ORIGINAL RESEARCH ARTICLE

PLANT DIVERSITY ASSESSMENT IN *CUPRESSUS TORULOSA* D. DON FOREST IN NAINITAL, CENTRAL HIMALAYA'S

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ABSTRACT:

The study of plant community structure is called plant sociology or phytosociology and this study is important for understanding the functioning of community. *Cupressus* Linn. Commonly known as cypress is one of the important genus of family Cupressaceae. The genus has wide and discontinuous distribution in Northern Hemisphere. It consists of 20 species growing at different altitude at different places. *Cupressus torulosa* D.Don commonly known as Himalayan cypress is an evergreen conifer tree species distributed throughout the Himalayan region along an elevation belt of 1800 to 2800 m asl. In Nainital, cypress is found wild at the slopes of china hill on shale but not far from limestone. In the present study plant diversity assessment is assessed in a *Cupressus torulosa* D.Don forest of Nainital, Kumaun Himalaya.

KEYWORDS: Community, phytosociology, distributed, assessment.

INTRODUCTION:

Study of plant community structure is called plant sociology or phytosociology and it is important for understanding the functioning of community [1]. *Cupressus* Linn. Commonly known as cypress is one of the important genus of family Cupressaceae. The genus has wide and discontinuous distribution in Northern Hemisphere. It consists of 20 species growing at different altitude at different places

Cupressus torulosa D.Don commonly known as Himalayan cypress is an evergreen conifer tree species distributed throughout the Himalayan region along an elevation belt of 1800to 2800

masl [2]. In Nainital, cypress is found wild at the slopes of china hill on shale but not far from limestone.

In the present study plant diversity, population structure, biomass and carbon stock was assessed in a *Cupressus torulosa* D.Don forest of Nainital, Kumaun Himalaya.

MATERIALS AND METHODS:

Study Area:

Figure 1. Bird eye view of *C. torulosa* forest

- The study sites were selected between 2200-2300m above mean sea level (between 29°19'-29°28' N latitude and 79°22'-79°38' E longitude) in Nainital, Kumaun Himalaya.
- This area mainly lies in the hilly tract of the district Nainital in Uttarakhand.
- Originally, the study area was dominated by *C. torulosa* forest.

Site was further divided into three sub sites viz. Hill base, Hill slope and Hill top

