

# A Study of the Plant Community Structure in and Around City of Alwar (Rajasthan, India)



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## Abstract

The plant community structure was studied in different region of Alwar district of Rajasthan, India. On the basis of vegetational type and diversity, studied region was divided into three different sites. The vegetational occurrence, growth and phytosociological characters viz. Frequency, density, abundance dominance and sociability were recorded for each studied site. Importance value Index (IVI) was also recorded to determine the dominance of plant species. In the Present study, thirty plant species belonging to eighteen different families were studied. Five plant species were found most dominant in the studied region. The present study throws some light on the plant community structure in different studied sites which reflects the phytogeographical and ecological status of Alwar district of Rajasthan, India.

**Keywords:** Community, Floristics, Phytosociological Characters, Vegetation.

## Introduction

Alwar District is situated in the North East of The state of Rajasthan between 27°4' and 28°4' North Latitudes and 76°7' and 77°13' East Longitudes. It is bounded on The North & North East by Gurgaon District of Haryana state and Bharatpur District and on The North-west by Jaipur District and on the South by swai madhopur and Raipur District of the state of Rajasthan. The central part of the the district is covered by the Aravali hills which run North-south ranging in height from 450 m. to 700 m. The region has more or less feat topped hills, which become more prominent in the South-Western Part of the District. They enclose between them fertile valleys which have provided sanctuary to the wild life of the region in the Sariska forest. The two seasonal rivers in the district are Ruparel and Sabi.

The climate of the district is very hot in summer and cold in winter the Monsoon is of a very short duration. The South-west monsoon season continues from July to mid September. The highest temperature of district has been 47°C and the lowest temperature is upto frozen point. Average temperature is 26°C and average rainfall is 6.1-16 cm. The rainfall during the South-west monsoon season constitutes about 80 % of the annual rainfall. The soil of the district is sandy loam. Water is available at a depth ranging between 4.6.m to 24.6 m. The arid and semi-arid tract of Rajasthan support various integrated plant communities as shown by different workers. It is however felt that the Information on the ecological status of the vegetation of different parts of Rajasthan is fragmentary. Dashahre *et al.* () described the medicinal flora of sarsika tiger reserve of Alwar, Rajasthan and reported ninety nine plants of medicinal uses. The phytogeographical and geological status of Rajasthan has been debated in recent years. The floristic composition of the area and its ecological status may be useful indices of its past, consequently the present study was designed to relate the vegetation with the environment and to understand the phytogeographical status of the area.

The fundamental knowledge of community structure standing state of biomass etc is essential to understand the functional dynamics of an ecosystem in which transformation and flow of energy as well as nutrients are involved. The functioning of the system is intimately related with the components of the community. The components vary in quality as well as quantity and impart a structure of community (Misra, 1968). Phytosociological analysis of a plant community is an essential pre-requisite for the study of any piece of vegetation. A community structure can be

expressed by the importance value index (IVI) which was introduced by (Curtis and McIntosh 1951). The study was carried out of different region of Alwar which lies in the biologically semi-arid region. The study sites were sariska forest region, Bala kila region and region of college campus of R. R.College and Nehru garden.

### Aim of the Study

The present study is conducted to determine the community structure at different sites of alwar district of Rajasthan, India. An ecological region can be best described by the diversity of its flora and fauna. An attempt has been made to study the flora diversity of studied region, to determine the phytosociological characters and importance value index of selected plant species.

### Vegetation

The vegetation is typically a thorny shrub. Plant species are almost similar to those found in adjacent areas. The vegetation of the area is very heterogeneous. There were 18 families and 30 genera were included in investigation in studied region. The study site was divided into three subsites based on distribution of plants. Occurrence of different plant species were recorded during study period.

### Climate

The climate of Alwar is semi arid type. The general average annual rainfall is about 667mm. distributed over 36 rainy days. The mean annual temperature is about 32.6°C. The monthly mean maximum temperature varies between 20.3°C in January and 44°C in May. The mean minimum temperature varies from 6°C in January to 31°C in June.

