International Journal of Research (IJR)

e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 9 Issue 04
April 2022

Quantitative Analysis of Plant Biodiversity of Bagla, Raya Suchani Area Of Samba District of Jammu and Kashmir

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Abstract: *Biodiversity comprises variety of life forms at all the levels of ecosystem and includes Species diversity, genetic diversity and ecosystem diversity. This study aims to quantitatively assess the biodiversity of main campus and near-by area of Central University of Jammu, Bagla, Raya Suchani in Samba district of Jammu and Kashmir. Total of 34 quadrats were plotted for studying tree and shrub species of this area. Shannon-Wienner Index and Simpson's Index were also calculated to assess the species diversity and dominance of particular species in the study area. Murraya koeniggi and Mallotus philippensis found to be the dominant shrub and tree species respectively. Biodiversity of the study area is affected by various anthropogenic activities and need to be maintained and improved.*

Keywords: Biodiversity, Shannon- Wienner Index, Simpson's Index, Abundance.

INTRODUCTION

Planet Earth has a vast variety of life on it in terms of plants, animals, and microbes. This variety and variability of plants, animals, and microbes is called as Biodiversity. The term "biological diversity" was first used by wildlife scientist and conversationalist **Raymond F. Dasmann** in **1968,** where he advocated the conservation of biodiversity. It was widely adopted only in the 1980s. It also includes the genes they contain and the ecosystems they form. It represents the very foundation of human existence. Yet human interventions are eroding this biological capital at an alarming rate. The word "Biodiversity" was coined by **E.O.Wilson** to express total variation of life as a contraction of biological diversity.

Biodiversity encompasses the variety of life, at all levels of organization, classified both by evolutionary (phylogenetic) and ecological (functional) criteria. It is synonymous with "Life on Earth". It embraces two different concepts: one is a measure of how many different living things there are and the other is the measure of how different they are. (Hens and

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Boon, 2003). Biological diversity is a key issue of nature conservation, and species diversity is one of important components of the biological diversity (Ozcelik et al., 2008).

Although many definitions for biodiversity exist, the most often-cited is provided by the "convention on Biological Diversity" as "variability among living organisms from all sources, including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems" (UNCBD,1992).

Biologists most often define Biodiversity as the "totality of genes, species and ecosystems of a region". There are three levels of biodiversity at which Biological variety has been identified:

- Species diversity
- Ecosystem diversity
- Genetic diversity.

The species is the basic unit of classification in biology. Although species might be defined as a group of similar organisms that interbreed or share a common lineage of descent, there is no universal agreement on how to define a species. Even when the species is the basic unit, it represents only one level of a complex phylogenetic hierarchy: related species are grouped in genera, related genera in families, families in orders, and so on, up to the highest level, the kingdom, of which five are generally recognised at present (animals, plants, fungi, bacteria and protoctists) (Hens and Boon, 2003).

Species richness measures the number of species within a given area, giving equal weight to each one. It is still the most straightforward and, in many ways, the most useful measure of biodiversity. The number or richness of species is complemented by:

- **Species diversity**: measures the species in an area, adjusting for both sampling effects and species abundance.
- **Taxic (taxonomic) diversity:** measures the taxonomic dispersion of species, thus emphasizing isolated evolutionary species. The basic idea behind this measure is that biodiversity might be better measured at higher taxonomic levels (e.g. genera or families).
- **Functional diversity**: assesses the richness of functional features and interrelations in an area, identifying food webs along with keystone species and guilds.

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e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 9 Issue 04
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However, not only diversity is of importance. Species endemism, that is whether a species is restricted to ("endemic to") an area under discussion, is equally vital. For example, islands typically have fewer species than equivalent-sized continental areas. They also usually have a higher percentage of species found nowhere else. In other words, they have lower Species richness and higher species endemism (Hens and Boon, 2003).

Genetic diversity is the variation of the set of genes carried by different organisms. It occurs on a small scale among organisms of the same species, among closely related species such as those in the same genus, and among more distantly related species, in different families, orders, or kingdoms. Genetic diversity might be characterised by a range of techniques: by observation of inherited genetic traits, by studying the chromosomes and their species specific karyotype, and by analysing the DNA information using molecular technology. Global genetic diversity is extremely large. It has been estimated that there are some 10^9different genes present in the world's biota. The number of possible combinations of gene-sequence variants in a population is so great that it cannot even be expressed in a meaningful way. This amazing variation in the genetic code offers opportunities for evolutionary change, the survival of species, adaptations to a changing environment, and the formation of new species. More recently, biotechnology and crop or breed improvement programmes rely on the identification of genetic material giving rise to desirable traits, and the incorporation of this material in appropriate organisms (Hens and Boon, 2003).

So, whenever we want to know the number, richness, rarity, evenness of the species as well as species diversity present in a particular place can be assessed by quantitative analysis.

The Quantitative analysis is a statistical tool which is used to determine various parameters. It generally includes the statistical tools like abundance, frequency, density and calculation which help in conserving biodiversity. Quantitative research focuses on gathering numerical data and generalizing it across groups of people or to explain a particular phenomenon. According to the quantitative measurement of biodiversity indicators, diversity is a statistical tool which allows the combination of the two factors: the number of species composition and distribution, uniformity or potentially appearance of individuals of each species (Thoa et al., 2013).

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Quantitative analysis helps in identification of economically useful species as well as species of special concern, i.e., rare, uncommon and vulnerable species (Padalia et al., 2004). Quantitative information on the structure of a plant community is desirable for planning, and evaluating the success of restoration and re-vegetation projects (Barbour et al., 1987).

The concept of frequency as a parameter for quantifying vegetation is generally credited to the Scandinavian researcher, Raunkiaer in 1909. Frequency is defined as the number of times a plant species is present within a given number of sample quadrat of uniform size placed repeatedly across a stand of vegetation**.** It is generally expressed as a percentage of total placements and reflects the probability of encountering a particular species at any location within the stand (Kumar and Bhatt, 2006).

Frequency refers to the degree of dispersion of individual species in an area and usually expressed in terms of percentage occurrence. It is generally studied by sampling the study area at several places at random and recorded the name of the species that occurred in each sampling units (Haripal and Sahoo, 2011).

Plant frequency is a function of quadrat size and reflects both plant density and dispersion. The sensitivity of frequency data to density and dispersion make frequency a useful parameter for monitoring and documenting changes in plant communities. Plant frequency is useful for monitoring vegetation changes over time at the same location or for comparisons of different locations. Frequency is most often used to compare plant communities and to detect changes in Vegetation composition over time and is also used to describe the distribution of a species in a community (Padalia et al., 2004).

Density is the number of plants per unit area. Density refers to the closeness of individual plants. It is often used as a baseline inventory of the structure of rangeland vegetation by quantifying different species, or various ages within a single species. Density can be determined by counting all plants in a particular quadrat, or it can be used to measure the prevalence of certain plant species present in a particular quadrat (Bargali et al., 2011).

The abundance and density represent the numerical strength of species in the community**.** Abundance is described as the number of individuals of each species occurring per sampling unit and density as the number of individuals per sampling unit**.** It is used to infer

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information about the mode of interaction and the type of relationship among different species in a given community.

The abundances are grouped to assign abundance-categories, as Suggested by Dagar et al., (1991) and are detailed below:

Values	Category of Abundance	Abbreviation
>25	Dominant	D
15-25	Very abundant	Va
10-15	Abundant	A
6-10	Frequent	F
3-6	Occasional	O
1-3	Rare	R
< 1	Very rare	Vr

Diversity indices provide important information about rarity and commonness of species in a community. The ability to quantify diversity in this way is an important tool for biologists trying to understand community structure (Beals et al., 2000). A diversity index is a mathematical measure of species diversity in a community. Diversity indices provide more information about community composition than simply species richness (i.e., the number of species present); they also take the relative abundances of different species into account (Beals et al., 2000).

