babul) etc. Among grasses, dominant species are *Apluda mutica*, *Cenchrus ciliaris*, *C. setigerus*, *Chrysopogon montanus*, *Chloris barbata*, Cymbopogon martini, *C. jwarncussa*, *Cynodon dactylon*, *Dichanthium annulatum*, *Heteropogon contortus*, *Iseilema laxum*, *Sehima nervosum*, *Themada quadrivelvis* etc.

Area under non-agriculture uses: This category belongs to the land put to non-agriculture uses such as residential, roads/paths, water bodies etc. The share of such land use is only about 5 percent of the reporting areas. In different climatic zone, it varies from 3% to 8%.

Barren and Un-culturable Land: This category of land is considered as non-suitable for agricultural operation. About 7% of the total area of Rajasthan is categorized as barren and un-cultural waste land. In different zones it varies between 10% and 20% area. However, in irrigated North Western Plain, this category is negligible, i.e. <1%.

Grazing Lands: This is one of the most important categories of land use. The availability of permanent pasture and grazing land determines the status of livestock economy in the regions. It constituted about 5% of the total area in Rajasthan. In irrigated North Western Plain, the grazing land is negligible, whereas in eastern areas it constitutes about 4 to 7% area.

Land under Misc Tree Crops and Groves: Area under fruit crop falls under this category of land use. In Rajasthan, it is less than 1%. In certain regions, area under fruit crop is absolutely missing.

Culturable Waste Land: This is also one of the major categories of land use covering about 13% of the total reported area of Rajasthan. Agriculture operations are possible on these lands. In Hyper - arid partial Irrigated Zone, land under this category in substantial proportion, i.e. 40% followed by sub humid southern and Irrigated North Western Plain zones with 15% and 12%, respectively. In rest of the zones it varies from 2 to 8 per cent.

Fallow land*:* There are two types of fallow land, i.e. current fallow and long fallow. Lands with suspended agriculture operation for one to five years fall under this category. At the state level, it covers about 11% area of Rajasthan.

Agriculture: About half of the total reported area is under agriculture operation. The irrigated northern-western region and internal drainage dry zones leading ahead as compared to other zones in bringing larger proportion of area under agriculture that depends upon the availability and access to irrigation facilities, status of aquifer and geophysical features of the regions.

4. METHODS OF OBSERVATION RECORDING

A total 123 sacred groves have been surveyed covering all 33 district of Rajasthan (Table 1.4). It ranged from lowest of 3 numbers of sacred groves in most of the districts to 9 numbers in Kota

district. Most of the sacred groves/Dev bans/Orans situated in the forest or in the vicinity of the forest areas are smaller in size, whereas our target was to cover bigger sacred groves situated outside forest area particularly in the community lands so that an effective area of measurement (i.e., 0.25 ha × 5 plots = 1.25 ha) could be obtained. It was also to develop an effective management plan for the bigger groves.

Table 1.4. Numbers of sacred groves studied during this programme covering different districts of Rajasthan.

SNo	District	Divisions	SNo	District	Divisions
1	Ajmer	3	18	Bhilwara	3
2	Barmer	5	19	Bundi	3
3	Bikaner	3	20	Chittorgarh	3
4	Churu	3	21	Dausa	3
5	Ganganagar	4	22	Dholpur	3
6	Hanumangarh	3	23	Dungarpur	3
7	Jaisalmer	4	24	Jaipur	3
8	Jalore	3	25	Jhalawar	5
9	Jhunjhunu	3	26	Karauli	3
10	Jodhpur	5	27	Kota	9
11	Nagaur	4	28	Pratapgarh	4
12	Pali	5	29	Rajsamand	3
13	Sikar	3	30	Sawaimadhopur	3
14	Alwar	5	31	Sirohi	3
15	Banswara	3	32	Tonk	3
16	Baran	3	33	Udaipur	8
17	Bharatpur	2	Total		123

Positions of these sacred groves have been geo-referenced for easy access of the area in different locations (Fig 1.3). The numbers of a particular sacred grove in figure 2 have been described in details in the preceding sections for their geographical position and other related information.

4.1 Stratification and sample size

For stratification of the study area we followed administrative forest divisions as the strata and in each forest division 3-9 sacred groves were selected for the details study as given below:

Rajasthan →Forest division → Sacred grove (3-9 sacred grove in each division).

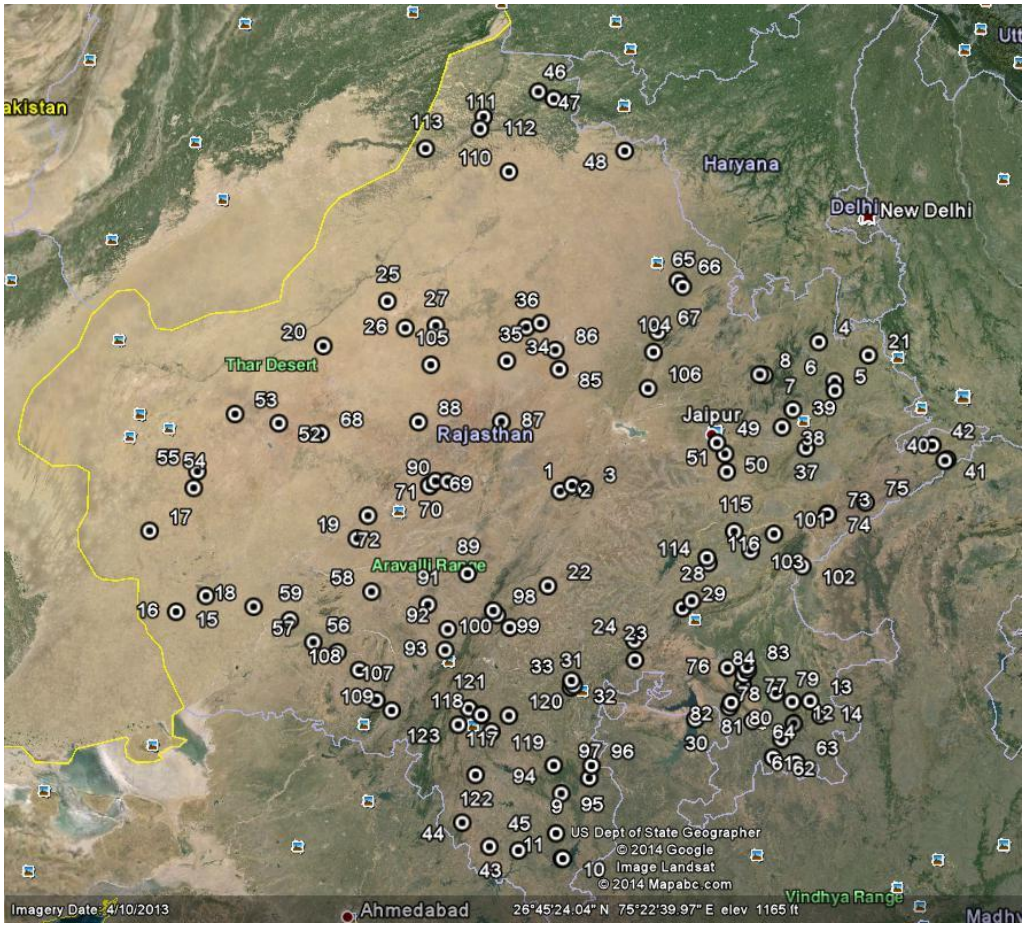


Fig 1.3. Distribution of sampling plots in different districts of Rajasthan.

4.2. Area surveyed and field observation design

All the thirty three districts of Rajasthan have been covered during survey so that spatial variability in the types and structures of the vegetation in these sacred groves could be captured. For detailed study a cluster design of fives plots of 0.25 ha (50 m × 50 m) each had been followed to make observations on the tree species and their population in 1.25 ha area in total area coverage of about 5 ha of the sacred grove. This was only to have knowledge on frequency of distribution of a particular species under study and to calculate the importance value index of each species for a sacred grove. In this design, four plots of above-mentioned area are distributed at the four corners of a central plot. Distance between the corner of the central plot and the corner of the other plots were 50 m (Fig 1.4). The smaller plots for recording observations on shrubs and herbs/grasses were nested in the above-mentioned plots (Fig 1.4). The survey study was conducted during March 2013 to February 2014.

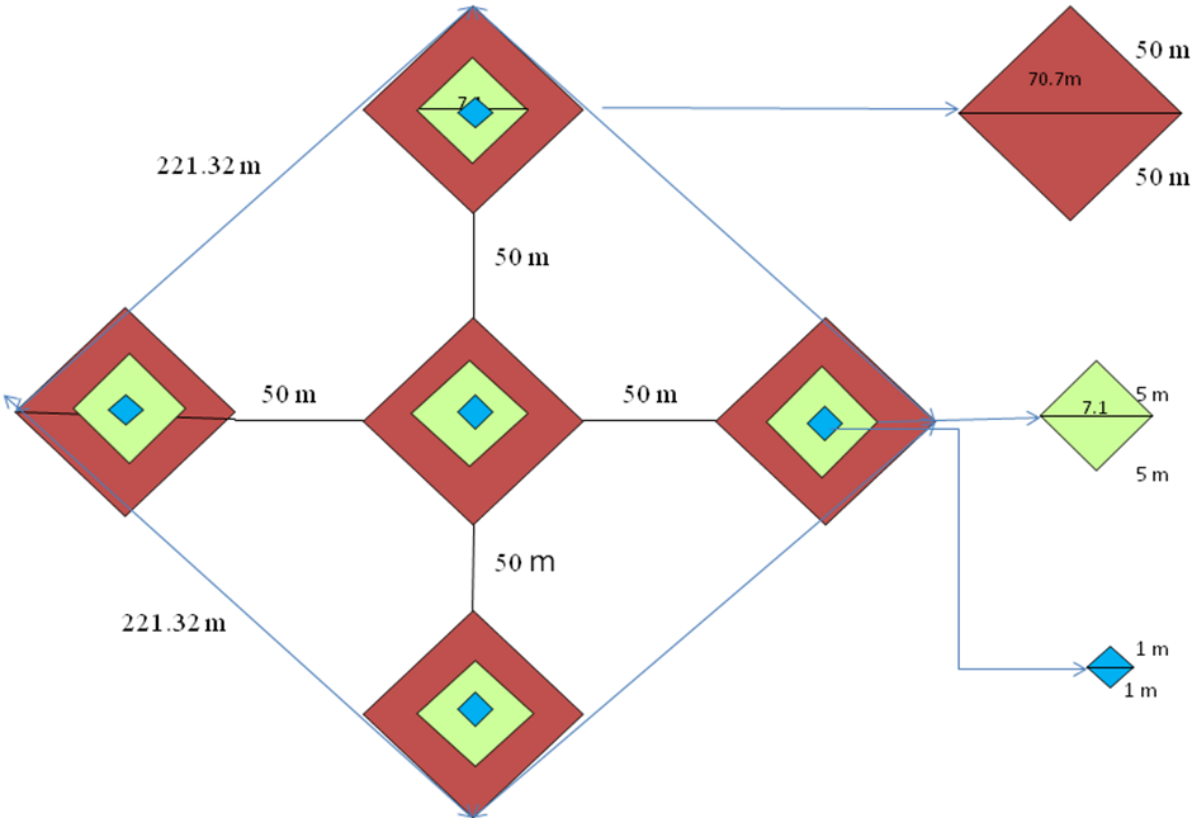


Fig 3. A cluster design of plots nested with the smaller plots for recording observations on tree, shrubs and herbs, respectively.

4.2.1 Vegetations and growth measurements

Survey was conducted in the plots of 0.25 ha and all trees species having girth at breast height (GBH, at 1.37 m height) >10 cm were measured for girth and total height (Fig 1.4).

Fig 1.4. Growth measurement of *A. nilotica* (left) and *Cocculus pendulus* (right) of 98 cm girth– a woody climber on *P. cineraria*.

In each 0.25 ha plot, nested plots of 5 m × 5 m were laid out for recording growth variable of shrub species. Based on the measured diameter at breast height trees were further categorized into >30cm dbh and 10-30 cm dbh to have a knowledge about saplings recruitments. All shrubs were counted and measured for collar girth at 15 cm above soil surface and height in the plots of 5 m x 5 m size nested in the above-mentioned tree plots. Numbers of tillers were also counted and measured for its length for the shrubs. In case of less population, all shrubs were counted and measured in the plots. Observations on herbaceous vegetation and grasses available in the areas were recorded in plots of 1 m x 1m size nested in the plots laid out for recording observation on shrub species (Fig 4). Types of herbaceous/grass species and their population were recorded in each sacred groves depending upon the availability.

Regeneration of tree species was also recorded in the plots of shrubs (5 m x 5 m size) to determine natural regeneration patterns and changes in species compositions across mature and regenerating phases of trees and seedling recruitment of tree species under the influence of climatic conditions (Jayakumar and Nair, 2013). In this tree saplings of >10 cm tall and girth of 3 to < 10 cm were counted and measured for collar diameter and total height.

Identification of tree and shrubs species was made on the basis of people interaction (local name), morphological and floral (if available) characters as well as by use of 'Flora of Rajasthan', flora and working plan of concerned districts and help of Botanical Survey of India (BSI, Jodhpur). Morphological characters were noted from the specimens. The specimen was brought to the laboratory at AFRI, Jodhpur, where microscopic characters were studied and identification of the specimen was made with the help of standard references (Hooker, 1897; Bor, 1960; Shetty and Singh, 1993; Bhandari, 1990) and related literatures comparing the characters with the other related species.

4.2.2 Mapping and general information of sacred groves

Sacred groves were identified based on the interactions with the local people as well as the forest field staff working in the districts or region. Observations were made on the general geo-morphological factors related to the groves and status of soil moisture conditions, litter cover,

soil erosion status etc. Details regarding the existing management regimes were also recorded through interviews with the community people.

4.2.3 Recording of disturbances

Details about weed infestation, invasion by species from nearby plantations, soil erosion, relative distance from the roads, division of sacred groves by roads and railway lines, lack of protection, cattle grazing etc. have been collected. Likewise types and extent of encroachment was also captured during the survey.

4.3 Socio-economic survey

The sacred groves of India represent a long-held tradition of community management of forests for cultural reasons. To determine local attitudes toward the sacred groves, elements of sacred grove management including restrictions on resource use, as well as ceremonies associated with sacred groves there is need to use social science research methods (Ormsby, 2013). For this purpose a well designed questionnaires (Annexure I) was developed for interacting with the resident of the nearby area of the sacred groves and recording observations. Questionnaire was for recording the views of the local people about general management, protection, social acceptance of the sacred groves and their opinion for developing management plan of these sacred groves. A total number of 615 people were interacted belonging to Hindu (95.4%), Muslim (3.7%) and Shikh (0.8%) religions. The respondents were also categorized depending upon number of family member and income categories, land holding size and occupation.

Maximum number of respondents during the survey belonged to 6-10 persons per house hold, i.e. 55.3%. It was followed by 5 and less persons per house hold. Greater than 10 persons per house were recorded for only 6.5% respondents. Likewise, according to the income categories were categorized into Rs <5001 per month, Rs 5001-10000 per month and Rs >10000 per months. In each category there were 28%, 54.3% and 17.7% respondents, respectively (Table 1.5). This indicates that highest number of respondents fell into Rs 5001-10000 per month income group category. According to land holding size, about 11.4% respondents were landless and depended upon common lands for their livelihood, 58.5% respondents were marginal in

category, whereas 21.3% respondents were small farmers in category. About 8.8% respondents were of bigger in land holding size (Table 1.6).

Table 1.5. Number of family members and the income categories of the respondent in sacred grove surveyed area of Rajasthan

SNo.	Family members	Frequency	Percent	Income (Rs/month)	Frequency	Percent
1.	1-5 members	235	38.2	<5001	172	28.0
2.	6-10 members	340	55.3	5001-10000	334	54.3
3.	>10	40	6.5	>10000	109	17.7
	Total	615	100.0	**Total**	615	100.0

Table 1.6. Categories of respondents based on the land holding size in studied area of Rajasthan

SNo.	Group of land holding	Frequency	Percent
1.	Land-less	70	11.4
2.	Marginal Farmer (< 11 bigha)	360	58.5
3.	Small Farmer (11-30 bigha)	131	21.3
4.	Big Farmer (> 30 bigha)	54	8.8
	Total	615	100.0

While considering occupation of the respondent, about 78.1% respondents were farmers, 5.7% respondents were in business and 3.6% respondents were in government service. About 9.4% respondents were labourer in category. Only 1.6% respondents were herdsmen and the rests were of mixed in categories (Table 1.7).

Table 1.7. Categories of respondents based on occupation in studied area of Rajasthan.

SNo.	Occupation	Frequency	Percent
1.	Agriculture	480	78.1
2.	Business	35	5.7
3.	Govt. Job	22	3.6
4.	Labour	58	9.4
5.	Agriculture and Labour	6	1.0
6.	Agriculture and shop	4	0.7
7.	Herdsman	10	1.6
	Total	615	100.0

4.4 Characterization of soil properties

Soil samples were collected from the centre point of the central plot of the cluster in 0-30 cm soil layer using iron core sampler. The soil samples were put in polythene bags and transported to laboratory for analysis work. Soil samples were air dried and passed through a 2 mm mesh sieve so that stony part (gravel) fraction could be separated from the soils and actual soil fraction (fine earth fraction) could be determined as: Soil fraction = 1- G (gravel fraction).

4.4.1 Bulk Density Measurement

An iron core cutter of fixed volume placed with a steel dolly on top was hammered adequately and cautiously so that complete core should penetrate into the intact soil. Care was taken not to rock the core cutter. Core samples were dug out taking care not to damage the core. End of the core level with the ends of the cutter was trimmed by means of a spatula and steel knives. Cores samples were collected for 0-30 cm soil layer, respectively. In laboratory, cores samples were weighed to the nearest gram and put into dry to constant weight at 110 ° C (for a constant weight) in a hot air Oven after putting the sample into a pre-weighed glass beaker for 48 to 72 hrs. Dry weight of the samples recorded in g and volume of the core recorded in cubic centimeters from its dimensions measured to the nearest 0.5 mm. Bulk density was calculated as equation provided below and it is reported as bulk density in Mg/m^3 (equivalent to g/cm^3) on an oven-dry basis to the nearest 0.01 Mg/m^3.

Bulk density (BD) (Mg/m^3) = Mass of dry soil (g)/ Volume of Core (cm^3).

4.4.2 Soil pH and organic carbon

Soil pH was monitored in 1:2 soil-water ratio, whereas organic carbon (SOC) were determined using standard procedures (Jackson 1973; Walkley and Black 1934). Walkley-Black method (1934) of soil organic carbon (SOC) determination provides an accurate estimate of SOC with 100% recovery (Wang et al., 2012) and was used. In this potassium dichromate ($K_2Cr_2O_7.5H_2O$) was used as the oxidant and ferrous ammonium sulphate ($FeSO_4$ $(NH_4)_2SO_4.6H_2O$) as the reducing agent (IPCC, 2007).

% organic carbon $=1.334 \times [(V_{blank} - V_{sample})/Wt] \times 0.003 \times M$…….. (Eq 3)

Where V_{blank} is volume of ferrous ammonium sulfate required to titrate the blank (ml), V_{sample} is the volume of ferrous ammonium sulfate required titrating the sample (ml), Wt is weight of the soil sample (g), and M is the molarity of ferrous ammonium sulfate solution.

4.5 Soil nutrients

Available nitrogen (NH_4-N and NO_3-N) was determined using UV spectrophotometer Model Shimadzu-1650PC after 0.5 M K_2SO_4 extraction. Extractable phosphorus was determined by the Olson's extraction method (Jackson 1973) and by using above-mentioned UV spectrophotometer.

4.6 Data calculation and Statistical analysis

4.6.1 Diversity variables and forest type assessment

The diversity variables like number of species, species richness in terms of Menhinick diversity index, Shanon-Weiner index of diversity (*H*'), species evenness (*e*') and species dominance (D) were calculated following standard literatures (Magurran, 1988; Shannon and Weiner, 1963; Simpson, 1949; Pielou, 1966; Misra, 1968). Importance value index (IVI) was calculated as below to know the dominant trees/shrubs and to identify the dominant species either trees or shrubs in a particular sacred grove.

Importance Value Index (IVI) = RD + RF + RDom …… (Eq 6)

Where RD is relative density, RF is relative frequency and RDom is relative dominance.

Simpson's Index (D) measures the probability that two individuals randomly selected from a sample will belong to the same species. Formula for calculating D is as below:

$$D=\Sigma(n/N)2$$

Where n is the total number of a particular species and N is the total number of all species. The value of D ranges between 0 and 1. With this index, 0 represents infinite diversity and 1, no diversity. That is, the bigger the value of D, the lower the diversity. This is neither intuitive nor logical, so to get over this problem, we calculated Simpson's Reciprocal Index, i.e., 1/D. The value of this index starts with 1 as the lowest possible figure, i.e. a community containing only

one species. The higher the value, the greater is the diversity. The maximum value is the number of species in the sample. For example if there are five species in the sample, then the maximum value is 5. Likewise the number of equally-common species that give a particular value of an index is called the "**effective number of species**" (ENS). This is the true diversity of a community in question and calculated using Shannon-Wiener index and known also as Shannon entropy (Table 7). For examples of ENS is exponential of Shannon-Wiener index.

Jaccard similarity coefficient (originally coined coefficient de communauté by Paul Jaccard), is a statistic used for comparing the similarity and diversity of Sample sets. The Jaccard coefficient measures similarity between sample sets, and is defined as the size of the intersection divided by the size of the union of the sample sets (Ludwing and Renolds, 1988). This index only uses presence-absence data. It was calculated as:

$$SJ = a /a+b+c$$

Where Sj is Jaccard similarity index; a is number of species in both sites; b is number of species in second site only; and c is number of species in first site only.

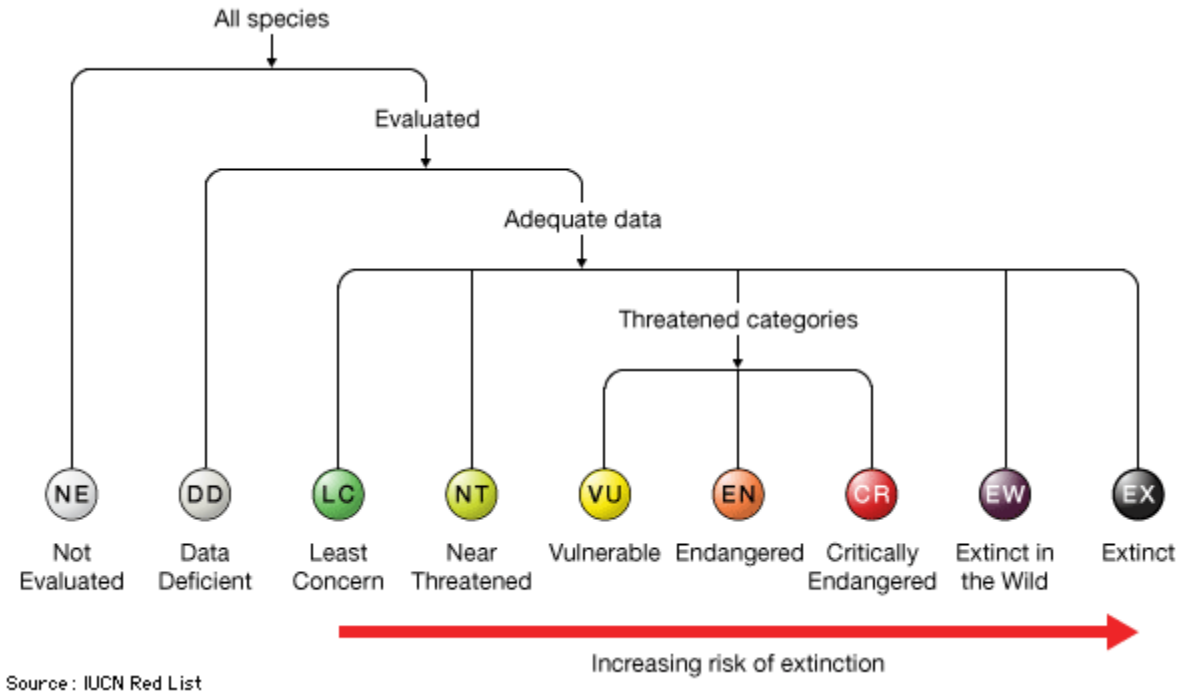
Table 1.8. Conversion of common indices to true diversities. (Source: Jost, 2006; Chao et al., 2014).

Index	Formula	Diversity in terms of x:	Diversity in terms of p_i :
Species richness	$x \equiv \sum_{i=1}^{S} p_i^0$	x	$\sum_{i=1}^{S} p_i^0$
Shannon entropy	$x \equiv -\sum_{i=1}^{S} p_i \ln p_i$	exp(x)	$\exp(-\sum_{i=1}^{S} p_i \ln p_i)$
Simpson concentration	$x \equiv \sum_{i=1}^{S} p_i^2$	1/x	$1/\sum_{i=1}^{S} p_i^2$

4.5.2 Endemic species population and regeneration analysis

The Red list of threatened species, prepared by the International Union for Conservation of Nature (IUCN), has listed 132 species of plants and animals as Critically Endangered, the most threatened category, from India. Plants appeared to be the most threatened life form with 60 species being listed as critically endangered and 141 as endangered. Trees and shrubs are

categorized into different categories of IUCN Red data list, criterion of which are provided below:



4.6.3 Calculations of soil carbon density and stock

Soil organic carbon (SOC) and soil inorganic carbon (SIC) densities were calculated using the following equation (Batjes, 1996):

$$Qi = CiDiEi\ (1-Gi)*10000 \quad \text{(Eq. 10)}$$

Here Qi (tonnes or Mg C ha^{-1}) is soil organic/inorganic carbon content in a soil layer i, Ei is soil depth in meters), Ci is carbon content in g C g^{-1} soil, Di is bulk density in Mg m^{-3} and Gi is volume fraction of coarse (gravel or stones of >2 mm size) elements defined as SOC_G/SIC_G in preceding sections.

4.7 Statistical Analysis

Data were analyzed statistically using SPSS version 8.0 statistical package. Since the data on soil samples for bulk density, SOC, soil nutrients and growth parameter and diversity variables were obtained from 103 sacred groves covering 33 districts of Rajasthan, these data were

analyzed using one way ANOVA considering dominant species as the main factor and above-mentioned parameters as the dependent variables. Wherever necessary the data were transformed to reduce heteroscenesdity (Sokal and Rolf, 1981). Duncan Multiple Range Tests (DMRT) was applied to group homogeneous subsets of districts at the $P < 0.05$ levels. To obtain relations among rainfall, SOC, SIC and biomasses/carbon in different components of the ecosystem, Pearson correlation coefficient was calculated. Regression relations were observed to relate rainfall, vegetation diversity, soil carbon stock and soil properties.

SACRED PLACES, TREES AND GROVES: AN OVERVIEW

The sacred is the object of veneration and admiration. It is a Latin word '*sacer'* means restricted or set off. A place, a person, a tree or an object may be designated as sacred, which is regarded as extraordinary or unique. The holy places are not only simply geographically beautiful but are more holy than shrines. These places are not commercialized rather sacred to whom the greatest respect is shown. They are used for the generation of our people, the continuum of our life: because that's where we begin and that's where we return (Hubert, np). Among primitive peoples the concept of nature as a totality was unknown and only individual natural phenomena like stars, rain, and animals- were comprehended as natural objects or forces that influence them and were thus in some way admirable of being venerated or conciliated.

1. SACRED PLACES

There are sacred places or area too that encompass various individual sites and phenomena as integral parts of the whole or a sacred landscape. There are springs, caves, meadows on a mountain, rivers or its origin place like Gangotri and Jumaunotri in Uttarakhand, Amarkantak in Madhya Pradesh etc. Sites connected by a river, legends or stories, the histories of individuals or groups, and/or a pilgrimage routes like the centuries old Way of Lord Rama toward Lanka or similar other are also considered sacred. These sacred natural sites are important areas for environmental conservation (Lee and Wauchope, 2003). Certain sacred places have persisted for centuries or even millennia and attracting thousands or even millions of pilgrims and visitors. Mention to some are Bodh Gaya in Bihar, Ajanta, Ellora and Elephanta caves in Maharasthra, Amritsar in Pujab. Haridwar, Allahabad, Nasik and Ujain are famous for hosting the holy Kumbh fair in different parts of India, where people make holy dip; whereas Ramdeora in Jaisalmer, Pushkar in Ajmer, Baneshwar Dham in Banswara in Rajasthan are other sacred sites. Sita Mata Sanctuary in Pratapgarh district and Ghotiya Abma in Bansawra have some mythological religious relations with 'Lord Rama'. While Sita Mata sanctuary is associated with Maharshi Balmiki Ahsram and the birth place of Devi Sita's two sons 'Lav' and 'Kush'' Ghotiya Amba is associated with Rama, who visited Ramakunda and Pandava, who visited Bhim Kunda during their exile, where the latter has used a tunnel as their passage during rainy season that

connect Bhim Kunda with Ghotiya Amba in Banswara district. In contrast, there are sacred places where humans are excluded or access is strictly limited to a special class of individuals such as ritual specialists, healers, or elders. Sacred places are considered as a complex phenomena that can be viewed usefully as varying along several continua ranging from natural to socio-cultural; prehistoric to historic, recent, or newly created; secret or private to public; single culture (or religion) to multicultural (or multi religious); intrinsic to extrinsic in value; uncontested to contested; and protected to endangered.

2. SACRED PLANTS

Plants are the medium that connects the living and nonliving things in the environment. There exists a unique relationship between trees and human beings (Choudhary et al., 2008; Donovan et al., 2013). For example both trees and human produce the gasses that enable the other to exist. Trees produce oxygen as byproduct that we need to breathe, and we produce carbon dioxide which trees utilize to make food, i.e. carbohydrates. Trees played important roles in many of the world's mythologies and religions, and are given deep and sacred meanings throughout the ages.

Trees are symbols of physical and spiritual nourishment, transformation and liberation, sustenance, spiritual growth, union and fertility (Burman, 2014). In addition to the places of birth and death, trees are also used as sacred shrines and places of spiritual pilgrimage, peace, ritual, ceremonies and celebrations (Dafni, 2007; Fowler-Smith, 2009). Vatsyayan (1992) informs the sacredness of trees seen in every part of India. Deodar (*Cedrus deodara*) is considered the abode of the gods; Sal (*Shorea robusta*) is venerated in Uttar Pradesh, Bihar and Madhya Pradesh and Coconut (*Cocos nucifrea*) in south India. Similarly Rudraksha (*Elaeocarpus ganitrus*), Bel (*Aegle marmelos*), Ashok (*Saraca asoka*), Kadam (*Anthocephalus chinensis*), Pipal (*Ficus religiosa*), Kalpavriksha (*Adansonia digitata)* and Khezri (*Prosopis cineraria*) are considered sacred in Rajasthan. The best example in Rajasthan is worshiping of two revered trees for more than 800 years old, i.e., 'Kalpavriksha' (*Adansonia digitata*)- a wish-fulfilling divine tree in Hindu mythology situated at Mangaliyawas near Ajmer, Rajasthan on an Amavashya (new moon night) day in the Hindu month of Shravan (Plat 1). There is belief that sage '*Durvasa*' meditated under the Kalpavriksha and Lord Shiva's daughter Ashok Sundari was created from Kalpavriksha tree by '*Parvati*', to alleviate her loneliness.

	
Terminalia arjuna in Chandi Mata ki Bani, Pratapgarh	*Salvadora oleoides* in Kubad Mata Oran, Kosloo, Barmer
	
Adansonia diggitata in Mangaliavas, Ajmer	*Tamarindus indica* in Hanumanji Ki bani, Baran
	
A devasthan under *Dolichonron falcata* in Kota	A devasthan under *Matenus emarginata* in Kota

Plat 1. Some sacred trees in Rajasthan under which people offers worship.

Banni (*Accacia ferruginea*) is also considered sacred because it was in one such tree that Arjuna, as stated in the Mahabharat, hid his Gandhiva bow and arrows while in his one year *agyatavasa*, (one year of total anonymity), when the Pandavas were exiled to the forest (Murthy, 2006). Sacrifice of life in protecting trees can only be observed in the history of Rajasthan, when the King of Jodhpur ordered his soldiers to cut the 'Khezri' (*Prosospis cineraria*) tree in village Khezadali in 1730 AD. The soldiers together with the workers did not accept the goddess's interdiction, and began to cut the trees anyway, telling the villagers: "If you want to save the trees, then pay a tax; if not we will cut the trees." In response Amrita Devi- a lady said in her rhymed couplet:

> Dam diya, dag lage, tukro na dev a, dan;
> Sir sante runkh rahe to bhi sasto jan.

With this rhyme the villagers wrapped themselves around the trunks of the trees, and the laborers with their axes chopped them down. In this way, one by one, 363 people were martyred in order to save these trees. Other examples of such faith is the alpine plants *Saussurea obvallata* and *Delphinium vestitum* locally called Dongar and Loshkar; which have been protected through local customs and beliefs by linking these plants with local deity and not allowing any one from the village or outside to pluck the flowers except the village priest during specific day and time only (Meenakshi et al., 2011). Sacred trees are not only related to Hindu tradition but also to Shamanic, Egyptian, Sumerian, Toltec, Mayan, Norse, Celtic and Christian traditions and thus elaborate mythology of trees exists across a broad range of ancient cultures throughout the world (Table 2.1). The World Conservation Monitoring Centre (1982) states that the tradition is thought to date back several thousand years or at least the pre agrarian period of the hunter-gatherer societies. Being largest plant on earth, the tree has been a major source of stimulation to the mythic imagination and have been conferred on in all cultures with a dignity unique to their own nature, and tree cults, in which a single tree or a grove of trees is worshipped, have flourished at different times almost everywhere in the world including Europe and Asia (Gorshunova, 2008). Christianity and Islam treated the worship of trees as idolatry and this led to their destruction in Europe and most of West Asia.

Table 2.1. Some important sacred trees of the world and belief behind these trees.

Local name	Botanical name	Belief
Willow Tree	*Salix alba*	In Japanese tradition, it is believed that wherever a willow is present, a ghost will appear.
Ash tree	*Fraxinus spp*	It is associated with healing and enchantment, and in particular to the Welsh magician/god Gwyddion, who had an ash wand. This tree is also associated in Norse mythology to the god Odin.
Sacred Oak	*Quercus muhlenbergii*	Native Indian legend claims that the tree possesses the power to heal. It was looked upon as the shrine tree of the Delaware Indians, who prayed for it whenever they needed help.
Italian Cypress	*Cupressus sempervirens*	Known as "The Mournful Tree", and has been associated with death and mourning for the past 2,000 years.
The Bodhi Tree	*Ficus religiosa*	Lord Buddha gained his enlightenment under this tree, which became a symbol of his presence and an object of worship after Buddha's death
Witch Tree	*Thuja Occidentalis*	Sacred among the Chippewa Indian tribe. People are now prohibited to come near the tree.
Banyan Tree	*Ficus benghalensis*	Due to its shape, the tree represents eternal life. In 'Bhagavad Gita' Krishna uses the banyan tree as a symbol to describe the true meaning of life to 'Arjuna'.
Lebanese Cedar	*Cedrus libani*	It holds a religious Christian significance and mentioned in the bible 75 times and a symbol of national pride of Lebanon.
Baobab Tree	*Adansonia digitata*	Due to its massive size, fascinating shape, and long aging, people believe that baobab holds the spirits of the dead and magical properties, and help in making wise decisions.
Christmas Tree	*Abis alba pyramidalis*	The most renowned sacred tree and was known as Yule tree in pagan tradition and was decorated as an outdoor live tree with hanging candles.

India is country in the world, where many communities practice different forms of worship of nature (Gold and Gujar, 1989). Worship of stones and hills, worship of plants and trees, worship of animals, worship of the elements, worship of the heavenly bodies and worship of man are some of them (http://www.urantiabook.org/newbook/papers/p085.htm; Shah and Patel, 2011). Tradition of nature worship by providing protection to trees or patches of forests designated as sacred groves dedicated to deities or ancestral spirits is date back to third and fourth millennia BC, i.e. during highly evolved Harappan Civilization (Bhatla et al., 1984; Haberman, 2013). One such example is carving of stylish *Peepal* tree (*Ficus relegiosa*) with two heads of unicorn emerging from its stem on the seals of Mohenjodaro. Even during Vedic period, tree worshiping

has occupied a very important place, where Lord *Soma* has been described as the presiding deity of trees. Hindu religion is replete with the events of celebration involving several trees and herbaceous plants (Table 2.2). Many of the trees of different species have special associations with particular deities. For example, the Lord Vishnu is associated with the '*Pipal*' (*Ficus religiosa*), Bargad (*Ficus bengalensis*), and '*Gular*' (*Ficus glomerata*); the Lord Shiva with '*Bel*' (*Aegle marmelos*) and '*Maulashri*' (*Mimusops elengi*); the Lord Dattatreya with '*Gular'* (*Ficus glomerata*). Bel (*Agele marmelos*) and Rudraksha (*Elaecarpus ganitrus*) are associated with Lord Rudra (an incarnation of Lord Shiva). *Acacia ferruginea* is the most feared and respected tree because it represents the dangerous planet Saturn, and Agni, the powerful fire god.

Table 2.2. Religious festivals in India and the associated sacred trees.

Festivals	Month of festival	Species associated
Maha Shivaratri	February	*Aegle marmelose/ Ziziphus spp. Datura spp.*
Sheetla Asthami	March	*Azadirachta indica*
Dasha Mata	March/April	*Prosopis cineraria*
Neem Saptami	April	*Azadirachta indica*
Vat Savitri	May	*Ficus bengalensis*
Bilva Mangal	May – June	*Aegle marmelos*
Sawan ke Somvaar	Mid July – Mid August	*Aegle marmelos*
Kadii Vrat	September	*Musa paradisica*
Jeevit Putrica	September/October	*Sida cordata*
Aonla Ekadashi	October/November	*Emblica officinalis*
Chhauth Vrat	November	*Saccharum officinarum*
Somvari Amavasya	15^{th} of all months	*Ficus religiosa*

Every festival in India is virtually associated with a plant species and foods derived from different species. A harvest festival is an annual celebration that occurs around the time of the main harvest of a given region. Given the differences in climate and crops around the world, harvest festivals can be found at various times at different places. Annual cherry blossom festivals in Japan or Hanami are a special feature of Japanese life, when all ages spend time outdoors, enjoying the beauty of the cherry blossoms by day and by night, with their family, friends, and workmates. Festival activities include eating seasonal foods, such as bamboo shoots,

rice cakes with red beans, and wild vegetables, playing games, listening to musical instruments, and singing (Primack and Higuchi, 2006). A harvest festival 'Baisakhi' is celebrated on the thirteenth day of April according to the solar calendar, the day marks the beginning of the Hindu solar new-year in India. In fact this day is celebrated all over the country as new-year day under different names. It is celebrated in North India, particularly in Punjab and Haryana, when the 'Rabi' crop is ready for harvesting. This can be seen as one of the ways of celebrating biodiversity of nature. Use of Amaranth and buckwheat on the occasion of observing a fast is common practice in India. This reveals that our ancestors knew for ages that amaranth and buckwheat are not cereals. For example, out of the 34 plant species considered sacred by the Dimasas community in Assam, India, 13 species are related to worshiping, 21 species involved in naming of areas/villages and eight species are associated with the naming of the Clans (Medhi and Borthakur, 2013).

3. SACRED GROVES

A community based repositories of biological diversity sacred groves are segments of landscape with typical geographical features. It is virtually a patch of forest or a clump of trees associated with other forms of life, and affords protection on the basis of religious practice or faith (Colding and Folke, 2001). The groves are dedicated to a deity God, Goddess and it's a taboo even to cause a simple damage to life in the grove area. The groves are considered to be the fragments of original ecosystem and constitute unique examples of *in situ* conservation of genetic resources and serve as refuge for many threatened and endemic species (Ormsby and Bhagwat, 2010). Most often felling of trees and branches or twigs from the groves is strictly prohibited. Even lifting of leaf litter is not allowed. Many a time the groves are also associated with cremating or burial grounds.

Hughes and Chandran (1998) have presented an overview of the distribution of sacred groves around the world. This indicates that sacred grove concept of biodiversity conservation had adopted by various indigenous communities worldwide, like aboriginals of Australia, Caucasus Mountains community, ancient Slavic people, German tribes (Tokarev, 1989), Greek and Romans, Kikuyu of Africa (Huges, 1990), and Mbeere tribe of East Africa (Gowda, 2006).

Before the spread of Christianity and Islam the sacred groves covered much of the Middle East and Europe. Frazer (1915) has also provided illustrations of sacred groves which were earlier prevalent or are so even now in Europe, India, Australia, America, Africa, China and Japan. Among the Celts, the Oak-worship of the Druids is quite well known. At Uppsala, the old religious capital of Sweden there was a sacred grove in which every tree was regarded as divine. Among the Finnish-Ugrian tribes, heathen worship used to take place within sacred groves, which were fenced and protected. The African continent-predominated by the tribal communities is also replete with sacred forests and sacred groves (Little and Brokensha, 1987; Castro, 1990; Byers et al., 2001; Campbell, 2005; Sarfo-Mesah et al., 2010).

4. SACRED GROVES IN INDIA

Sacred groves have existed in India since time immemorial and India has the highest concentration of sacred forests in the world. Agglomeration of over 40,000 endogamous groups together with heterogeneity in the Indian society in terms of religious beliefs, customs, taboos, culture, language and livelihood availability of sacred groves vary widely in size and composition (Malhotra, 1998). Further, high flexibility in Hinduism and potential of absorbing numberless local cults including many tribal ones, instead of vanquishing them as done by other major religions, a large number of sacred groves are still available in India. These sacred groves are patches of densely wooded segments of landscape containing vegetation and other forms of life and geographical features that are delimited and protected by human societies to keep them in a relatively undisturbed state on religious grounds (Kosambi, 1962; Gadgil and Vartak, 1981; Chandran et al., 1998; Malhotra et al., 2000; Anthwal et al., 2010). These sacred groves were dedicated by local communities to their ancestral spirits or deities. These groves are protected by local communities, usually through customary taboos and sanctions with cultural and ecological implications. It consists of a multi-species, multi-tier primary forest or a cluster of trees, depending on the history of the vegetation in the region. Sometimes a groves in composed of single tree species, whereas a single tree is also considered a grove at places because of its size and sacredness in the region, i.e., a tree of *Ficus bengalensis*. Existence and importance of sacred groves have also been describes in the word of the first Inspector General of Forests in India, D. Brandis (1897) like:

"Very little has been published regarding sacred groves in India, but they are, or rather were, very numerous. I have found them in neraly all provinces. An instance I mention the Garo and Khasi hills..... the Devara Kadus of Coorg and all the hill ranges of Salam district in Madras Presidency.... In the dry region sacred groves are particularly numurous in Rajputana..... In Mewar they usually consist of Anogeissus pendula.....in Partapgarh and Banswara..... the sacred grove , here called Malwan, consist of a variety of trees.....These.....as a rule, are never touched by the axe, except when wood is wanted for the repair of religious buildings....."

Existing information in terms of association of sacred groves with different ethnic groups indicates that the sacred groves are found among both tribal and non-tribal communities indicating variation at the regional level in terms of ethnic association. However, the association of sacred groves with castes of different varnas is still unclear. Likewise, in the states like Bihar, Madhya Pradesh, Orissa, West Bengal, etc., where both tribal and non- tribal exists, the existence of groves in the non-tribal areas is also not clear. In fact different deities are worshipped in the sacred groves and each grove is named after the deity dwelling in the respective sacred grove. Kala (2011) observed a total of 19 deities worshipped by the local people in sacred groves in Panchmarhi Biosphere Reserve of India. More importantly is that various traditional customs associated with these sacred groves have been reported earlier from the Himalayas, North-east India, highlands of Bihar, Orissa, Madhya Pradesh, Andhra Pradesh, Karnataka, Tamil Nadu and Kerala etc.

According to an estimate there are numbers of sacred groves lies between 100,000 and 150,000 covering about more than 100, 000 ha area (Malhotra, et.al., 1999; Kala, 2010) (Table 3) as compared to the documented ones (Table 2.3). These sacred groves are located in a variety of habitats ranging from resource rich forested landscape of Western Ghats and North-East to the extremely resource poor desert conditions in north-western and central India. In Himalayan region, Himachal Pradesh has largest number with about 5000 documented sacred groves (Sharma, 2000). East Khasi Hill district of Meghalaya and Karbi Anglong district in Assam in north east harbor substantial number of sacred groves of varying size. These districts, both inhabited by indigenous tribal populations represent different contexts of conservation of sacred

groves in the region (Khiewtan and Ramakrishna 1989; Ramakrishnan 1998, 2001; Sinha and Maikhuri 1998; Tripathi *et al.* 1995; Jamir and Pandey 2002). In Mizoram, each village has its own sacred grove, though their size varies from village to village. The Western Ghats through the states of Maharashtra, Goa, Karnataka, Tamil Nadu and Kerala - is one of the world's biodiversity "hotspots" have substantial number of sacred groves, where Karnataka alone have nearly 1,500 documented sacred groves. Though highly populated, population of sacred groves is also high in Uttar Pradesh, where Singh (2011) reported 32 sacred groves in Devipatan region only. Tree cutting or other resource extraction is strictly prohibited in smaller groves, while larger groves often function as "resource forests," in which people are allowed to gather products for sustenance. There are 2,000 well documented sacred groves in Kerala, where more than hundreds are dedicated to snakes, which protect agricultural crops by controlling insect and rodent populations. Rajasthan is another region, where numbers of sacred groves are more than the number of villages (Chaudhary et al., 2002). During exhaustive survey of common resources that includes Oran, guacharo and other in Jodhpur district with 1846 villages indicates 3278 number of Orans, gauchar, Agore and parat land in combine and 3497 numbers of water bodies (Anon, 2004). However projected number of sacred groves in Rajasthan is 25000 based on the ratio of 1027 recorded groves and number of villages of Rajasthan (Pandey, 2000).

