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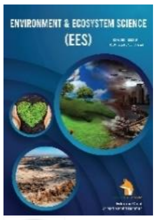

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RESEARCH ARTICLE

TREE CARBON STOCK ESTIMATION AND ITS RELATIONSHIP WITH SPECIES DIVERSITY (JAMUNA DADA COMMUNITY FOREST, MATATIRTHA KATHMANDU)

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ABSTRACT

Community forests play a critical role in global carbon sequestration, acting as a carbon sink amid increasing urbanization. Despite their ecological significance, mid-hill forests of Nepal like Jamuna Dada Community Forest located in Kathmandu, remain understudied regarding carbon stock, species diversity and their interrelationship. This study assessed the carbon stock (CS) and species diversity (SD) in the Jamuna Dada Community Forest while deriving their relationship through field survey, statistical tests and regression analysis. Twenty-seven circular plots covering 0.54 hectares were surveyed across the 108-hectare total forest area. Above-ground biomass was estimated using volume and wood density. Biomass was then converted to carbon stock using Biomass Expansion Factor (BEF) of 0.45. The carbon stock from the plots was then converted to total carbon stock of the forest. Species diversity was then quantified using Shannon-Weiner Index (H') and Simpson's Diversity Index (SDI) across the plots. An average carbon stock of 45.23 tonnes/ha, totaling 4,884.8 tonnes across the whole forest area was estimated. Species diversity varied significantly (H' = 0–1.65; SDI = 0–0.814), with *Syzygium cumini* (high wood density) correlating with higher CS. Statistical analyses like chi-square test (χ^2 = 2.08, p = 0.65), Fisher's exact test (p = 0.24), ordinal logistic regression (β = -0.18, p > 0.05), and Spearman Rank Correlation (ρ = 0.152, p = 0.450) showed no significant relationship between species diversity and carbon stock. These findings aligned with the mass ratio hypothesis, suggesting that functional traits of dominant species drive carbon storage rather than diversity alone. This study emphasizes the importance of species-specific management for optimizing carbon stock. These findings provide crucial baseline data for Jamuna Dada Community Forest and advocate for more integrated and science-based management practices.

KEYWORDS

Carbon Stock Estimation, Species Diversity, Community Forest, Forest Biodiversity Conservation, Climate Change Mitigation, Sustainable Forest Management

1. INTRODUCTION

Forests are fundamental components of the global carbon cycle, capturing and storing atmospheric carbon and also covering 31% of the Earth's surface area (FAO 2022). Forest ecosystems store about 80% of all aboveground and 40% of all belowground terrestrial organic carbon, making them crucial to maintaining the global carbon balance and mitigating climate change (IPCC 2001). They sequester 15-20% of annual human carbon emissions (Le Quéré et al., 2018; Case et al, 2021). 80% of Earth's biomass occurs in forests, holding more carbon in their biomass and soil than the atmosphere (Kindermann et al 2008; Pan et al 2013).

The total forested area of Nepal, including other wooded land was reported to be 44.74% (DFRS, 2015). Community forests in Nepal represent a significant portion of the country's forested area, with local communities managing these resources for both conservation and livelihood needs. Jamuna Dada Community Forest, located in Matatirtha, Kathmandu, represents a unique peri-urban forest ecosystem characterized by mixed deciduous and evergreen broadleaf composition, typical of mid-hills forests of Nepal. Despite its proximity to the industrial side of Kathmandu and potential for significant carbon sequestration, systematic assessment of this forest's carbon storage capacity and biodiversity patterns remains absent from scientific literature. The forest's composition includes *Alnus nepalensis*, *Schima wallichii*, *Castanopsis indica*, and *Pinus* species, creating a distinct ecological makeup representative of transitional mid-hill forest ecosystems.

Understanding carbon stock and species diversity in a community-managed forest is essential for optimizing both biodiversity conservation and climate mitigation benefits under participatory management regimes. According to a study diverse stands increase soil quality hence organic carbon content, but studies rarely mention a direct relation of carbon stock or content with diversity of species or tree biodiversity of the forest stands (Zuo et al., 2023). According to a study, Aboveground biomass (AGB) is the total mass of living vegetation above the soil, primarily in woody plants, while carbon stock is the total amount of carbon stored in the biomass (Masri and Xiao, 2024). To estimate AGB and carbon stock, both traditional and modern methods are applied according to site characteristics and resources. Some researcher mentions use of DBH and height as basic variables to calculate AGB traditionally, while modern methods like UAV photogrammetry are employed to enhance the accuracy of AGB estimation (Gaikadi and Kumar, 2023; Basyuni et al., 2025).

