

A COMPARISON BETWEEN PLANT DIVERSITY OF RESERVED AND GUZARA FORESTS OF MURREE HILLS

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Abstract

Biodiversity is a term commonly used to describe all kinds of life forms on earth. Sub-tropical Chir Pine forests of Pakistan support a wide variety of plant and animal life. These forests are facing an increasing problem of forest degradation and species loss. This study is aimed at the assessment and comparison of plant diversity of a Reserve forest with a Guzara forest in the Chir pine zone of Murree hill, so as to see which forest is richer and more diverse in plant diversity.

Systematic sampling design was used to record the plant species found in the Reserved and Guzara forests. Sample plots of sizes 500 m² and 10² m were laid out to collect the data regarding tree & shrub species respectively. A total of 10 sample plots were measured in each forest. Later on, the data from these plots were combined to arrive at a single figure for each plant species found at two sites of study. The plant diversity of both types of forests was assessed and compared by computing two diversity indices viz. Species richness and Shannon diversity and evenness indices.

Results indicated higher plant species richness for the Reserved forest as compared to the Guzara forest. Similarly, the Shannon diversity indices suggest that the Reserved forest was more diverse in flora than the Guzara forest. The Reserved forests are better protected and managed in contrast to the Guzara forests which suffer from problems related to management issues and local rights in the forest.

Introduction

Biological diversity is the hallmark of the planet earth; without it the bio-sphere would be an abiotic and monotonous zone of air, land and water. It provides the very basis for a sustained life-support system on this earth, the maintenance of oxygen and carbon dioxide balance, continuity of water cycles, regulation of climate production and protection of soil, storage and recycling of essential nutrients, and absorption and breakdown of pollutants.

Biodiversity has often been interpreted as species richness, i.e. the number of species in any given site or habitat. Most species, however, comprise individuals, which differ from one another genetically. This variability also encompasses the concept of biodiversity. Moreover, the species do not exist in strict isolation in nature but occur in biotic communities and ecosystems and these ecological complexes of living organisms, too come within the purview of biodiversity.

Species become extinct due to a multitude of complex factors. Habitat destruction and modification rank number one among the current threats and are the primary cause of recent extinctions. In the current century scientists predict large-scale

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changes in global climate, which may enhance extinction rates further. In case of Chir forest the causes of extinction of biodiversity are; heavy grazing and browsing, grass cutting, illicit felling lopping and fires (Ahmed, 1953).

There are nine major ecological zones in Pakistan. Sub-tropical Chir pine forest is one of the important forest type (Siddiqui, 1997). These are open and inflammable pine forests found in a fairly narrow zone between 900 meter and 2000 meter in the Western Himalayas within the range of the south-west summer monsoon. The trees *Pinus roxburghii* and *Quercus incana* dominate, with an under storey of *Berberis* spp. *Clematis gouriana*, *Carissa* spp, *Contoneaster* spp. and clumps of grasses.

In the case of Pakistan, Reserved forests are a kind of protected area, because these forests are generally free of rights and concessions and all acts are prohibited unless permitted specifically by the Government through notification. On the other hand Guzara forests are burdened with rights. When forests were reserved for Government ownership and management at the time of first settlement of land ownership in 1872, sizeable patches of wooded lands close to habitations were set aside to meet the domestic needs of the local communities. Such forests were designated as Guzara forests.

Measuring biodiversity is a major need for its assessment and conservation. Measurement of diversity is only possible when some quantitative value is given to its elements so that these values can be compared. Many methods, mostly based on rarity and abundance of species, have been suggested to measure diversity at the species level. Magurran (1988) has listed 15 such methods used by ecologists.

For the present study, sub-tropical Chir pine forest was selected as it is vulnerable to deforestation and the accompanying loss of plant diversity (Rahim, 2000) due to heavy grazing pressure, extension in road network, fire, illicit cuttings, agricultural practices (especially in Guzara forests) and increasing population pressure.

The objectives of this study were:

- To record the plant species of Guzara and Reserved Forests.
- To compare the plant diversity of Guzara and Reserved Forests.

Material and Method

The objectives of this research required that the study area should have the following features.

- Presence of Reserved and Guzara forests in close vicinity.
- Plant diversity under threat.

To meet the above-mentioned requirements, the Ghora-Gali Forest sub-division in Murree forest division was selected as it fulfilled both the conditions.

Material

The equipment used during the research work were plant presser, drying paper (old newspaper and blotting paper), measuring tape, compass, and field inventory form for data recording.

Method

First of all, the study area was identified for fieldwork. Compartment No. RF 57 of Ghora-gali Forest sub-division and Company Bagh area were selected for data collection in Reserved forest and Guzara forest, respectively.

