J. Himalayan Ecol. Sustain. Dev. Vol 5. (2010) *ISSN 0973-7502*

IMPACT OF BIOTIC FACTOR ON THE VEGETATION OF SHANKERACHARYA FOREST ECOSYSTEM

Basharat Mushtaq and Ashok K Pandit
Centre of Research for Development and P.G. Department of Environmental Sciences, University of Kashmir, Srinagar-190006, J&K, India

ABSTRACT

The present investigation of Shankeracharya forest ecosystem was undertaken during June to November 2007. The main aim of the study was to document the impact of biotic interferences on Shankeracharya forest ecosystem. Though the Shankeracharya forest ecosystem has been designated as a reserved forest of the valley, yet it was impacted by varied kinds of biotic interferences. The cumulative effect of the biotic interferences was significantly seen in the reduction of vegetation cover. The increasing disturbances not only disturb the plant species diversity, richness and evenness significantly but various plant species have got completely eliminated by different kinds of interferences like deforestation, forest fire, tourism impacts etc. On the whole upper sites (I and II) were severely affected than lower site (III and IV) due to the pilgrims visiting the temple and the military activities in the area.

Key words: Shankeracharya forest ecosystem, biotic interferences, vegetation analysis.

INTRODUCTION

The Jammu and Kashmir State, situated in the north of Indian subcontinent and forming the northwestern extremity of the Himalayan mountain range is spread over an area of 2, 22,236 km^2. Kashmir lies between 33^0.20' and 34^0.54'N latitude and 73^0.55' and 75^0.35'E longitude and covers an area of 15,498 km^2. Topographically, it is a deepest elliptical bowl-shaped valley bounded by lofty mountains of Pir Panjal in the north and east and has 64% of the total area under the mountains. The city of Srinagar, the summer capital of Jammu and Kashmir state, has a plain concave topography and is situated at an average altitude of about 1586m a.s.l. The Shankeracharya hill, forming part of the inner Great Himalaya and being situated within the Srinagar city on the bank of famous Dal lake, is on the right bank of Jhelum river and flanks the city of Srinagar in the east. The average height of the Shankeracharya hill is nearly 300m from the floor of valley (Pandit, 2002).

Forests, despite being the dominant land use from the geological past, unfortunately are a dwindling natural resources throughout the globe. They are the first victims of outpacing populations, being faster than they can regenerate thereby aggravating with various anthropogenic pressures like deforestation, grazing, desertification etc. (Cronin, 1979; Eckholm, 1979; Kayastha and Jayal, 1979; Joshi,

J. Himalayan Ecol. Sustain. Dev. Vol 5. (2010) *ISSN 0973-7502*

IMPACT OF BIOTIC FACTOR ON THE VEGETATION OF SHANKERACHARYA FOREST ECOSYSTEM

Basharat Mushtaq and Ashok K Pandit
Centre of Research for Development and P.G. Department of Environmental Sciences, University of Kashmir, Srinagar-190006, J&K, India

ABSTRACT

The present investigation of Shankeracharya forest ecosystem was undertaken during June to November 2007. The main aim of the study was to document the impact of biotic interferences on Shankeracharya forest ecosystem. Though the Shankeracharya forest ecosystem has been designated as a reserved forest of the valley, yet it was impacted by varied kinds of biotic interferences. The cumulative effect of the biotic interferences was significantly seen in the reduction of vegetation cover. The increasing disturbances not only disturb the plant species diversity, richness and evenness significantly but various plant species have got completely eliminated by different kinds of interferences like deforestation, forest fire, tourism impacts etc. On the whole upper sites (I and II) were severely affected than lower site (III and IV) due to the pilgrims visiting the temple and the military activities in the area.

Key words: Shankeracharya forest ecosystem, biotic interferences, vegetation analysis.