For measuring using AGB, methods like conversion using allometric equations to get carbon storage values or the use of BEF and wood density can be used. This estimate provides both the carbon sequestration potential of forests and baseline data for conservation strategies aimed at maintaining or enhancing carbon stocks. The relationship between species diversity and carbon storage remains theoretically contested. While some studies suggest positive correlations between biodiversity and ecosystem

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functioning, others support the mass ratio hypothesis, which emphasizes the importance of dominant species' functional traits over species richness in driving ecosystem processes.

This study addresses critical research gaps by: (1) quantifying above-ground carbon stock in a mid-hill community forest, (2) assessing species diversity patterns, and (3) investigating relationships between carbon storage and biodiversity. The findings will inform evidence-based forest management practices, support Nepal's climate policy development under international frameworks including REDD+ and the Paris Agreement, and contribute to theoretical understanding of diversity-carbon relationships in tropical montane forests.

2. METHODOLOGY

The methodology included a primary methodology for a field survey with the use of GIS applications, MS Excel, and R for analysis. Furthermore, relevant literature, books, reports, etc. were consulted as well.

2.1 Study Area

Jamuna Dada Community Forest is situated in Matathirtha, Chandragiri Municipality in western side of the Kathmandu Valley. Kathmandu, being an industrial and highly polluted area, the study forest has a high potential for Carbon storage. The study site is located approximately 5km from Kathmandu Metropolitan City. The total area of forest is 108 hectares, bordered by Matatirtha Temple in the North and Chandragiri Hills in Southwest which represents a unique periurban forest ecosystem. This north-facing forest predominantly consists of naturally occurring mixed deciduous and evergreen broadleaf species. Vegetation in the steeper slopes mainly includes species such as *Castanopsis indica*, *Pinus wallichiana*, *Pinus roxburghii*, *Alnus nepalensis*, and *Schima wallichii*. Soil characteristics vary significantly, ranging from clayey loam to sandy and silty clayey loam enriched with forest humus, sandy alluvial soil in streambeds, and shallow dry soil on ridge tops. This heterogeneity contributes to diverse vegetation and forest dynamics. The study site, being an urban forest, highlights its role in providing ecosystem services to the local communities; like air purification, carbon sequestration, and supporting biodiversity inbetween the increasing rate of loss of ecosystems in urban areas.

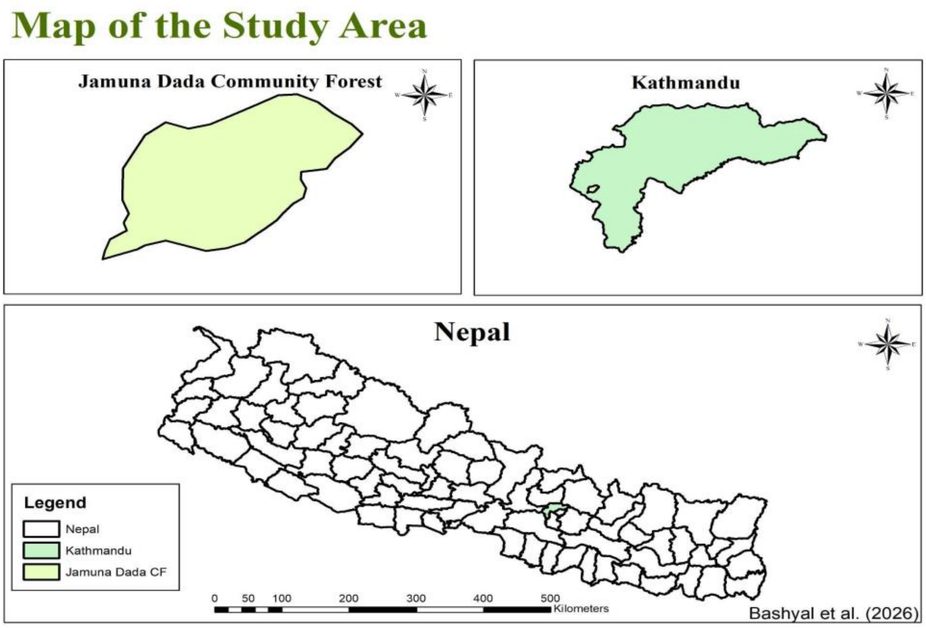

Figure 1: Map of the Study Area

During field sampling, data was critically collected by conducting a field inventory to capture representative data for the estimation of carbon stock and species diversity within the Jamuna Dada Community Forest. A simple random sampling was conducted in the forest.