The sacred groves in India are known by different names at different places like '*Devray*' in Maharastra, '*Devarkand*' and '*Siddarvanam*' in Karnataka, '*Orans*', '*Kenkari*', '*Malvan*' and '*Yogmaya*' in Rajasthan and '*Saranya*' in Bihar (Ramchandran, 1999; Joshi and Shrivastava, 2000), and *Jaher* (Xaxa, 1991) in tribal region of Jharkhand and Orissa. There is no generic name for sacred groves in Haryana, though there are about 248 sacred groves in Kurukshetra district (Silza et al., 2008). In Mizoram, sacred groves are called Ngawpui. Each village has its own sacred grove of varying sizes. No tree is allowed to be cut in the Sacred Grove, except for those trees that showed signs of age and decay.

5. TYPES OF SACRED GROVES

Sacred groves have been categorized depending upon the deities, types of protection or sacredness like Mandir groves, Samadhi groves, Ashram groves and Tirath groves (Yadeo et al.,

2010). Moreover, there are three types of sacred groves and these are Dev van or bani, Kaker bani and Oran. Pandey and Singh (2000) divided sacred groves of the southern Aravalli ranges and Vindhyachal ranges into three major categories.

Table 2.3. Documented sacred groves in India with their local names and sources.

SNo.	State	Local name	Nos	References
1	Andhra Pradesh	Pavithravana	761	WF -A. P. (1996)
2	Arunachal Pradesh	Gumpa Forests	65	Chatterjee et al. (2000); Chakrabarti, (2010).
3	Assam	Than, Madaico	40	Chakrabarti (2010).
4	Bihar	Sarana	-	-
5	Chhattisgarh		600	Patnaik and Pandey (1998); Pandey (2000)
6	Delhi		1	Bhaviskar (2014)
7	Goa	Devarais	55	Envis, Kakar (2013)
8	Gujarat	Deorai, Pann	41	Gupta et al. (2000); Patel and Patel (2013)
9	Haryana		248	NAEB (1995)
10	Himachal Pradesh		5000	Sharma (2000)
11	Jammu & Kashmir		96	Kumar et al. (2011); Gupta and Sharma (2014), Sharma (2014).
12	Jharkhand	Sarana	21	Jayapal et al. (2014)
13	Karnataka	Devara Kadu	1424	Kalam, 1996; Gokhale,2000
14	Kerala	Kavu, Sara Kavu	2000	Rajendraprasad (1995)
15	Madhya Pradesh		275	Srivastava (1994).
16	Maharashtra	Devrai, Devrahati, Devgudi	2808	Deshmukh et al., 1998
17	Manipur	Gamkhap, Mauhak	365	Chakrabarti (2010).
18	Meghalaya	Ki Law Lyngdoh, Ki Law Kyntang, Ki Law Niam	79	Chakrabarti, (2010); Tiwari et al. (2013)
19	Mizoram	Mawmund, Ngawpui	Many	Tiwari et al. (2013)
20	Orissa	Jahera, Thakuramma	322	Malhotra et al. (1997)
21	Puduchery	Kovil Kadu	15	Sambandan and Dhatchanamoorthy (2012)
22	Rajasthan	Orans, Kenkris, Jogmaya	3164	Pandey et al. (2003); Gold and Gujar (1989), Singh and Sisodia (2003).
23	Sikkim	Gumpa forests	56	Chakrabarti (2010).
24	Tamil Nadu	Swami shola, Koilkadu	448	Amrithalingam, 1998).
25	Uttarakhand	Deo Bhumi, Bugyal	55	Gokhale and Pala (2011)
26	Uttar Pradesh	-	35	Singh (2011), Garg and Singh, (2013)
27	West Bengal	Garamthan, Harithan, Jahera, Sabitrithan, Santalburithan	670	Deb et al. (1997)
	Total		18644	

The first type of sacred groves were developed and managed by tribes, and are located in forests, near streams or on hills and is known as Dev Bans. The second types are devoted to Shankara

and are located in watershed areas. The third type consists of single trees like banyan (*Ficus bengalensis*), peepal (*Ficus religiosa*), and so on. Institutional structures in management of these sacred groves were assured by linking them to religious sentiments. However, sacred groves are also categorized based on their legal status and management, which vary among regions and individual villages. Some groves are associated with and managed by separate caste groups within a community, some by a village as a whole, and some by neighboring districts within a larger geographical area. There are also large "pan-Indian" groves that involve people from many parts of the country. In some groves, all forms of resource extraction are strictly prohibited, while in others people may collect material such as fallen branches and leaves from the forest floor or fruit from the trees. Most of the sacred groves fall under following three categories:

- Control of state forest departments;
- Control of revenue and other government departments; and
- Privately owned sacred groves.

The unique management and ownership of the sacred groves is one significant reason that they are so special. In most cases, the sacred groves are owned and managed by local communities, and sometimes by one or more families or clans (Ormsby, 2011). Most sacred groves like that in Maharashtra are either under the control of the Forest Department and or under the control of the Revenue Department (Godbole et al., 1998). Many groves associated with temples in western Maharashtra were brought under the scrutiny of the government by forming the Paschim Maharashtra Deosthan Prabodhan Samiti in 1960s (Gadgil and Vartak, 1976). In Rajasthan, Orans are managed by Grama Panchayat, whereas sacred groves in Meghalaya are under the control of District Councils (Tiwari et al., 1998). However, management of sacred groves are also done by temple committee consisting of members of different villages, i.e., Haryali grove in Garhwal (Sinha and Maikhuri, 1998), by clan elders, i.e. Mahadeo Kolis of Pune district, village elders, i.e. Kunbis of Kolhapur district, two clans of the Proja Tribe in Kantabanshini Thakurma sacred grove in Koraput district, Orrisa. Clan-based management is widespread practice among the Santhal, Oraon, Milnda, Kharia and other tribes of central, eastern and north-eastern India. In

Kerala, several sacred groves are owned by a family (i.e, Ollur Kavu sacred grove), a group of families (i.e., S.N. Puram Grove), a caste, or a trust (i.e., Iringole Kavu sacred grove) (Chandrashekara and Sankar, 1998). It clear that encroachments are not permitted or tolerated rather it can only be used for open grazing; there is no commercial use of the resources extracted from the van; dry wood extraction is permitted only for religious function in the van; green felling, open toilets and hunting in these groves are totally not allowed. The guilty party is punished and has to provide grain at the local village court and was also fined a sum of money.

6. IMPORTANCE OF SACRED GROVES

Various live forms in sacred groves serve a variety of ecosystem functions including biodiversity conservations, removal of atmospheric pollutants, oxygen generation, microclimate regulation, stabilization of soil, ground water recharge, prevention of soil erosion and carbon sequestration. Likewise scared groves possess a great heritage of diverse gene pool of many forest species having socio-religious attachment and possessing high values including medicinal ones (Anderson, 1996; Sharifi et al., 2000). For example Patel et al (2014) recorded 78 species in two small sacred groves in Kuchh region of Gujarat, where about 75 % of tree species of arid region of Gujarat state was recorded. Major services provided by these sacred groves are: provisioning services focusing on directly supplying food and non food products; regulating services, which are obtained from regulation of ecosystem processes; supporting services, which provide support to habitats and ecosystem functioning; and cultural and amenity services relating to recreation and human inspiration (Table 2.4).

Table 2.4. Various services provided by the sacred groves.

Services	
Provisioning services	➢ Soil and water conservation ➢ Water supply for drinking and irrigation ➢ Sources of NTFP (medicinal plants, fruits, fuel wood, fodder etc.)
Regulating services	➢ Maintenance of hydrology and water flow regulation ➢ Mitigation of natural hazards, i.e. pollutants
Supporting services	➢ Carbon sequestration and climate change mitigation ➢ Pollination and seed dispersal ➢ Amelioration of microclimate for flora and fauna
Cultural and amenity services	➢ Religious, cultural tradition and ethnic identity ➢ Landscape aesthetics, research and education

The main economic benefits of sacred groves are: place of grazing for the livestock, (ii) place of drinking water, (iii) resting places, and (iii) medicine in ethno botanical form; whereas the main environmental benefits are: refugia for bio-genetic diversity, repositories of ethno-social codes of relation and regulation, venues of local and universal manifestation of aesthetic tradition and religiosity, and community resources, commons or cultural space between private domain and the rest of cosmos.

6.1 Religio-cultural

Most of the sacred groves are associated with certain deities. Villagers use to perform annual rituals and ceremonies to appease the presiding deity and ensure the well-being of the community. Sacred groves help to define the cultural identity of the communities that revere and protect them. During these rituals sacrifices of animals (birds, animals) are made. However, in sanskritized groves offerings of vegetable, fruits or sweats are made. These rituals are performed for the well-being of the people, animals, crops, etc. The presiding deities are believed to look after the well-being of the people, and also protect the groves by administering punishment (mostly death) to the offenders (Roy Burban, 1912; Sisodia and Malhotra, 1963; Kalam, 1996). People take vows for wish-fulfillment when there is a crisis, particularly bearing on health and offerings mostly of terracotta of animals, birds, humans, etc. are made. In some of the groves of West Bengal heaps of such terracotta offerings of elephants and horses are found (Malhotra and Das, 1997). Groves are mostly managed by the local community, and owned by a family, group of families, or a clan. A second category is represented by those managed by the entire village community. The local-level groves are those where people from larger geographical areas, usually a few neighbouring districts come to worship a particular grove, i.e. Iringole in Kerala and Kantabanshini hakurma in Orissa, which area managed by local community and/or committees. The regional-level sacred groves are those where people from several districts or states participate like that in Sabarimala in Kerala and Ramdeora in Rajasthan. Such groves are usually managed by temple trusts (http://www.thealternative.in/society/on-the-knees-to-nature/). The next higher level is Pan-Indian character where people from many parts of the country participate. Hariyali sacred grove in Garhwal Himalayas is example of Pan-Indian (Sinha and

Maikhuri, 1998) and managed by temple trusts. Another category of SGs includes those that are believed to be abodes of ancestral spirits.

Sacred groves have important socio-cultural functions too. Several festivals are performed in these sacred groves (Rao et al., 2011). Annual festivals associated with the sacred grove range from one to nine days in length and vary between the regions (Ormsby, 2013). Some examples are: offerings of food and liquor in groves among the Bhils of Ratanmal once a year on the occasion of Deepavali (Nath, 1960); social gatherings on the occasion of Salui and Karam festivals, as well as wedding ceremonies among the tribes of southwest Bengal (Deb and Malhotra, 1997); celebration of major festivals at the sacred groves among different tribes of Bihar (Vidyarthi and Rai, 1997); socialization of the youth among the tribes of Chhotanagpur (Fernandes, 1993) and celebration of festivals like Holi, Navratri, Devdiwali in sacred groves in Ratnagiri district of Maharashtra (Godbole et al., 1998; Waghchaure et al., 2006).

6.2 Conservation of Biodiversity

Cultural and spiritual aspects of the ecology of indigenous societies help conserve biodiversity, ecosystems, and landforms in their habitat as there are significant relationships between sacred places, biodiversity and the conservation measures (Patel and Patel, 2013). Sacred groves are dynamic systems because the species composition of any plant community change naturally over time with ecological succession, even in absence of natural perturbations or human disturbances. As a result, a landscape can be a mosaic of patches of various types of plant communities, and that help sustain some of the biodiversity in a region. Because of cultural restriction of access to and interference with sacred groves to reduce the human impact, the sacred groves have been evolved as reservoirs of biodiversity and germplasm allowing the complex and diverse array of ecological processes to continue uninterruptedly over long period of time (Yelvattimath and Kotresha, 2011, Gokhale et al., 2011). The religious or cultural designation of an area as sacred promotes the conservation of its associated biodiversity (Maru and Patel, 2013). These sacred groves complement national parks, sanctuary and other protected areas (Khandal, 2014). Many a times these sacred groves show greater diversity in terms of number of species and their importance as compared to the nearby forest areas, which are generally due to monoculture

plantation in forest areas (Singh, 2008). Pushpangadan et al (1998) observed 722 species of angiosperm in a sacred grove in Kerala with only 1.4 sq. km as compared to 960 species occurred in 90 sq. km of the Silent Valley forest. Many endangered, rare and endemic species and their wild relatives find their place in these sacred groves. Some of them are *Phoeba hainsiana*, *Rhus hookeri* and *Flacourtia cataphracta* in sacred groves of Manipur (Haridasan and Rao, 1985), *Kunstleria keralensis* (Mohanan and Nair 1981), *Belpharistemma embranifolia*, *Buchanania lanceolata*, *Syzygium travuncoricum* and *Cinnamomum quilonensis* in sacred groves of Kerala (Nair and Mohanan, 1981; Unnikrishnan, 1995) and *Myristica malabarica*, *Garcinia gummi-gutta* and wild pepper in sacred groves of Karnataka (Chandran et al., 1998). Some of the rare plants observed in orans of Rajasthan are *Acacia catechu*, *Acacia nilotica*, *Anogeissus serecea*, *Blephariss sindica*, *Boswellia serrata*, *Caralluma edulis*, *Ficus bengalensis*, *Ficus glomerata*, *Ficus religiosa*, *Glossonema varians*, *Haloxylon recurvum*, *Commiphora wightii*, *Tribulus rajasthanensis*, *Zizyphus spp.* etc. (Singh, 2008; Meena and Singh, 2012; Rathore and Shekhawat, 2012). Interesting to see are the facilitative effects of trees or shrubs to live together in these sacred areas (Fig 2.1). Byers et al. (2001) highlighted the importance of sacred groves in terms at least 50% lower deforestation than in their secular counterparts, where some 133 species of native plants occurred in the sacred forests, but are under variously threatened, endangered, or extirpated categories in Zimbabwe. The study of Mgumia and Oba (2003) recorded a greater woody species richness and taxonomic diversity in a sacred grove than in the state managed forest Reserve despites of relatively small area of the sacred groves. Some of the woody species were absent in the forest plots, also suggesting that groves served as a refuge for some species. Christopher et al. (2014) gave an account of species richness and diversity in sacred groves of different ecosystems and abiotic factors and observed significantly higher herbaceous α-diversity in the fallows than the sacred groves at the low altitude. The tree species richness was higher at the low altitude compared to the high altitude with tree β-diversity increasing with altitude. Varying combinations of soil pH, total P, total K, CEC and slope per cent were related to some of the parameters and indicates that biodiversity changes in the sacred groves are governed by biophysical drivers, while a combination of human and biophysical explained the variation in rotational fallow vegetation. Many animal species including birds that are otherwise threatened

or becoming rare find a safe refuge in many a sacred groves throughout the world (Mondal and Roy, 2010; Yadeo et al., 2010; Ray et al., 2014).

Fig. 2.1. Association of *Salvadora oleoides*, *Cocculus pendulus* and *Clerodendrum phlomides* in Kubad Mata Oran, Sindhari, Barmer (left) and those of *Salvadora oleoides*, *Maytenus emarginata* and *Cadaba fruticosa* in Mangal Das ki Bani, Alwar

6.3 Ethnomedicinal importance

Besides conservation of biodiversity, the role of sacred groves is also important as a life support system. The sacred groves help indigenous communities by providing edible fruits, leaves, fibers, gums, resins and medicinal plants (Bhakat and Pandit, 2003; 2004). The people are in opinion that the required species if not found elsewhere around their village surroundings, there are high probability of its occurrence in the sacred grove sites. Thus sacred groves act as a nursery and storehouse of many of the ayurvedic, tribal and folk medicines too (Rao and Sunitha, 2011; Sambandan and Dhatchanamoorthy, 2012). Most of the indigenous people residing near the groves are illiterate, but have scrupulously nurtured their traditional customs, rituals, ceremonies and a way of forest life through folk beliefs with great vitality. The fact that 'Sanjeevani' found in Himalayan region was used by Lord Hanuman to resuscitate Lakshman the brother of Lord Rama is well known to all Indians. In view of reduced human interferences, there are lesser chances of species extinction, if they preserved in the sacred groves. These groves also serve to preserve genotypes which may be useful in forest tree-breeding programmes and as indicators of the natural productivity of the region. Ecologically valuable species like *Albizia lebbeck*, *Ficus glomerata*, *Prosopis cineraria* conserve high amount of nutrients both in soils and

the plant system itself. Keystone species that contribute to the maintenance and enhancement of biodiversity and socially valued by local communities for cultural or religious reasons, are often found in sacred groves. Medicinal plant conservation is an integral part of sustainable (King-Oliver et al., 1997) and there is a need for protection of large number of medicinal plants as an important component of common resources including sacred groves already documented in various studies (Vartak et al., 1987; Bhandary and Chandrasekhar, 2003; Pandit and Bhakat, 2007, Rao and Sunitha, 2011; Singh et al., 2014).

6.4 Source of non-timber produce

People normally do not collect/ harvest plants from sacred groves for domestic uses (Gadgil and Vartak, 1976; Roy Burman, 1995; Pushpangadan et al., 1998; Malhotra et al., 1998; Swamy et al. 1998). But there are reports (Singh and Saxena, 1998; Jha et al., 1998; Godbole et al., 1998) indicating biomass extraction and deriving certain direct economic benefits in a restricted/ sustainable way without affecting the local resources (Bhakat and Sen, 2012). Sacred groves provide shade, fuel wood, fodder and even food and livelihood for humans and animals. In western Rajasthan, orans also protect local livelihoods and provide minor forest produce that are collected from the Oran and used or sold. Fuel wood and fodder for animals are available in the sacred groves and are utilized by the villagers. Grasses are gathered for basket-weaving, clay for pottery and leaves for making brooms. Honey, fruits, seeds and medicinal plants are other MFPs available for local use or the market. Nesting birds, such as owls, parakeets and woodpeckers, build their homes in the khajjur and other large trees, assisting farmers by eliminating insects and other agricultural pests. The faunal wealth of sacred groves is also worth mentioning. Harvesting of certain species of trees (i.e., *Caryota urens*, *Mangifera indica*, *Entada phaseoloides; Diospyros melanoxylan* etc) from groves provide livelihood to many families (Gadgil and Vartak, 1976; Malhotra et al., 1997; Unnikrishnan, 1990). In some cases wood is also extracted from many groves dedicated to ancestor spirits for cremation (Mitra and Pal, 1994). Some of the important trees/plants of orans in Rajasthan provide fruits (*Salvadora oleoides, Capparis decidua*, *Prosopis cinerria, Zyziphus spp.*), oils (*Salvadora* spp., *Citrullus colosynthesis*), fodder (*P. cineraria*, *Tecomella undulata*, *Zyziphus* spp.), fuel wood (all the above-mentioned species including *Maytenus emarginata*) etc.

6.5 Sources of water supply and recharge of aquifers

Most of the sacred groves hold water resource in the form of springs, ponds, lakes, streams or rivers (Chaudhary et al., 2002; Singh, 2011). People believe, with some justification, that forests bring rain. Watersheds associated with forests have sanctity in every village. Sometimes the only source of water in a village is the grove's spring. Groves can supply fresh water in regions where other water is saline or not suitable for drinking. The sacred groves of Parinche valley in Pune, Maharashtra is present near water resources and is assumed to be responsible for water availability in lean season (Waghchaure et al., 2006). Likewise the Lum Shyllong-Nongkrim sacred groves in Meghalaya are the source of as many as eight streams that supply water to Shillong city, the capital of Meghalaya (Down to Earth, 2003). However, the most significant contribution of sacred grove in water conservation could be witnessed in Rajasthan, where water bodies associated with Orans serve as lifeline for local inhabitants as well as livestock. In general small natural water bodies are maintained near or inside the sacred groves to take care of drinking water problem during drought (Fig 2.2).

Fig 2.2. Pond in Vadara Hanumanji Ka Oran, Sirohi (left) and a water body in Gosaiji Ka Oran, Nagaur is utilised by villagers for varying purposes.

There are 3497 water bodies documented in Orans, pasturelands, paratlands and agores of Jodhpur district (Anon., 2004). However, there are problems of siltation of the ponds and Kunds in different regions reducing capacity of these water harvesting devices (Saha et al., 2010). In western Rajasthan, the villagers are now improving the surrounding areas of water bodies by

excavation and applying concrete structure to conserve natural flowing and maintain it in a hygienic condition. In this regard the works of renovating ponds and Talabs in the Agore or sacred groves in western Rajasthan by Jal Bhagirathi Foundation (JBF), a Jodhpur based NGO is worth mentioning that has not only enhanced the availability of drinking water in many villages but has also to the adjoining villages in addition to the ground water recharge. While many Orans like Gar vaji, Adaval, Talv raksh, Kalaka, Bhar thari, Naraini Mata, Nadeshwarji, Parashar ji and other in Sariska sanctuary area of Alwar district, Rajasthan, have large perennial water springs used for irrigation and other purposes all the year-round and thus protect watersheds and/or water sources (Singh, 2011), only 7.6% of the ponds located in the Orans of Jodhpur districts were perennial and contained water for the entire year (Chaudhary et al., 2002). Orans conserve valuable water in the ponds, reservoirs, step wells, streams and springs that are an essential feature of the Oran and the availability of water is major incentive for communities to use this valuable resource in a sustainable manner. In Hadoti region, dev bani were maintained in the belief that the local deity would protect the community's water bodies and other water harvesting structures. Groves were developed on the main bund of the talab to strengthen it. A large patch of land downstream of the talab is also demarcated as part of the dev van to compensate for any losses of tree growth to submergence. One best example is Jharan Mahadeo sacred grove in Jhalawar, which is situated along the stream leading to a large tank that ensures round the year supply of water to Jhalawar city. This is the only green patch in the area harbouring some rare plants like *Bambusa hamiltonii* and *Scleichera oleosa*.

The ponds and streams in the groves are often perennial and in some cases, act as the last resorts to many of the animals and birds for their water requirements, especially during dry seasons. Thus one of the important ecological roles of these groves is to provide a more dependable source of water for the organisms living in and around the sacred groves (Puspangadan et al., 1998). In addition, transpiration from the sacred groves vegetation would increase atmospheric humidity and reduce temperature in the immediate vicinity and produce a more favourable microclimate for the organisms (Khiewtam and Ramakrishnan, 1989). Sometimes plants like vetiver grass (*Vetiveria zizanioides*), *Saccharum munja*, and tree species are maintained to bind the soil thereby preventing soil erosion.

'Khadu'

It is an important traditional system of resource use in some villages of Alwar district, where each family group use to bring their livestock to graze around one particular johad (pond), of which there are eleven in the village. Family rights to johads are inheritable, and it is universally known to each villager that which johad is used by which family. Management of both the watering hole and the grazing land surrounding the water point is the responsibility of the extended family group. This practice reduces the likelihood of exploitation and instead promotes wise use of the available resources. Such interlinking of ecology and kin-based history of 'Khadu' system of resource conservation and use encourages conservation and ensure welfare of future generations of a given family.

6.6 Conservation of soil and water and in nutrient cycling

Sacred groves play a crucial role in soil and water conservation. As community-aggregated specific leaf area, leaf nitrogen concentration, canopy interception, stem flow, surface runoff and soil erosion and litter biomass (Fu et al., 2009). High accumulation of litter biomass at soil surface strongly increases the maximum water-retaining capacity of litter and reducing surface runoff and soil erosion. Increased fine root biomass also reduces surface runoff and soil erosion. This indicates that high canopy characteristics in a sacred grove play a more important role in control of runoff and soil erosion. The Mawsmai sacred groves in the Cherrapunji ecosystem receive very high rainfall. With a rapid litter decomposition rate, nutrient release in the soil of these groves is very high. The soil itself has little nutrients to support a large biomass of the sacred grove. The fine roots developed on the surface layers of the soil is important for supporting the large above-ground biomass and for tight cycling of the nutrients (Lima et al., 2010; Rawat, 2012). Many microorganisms, invertebrates, fungi, etc. flourish and a vast array of species not hither to indigenous to the groves may also colonise and thrive and help in nutrient cycling (Tripathi et al., 2013). Dense root mat prevents the nutrients from leaching out and restore soil moisture favouring regeneration and growth of herbaceous vegetation. Further, fine roots act as a medium for transfer of atmospheric carbon into the soil in the form of carbon containing compounds that help enhance soil carbon sequestration. The land surrounding the

sacred groves, which are devoid of necessary root mat and litter decomposition, can no longer sustain vegetation growth (Khiewtam and Ramakrishnan, 1989; Skinner et al., 2009). All of these factors indicate that the conservation of sacred groves is essential for maintaining local/regional biodiversity, the comprehensive health of a landscape, and preserving the socio-cultural integrity of local communities (Cardelús et al., 2013).

6.7 Carbon cycling and carbon sequestration

Forest preservation on religious ground (Kulkarni et al., 2010, Kulkarni and Nipunage, 2009), cultural heritage conservation (Sebastiano, 2009; Barbaro et al., (2007) and restrictions on excessive extraction of natural resources and on human settlement within the defined boundaries of sacred forests have indirectly contributed to conservation of the habitat and protected animals residing therein that help conserve carbon and mitigate climate change too (Arora, 2011). Estimation of carbon stocks and stock changes in existing tree or shrub biomass are necessary for reporting to the United Nations Framework Convention on Climate Change (UNFCCC) and which is required for Kyoto Protocol reporting also. Recent assessment indicates about 288.8 billion tons of carbon in forest living biomass in 2010 as compared to 299.2 billion tons in 1990 (FAO, 2010). Because of harboring large biomass per unit area of land and greater diversity sacred groves make an important contribution to the global carbon cycle (Hangarge et al., 2012). Trees absorb more carbon dioxide from the atmosphere than they release under the combined effect of photosynthesis and respiration. Plants store atmospheric carbon in the form photosynthetic products, standing biomass, leaf litter and also contribute to soil organic carbon. It has been observed that unmanaged and old growth forests have better carbon sequestration capability than plantation and managed forests (Chen et al., 2005; Stoy et al., 2007). Thus a well maintained grove can have great potential in carbon storage due to having older trees with bigger stem bulk; presence of good number of young individuals thus ensures future carbon storage also. A study from Himachal Pradesh showed higher percentage of soil carbon stock in comparison to the other forest ecosystems. Furthermore, a protected sacred forest, because of its higher biomass, sequesters significantly more carbon compared to other forest ecosystems (Singh et al., 1996). Hangarge et al. (2012) studied carbon sequestration potential of tree species in Somjaichi Rai sacred grove at Nandghur village, Pune District, Maharashtra, where tree species

having 4000 individuals were recorded in 5 ha area. In this study, *Terminalia bellirica* was dominant species with 180 individuals and sequestrated 327.78 tons of carbon followed by *Ficus amplissima* (221 tons). The species *Gnidia glauca* showed the lowest carbon sequestration potential, i.e. 0.0808 tons, whereas the second lowest carbon sequestration species was *Nathapodytes nimoniana* (0.182 tons). In Benin, the njangsa (*Ricinodendron heudelotii*), a taboo species, has recently been assessed as one of the trees with both the highest carbon sequestration potential and fallow improvement of cash crop tree plantations in West Africa. *Antiaris toxicaria* and the African border tree (*Newbouldia laevis*) have also proven important for the plantation in Benin (Quiroz, 2013). However, there are studies strong spatial patterns in soil carbon storage, declining quite sharply in the more isolated sacred groves. Tree stand density appears to be an important positive correlate of most of the bird and carbon storage ecosystem service responses studied Tree density, in turn, seemed to decline at higher levels of site isolation.

6.8 Sacred grove and landscape heterogeneity

Sacred grove is not an isolated system. They formed significant landmarks in the landscape, both urban and rural areas. The flora and fauna observed in the sacred groves is unique to the habitat and climatic condition of the region, where the grove is located. The groves serve as both feeding and nesting grounds for innumerable bird species, which in turn help in dispersion of seeds and fertilization of soil through their droppings. Due to its presence in a mosaic of landscape elements like forests, agricultural lands, grazing lands, plantations and human settlements the groves enhance landscape heterogeneity and biodiversity. Sacred groves in combination with variety of tree cover play important role in maintaining diverse microclimate and habitat which nurture several distinct macro- and micro-flora and fauna (Bhagwat et al 2005). Sacred grove fragments offer more intra patch habitat diversity to different life forms such as epiphytes, shrubs and lianas thus increasing total pool of regional species diversity (Page et al., 2009). However, fragmentation of the groves often affects seed dispersal and regeneration of rare plants which ultimately causes decline of plant population. The study of Cardelús et al. (2013) observed significant decrease in soil carbon and nitrogen stocks in sacred groves with increased distance from forest interior indicating decreased soil fertility. Because of small average size, isolation from seed sources and decreasing soil status the sacred groves becomes more vulnerable to loss.

Further, the availability of pollinators and seed dispersers is adversely affected causing decline in mutualistic relationship between trees and animals. The study from the Konkan region has also shown that larger groves have better recruitment potential (both seedling density and seedling survival) than the smaller ones with regard to *Antiaris toxicaria* and *Strychnos nux-vomica* tree species. However, it has also been indicated that apart from grove size, habitat quality, connectivity and population of seed dispersers may have a role in plant population dynamics (Dunde, 2007).

6.9 Sacred groves and animal diversity

Almost all Hindu Gods are associated with animals, birds and creatures as their vehicles or vahanas. To promote harmony in nature and to maintain ecosystem balance, protection of animals and other creatures along with human beings is essential. The association of animals with Gods as Vahanams (vehicles) is a deliberate attempt to weave mythology for protection of animals and plants in order to maintain ecological balance. For instance, Garuda (eagle) was symbolized as the Vahan (means of transport) of Lord Vishnu, Peacock to Muruga, Bull to Lord Shiva, Tiger to goddess Durga and Rat to Vinayaka etc. Lord Shiva uses lion skin for his attire and as supports a reptile king cobra as an ornament. Serpents are also venerated on Nagpanchami day and offered milk for maintaining the natural food chain and preserving environment of sacred groves. Monkeys as a part of respect to Lord Hanuman and bears were also treated as gods and remained a part of the army force of Lord Rama.

Though the animals found in most of the sacred groves are those which inhabit the groves like snakes, frogs, lizards and other lower organisms; a higher group of fauna who nest and den in the groves; and those who visit the grove temporarily for food, shelter, etc. Besides sacred groves also provides shelters to many of the livestock of the adjoining village residing around the sacred groves. Many sacred groves act as an abode for many rare, endemic, endangered plant and animal species, i.e. spiny tailed lizard in sacred groves of western Rajasthan (Ramesh and Ishwar, np). Birds constitute one of the common fauna of sacred groves and their diversity and abundance reflect ecological trends in a particular habitat (Kangah-Kesse et al., 2003). The orans in Rajasthan, in the vicinity of Bishnoi community villages provide protection to the Indian

gazelle (*Gazella gazella*), blackbuck (*Antelope cervicarpa*) (Fig. 2.3) and to the migratory bird like Demoiselle crane (*Anthropoides virgo*) and the important bird Great Indian Bustard (Dagla et al., 2007).

Fig 2.3. Nesting of Egret and snake bird on *A. nilotica* in Raghunathji Devban, Bhiluda, Dungarpur (left) and protecting wild life through conservation of Orans, Lohawat, Jodhpur (right)

7. THREATS AND OPPORTUNITIES

In recent age of liberalization, privatization and globalization, communities are losing their traditional bases of sustainable livelihoods. Forests, rangelands and other common land resources are being forced to enter into market system that generally regards nature as a commodity. This make community's deviate from the customs which were the guiding principle in protecting and maintaining sacred groves. As market-oriented social systems do not hold respectful attitude towards nature, sanctity of life has no place in this market-linked livelihood systems. Further, modern education system has no respect for local traditions. As a result this ancient and widespread institution is now weakening in terms of both cultural and biological integrity. Increasing pressure from population and livestock and encroachments are major threats. More worse is regularization of these encroachments by the Governments. Area and legal status of several sacred groves has not been clearly defined and lack effective legislation against offenders. Developmental activities, agricultural encroachment, increased resource use, cattle trampling and renovations of temples lead to damage this valuable habitat (Blicharska et al., 2013). Over-exploitation and unscientific collection of plants for varying uses, eroding

community values and lack of faith in the younger generation are other threats to the sacred groves (Yadeo et al., 2010; Rao and Sunitha, 2011). Despite of such threats there are lots opportunities too. These are responses of these sacred groves towards changing climate in terms of ecological succession and adaptability. A challenge towards devising management options with ever increasing threats of multiple uses and changing market economy.

Conclusion and recommendations

Sacred place, sacred trees and sacred groves have been flourishing since time immemorial. Culture of worshiping each live form in India is a way of celebrating the sanctity of life and sacred groves serve as a meaningful fusion of religion and ecology. Protecting nature's biodiversity and especially the rare types of life forms through sacred groves is the astonishing response of people to the conserve biodiversity. Availability of a number of plants and animals species described rare, endangered, vulnerable and threatened in sacred groves are living examples of rich and vibrant biodiversity in this cultural heritage. In addition to conserving biodiversity, sacred groves also conserve soil and water and are sources of water and ethno-medicinal plants. Besides it plays an important role protecting various life forms and sequester atmospheric carbon dioxide thus help mitigate climate change.

However, decline in traditional beliefs, westernization and market-linked economy and other socio-economic factors have undermined the status of the sacred groves. Lack of legal status and awareness, internal politics and conflicts, little or no financial support, encroachments of varying kinds and exotics invasion have led to the degradation of these resource-use areas. Grazing, lopping and removal of biomass from some of the sacred groves have also resulted in dwindling of these groves.

Concerted efforts are required to protect and conserve the sacred values of these deteriorating life support resources for the survival of existing biodiversity. For necessary protection and to maintain their natural identity and sanctity cooperation of the local people should be extended. Likewise surrounding village communities need to be educated and guided for sustaining the sanctity of existing grove in the area and strengthening them.

BIOLOGICAL DIVERSITY AND SATATUS OF SACRED GROVES IN RAJASTHAN

1. Background

The sacred groves in Rajasthan are illustrated by the Banis of Mewar, the Kenkris of Ajmer, the Orans of Jodhpur, Jaisalmer, Bikaner, the Shamlat Dehs and Devbanis of Alwar and Baag in south eastern Rajasthan regions. However, there is an overlap between 'gauchar' or 'roondhs', the common pastures, and 'Oran' the sacred woodland around a temple (Singh and Sishodia, 2003). Despite of climatic vagaries, sparse vegetation and limited water resources the tradition of maintaining sacred groves is still there in Rajasthan. The desert region of Rajasthan supports a higher density of human and animal populations than any other desert region in the world because of the conservation practices of the people of the region (GoI, 2011). About 8 to 9% of the total area of desert account sacred groves called 'Oran' in western Rajasthan.

Oran word is derived from the Sanskrit word Aranya, meaning forest. These are patches of jungle preserved in the name of local deities or saints. People believe that Aranya or the forest is the place where the Aranyakas ("Forest Books"), a part of the Vedas, were written. Development of Orans is a complex phenomena that can be viewed useful as varying along several continua ranging from socio-cultural; prehistoric to historic, recent, or newly created; secret or private to public; single religion to multi religious; intrinsic to extrinsic in value; uncontested to contested; and protected to endangered (Rathore and Shekhawat, 2012).

Delineation of an Oran is conducted during a ceremony called Doodh Jal or Kesar Chaanta, when boundaries of the sacred grove is marked by pouring Ganga water or saffron milk around a specific area within the forest, which is thereafter declared as an Oran or Dev bani (God's forest). There is report that Bisnois maintained 9 sacred groves in vicinity of their villages covering about 241 hectares area (Sethi and Vishwanath, 2003). In another report Jha *et al.* (1998) reported five sacred groves in Peepasar and Kherzadli village area of Jodhpur. Some of them are more than 200 year old. There are only a handful of documented sacred groves in Rajasthan, but their areas often exceed thousands of acres (Khiewtan and Ramakrishna, 1989; Tripathi *et al.*, 1995; Malhotra, 1999; Jamir and Pandey, 2002). About 2804 sacred groves have been documented in Rajasthan against the projected number of 25000 covering an area of more

than 6,00,000 hectares and providing livelihood to the rural population (Table 3.1). These sacred groves vary from 0.1 hectares to 500 hectares (Dande, 2014). According to a study Chaudhary *et al.* (2002) observed 732 'Orans' and 443 'Gauchars' covering 334 villages in 4 tehsils of Jodhpur district that vary from less than 2 hectares to greater than 320 hectares. Interestingly number of pond availability equaled to the number of Oran and Gauchars. Some big '*orans*' in Rajasthan are Bhadriyaji in Jaisalmer district that covers about 15000 hectares area and Kundla's Oran in Barmer district that covers about 7500 hectares (Khandal, 2014).

Gujjar community of Rajasthan use to plant 'Neem' (*Azadirachta indica*) and worship it as Neem-god. A Gujjar settlement normally starts near a water source or along a stream or river. Initially few houses are constructed and neem saplings procured from varying sources are planted in the enclosure around the hut, and worshiped it as the abode of God Deonarayan (Gold and Gujar, 1989). Likewise Bishnoi community in western Rajasthan protects 'Khezri' (*Prosopis cineraria*) from cuttings and associated sacred groves for promoting wild life (Gold and Gujar, 1989). The basic philosophy of the Bishnoi community faith is that all living things have a right to live and share resources; this group has a set of abiding laws including a ban on killing animals and on felling trees, especially the most sacred *khejri* tree, every part of which has numerous life-sustaining properties. The *orans* provide a protective habitat together with pasture lands for the Indian gazelle and blackbuck (Dixit et al., 2007). In some places in south east Rajasthan sacred groves are also named as ' Baag'- an ethno-silvihorticultural garden planted near settlements for fruit, fodder, fuel wood, medicine, NTFPs and shade, and said to be the backbone of livelihoods (Pandey, 2000).

It is not the tree only but animals are also conserved through such sacred groves. One best example is the Karni Mata ji Oran at Deshnok in Bikaner, where the rodents are regarded as reincarnations of the goddess's. Here one can see much deeper relation with nature on the 2,100 hectare woodland which is protected by the local communities. Thousands of rates can be seen freely roaming in the temple. Some of them are 'albino' too, which are considered to be luckier than the normal once. Villagers are following the orders of Mata Karni Devi and thousands of jhad beris (*Ziziphus nummularia*) -a fruit bearing shrub, dot the area as cattle of the whole village graze freely in the area. According to a belief, the goddess 'Karni Mata' had special affection for

cows and this town was established by her. Other worshiped trees are Salra (*Boswellia serrata*) and Pipal (*Ficus religiosa*) and are prohibited from either to cut them or to burn their wood. The trees on Chavariya hill are preponderantly (*Anogeissus pendula*) – a species that had dominated most of the hills of Aravallies through the first half of the 20th century, i.e. before radical deforestation (Gold and Gujar, 2002).

Table 3.1. Distribution of sacred groves in different districts of Rajasthan and the area covered under it.

SNo.	District	Number of Scared groves			Area (ha)	Reference
		ENVIS	CECODECON	All		
1	Ajmer	38	-	38	1424	Envis
2	Alwar	116	-	163	7459	Singh and Sisodia (2003)
3	Banswara		18	18		CECODECON
4	Baran		-	3		Gold and Gujar (1997)
5	Barmer	6	253	253	14532	CECODECON/Singh (2008)
6	Bharatpur	-	-	5		Charanji (2008)
7	Bhilwara	9	-	9	431	Envis/ Gujar and Gold(2007)
8	Bikaner	5	-	5	3142	Envis
9	Bundi	-	-	1	-	Gold and Gujar (1997)
10	Chitaurgarh	5	83	83	955	CECODECON
11	Dausa	12	-	12	149	Envis
12	Dungarpur	-	25	25		CECODECON
13	Jaipur	26	-	26	693	Envis
14	Jaisalmer	10	27	28	52743	Envis, CECODECON, CSE (2003)
15	Jhalawar	1		1		UNDP (2008)
16	Jalore	3	22	22	266	CECODECON
17	Jodhpur	-	-	1690	-	Chaudhary *et al.* (2002), Anon (2004)
18	Kota	-	-	2	-	Gold and Gujar (1997)
19	Nagaur	-	31	31	-	CECODECON
20	Pali	-	57	57	-	CECODECON
21	Rajsamand	-	13	13	-	CECODECON
22	Sikar	4	2	4	760	Envis/ CECODECON
23	Sirohi	2	92	92	138	Envis/ CECODECON
24	Tonk	3	-	3	331	Envis
25	Udaipur	221	46	221	6387	Envis/ CECODECON
	Total	461	669	2804		

Sources: ENVIS; Chaudhary *et al.*, 22002; CECODECON, Charanji (2008); and SewaMandir (1997).

Sacred grove (Oran) serves four main purposes: vegetation as grazing ground for the livestock; watering place for the livestock; resting places for the livestock; and availability of medicine in

ethno botanical form. It play an important role in promoting a flourishing livestock based economy and growth of livestock rearing communities in Rajasthan. The sustainable lifestyle practiced by the desert people in the past and the common resource pool in the villages in the form of "Orans" and "gochars" had made the Thar desert one of the most livable dry lands in the whole world (The Hindu, 7th July 2007). According to a study, about 41% livestock in Barmer district of Rajasthan is dependent on these resources. Though water availability in the ponds varied widely, but most of the sacred groves have water ponds and other water body therein. Survey of all 163 existing *Orans* in Alwar district, a water body like Johad, Tank, spring, Baori, Well etc were reported (Singh, 2010).

Sacred Forestry

'Jharan Mahadeo' sacred grove in Jhalawar is situated along the stream leading to a large tank that ensures round the year supply of water to the city of Jhalawar. This is the only green patch in the area. It is important because it protects catchment that might otherwise be silted very quickly in the absence of vegetation. Rare plants include *Bambusa hamiltonii* and *Schleichera oleosa*. It is also important because it is a de facto sanctum sanctorum of threatened plants, all of which have become extinct in the adjoining area outside the grove. The Jharan Sacred Grove is also an indicator and benchmark of forests that might have existed in the region. Today, it is a natural laboratory, a habitat island, a gene bank and a store-house of ethno-medicine. There is a perennial water spring. The Forest Department has run a forest nursery inside the groves for the last 50 years for the production of seedlings for plantations and distribution. This ensures the survival of the grove in its original condition.

UNDP, 2009

Many rituals are performed in these sacred groves. For examples, many orans host an annual mela (festival), at which communities reaffirm their commitment to the forest and the deity. Presence of a Mahatma or priest is a socio-cultural phenomenon in most of the sacred groves. Somewhere between a sentry and saddhu, the mahatma resides in an Oran or asides and, in exchange for basic provisions from the community, keeps watch over the forest and its other inhabitants (Singh, 2011). However, the traditional community practices of conserving and managing these sacred groves is rapidly declining.

2. Documentation of some sacred groves

After the finalization of the design and the number of sacred groves was to be surveyed, field study was conducted. Based on the various information collected through field observations and people interaction, a format has been designed for compilation of data for easy access and knowledge about the particular sacred grove. Following information have been incorporated in the format together with a photograph of the site in the preceding sheets for sacred grove number 1 to 123. This includes sacred grove number for its location in the given Google map.

A. Basic Information about the sacred groves

- Name of village
- Panchayat Samiti
- Nearest Forest block
- District
- Name of sacred grove
- Geographical position

B. Topographical features

- Erosion status
- Topography
- Soil depth

C. Vegetation status

- Tree species (>30 cm girth) with importance value index (IVI)
- Shrub species with IVI
- Effective number of species (ENS): For trees (>30 cm girth) and shrubs
- Herbs and grass species

D. Wild-life

- Animals
- Birds

E. Soil characteristics

- Soil pH and electrical conductivity (EC),
- Soil bulk density
- Soil organic carbon (SOC), and soil carbon density in 0-30 cm soil layer

3. Topography and soil erosion in sacred groves

Delineation of the sacred groves has been done mostly in hill slopes or in plain land, which covered about 29% and 63% of the sacred groves, respectively. About 5% of the sacred groves are observed on hill top and another five per cent along the river or have river passing through it (Table 3.2). About 28 (23%) sacred groves had soil depth of <20 cm. Another 15% fell into 25-50 cm soil depth region. About 15% sacred groves have soil depth 50-100 cm, whereas rests 46% sacred groves had deep soil and appears to be favourable for enhanced diversity and productivity (Table 3.2).

Table 3.2. Topographical positions of the sacred groves and the soil depth therein in the sacred groves of Rajasthan.

Topography	Number of sacred groves	Soil depth	Number of sacred groves
Hill top	6	Shallow (<25 cm)	28
Hill slope	35	Moderately deep (25-50)	19
Plateau	1	Moderate (50-100)	19
Plane	77	Deep (>100 cm)	57
Valley (riverbed)	4		

Status of soil surface of the studied sacred groves indicated varying degree of erosion (Table 3.2). Out of the 123 sacred groves almost 27% sacred groves indicated slight erosion and under safe condition. About 67% of the sacred groves showed moderate soil erosion. This indicates that almost 90 % of the sacred groves vary between slight to moderate level of soil erosion. Severity of the soil erosion was high in about 10% of the sacred groves, in which 5% fell into severe category, whereas another 5% fell into gullies with ravenous structure.

Table 3.3. Erosion status of the soil surface in studied sacred groves of Rajasthan.

