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Structure and Composition *Seedling* Plant in the Campus Forest of UIN Sulthan Thaha Saifuddin Jambi

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Abstract

Seedlings are the first stands that grow to replace damaged forest vegetation. Seedlings can have a positive impact on the balance of the wider ecosystem, because seedlings are the beginning of an ecosystem regeneration process that is greatly influenced by that ecosystem The purpose of this research to information regarding the structure and composition of seedling in the UIN Sulthan Thaha Saifuddin Jambi Campus Forest. This research was carried out in July 2022 – March 2023. The research location was determined using the Purposive Sampling Method, determining the plot using systematic sampling, and data collection using the quadratic method with a size of 2 m x 2 m. The observation results were analyzed using the Importance Value Index, Shannon-Winner Diversity Index, Morisita Index, and the Evenness Index. The research results found that there were 332 individuals, 84 types of seedlings, belonging to 28 families. The highest Importance Value Index (INP) is Gmelina arborea Roxb (11.19%), the Diversity Index (H') is in the high category (H' 3.94). The evenness index (E) (0.89) is in the high (even) category.

Keywords: *Campus Forest, Composition, Seedling, Structure*

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INTRODUCTION

A forest is an area with dense vegetation, including various plant types such as trees, shrubs, ferns, grass, fungi, and more. It covers a considerable expanse and serves as a carbon dioxide sink, a habitat for wildlife, and a soil preserver. Forests are among the most vital components of Earth's biosphere. They exist all over the world, from tropical to cold climates, from lowlands to mountains, on small islands and vast continents (Firaz *et al*., 2021).

The university is a higher education institution, the educational level after secondary education which includes diploma, bachelor's, master's, and doctoral

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programs that confer academic degrees in various fields (Bafadhol, 2017). One of the universities in Indonesia is UIN Sulthan Thaha Saifuddin Jambi, located at the border of Jambi City and Muaro Bulian, 16 km from Simpang Sungai Duren, Muaro Jambi District, precisely at the coordinates 1°36.449'S-103°30.604'E to 1°36.451'S-103°30.603'E (Susanti & Yamin, 2017). UIN Sulthan Thaha Saifuddin Jambi consists of office or lecture buildings, as well as gardens and forests. Campus forest is a forest area with a group of trees left or intentionally created to improve the campus environment (Siagin *et al*., 2021). UIN Sulthan Thaha Saifuddin Jambi's campus forest is located in campus II, at the border of Jambi City and Muaro Bulian, 16 km from Simpang Sungai Duren, Muaro Jambi District. The campus forest is home to various living and non-living organisms. There is a diverse range of plant species in the campus forest, including trees, saplings, and undergrowth such as shrubs and herbs.

Seedlings are the first stands that grow to replace the damaged forest vegetation. The development of these stands takes a considerable amount of time to reach a state resembling the original forest before the damage. The ability of seedlings to sustain their lives influences the existence of the forest. The regeneration process of seedlings is related to disturbances in their ecosystem. Human exploitation of the forest affects the population characteristics of plant seedlings (Farhan *et al.*, 2019). The presence of seedling vegetation can have a positive impact on the broader ecosystem balance since seedlings mark the beginning of an ecosystem regeneration process greatly influenced by that ecosystem. Understanding seedling ecology is crucial not only for comprehending the processes leading to new growth and succession but also for developing strategies for conserving biodiversity. This research aims to gather information about the structure and composition of seedling species in the UIN Sulthan Thaha Saifuddin Jambi Campus Forest.

METHOD

This research was conducted from July 2022 to March 2023 at UIN Sulthan Thaha Saifuddin Jambi Campus Forest, located at the border of Jambi City and Muaro Bulian, 16 kilometers from Simpang Sungai Duren, Muaro Jambi Regency, specifically at coordinates 1°36.449'S - 103°30.604'E to 1°36.451'S - 103°30.603'E.