2.2 Determine the Number of Plots

To determine the number of plots following steps were taken.

- *Sampling Intensity*: 0.5% of the total area (108 ha).
- Area to be sampled (ha) = 108 $\times 0.5/100 = 0.54ha$ (5400 m^2)
- *Plot Area* = πr^2 = $\pi(8)^2$ = $200m^2$
- *Number of Plots* = *Area to be sampled* / *Plot area* = 5400/ 200 = 27 Plots

2.3 Field Measurements

Simple stratified random sampling was used to cover all vegetation types in the community forest. The GPS points and elevation for each plot were noted. In the sample plots, using the measuring tape, circular plots of radius 8 meters for 27 plots were established across the forest. Trees with DBH > 10cm were only considered, and the rest were disregarded as seedlings or saplings. The DBH was measured using a diameter tape, and a clinometer was used to measure the height of the tree.

2.4 Carbon stock quantification

In the quantitative analysis, various parameters such as species diversity indices (Shannon-Weiner's and Simpson's diversity indices), above-ground biomass, and carbon stock were calculated. The relationship between species diversity and carbon stock was analyzed using the Chi-Square Test and Fisher's exact Test. Microsoft Excel was used for data entry, calculation, and preliminary analysis of recorded data. Species diversity indices, AGB, and Carbon Stock were calculated using standard formulas and equations. MS Excel was used to conduct a Statistical analysis of the relationship between species diversity and carbon stock.

2.5 Calculation of Aboveground biomass

The AGB was computed by estimating the biomass of the inventoried volume and then expanding the value to take into account the biomass of the other above-ground components (Brown et al., 1999).

AGB was obtained using the formula stated below;

AGB = Volume x Wood Density. (Brown et al., 1999). The wood density values were used from (Sharma and Pukala, 1990).

2.6 Carbon Stock Estimation

Carbon stock was calculated using a carbon fraction or Biomass Expansion Factor (BEF) which is 0.45 (Ureigho and Chukwurah, 2022).

Carbon stock = Biomass x 0.45. (Ureigho and Chukwurah, 2022)

Then, the average per hectare carbon stock for each plot was calculated using the sum of estimated carbon stock and dividing by the total plot area.

Average carbon stock (kg/ha) = Total Carbon stock of plots estimated/ total area of sample plots

Total carbon stock (kg/ha) was calculated by multiplying the average carbon stock per ha by the total forest area.

Total carbon stock (kg)= Average carbon stock (kg/ha) * total forest area (ha) (Total forest area=108 ha)

2.7 Plant diversity index

To measure species richness and evenness, the Shannon-Weiner Index was used, while to evaluate species dominance and the probability of encountering different species, Simpson's diversity index was used. These indices together gave a comprehensive picture of the plant diversity in the forest. Diversity was calculated from each plot, highlighting the most and least diverse plots, helping in the comparative study across the study area.

2.8 Shannon-Weiner's index (H′)

H′ is a widely used diversity index that is used to measure the species richness and evenness within an ecosystem. The higher the value of H', the higher the species diversity.

From each of the 27 circular plots, the total number of individuals per species was recorded, and the relative abundance (ρi) of each species was calculated.

The following formula is used to calculate the Shannon-Weiner's index of each plot:

$H' = -\sum (p_i \cdot \ln p_i)$

Where,

- H′= Shannon-weiner index
- ρi= proportion of individuals of species i relative to the total number of individuals
- ln= Natural logarithm with base e
- S= total number of species (richness)
- ∑= from species i to S

The value of H' ranges from 0 to Hmax, where Hmax differs in each plot with the difference of species richness.

2.9 Simpson's diversity index

Simpson's diversity index is a measure of biodiversity that accounts for both species richness and evenness. A lower SDI value signified greater diversity, while a higher value indicates dominance by fewer species (Sharashy, 2022). Simpson's Diversity Index (D) measures the probability that two individuals randomly selected from a sample will belong to the same species. It ranges from 0 (infinite diversity) to 1 (no diversity), indicating community diversity and species richness (Sharashy, 2022).

$SDI = 1 - \sum (n/N)^2$ (Simpson, 1949)

Where,

- n = no. of individuals of a specific species
- N = Total number of individuals in the sample
- ∑= Sum of the squared terms for all species

The value of SDI ranges from 0 to 1, where 0 represents infinite diversity, and 1 represents no diversity, which means the greater value of SDI represents lower diversity, having them in the inverse equation. That's why Simpson's Diversity Index is mostly expressed as its inverse (1/D) or complement (1-D). The value of the inverse version starts from 1, resulting in having higher diversity with higher value. Similarly, in the complement version, the higher the value, the higher its diversity, but its value ranges from 0 to 1 (Simpson, 1949).

