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*Original Article*

# Non-Tree Woody Plant Species Composition and Structure. A Case Study of Gidabwanja Forest Reserve (GFR) in Hanang'i District, Northern Tanzania

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*Non-Tree Woody Plants, Composition, Structure, Gidabwanja Forest Reserve.*

**ABSTRACT**

The determination of non-tree woody plant species composition and structure was conducted at Gidabwanja Forest Reserve vegetation types in the Hanang'i district. Plots of 20 m x 20 m were established whereby shrubs and lianas were identified for their botanical names and counted for their individuals. RA and RD were calculated. A total of 40 non-tree woody plant species were identified during this study, and of those, 29 were shrubs, while 11 were woody climbers. Most non-tree woody plants were identified in bushland (34) followed by woodland (19), and the least number was recorded in shrubland. The calculated H′ at shrub land of 0. 352 implied low shrub and woody climbers diversity. The calculated mean H′ of 1.605 in woodland implied high diversity within this vegetation type. The calculated H′ mean of 1.607 from the overall total of 4.82 entails high diversity as the high H′ ranges from 3.5 ±1.5 or beyond but not exceeding H′ of 5 within the same growth forms of plants. The plant species with the highest RA is judged to be the most abundant within the specified locality. The plant species with the highest RD occupy the largest land size in the locality. The mean H′ of ≥1.5 of Gidabwanja Forest Reserve revealed high non-tree woody plant species. The non-tree woody plant species composition and structure are sampled in the established sample plots within the specified study area. Gidabwanja Forest Reserve has potential regarding vegetation species demanding high conservation attention. Further study is required to assess the conditions of all biological species in the Gidabwanja Forest Reserve and upgrade the forest reserve to a nature reserve, conservation awareness creation, and regular patrolling along the boundaries of the forest reserve.

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## INTRODUCTION

This paper determines the non-tree woody plant species composition and structure of Gidabwanja Forest Reserve, in Hanang'i district, northern Tanzania. The composition focuses on the richness (S), and diversity index (diversity), while the structure pays attention to the relative abundance (RA) and relative density (RD). Species composition can be compared across different areas or habitats (Aggemyr et al., 2018). Species composition is the total number and diversity index of different individuals of different species in an ecosystem or a community reflects the diversity and interactions of the organisms in an area, while species structure can be expressed as a percent of cover, density, weight, or biomass of each species so that the total adds up to 100% (Lefcheck et al., 2021). The non-tree woody plant species include shrubs and lianas (woody climbers) (Shumi et al., 2021). Shrubs are woody plant species that cannot grow to tree level, while woody climbers are woody plants that lean on shrubs or trees (Fischer et al., 2021; Willis, 2019). Species composition is a commonly determined attribute in the vegetation inventory and monitoring which is regarded as an **important indicator of ecological and management processes at a site (Schulz et al., 2009).** Species composition and structure are ecological indicators that provide the essential description of the character of the vegetation at any site (Wang et al., 2021).

It is essential to study the RA and RD in finding out the arrangement of taxa of a particular group. The RA measures the functioning of diversity in the ecosystem (Hou et al., 2020). The RA can show how different species are distributed and interact with each other and their environment, and studying relative abundance can also help to track changes over time and ask ecological questions (Lin & Da Peddada, 2020). The **RD measures th**e ratio of either **densities** or weights of matter (Hou et al., 2020). The vegetation studies depend on intensive fieldwork with high resource requirements (Kielak et al. 2008). Gidabwanja Forest Reserve is situated within an area with various vegetation cover with fairly high diversity, though inadequately studied. This investigation intended to determine the non-tree woody plant composition and structure of Gidabwanja Forest Reserve.

## METHODOLOGY

### Study Location

The study was conducted at Gidabwanja Forest Reserve (GFR) in Hanang′ district. The GFR is situated at UTM of 750924 and 9487670 in the south and UTM 745870 and 9485418 in the north with an altitude ranging from 1413 m to 1695 above sea level (Garmin GPSMAP 64s). The GFR borders Mogitu village on the north, Ming'enyi on the west, Gehandu on the southwest, Murumba on the south Gidabwanja village on the east and Balang'dalalu on the northeast and Balang'dalalu Lake on the south (*Figure 1*).

