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Short Communication

Plant species diversity along the altitudinal gradient at Garhi Dopatta Hills, Muzaffarabad

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The present study reveals vegetation diversity and species richness along the altitudinal gradient ranged from 900 to 3000 m at Garhi Dopatta Hills. Species diversity and richness values were high in the tree layer in the middle part of the altitudinal gradient. It decreases both towards upper and lower altitude, which was due to deforestation, human interaction, encroachment pressure, low number of species and soil erosion. There is great need of reforestation in the area. Alternate sources of fuel must be provided to local inhabitants to minimize the pressure on wealth of wild plants.

Key words: Garhi Dopatta, species diversity, species richness, deforestation.

INTRODUCTION

Plant species diversity refers to the variety and variability among the organisms and ecosystem complexes in which they occur. According to Whittaker (1975), diversity in the strict sense is richness in species and is appropriately measured as the number of species in a sample of standard size. Species diversity is a measurable biological character unique to the community level of ecological organization. It reflects organizational features important in the functioning of the community (Hussain, 1989). For the evaluation of ecosystems at different scales species diversity and species level is most important indices used to measure biodiversity, (Ardakani, 2004). Classification, composition and distribution of plant communities are at the heart of vegetation science for centuries, (Kashian et al., 2003). Altitude, aspect and disturbance from human settlements has linear relationship with vegetation attributes such as species richness, diversity and maturity (Schuster and Diekmann, 2005). Numerous studies acknowledges the relationship among plant species diversity, richness climate and spatial variables in the area (Vetaas, 2000; Nautiyal et al., 2001; Kala and Mathur, 2002, SCBD, 2003, Hussain and Ali, 2006; Panthi et al., 2007; Peer et al., 2007).

So far, no research has been done to evaluate the plant species diversity in different plant communities Garhi Dopatta Hills. Therefore, the aim of this study was to reveal the impact of anthropogenic and environmental stimuli affecting the plant species diversity and richness. Present study will be helpful to conservationists, ecologists, forest managers and future researchers by providing a comparison to ascertain any change in species and species composition of plant communities of this hilly area, Garhi Dopatta, Muzaffarabad, Azad Kashmir.

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MATERIALS AND METHODS

Study area

The study was conducted in Garhi Dopatta Hills (34.21°N and 73.60 °E) at an altitude between 900 to 3000 m, during 2006 to 2007. It is a mountainous region with sparsely distributed population. The area has variable climate. The mountains of study area are well with in the reach of monsoon. The average annual rainfall of the area is 141.76 mm and the mean monthly rainfall is 142.44 mm. The average maximum and minimum humidity is 78.38 and 49.58%. The average maximum and minimum temperature of Garhi Dopatta Hills is 26.55 and 12.47°C, respectively, (Pakistan Met data department Lahore, 2002 to 2008).

Methodology

We selected a study area in a traditionally managed mountain woody pasture. The area was sampled by quadrat method. The quadrats were laid down at regular intervals of 150 m. The size of quadrats was kept 10 × 2, 5 × 2 and 1 × 1 m for trees, shrubs and herbs respectively. Density, frequency and cover were recorded (Mueller-Dombois and Ellenberg, 1974). Importance value index of each plant species was calculated and plant communities were