INTRODUCTION

The Jammu and Kashmir State, situated in the north of Indian subcontinent and forming the northwestern extremity of the Himalayan mountain range is spread over an area of 2, 22,236 km^2. Kashmir lies between 33^0.20' and 34^0.54'N latitude and 73^0.55' and 75^0.35'E longitude and covers an area of 15,498 km^2. Topographically, it is a deepest elliptical bowl-shaped valley bounded by lofty mountains of Pir Panjal in the north and east and has 64% of the total area under the mountains. The city of Srinagar, the summer capital of Jammu and Kashmir state, has a plain concave topography and is situated at an average altitude of about 1586m a.s.l. The Shankeracharya hill, forming part of the inner Great Himalaya and being situated within the Srinagar city on the bank of famous Dal lake, is on the right bank of Jhelum river and flanks the city of Srinagar in the east. The average height of the Shankeracharya hill is nearly 300m from the floor of valley (Pandit, 2002).

Forests, despite being the dominant land use from the geological past, unfortunately are a dwindling natural resources throughout the globe. They are the first victims of outpacing populations, being faster than they can regenerate thereby aggravating with various anthropogenic pressures like deforestation, grazing, desertification etc. (Cronin, 1979; Eckholm, 1979; Kayastha and Jayal, 1979; Joshi,

1981; Babu *et al.*, 1984; and Kaul and Dar, 1985). Although the large scale effects of human disturbances on forest vegetation have been very much high lighted, yet little literature is available on the smaller scale effects of disturbances on Himalayan vegetation in general and Kashmir region in particular (Babu *et al.*, 1984). The impact of the increasing biotic factors on the forest diversity influences the ecosystem functioning (Wilson, 1992).

Shankeracharya forest ecosystem has been designated as one of the reserved and protected forest ecosystem of the valley in the close proximity of Srinagar city, providing a rich variety of forest bioresources, still it is subjected to some major biotic interferences in the form of varied anthropogenic pressures like forest fires, deforestation, tourism activities, fragmentation of ecosystem due to road construction making vehicular traffic possible, and inhabitation of the upper reaches by security forces which bring doom to the fragile ecosystem. It is through these biotic interferences that the vegetal cover of the forest has changed considerably and the aim of the present investigation is to compare the vegetation in protected and unprotected areas under the operative anthropogenic factors.

STUDY AREA

For the present study, four sampling sites have been selected at different locations in the whole forest ecosystem (Fig.1). Site-I was situated at the top of forest near by transmission tower facing towards Dalgate. Site-II was in the coniferous area and is situated just below the temple, opposite to Sonawar area of the city. Site-III was located in the middle portion of the forest again dominated with decidious trees. Site- IV was situated near the main entrance of the forest near the base of hill and opposite to Nehru park.

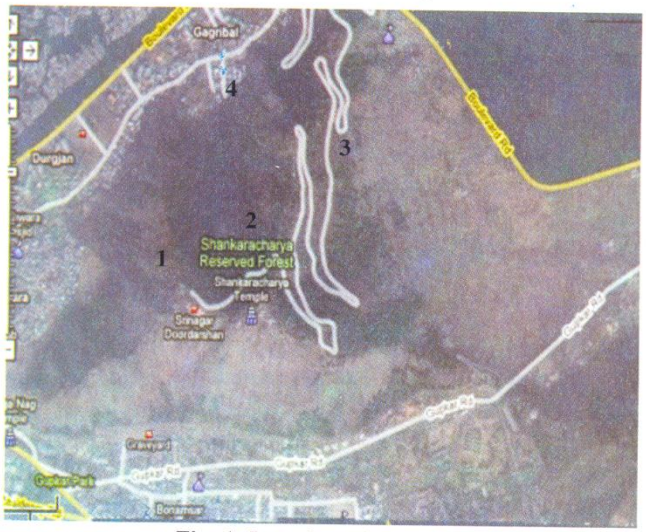

Fig. 1. Location of study site

METERIAL AND METHODS

During the present investigation each study site was divided into protected and unprotected part so as to compare the vegetation of both parts which provide a better understanding about the impact of biotic interferences on the vegetation.

Vegetation analysis was carried out on the monthly basis during June to November 2007. The vegetation and composition was recorded by quadrat method (Misra, 1968). Herbs, shrubs and tree species were recorded by taking quadrates of size 1×1sq.m, 5×5sq.m and 10×10 sq.m respectively at various stations at each site depending upon the vegetal cover the site sustains. Herb and shrub covers were determined by the method preposed by Cain and Castro (1959). Tree canopy cover was determined by the method proposed by Babu *et al.* (1984). Vegetation survey of all sites were carried out and the vegetation analysis in terms of frequency, density and abundance which was obtained by actual count method (Misra, 1968). Curtis and Mcintosh (1950) was followed in obtaining the important value index (IVI) from the relative values of frequency, density and abundance of each species.