 

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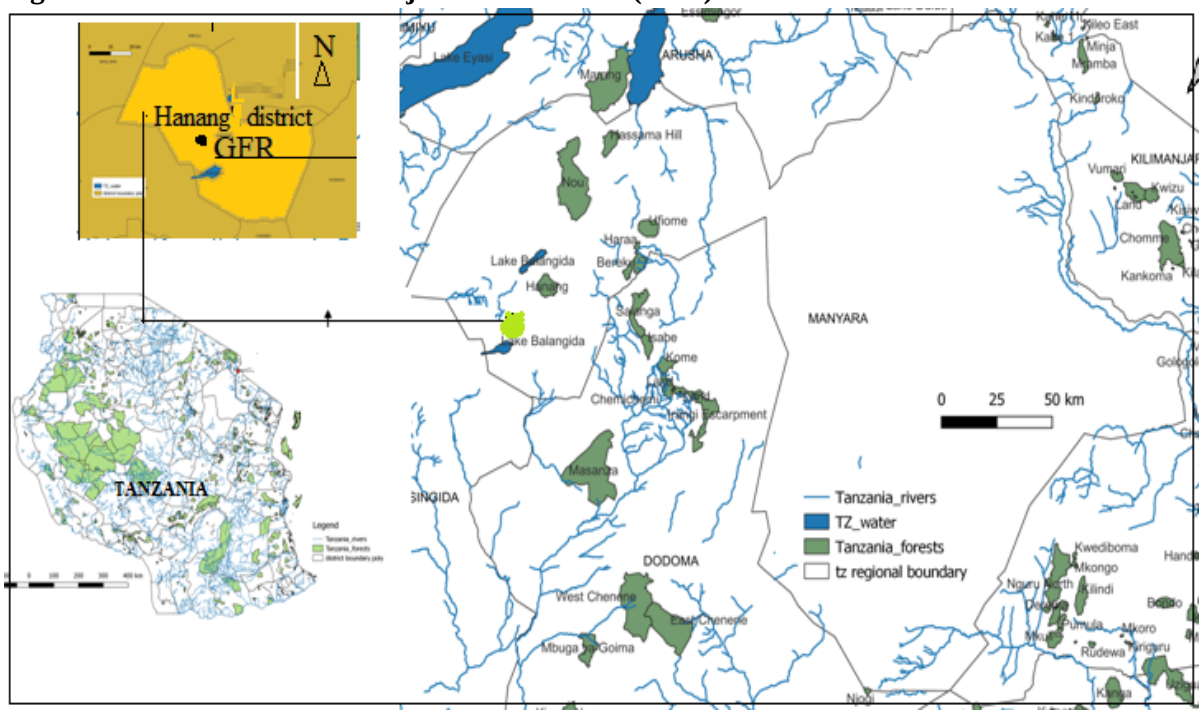
**Figure 1: Location of Gidabwanja Forest Reserve (GFR)**




### Research Design

A cross-sectional research design was applied, whereby the investigation concentrated on taking the measurements at once and giving outcomes at once. Cross-sectional study design is a type of observational study design intended to take measurements once and come up with the outcome (Setia, 2016)

### Data Collection

Plots of 20 m x 20 m were set at an interval of 250 m, within which 2m x 5m plots were established to determine the non-tree woody plant species. The vegetation types were described. Shrubs and lianas were identified for their botanical names and counted for their number of individuals.

### Data Analysis

The composition focused on the diversity index was calculated through the Shannon Wiener index; $H' = -\sum pilnpi$ (Kent & Coker, 1992), whereas pi = the proportion of individuals of a single species to overall individuals of all species were identified in the study area. The structure focused on relative abundance (RA) and relative dominance (RD). Tree species regeneration dominance (ID) was calculated through the Simpson index, $ID = \sum pi^2$ (Kent & Coker, 1992), which is the summation of the proportion of individuals of a single species to an overall summation of all species (*Table 2*).

Relative abundance (RA) and relative density (RD) were calculated (*Table 3-5*). The RA was determined as per Engel et al. (2022), through,

$$RA = \frac{nA}{NA} * 100$$

Where; RA = relative abundance; nA = abundance of a single species; NA = total abundances of all species recorded from the sampled area.

The RD was determined through:

$$RD\ (\%) = \frac{Dni}{\sum N!}\ x\ 100\%; \text{where } RD(\%) = \text{relative density in percentage; } Dni = \text{density of a single species; } \sum N! = \text{summation of densities of all species}$$

(Liu et al., 2017).