The data was collected through circular sample plots in selected areas of Reserved Forest and Guzara Forest, having similar environmental factors; slope, aspect, soil type, elevation, climatic conditions, distance from road and population centre, etc. Field inventory form was developed according to vegetation description and analysis methods (Kent and Coker, 1992).

Systematic sampling was adopted in this study in which first plot was laid out randomly while the subsequent plots were laid out systematically, 250 m apart on transect, in each forest category. In total 10 sample plots were measured in each forest category. Later on, the data collected from the 10 plots was combined to get a single figure for each plant species found at the two sites. Circular plot of 500 square meters size was laid out for recording trees within which subplot of 10 square meters was laid out for data collection regarding shrubs.

Field data collected from sample plots was recorded on a field inventory form. The measurement recorded in each sample plot was the number and type of trees and shrubs encountered.

The unidentified plant species specimens were collected. They were given field numbers and were pressed by plant presser containing blotting paper. The collected plants were dried in the field and brought to Pakistan Forest Institute, Peshawar, for identification.

The collected data was analyzed by computing the following diversity indices.

1. Species richness
2. Shannon diversity index and Shannon evenness index

Species Richness

A straightforward count of the number of species present in a sample area.

Shannon diversity index and Shannon evenness index

The formula for calculating the Shannon diversity index is:

$$H' = -\sum p_i \ln p_i$$

Where p_i , the proportional abundance of the i th species = (n_i/N)

n_i = number of individuals of the i th species.

N = Sum total of all individuals of all species.

The formula for calculating the Shannon evenness index is

$$E = H' / \ln S$$

Where S	=	number of species
H'	=	Shannon Diversity index
\ln	=	Natural logarithm

Results and Discussion

The assessment and comparison of plant diversity in Reserved and Guzara forests is based on field data analysis by using diversity indices (viz. Species richness, Shannon diversity index and Shannon Evenness index). The results obtained from these diversity indices are presented and discussed.

Species Richness

Table 1 shows the data about the plant species found in the survey of the Reserved forest and the Guzara forest. A total of 32 plant species were recorded in the Reserved forest in contrast to 23 species for the Guzara Forest. A total of 9 plant species including 2 tree species, 4 shrub species and 3 herb species were found completely absent from the sampled Guzara forest area. This result suggests that, regarding plant species, the Reserved forest was richer than the Guzara forest.

Higher plant diversity in Reserved forest as compared to Guzara Forest could be due to the differences in their control and management and their relative locations with respect to habitations. Reserved forests are usually located far from villages and population centers, but the Guzara forests are located near to the habitations from the very time of their constitution. Because of this there is a greater human interference in natural ecosystem persisting in the Guzara forests.

Reserved forests are managed and controlled by the forest department and the local people in these forests can exercise few rights. Therefore, they are relatively more natural. Guzara forests, on the other hand, are primarily managed to fulfill the requirements of the local people. Therefore, many rights such as free grazing, grass cutting, timber for building construction, firewood collection, grant of tree on death and marriage, timber for agricultural implementations, and breaking up of land for cultivation are allowed. Excessive exercise of these rights is a major threat to the local biodiversity.

Shannon Diversity Index and Shannon Evenness Index

Data about tree and shrub species found in the Reserved and the Guzara forests and their numbers in each forest type is given in Tables 2 and 3 respectively. Analysis of

the data reveals that Reserved forest had higher values for both the Shannon diversity index and the Shannon evenness index as compared to Guzara forest. These results are presented in table 4. The results indicate that Reserved forest was more diverse than Guzara forest in terms of trees and shrub vegetation.

Table 1. Plant Species found in the sampled Reserved Forest and Guzara Forest

Species	Type/ Life form	Presence of species	
		Reserved Forest	Guzara Forest
<i>Pinus roxburghii</i>	Tree	✓	✓
<i>Quercus incana</i>	Tree	✓	×
<i>Pyrus pashia</i>	Tree	✓	×
<i>Mallotus philippensis</i>	Tree	✓	✓
<i>Ficus glumerata</i>	Tree	✓	✓
<i>Myrcine africana</i>	Shrub	✓	✓
<i>Berberis lycium</i>	Shrub	✓	✓
<i>Rubus ellipticus</i>	Shrub	✓	✓
<i>Gymnosporia royleana</i>	Shrub	✓	✓
<i>Carissa spinarum</i>	Shrub	✓	✓
<i>Cotoneaster</i> spp.	Shrub	✓	×
<i>Rosa moschata</i>	Shrub	✓	✓
<i>Abutilon bidentatum</i>	Shrub	✓	×
<i>Clematis gouriana</i>	Shrub	✓	×
<i>Hedera helix</i>	Shrub	✓	✓
<i>Pelphem</i> spp.	Shrub	✓	×
<i>Indigofera</i> spp.	Shrub/Herb	✓	✓
<i>Cannabis sativa</i>	Shrub/Herb	✓	✓
<i>Plantago ovate</i>	Herb	✓	✓
<i>Saxifraga ligulata</i>	Herb	✓	×
<i>Fragaria vesca</i>	Herb	✓	✓
<i>Ferns</i>	Herb	✓	×
<i>Xanthium strumarium</i>	Herb	✓	×
<i>Themeda anathera</i>	Herb	✓	✓
<i>Ranunculus</i> spp.	Herb	✓	✓
<i>Trifolium</i> spp.	Herb	✓	✓
<i>Verbericum</i> spp.	Herb	✓	✓
<i>Arthraxon prionodes</i>	Grass	✓	✓
<i>Imperata cylindrica</i>	Grass	✓	✓
<i>Chrysopogon aucheri</i>	Grass	✓	✓
<i>Cynodon dactylon</i>	Grass	✓	✓
<i>Andropogon contortus</i>	Grass	✓	✓
Total species richness		32 spp.	23 spp.

