Identification of Dominant Plants in Forest Ecosystems in some Manado State University Land as Explorative Learning Reference

by Anneke Rondonuwu

Identification of Dominant Plants in Forest Ecosystems in some Manado State University Land as Explorative Learning Reference

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Abstract— *This study aims to determine the dominant plant species in forest ecosystems in several Unima lands and to explore scientific concepts and processes that will serve as references in the explorative learning process. This type of research is a type of exploratory research. The method used in this study is qualitative. The object in this study is the dominant plant in the forest ecosystem in several Unima fields. Based on the analysis of vegetation that has been carried out to determine the dominant plants in the forest ecosystem in the front of the Unima new workshop and the land at the bottom of the Unima Auditorium, the dominant plants are Bankruptcy (Spathodea campanulata), Forest Betel (Piper aduncum L), Nest Nest Asplenium nidus and Aren (Arenga pinnata Merr). After knowing the dominant plants, then the concept of science and the scientific process are formulated based on facts or phenomena about the dominant plant in the form of a matrix that will be used as a reference in explorative learning.*

Keywords— *Plants, Vegetation Analysis, Explorative Research.*

I. INTRODUCTION

Forests in general can be interpreted as an area that has a lot of dense plants which include trees, shrubs, ferns, grass, mushrooms, and so on and occupy a fairly large area. According to Law No. 41 of 1999 concerning forestry, the definition of forest is a unified ecosystem in the form of a landscape of land containing biological natural resources that are dominated by trees in a natural environment that cannot be separated from one another. Forests are one of the sources of life that protect the earth for the sake of the continuity of human life on earth, forests are also the lungs of the world with various types of plants in them that maintain the availability of oxygen on earth and absorb carbon dioxide (Rivilio, 2010).

Plants are one of the most abundant organisms in the forest in the form of trees, bushes, ferns, grass, and others. Plants have chlorophyll or leaf green substance which has a function as a medium for the photosynthesis process or making food. Not only food that it produces, but plants can also produce oxygen (O_2) and convert carbon dioxide (CO_2) produced by humans and animals into oxygen (O_2) that can be used by other living things. (Ferdinand, 2009)

The relationship between plants and forests and wildlife is very close. According to Rusdianan and Lubis (2012), a forest is an ecosystem unit that is closely related to natural processes that are interconnected between the components of the ecosystem. The ecosystem is an ecological system that is formed because of the mutual relationship that cannot be separated between living things and their environment. The ecosystem is a combination of each biosystem unit that involves a reciprocal relationship between organisms and the physical environment so that the flow of energy into certain biotic structures that cause the material cycle of organisms within organisms.

Manado State University (Unima) is one of the state universities located in the North Sulawesi Prevention and precisely on the Tonsaru Tataaran hill, Tondano. Unima is categorized as a green campus because the natural conditions around the Unima campus are still awake with lots of trees and

other plants. Because Unima is located in the hills there are many types of plants that live around the campus, which causes the campus atmosphere to be cool. The Unima campus forest as one of the potential assets for the sustainability and comfort of the campus in terms of knowledge, beauty, and the environment has not yet been fully developed, especially in the use of forests as a source of explorative learning. The surrounding environment or the natural environment can be used as a learning resource to develop the potential of students to find the causes of events around them and look for facts in the surrounding environment (Komalasari, 2013). Explorative learning is learning that emphasizes student activity and is thought to be able to improve students' understanding of communication skills. Explorative learning begins with understanding the problem, analyzing, making guesses, and then making conclusions. In exploratory learning, students are allowed to construct their knowledge by building their constructs, then looking for answers based on the ideas and facts learned. (Rohmat, 2017)

Based on the above thinking, it is necessary to introduce the forest ecosystem as a source of exploratory learning, which is very important to understand the nature of forests and the diversity that is found in forests, especially for diverse plants. Researchers, in this case, will utilize plants that live in the forest ecosystem around the Unima campus as a reference to be used as a reference point in explorative learning, as well as discovering the science concept of certain plants that live in the forest ecosystem in several Unima fields. Based on the description above, the researcher will identify the dominant plants as a source of reference for explorative learning that will be packaged in the form of relationships of facts / natural phenomena that are around.