RESULTS AND DISCUSSION

I. Species Composition of Forest Vegetation

A total of 27 angiosperms were recovered out of which 11 species belonged to herbs, 9 to shrubs and 7 to trees (Table 1)

Table 1. Species composition of forest vegetation

S.No	Herbs	Shrubs	Trees
1	*Bupleurum* sp.	*Rosa marcophyla*	*Cedrus deodara*
2	*Themeda anathera*	*Beriberis lyceum*	*Pinus helipensis*
3	*Poa* sp.	*Rosa webbiana*	*Colitis australis*
4	*Salvia moorcrotiana*	*Saphora* sp..	*Creatagis oxycantha*
5	*Arthraxon lencifolium*	*Hibiscus* sp.	*Alianthus altisma*
6	*Hypecium perforatum*	*Rulus* sp..	*Thuja orientalis*
7	*Artemisia india*	*Vinca major*	*Rubenia psedopodia*
8	*Artemisia moorcroftiana*	*Coteuster* sp.	
9	*Lespedeza variega*	*Daphne oleoides*	
10	*Artemisia absinthin*		
11	*Rumex haustatum*		

II. Community features of forest vegetation

A. Herbs

In the first set of vegetation analysis frequency, density, abundance and IVI was compared between the protected and unprotected plots at each site. So as to determine the intensity of impact of biotic factors (Fig. 2)

A perusal of the data presented in Fig.2

shows that Site-I had the highest biotic interference as depicted by the vegetation analysis of herbaceous vegetation, followed by Site-II, IV and III in a decreasing order. At the former site the total values of frequency, density and abundance of all species in protected plot were 830, 62.7 and 106.20 respectively, and in its comparison such values for unprotected plot were frequency (410), density (13.30) and abundance (34.70) (Fig.2.1.1 and 2.1.2). However, the values of IVI are not only maximum in protected plots for some species but also in unprotected plots. Similar observations have also been reported by other authors else where Vesk and Westoby, 2000; Sher *et al.*, 2005; and Kukshal *et al.*, 2006; It was evident from present study that Site-I had very less herbaceous cover as compared to other sites because of impacts of various biotic factors. Like Site-I, Site-II also sustains less herbaceous cover because of the forest fire destroying the vegetal cover at this site. At Site-II the corresponding values of the total frequency, density and abundance were 560.00, 51.00 and 81.41 respectively at protected plots. In comparison to these, frequency, density and abundance were 380, 10.10, 27.30 respectively in unprotected plots (Fig. 2.2.1 and 2.2.2). At Site-III little biotic interference leads to the development of herbaceous cover in comparison to other sites and as such quite insignificant differences were noticed between protected and unprotected plots. Site-IV also witnessed interferences by way of tresspassing and other human pressures including tourism activities which impacted upon the herbaceous vegetation of the site, thus depicting greater variations between the pytosociological attributes of the protected and unprotected plots.

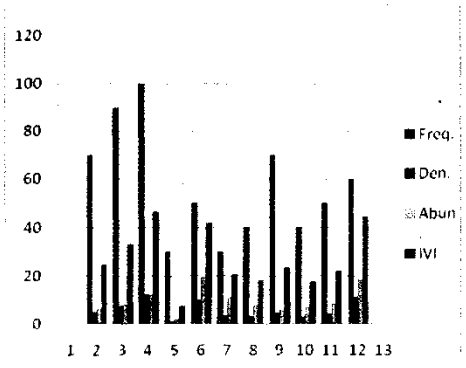

Fig. 2.1.1. Site - I (protected plot)

