Plant Diversity and Its Measurement: A Case Study of RPS College Campus, Balana, Mahendergarh, Haryana

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Abstract: ***Biodiversity provides us with food, medicine, and other resources. Many of the foods we eat, such as fruits, vegetables, and grains, come from wild plants. We also rely on wild animals for food, such as fish, meat, and eggs. Biodiversity also provides us with medicinal plants and other natural resources. Biodiversity helps to regulate the environment. Plants and animals play important roles in ecosystems, such as filtering water, pollinating crops, and controlling pests. Biodiversity helps to maintain the balance of these ecosystems and to protect us from environmental hazards. This can help to improve water quality for drinking, irrigation, and recreation. Biodiversity helps to reduce the risk of natural disasters. Diverse ecosystems are more resilient to natural disasters such as floods, droughts, and storms. This paper is intended to measure plant diversity on college campuses and determine the degree of diversity found there. This investigates the intricate dynamics of plant biodiversity, providing fresh viewpoints and trustworthy methods for assessing and analysing it. The loss of biodiversity is a serious threat to human well-being. It is important to take steps to protect biodiversity for future generations. For its conservation, it is necessary to understand its level thoroughly. For this, many methods of diversity measurement are used. In view of these facts, through this study we have measured the plant diversity in RPS Degree College, Balana, Mahendergarh campus. The Alpha diversity, which is the richness and evenness of individuals within a habitat unit, is showing greater species richness in Plot A compared to Plots B and C in surveyed part of RPS College campus. The Beta Diversity Index, which is the expression of unique species in two and more habitats is found 34 in Plots A & B, 29 in plot B & C and it is 33 in plot C & A. The Gama diversity across the all-surveyed Plots is 44. The community's diversity is evaluated with the Shannon-Wiener diversity index, which takes into consideration both the richness (number of distinct species) and the evenness of their abundances where the values of selected plots are 2.94, 0.393 and 0.897. This study sheds light on the intricate relationships among various plant species found in natural ecosystems. By enhancing our understanding of plant diversity patterns and their ecological implications, it highlights the vital role biodiversity plays in maintaining ecosystem resilience and functionality.***

Keywords: Plant Diversity, Alpha Index, Beta Index, Gama Index, Shannon-Wiener diversity index, College Campus

1. Introduction

A region's biodiversity is its ability to support a wide range of living things, including naturally existing or artificially altered biotic communities, assemblages of living things, and individual species. The amount (e.g., abundance, biomass, cover and rate) and structure of each of the following can be used to quantify biodiversity: genetic diversity, species identification and number, assemblages, biotic communities, and biotic processes. Any geographic scale, from micro sites and habitat patches to the entire biosphere, can be used for observation and measurement (DeLong, 1996). While the concept "biodiversity" is relatively new, biological diversity (as it relates to the number of species) is not. Its definition has been more reductionist within the past ten years. The number of species is arguably the most basic definition of biodiversity, devoid of context or specialization (Swingland, 2001). The diversity of living things, including species within species, species between species, and ecosystems; this can be found in all sources of living things, including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are a part (UNDP, 2011). The term "biological diversity" describes the range and diversity of living things as well as the ecological complexity in which they coexist. The quantity and relative frequency of distinct items can be used to define diversity. (Pullaiah, 2015).

Plants are an essential part of the world's animal habitats and are crucial to preserving the planet's fundamental environmental balance and ecological stability. Although a comprehensive list of all plant species worldwide has not yet been compiled, it is thought that there may be as many as 400,000 different types of vascular plants (GSPC, 2011). In general, biological diversity provides direct and indirect means of meeting human requirements. Prime woods provide a large portion of the world's needs for agriculture and pharmaceuticals, from creating hybrid seeds to creating herbal remedies. In addition to boosting agricultural productivity, biodiversity will aid in the development of disease-resistant cultivars (Pullaiah, 2015).