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## RESULTS

This section presents the results on the non-tree woody plant species including shrubs and woody climbers (liana) composition and structure. The composition includes richness (S) and diversity, while the structure focuses on the distribution presented by the relative frequency (RF), the relative abundance (RA) and relative density (RD).

A total of 40 shrubs and woody climbers were recorded at Kidabwanja Forest Reserve bushland (14 plots), scrubland (2 plots), and woodland (14 plots). A total of 34 shrub and woody climbing species were recorded in the bushland, 19 in the woodland, and only seven (7) were recorded in the shrubland (Table 1). The identified woody climbers were only 11 (27.5%), including; *Ampelocissus africana, Capparis tomentosa, C.sepiaria, Combretum purpureiflorum, Flabellaria paniculata, Ipomoea spathulata, Microglossa densiflora,* and *Opilia amentacea, Salacia madagascariensis, Senegalia brevispica,* and *Turbina stenosiphon* (*Table 1*).

**Table 1: Shrub and Woody Climbing Species Richness and Distribution of Kidabwanaj Forest Reserve (KFR)**

| Botanical name | Family | GH | BL | SL | WL | TT |
|---|---|---|---|---|---|---|
| *Abrus schimperi* Baker | Rosaceae | S | 1 | 0 | 0 | 1 |
| *Abutilon hirtum* (Lam.) Sweet | Malvaceae | S | 1 | 0 | 0 | 1 |
| *Abutilon longicuspe* Hochst. ex A.Ric | Malvaceae | S | 1 | 1 | 1 | 3 |
| *Abutilon mauritianum* (Jacq.) Medik | Malvaceae | S | 1 | 0 | 0 | 1 |
| *Acalypha fruticosa* Forssk | Euphorbiaceeae | S | 1 | 1 | 1 | 3 |
| *Acalypha neptunica* Müll.Arg. | Euphorbiaceeae | S | 1 | 0 | 1 | 2 |
| *Acalypha ornata* Hochst. | Euphorbiaceeae | S | 1 | 0 | 0 | 1 |
| *Acalypha racemosa* Wall. ex Bail | Euphorbiaceeae | S | 1 | 0 | 0 | 1 |
| *Ampelocissus africana* (Lour.) Merr. | Vitaceae | WC | 1 | 0 | 1 | 2 |
| *Cadaba farinosa* Forssk. | Capparaceae | S | 0 | 0 | 1 | 1 |
| *Canthium lactescens* Hiern | Rubiaceae | S | 1 | 0 | 0 | 1 |
| *Capparis sepiaria* L. | Capparaceae | WC | 1 | 0 | 0 | 1 |
| *Capparis tomentosa* Lam | Capparaceae | WC | 1 | 0 | 1 | 2 |
| *Combretum purpureiflorum* Engl. | Combretaceae | WC | 1 | 0 | 0 | 1 |
| *Conyza newii* Oliv. & Hiern | Asteraceae | S | 1 | 0 | 0 | 1 |
| *Crotalaria axillaris* Ait. | Fabaceae | S | 0 | 1 | 1 | 2 |
| *Dichrostachys cinerea* (L.) Wight et Arn | Fabaceae | S | 1 | 1 | 1 | 3 |
| *Erythrococca bongensis* Pax | Euphorbiaceeae | S | 1 | 0 | 0 | 1 |
| *Flabellaria paniculata* Cav. | Malpighiaceae | WC | 1 | 0 | 1 | 2 |
| *Gnidia subcordata* (Meisn.) Engl. | Thymeliaceae | S | 1 | 0 | 1 | 2 |
| *Grewia forbesii* Harv. ex Mast. | Tiliaceae | S | 0 | 0 | 1 | 1 |
| *Grewia similis* K. Schum. | Tiliaceae | S | 1 | 1 | 1 | 3 |
| *Hibiscus aponeurus* Sprague & Hutch | Malvaceae | S | 1 | 1 | 1 | 3 |
| *Hoslundia opposita* Vahl. | Lamiaceae | S | 1 | 0 | 0 | 1 |
| *Indigofera rynchocarpa* Welw. ex Baker | Fabaceae | S | 1 | 0 | 0 | 1 |
| *Ipomoea spathulata* Hall.f. | Convolvulaceae | WC | 1 | 0 | 0 | 1 |
| *Lippia javanica* (Burm.f.) Spreng | Verbenaceae | S | 1 | 0 | 1 | 2 |
| *Microglossa densiflora* Hook. f. | Asteraceae | WC | 1 | 0 | 0 | 1 |
| *Micromeria imbricata* (Forssk.) C. Chr. | Lamiaceae | S | 1 | 0 | 1 | 2 |
| *Ocimum suave* Willd | Lamiaceae | S | 0 | 0 | 1 | 1 |
| *Opilia amentacea* Roxb. | Opiliaceae | WC | 1 | 0 | 1 | 2 |
| *Pavetta abyssinica* Fresen | Rubiaceae | S | 1 | 0 | 0 | 1 |
| *Phyllanthus ovalifolia* Forssk. | Euphorbiaceeae | S | 1 | 0 | 0 | 1 |
| *Psiadia punctulata* Vatke | Asteraceae | S | 1 | 0 | 0 | 1 |
| *Rothecca myricoides* (Hochst.) Stean & Mabb. | Verbenaceae | S | 1 | 0 | 0 | 1 |
| *Salacia madagascariensis* (Lam.) D. C. | Celasteraceae | WC | 1 | 0 | 0 | 1 |

