Octa Journal of Environmental Research
International Peer-Reviewed Journal
Oct. Jour. Env. Res. Vol. 4(3): 237-242
Available online http://www.sciencebeingjournal.com

Jul. – Sept., 2016
ISSN 2321 3655

Research Article

Octa Journal of Environmental Research
(Oct. Jour. Env. Res.) ISSN: 2321-3655
Journal Homepage: http://www.sciencebeingjournal.com

COMMUNITY LEVEL FLORAL DIVERSITY IN SAHASTRADHARA FOREST, DEHRADUN, UTTARAKHAND

Sandeep Dhyani*, Neha Saini and Neha Tiwari
Department of Botany, Uttaranchal (PG) College of Biomedical Sciences & Hospital, Dehradun-248001
Corresponding author's Email: **hodbotany@ucbmsh.org**
Received: 30th Aug. 2016 **Revised**: 25th Sep. 2016 **Accepted**: 29th Sept. 2016

Abstract: Sahastradhara is situated in Shivalik foot hills of district Dehradun. Lime stone mining and tourism has affected the floristic diversity of the area. The present study was conducted in three different sampling communities which were selected from quite different habitats with conspicuously different physiognomic, floristic and species richness characteristics and represented by different classification types of vegetation. Phytosociological observation indicates that all three communities were having invading plant species such as *Eupatorium adenophorum*, *Lantana camara*, *Parthenium hysterophorus*, *Amaranthus spinosus* etc., which is due to human interference as well as climate change along with change in soil profile. Forest community is more diverse and heterogeneous (3.26) then other communities (2.29 and 2.79). Values of concentration of dominance (Cd) prove that the plant communities are not dominated by single species.
Keywords: Community; Floral diversity; Phytosociology; Sahastradhara.
Postal Address: Department of Botany, (Uttaranchal (P.G.) College of Biomedical Sciences & Hospital, Dehradun-248001 Uttarakhand India

INTRODUCTION

The knowledge of the floristic composition of a plant community is a prerequisite to understand the overall structure and function of any ecosystem (Gairola *et al*., 2010). Time to time the work of plant exploration from Uttarakhand himalaya has been conducted by Gaur, 1999; Rawat *et al.,* 2001; Adhikari, 2003; Samant and Joshi, 2003; Rana, 2007.Varied topographical features of Himalayan region supports unique and rich biodiversity elements ranging from genes and ecosystems. Almost every plant has economic value from either a nutritional, aesthetic or medicinal viewpoint. In fact, a large percentage of crude drugs in the Indian market come from this Himalayan area (Badoni, 1989). According to cumulative evidence, the Garhwal Himalaya has more than 3500 species of flowering plants, most of which are in forest and alpine meadows. Plant species diversity is affected by several topographic gradients and climatic variations. The rapid loss in the floristic diversity and changing pattern of vegetation due to various biotic and abiotic factors has necessitated the qualitative and quantitative assessment of vegetation (Sharma *et al*., 2014). Factors such as anthropogenic pressure, construction, industrialization and natural calamities aids to the declination of natural plant diversity. Doon valley in Uttarakhand till early eighties faced a serious threat due to heavy limestone quarrying with 105 working mines in this region (Rajdeep *et al*., 2011). It was the over extraction of limestone that caused ruthless cutting of forest vegetation and, converting the mine areas and its surroundings into a barren land with stony/boulder debris. Such disturbances change the species composition, distribution and, affect its frequency and abundance in the forest area. Besides this increasing tourism is also one of principle factors affecting the floristic diversity of the area. Owing to this, the present study was conducted in the Sahastradhra forest (affected by limestone

mining and tourism) to assess the floristic diversity of the area.

EXPERIMENTAL

Study Area

The Dehradun district lies between 30.3840°N, 77.9739°E. The climate of the district varies greatly from tropical to severe cold depending upon the altitude of the area. The area receives an average annual rainfall of 2073.3 mm. The natural vegetation generally composed of forest communities with frequent scattered scrub layer, grassy localities and crop fields. The study was conducted in the Sahastradhra forest area which is situated 18 km from Dehradun long the Baldi River. The area has a rich repository of limestone rocks. Due to overexploitation of lime stone from adjoining hills, several native species of plants are on the close verge of extinction (Bisht and Bhatt, 2012). The study was subdivided into three study areas (community) and in each community ten quadrates (1×1m) was laid down for phytosociological study on the basis of vegetation composition and topographical features.