2. Measurements of Plant Biodiversity

Darwin most likely initiated the process of quantifying biodiversity when he registered 142 species in the meadow near his house in 1855. Raunkaier was the one who first recognized the significance of species relative abundance in evaluating biodiversity approximately a century ago (Magurran and McGill, 2011). Getting a quantitative assessment of biological variability that can be used to compare biological entities made up of distinct components over space or time is the fundamental principle behind a diversity index (Carlo, 1998). As per the "political" interpretation of biodiversity, these entities can be classified as gene pools, species communities, or landscapes, with the former being made up of genes, the latter of species, and environments. Diversity indices have, however, primarily been used in practice with regard to groups or collections of species or other taxonomic groupings. In such cases, species richness and evenness are widely acknowledged to be two distinct factors that add to the intuitive notion of diversity within a community. The overall number of species in the community is represented by species richness, however it should be noted that real species counts are typically impossible to measure. The concept of evenness describes how equally each member of the community is distributed among the many species (Peet, 1974). Evenness is the distribution of individuals across species. Considering species richness and species evenness as two distinct features of biological communities that together make up their variety makes sense (Heip, 1974). Sometimes, species richness is the only way to define biodiversity; nevertheless, relative species abundance is also a crucial factor in determining how common or uncommon a species is in a group (Tilman, 1993; Sasaki, 2011).

One can determine how many species are high (dominant species), medium, and very low numerous (rare species) in a society by looking at the relative abundance of species (Whittaker 1960). (Ellison, 2010) claims that (Jost's, 2007) suggestion to divide gamma into its alpha and beta components using numerical equivalents is the most significant theoretical advancement in biodiversity measurement since Whittaker's introduction of the idea of beta diversity in ecology. The partition theorem (Jost, 2007; Jost et al., 2011) presents the proposition, wherein alpha, gamma, and beta are stated as the effective number of species and communities, respectively. There are no issues if we merely express the alpha, beta, and gamma diversities as the number of species, or as species richness. However, as no two species are the same in terms of biomass or number of individuals, this only gives a partial picture of the actual situation. While it is accurate to refer to the measurements that take abundance into account as diversity indices, they are not always diversities (HalFFTER, 2013).

Among other diversity indices, the Shannon-Wiener Index is frequently used because it represents biodiversity, species variety, species richness, evenness, and other characteristics more accurately than other indices. Since there is no mean, median, or measure of variations for categorical data for the species, the measures of variability cannot be used to calculate Shannon's index of diversity (Das, 2021). When determining community diversity, Shannon's diversity index is frequently employed to show how shifts in community structure reflect the existence or absence of ecological forces (Wilhm and Dorris, 1966). The number of each species, its percentage to the total number of individuals, and the sum of the proportion times the natural log of the proportion for each species are used to construct the Shannon-Weiner Species Diversity Index. We next take the negative of the negative of this total because it is a negative number. The diversity of species increases with increasing number. Ideally, comparisons should be made between groups with similar sizes of individuals. The following is the formula:

$$H' = -\sum_{i=1}^{s} pi\ In\ pi$$

Where, **s** is the number of species, **pi** is the percentage of each species' individuals that belong to the **i^th^** species relative to the total number of individuals, and **H’** is the species diversity index (Kathleen, 2006).

Study Area

The sports field on the RPS Degree College campus, which is located at 28.28° North latitude and 76.04° East longitude, provided the data used in this study. It's an artificial grass football pitch that's oval in shape and has a 400-meter running track surrounding it (Fig. 01). The campus is situated on state highway- 24 in Balana village located at the base of the Aravali mountain range, eight miles from the Mahendergarh district. Delhi, Haryana, Rajasthan, and Gujarat are the four main states of India that are surrounded by the northwest mountain ranges known as the Aravalli hills, sometimes referred to as the "line of peaks." The oldest fold mountain range in India, the Aravali is even older than the Himalayan mountains, which adds to its historical and ecological significance. The flora and animals of the areas that surround the Aravali hills have benefited from them (Joshi, 2013). Mahendragarh district is in the southern part of Haryana and its geographical coordinates ranges from 27°47’50’’ N and 28°28’15’’ N latitude and between 75°53’40’’ E and 76°22’10’’ E longitude. The district displays the entire series of exposures from the Precambrian Delhi and Aravali mountains, which are made up of various igneous intrusives and quartzite, shales, phylites, schists, and other materials (Sanjay Kumar, 2011). Thematically, this area is primarily plain with sporadic, parallel Aravali range hills scattered throughout, ranging in elevation from 67 to 529 meters. The majority of the year is marked by high temperatures and a lack of moisture in the hot-tropical to sub-tropical climate of the region. Rainfall varies greatly from 240 to 650 mm, with an average of roughly 310 mm each year. The region's forest resources are deemed sufficient (Kuldeep Singh, 2012). The district's two main characteristics are its hot summers and its cold winters. For the most of the year, the climate is extremely hot, tropical to subtropical, with high temperatures and low moisture levels (Sucheta Yadav, 2019)

