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# Bioprospection of Potential Medicinal Plant Diversity in the Wana Lestari Community Forest, Karang Sidemen Village

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**Abstract:** Medicinal potential plants that are scattered in community forest areas have opportunities that can be utilized in ecosystem-based sustainable forest management. Considering the potential medicinal plants have played a major role in maintaining the health condition of the community around the forest from generation to generation. This study aims to determine the abundance of medicinal plant species in the Wana Lestari Community Forest, Karang Sidemen Village based on the value of the Ecological Index. The research method used is Stratified Random Sampling with Replacement with a total of 59 research sample plots. The results showed that the types of medicinal plants at the level of trees, poles, saplings, seedlings, shrubs, bush, terna, lianas, and ferns which had the highest Importance Value Index (IVI) were *D. zibethinus* (72.42%) trees level, *D. zibethinus* (111.82%) poles level, *C. canephora* (144.98%) saplings level, *C. canephora* (109.64%) seedlings level, *C. frutescens* L (70.33%) shrubs level, *H. capitata Jacq.* (103.07%) bushs level, *C. prostrata* (26.69%) ternas level, *M. cordata* (92.46%) lianas level, and *D. esculentum* (169.39%) ferns level. The Morishita index shows that most species at the trees, shrubs, bushes, ternas, lianas, and ferns levels spread in groups while most of the plant species at the pole, sapling, and seedling levels spread randomly. In addition, the Species Diversity Index (H') of medicinal plants showed values at the level of trees (2.08), poles (1.92), saplings (1.16), seedlings (1.72), shrubs (1.8), bushs (1.79), ternas (2.94), lianas (1.44) and ferns (0.53). Furthermore, the value of the species richness index ($R_1$) of plants with medicinal potential is at the level of the tree (2.68), poles (2.82), saplings (1.93), seedlings (1.72), shrubs (1.84), bushs (2.22), ternas (4.17), lianas (1.87) and ferns (0.38). The evenness index value (E') of medicinal potential plants is at the level of trees (0.73), poles (0.75), saplings (0.48), seedlings (0.61), shrubs (0.92), bushs (0.7), ternas (0.82), lianas (0.58) and ferns (0.49).

**Keywords:** Medicinal plants; IVI; Diversity index (H'); Distribution index (ip); Species richness index (R1), Evenness index (E).

## Introduction

Medicinal plants are all types of plants that have benefits as medicine and contain nutrients that are proven to be good for health through the availability of useful phytochemical sources, one of which is an antioxidant (Lim, 2016). Medicinal plants are divided into 3 groups, namely traditional medicinal plants, modern medicinal plants, and potential medicinal plants (Rubiah et al., 2015). Parts of plants that can be used as medicine include roots, stems, twigs, leaves, flowers, fruit, tubers, rhizomes, seeds, bark, and sap (Jadid et al., 2020; Rahayu et al., 2019). Medicinal plants themselves are widely used in various countries as an alternative to maintaining the body's immune system during the Covid-19 pandemic, besides that they are also used as an alternative to support the healing of patients affected by the Covid-19 virus (Demeke et al., 2021).

One of the sources of knowledge about medicinal plants is information from the public and even the

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diversity of types of knowledge of medicinal plants in Indonesia is directly proportional to the diversity of ethnic groups. This knowledge is known to the community as the fruit of its interaction with the natural surroundings to maintain its existence, especially in the field of medicine (Yeung et al., 2020).

The existence of medicinal plants in nature is spread across various types of habitats and ecosystems. One area that is the habitat of medicinal plants is the forest area. Forest areas developed through social forestry schemes, one of which is community forestry, is an area that has the greatest opportunity for interaction with the surrounding community, considering that the forest area is designated for the empowerment of local communities following the contents. Therefore community forest areas may have great potential for medicinal plants.

The Wana Lesatari Community Forest of Karang Sidemen Village is one of many HKm in Indonesia that was legalized through a community forest utilization business permit (IUPHKm) based on the Decree of the Central Lombok Regent Number 39 of 2010. This community forest is managed by the community with an agroforestry scheme by utilizing the forest floor for planting various types of plants, one of which is medicinal plants that have commercial value (Markum et al., 2014). However, many wild plants that are thought to have medicinal properties are also found in this HKm.

The lack of research related to medicinal plants on Lombok Island, especially those related to the abundance of medicinal plant species in Community Forests, the large potential for developing medicinal plants, and the noble aspirations to improve the welfare of the community around the forest according to the vision in P.88/Menhut-II/2014. making this research very important to do for the development of sustainable community forest areas in Karang Sidemen Village in the future. This study aims to determine the ecological index of medicinal plants in the Sustainable Community Forest of Karang Sidemen Village based on the value of IVI, Distribution Index, Diversity Index (H'), Evenness Index (E), and Species Richness Index (R1).

## Method

*Time and place*

Vegetation data collection was carried out in the Wana Lestari Community Forest of Karang Sidemen Village, Batu Kliang Utara District, Central Lombok Regency. The research was conducted from May to June 2021.

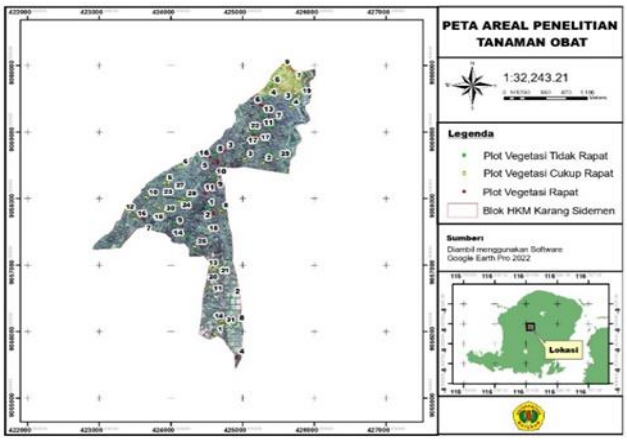


**Figure 1.** Map of research locations and distribution of bioprospection sample plots of plant diversity with potential for medicinal purposes in the Wana Lestari HKm, Karang Sidemen Village

*Tools and Materials*

The research materials were the types of medicinal plants located in predetermined plots, a map of the location of the study plot distribution, and 70% alcohol. The tools used consist of Tally sheets, GPS, Haga meters, Rapia ropes, Compasses, Roll meters, Phi bands, herbarium-making tools, cameras, and identification books (Dalimartha, 2008; Nurbaeti, 2015; Faisyal et al., 2017).