 

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| Botanical name | Family | GH | BL | SL | WL | TT |
|---|---|---|---|---|---|---|
| *Senegalia brevispica*(Harms) Seigler & Ebinger | Fabaceae | WC | 1 | 0 | 1 | 2 |
| *Turbina stenosiphon* (Hallier. F. A). Meeuse | Convolvulaceae | WC | 1 | 0 | 0 | 1 |
| *Vernonia cinerascens* Sch. Bip | Asteraceae | S | 0 | 1 | 0 | 1 |
| *Viscum schimperi* Engl. | Viscaceae | S | 0 | 0 | 1 | 1 |
| **Total** | | | **34** | **7** | **19** | **60** |

BL=bush land; GH=growth habit; SL=shrub land; WL=woodland; S=shrub; WC=woodclimber

**Mean Shrub and Woody Climbing Plant Species Richness**

During this study, the highest mean species richness (S) was revealed in shrubland with four (4) species, followed by bushland with three (3) species, and woodland with only two (2) species. This implies that a larger number of species was only contributed by a larger sample size, while the comparison within equal-sized plots of shrubland yields most others (*Table 1*).

**Table 2: Plot Mean Shrub Species Richness (S) and H′ for Gidabwanja Forest Reserve**

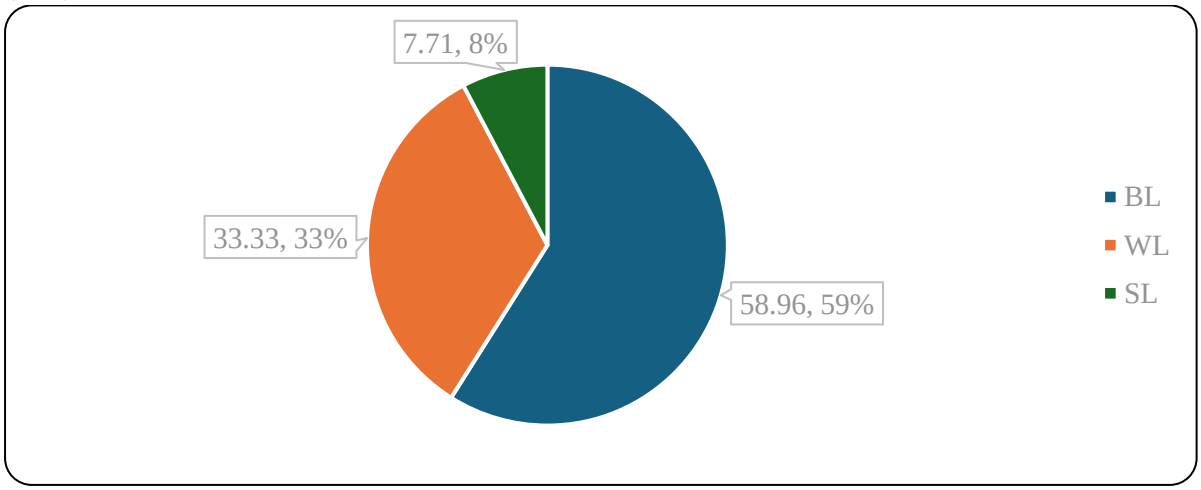
| Vegetation type | No. of plots | % | TS | S/plot | Approximated (≈) | H' |
|---|---|---|---|---|---|---|
| Bushland | 14 | 46.7 | 34 | 2.43 | 3 | 2.86 |
| Shrubland | 2 | 6.6 | 7 | 3.50 | 4 | 0.35 |
| Woodland | 14 | 46.7 | 19 | 1.36 | 2 | 1.61 |
| Total | 30 | 100 | | | | 4.82 |