Hill base area **Hill slope area** **Hill top area**

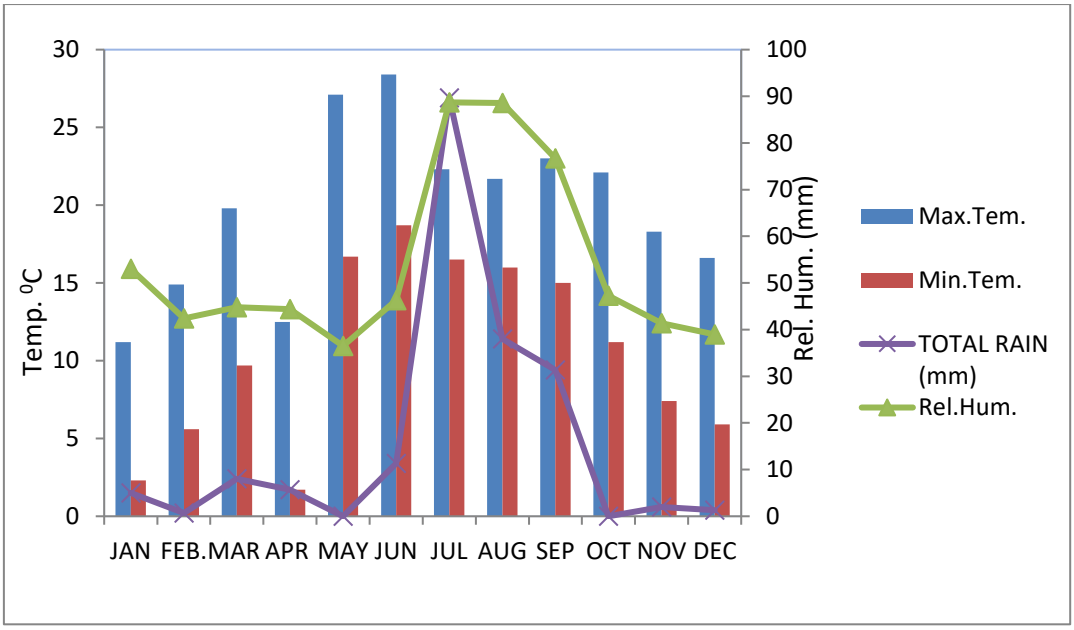

Figure 2. Monthly metrological observations of 2012 (source: GIC Nainital)

METHODS:

- The number and size of the quadrats were determined by the running mean method [3] and species area curve [4].
- Ten plots of 10 x 10m were randomly established at hill base, slope and top for determination of species richness and other vegetational parameters.
- Trees and saplings were analysed in 10x10 m, shrubs in 5x5 m and seedlings and herbs in 10, 1x1m quadrat within each plot [5].
- Circumference at breast height (cbh at 1.37m from the ground) of all the trees and saplings was measured in each plot.
- The vegetational data were quantitatively analysed for frequency, density, abundance, basal area, IVI, species richness, diversity, concentration of dominance by using standard ecological mehods [5].

RESULTS AND DISCUSSION:

Tree Layer:

Table 1. Phytosociology of tree layer in *C. torulosa* forest:

Position on Slope	A	D (ind ha-1)	F (%)	A/F	MBA (m2 ind-1)	TBA (m2 ha-1)	IVI
Hill Base							
Cupressus torulosa	4	360.00	90.00	0.04	0.038	13.55	205.40
Cedrus Deodara	1	40.00	40.00	0.03	0.102	4.10	55.15
Quercus floribunda	2	60.00	30.00	0.07	0.024	1.46	39.43
Total		**460.00**				**19.11**	
Hill Slope							
Cupressus torulosa	4.1	410.00	100.00	0.04	0.050	20.50	225.37
Cedrus deodara	1.83	110.00	60.00	0.03	0.035	3.85	74.52
Total		**520.00**				**24.35**	
Hill Top							
Cupressus torulosa	6	**600.00**	100.00	0.06	0.097	**58.20**	300.00

Sapling Layer:

Table 2. Phytosociology of sapling layer in *C. torulosa* forest:

Position on Slope	A	D (ind ha-1)	F (%)	A/F	MBA (m2 ind-1)	TBA (m2 ha-1)	IVI
Hill Base							
C.torulosa	4.44	400	90	0.05	0.0034	1.35	209.4
P.cerasoides	0.8	60	50	0.02	0.0021	0.12	45.71
Q. floribunda	0.8	40	50	0.02	0.0044	0.17	44.86
Total		**500**				**1.65**	
Hill Slope							
C.torulosa	4.57	320	70	0.06	0.0034	0.78	154.09
P.cerasoides	1	20	20	0.05	0.0035	0.07	19.37
Q. floribunda	3	90	30	0.10	0.0022	0.19	46.66
Q. leucotrichophora	1	20	20	0.05	0.0014	0.02	15.80
C.deodara	1.4	70	50	0.028	0.0049	0.34	64.06
Total		**520**				**1.4**	

Hill Top							
C. torulosa	1.6	80	50	0.03	0.0035	0.28	141.54
P.cerasoides	1	30	30	0.03	0.0013	0.04	52.14
F.nemoralis	2	20	10	0.20	0.0033	0.06	32.11
R.purpurea	7	70	10	0.70	0.0023	0.16	74.19
Total		**200**				**0.54**	

Seedling Layer:

Table 3. Phytosociology of seedling layer in *C. torulosa* forest:

Position on Slope	A	D (ind. ha-1)	F (%)	A/F	PV
Hill Base					
P.cerasoides	2.88	230	80	0.04	94.37
C. torulosa	2.60	130	50	0.05	55.86
Q. floribunda	0.75	50	40	0.03	27.87
Q.leucotrichophora	2.50	30	20	0.13	21.88
Total		**440**			
Hill Slope					
C. torulosa	2	60	30	0.07	41.42
Q. floribunda	3.66	110	30	0.12	58.08
P.cerasoides	1.625	130	80	0.02	100.47
Total		**300**			
Hill Top					
C.torulosa	1.2	60	50	0.02	45
P.cerasoides	2.14	150	70	0.03	85
F.nemoralis	1	50	50	0.02	41.66
R. purpurea	1	40	30	0.04	28.33
Total		**300**			

Table 4. Phytosciological characterstics of the three study sites:

Parameters	Sites		
	Hill Base	**Hill Slope**	**Hill Top**
Tree layer			
Species richness	**03**	**02**	01
Density	460.00	520.00	600.00
TBA	19.11	24.35	58.20
H'	0.96	0.74	-
CD	0.64	0.67	-
Equability(e)	0.88	1.07	-
Sapling layer			
Species richness	3	5	4
Density	500	520	200
TBA	1.65	1.4	0.54
H'	0.86	1.60	1.80
CD	0.74	3.31	1.31
Equability(e)	0.98	1.00	1.29
Seedling layer			
Species richness	4	3	4
Density	440	300	300
H'	1.62	1.51	1.88
CD	0.39	0.36	0.42
Equability(e)	1.18	1.39	1.35
Shrub layer			
Species richness	6	8	6
Density	5380	3046	1303
Herb layer			
Species richness	15	12	18
Density	5110.8	10320	15480

Index of similarity:

- Index of similarity (IS) was calculated [6] as:

  IS= 2C x 100 / (A+B)

- Where, A the number of species in stand A, B the number of species in stand B and C common species in both the stands.
- On the basis of percent similarity, HB and HS were 80 % similar in tree layer.
- 85.7% similar in shrub layer.
- 81.4% similar in herb layer.
- The HS and HT were 66.6% similar in tree layer.

- 50% similar in shrub layer.
- 80% similar in herb layer.
- The HB and HT were 50% similar in tree layers.
- 57.1% in shrub layer.
- 66.6% similar in herb layer.

SUMMARY:

- A total of 29 species were reported, of these 03 were trees, 08 were shrubs and 18 were herbs.
- The total density value of trees was 460-600 trees ha^{-1} and the total basal area between 19.11 to 58.31m^2 ha^{-1} of which *C.torulosa* contributed 70% to 100%.
- The sapling density ranged between 200 and 520 individual ha^{-1} and it was maximum at hill top.
- The Seedling density ranged between 300-400 individual ha^{-1} and it was maximum at hill base.
- The density of shrubs in the present study ranged between 1303 ind.ha^{-1} and 5380 ind. ha^{-1}.
- In this forest the number of herbs species varied from 12 at hill base 18 at hill top while herb density ranged from 5110 ind ha^{-1} to 15,480 ind ha^{-1}.
- The diversity (H') raged between 0.28 and 0.38 at Hill Base and 0.27 and 0.47 at Hill Slope.
- Concentration of dominance ranged between 0.007 and 0.61 at Hill Base and 0.05 and 0.62 at Hill Slope
- At Hill Top only one tree species i.e. *C.torulosa* was present so diversity parameters could not be calculated
- Most of the species showed random or contagious type of distribution pattern.

REFERENCES:

1. Sing, E. and Singh, M. P. (2010), Int. J. Biol. Life sci., 6(2): 77-82
2. Shahni KC (1990), Gymnosperms of India and addjacent countries. Dehradun, India
3. Kershaw KA (1973), Edward Arnold Ltd. London.pp 308.
4. Misra R (1968), Ecology Work Book.Oxford Publishing Company, Calcutta.
5. Curtis JT,McIntosh RP(1950),Ecol.31:434-455.
6. Mueller-Dombois D, Ellenburg H (1974), J. Wiley and Sons, Inc.