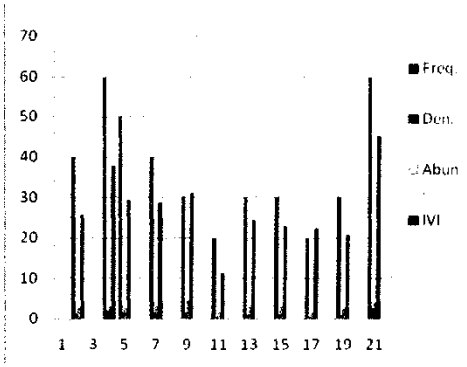

Fig. 2.1.2. Site - I (unprotected plot)

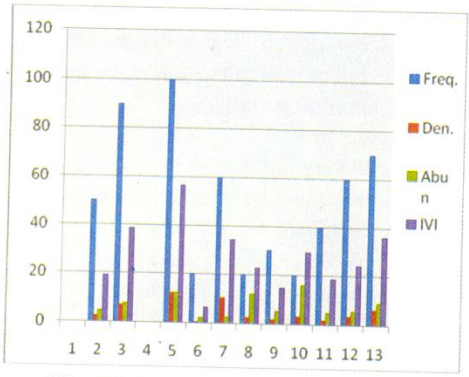

Fig. 2.2.1. Site - II (protected plot)

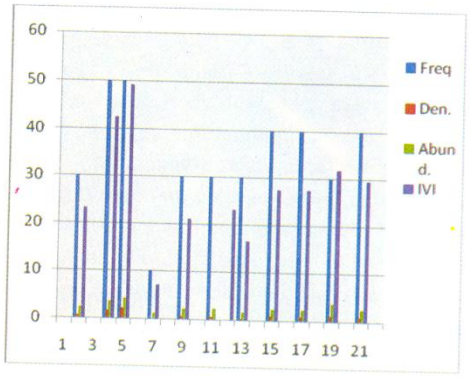

Fig. 2.2.2. Site - II (unprotected plot)

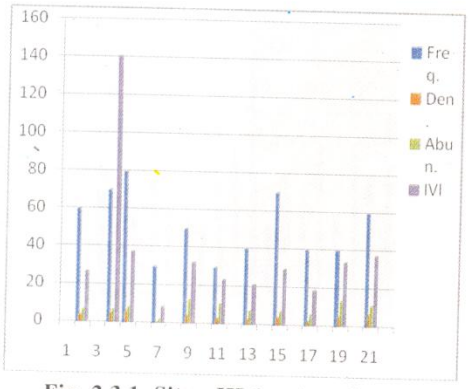

Fig. 2.3.1. Site - III (protected plot)

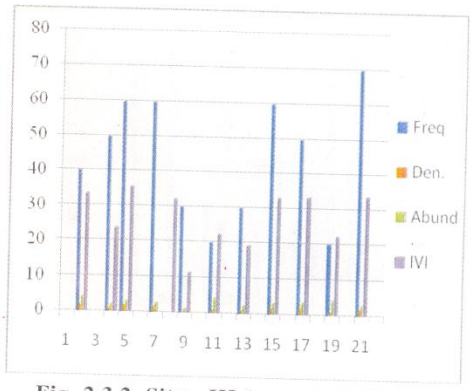

Fig. 2.3.2. Site - III (unprotected plot)

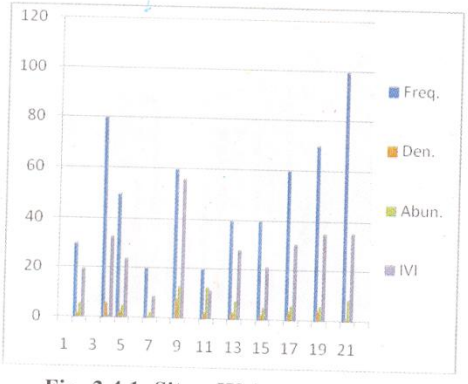

Fig. 2.4.1. Site - IV (protected plot)

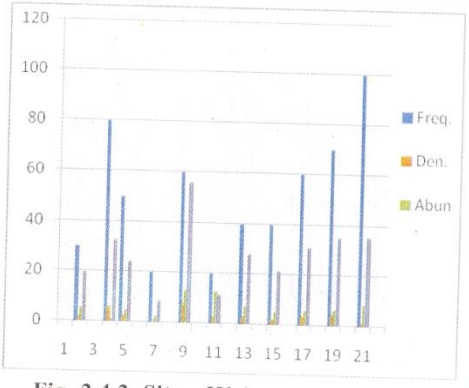

Fig. 2.4.2. Site - IV (unprotected plot)