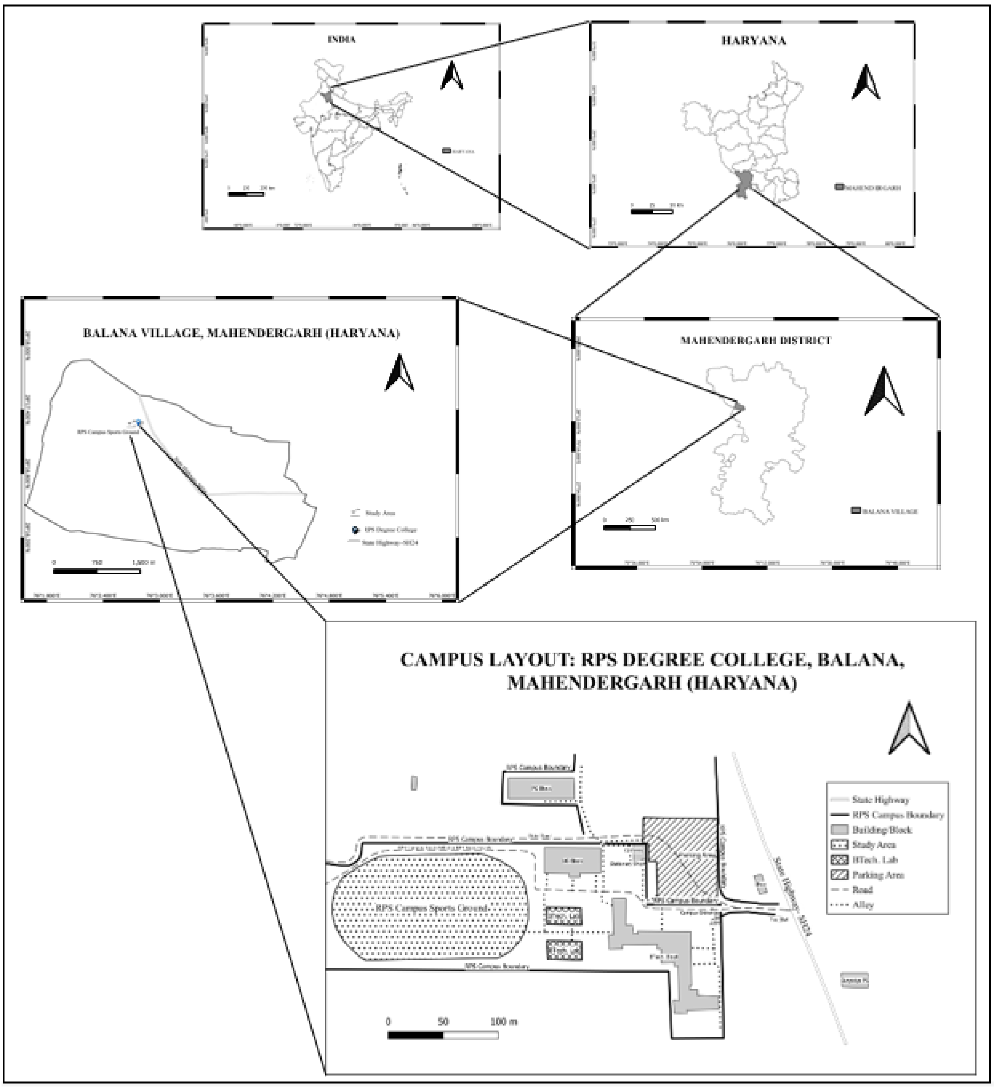

Figure 1: Study Area
Source: Prepared using shapefiles from Survey of India in QGIS software

Hypothesis
A good or a high biodiversity index of an ecosystem is indicating towards stable ecosystem.

Objectives
a) To count the plant species of the study area.
b) Preparing plant biodiversity index of surveyed area.

3. Data Source & Methodology

The study paper is based on primary data as the team of students collected this from the study area. Some necessary information about the biodiversity concept, index calculation, physiographic and climatic conditions of the study area etc., has been taken from various reports, books, articles, blogs etc.