II.   RESEARCH METHODS

This type of research is a type of exploratory research. According to Fathoni (2005), explorative research is a study that intends to conduct an assessment or introduction of certain symptoms. In this research, theoretical references are not needed and hypotheses are not yet used. Explorative research is a study by tracing, especially in stabilizing concepts that will be used in a wider scope of research with greater conceptual reach (Yusuf, 2017). The object in this study is the dominant plant. Data collection techniques used in this study are observation and documentation as well as instruments used in observation sheets and documentation sheets. Measurements made in this study use vegetation

analysis techniques to determine the dominant plants in the forest ecosystem on the land. Forest vegetation analysis is a way to find out how large is the distribution of various species in an area through direct observation (Binari, 2011)

III.   RESEARCH RESULT

Manado State University is located on the hill of Tonsaru Tondano, Minahasa Regency, North Sulawesi Province, covering an area of 270 hectares with an altitude of 800 meters above sea level. On Manado State University Campus, there are 7 faculties scattered around Unima land with a considerable distance. Unima is categorized as a green campus because the natural conditions around the Unima campus are still awake with lots of trees and other plants. Due to the location of Unima in the hills, many species of plants live around the campus, so researchers are interested in making Unima land as a place of research and data collection on the dominant plants that exist around the Unima campus.

Explore Science Concepts and Processes

According to (Medellu, C. 2019) at the stage of exploring scientific concepts and processes there are five stages, namely:

1. Detailed observations of the phenomenon of components - components that interact affect the phenomenon

There are two fields used by researchers as research sites, the conditions in these two fields are different, the land in front of the Unima workshop building at the coordinates of 1 ° 16'08.11 "LU 124 ° 53'09.34" BT has a land condition that is not too sloping, there are various types plants and land cover plants and dense trees. While the land at the back of the Unima auditorium building has sloping land conditions, there are only a few species of vegetation and cover plants and trees that are not too dense.

2. Identifying variables influencing phenomena and relationships between variables based on scientific concepts and processes

The results of identification carried out by researchers on these two fields, the factors that affect plants are what can be seen are sunlight, water, and humidity, and factors that can be measured that affect plants are air temperature and soil pH. The instrument used to measure air temperature is the LM-8000 digital instruments and the instrument to measure soil pH is a 4 in 1 soil meter. These factors are very influential in the growth and development of plants both from seeds to mature plants.

3. Take measurements in the field of variables

Based on the research that has been carried out, the results of the calculation of plant parameters in the land in front of the Unima Workshop building on a 20 m X 20 m plot as presented in the following table:

Table 1. Composition of vegetation types in front of the Unima Workshop building

No	Name of Vegetation Type	Tree	Stake	Seedling	Under	amount
1	Bankruptcy (Spathodea *campanulata*)	√				14
	Banyan (*Ficus Benjamina*)					
2	Ara (*Ficus fistulsa*)	√				2
3	Money Tree (*Pachira aquatic*)	√				2
4	Bankruptcy (*Spathodea campanulata*)	√				2
	Durian (*Durio zibethinus*)					
5	Betel Forest (*Piper aducum*)		√			9
	Wood Macis (*Albizia julibrissin*)			✓		
6	Betel Forest (*Piper aducum*)		√			3
7	Wood Macis (*Albizia julibrissin*)		√			1
8	Bankruptcy (*Spathodea campanulata*)		√			3
	Dog Mercury (*Mercurialis perennis*)			✓		
9	Betel (*Piper caducibracteum*)			√		4
10	Bird's Nest Nail (*Asplenium nidus L*)		✓	√		3
			✓			
11			✓	√		3
			✓			
12					√	3
13					√	3
14					√	9
	TOTAL					61

Relative Density, Relative Frequency, Relative Dominance, and Vegetation INP at the Tree level in the front area of the Unima Workshop building. In Spathodea campanulata there are 14 stands with a diameter of 45, 31 cm, and INP of 170,96%. In Ficus Benjamina trees there are 2 stands with a diameter of 67, 28 cm, and INP of 65, 97%. In Ficus fistulsa trees there are 2 stands with a diameter of 16, 72 cm, and INP of 31.42%. In Pachira Aquatica there are 2 stands with a diameter of 17, 04 cm, and INP of 31.64%. Thus the highest INP value for the tree level is found in the Spathodea campanulata tree with an INP of 170.96%.

Relative Density, Relative Frequency, Relative Dominance, and Vegetation INP at the stake level in front of the Unima Workshop building. At the plant level of Spathodea campanulata, there were 9 stands with a diameter of 2, 93 cm, and INP of 139, 01%. In-plant stakes, Durio zibethinus amounted to 3 stands with a diameter of 3, 32 cm, and INP of 67, 52%. In plants, the level of Piper aducum is 2 stands with diameter 2, 71 cm, and INP of 36, 88%. In plants, the level of

Albizia julibrissin was 3 stands with a diameter of 2.12 cm and INP of 19.09%. Thus, the highest INP value for the sapling level is found in Spathodea campanula ta plants with an INP of 139, 01%.

Relative Density, Relative Frequency, and INP Vegetation at the seedling level in front of the Unima Workshop building. In the seedling level of Piper aducum there are 4 stands with INP of 88, 88%. In Albizia julibrissin plants amounted to 3 stands with INP of 66, 66%. In the plants, Spathodea campanuata amounted to 2 stands with an INP of 44.44 %. Thus, the highest INP value for the seedling level was found in the Piper aducum plant with an INP of 88.88%.