Fig. 2. Impact of biotic factors on the phytosociological attributes of herbs at four different study sites. A comparison of protected and unprotected plots

B. Shrubs

Only two sites (Site-I and Site-IV) having a good coverage of shrub vegetation were the focus of present investigation while the other two sites had scanty shrub vegetation. Data presented in Fig.3, revealed that the values of frequency, density and abundance were greater in protected plots as compared to unprotected plots. It may also be observed during present investigation that both the sites (Site I and Site IV) have *Rosa webbiana* and *Berberis lyceum* as the dominant scrub cover type. Such results were also obtained by Dar and Kaul (1987). However, it does not hold true as many species showed maximum values of IVI even in unprotected plots. Mc Naughton (1967), Pandey and Singh (1985) have also reported similar results in disturbed ecosystem of Kumaon Himalaya. A comparison of the two sets of data of shrubs revealed that Site-I represents higher degree of biotic interference than site-IV. Further little variation were noticed between protected and unprotected plots.

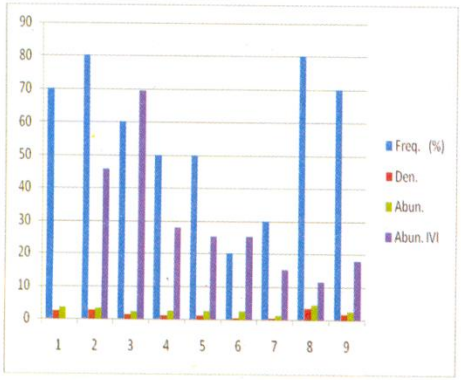

Fig. 3.1. Site - I (protected plot)

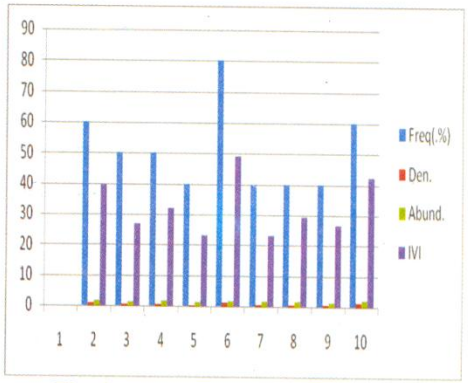

Fig. 3. . Site - I (unprotected plot)

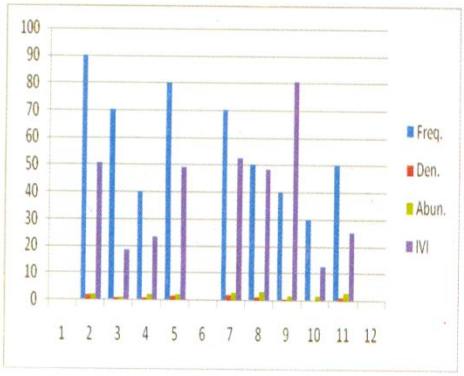

Fig. 3.3. Site - IV (protected plot)

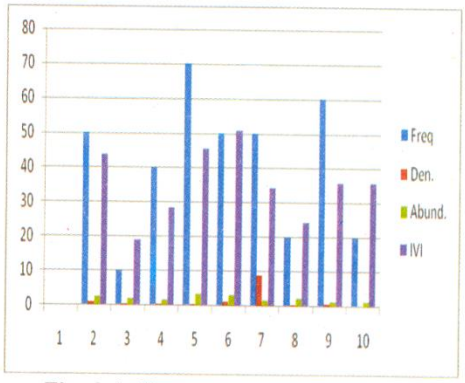

Fig. 3.4. Site - IV (unprotected plot)

Fig. 3. Impact of biotic factors on the community features of shrubs at two sites (I and IV). A comparison between protected and unprotected plots