A diversity index is a quantitative measure that reflects how many different types (such as species) there are in a dataset, and simultaneously takes into account how evenly the basic entities (such as individuals) are distributed among those types. The value of a diversity index increases both when the number of types increases and when evenness increases. For a given number of types, the value of a diversity index is maximized when all types are equally abundant. Diversity indices provide important information about rarity and commonness of species in a community. The ability to quantify diversity in this way is an important tool for biologists trying to understand community structure (Beals et al., 2000).

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There are various types of indices used to measure diversity of plants like diversity index (Shannon's index), evenness index (Pielou index), index of similarity and dissimilarity (Sorenson's index of similarity and dissimilarity), dominance index (Simpson's index) (Sharma and Kant, 2014).

Shannon Index is an index applied to biological systems and derived from a mathematical formula used in communication area by Shannon (Shannon, C. E. and W.Wiener, 1963). It's the most preferred index among the other diversity indices. In addition, H index also depends on many other factors such as climatic conditions, latitude, levels of environmental pollution (Thoa et al., 2013).

The Shannon index is an information statistic index, which assumes that all species are represented in a sample and that they are randomly sampled whereas the Simpson index is a dominance index because it gives more weight to common or dominant species. Simpson's index gives the probability of any two individual species taken at random from an infinitely large community of different species (Parsee et al., 2014).

Simpson's Diversity Index is a measure of diversity. In ecology, it is often used to quantify the biodiversity of a habitat. It is a measure of diversity which takes into account the number of species present, as well as the relative abundance of each species. As species richness and evenness increase, so diversity increases. The value of ***D*** ranges between 0 and 1. With this index, 0 represents infinite diversity and 1 represents no diversity (Parsee et al., 2014).

Several quantitative indices have been designed to provide information on the various aspects of plant diversity in landscapes. The various biodiversity indices (i.e., plant diversity and dominance in this context) can be used depending on the circumstances of the area under study and the incorporation of the nature of the diversity information required in monitoring changes with changes in land use (Kour and Sharma, 2014).

The main objective of the biodiversity assessment is to obtain data on the current state of knowledge or identify gaps in our knowledge and in the critical scientific issues. Data obtained are essential for identifying key issues for management goals. Several important features of biodiversity are generally measured by mathematical variables and indices. A biodiversity index is a summary statistic that measures the local number of sets consisting of various types of objects in a habitat. It is extremely important to measure biodiversity to monitor changes due to natural and anthropogenic pressure that tend to degrade natural

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e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 9 Issue 04
April 2022

systems and deplete diverse organisms. These diversity indices help us a lot in understanding the current status of the biodiversity of a particular place.

So, keeping all this in view, the present work has been undertaken with the following objectives:

- To study the frequency percent, density and abundance of tree and shrub species.
- To study the diversity and dominance of tree and shrub species using Shannon-wiener index and Simpson's index respectively.

REVIEW OF LITERATURE

Biodiversity forms an important aspect of our ecosystem. We see different forms of life surrounding us. It is very important for our survival even we cannot imagine our life without it. As Biodiversity is getting deteriorated and over exploited day by day, then there comes a great need to conserve it. Various studies have been conducted at different area of the world to provide some solution to this issue. So, literature survey from various parts of India and world has been done and given as below:

Saxena and Singh (1982) conducted a phytosociological analysis of woody species in forest communities of Kumaun Himalayas. A total of 14 sites were selected for quantitative study. 5 forest types were investigated i.e. *Pinus roxburghii, mixed, Quercus leucotricophora, Quercus lanuginose and Quercus floribunda*. A randomly placed quadrats each of size 10m×10m, were plotted for the quantitative analysis of vegetational data for abundance, density, frequency, IVI, Shannon and Simpson index. The dominant tree species was *Pinus roxburghii* and *Lantena camara* was the dominant shrub. The mixed forest had the greatest tree diversity.

Singh et al., (1995) analysed woody vegetation of Corbett National Park, India of 29 forest stands. Quadrats of size 10m×10m for trees, 5m×5m for shrubs were selected. The data on tree vegetation were quantitatively assessed for abundance, density, frequency, IVI, Shannon-wiener and Simpson's index. The most dominant tree species was *Shorea robusta*. Sapling and seedling species diversities showed negative relation with total tree basal area.

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e-ISSN: 2348-6848
p-ISSN: 2348-795X
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Ganesh et al., (1996) assessed the plant biodiversity at mid- elevation evergreen forest of Kalakad- Mundanthurai Tiger Reserve, Western Ghats, India using Transect method. 5 separate transects were laid and 10 plots of 10m×10m were established along three 1km transects at intervals of 100m for Frequency, density, IVI, stem density, basal area and species diversity index. 173 woody plant species from 58 families were recorded. *Cullenia Agalaia Palaquium* was dominant species. Stem density and basal area was 363.67 sq. m and 42.03 sq. m per hectare respectively.

Parthasarathy and Karthikeyan (1997) assessed the plant biodiversity of two 1-hectare plots of tropical dry evergreen forests at Kuzhanthaikuppam (KK) and Thirumanikkuzhi (TM) on the Coromandel Coast, South India using Shannon-index, Simpson's index, Hill diversity, Hierarchal richness index (HRI) and IVI. A total of 54 woody species belonging to 47 genera and 31 plant families were found. Out of these 54 species, only 2 tree species i.e. *Lannea coromandelica* and *Cassia fistula* are deciduous, rest are evergreen. Shannon index density was higher in TM than KK. Total of 9 species in KK and 8 species in TM were dominant and concluded that variations in plant diversity and abundance are related to site attributes and human impacts.
Eriksson and Jakobsson (1998) conducted a comparative study of 81 species of grassland in Sweden and examined the abundance and distribution of grassland species and concluded that seed size was positively related to plant size and either dispersal mode or life form. The annuals and biennials were less abundant than perennials.

Kadavul and Parthasarathy (1999) assessed the plant biodiversity and conservation of tropical evergreen forests in the Shervarayan hills of Eastern Ghats, India. Four 1-ha plots were established in Sanyasimalai (SM) reserve forest of Shervarayan hills, one plot (SM1) located close to mining and quarrying area, two other contiguous plots (SM2 and SM3) located in selective felling area and fourth (SM4) in a relatively undisturbed forest. Shannon index, Simpson index, Hill diversity, Hierarchial richness index, IVI was calculated and species area curve was plotted. A total of 80 woody tree species were found. Species richness was greatest in SM4 plot. Shannon index, Hill diversity and evenness index was greater in SM1 while Hierarchical richness index was greater in plots SM1 and SM3. 15 species were common to all 4 plots. Species richness and density decreased with increasing tree size classes in all 4 plots.

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Bhuyan et al., (2002) conducted a study on tree species richness, density, basal area, population structure, IVI, Shannon-index, Simpson's index and Similarity index in Undisturbed, mildly disturbed, moderately disturbed and highly disturbed strands of tropical wet evergreen forests of Arunachal Pradesh. The forest stands were based on disturbance index i.e., i) Undisturbed stand (0% disturbance index), ii) Mildly disturbed (20% disturbance index), iii) Moderately disturbed (40% disturbance index), and iv) Highly disturbed (70% disturbance index). In all 4 forest stands, vegetation is dominated by emergent strata of *Dipterocarpus marcocarpus* and *Shorea assamica* along with *Terminalia myriocarpa* and *Altingia excelsa*. 10 quadrats of 30m×30 were laid randomly in each forest stand. Shannon index ranged 0.7-2.02 and highest tree species was found in undisturbed stand and is because of human pressure on the resources of these forests.

Kunwar and Sharma (2004) conducted quantitative analysis of tree species in two community forests i.e., Amaldapani and Juphal, from Dopla district, mid-west Nepal and explained the variation in vegetation composition and diversity components of tree species in both forests. 20 plots, 10 in each community forest, each of size 10m×10m, were studied for Density, frequency, IVI, basal area and Shannon-wiener index and found that the slope of the species area curve declined as sample area increased. Further, concluded that maximum species richness, Shannon index as well as Simpson index was highest for Juphal forest community.