This index also served as a parameter to compute the relationship between species diversity and carbon stock in the Jamuna Dada Community Forest.

2.10 Quantitative analysis

2.10.1 Chi-square test

The chi-square test is a nonparametric statistical tool used to analyze associations among categorical data (Valarmathi et al., 2024). This test was used to test the relationship between species diversity and carbon stock in forest plots. R was utilized to conduct a chi-square test for this research. The categorised division of both carbon stock and species diversity was made to conduct a chi-square test to test their relationships.

2.10.2 Fisher's exact test

Fisher's exact test is a statistical method used to determine the significance of associations between categorical variables in small sample sizes (Shan and Gerstenberger, 2017). Fisher's exact test was used to test the association between species diversity (SD) and carbon stock (CS) in forest plots. The test was chosen because the contingency table had small expected frequencies. The same 3*3 matrix table is used as it was used in the chi-square test.

2.10.3 Ordinal logistic regression

Ordinal logistic regression is a statistical method for studying ordinal response variables with three or more categories. It accommodates both categorical and continuous predictor variables, allowing researchers to model relationships effectively in scientific research contexts (Rifada et al., 2023).

- Both CS and SD were divided as ordered categorical variables with three levels (Low<Medium<High). This helps categorise and analyse the scattered data as discrete groups.
- This method provides more stability to low expected frequency, thus higher accuracy than traditional methods like the Chi-square test.

2.10.4 The Spearman Rank Correlation test

Spearman's rank correlation coefficient is a nonparametric (distribution-free) rank statistic proposed as a measure of the strength of the association between two variables (Hauke and Kossowski, 2011). The CS (tonnes/ha) and 1-D were assessed to see the correlation between them.

3. Results

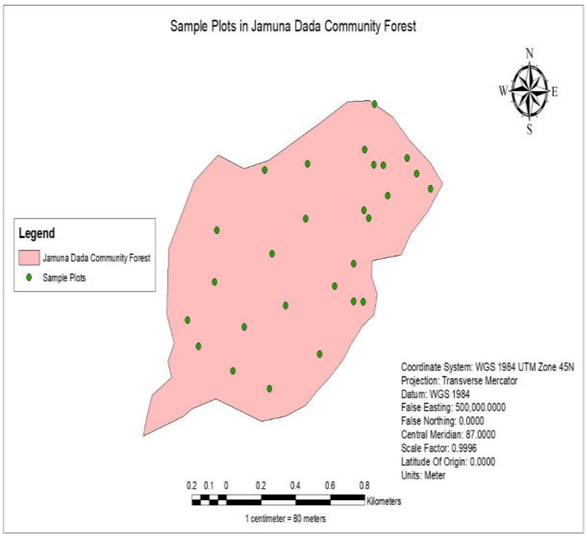

Figure 2: Sample plots in Jamunadada Community Forest

3.1 Forest plot Characters and Species Diversity

The plots of the study area were found to range from single-species plots to diverse multi-species plots. The number of individual trees ranged from 6 to 19 per plot, with an average of 10 trees per plot. Using the Simpson's diversity index (SDI), the species diversity ranging from 0 to 0.814 successfully shows the heterogeneity of the forest ecosystem. Plot 6 was identified as the most diverse, with the SDI = 0.186, while Plot 17 was the least diverse plot with the SDI = 1. Similarly, using the Shannon diversity index (H'), it revealed that the forest contains limited species evenness, as 20 out of 27 plots exhibited H' less than 1. Plot 6 was the most diverse plot with H'= 1.6535, while plot 17 revealed monoculture with H' = 0. This matches the Simpson diversity index. The dominant tree species recorded across the plots were:

- *Schima Wallichi* (Chilaune)
- *Pinus roxburghii* (Khote salla)
- *Pinus wallichiana* (Gobre salla)
- *Castanopsis indica* (Katus)
- *Alnus nepalensis* (Uttis)

The variation in species diversity was influenced by many ecological factors like altitude, soil fertility, and microclimatic conditions. Higher diversity in certain plots, such as Plot number 6 showed the highest species richness of 6 species recorded, including *Pinus roxburghii* (Khote salla), *Pinus wallichiana* (Gobre salla), *Castanopsis indica* (Katus), *Alnus nepalensis* (Uttis), and *Schima Wallichi* (Chilaune), and Katus in Miscellaneous), in the plot, while Plot 17 showed the lowest species richness of 1 species: *Alnus nepalensis* (Uttis).