- A Sample area is decided of 5×5 meters in the study field and manually counted all type of plants in that grid. After this, 3 grids are selected and manually counted plant species. In later phase, the data has been arranged in tabulation format.
- From the tabulation format, alpha (α) index, Beta (β) index and Gamma (γ) index are calculated.
- The Shannon Diversity Index is used to measure the diversity of species in a community.

"Shannon Diversity Index" Denoted as H, this index is calculated as:
$H = -\Sigma p_i \times \ln(p_i)$ where,
Σ = A Greek symbol that means "sum"
ln = Natural log
pi = The proportion of the entire community made up of species "i".
(<H) = high diversity of species.
(≥H) = Low diversity of species.
(H=0) = Only one species.

The Shannon Equitability Index is a way to measure the evenness of species in a community. The term "evenness" simply refers to how similar the abundances of different species are in the community.

Denoted as EH, this index is calculated as:
$E_H = H / \ln(S)$ where,
H= The Shannon Diversity Index
S= The total number of unique species.
This value ranges from 0 to 1 where 1 indicates complete evenness (Bobbitt, 2021).

4. Results & Discussion

This study of plant biodiversity analysis through various measurement methods has a comprehensive understanding of the ecological dynamics within the study area. consider three Plots labeled A, B, and C.

Alpha (α) diversity index

Alpha (α) diversity indices for A, B and C Plots show specific patterns in plant biodiversity. The A plot shows the highest diversity index of 23, indicating a rich and evenly distributed assortment of plant species. This suggests a rich and ecologically balanced habitat. In contrast, the B plot, with a diversity index of 18, displays a moderately diverse plant community, while the C plot records the lowest diversity index of 10, indicating a less diverse and potentially less stable ecosystem.

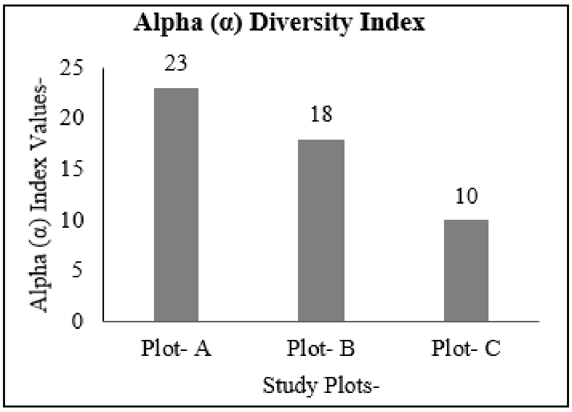

Figure 2: Alpha Diversity Indices Graph of various study plots

Source: Calculated from the collected data of various plants in study plots

The comparative analysis emphasizes gradations in biodiversity levels across Plots, allowing a nuanced understanding of ecological dynamics within the study area. The data implies that the A plot probably represents a deeper and healthier ecosystem than the B and C Plots. This information guides targeted conservation efforts and focuses attention on conserving and increasing biodiversity in areas where it is relatively low. Appropriate conservation strategies should be addressed, ensuring sustainable management of plant communities in the study area by exploring the underlying factors influencing this diversity pattern.