Erosion status	Number of sacred groves	Sacred grove number
Slight	33	5-8, 22-24, 27, 37, 46-48, 50-51, 56, 58, 63, 67, 70, 75, 77, 79, 81, 85, 88, 92, 102-104, 108, 110-112, 120
Moderate	82	1, 3, 4, 7, 9, 10-21, 25-26, 28-36, 38-45, 49, 52-53, 55, 57, 59-62, 64-66, 68-69, 73-74, 76, 78, 80, 82-83, 86, 89-91, 93-100, 105-107, 113-119, 121-123
Severe	4	54, 84, 87, 109
Gullied	4	2, 71-72, 101

DATA ON SACRED GROVES OF RAJASTHAN	
Sacred Grove No.	**1**
A. Basic Information about the sacred groves	
Name of sacred groves	Devnarayan Ji Ka Oran
Name of village	Devnagar
Panchayat	Pishangan
Nearest forest Block	Devnagar-khori
District	Ajmer
Area	20 bigha
Altitude (m)	473
Latitude	26° 31’ 36.3
Longitude	74° 33’ 41.5

B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
Prosopis juliflora (194), *Ficus benghalensis* (55), *Tamarindus indica* (20), *Prosopis cineraria* (17), *Acacia leucophloea* (14)	*Lantana camara* (170), *Calotropis procera* (131)
Effective Number of Species (ENS) of Tree > 30: 1.38	**ENS of Shrub: 2.00**
Herb and Grass species	
Eragrostis ciliaris, Eragrostis tenella, Eragrostis minor, Tridax procumbens, Evolvulus alsinoides, Polygala erioptera, Indigofera cordifolia, Commelina benghalensis, Dactyloctenium sindicum, Datura stramonium, Peristrophe paniculata, Phyllanthus amarus, Sida cordifolia, Tragus roxburghii.	
D. Wild-life	
Blue Bull, Jackal, Hare, Pea Fowl, Jungle Babbler.	
E. Soil characteristics	

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.52	0.25	0.195	1.44	5.31

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**2**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bheruji Ka Oran					
Name of village	Naand					
Panchayat	Pushkar					
Nearest forest block	Naand					
District	Ajmer					
Area of sacred grove	70 bigha					
Altitude (m)	448					
Latitude	26° 28’ 49.4					
Longitude	74° 27’ 21.9					
B. Topographical features						
a)	Erosion:	Slight	Moderate	Severe	√ **Gullied**	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
Maytenus emarginata (231), *Acacia excelsa* (26), *Ailanthus excelsa* (17), *Acacia leucophloea* (14), *Prosopis juliflora* (12)					*Acacia jacquemontii* (170), *Leptadenia pyrotechnica* (91), *Crotalaria burhia* (39)	
Effective Number of Species (ENS) of Tree : 1.59					**ENS of Shrub:** 4.70	
Herb and Grass						
Amaranthus viridis, Boerhaevia diffusa, Borreria articularis, Brachiaria ramose, D. sindicum, E. alsinoides, I. cordifolia, Indigofera linifolia, Indigofera linnaei, Justicia procumbense, P. paniculata, Tephrosia purpurea, Tribulus terrestris, P. amarus, T. roxburghii.						
D. Wild life						
Chinkara, Jackal, Blue Bull, Pea Fowl, Jungle Babbler, Grey Partridge						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.28	0.19	0.060	1.58	1.80

DATA ON SACRED GROVES OF RAJASTHAN

Sacred Grove No.	**3**

A. Basic Information about the sacred groves	
Name of sacred groves	Bhuna Bai ji ka Oran
Name of village	Bhuna bai
Panchayat	Ajmer
Nearest forest Block	Muabead
District	Ajmer
Area of sacred grove	25 bigha
Altitude (m)	515
Latitude	26° 29’ 54.1
Longitude	74° 40’ 19.6

B. Topographical features

a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√ **Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)

C. Vegetation status

Tree species with IVI	**Shrub species with IVI**
Prosopis juliflora (246), *Cordia gharaf* (29), *Ficus infectoria* (25)	*Calotropis procera* (125), *Jatropha gossypifolia* (109), *Grewia tenax* (22), *Lantana camara* (22), *Securinega virosa* (22)
ENS of Tree : 1.31	**ENS of Shrub:** 4.00

Herb and Grass

Aristida funiculata , Borreria pusilla, B. diffusa, Dipteracanthus patulus, Pupalia lappacea, Triumfetta rhomboide, Zornia gibbosa, D. sindicum, E. alsinoides, I. cordifolia, Justicia procumbense, P. paniculata, T. purpurea, Tribulus terrestris, P. amarus, T. roxburghii, Vernonia cinerea, Xanthium stramonium.

D. Wild-life

Jackal, Hare, Dove, Grey Partridge, Red-vented bulbul, House sparrow.

E. Soil characteristics

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.23	0.09	0.105	1.55	2.98

7. History

As per villagers Bhuna Bai- a lady got meditated here and protected the villagers from the ill effect of a devil.

DATA ON SACRED GROVES OF RAJASTHAN

Sacred Grove No.	**4**
A. Basic Information about the sacred groves	
Name of sacred groves	Mandal Das ji Ka Oran
Name of village	Todli
Panchayat	Ramgarh
Forest Block	
District	Alwar
Area of sacred grove	240 bigha
Altitude (m)	262
Latitude	27° 38’ 40.0
Longitude	76° 45’ 40.6

B. Topographical features

a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	Plane	√**Valley (riverbed)**
c)	Soil Depth	Shallow (<25 cm)	**Moderately deep (25-50)**		Moderate (50-100)	√Deep (>100 cm)

C. Vegetation status

Tree species with IVI	**Shrub species with IVI**
Acacia nilotica (145), *Maytenus emarginata* (33), *Acacia senegal* (31), *Prosopis cineraria* (27), *Salvadora oleoides* (25), *Capparis decidua* (12), *Holoptelea integrifolia* (8), *Acacia nilotica var. cupressiformis* (8), *Acacia leucophloea* (6), *Balanites aegyptiaca* (6)	*Ziziphus nummularia* (205), *Lycium barbarum* (35), *G. tenax* (22), *Capparis sepiaria* (21), *Leptadenia pyrotechnica* (17)
ENS of Tree : 5.17	**ENS of Shrub:** 2.28

Herb and Grass

Achyranthes aspera, Arnebia hispidissima, Cynodon dactylon, Dactyloctenium aegyptium, B. diffusa, I. linnaei, Spergula arvensis, E. minor, Cenchrus ciliaris, Saccharum munja, Argemone mexicana, Chenopodium murale, Parthenium hysterophorus, E. alsinoides, I. cordifolia, T. Purpurea.

D. Wild-life

Blue bull, Porcupine, Hyena, Hare, Dove, Bank Myna.

E. Soil characteristics

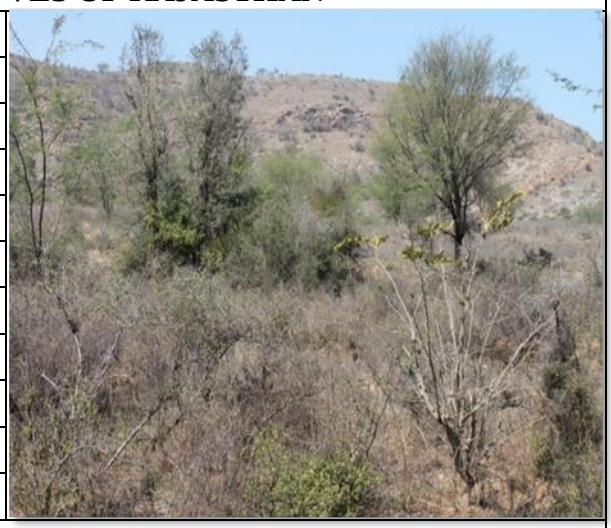
pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.66	0.29	0.435	1.40	17.05

7. History

Sh Mandal Das ji got meditated in the foothill. There is a temple on the hill top at present.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**5**					
A. Basic Information about the sacred groves						
Name of sacred groves	Hanuman Ji Ka Oran					
Village	Jatwada					
Panchayat	Laxmangarh					
Forest Block	Laxmangarh					
District	Alwar					
Area of sacred grove	700 bigha					
Altitude (m)	226					
Latitude	27° 15’ 26.8					
Longitude	76° 53’ 55.5					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth:	Shallow (<25 cm)	Moderately deep (25-50)		√ **Moderate (50-100)**	Deep (>100 cm)
B. Vegetation status						
Tree species with IVI				**Shrub species with IVI**		
Salvadora oleoides (142), *Acacia. nilotica* (35), *H. integrifolia* (33), *Azadirachta indica* (31), *P. cineraria* (26), *C. decidua* (23), *Cordia myxa* (5), *A. leucophloea* (5)				*Clerodendrum phlomidis* (107), *C. sepiaria* (100), *Adhatoda vasica* (73), *Cadaba fruticosa* (11), *Calotropis procera* (10)		
ENS of Tree : 4.19				**ENS of Shrub:** 3.54		
Herb and Grass						
A. aspera, C. dactylon, B. diffusa, I. linnaei, E. alsinoides, I. cordifolia.						
D. Wild-life						
Rabbit, Blue bull, Hyena, Jackal, Dove, Pea Fowl, Parakeet, Pea Fowl.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
8.15	0.18	0.375	1.42	10.68

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**6**					
A. Basic Information about the sacred groves						
Name of sacred groves	Jharna Ji Ka Oran					
Name of village	Lioi, Raipur, Makreta					
Panchayat	Toda					
Forest Block	Toda					
District	Alwar					
Area of sacred grove	100 bigha					
Altitude (m)	232					
Latitude	27° 19’ 49.3					
Longitude	76° 53’ 48.0					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth:	Shallow (<25 cm)	√ **Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)
B. Vegetation status						
Tree species with IVI				**Shrub species with IVI**		
P. juliflora (92), *M. emarginata* (36), *B. aegyptiaca* (34), *P. cineraria* (33), *A. nilotica* (30), *Anogeissus pendula* (24), *C. decidua* (23), *H. integrifolia* (22), *Acacia tortilis* (7)				*Z. nummularia* (150), *C. sepiaria* (63), *S. virosa* (43), *G. tenax* (31), *L. barbarum* (13)		
ENS of Tree: 5.90				**ENS of Shrub:** 3.24		
Herb and Grass						
B. diffusa, E. alsinoides, I. cordifolia.						
D. Wild-life						
Blue Bull, Jackal, Rat, King Cobra, Hare, Mongoose, Dove.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.69	0.22	0.705	1.35	21.95

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred grove No.	**7**					
A. Basic Information about the sacred groves						
Name of sacred groves	Rupu Ka Vas Oran					
Name of village	Godi, Arnar, Amada, Bhopada					
Panchayat	Thanagari					
Forest Block	Thanagari					
District	Alwar					
Area (bigha)	150					
Altitude (m)	487					
Latitude	27° 23’ 17.3					
Longitude	76° 16’ 11.7					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√ **Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)
B. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. pendula (248), *C. decidua* (52)					no	
ENS of Tree : 1.17					**ENS of Shrub: 1.00**	
Herb and Grass						
Adiantum lunulatum, Actiniopteris radiata, Aerva lanata, B. diffusa, E. alsinoides, I. Cordifolia.						
D. Wild-life						
Blue Bull, Pea Fowl, Parakeet, House Sparrow.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.66	0.18	1.140	1.32	31.15

DATA ON SACRED GROVES OF RAJASTHAN

Sacred Grove No.	**8**

A. Basic Information about the sacred groves	
Name of sacred groves	Shiv Ji Maharaj Ka Oran
Name of village	Garh Bassi
Panchayat	Thanagazi
Nearest forest Block	Garh bassi
District	Alwar
Area	125 bigha
Altitude (m)	434
Latitude	27° 23’ 35.6
Longitude	76° 13’ 48.0

B. Topographical features

a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√ **Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)

C. Vegetation status

Tree species with IVI	**Shrub species with IVI**
A. leucophloea (110), *A. senegal* (45), *P. juliflora* (39), *A. indica* (39), *B. aegyptiaca* (31), *H. integrifolia* (23), *A. nilotica* (15), *Moringa concanensis*	*A. vasica* (73), *Z. nummularia* (55), *Dichrostachys cinerea* (34), *Rhus mysurensis* (31), *G. tenax* (29), *Commiphora wightii* (23), *Grewia flavescence* (19), *C. sepiaria* (19), *S. virosa* (10), *C. fruticosa* (9)
ENS of Tree : 5.48	**ENS of Shrub:** 7.00

Herb and Grass

Elytraria acaulis, A. radiata, Euphorbia hirta, Pavonia arabica, T. purpurea, B. diffusa, E. alsinoides, I. cordifolia.

D. Wild-life

Red vented bulbul, Ring dove, Pea fowl.

E. Soil characteristics

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.94	0.31	0.300	1.43	5.74

7. History

A fair is used to commence here in October each year.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**9**					
A. Basic Information about the sacred groves						
Name of sacred groves	Dagia Bheruji Ka Oran					
Name of village	Lakheria, Ghatol					
Panchayat	Ghatol					
Nearest forest Block	Lakeria					
District	Banswara					
Area	84 bigha					
Altitude (m)	267					
Latitude	23° 45’ 08.5					
Longitude	74° 24’ 55.9					

B.Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
Tectona grandis (150), *H. integrifolia* (66), *Adina cordifolia* (61), *Wrightia tinctoria* (13), *A. indica* (11)	*L. camara* (161), *Barleria prionitis* (94), *C. sepiaria* (45)
ENS of Tree : 1.38	**ENS of Shrub: 2.55**

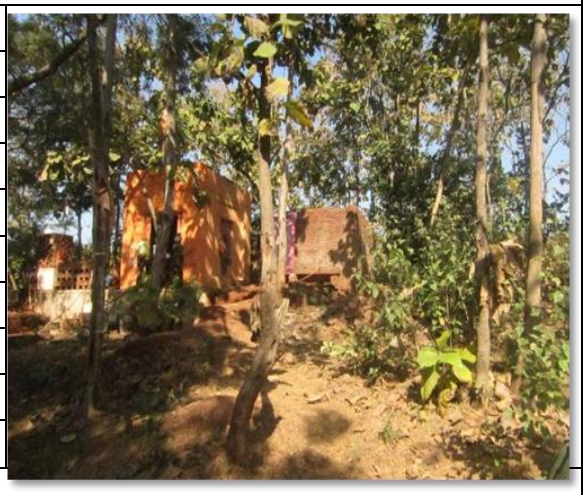
Herb and Grass
Elytraria acaulis, Euphorbia hirta, T. purpurea, B. diffusa, E. alsinoides, I. Cordifolia.

D. Wild-life
Blue Bull, Jackal, Parakeet, Jungle Crow.

E. Soil characteristics

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
6.33	0.12	0.623	1.36	9.29

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**10**					
A. Basic Information about the sacred groves						
Name of sacred groves	Prathurinath ji Ka Oran					
Name of village	Amlipada					
Panchayat	Banswara					
Nearest forest Block	Anand sagar					
District	Banswara					
Area	35 bigha					
Altitude (m)	270					
Latitude	23° 32’ 51.3					
Longitude	74° 28’ 30.1					



B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
T. grandis (160), *A. cordifolia* (47), *Aegle marmelos* (41), *Morinda tinctoria* (17), *Diospyros melanoxylon* (17), *Mitragyna parviflora* (17)	No shrub
ENS of Tree : 2.39	**ENS of Shrub: 1.00**
Herb and Grass	
Alysicarpus vaginalis, Cassia tora, E. acaulis, E. hirta, B. ramose, B. diffusa, E. alsinoides, I. cordifolia.	
D. Wild-life	
Panther, Blue Bull, Jackal, Jungle Crow, Parakeet.	
E. Soil characteristics	

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
6.12	0.19	1.080	1.40	12.64

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**11**					
A. Basic Information about the sacred groves						
Name of sacred groves	Sai Baba Ka Mandir					
Name of village	Anari					
Panchayat	Banswara					
Nearest forest block	Anand sagar					
District	Banswara					
Area	14 bigha					
Altitude (m)	265					
Latitude	23° 32’ 53.4					
Longitude	74° 27’ 54.5					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	√ **Hill top**	Hill slope	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√ **Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI			**Shrub species with IVI**			
T. grandis (131), *A. leucophloea* (60), *P. juliflora* (55), *Bombax ceiba* (38), *A. indica* (17)			*L. camara* (114), *C. procera* (107), *Z. nummularia* (42), *Cassia auriculata* (37)			
ENS of Tree : 2.73			**ENS of Shrub: 3.59**			
Herb and Grass						
A. vaginalis, C. tora, B. ramosa, B. diffusa, D. sindicum, E. alsinoides, I. cordifolia, E. acaulis, E. hirta, Leonotis nepetifolia.						
D. Wild-life						
Panther, Jackal, Hyena, Parakeet, Pea Fowl, King Cobra.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.20	0.18	0.420	1.41	7.19

F. History and status

Approx.250 years old. People believe that God Bheroji appeared from a wall where the present statue is. The old temple is under ruin and the new temple was built up in 1982.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**12**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnarayan Ji Ka Oran					
Name of village	Jhadoda					
Panchayat	Attru					
Nearest forest block	Jhadoda					
District	Baran					
Area	28 bigha					
Altitude (m)	293					
Latitude	24° 47’ 58.6					
Longitude	76° 28’ 49.9					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	√ **Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
Butea monosperma (133), *P. juliflora* (40), *Tamarindus indica* (31), *M. parviflora* (30), *Phoenix sylvestris* (21), *A. marmelos* (13), *P. cineraria* (13), *A. leucophloea* (10), *Crataeva nurvala* (10)					*Z. nummularia* (129), *Flacourtia indica* (45), *C. sepiaria* (44), *S. virosa* (43), *Carissa carandas* (19)	
ENS of Tree : 4.09					**ENS of Shrub: 4.37**	
Herb and Grass						
Blumea eriantha, Cassia tora, E. hirta, T. roxburghii, T. procumbense						
D. Wild-life						
Hare, Pea Fowl, Parakeet, Grey Partridge, Jackal, Blue Bull, Jungle Crow, Snake, Hanuman Langur.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.59	0.59	0.285	1.47	10.05

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**13**					
A. Basic Information about the sacred groves						
Name of sacred groves	Musain Mata Ji Ka Oran					
Name of village	Musain Mata ji					
Panchayat	Attru					
Nearest forest block	Musain Mata ji					
District	Baran					
Area of sacred grove	150 bigha					
Altitude (m)	490					
Latitude	24° 48’ 10.3					
Longitude	76° 38’ 19.8					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√ **Moderate (50-100)**	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. pendula (190), *D. melanoxylon* (32), *A. leucophloea* (27), *G. montana* (16), *Acacia catechu* (13), *Anogeissus latifolia* (12), *P. juliflora* (11)					*Carissa carandas* (186) *F. indica* (62), *C. sepiaria* (21), *Z. nummularia* (16), *S. virosa* (15)	
ENS of Tree : 4.22					**ENS of Shrub: 2.97**	
Herb and Grass						
E. hirta. T. roxburghii, T. procumbense, E. alsinoides, I. Cordifolia.						
D. Wild-life						
Bear, Tiger, Dear, Hare, Pea Fowl, Parakeet, Grey partridge, Jackal, Blue Bull, Jungle Crow, Snake, Hanuman Langur, Wild pig.						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
7.62	1.94	0.390	1.48	10.58		
F. History and status						
In ancient time area was covered with dense forest and many wild animals lived here, roaring of the lion or panther could be heard in evening. People started worshiping the miraculous Goddess, in name of whom this oran is conserved at present.						

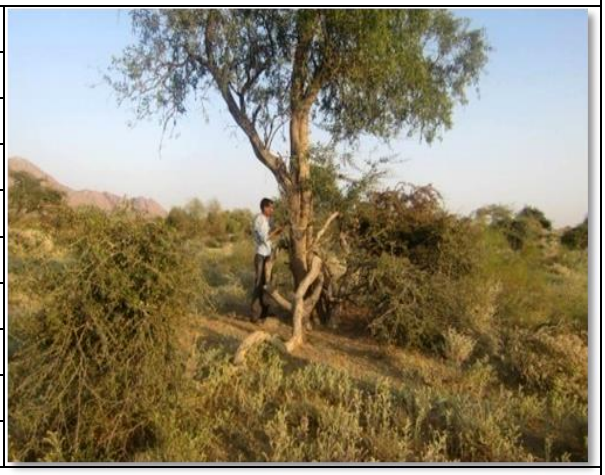
DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**14**					
A. Basic Information about the sacred groves						
Namew of sacred groves	Kalla ji Ka Bagh (Nag)					
Name of village	Tanchla					
Panchayat	Chhipabadod					
Nearest forest Block	Tanchla					
District	Baran					
Area (bigha)	86					
Altitude (m)	331					
Latitude	24° 41’ 05.2					
Longitude	76° 43’ 39.9					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√ **Moderate (50-100)**	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					Shrub species with IVI	
B. monosperma (95), *P. juliflora* (47), *M. parviflora* (46), *H. integrifolia* (37), *A. leucophloea* (28), *Terminalia arjuna* (14), *A. pendula* (10), *Holarrhena antidysenterica* (9), *Syzygium cummini* (7)					*C. sepiaria* (300)	
ENS of Tree : 5.77					**ENS of Shrub: 1.00**	
Herb and Grass						
C. tora, E. hirta, T. procumbense, E. alsinoides, I. cordifolia.						
D. Wild-life						
Bear, Deer, Hare, Pea Fowl, Parakeet, Pigeon, Grey Partridge, Jackal, Blue Bull, Jungle Crow, Snake, Hanuman Langur, Mangoose.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.87	0.17	0.555	1.52	16.05

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**15**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bankal Mata ji Ka Oran					
Name of village	Ranigaow					
Panchayat	Barmer					
Nearest forest Block	Ranigaon					
District	Barmer					
Area	800 bigha					
Altitude (m)	173					
Latitude	25° 35’ 57.9					
Longitude	71° 17’ 50.5					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√ **Moderate (50-100)**	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
Tecomella undulata (181), *S. oleoides* (78), *P. juliflora* (41)					*Aerva persica* (249), *Z. nummularia* (196)	
ENS of Tree : 2.34					**ENS of Shrub: 1.89**	
Herb and Grass						
T. purpurea, Lindenbergia muraria, A. senegalensis.						
D. Wild-life						
Chinkara, Pea fowl, Grey Partridge, Dove, Hare, Desert rat, Desert Fox, Chameleon.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.80	0.21	0.150	1.58	5.17

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**16**					
A. Basic Information about the sacred groves						
Name of sacred groves	Viratra Mata Ka Oran					
Name of village	Dhok					
Panchayat	Dhok					
Nearest forest Block	Chouhatan					
District	Barmer					
Area	1859 ha					
Altitude (m)	234					
Latitude	25° 27’ 48.2					
Longitude	71° 01’ 34.4					



B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100cm)**

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
M. emarginata (224), *S. oleoides* (58), *A. tortilis* (19)	*Z. nummularia* (92), *C. burhia* (54), *Calligonum polygonoides* (51), *Aerva pseudotomentosa* (50), *L. barbarum* (20), *A. jacquemontii* (16), *Marva oblongifolia* (9), *L. pyrotechnica* (8)
ENS of Tree : 1.65	**ENS of Shrub:** 5.79

Herb and Grass

Ephedra foliata, Aristida funiculata, A. hispidissima, B. erecta, D. sindicum, Mollugo cerviana, P. erioptera, T. roxburghii.

D. Wild-life

Chinkara, Blue Bull, Desert Fox, Pea Fowl, Hare, Grey Partridge, Chameleon, Chandan Goh, Kite Eagle.

E. Soil characteristics

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.26	0.15	0.060	1.60	2.88

F. History and status

Shree Vakrangi Mata (Vankal Mata) is the KulDevi of Nandwana community. The Oran is covering 1859 ha area. Penalties for violations are Rs. 500 to 1000, imposed by the Oran Prabandhak Samiti, involving 7-8 villages. Earlier the Samiti was dominated by Rajputs, but now other casts have also joined and their needs accommodated.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**17**					
A. Basic Information about the sacred groves						
Name of sacred groves	Mata ji Ka Oran					
Name of village	Unrod					
Panchayat	Shiv					
Nearest forest Block	Harshani					
District	Barmer					
Area	2000 bigha					
Altitude (m)	152					
Latitude	26° 06’ 18.1					
Longitude	70° 45’ 59.3					
B.Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI			**Shrub species with IVI**			
C. decidua (300)			*Z. nummularia* (127), *C. procera* (112), *L. pyrotechnica* (45), *A. pseudotomentosa* (16)			
ENS of Tree : 1.00			**ENS of Shrub: 3.55**			
Herb and Grass						
A. funiculata, Corchorus depressus, E. minor, Fegonia cretica, Heliotropium species, T. roxburghii.						
D. Wild-life						
Chinkara, Desert fox, Hare, Jackal, Chameleon, Sand boa, Grey Partridge, Red-vented bulbul, Sun bird						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.78	0.18	0.135	1.59	6.05

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**18**					
A. Basic Information about the sacred groves						
Name of sacred groves	Khubad Mata Ji Ka Oran					
Name of village	Nimbal Kot					
Panchayat	Koslu					
Forest Block	Banadion ki dhani					
District	Barmer					
Area	210 bigha					
Altitude (m)	105					
Latitude	25° 31’ 31.6					
Longitude	71° 43’ 52.0					

B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
S. oleoides (174), *P. cineraria* (50), *C. decidua* (39), *T. undulata* (33)	*C. phlomidis* (138), *A. pseudotomentosa* (85), *L. pyrotechnica* (73), *Lycium barbarum* (5)
ENS of Tree : 2.81	**ENS of Shrub: 2.97**
Herb and Grass	
Cenchrus biflorus, E. minor, Heliotropium marifolium, Leucas cephalotes, Solanum albicaule, T. purpurea, T. roxburghii.	
D. Wild-life	
Blue bull, Chinkara, Jackal, Desert Fox, Dove, Grey Partridge, Hare, Kite Eagle, Red-vented Bulbul and Spiny tailed lizard.	

E. Soil characteristics

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.90	0.15	0.090	1.58	4.27

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**19**					
A. Basic Information about the sacred groves						
Name of sacred groves	Mama ji Ki Selenadi					
Name of village	Doli					
Panchayat	Doli					
Nearest forest Block	Sarvadi					
District	Barmer					
Area	400 bigha					
Altitude (m)	160					
Latitude	26° 05’ 21.4					
Longitude	72° 39’ 11.3					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
P. cineraria (101), *C. decidua* (85), *P. juliflora* (45), *S. oleoides* (66)					*Z. nummularia* (300)	
ENS of Tree : 3.54					**ENS of Shrub: 1.00**	
Herb and Grass						
B. diffusa, D. sindicum, Euphorbia granularis, I. cordifolia, Justicia procumbens, P. crispa, Zygophyllum simplex.						
D. Wild-life						
Peacock, Chinkara, Hare, Grey Partridge, Chameleon, Pata Goh.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.88	0.16	0.089	1.58	4.03

F. History

This area is now considered as community reserve observed in famous Dhava-Doli wild life area of Jodhpur-Barmer region.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**20**					
A. Basic Information about the sacred groves						
Name of sacred groves	Ghanshsyam Baba Ka Ashram					
Name of village	Mulla					
Panchayat	Kanwara					
Nearest forest Block	Kanwara					
District	Bharatpur					
Area	500 bigha					
Altitude (m)	202					
Latitude	27° 36’ 50.6					
Longitude	72° 18’ 68.1					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
S. oleoides (224), *P. cineraria* (77), *A. pendula* (45), *H. integrifolia* (42), *A. indica* (33), *C. decidua* (30), *B. aegyptiaca* (23), *Ficus religiosa* (10), *Pongamia pinnata* (6), *Morus alba* (5), *Dalbergia sissoo* (4), *Cordia dichotoma* (3)					No shrub	
ENS of Tree : 6.75					**ENS of Shrub: 1.00**	
Herb and Grass						
B. diffusa, D. sindicum, E. hirta, I. cordifolia, J. procumbens.						
D. Wild-life						
Hare, Pea Fowl, Parakeet, Pigeon, Grey Partridge, Jackal, Blue Bull, Jungle Crow, Snake, Monkey.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.04	0.11	0.338	1.48	13.75

F. History

This is 25-30 years old grove. People of two villages donated their lands for this sacred grove and on demand of villagers Baba Ghanshyamdas secured this place. Baba Ramchara Das constructed this temple and baba Makhandas is now taking care of it.

DATA ON SACRED GROVES OF RAJASTHAN

Sacred Grove No.	**21**

A. Basic Information about the sacred groves

Name of sacred groves	Adi Badri Dham
Name of village	Alipur
Panchayat	Pasopa
Nearest forest Block	Pasopa
District	Bharatpur
Area	4.5 bigha
Altitude (m)	207
Latitude	27° 32’ 00.0
Longitude	77° 12’ 18.2

B. Topographical features

a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√**Moderate (50-100)**	Deep (>100 cm)

C. Vegetation status

Tree species with IVI	**Shrub species with IVI**
M. parviflora (74), *C. dichotoma* (55), *A. indica* (54), *F. religiosa* (45), *T. indica* (24), *A. marmelos* (18), *Lawsonia inermis* (14), *A. lebbeck* (9), *Mangifera indica* (7)	*Z. nummularia* (300)
ENS of Tree : 5.84	**ENS of Shrub: 1.00**

Herb and Grass

no

D. Wild-life

Hare, Pea Fowl, Parakeet, Pigeon, Grey Partridge, Jackal, Jharakh, Blue Bull, Jungle Crow, Snake, Monkey, Myna, House Sparrow.

E. Soil characteristics

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.67	0.12	0.315	1.49	11.65

F. History

It is said that Nand Baba was not having a child. He prayed if child is born he will travel to all Teerth. After fulfillment of his desire, Baba requested Lord Krishna for travel of all Teerth. In reply Lord said – I will bring all Teerth here for you and did so by bringing all Teerth at this place within a moment.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**22**					
A. Basic Information about the sacred groves						
Name of sacred groves	Sawai Bhoj/Devnarayan Mandir					
Name of village	Asind					
Panchayat	Asind					
Forest Block	Amesar					
District	Bhilwara					
Area	679 bigha					
Altitude (m)	467					
Latitude	254351.9					
Longitude	742054.7					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√ **Moderate (50-100)**	Deep (>100 cm)

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
P. juliflora (88), *Salvadora persica* (56), *A. leucophloea* (44), *P. cineraria* (31), *A. indica* (26), *A. senegal* (21), *C. decidua* (19), *B. aegyptiaca* (14)	*Euphorbia neriifolia* (113), *G. tenax* (71), *S. virosa* (61), *Z. nummularia* (31), *D. cinerea* (24)
ENS of Tree : 6.16	**ENS of Shrub: 4.34**

Herb and Grass

A. aspera, Enicostemma axillare, A. funiculata, Apluda mutica, A. vaginalis, Barleria acanthoides, B. barbata, B. erecta, Chloris barbata, C. benghalensis, Crotalaria medicaginea, Cassia pumila, D. fovelatum, E. hirta, Heteropogon contortus, Hibiscus species, I. cordifolia, Martynia annua, Pentatropis spiralis, Sporobolus species.

D. Wild-life

Blue Bull, Jackal, Chameleon, Pea Fowl, Kite Eagle, Dove, Grey Partridge, Quilt (Bater).

E. Soil characteristics

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.33	0.20	1.080	1.42	32.91

F. History

This temple was built in 10th century by Sh. Sawai Bhoj on the left bank of the Khari River. This temple is now dedicated to Lord Deo Narain' and caters the religious need of Gujar community.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**23**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnaryan Ji Ki Bani					
Name of village	Ladpura					
Panchayat	Mandalgarh					
Nearest forest block	Naya nagar					
District	Bhilwara					
Area	400 bigha					
Altitude (m)	393					
Latitude	25° 08’ 37.8					
Longitude	75° 06’ 35.8					

B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	√ **Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
A. pendula (225), *Acacia catechu* (63), *Anogeissus latifolia* (10), *P. cineraria* (10)	No shrub
ENS of Tree : 1.56	**ENS of Shrub: 1.00**

Herb and Grass

A. lunulatum, B. pussilla, C. dactylon, C. tora, D. aegyptium, E. alsinoides, Funaria, Glossocardia bosvallia, H. hispida, Hibiscus species, I. cordifolia, J. procumbense, T. tennala, Themeda species.

D. Wild-life

Blue Bull, Jackal, Rabbit, Red vented Bulbul, Dove.

E. Soil characteristics

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.42	0.22	1.155	1.41	29.48

F. History and status

This temple was built by Nayanagar King Mann Singh during his journey to this area.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**24**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnaryan ji Ka Oran					
Name of village	Manpur					
Panchayat	Mandalgarh					
Nearest forest Block	Manpura beed					
District	Bhilwara					
Area	58 bigha					
Altitude (m)	369					
Latitude	25° 17’ 55.1					
Longitude	75° 06’ 21.0					
B. Topographical features						
a)	Erosion:	√**Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√**Moderate (50-100)**	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. leucophloea (98), *A. catechu* (49), *B. monosperma* (38), *A. nilotica* (37), *A. indica* (37), *F. religiosa* (32), *P. juliflora* (10)					*S. virosa* (300)	
ENS of Tree : 4.84					**ENS of Shrub: 1.00**	
Herb and Grass						
A. mutica, A. vaginalis, C. dactylon, C. rotundus, C. tora, E. aculis, E. colona, E. hirta, Euphorbia indica, P. paniculata, Themeda sp.						
D. Wild-life						
Blue Bull, Jungle Crow, Bank Myna.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.74	0.31	1.290	1.41	22.00

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**25**					
A. Basic Information about the sacred groves						
Name of sacred groves	Goga Ji Ka Oran					
Name of village	Gangapura					
Panchayat	Khari					
Nearest forest Block	Balleri					
District	Bikaner					
Area of sacred grove	115 bigha					
Altitude (m)	218					
Latitude	27° 58’ 33.9					
Longitude	72° 53’ 34.9					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
Ziziphus rotundifolia (139), *C. decidua* (139), *P. juliflora* (22)					No shrub	
ENS of Tree : 2.51					**ENS of Shrub: 1.00**	
Herb and Grass						
Cenchrus species, C. dactylon, E. hirta, D. sindicum.						
D. Wild-life						
Chinkara						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
8.74	0.30	0.345	1.50	11.01

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**26**					
A. Basic Information about the sacred groves						
Name of sacred groves	Karni Mata Ji ka Oran					
Name of village	Mokha Charan					
Panchayat	Kolayat					
Nearest forest Block	Mokh khalsa					
District	Bikaner					
Area of sacred grove	1800 bigha					
Altitude (m)	292					
Latitude	27° 45’ 52.3					
Longitude	73° 03’ 36.8					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
Z. rotundifolia (155), *S. oleoides* (88), *C. decidua* (78), *A. tortilis* (53), *P. juliflora* (17)					*L. barbarum* (300)	
ENS of Tree : 3.96					**ENS of Shrub: 1.00**	
Herb and Grass						
Cenchrus species, C. dactylon, E. hirta, D. sindicum, T. procumbense.						
D. Wild-life						
Deer, Fox, Hare, Pigeon, Dove.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
8.52	0.29	0.330	1.51	14.27

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**27**					
A. Basic Information about the sacred groves						
Name of sacred groves	Karni Mata Ji Ka Oran					
Name of village	Deshnok					
Panchayat	Bikaner					
Nearest forest Block						
District	Bikaner					
Area of sacred grove	2216 bigha					
Altitude (m)	290					
Latitude	27° 47’ 07.0					
Longitude	73° 20’ 11.5					
B. Topographical features						
a)	Erosion:	√**Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI			**Shrub species with IVI**			
Z. rotundifolia (300)			*L. pyrotechnica* (141), *A. pseudotomentosa* (100), *C. burhia* (32), *L. barbarum* (15), *A. persica* (13)			
ENS of Tree : 1.00			**ENS of Shrub: 3.06**			
Herb and Grass						
Cenchrus species, C. dactylon, E. hirta, D. sindicum, T. procumbens, Lasiurus sindicus.						
D. Wild-life						
Deer, Fox, Hare.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
8.64	0.19	0.330	1.49	13.77

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**28**					
A. Basic Information about the sacred groves						
Name of sacred groves	Siya Mata ji Ki Bani					
Name of village	Siya Mata ka Kheda					
Panchayat	Hindoli					
Nearest forest Block	Devnarayan					
District	Bundi					
Area of sacred grove	96 bigha					
Altitude (m)	295					
Latitude	25° 36’ 45.9					
Longitude	75° 36’ 37.5					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√ **Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. pendula (230), *P. juliflora* (32), *A. leucophloea* (29), *B. monosperma* (9)					No shrub (0)	
ENS of Tree : 3.54					**ENS of Shrub: 1.00**	
Herb and Grass						
Blumea eriantha, C. rotundus, E. granulata, B. pussilla, E. hirta, E. alsinoides, Mollugo cerviana, E. ciliaris, J. simplex, Digera muricata, C. benghalensis, Oropetium thomaeum.						
D. Wild-life						
Blue Bull, Jackal, Wild cat, Pea Fowl.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.40	0.35	0.555	1.44	8.60

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**29**					
A. Basic Information about the sacred groves						
Name of sacred groves	Gangrawal Ji Maharaj Ki Vani					
Name of village	Chhatarganj					
Panchayat	Hindoli					
Nearest forest Block	Aakhlod paandal					
District	Bundi					
Area of sacred grove	40 bigha					
Altitude (m)	314					
Latitude	25° 32’ 75.4					
Longitude	75° 30’ 96.5					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√**Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI				**Shrub species with IVI**		
A. pendula (220), *P. juliflora* (44), *A. leucophloea* (26)				*A. vasica* (171), *C. procera* (86), *C. sepiaria* (43)		
ENS of Tree : 2.78				**ENS of Shrub: 2.60**		
Herb and Grass						
Acalypha indica, B. diffusa, B. ramosa, C. tora, C. benghalensis, Euphorbia chamesiana, E. hirta, J. procumbens, P. paniculata, Physalis minima, Sida cordata, Sida cordifolia, T. procumbens.						
D. Wild-life						
Cow, Pea Fowl, Pigeon, Parakeet.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.47	0.32	0.750	1.32	12.54

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**30**					
A. Basic Information about the sacred groves						
Name of sacred groves	Parbatheshwar Mahadeo ki Bani					
Name of village	Bharmal ka kheda					
Panchayat	Hindoli					
Nearest forest Block	-					
District	Bundi					
Area of sacred grove	51 bigha					
Altitude (m)	303					
Latitude	24° 40’ 14.9					
Longitude	75° 38’ 04.3					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
M. parviflora (151), *B. monosperma* (101), *A. leucophloea* (35), *B. aegyptiaca* (30), *F. religiosa* (27), *A. nilotica* (26), *H. integrifolia* (18), *C. decidua* (16), *P. juliflora* (13), *Acacia pennata* (10), *Maytenus emarginata*					*D. cinerea* (154), *C. sepiaria* (110), *S. virosa* (37)	
ENS of Tree : 8.33					**ENS of Shrub: 2.81**	
Herb and Grass species						
J. procumbens, P. paniculata, Digitaria ciliaris, Triumfetta rhomboidea, Ochthochloa compressa, E. hirta, Hackelochloa granularis, E. ciliaris, E. acaulis, C. tora, Desmostachia bipinnata, B. ramosa.						
D. Wild-life						
Parakeet, Squirrel						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
8.22	0.22	0.750	1.29	13.42

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**31**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnarayan ji Ka Oran					
Name of village	Mondalda					
Panchayat	Mata ji ki pandoli					
Nearest forest Block						
District	Chittorgarh					
Area of sacred grove	1100 bigha					
Altitude (m)	439					
Latitude	24° 55’ 37.6					
Longitude	74° 32’ 59.0					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. pendula (210), *Crateva religiosa* (28), *A. indica* (15), *Boswellia serrata* (14), *M. emarginata* (12), *M. concanensis* (11)					*M. oblongifolia* (150), *F. indica* (150)	
ENS of Tree : 1.67					**ENS of Shrub: 2.00**	
Herb and Grass						
A. funiculata, A. lunulatum, Blainvillea acmella, B. pussilla, I. cordifolia, T. procumbens.						
D. Wild life						
Wild cat, Hare.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
6.21	0.22	2.955	1.25	52.25

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**32**					
A. Basic Information about the sacred groves						
Name of sacred groves	Rishi Mangri Oran					
Name of village	Paroli					
Panchayat	Rohlada					
Nearest forest Block	-					
District	Chittorgarh					
Area of sacred grove	32 bigha					
Altitude (m)	445					
Latitude	24° 56’ 40.6					
Longitude	74° 34’ 23.6					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI			**Shrub species with IVI**			
A. pendula (229), *A. leucophloea* (61), *B. monosperma* (11)			*D. cinerea* (148), *S. virosa* (125), *M. oblongifolia* (28)			
ENS of Tree : 1.39			**ENS of Shrub: 2.36**			
Herb and Grass						
A. aspera, B. acmella, B. pussilla, Urginea indica.						
D. Wild-life						
Squirrel, Pea Fowl.						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
7.29	0.18	1.290	1.31	18.71		

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**33**					
A. Basic Information about the sacred groves						
Name of sacred groves	Nahar Singhji Mata ka Oran					
Name of village	Borda					
Panchayat						
Nearest forest Block						
District	Chittorgarh					
Area	110 bigha					
Altitude (m)	481					
Latitude	24° 58’ 54.8					
Longitude	74° 33’ 16.1					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI			**Shrub species with IVI**			
A. pendula (277), *A. leucophloea* (23), *Diospyros cordifolia* (17)			*L. camara* (221), *A. jacquemontii* (79)			
ENS of Tree : 1.20			**ENS of Shrub: 1.57**			
Herb and Grass						
B. diffusa, B. articularis, B. ramosa, D. sindicum, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, T. roxburghii.						
D. Wild-life						
Hare, Deer						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.43	0.12	0.525	1.44	3.35

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**34**					
A. Basic Information about the sacred groves						
Name of sacred groves	Junjan Dodaji Ka Oran					
Name of village	Jogalsar					
Panchayat	Sujangarh					
Nearest forest Block	Lalgarh					
District	Churu					
Area of sacred grove	3500 bigha					
Altitude (m)	319					
Latitude	27° 30’ 27.3					
Longitude	73° 58’ 33.6					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√**Moderate (50-100)**	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI			**Shrub species with IVI**			
M. emarginata (224), *P. cineraria* (38), *C. decidua* (27), *A. catechu* (12)			*C. procera* (108), *Aerva persica* (87), *L. pyrotechnica* (62), *Z. nummularia* (43)			
ENS of Tree : 1.72			**ENS of Shrub: 3.32**			
Herb and Grass						
B. diffusa, B. articularis, B. ramose, D. sindicum, E. ciliaris, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, T. purpurea, T. terrestris, Pedalium murex, P. amarus, T. roxburghii.						
D. Wild-life						
Deer, Hare.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
6.71	0.08	0.180	1.58	8.36

F. History and status

About 500 years old. A fair is generally organized on the occasion of Vijayadashmi.

ATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**35**					
A. Basic Information about the sacred groves						
Name of sacred groves	Gogaji Ka Oran					
Name of village	Manpura					
Panchayat	Badi gatyal					
Nearest forest Block	Manpura					
District	Churu					
Area of sacred grove	200 bigha					
Altitude (m)	302					
Latitude	27° 48’ 25.6					
Longitude	79° 16’ 34.9					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
M. emarginata (162), *C. decidua* (53), *A. tortilis* (49), *P. cineraria* (36)	*L. pyrotechnica* (300)
ENS of Tree : 2.97	**ENS of Shrub: 1.00**

Herb and Grass
B. diffusa, B. articularis, B. ramose, D. sindicum, E. ciliaris, E. alsinoides, Gisekia pharnacioides, I. cordifolia, I. linnai, J. procumbense, T. purpurea, T. terrestris, P. amarus, T. roxburghii.
D. Wild life
Blue Bull.
E. Soil characteristics

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.06	0.02	0.135	1.55	6.28

F. History

About 200-250 years old. Temple has been established in name of Gogaji, who stopped the horse of the king of Gopalpura at this place as people believe.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**36**					
A. Basic Information about the sacred groves						
Name of sacred groves	Gosai Ji Ka Oran					
Name of village	Berasar					
Panchayat	Bambu					
Nearest forest Block	Sandawa					
District	Churu					
Area of sacred grove	285 bigha					
Altitude (m)	324					
Latitude	27° 46’ 32.5					
Longitude	74° 08’ 58.2					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√ **Moderate (50-100)**	Deep (>100 cm)

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
S. oleoides (331), *A. tortilis* (174), *P. cineraria* (92), *M. emarginata* (23), *C. decidua* (11)	*Z. nummularia* (219), *A. persica* (66), *Cucumis callosus* (15)
ENS of Tree : 1.71	**ENS of Shrub: 2.03**

Herb and Grass

Cenchrus species, B. diffusa, B. articularis, B. ramose, D. sindicum, E. ciliaris, E. alsinoides, G. pharnacioides, I. cordifolia, I. linnai, J. procumbense, T. purpurea, T. terrestris, P. amarus, T. roxburghii.

D. Wild-life

Hare, Deer, Blue Bull.

E. Soil characteristics

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
6.41	0.04	0.195	1.54	9.01

F. History

It is about 500 years old. It is considered that God Vishnu put his leg at three places, i.e., Makka Madina, Jhujhala and Berasar, when he took 52nd Avatar. This temple was built to worship him.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**37**					
A. Basic Information about the sacred groves						
Name of sacred groves	Kaludas Baba Ki Dungri					
Name of village	Sikra, Baradu, Gijgad					
Panchayat	Sikrai					
Nearest forest Block	Jagrampura pati					
District	Dausa					
Area of sacred grove	56 bigha					
Altitude (m)	374					
Latitude	26° 48’ 28.0					
Longitude	76° 37’ 53.3					

B. Topographical features						
a)	Erosion:	√**Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√ **Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
A. pendula (265), *H. integrifolia* (36)	*A. vasica* (300)
ENS of Tree : 1.15	**ENS of Shrub: 1.00**

Herb and Grass

B. diffusa, B. ramosa, C. tora, E. hirta, J. procumbens, T. procumbens.

D. Wild-life

Hare, Deer, Blue Bull.