*Method of Collecting Data*

The data collected consisted of data on height, diameter, amount of vegetation, and the number of individual types found in the study plots. Vegetation sampling used the squared plot method with the size of each sample plot adjusted to the growth rate and shape of the plant as shown in Figure 2.

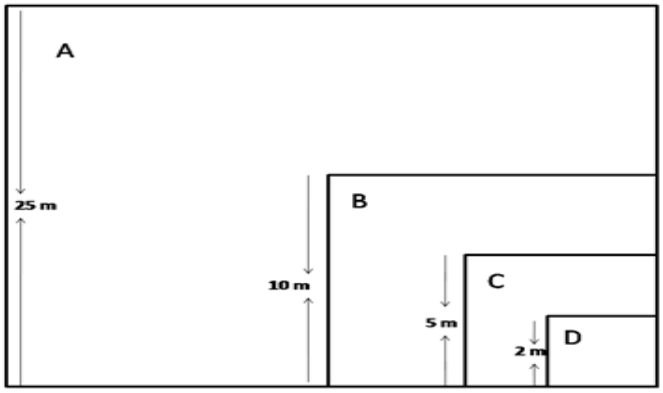


**Figure 2**. Quadratic measure plot

Description: (1). Plot A: measuring plot for trees with a size of 25 x 25 m, ie trees with a trunk diameter of ≥ 20 cm, (2). Plot B: measuring plot for a pole with a size of 10 x 10 m, ie the stem diameter is < 20 cm, (3). Plot C: plot

plots for saplings with a size of 5 x 5 m, namely saplings with a height of > 1.5 m and a trunk diameter < 10 cm, (4), Block D: plots for seedlings with a size of 2 x 2 m, namely saplings with a height < 1.5 m and undergrowth/shrubs/herbs, including lianas, epiphytes, pandanus and palms (Sundra, I K, 2016; Simamora, 2018).

The magnitude of the number of samples taken in the field is determined by a sampling intensity of 2% of the total area of 403 ha so that 59 sample units are obtained. The placement of the selected sample units used stratified random sampling with replacement with the consideration that there were differences in vegetation strata at the study site, with the sample units placed randomly in each stratum where the size and size of the sample in each stratum were influenced by the proportion of its area with details as follows: 17 plots for sparse strata, 31 plots of moderately dense strata, and 11 plots of dense strata.

*Data Analysis*

The results of field data measurements that have been obtained were analyzed using an ecological index consisting of the Importance Value Index, the Shanon Wiener Diversity Index (H'), the Morisita index (IP), the Margalef species richness index (R1), the evenness index of species (E).

*Significant Value Index*

The important value index can be calculated using the formula: IVI = KR + FR +DR (tree and pole levels) and IVI = KR + FR (for saplings, seedlings, shrubs, shrubs, lianas, and ferns) (Indriyanto, 2017). Parameter values such as relative density, relative frequency, and relative dominance can be calculated by the formula:

Density

$$\mathrm{K} = \frac{\text{Number of individuals of a species}}{\text{area of all plot}} \quad (1)$$

Relative density

$$\mathrm{KR} = \frac{\text{Density of a species}}{\text{density of all species}} x\ 100\% \quad (2)$$

Frequency

$$\mathrm{F} = \frac{\text{Number of sample plots of a species found}}{\text{number of all sample plots}} \quad (3)$$

Relative Frequency

$$\mathrm{FR} = \frac{\text{Frequency of a species}}{\text{Frequency of all species}} x\ 100\% \quad (4)$$

Dominance/Basal Area

$$\mathrm{D} = \frac{\text{Sum of basal area of a species}}{\text{Area of all sample plots}} \quad (5)$$

Relative Dominance

$$\mathrm{DR} = \frac{\text{Dominance of one species}}{\text{Dominance of all species}} x\ 100\% \quad (6)$$

*Diversity Index (Shanon-wiener)*

$$H = -\sum\left\{\left(n.\frac{i}{N}\right) Log\ \left(n.\frac{i}{N}\right)\right\} \quad (7)$$

Where n.i = The importance of each species, and N = the Total important value.

The Shannon Species Diversity Index has several indicators to explain the values obtained, namely: (1) H' < 1.5 indicates a low level of diversity (2) 1.5 < H' ≥ 3.5 indicates a moderate level of species diversity, (3) H' > 3.5 indicates a high level of species diversity.

*Species Richness Index (Margalef)*

$$\mathrm{DMg} = \frac{(S-1)}{\ln N} \quad (8)$$

Where DMg = Margalef Species Richness Index, S = Number of species, and N = Total individuals.

The criteria for the Margalef species richness index are as follows: (1). D<2.5: Low species richness level, (2). 2.5<D<4 Moderate levels of species richness, (3). D>4 high species richness levels (Baderan et al., 2021).

*Evenness Index (Evennes)*

$$E = \frac{H'}{H\ max}\ \mathrm{H'\ max\ is\ ln\ S} \quad (9)$$

Where E = Evenness index (value between 0-1), H' = Shannon-Wiener diversity index and S = Number of species.

The criteria for the Evenness Index are as follows: (1). 0.00 < E ≤ 0.25: Not evenly distributed, (2). 0.26 ≤ E ≤ 0.50: Classified as uneven, (3). 0.51 ≤ E ≤ 0.75: Quite evenly distributed, (4). 0.76 ≤ E ≤ 0.95: classified as almost evenly distributed and (5). 0.96 ≤ E ≤1: Classified evenly (Andesmora et al., 2021).