*Key: H' = Shannon wiener diversity index; S/plot = species per plot; TS = total species*

**Species Richness, Diversity Index, and Relative Density**

Of the 40 identified shrub and woody plant species, 34 the highest H′ was recorded in BL (H′ = 2.86), followed by WL (H′ = 1.61), and shrub land was ranked the least (H′ = 0.352) (*Table 3-5*). The highest RD was recorded in BL (58.96%), followed by WL (33.33%), and shrubland was the least (7.71%) (*Figure 2*).

**Figure 2: Total Relative Density (RD) for Bush Land (BL), Shrub Land (SL), and Woodland (WL)**




***Bush Land***

Bushland with the S of 34 and the H′ of 2.86 was recorded to have very few species with the highest RD of all others. The calculated H′ was 2.69, an implication of the high diversity of the shrub and woody climbers of GFR. The shrub and woody

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climbing species with the highest RD got the RD of 17.74 ± 2.69%, while the rest got the RD ≤2.68%. The plants with the highest RD were *Acalypha fruticosa, Erythrocca bongensis, Flabellaria paniculata, Gnidia subcordata,* and *Senegalia breviuspica,* making 14.7% of all plant species identified on bushland. The shrub and woody climbers with the highest RD also got the highest RA (*Table 3*).

**Table 3: Shrub and Woody Climbing Species H′, RA, and RD of Gidabwanja Forest Reserve Bushland**

| Botanical name | Family | Ind. | H' | A | RA | D | RD |
|---|---|---|---|---|---|---|---|
| *Abrus schimperi* | Rosaceae | 2 | 0.02 | 0.07 | 0.36 | 66.67 | 0.36 |
| *Abutilon hirtum* | Malvaceae | 3 | 0.03 | 0.10 | 0.54 | 100.00 | 0.54 |
| *Abutilon longicuspe* | Malvaceae | 9 | 0.08 | 0.30 | 1.61 | 300.00 | 1.61 |
| *Abutilon mauritianum* | Malvaceae | 2 | 0.02 | 0.07 | 0.36 | 66.67 | 0.36 |
| *Acalypha fruticosa* | Euphorbiaceeae | 99 | 0.77 | 3.30 | 17.74 | 3,300.00 | 17.74 |
| *Acalypha neptunica* | Euphorbiaceeae | 2 | 0.02 | 0.07 | 0.36 | 66.67 | 0.36 |
| *Acalypha ornata* | Euphorbiaceeae | 3 | 0.03 | 0.10 | 0.54 | 100.00 | 0.54 |
| *Acalypha racemosa* | Euphorbiaceeae | 4 | 0.04 | 0.13 | 0.72 | 133.33 | 0.72 |
| *Ampelocissus africana* | Vitaceae | 7 | 0.07 | 0.23 | 1.25 | 233.33 | 1.25 |
| *Canthium lactescens* | Rubiaceae | 5 | 0.04 | 0.17 | 0.90 | 166.67 | 0.90 |
| *Capparis sepiaria* | Capparaceae | 3 | 0.03 | 0.10 | 0.54 | 100.00 | 0.54 |
| *Capparis tomentosa* | Capparaceae | 4 | 0.04 | 0.13 | 0.72 | 133.33 | 0.72 |
| *Combretum purpureiflorum* | Combretaceae | 10 | 0.08 | 0.33 | 1.79 | 333.33 | 1.79 |
| *Conyza newii* | Asteraceae | 2 | 0.02 | 0.07 | 0.36 | 66.67 | 0.36 |
| *Dichrostachys cinerea* | Fabaceae | 11 | 0.10 | 0.37 | 1.97 | 366.67 | 1.97 |
| *Erythrococca bongensis* | Euphorbiaceeae | 15 | 0.13 | 0.50 | 2.69 | 500.00 | 2.69 |