E. Soil characteristics

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.55	0.28	0.465	1.46	7.47

F. History

Baba Kaludas ji had meditated here. In the name of him the sacred groves is maintained and worshiped.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**38**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnarayna Ji Ka Oran					
Name of village	Kalota					
Panchayat	Dausa					
Nearest forest Block	Kalota					
District	Dausa					
Area of sacred grove	20 bigha					
Altitude (m)	329					
Latitude	26° 58’ 29.1					
Longitude	76° 25’ 17.0					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√ **Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI			**Shrub species with IVI**			
A. nilotica (205), *A. leucophloea* (27), *H. integrifolia* (24), *P. juliflora* (19), *W. tinctoria* (15)			*A. vasica* (117), *Euphorbia caducifolia* (91), *Euphorbia neriifolia* (36), *C. procera* (28), *C. sepiaria* (14), *Z. nummularia* (14)			
ENS of Tree : 1.83			**ENS of Shrub: 3.94**			
Herb and Grass						
Blepharis repens, B. diffusa, B. ramosa, C. tora, E. hirta, J. procumbens, T. procumbens.						
D. Wild-life						
Hare, Deer.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.25	0.26	0.326	1.43	7.30

F. History

People believe that God Deonarain has taken rebirth in form of a Saandu Mata. At present a new temple is under construction.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**39**					
A. Basic Information about the sacred groves						
Name of sacred groves	Sawanria ji Seth Dham					
Name of village	Kanawar					
Panchayat	Bandikue					
Nearest forest Block	Basura					
District	Dausa					
Area	50 bigha					
Altitude (m)	336					
Latitude	27° 06’ 43.2					
Longitude	76° 31’ 13.7					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
H. integrifolia (231), *A. nilotica* (60), *A. leucophloea* (10)					*A. vasica* (300)	
ENS of Tree : 1.78					**ENS of Shrub: 1.00**	
Herb and Grass						
Blepharis repens, B. diffusa, B. ramosa, C. tora, E. hirta, J. procumbens, T. purpurea, T. procumbens.						
D. Wild-life						
Hare, Jackal, Wild pig, Fox, Parakeet, Pea Fowl, Myna						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.68	0.23	0.360	1.44	9.21

F. History

People say that some body was moving with an idol (murti) of Lord Krishna. Unfortunately the idol fell at the place and could not be taken back. Later the Murti was established here and worshiped.

DATA ON SACRED GROVES OF RAJASTHAN

Sacred Grove No.	**40**

A. Basic Information about the sacred groves

Name of sacred groves	Bali Baba Ki Dargah
Name of village	Longpura
Panchayat	
Nearest forest Block	Longpura
District	Dholpur
Area	300 bigha
Altitude (m)	222
Latitude	26° 41’ 41.2
Longitude	77° 52’ 82.1

B. Topographical features

a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√**Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)

C. Vegetation status

Tree species with IVI	**Shrub species with IVI**
P. juliflora (154), *H. integrifolia* (84), *A. pendula* (46), *F. religiosa* (16)	*Z. nummularia* (145), *C. procera* (84), *C. sepiaria* (71)
ENS of Tree : 1.85	**ENS of Shrub: 2.95**

Herb and Grass

B. ramosa, C. tora, E. hirta, J. procumbens, T. purpurea, T. procumbens.

D. Wild-life

Jarakh, Fox, Hare, Chandan Goh, Pea Fowl.

E. Soil characteristics

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.48	0.19	0.720	1.39	20.28

F. History

It is about 700 years old, near baba garib nawaz, situated on high altitude.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**41**					
A. Basic Information about the sacred groves						
Name of sacred groves	MuchKund					
Name of village	Yogpura					
Panchayat	-					
Nearest forest Block	-					
District	Dholpur					
Area	250 Bigha					
Altitude (m)	210					
Latitude	26° 40’ 69.9					
Longitude	77° 52’ 02.1					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√ **Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI			**Shrub species with IVI**			
A. pendula (151), *P. juliflora* (69), *A. indica* (38), *A. nilotica* (14), *F. religiosa* (14), *H. integrifolia* (14), *Capparis decidua*			*C. procera* (166), *C. sepiaria* (105), *Z. nummularia* (28)			
ENS of Tree : 3.43			**ENS of Shrub: 3.18**			
Herb and Grass						
C. tora, E. hirta, T. procumbens.						
D. Wild-life						
Snake, Jarakh, Chandan Goh, Fox, Pea Fowl, Parakeet.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
5.20	0.26	0.480	1.47	17.42

F. History

It is a historical place and also one of the teerth places of very high belief among the people of nearby places. People take bath in the holy lake here.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**42**					
A. Basic Information about the sacred groves						
Name of sacred groves	Mahadeo Ji Ka Oran					
Name of village	Sadpura					
Panchayat	Seyru					
Nearest forest Block						
District	Dholpur					
Area	350 bigha					
Altitude (m)	172					
Latitude	26° 47’ 57.0					
Longitude	77° 44’ 54.5					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√ **Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI				**Shrub species with IVI**		
F. benghalensis (132), *A. indica* (80), *H. integrifolia* (60), *F. religiosa* (17) *Capparis decidua*				*Z. nummularia* (202), *C. sepiaria* (98)		
ENS of Tree : 3.34				**ENS of Shrub: 2.99**		
Herb and Grass						
No						
D. Wild life						
Pea Fowl, Parakeet, Snake.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
8.21	0.32	0.180	1.51	6.35

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**43**					
A. Basic Information about the sacred groves						
Name of sacred groves	Govindguru Chhari Magri					
Name of village	Bersa					
Panchayat	Simalwara					
Nearest forest Block	Dhambola					
District	Dungarpur					
Area of sacred grove	54 bigha					
Altitude (m)	229					
Latitude	23° 38’ 21.5					
Longitude	73° 49’ 59.6					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	√Shallow (<25 cm)	Moderately deep (25-50)		√**Moderate (50-100)**	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
P. juliflora (264), *D. melanoxylon* (20), *A. indica* (17), *Ehretia laevis*					*Z. nummularia* (300)	
ENS of Tree : 1.20					**ENS of Shrub: 1.00**	
Herb and Grass						
B. ramosa, B. repens, C. tora, D. sindicum, E. hirta, J. procumbens, I. cordifolia, T. purpurea, T. procumbens.						
D. Wild-life						
Blue Bull, Hare, Jackal, Red vented Bulbul.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
6.67	0.15	0.780	1.42	17.79

F. History and status

About 1000 years old and considered sacred by the local people.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**44**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bhuneshwar Mahadev Ka Oran					
Name of village	Karauli					
Panchayat	Karauli					
Nearest forest Block						
District	Dungarpur					
Area of sacred grove	119 bigha					
Altitude (m)	235					
Latitude	23° 49’ 50.9					
Longitude	79° 35’ 43.3					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	√**Hill top**	Hill slope	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
A. pendula (148), *A. leucophloea* (55), *A. catechu* (33), *A. indica* (23), *M. parviflora* (16), *Madhuca indica* (7), *T. grandis* (6), *D. melanoxylon* (6), *H. integrifolia* (6), *M. emarginata*	*D. cinerea* (118), *L. camara* (93), *S. virosa* (29), *Aristolochia bracteata* (29), *Z. nummularia* (16), *C. sepiaria* (16)
ENS of Tree : 3.13	**ENS of Shrub: 5.54**
Herb and Grass	
B. ramosa, B. repens, D. sindicum, E. hirta, J. procumbens, I. cordifolia, T. procumbens.	
D. Wild-life	
Blue Bull, Hare, Pea Fowl.	
E. Soil characteristics	

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.30	0.27	1.862	1.38	32.47

F. History

There are 6 siblings in this oran. It is believed that all siblings are self originated.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**45**					
A. Basic Information about the sacred groves						
Name of sacred groves	Neelkanth Mahadev					
Name of village	Bhiluda					
Panchayat	Bhiluda					
Nearest forest Block						
District	Dungarpur					
Area of sacred grove	71 bigha					
Altitude (m)	200					
Latitude	23° 36’ 39.5					
Longitude	74° 05’ 13.1					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√ **Moderate (50-100)**	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
Prosopis juliflora (182), *A. indica* (55), *F. benghalensis* (24), *A. nilotica* (15), *A. excelsa* (12), *C. decidua* (11)					*Jatropha curcas* (151), *C. auriculata* (104), *L. camara* (45)	
ENS of Tree : 2.02					**ENS of Shrub: 2.80**	
Herb and Grass						
B. ramosa, B. repens, C. tora, E. hirta, J. procumbens, I. cordifolia, T. purpurea, T. procumbens.						
D. Wild-life						
Blue Bull, Hare, Jackal, Pea Fowl.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.50	0.18	0.630	1.47	12.01

7. History

An old temple is situated along a river. The land is in name of temple only.

DATA ON SACRED GROVES OF RAJASTHAN

Sacred Grove No. **46**

A. Basic Information about the sacred groves

Name of sacred groves	Bhadra Kali Mata Ji Ka Oran
Name of village	Amarpura
Panchayat	Hanumangarh
Nearest forest Block	Kolu farum
District	Hanumangarh
Area of sacred grove	125 bigha
Altitude (m)	192
Latitude	29° 36’ 00.6
Longitude	74° 23’ 02.3

B. Topographical features

a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√**Moderate (50-100)**	Deep (>100 cm)

C. Vegetation status

Tree species with IVI	**Shrub species with IVI**
P. juliflora (105), *A. nilotica* (48), *Tamarix aphylla* (45), *P. cineraria* (42), *S. oleoides* (29), *C. decidua* (23), *F. religiosa* (7)	No shrub (0)
ENS of Tree : 4.42	**ENS of Shrub: 1.00**

Herb and Grass

Fagonia cretica, Peganum harmala, E. hirta, I. cordifolia, T. procumbens.

D. Wild-life

House sparrow, Myna

E. Soil characteristics

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.67	0.24	1.290	1.42	43.58

F. History

During the period of Maharaja Ganga singh, this temple was constructed. People are worshipping it since then. Animals like goat are sacrificed and wine distribution is a custom here.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**47**					
A. Basic Information about the sacred groves						
Name of sacred groves	Chisti Peer ki Dargah					
Name of village	Chhistiya					
Panchayat	Hanumangarh					
Nearest forest Block	Kolu farum					
District	Hanumangarh					
Area of sacred grove	13 bigha					
Altitude (m)	180					
Latitude	29° 39’ 31.6					
Longitude	74° 14’ 23.9					
B. Topographical features						
a)	Erosion:	√**Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√ **Moderate (50-100)**	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
C. decidua (232), *A. nilotica* (20), *S. oleoides* (19), *D. sissoo* (15), *M. emarginata* (15)					*Z. nummularia* (244), *Opuntia dillenii* (40), *A. persica* (16)	
ENS of Tree : 1.50					**ENS of Shrub: 1.72**	
Herb and Grass						
F. cretica, T. procumbens.						
D. Wild-life						
House sparrow, Hare						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
8.14	0.29	0.390	1.55	18.14

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**48**					
A. Basic Information about the sacred groves						
Name of sacred groves	Guru Gorakhnath Ji Ka Oran					
Name of village	Gogamed					
Panchayat	Nohar					
Nearest forest Block	Gogamedi					
District	Hanumangarh					
Area	91 bigha					
Altitude (m)	196					
Latitude	29° 10’ 41.7					
Longitude	75° 01’ 57.1					
B. Topographical features						
a)	Erosion:	√**Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
S. oleoides (167), *A. indica* (45), *P. cineraria* (25), *D. sissoo* (17), *A. tortilis* (17), *F. benghalensis* (17), *A. nilotica* (12)					*Z. nummularia* (300)	
ENS of Tree : 4.27					**ENS of Shrub: 1.00**	
Herb and Grass						
B. ramosa, F. cretica, Glinus lotoides, T. procumbens, Solanum nigrum.						
D. Wild-life						
Blue Bull, Hare, Pea Fowl						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.67	0.32	0.450	1.52	8.65

F. History

People believe that Guru Gorakhnath has mediated here and since then this place is a sacred place.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**49**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bheru ji Ki Bani					
Name of village	Khonagorian					
Panchayat	Sangner					
Nearest forest Block	Jhalana					
District	Jaipur					
Area of sacred grove	9 bigha					
Altitude (m)	406					
Latitude	26° 51’ 30.1					
Longitude	75° 50’ 32.3					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. tortilis (129), *P. cineraria* (111), *A. marmelos* (17), *A. indica* (15), *E. genita* (14), *A. digitata* (14)					*C. sepiaria* (300)	
ENS of Tree : 3.23					**ENS of Shrub: 1.00**	
Herb and Grass						
A. aspera, D. aegyptium, D. sindicum, Ipomoea pes-tigridis, O. canum, P. minima, P. paniculata, Perotis indica, S. cordifolia, S. indica, Xanthium strumarium.						
D. Wild-life						
Blue Bull, sparrow						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.50	0.18	0.225	1.55	9.94

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**50**					
A. Basic Information about the sacred groves						
Name of sacred groves	Kapil Muni Ashram					
Name of village	Goner					
Panchayat	Sanganer					
Nearest forest Block	Gonu beed					
District	Jaipur					
Area of sacred grove	7 bigha					
Altitude (m)	352					
Latitude	26° 46’ 11.4					
Longitude	75° 54’ 47.5					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. indica (93), *P. cineraria* (78), *F. religiosa* (21), *Polyalthia longifolia* (19), *A. leucophloea* (17), *Leucaena leucocephala* (16), *Nerium* odoratum (15), *S. cummini* (14), *F. glomerata* (12), *C. decidua* (8), *Thespesia populnea* (8).					*C. procera* (204), *Z. nummularia* (96)	
ENS of Tree : 5.57					**ENS of Shrub: 2.80**	
Herb and Grass						
B. diffusa, B. ramosa, C. benghalensis, E. acaulis, E. aspera, P. amarus, P. hysterophorus, P. paniculata, Rhynchosia minima, T. roxburghii, V. cinerea.						
D. Wild-life						
Blue Bull, Wolf						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
8.14	0.22	1.125	1.49	41.36

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**51**					
A. Basic Information about the sacred groves						
Name of sacred groves	Shiv Dungri					
Name of village	Manpur Dungri					
Panchayat	Chaksa/Kathawada					
Nearest forest Block	Paharia					
District	Jaipur					
Area of sacred grove	12 bigha					
Altitude (m)	374					
Latitude	26° 37’ 42.3					
Longitude	75° 55’ 38.9					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	√ **Hill top**	Hill slope	Plateau	Plane	Valley (riverbed)
c)	**Soil Depth**	√ **Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
P. juliflora (178), *B. monosperma* (81), *P. cineraria* (28), *A. indica* (13)					*Z. nummularia* (300)	
ENS of Tree : 2.02					**ENS of Shrub: 1.00**	
Herb and Grass						
A. funiculata, A. vaginalis, B. acanthoides, B. articularis, B. eracta, C. barbata, C. ciliaris, C. pumila, D. aegyptium, D. annulatum, D. ciliaris, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, L. trinervis, M. jacqmontii, P. hysterophorus, P. lappacea, P. paniculata, T. purpurea, T. roxburghii, T. tennalus, T. terrestris, T. villosa.						
D. Wild-life						
Blue Bull, Hare, Pea Fowl						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.60	0.19	0.150	1.57	6.53

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**52**					
A. Basic Information about the sacred groves						
Name of sacred groves	Ramdevji ka Oran					
Name of village	Pokharan					
Panchayat	Pokgaran					
Nearest forest Block						
District	Jaisalmer					
Area of sacred grove	12 bigha					
Altitude (m)	245					
Latitude	26° 59’ 37.9					
Longitude	71° 55’ 46.2					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
S. oleoides (134), *A. tortilis* (85), *Mangifera indica* (41), *T. undulata* (40)					*C. burhia* (170), *Z. nummularia* (130)	
ENS of Tree : 3.08					**ENS of Shrub: 1.70**	
Herb and Grass						
L. sindicus, B. articularis, E. alsinoides, I. cordifolia, I. linnai, M. jacqmontii, T. roxburghii, T. tennalus, T. terrestris.						
D. Wild-life						
Blue Bull, Hare.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
8.04	0.35	0.235	1.65	11.36

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**53**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bhadariya ji Ka Oran (old)					
Name of village						
Panchayat	Pokharan					
Nearest forest Block						
District	Jaisalmer					
Area of sacred grove	165000 bigha					
Altitude (m)	212					
Latitude	27° 03’ 33.4					
Longitude	71° 31’ 38.9					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI			**Shrub species with IVI**			
Z. rotundifolia (265), *P. cineraria* (35)			No shrub			
ENS of Tree : 1.17			**ENS of Shrub: 1.00**			
Herb and Grass						
Dactyloctenium sindicum, Cenchrus biflorus, Tephrosia purpurea						
D. Wild life						
Blue bull, Rabbit, Rat.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
8.12	0.4	0.325	1.61	14.65

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**54**					
A. Basic Information about the sacred groves						
Name of sacred groves	Malani Oran					
Name of village						
Panchayat	Pokhran					
Forest Block	Rajmathai					
District	Jaisalmer					
Area	450 bigha					
Altitude (m)	276					
Latitude	26° 27’ 39.4					
Longitude	71° 09’ 54.1					
B. Topographical features						
a)	Erosion:	Slight	Moderate	√**Severe**	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
C. decidua (300)	*Calotropis procera* (210), *A. persica* (47), *L. pyrotechnica* (19), *C. burhia* (13), *Z. nummularia* (11)
ENS of Tree : 1.00	**ENS of Shrub: 2.40**
Herb and Grass	
Convolvulus spp. E. alsinoides, Farsetia hamiltonii, I. cordifolia, T. terrestris, C. biflorus, C. Burhia	
D. Wild-life	
Goh, Indian gerbil, Indian spiny-tailed, Deer, snack (do muhi), Grey Partridge, Blue Bull.	
C. Soil characteristics	

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
8.04	0.29	0.215	1.67	10.58

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**55**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bellane Oran					
Name of village						
Panchayat						
Nearest forest Block						
District	Jaisalmer					
Area						
Altitude (m)	288					
Latitude	26° 35’ 37.8					
Longitude	71° 11’ 41.2					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
C. decidua (202), *A. senegal* (98)					*Z. nummularia (196), C. procera (104)*	
ENS of Tree : 1.82					**ENS of Shrub: 1.95**	
Herb and Grass						
Convolvulus species, F. hamiltonii, I. cordifolia, T. terrestris.						
D. Wild-life						
Goh, Indian gerbil, Indian spiny-tailed, Deer, snack (do muhi), Grey Partridge, Blue Bull.						
C. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.89	0.34	0.341	1.59	16.06

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**56**					
A. Basic Information about the sacred groves						
Name of sacred groves	Dharneswar Mahadeo ka Oran					
Name of village	Borwada					
Panchayat	Jalore					
Nearest forest Block						
District	Jalore					
Area	115 bigha					
Altitude (m)	123					
Latitude	25° 15’ 36.6					
Longitude	72° 16’ 30.0					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI				**Shrub species with IVI**		
Salvadora oleoides (193), *Prosopis cineraria* (53), *Capparis decidua* (32), *Prosopis juliflora* (22), *Maytenus emarginata*				*Acacia jacquemontii* (151), *Cassia auriculata* (111), *Leptadenia pyrotechnica* (39).		
ENS of Tree : 1.63				**ENS of Shrub: 1.60**		
Herb and Grass						
A. aspera, A. funiculata, B. ramosa, H. marifolium, J. procumbens, I. cordifolia, M. cerviana, T. procumbens, T. purpurea.						
D. Wild life						
Chandan Goh, Hare, Pea Fowl, Parakeet, Pigeon, Grey Partridge, Jackal, Jharakh, Blue Bull, Snake, Koel.						
F. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
7.85	0.18	0.135	1.56	5.46		
F. History and status						
It is an ancient temple. Presently taken care by Mandir trust.						

DATA ON SACRED GROVES OF RAJASTHAN	
Sacred Grove No.	**57**
A. Basic Information about the sacred groves	
Name of sacred groves	Dudeshwar Mahadeo Ka Oran
Name of village	Noon
Panchayat	Jalore
Forest Block	Sayla
District	Jalore
Area	224 bigha
Altitude (m)	165
Latitude	25° 10' 78.1
Longitude	72° 29' 83.0

B. Topographical features

a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	Plane	√**Valley (riverbed)**
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**

C. Vegetation status

Tree species with IVI	**Shrub species with IVI**
Tecomella undulata (233), *Prosopis cineraria* (21), *Prosopis juliflora* (16), *Acacia leucophloea* (11), *Acacia indica* (10)	*Acacia jacquemontii* (264), *Cassia auriculata* (36)
ENS of Tree : 2.48	**ENS of Shrub: 1.14**

Herb and Grass

I. pes-tigridis, H. marifolium, T. purpurea.

D. Wild-life

Chandan Goh, Hare, Pea Fowl, Parakeet, Pigeon, Grey Partridge, Jackal, jharakh, Blue Bull, Snake, Indian spiny-tailed.

F. Soil characteristics

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.85	0.28	0.090	1.61	4.32

F. History and status

An ancient temple, presently taken care by local panchayat and is under good condition.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**58**					
A. Basic Information about the sacred groves						
Name of sacred groves	Jhootana Mama ji Ka Oran					
Name of village	Bhorda					
Panchayat	Aahore					
Forest Block	-					
District	Jalore					
Area	100 bigha					
Altitude (m)	174					
Latitude	25° 40’ 18.6					
Longitude	72° 47’ 34.0					
B. Topographical features						
a)	Erosion:	√**Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
Salvadora oleoides (198), *Prosopis juliflora* (58), *Capparis decidua* (45)	*Cassia auriculata* (300)
ENS of Tree : 2.25	**ENS of Shrub: 1.16**
Herb and Grass Species	
A. aspera, Cleome viscosa, Corchorus tridens, H. marifolium, T. purpurea.	
D. Wild-life	
Goh, Hare, Blue Bull, Sparrow, Grey Partridge.	
E. Soil characteristics	

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.36	0.21	0.135	1.55	6.12

F. History and status

It is an ancient temple. At present temple is under care of Mandir trust.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**59**					
A. Basic Information about the sacred groves						
Name of sacred groves	Kalla ji Ka Oran					
Name of village	Akawad Khurd					
Panchayat	Khabpur					
Forest Block						
District	Jhalawar					
Area	50 bigha					
Altitude (m)	326					
Latitude	24° 37’ 33.0					
Longitude	76° 29’ 34.8					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√**Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. leucophloea (155), *D. melanoxylon* (80), *P. juliflora* (31), *H. integrifolia* (14), *P. sylvestris* (11), *A. nilotica* (10)					No shrub	
ENS of Tree : 3.68					**ENS of Shrub:** 1.00	
Herb and Grass Species						
No						
D. Wild-life						
Blue Bull, Sambar Deer, Wild Pig, Hyena						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.97	0.12	0.990	1.36	25.53

F. History and status

People come here for the cure of poisonous Snake bite.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**60**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bapulala Smirti Van					
Name of village	Taandi Sohanpura					
Panchayat	Jhalrapaatan					
Forest Block						
District	Jhalawar					
Area	14 bigha					
Altitude (m)	371					
Latitude	24° 30’ 04.2					
Longitude	76° 23’ 09.7					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. pendula (193), *D. melanoxylon* (95), *M. parviflora* (13)					No shrub	
ENS of Tree : 2.10					**ENS of Shrub: 1.00**	
Herb and Grass Species						
B. eriantha, B. pussilla, E. alsinoides, I. cordifolia, J. procumbense, T. tennala, T. procumbens.						
D. Wild-life						
Hare, Pea Fowl.						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
7.75	0.23	0.585	1.52	15.64		
F. History and status						
Temple of Mahadev ji is also here. In the memory of nature lover Babulal ji, large fair is organised here on every Shivratri.						

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**61**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnarayan Ji Ka Asthan					
Name of village	Savalpura, Kheria					
Panchayat	Bakani					
Forest Block						
District	Jhalawar					
Area	100 bigha					
Altitude (m)	366					
Latitude	24° 21’ 21.9					
Longitude	76° 18’ 33.7					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. leucophloea (148), *P. sylvestris* (92), *A. indica* (18), *P. juliflora* (17), *F. religiosa* (10), *H. integrifolia* (8), *Z. mauritiana* (8)					*C. procera* (300)	
ENS of Tree : 3.16					**ENS of Shrub: 1.00**	
Herb and Grass Species						
C. tora, E. alsinoides, E. hirta, I. cordifolia, T. procumbens.						
D. Wild-life						
Wild Mangoose, Hare, Pea Fowl.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.04	0.14	0.450	1.59	19.21

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**62**					
A. Basic Information about the sacred groves						
Name of sacred groves	Shiv Mandir, Kelkheura					
Name of village	Dudharkhedi, Chanderia, Kelkheura					
Panchayat	Ghatoli					
Forest Block						
District	Jhalawar					
Area	400 bigha					
Altitude (m)	345					
Latitude	24° 18’ 53.3					
Longitude	76° 90’ 40.5					
B. Topographical feature						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
D. melanoxylon (161), *T. bellerica* (59), *Madhuca indica* (42), *A. pendula* (38)					No shrub	
ENS of Tree : 2.30					**ENS of Shrub: 1.00**	
Herb and Grass Species						
B. pussilla, B. repens, E. alsinoides, E. hirta, I. cordifolia, J. procumbens, T. procumbens.						
D. Wild-life						
Panther, Blue Bull, Jarakh, Wild Dog, Sambar Deer, Wild Pig, Hyena, Hare						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
8.43	0.11	0.285	1.63	5.78

F. History and status

Guru Makhandas ji Maharaj ki Samadhi, Kelkherua village, Ghatoli, 400 years old. Natural water reservoir is present here.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**63**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bhairav Ji Ka Bag					
Name of village	Ladania, Kheda					
Panchayat	Khanpur					
Forest Block						
District	Jhalawar					
Area	15 bigha					
Altitude (m)	295					
Latitude	24° 39’ 03.9					
Longitude	76° 08’ 01.4					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
B. monosperma (100), *P. sylvestris* (59), *T. indica* (39), *F. religiosa* (26), *A. leucophloea* (21), *H. integrifolia* (18), *A. nilotica* (17), *M. parviflora* (10), *D. melanoxylon* (5), *T. bellerica* (5)					*C. sepiaria* (262), *F. indica* (38)	
ENS of Tree : 5.03					**ENS of Shrub: 1.40**	
Herb and Grass Species						
Cryptolepis buchananii (Climber), C. tora, E. alsinoides, I. cordifolia, J. procumbense, T. procumbens.						
D. Wild-life						
Hare, Blue Bull.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.14	0.09	0.375	1.60	16.40

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**64**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bihari ji Ka Mandir					
Name of village	Brindavan, Bhadinda Kala					
Panchayat	Bhadunda kala					
Forest Block	Chidawa					
District	Jhunjunnu					
Area	60 bigha					
Altitude (m)	356					
Latitude	28° 05’ 37.0					
Longitude	75° 32’ 59.9					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
S. oleoides (160), *P. cineraria* (117), *A. nilotica* (24)					No shrub (0)	
ENS of Tree : 2.16					**ENS of Shrub: 1.00**	
Herb and Grass						
Amaranthus species, C. dactylon, C. tora, O. compressa, T. terrestris.						
D. Wild-life						
Hare, Blue Bull.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
6.90	0.22	0.165	1.65	8.17

F. History and status

Temple is 500 years old. Cutting of trees is prohibited here.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**65**					
A. Basic Information about the sacred groves						
Name of sacred groves	Prithviraj Ki Bani					
Name of village	Bhachunda Khurd					
Panchayat	Bhadunda khurd					
Forest Block	Chidawa					
District	Jhunjunnu					
Area	250 bigha					
Altitude (m)	332					
Latitude	28° 08’ 29.0					
Longitude	75° 30’ 36.2					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
P. cineraria (218), *C. decidua* (68), *S. oleoides* (15)					*C. procera* (300)	
ENS of Tree : 1.88					**ENS of Shrub:** 1.00	
Herb and Grass Species						
Amaranthus species, C. dactylon, C. tora, D. sindicum, E. hirta, H. marifolium, I. cordifolia, T. purpurea, T. terrestris, V. cinerea, Verbesina encelioides.						
D. Wild-life						
Hare, Blue Bull.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.46	0.12	0.390	1.62	18.95

F. History and status

This place is 200-250 years old. Prathiviraj is the kuldev of Jhakhadia vansh and temple was established in his memory.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**66**					
A. Basic Information about the sacred groves						
Name of sacred groves	Panchmir Pir Ki Bani					
Name of village	Mahawadi					
Panchayat	Nawalgarh					
Forest Block	lohagal					
District	Jhunjunnu					
Area	100 bigha					
Altitude (m)	450					
Latitude	27° 44’ 15.3					
Longitude	75° 19’ 30.7					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. tortilis (125), *P. cineraria* (116), *A. nilotica* (30),*M. emarginata* (16), *C. decidua* (14)					*Z. nummularia* (237), *C. procera* (63)	
ENS of Tree : 2.43					**ENS of Shrub:** 1.81	
Herb and Grass						
Amaranthus species, C. dactylon, C. tora, D. sindicum, H. marifolium, I. cordifolia, T. purpurea, T. terrestris, V. cinerea.						
D. Wild-life						
Hare, Sparrow.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
6.18	0.14	0.180	1.63	8.80

F. History and status

This place is 300 years old.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**67**					
A. Basic Information about the sacred groves						
Name of sacred groves	Kolu Pabuji Ka Oran					
Name of village						
Panchayat						
Forest Block						
District	Jodhpur					
Area	20000 bigha					
Altitude (m)	262					
Latitude	26° 55’ 03.1					
Longitude	72° 18’ 44.6					
B. Topographical features						
a)	Erosion:	√**Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√**Moderate (50-100)**	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
C. decidua (240), *P. cineraria* (60)					No shrub	
ENS of Tree : 1.04					**ENS of Shrub: 1.00**	
Herb and Grass Species						
D. sindicum						
D. Wild-life						
Blue Bull, Snake						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
6.23	0.23	0.220	1.62	10.22

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**68**					
A. Basic Information about the sacred groves						
Name of sacred groves	Karni Mata Ji Oran					
Name of village	Khari Khurd					
Panchayat	luni					
Forest Block	Kharikurd					
District	Jodhpur					
Area	175 bigha					
Altitude (m)	230					
Latitude	26° 10’ 26.9					
Longitude	73° 21’ 10.5					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI			**Shrub species with IVI**			
C. decidua (139), *P. juliflora* (125), *P. cineraria* (20), *S. oleoides* (16)			*Z. nummularia* (82), *G. tenax* (80), *C. procera* (78), *C. burhia* (30), *A. persica* (30)			
ENS of Tree : 2.47			**ENS of Shrub: 4.71**			
Herb and Grass Species						
C. tora, D. sindicum, E. ciliaris, H. marifolium, I. cordifolia, T. purpurea, T. terrestris, V. cinerea.						
D. Wild-life						
Wild Dog, Squirrel.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
8.18	0.38	0.210	1.63	10.17

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**69**					
A. Basic Information about the sacred groves						
Name of sacred groves	Ramdeo Ji ka Oran					
Name of village	Nandiya, Birahi					
Panchayat	Bavdi					
Forest Block	Bilara					
District	Jodhpur					
Area						
Altitude (m)	273					
Latitude	26° 31’ 05.6					
Longitude	73° 17’ 48.5					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI			**Shrub species with IVI**			
P. cineraria (235), *P. juliflora* (65)			*C. procera* (300)			
ENS of Tree : 1.74			**ENS of Shrub: 1.00**			
Herb and Grass Species						
C. tora, D. sindicum, E. hirta, E. ciliaris, H. marifolium, I. cordifolia, T. purpurea, T. terrestris, V. cinerea.						
D. Wild-Life						
Wild Dog, Squirrel, Sparrow						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
8.24	0.24	0.300	1.59	11.61

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**70**					
A. Basic Information about the sacred groves						
Name of sacred groves	Pabuji Ka Oran					
Name of village	Nandiya Prabhavati					
Panchayat	Bhopalgarh					
Forest Block	Nandiya					
District	Jodhpur					
Area	40 bigha					
Altitude (m)	349					
Latitude	26° 33’ 14.0					
Longitude	73° 20’ 56.8					
B. Topographical features						
a)	Erosion:	√**Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√ **Shallow** (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI			**Shrub species with IVI**			
P. juliflora (300)			No shrub (0)			
ENS of Tree > 30: 1.00			**ENS of Shrub: 1.00**			
Herb and Grass Species						
B. diffusa, B. pussilla, B. ramosa, B. repens, C. tora, D. sindicum, E. hirta, E. ciliaris, H. marifolium, I. cordifolia, T. purpurea, T. terrestris, V. cinerea						
D. Wild-Life						
Squirrel, Sparrow, Fox.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.82	0.28	0.030	1.71	1.52

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**71**					
A. Basic Information about the sacred groves						
Name of sacred groves	Joleyali Oran					
Name of village	Joleyali					
Panchayat	mandor					
Forest Block						
District	Jodhpur					
Area	260 bigha					
Altitude (m)	195					
Latitude	26° 16’ 21.4					
Longitude	72° 44’ 59.9					

B. Topographical features						
a)	Erosion:	Slight	Moderate	Severe	√**Gullied**	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)	Moderate (50-100)		√ **Deep** (>100 cm)

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
P. cineraria (267), *A. sericea* (33)	No shrub (0)
ENS of Tree : 1.26	**ENS of Shrub: 1.00**

Herb and Grass Species
B. diffusa, B. ramosa, C. tora, D. sindicum, E. hirta, E. ciliaris, H. marifolium, I. cordifolia, T. purpurea, T. terrestris.
D. Wild-Life
Snake, Sparrow.
E. Soil characteristics

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.67	0.34	0.300	1.66	5.00

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**72**					
A. Basic Information about the sacred groves						
Name of sacred groves	Jardabala Ji Ka Oran					
Name of village	Langra					
Panchayat	Sapotra					
Forest Block	Langra					
District	Karauli					
Area	2 bigha					
Altitude (m)						
Latitude						
Longitude						
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	Plane	√**Valley (riverbed)**
c)	Soil Depth	Shallow (<25 cm)	√**Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI				**Shrub species with IVI**		
T. indica (71), *Mangifera indica* (50), *H. integrifolia* (31), *F. glomerata* (30), *F. benghalensis* (28), *A. leucophloea* (27), *C. nurvala* (21), *A. procera* (12), *P. pinnata* (12), *Syzygium cummini* (11), *M. hortensis* (9)				*C. procera* (150), *Z. nummularia* (100), *S. virosa* (27), *D. cinerea* (24)		
ENS of Tree : 8.75				**ENS of Shrub: 2.85**		
Herb and Grass Species						
B. pussilla, B. ramosa, B. repens, C. tora, E. hirta, E. ciliaris, H. marifolium, I. cordifolia, L. trinervis, M. jacquemontii, T. purpurea, V. cinerea.						
D. Wild-Life						
Parakeet, squirrel, Pea Fowl.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
6.38	0.26	0.855	1.32	29.61

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**73**					
A. Basic Information about the sacred groves						
Name of sacred groves	Barbasni Mata Ji Ka Oran					
Name of village	Dudherai					
Panchayat	Amarwa					
Forest Block	Barbasni					
District	Karauli					
Area	252 bigha					
Altitude (m)	279					
Latitude	26° 17’ 00.3					
Longitude	76° 48’ 40.4					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	Plane	√ **Valley (riverbed)**
c)	Soil Depth	Shallow (<25 cm)	√**Moderately deep** (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. pendula (215), *W. tinctoria* (46), *D. melanoxylon* (24), *L. coromandelica* (15)					No shrub (0)	
ENS of Tree : 1.79					**ENS of Shrub: 1.00**	
Herb and Grass						
B. pussilla, B. ramosa, B. repens, C. tora, E. hirta, I. cordifolia, L. trinervis, M. Jacquemontii, V. cinerea.						
D. Wild-Life						
Blue Bull, Sambar Deer						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
6.97	0.31	0.390	1.52	13.25

DATA ON SACRED GROVES OF RAJASTHAN

Sacred Grove No.	**74**

A. Basic Information about the sacred groves

Name of sacred groves	Devnarayan Ji Ki Banni
Name of village	Shyampur
Panchayat	Sapotra
Forest Block	Langra
District	Karauli
Area	21 bigha
Altitude (m)	375
Latitude	26° 22’ 09.9
Longitude	77° 09’ 04.6

B. Topographical features

a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)

C. Vegetation status

Tree species with IVI	**Shrub species with IVI**
A. pendula (300)	*D. cinerea* (265), *Z. nummularia* (35)
ENS of Tree : 1.00	**ENS of Shrub: 1.33**

Herb and Grass Species

B. pussilla, B. ramosa, B. repens, Corchorus tridens, C. pumila, E. granularis, E. hirta, H. granularis, I. cordifolia, L. trinervis, M. Jacquemontii, V. cinerea.

D. Wild-Life

Blue Bull, Dog, Sparrow.

E. Soil characteristics

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.85	0.18	0.435	1.45	14.74

F. History and status

This temple was built up 25 years ago. People of 24 villages of Gunjan community were forced by sh. Swami Ganeshsanand baba to build this temple up. All families gave 250 gm. ghee for temple’s Akhand Jyoti.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**75**					
A. Basic Information about the sacred groves						
Name of sacred groves	Dardevi Mata ji Ka Oran					
Name of village	Prahladpura, Umedganj, Ganeshpura.					
Panchayat	Laadpura					
Forest Block	Dardevi					
District	Kota					
Area	80 bigha					
Altitude (m)	289					
Latitude	25° 04’ 38.1					
Longitude	75° 55’ 08.6					
B. Topographical features						
a)	Erosion:	√**Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√ **Moderate (50-100)**	Deep (>100 cm)

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
T. arjuna (101), *M. parviflora* (41), *A. pendula* (37), *P. juliflora* (20), *P. dulce* (19), *L. coromandelica* (15), *P. sylvestris* (14), *B. monosperma* (14), *A. leucophloea* (10), *E. camaldulensis* (10), *A. indica* (8), *Sterculia urens* (7), *W. tinctoria* (6), *H. integrifolia* (4), *C. fistula* (4)	*Z. nummularia* (196), *F. indica* (68), *C. carrundas* (36)
ENS of Tree : 8.84	**ENS of Shrub: 2.28**
Herb and Grass Species	
B. ramosa, B. repens, C. tora, C. pumila, E. granularis, E. hirta, H. granularis, I. cordifolia, L. trinervis, M. Jacquemontii, T. procumbens, V. cinerea.	
D. Wild-Life	
Deer, Blue Bull, Jackal.	

E. Soil characteristics

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.71	0.57	0.495	1.44	18.94

F. History and status

In ancient times King of Kota used to come here to worship the Goddess, so people kept this routine continue. Goats are sacrificed here as a custom.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**76**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnarayan Bhagwan Ka Oran					
Name of village	Keechalheda					
Panchayat	Laadpura					
Forest Block						
District	Kota					
Area	50 bigha					
Altitude (m)	278					
Latitude	25° 01’ 14.7					
Longitude	76° 03’ 38.7					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√**Moderate (50-100)**	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. catechu (120), *A. nilotica* (48), *B. monosperma* (44), *M. parviflora* (24), *Z. mauritiana* (17), *A. leucophloea* (17), *Randia dumetorum* (9), *D. falcata* (8), *Ehretia aspera* (7), *C. decidua* (7)					*D. cinerea* (300)	
ENS of Tree : 4.50					**ENS of Shrub: 1.00**	
Herb and Grass Species						
B. ramosa, B. repens, C. tora, E. alsinoides, E. granularis, E. hirta, I. cordifolia, T. procumbens, V. cinerea.						
D. Wild-Life						
Deer, Blue Bull, Hare.						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
7.73	0.45	0.945	1.33	20.61		
F. History and status						
This temple is approximately 200 years old.						

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**77**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnarayan Ji Ka Oran					
Name of village	Khajuri					
Panchayat	Sangoda					
Forest Block						
District	Kota					
Area	600 bigha					
Altitude (m)	268					
Latitude	25° 03’ 34.1					
Longitude	76° 05’43.8					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
E. camaldulensis (208), *P. sylvestris* (59), *P. juliflora* (32)					No shrub (0)	
ENS of Tree : 1.89					**ENS of Shrub: 1.00**	
Herb and Grass Species						
B. ramosa, C. tora, E. alsinoides, E. hirta, I. cordifolia, T. procumbens, V. cinerea.						
D. Wild-Life						
Deer, Blue Bull, Hare, Wild Pig, Cow.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
8.33	0.35	0.720	1.68	22.85

F. History and status

In ancient time tree of Khajur (*Phoenix sylvestris*) was found here in much diversity hence the name of village Khajuriya. At present plantation of *Eucalyptus camaldulensis* has been done.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**78**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnarayan Ji Ka Oran					
Name of village	Chatarpura					
Panchayat	Sangoda					
Forest Block						
District	Kota					
Area	25 bigha					
Altitude (m)	269					
Latitude	24° 52’ 10.0					
Longitude	76° 20’ 18.0					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)	Moderate (50-100)		√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. nilotica (92), *A. leucophloea* (92), *P. sylvestris* (33), *P. juliflora* (31), *C. decidua* (27), *A. indica* (10), *D. falcata* (9), *Pithecellobium dulce* (6)					*D. cinerea* (177), *C. sepiaria* (81), *C. procera* (42)	
ENS of Tree : 4.91					**ENS of Shrub: 2.86**	
Herb and Grass Species						
B. ramosa, C. tora, E. alsinoides, E. hirta, I. cordifolia, T. procumbens.						
D. Wild-Life						
Deer, Blue Bull.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.76	0.45	1.035	1.40	24.83

F. History and status

God Devnarayan is worshipped at this place.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**79**					
A. Basic Information about the sacred groves						
Name of sacred groves	Dhokad Wali Mata ji Ka Oran					
Name of village	Daarupura					
Panchayat	Kherabad					
Forest Block						
District	Kota					
Area	7 bigha					
Altitude (m)	347					
Latitude	24° 45’ 51.0					
Longitude	75° 55’ 53.9					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. pendula (211), *A. leucophloea* (59), *A. nilotica* (16), *D. falcata* (15)					*C. sepiaria* (300)	
ENS of Tree : 1.77					**ENS of Shrub: 1.00**	
Herb and Grass Species						
E. alsinoides						
D. Wild-Life						
Hare, Jackal.						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
7.99	0.31	0.210	1.62	7.21		
F. History and status						
This is very old temple. In old times the whole area was covered with dense forest.						

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**80**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnarayan Ji Ka Oran					
Name of village	Minyakhedi					
Panchayat	Kherabad					
Forest Block						
District	Kota					
Area	23 bigha					
Altitude (m)	336					
Latitude	24° 48’ 00.5					
Longitude	75° 56’ 54.0					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. catechu (163), *C. decidua* (38), *A. pendula* (25), *M. parviflora* (24), *B. monosperma* (18), *B. aegyptiaca* (15), *A. leucophloea* (10), *P. juliflora* (7)					*D. cinerea* (127), *C. sepiaria* (97), *Z. nummularia* (52),*C. procera* (24)	
ENS of Tree : 2.97					**ENS of Shrub: 3.60**	
Herb and Grass Species						
B. diffusa, B. ramosa, C. tora, E. alsinoides, E. hirta, E. ciliaris, I. cordifolia, T. procumbens, V. cinerea.						
D. Wild-Life						
Hare, Jackal.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.90	0.33	0.660	1.40	17.46

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**81**					
A. Basic Information about the sacred groves						
Name of sacred groves	Hanuman Ji ka Oran					
Name of village	Kushalipura					
Panchayat	Kurad					
Forest Block						
District	Kota					
Area	17 bigha					
Altitude (m)	268					
Latitude	25° 02’ 49.7					
Longitude	76° 07’ 31.3					
B. Topographical features						
a)	Erosion:	√**Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√ **Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI				**Shrub species with IVI**		
B. monosperma (271), *C. nurvala* (29)				*Z. nummularia* (202), *D. cinerea* (69), *S. virosa* (29)		
ENS of Tree : 1.06				**ENS of Shrub: 2.08**		
Herb and Grass Species						
B. eriantha, B. diffusa, B. ramosa, C. tora, E. alsinoides, E. hirta, E. ciliaris, I. cordifolia, T. procumbens, Urginea indica, V. cinerea.						
D. Wild-Life						
Deer, Blue Bull, Hare.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.66	0.24	0.945	1.32	24.15

F. History and status

This place is 260 years old. People believe that diseases can be cured by coming to this land.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**82**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnarayan Ji ka Oran					
Name of village	Bambali					
Panchayat	Sultanpur					
Forest Block						
District	Kota					
Area	125 bigha					
Altitude (m)	276					
Latitude	25° 05’ 06.1					
Longitude	76° 05’ 22.8					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
P. juliflora (102), *M. parviflora* (81), *C. decidua* (40), *B. aegyptiaca* (27), *A. catechu* (27), *A. indica* (12), *H. integrifolia* (11)					*C. sepiaria* (300)	
ENS of Tree : 4.35					**ENS of Shrub: 1.00**	
Herb and Grass Species						
B. diffusa, B. ramosa, C. tora, E. alsinoides, E. hirta, I. cordifolia, T. procumbens, V. cinerea.						
D. Wild-Life						
Deer, Blue Bull, Hare.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
8.05	0.29	0.780	1.44	13.05

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**83**					
A. Basic Information about the sacred groves						
Name of sacred groves	Kalaji-Gora Ji Oran					
Name of village	Mohanpura					
Panchayat						
Forest Block						
District	Kota					
Area	24 bigha					
Altitude (m)	268					
Latitude	24° 56’ 16.8					
Longitude	76° 03’ 00.3					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√ **Moderate (50-100)**	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. pendula (158), *P. sylvestris* (42), *B. monosperma* (32), *P. juliflora* (11), *T. arjuna* (11), *D. regia* (10), *D. falcata* (10), *A. nilotica* (9), *Z. mauritiana* (9), *C. siema* (9)					*Z. nummularia* (165), *F. indica* (84), *C. sepiaria* (52)	
ENS of Tree : 3.19					**ENS of Shrub: 2.34**	
Herb and Grass Species						
B. eriantha, B. diffusa, B. ramosa, C. tora, E. alsinoides, E. hirta, I. cordifolia, J. procumbens, T. procumbens, V. cinerea.						
D. Wild-Life						
Deer, Blue Bull, Hare, Wild Pig.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.34	0.36	0.645	1.48	23.85

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**84**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bheruji Ka Oran					
Name of village	Theakariyawas					
Panchayat	Deedwana					
Forest Block						
District	Nagour					
Area	23 bigha					
Altitude (m)	333					
Latitude	27° 26’ 33.2					
Longitude	74° 26’ 41.8					
B. Topographical features						
a)	Erosion:	Slight	Moderate	√**Severe**	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
P. cineraria (111), *M. emarginata* (110), *A. senegal* (40), *F. religiosa* (27), *C. decidua* (13)	*A. jacquemontii* (133), *C. burhia* (55), *C. procera* (37), *L. pyrotechnica* (34), *Z. nummularia* (16), *L. barbarum* (13), *A. pseudotomentosa* (12)
ENS of Tree : 3.57	**ENS of Shrub: 5.77**
Herb and Grass Species	
A. funiculata, B. articularis, B. eracta, C. ciliaris, D. aegyptium, D. annulatum, D. ciliaris, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, M. jacqmontii, P. paniculata, T. purpurea, T. roxburghii, T. tennalus, T. terrestris. V. encelioides, V. cinerea.	
D. Wild-Life	
Deer, Blue Bull, Hare.	
E. Soil characteristics	

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
8.37	0.27	0.525	1.55	15.72

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**85**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bheruji Ka Oran					
Name of village	Dujar					
Panchayat	Laadnu					
Forest Block	Bhanglaw					
District	Nagour					
Area	14 bigha					
Altitude (m)	338					
Latitude	27° 35’ 41.5					
Longitude	74° 24’ 35.9					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
P. juliflora (133), *A. senegal* (85), *C. decidua* (61), *M. emarginata* (12), *A. tortilis* (8)					*L. barbarum* (202), *C. procera* (81), *L. pyrotechnica* (17)	
ENS of Tree : 2.98					**ENS of Shrub: 1.90**	
Herb and Grass Species						
A. funiculata, B. articularis, B. eracta, Corchorus depressus, C. ciliaris, D. aegyptium, D. annulatum, D. ciliaris, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, M. jacqmontii, P. erioptera ,P. paniculata, T. purpurea, T. roxburghii, T. tennalus, T. terrestris, V. cinerea, V. encelioides.						
D. Wild-Life						
Deer, Blue Bull, Hare, Parakeet.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.25	0.22	0.075	1.68	3.69

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**86**					
A. Basic Information about the sacred groves						
Name of sacred groves	Gosai Ji Ka Oran					
Name of village	Junjala					
Panchayat	Jaayal					
Forest Block						
District	Nagour					
Area	420 bigha					
Altitude (m)	317					
Latitude	27° 01’ 44.5					
Longitude	73° 55’ 58.4					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. sericea subsp nummularia (114), *C. decidua* (96), *P. cineraria* (90)					*Z. nummularia* (300)	
ENS of Tree : 2.70					**ENS of Shrub: 1.00**	
Herb and Grass Species						
A. funiculata, B. articularis, B. diffusa, C. depressus, C. ciliaris, D. aegyptium, D. ciliaris, E. ciliaris, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, M. jacqmontii, P. erioptera, T. purpurea, T. roxburghii, T. tennalus, T. terrestris, V. cinerea.						
D. Wild-Life						
Deer, Blue Bull, Hare, Parakeet, Pea Fowl, Fox.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
8.23	0.29	0.315	1.48	13.73

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**87**					
A. Basic Information about the sacred groves						
Name of sacred groves	Sathika Jogmaya Ji Ka Oran					
Name of village	Sathika Kala, Sathika kurd,Virloka					
Panchayat						
Forest Block						
District	Nagour					
Area	3000 bigha					
Altitude (m)	318					
Latitude	27° 01’ 11.4					
Longitude	73° 11’ 30.1					
B. Topographical features						
a)	Erosion:	Slight	Moderate	√**Severe**	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI			**Shrub species with IVI**			
Capparis decidua (194), *M. emarginata* (77), *P. cineraria* (30)			*Z. nummularia* (168), *A. pseudotomentosa* (60), *L. pyrotechnica* (36),*C. procera* (24), *A. persica* (11)			
ENS of Tree : 1.85			**ENS of Shrub: 3.94**			
Herb and Grass Species						
A. funiculata, B. diffusa, C. ciliaris, Cassia italic, D. aegyptium, D. ciliaris, E. ciliaris, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, M. jacqmontii, P. erioptera, T. purpurea, T. roxburghii, T. tennalus, T. terrestris, V. cinerea.						
D. Wild-Life						
Deer, Blue Bull, Hare, Parakeet, Pea Fowl.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
8.52	0.31	0.255	1.49	10.57

F. History and status

Kuldevi of Rajpurohit is being worshipped here.