C. Trees

While making a vegetation analysis for trees only three sites (I, II and IV) were selected for the present investigation. On the basis of biotic pressures, Site (III) was least affected by any kind of anthropogenic pressure. Among the three selected sites, a portion of site- I was severely impacted due to security personals guarding the Shankeracharya temple and transmission (T.V) tower. While the site-II was heavily disturbed due to forest fires caused by security forces, Site-IV was again disturbed due to human pressures like tourism, road construction and fuel collection. At site-I the total values of frequency percentage (400), density (13.7) and abundance (23.10) were obtained in protected plots, while as the corresponding values in unprotected plots were: frequency percentage (170), density (3.70) and abundance (8.50). Similar results were also obtained by Lone and Pandit (2005), Kumar *et al.* (2004), Rajwar and Gupta (1992), Mishra *et al.* (2002). In comparison to Site-I, other two Sites (II and IV) depicted lesser variation between the phytosociological attributes of trees in the protected and unprotected plots, thereby corroborating the fact that the Site-I was grosy impacted by the security forces. From the present investigation it is clear that heavy anthropogenic pressure of biotic factors on Shankeracharya forest have markedly deteriorate the forest vegetation in different classes like herbs, shrubs and trees. Similar investigation has been reported by Kumar and Joshi (1972), Brown and Schuster (1969) and Lloyrd (1972).

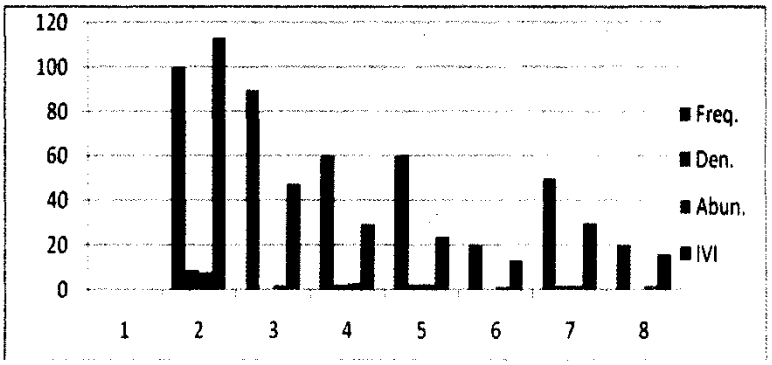

Fig.4.1. Site-I (protected plot)

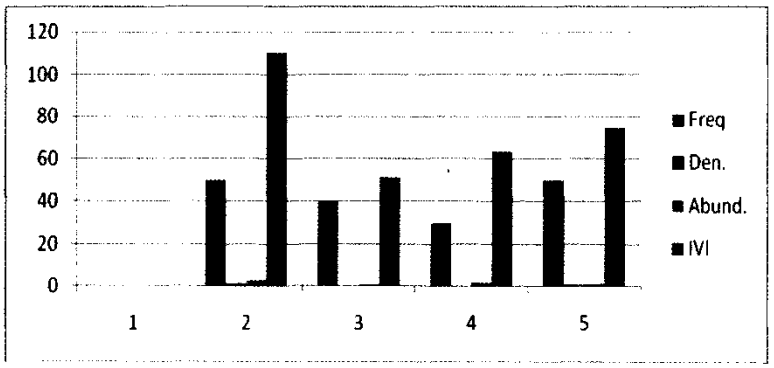

Fig.4.2. Site-I (unprotected plot)

Fig. 4. Community architecture of trees at site-I depicting the impact of anthropogenic pressures

CONCLUSIONS

In conclusion, it is evident that the anthropogenic pressures markedly change the phytososciology of forest ecosystem as regards the different life form - classes viz. herbs, shrubs and trees.

ACKNOWLEDGEMENTS

The present work is a part of M.Sc project work of the first author. Thanks are due to Head, P. G. Department of Environmental Science University of Kashmir for providing necessary laboratory facilities.

BIBLIOGRAPHY

Babu, C. R., Gatson, A. J., Chaudri, A. and Khandwa, R. 1984. effects of human disturbance in three areas of West Himalaya moist dedicious forest. *Environmental Conservation*. 11(1): 55 – 60.

Brown, J. W. and Schuster, J. L., 1969.effects of grazing on hard land site in the southern high plains. *J. Manage.*, 22: 418-423

Cain, S.A and Castro, G.M. 1959. *Manual of Vegetation Anaysis*. Harpour & Brothers, New York.