The research location was determined through purposive sampling, and the plot locations were determined using systematic sampling. Data collection was conducted using 2 m x 2 m quadrats. Transects with approximately 1,500 m long were established with 4 transect lines with each transect consisted of 4-6 plots, with a distance of approximately 30 m between plots. In total, there were 22 plots. Data collection focused on seedlings with a height of <1.5 m, including the total number of species within the plot, for identification purposes, samples were collected and herbariums were created.

Picture 1. Research Location

Specimens taken from each observation plot are labeled with tags and their morphological characteristics are recorded. The specimens are then preserved by wrapping them using newspaper and placing them in plastic bags, then adding 70% alcohol. The plastic bags are sealed tightly and taped shut. Afterwards, they were taken to the laboratory, dried using an oven, and identified using the Tree Flora of Malaya identification book and official botanical publications' website: http://www.asianplant.net, http://www.natureloveyou.sg. http://www.plantamor.com, https://powo.science.kew.org/ The data obtained in the field will be processed using the following formula,

Important Value Index (INP) = KR+FR

Index of Diversity

Species diversity data is analized using the Shannon-Wiener diversity index (H′) according to Odum (1971) as cited in Auliandari *et al.*, (2020). The diversity index is calculated with the following formula.

$$H' = -\sum(\frac{ni}{N})\ln(\frac{ni}{N})$$

Explanation,
H' : Diversity Index Shannon-Wienner
Ni : Number of individual of the i-th species
N : Total number of individual across all species

The value of H' falls into the following categories:
H' > 3 = High species diversity,
1 ≤ H' ≤ 3 = Moderate species diversity,
H' < 1 = Low species diversity.

Index of Evennes

The Index of Evennes is used to measure the uniformity of each type within any given community, calculated based on Sebastian, *et al.* (2022).

$$E = \frac{H'}{ln\, S}$$

Explanation:
E : Index of Evennes
H′ : Index of Diversity
Ln : Natural Logarithm
S : Number of Genera/Species

Evenness Index (E) is categorized into three criteria: If value < 0.3= Evenness Index is considered low; if the value in 0.3-0.6= Evenness Index is considered moderate

RESULTS AND DISCUSSION

Species Composition of Seedlings

A total of 332 seedling individuals were found in the UIN Sulthan Thaha Saifuddin Jambi Campus Forest, belonging to 84 species that fall within 28 families. The importance value of a plant can be determined from the total relative frequency and relative density values. Importance value indicates the dominance of a plant species in a particular habitat. The highest Importance Value Index (INP) was recorded for the species *Gmelina arborea Roxb.*, with a value of 11.19%. There were 30 individuals of this species, and *Dyera costulata* (Miq.) also showed significant importance with the data presented in Table 1.

Table 1. Types of seedlings found in the UIN Sulthan Thaha Saifuddin Jambi campus forest.

No	Species	KR	FR	INP
1	*Fissistigma* sp.	0,90	0,72	1,62
2	*Uvaria* sp.	1,20	0,72	1,92
3	*Dyera costulata* (Miq.) Hook.f.	5,42	3,60	9,02
4	*Alstonia angustifolia* Wall. Ex A.DC.	4,82	3,60	8,42
5	*Canarium denticulatum* Blume.	0,60	1,45	2,05
6	*Canarium megalanthum* Merr.	0,60	0,72	1,32
7	*Santiria apiculate* A.W.Benn.	0,30	0,72	1,02
8	*Gironniera nervosa* Planch.	2,11	2,88	4,99
9	*Gironniera subaequalis* Planch.	5,12	2,16	7,28
10	*Trema orientalis* (L.) Blume.	0,60	0,72	1,32
11	*Garcinia benthami* Pierre.	3,31	1,44	4,75