Table 1: Shannon-weiner (H') and Simpson's Diversity(D) Index			
Plot No.	**(H')**	**D**	**1-D**
1	0.6365	0.554	0.4460
2	0.949	0.38	0.6200
3	0.6387	0.66	0.3400
4	0.8625	0.469	0.5310
5	1.039	0.339	0.6610
6	1.6535	0.186	0.8140
7	1.3185	0.274	0.7260
8	1.2168	0.337	0.6630
9	0.9151	0.395	0.6050
10	1.4808	0.257	0.7430
11	0.949	0.38	0.6200
12	0.9437	0.43	0.5700
13	1.039	0.375	0.6250
14	1.498	0.221	0.7790
15	1.0114	0.389	0.6110
16	0.6931	0.5	0.5000
17	0	1	0.0000
18	0.414	0.734	0.2660
19	0.6616	0.531	0.4690
20	0.3506	0.755	0.2450
21	0.3506	0.755	0.2450
22	0.6881	0.541	0.5490
23	1.3185	0.289	0.7110
24	1.2739	0.336	0.6640
25	0.6365	0.556	0.4440
26	0.4506	0.722	0.2780
27	0.5623	0.625	0.3750
Total	23.5513		14.1000

3.2 Forest tree carbon stock assessment

The total Carbon stock across 27 plots was 24.424 tons. The average CS per hectare was estimated to be 45.23 tons/hectare, while the total CS of Jamuna Dada CF was estimated to be 4884.8 tons. The variability in C-stock of forest plots showed differences in tree volume, aboveground biomass, and species composition. Plot 2 had the highest C-stock of 2.732 tons with a total tree volume of 8.542m^3 and AGB of 6071.262 kg containing 10 individual trees. Similarly, Plot 26, as calculated, had the lowest C-stock of 0.233 with a total tree volume of 0.7747 m^3 and an AGB of 518.488 kg.

Table 2: Total tree volume, AGB, CS in tons and CS (tonnes/ha) of each plot				
Plot No.	**Total tree volume**	**AGB**	**CS in tons**	**CS (tonnes/ha)**
1	7.819	5143.63	2.314	115.7
2	8.542	6071.262	2.732	136.6
3	8.419	5477.09	2.464	123.2
4	5.499	2895.896	1.303	65.15
5	3.167	1670.04	0.752	37.6
6	5.101	3332.77	1.499	74.95
7	2.672	1438.98	0.647	32.35
8	2.38	1279.748	0.575	28.75
9	3.1	1703.68	0.766	38.3
10	1.989	1072.46	0.482	24.1
11	1.567	890.292	0.401	20.05
12	2.897	1914.384	0.861	43.05

Table 2 (Cont): Total tree volume, AGB, CS in tons and CS (tonnes/ha) of each plot				
13	2.501	1630.72	0.733	36.65
14	3.659	2049.267	0.922	46.1
15	2.036	1335.833	0.601	30.05
16	3.284	1434.569	0.645	32.25
17	7.839	3057.119	1.375	68.75
18	3.06	1420.84	0.639	31.95
19	2.046	992.396	0.446	22.3
20	3.332	1338.697	0.602	30.1
21	1.769	725.618	0.326	16.3
22	1.219	835.251	0.375	18.75
23	1.696	1086.342	0.488	24.4
24	3.959	2496.363	1.123	56.15
25	1.758	1262.861	0.568	28.4
26	0.747	518.488	0.233	11.65
27	2.977	1226.72	0.552	27.6
Total	95.034	54301.316	24.424	1221.2

3.3 Relationship between species diversity and carbon stock

Three statistical tests(Chi-squared test, Fisher's Exact Test, and Ordinal Logistic regression) were conducted to examine the relationship between species diversity and carbon stock using a 3×3 categorical matrix (low, medium, high for both variables). The categorical divisions were made as: Lowest 33.3% as Low, Middle 33.3% as Medium, and Highest 33.3% as High. While the CS (tonnes/ha) and 1-D values of each plot were used in Spearman's Rank Correlation Test

3.4 Chi-Square Test

The test yielded a Chi-Square value of 2.0765, and p = 0.654 at 0.05 significance level. This result indicated no statistically significant relationship between species diversity and carbon stock.

3.5 Fisher's exact test

A p-value of 0.24, which is more than the level of significance 0.05. Thus, we failed to reject the null hypothesis and hence conclude there was no significant difference in carbon stock due to species diversity.