Relative Density, Relative Frequency, and Vegetation INP at the lower level in the front area of the Unima Workshop

building. In table 4.5 shows the results of observations of lower plants in the plot 2 mx 2 m there are 15 lower level plants and 3 types of lower level. In the lower level plants Mercurialis perennis amounted to 3 stands with INP of 40%. In the lower plants Piper caducibracteum amounted to 3 stands with INP of 40%. In the lower plants of Asplenium nidus there are 9 stands with an INP of 120%. Thus, the highest INP value for the lower level is found in Asplenium nidus plants with an INP of 120%.

Based on research that has been carried out on the forest ecosystem in the lower part of the Unima Auditorium, the results of the calculation of plant parameters in the lower area of the Unima Auditorium in the 20 m X 20 m plot are presented in the following table.

Table 2. Composition of vegetation types in the lower part of the Unima Auditorium

No	Name of Vegetation Type	Tree	Stake	Seedling	Under	amount
1	Candlenut (*Aleusrites moluccanus*)	√				4
	Banyan (*Ficus Benjamina*)					
2	Aren (*Arenga pinnata*)	√				4
	Bankruptcy (*Spathodea campanulata*)					
3	Aren (*Arenga pinnata*)	√				7
	Rambutan (*Nephelium lappaceum*)					
4	Aren (*Arenga pinnata*)	√				1
5			√			6
6			√			2
7				√		20
	TOTAL					44

Relative Density, Relative Frequency, Relative Dominance, and Vegetation INP at the Tree level in the lower part of the Unima Auditorium. In Aleusrites moluccanus trees, there are 4 stands with a diameter of 61, 704 cm, and INP of 84.32%. In the Ficus Benjamina tree, there are 4 strands with a diameter of 54.3 cm and an INP of 80.2%. In Arenga pinnata trees there are 7 stands with a diameter of 36.71 cm and INP of 107, 92%. In Spathodea campanulata trees there is 1 stand with a diameter of 27, 07 cm, and INP of 27, 55%. Thus, the

highest INP value for tree-level is found in Arenga pinnata trees with INP of 107, 92%.

Relative Density, Relative Frequency, Relative Dominance, and Vegetation INP at the sapling level at the bottom of the Unima Auditorium. In-plant Arenga pinnata saplings amounted to 6 stands with a diameter of 21, 23 cm, and INP of 218, 61%. In-plant stakes, Nephelium lappaceum amounted to 2 stands with a diameter of 9.71 cm and INP of

81, 39%. Thus, the highest INP value for the sapling level is found in Arenga pina ta plants with an INP of 218.61%.

Relative Density, Relative Frequency, and INP Vegetation at the seedling level in the lower part of the Unima Auditorium. In the Arenga pinata plants amounted to 1 stand

with an INP of 200%. Thus the highest INP value for seedling level is found in Arenga pinnata plants with an INP of 200 %.

Relative Density, Relative Frequency, and Vegetation INP at the lower level in the lower part of the Unima Auditorium as a result of observation of lower-level plants in the 2 m X 2 m plot there were no lower-level plants.

4. Conduct data analysis and interpret the processes that occur in dominant plants

Table 3. *Important Value Index at the tree, sapling, seedling, and lower level in the front area of the Unima workshop building.*

No	Species name	Number of Types	Diameter (cm)	INP (%)
1	Spathodea campanulata	14	45.31	170.96
2	Spathodea campanulata	9	2,93	139.01
3	Piper aducum	4	-	88.88
4	Asplenium nidus	9	-	120

Based on observations made to find out the dominant plants in the land in front of the Unima workshop building, seen from the highest important index value (INP) of these plants. Then an important value index was obtained at the tree level found in Spathodea campanulata plants at 170.96%, at the sapling level there were at Spathodea campanulata plants at 139, 01%, at the seedling level there was at Piper aducum

plants at 88, 88%, and at the level, bottom is found in plants Asplenium nidus by 120%.

The second land in this study is located at the bottom of the Unima Auditorium where the land is quite large, therefore a measurement of important value index (INP) is needed in this case on a tree stand with the same plot on the first land of 400 m2.

Table 4. *Importance Value Index at the tree, sapling, seedling and lower level in the area under the Unima Auditorium*

No	Species name	Number of Types	Diameter (cm)	INP (%)
1	Arenga pinnata	7	36, 71	107.92
2	Arenga pinnata	6	21.23	218.61
3	Arenga pinnata	20	-	200
4	-	-	-	-

Based on observations made to determine the dominant plants in the lower part of the Unima Auditorium, it is seen from the highest important index value (INP) of these plants. Then obtained an important value index at the

level of trees contained in Arenga pinnata plants at 107, 92%, at the sapling level found at Arenga pinnata plants at 218.61%, at seedling levels found at Arenga pinnata plants at 200%, and at lower levels not there are types of plants.