The climate of Alwar is almost dry, with few months of precipitation followed by long period of low or high temperatures devoid of any appreciable amount of precipitation. The moisture status of Alwar indicated in the water balance. Moisture and temperature are very unfavourable for plant Growth. The soils in the area are comparatively poor and unproductive because of the large percentage of sand. The soils on the hills and valleys are comparatively richer in humus and nitrate content, which promotes aggregation of soil particles and increase the water holding capacity. These soils are either neutral or slightly acidic and support a better vegetation, consisting of tree species. The soil of the plains is sandy with low percentage of nitrates, humus and consequently of low water-holding capacity and alkaline in nature.

### Materials and Methods

Three sites were identified and studied on the basis of vegetation diversity as following:

#### Site-1

The site I was hilly or valley sides area of Bala Kila region. Hill sides were excessively stony and

seem bare of soils they support an extra ordinarily rich flora in both herbaceous and perennial species. The common shrubs and under shrubs were also found. During the rainy season vegetation includes different types of species. The herbaceous vegetation during the winter is comparatively poor. In this site 13 family and 17 species were studied.

#### Site-2

The site 2 region belongs to Sariska forest region. The forest of Alwar is under the category of deciduous forest. The vegetation was distinctly xerophytic in character. The forest cover includes fairly dense vegetation during the monsoon months both and the growth of the perennial species. In winter, due to low temperature show abrupt change in vegetation. The hot season is best for the flowering of woody species and large number of herbs and shrubs flower in the cold season. In this site 12 families and 13 species were studied.

#### Site-3

Site 3 region was area of college campus and Nehru garden region this area of site was loamy plains. In rainy season show a luxuriant growth of vegetation. In the site 17 families and 24 species were studied. Phytosociological characters VIZ. Frequency, density, abundance, dominance and sociability of plant species were recorded for each site. Dominance of plant species in all three sites were determined by calculating importance value index (IVI).

### Results and Discussion

The selected area for study, divided in to three sites. In all three sites total 18 angiospermic families were studied. (Table 1) Total 30 species belonging these 18 families were studied. In the studied site 1 – out of 18 families and 30 species, 17 species studied, which were belong to 13 different families. In site 2 out of 18 families and 30 species, 13 species studied which were belongs to 12 different families. In site 3 out of 18 families and 30 species, 24 species studied, which belong to 16 different families.

### Floristic Studies

The enumeration and compilation of the flora has been of much interest even in the vedic ages, as various references of floristic composition in different areas are found in the Patliputra age. Various workers, specially father Santapau, 1956 has emphasized the need of an up-to date flora of every region of India. Need for the comprehensive and up-to-date flora for the state of Rajasthan is strongly felt because the flora of Rajasthan compiled by Puri *et al.*, 1964, Bhandari, 1978 and Sharma and Tiagi 1979 includes a part of western and eastern Rajasthan only. Floristically southern Rajasthan is considered to be the richest part of the state, still it has not received due attention. Reports available on this tract are those of Vyas 1962, Ramdeo 1965 and Vyas 1967.

Table-1 Flora of Studied Sites

S.No.	Family and species of Plant in studied area	Site-1	Site-2	Site-3
1	Papaveraceae 1. <i>Argemone Mexicana</i>	+	+	+
2	Cruciferae 1. <i>Coronopus didymus</i>	+	+	+
3	Capparidaceae 1. <i>Cleome viscosa</i> 2. <i>Cleome gynandra</i>	+ -	+ -	+ +
4	Portulacaceae 1. <i>Portulaca oleraceae</i>	-	-	+
5	Malvaceae 1. <i>Hibiscus ficulneus</i>	-	-	+
6	Tiliaceae 1. <i>Grewia flavescens</i>	+	-	-
7	Rhamnaceae 1. <i>Zizyphus xylopura</i>	+	-	-
8	Leguminosae 1. <i>Teprosia purpurea</i> 2. <i>Cassia tora</i>	+ +	+ -	+ +
9	Zygophyllaceae 1. <i>Tribulus terrestris.</i>	-	+	+
10	Compositae 1. <i>Parthenium hysterophorus</i> 2. <i>Tridax procumbens</i> 3. <i>Vernonia cinerea</i> 4. <i>Sonchus asper</i>	+ + - -	+ + - -	+ - + +
11	Asclpiadaceae 1. <i>Calotropis procera</i>	+	+	+
12	Solonaceae 1. <i>Datura innoxia</i> 2. <i>Withania somnifera</i>	- +	+ +	+ +
13	Acanthaceae 1. <i>Adhatoda vasica</i>	-	-	+
14	Verbenaceae 1. <i>Phyla nodiflora</i>	-	+	+
15	Convolvulaceae 1. <i>Convolvulus arvensis</i> 2. <i>Ipomoea maxima</i>	+ -	- -	- +
16	Amaranthaceae 1. <i>Amaranthus spinosus</i> 2. <i>Achyranthus asper</i>	+ +	- +	+ +
17	Euphorbiaceae 1. <i>Euphorbia hirta</i> 2. <i>Euphorbia neriifolia</i> 3. <i>Phyllanthus niruri</i> 4. <i>Ricinus communis</i>	- + - -	- - - -	+ - + +
18	Gramineae 1. <i>Aristida depressa</i> 2. <i>Cyadadon dectylon</i>	+ +	- +	- +