Padalia et al., (2004) analysed the pattern of tree species diversity of Andamon Islands, India using Random sampling method. During the year 1999-2000, 462 sample plots were laid out for covering the whole Andamon islands. The trees of more than 17cm circumference at breast height were identified and quantitatively assessed for density, abundance, frequency, IVI, Shannon's index, Simpson's index, Margalef index, Pielou index, Whittaker index, Sorenson's index. A total of 369 species belonging to 233 genera and 77 families were found. Densities of trees/hectare for evergreen and semi evergreen forests were 1137 and 1027 respectively. Out of 369 tree species, 41 were endemic and 28 were rare. *Dipterocarpus species* and *Myristica species* were dominant species in evergreen and semi evergreen forests. Among tree species, 11% were endemic and 7.7% were under rare category. Diversity indices and evenness indices

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e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 9 Issue 04
April 2022

decreases from natural to man- made vegetation types. *Euphorbiaceae* was the dominant family.

Kumar and Bhatt (2006) assessed the floristic diversity, dominance and abundance to frequency ratio of tree, IVI for sapling, seedling, shrub and herb species at two different forest sites of Foot hill region Garhwal Himalaya. 30 quadrats, 10m×10m for trees, 5m×5m for shrubs and saplings, 1m×1m for herbs and seedlings, were laid. In site I, a total of 33 tree species were recorded and *Lannea coromandelica* was dominant species while in site II, a total of 34 tree species were recorded and *Anogeissus latifolia* was dominant species. The range of diversity for tree layers was 4.580 to 4.643; for shrubs and saplings was4.695 to 5.021 and for herbs and seedlings was 4.962 to 4.986.

Kumar et al., (2006) analysed the tree species diversity and distribution pattern of tropical forests of Garo Hills, North East India. Random sampling was done to collect tree data within 1-ha belt transects. 35 belt transects were plotted. Frequency, Abundance, density, basal area, species richness index, diversity index and species evenness index were calculated. A total of 29,884 trees were found. The main vegetation of the region included primary forests (PFs), secondary forests (SFs), and Sal (*Shorea robusta*) plantations with 162,132 and 87 tree species respectively. The Shannon- Index of trees in PF was 4.27. Further, concluded that primary forests were more tree-rich and diverse than secondary forests or Sal plantations.

Bumrungsri et al., (2008) conducted quantitative analysis of plant community structure in abandoned rubber plantations on Kho-Hong hill, Southern Thailand for density, frequency, dominance. 31 plots were studied and found that 71% of native species were limited to 1-2 plots. Further, concluded that from a total native tree species density of 529 trees/hectare, the 4 species showed the highest density of 35.5-54.8 trees/hectare while the density of rubber tree was 235.5 tree/hectare.

Ozcelik et al., (2008) studied the tree species diversity and its relationship to stand parameters and geomorphology features in the Eastern Black sea region forests of Turkey. 26 sample plots were taken and were located at an elevation of 1100m-1900m above the sea level. Shannon index, Simpson index and correlation values were calculated. The value of Shannon index and Simpson index varied from 0.339-1.096

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e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 9 Issue 04
April 2022

and 0.179-0.665 respectively. The relationship between the tree species diversity and stand parameters was loose with a correlation coefficient between 0.02 and 0.70.

Pitchairamu et al., (2008) conducted a quantitative analysis of tropical dry deciduous forest in Piranmalai forest, Eastern Ghats, Tamil Nadu, India. 6 sites of 0.1 hectare were studied. These include Nehru Park (N.P), Foot Hill (F.H), Vannar Iruppu (V.I), Alagu Chokkan (A.C), Dhargha Area (D.A), and Veerappan Koil (V.K). The index of dominance, species richness, evenness index was calculated. A total of 16 tree species recorded in III, IV, V & VI strands and lowest in sites I & II. Dominance index was higher for site III whereas evenness index was greater in site II. Tree species richness was higher in VI strand.

Reddy and Ugle (2008) studied the tree species diversity and distribution patterns in tropical forest of Eastern Ghats, India and compared the tree parameters among 3 forests types i.e., Semi-evergreen, Moist deciduous, Savannah for 50 Plots, each of (20×20), were studied. Certain parameters were assessed like frequency %, density, abundance, IVI and Shannon index. Shannon index was highest in moist deciduous forest and tree species density was highest in Semi-evergreen forest.

Dash et al., (2009) conducted a study on the diversity and distribution pattern of tree species in Niyamgiri Hill ranges, Orissa, India. 100m×100m quadrat on each site was laid which was further divided into 20m×20m sub plots. Vegetation data was analysed for frequency, density, abundance, basal area, IVI, R/F ratio, Shannon's index, dominance index, Pielou index and species richness index. A total of 147 species were found, out of which, 13 species were under Euphorbiaceae family. *Shorea robusta* possess the highest IVI. The total density ranged from 650±25 to 754±41 per hectare. The density and basal area showed a positive correlation with altitude.

Akwee et al., (2010) conducted a comparative study of plant species composition of grasslands in Saiwa Swamp National Park and Kakamega Forest, Kenya. Kakamega forest is a tropical rainforest ecosystem while Saiwa National park is a riverine ecosystem and determined the plant species diversity of grasslands of both ecosystems. Species diversity was assessed by using inverse Simpson index. Density, frequency, IVI, and relative values were calculated and concluded that Kakamega forest grassland

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had the highest species diversity of 0.9 as compared to the Saiwa national park of species diversity of 0.8.

Gurarni et al., (2010) studied the plant biodiversity of pure *Pinus roxburghii* sarg forest and mixed pine- oak forest in Uttrakhand Himalaya. Species richness, density, IVI, frequency, relative density and Shannon-weinner index was calculated. The total tree density varied from 485-1000 trees/hectare. The diversity was lowest for the pine forest and highest for the pine-oak forest.

Gwali et al., (2010) studied the taxonomic diversity and abundance of tree species in Kasagala forest reserve, Uganda. Four major plots were studied, each of (100×100) 1-hectare. Abundance between the different vegetation strata was calculated using Bray-Curtis index. It was found that the species abundance curves showed that species were unevenly distributed. The high ranked species were more abundant than low ranked species. They concluded that the low taxonomic distinctness value for plot 3 is a result of anthropogenic influences.

Hayat et al., (2010) assessed the plant species diversity at Pasir Tengkorak forest reserve, Langkawi Island, Malaysia. A 1-ha plot was further divided into 100 quadrats of 10m×10m to study the species richness, species diversity, similarity, abundance, density, frequency, basal area and IVI. A total of 3414 individual tree species were recorded. *Swintonia species* was having highest IVI and abundance. Value of Simpson's index and Shannon's index were 0.96 and 5.61 respectively. Evenness index was low ranging from 0.2-0.3. Anacardiaceae and Mystaceae families were the most common species and showed highest basal area. Regeneration of 1-ha plot was considerably high and thus, concluded that the generation sampling will be degraded by human activities because this forest reserve is well known as recreational forest.

Sundararaj and Sharma (2010) conducted a study on the floral composition in 6 selected provenances of Sandal (Santalum album Linnaeus) of South India namely Bangalore, Thangli and Mandagadde in Karnataka, Javadis and Chitteri in Tamil Nadu and Marayoor in Kerala. Blocks of 50×50 feet in five replications were marked in all the selected provenances.76 floral species were found. Maximum floral composition was found in Javadis i.e. 28 species under 22 families. Density, frequency, abundance and

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e-ISSN: 2348-6848
p-ISSN: 2348-795X
Vol. 9 Issue 04
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A/F ratio was calculated and found that Sandal exhibits highest frequency, density, abundance, A/F ratio than other species. Further, concluded that there is continuous decline in our existing plant species due to developmental activities, increase of population and destruction of habitats.

Bargali et al., (2011) conducted a study on the diversity and regeneration status of tree species at Oak forests at Nainital catchment, Uttrakhand, India for two sites i.e. undisturbed open area and moderately disturbed open area. 10 plots of 10m×10m for trees, 5m×5m for shrubs and 1m×1m for herbs were plotted at both sites for Variables like frequency, abundance, density, IVI, Shannon index, Simpson index and index of similarity. Total species richness, diversity index as well as Simpson's index were higher in disturbed area. *Quercus floribunda* was dominant tree species whereas *Salvia officinialis* was dominant shrub. In protected area, a total of 17 plant species were recorded, out of which 4 were trees and 13 were shrubs and in undisturbed area, a total of 23 species were recorded with 5 trees and 18 shrubs. Further, concluded that Oak species of Kumaun Himalayan region have ability to regenerate when anthropogenic pressures are negligible.