*Morisita Distribution Index (id)*

$$\text{id} = \frac{(\sum xi^2 - \sum xi^2)}{(\sum xi)^2 - \sum xi} \quad (10)$$

$$\text{Mu} = \frac{x^2\, 0{,}975 - n + \sum xi}{(\sum xi) - 1} \quad (11)$$

$$\text{Mc} = \frac{x^2\, 0.025 - n + \sum xi}{(\sum xi) - 1} \quad (12)$$

$$\text{Ip} = 0.5 + 0.5\frac{(id-Mc)}{(n-Mc)} : \text{if Id} \geq \text{Mc} > 1 \quad (13)$$

$$\text{Ip} = 0.5\frac{(id-1)}{(Mc-1)} : \text{if Mc} > \text{Id} \geq 1 \quad (14)$$

$$\text{Ip} = -0.5\frac{(id-1)}{(Mc-1)} : \text{if } 1 > \text{Id} > \text{Mu} \quad (15)$$

$$\text{Ip} = -0.5 + 0.5\frac{(id-Mu)}{(Mu)} : \text{if } 1 > \text{Mu} > \text{Id} \quad (16)$$

Where N = Number of plots, Xi = Individuals, Mu = Morisita Index for a uniform distribution pattern, $x^2$ 0.975 = Chi-Square Table value of degrees of freedom n-1, 97.5% confidence interval, Mc = Morisita Index for clustered distribution patterns, $x^2$ 0.025 = Chi-Square Table values of degrees of freedom n-1, 2.5% confidence interval, and Ip = Standard Morista Degrees.

The criteria for the distribution pattern are: (1). Ip<0, uniform distribution pattern (2). Ip=0, random distribution pattern (3). Ip>0, the distribution pattern is clustered.

## Result and Discussion

*Diversity of Types of Medicinal Plants*

Based on field surveys, 110 plant species were obtained consisting of 44 plant families, with 102 of them being medicinal plants. The types of medicinal plant species found in the study area consisted of all levels of habitus starting from the levels of habitus trees, poles, saplings, seedlings, shrubs, shrubs, herbs, lianas, and ferns. The total number of individual medicinal plants found at the study site was 8,494 individuals, with 14.87% found at the dense stratum level, 54.45% found at the moderately dense strata level and 30.68% found at the rare strata level.

The number of medicinal plant species in the Sustainable Forest Conservation Forest in Karang Sidemen Village was then seen according to the number of each type of medicinal plant vegetation at each stratum level, as shown in Table 1. Based on Table 1, it can be seen that strata with relatively dense categories have the highest number of species for all habitus levels. Therefore, the division of strata is not to see in which strata the medicinal plant vegetation is more numerous in one location because the number of species in a location is influenced by its area. However, this division of strata is carried out by estimating that the number of species found in the field can be covered by the research plots made. So that the number of species obtained is more diverse considering that the plotting is done randomly.

**Table 1.** Number of Plant Species With Medicinal Potential in HKm Wana Lestari Based on Stratum Level and Habituation

| Habitus Strata | Tree | Pole | Stake | Seedling | Undergrowth |
|---|---|---|---|---|---|
| Meeting | 9 | 2 | 4 | 9 | 33 |
| Enough Meeting | 14 | 12 | 8 | 10 | 57 |
| Seldom | 11 | 4 | 6 | 10 | 49 |

*Important Value Index of Medicinal Plants*

The Importance Value Index indicates that a species has a high level of adaptation to its environment. In addition, it also shows the role of a plant species in a community (Hidayat, 2018). The IVI value consists of components such as relative density values, relative basal area (dominance) values, and relative frequency values (Indriyanto, 2017). The important value index of medicinal plants in Karang Sidemen village based on their growth rate can be seen in table 2, table 3, table 4, table 5, table 6, table 7, table 8, table 9, and table 10.

**Table 2.** Important Value Index and Tree-Level Diversity Index

| *Scientifict Name* | Dominance Index | | | | Diversity Index | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | KR (%) | FR (%) | DR (%) | IVI | id | mu | Mc | Ip | Description |
| *Aleurites moluccana* | 2.81 | 2.38 | 4.36 | 9.55 | 18.24 | -0.92 | 3.29 | 0.63 | M |
| *Artocarpus heterophyllus* Lam. | 16.11 | 13.69 | 10.11 | 39.92 | 3.23 | 0.69 | 1.37 | 0.52 | M |
| *Baccaurea racemose* | 3.58 | 5.36 | 2.05 | 10.99 | 4.54 | -0.47 | 2.76 | 0.52 | M |
| *Ceiba pentandra* (L.) Gaertn. | 13.81 | 14.88 | 42.51 | 71.20 | 2.52 | 0.64 | 1.43 | 0.51 | M |
| *Dalbergia latifolia* | 1.28 | 2.38 | 0.77 | 4.43 | 5.90 | -3.79 | 6.75 | 0.43 | M |
| *Dendrocnide stimulans* | 0.26 | 0.60 | 0.27 | 1.12 | 0.00 | -18.20 | 23.90 | 0.02 | MA |
| *Durio zibethinus* | 33.50 | 25.00 | 13.92 | 72.42 | 1.59 | 0.85 | 1.18 | 0.50 | M |
| *Erythrina variegata* L. | 13.30 | 14.29 | 16.94 | 44.52 | 2.18 | 0.62 | 1.45 | 0.51 | M |
| *Ficus Racemosa* | 0.26 | 0.60 | 0.96 | 1.81 | 0.00 | -18.20 | 23.90 | 0.02 | A |

| Scientifict Name | Dominance Index | | | | Diversity Index | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | KR (%) | FR (%) | DR (%) | IVI | id | mu | Mc | Ip | Description |
| *Garcinia antroviridis* | 0.26 | 0.60 | 0.17 | 1.02 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Gmelina arborea* | 3.07 | 2.38 | 3.00 | 8.45 | 21.45 | -0.74 | 3.09 | 0.66 | M |
| *Gnetum gnemon* | 1.02 | 1.79 | 0.38 | 3.19 | 9.83 | -5.39 | 8.65 | 0.51 | M |
| *Mangifera indica* | 1.28 | 1.79 | 0.47 | 3.53 | 11.80 | -3.79 | 6.73 | 0.55 | M |
| *Nephelium lappaceum* | 0.51 | 1.19 | 0.12 | 1.83 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Persea americana* | 8.18 | 11.31 | 3.72 | 23.22 | 2.62 | 0.38 | 1.74 | 0.51 | M |
| *Pterospermum javanicum* Jungh. | 0.26 | 0.60 | 0.06 | 0.91 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Theobroma cacao* L. | 0.51 | 1.19 | 0.20 | 1.90 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| | 100.00 | 100.00 | 100.00 | 300.00 | | | | | |