Community 1 (C1): It is hilly slope community extends from both sides of river bank .The community is dominated by shrub species Such as *Woodfordia fructicosa* and *lantana camara.*

Community 2 (C2): This community is an agricultural field generally under human observation and dominated by cultivated plants such as *Triticum aestivum* and *Chenopodium album*.

Community 3 (C3): Third community termed as submerged community. It was occupied by algal mats with *Chara* and semi aquatic plants such as *Rorripa nausturtium* and *Equisetum*.

Methodology

The study area was repeatedly surveyed for its topography, micro climate and biotic stress conditions. During the study ten quadrats of 1×1 m were laid down in each plot randomly. Data were analyzed for phytosociological study and population analysis and frequency (F,%), density (D), abundance (A), relative frequency, relative density, relative dominance, Importance Value Index (IVI) and total basal cover was calculated using the formula given by Mishra, 1968 and Curtis and MCIntosh, 1950.Species diversity was determined using Shannon–Weaver information function (Shannon–Weaver, 1963). The index of dominance (Cd) of the community was calculated by Simpson's index (Simpson, 1949). The Evenness/ Equitability index of the community was calculated following Pielou, 1966.

RESULTS AND DISCUSSION

Table 1, 2, 3 represent the data of phytosociological features *viz*. frequency (%), density, abundance, and importance value index of different communities in Sahastradhra forest area. Floristic survey reveals that a total of 39, 27 and 19 species were present in C1, C2 and C3 communities respectively. In terrestrial community IVI indicates that *Eupatorium adenophorum* is the most dominant herb species with IVI value of 29.6 while *Adhatoda vasica* is the co-dominant species with IVI of 15.0. *Triticum aestivum* and *Equisetum sps.* were the most dominant species in agricultural and aquatic communities respectively with the IVI value of 42.58 and 44.04 respectively. A variety of factors contribute to the diversity of plants in a region. The dominant species in each community possibly shows the availability of optimum conditions for its growth in that area. Plant species diversity is affected by several topographic gradients and climatic variations. The high IVI of a species indicated its dominance and ecological success, in the form of its better regeneration and greater ecological amplitude (Kukshal *et al*., 2009). Distribution pattern an important aspect of ecological studies showed that all the three communities followed contagious distribution. Odum (1971) described that in natural conditions contagious distribution is the most common type of distribution and is performed due to small but significant variations in the environmental conditions. Kumar and Bhatt (2006) also reported clumped distribution pattern in foot-hills forests of Garhwal Himalaya.

Table 1. Phytosociological features of Community-1 (Hilly Slopes)