Table 1: Various plants species and their frequency in surveyed plots

		Surveyed Plots		
Species Code	Plant Species	Plot- A	Plot- B	Plot- C
T1	*Annual bluegrass*	11	×	×
T2	*Hairy fleabane*	9	×	×
T3	*Prickly*	1	×	×
T4	*Dan delion*	8	×	×
T5	*Rumexacetasella*	6	×	×
T6	*White goosefoot*	15	24	×
T7	*Spare gularia*	2	6	×
T8	*Phacelia ramosissima*	2	×	×
T9	*Thale cress*	7	×	×
T10	*Burr medic*	9	×	×
T11	*Medicago*	8	×	×
T12	*Digitaria*	5	×	×
T13	*Santa maria feverfew*	6	×	×
T14	*Pink purslane*	1	3	×
T15	*Brown patch*	183	×	×
T16	*False mermaid*	3	×	×
T17	*Tabacco*	1	×	×
T18	*Annual beardgrass*	3	×	×
T19	*Lepidium didymum*	1	×	×
T20	*Nut grass*	8	15	×
T21	*Rumex acetosella*	1	×	×
T22	*Crabgrass*	7	×	×
T23	*Badi dudhi grass*	2	×	×
T24	*Chromolaena odorata*	×	14	×
T25	*London rocket*	×	56	×
T26	*Wild flower*	×	8	×
T27	*Bur clover*	×	39	×
T28	*Common purslane*	×	13	×
T29	*Cynodon dactylon*	×	900	×
T30	Dalbergia sissoo	×	1	×
T31	*Ajuga australis*	×	35	×
T32	*Schefflera leucantha*	×	1	×
T33	*Lepidium oblongum*	×	2	×
T34	*Asthma plant*	×	3	×
T35	*Emilia sonchifolia*	×	4	×
T36	*Indian goosegrass*	×	2	×
T37	*Acacia confusa*	×	6	×
T38	*Common mullein*	×	2	×
T39	*Hawkweed*	×	×	27
T40	*Common sowthistle*	×	×	13
T41	*Medicago scutellata*	×	×	21
T42	*Rostraria cristata*	×	×	19
T43	*Axonopus cumpressus*	×	×	1
T44	*Salsola komarovii*	×	×	8
T45	*Visul matches*	×	×	9
T46	*Sesuvium verrucosum*	×	×	11
T47	*Gnaphalium purpureum*	×	×	2
T48	*Purple nutsedge*	×	×	1
Total		299	1134	112

Source: Summarized from the survey and calculation results

Beta (β) diversity index

Beta (β) diversity values for Plots AB, BC and CA provide important insights into plant biodiversity and distinctiveness among these habitats within the study area. The beta diversity index, which focuses on the number of species unique to each environment, is helpful in assessing the uniqueness of plant communities in nearby ecosystems (Bynum, 2022).

Table 2: Beta Diversity Index values of various study plots

Beta(β) Index	Plot- A	Plot- B	Plot-C
Plot- A	×	×	×
Plot- B	34	×	×
Plot-C	33	29	×

Source: Calculated from the collected data of various plants in study plots

In the case of AB, the beta diversity value of 34 indicates substantial dissimilarity in plant species between Plots A and B. This suggests the presence of 34 species that are either specific to A or B, or exhibit significantly different abundances in each plot. This high dissimilarity underlines the unique nature of the plant communities in these two habitats, highlighting the importance of both A and B to overall biodiversity in the region. Moving towards BC with a beta diversity value of 29, we see a moderate dissimilarity in plant species between Plots B and C. While not as obvious as the AB comparison, this value suggests that 29 species are either unique to B or C or have different distributions between the two Plots. This implies a level of shared species between B and C, indicating some similarity in the plant communities of these adjacent habitats. Finally, the CA beta diversity value of 33 shows substantial dissimilarity in plant species between Plots C and A, like the AB comparison. The presence of 33 unique species in C or A enhances the distinctive features of plant communities in these two Plots.

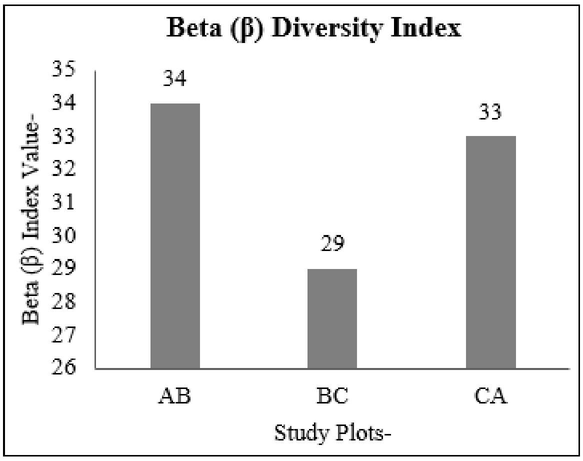

Figure 3: Beta Diversity Indices Graph of various study plots
Source: Calculated from the collected data of various plants in study plots

Comparative analysis of beta diversity values highlights varying degrees of dissimilarity between habitats, providing essential information for conservation efforts. These findings show that although some plant species are unique to specific Plots, others are somewhat similar. The need for targeted conservation strategies should be emphasized to preserve the ecological diversity of the study area and the diverse plant assemblage present in each location.