**Table 3.** Important Value Index and Pole Level Diversity Index

| Scientifict Name | Dominance | | | | Diversity | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | KR (%) | FR (%) | DR (%) | IVI | id | mu | mc | ip | Description |
| *Durio zibethinus* | 34.29 | 39.53 | 38.00 | 111.82 | 2.14 | 0.17 | 2.00 | 0.50 | M |
| *Persea americana* | 20.00 | 16.28 | 25.57 | 61.85 | 7.13 | -0.47 | 2.76 | 0.54 | M |
| *Lansium domesticum* | 1.43 | 2.33 | 0.95 | 4.71 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Theobroma cacao* L. | 18.57 | 11.63 | 14.11 | 44.31 | 15.88 | -0.60 | 2.91 | 0.62 | M |
| *Spondias dulcis* Parkinson. | 1.43 | 2.33 | 0.90 | 4.65 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Aleurites Moluccana* | 1.43 | 2.33 | 1.88 | 5.63 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Coffea canephora* | 1.43 | 2.33 | 0.76 | 4.51 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Mangifera indica* | 2.86 | 4.65 | 2.10 | 9.61 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Gnetum gnemon* | 8.57 | 4.65 | 6.38 | 19.61 | 27.53 | -2.83 | 5.59 | 0.71 | M |
| *Artocarpus heterophyllus* Lam. | 2.86 | 4.65 | 2.01 | 9.52 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Nephelium lappaceum* | 4.29 | 4.65 | 4.05 | 12.98 | 19.67 | -8.58 | 12.47 | 0.58 | M |
| *Dalbergia latifolia* | 1.43 | 2.33 | 1.41 | 5.16 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Garcinia antroviridis* | 1.43 | 2.33 | 1.88 | 5.63 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| | 100.00 | 100.00 | 100.00 | 300.00 | | | | | |

**Table 4.** Importance Value Index and Stake Level Diversity Index

| Scientifict Name | Dominance | | | | Diversity | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | KR (%) | FR (%) | DR (%) | IVI | Id | mu | mc | Ip | Description |
| *Persea americana* | 1.14 | 3.51 | | 4.65 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Durio zibethinus* | 3.98 | 10.53 | | 14.50 | 2.81 | -2.19 | 4.82 | 0.24 | M |
| *Gliricidia sepium (Jacq.) Walp.* | 5.68 | 3.51 | | 9.19 | 31.47 | -1.13 | 3.55 | 0.75 | M |
| *Psidium guajava Linn.* | 0.57 | 1.75 | | 2.32 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Theobroma cacao L.* | 1.70 | 5.26 | | 6.97 | 0.00 | -8.58 | 12.47 | 0.04 | A |
| *Syzygium polyanthum (Wight) Walp.* | 0.57 | 1.75 | | 2.32 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Baccaurea racemosa* | 0.57 | 1.75 | | 2.32 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Coffea canephora* | 81.82 | 63.16 | | 144.98 | 1.96 | 0.87 | 1.16 | 0.51 | M |
| *Ficus septica* | 0.57 | 1.75 | | 2.32 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Nephelium lappaceum* | 1.14 | 1.75 | | 2.89 | 59.00 | -18.20 | 23.90 | 1.00 | M |
| *Leucaena leucocephala* | 2.27 | 5.26 | | 7.54 | 9.83 | -5.39 | 8.65 | 0.51 | M |
| | 100.00 | 100.00 | | 200.00 | | | | | |

**Table 5.** Importance Value Index and Seedling Level Diversity Index

| Scientifict Name | Dominance | | | | Diversity | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | KR (%) | FR (%) | DR (%) | IVI | | mu | mc | ip | Description |
| *Coffea canephora* | 67.28 | 42.35 | | 109.64 | 3.57 | 0.92 | 1.10 | 0.52 | M |
| *Pterospermum javanicum Jungh.* | 0.79 | 1.18 | | 1.97 | 59.00 | -8.58 | 12.47 | 1.00 | M |
| *Persea americana* | 0.79 | 3.53 | | 4.32 | 0.00 | -8.58 | 12.47 | 0.04 | A |
| *Durio zibethinus* | 0.79 | 2.35 | | 3.14 | 19.67 | -8.58 | 12.47 | 0.58 | M |
| *Ficus Racemosa* | 0.53 | 2.35 | | 2.88 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Psidium guajava Linn.* | 3.96 | 4.71 | | 8.66 | 31.47 | -0.37 | 2.64 | 0.76 | M |
| *Gmelina arborea* | 0.26 | 1.18 | | 1.44 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Dendrocnide stimulans* | 5.28 | 4.71 | | 9.98 | 12.42 | -0.01 | 2.21 | 0.59 | M |
| *Syzygium polyanthum (Wight) Walp.* | 0.26 | 1.18 | | 1.44 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Leucaena leucocephala* | 2.11 | 1.18 | | 3.29 | 59.00 | -1.74 | 4.28 | 1.00 | M |
| *Ficus septica* | 1.85 | 8.24 | | 10.08 | 0.00 | -2.19 | 4.82 | 0.13 | S |
| *Mangifera indica* | 0.26 | 1.18 | | 1.44 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Artocarpus heterophyllus Lam.* | 0.53 | 2.35 | | 2.88 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Nephelium lappaceum* | 0.26 | 1.18 | | 1.44 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Ceiba pentandra (L.) Gaertn.* | 13.72 | 16.47 | | 30.19 | 9.48 | 0.62 | 1.45 | 0.57 | M |
| *Macaranga tanarius Muell. Arg.* | 0.53 | 2.35 | | 2.88 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Dalbergia latifolia* | 0.79 | 3.53 | | 4.32 | 0.00 | -8.58 | 12.47 | 0.04 | A |
| | 100 | 100 | | 200 | | | | | |