Haripal and Sahoo (2011) examined three rice fields i.e., abandoned for 3 years, 5 years, 10 years, for community analysis. 10 quadrats, each of size, 1m×1m, 5m×5m, 10m×10m, were laid for herbs, shrubs, trees respectively. Frequency, Abundance, Density, IVI, Shannon's index, Correlation dominance index was calculated. The families like Poaceae, Cyperaceae, and Asteraceae were present in all the sites. It shows a strong correlation between species richness and diversity with the year of abandonment but shows a negative correlation between diversity and dominance.

Bharali et al., (2012) conducted quantitative analysis of three *Rhododendron* forests in West Siang district of Arunachal Pradesh, India (i.e., Shegong, Hanuman, and Yarlung). 40 quadrats were laid, for trees and shrubs (10m×10m) and for herbs (1m×1m) for Parameters like frequency, density, abundance, IVI, Shannon index, Simpson index, and species richness index.72 species were recorded from three study strands at different attitudes. *Rhododendron grande* was the dominant tree species. Simpson's index value was higher for Shegong region. Dominance index of shrub species have negative relation while Shannon index of tree and shrub species shows a

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positive relation with increasing altitude. Further, concluded that the lower altitude has more species richness and decreases with increase in altitude.

L.R and Tajinder (2012) compared the vegetation of chirpine forest and the regeneration status of these forests in Nowshera block, Rajouri, J&K. Whole area was divided into 5 sites (I-Chowki; II-Nowshera; III-Rajalkote and Gharan kaun; IV-Bhatta; V-Andhroth). 10 quadrats, 10m×10m, were laid for calculating frequency, density, abundance, IVI, Shannon's index and Simpson's index. A total of 58 plant species (23 were trees, 13 were shrubs, 22 were herbs) were recorded. The dominant species was *Chirpine.* Total tree and herb species were dominant in site II while shrub species were higher in site III. *Chirpine* forest showed greater variation in shrubs and herbs species richness. Site III and IV showed poor regeneration whereas in site II, regeneration status is good. Further, concluded that the *Mallotus philippensis* had good regeneration in all sites and *Pinus roxburghii* showed very poor regeneration in all the sites due to anthropogenic disturbances and site III and IV were more disturbed area due to colonisation of villages near forest area and entrances of Gujjar and Bakarwal tribes in these areas.

Kour and Sharma (2012) conducted the phytosociological analysis of tree species in sacred groves of Vijaypur block, Samba (j&k). 30 plots, each of (10×10) sq. m, were studied. Various parameters like frequency, density, abundance, IVI; Shannon-weinner index was calculated. *Eucalyptus* was having maximum IVI and highest density while *Morus alba* was having lowest density. The value for Shannon index was 2.62.

Pant and Samant (2012) assessed the diversity and regeneration status of tree species in Khokhan wildlife sanctuary, north western Himalaya. Sites were selected on assessable aspects along transects between 1640-2400m. 10 randomly placed 10m×10m quadrats were laid for studying the Basal area, IVI, abundance, density, and Shannon-Wienner index. 17 forest communities were identified and total 28 tree species were recorded. The tree species richness was highest in *Cedrus deodara*. Species diversity index ranged from 0.74-2.66. Of the 17 forest tree communities, 8 showed maximum regeneration of the dominant species. Further, concluded that heavy grazing is responsible for habitat degradation and poor regeneration.

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e-ISSN: 2348-6848
p-ISSN: 2348-795X
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Skinder and Pandit (2012) analysed the impact of biotic interferences on Yousmarg forest ecosystem, Kashmir. For trees, 10 quadrats of 10m×10m and for shrubs, 20 quadrats of 5m×5m, were laid for various parameters like abundance, frequency, density, Shannon index, Simpson's index and IVI. 29 species of plants were collected, among which, 24 were herbs, 2 were shrubs and 3 were trees and found that 10 species were absent in grazing area as compared to protected area. Value of frequency, density and abundance decrease from protected site to degrade area. The density and abundance of trees, shrubs at degraded site are more than the protected area.

Singh and Rawat (2012) analysed the tree species diversity in different Oak (*Quercus Spp*.) dominated forests in Garhwal Himalaya, India. 10 sample transect plots were taken; at an interval of 200m.Total 287 circular plots were laid in 3 oak forests i.e. *Q. Leucotrichophora, Q. Floribunda* and *Q. Semecarpifolia* for frequency, density, basal area, IVI, Shannon index and Pielou's evenness index. A total of 54 tree species were found. Lauraceae was dominant family in *Q. Leucotrichophora* and *Q. Floribunda* while Eriaceae was dominant in *Q. Semecarpifolia*. Further, concluded that regenerating individuals were higher in *Q. Floribunda* and *Q. Leucotrichophora* forests because of mesic conditions but density *in Q. Semecarpifolia* forsts is a matter of concern and needs some protection from grazing in the early stage of plant growth.

Shaheen and Shinwari (2012) assessed the phytodiversity and endemic richness of Karambar lake, Hindukush Himalayas. Line transect method was used to collect the vegetation data. A total of 24 transects, 10m each, were laid at 6 sites along the periphery of the lake for calculating density, frequency, abundance, cover, dominance, Shannon's index and Simpson's index. A total of 108 herbaceous species belonging to 27 families of vascular plants were found. Asteraceae was the predominant family and 4 different vegetation communities were identified at the 6 sites at Karambar lake.

Dar et al., (2013) assessed the community organisation, ecological distribution and diversity of trees in selected areas of Branwar forest of Kashmir Himalaya at different sites i.e., Site I, II, III, IV, the quadrats of size 10m×10m were studied for frequency, abundance, density, Simpson's dominance index and Shannon diversity index. Density was maximum for site IV and minimum for Site I and *Pinus wallichiana* had highest density. Shannon index was highest for site I and lowest for site IV.

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e-ISSN: 2348-6848
p-ISSN: 2348-795X
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Dutta and Devi (2013) conducted quantitative analysis of plant diversity and community structure of tropical moist deciduous Sal (*Shorea robusta*) forests of Assam, Northeast India. Total of 50 quadrats for trees (10m×10m), 50 for shrubs (5m×5m) and 100 for herbs and climbers (1m×1m) were sampled. Basal area, density, IVI, Shannon index, Simpson's index, Pielou evenness index was calculated. A total of 89 plant species (34 tree species, 15 shrubs, 25 herbs and 15 climbers) were found. Overall, Poaceae was the dominant family. Value of Shannon's index ranges from 2.02-2.43 and Simpson's index indicate that the dominance of trees was higher than shrubs and herbs. *Shorea robusta* had highest IVI and stand density of tree species was 422 individuals per hectare.

Gupta and Sharma (2013) conducted a study on the sacred groves from ecological and floristic point of view in Rajouri district of J&K using Random sampling quadrat method. 75 plant species were enumerated from the sacred groves which include 48 tree species. Frequency, abundance, density were calculated. Further found that apart from religious purposes, these groves are used for different purposes like fuel, medicine, food, fodder and recreational purposes. These groves are shrinking in size and number due to civilization in remote areas, agricultural practices, monsoon failure, low rainfall, education and literacy brought to tribal people.

Hussain et al., (2013) conducted a quantitative assessment of wild and cultivated olive in J&K at 25 plots, each of size 10m×10m for some statistical attributes like relative frequency, relative density, relative abundance and IVI. Sampling was restricted to dense population of olive. *Olea* species was most abundant and widely distributed in 23 plots. *Olea cuspidate* communities were dominant. These species are being cleared because of human settlement pressure.

Ngo and Hoischer (2013) calculated the abundance of five rare tree species in forests of limestone hills of northern Vietnam. Out of these 5, 3 are largely restricted to limestone hills and regarded as specialists while other 2 species were more widely distributed. Various variables like density, Shannon- Index, species richness were studied and found that densities of these species were relatively low and the density of 3 specialist species tended to increase from lower to upper slope positions. Further,

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e-ISSN: 2348-6848
p-ISSN: 2348-795X
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concluded that these specialist species play an important role in stabilization of steep slopes.