S.No.	Botanical Names	Total Individuals	Occurrence	F%	D	A	IVI
1.	*Eupatorium adenophorum*	29	7	70	2.9	4.14	29.6
2.	*Woodfordia fruticosa*	8	4	40	0.8	2.00	14.1
3.	*Parthenium hysterophorus*	3	2	20	0.3	1.50	7.6
4.	*Lantana camara*	7	4	40	0.7	1.75	14.5
5.	*Sida cordata*	7	1	10	0.7	7.00	7.7
6.	*Ageratum conyzoides*	5	2	20	0.5	2.50	8.5
7.	*Lepidagathis incurva*	6	2	20	0.6	3.00	8.8
8.	*Solanum toruvum*	3	2	20	0.3	1.50	8.4
9.	*Bidens biternata*	4	1	10	0.4	4.00	7.2
10.	*Adhatoda vasica*	12	4	40	1.2	3.00	15.0
11.	*Centella asiatica*	5	1	10	0.5	5.00	5.5
12.	*Chenopodium album*	1	1	10	0.1	1.00	4.3
13.	*Aerva sanguinolenta*	7	1	10	0.7	7.00	7.8
14.	*Ajuga bracteosa*	1	1	10	0.1	1.00	3.7
15.	*Clerodendron viscosum*	2	2	20	0.2	1.00	7.5
16.	*Cissampelos pareira*	12	4	40	1.2	3.00	14.7
17.	*Amaranthus spinosus*	6	3	30	0.6	2.00	11.0
18.	*Desmodium gangeticum*	2	1	10	0.2	2.00	4.2
19.	*Evolvulus alsinoides*	2	1	10	0.2	2.00	3.9
20.	*Flemingia strobilifera*	1	1	10	0.1	1.00	4.4
21.	*Gnaphalium adnatum*	1	1	10	0.1	1.00	4.0
22.	*Ipomea nil*	1	1	10	0.1	1.00	3.9
23.	*Boerhavia diffusa*	5	2	20	0.5	2.50	7.4
24.	*Rubus ellipticus*	2	2	20	0.2	1.00	7.9
25.	*Colebrookia oppositifolia*	1	1	10	0.1	1.00	5.7
26.	*Carissa opaca*	1	1	10	0.1	1.00	6.7
27.	*Achyranthes aspera*	3	1	10	0.3	3.00	6.0
28.	*Jasminum multiflorum*	1	1	10	0.1	1.00	4.8
29.	*Sida rhombifolia*	6	2	20	0.6	3.00	8.8
30.	*Boehmeria plahyphylla*	1	1	10	0.1	1.00	5.2
31.	*Fragaria indica*	5	1	10	0.5	5.00	5.9
32.	*Dicliptera roxburghiana*	2	1	10	0.2	2.00	4.7
33.	*Urtica dioica*	1	1	10	0.1	1.00	5.9
34.	*Silene indica*	1	1	10	0.1	1.00	3.7
35.	*Rumex hastatus*	3	1	10	0.3	3.00	6.0
36.	*Reinwardtia indica*	2	1	10	0.2	2.00	4.6
37.	*Cyperu srotundus*	4	1	10	0.4	4.00	5.4
38.	*Adiantum sps.*	7	1	10	0.7	7.00	6.7
39.	*Sida cordifolia*	8	1	10	0.8	8.00	8.3
		178		**670**	**18**	**103.8**	**300**

Table 2. Phytosociological features of Community-2 (Agricultural field)

S.No.	Botanical Names	Total Individuals	Occurrence	F%	D	A	IVI
1.	*Amaranthus spinosus*	10	2	20	1	5.00	16.04
2.	*Rume xhastatus*	5	3	30	0.5	1.67	11.74
3.	*Poa annua*	12	4	40	1.2	3.00	15.94
4.	*Triticum aestivum*	53	7	70	5.3	7.57	42.58
5.	*Chenopodium album*	10	5	50	1	2.00	17.19
6.	*Polygonum hydropiper*	8	3	30	0.8	2.67	11.81
7.	*Anagallis arvensis*	5	3	30	0.5	1.67	10.10
8.	*Stellaria media*	12	4	40	1.2	3.00	14.70
9.	*Lycopersicom esculentum*	2	2	20	0.2	1.00	10.13
10.	*Solanum nigrum*	5	3	30	0.5	1.67	11.56
11.	*Oplismenus compositus*	14	2	20	1.4	7.00	12.78
12.	*Cynodon dactylon*	11	2	20	1.1	5.50	11.44

13.	*Oxalis corniculata*	2	1	10	0.2	2.00	4.75
14.	*Pennisetum flaccidum*	2	1	10	0.2	2.00	4.94
15.	*Apluda mutica*	7	2	20	0.7	3.50	9.03
16.	*Peperomia pellucida*	2	1	10	0.2	2.00	6.95
17.	*Sida cordifolia*	6	2	20	0.6	3.00	11.26
18.	*Cyperu srotundus*	8	1	10	0.8	8.00	8.73
19.	*Polygonum barbatum*	2	1	10	0.2	2.00	6.58
20.	*Bidens biternata*	3	1	10	0.3	3.00	8.37
21.	*Urtica dioica*	2	1	10	0.2	2.00	9.32
22.	*Brassica sps.*	4	2	20	0.4	2.00	9.69
23.	*Sida cordata*	3	1	10	0.3	3.00	6.73
24.	*Achyranthus aspera*	1	1	10	0.1	1.00	6.25
25.	*Dicliptera roxburghiana*	2	1	10	0.2	2.00	5.67
26.	*Ageratum conyzoides*	4	1	10	0.4	4.00	7.60
27.	*Argemone mexicana*	1	1	10	0.1	1.00	8.08
		196		**580**	**20**	**82.2**	**300**

Table 3. Phytosociological features of Community-3 (Submerged community)