(✓ - Present, × - Absent)

Table 2. Plant species (Trees and Shrubs only) and the number of individuals in the sampled Reserved Forest

Species	Type/ Life form	Number of individuals
<i>Pinus roxburghii</i>	Tree	60
<i>Quercus incana</i>	Tree	13
<i>Ficus glumerata</i>	Tree	5
<i>Mallotus philippensis</i>	Tree	4
<i>Pyrus pashia</i>	Tree	3
<i>Myrcine africana</i>	Shrub	35
<i>Berberis lycium</i>	Shrub	30
<i>Hedera helix</i>	Shrub	20
<i>Rubus ellipticus</i>	Shrub	18
<i>Rosa moschata</i>	Shrub	16
<i>Cannabis sativa</i>	Shrub	8
<i>Indigofera</i> spp.	Shrub	8
<i>Gymnosporia royleana</i>	Shrub	7
<i>Carissa spinarum</i>	Shrub	6
<i>Clematis gouriana</i>	Shrub	5
<i>Abuliton bidentatum</i>	Shrub	4
<i>Cotoneaster</i> spp.	Shrub	3
<i>Pelphem</i> spp.	Shrub	1
No. of species (S) = 18		Total No. of individuals (N) = 246

Table 3. Plant species (Trees and Shrubs only) and the number of individuals in the sampled Guzara Forest

Species	Type/ Life form	Number of individuals
<i>Pinus roxburghii</i>	Tree	43
<i>Ficus glumerata</i>	Tree	7
<i>Mallotus philippensis</i>	Tree	3
<i>Cannabis sativa</i>	Shrub	31
<i>Rubus ellipticus</i>	Shrub	24
<i>Berberis lycium</i>	Shrub	19
<i>Myrcine africana</i>	Shrub	16
<i>Indigofera</i> spp.	Shrub	13
<i>Hedera helix</i>	Shrub	4
<i>Gymnosporia royleana</i>	Shrub	3
<i>Carissa spinarum</i>	Shrub	2
<i>Rosa moschata</i>	Shrub	1
No. of species (S) = 12		Total No. of individuals (N) = 166

Table 4. Shannon Diversity Index and Shannon Evenness Index

Forest Type	S	N	H'	E
Reserved Forest	18	246	2.451	0.8479
Guzara Forest	12	166	1.960	0.7889

S = Number of species

N = Number of individuals

H' = Shannon diversity index (please see 'Method' for computing it)

E = Shannon evenness index (please see 'Method' for computing it)

Table 4 shows that the Shannon diversity index (H') and Shannon evenness index (E) values for Reserved forest (H' = 2.451, E = 0.8479) are higher than the corresponding values for Guzara forest (H' = 1.960, E = 0.7889).

The reason behind this variation in plant (trees and shrubs) diversity is the difference in management and intensity of abiotic factors, which adversely affect the plant diversity. Reserved forests are scientifically managed by the forest department. They are highly protected areas where no rights or a few rights are being practiced by the local people. On the other hand, Guzara forests are burdened with rights.

Factors such as encroachment, fire, population growth, illicit grazing and felling, firewood collection for winter spell etc. also affect badly the plant diversity of the area. These factors are commonly observed in Guzara forests. Reserved forests provide suitable places for biodiversity conservation. Moreover, the management of the Guzara forests is poorly organized as compared to the management of the Reserved forests because of shortage of trained staff and the low priority given to their scientific management.

Conclusion

The general conclusion of the study is that Reserved forests have higher plant diversity as compared to Guzara forests. In Reserved forests local people have few rights or even no rights. The ruthless exercise of rights in Guzara has led to impoverished plant diversity in the area. It is imperative that the management of Guzara Forests be improved.

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