N.L. et al., (2013) conducted a study on floristic and diversity trend of regeneration in a quartz dominated quarry impacted site in parts of Umuoke, Nigeria. A 1-ha plot, sub divided into five quadrat sampling plots of 100m×20m each, was plotted. Parameters like frequency, abundance, Shannon's index, IVI and A/F ratio were calculated. Total of 64 plant species were recorded. Poaceae had the highest species diversity in terms of richness while Spermacoce verticillata had maximum diversity in terms of evenness. Further, concluded that the area is dominated by herbaceous regenerating species that could result in the establishment of a diverse natural forest and this quartz dominated quarry site, over times has the potential in turning into diverse heterogeneous natural forest vegetation again.

Parejiya et al., (2013) analysed vegetation at Bandiyabedi forest in Gujarat for 4 forest sites i.e. site 1, 2, 3 and 4. 25 plots, each of 10m×10m size, were laid to study like density, abundance, frequency, IVI, basal cover, Shannon index, Simpson's index and Sorenson's similarity index and found that at site1, only 1 species i.e. *Acacia senegal* was found. At site2, 3 and 4, *Acacia senegal*, *Acacia senegal*, *Butea monosperma* had maximum value of density and IVI respectively. Simpson's index value as well as Shannon's index ranged from 0.181-0.233 and 0.626-0.736 respectively and found *A.senegal* the dominant tree species. Further, concluded that the values of diversity as well as dominance index don't fall in the range of values reported for tropical forest and this low value was because of human activity which leads to easy degradation of forest and vulnerable to desertification.

Sharma and Raina (2013) analysed the composition structure and diversity of tree species along an elevation gradient in Jammu province of North western Himalayas, J&K, India. 13 community groups were characterised by different dominants in tree layer were distinguished. A total of 750 plots, each of 20m×20m, were laid for quantitative analysis of tree vegetation for calculating species richness, density, species diversity, Shannon index, Simpson index. Highest IVI was found by *Rhododendron campanulayum* for alpine scrub. Maximum value of species richness and Margalef's index was recorded for northern dry mixed deciduous forests. Maximum density was

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recorded for *Cedrus deodara*. Shannon index vary between 2.023-2.992. Simpson's index was recorded highest for northern dry mixed deciduous forests. Further, concluded that the pattern of plant diversity as observed by the values of species richness and diversity show a decreasing trend from lower to higher altitudes.

Thoa et al., (2013) assessed the biodiversity indices and utilisation of edible wild plants of Cham Island in Quang Nam province, Vietnam. Shannon index, Simpson index, abundance and frequency have been calculated. Total of 20 plots, each 5m×5m, surveyed and 43 plant species were recorded. The value of Shannon index ranged from 0.46- 1.94. Further, this study provides solution for the conservation, development and planning sustainable use of biodiversity resources.

Bhatt et al., (2014) observed the annual changes in pytosociological characters of *Picrorhiza Kurroa* Royle ex Benth. (Family- Scrophulariaceae) in high altitudinal regions of Kumaun Himalaya, Uttrakhand. The surveys were made for three successive years i.e. 2009-2012 to record annual variation in density, abundance and IVI for selected sites. Total 30 quadrats were laid and found that the Kumaun region of Uttrakhand has a rich floristic wealth. *P. Kurroa* Royle ex. Benth. is the species which was categorised as critically endangered by IUCN in 2009 and found that the phytosociological status of *P. Kurroa* Royle ex. Benth. varies annually to great extent and concluded that this species is getting diminished day by day at higher rate, probably due to climatic and seasonal changes, habitat fragmentation/destruction, over grazing, over expoitation in trade and lack of pollinator in the higher alpine region.

Kour and Sharma (2014) studied the distribution pattern and quantitative analysis of tree species in Ramgarh block, Samba (J&K). 30 plots, each of 1 hectare, were studied for Frequency, abundance, IVI, and Shannon index was calculated. It was found that the *Mangifera indica* was the most frequent and abundant tree species while *Bauhinia purpurae* the least. The maximum IVI was for *Mangifera indica*. The value for Shannon index was 2.41 for tree species.

Kumar and Sharma (2014) assessed the tree and shrub diversity in forest and agricultural land use classes of Mehari watershed of Doongi block in Rajouri, J&K. 25 plots, each of 10m×10m and 5m×5m for trees and shrubs respectively, were laid and a

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e-ISSN: 2348-6848
p-ISSN: 2348-795X
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total of 7 tree species and 5 shrub species, out of which *Pinus roxburghii* was dominant in case of trees while *Carissa opaca* in case of shrubs. The Shannon index for trees and shrubs was 1.231 and 0.285 respectively.

Majumdar and Datta (2014) conducted a quantitative vegetation inventory in Trishna wildlife sanctuary of Tripura. 25 belt transects, 500m×10m, used to record diversity. Frequency, Abundance, Density, basal area, IVI, Shannon-Wieners' index, Simpson's dominance index, Evenness index were calculated. The population of each species was grouped by number of individuals as Predominant (>50), Dominant (25 to <50), Common (10 to <25), Rare (2 to <10) and Very rare (<2). Overall, 289 species belonging to 158 genera and 64 families were recorded. The mean value for Shannon and Simpson index were 3.23 and 0.12 respectively and mean Density was 875.92 per hectare. The Predominant group had highest density and IVI value.

Rabha (2014) conducted a study on the structure and species composition of undisturbed and disturbed secondary Sal forests of Goalpara district, western Assam, India. A total of five 0.1 hectare quadrats were randomly laid for density, basal area, IVI, Shannon's index, Simpson's index and disturbance index and found that the species richness of pure Sal forests was generally very poor. Only 3 species belonging to three families were recorded in undisturbed forests while 18 species representing 14 families in disturbed Sal forests were found. *Shorea robusta* was dominant in both forests. Further, concluded that the anthropogenic disturbance influences the forest structure, function as well as services in both forest types.

Sarkar and Devi (2014) conducted a study on the quantitative analysis of diversity, population structure and regeneration status of tree species in tropical Semi-evergreen forests of Hollongapar Gibbon Wildlife scantuary, Assam. 100 quadrats(10m×10m) were laid for parameters like frequency, abundance, density, IVI, Shannon index, Simpson's index and basal area for 13 girth classes. Dominant tree species was *Vatica lanceaefolia*, a critically endangered species as given by IUCN red list (2014) of threatened species. Shannon index and Simpson index value was 3.55 and 0.05 respectively. Further, concluded that 24% tree species exhibit 'good' regeneration status, 8% showed 'poor' regeneration status and 17% of tree species were not regenerating at all.

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e-ISSN: 2348-6848
p-ISSN: 2348-795X
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Sharma and Devi (2014) conducted a study in 16 sacred groves, distributed over 9 villages of Bhalwal district of J&K for studying diversity of tree species in these sacred groves.45 plots of 10m×10m size were laid randomly within different sacred groves for calculating Frequency, abundance, density, IVI, Shannon index and basal area. Total area under 16 groves was recorded to be 10.02 hectare. Total 54 tree species belonging to 42 genera and 25 families were found. Fabaceae was the dominant family. IVI was highest for *Mangifera indica* and Shannon index found to be 3.43. Further, concluded that these sacred groves are facing various threats like construction activities, grazing of live stocks and modernisation.

Sharma and Kant (2014) conducted a study on vegetation structure, floristic composition and species diversity of woody plant communities in sub-tropical kandi Shiwaliks of J&K. The forests of kandi belt divided into three forest types i.e., Northern dry mixed deciduous forests, Himalayan sub-tropical scrub and Himalayan sub-tropical pine forest. 750 quadrats were laid to study the Margalef's index, Menhinik's index, Shannon index, Simpson's index and Peilou's index and found that *Senegella modesta* the most dominant species. A total of 112 specimens of woody plants (65 trees and 47 shrubs) were recorded. 4259 individuals from sub-tropical dry deciduous forest, 4065 in Himalayan sub-tropical scrub and 1994 in Himalayan sub-tropical pine forest were found. Maximum species richness and species diversity was found in sub-tropical dry deciduous forest.