S.No.	Botanical Names	Total Individuals	Occurrence	F%	D	A	IVI
1.	*Equisetum sps.*	76	6	60	7.6	12.67	44.04
2.	*Eupatorium adenophorum*	33	7	70	3.3	4.71	30.45
3.	*Solanum nigrum*	6	4	40	0.6	1.50	16.93
4.	*Poa annaua*	7	1	10	0.7	7.00	7.32
5.	*Rorippa nausturtium*	22	4	40	2.2	5.50	22.78
6.	*Polygonum hydropiper*	5	6	60	0.5	0.83	18.38
7.	*Chara nutans*	32	3	30	3.2	10.67	19.69
8.	*Fimbristylis dichotoma*	38	4	40	3.8	9.50	27.09
9.	*Solanum torvum*	2	2	20	0.2	1.00	13.93
10.	*Cyperus rotundus*	34	4	40	3.4	8.50	24.15
11.	*Impatiens sps.*	2	1	10	0.2	2.00	6.88
12.	*Eragrostis gangeticum*	3	1	10	0.3	3.00	7.89
13.	*Azolla sps.*	8	1	10	0.8	8.00	7.45
14.	*Polygonum barbatum*	3	1	10	0.3	3.00	8.11
15.	*Amaranthus spinosus*	1	1	10	0.1	1.00	10.26
16.	*Setaria glauca*	3	1	10	0.3	3.00	7.89
17.	*Ranunculus sceleratus*	3	1	10	0.3	3.00	8.33
18.	*Hedyotis hispida*	3	1	10	0.3	3.00	9.87
19.	*Carex sps.*	3	1	10	0.3	3.00	8.55
		284		**500**	**28**	**90.88**	**300.00**

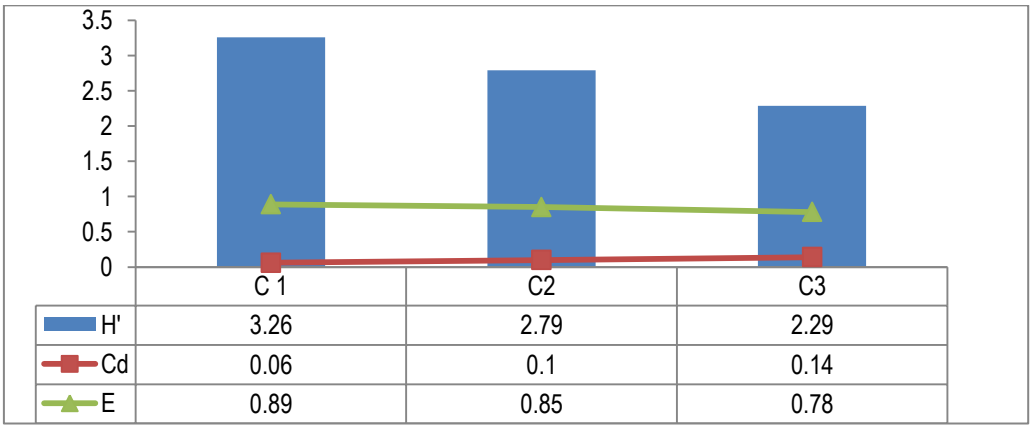

Figure 1. Values of Shannon Weaver diversity index (H'), Concentration of Dominance (Cd) and Evenness Index (E) among different communities

Higher the value of H', greater is the species diversity in the community. Shannon Weiner diversity index, H' was maximum for C1 community (3.26) and minimum for C2 community (2.29). H' is inversely proportional to Simpson index (Cd), therefore value of Cd decreased from C1 to C3 *i.e.* 0.06, 0.1 and 0.14 for C1, C2 and C3 respectively. Concentration of dominance (Cd) or Simpson's index shows the richness of particular community or a habitat. It indicates that a particular habitat is homogenous or heterogenous. In all three communities Simpson's index value indicates toward more heterogeneity i.e. species diversity is maximum. The value of Cd shows that in all communities, vegetation is not dominated by a single species because in all communities value of Cd is below one. Evenness or equitability represents the distribution of individuals among the species and for the purpose the Pielou's evenness index was used. Evenness values for C1, C2 and C3 communities were 0.89, 0.85 and 0.78 respectively. Diversity of the species was concentrated in the C1 community followed by C2 and C3 community. Observation of plant species in different frequency classes explains a moderate heterogeneity in communities at Sahastradhara forest. The ecological amplitude also plays an important role against different stress conditions. The uniform abundance of *lantana camara*, *Ageratum conyzoides* and *Amaranthus spinosus* could explain its environmental plasticity, being both shade and light tolerant. Present species composition is the resultants of human induced perturbations such as alteration in habitats, forest fragmentation and human interference. Hence, the present investigation was aimed at assessing the plant diversity and phytosociological behavior in the disturbed ecosystem of sahastradhara forest.