A (Random Spread), (M) (clustered Spread), and (S) Uniform Spread

Based on the results of data analysis, the medicinal plant species that had the highest IVI value for tree growth was *Durio zibethinus* at 72.42%, the pole growth rate was also dominated by *Durio Zibethinus* with an IVI value of 111.82%, the sapling growth rate was dominated by *Coffea Canephora* with an IVI value of 111.82%. 144.98% and the seedlings were also dominated by *Coffea canephora* with a value of 109.64%. The type of medicinal plant that has the lowest IVI for tree growth is *Pterospermnum javanicum* Jungh. of 0.91%, the growth rate of the pole was *coffea canephora* which was 4.51%, the growth rate of the saplings was *psidium guajava* Linn., *Syzygium polyanthum*, *baccaurea racemosa* and *ficus septica* with an IVI value of 2.32 each. %, and on the growth rate of the seedlings namely *Gmelina arborea*, *Leucaena leucocephala*, *syzygium polyanthum*, *mangifera indica*, *Nephlium lappaceum* and *Pterospermum javanicum* with an additional value of 1.18% each. IVI values are categorized as high or low, namely: (1). IVI > 42.66 is categorized as high, (2). IVI 21.96-42.66 moderate, and (3). IVI <21.96 is categorized as low (Fachrul, 2007; Hidayat et al., 2017).

A high IVI value indicates that a species has better adaptability, competitive ability, and reproductive ability when compared to other plants on certain land. Meanwhile, low IVI values indicate that these plant species have the potential to disappear from the ecosystem if pressure occurs due to the influence of small numbers, with low reproductive and dispersal capabilities (Zulkarnain et al., 2015).

The IVI value of medicinal plants at all growth levels is influenced by the density, frequency, and basal area values (Indriyanto, 2017). According to Hidayat (2018) that the Density Value of a species illustrates that the type has the ability and suitability to grow and reproduce well in a location. A high frequency of species indicates that the species is evenly distributed in the study plots. Adpun The dominance value indicates that a species can adapt to the environment in which it grows and regenerates well. Amrina et al. (2019) stated that high or low IVI values were caused by distribution factors, the more evenly distributed a species, the higher the IVI value of the plant. the ability of a species to be able to grow and develop at its distribution location is determined by environmental factors where it grows because environmental factors will affect physiological processes in plants such as temperature and sunlight (Paembonan, 2020).

Based on the results of a survey of vegetation in the field in the HKm Wana Lestari area of Karang Sidemen Village with agroforestry-based management. That the size of the IVI value of a plant species at various growth levels is strongly influenced by the activities of the people who cultivate the land. Plants such as durian and coffee have high IVI values because they are deliberately planted by the community in large quantities because they have high economic value. The same thing was also found in the study of Rendra et al. (2018) that the type Durio zibethinus has a high IVI value because it is cultivated massively by the community because it has economic potential.

**Table 6.** Importance Value Index and Diversity Index of Shrub Levels

| *Scientifict Name* | Dominance | | | Diversity | | | | |
|---|---|---|---|---|---|---|---|---|
| | KR (%) | FR (%) | IVI | id | mu | mc | ip | Description |
| *Capsicum frutescens* L. | 34.62 | 35.71 | 70.33 | 8.19 | -1.39 | 3.87 | 0.54 | M |
| *Hibiscus rosa-sinensis* L. | 15.38 | 7.14 | 22.53 | 59.00 | -5.39 | 8.65 | 1.00 | M |
| *Codiaeum variegatum* L. | 15.38 | 14.29 | 29.67 | 29.50 | -5.39 | 8.65 | 0.71 | M |
| *Sida Rhombifolia* | 11.54 | 7.14 | 18.68 | 59.00 | -8.58 | 12.47 | 1.00 | M |
| *Manihot utilisima* | 7.69 | 14.29 | 21.98 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Solanum torvum* Swartz | 7.69 | 14.29 | 21.98 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *jathropa curcas* L | 7.69 | 7.14 | 14.84 | 59.00 | -18.20 | 23.90 | 1.00 | M |
| | 100.00 | 100.00 | 200.00 | | | | | |

**Table 7.** Importance Value Index and Bush Level Diversity Index

| *Scientifict Name* | Dominance | | | Diversity | | | | |
|---|---|---|---|---|---|---|---|---|
| | KR (%) | FR (%) | IVI | id | mu | mc | ip | Description |
| *Clerodendrum japonicum* (Thunb.) Sweet. | 0.89 | 1.67 | 2.56 | | | | | |
| *Desmodium gangeticum* | 3.13 | 6.67 | 9.79 | 8.43 | -2.19 | 4.82 | 0.53 | M |
| *Eupatorium odoratum* L.f. | 3.57 | 8.33 | 11.90 | 8.43 | -1.74 | 4.28 | 0.54 | M |
| *Hyptis capitata* Jacq. | 64.73 | 38.33 | 103.07 | 4.63 | 0.87 | 1.16 | 0.53 | M |
| *Maesa indica* (Roxb.) A. DC. | 0.45 | 1.67 | 2.11 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Orhosiphonaristatus* (Blume) Miq | 0.89 | 1.67 | 2.56 | 59.00 | -18.20 | 23.90 | 1.00 | M |
| *Rubus rosaefolius* Smith. | 7.14 | 13.33 | 20.48 | 4.92 | -0.28 | 2.53 | 0.52 | M |
| *Mimosa pudica* L. | 2.68 | 6.67 | 9.35 | 11.80 | -2.83 | 5.59 | 0.56 | M |
| *Oxalis corniculata* | 5.36 | 6.67 | 12.02 | 13.41 | -0.74 | 3.09 | 0.59 | M |
| *piper umbellatum* | 4.02 | 8.33 | 12.35 | 11.47 | -1.39 | 3.87 | 0.57 | M |
| *Euphorbia heterphylla* L. | 0.89 | 1.67 | 2.56 | 59.00 | -18.20 | 23.90 | 1.00 | M |
| *Drymaria cordata* (L.) Willd. ex Schult. | 5.36 | 1.67 | 7.02 | 59.00 | -0.74 | 3.09 | 1.00 | M |
| *Solanum americanum* | 0.89 | 3.33 | 4.23 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| | 100.00 | 100.00 | 200.00 | | | | | |