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**88**					
A. Basic Information about the sacred groves						
Name of sacred groves	Laba ji Maharaj Ka Oran					
Name of village	Khariya Soda					
Panchayat						
Forest Block						
District	Pali					
Area	130 bigha					
Altitude (m)	288					
Latitude	25° 49’ 28.3					
Longitude	73° 38’ 20.4					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. sericea (279), *A. indica* (21)					No shrub (0)	
ENS of Tree : 1.19					**ENS of Shrub: 1.00**	
Herb and Grass Species						
B. diffusa, E. ciliaris, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, M. jacqmontii, P. erioptera, T. tennalus, T. terrestris, V. cinerea.						
D. Wild-Life						
Blue Bull, Sparrow.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.08	0.17	0.345	1.58	16.03

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**89**					
A. Basic Information about the sacred groves						
Name of sacred groves	Mama ji Ka Oran					
Name of village	Nimbuda(Busi)					
Panchayat	Pali					
Forest Block						
District	Pali					
Area						
Altitude (m)	277					
Latitude	26° 33’ 06.3					
Longitude	73° 27’ 33.0					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
P. juliflora (126), *S. oleoides* (114), *P. cineraria* (38),*C. decidua* (22)					*C. auriculata* (263), *G. tenax* (37)	
ENS of Tree : 2.09					**ENS of Shrub: 1.14**	
Herb and Grass Species						
B. diffusa, C. tora, C. italic, E. ciliaris, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, M. jacqmontii, P. erioptera, T. tennalus, T. terrestris, V. cinerea.						
D. Wild-Life						
Blue Bull, Sparrow, Grey Partridge.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.11	0.15	0.360	1.55	14.84

DATA ON SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**90**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnarayanji Ka Oran					
Name of village	Digai (Gundoj)					
Panchayat						
Forest Block						
District	Pali					
Area	30 bigha					
Altitude (m)	246					
Latitude	25° 34’ 28.4					
Longitude	73° 17’ 21.6					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
S. oleoides (196), *C. decidua* (79), *P. juliflora* (24)					*C. auriculata* (300)	
ENS of Tree : 2.59					**ENS of Shrub: 1.00**	
Herb and Grass Species						
B. diffusa, C. tora, C. italic, E. ciliaris, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, T. procumbens, T. terrestris.						
D. Wild-Life						
Blue Bull, Sparrow, Snake.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.15	0.12	0.360	1.56	14.36

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**91**					
A. Basic Information about the sacred groves						
Name of sacred groves	Ashapura Mata ji ka Oran					
Name of village	Guda keshor singh					
Panchayat	Nadole					
Forest Block						
District	Pali					
Area	80					
Altitude (m)	306					
Latitude	25° 22’ 51.1					
Longitude	73° 28’ 02.9					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
S. oleoides (199), *P. juliflora* (45), *A. nilotica var. cupressiformis* (25), *A. nilotica* (20), *A. leucophloea* (10)					*C. sepiaria* (228), *C. auriculata* (72)	
ENS of Tree : 2.69					**ENS of Shrub:** 1.67	
Herb and Grass Species:						
B. diffusa, B. ramose, C. tora, C. italic, D. sindicum, E. ciliaris, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, T. procumbens, T. terrestris, V. cinerea.						
D. Wild- life						
Blue Bull, Jarakh, Hare, Pea Fowl, Parakeet, Myna.						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
7.11	0.11	0.300	1.55	10.54		
F. History and status						
This place have history with the great Hindu king Prithviraj Chauhan. Before going to any battle Prithivi raj would come here for blessing in temple. She is also “kul devi” of Chouhan.						

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**92**					
A. Basic Information about the sacred groves						
Name of sacred groves	Mata ji Ka Oran (Mada)					
Name of village	Shree Mangleshwar Mahadev Dham					
Panchayat						
Forest Block						
District	Pali					
Area	7 bigha					
Altitude (m)	349					
Latitude	25° 12’ 53.5					
Longitude	73° 26’ 41.6					
B. Topographical features						
a)	Erosion:	√**Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. leucophloea (149), *P. cineraria* (43), *C. decidua* (34), *B. aegyptiaca* (32), *P. juliflora* (26), *A. nilotica* (17)					*C. auriculata* (210), *Z. nummularia* (51), *D. cinerea* (28),*S. virosa* (11)	
ENS of Tree : 4.36					**ENS of Shrub:** 1.43	
Herb and Grass Species:						
B. diffusa, B. ramose, C. tora, D. sindicum, E. ciliaris, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, T. procumbens, T. purpurea, T. terrestris, V. cinerea.						
D. Wild- life						
Blue Bull, Jarakh, Hare, Pea Fowl, Parakeet, Myna.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.25	0.23	0.330	1.52	10.87

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**93**					
A. Basic Information about the sacred groves						
Name of sacred groves	Dhundhlimata Ki Banni					
Name of village	Banshi					
Panchayat	Badi sadri					
Forest Block						
District	Pratapgarh					
Area	500 bigha					
Altitude (m)	599					
Latitude	24° 18’ 1.4					
Longitude	72° 23’ 49.9					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√ **Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
T. grandis (132), *W. tinctoria* (35), *D. melanoxylon* (22), *H. integrifolia* (19), *H. antidysenterica* (17), *M. tomentosa* (15), *Soymida febrifuga* (11), *A. marmelos* (10), *B. monosperma* (9), *L. coromandelica* (6), *G. tiliifolia* (6), *A. lebbeck* (4), *Sapindus mukorossi* (4), *E. laevis* (4), *Z. mauritiana* (4), *B. racemosa* (4)					*F. indica* (208), *Z. nummularia* (92)	
ENS of Tree : 4.76					**ENS of Shrub:** 1.82	
Herb and Grass Species:						
A. vaginalis, B. diffusa, B. ramose, B. repens, E. acaulis, E. hirta, C. tora, D. sindicum, E. alsinoides, I. cordifolia, J. procumbense, T. procumbens.						
D. Wild- life						
Blue Bull, Jarakh, Hanuman Langur, Hyena, Hare, Pea Fowl, Parakeet, Myna.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
6.42	0.22	0.630	1.40	19.55

F. History and status

A saint Dhundharimal took Samadhi here 20 years ago. Now a temple has been build up here.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**94**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bijasau mata ji Bani					
Name of village	Vijania					
Panchayat	Dhariavad					
Forest Block						
District	Pratapgarh					
Area	35 bigha					
Altitude (m)	263					
Latitude	24° 04’ 34.1					
Longitude	74° 27’ 41.8					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√ **Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
T. grandis (133), *H. integrifolia* (82), *D. melanoxylon* (40), *B. monosperma* (18), *A. leucophloea* (15), *A. marmelos* (12)					*L. camara* (300)	
ENS of Tree : 3.68					**ENS of Shrub:** 1.00	
Herb and Grass Species:						
A. vaginalis, B. diffusa, B. ramose, B. repens, C. pumila, E. granularis, E. acaulis, E. hirta, C. tora, D. sindicum, E. alsinoides, I. cordifolia, J. procumbense, T. procumbens.						
D. Wild- life						
Blue Bull, Jarakh, Hanuman Langur, Hyena, Hare, Pea Fowl, Parakeet, Myna.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha-^{1})**
7.60	0.17	1.515	1.35	14.03

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**95**					
A. Basic Information about the sacred groves						
Name of sacred groves	Chandimata ji Ka Oran					
Name of village	Barol					
Panchayat	Choti sadri					
Forest Block						
District	Pratapgarh					
Area	40 bigha					
Altitude (m)	464					
Latitude	24° 18’ 09.4					
Longitude	74° 43’ 37.8					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
T. arjuna (105), *B. monosperma* (100), *P. sylvestris* (43), *M. parviflora* (22), *H. integrifolia* (18), *D. cordifolia* (12)					*L. camara* (300)	
ENS of Tree: 4.11					**ENS of Shrub:** 1.00	
Herb and Grass Species:						
C. tora, D. sindicum, E. acaulis, E. hirta, E. alsinoides, I. cordifolia, J. procumbense, T. procumbens.						
D. Wild- life						
Bagh, Bhalu, Blue Bull, Jarakh, Hanuman Langur, Hyena, Hare, Pea Fowl, Parakeet, Myna.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
6.05	0.08	0.570	1.42	17.46

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**96**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnarayan ji Ki Bani					
Name of village	Chhotidati					
Panchayat	Bara barda					
Forest Block						
District	Pratapgarh					
Area	35 bigha					
Altitude (m)	412					
Latitude	24° 12’ 05.2					
Longitude	74° 42’ 25.6					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI				**Shrub species with IVI**		
T. grandis (227), *B. monosperma* (73)				*L. camara* (250), *C. sepiaria* (50)		
ENS of Tree : 1.54				**ENS of Shrub:** 1.46		
Herb and Grass Species:						
A. vaginalis, B. diffusa, B. ramose, B. repens, E. acaulis, E. hirta, C. tora, D. sindicum, E. alsinoides, I. cordifolia, J. procumbense, T. procumbens.						
D. Wild- life						
Blue Bull, Jarakh, Hanuman Langur, Hyena, Hare, Pea Fowl, Parakeet, Myna.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
6.55	0.19	0.512	1.44	13.71

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**97**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnarayan ji ki Bani					
Name of village	Hira Ki Bassi					
Panchayat	Devgarh					
Forest Block	Bagna					
District	Rajsamand					
Area	40 bigha					
Altitude (m)	657					
Latitude	25° 32’ 01					
Longitude	73° 52’ 04.8					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√ **Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. pendula (253), *A. indica* (28), *P. cineraria* (19)					*D. cinerea* (194), *G. tenax* (106)	
ENS of Tree: 1.17					**ENS of Shrub:** 1.75	
Herb and Grass Species:						
A. vaginalis, B. diffusa, B. pussilla, B. ramose, B. repens, C. tora, D. sindicum, E. acaulis, E. hirta, E. alsinoides, I. cordifolia, J. procumbense, T. procumbens, T. rhomboidea, V. cinerea, Zornia gibbosa.						
D. Wild- life						
Blue Bull, Jarakh, Hanuman Langur, Hyena, Hare, Pea Fowl, Parakeet, Myna.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
6.58	0.12	0.675	1.46	20.92

F. History and status

This oran is conserved by villagers for the sake of Devnarayan God.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**98**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bheru Nath ji Ki Vani					
Name of village	Swadari					
Panchayat	devgarh					
Forest Block	Devgarh need					
District	Rajsamand					
Area	75 bigha					
Altitude (m)	652					
Latitude	25° 29’ 51.1					
Longitude	73° 54’ 02.4					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. pendula (130), *A. leucophloea* (60), *W. tinctoria* (40), *M. emarginata* (31), *F. benghalensis* (11), *H. integrifolia* (8), *P. juliflora* (8), *B. monosperma* (7), *A. nilotica* (7)					*G. tenax* (197), *Euphorbia caducifolia* (103)	
ENS of Tree : 4.24					**ENS of Shrub:** 1.75	
Herb and Grass Species:						
A. vaginalis, B. diffusa, B. pussilla, B. ramose, B. repens, C. tora, D. sindicum, E. acaulis, E. hirta, E. alsinoides, G. bosvallia, I. cordifolia, J. procumbense, S. cordifolia, T. rhomboidea, T. procumbens, T. tennalus, V. cinerea, Z. gibbosa.						
D. Wild- life						
Bagh, Blue Bull, Jarakh, Hanuman Langur, Hyena, Hare, Pea Fowl, Parakeet, Myna.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.12	0.15	0.525	1.49	15.19

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**99**					
A. Basic Information about the sacred groves						
Name of sacred groves	Chamunda Mata ji Ki Bani					
Name of village	Chamunda Khoot					
Panchayat	Amet					
Forest Block						
District	Rajsamand					
Area	36 bigha					
Altitude (m)	602					
Latitude	25° 23’ 59.3					
Longitude	74° 00’ 51.3					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√ **Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. pendula (216), *M. emarginata* (84)					*R. mysurensis* (300)	
ENS of Tree: 1.75					**ENS of Shrub:** 1.00	
Herb and Grass Species:						
A. vaginalis, B. diffusa, B. pussilla, B. ramose, B. repens, C. tora, D. sindicum, E. acaulis, E. hirta, E. alsinoides, G. bosvallia, I. cordifolia, J. procumbense, L. trinervis, P. erioptera, S. cordifolia, T. rhomboidea, T. procumbens, T. tennalus, V. cinerea, Z. gibbosa.						
D. Wild- life						
Blue Bull, Jarakh, Hanuman Langur, Hyena, Hare, Pea Fowl, Parakeet, Myna, Bulbul.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.25	0.18	0.600	1.52	18.24

F. History and status

This area is conserved by village community for the temple Goddess Chamunda Mata ji.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**100**					
A. Basic Information about the sacred groves						
Name of sacred groves	Haumanji ki Dungri					
Name of village	Neenadra					
Panchayat	sawaimadhopur					
Forest Block	Dunda					
District	Sawaimadhopur					
Area	8 bigha					
Altitude (m)	267					
Latitude	26° 08’ 01.0					
Longitude	76° 20’ 17.5					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√ **Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
P. juliflora (141), *A. pendula* (139), *A. nilotica* (20)					*C. procera* (300)	
ENS of Tree : 2.17					**ENS of Shrub:** 1.00	
Herb and Grass Species:						
A. hispidum, Alysicarpus monilifer, A. vaginalis, B. diffusa, B. pussilla, B. ramose, B. repens, Cyanotis cristata, C. tora, D. sindicum, E. acaulis, E. hirta, E. alsinoides, G. bosvallia, I. cordifolia, J. procumbense, L. trinervis, P. erioptera, S. cordifolia, T. rhomboidea, T. procumbens, T. tennalus, V. cinerea, Z. gibbosa.						
D. Wild- life						
Blue Bull, Jarakh, Wild Dog, Hanuman Langur, Hyena, Hare, Pea Fowl, Parakeet, Myna.						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
7.48	0.27	0.630	1.50	9.07		
F. History and status						
The area around God Hanuman ji temple has been conserved.						

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**101**					
A. Basic Information about the sacred groves						
Name of sacred groves	Jasram Baba Ji Ki Bani					
Name of village	Naroda, Meesakhedi					
Panchayat	khardar					
Forest Block	no					
District	Sawaimadhopur					
Area	12 bigha					
Altitude (m)	207					
Latitude	25° 52’ 30.0					
Longitude	76° 35’ 00.4					
B. Topographical features						
a)	Erosion:	Slight	Moderate	Severe	√ **Gullied**	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√ **Moderate (50-100)**	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
M. parviflora (87), *P. juliflora* (55), *C. dichotoma* (43), *F. infectoria* (34), *A. indica* (31), *B. aegyptiaca* (24), *A. nilotica* (16),*A. pendula* (11)					*C. phlomidis* (221), *C. sepiera* (48), *C. carrundus* (31)	
ENS of Tree : 6.12					**ENS of Shrub**: 2.14	
Herb and Grass Species:						
A. hispidum, A. monolifer, B. diffusa, B. pusilla, B. ramose, B. repens, E. acaulis, E. hirta, E. alsinoides, I. cordifolia, J. procumbense, L. trinervis, P. erioptera, S. cordifolia, T. rhomboidea, T. procumbens, T. tennalus, V. cinerea.						
D. Wild- life						
Crocodile, Blue Bull, Jarakh, Wild Dog, Hanuman Langur, Wild Pig, Hyena, Hare, Pea Fowl, Parakeet.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.58	0.26	0.660	1.49	9.96

F. History and status

Jasram baba took here “jal-samadhi” in Chambal river so people come here to worship him. Temple has been build along the Chambal river and surrounding area has been conserved by temple priest.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**102**					
A. Basic Information about the sacred groves						
Name of sacred groves	Peer Baba Ki Dargah					
Name of village	Garadwas					
Panchayat	sawaimadhopur					
Forest Block	Chauth ka barbada					
District	Sawaimadhopur					
Area	40 bigha					
Altitude (m)	329					
Latitude	26° 00’ 09.6					
Longitude	76° 07’ 51.3					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	√ **Hill top**	Hill slope	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√ **Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. pendula (212), *P. juliflora* (35), *C. decidua* (19), *A. indica* (14), *C. nurvala* (11), *A. nilotica* (10)					*C. sepiaria* (300)	
ENS of Tree: 2.09					**ENS of Shrub:** 1.00	
Herb and Grass Species:						
A. monolifer, A. vaginalis, B. diffusa, B. pusilla, B. ramose, B. repens, Cyanotis cristata, C. tora, D. sindicum, E. acaulis, E. hirta, E. alsinoides, G. bosvallea, H. granularis, O. thomaeum , I. cordifolia, J. procumbense, L. trinervis, P. erioptera, S. cordifolia, T. rhomboidea, T. procumbens, T. tennalus, V. cinerea, Z. gibbosa.						
D. Wild- life						
Bagh, Blue Bull, Jarakh, Wild Dog, Deer, Wild Pig, Hyena, Hare, Pea Fowl, Parakeet.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.66	0.23	0.562	1.55	9.03

F. History and status

This place is conserved by villagers because of Peer baba mosque at top of hill. There is a penalty of 1100 Rs. if anyone cut the trees.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**103**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bheruji Ki Bani					
Name of village	Tadi					
Panchayat	Pipradi					
Forest Block	Sangarwa					
District	Sikar					
Area	50 bigha					
Altitude (m)	480					
Latitude	27° 33’ 98.3					
Longitude	75° 17’ 05.5					

B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√**Moderate (50-100)**	Deep (>100 cm)

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
P. cineraria (125), A. tortilis (93), A. nilotica (67), M. emarginata (16)	*C. procera* (191), *L. pyrotechnica* (90), *C. callosus* (19)
ENS of Tree: 3.43	**ENS of Shrub:** 2.20

Herb and Grass Species:
Aristida adscensionis, A. funiculata, B. diffusa, C. ciliaris, D. aegyptium, D. ciliaris, E. ciliaris, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, P. erioptera, T. purpurea, T. roxburghii, T. terrestris, V. cinerea.
D. Wild- life
Hare, Blue Bull, Deer, Mangoose, Pea Fowl, Grey Partridge.
E. Soil characteristics

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
6.20	0.12	0.210	1.62	10.21

F. History and status

2000 years old.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**104**					
A. Basic Information about the sacred groves						
Name of sacred groves	Kheri Walai Balaji ka Oran					
Name of village	Raipura					
Panchayat	Pipradi					
Forest Block	Jeen mata					
District	Sikar					
Area	257 bigha					
Altitude (m)	482					
Latitude	27° 28’ 27.2					
Longitude	73° 17’ 45.2					

B. Topographical features						
a)	Erosion:	√**Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√**Moderate (50-100)**	Deep (>100 cm)

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
C. decidua (104), *M. emarginata* (67), *P. cineraria* (57), *A. tortilis* (45), *A. catechu* (28)	*Z. nummularia* (171), *C. procera* (129)
ENS of Tree: 4.44	**ENS of Shrub:** 1.96

Herb and Grass Species:

A. adscensionis, B. diffusa, C. ciliaris, D. aegyptium, D. ciliaris, E. ciliaris, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, P. erioptera, T. purpurea, T. roxburghii, T. terrestris.

D. Wild- life

Hare, Blue Bull, Parakeet.

E. Soil characteristics

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.06	0.09	0.390	1.60	18.72

F. History and status

1500 years old temple. People have been worshipping and protecting this place since ancient times.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**105**					
A. Basic Information about the sacred groves						
Name of sacred groves	Satimata Ji Ka Mandir					
Name of village	Moklawas					
Panchayat	Danta Ramgarh					
Forest Block						
District	Sikar					
Area	500 bigha					
Altitude (m)	431					
Latitude	27° 17’ 26.6					
Longitude	75° 14’ 08.3					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
P. cineraria (184), *C. decidua* (116)	*C. procera* (300)
ENS of Tree: 1.99	**ENS of Shrub:** 1.00

Herb and Grass Species:

A. adscensionis, B. diffusa, C. tora, C. ciliaris, D. aegyptium, D. ciliaris, E. ciliaris, E. alsinoides, I. cordifolia, I. linnai, J. procumbense, H. marifolium, O. compressa, P. amarus, P. erioptera, T. purpurea, T. roxburghii, T. terrestris.

D. Wild- life

Blue Bull, Deer, Pigeon, Pea Fowl, Parakeet, Koyal, Hare.

E. Soil characteristics

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
6.70	0.34	0.225	1.59	10.73

C. F. History and status

70 years old, smt. krishna kumari w/o shri satidhan singh became sati with his husband. Hence the temple was established.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**106**					
A. Basic Information about the sacred groves						
Name of sacred groves	Sidheswar Mahadeo Mandir					
Name of village	Dhanta, Makrod, Khera					
Panchayat	Sirohi					
Forest Block	Meerpur					
District	Sirohi					
Area	850 bigha					
Altitude (m)	338					
Latitude	24° 48’ 13.5					
Longitude	72° 50’ 16.9					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
Acacia senegal (134), *Anogeissus pendula* (86), *Prosopis juliflora* (44), *Balanites aegyptiaca* (28), *Prosopis cineraria* (7)					*Ziziphus nummularia* (183), *Dichrostachys cinerea* (117)	
ENS of Tree : 2.82					**ENS of Shrub**: 1.70	
Herb and Grass Species:						
A. aspera, Borreria stricta, B. ramosa, D. ciliaris, E. alsinoides, I. cordifolia, P. amarus, Rhynchosia minima, T. purpurea, T. tennalus.						
D. Wild-life						
Goh, Hare, Blue Bull, Deer, Mangoose, Pigeon, Pea Fowl, Parakeet, Koyal.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.82	0.16	0.225	1.50	9.59

F. History and status

It is an ancient temple. Presently under care of gram panchayat and is good in condition.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**107**					
A. Basic Information about the sacred groves						
Name of sacred groves	Vorada Hanuman ji Ka Oran					
Name of village	Vorada					
Panchayat						
Forest Block						
District	Siroh					
Area	2380 bigha					
Altitude (m)	222					
Latitude	25° 02’ 31.0					
Longitude	72° 40’ 60.7					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
S. oleoides (197), *P. juliflora* (79), *C. decidua* (24)					*C. auriculata* (300)	
ENS of Tree : 2.15					**ENS of Shrub:** 1.00	
Herb and Grass Species:						
A. funiculate, B. diffusa, B. ramosa, C. viscosa, D. ciliaris, E. alsinoides, I. cordifolia, P. amarus, T. purpurea, T. tennalus.						
D. Wild- life						
Goh, Rat, Hare, Blue Bull, Deer, Mangoose, Pigeon, Pea Fowl.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.82	0.16	0.225	1.55	9.53

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**108**					
A. Basic Information about the sacred groves						
Name of sacred groves	Magriwali Mata ji Ka Oran					
Name of village	Pesua					
Panchayat	Pesua					
Forest Block	Rampura					
District	Sirohi					
Area	25 bigha					
Altitude (m)	409					
Latitude	24° 43’ 45.3					
Longitude	72° 58’ 43.3					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	√ **Hill top**	Hill slope	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√ **Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
Anogeissus pendula (172), *Holoptelea integrifolia* (37), *Capparis decidua* (30), *Acacia leucophloea* (28), *Butea monosperma* (25), *Prosopis juliflora* (15), *Ficus benghalensis* (10)					*Grewia tenax* (300)	
ENS of Tree: 2.88					**ENS of Shrub:** 1.00	
Herb and Grass Species:						
A. aspera, B. diffusa, B. ramosa, C. italic, D. ciliaris, E. acaulis, E. alsinoides, I. cordifolia, P. amarus, T. procumbens, T. tennalus.						
D. Wild- life						
Hare, Blue Bull, Deer, Mangoose, Pigeon, Pea Fowl, Grey Partridge.						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
6.99	0.19	0.300	1.41	2.07		
F. History and status						
It is an ancient temple. Presently under care of local panchayat and under good condition.						

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**109**					
A. Basic Information about the sacred groves						
Name of sacred groves	Gosai Ji Ka Jod					
Name of village	Daidaspura					
Panchayat	Suratgarh					
Forest Block						
District	Sri Ganganagar					
Area	216 bigha					
Altitude (m)	205					
Latitude	29° 00’ 50.5					
Longitude	73° 58’ 45.5					
B. Topographical features						
a)	Erosion:	Slight	Moderate	√**Severe**	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
C. decidua (197), *P. cineraria* (53), *Z. mauritiana* (24), *A. indica* (13)					*Z. nummularia* (188), *A. persica* (112)	
ENS of Tree : 1.71					**ENS of Shrub:** 1.96	
Herb and Grass Species:						
B. diffusa, B. ramosa, G. pharnacioides, E. alsinoides, I. cordifolia, T. procumbens.						
D. Wild- life						
Chandan Goh, Rat, Hare, Blue Bull, Deer, Mangoose, Pigeon, Pea Fowl, Grey Partridge, Jungle Crow, House sparrow.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
6.99	0.19	0.300	1.62	11.65

F. History and status

Being a temple of God Gosai ji people come here to worship and area is conserved by Panchayat of nearby villages.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**110**					
A. Basic Information about the sacred groves						
Name of sacred groves	Baba Gadanpur Ki Dargah					
Name of village	Hindo, 15 spdm, Swaroopsar					
Panchayat	Anoopgarh					
Forest Block	No					
District	Sri Ganganagar					
Area	8 bigha					
Altitude (m)	167					
Latitude	29° 21’ 37.9					
Longitude	73° 42’ 37.0					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
C. decidua (99), *A. nilotica* (98), *S. oleoides* (73),*P. juliflora* (30)					No shrub	
ENS of Tree : 3.18					**ENS of Shrub:** 1.00	
Herb and Grass Species:						
Amaranthus species, B. diffusa, B. ramosa, Cadaba fruticosa, Cistanche tubulosa, G. pharnacioides, Heliotropium subulatum, E. alsinoides, I. cordifolia, T. procumbens.						
D. Wild- life						
Blue Bull, Pea Fowl, Parakeet, Koyal, Myna, Hare.						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
7.78	0.26	0.465	1.60	16.66		
F. History and status						
An ancient mosqe of Baba Gadanpur. People worshiped here and conserve this area.						

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**111**					
A. Basic Information about the sacred groves						
Name of sacred groves	Miyan Mama Peer Baba					
Name of village	Sardargarh					
Panchayat						
Forest Block						
District	Sri Ganganagar					
Area	50 bigha					
Altitude (m)	192					
Latitude	29° 27’ 23.5					
Longitude	73° 44’ 24.5					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√**Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. nilotica (172), *C. decidua* (72), *A. tortilis* (45),*P. juliflora* (11)					*C. procera* (170), *Haloxylon salicornicum* (130)	
ENS of Tree: 2.41					**ENS of Shrub:** 2.00	
Herb and Grass Species:						
Amaranthus species, B. diffusa, B. ramosa, Cistanche tubulosa, G. pharnacioides, Heliotropium subulatum, E. alsinoides, I. cordifolia, T. procumbens.						
D. Wild- life						
Blue Bull, Jackal, Pea Fowl, Parakeet, Koyal, Myna, Hare.						
E. Soil characteristics						

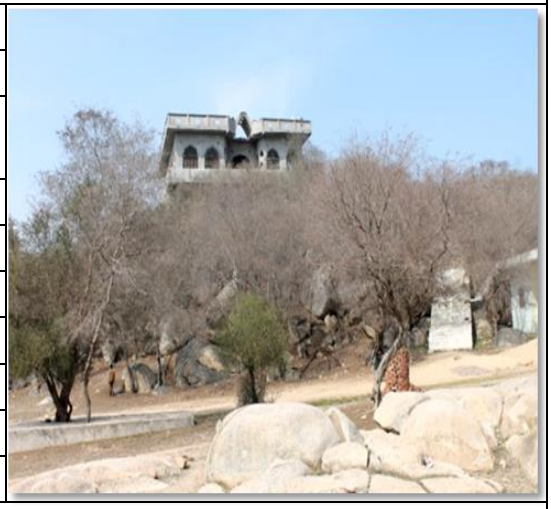
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.53	0.18	0.855	1.44	31.77

F. History and status

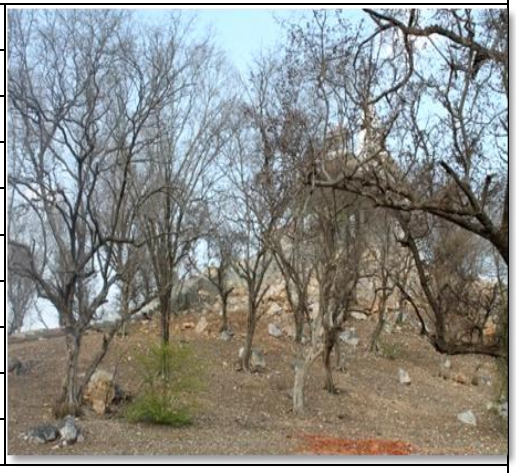
It is the cremation place so nobody can enter in this grove. As well as Miyan Mama Peer Baba mosque is present here. So this place is conserved by villagers. If anybody is seen cutting trees then they have to pay 500 rupees as penalty.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**112**					
A. Basic Information about the sacred groves						
Name of sacred groves	Baba Rahupeer Dargah					
Name of village	2MSR					
Panchayat	Anoopgarh					
Forest Block	5/7 PGM					
District	Sri Ganganagar					
Area	210 bigha					
Altitude (m)	157					
Latitude	29° 11’ 58.2					
Longitude	73° 12’ 49.0					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√**Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
S. oleoides (180), *A. nilotica* (46), *C. decidua* (37),*P. juliflora* (27), *P. cineraria* (10)					*Z. nummularia* (300)	
ENS of Tree: 3.22					**ENS of Shrub:** 1.00	
Herb and Grass Species:						
B. diffusa, B. ramosa, G. pharnacioides, E. alsinoides, I. cordifolia, T. procumbens.						
D. Wild- life						
Deer, Blue Bull, Pea Fowl, Parakeet, Koyal, Myna, Hare,						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
7.70	0.18	0.450	1.58	15.38		
F. History and status						
Very old mosque, more than 65 years. So people of all community come here for fulfillment of aspiration. It is being conserved by local Muslims God Rahupeer baba.						

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**113**					
A. Basic Information about the sacred groves						
Name of sacred groves	Mata Ji Ka Darra					
Name of village	Beldi					
Panchayat						
Forest Block	No					
District	Tonk					
Area	4 bigha					
Altitude (m)	345					
Latitude	25° 54’ 40.5					
Longitude	75° 45’ 29.4					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√ **Moderate (50-100)**	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
Prosopis juliflora (152), *Anogeissus pendula* (149)					*Capparis sepiaria* (300)	
ENS of Tree: 1.89					**ENS of Shrub:** 1.00	
Herb and Grass Species:						
B. diffusa, B. ramosa, J. procumbens, E. alsinoides, I. cordifolia, T. procumbens.						
D. Wild- life						
Bhalu, Bheria, Hyena, Blue Bull, Bulbul, Koyal, Jarakh, Pea Fowl, Parakeet, Hare.						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
7.45	0.24	0.075	1.68	1.67		

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**114**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devnarayan Ka Asthan					
Name of village	Devgaon, Mandavar, Sitarampur					
Panchayat	Marelawar					
Forest Block	Soyala					
District	Tonk					
Area	13 bigha					
Altitude (m)	301					
Latitude	26° 09’ 22.3					
Longitude	75° 59’ 17.4					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√ **Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. pendula (207), *W. tinctoria* (29), *A. nilotica* (20), *C. decidua* (16), *P. cineraria* (11), *C. religiosa* (9), *C. nurvala* (9)					*C. sepiaria* (300)	
ENS of Tree : 1.64					**ENS of Shrub:** 1.00	
Herb and Grass Species:						
B. diffusa, B. ramosa, J. procumbens, E. alsinoides, I. cordifolia, T. procumbens, V. cinerea, Z. gibbosa.						
D. Wild- life						
Blue Bull, Jarakh, Pea Fowl, Parakeet, Wild Pig, Hyena, Hare.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
7.24	0.22	0.180	1.65	5.44

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**115**					
A. Basic Information about the sacred groves						
Name of sacred groves	Devmaharaj Ka Asthan					
Name of village	Devpura, Bhanvarthal					
Panchayat	Sakhar					
Forest Block	Garota					
District	Tonk					
Area	15 bigha					
Altitude (m)	332					
Latitude	25° 57’ 04.7					
Longitude	75° 44’ 45.3					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√ **Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. pendula (223), *S. oleoides* (35), *C. decidua* (16), *A. indica* (10), *A. leucophloea* (9), *P. juliflora* (8)					No shrub	
ENS of Tree : 1.35					**ENS of Shrub:** 1.00	
Herb and Grass Species:						
B. diffusa, B. ramosa, B. repens, C. Tora, J. procumbens, E. alsinoides, I. cordifolia, T. procumbens, V. cinerea, Z. gibbosa.						
D. Wild- life						
Blue Bull, Jarakh, Pea Fowl, Parakeet, Wild Pig, Hyena, Hare.						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
7.33	0.26	0.235	1.55	7.13		

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**116**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bhairon ji Ka Oran, Pava Bab ji					
Name of village	Pava					
Panchayat	Girva					
Forest Block	Alsigarh marvad					
District	Udaipur					
Area	50 bigha					
Altitude (m)	865					
Latitude	24° 25’ 25.3					
Longitude	23° 32’ 55.5					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√**Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√**Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
W. tinctoria (112), *M. tomentosa* (40), *T. bellerica* (37), *L. coromandelica* (21), *B. retusa* (14), *A. latifolia* (13), *C. fistula* (11), *M. parviflora* (11), *H. integrifolia* (9), *E. officinalis* (7), *Ougeinia oojeinensis* (5), *D. melanoxylon* (4), *B. racemosa* (4), *P. sylvestris* (4), *B. monosperma* (4),*C. dichotoma* (4)					*Grewia villosa* (132), *L. camara* (87), *G. flavescence* (81)	
ENS of Tree: 6.20					**ENS of Shrub:** 2.66	
Herb and Grass Species:						
B. diffusa, B. ramosa, B. repens, C. Tora, J. procumbens, E. alsinoides, I. cordifolia, T. rhomboidea, T. procumbens, V. cinerea, Z. gibbosa.						
D. Wild- life						
Bagh, Bhalu, Blue Bull, Jarakh, Wild Dog, Pea Fowl, Parakeet, Wild Pig, Hyena, Hare.						
E. Soil characteristics						

pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**
6.78	0.11	0.465	1.44	10.85

F. History and status

This area is conserved naturally as people believe that the area is protected by miraculous power of God Bhairon Ji. So no one dare to disturb the place.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**117**					
A. Basic Information about the sacred groves						
Name of sacred groves	Hanuman Ji Ka Oran					
Name of village	Madri					
Panchayat						
Forest Block	No					
District	Udaipur					
Area	8 bigha					
Altitude (m)	704					
Latitude	24° 14’ 49.8					
Longitude	73° 29’ 15.9					
B. Topographical features						
a)	Erosion:	Slight	√**Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		√**Moderate (50-100)**	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
F. benghalensis (277), *P. sylvestris* (23)					No shrub (0)	
ENS of Tree: 1.23					**ENS of Shrub:** 1.00	
Herb and Grass Species:						
B. diffusa, B. ramosa, C. Tora, J. procumbens, E. alsinoides, I. cordifolia, T. rhomboidea, T. procumbens.						
D. Wild- life						
Fox, Hare, Pea Fowl, Parakeet, Pigeon.						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
6.27	0.14	0.480	1.51	13.10		
F. History and status						
The area is conserved by people in name of God Hanuman ji.						

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**118**					
A. Basic Information about the sacred groves						
Name of sacred groves	Shringi Rishi Ji Ka Oran					
Name of village	Bhikarni/ Chirva					
Panchayat	Udaipur					
Forest Block	Shringi Rishi					
District	Udaipur					
Area	**200** bigha					
Altitude (m)	732					
Latitude	73° 45’ 52.3					
Longitude	24° 42’ 06.2					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√ **Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
A. senegal (114), *W. tinctoria* (54), *A. leucophloea* (45), *H. integrifolia* (42), *A. leucophloea* (24), *E. camaldulensis* (11), *Z. mauritiana* (11), *Diospyros cordifolia* (10)					*G. tenax* (119), *Dyerophytum indicum* (65), *D. cinerea* (43), *Annona squamosa* (42), C. *sepiaria* (31)	
ENS of Tree : 5.22					**ENS of Shrub:** 4.17	
Herb and Grass Species:						
B. diffusa, B. ramosa, C. Tora, J. procumbens, E. alsinoides, I. cordifolia, Rungia pectinata, T. rhomboidea, T. procumbens.						
D. D. Wild- life						
Bagh, Bhalu, Fox, Myna, Mangoose, Blue Bull, Jarakh, Wild Dog, Pea Fowl, Parakeet, Wild Pig, Hyena, Hare.						
E. Soil characteristics						

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
8.16	0.18	1.845	1.28	30.47

C. F. History and status

In ancient time an ascetic saint Shree Shringi Rishi worshiped here God Shiv. From that time people come here to worship.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**119**					
A. Basic Information about the sacred groves						
Name of sacred groves	Bhanvar Mata ji Ki Bani					
Name of village	Sakroda					
Panchayat	Girva					
Forest Block						
District	Udaipur					
Area	625 bigha					
Altitude (m)	642					
Latitude	24° 34’ 07.6					
Longitude	73° 51’ 11.5					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	√ **Hill top**	Hill slope	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	√ **Shallow (<25 cm)**	Moderately deep (25-50)		Moderate (50-100)	Deep (>100 cm)

C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
A. pendula (188), *M. parviflora* (34), *L. coromandelica* (19), *A. indica* (15), *P. cineraria* (12), *A. senegal* (11), *C. decidua* (11), *A. leucophloea* (11)	*Euphorbia caducifolia* (163), *G. tenax* (82), *Commiphora wightii* (23), *D. cinerea* (17), *Calotropis procera* (16)
ENS of Tree : 2.17	**ENS of Shrub:** 2.88
Herb and Grass Species:	
B. diffusa, B. pussilla, B. ramosa, C. Tora, J. procumbens, E. acaulis, E. granularis, E. alsinoides, I. cordifolia, S. cordata, T. rhomboidea, T. procumbens.	
D. Wild- life	
Hare, Blue Bull, Pea Fowl, Parakeet, Jarakh, Jackal, Hanuman Langur.	

E. Soil characteristics

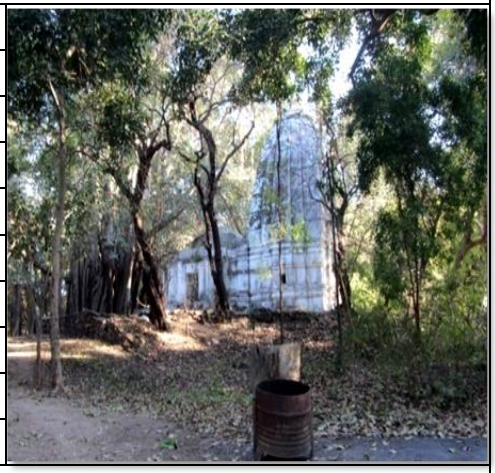
pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
6.60	0.32	1.305	1.25	15.58

C. F. History and status:

Because of presence of Local Goddess Bhanvar Mata ji, the whole area is conserved by villagers.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**120**					
A. Basic Information about the sacred groves						
Name of sacred groves	Kali Pahari Mata ji Ka Oran					
Name of village	Gumanpura, Ballabhnagar					
Panchayat	Bhinder					
Forest Block	Kali Pahari					
District	Udaipur					
Area	10 bigha					
Altitude (m)	525					
Latitude	24° 41’ 53.4					
Longitude	74° 00’ 20.4					
B. Topographical features						
a)	Erosion:	√ **Slight**	Moderate	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	√ **Plane**	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
P. juliflora (180), *A. senegal* (74), *A. catechu* (35), *B. serrata* (11)					No shrub	
ENS of Tree : 2.22					**ENS of Shrub:** 1.00	
Herb and Grass Species:						
B. diffusa, B. eriantha, B. pussilla, B. ramosa, C. Tora, J. procumbens, E. acaulis, E. granularis, E. alsinoides, I. cordifolia, P. paniculata, S. cordata, T. rhomboidea, T. procumbens, V. cinerea.						
D. Wild- life						
Hare, Blue Bull, Pea Fowl, Jarakh, Jackal, Hanuman Langur.						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
8.14	0.22	0.135	1.40	2.29		
F. History and status						
This area conserved in name of Local Goddess: Mata ji.						

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**121**					
A. Basic Information about the sacred groves						
Name of sacred groves	Kundeshwar Mahadevji Oran					
Name of village	Basaliya					
Panchayat	Iswal					
Forest Block						
District	Udaipur					
Area	13 bigha					
Altitude (m)	708					
Latitude	24° 45’ 06.3					
Longitude	73° 39’13.6					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	Hill slope	Plateau	Plane	√**Valley (riverbed)**
c)	Soil Depth	Shallow (<25 cm)	Moderately deep (25-50)		Moderate (50-100)	√ **Deep (>100 cm)**



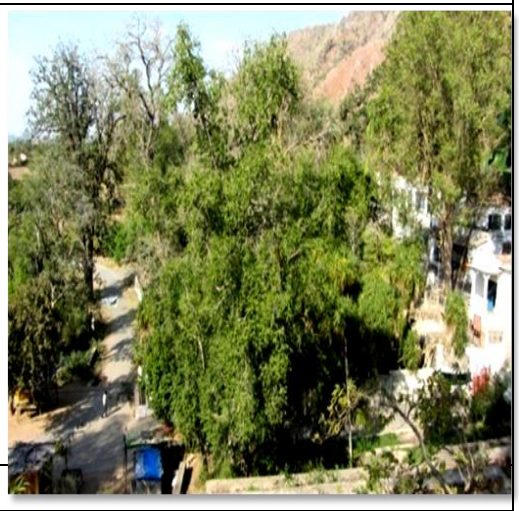
C. Vegetation status	
Tree species with IVI	**Shrub species with IVI**
F. benghalensis (141), *F. infectoria* (33), *Syzygium cummini* (31), *D. cordifolia* (29), *B. retusa* (14), *Santalum album* (9), *M. indica* (7), *Polyalthia longifolia* (7), *C. myxa* (6), *A. indica* (6), *C. fistula* (6), *H. integrifolia* (6), *T. indica* (8)	*C. sepiaria* (183), *A. squamosa* (117)
ENS of Tree : 5.83	**ENS of Shrub:** 1.89
Herb and Grass Species::	
B. diffusa, B. pussilla, B. ramosa, J. procumbens, E. acaulis, E. granularis, E. alsinoides, I. cordifolia, S. cordata, T. rhomboidea, T. procumbens, V. cinerea.	
D. Wild- life	
Bagh, Hare, Blue Bull, Pea Fowl, Parakeet, Jarakh, Hanuman Langur, Snake.	
E. Soil characteristics	

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.08	0.18	1.620	1.25	19.96

F. History and status

This is the oldest temple of God Shiv from ancient time. So people worship here and surroundings area is being protected by villagers.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN	
Sacred Grove No.	**122**



A. Basic Information about the sacred groves	
Name of sacred groves	Tarkeshwar Mahadev Oran
Name of village	Delwas
Panchayat	Sirada
Forest Block	
District	Udaipur
Area	30 bigha
Altitude (m)	466
Latitude	24° 13’ 07.2
Longitude	73° 42’ 47.8

B. Topographical features

a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√ **Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)

C. Vegetation status

Tree species with IVI	**Shrub species with IVI**
Putranjiva roxburghii (53), *H. integrifolia* (52), *M. indica* (37), *T. indica* (24), *F. benghalensis* (22), *Syzygium cummini* (16), *Feronia limonia* (14), *F. glomerata* (14), *D. melanoxylon* (13), *M. tomentosa* (12), *Cocos nucifera* (11), *C. dichotoma* (11), *Pendanus odoratissinus* (8), *F. infectoria* (9), *C. fistula* (5), *Guazuma ulmifolia* (6)	*A. squamosa* (168), *Jatropha curcas* (74), *C. auriculata* (25),*Cordia myxa* (17), *C. carrundas* (17)
ENS of Tree : 10.47	**ENS of Shrub:** 2.81

Herb and Grass Species:

B. diffusa, Blumea mollis, B. pussilla, B. ramosa, Hyptis suaveolens, J. procumbens, L. trinervis, E. acaulis, E. granularis, E. alsinoides, I. cordifolia, S. cordata, T. tennalus, T. rhomboidea, T. procumbens, V. cinerea.