Gamma (γ) diversity index

The gamma diversity indices of a total of 48 plant species in the three Plots A, B and C of the study area is 44. This indicates the high level of overall biodiversity of this selected area. This diversity index reflects the collective diversity of plant species present in the selected Plots (Samanthi, 2021). This shows that the area supports a rich and diverse range of plant species in different habitats. Despite some variation in specific species composition between Plots, overall diversity remains consistently high.

This shows that each individual plot (A, B, and C) contributes significantly to the overall plant biodiversity of the region. Even though there may be some unique species specific to specific Plots, most plant species are shared or overlapping between these areas, collectively contributing to the high gamma diversity value. The uniformity of the gamma diversity index across all Plots highlights the importance of considering the biodiversity of the entire region when assessing conservation strategies. This shows that efforts aimed at preserving any one of these Plots can have a positive impact on the overall plant diversity of a large geographic area. In summary, the consistent gamma diversity index of 44 across all three Plots in the study area, which accounts for most total plant species, underlines a thriving and diverse plant community. This holistic conservation addresses the collective biodiversity of the different ecosystems within the region to ensure the conservation and sustainability of its rich plant life.

Shannon-Wiener diversity index

The Shannon–Wiener index is a key metric in ecology, assessing species diversity within a given habitat. It takes into account both species richness and evenness in the community. This index provides a single numerical value that reflects the diversity of a system (SWID, 2018).

Plant biodiversity studies conducted at Plot-A revealed that the Shannon Diversity Index is 2.94, indicating an appreciable level of biodiversity. With 23 distinct plant species, the community displays a diverse structure, and the even distribution of individuals among species contributes to ecological stability. The composition of the plant community, including species such as *Annual bluegrass*, *White goosefoot* and *Brown patch*, reflects the richness of the flora.

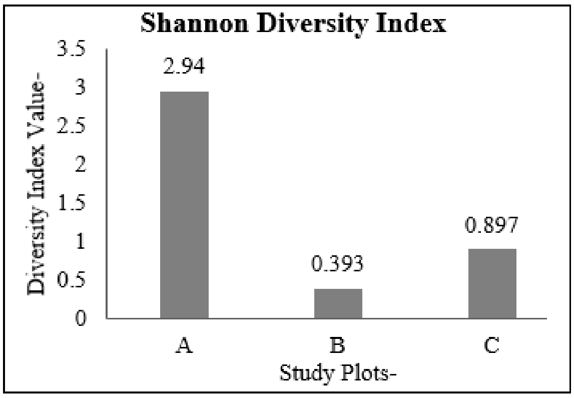

Figure 4: Shannon- Wiener Diversity Indices Graph of various study plots
Source: Calculated from the collected data of various plants in study plots

The plant community at Plot-B, which shows a diversity index of 0.393, consists of 19 different species with varying frequencies. In particular, *White goosefoot*, *Spare guleria* and *London rocket* exhibit high frequencies, potentially indicating levels of dominance within the ecosystem. In contrast, some species such as *Dalbergia sissoo*, *Schefflera leucantha* and *Indian goosegrass* appear less frequently, thereby contributing. The dominance of a few species may account for the overall uneven distribution, leading to the low diversity index observed.

Plant biodiversity assessment at Plot-C reveals a rich and diverse plant community, with index value of 0.897. Out of the species recorded, i.e., 10, *Hawkweed* dominates with high frequency followed by *Medicago scutellata*, *Rostraria cristata* and *Common sawthistle*. The relatively equal distribution of individuals among these species symbolizes ecological balance. The calculated diversity index reflects moderate to high levels of biodiversity, which is important for ecosystem resilience.

The different indices reflect the unique ecological characteristics at each Plot, emphasizing the importance of tailored conservation strategies. These findings provide valuable insights into the health, resilience and conservation needs of plant communities in the respective locations.

Equitability index

The Shannon equitability index, specifically measures the evenness or equitability of the distribution of species within a community (Adnan, 2020). Equitability indices of Plots A, B and C emerge a nuanced understanding of similarity in species distribution.