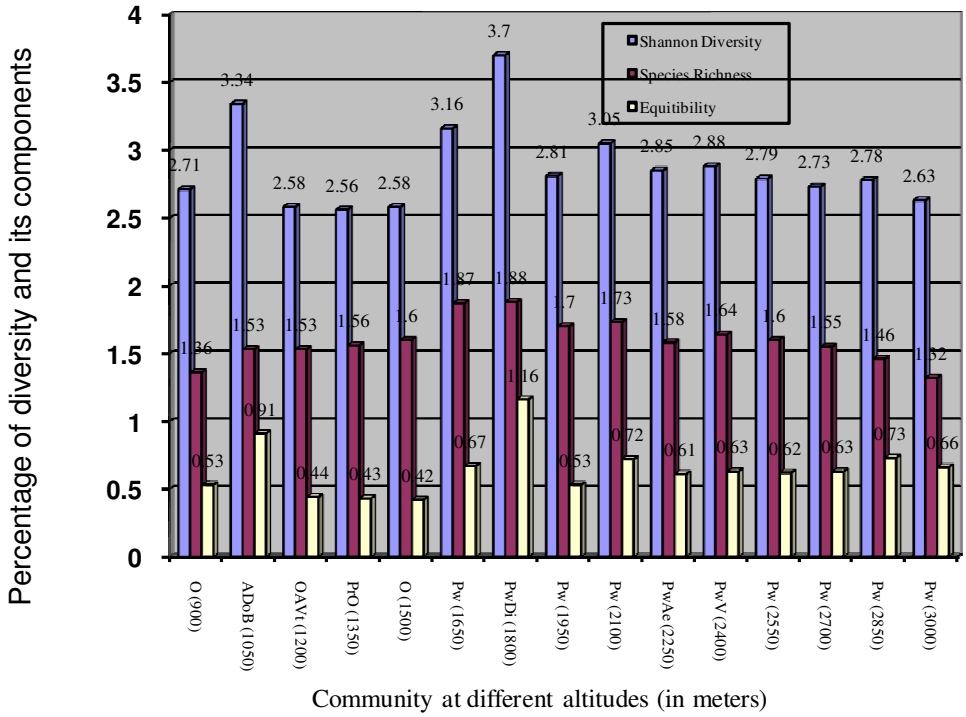

Figure 1. Percentage of plant species diversity and Its components Different Communities recorded at Garhi Dopatta hills. Key: O = *Olea ferruginea;* A DoB = *Acacia-Dodonaea-Brachiaria*; OAVt = *Olea-Acacia-Vitex*; Pw = *Pinus wallichiana*; PrO = *Pinus roxburghii-Olea*; PwDi = *Pinus wallichiana-Diospyrus*; PwAe = *Pinus wallichiana-Aesculus indica*; PwVi = *Pinus wallichiana-Viburnum grandiflorum.*

named after the plant species having the highest IV (Hussain, 1989; Malik, 2005). Species diversity was measured by Shannon-Wiener (1949) methods. The components of diversity as species richness and equitability were measured after Margalef (1958) and Sheldon (1969), respectively.

RESULTS

The Shannon-Wiener (1949), diversity index ranged form 2.56 to 3.70 (Figure 1). The highest diversity was recorded in *Pinus – Diospyrus* community (3.70) which was harbored at an elevation of 1800 m. It was followed by *Acacia - Dodonaea - Brachiaria* (3.34) and *Pinus wallichiana* community (3.16) at an elevation of 1050 and 1650 m, respectively. The lowest area species diversity was recorded in *Pinus* – community (2.56) at an altitude of 1350 m. The value of species diversity decreases with increase in altitude up to 2700 m (*P. wallichinana* community). Some communities showed a slight variation in diversity values (Figure 1).

The values of species richness ranged from 1.32 to 1.88 (Figure 1). The highest value of species richness was recorded in *Pinus – Diospyrus (*1800 m) community which was 1.88 and *Pinus wallichinana* 1650 m. Species richness decrease with increase in altitude from 2400 to 3000 m. Some communities show slight variations in species richness values (Figure 1).

The values of equitability ranged from 0.42 to 1.16 (Figure 1). The highest value was recorded form *Pinus - Diospyrus* community which was 1.16 whereas the lowest value (0.42) was recorded from *Olea ferruginaea* community harbored at 1500 m height.

DISCUSSION

In the investigated area species diversity was high (2.71). It decreases with the increase of altitude 900 to 1500 m while it was low in the high altitude. Similar findings were reported by Malik (2005) and Colinvaux. (1993). The observed lowered species diversity in Garhi Dopatta hills is due to deforestation, human interaction (Kumar and Bhutt, 2006), collection of medicinal plants and quick disappearance of annual plants because of cold conditions (Ram et al., 2004). In some communities, very high species diversity was recorded in the investigated area. The high species diversity was reported in *Acacia-Dodonaea – Brachiaria, Pinus wallichiana Pinus – Aesculus* and *P. wallichana* communities harbored at an altitude of 1050, 1650, 1800 and 2100 m in moist temperate zone. Malik et al. (2001), reported similar

vegetation in Daukhan area, where high species diversity was reported in upper reaches, while low diversity in low altitude. Similarly, Khan et al. (1999), reported low species diversity due to few species by stressful environmental stress. In over case species diversity was low due to less number of species at higher altitude and high diversity due to high number of species at low altitude.

The diversity of species was high in the tree layer in the middle part (1650, 1800 and 1050 m) of altitudinal gradient. It decreases both toward lower and higher altitude. However, *P. wallichinana, Aesculus* and *Acacia* forest occupying the middle altitudinal zone had high diversity. The results are in agreement with Saxena et al., (1987) who reported that in Kuman Himalaya, the diversity of tree layer was higher, which decreased both at lower and upper altitude. Kharkwal et al. (2005) reported the same pattern of species diversity and richness in Kuman, India.

Species richness was low in lower reaches, it increases with increase in altitude from 900 to 1800 m, however, form 1950 to 3000 m species richness decreased with the increase in altitude. In the investigated area, there was abundance of annuals due to which species richness increased. In the monsoon most of annuals disappeared that decreased species richness. The higher value of species richness was recorded for communities of moist temperate habitat that had relatively optimum climatic conditions between lower to higher altitude. Parthasarthy and Karthikeyan (1997) stated that species richness, stand diversity and diversity indices consistently decreased with increase in size classes of woody species 30 to 1800 m girth from 30 to 1500 m girth. In over case, species richness and diversity indices consistently decreased with increasing size classes of woody species.