D. Wild- life

Bagh, Blue Bull, Jarakh, Wild Dog, Pea Fowl, Parakeet, Wild Pig, Hyena, Hare.

E. Soil characteristics

pH	EC	SOC (%)	BD (g/cm^3)	Carbon density (t ha^{-1})
7.96	0.16	0.645	1.47	8.73

F. History and status

This is the oldest temple of God Shiv from ancient time. So people come here to worship God. Area is being conserved by villagers.

DATA ON NAME OF SACRED GROVES OF RAJASTHAN						
Sacred Grove No.	**123**					
A. Basic Information about the sacred groves						
Name of sacred groves	Ubeshwar ji Oran					
Name of village	Dhar					
Panchayat	Badgano					
Nearest forest Block	Ubeshwar ji					
District	Udaipur					
Area of sacred grove	700 bigha					
Altitude (m)	880					
Latitude	24° 37’ 13.2					
Longitude	73° 33’ 40.7					
B. Topographical features						
a)	Erosion:	Slight	√ **Moderate**	Severe	Gullied	
b)	Topography:	Hill top	√ **Hill slope**	Plateau	Plane	Valley (riverbed)
c)	Soil Depth	Shallow (<25 cm)	√ **Moderately deep (25-50)**		Moderate (50-100)	Deep (>100 cm)
C. Vegetation status						
Tree species with IVI					**Shrub species with IVI**	
E. camaldulensis (83), B. monosperma (70), D. cordifolia (35), M. parviflora (24), Acacia auriculiformis (20), Syzygium cummini (17), A. leucophloea (15), Mangifera indica (9), P. cineraria (8), F. infectoria (8), A. latifolia (7), R. dumentorum (6)					*L. camara* (136), *A. vasica* (63), *Jatropha curcas* (36), *G. flavescence* (18), *Agave americana* (14), *Z. nummularia* (13), *E. nerrifolium* (10), *C. sepiaria* (10)	
ENS of Tree : 6.72					**ENS of Shrub:** 3.41	
Herb and Grass Species:						
B. diffusa, B. pussilla, B. ramosa, J. procumbens, L. trinervis, E. acaulis, E. granularis, E. alsinoides, I. cordifolia, S. cordata, T. tennalus, T. rhomboidea, T. procumbens, V. cinerea.						
D. Wild-life						
Tiger, Blue Bull, Jarakh, Wild Dog, , Wild Pig, Hyena, Hare, Pea Fowl, Parakeet						
E. Soil characteristics						
pH	**EC**	**SOC (%)**	**BD (g/cm^3)**	**Carbon density (t ha^{-1})**		
7.98	0.17	1.905	1.25	40.80		
F. History This is an old temple of Lord Shiva since the time of Maharana Kumbha. People offer their prayers here and help in conserving the surroundings area.						

BIOLOGICAL DIVERSITY AND SOIL STATUS OF SACRED GROVES

Interface of ecology and evolution describes that biotic interactions contribute to regional biodiversity by accelerating adaptation and speciation (Deren et al., 2012). The benefits of increased biodiversity, i.e. number of species are that different species promotes ecosystem functioning during different years, at different places, for different functions and under different environmental change scenarios. Further, the species needed to provide one function during multiple years are not the same as those needed to provide multiple functions within one year (Isbell et al., 2011). Rapidly declining biodiversity worldwide resulting from anthropogenic alterations decrease ecosystem functioning and services (Cardinale et al., 2011). Though species may appear functionally redundant when one function is considered under one set of environmental conditions, but many species are needed to maintain multiple functions at multiple times and places in a changing world (Isbell et al., 2011). This heightens the need to enhance biological diversity of our ecosystem and develop suitable management strategies that conserve species and maintain ecosystem services. Careful selection of plants through evaluation and assessment in managed landscapes can augment ever needed management goals (Bennett and Gratton, 2013). In this chapter diversity of trees categorized into trees of >30 cm girth and 10-30 cm girth, tree saplings (> 3.0 cm to 10 cm girth) and shrub species have been described. It also covers faunal diversity in general based on the interaction with the local people and sighting. Soil characteristics, i.e. physic-chemical, nutritional and soil carbon density in 0-30 cm soil layer have also been described.

1. FLORAL DIVERSITY ACROSS THE SITES

In all 123 number of sacred groves studied, total number of tree species categorized in to >30 cm girth and 10-30 cm girth classes were 92 tree species, which belongs to 36 families. Likewise 39 numbers of shrub species belonging to 23 families have been identified in these sacred groves (Annexure I). Thus, all these 131 woody species (both trees and shrubs species) were covered under 48 botanical families (Table 4.1).

Table 4.1. Number of trees and shrubs belonging to various families recorded in different sacred groves of Rajasthan.

SNo.	Family	No. of tree species	No. of shurb species
1	Acanthaceae	-	2
2	Agavaceae	-	1
3	Amaranthaceae	-	2
4	Anacardiaceae	2	1
5	Annonaceae	2	1
6	Apocynaceae	2	2
7	Arecaceae	2	-
8	Aristolochiaceae	-	1
9	Asclepiadaceae	-	2
10	Balanitaceae	1	-
11	Bignoniaceae	3	-
12	Bombacaceae	2	-
13	Boraginaceae	5	-
14	Burseraceae	1	1
15	Cactaceae	-	1
16	Capparaceae	3	3
17	Celastraceae	1	1
18	Chenopodiaceae	-	1
19	Combretaceae	6	-
20	Ebenaceae	2	-
21	Elaeocarpaceae	1	-
22	Euphorbiaceae	2	5
23	Fabaceae	23	4
24	Flacourtiaceae	-	1
25	Lythraceae	1	-
26	Malvaceae	1	-
27	Meliaceae	2	-
28	Moraceae	5	-
29	Moringaceae	1	-
30	Myrtaceae	2	-
31	Pandanaceae	-	1
32	Plumbaginaceae	-	1
33	Polygonaceae	-	1
34	Putranjivaceae	1	-
35	Rhamnaceae	2	1
36	Rubiaceae	5	-
37	Rutaceae	2	-
38	Salvadoraceae	2	-
39	Santalaceae	1	-
40	Sapindaceae	1	-
41	Sapotaceae	1	-
42	Simaroubaceae	1	-
43	Solanaceae	-	1
44	Sterculiaceae	2	-
45	Tamaricaceae	1	
46	Tiliaceae	1	3
47	Ulmaceae	1	-
48	Verbenaceae	1	2

1.1 Population and species richness

1.1.1 Tree species >30 cm girth: Average number of tree (>30 cm girth) species per plot across Rajasthan was 5.5 tree species per site (ranging from 1 species in Mata ji Ka Oran, Barmer, Karni Mata Oran, Bikaner, Malani Oran, Jaisalmer, Dev Narain ji Ki Banni, Karauli to 16 species in Tarkeshwar Mahadev Ji ka Oran, Uadaipur), indicating almost 2.9-fold change in the number of tree species between different sacred groves. Average number of trees per plot was 78.6, ranging from 15 per 1.25 ha in Kolu Pabuji Ka Oran, Jodhpur to 272 trees per 1.25 ha in Rupu Kawas Oran, Alwar (Annexure II).

1.1.2 Tree 10-30 cm girth: Number of tree species in category of 10-30 cm dbh (diameter at breast height) was 2.6 tree species per site (ranging almost 1 species in 28 sacred groves including Shringi Rishi Ji ka Oran, Udaipur to 10 species in Pava Bab ji, Udaipur). There were 3.8 fold variations in number of species in girth class 10-30 cm between different sacred groves. Average population of trees in this category across Rajasthan was 25.9 trees per 1.25 ha ranging from 1 number in 9 sacred groves to 373 trees per 1.25 ha in Dagia bherogi ka Oran, Banswara. Unfortunately 13% sacred groves had no trees of this girth class (Annexure II).

1.1.3 Shrub species: Twenty one sacred groves did not show shrubs as the ground vegetation, whereas 33 sacred groves had only one shrub species. Average number of shrub species across the study sites was 2.23 species per site, where number of species ranged between 1 and 10 species (highest in Shiv Ji Maharaj ki Devbani, Alwar). Average population of the shrubs was 18.1 individuals per 125 m^2 (sum of five plots of 5 m × 5 m size). Lowest population of the shrubs was recorded in 7 sacred groves, i.e. 1 individual, whereas highest number of shrub, i.e. 197 individuals was recorded in Malani Oran, Jaisalmer (Annexure III).

***1.1.4 Tree saplings*:** About 45% sacred groves had no saplings on the ground. Average number of tree species, for which the saplings were recorded was less than 1 (i.e., 0.89 species) across the state. Highest number of individuals was observed for 6 species in Tarkeshwar Mahadev Ji ka Oran in Udaipur, followed by 4 numbers of species in Pava Bab ji sacred grove, Udaipur. Otherwise most of the sacred groves showed regeneration of 1 or two species. Population of

saplings varied from 1 in Ramdevji ki Oran, Jaisalmer to 62 individuals per site in Tarkeshwar Mahadev Ji ka Oran, Udaipur (Annexure III).

1.2. Shannon-Weiner diversity Index (H') and Effective Number of Species (ENS)

1.2.1 Tree >30 cm girth: Six sacred groves namely Mata ji Ka Oran, Barmer, Karni Mata Ji Ka Oran, Bikaner, Malani Oran, Jaisalmer, Pabu ji Ka Oran and Shri Devnarayan Ji Ki Banni, Karauli showed only one species hence zero Shannon-Weiner diversity index (H'). For the others sacred groves, H' varied from 1.04 in Kalu Pabu ji Ka Oran, Jodhpur (with effective number of species 1.04, ENS) to 2.35 (ENS value of 10.47) in Tarkeshwar Mahadev Ji ka Oran, Udaipur. Average values of H' and ENS across the sites are 0.96 and 2.60 for the tree category of >30 cm girth (Annexure II).

1.2.2 Tree 10-30 cm girth: For tree category of 10-30 cm girth, about 40 (i.e., 33%) sacred groves including Devnarayan Ji ka Oran and Bhuna Bai ji ka Oran, Ajmer, Rupu Ka Vas Oran, Alwar, Prathurinath ji ka Oran, Banswara, Devnarayan Ji ka Oran, Baran, Viratra Mata ka Oran, Mata ji Ka Oran, Khuwas Mata Ji Ka Oran and Mama ji ka Selenadi, Bamer, Adibadri Mahatmya Oran, Bharatpur, Dennaryan Ji ki Bani and Devnayan Oran, Bhilwara, Goga Ji Ka Oran and karni Mata Oran, Bikaner, Devnarayan ji ka Oran, Chitto rgarh and others had zero value of H' with ENS value of 1 indicating almost dominance of one tree species. In the rest of the sacred groves H' ranged between 0.04 in Mataji Ka Darra, Tonk and 2.08 in Pawa Bab ji Ka Oran, Udaipur with respective ENS value of 1.05 and 8.02. Average value of H' and ENS across the sites are 0.56 and 1.76, respectively (Annexure II).

1.2.3 Shrub species: About 42% of the studied sacred groves have zero H' value and 1 ENS value indicating availability of single dominant shrubs in these sacred groves (Annexure III). In rest of the sacred groves H' varied from 0.13 in Dhudheshwar Mahadeoji Ka Oran, Jalore and Mamaji Ka Oran, Pali to 1.75 in Bheruji Ka Oran, Nagaur district. The corresponding ENS varied from 1.14 to 5.77 at the respective site. Average values of H' and ENS across the sites were 0.50 and 1.65. This indicates significant variation in these diversity variables between the sacred groves situated throughout Rajasthan.

1.2.4 Tree saplings: About 78% of the sacred groves showed dominance of a single species indicated by zero H' value and 1 ENS value (Annexure III). In rest of the sacred groves diversity index (H') varied from 0.34 in Bhairav Ji Ka Bag, Jhalawar to 1.55 in Tarkeshwar Mahadev Ji ka Oran, Udaipur, whereas ENS values varied from 1.40 to 4.77 in the respective sacred grove. Average diversity and effective number of species across the studied sites were 0.16 and 1.17, respectively.

1.3. Reciprocal of Simpson index (1/D)

The highest value of reciprocal of Simpson dominance of tree >30 was 10.77 in Shri Parbateshwar Mahadeo ji ki Bani in Bundi district, whereas lowest value of this variable was 0.55 in Gosaiji Ka Oran in Churu district. Average across the site indicated I/D value 1.81 for the trees of this category. For the trees of 10 to 30 cm girth, 1/D was highest in Pava Bab ji ka Oran (6.66) in Udaipur district, whereas the lowest value of 1 was recorded in almost 28 sacred groves of the total studied groves in Rajasthan. The lowest value of 1 is indicative of dominance of one tree species of this girth category in the particular groves. Average value of reciprocal of Simpson dominance across the studied sites was 1.82, which is relatively greater as compared to the trees of >30 cm girth.

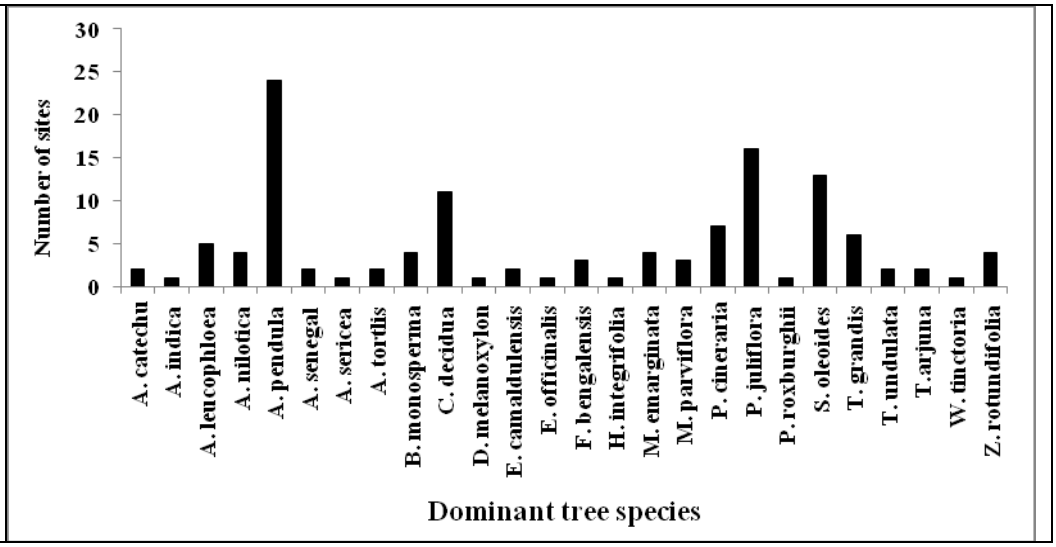
The highest 1/D tree sapling and shrub was recorded in Tarkeshwar Mahadev Ji ka Oran (4.01), Udaipur district and Bhairo Ji Ka Oran (5.11) in Nagaur district, respectively. The lowest values of these variables were recorded in almost 41 and 32 sacred groves, respectively. The average value of reciprocal dominance for sapling and shrub are 2.25 and 1.86, respectively. This indicates that these sacred groves are more diverse in terms of tree sapling diversity as compared to shrub diversity.

2. DOMINANT TREES AND DIVERSITY VARIABLES

Out of 123 numbers of sacred groves studied, 24 sacred groves were dominated by *A. pendula*, followed by *P. juliflora*, which was dominant in 16 sacred groves. *Salvadora oleoides* and *Capparis decidua* dominated in 13 and 11 sacred groves, respectively. Seven and 6 numbers of studied sacred groves were dominated by *P. cineraria* and *Tectona grandis*. *Acacia leucophloea*, *Acacia nilotica*, *Butea monosperma* and *Zyziphus rotundifolia* were dominant in 5, 4, 4 and 4

sacred groves, respectively (Fig 4.1). Other species were observed dominant in relatively less numbers of sacred groves.

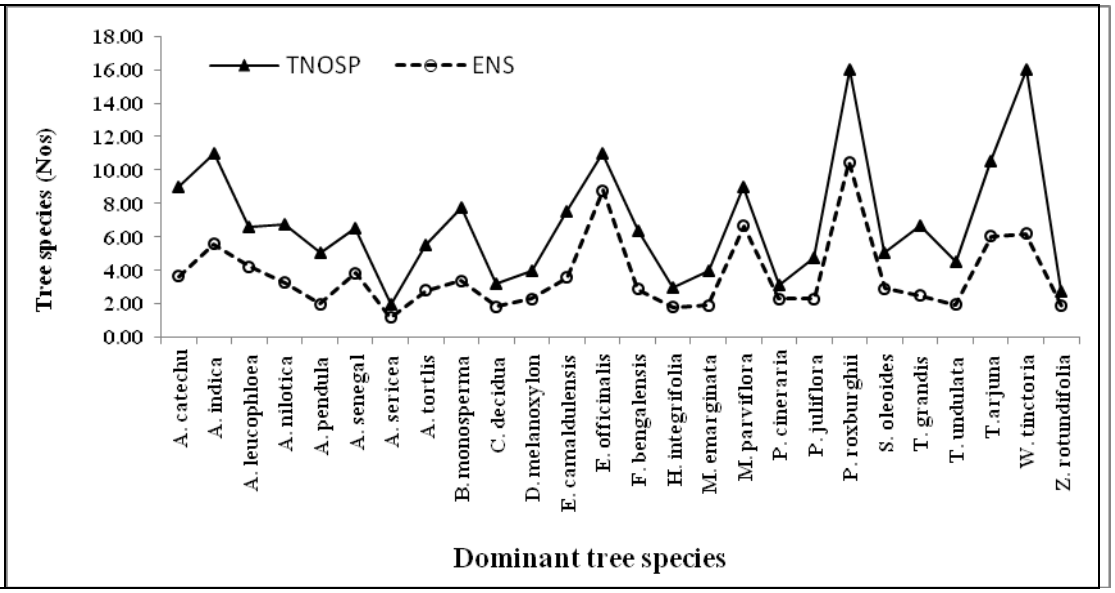
Fig 4.1. Number of sites dominated by different tree species of girth >30 cm.



2.1 Tree diversity

For trees of >30 cm girth, species richness (numbers of species), H' and ENS were highest in the sacred groves dominated by *Putranjiva roxbughii*, whereas 1/D was highest in *E. officinalis* dominated sacred grove. All above-mentioned diversity variables including tree population itself showed their lowest values in the sacred grove dominated by *Anogiessus serecea* (Table 4.2).

Fig 4.2. Trends in H' and ENS for dominant tree species in different sacred groves in Rajasthan.



Population of the dominant species observed highest in sacred groves dominated by *Acacia catechu*. Similar trend in both H' and ENS values can be observed (Fig 4.2) but variation in values was due to effectiveness of the species in terms of their population also. For trees in categories of 10-30 cm girth, species richness, H' and ENS values were highest ($P<0.01$) in the sacred groves dominated by *Wrightia tinctoria* and the lowest values were observed in the sacred groves dominated by *Z. rotundifolia*. Value of 1/D was observed highest ($P<0.01$) in sacred groves dominated by *Holoptelia integrifolia*, whereas the lowest 1/D was observed in the sacred groves dominated by *Tecomella undulata* (Table 4.2).

Table 4.2. Diversity variables (in 1.25 ha) of trees of different girth class in sacred groves dominated by different tree species in Rajasthan. Values are mean±SE of multiple replicates.

SNo.	Dominant tree species	Tree (>30 cm girth)			Tree (10-30 cm girth)		
		H'	ENS	1/D	H'	ENS	1/D
1	*A. catechu*	1.30±0.21	3.74±0.77	2.41±0.40	0.71±0.71	2.57±1.57	2.18±1.18
2	*A. indica*	1.72±0.00	5.57±0.00	3.83±0.00	0.64±0.00	1.89±0.00	1.8±0.00
3	*A. leucophloea*	1.44±0.10	4.30±0.41	3.38±0.38	0.74±0.34	2.64±0.94	2.18±0.94
4	*A. nilotica*	1.18±0.26	3.58±0.85	2.71±0.62	0.95±0.18	2.72±0.51	2.36±0.47
5	*A. pendula*	0.69±0.09	2.18±0.20	1.76±0.15	0.56±0.09	1.95±0.18	1.57±0.17
6	*A. senegal*	1.35±0.31	4.02±1.20	3.08±0.88	0.53±0.53	1.94±0.94	2.00±1.00
7	*A. sericea*	0.17±0.00	1.19±0.00	1.09±0.00	0.44±0.00	1.55±0.00	1.37±0.00
8	*A. tortilis*	1.03±0.14	2.83±0.40	2.16±0.40	0.87±0.18	2.42±0.42	2.34±0.34
9	*B. monosperma*	1.21±0.39	3.99±1.03	2.95±0.76	0.76±0.32	2.48±0.77	1.91±0.76
10	*C. decidua*	0.61±0.15	2.06±0.32	1.82±0.28	0.34±0.13	1.53±0.21	1.28±0.26
11	*D. melanoxylon*	0.83±0.00	2.3±0.00	1.78±0.00	0.67±0.00	1.95±0.00	1.90±0.00
12	*E. camaldulensis*	1.28±0.64	4.31±2.42	3.08±1.57	0.92±0.66	3.06±1.77	2.44±1.29
13	*E. officinalis*	2.17±0.00	8.75±0.00	7.36±0.00	0.00±0.00	1.00±0.00	0.00+0.00
14	*F. bengalensis*	1.06±0.45	3.47±1.33	2.69±0.79	0.91±0.49	3.06±1.26	3.36±1.69
15	*H. integrifolia*	0.58±0.00	1.78±0.00	1.55±0.00	0.00±0.00	1.00±0.00	1.00±0.00
16	*M. emarginata*	0.65±0.15	1.98±0.33	1.57±0.27	0.17±0.17	1.25±0.25	1.00±0.40
17	*M. parviflora*	1.90±0.11	6.76±0.79	6.80±2.00	1.09±0.55	3.76±1.40	3.82±1.47
18	*P. cineraria*	0.84±0.16	2.49±0.37	2.26±0.34	0.25±0.17	1.41±0.29	0.96±0.42
19	*P. juliflora*	0.84±0.14	2.69±0.41	2.13±0.30	0.56±0.15	2.11±0.35	1.99±0.32
20	*P. roxburghii*	2.35±0.00	10.47±0.00	6.75±0.00	0.90±0.00	2.45±0.00	1.76±0.00
21	*S. oleoides*	1.06±0.10	3.10±0.37	2.05±0.20	0.55±0.18	2.18±0.52	1.93±0.49
22	*T. grandis*	0.92±0.20	2.75±0.53	1.98±0.29	0.61±0.17	1.99±0.36	1.54±0.37
23	*T. undulata*	0.67±0.18	1.99±0.36	1.63±0.36	0.38±0.08	1.47±0.12	1.30±0.11
24	*T.arjuna*	1.80±0.39	6.48±2.37	4.59±1.32	0.60±0.45	2.00±0.83	1.76±0.69
25	*W. tinctoria*	1.82±0.00	6.2±0.00	3.49±0.00	2.08±0.00	8.02±0.00	6.67±0.00
26	*Z. rotundifolia*	0.62±0.32	2.16±0.69	1.64±0.35	0.19±0.19	1.29±0.29	0.95±0.36

However, population of trees of 10-30 cm girth (sub-dominant trees) was highest (P<0.01) and lowest in the sacred groves dominated by *Tectona grandis* and *Azadirachta indica*, respectively. Unfortunately there were no trees of 10-30 cm girth class in the sacred groves, where *E. officinalis* was the dominant tree. Furthermore, average population of trees of girth class 10-30 cm were significantly (P<0.01) less as compared to the trees of >30 cm girth class.

2.2 Diversity of tree saplings and shrubs

Sacred groves dominated by *A. indica*, *D. melanoxylon*, *E. officinalis* and *M. parviflora* trees of >30 cm girth had no sapling at the ground surface (i.e., no saplings). Values of sapling population, sapling species richness, diversity index (H'), ENS and 1/D were highest (P<0.01) in the sacred groves dominated by *P. roxburghii* trees (Table 4.3).

Table 4.3. Variations in diversity variables of tree saplings and shrub species in sacred groves dominated by different tree species in Rajasthan. Values are mean±SE of multiple replicates.

SNo.	Dominant tree species	Tree sapling (nos. per 125 m^2)			Shrubs (nos. per 125 m^2)		
		H'	ENS	1/D	H'	ENS	1/D
1	*A. catechu*	0.30±0.30	1.41±0.41	1.35±0.35	0.64±0.64	2.3±1.3	2.15±1.15
2	*A. indica*	0±0	1±0	0±0	1.03±0.00	2.80±0.00	2.63±0.00
3	*A. leucophloea*	0.11±0.11	1.15±0.15	0.92±0.26	0.46±0.38	2.29±1.18	1.69±0.86
4	*A. nilotica*	0±0	1±0	0.25±0.25	0.99±0.15	2.77±0.43	2.37±0.34
5	*A. pendula*	0.21±0.08	1.35±0.15	0.72±0.15	0.43±0.1	1.76±0.22	1.34±0.23
6	*A. senegal*	0.33±0.33	1.47±0.47	0.94±0.94	0.98±0.45	2.94±1.24	2.57±0.96
7	*A. sericea*	0.65±0.00	1.91±0	1.83±0.00	0±0	1.00±0.00	0±0
8	*A. tortlis*	0±0	1±0	0.50±0.50	0.30±0.3	1.41±0.41	1.34±0.34
9	*B. monosperma*	0.38±0.14	1.51±0.21	1.42±0.20	0.64±0.32	2.21±0.75	1.92±0.63
10	*C. decidua*	0.03±0.03	1.04±0.04	0.48±0.17	0.69±0.17	2.29±0.38	1.94±0.42
11	*D. melanoxylon*	0±0	1±0	0±0	0±0	1.00±0.00	0±0
12	*E. camaldulensis*	0.54±0.02	1.72±0.03	1.56±0.04	0.62±0.62	2.21±1.21	1.18±1.18
13	*E. officinalis*	0±0	1.00±0.00	0±0	1.05±0.00	2.85±0.00	2.48±0.00
14	*F. bengalensis*	0±0	1.00±0.00	0±0	0.58±0.32	1.96±0.58	1.59±0.86
15	*H. integrifolia*	0±0	1.00±0.00	1.00±0.00	0±0	1.00±0.00	1.00±0.00
16	*M. emarginata*	0±0	1.00±0.00	0.25±0.25	1.13±0.39	3.7±1.03	2.91±0.76
17	*M. parviflora*	0±0	1.00±0.00	0±0	0.6±0.31	1.98±0.53	1.65±0.35
18	*P. cineraria*	0±0	1.00±0.00	0.29±0.18	0.36±0.26	1.85±0.67	1.58±0.63
19	*P. juliflora*	0.06±0.04	1.08±0.06	0.87±0.12	0.48±0.14	1.9±0.3	1.59±0.29
20	*P. roxburghii*	1.55±0.00	4.70±0.00	4.01±0.00	1.03±0.00	2.81±0.00	2.4±0.00
21	*S. oleoides*	0.13±0.07	1.17±0.09	0.75±0.19	0.34±0.12	1.55±0.23	1.32±0.26
22	*T. grandis*	0.30±0.21	1.53±0.39	0.94±0.49	0.53±0.21	1.90±0.41	1.60±0.46
23	*T. undulata*	0.35±0.35	1.50±0.50	1.00±1.00	0.56±0.09	1.75±0.15	1.63±0.18
24	*T.arjuna*	0.23±0.23	1.29±0.29	0.69±0.69	0.41±0.41	1.64±0.64	1.48±0.48
25	*W. tinctoria*	1.30±0.00	3.67±0.00	3.38±0.00	0.98±0.00	2.66±0.00	2.49±0.00
26	*Z. rotundifolia*	0±0	1.00±0.00	0.25±0.25	0.28±0.28	1.52±0.52	1.13±0.52

Values of H' was zero in the sacred groves dominated by *A. indica, A. nilotica, A. tortilis, D.melnoxylan, E. officinalis, F. bengalensis, H. integrifolia, M. emarginata, M. parviflora, P. cineraria* and *Z. rotundifolia,* where ENS value was 1. This indicates the availability of the saplings of only one species. Lowest values of H', and ENS including species evenness were lowest in the sacred groves dominated by *Capparis decidua* (Table 4.3). Sacred groves dominated by *W. tinctoria* showed even distribution of sapling species. Lowest numbers of saplings and their species richness were recorded in the sacred groves dominated by *H. integrifolia* and *P. cineraria* tree, respectively. There were no shrubs in the sacred groves dominated by *A. serecea* and *D. melanoxylan* (Table 4.3). In rests, population of shrubs was highest ($P<0.01$) in the sacred grove dominated by *W. tinctoria,* whereas the lowest population of shrubs was recorded in the sacred groves dominated by *T. grandis*. While species richness for the shrubs was highest in the sacred groves dominated by *P. roxburghii*, the lowest species richness for shrub was recorded in the sacred groves dominated by *H. integrifolia* trees. Values of H', ENS and I/D for shrubs were highest in the sacred groves dominated by *M. emarginata* trees (Table 4.3). Shrub diversity was zero with ENS value of 1 was observed in the sacred groves dominated by *A. sericea, D. melanoxylon* and *H. integrifolia* trees indicating dominance of a single shrub species.

3. AGRO-CLIMATIC ZONES AND DIVERSITY VARIABLES

All diversity variables for trees of girth class >30 cm and 10-30 cm girth differed ($P<0.05$) significantly except population of the latter category. Lowest values of tree population, species richness, H' and ENS for both girth class were lowest ($P<0.01$) in the sacred groves in IA (Arid western plain) agro-climatic zone. The highest population was observed in the sacred groves in IIIA (Semi arid Eastern Plain) for trees with girth class >30 cm) and in the sacred groves in IVA (Sub humid Southern Plain) agro-climatic zone for tree population of girth class 10-30 cm. Species richness for both the girth class trees were highest in the sacred groves in IVB (Humid Southern plain) agro-climatic zone, whereas and ENS were highest in the sacred groves available in IIIB (Flood Prone Eastern Plain) agro-climatic zone. The value of 1/D was highest in the sacred groves available in V (Humid Southern Eastern Plain) zone for trees of >30 cm girth class and in the sacred groves available in IIIB for the trees of 10-30 cm girth class (Fig 4.3).

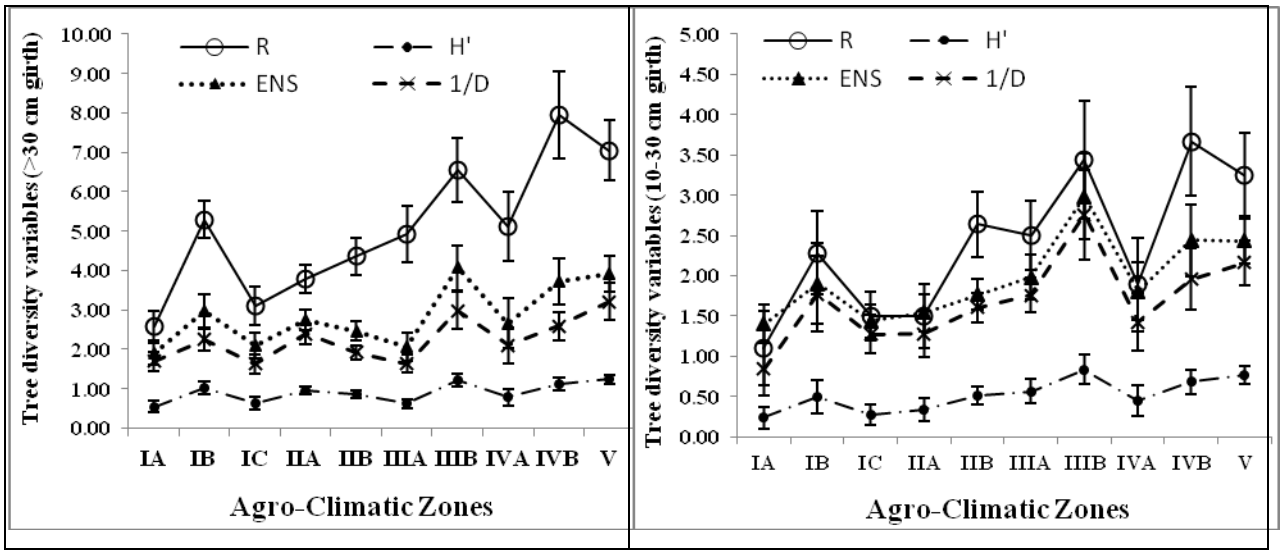


Fig 4.3 Variations in tree diversity in sacred grove situated in different agro-climatic zones of Rajasthan. Error bars are ± 1SE.

Except tree sapling population, all other diversity variables varied significantly ($P<0.05$) among the sacred groves of different agro-climatic zones. Population of tree saplings in the sacred groves was highest in V agro-climatic zone, whereas the lowest values of 1.25 individuals per 125 m^2 area was observed in IIIB. The highest and lowest species richness (number of species) for the tree saplings were observed in the sacred groves of IVA and IIA (Irrigated North Western plain) agro-climatic zone. Shanon-Weiner diversity index (H') and ENS values were highest in the sacred groves in IVB, whereas lowest diverse sacred groves were observed in IA zone. Simpson's reciprocal diversity index (1/D) was highest in IIB and lowest in IIIB agro-climatic zones (Fig 4.4, left panel).

Variations in shrubs diversity variables between agro-climatic zones are not significant ($P>0.05$) except for shrub population, which was highest in IC (Hyper-arid partly Irrigated Zone) agro-climatic zone and lowest in IVA agro-climatic zone. Species richness of shrub species was lowest in IB (Irrigated North Western plain) agroclimatic zone, whereas lowest number of shrub species was recorded in IIIB (Flood Prone Eastern Plain) zone. Agroclimatic zone IVB showed highest shrub diversity in terms of both H' and ENS value, whereas IIB zone indicated lowest shrub diversity. However, Simpson reciprocal diversity index showed highest shrub diversity in

IA zone and lowest shrub diversity in IB zone (Fig 4.4, right panel). Most of these diversity variables followed almost similar pattern though varied in values.

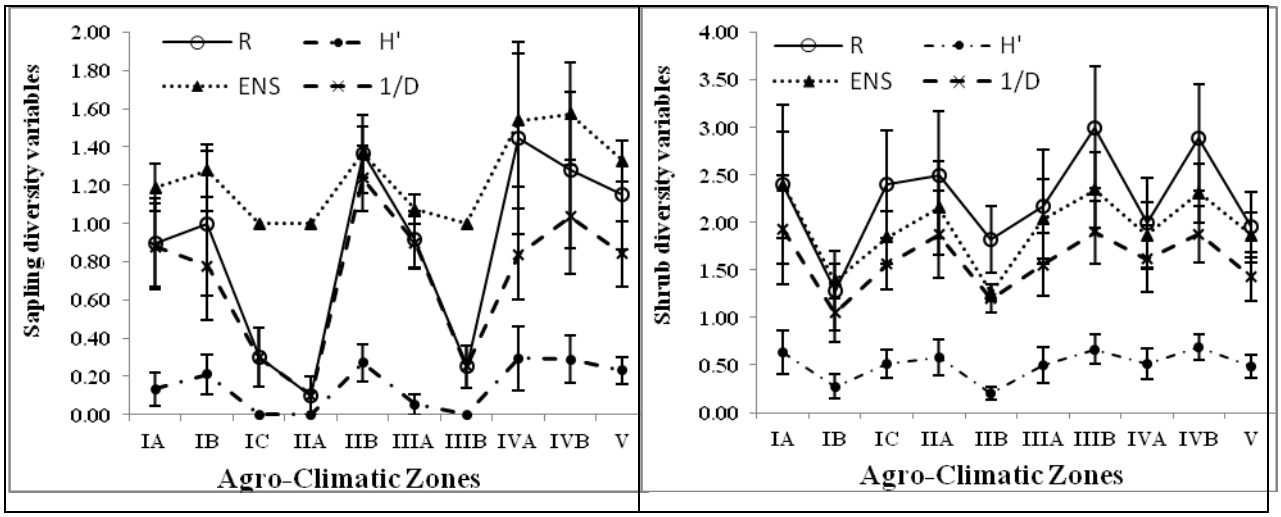


Fig 4.4 Variations in tree sapling (left panel) and shrubs (right panel) diversity in sacred groves situated in different agro-climatic zones of Rajasthan. Error bars are ± SE.

4. BASAL AREA OF VEGETATION

Basal area of trees of >30 cm girth was highest (35.82 m^2 ha^{-1}) in Baba Rahupeer Dargah, Sri Ganganagar and lowest (0.13 m^2 ha^{-1}) in Pabu ji Ka Oran, Jodhpur. The basal area of tree of 10-30 cm girth ranged between 0.91 m^2 ha^{-1} in Dhundhali Mata ki Banni, Pratapgarh and 0.01 m^2 ha^{-1} in Bihari ji ka Madir Oran, Jhunjhunu. Though contribution of this category was almost zero in eight sacred groves situated in Barmer, Bhilwara, Jhunjhunu, Jodhpur, Karauli, Nagaur and Udaipur. Basal area of tree saplings varied from 2.63 m^2 ha^{-1} in Dev Narain ji Ka Oran, Kota to almost zero in many of the sacred groves. For shrubs it varied from 27.07 m^2 ha^{-1} in Hanuman ji Ka Oran, Alwar to almost zero in Prathurinath ji ka Oran, Banswara.

Basal area of trees of >30 cm girth and tree saplings varied significantly ($P<0.01$) both due to dominant tree species and agro-climatic zones, whereas basal area of trees of 10-30 cm girth category and that of shrubs did not show significant ($P>0.05$) variation due to both dominant tree species and agro-climatic zones (Fig 4.4). Though variation in basal area of trees of 10-30 cm girth and saplings indicated significant level $P<0.10$. Basal area due to shrub appeared lesser than the basal areas of trees of >30 cm girth category. It was lowest for trees of 10-30 cm girth

category in most of the sacred groves dominated by various tree species. Interestingly the pattern between basal area of trees of >30 cm girth and shrub was almost in reverse in most of the cases, whereas basal area of tree saplings flowed the pattern of tree (>30 cm girth). Basal area due to saplings was also greater as compared that of the trees of 10-30 cm girth category. This indicates reduced recruitment of the sapling to trees of 10-30 cm girth class.

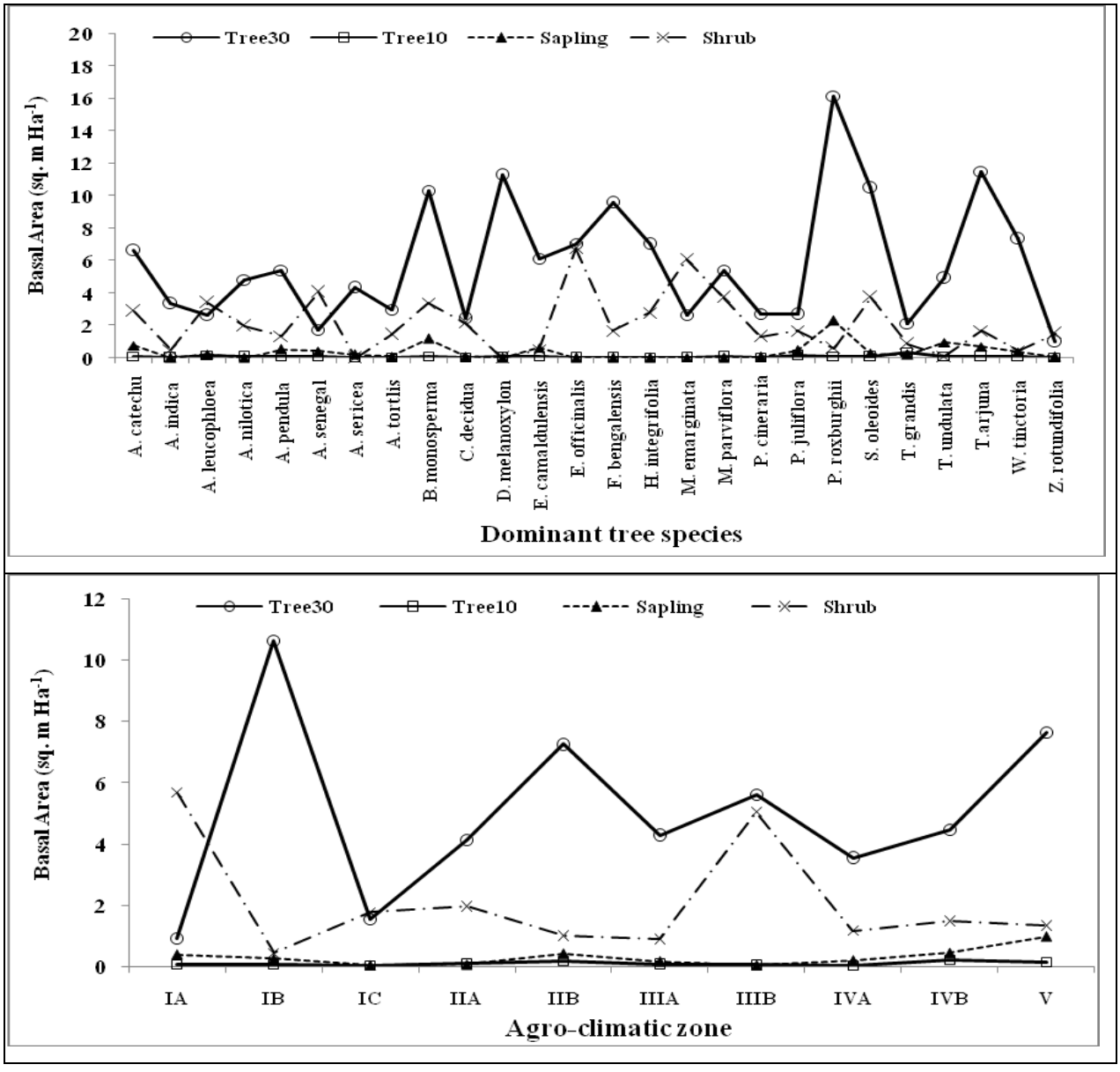


Fig 4.5 Changes in basal area of different plant habits in sacred groves of Rajasthan influenced by dominant tree species (top) and agro-climatic regions (below)

Among the dominant tree species, highest (16.14 m^2 ha^{-1}) and lowest (0.99 m^2 ha^{-1}) basal area was recorded in the sacred groves dominated by *P. roxburghii* and *Z. rotundifolia*, respectively. For trees of 10-30 cm girth, the corresponding basal areas were 0.39 m^2 ha^{-1} under *T. grandis* and almost zero under *E. officinalis*. Basal area of tree saplings (ranging from 0.01 to 2.30 m^2 ha^{-1}) was highest under *P. roxbughi* and almost zero under *A. indica*, *E. officinalis*, *D. melanoxylan*, *F. bengalensis* and *M. parviflora*. Range of basal area of shrubs was 6.12 m^2 ha^{-1} under *M. emarginata* and almost zero under *Anogeissus serecea* and *D. melanoxylan* (Fig 4.5). The highest and lowest basal area of trees >30 cm girth were 10.62 m^2 ha^{-1} and 0.92 m^2 ha^{-1} in IB and IA zone, respectively, whereas the corresponding values for trees of 10-30 cm girth were 0.17 m^2 ha^{-1} and 0.02 m^2 ha^{-1} in IVA and IIB. For tree saplings highest basal area was recorded in V zone and lowest in IIIB zone. Shrubs indicated highest basal area in IA and lowest basal area in IB agro-climatic zone.

5. ANIMAL DIVERSITY

A wide range of animals were observed in these sacred groves. Some of the sacred groves are important in terms of wild life particularly for birds. Some of the wild animals associated with these sacred groves are:

Birds: Indian sand goose (*Pterocles exustus*), Grey Quil (*Coturnix coturnix*), Spotted owlet (*Athene brama*), Spotted dove (*Streptopelia decocto*), Common babbler (*Turdoides caudatus*), Red-vented bulbul (*Picnonotus cafer*), Grey shrike (*Lanius exubitor*), Grey partridge (*Francolinus pondicerianus*), White vulture (*Gyps bengalensis*), Koel (*Eudynamys scolopaceus*), sun-bird (*Leptocoma zeylonica*), Sparrow (*Passer domesticus*), Myna (*Acridotheres tristis*), Parrot (*Psittacula krameri*), Crow (*Corvus splendens*), Eagle (*Aquila hastate*), Pigeon (*Columba livia*), Pea fowl (*Pavo cristatus*) and Alexandrine parakeet (*Psittacula eupatria eupatria*) (Fig 4.6).