Sharma and Kour (2014) conducted a study on tree diversity of two villages i.e., Chak Salarian and Chak Bagla of block Vijaypur, Samba (J&K). 20 plots, each of 1 hectare, were plotted for studying the tree diversity in agricultural field. 5 belts transect, each of 100m ×5m were laid randomly along the link roads and canal in both villages. The quantitative analysis of frequency, density, abundance, IVI, Shannon index have been done. A total of 17 tree species were identified. Chak Salarian had the highest value of IVI in agricultural fields while in case of Chak Bagla the highest IVI was found in *Mangifera indica* . *Dalbergia sissoo* was most dominant and Shannon index was greater in case of Chak Salarian.

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Shukla and Singh (2014) assessed the diversity of forest tree in the forest of Sarguja district of Chattisgarh, India. 67 quadrats of 15m×20m were laid to study the parameters like frequency, abundance and density. 79 deciduous forest tree species belonging to 32 different families were found. *Fabaceae* was the dominant family. *Butea monosperma* showed maximum frequency, density and abundance. Further, concluded that the present condition of forest is very poor and many species of this region have been disappeared and many other species are endangered and rare and is due to human pressure on timber wood, fuel wood and non-timber products.

Sultana et al., (2014) assessed the tree diversity of tropical dry deciduous forest in Rajasthan at 5 sites i.e. Jalmahal, Ramgarh,Nahargarh, Jhalana and Digota. 30 plots were laid and parameters like basal area, IVI, Abundance/frequency ratio, Sorenson's coefficient, similarity index were computed. A total of 23 families, 45 genera, 69 species and 3367 individuals of tree species were found. Digota site had maximum number of families and highest species richness. Shannon index and species heterogeneity were highest for Ramgarh site and concluded that the presence of exotic species *Prosopis juliflora* is notable at Jalmahal, Jhalana and could be a potential threat to native species.

MATERIALS AND MEHTODS

Study Area: Jammu and Kashmir constitutes northern most extremity of India having geographical area of 2, 22, 236 Km^2. The state is situated between 32˚ 27′ and 37˚30′ North latitude and 73˚26′ and 80˚30′ East longitude (Digest of the Forest Statistics, J&K, 2000). The state has been divided into three divisions i.e., Jammu, Kashmir and Ladakh. There are 22 districts in the state which include 8 recently formed districts. Jammu division has 10 districts in all and Samba is one of these districts.

Samba is located at 32.57°N 75.12°E. It has an average elevation of 384 metres (1259 feet). Samba town is situated on range of Shivalik hills alongside the National Highway 1-A / on the bank of river Basantar at a distance of 40 km from Jammu city. Samba district is adjacent to the International Border with Pakistan. About two third of the area of the tehsil Samba is *Kandi* and rain fed. The southern area downside of the national highway is irrigated through Ravi Tawi Irrigation Canal Network which contributes towards cultivation of major cereal crops and vegetable cultivation. Special focus has been assigned

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to these activities by the Government of India, Ministry of Water Resources through command area development department. The climate of the district is sub-tropical being hot and dry in summer and cold in winter. The temperature ranges between 6˚ C in winter and 45˚ C in summer (Sharma and Kour, 2014).

The main study area has been the Central University of Jammu Bagla, Rahya-Suchani. Bagla, Rahya is a Village in Vijaypur Tehsil in Samba District of Jammu & Kashmir State, India. It is located 10 KM towards west from District headquarters Samba and is 198 KM from State capital Srinagar, Jammu. Its geographical coordinates are 32° 37' 10" North, 74° 59' 50" East. Bagla Raya is surrounded by Samba Tehsil towards East, Purmandal Tehsil towards west, Bishnah Tehsil towards west, Ghagwal Tehsil towards East (Fig.1).

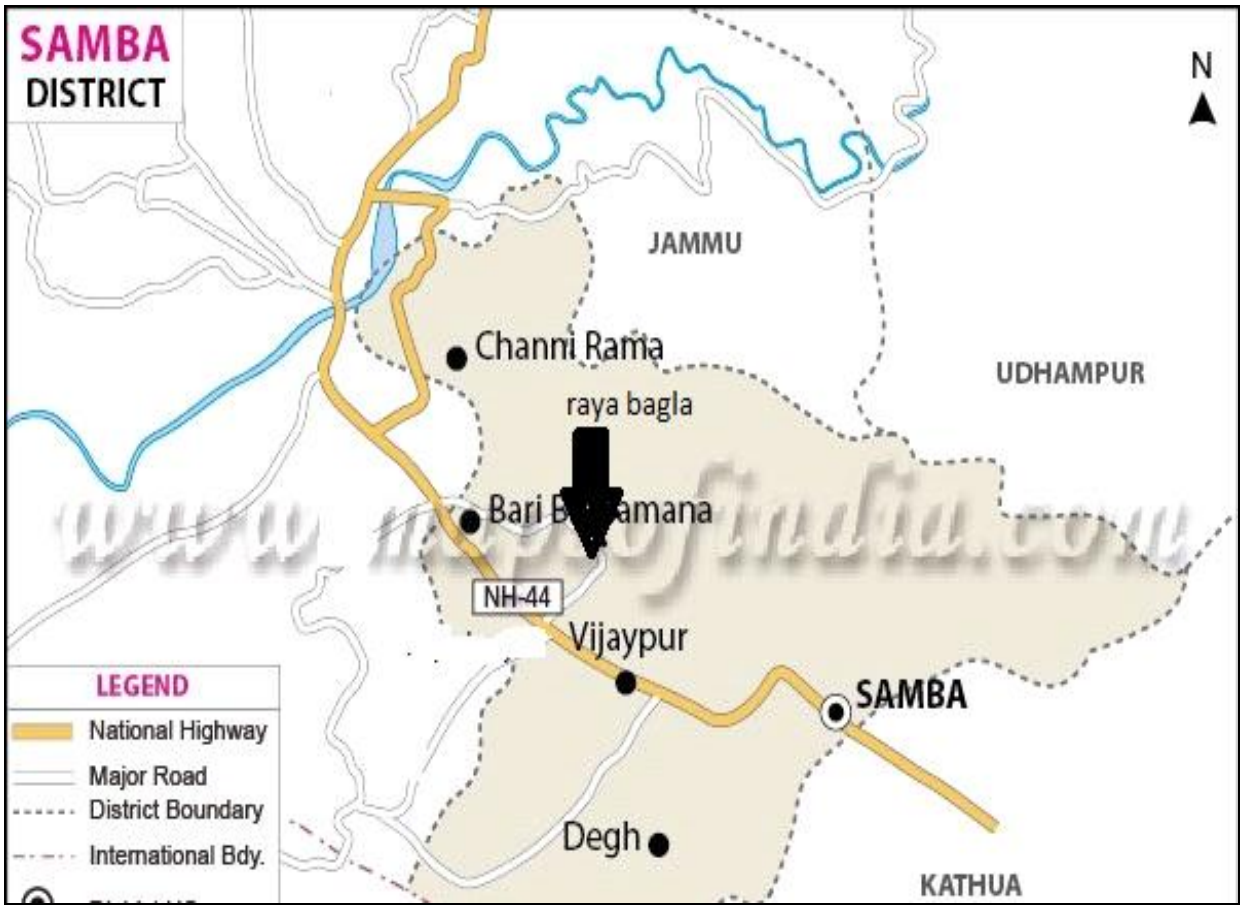

Fig 1: Map showing the University campus area and our study area

s ; of Central university of Jammu, Bagla, Samba, J&K. The study has been conducted from January 2015- May 2015. The quantitative analysis has been carried out using Quadrat sampling method. The size of the quadrats for shrubs and trees were 5m×5m and 10m×10m respectively. Total of 34 quadrats were plotted for studying the tree and shrub diversity at

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e-ISSN: 2348-6848
p-ISSN: 2348-795X
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the new university campus of Central University of Jammu. The plant species encountered during sampling were recorded and afterwards identified.