12	*Garcinia parvifolia* (Miq.) Miq.	0,30	0,72	1,02
13	*Dipterocarpus confertus* Sloot.	0,30	0,72	1,02
14	*Diospyros confertiflora* Hiern.	0,30	0,72	1,02
15	*Diospyros* sp.	0,30	0,72	1,02
16	*Elaeocarpus* sp.	0,30	0,72	1,02
17	*Alchorea tilifolia* (Benth.) Mull.Arg.	0,90	0,72	1,62
18	*Blumeodendron kurzii* (Hook.f.) J.J.Sm.	0,90	1,44	2,34
19	*Botryophora geniculata* (Miq.) Beumee ex Airy Shaw.	0,30	0,72	1,02
20	*Endospermum diadenum* (Miq) Airy Shaw.	2,11	2,16	4,27
21	*Macaranga bancana* (Miq.) Mull.Arg.	0,60	0,72	1,32
22	*Macaranga conifera* (Zoll.) Mull.Arg.	0,30	0,72	1,02
23	*Macaranga gigantea* (Reichb.f. & Zoll.) Mull.Arg.	2,41	1,44	3,85
24	*Macaranga hypoleuca* (Reichb.f. & Zoll.) Mull.Arg.	0,60	0,72	1,32
25	*Macaranga indica* Wight.	1,51	0,72	2,23
26	*Macaranga* sp.	0,90	2,16	3,06
27	*Macaranga trichocarpa* (Reichb.f. & Zoll.) Mull.Arg.	3,61	2,16	5,77
28	*Mallotus paniculatus* (Lam.) Mull.Arg.	0,30	0,72	1,02
29	*Tabernaemontana* sp.	0,30	0,72	1,02
30	*Trigonostemon* sp.	0,30	0,72	1,02
31	*Acacia* sp.	0,60	1,44	2,04
32	*Archidendron* sp.	0,90	1,44	2,34
33	*Flacourtia* sp.	0,60	0,72	1,32
34	*Ixonanthes* sp.	1,81	2,88	4,68
35	*Gmelina arborea* Roxb.	9,04	2,16	11,19
36	*Vitex pinnata* L.	0,30	0,72	1,02
37	*Barringtonia racemosa* (L.) Spreng.	0,90	0,72	1,62
38	*Durio* sp.	0,30	0,72	1,02
39	*Microcos* sp.	0,30	0,72	1,02
40	*Melastoma malabatricum* L.	2,11	1,44	3,55
41	*Melastoma* sp.	1,81	2,16	3,97
42	*Ptenandra* sp.	3,01	2,16	5,17
43	*Dysoxylum cyrtobotryum* Miq.	0,30	0,72	1,02
44	*Swietenia* sp.	1,20	1,44	2,64
45	*Artocarpus altilis* (Parkinson) Fosberg.	0,60	1,44	2,04
46	*Artocarpus elasticus* Reinw. Ex Blume.	0,90	1,44	2,34
47	*Ficus* sp.	0,60	1,44	2,04
48	*Horsfieldia* sp.	0,90	1,44	2,34
49	*Rhodamnia cinerea* Jack.	1,51	0,72	2,23
50	*Syzygium acuminatissimum* (Blume) A.DC.	0,30	0,72	1,02
51	*Syzygium chloranthum* (Duthie.) Merr. & L.M.Perry.	0,30	0,72	1,02
52	*Syzygium hirtum* (Korth.) Merr. & L.M.Perry.	0,90	0,72	1,62
53	*Syzygium mappaceum* (Korth.) Merr. & L.M.Perry.	1,51	1,44	2,94
54	*Syzygium napiforme* (Koord. & Valet.) Merr. & L.M.Perry.	0,30	0,72	1,02
55	*Syzygium scortechinii* (King) Chantar. & J.Parn.	2,11	0,72	2,83
56	*Syzygium* sp. 1	0,30	0,72	1,02
57	*Syzygium* sp. 2	0,30	0,72	1,02
58	*Syzygium* sp. 3	0,30	0,72	1,02
59	*Syzygium* sp .4	1,20	0,72	1,92