3.6 Ordinal logistic regression

The model fit was tested using Residual deviance (40.18- acceptable absolute fit), and AIC (48.18 - enables model comparison) (Akaike, 1974). Threshold validation between CS categories ($p<0.01$) confirms meaningful categorization. For the linear term (LSD), the coefficient value -0.1796 suggested a slight tendency for high species diversity plots to be associated with low carbon stock, but this effect was not statistically significant for t value=-0.1610 at $p>0.05$.

Similarly, for the Quadratic term (QSD), the effect was not statistically significant ($t = -0.491$, $p > 0.05$) for the coefficient -0.3794. Neither coefficient was statistically significant.

3.7 Spearman Rank Correlation test

The Spearman rank correlation performed via R with the stats package (version 4.3.1) showed that there is no statistically significant correlation between species abundance (diversity as determined based on the Simpson 1-D index) and carbon storage (0.152, p = 0.450). Although this weak positive relationship shows a possible trend toward greater carbon stocks being found in higher diversity plots, there was no statistically significant trend ($p > 0.05$). Our failure to reject the null hypothesis by obtaining a non-significant result (p-value = 0.450) showed that we cannot reject the null hypothesis of the absence of a monotonic relationship ($\tau = 0$). Hence, species diversity alone could not be a very good predictor of the carbon storage capacity of these forest plots.

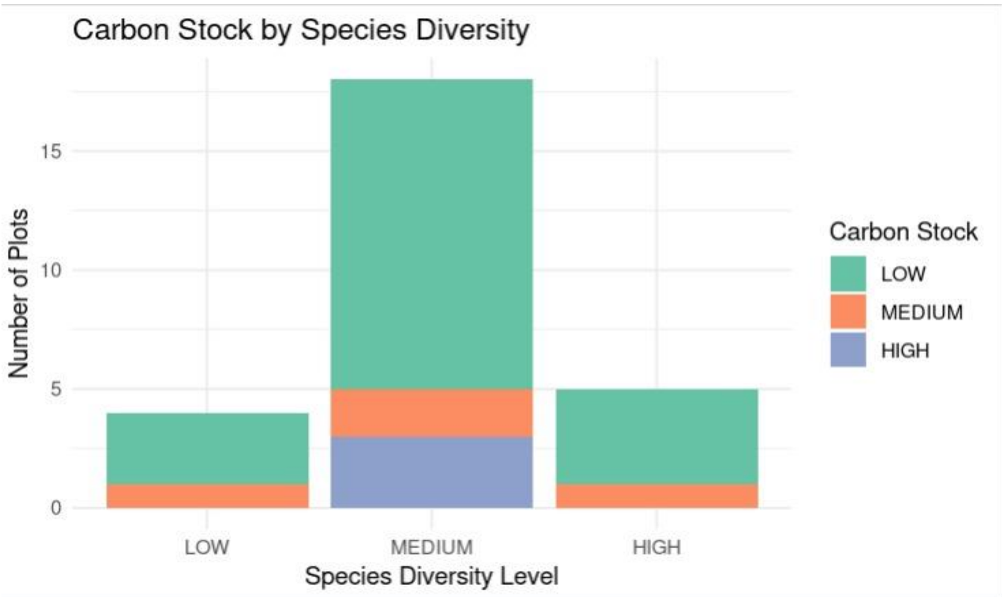

Figure 3: No. of plots count plotted as levels of Carbon stock in Species diversity levels