**Table 8.** Important Value Index and Livestock Level Diversity Index

| *Scientifict Name* | Dominance | | | Diversity | | | | |
|---|---|---|---|---|---|---|---|---|
| | KR (%) | FR (%) | IVI | id | mu | mc | ip | Description |
| *Bidens pilosa* L. | 0.98 | 1.63 | 2.62 | 14.64 | 0.54 | 1.55 | 0.61 | M |
| *Imperata cylindrica* (L.) Beauv | 2.42 | 0.82 | 3.24 | 26.21 | 0.82 | 1.22 | 0.72 | M |
| *Ageratum conyzoides* L. | 7.82 | 6.81 | 14.63 | 59.00 | -18.20 | 23.90 | 1.00 | M |
| *Centela asiatica* (Linn.) Urb. | 1.87 | 0.82 | 2.69 | 19.49 | 0.76 | 1.28 | 0.66 | M |
| *Synedrella nodiflora* | 13.35 | 8.99 | 22.34 | 3.99 | 0.97 | 1.04 | 0.53 | M |
| *Alocasia macrorrhizos* | 0.82 | 2.72 | 3.55 | 7.21 | 0.45 | 1.66 | 0.55 | M |
| *Selaginella doederleinii* Hieron | 0.05 | 0.27 | 0.32 | 59.00 | -18.20 | 23.90 | 1.00 | M |
| *Stachytarpheta jamaicensis* (L) Vahl | 0.53 | 1.36 | 1.89 | 15.39 | 0.13 | 2.04 | 0.62 | M |
| *Laportea interupta* | 0.27 | 1.09 | 1.36 | 12.52 | -0.74 | 3.09 | 0.58 | M |
| *Chlorantus officinalis* Blume. | 5.71 | 4.09 | 9.80 | 9.42 | 0.92 | 1.09 | 0.57 | M |
| *Cyperus brevifolius* Rottb | 5.37 | 5.45 | 10.82 | 3.55 | 0.92 | 1.10 | 0.52 | M |
| *Emilia sonchifolia* (L.) DC. | 0.14 | 0.82 | 0.95 | 15.73 | 2.83 | 5.59 | 0.59 | M |
| *Alternanthera sessilis* (L.) DC | 1.01 | 1.09 | 2.10 | 14.53 | 0.55 | 1.53 | 0.61 | M |
| *Cyathula prostrata* | 15.52 | 11.17 | 26.69 | 2.26 | 0.97 | 1.03 | 0.51 | M |
| *Xanthosoma violaceum* Schott | 1.12 | 3.00 | 4.12 | 8.88 | 0.60 | 1.48 | 0.56 | M |
| *Phyllanthus niruri* L. | 0.91 | 1.63 | 2.55 | 25.11 | 0.51 | 1.59 | 0.70 | M |
| *Costus speciosus* | 0.69 | 3.54 | 4.23 | 6.92 | 0.34 | 1.79 | 0.54 | M |
| *Amomum maximum* Roxb. | 0.09 | 0.54 | 0.64 | 29.50 | -5.39 | 8.65 | 0.71 | M |
| *Pennisetum purpureum* Schumach. | 0.34 | 1.09 | 1.43 | 17.98 | -0.37 | 2.64 | 0.64 | M |
| *Oxalis barrrlieri* L | 0.27 | 1.09 | 1.36 | 22.46 | 0.36 | 1.76 | 0.68 | M |
| *Erechtites valerianifolia* | 1.76 | 6.27 | 8.03 | 3.81 | 0.75 | 1.30 | 0.52 | M |
| *Peperomia pellucida* | 3.18 | 1.91 | 5.08 | 13.53 | 0.86 | 1.17 | 0.61 | M |
| *Calopogonium mucunoides* Desv. | 0.09 | 0.27 | 0.36 | 59.00 | -5.39 | 8.65 | 1.00 | M |
| *Paspalum conjugatum* | 17.51 | 8.99 | 26.50 | 3.06 | 0.97 | 1.03 | 0.52 | M |
| *Ipomoea trioba* | 0.37 | 2.18 | 2.55 | 7.87 | -0.28 | 2.53 | 0.55 | M |
| *Centrosema pubescens* Benth. | 1.28 | 4.09 | 5.37 | 4.06 | 0.65 | 1.42 | 0.52 | M |
| *Elephantopus mollis* Kunth | 0.18 | 0.27 | 0.46 | 59.00 | -1.74 | 4.28 | 1.00 | M |
| *Commelina diffusa* Burm. f. | 9.60 | 7.63 | 17.23 | 2.72 | 0.95 | 1.05 | 0.51 | M |
| *Salvia occidentalis* Sw | 3.34 | 2.45 | 5.79 | 11.56 | 0.87 | 1.16 | 0.59 | M |
| *Tetrastigma leucostaphylum* (Dennst.) Alston | 0.02 | 0.27 | 0.30 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Urena lobata* L. | 0.09 | 0.54 | 0.64 | 29.50 | 5.39 | 8.65 | 0.71 | M |
| *Colocasia esculenta* (L.) Schott | 0.62 | 2.45 | 3.07 | 7.73 | 0.26 | 1.88 | 0.55 | M |
| *Curcuma zanthorrhiza* | 0.09 | 0.27 | 0.36 | 59.00 | -5.39 | 8.65 | 1.00 | M |
| *Poligonum chinense* L. | 0.05 | 0.27 | 0.32 | 59.00 | -18.20 | 23.90 | 1.00 | M |
| *Ipomoea batatas* (L.) Lam. | 0.02 | 0.27 | 0.30 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Borrearia laevis* (Lamk.) Griseb | 2.51 | 3.81 | 6.33 | 4.69 | 0.82 | 1.21 | 0.53 | M |
| | 100.00 | 100.00 | 200.00 | | | | | |