60	*Antidesma coriaceum* Tul.	0,30	0,72	1,02
61	*Aporosa* sp.	0,60	1,44	2,04
62	*Baccaurea odoratissima* Elm.	0,30	0,72	1,02
63	*Bischofia* sp.	1,20	1,44	2,64
64	*Bridelia* sp.	0,30	0,72	1,02
65	*Ardisia lurida* Blume.	2,41	3,60	6,01
66	*Gynotroches axillaris* Blume.	0,30	0,72	1,02
67	*Aidia densiflora* (Wall.) Masam.	0,30	0,72	1,02
68	*Canthium confertum* Korth.	3,31	0,72	4,03
69	*Gardenia* sp.	0,90	0,72	1,62
70	*Hancea eucausta* (Airy Shaw) S.E.C.Sierra, Kulju & Welzen	0,30	0,72	1,02
71	*Ixora blumei* Zoll. & Moritzi	4,22	1,44	5,66
72	*Lasianthus borneensis* Merr.	1,20	1,44	2,64
73	*Lasianthus* sp.	0,30	0,72	1,02
74	*Nauclea* sp.	1,20	0,72	1,92
75	*Pavetta indica* L.	0,90	2,16	3,06
76	*Tarenna fragrans* (Blume) Koord. & Valeton.	0,30	0,72	1,02
77	*Citrus* sp.	0,60	0,72	1,32
78	*Euodia* sp.	0,30	0,72	1,02
79	*Melicope hookeri* T.G.Hartley.	0,60	0,72	1,32
80	*Melicope lunu-ankenda* (Gaertn.) T.G.Hartley.	0,90	2,16	3,06
81	*Lepisanthes tetraphylla* (Vahl) Radlk.	0,30	0,72	1,02
82	*Eurya* sp.	0,30	0,72	1,02
83	*Eurya acuminata* DC.	0,90	1,44	2,34
84	*Villebrunea rubescens* Blume.	0,90	0,72	1,62

The Diversity Index (H') and Evenness Index (E)

The number of seedling species in the UIN Sulthan Thaha Saifuddin Jambi Campus Forest determines the diversity value of the plant seedlings in that area. The data results in Diversity Index (H') and Evenness Index (E). The values of the Diversity Index (H') and Evenness Index (E) of plant seedlings in the UIN Sulthan Thaha Saifuddin Jambi Campus Forest can be seen in Table 2.

Table 2. Diversity Index of Seedling Plant Species in the UIN Sulthan Thaha Saifuddin Jambi Campus Forest.

Structure Vegetation	Nilai
The Diversity Index (H')	3,94
The Evenness Index (E)	0,89

Table 3. Measurement Data of Physical-Chemical Environmental Conditions in UIN Sulthan Thaha Saifuddin Campus Forest, Jambi

Observation Location	Physical-Chemical Parameter			
	Soil Moistures (%)	pH Soil	Air Temperature (˚C)	Light Intensity (lux)
Transect I	20 %	6.53	29.67	463
Transect II	15 %	6.55	29	581,5

Transect III	14 %	6.73	28.67	252
Transect IV	34 %	6.61	28.5	320,5
Average	22 %	6,61	28,92	382,42

DISCUSSION

The research conducted in the UIN Sulthan Thaha Saifuddin Jambi Campus Forest showed that there were 332 individuals of seedling plants, comprising 84 species of seedlings belonging to 28 families. The most commonly found species in the research location was *Gmelina arborea* Roxb. also known as White Teak from the Lamiaceae family, with a total of 30 individuals. The least commonly found species included *Santiria apiculate* A.W.Benn., *Garcinia parvifolia* (Miq.) Miq., *Dipterocarpus confertus* Sloot., *Diospyros confertiflora* Hiern., *Botryophora geniculata* (Miq.) Beumee ex Airy Shaw., *Tabernaemontana* sp, *Vitex pinnata* L., *Dysoxylum cyrtobotryum* Miq., *Syzygium chloranthum* (Duthie.) Merr. & L.M.Perry., *Baccaurea odoratissima* Elm., *Hancea eucausta* (Airy Shaw) S.E.C.Sierra, Kulju & Welzen., dan *Lepisanthes tetraphylla* (Vahl) Radlk., each with 1 individual.