| *Flabellaria paniculata* | Malpighiaceae | 21 | 0.20 | 0.70 | 3.76 | 700.00 | 3.76 |
| *Gnidia subcordata* | Thymeliaceae | 17 | 0.14 | 0.57 | 3.05 | 566.67 | 3.05 |
| *Grewia similis* | Tiliaceae | 5 | 0.05 | 0.17 | 0.90 | 166.67 | 0.90 |
| *Hibiscus aponeurus* | Malvaceae | 2 | 0.02 | 0.07 | 0.36 | 66.67 | 0.36 |
| *Hoslundia opposita* | Lamiaceae | 10 | 0.07 | 0.33 | 1.79 | 333.33 | 1.79 |
| *Indigofera rynchocarpa* | Fabaceae | 9 | 0.08 | 0.30 | 1.61 | 300.00 | 1.61 |
| *Ipomoea spathulata* | Convolvulaceae | 2 | 0.02 | 0.07 | 0.36 | 66.67 | 0.36 |
| *Lippia javanica (Burm.f.) Spreng* | Verbenaceae | 3 | 0.03 | 0.10 | 0.54 | 100.00 | 0.54 |
| *Microglossa densiflora* | Asteraceae | 3 | 0.03 | 0.10 | 0.54 | 100.00 | 0.54 |
| *Micromeria imbricata* | Lamiaceae | 3 | 0.03 | 0.10 | 0.54 | 100.00 | 0.54 |
| *Opilia amentacea* | Opiliaceae | 9 | 0.09 | 0.30 | 1.61 | 300.00 | 1.61 |
| *Pavetta abyssinica* | Rubiaceae | 6 | 0.06 | 0.20 | 1.08 | 200.00 | 1.08 |
| *Phyllanthus ovalifolia* | Euphorbiaceeae | 5 | 0.05 | 0.17 | 0.90 | 166.67 | 0.90 |
| *Psiadia punctulata* | Asteraceae | 3 | 0.03 | 0.10 | 0.54 | 100.00 | 0.54 |
| *Rothecca myricoides* | Verbenaceae | 5 | 0.05 | 0.17 | 0.90 | 166.67 | 0.90 |
| *Salacia madagascariensis* | Celasteraceae | 3 | 0.03 | 0.10 | 0.54 | 100.00 | 0.54 |
| *Senegalia brevispica* | Fabaceae | 37 | 0.33 | 1.23 | 6.63 | 1233.33 | 6.63 |
| *Turbina stenosiphon* | Convolvulaceae | 5 | 0.05 | 0.17 | 0.90 | 166.67 | 0.90 |
| **Total** | | **329** | **2.86** | **10.97** | **58.96** | **10,966.67** | **58.96** |

***Shrub land***

Only seven (7) shrub and woody climbing plants with a total of H′ 0.352 were identified at the shrubland, and the densest got an RD of 2.688% (Table 4). The calculated H′ at shrubland was 0. 352 (*Table 4*).

 

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**Table 4: Shrub and Woody Climbing Diversity Index (H′) and Relative Density (RD)**

| Botanical name | Family | Ind. | H' | A | RA | D | RD |
|---|---|---|---|---|---|---|---|
| *Abutilon longicuspe* | Malvaceae | 2 | 0.020 | 0.067 | 0.358 | 66.667 | 0.358 |
| *Acalypha fruticosa* | Euphorbiaceeae | 15 | 0.116 | 0.500 | 2.688 | 500.000 | 2.688 |
| *Crotalaria axillaris* | Fabaceae | 7 | 0.055 | 0.233 | 1.254 | 233.333 | 1.254 |
| *Dichrostachys cinerea* | Fabaceae | 7 | 0.055 | 0.233 | 1.254 | 233.333 | 1.254 |
| *Grewia similis* | Tiliaceae | 4 | 0.035 | 0.133 | 0.717 | 133.333 | 0.717 |
| *Hibiscus aponeurus* | Malvaceae | 3 | 0.028 | 0.100 | 0.538 | 100.000 | 0.538 |
| *Vernonia cinerascens* | Asteraceae | 5 | 0.042 | 0.167 | 0.896 | 166.667 | 0.896 |
| Total | | 43 | 0.35 | 1.43 | 7.71 | 1,433.3 | 7.71 |