The quadrats have been selected randomly for the analysis of few parameters like Density, Abundance, and Frequency (Curtis and McIntosh, 1950). Certain indices have been calculated like Species diversity index i.e., Shannon-Wienner index and dominance index i.e., Simpson's index (Kumar and Sharma, 2014).

The diversity of the tree species as well as shrub species in the area have been assessed by recording all the tree species encountered during the field survey. All the species of plants (trees and shrubs) in all the quadrats were recorded and the above-mentioned parameters were calculated.

Quantitative Parameters:

The important quantitative parameters such as density, frequency, and abundance of tree species, shrubs and herbs species were determined as per Curtis and McIntosh (1950).

(a) Density:

Density is calculated by the following formula:

$$Density = \frac{Total\ number\ of\ individuals\ of\ a\ species\ in\ all\ the\ quadrats}{Total\ number\ of\ quadrats\ studied}$$

(b) Frequency (%):

It is calculated by the following formula:

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$$Frequency = \frac{Number\ of\ quadrats\ in\ which\ species\ occured}{Total\ number\ of\ quadrats\ studied} \times 100$$

(c) Abundance:

It is represented by the following formula:

$$Abundance = \frac{Total\ number\ of\ individuals\ of\ a\ species\ in\ all\ the\ quadrats}{Total\ number\ of\ quadrats\ in\ which\ the\ species\ occured}$$

Diversity indices:

(a) Shannon–Weaver index of diversity:

The formula for calculating the Shannon diversity index is

$$H' = -\Sigma\, pi\ ln\, pi$$

Where, H' = Shannon index of diversity

pi = the proportion of important value of the ith species (pi = ni / N)

ni is the important value index of ith species and

N is the important value index of all the species

This index is applied to biological systems and is most preferred biodiversity index. The index values are between 0.0-5.0. Results are generally between1.5-3.5 and rarely exceed 4.5. The value above 3 indicates the stable and balances habitat. The values below 1 indicate the degraded habitats.

(b) **Simpson index of Dominance:**

The equation used to calculate Simpson's index

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$$D = \sum(pi)^2$$

Where, D = Simpson index of dominance

pi = the proportion of important value of the ith species (pi = ni / N)

ni is the important value index of ith species and

N is the important value index of all the species.

As D increases, diversity decreases and Simpson's index therefore usually expressed as 1 – D or 1/ D.

RESULTS AND DISCUSSION

The importance of plants can be seen from many aspects and in terms of services they deliver. Plants are not just confined to forests but exist outside the forests also. Plants outside forests are of significant importance and perform a number of ecological, economic and socio-cultural functions. Plants are important in every facet of life, be it the restoration of degraded land or enhancing the immediate surroundings (Sharma and Kour., 2014).

All the species that were encountered during field survey have been listed in the Table 1 and Table 2. A total of 29 plant species have been found. Out of these 29 species, 17 were trees species and 12 were shrubs species. The quantitative parameters like density, frequency and abundance have been calculated. Diversity index and Simpson's index of the tree and shrub species have also been estimated for the study area.

Mallotus philippensis (Sinduria) have been the most dominant species among trees which have been followed by *Dalbergia sisoo* (Sheshum)while *Mangifera indica* (Aam), *Acacia Nilotica (*Kikar) *and Premna latifolia* (Gandila) were the least dominant tree species. Also, *Mallotus philipensis* (Sinduria) were the most abundant tree species while *Embilica officinalis* (Amla), *Ficus palmate* (Pkodia), *Mangifera indica* (Aam), *Acacia nilotica (*Kikar) and *Premna latifolia* (Gandila) were the least abundant species. *Mallotus philippensis* (Sinduria) also having the highest frequency (%) have been shown in Table 1.

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e-ISSN: 2348-6848
p-ISSN: 2348-795X
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Mallotus philippensis (Sinduria) have been found to have highest density (2.97 trees /m^2), highest abundance (4.81) as well as highest frequency (61.76%) which have been followed by *Dalbergia sisoo* (Sheshum) having density (0.97 trees /m^2), *Acacia catechu* (Khair) having abundance (3.56) and *Dalbergia sissoo (*Sheshum) having frequency (32.35%). The Shannon- Wienner index, also called as species diversity index, have been 2.15 in case of tree species and the Dominance index i.e., Simpson's index has been found to be 0.17 (Table 1).

Among shrubs, *Murraya koenigii* (Curry patta) have been the dominant species followed by *Adhatoda vasica (*Barainkar) while *Ageratium conozoides* (Pudina jarhi) and *Achyranthes aspera (*Purkanda) were the least dominant shrub species. Also, *Murraya koenigii* (Curry patta) have been the most abundant shrub species while *Ageratium conozoides* (Pudina jarhi) and *Achyranthes aspera (*Purkanda) were the least abundant shrub species. *Murraya koenigii* (Curry patta) were also having highest frequency (%).

Also, it has been observed that the *Murraya koenigii* (Curry patta) having highest density (22.32 shrubs/m^2), abundance (22.32) and frequency (100%) which have been followed by the *Adhatoda vasica (*Barainkar) having density (20.82 shrubs/m^2), abundance (21.45) and frequency (97.06%). Simpson's index has been found to be 0.35 while that of Shannon-Wienner index have been calculated to be 1.32 in case of shrub species (Table 2).

Abundances have been classified as suggested by Dagar et al., (1991) and according to that classification the results have been interpreted as: in case of trees, no species were found to be very abundant and frequent but according to this classification species namely: *Ficus palmate* (Pkodia), *Mangifera indica* (Aam), *Acacia nilotica* (Kikar) and *Premna latifolia* (Gandila) have been found to be very rare tree species while in case of shrubs, *Murraya koenigii* (Curry patta) and *Adhatoda vasica* (Barainkar) have been found to be very abundant species while *Bambusa multiplex* (Bamboo), *Flacourtia indica (*Kakoya), *Achyranthes aspera* (Purkanda), *Datura innoxia* (Datura) and *Ageratium conozoides* (Pudina Jarhi) have been found to be rare species among shrubs (table 3)

As value of D increases, the diversity decreases. The results of the present study also lie in this range. Thus, it can be concluded that D value of both the tree and shrubs species is closer to 0, hence represents infinite diversity.

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Mallotus philippensis (Sinduria) have been the most dominant tree species in the study area because of the conditions favouring its growth. It is generally a perennial shrub or small tree found in tropical and subtropical region which is mostly grown at an altitude of 0–1600m at a mean annual temperature of 16–28°C. The annual rainfall required for the growth of *Mallotus philippensis* is 800–2000mm. This will grow mostly in a wide range of soil types, including infertile soils, limestone, acid, and rocky land. (http://www.hindawi.com/journals/bmri/2014/213973/). The Samba region is also a subtropical region having altitude of 384m and average temperature ranges from 6˚C-47˚C and supports rocky and sandy soil. (http://samba.gov.in/district/aboutsamba.html). That's why it is abundantly available in this particular area.

Murraya koenigii (Curry patta) have been found to be the dominant Shrub species in the study area. This plant generally grows with an optimum temperature requirement of 26-37˚C and grows in any type of soil but give good results in sandy soil (http://agrifarming.in/curry-leaves-farming) which have been the set conditions for the district Samba of J&K. Hence, it dominates because of the favourable climatic as well as soil conditions. The results of the present study are in accordance with some other study of that area (Sharma and Kour., 2014; Kumar and Sharma., 2014; Kour and Sharma., 2012).

There is continuous decline in our existing plant species due to developmental activities, increase of population and destruction of habitats and its fragmentation. Therefore, the efforts are required all over the globe for the conservation of existing natural or artificial habitats, is the only method for survival of biodiversity (Sundraraj and Sharma., 2010).