Table-2 Flora of studied Sites

The number and percentage of families and species in dicots and monocots are as follows-

	Dicotyledons		Monocotyledons		Total
	No.	%	No.	%	
Families	17	94.44	1	5.55	18
Species	18	93.44	2	6.66	30

In all 3 studied sites Total 18 Families are studied 17 families belong to dicots and 1 family was monocot. Out of 30 species belonging to 18 families are 28 species of dicots and 2 species of monocot studied in different sites. (Table3)

**Table-3. Total No. of Family and species found in different sites during the study period.**

S.No.	Family	Total No. of species	Site-1		Site-2		Site-3	
			Family	Species	Family	Species	Family	Species
1	Papavaraceae	1	P	1	P	1	P	1
2	Crucifirae	1	P	1	P	1	P	1
3	Capparidaceae	2	P	1	P	1	P	2
4	Portulacaceae	1	A	A	A	A	P	1
5	Malvaceae	1	A	A	A	A	P	1
6	Tiliaceae	1	P	1	P	A	A	A
7	Rhmnaceae	1	P	1	A	A	A	A
8	Leguminosae	2	P	2	P	1	P	2
19	Zygophyllaceae	1	A	A	P	1	P	1
10	Compositae	4	P	2	P	2	P	3
11	Asclepiadaceae	1	P	1	P	1	P	1
12	Solonaceae	2	P	1	P	2	P	2
13	Acanthaceae	1	A	A	A	A	P	1
14	Verbenaceae	1	A	A	P	1	P	1
15	Convolvulaceae	2	P	1	A	A	P	1
16	Amaranthaceae	2	P	2	P	1	P	2
17	Euphorbiaceae	4	P	1	A	A	P	3
18	Gramineae	2	p	2	P	1	P	1
	Total	30	P-13 A-5	P-17 A-5	P-12 A-6	P-13 A-7	P-16 A-2	P-24 A-2

S.No		Total no. of studied	Site-1		Site-2		Site-3	
			P	A	P	A	P	A
1	Family	18	13	5	12	6	16	2
	Species	30	17	5	13	7	24	2

Note :- P= Present

A= Absent

The plant community was studied by quadrat method as suggested by Misra and Puri (1954). The phytosociological characters noted in the field were frequency, Density, abundance, Dominance, Sociability. (Bharucha and Deleeuw 1957). The phytosociological characters are influenced by factors like moisture, temperature, topography and biotic disturbance. During monsoon season optimum temperature and moisture conditions are available for plant growth, the perennial herbs bud under shrubs attain their maximum development and the ground surface of earth is covered with luxuriant growth of annuals. All these developments change abruptly the physiognomy of the area. As soon as winter sets in a change in the face of vegetation occurs due to low temperature and decrease in moisture content of the soil. In spring most of the trees loose their leaves and become naked. In summer season is marked by the flowering of woody species while large numbers of shrubs and herbs flower during the winter season. The fundamental knowledge of community structure standing state of biomass etc. is essential to understand the functional dynamic of an ecosystem in which transformation and flow of energy as well as nutrient are involved. The functioning of the system is intimately related with the components of the community. The component vary in quality as well as quantity and impart a structure to community (Misra, 1968). The phytosociological aspects of grasslands of Rajasthan has also been studied by peddi *et al.* (2014) and reported grasslands as highly diverse in terms of species and communities and recommended long term conservation plannings.