*Key: Ind=individual(s); H'=Shannon wiener diversity index; A=abundance; RA=relative abundance; D=density; RD= relative density*

***Woodland***

Woodland with the recorded 19 shrubs and woody climbing plants got five (5) species with the highest RD ranging from 6.272 ± 2.688. The plants with the highest RD were *Abutilon longicuspe, Acalypha fruticosa, Acalypha neptunica, Capparis tomentosa,* and *Grewia similis.*

**Table 5: Woodland Non-tree Woody Plants H′, RA and RD**

| Botanical name | Family | Ind | H' | A | RA | D | RD |
|---|---|---|---|---|---|---|---|
| ***Abutilon longicuspe*** Hochst. ex A.Rich. | Malvaceae | 19 | 0.152 | 0.633 | 3.405 | 633.333 | 3.405 |
| *Acalypha fruticosa* Forssk | Euphorbiaceeae | 32 | 0.256 | 1.067 | 5.735 | 1066.667 | 5.735 |
| *Acalypha neptunica* Müll.Arg | Euphorbiaceeae | 15 | 0.097 | 0.500 | 2.688 | 500.000 | 2.688 |
| *Ampelocissus africana* (Lour.) Merr. | Vitaceae | 6 | 0.056 | 0.200 | 1.075 | 200.000 | 1.075 |
| *Cadaba farinosa* Forssk | Capparaceae | 5 | 0.047 | 0.167 | 0.896 | 166.667 | 0.896 |
| *Capparis tomentosa* Lam. | Capparaceae | 23 | 0.213 | 0.767 | 4.122 | 766.667 | 4.122 |
| *Crotalaria axillaris* Aiton | Fabaceae | 2 | 0.020 | 0.067 | 0.358 | 66.667 | 0.358 |
| *Dichrostachys cinerea* (L.) Wight & Arn | Fabaceae | 2 | 0.020 | 0.067 | 0.358 | 66.667 | 0.358 |
| *Flabellaria paniculata* Cav. | Malpighiaceae | 3 | 0.028 | 0.100 | 0.538 | 100.000 | 0.538 |
| *Gnidia subcordata* (Meisn.) Engl. | Thymeliaceae | 3 | 0.028 | 0.100 | 0.538 | 100.000 | 0.538 |
| *Grewia forbesii* Harv. Ex Mast | Tiliaceae | 8 | 0.070 | 0.267 | 1.434 | 266.667 | 1.434 |
| *Grewia similis* K. Schum | Tiliaceae | 35 | 0.308 | 1.167 | 6.272 | 1166.667 | 6.272 |
| *Hibiscus aponeurus* Sprague & Hutch | Malvaceae | 5 | 0.048 | 0.167 | 0.896 | 166.667 | 0.896 |
| *Lippia javanica* (Burm.f.) Spreng. | Verbenaceae | 5 | 0.048 | 0.167 | 0.896 | 166.67 | 0.89 |
| *Micromeria imbricata* (Forssk) C. Chr | Lamiaceae | 2 | 0.020 | 0.067 | 0.358 | 66.667 | 0.358 |
| *Ocimum suave* Willd. | Lamiaceae | 5 | 0.042 | 0.167 | 0.896 | 166.667 | 0.896 |
| *Opilia amentacea* Roxb. | Opiliaceae | 9 | 0.089 | 0.300 | 1.613 | 300.000 | 1.613 |
| *Senegalia brevispica* (Harms) Siegler & Ebinger | Fabaceae | 5 | 0.04 | 0.17 | 0.89 | 166.6 | 0.89 |
| *Viscum schimperi* Engl. | Viscaceae | 2 | 0.020 | 0.067 | 0.358 | 66.667 | 0.358 |
| **Total** | | **186** | **1.605** | **6.200** | **33.333** | **6200.000** | **33.333** |

 