**Table 9.** Importance Value Index and Diversity Index of Lianas

| *Scientifict Name* | Dominance | | | Diversity | | | | |
|---|---|---|---|---|---|---|---|---|
| | KR (%) | FR (%) | IVI | id | mu | mc | ip | Description |
| *Mikania cordata* | 49.30 | 43.16 | 92.46 | 2.13 | 0.89 | 1.13 | 0.51 | M |
| *Anredera cordifolia* | 0.28 | 1.05 | 1.33 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *epipermnum pinnatum* L. | 0.56 | 1.05 | 1.61 | 59.00 | -18.20 | 23.90 | 1.00 | M |
| *Sechium edule* (Jacq.) Sw. | 0.56 | 1.05 | 1.61 | 59.00 | -18.20 | 23.90 | 1.00 | M |
| *piper nigrum* L. | 0.56 | 1.05 | 1.61 | 59.00 | -18.20 | 23.90 | 1.00 | M |
| *Piper retrofractum* Vahl | 3.64 | 7.37 | 11.01 | 7.56 | -0.60 | 2.91 | 0.54 | M |
| *Piper sarmetosum* Roxb. Ex Hunter | 0.28 | 1.05 | 1.33 | 0.00 | -18.20 | 23.90 | 0.02 | A |
| *Coccinia grandis* (L.) Voigt | 0.84 | 3.16 | 4.00 | 0.00 | -8.58 | 12.47 | 0.04 | A |
| *Momordica charantia* L. | 3.36 | 2.11 | 5.47 | 49.17 | -0.74 | 3.09 | 0.91 | M |
| *Stephania japonica* (Thunb. ex Murr) Miers) | 1.96 | 5.26 | 7.22 | 5.62 | -2.19 | 4.48 | 0.51 | M |
| *Cissus discolor* Blume | 1.96 | 2.11 | 4.07 | 25.29 | -2.19 | 4.48 | 0.69 | M |
| *Piper Betle* L | 36.69 | 31.58 | 68.27 | 2.77 | 0.85 | 1.18 | 0.51 | M |
| | 100.00 | 100.00 | 200.00 | | | | | |

**Table 10.** Importance value index and diversity index of the fern/epiphyte level

| *Scientifict Name* | Dominance | | | Diversity | | | | |
|---|---|---|---|---|---|---|---|---|
| | KR (%) | FR (%) | IVI | id | Mu | mc | Ip | Description |
| *Asplenium nidus* Linn. | 3.02 | 12.82 | 15.84 | 3.93 | -2.83 | 5.59 | 0.48 | M |
| *Diplazium esculentum* | 92.46 | 76.92 | 169.39 | 6.08 | 0.90 | 1.13 | 0.54 | M |
| *Drymoglossum piloselloides* (L.) Presl. | 4.52 | 10.26 | 14.78 | 11.47 | -1.39 | 3.87 | 0.57 | M |
| | 100.00 | 100.00 | 200.00 | | | | | |

Based on the results of the data analysis listed in Table 6, Table 7, Table 8, Table 9, and Table 10, the value of the IVI of plants was obtained at the level of shrubs, shrubs, herbs, lianas, and ferns. The IVI value at the shrub level was dominated by *Capsicum frutescens L.* with an IVI of 70.33%, at the shrub level, namely *Hyptis capitata* jacq with an IVI of 103.07%, at the herb level dominated by *Cyathula prostrata* with an IVI of 26.69%, at the liana level there was *Mikania cordata* with an IVI value of 92.46% and at the ferns level there was *Diplazium esculantum* with an IVI value of 169.39%. The medicinal plant that has the lowest IVI value at the shrub level is *Jatropha curcas L.* with an IVI of 14.84%, at the shrub vegetation level there is *Maesa indica* (Roxb) A.DC. with an IVI of 2.11%, at the herbaceous vegetation level there were *Ipomea batatas L.*, *Tetrastigma Leucostaphyllum*, and *stachytarpheta jamaicensis* with an IVI of 0.30% each, at the liana vegetation level there were *Anredera cordifolia* and *Piper sarmetosum* Roxb. with an IVI value of 1.33%, and at the fern level, there is *Drymoglossum pilloselloides L.* with an IVI of 14.78%. According to Amirina et al. (2019), the IVI value indicates the dominance level of a species in an ecosystem. Plant species that have a high-density value are characterized by having the highest number of individuals of any other type at a certain growth rate, indicating that this species is a species characteristic of the community in that area (Zulkarnain et al., 2015).

In this study, terna is a habitus species that has the most species in the undergrowth category. According to Sahira (2016), many herbaceous plants are found because herbaceous plants are plants that easily grow and develop well in unshaded environmental conditions and have sufficient sunlight.

*Morisita Distribution Pattern Index*

The index value of the moricita distribution pattern for each plant species at all growth levels and habitus can be seen in Table 2, Table 3, Table 4, Table 5, Table 6, Table 7, Table 8, Table 9, and Table 10. Species distribution pattern index showed that most of the species at the level of trees, shrubs, shrubs, herbs, lianas, and ferns spread in groups, while most of the species at the level of poles, saplings, and seedlings spread randomly. Data related to the pattern of distribution of these plants are used as basic data for the management of the area, namely a reference for placing plants in the spatial dimension. In addition, the distribution pattern can indicate the preferred location of these plants. The random distribution pattern is a sign that an environmental condition is homogeneous or shows a behavior pattern of living things that are not selective about their environmental conditions. Random distribution patterns tend to be safer for plant management efforts. Uniform/regular distribution patterns indicate negative interactions between individuals, such as competition for food and space (Gates et al., 1990; Metananda et al., 2015).

*Shannon-Wiener Species Diversity Index*

The species diversity index is a parameter that can see the structure and level of stability of plant communities in nature and indicates how high the diversity of a species is in an area (Andesmora et al., 2021; Baderan et al., 2021). Figure 3 shows that the range of plant species diversity index values at all vegetation levels in the Wana Lestari Community Forest of Karang Sidemen Village is between 0.53 to 2.94, so the diversity index is classified as low to medium. The level of vegetation that is classified as having a low diversity index value, namely; stakes, lianas, and ferns. The plants classified as having moderate index values are trees, poles, seedlings, shrubs, shrubs, and herbs. Environmental factors are the cause of differences in the shape and number of plant species in an area, such as repeated changes in vegetation, and availability of nutrients, light, and water obtained by plants (Soerianegara, 2008). In addition, a low diversity value indicates that a certain level of vegetation in an area is vulnerable to various disturbances.