TABLE 1: Quantitative details for tree species of Bagla, Samba, J&K

S. NO.	SPECIES NAME (TREES)	COMMON NAMES	NO. OF SPECIES	DENSITY	ABUNDANCE	FREQUENCY (%)
1)	*Acacia catechu*	Khair	32	0.94	3.56	26.47

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2)	*Senegalia modesta*	Flahai	31	0.91	3.1	29.41
3)	*Albizzia lebeck*	Sareen	5	0.15	1.25	11.76
4)	*Butea monosperma*	Palash	8	0.24	2.0	11.76
5)	*Cassia fistula*	Amaltas	15	0.44	2.14	20.59
6)	*Dalbergia sisoo*	Sheshum	33	0.97	3.0	32.35
7)	*Diospyros cordifolia*	Rajain	6	0.18	1.5	11.76
8)	*Embilica officinalis*	Amla	2	0.06	1.0	5.88
9)	*Premna latifolia*	Gandila	1	0.03	1.0	2.94
10)	*Mallotus philippensis*	Sinduria	101	2.97	4.81	61.76
11)	*Mangifera indica*	Aam	1	0.03	1.0	2.94
12)	*Ficus palmata*	Pkodia	5	0.15	1.0	14.71
13	*Pinus*	Chir	9	0.26	2.25	11.76
14)	*Acacia nilotica*	Kikar	1	0.03	1.0	2.94
15)	*Syzygium cumini*	Jamun	6	0.18	1.2	14.71
16)	*Grewia tilifolia*	Taman	8	0.24	1.33	17.65
17)	*Ziziphus mauritiana*	Ber	23	0.68	2.56	26.47
			∑N= 287			

SHANNON-WIENNER INDEX = 2.15

SIMPSON'S INDEX = 0.17

TABLE 2: Quantitative details for shrubs species of Bagla, Samba, J&K

S. NO.	SPECIES NAME (SHRUBS)	COMMON NAMES	NO. OF SPECIES	DENSITY	ABUNDANCE	FREQUENCY (%)
1)	*Ipomoea fistulosa*	Aak	25	0.74	12.5	5.88
2)	*Adhatoda vasica*	Barainkar	708	20.82	21.45	97.06
3)	*Bambusa multiplex*	Bamboo	15	0.44	3.0	14.71
4)	*Chenopodium album*	Baathu	15	0.44	15.0	2.94

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5)	*Datura innoxia*	Datura	2	0.06	2.0	2.94
6)	*Carissa spinosa*	Garna	123	3.62	5.32	67.65
7)	*Flacourtia indica*	Kakoya	30	0.88	2.5	35.29
8)	*Lantena camara*	Fuljarhi	72	2.12	4.5	47.06
9)	*Maytenus royleanus*	Lei	14	0.41	4.67	8.82
10)	*Murraya koenigii*	Curry patta	759	22.32	22.32	100
11)	*Achyranthes aspera*	Purkanda	1	0.03	1.0	2.94
12)	*Ageratium conezoides*	Pudina jarhi	1	0.03	1.0	2.94
			∑N= 1765			

SHANNON- WIENNER INDEX = 1.32

SIMPSON'S INDEX= 0.35

Table 3: Classification of abundances given by Dagar et al., (1991)

> 25	**D**	**Dominant**
15-25	**Va**	**Very abundant**
10-15	**A**	**Abundant**
6-10	**F**	**Frequent**
3-6	**O**	**Occasional**
1-3	**R**	**Rare**
< 1	**Vr**	**Very rare**

CONCLUSION

Among all biological resources, trees appear to have received more attention in almost all international conventions probably because of adage that says "when the last tree dies, the last man also dies" (Beals et al., 2000), which signifies strong dependency of humans on trees. The main driving force behind the disturbance and degradation of the plants occurs due to human activities. The increasing human interference has changed the structural and

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functional pattern of the landscape and has influenced the biodiversity significantly (Sinha and Sharma., 2006).

The present study have been conducted at the Campus of Central University of Jammu, Bagla, Samba, J&K. Quadrat method have been used to calculate various parameters like Density, Abundance, Frequency, Shannon's index, Simpson's index. The quantitative characters with reference to density, diversity and frequency distribution could well act as indicators of anthropogenic disturbances that are affecting the various forest types and such studies would help in understanding the threats that are being faced by the forests and would help in deriving conservation policies (Reddy and Ugle, 2008).

A total of 34 quadrats have been plotted and total of 29 plant species have been found during the survey. Out of these 29 species, 17 were tree species while 12 were shrubs species. In the present study, it has been found that *Mallotus philippensis* (Sinduria) were the most dominant species among trees followed by *Dalbergia sisoo* (Sheshum) while *Mangifera indica (*Aam), *Acacia nilotica* (Kikar) *and Premna latifolia (*Gandila) were least dominant tree species. Also, *Mallotus philipensis* (Sinduria) were the most abundant tree species while *Embilica officinalis* (Amla), *Ficus palmata* (Pkodia), *Mangifera indica* (Aam), *Acacia Nilotica (*Kikar) *and Premna latifolia (*Gandila) were the least abundant species. *Mallotus philippensis* (Sinduria) were also having the highest frequency (%) followed by *Dalbergia sisoo* (Sheshum), *Senegalia modesta* (Flahai), *Acacia catechu* (Khair).

Among shrubs, *Murraya koenigii* (Curry Patta) were the dominant species followed by *Adhatoda vasica* (Barainkar) while *Ageratium conozoides* (Pudina jarhi) and *Achyranthes aspera* (Purkanda) were the least dominant shrub species. Also, *Murraya koenigii* (Curry Patta) were the most abundant shrub species while *Ageratium conozoides* (Pudina jarhi) and *Achyranthes aspera* (Purkanda) were the least abundant shrub species. *Murraya koenigii* (Curry Patta) also having highest frequency (%) followed by *Adhatoda vasica* (Barainkar), *Carissa spinosa* (Garna), *Lantana camara* (Fuljarhi).

Also, the Shannon- Wienner index for tree and shrub species is 2.15 and 1.32 respectively. Shannon Index value generally lies between 1.5 and 3.5 and rarely greater than 4. The Shannon's Index increases as both richness and the evenness of the area increases. Thus,

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e-ISSN: 2348-6848
p-ISSN: 2348-795X
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from our study results it can be concluded that there is a moderate diversity, neither stable nor degraded.

The dominance index for trees as well as for shrub species is found to be 0.17 and 0.35 respectively. The value of the Simpson's index (D) generally ranged between 0-1, where 0 represents infinite diversity and 1 represents no diversity. That is, the bigger the value of D, the lower the diversity. Since D is a measure of dominance, so as D increases, diversity decreases (Parsee et al., 2014). Since the result of the D of the present study is closer to 0 which means that the diversity of the study area is quite good.

Biodiversity of an area is generally being affected due to:

- Developmental activities
- Overexploitation
- Overgrazing
- Increase in population
- Destruction of habitats
- Clearance of agricultural land
- Economic interest
- Industrialisation and Urbanisation
- Climate change

Anthropogenic disturbances play an important role in change, loss or maintenance of plant biodiversity and more recent phenomenon of climate change will also be responsible for the change in species composition and other ecosystem activities (Ram et al., 2005). Biodiversity is essential for human survival and economic well-being and for the ecosystem function and stability.

Most Ecologists are convinced that species diversity is important for the stability and proper functioning of ecosystems (Schlapfer et al., 1999), however, with increasing disturbance in the forests the plant species diversity, richness and evenness are significantly reduced (Dar and Kaul., 1987).

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Biodiversity protection and maintenance is an important issue, which should be integrated into forest management plans or models applied to the management of natural resources. (Ozcelik et al., 2008).

Several alternatives are there to improve the biodiversity of an area. Now–a-days, the practice of cutting trees ruthlessly is common and there is no penalty for cutting down of those trees. This can be compensated by planting more trees so that the net balance of biodiversity can be maintained. On the basis of the study various measures can be adopted to improve the status of plants in the study area and following efforts can help in maintaining and improving the biodiversity of an area.

- Awareness Programmes among the local people
- Need for increased legal protection
- Well-designed management practices
- Proper conservation measures
- Afforestation
- Sustainable harvesting
- By strengthening the agro-forestry system, agri-silviculture practices
- Planting indigenous trees in the wasteland such as along the road, canals and community lands.
- Production of Sacred groves.

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e-ISSN: 2348-6848
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