CONCLUSION

Floristic analysis shows that the study site harbors varied forms of vascular plants and the area is also inhabited by a large number of endemic and medicinally important plant species. The value of diversity index is least in submerged community which shows the effect of anthropogenic activities such as tourism, construction along the river side. The study area needs to be protected and conserved due to its unique vegetation and topographical features.

REFERENCES

Adhikari BS. (2003). Ecological attributes of vegetation in and around Nanda Devi national park. In: Biodiversity Monitoring Expedition Nanda Devi 2003. A report to the Ministry of Environment and Forests, Govt. of India. Uttaranchal State Forest Department, Dehradun, India.15-38

Badoni AK. (1989-90). Remarks on the high altitude medicinal plants of Garhwal Himalayas. J. Himalayan Studies and Regional Development, 13 &14: 37-45.

Bisht AS and Bhatt AB. (2012). A contribution to the medicinal plants of Sahastradhara, district Dehradun, Uttarakhand (with ethenobotanical notes). Journal of Drug Delivery & Therapeutics, 2(5): 114-120.

Curtis JT and McIntosh RP. (1950). The interrelations of certain analytic and synthetic phytosociological characters. Ecology, 31: 434-455.

Gairola S, Sharma CM, Rana CS, Ghildiyal SK and Suyal S. (2010). Phytodiversity (Angiosperms and Gymnosperms) in Mandal-Chopta Forest of Garhwal Himalaya, Uttarakhand, India. Nature and Science, 8(1):1-17

Gaur, R.D. (1999). Flora of the District Garhwal North West Himalaya: with ethnobotanical notes. Transmedia, Srinagar Garhwal.

Kukshal S, Nautiyal BP, Anthwal A, Sharma A and Bhatt AB. (2009). Phytosociological investigation and life form pattern of grazinglands under pine canopy in temperate zone, Northwest Himalaya, India. Research Journal of Botany, 4(2):55-69.

Kumar M. and Bhatt VP. (2006). Plant biodiversity and conservation of forests in foot hills of Garhwal Himalaya. Journal of Ecology and Application, 11(2): 43-59.

Mishra R. (1968). Ecology workbook. Oxford and IBH Publishing Company, Calcutta, India.

Odurn EP. (1971). Fundamentals of Ecology, W. B. Sounders and Co., Philadelphia. 557.

Pielou EC. (1966). The measurement of diversity in different types of biological collections.

Journal of Theoretical Biology, 13: 131-44.

Rajdeep, Prafulla S, Lal Singh and Rana BB. (2011). Floristic Diversity in Ecologically Restored Lime Stone Mines and Natural Forests of Mussoorie and Doon Valley, India. Ecologia, 1: 44-55.

Rana CS. (2007). Ethono-botanical studies on the medicinal plants of Nanda Devi Biosphere Reserve Uttranchal. D.Phil Thesis, HNBGU, Srinagar Garhwal.

Rawat DS, Bhandari BS and Gaur RD. (2001). Vegetation Wealth of Garhwal Himalaya, *In:* Kandari OP and Gusian OP (eds), Himalaya: Nature, Culture and society, Transmedia, Srinagar Garhwal, 69-92.

Samant SS and Joshi HC (2003). Floristic diversity ,Community pattern and Changes of vegetation in Nanda Devi National Park. Biodiversity Monitoring Expedition. Uttaranchal Forest Department. 39-44.

Shannon CE and Weaver W. (1963). The Mathematical Theory of Communication, University of Illinois Press, Urbana. pp. 127.

Sharma P, Rana JC, Devi U, Randhawa SS and Kumar R. (2014). Floristic Diversity and Distribution Pattern of Plant Communities along Altitudinal Gradient in Sangla Valley, Northwest Himalaya. *The Scientific World Journal,* 14: 11 pages.

Simpson EH. (1949). Measurement of diversity. Nature, 163-188.

Source of Financial Support: None.
Conflict of interest: None. Declared.