Mammals: Chinkara (*Gazella gazella*), Blue Bull (Boselaphus tragocamelus), Desert Fox (Vulpes vulpes pusilla), Indian Fox (*Vulpes bengalehsis*), Mongoose (*Herpestes edwardsi*), Jackal (*Canis aureus auveus*), Desert Cat (*Felis silvetri oranata*), Hedghog (*Hemiechinus auritus*

callaris), Porcupine (*Hystrix indica indica*), Five-striped (*Funambulus pennati*), Indian desert gerbil (*Meriones hurrianae*), Indian gerbil (*Tetera indica*), Desert hare (*Lepus nigri collis*), Fruit bat (*Pteropus giganteus*), Cow (*Bos taurus*), Hyena (*Hyaena hyaena*), Rat (*Rattus norvegicus*), Deer (*Axis axis*), Wild cat (*Felis chaus*), Squirrel (*Funambulus palmarum*), Wild pig (*Sus scrofa*), Wolf (*Canis lupus*), Samber deer (*Rusa unicolor*), Wild dog (*Cuon alpinus*) and Bear (*Melursus ursinus*).

Reptiles: House gecko (*Hemidactylus flarviviridis*), Agma (*Agma agilis*), Viper (*Echis carinatus*), Earth snake (*Eryx johnii*), Varanus-Pata goh (*Varanus bengalensis*), Sand fish (*Ophiomorus tridactylus*), King kobra (*Ophiophagus hannah*), Chameleon (*Chamaeleo zeylanicus*), Varanus-chandan goh (*Varanus griseus*) and Indian spiny-tailed (*Uromastix hardwickii*).

Fig 4.6. Alexandrine parakeet in Kalu Das Ki Dungari sacred grove, Dausa (left) and a group of birds (Red ring parakeet, Ring Dove, Pigeon and House Sparrow) in Hanuman Ji Oran, Alwar (right)

6. SOIL PROPERTIES

Soils differ dramatically under different types of vegetation and within forest vegetation under different species of trees (Binkley, 1995). Further, composition and productivity of forests differ strongly among sites that differ in soil properties (Binkley and Giardina, 1998). Forest ecosystems with low soil nutrients availability are characterized by competitive effects the growth-limiting resource between several players, i.e. various components of vegetation, like

old-growth trees, natural regeneration and under storey species, mycorrhizal fungi, free-living fungi and bacteria (Rennenberg et al., 2009).

6.1 Soil properties of different sacred groves

6.1.1 Soil physico-chemical properties: Gravel content was highest (i.e., 85.2%) in Nahar Singhji Mata ka Oran in Chittorgarh district. Eleven numbers of sacred groves have no gravel content and appear to be better in soil conditions. In the rests it was lowest in Karni Mata Ji Ka Oran, Bikaner, with an average value of 29.5% across the sites under study. This indicated significant variations in gravel content of the soils of varying regions. Soil bulk density ranged between 1.25 g cm^{-3} in Devnarayan ji ka Oran, Chittorgarh district and 1.71 g cm^{-3} in Pabuji ka Oran, Jodhpur district. Average value of soil bulk density was 1.49 g cm^{-3} for the state. Soil pH was recorded highest (8.74) in Gogaji ka Oran in Bikaner district and lowest pH in Muchkund Oran in Dholpur district. The highest electrical conductivity (EC)- a measure of soil salt content was 1.94 dSm^{-1} in Musain Mata ji ka Oran in Baran district, whereas the lowest value of EC was found in Gogaji ka Oran (0.02) in Churu district. The average values of pH and EC across the sites were 7.46 and 0.23 dSm^{-1}, respectively.

6.1.2 Soil nutrients: Among the soil nutrients like nitrate nitrogen (NO_3-N), ammonium nitrogen (NH_4-N), and phosphate phosphorus (PO_4-P), soil concentration of NO_3-N was observed highest (8.20 mg kg^{-1} soil) in the soils of Kundeshwar Mahadev ka Oran in Udaipur district, whereas the lowest concentration of 0.09 mg kg^{-1} was observed in the soil of Viratra Mata ji ka Oran, Barmer (Annexure IV). Concentration of NH_4-N was highest (13.55 mg kg^{-1}) and lowest (0.54 mg kg^{-1}) in the soils of Ubheshwar ji Oran in Udaipur district and Devnarayan ji ka Oran in Chittaurgarh district, respectively. The concentration of PO_4-P was recorded maximum in the soil of Sidheswar Mahadeo ji Ka Mandir (22.00 mg kg^{-1}) in Sirohi district and the lowest concentration was observed in the soil of Devnarayan ji ka Oran (2.32 mg kg^{-1} soil) in Kota district. The average values of NO_3-N, NH_4-N and PO_4-P across all sacred groves studied were 2.94 mg kg^{-1}, 4.76 mg kg^{-1} and 9.65 mg kg^{-1}, respectively.

6.1.3 Percent soil organic carbon and density: Devnarayan ji ka Oran, Chittorgarh recorded highest (2.95%) value of soil organic carbon (SOC) as well as soil carbon density (52.24 tons ha^{-}

^{1} in top 0-30 cm soil layer). The lowest values of SOC (0.03%) and soil carbon density (1.51 tons ha^{-1}) were in Pabuji ka Oran, Jodhpur. The average values of SOC and soil carbon density in 0-30 cm soil layer were 0.54% and 17.09 tons ha^{-1}, respectively.

6.2 Effect of dominant trees on soils

Effects of tree on soils is by providing quantities of organic matter of varying chemical composition which in turn may contribute to different levels of organic matter degradation under different species of trees (Grayston and Prescott, 2005). For example, red alder (*Alnus rubra*) promotes productivity and long term sustainability through its higher litter nutrient concentration and accelerated nutrient cycling, while vine maple leaves (*Acer circinatum*) increase N, P, K, Ca, Mg, and Zinc (Zn) and decompose much quicker than conifer litter (Hibbs and Bower, 2001). Further, soil microbial or arthropod communities do adapt to types of litter produced within stands; litter in stands of origin usually decompose faster than if the same litter is introduced to different species (Tripathi et al., 2013). In present study, all soil variables studied varied significantly ($P<0.05$) between the sacred groves dominated by different tree species, except for electrical conductivity (EC) and NO_3-N and PO_4-P concentrations. Gravel content varied significantly ($P<0.01$) between 1.99% in the sacred groves dominated by *Anogeissus serecea* and 69.32% in sacred grove dominated by *P. roxburghii*. Soil pH was observed highest ($P<0.01$, 8.5.1) in the sacred grove dominated by *Z. rotundifolia*, whereas the lowest soil pH was recorded in the sacred groves dominated by *E. officinalis* trees (Table 4.4). Electrical conductivity ranged between 0.11 dSm^{-1} in *P. cineraria* dominated sacred grove and 0.39 dSm^{-1} in *A. catechu* dominated sacred groves. Soil pH and acidity are very much related with proton-producing components of the soil N cycle like nitrification, which are positively correlated with species-level variability in N concentrations (Angima et al., 2010; Kevin et al., 2012).

Accumulation of mineral substrates through dead materials results in changes in soil features and consequently influences the plant growth and the completion between plant species. Concentrations of soil nutrients namely NO_3-N, NH_4-N and PO_4-P varied widely due to dominance of trees. The highest and lowest concentrations of NO_3-N were recorded in sacred groves dominated by *A. indica* (5.30 mg kg^{-1} soil) and *Z. rotundifolia* (1.24 mg kg^{-1} soil),

respectively. Concentration of NH_4-N ranged between 0.82 mg kg^{-1} soil in the sacred groves dominated by *E. officinalis* and 10.34 mg kg^{-1} soil in sacred groves dominated by *E. camaldulensis.* Soil available PO_4-P varied from 5.66 mg kg^{-1} soil in *A. sericea* dominated sacred grove to 16.57 mg kg^{-1} soil in *A. senegal* dominated sacred groves (Table 4.4). Such changes in soil nutrients leads to species with low maximum growth rates and low biomass loss rates being replaced by species with high potential growth rates and high biomass losses. The plant properties responsible for reduced biomass loss rates appear to result in the litter produced being poorly decomposable, whereas the litter from plants with high potential growth rates decomposes more easily (Berendse, 1998).

Table 4.4. Soil characteristics under the influence of dominant tree species in sacred groves of Rajasthan. Values are mean±SE of multiple replicates.

SNo.	Dominant tree species	Physico-chemical			Soil nutrients (mg kg^{-1} soil)		
		Gravel	pH	EC (dSm^{-1})	NO_3-N	NH_4-N	PO_4-P
1	*A. catechu*	41.18±4.16	7.82±0.09	0.39±0.06	2.35±0.01	5.49±1.71	8.99±4.01
2	*A. indica*	17.75±0	8.14±0.00	0.22±0.00	5.30±0.00	2.86±0.00	9.08±0.00
3	*A. leucophloea*	38.03±9.05	7.59±0.19	0.22±0.04	3.34±1	2.84±0.43	8.83±1.21
4	*A. nilotica*	28.24±10.08	7.55±0.11	0.3±0.06	2.15±0.42	4.51±1.51	8.71±2.78
5	*A. pendula*	45.19±3.89	7.26±0.12	0.31±0.07	3.21±0.42	6.26±0.58	11.00±0.81
6	*A. senegal*	41.11±15.88	8.23±0.06	0.17±0.02	4.3±0.27	7.38±3.15	16.57±5.44
7	*A. sericea*	1.99±0.00	7.08±0.00	0.17±0.00	3.12±0.00	3.23±0.00	5.66±0.00
8	*A. tortlis*	2.50±2.5.00	6.84±0.66	0.16±0.02	2.88±1.16	5.73±1.13	10.38±0.03
9	*B. monosperma*	25.25±6.63	7.57±0.15	0.27±0.11	1.75±0.37	8.34±1.12	10.88±2.05
10	*C. decidua*	6.27±2.58	7.71±0.20	0.26±0.02	2.61±0.29	3.93±0.53	7.93±0.69
11	*D. melanoxylon*	58.52±0.00	8.43±0.00	0.11±0.00	3.65±0.00	3.2±0.00	6.50±0.00
12	*E. camaldulensis*	39.95±2.93	8.16±0.18	0.26±0.09	3.49±1.96	10.34±3.22	6.42±4.10
13	*E. officinalis*	12.54±0.00	6.38±0.00	0.26±0.00	3.45±0.00	0.82±0.00	6.40±0.00
14	*F. bengalensis*	43.02±13.08	7.19±0.56	0.21±0.05	4.97±1.62	3.31±0.69	11.05±2.54
15	*H. integrifolia*	40.75±0.00	7.68±0.00	0.23±0.00	4.23±0.00	2.82±0.00	11.8±0.00
16	*M. emarginata*	9.66±8.98	7.08±0.13	0.11±0.04	1.81±0.72	4.21±1.27	9.72±2.61
17	*M. parviflora*	45.74±14.69	7.82±0.20	0.20±0.04	3.59±2.02	4.74±1.01	11.61±1.88
18	*P. cineraria*	17.93±9.54	7.5±0.30	0.23±0.04	2.93±0.52	3.94±0.86	7.54±1.29
19	*P. juliflora*	34.46±5.53	7.50±0.09	0.21±0.01	2.65±0.48	5.18±0.57	9.04±0.83
20	*P. roxburghii*	69.32±0.00	7.96±0.00	0.16±0.00	4.46±0.00	3.05±0.00	14.06±0.00
21	*S. oleoides*	13.90±4.86	7.51±0.15	0.18±0.02	2.63±0.39	3.75±0.48	9.26±0.80
22	*T. grandis*	47.91±8.01	6.70±0.23	0.18±0.01	2.90±0.71	4.18±0.93	9.48±1.16
23	*T. undulata*	28.3±0.99	7.86±0.06	0.2±0.02	2.82±1.57	3.9±2.40	10.02±4.22
24	*T.arjuna*	19.78±8.35	6.88±0.83	0.33±0.25	3.15±0.80	3.24±1.23	7.88±1.36
25	*W. tinctoria*	45.97±0.00	6.78±0.00	0.11±0	1.73±0.00	3.3±0.00	13.34±0.00
26	*Z. rotundifolia*	11.73±5.81	8.51±0.14	0.3±0.04	1.24±0.44	3.47±0.54	7.94±0.66

Soil bulk density ranged between 1.32 g cm^{-3} in the sacred groves dominated by *E. officinalis* and 1.63 g cm^{-3} in the sacred groves dominated by *Diospyros melanoxylon*. Except the sacred

groves dominated by *A. serecea*, *A. tortilis*, *C. decidua*, *D. melanoxylon*, *M. emarginata*, *P. cineraria*, *S. oleoides*, *T. undulata* and *Z. rotundifolia*, other sacred groves showed below average (horizontal line on the bars) soil bulk density (Fig 4.7, top). However, all the sacred groves dominated by above mentioned tree species appears to situated either in arid region or the dryer parts of the semi-arid region.

Per cent soil organic carbon varied ($P<0.05$) from 0.16% in the sacred groves dominated by *T. undulata* to 1.32% in sacred groves dominated by *E. camaldulensis* indicating effect of dominant tree species in soil carbon concentration added through leaf litter and other dry materials. While comparing the data of average for all sites, the sacred groves dominated by *Acacia catechu*, *Azadirachta indica*, *Acacia leucophloea*, *A. nilotica*, *Anogeissus pendula*, *Acacia senegal*, *E. camaldulensis*, *E. officinalis*, *F. benghalensis*, *P. roxbughii* and *T. grandis* showed above average SOC. Sacred groves dominated by other species under study showed below average per cent SOC (Fig 4.7, middle). This indicates that sacred groves situated in arid regions indicated relatively lower SOC as compared to those situated in semi-arid region.

Soil carbon density measured in 0-30 cm soil layer (after correction of gravel content) indicated highest ($P<0.05$) carbon density in the sacred groves dominated by *A. indica* (41.36 tons ha^{-1}). The lowest carbon density of 4.83 tons ha^{-1} was observed in the sacred groves dominated by *M. emarginata* trees. Thus spatial variation in soil carbon density (ratio of highest to lowest) was 8.56 fold indicating strong influence of tree species under dominance. When comparing with the average carbon density across all sites, sacred groves dominated by *Acacia catechu*, *Azadirachta indica*, *A. nilotica*, *Acacia senegal*, *E. camaldulensis*, *E. officinalis*, *T. grandis* and *Terminalia arjuna* showed above average soil carbon density. The others sacred groves indicated below average soil carbon density recorded in 0-30 cm soil layer (Fig 4.5, bottom). This indicates strong effects of dominant species together vegetation traits such as composition and plant species influencing soil carbon storage (Erfanzadeh et al., 2014).

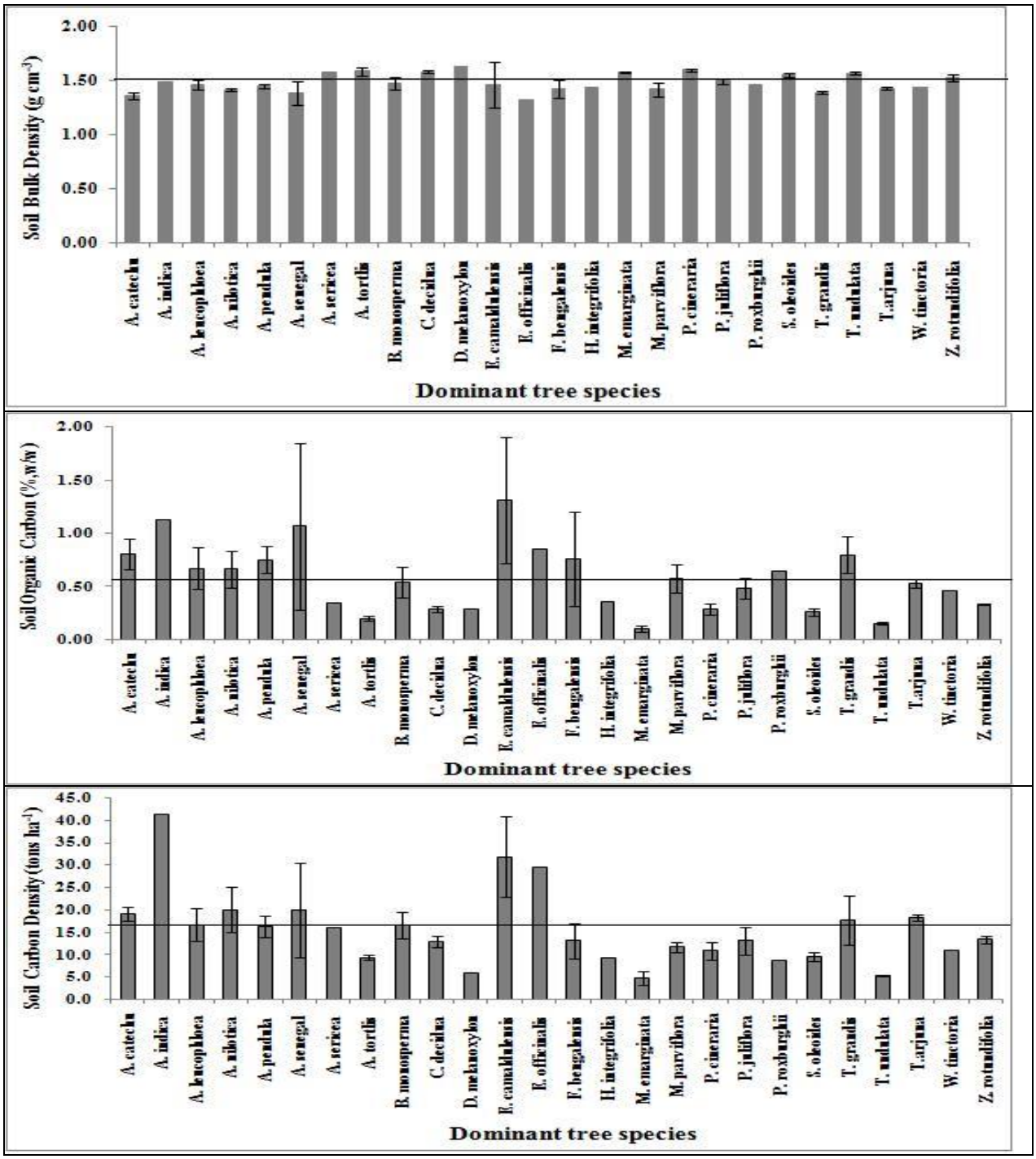


Fig 4.7 Changes in soil bulk density (top), per cent soil organic carbon (middle) and soil carbon density in 0-30 cm soil layer (lower) in sacred grovess dominated by different tree species. Error bars are ±1SE.

6. 3 Soil properties with agro-climatic region

Effects of agro-climatic zones on soil properties of the sacred groves under study was significant ($P<0.05$) on all observed soil variables except NH_4-N, which was not significant ($P>0.05$). Electrical conductivity ranged between 0.18 dSm^{-1} in IIB (Transitional Plain of Luni Basin) and 0.38 dSm^{-1} in IVB (Humid Southern plain), whereas soil bulk density varied from 1.38 g cm^{-1} in IVB to 1.61 g cm^{-3} in IA (Arid Western plain) agro-climatic zone. Percent soil organic carbon was highest (1.13%) in IVA (Sub humid Southern Plain), whereas the lowest amount of soil organic carbon was observed in IA agro-climatic zone (Fig 4.6).

Lowest and highest values of soil pH in the soils of sacred groves of different agro-climatic zones were 7.04 in IVB and 7.82 in IC (Hyper-arid partly irrigated zone), respectively. Gravel content showed wide variations between the agro-climatic zones being highest ($P<0.01$) in IVB (51.48%) and lowest in IIA (Internal drainage dry zone) agro-climatic zone (Fig 4.5, top right). Lowest concentrations of SOC, PO_4-P and soil carbon density was in the soils of sacred groves in IA agro-climatic zone, whereas NO_3-N and NH_4-N concentrations were lower in the soils of sacred groves in IC zone. These observations are obvious because of aridity in western Rajasthan which influences soil characteristics and soil nutrient availability. SOC and related soil carbon density in top 0-30 cm soil layer was highest in the soils of sacred groves situated in IVA agro-climatic zone.

But soil availability of NO_3-N, NH_4-N and PO_4-P were highest in IVB, V and IIB agro-climatic zone, respectively. Such spatial heterogeneity in soil nutrients appear to be due to differences in vegetation types as the main source of soil nutrients in natural ecosystems is litter input (Schlesinger et al., 1996). The spatial heterogeneity of soil nutrients may be random in the dense, uniform vegetation of relatively humid regions (Schlesinger et al., 1996), whereas in the patchy vegetation of relatively arid regions, concentrated distributions of nutrients beneath vegetation patches are often observed and referred to as “islands of fertility” (Garner and Steinberger, 1989; Hirobe et al., 2001; Kondo et al., 2012). However, the toxicity effects also change the stability properties of the vegetation patterns and thus spatial variations in soil properties.

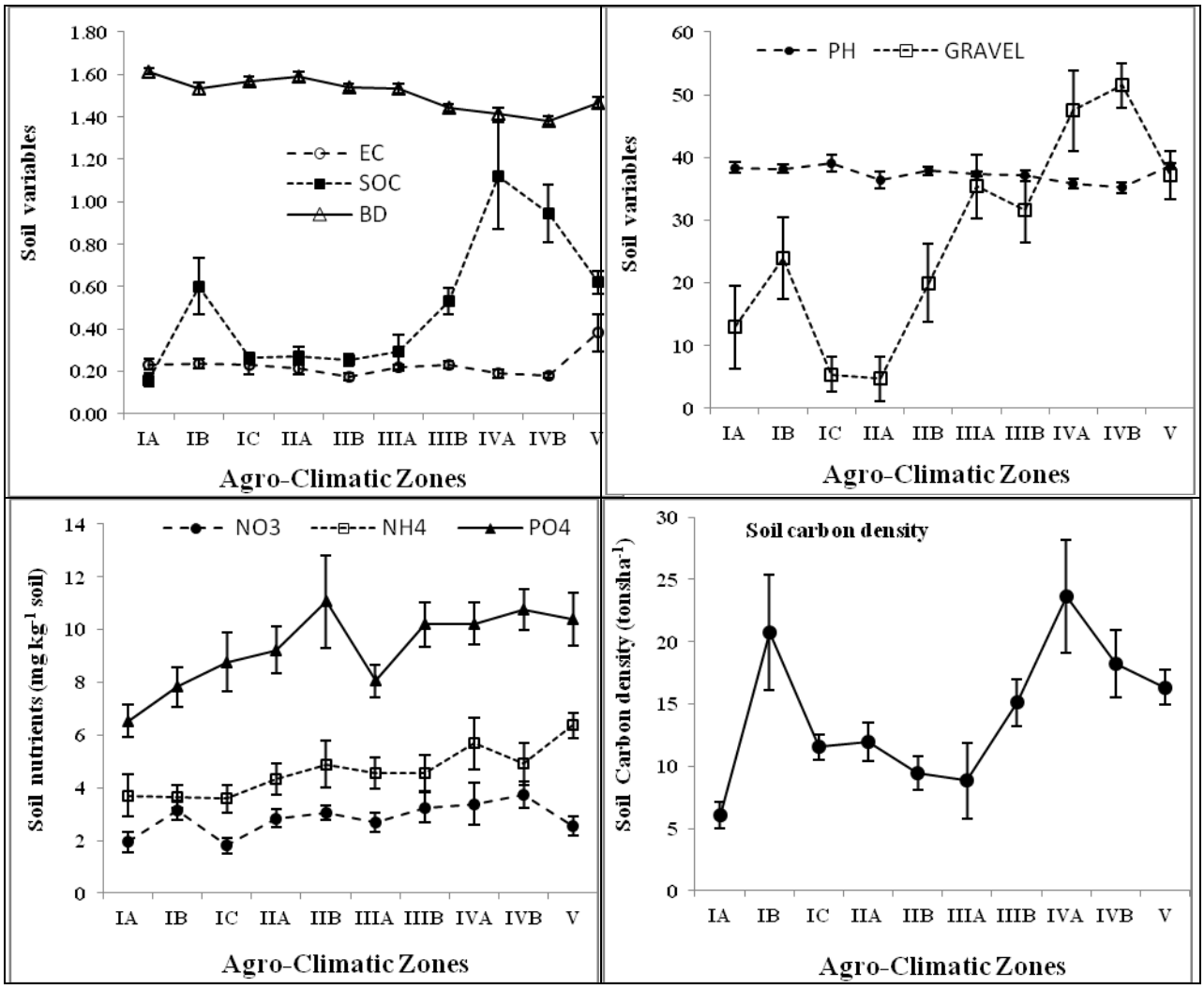


Fig 4.8 Variations in soil characteristics in sacred groves in different agro-climatic zones of Rajasthan. Error bars are ±1SE.

7. SPECIES OF IUCN LIST

Some of the species identified during the sacred grove survey have been categorized in different categories of IUCN list and provided in Table 4.5.

8. STATISTICAL RELATIONS

Population, species richness (S), Shanon-Winer diversity index (H'), effective number of species (ENS) and Reciprocal Simpson diversity index (I/D) of both trees of >30 cm girth and 10-30 cm girth were positively related to both long term average rainfall (RF1) as well as rainfall averaged for 2003-2012 (RF2). For tree saplings and shrubs only diversity ($r=0.252$, $P<0.05$, $n=123$) and

population (r=-0.218, P<0.05) showed significant correlations with RF2, indicating the positive effects of rainfall of 2003-2012 period on tree saplings and negative effects on shrub population (Fig 4.9).

Table 4.5 Red lists of some of the species recorded in the sacred groves of Rajasthan.

SNo.	Species	Local name	Family	Habit	Red List category
1	*Acacia catechu* (L.f) Willd.	Khair	Mimosaceae	Tree	Invulnerable
2	*Adina cordifolia* (Willd) ex Roxb.	Haldu	Rubiaceae	Tree	Vulnerable
3	*Ailanthes execlsa* Roxb.	Aruu	Simaroubaceae	Tree	Vulnerable
4	*Alangium salvifolium* L.f.Wang.	Ankol	Alangiaceae	Tree	Rare
5	*Alysicarpus vaginalis* (L.)D.C.	----	Fabaceae	Herb	Invulnerable
6	*Boswellia serrata* Roxb.	Salar	Burseraceae	Tree	Rare
7	*Celastrus paniculata* Willd.	Malkagini	Clastraceae	Climber	Rare
8	*Cordia dichotoma* Forst.	Lasora	Ehreteaceae	Tree	Vulnerable
9	*Crateva nervosa* DC.	Varana	Capparaceae	Tree	Rare
10	*Dalbergia latifolia* Roxb.	Safed Shisham	Fabaceae	Tree	Invulnerable
11	*Feronia limonia* L.	Kaith	Rutaceae	Tree	Invulnerable
12	*Gloriosa superba* L.	Kalihari	Liliaceae	Climber	Endangered
13	*Mallotus philippensis* Lam.	Sindhuria	Euphorbiaceae	Tree	Rare
14	*Manilkara hexandra* Roxb.Dub	Khirani	Sapotaceae	Tree	Invulnerable
15	*Melhania futtetyporensis* Munro	-	Sterculeaceae	Shrub	Rare
16	*Mimosa hamata* Willd.	Bander ki roti	Mimosaceae	Shrub	Invulnerable
17	*Morinda tomentosa* Heyne.	Aal	Rubiaceae	Tree	Vulnerable
18	*Nyctanthes arbortristis* L.	Harsingar	Nyctagenaceae	Tree	Vulnerable
19	*Sarcostemma viminale* L.	Sambher bel	Asclepiadaceae	Climber	Endangered
20	*Soyamida febrifuga*	Rohin	Meliaceae	Tree	Rare
21	*Tecomella undulata*	Rohida	Binoniaceae	Tree	Rare
22	*Terminalia alata* Heyne. Ex Roth.	Sadada	Combretaceae	Tree	Rare
23	*Terminalia bellerica* Gaertn.	Baheda	Combretaceae	Tree	Invulnerable
24	*Wrightia tinctoria* R.Br.	Dhudhi	Apocynaceae	Tree	Invulnerable

The relationship of rainfall of 2003-2012 appeared more strong in case of trees of >30 cm girth and relatively weaker in case of trees of 10-30 cm girth. Rainfall of 2003-2012 also showed better relationship with tree saplings S, H' and ENS, soil bulk density, per cent SOC, NO_3-N, NH_4-N and PO_4-P and basal area of trees of 10-30 cm girth as compared to the long term average rainfall. Thus rainfall of latter period had played a significant role in adding the number of trees

in 10-30 cm girth category and further to >30 cm girth category. Long term average rainfall showed negative relationships with soil pH (r=-0.252, P<0.01) and soil bulk density (r=-0.541, P<0.01) and positive relationships with gravel content of soil (r=0.597, P<0.01), per cent SOC (r=0.406, P<0.01), soil available NH_4-N (r=0.278, P<0.01) and PO_4-P (r=0.274, P<0.01).

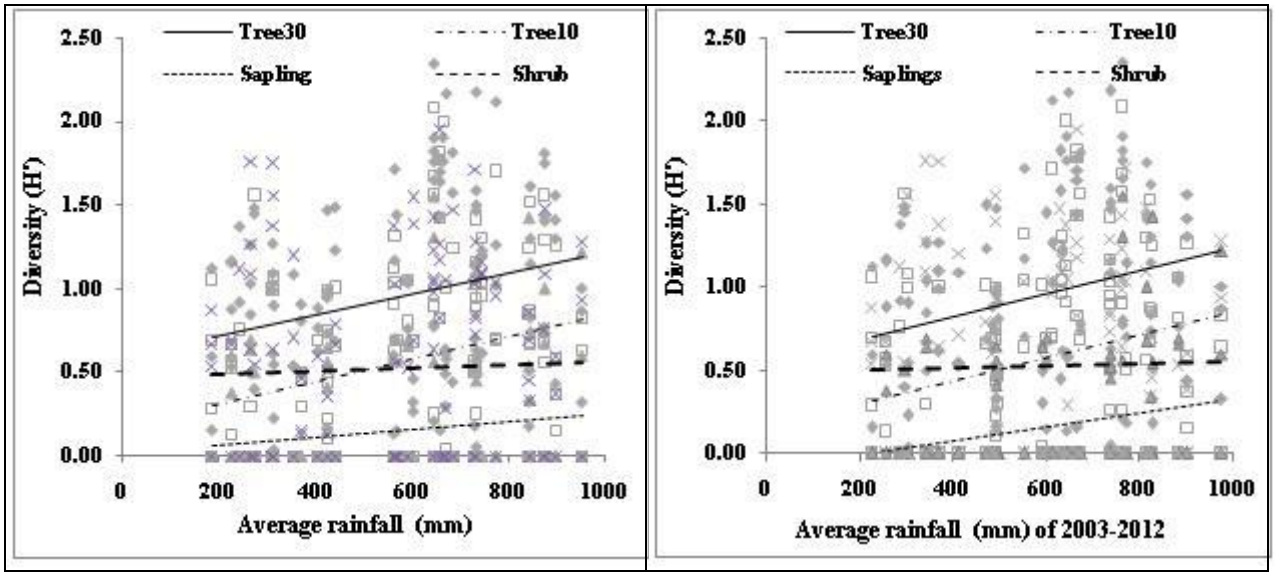


Fig 4.9. Trend lines for diversity variables of different plant habits and rainfall of long term average (left) and 2003-2012 average (right)

Species richness, H' and ENS of trees of >30 cm girth had positive correlation to the same parameters of the trees of 10-30 cm girth category. ENS and S values of both tree categories showed beneficial effects on the number of species as well as diversity of trees saplings (Table 4.6). But population of tree of both girth categories had no effects on the tree sapling population and diversity. A diverse community of tree species observed beneficial (positive correlations) for shrub species, SOC and soil carbon density and soil bulk density (negative correlation).

A significant positive relation between SOC and H' of trees of >30 cm girth indicates beneficial impacts of older trees in soil organic carbon accumulation. Other plant habits (trees of 10-30 cm girth, shrubs and tree saplings) had indicated positive relations but were not significant (Fig 4.8). Basal area of trees of >30 cm girth showed negative effects (negative correlations) on number of shrub species and its diversity variables. We did not observed any significant relationships

between basal area of trees of >30 cm girth and the soil variables, whereas basal area of trees of 10-30 cm girth showed negative relationship with soil pH (r=-0.186, P<0.05). This indicates that increase in population of trees of 10-30 cm category had favorable effects on soil properties.

Table 4.6. Correlation coefficients indicating relationships between different plant, topography and soil variables.

	Variable	RF1	RF2	pH	SOC (%)	BD	NO_3-N	NH_4-N	PO_4-P	Carbon density
Tree >30 cm girth	Population	0.234	0.303	NS	-0.277	0.204	NS	-0.234	NS	-0.246
	Richness	0.390	0.413	NS	0.352	-0.436	0.183	NS	NS	0.311
	H'	0.244	0.244	NS	0.242	-0.321	NS	NS	NS	0.270
	ENS	0.250	0.243	NS	0.258	-0.357	NS	NS	NS	0.278
	1/D	0.216	0.167	NS	0.219	-0.324	NS	NS	NS	0.225
	Basal area	NS	NS	NS	NS	NS	NS	NS	NS	NS
Trees 10-30 cm girth	Population	0.229	0.242	-0.250	NS	NS	NS	NS	NS	NS
	Richness	0.286	0.281	NS	NS	-0.301	NS	NS	NS	NS
	H'	0.265	0.249	NS	NS	-0.255	NS	NS	NS	NS
	ENS	0.39	0.225	NS	NS	-0.273	NS	NS	0.190	NS
	1/D	0.234	0.202	NS	NS	-0.248	NS	NS	0.192	NS
	Basal area	0.239	0.244	-0.186	NS	NS	NS	NS	NS	NS
Sapling	Population	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Richness	NS	0.220	NS	NS	NS	NS	NS	NS	NS
	H'	NS	0.253	NS	NS	NS	NS	NS	NS	NS
	ENS	NS	0.256	NS	NS	NS	NS	NS	NS	NS
	1/D	NS	NS	NS	NS	NS	NS	NS	NS	NS
	Basal area	NS	NS	NS	NS	NS	NS	NS	NS	NS
Shrub	Population	-0.218	-0.177	NS	NS	NS	NS	NS	NS	NS
	Richness	NS	NS	NS	NS	-0.255	NS	NS	NS	NS
	H'	NS	NS	NS	NS	-0.262	NS	NS	NS	NS
	ENS	NS	NS	NS	NS	-0.217	NS	NS	NS	NS
	1/D	NS	NS	NS	NS	-0.222	NS	NS	NS	NS
	Basal area	-0.188	NS	NS	NS	NS	NS	NS	NS	NS
Altitude		-0.335	0.354	-0.337	0.245	-0.333	0.376	NS	NS	NS
SOC		0.406	0.413	NS	-	-0.731	0.248	NS	NS	0.841

Per cent soil organic carbon showed positive relationship with rainfall (r=0.406, P<0.01), altitude (r=0.245, P<0.01), tree (>30 cm girth) species richness, H', ENS, 1/D, gravel content (r=0.440, P<0.01), NO_3-N (r=0.246, P<0.01) and soil carbon density (r=0.841, P<0.01) in 0-30 cm soil layer. Thus increase in rainfall, species diversity and number of species favoured carbon accumulation in the soil (Fig 4.10).

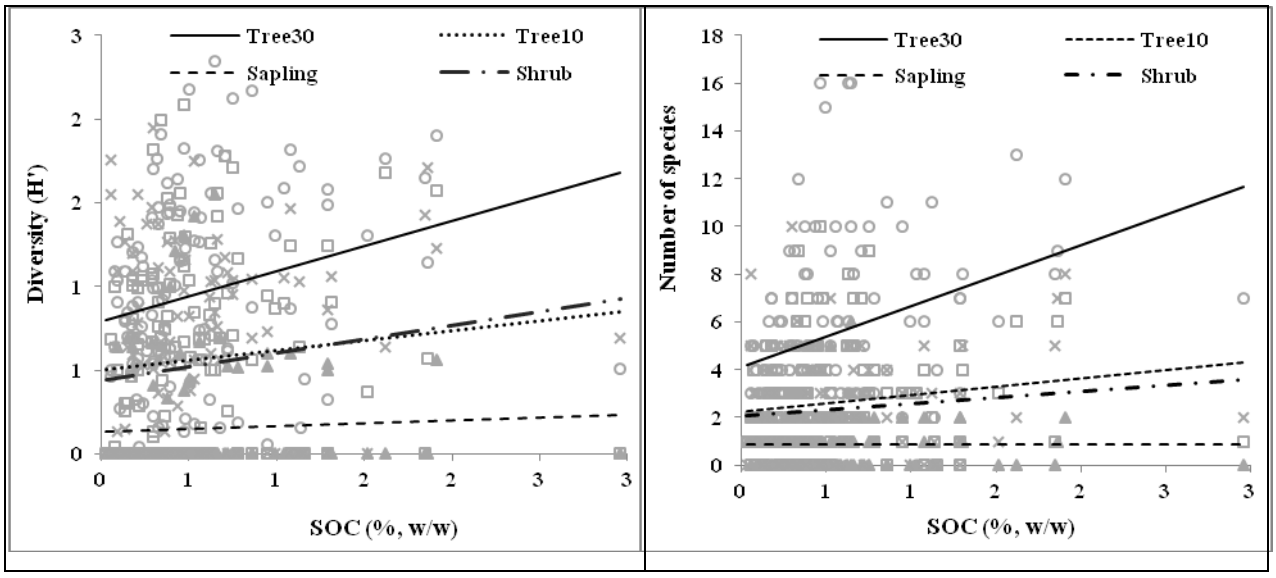


Fig 4.10. Relationships between SOC and Effective number of species of different plant habit.

8. CONCLUSIONS

Sacred groves of Rajasthan vary widely in their floral and faunal diversity. These sacred groves function as important refugia for many plants and animal species. The anthropogenic pressure or when the area of the groves is small, a strong selection and hierarchy are taking place among the species available in the grove. From grove to grove, it is not always the same species, which is dominant. In the 123 studied sacred groves there are 26 types of tree species, which area are dominating depending upon adaptability to the climatic conditions. The local variations reflect variability due to edaphic and environmental conditions, topographic differences, climatic variations, varying degrees of human interference and elements of climax vegetation. A total number of 131 woody species belonging to 48 families were identified. Dominant species with decreasing number of sacred groves are in order *A. pendula>P. juliflora>Salvadora oleoides> Capparis deciduas>P. cineraria>Tectona grandis>Acacia leucophloea>Acacia nilotica>Butea monosperma>Zyziphus rotundifolia*. It has been observed that under conditions of stress, single species dominance takes place in the community. Rapid changes in the plant communities due to changes in land-use pattern are also taking place. Sometimes the biomass in groves is lesser than that of adjoining vegetation particularly in western of Aravalli, is attributable to the decline in the number of climax species. However, it was observed higher in eastern Aravalli. The loss of

climax species can be expected as a result of the dominance of certain secondary species, affecting the regeneration of climax species.

Sacred groves dominated by *P. roxburghii, W. tinctoria, E. officinalis, B. monosperma, M. parviflora, A. indica, A. catechu* and *Tectona grandis* indicated higher vitality in terms of diversity and regeneration status in the sacred groves and can be promoted under restoration of the groves. In arid region *P. cineraria* and *Salvadora* spp. found effectives in maintaining diversity of the groves. Likewise sacred groves of IB, IIB, IIIB and IVB agro-climatic zone showed better floral diversity and thus ecological status. However, it is clear that with the decrease in soil water availability (increase in dryness) and disturbance there is corresponding decrease in the endemic elements of vegetation leading to invasion by the other species. Further the sacred groves available in west of Aravalli are relatively less diverse in nature and lower in soil nutrients as compared to that of the Aravalli regions and the groves available in the east of Aravalli.

At least 19 birds, 25 mammals and 10 reptiles including the Alexandrine parakeet were observed or said visited these sacred groves. For example Kalu Das ji Ki Dungari, Dausa is full of Alexandrine parakeet and could be a bird watching place, where almost each tree of *Anogeissus pendula* have 1-3 numbers of holes as residence of these parakeets. The increase in diversity and quantity of SOC, NH_4-N, NO_3-N and PO_4-P and soil carbon density with increased rainfall indicated favourable conditions of the sacred groves available in east of the Aravalli. The sacred groves dominated by *A. indica, A. senegal, A. nilotica, E. officinalis, T. grandis* and *T. arjuna* appeared best in accumulating soil organic carbon. Whereas the agro-climatic zone IB and IV showed greater soil carbon density as compared to the other zones.

Further, significantly low values of diversity and the basal area for the trees of 10-30 cm girth even below the tree saplings indicates reduced capacity of natural regeneration and low recruitment of plants from saplings to trees of 10-30 cm girth in most of the sacred groves which requires major attention. Further, in most of the sacred groves the climax species particularly *Anogeissus pendula* is degenerating with very poor regeneration and seedling recruitment.

LIVELIHOODS FROM AND THREATS TO SACRED GROVES

Sacred forests have been integral parts of our life since ancient times. The local communities have respected and protected them, through a sacredness associated with taboos. Because of sacredness and social restrictions these forest patches are important reservoirs of biological diversity and preserve unique floral and faunal species (Gupta and Sharma, 2013). These are considered remnants of the past dominant forest vegetation which once existed in the locality but are degrading due to anthropogenic interventions like overexploitation of forest products, cattle grazing and changes in land use by converting forest to monoculture plantations, agricultural lands and dwelling sites. These activities have been continuing ever since men started cultivation and exploitation of natural resources for their livelihood. Having left undisturbed and unexploited for years, these sacred groves even now remains a treasure of biodiversity and gene pool conserving many endemic and endangered plants and animals of economic and scientific importance which does not exist even in the adjoining forest areas at some of the places (Chandrashekara, 2011). This chapter contained the benefits accrued from the 123 sacred groves surveyed during the study. Out of these 123 sacred groves, 6 are in the control of state forest department, Rajasthan and the rests are under the control of village Panchayat, in which one has been recently converted sacred grove from pastureland.

1. BENEFITS OF SACRED GROVES

In addition to provide habitat for a range of flora and fauna, these sacred groves are utilized for multiple purposes. People use the sacred groves as grazing land for their cattle and collect minor produces for their day to day livelihood (Table 5.1).

1.1 Availability of water

Most of the sacred groves were found associated with some water body that includes pond, Talab, Nadi, spring, stream, deep well etc. These water bodies are not only provide drinking water for wild and domestic animals but also help supply of water to the human habitation. In some cases these water bodies act as aquifer and help charging ground water, which latter utilized for drinking water supply or under irrigation. Some of the sacred groves have more than one water body if bigger in size.

Table 5.1. Benefits accrued from sacred groves by the people of adjoining villages in Rajasthan.

SNo.	Type of requirements	Number of sacred groves
1.	Water availability	113
2.	Fuel wood collection	38
3.	Grazing for livestock	94
4.	Dry wood collection	39
5.	Fruit and fodder collection	17
6.	Drinking water for human beings	1
7.	Fodder and other material collection	1
8.	Place of rituals and social gathering	123
9.	Place of meeting and decision making	all
10.	None	13

Sacred groves also work as a catchment area for many water bodies and the springs passing through it and promote agriculture activities in nearby areas. One such example is the 'Khadin System of Cultivation' in western Rajasthan, where water coming from uplands mostly forests, sacred groves or other similar areas is collected in farmlands down slope areas and conserved for cultivating agriculture crop (Fig 5.1).

1.2. A place of grazing

Animal husbandry has main stay and second occupation in Rajasthan. People are using the sacred groves/Orans as grazing ground together with the pasturelands. At sometimes demarcation between pastureland and oran is very confusing except a small temple put aside in the area. Almost 76% of the sacred groves observed utilized for the animals and ruminants grazing. Sometimes the grazing needs of the local peoples are accommodated by the management committee of the sacred grove. For example Viratra Mata Oran coveres about 1859 ha area and is ruled by the Oran Prabandhak Samiti involving 7-8 villages, which impose a penalties of Rs. 500 to 1000 under violations formulated rules. Earlier the Samiti was dominated by Rajputs, but now other casts have also joined, and their needs accommodated. However, people sometimes debranch the tree for the grazing animals. One can see the trimming of *Prospis cineraria* canopy almost at same height from the soil surface. This is done by the Camel-the so called ship of the desert (the population of which is dwindling now because of varying threats) feeding on this important multipurpose tree. Likewise other trees are also pruned and grazed in different localities. However, overcrowding of the animals is resulting soil surface almost bare (Fig 5.2).

Fig 5.1. Sacred grove near Kaladungar Jaisalmer working as area water resource for cultivating agriculture crop and supporting Salvadora-Tamarix association down slope area.

Fig 5.2 Grazing animals in Kolu Pabuji Oran, Jodhpur and drinking water at the adjoining site in the Oran.

1.3 Fuelwood collection

As an institution sacred grove is perhaps the best example of indigenous traditional resource use practices promoting conservation of biodiversity, where removal of any living things from sacred groves is a taboo. Despite of such social restriction, people use to collect fuelwood from these areas. There were 38 sacred groves observed during the survey from which the collection of fuel wood is continued and residents are benefited in this farm. The collection is mostly fallen dry twigs and branches. However, at some of the places people has pruned and pollarded some plants for their collection after drying. For example people use to cut even some tree despite of

protection made by the temple personals in Devani of Shivji Mahraj, Garh Bassi, Alwar-said the head priest of the temple.

1.4 Dry wood collection

This is normal practice; people use to collect dry woods generally at the time of death of a person for cremation. However, wood is also collected while performing some rituals and social gathering.