Phytosociological analysis of a plant community is an essential pre-requisite for the study of any piece of vegetation. The community structure can be expressed by the Importance Value Index (IVI) which was introduced by Curtis and McIntosh, 1957, claimed that this index is an excellent indication of the vegetational importance of species with in a stand.

Community structure was studied by quadrat method. The present study has suggested that the community of perennial species in the study sites is composed of 10 species. *Argemone Mexicana*, *Hibiscus ficulneus*, *Grewia flavescens*, *Zizyphus xylopera*, *Cassia tora*, *Calotropis procera*, *Withania somnifera*, *Adhatoda vasica*, *Ipomoea maxima* and *Ricinus communis*. On the basis of IVI values 5 plants have been identified as the dominant. (Table-4)

**Table – 4 Importance value Indexd of dominant Plants**

S.No.	Palnt Species	IVI
1	<i>Calotropis procera</i>	36.36
2	<i>Withania somnifera</i>	33.62
3	<i>Argemone Mexicana</i>	33.02
4	<i>Cassia tora</i>	29.67
5	<i>Ipomia maxima</i>	16.91

Phytosociological characters were also recorded of plant species present in the studied sites. (Table 5, 6)

**Frequency**

Frequency of plant species in studied area varies from 1% to 100% Maximum frequency noted in 21-40% range and lowest frequency noted in 1-20% range. Other range noted in intermediated condition.

**Density**

Density of plant species in studied area varies from 0.1 to 3.00 range. Maximum density noted in 0.1-1.0 range and minimum density noted in 1.1-3.00 range.

**Abundance**

Abundance of plant species in studied area varies from 1.0 to 3.0 range. Maximum plant species present in lowest abundance range 1.0-1.5 and few plant species present in highest abundance range 2.6-3.0.

**Dominance**

Dominance of plant species in studied area found in three type-commonly, rarely, abundantly. Maximum plant species present commonly and some plant species found rarely and abundantly.

**Sociability**

Sociability of plant species in studied area found in three way-growing singly, growing in patches, and growing in colonies. Maximum plant species growing singly and in patches and few plant species were growing in colonies.

**Table-5 Phytosociological Characters of Studied Plant Species**

S.No.	Plant Species	Frequency	Density	Abundance	Dominance	Sociability
1	<i>Argemone Mexicana</i>	4	B	+	C	GS
2	<i>Coronopus didymus</i>	3	B	+	C	GS
3	<i>Cleome gynandra</i>	5	C	+	C	GP
4	<i>Cleome gynandra</i>	2	A	+	R	GP
5	<i>Portulaca oleraceae</i>	2	B	++	R	GP
6	<i>Hibiscus ficulneus</i>	2	A	+	R	GS
7	<i>Grewia flavescens</i>	2	A	+	R	GS
8	<i>Zizyphus xylopera</i>	2	A	+	R	GS
9	<i>Tephrosia purpurea</i>	5	C	+	C	GP
10	<i>Cassia tora</i>	3	B	+	A	GP
11	<i>Tribulus terrestris</i>	2	A	+	A	GS
12	<i>Parthenium hysterophorus</i>	5	E	+++	C	GC
13	<i>Tridax procumbens</i>	3	A	+	A	GP
14	<i>Vernonia chnerea</i>	2	A	++	R	GP
15	<i>Sonchus asper</i>	2	B	++	R	GC
16	<i>Calotropis procera</i>	5	B	+	C	GS
17	<i>Datura innoxia</i>	3	B	+	A	GS
18	<i>Withania somifera</i>	4	B	+	C	GP
19	<i>Adhatoda vasica</i>	2	A	+	R	GS
20	<i>Phyla nodiflora</i>	3	A	+	A	GS
21	<i>Convolvulus arvensis</i>	2	A	+	R	GS
22	<i>Ipomoea maxima</i>	2	A	+	R	GS
23	<i>Amaranthus spinosus</i>	3	B	+	A	GP
24	<i>Achyranthus asper</i>	4	B	+	C	GP
25	<i>Euphorbia hirta</i>	2	A	++	R	GP
26	<i>Euphorbia berriifolia</i>	2	A	+	R	GP
27	<i>Phyllanthus niruri</i>	2	A	+	R	GP
28	<i>Ricinus communis</i>	2	A	+	R	GS
29	<i>Aristida depressa</i>	1	A	+	R	GS
30	<i>Cynodon dactylon</i>	5	F	++++	C	GC