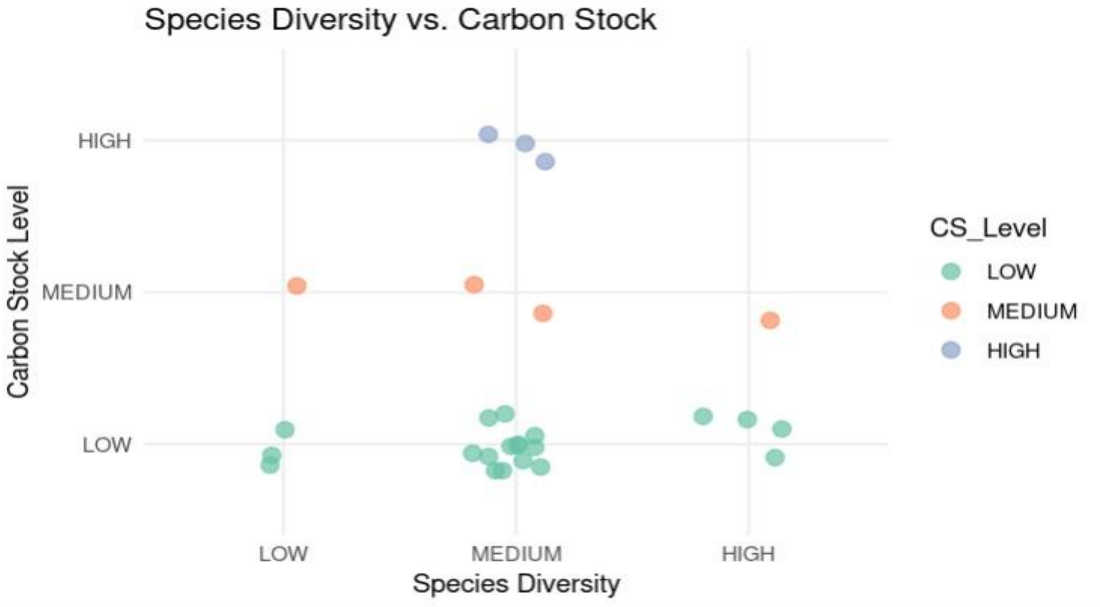

Figure 4: Plotting of plots in Carbon stock levels vs Species diversity level

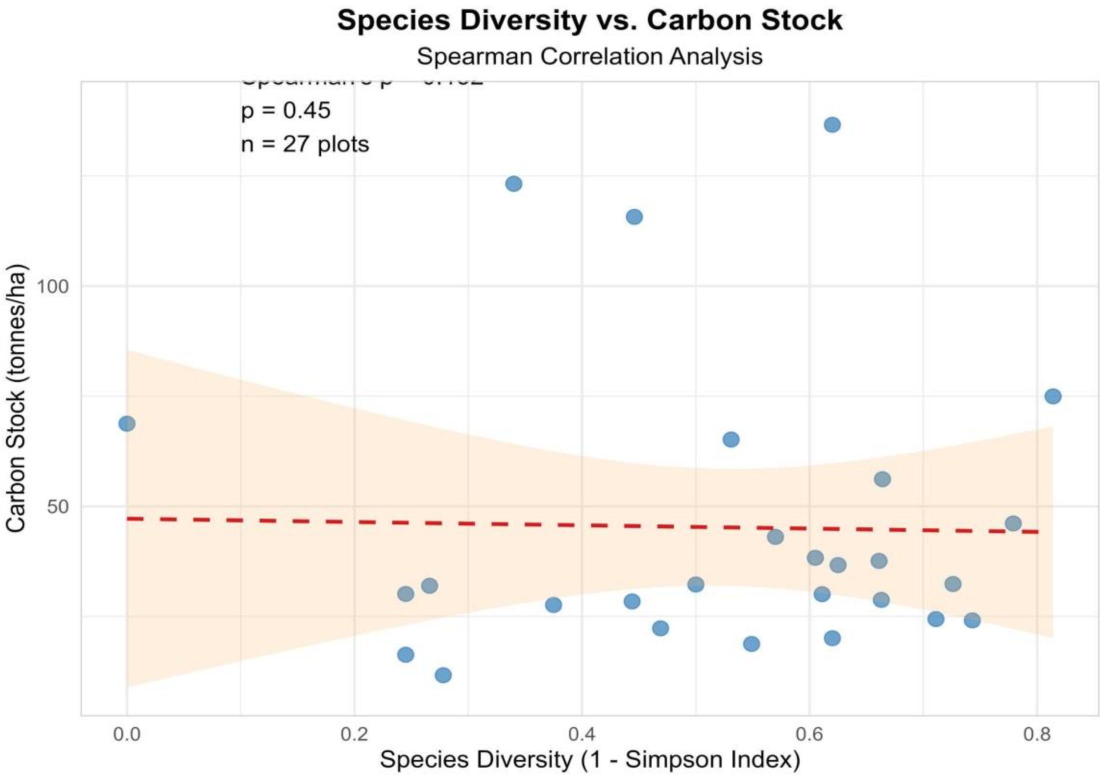

Figure 5: Visual representation of Spearman Coefficient Analysis of Species diversity and carbon stock