1.5 Collection of minor produce

Diverse vegetation growing in general in the sacred groves provides a variety of non-wood produce. Fruits and berries produced by the trees and shrubs are used by the wild as well as domestic animals. However, people use to collect these produce for their personel uses and sometimes considered famine foods. Fruits of *Zizyphus* spp., *Salvadora* spp., *Caparis decidua*, *Diospyros melanoxylan* etc. are collected by the local villagers and utilized immediately or stored after drying for long term uses (Fig 5.3). Some of the species have multiple uses and have considerable value for the traditional medicinal use among the local community. For example Khakhra (*Butea monosperma*) is used as brushes for white washing. They are cut into strips and used to make a juice, which is mixed with butter milk, gum is eaten by women, root and bark used in heeling blood in stool and dried and powdered flowers heels blood in urine. Lac insect is also found on its leaf tree. Branches of Salar (*Boswellia serrata*) are used to make a 'Mandap', which plays an important role in a marriage ceremony. Gum is used to make dhoop (incense sticks). Pipal (*Ficus religiosa*) helps in treatment of Guinea worms, whereas different parts of Neem (*Azadirachta indica*) are used in various ailments. Many other herbs growing naturally in the sacred groves are collected and utilized by the villager in the form of medicine as a part of traditional knowledge or with the help of local 'Baidya'. Prospects of honey collection have also been observed in some groves.

1.6 A place of social gathering and rituals

Sacred groves provide sacred physical space, which is communally shared as commons, and used to observe important social ceremonies in indigenous societies. Several cultural festivals are

performed in these sacred groves/Orans (Fig 5.4). These sacred groves also provide a meeting place on various occasions including social gatherings, marriage, after-death rituals, etc.

Fig 5.3. Collection of fruits of *C. deciduas* (left) and harvesting of *S. munja* for thatching purpose (right) from the sacred groves

Fig 5.4. Sacred groves as place of performing rituals (left) and a place of discussion (right).

2. THREATS TO THE SACRED GROVES

Extraction of more and more resources from the forest area due to less income and inadequate marketing support together with lack of communication results in overexploitation of available resources. Increase biotic pressure on the existing sacred groves in the form of cuttings, over grazing, hunting and forest fires, which are neglected by the local people, leads to gradual

degradation. Dilution of traditional values, such as expansion of agriculture and settlement areas, unplanned development, illegal tree felling, poaching leads weakening and decrease cultural, biological and ecological values of these sacred groves (Madeweya et al., 2004). Further, human activities that were previously taboo, such as dead wood collection, biomass gathering, lopping of tender branches and green leaves for goats, creation of footpaths, cattle grazing, mining of sand and clay, brick-making and collection of wild fruits, vegetables, medicinal plants, fruit-eating bats and fireflies, are affecting the ecology of the sacred groves.

The number of sacred groves in various locations and regions depends upon the magnitude of the varying threats which are area specific. Over the past few decades many people have lost their rights of forest management to the government. Many researchers have worked on conservation aspects of sacred groves through socio-cultural practices in India (Gadgil and Vartak, 1975; Khiewtam and Ramakrishnan, 1989; King-Oliver et al., 1997; Tiwari et al., 1998; Sinha and Maikhuri, 1998; Sunitha and Rao, 1999; Basu, 2000; Kushalapa et al., 2001; Bhagwat et al., 2005; Deb, 2007; Jaryan et al., 2010; Kala and Sharma, 2010; Anthwal et al., 2010). There are several reasons for this decrease in terms of area and number. Primary cause is the lack of documentation as a result of which it becomes difficult to conserve and maintain these sacred groves. Some common threats identified during the survey of the sacred groves of Rajasthan are:

2.1 Disappearance of the traditional belief systems

Traditional belief is fundamental to the concept of sacred groves throughout the world. These systems and their rituals are now considered mere superstition. Lack of awareness in terms of long term future benefits has also resulted in the destruction of these sacred groves. Various religious beliefs, influx of large number of pilgrims and tourists and conversion to other religions axing of plants for monetary benefit are contributing consistently to the degradation of these well flourished areas of vegetation to a mere crunch of trees in many parts of the state. The rituals are now known to very few people, mostly belonging to the older generation. In some of the regions with larger sacred groves the traditional rituals are still performed in accordance with the customary beliefs, but in smaller groves the traditional rituals are no longer performed. Though silently but the traditional values appear to be gradually disappearing with the recent advent of modernization, urbanization and people's changing aspirations. As a result, the violation of

cultural norms and taboos no longer carries heavy consequences, and the sacred groves are becoming degraded.

> Erosion in people's beliefs in nature worship, religion and social values are major threats to the sacred forests, which are conserved patches of forests that lay undisturbed. Fear of Gods and social taboos prevented people from harvesting resources from these sacred forests though there are no physical borders. Thus change in social and religious values are now posing a danger to these sacred forests.
>
> Bhattacharya, (2014)

2.2 Rapid urbanization and developmental interventions

Sacred groves in many parts of India and the state of Rajasthan have been destroyed due to construction of roads, raillways tracks, dams etc. Thus the recent threat to sacred groves/Oran is witnessed from the process of modernization, industrialization, greed of land mafias and construction of building structures resulting is loss of cultural and ecological importance among the younger generation of local people. Out of 123 sacred groves, one has been observed bisected by railway tract, whereas 19 sacred groves were observed bisected by both railway and highway (Table 5.2). Eight sacred groves provided place of cremation, whereas 16% sacred groves have been utilized for a mixed activities like construction of temple, Dharmashala and road as well as railway tract (Fig 5.5).

Table 5.2. Types of utilization of sacred groves of Rajasthan

SNo.	Type of land uses	Sacred groves (nos.)
1	Construction of temple or mosque	57
2	Railway track	1
3	Construction of Road or highway	19
4	Place for cremation	8
5	Construction of both Temple and Road	12
6	Construction of temple, Road and railway track	1
7	Construction Dharamshala, shops and Road	2
8	Construction Dharamshala,Temple and Road	3
9	Plantation activity	2
10	No change	18
Total		123

Fortunately, 15% of the sacred groves have been found in safe conditions and with full sanctity. Multiple crossing and a net of roads and the railway lines fragments the groves into smaller isolated patches of some trees of plants, which ultimately lose their entity in absence of effective pollination and seed setting and dispersal. Ultimately affect regeneration of the climax species.

Fig 5.5. Construction of Dharmashala (left) and encroachment as house construction are some of the important threats to the sacred groves.

2.3 **Sanskritisation**

Many groves are suffering due to '**Sanskritisation'** or the transformation of the primitive forms of nature worship into formal temple or mosque worship. This has also changed the shape of the sacred groves. Out of the 123 sacred groves surveyed, 57 sacred groves are under construction of temples and mosque and now transforming the nature of primitive worship (Table 5.2).

2.4 Pressures of livestock and fuel wood collection

Increased livestock and human population have enhanced the intensity of grazing, lopping and removal of biomass that have also resulted in dwindling of the groves. We observed almost 5 types of disturbances in the sacred groves. These are grazing, cutting, mining, movements of vehicles and dumping of garbage (Table 5.3). Seven sacred groves observed intact without any disturbance, i.e., 6% of the total sacred groves, whereas 85% sacred groves are under pressure of grazing of varying intensity. In this some of the sacred groves there is severe grazing affecting ground vegetation. About 3% sacred groves are affected by both grazing and cutting of fodder or

fuel wood. Though pure mining activity has been observed at one site, but excavation of soils and murram (calcium carbonate aggregates) have been observed in many of the sacred groves. Because of sanctity visit of sacred groves by the local people is also common, vehicular movement causing disturbances have been observed in 6 sacred groves.

T**able 5.3.** Types of disturbances and exploitation of resources in the studied sacred groves in Rajasthan

SNo.	Type of exploitation	Number of sacred groves
1.	Grazing	104
2.	Grazing and cutting	4
3.	Grazing and Mining activity	1
4.	Vehicle movement	6
5.	Dumping Garbage and Grazing	1
6.	No disturbance	7
Total		123

2.5 Human greed

Encroachments of sacred groves by local communities or various other government departments, migration and immigration of people have contributed to the extinction of some of the sacred groves. Encroachment of sacred groves for varying uses is one of the major threats for the survival of sacred groves in India and Rajasthan in particular. We observed 79 sacred groves intact with minimal encroachments. Major encroachments are for agriculture purpose, which accounts almost 27% of the total number of sacred groves surveyed (Table 5.4). Next was for both constructions of house and agriculture activities. About 3% sacred groves have been encroached upon for construction of houses only.

Table 5.4. Type of encroachments observed in the studied sacred groves of Rajasthan.

S. No.	Type of encroachments	Number of sacred groves
1.	Agriculture	33
2.	Construction of House/ Dhani	3
3.	Both Agriculture house and Dhani	8
4.	No encroachment	79

Like railways and roads, encroachments for agriculture and other activities lead to fragmentation of the sacred groves into smaller patches and simultaneously loss to entity. Encroachment has led

to the shrinkage of some of the largest groves in the country. Greed for certain plants like sandal (*Santalum album*) in Southern India and Teak (*Tectona grandis*) in Rajasthan has resulted in decrease of their population. In a study in Jodhpur district (Chaudhary et al., 2002) also indicates varying degree of encroachment of oarna and pasture, where halh of the surveyed oran/pasture lands had marginal (0-20%) encroachments, 25% had more than 20% encroachments. More than 90% and upto 100% encroachments have also been reported in the above-mentioned study (Chaudhary et al., 2002).

2.6. Species in afforestation programme

Inappropriate selection of species under strengthening plantation of sacred groves has also affected the ecology and overall diversity of the sacred groves. One such example is a sacred groves dominated by *Eucalyptus camaldulensis*. Further plantation of *Acacia tortilis* in some of the sacred groves particularly in western Rajasthan does not appears appropriate, rather indigenous species like *Prosopis cineraria*, *Cordia* spp., *Ziziphus* spp. and *Salvadora* spp. should be promoted in sacred groves of western Rajasthan.

2.7. Invasion by exotic weeds/species

The indigenous species found in the sacred groves are now threatened by the introduction of many exotic weeds. Some of the common exotic weeds are floss flower (*Eupatorium odoratum*), shrub verbenas (*Verbena officinalis*), Lantana (*Lantana camara*), *Hyptis suaveolens*, Parthenium (*Parthenium hysterophorus*) and *Prospis juliflora* etc. Invasion of *L. camara* and *P. juliflora* in the sacred groves of Rajasthan has become a serious problem in the ecology of these sacred groves. We observed dominance of *P. juliflora* in almost 16 sacred groves. However, *P. juliflora* of girth class >30 cm have been observed in 58 (47%) sacred groves. While considering the second dominant trees *P. juliflora* observed in almost 47% of the sacred groves of Rajasthan (Table 5.5). Saplings of *P. juliflora* had also been observed in 38 sacred groves. Among the shrubs the invasive L. camara has been observed in 11 sacred groves under studied (Table 5.4).

As compared to the total population of trees in >30 cm and 10-30 cm girth population of *P. juliflora* varied under dominance tree species (Fig 5.6). It ranged from 0.25 tree per 1.25 ha under *M. emarginata* dominant sacred grove (with total 66.5 trees per 1.25 ha) to 49.31 tree per

1.25 ha under *P. juliflora* dominant sacred grove (with total 73.3 trees per 1.25 ha). Average population of *P. juliflora* of >30 cm girth was 6.03 tree as compared to 75.1 tree per 1.25 ha for all tree across state.

Table 5.5. Extent of distribution of *P. juliflora* (trees of >30 cm girth, 10-30 cm girth and saplings) and Lantana camara in sacred groves of Rajasthan.

SNo.	Invasive species	Total grove	Sacred groves number
1	*P. juliflora* tree>30 cm girth	58	1-3, 6, 8, 11-15, 18-19, 22, 24-26, 28-30, 38, 40-41, 43, 45-46, 51, 56-59, 61, 68, 69, 70, 75, 77-78, 80, 82-83, 85, 89, 90-92, 98, 100-102, 106-108, 110-113, 115, 120
2	*P. juliflora* tree 10-30 cm girth	57	1-3, 6, 8, 11, 13-15, 20, 22, 25-26, 28-30, 40-41, 43, 45-46, 49, 51, 54, 56-59, 61, 68, 69, 70, 75, 76, 77-78, 81, 82-83, 85, 89, 90-92, 97-98, 101-102, 106-108, 110, 112-115, 120
3	*P. juliflora* saplings	38	1-2, 14-15, 22, 24, 29, 43, 45-46, 49, 51, 57-58, 68-71, 75-77, 81-82, 85, 88, 90-92, 97-98, 106-108, 110, 112-115
4	*Lantana camara*	11	1, 9, 11, 33, 44-45, 94-96, 116, 123

For trees of 10-30 cm girth class, population of *P. juliflora* varied from 0.17 tree in *T. grandis* dominated grove (as compared to total 118.5 tree) to 22.0 in *A. leucophloea* dominated grove (as compared to 38.0 total trees). In this category, average population of all tree species and *P. juliflora* were 21.4 trees and 5.7 trees, respectively (Fig 5.5, left middle panel). In case of saplings, population of *P. juliflora* saplings ranged between 1 and 48 individuals per 125 sq m. In this the highest population of *P. juliflora* sapling was observed in Neelkanth Madeo Oran, Dungarpur. Among the dominant tree species saplings of *P. juliflora* was highest with *A. sericea* followed by *T. arjuna* (Fig 5.5, left lower panel). Among the agro-climatic region, population of *P. juliflora* of >30 cm girth varied from 0.6 tree to 19.8 trees per 1.25 ha as compared to the total tree population of 51.8 tree and 113.9 tree in IC and IIIA agro-climatic zone, respectively. Population of *P. juliflora* trees of 10-30 cm girth ranged from 0.56 tree to 34.0 tree as compared to the total tree population 6.67 trees and 51.32 trees per 1.25 ha in IVA and IIB, agroclimatic zone, respectively (Fig 5.7, right panels). The saplings of *P. juliflora* observed highest in IIB and almost nil in IC and IIIB agro-climatic zones.

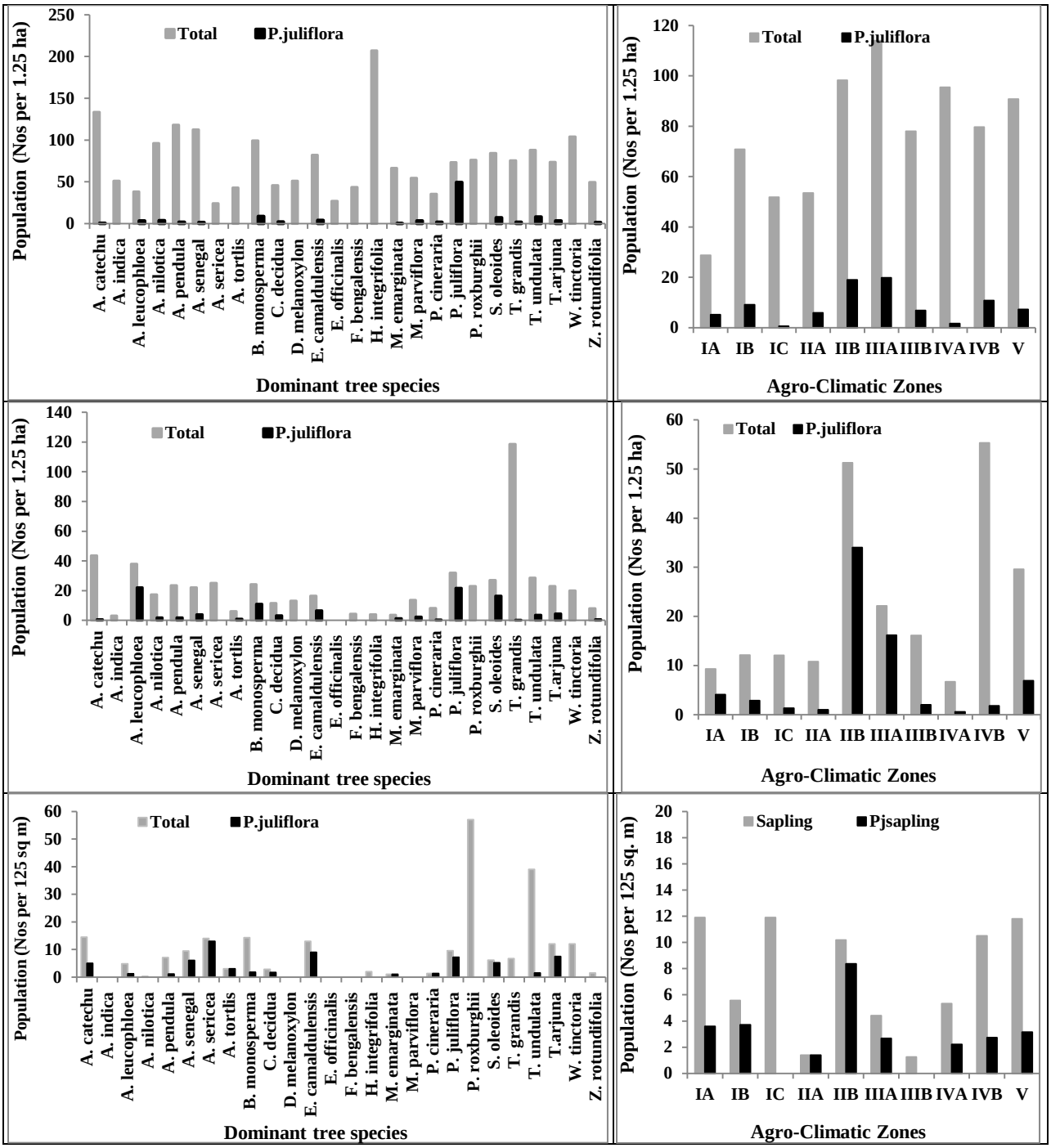


Fig 5.6. Population of *P. juliflora* of >30 cm girth (top), 10-30 cm girth (middle) and saplings (bottom) with respect to total population of all species influenced by dominant tree species and agro-climatic zones in Rajasthan.

Among the shrubs *Lanatan camara* confined only to the sacred grove of Ajmer, Alwar, Pratapgarh, Banswara, and Udaipur. Population of *L. camara* varied from 1 to 68 individuals per 125 sq m. Among the dominant tree species its population was highest with *E. camaldulensis*

followed by *W. tinctoria* (Fig 5.7, left panel), whereas almost no *L. camara* associated with the tree species of the western Rajasthan. Among the agro-climatic zones, highest population of *L. camara* observed in IVB agroclimatic zone, whereas IA to IIB zone had no *L. camara* shrub.

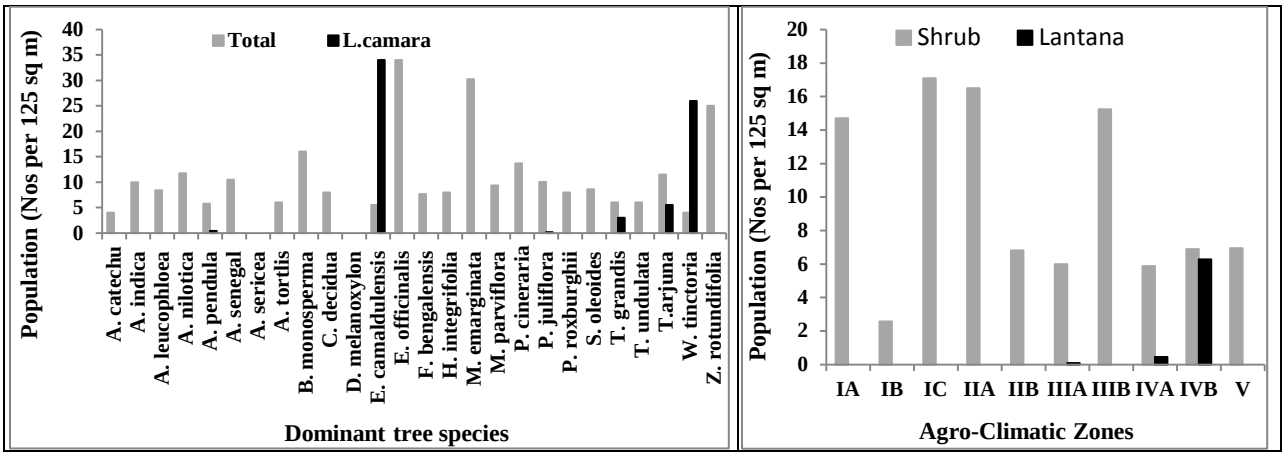


Fig 5.7. Changes in the population of *L. camara* in the sacred groves dominated by different tree species and in different agro-climatic zones of Rajasthan.

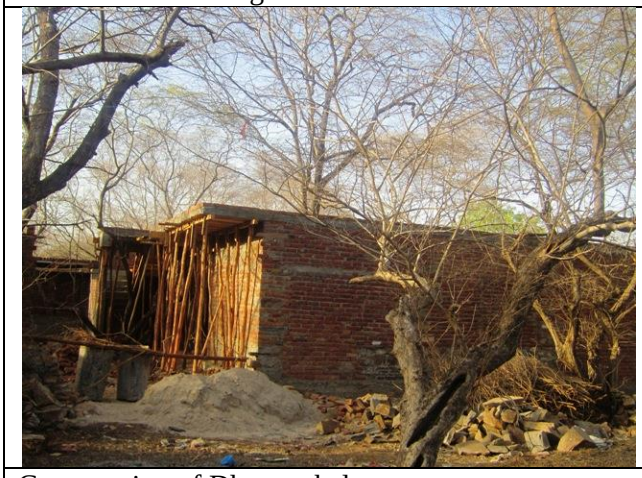
2.8 Policy implication

Conflicts among the sacred grove managers have also resulted in loss of biodiversity in certain sacred groves, when policy decisions have been made to benefit certain minority sections of the village society, against the traditions of the sacred grove. Moreover, area and legal status of several sacred groves has not been clearly defined. This results in lack effective legislation against offenders. More worse is the regularization of the encroachments by the Governments.

3. CONCLUSIONS

Despite of several benefits sacred groves provide to the local people in terms of ecological, social and economic, these ancient institutions are under degradation. Different benefits are place of water availability, grazing, fuel wood and fodder collection and work as communally shared commons and used to observe important social ceremonies in indigenous societies. Several cultural festivals are performed in these sacred groves, which also provide a meeting place on various occasions including social gatherings, marriage, after death rituals etc. However, modern age of liberalization, privatization and globalization make community's deviate from the customs which were the guiding principle in protecting and maintaining the sacred groves. Sanctity of life has no place in this market-linked livelihood systems and modern education has no respect for

local traditions. As a result this ancient and widespread institution is now weakening in terms of both cultural and biological integrity. Increasing pressure from population and livestock and encroachments by the individuals, government organizations are the major threats. Developmental activities, agricultural encroachment, increased resource use, cattle trampling and renovations of temples lead to damage of this valuable habitats (Blicharska et al., 2013). Over-exploitation and unscientific collection of plants for varying uses, eroding community values and lack of faith in the younger generation are other threats to the sacred groves (Yadav et al., 2010; Rao and Sunitha, 2011). Invasion of sacred groves by *P. juliflora* and *L. camara* are now becoming one of the major threats as population of these invasive species are increasing every years and requires special attention to adopt control measures for these invasive. Moreover, lack of policy and any legal status to the sacred groves also promoting offender for illegal activities in this ancient treasure. Though threats to the sacred groves vary from one region to another or even from one grove to the other, but most common threats are: (i) loss of traditional beliefs; (ii) rapid urbanization and developmental interventions (dams, large-scale mining works, road construction, tourism, and industrialization); (iii) commercial forestry; (iv) transformation of the primitive forms of nature worship into formal temple worship; (v) invasion by exotic weeds like *Lantana camara* and *Prosopis juliflora*; (vi) increasing livestock and fuelwood collection; (vii) fragmentation and perforation of sacred groves.

	
Over grazing	Construction of road
	
Encroachment for agriculture	Mining activity
	
Construction of Dharmashala	Cutting for fuel wood

Plat 3. Varying types of disturbances in sacred groves of Rajasthan

With the passage of time, there are considerable changes in the extent, status, vegetation structure, religious beliefs and taboos and even peoples' perception towards the sacred groves. A holistic understanding of the current status, structure and function of sacred grove is essential for formulating strategies for sacred grove conservation and ensuring ecological role of these values ancient institution.

6.1 PEOPLE'S PERCEPTION

People response to a programme is backbone of success through proper implementation, maintenance and management. Personal interactions and discussion indicated that entire respondent got some sort of direct or indirect benefit from the sacred groves and the product from the areas. Most of the respondents were in favour of conserving these areas so that benefits arise of it could not be hampered and its entity should be maintained. The requirements of most of the respondents combined according to the sacred groves and have been enlisted in Table 6.1, which area 15 in numbers. It is clear from the table that respondents of almost 100 (81.3% respondents) sacred grove sites were in favor of erecting boundary for effective protection and conservation of the diversity and treasures available in the sacred grove area.

Table 6.1. People requirements in protection and conservation of sacred groves of Rajasthan.

SNo.	Types of management	Sacred groves (Nos.)
1.	Demarcation and erection of boundary	100 (81.3%)
2.	Plantation	94 (76.4%)
3.	Development of water facility in sacred rove area	48 (39.0%)
4.	Documentation	20 (16.3%)
5.	Construction of Dharamshala for rituals	14 (11.4%)
6.	Requires government intervention in curbing encroachments	11 (8.9%)
7.	Proper protection and caring	8 (6.5%)
8.	Declaration as a tourist place	2 (1.6%)
9.	Road construction	2 (1.6%)
10	No interference from the government departments	2(1.6%)
11.	Construction of Temple	1 (0.8%)
12.	Eradication of invasive, i.e. *Prosopis juliflora*	1(0.8%)
13.	Development of garden/park	1 (0.8%)
14.	Electrification of the main temple area	1 (0.8%)
15.	Ban on mining Activity	1 (0.8%)

About 76.4% respondents posed their requirement for plantation in the sacred groves so that its diversity and benefits could be enriched. However, the respondents were mostly in favour of indigenous species of multiple benefits so that the requirement of human and domestic as well as wild life could be met.

Though most of the sacred groves were associated with some water body, but erosion from the adjoining upper or uphill area has led siltation and negatively affected the water storage capacity and its life span. It is also reflected in the response of the villagers during the survey. About 39.0% respondents demanded for developing water bodies in the sacred groves so that drinking water supply for domestic and wild animals could be ensured. Further it will also help charging ground water for fulfilling future requirements. Interestingly respondents of almost 20 sacred grove sites were so sensitive about the sanctity of the sacred groves and aware too about ecological, cultural and economic benefits, that they need full documentation of these sacred groves so that effective management strategies could be framed.

About 11.4% respondents had their demands for construction of Dharmashala so that people coming to the sacred groves to attend different functions as well as during social gatherings could be benefited from it and its sanctity could be maintained. Another 8.9% respondents were in favour of government intervention effective control measures regarding encroachments including enforcement of laws. Peoples were also in favour of effective protection and conservation but needs help from the government for proper caring of the sacred groves. However, some respondents do not want involvements of government organization in protecting and conserving these sacred groves.

Awareness about the invasive species like *P. juliflora* was also observed as some respondents also posed their response to irradiate or control this species affecting composition, structure and ecological function of sacred groves. This needs to be taken care at different levels. Likewise demands to ban mining activities in the sacred groves area were also there. Further, local peoples are also in support of developing some of the potential sacred groves as spot of tourism and nature watch. However, the level of community involvement in the tourism, and tourism profit sharing may affect the effectiveness of the protection and conservation of the sacred groves, in which transparency in revenue sharing is needed for facilitative positive tourism development at

the community level (Ormsby, 2012). Likewise other requirements mentioned in the Table 6.1 may have different impacts in terms of environment

2. CUASE OF CONCERNS

Tree worship is not related to any particular religion, but to the entire mankind since time immemorial. Trees thus have occupied a prominent place of pre-eminence and sanctity in every Indian in one way or other. The present study reinforces the notion that the sacred groves, though small in size, are important repositories of endemic flora and fauna. However, it is clear that tradition and way of life associated with the sacred groves which used to follow strictly earlier have been eroded during the last few decades and the groves are no longer enjoying the same status and privilege as they used to in the past (Khumbongmayum 2004).

National Environment Policy 2006, says that sacred groves are nature's laboratories for evolution of wild species and repositories of significant genetic and ecosystem diversity.

Lands of sacred groves are at present no man's land. In absence of effective legislation and action against deter offenders it will be difficult to protect and conserve this ancient system of nature conservation. Community-based land and resource management systems to conserve biodiversity were recognized by the anthropologists, biologists, conservationists and environmentalists and restrictions on access and use of such areas generally reduced or even eliminated human environmental impact and thereby helped protect species in the sacred groves (Christopher et al., 2014).

The legal status and total area of several groves have not been clearly defined. Despite of significant role played by sacred groves in conserving biodiversity there is no policy for management, conservation and utilization of these resources. Further there are no special laws for eviction of unauthorized occupants. Absence of a single coordinating agency results in fragmentations as well as duplication of the efforts undertaken by various governmental and non-governmental agencies for conservation and rehabilitation of the sacred groves. Further, almost all sacred groves do not have any kind of physical boundary demarcation. In absence of such

demarcation the extension of the agriculture lands and encroachments for various uses are continued.

Diversion of sacred groves as well as grazing lands is increasing at a very fast rate for other uses. Utilization for construction of various community assets life Schools, Hospitals, Community Halls, Panchayat Bhavans, Public Distribution Systems, Meeting Halls etc by various government departments and non-governmental organizations are going to hamper all the cultural, social, economic and ecological values of the sacred groves. Construction of houses, *bara*, shops and other commercial establishment by local resident, elected representatives, land-mafias, etc together with slow but steady extension of the boundary of the adjoining agriculture fields are also resulting in reduction in the size of sacred groves.

In addition to the anthropogenic problems, frequent drought is inherent characteristic of the climatic conditions of the Rajasthan, particularly in the western Rajasthan. The adverse effects of the deficit rainfall are on the natural regeneration and seedling recruitments and overall survival and growth of the plantation too if taken in it. Higher mortality of the plants raised under various schemes in rehabilitating sacred groves results in frequent plantation activities in absence of suitable species and sufficient provision of funds for cultural practices like fertigation, hoeing, irrigation or application of fungicide/insecticides for the raised plantation.

The principal cause for fragmentation is population pressure, requirement for biomass and agriculture. Once the grove interior is exposed, this will lead other species to invade the area, thus changing the floral composition as well as microclimate to a great extent. These changes will facilitate establishment of the invasive species in the grove and leaving the endemic flora on the verge of extinction. Simultaneously shrinkage in the area of grove and change in microclimate would affect the composition of flora and fauna. Large to medium size animals cannot stay in a small fragment and smaller ones which can stay, they face shortage of resources, shelter etc affecting the normal life of the biological entity.

There is lack of adequate scientific data about the ecological, economic as well as environmental values of these sacred groves. Though there is projection of about 25000 sacred groves in

Rajasthan, but a concerted effort is still lacking to come to the exact number and the area therein in the sacred groves of Rajasthan. In view of climate change also there is very limited data available about the existing carbon stock in both green biomasses as well as in soil of the sacred groves of Rajasthan.

Gradual decline social structure is also playing role in sacred grove degradation. Cultural changes among the young people are so rapid that they no longer believe in the methods their ancestors followed to maintain the fragile ecosystem. The worship places in many of the areas have already been replaced by temples/solid structures in the name of modernization. Once the god/goddess will be shifted to the temple, the surrounding places will become irrelevant to the people, leading to its conversion for other usage. As a result, the local shelter for plants and animals as well as ecosystem functioning will be completely lost.

Once the maintenance of the grove is neglected grove condition becomes vulnerable due to various factors like cattle grazing affecting regeneration), leaf litter and twig collection (affects nutrient cycling and moisture conservation), encroachment for some other purposes etc. This is going to affect overall functioning of the grove.

Most hidden matter in conservation of sacred grove is that the village people living nearby the sacred groves are relatively poor and their livelihood depends upon the grove. So, until and unless viable option is provided to these people for sustaining their economic condition, any step for the conservation of the sacred groves may not be successful.

3. MANAGEMENT STRATGIES

Sacred groves are perfect system of conservation, where in an entire ecosystem is protected and conserved for the sustainable development. This system could be strengthened by monitoring of the sacred groves through newly established 'Bio-diversity monitoring committees' by formulating local specific rules and regulations for the sustainable management. If their security is ensured through fencing and community awareness programs, these groves can play more important roles as decentralized centres of biodiversity conservation and ecological services. The groves were once recognized sources of springs and streams that benefited the village

communities. It is now essential that through restoration of sacred grove system and revitalization of community centered management system the groves can continue to play a greater role in strengthening rural livelihoods by supply of various non-timber forest produce as well as providing water security, rendering pollination services and as ideal local level mitigation measure for global climatic change. Restrictions on access and use of such areas generally reduce or even eliminate human environmental impact and thereby help protect species in the sacred groves (Christopher et al. 2014). This indicates that strategies for biodiversity conservation that link culture and nature are more likely to be effective than those imposed from the top down by government and/or international agencies and that ignore the traditional beliefs, values, institutions, and practices of local societies. However, management of sacred groves is under the Village Panchayats, which unfortunately are highly political institutions with artificially constituted units of communities or villages with divergent agendas and social and economic identities. This leads to conflict development many of the times. For ecologists, traditional ecological knowledge offers a means to improve research and also to improve resource management and environment impact assessment (Stevenson, 1996). For effective management of the sacred groves there is need to **s**trengthen the existing conservation activities of the villagers and to restore degraded sacred groves following landscape level approach.

3.1 People participation and awareness programme

For the protection and conservation of sacred groves and to maintain their natural identity and sanctity, there is need to uphold traditions and beliefs through people participation. Surrounding village communities need to be educated and guided for sustaining the sanctity of the existing grove. The local people basically are interested in continuation of sacred grove based tradition, but in the sway of modernism in life and religion the tradition is subjected to erosion. In this villager with support from forest department and non government organization can protect the groves at their vicinity. Conservation of sacred groves requires a step-wise approach including comprehensive recognition of the natural and social values, capacity building among local communities and design of locally suited incentives with participatory planning and implementation (Blicharska et al., 2013). Grove conservation activities could also be enlisted in the programmes along with the provision of small incentives to the young people. These incentives could be made in the form of carbon credit, ecotourism and for monitoring activities

depending upon local condition and requirement. Further, to avoid the scramble of modernization and globalisation from causing casting aside of this ancient, decentralized and local community centered conservation practice; conservation of sacred groves can be enhanced by establishing "buffer zones" around the sacred site itself. These zones can help to promote sustainable development and sustain the people livelihood.

3.2 Government policy and planning

A separate policy may be formulated at state level to ensure conservation, protection and rehabilitation of sacred groves through active cooperation and involvement of the local people, while meeting the basic requirements of livelihood like fuel wood, fodder, small timber and ethnobotanical needs on sustained basis. As women are more enthusiastic regarding conservation and preservation of different plants, the strategy at local and regional level should be adopted with major emphasis on women participation. Existing statutory rules and regulations governing protection and management of sacred groves needs critical review, whereas Acts and rules governing removal of unauthorized occupants from the sacred groves area may be made more stringent and effective.

3.3 Documentation and delineation

In lack of knowledge about the extent and distribution of the sacred groves, their edaphic and ecological conditions and social environment in the adjoin areas, any management strategies or management plan are not going to get success. There should be detailed survey to know the number, extent of distribution and present status of the sacred groves in each district of Rajasthan by physical approach and taking help of remote sensing technique. Further, the boundary of each sacred grove needs physically demarcation by fixing of suitably spaced stone/RCC boundary pillars. Once boundary is delineated by fixing of boundary pillars,. Once all available sacred groves have been identified, detailed history card prepared, and boundary delineated by fixing of boundary pillars the periodic changes in their status could be monitored through analysis of the multi-special satellite imageries taken at regular interval. Concerned Patwari of the village/area may inspect physical condition of the boundary pillars at least once in every year so that any damage/shifting of the boundary pillars by unscrupulous persons can be detected in time and necessary remedial measures could be taken

3.4 Management of sacred groves and people mobilization

The disappearance and/or degradation of sacred groves not only symbolize the loss of the rich relict flora and fauna but also its rich tapestry of culture associated with the grove (Kushalappa and Bhagwat 2001). Management of sacred groves or sacred patches/sites through the traditional system is now being challenged by a number of economic and social issues, and thus the traditional methods appear to be less effective. For this complete sacred grove area can be divided into core zone and buffer zone as available in 'Man and Biosphere Reserve' programme, where core zone should be maintained under conservation, whereas buffer zone for sustained use. But for the smaller groves a buffer zone 10-20 m may be maintained as buffer zone to control encroachments and other illegal occupation.

Mobilization and group formation with the support of the respective village panchayat is necessary for each sacred grove. Besides, grove specific sacred grove management committee should also be formed involving representatives of all stakeholders. Technical support to local communities is essential for the sustainable management of sacred groves. In this regards some technical organization may be involves. Moreover, local youths should be trained for wild plant species identification and assessment, seed collection or propagation, nursery development/ gap filling/planting, weed management, maintenance of sacred grove, selective collection and marketing of non-timber forest produce. For effective protection, village communities should be provided with alternatives for fulfilling fuel and fodder requirement. Information on forest produce from the sacred groves and possibilities of their value addition and marketing linkage may also help in ensuring people livelihood and the benefits of conservation. However, there is need to promote management in an era of market-orientated economy, where communities would need technical help in order to explore the ways in which sacred groves could evolve to meet contemporary needs, i.e. regenerated bio-diversity and biotic composition. For this adequate documentation of the biological resources of the state could be done implying People's Bio-diversity Registers (PBRs). Further, ecological services rendered by sacred groves needs to be highlighted and people should be made to realize that the conservation of groves is crucial for their sustenance.

3.5 Restoration of sacred groves

Though there is need to conserve the integrity of the tree-covered adopting landscape matrix (Bhagawat et al., 2005), but sacred groves are no longer free from anthropogenic pressure. In such a conditions restoration activities include planting native species, protection for seedlings and saplings, nursery establishment for rare, endemic plants, measures for soil and water conservation etc. If the security is ensured through fencing or boundary wall and the relevant communities are aware for the security of sacred groves, these groves can play more important roles as decentralized centres of biodiversity conservation and ecological services. Through restoration of sacred groves in accordance with ecological and environmental values and revitalisation of the community centred management system the groves could continue to play a greater role in strengthening rural livelihoods by supplying various non-timber forest produce as well as providing water security, rendering pollination services and as ideal local level mitigation measure for global climatic change. Thus to maintain the functional values and attributes of sacred groves, there is need to conserve threatened and indigenous species *in situ* effectively (Manikandan et al., 2011). For this external intervention taking the local people into confidence is call of the day.

However, despite of rich in species diversity and endemism, sacred groves cannot be treated as climax formation, because of dominance of large number of secondary or invasive species. In such a case without increase in the area, the vegetation of the groves cannot return to the climax formations by natural dynamics. In such a condition larger areas could be earmarked for their growth and a network of sacred groves could be established to promote endangered and endemic species (Sarfo-Mesah et al., 2010). Thus important and larger sacred groves could be brought under the 'Protected area Network' to ensure their proper protection and conservation. Ecosystem services like pollination, seed dispersal, nutrients cycling and soil and water conservation are usually operated in larger spatial extent combining different land use types at different times and therefore, require an integrated approach at landscape level. Considering the present fragmented conditions of the groves, they can be used as repositories of endemic plants, soil seed bank, connective corridor for birds and animals in human dominated landscapes. Therefore, it requires combined and holistic approach to conserve the grove tradition in landscape level. In this landscape approach appears more appropriate due to wider in spatial

scale as well as in application as it covers thorough knowledge on ecological processes, interactions of grove biota and issues of landscape ecology and taking cares of grove surroundings.

For rehabilitation of sacred groves through afforestation, local people should be taken into full confidence. The local people may be clearly made to understand that the rehabilitation works are to be undertaken for their benefits only and the implementing agency do not have any intention to grab the land. Type of species to be taken into restoration/rehabilitation of the sacred groves should be selected carefully with more emphasis on indigenous flora and the liking of the local fauna. For example *Prosopis cineraria*, *Tecomella undulata*, *Cordia* spp., *Salvadora* spp., *Zizyphus* spp, *Azadirachta indica* etc may be considered under rehabilitation of the sacred groves in western Rajasthan for utilization point of view and *Commiphora wightii*, *Moringa concanensis*, etc for conservation point of view. Likewise *Putanjiva roxbughii, Crateva relegiosa, Boswellia serrata, Acacia catechue, Emblica officinalis, Mangifera indica, Ficus spp., dansonia digiata, Mitragyna parviflora* etc may be considered in the afforestating the Devabanis of Aravalli and eastern Rajasthan. However, it better to ensure survival and growth rather than planting again and again.

3.6. Control of over grazing and over exploitation

In order to prevent overgrazing and consequent change in the vegetation composition of the the sacred groves possibilities of adopting the sustainable grazing practices like rotational grazing, deferred rotational grazing may be adopted or its possibility may be explored. Otherwise cut and carry system may also be adopted. Concerted research programme may also be initiated to assess present as well as potential productivity of such areas. However, in order to conserve representative biodiversity of a particular region, some selected sacred groves- repository of the biodiversity, may be protected from any interferences in the form of grazing or plant collection.

3.7. Control of invasive species

The expansion of *P. juliflora* and *Lantana camara* has affected human health, suppressed indigenous plants, and decreased livestock productivity (Priyanka and Joshi, 2013). The management measures that have been implemented are not able to yield the desirable results

because of the limited spatial scale, cost, and/or improper planning and implementation. Effective strategies for management of these invasive include the engagement of the community and the limiting of the number of vector animals (Haregeweyn et al., 2013).

3.7.1 Control of Lantana: Lantana camara is a noxious weed expanding and establishing in many regions of the world, including India. Most of the studies reveal that species have become menace and expanding its range and suggest that more than 80% of studies focus on its impact, use, toxicity, and its therapeutic uses only. It has many negative impacts including potential to disrupt succession cycle, displacing native biota resulting in decreased biodiversity. Its infestations alter the structural and floral composition of native communities (Sharma and Raghubanshi, 2010). As the density of *Lantana camara* in forest increases, allelopathic interactions increase and hence there is decline in species richness (Day et al., 2003).

Lantana camara can be removed mechanically or physically in several ways, including stickraking, bulldozing, ploughing and grubbing. These techniques are mainly suited to medium-sized infestations and require extensive follow-up, as they invariably lead to re-growth if the rootstock (up to 30 cm depth) is not removed (Love et al., 2009). Another approach for controlling Lantana is Fire, which is not recommended in forest and thickets because they are highly sensitive to fire. Other control measure of Lantana camara is through application of chemicals. Glyphosate is marginally effective as a foliar spray and regrowth is common. Fluroxypyr (Vista) plus aminopyralid when applied twice within 6 months is effective, but costly. Even, Fluroxypyr applied as a basal application is consistently effective. However, use of such chemicals tend to cause harm to the native biota of the ecosystem thereby affecting food chain, soil health, causing water pollution and giving genesis to ancillary problems.

Biological control organisms have also been studied for controlling *Lantana camara* spread. Though less effective, the biological organisms for controlling *Lantana camara* include *Ophiomyia lantanae* (fruit-mining fly), *Calycomyza lantanae* (agromyzid seedfly), *Teleonemia elata* (leaf-sucking bug), *Teleonemia scrupulosa* (leaf-sucking bug) but mostly failed as they have several varieties or forms resulting in complicating the introduction and establishment of exotic insects. Several other host specific insects such *Diastema tigris* (flower-mining moth), *Salbia haemorrhoidalis* (leaf-floding caterpillar), *Uroplata girardi* (leaf-mining beetle),

Octotoma scabripennis (leaf-mining beetle) and *Epinotia Lantanae* (flower-mining moth) have been introduced from time to time for the biological suppression of *Lantana camara* but have not been effective in controlling its infestation (Priyanka and Joshi, 2013).

3.7.2 Control of P. juliflora: *Prosopis juliflora* is undoubtedly a significant threat to conservation values of the sacred groves and forests as well and is likely altering ecosystem functions. Many efforts have been done to eradicate and control *Prosopis juliflora* from its areas of invasion (Geesing et al., 2004). However, general experiences from America, Asia and Australia have shown that eradication of *Prosopis juliflora*, by the different methods, especially the mechanical and chemical ones are highly expensive and relatively less effective (HDRA, 2005). The magnitude of resilience and distribution of the plant makes *Prosopis juliflora* virtually impossible to eradicate once established. Therefore it will be more appropriate to work for its irradiation during its seed setting, germination, and seedling and at establishment phase. Propagation of *P. juliflora* is mainly by seeds, the dispersal of which is done by the animals feeding on P. juliflora pods. In this circumstance control of such animals moving in the sacred groves can be stopped. Alternatively all pods of *P. juliflora* can be collected and grinded to make fodder for the animals. This will provide alternative livelihood to the locals and the spread of the seeds can be controlled.

Mechanical method involves plants removal by machine or people mechanically by hand pulling, cutting, hand digging or mechanical uprooting. Stick racking, chain pulling, bulldozer pushing and blade ploughing are some methods to control *P. juliflora*. In this stick racking (best results are achieved when soil moisture is sufficient to allow machinery to work with minimum strain, but soil is dry enough so the root system desiccates) and chain pulling (may kill up to 90% of trees in a mesquite infestation) were found effective in Australia. However, the effectiveness of control may be reduced when either very dense infestations or a high proportion of young trees and seedlings are present.

Though larger trees and shrubs are killed by cutting the stem at ground level and spraying or painting the freshly cut stumps with herbicides like Round up, 2-4, D, Glenside Kerosene and diesel oil.

Predators or pathogens are also used to control the *Prosopis juliflora* reproduction. Sudanese researchers found some predator insects that attack the leaves that lead to deterioration of the tree canopy. In Australia four species of insects like *Algarobius bottimeri* and *Algarobius prosopis* (the larvae of these beetles destroy mesquite seeds in mature pods both in the trees and on the ground), the *Prosopidopsylla flava* (a sap-sucking psyllid that causes dieback) and *Evippe* spp. (a leaf-tying moth that causes defoliation) have been introduced as biological control agents against *P. juliflora* (DAFF Queensland 2013). Another method that has been used in several countries is burning the stump after cutting from the ground. In Yemen for example the application of kerosene over the stump followed by burning has shown a way of eradicating the plant. However this only works when the plant is dry (not in stage of flowering) and the root system is not too deep to survive further otherwise re-growth will occur.