**Table-6 . Community Structure of Studied Area**

Requency	Density	Adundance	Dominance	Socialrty
1-(1-20%)	a-(0.1-0.5)	+ - (1.0-1.5)	C-Common	GS-Growing singly
2-(21-40%)	b-(0.6-1.0)	++ - (1.6-2.0)	R-Rare	GP-Growing in patches
3-(41-60%)	c-(1.1-1.5)	+++ - (2.2-2.5)	A-Abundant	GC-Growing in colonies
4-(61-80%)	d-(1.6-2.0)			
5-(81-100%)	e-(2.1-2.5)	++++ - (2.6-3.0)		
	f-(2.6-3.5)			

**Reference**

- Bhandari, M.M. (1978), 'Flora of Indian desert scientific publisher, Jodhpur. India.
- Bharucha, F.R. and Deleeuw, N.C. (1957). A Practical guide to plant sociology, orient Longmans, Bombay.
- Champion, H.S., Seth, S.K. (1968), A revised survey of forest type of India. Delhi manager of publication Delhi, Dehradun, India.
- Curtis, J.T., McIntosh, R.P. (1950) The interrelations of certain analytic and synthetic phytosociological characters. Ecology 31, 434-455.
- Curtis, J.T., McIntosh, R.P. (1951) An upland forest continuum in the prairie-forest boarder region of wiscosin, Ecology 31, 476-490.
- Dashahre, A.K., Navaneethan, B., Bhutt, P., Mahato, S. 2014. Medicinal plants of Sariska Tiger Researve (Rajasthan) India. Journal of Medicinal Plant species. 2(2):137-146.
- Garg, R.K. ; Vyas, L.N. (1975) Litter production in deciduous forest south Rajasthan. India PP 131-5. Tropical ecological systems. New York.

8. Misra, R. (1968) *Ecology work book*, Oxford and IBH publishing company, Calcutta India.
9. Misra, R. ; Puri, G.S. (2012) *Indian manual of plant ecology*. Scientific publisher Jodhpur, India.
10. Peddi, Hari Krishna and C., Sudhakar R. and Meena, Sriman and S.S., Katewa. (2014). *Pattern of Plant Species Diversity in Grasslands of Rajasthan, India*. *Taiwania*. 59. 111-118.
11. Pilonia, P.K., Gurjar, R.V., Joshi, P.M. Srivastava, S.C. Panchal, N.S. (2015) *Phytosociological and ethanobotanical study of trees in a tropical dry. Deciduous forest in Panchmahal Distt. Of Gujrat*. In . *India The Indian Forester* Vol. 141 Issue 4
12. Puri, G.S. ; Jain, S.K. ; Mukerji, S.K. ; Sarup, S. ; Kotwal, miss N.N. *Flora of Rajasthan*. The manager of publication. New Delhi India
13. Ramdeo, K.D. (1979) *Addition to the flora of Rajasthan , India for. 91: 123-25*
14. Rawat Vardan singh, Chandok Achala (2009) *phytosociological analysis and Distribution patterns of tree species : A case study from Govind pashu vihar, National park, uttarakhand* *New york science journal*
15. Santapau, H. (1956) *Extensive loss of water by forest trees in the Dang forest. The journal of Bombay natural history society* VOL. 53 50
16. Sharma shiva and Tiagi B. (1979) *Flora of North East Rajasthan, Kalayani publisher. Jodhpur India* 508-515
17. Vyas, L.N. (1967) *Contribution to The flora of North East Rajasthan. J. Bombay Natural History Society* 64 (2) 191-211
18. Vyas. L.N. (1962) *vegetation of Jaisamand Lake Alwar, Proceedings Rajasthan Acad.sci.* 9 45-63
19. Yadav, A.S. and Gupta, S. K. *Effect of Micro environmental and human disturbance on The diversity of herbaceous species in Sariska Tiger Project* *Tropical Ecology*.