Equitability or evenness was low at the base and high at the top. At 1050 m equitability was high; it decreased up to 1650 m, than abruptly it decreases up to 3000 m.

A higher equitability may result a highly stable environment or a prolonged period of time (Shoukat and Khan, 1999). The high total species diversity at the high level of disturbance resulted from high equitability of relatively small number of species.

REFERENCES

Ardakani MR (2004). Ecology. Tehran University Press, p. 340.

Colinvaux P (1993). Ecology. John Wiley and Sons Inc. New York, pp. 648-684.

Hussain F (1989). Field and Laboratoay Manual; Plant Ecology, University Grant Commission, Islamabad.

Hussain M, Ali A (2006). Spatial and Seasonal variation in the species composition of herbaceous vegetation indigenous to soone valley in the salt range of Pakistan. Pak. J. Agric. Sci., 43: 43-49.

Kala CP, Mathur V (2002). Patterns of plant species distribution o in the trans- Himalayan region of Ladakh. India, J. Veg. Sci., 13: 751-754.

Kashian DM, Barnes BV, Walker WS (2003). Ecological species groups of landform level ecosystems dominated by jack pine in northern Lower Michigan, USA. Plant Ecol., 166(1): 75-91.

Khan D, Alam MM, Feheemuddin M (1999). Structure Composition and above ground Standing phytomass of some grass dominated communities of Karachi: Summer aspects. Hamdard Med., 42: 19-52.

Kharkwal G, Mehrotra P, Rawat YS, Pangetey YPS (2005). Phtodiversity and growth form in relation to altitudinal gradient in the Central Himalaya (Kumaun) region of India. Curr. Sci., 89(5): 873-878

Kumar M, Bhutt V (2006). Plant Biodiversity and Conservation of forests in foot hills of Garhnal Himalaya. Lyonia, 11(2): 46-59.

Malik ZH, Malik NZ, Bashir S, Gorsi MS (2001). Phytosociological studies on the vegetation of Dao Khun Hills, J. Sci. Tech., 25: 35-41.

Malik ZH (2005). Comparative study of the Vegetation of the Ganga Choti and Badori Hills, Distt. Bagh, Azad Jammu and Kashmir, with special reference to range conditions. PhD thesis Dept. Bot. University of Peshawar.

Margalef R (1958). Informational theory in Ecology, Gen. Syst., 5: 36-71.

Mueller-Dombois D, Ellenberg H (1974). Aims and Methods of Vegetation Ecology. John Wiley and Sons. Inc.

Nautiyal MC, Nautiyal BP, Prakash V (2001). Phenology and growth form distribution in an alpine pasture at Tungnath, Garhwal, Himalaya. Mount. Res. Dev., 21(2): 168-174.

Panthi NP, Chaudhary RP, Vetaas OR (2007). Plant Species richness and composition in Trans- Himalayan inner valley of Manang district, central Nepal. Himalayan J. Sci., 4(6): 57-64.

Parthasarthy N, Karthikeyan R (1997). Biodiversity and population density of Woody species in a tropical evergreen forest in Coutallum Reserve Forests, Western Ghats, Ind. Trop. Ecol., 38(2): 297-306.

Peer T, Gruber JP, Millingard A Hussain F (2007). Phytosociology, Structure and Diversity of the steppes vegetation in the mountains of Northern Pakistan. Phytocoenologia, 37: 1-65.

Ram J, Kumar A, Bhatt J (2004). Plant diversity in six forest types of Uttaranchal, Central Himalaya, India. Curr Sci., 86(7): 208-215.

Saxina AK, Panday TP, Singh JS (1987). Altitudinal Variation in the Vegetation of Kuman Himalaya, Prespective in Environ. Bot., 44-66.

SCBD (2003). Secretariat of the Convention on Biological Diversity Status and Trends of, Threats to, Mountain Biodiversity, Marian and Coastal Inland Water Ecosystem. Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity. Meeting 8. Abstracts of poster presentation. CBD Technical Serie8. Montreal, Canada: SCBD. http://www cbd.int/doc/publication /cbd-ts-08 pdf; accessed on 11 April 2011.

Schuster B, Diekmann M (2005). Species richness and environmental correlates in deciduous forests Northwest Germany. For. Ecol. Manag., 206: 197-205.

Shoukat SS, Khan D (1999). A Comparative study of the Statistical behavior of diversity and equitability indices with reference to desert vegetation. Pak. J. Bot., 11: 155-165.

Shannon CE, Wiener W (1949). The Mathematical theory of Communication, University of Illinois Press Urgana, p. 117.

Sheldon AL (1969). Equitability indices: dependence on the species account. Ecology, 50: 466-467.

Whittaker RH, Niering WA (1975). Vegetation of the Santa Carolina Mountains Arizona. Biomass production and diversity along the elevational gradient. Ecology, 56: 771-790.

Vetaas OR (2000). Comparing species temperature response curve; population density versus second hand data. J. Veg. Sci., 11: 659-666.