Curtis, J. T. and McIntosh, R. P. 1950. The interrelations of certain analytic and synthetic phytosociologcal characteristics. *Ecology.*, 31: 434 – 455.

Cronin, E. W. 1979. *The Arun: A natural History of the World's Deepest Valley*. Houghton Miffitin Baston, Massachusetts, USA.

Dar, H. U. and Kaul, V. 1987. Forest vegetation in relation to varying anthropogenic disturbances: A case study from Kashmir Himalaya, 3: 623-638. In: Y. P. S. Pangtey and S.C. Joshi (eds.), *Western Himalaya (Environment, Problem and Development)* 1, Gyanoga Prakash Publications, Naintal, U.P.

Eckholm, E. 1979. Forest renewal in India. *Nat. Hist.*, 88: 12 -27.

Joshi, G. 1981. Chipko: a means of environmental conservation. *Environ. Conser.* 8 (1): 3-4.

Kukshal, S., Nautiyal, B.P., Anthwal, A., Sharma, A. and Bhatt, A.B., 2006. Phytosociological investigation and life form pattern of grazinglands under pine

canopy in temperate zone, Northwest *Himalaya, India. Res. J. Botany*, **4**: 55-69.

Kayastha, S. L. and Jayal, B. N. 1979. Forests,environment and development. p. 28-43. In: Gupta, K. M. and Bandu, D. (eds.) *Man and Forest*. Today and Tomorrow Printers and Publishers. New Delhi, India.

Kaul, V. and Dar, H. U. 1985. Changing vegetation of Kashmir valley. p. 45–59. In: M., Hussain, B., Zutshi, M., Siddique, M. Dautta and T. A. Kanth (eds.) *Geography of Jammu and Kashmir*. Ariana Publ. House, New Delhi, India.

Kumar, A. K. and Joshi, M. C., 1972. The effect of grazing on the structure and productivity of vegetation near Pilani, Rajesthan. *Indian J. Ecol.*, **60**: 665 – 675.

Kumar, M., Sharma C.M. and Rajwar, G.S. 2004. A study on the community structure and diversity of a sub-tropical forest of Garhwal Himalayas. *Indian Forester*, **130** (2): 207-214.

Lloyrd, P.S., 1972. Effect of the fire on Derbyshrine grassland community. *Ecology*, **53**: 915–920.

Lone, H. A. and Pandit, A. K. 2005. Impact of deforestation on some economical important tree species of Langate forest division in Kasdhmir Himalaya. *J. Res. Dev.*, **5**: 39-44.

Mc Naughton, S. J. 1967. Relationship among functional properties of California grassland. *Nature*. **216**: 168-169.

Misra, R. 1968. *Ecology Work Book*. Oxford and IBH New Delhi, pp. 244.

Mishra, A., Mishra, L. Sharma, C.M. and Sharma, S.D. 2002. Community structure and growing stock variation on different aspects of dry semi-evergreen Shorea robusta forest cover type of Garhwal Himalaya. *Annals of Forestry*, **10** (2): 233-242.

Pandey, A. N., and Singh, J. S., 1985. Mechanism of ecosystem recovery: A case study of Kumaun Himalaya. *Recreation and Revegetation Research*, **3**: 271-292

Pandit, A.K. 2002. *Natural Resources of Western Himalaya*. Valley Book House, Hazratbal Srinagar-19006, J& K. India.

Rajwar, G.S. and Gupta S.K. 1992. Structure of forest vegetation of Garhwal Siwalik Hills between Khoh and Ganga. *Indian Forester*, **118** (2): 148-165.

Schulze, E. D. and Mooney, H. A., 1993. *Diversity and Ecosystem Functioning*. Springer–Verlag, Berlin.

Sher, H., Khan, Z.D., Khan, A.U., and Hussain, F. 2005. In situ conservation of some selected medicinal plants of Upper Swat, Pakistan. *J. Acta Botanica Yunnanica*, **27**: 27-36.

Vesk, P.A., and Westoby, M. 2000. Predicting plant species responses to grazing. *J. Applied Ecol.*, **38**: 897-909.

Wilson, E. O. 1992. *The Diversity of Life*. Univ. Press, Cambridge, Massachusetts.