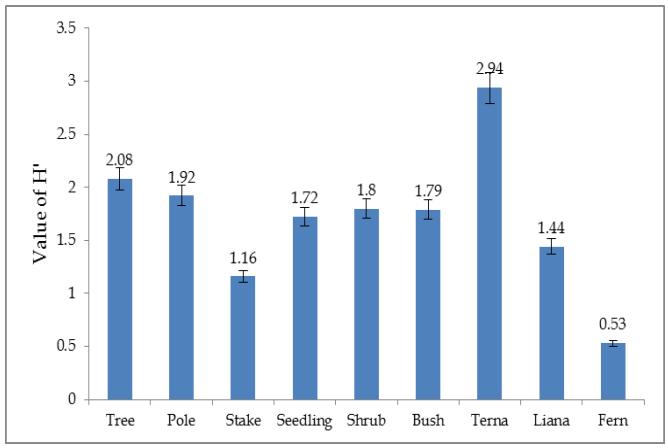


**Figure 3.** Diversity index (H') of the vegetation level of medicinal plants

*Species Evenness Index*

Evenness index shows the degree of evenness of individual abundance among each species. If each species has the same number of individuals, then the community has the maximum evenness value. Conversely, if the evenness value is small, then in that community there are dominant, sub-dominant, and dominant species, so that community has minimum evenness.

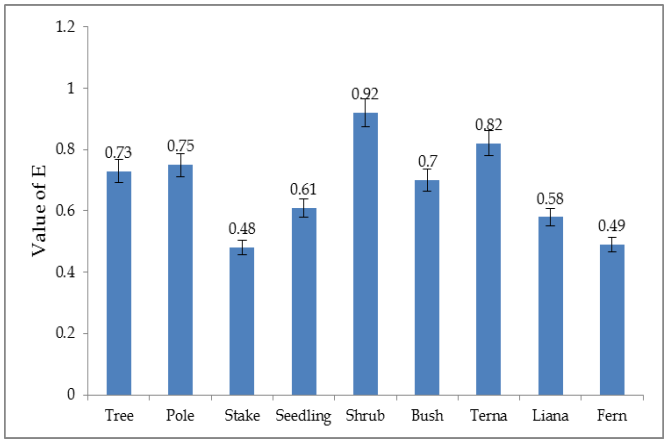


**Figure 4.** Species evenness index based on Habitus level

Figure 4 shows that the evenness index of plant species based on the level of vegetation has values ranging from 0.48 to 0.92. so based on the Evenness Index criteria according to Maguran (1998) the Evenness index value of plant species in the Wana Lestari Community Forest of Karang Sidemen Village is included in the criteria of less even to almost even. The higher the evenness index value of a vegetation level, it indicates that the vegetation level will be more stable and will recover quickly if a disturbance occurs. So based on Figure 4 the vegetation levels that are susceptible to disturbance are the saplings, lianas, and ferns.

*Margalef Species Richness Index*

Based on the results of the analysis of plant vegetation data in the Wana Lestari Community Forest of Karang Sidemen Village, the margalef jensi wealth index value was obtained as shown in Figure 5. The species richness index describes the number of species in a community. This index depends on the number of species in the field. The species richness index value is divided by the natural logarithm of the number of species, which means that the increase in the number of species is inversely proportional to the increase in the number of individuals. so the higher the number of species in the field, the fewer individuals in each species (Baderan et al., 2021).

Figure 5 shows that based on the species richness index criteria according to Baderan et al. (2021). Vegetation levels that have a low species richness index are saplings, seedlings, shrubs, shrubs, lianas, and ferns. Furthermore, the Vegetation level has a moderate Species Richness Index value, namely: trees and poles, Then the vegetation level with a high Species Richness Index value is the herb level.

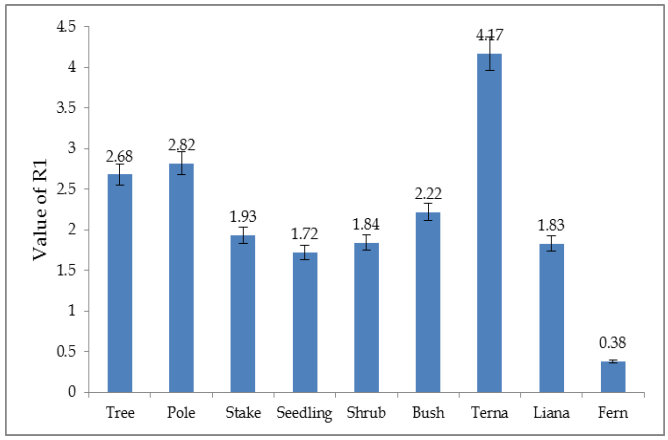


**Figure 5.** Margaleft species richness index (R1) values based on vegetation level

## Conclusion

Based on the results of the study it was found that the types of medicinal plants at the level of trees, poles, saplings, seedlings, shrubs, shrubs, herbs, lianas, and ferns that had the highest Importance Value Index (IVI) values were *D. zibethinus* (72, 42%) tree level, *D. zibethinus* (111.82%) pole level, *C. canephora* (144.98%) sapling level, *C. canephora* (109.64%) seedling level, *C. frutescens* L. (70, 33%) shrub level, *H. capitata* Jacq. (103.07%) at the shrub level, *C. prostrata* (26.69%) at the herb level, *M. cordata* (92.46%) at the lianas level, and *D. esculentum* (169.39%) at the ferns level. The Morishita index shows that most of the species at the level of trees, shrubs, shrubs, herbs, lianas, and ferns are distributed in groups, while most of the species at the level of poles, saplings, and seedlings are distributed randomly. In addition, the Species Diversity Index (H') of medicinal plants shows value at the level of trees (2.08), poles (1.92), saplings (1.16), seedlings (1.72), shrubs (1.8), shrubs (1.79), herbs (2.94), lianas (1.44) and ferns (0.53). Furthermore, the value of the species richness index (R1) of medicinal plants is at the level of trees (2.68), poles (2.82), saplings (1.93), seedlings (1.72), shrubs (1.84), shrubs (2.22), terna (4.17), lianas (1.87) and ferns (0.38). The Evenness Index value (E') of medicinal plants is at the level of trees (0.73), poles (0.75), saplings (0.48), seedlings (0.61), shrubs (0.92), shrubs (0.7), terna (0.82), liana (0.58) and fern (0.49).

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