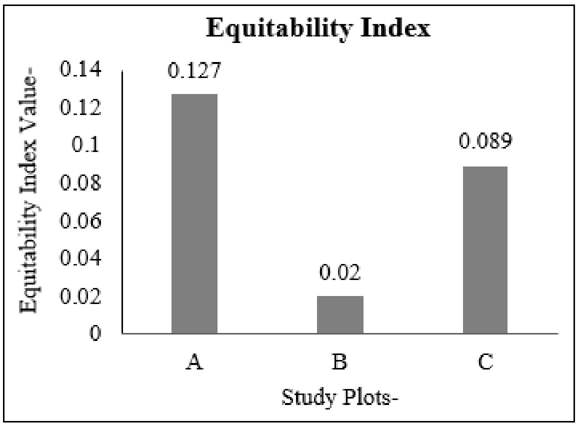

Figure 5: Equitability Indices Graph of various study plots
Source: Calculated from the collected data of various plants in study plots

Plot-A, with an evenness index of 0.127, reveals almost good evenness, indicating that some plant species may dominate, potentially affecting the ecological balance. Plot-B, characterized by an exceptionally low similarity index of 0.02, suggests a clear lack of evenness, indicating potential dominance of specific species that may influence community structure. In contrast, Plot-C exhibits a moderate similarity index of 0.089, suggesting a more balanced distribution of individuals among plant species than the other Plots.

While not exceptionally high, this index indicates greater equality, contributing to a more stable and resilient ecosystem. These findings underscore the unique ecological dynamics at each Plot, emphasizing the importance of considering both diversity and similarity to gain a comprehensive understanding of plant community structures and guide tailored conservation strategies. Further investigation of the factors influencing evenness at each Plot will provide important insights for effective ecosystem management and biodiversity conservation.

5. Conclusion

Insights have been provided into the adaptability of plant communities in semi-arid landscapes, highlighting the delicate balance between biodiversity and environmental factors. Conservation efforts must consider both the effects of external factors on native flora and synthetic environments to promote sustainable biodiversity in the face of dry environment challenges.

The semi-arid region, characterized by limited water availability and extreme temperature fluctuations, serves as a testing ground for the adaptability of plant species. The observed variations in plant diversity outcomes in synthetic lawns underline the importance of ecological resilience under adverse conditions. Some regions exhibited high diversity, indicating the existence of adaptive strategies developed by plant species to thrive in challenging arid environments.

In contrast, areas within synthetic lawns with low plant diversity indices raise questions about the influence of external factors. Soil composition, water availability and anthropogenic activities emerge as crucial determinants shaping plant communities. Semi-arid conditions enhanced by human-induced changes contribute to the observed variations in plant diversity. Human activities, in particular, brings about changes in land use patterns, affecting the composition and distribution of plant species.

The complex relationship between plant diversity and climatic conditions requires a nuanced understanding of environmental factors. While some plant species exhibit resilience and diversity, others may face challenges posed by aridity and human activities. The semi-arid landscape, although demanding, serves as an ecological canvas where plant communities paint adaptive pictures adapting to the canvas of climatic extremes.

Furthermore, synthetic lawn, designed for controlled environments, is not immune to the effects of its surroundings. Anthropogenic factors, including landscaping practices and soil management, contribute to the observed patterns in plant diversity. The synthetic environment, while providing a curated space, still reflects the broader ecological dynamics of the area.
As we consider the implications of these findings, recognition of the delicate balance between biodiversity and environmental factors becomes paramount. Conservation efforts in semi-arid regions must include not only the resilience of native vegetation, but also consider external influences. Sustainable landscaping strategies should incorporate drought-resistant species, promote native biodiversity and address the complex web of interactions between human activities and semi-arid landscapes.

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Appendix

Table 2: Shannon-Wiener diversity index calculations of various plant species in Plot- A

Species Code	Species Name	Frequency	Pi Value	In(Pi)	Pi×In(Pi)
T1	*Annual bluegrass*	11	0.036	-1.443	-0.051
T2	*Hairy fleabane*	9	0.03	-1.52	-0.045
T3	*Prickly*	1	0.003	-2.522	-0.007
T4	*Dan delion*	8	0.026	-1.585	-0.041
T5	*Rumexacetasella*	6	0.02	-1.698	-0.033
T6	*White goosefoot*	15	0.05	-1.301	-0.065