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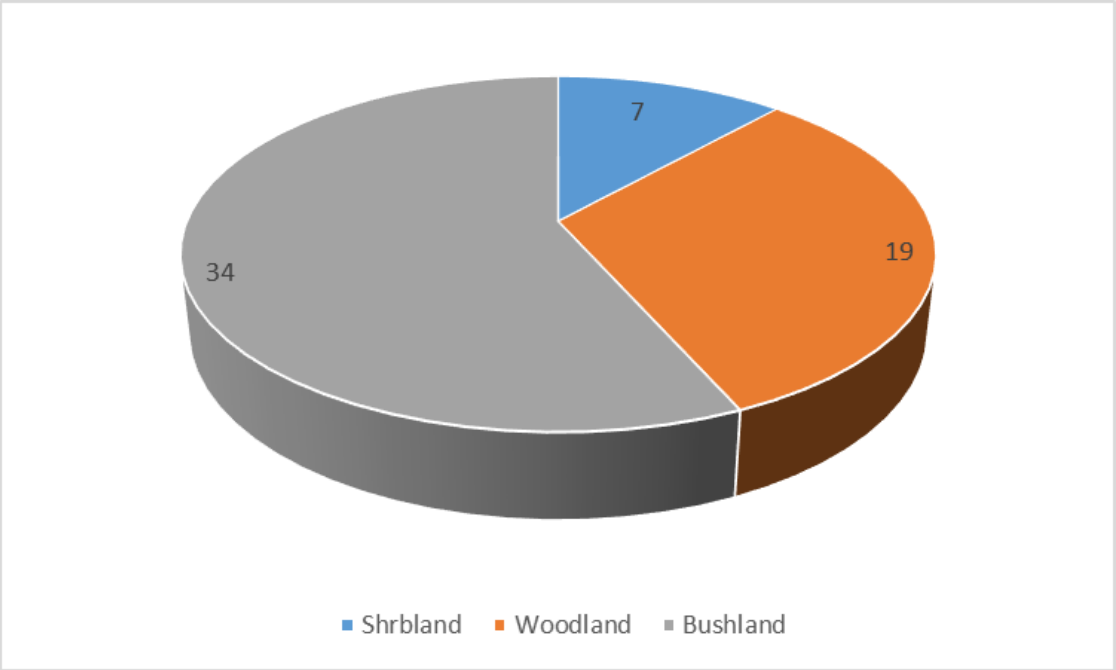
## DISCUSSION

The co-existence of high numbers of species has always fascinated ecologists, and the species-area relationship is among the best-known patterns in community ecology (Wilson et al., 2012). The highest number of plant species identified in the shrubland (Figure 3) implied favourable conditions to support non-tree woody plant species diversity. It has been known that a large number of different species in a habitat represents higher species richness, and an overall more diverse ecosystem (Paz-Kagan, 2021).

**Figure 3: Total Plant Species per Vegetation Type**




The calculated H′ at shrub land of 0. 352 (*Table 4*) implied low shrub and woody climbers diversity. The calculated mean H′ of 1.605 in woodland implied high diversity within this vegetation type. The calculated H′ mean from the overall total of 4.82 of 1.607 entails high diversity; as per Kent & Coker (1992), high diversity is implied by the H′ ranging from 3.5 ±1.5 or beyond but not exceeding H′ of 5 within the same growth forms of plants. The plant species with the highest RA is revealed to be the most abundant within the specified locality (Parker et al. 2019). The plant species with the highest RD occupy the largest land size in the locality (Woodall & Weiskittel, 2021). This implies that the non-tree woody plant species with the least RA are the least occurring, while those with the lowest RD are the least occupying species in the specified locality (Pablo et al., 2023).

## CONCLUSION AND RECOMMENDATION

Worldwide, trees are being considered most while the non-tree woody plants are left behind. The consideration of forest reserves always focuses on trees which are the highest woody forms of the vegetation cover. The non-tree woody plant species including shrubs and woody climbers (liana) are essential for the formation of woodland and forest ecosystems. The non-tree woody plant species composition (richness and diversity), and structure (distribution and abundance) are sampled in the established sample plots within the specified study area. The Gidabwanja Forest Reserve harbours conspicuous species of shrubs and liana associated with other plant forms such as grasses, sedges, and trees. Gidabwanja Forest Reserve is significant in terms of vegetation species demanding high conservation attention. Further study is required to assess the conditions of all biological species in the Gidabwanja Forest Reserve and upgrade the forest reserve to a nature

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reserve, enhancement of education and environmental conservation awareness and thinking of improving participatory forest management, regular patrols, and range post-construction.

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