4. DISCUSSION

The observed species diversity patterns in Jamunadada Community Forest reflect the heterogeneous nature of mid-hill forest ecosystems in Nepal. The dominance of *Schima wallichii*, *Pinus* species, *Castanopsis indica*, and *Alnus nepalensis* is consistent with typical subtropical to temperate forest compositions in the region. The wide variation in diversity indices (SDI: 0-0.814; H': 0-1.6535) suggests significant microhabitat heterogeneity within the forest. The prevalence of low diversity plots (74% with H' < 1) may indicate past disturbance regimes, selective logging, or natural succession processes. Plot 17's monoculture of *Alnus nepalensis* likely represents either early successional stages or areas of specific site conditions favoring nitrogen-fixing species. The high diversity in Plot 6 suggests mature forest conditions with favorable microhabitat conditions supporting multiple species coexistence. The estimated carbon stock of 45.23 tons/hectare falls within the reported range for similar forest types in Nepal's mid-hills. The substantial variation in plot-level carbon stock (0.233-2.732 tons per 0.02 ha plot) reflects the influence of species composition, tree size distribution, and stand density rather than simply tree abundance. The high carbon stock in Plot 2, attributed to the presence of *Syzygium cumini* (Jamun), demonstrates the critical role of wood density in carbon storage calculations. Species with higher wood densities contribute disproportionately to carbon stocks, emphasizing the importance of species-specific biomass characteristics in forest carbon assessments. The consistent lack of a significant relationship between species diversity and carbon stock across multiple statistical approaches suggests that diversity per se is not a primary driver of carbon storage in this forest system. This finding contrasts with some theoretical expectations but aligns with several empirical studies in similar forest types. Carbon storage may be more influenced by functional traits (wood density, growth rates, maximum size) than species number alone (Kershaw and Mallik, 2013). The dominance of high-biomass species regardless of plot diversity levels supports this interpretation. Also, factors like succession status and local environmental factors may play a role in the relationships seen. The forest's successional status may override diversity effects. Young or disturbed stands may prioritize rapid growth over diversity-mediated ecosystem functions. Plot-scale relationships may not capture landscape-level diversity benefits for carbon storage, which may emerge at larger spatial scales. Local environmental factors (soil, topography, microclimate) may be stronger determinants of both diversity and carbon stock than their interactive effects. The absence of a strong diversity-carbon relationship suggests that forest management strategies focusing solely on species diversity may not optimize carbon storage. Instead, management should consider:

- Species composition and functional traits
- Stand structure and tree size distribution
- Site-specific environmental conditions
- Long-term succession dynamics

However, the multiple ecosystem services provided by diverse forests beyond carbon storage warrant continued emphasis on maintaining species diversity for overall forest health and resilience.

5. Conclusion

This study provides the first comprehensive assessment of carbon stock and species diversity relationships in Jamuna Dada Community Forest. The distribution of plots with species evenness, richness, and diversity suggests that the forest is in a transitional stage between pioneer dominance and climax communities. While some plots contain multiple species, their abundance distribution remains uneven.

This challenges conventional assumptions regarding the relationship between species richness and ecosystem function, as even rich plots show dominance of some particular taxa. The concentration of some moderate density plot ($1< H'< 1.5$) in specific areas may even reflect the need for more environmental gradients like the soil or microclimate data, but due to the lack of such data in this study, it prevents definitive conclusions about these factors.

A remarkable variability can be observed among plots for carbon stock, ranging from 0.233 to 2.723 tons. This variation seems to be better explained by species composition than diversity. The highest estimated carbon stock occurs in plot 2, with the presence of *Syzygium cumini,* which is a high wood density species. Lower carbon stocks estimated in plots with the presence of low wood density pioneer species. This pattern strongly supports the mass ratio hypothesis, where ecosystem functions are determined by the traits of dominant species rather than overall diversity.

All three statistical tests yielded a non-significant relationship between carbon stock and species diversity. $\chi^2 = 2.08$, $p = 0.24$ values from the chi-square test and Fisher's exact test also indicate that there is no significant difference in carbon stock of plots. This was also supported by the ordinal logistic regression test. The ordinal logistic regression, while robust in handling ordered categories and low-frequency data, revealed non-significant linear ($\beta = -0.1796$, $p > 0.05$) and quadratic ($\beta = -0.3794$, $p >0.05$). The Spearman rank correlation analysis revealed no statistically significant relationship between species diversity (as measured by the Simpson's 1-D index) and carbon stock ($\rho = 0.152$, $p = 0.450$). This absence of the diversity-carbon relationship challenges conventional understanding or assumptions about the biodiversity-ecosystem functioning. The study aligns with studies that emphasize functional traits of species over species richness to drive carbon stock levels. Despite the fulfillment of the null hypothesis, the tendency of impact of species type like that of *Syzygium cumini*, as a high wood density species, points to the need for further examination with this factor in mind, along with other microclimate and soil properties.

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