Based on the number of discovered species, it can be stated that the UIN Sulthan Thaha Saifuddin Jambi campus forest has diverse species. This diversity is influenced by various factors such as altitude, air humidity, soil moisture, pH, and the influence of dominant wind speed and direction. These factors significantly impact the growth and regeneration processes of plants in the forest area.

The highest Importance Value Index (INP) is Gmelina arborea Roxb. from the Lamiaceae family. This can be observed from its Importance Value Index (INP) of 11.19% with a total of 30 individual plant species in a biome. This parameter signifies the role of plant species within that biome. The presence of plant species in an area demonstrates their ability to adapt to the habitat and their broad tolerance to environmental conditions. The higher the Importance Value Index (INP) of a species, the greater control it has over the community (Ardianto *et al*., 2020).

According to the study by Putra *et al*., (2022) *Gmelina arborea* Roxb. has the ability to grow and adapt well to high temperatures and humidity which allow it to thrive in environments with a significant dry season, receiving rainfall between 1200-3000 mm/year. This species requires light intensity between 75-100% and temperatures ranging from 22°C to 31°C. In the research location at UIN Sulthan Thaha Saifuddin Jambi Campus Forest, the average temperature is 28.92°C.

The most commonly found plants species in an area is influenced by the existing environmental factors, and these factors are influenced by certain minimum, maximum, and optimum conditions. If the environmental factors do not support, it will hinder the growth and development of a particular plant species. According to Gurnita *et al*., (2022) dominant plant species means they have a broader range of environmental conditions compared to other species. Hence, with a wide tolerance range for environmental factors, a plant species will have a widespread distribution.

The Importance Value Index (INP) of plant species in a biome is one of the parameters indicating the role of plant species in that biome. The presence of plant species in an area demonstrates their ability to adapt to the habitat and their wide

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tolerance to environmental conditions. The higher the Importance Value Index (INP) of a species, the greater the degree of control it has over the community (Ardianto, *et al*. 2022).

Based on the calculation of the plant seedling diversity index in the UIN Sulthan Thaha Saifuddin Jambi Campus Forest, the diversity index obtained is 3.94. This value falls into the high category. This classification is based on Odum's statement (1994) as cited in Wahyuningsih *et al.*, (2020) which states that when the diversity index (H' > 3), it indicates high species diversity. The level of diversity in a plant community depends on the number of species and the number of individuals of each species (species richness). Species diversity can be used to describe the community's structure. It can also be used to measure community stability, which is the community's ability to remain stable even in the presence of disturbances to its components (Masruroh *et al.*, 2022).

The Index of Evenness (E) is one component of species diversity within a community. It describes the level of evenness or similarity in the distribution of species composition. A higher Evenness Index value indicates a more even presence of individual species within a community. The results of this research indicate that the Evenness Index (E) value in the UIN Sulthan Thaha Saifuddin Jambi campus forest is close to one, specifically 0.89. This suggests a relatively high evenness in the distribution of species. According to Adiguna *et al.*, (2021) if the Evenness Index falls within the range of $0.75 < E \leq 1$, it indicates a stable community. Table 3 presents the Evenness Index of seedling species in the UIN Sulthan Thaha Saifuddin Jambi campus forest, which falls within the stable community category. Therefore, the population of seedling species is fairly evenly distributed, making disturbances less likely and allowing the community to return to its initial state easily.

The evenness index represents the degree of evenness in the wealth or abundance of individuals among species. If each species has an equal quantity of individuals, the community achieves maximum evenness. However, when the evenness value is low, the community has minimal evenness (Baderan *et al.*, 2021).

CONCLUSION

1. The seedlings found in UIN Sulthan Thaha Saifuddin Jambi campus forest consist of 332 individuals belonging to 84 species within 28 families. The species with the highest Importance Value Index (INP) is *Gmelina arborea* Roxb., accounting for 11.19%.
2. The diversity index of seedling species in UIN Sulthan Thaha Saifuddin Jambi campus forest is 3.94, categorizing it as highly diverse. Additionally, the evenness index is 0.89, indicating a high level of species evenness.

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