T7	*Spare gularia*	2	0.006	-2.221	-0.013
T8	*Phacelia ramosissima*	2	0.006	-2.221	-2.215
T9	*Thale cress*	7	0.023	-1.638	-0.037
T10	*Burr medic*	9	0.03	-1.52	-0.045
T11	*Medicago*	8	0.026	-1.585	-0.041
T12	*Digitaria*	5	0.016	-1.795	-0.028
T13	*Santa maria feverfew*	6	0.02	-1.698	-0.033
T14	*Pink purslane*	1	0.003	-2.522	-0.007
T15	*Brown patch*	183	0.612	-0.213	-0.13
T16	*False mermaid*	3	0.01	-2	-0.02
T17	*Tabacco*	1	0.003	-2.522	-0.007
T18	*Annual beardgrass*	3	0.01	-2	-0.02
T19	*Lepidium didymum*	1	0.003	-2.522	-0.007
T20	*Nut grass*	8	0.026	-1.585	-0.041
T21	*Rumex acetosella*	1	0.003	-2.522	-0.007
T22	*Crabgrass*	7	0.023	-1.638	-0.037
T23	*Badi dudhi grass*	2	0.006	-2.221	-0.01
Total		299	0.991	-42.492	-2.94
Diversity Index(H) :(-Σpi × ln(pi))		*Diversity Index(H) of Plot A: (-Σpi × ln(pi))*			2.94

Source: Summarized from the survey and calculation results

Table 3: Shannon-Wiener diversity index calculations of various plant species in Plot- B

Species Code	Species Name	Frequency	Pi Value	In(Pi)	Pi×In(Pi)
T6	*White goosefoot*	24	0.021	-1.677	-0.035
T7	*Spare gularia*	6	0.005	-2.301	-0.011
T14	*Pink purslane*	3	0.002	-2.698	-0.005
T20	*Nut grass*	15	0.013	-1.886	-0.024
T24	*Chromolaena odorata*	14	0.012	-1.92	-0.023
T25	*London rocket*	56	0.049	-1.309	-0.064
T26	*Wild flower*	8	0.007	-2.154	-0.015
T27	*Bur clover*	39	0.034	-1.468	-0.049
T28	*Common purslane*	13	0.011	-1.958	-0.021
T29	*Cynodon dactylon*	900	0.793	-0.1007	-0.07
T30	*Dalbergia sissoo*	1	0.0008	-3.096	-0.002
T31	*Ajuga australis*	35	0.0308	-1.511	-0.04
T32	*Schefflera leucantha*	1	0.0008	-3.096	-0.002
T33	*Lepidium oblongum*	2	0.001	-3	-0.003
T34	*Asthma plant*	3	0.002	-2.698	-0.005
T35	*Emilia sonchifolia*	4	0.003	-2.522	-0.007
T36	*Indian goosegrass*	2	0.001	-3	-0.003
T37	*Acacia confusa*	6	0.005	-2.301	-0.011
T38	*Common mullein*	2	0.001	-3	-0.003
Total		1134	0	-41.6957	-0.393
Diversity Index(H) :(-Σpi × ln(pi))		*Diversity Index(H) of Plot B: (-Σpi × ln(pi))*			0.393

Source: Summarized from the survey and calculation results

Table 4: Shannon-Wiener diversity index calculations of various plant species in Plot- C

Species Code	Species Name	Frequency	Pi Value	In(Pi)	Pi×In(Pi)
T39	*Hawkweed*	27	0.241	-0.617	-0.148
T40	*Common sowthistle*	13	0.116	-0.935	-0.174
T41	*Medicago scutellata*	21	0.187	-0.728	-0.136
T42	*Rostraria cristata*	19	0.169	-0.772	-0.13
T43	*Axonopus cumpressus*	1	0.008	-2.096	-0.023
T44	*Salsola komarovii*	8	0.071	-1.148	-0.081
T45	*Visul matches*	9	0.08	-1.096	-0.087
T46	*Sesuvium verrucosum*	11	0.98	-0.008	-0.007
T47	*Gnaphalium purpureum*	2	0.166	-0.77	-0.127
T48	*Purple nutsedge*	1	0.008	-2.096	0.016
Total		112	2.026	-10.266	-0.897
Diversity Index(H) :(-Σpi × ln(pi))		*Diversity Index(H) of Plot C: (-Σpi × ln(pi))*			0.897

Source: Summarized from the survey and calculation results

Figure 6: Images taken while gathering data
Source: Captured while gathering data in the study plots