5. Formulate concepts and networks of science process concepts based on the results of data analysis and references

Table 5. Explorative Infiltration Capacity

Facts / Phenomena	Variable	Exploration of scientific concepts and processes				Synthesis Analysis
		science concept			Science process	
		Physics	Chemistry	Biology		
Kecrutan (Spathodea *campanulata*) Sp.	Sunlight, wind, water, and soil	• Temperature • Blush	• pH	• *Spathoeea campanulata* Plants Classification • Plant Morphology of *Spahtodea campanulata* • How to *breed Spahtodea campanulata* • Benefits of *Spathodea campanulata* Plants	Sunlight is one important factor that plants need from seed to tree. The role of light for seeds is to warm the seeds so they don't rot in moist conditions. *Spathodea campanulata* has a cigar-like shape. When the fruit is dry the fruit will open and release thin seeds that have wings. Then the seeds will fly with the help of the wind until they reach the ground. Water and soil are also very important for the growth process of *Spathodea campanulata* both from seeds to trees. Seeds that have fallen on the ground will absorb water until the seeds increase in size and become soft. Water can be obtained from soil moisture or rainwater. After that, the seeds will continue to grow until they become a	*Spathodea campanulata is a* tree from Africa which is usually planted as a protective plant on the roadside and also grows naturally in secondary forests in high forest zones, deciduous forests, transitions, and savannahs in Africa. *Sparthodea campanulata* is one of the mainstay names of Indonesian citizens as green plants. This tree is able to cool the surrounding environment with its towering characteristics. Aside from being greening, spathodea campanulata trees are often ornamental plants. This tree is fast growing and the woody trunk is not hard, can continue to grow well until it reaches a height of 10 to 35 meters. This plant has a large red hemaphrodite and an inner orange. When the buds, the flowers are curved and contain red sap. The petiole is short with a thickness of about 0.7 cm. Equipped with Juda with striking lenticels on the rachis. For its own history, the *Spathodea campanulata* plant was named by Fuchs in 1542. *Campanulata* itself has the meaning of plants with rounded crowns and

					tree. For sunlight, water and soil will continue to be needed by spatodea campanulata both to carry out the process of photosynthesis and its survival as well as wind to assist in the distribution of *Spathodea campanulata* seeds.	broad grounds such as church bells.
Sirih Hutan (*Piper aducum L*)	Sunlight, wind, water and soil	• Temperature • Humidity	• pH	• Plant Classification *Piper aducum L* • Plant Morphology of *Piper aducum L* • How to *breed Piper aducum L.* • Benefits of *Piper aducum L* plants	• All living plants must need sunlight, water and soil for their survival. Plant *Piper aducum L* • not only does it require sunlight, water and soil, but it also requires wind to spread the seeds. *Piper aducum L* • is a monocot plant or has single seeded seeds? Seeds that are blown by the wind will fall on the ground; germination will occur if the seeds of *Piper aducum L* fall in a place that has enough water, sunlight, and oxygen. After the seeds have fallen	*Piper aducum L* is one type of plant from Piperaceae family, who came from South America and entered Indonesia was estimated in 1860. *Piper aducum L* is known in Sunda by the name Seuseureuhan. This plant is a bush or • small trees that can grow well at an altitude of 90-1000 m above sea level in the grove of forests and secondary forests, on the banks of rivers and cliffs. *Piper aducum L* can grow and develop in areas with temperatures between 24 and 30 ° C, with rainfall 2,345 mm. *Piper aducum L.* is a plant shrubs, woody stems, height can reach 2-8 m. Ovoid-shaped leaves pointed tip, leaf base rounded, leaf edges flat on each book, hairy stems, cylindrical-shaped measuring 3-9 cm,

					into a proper place, there will be a process of imbibition in the seeds or the entry of water into the seed cells. After that, the plant organs will appear namely the root organs, leaves, and the tips of the stem or young shoots. Then it will continue to grow until it becomes an adult plant that already has flowers and is ready to reproduce. The process is inseparable from the help of sunlight, water, and soil.	leaf length 12-20 cm. The betel root system of the forest is a taproot.
Asplenium nidus	Sunlight, soil, water, and wind	• Temperature • Humidity	• pH	• Classification of *Asplenium nidus* plants • Plant Morphology *Asplenium nidus* • How to breed *Asplenium nidus* plants • Benefits of *Asplenium nidus* plants	*Asplenium nidus* is a type of fern whose lives are also highly dependent on sunlight, water, and soil and wind. As with other plants *Asplenium nidus* utilizes sunlight, water, and nutrients in the soil for photosynthesis, while the wind is used by *Asplenium nidus* to help spread spores. Spores flown by the wind will develop into ferns if they fall in a	*Asplenium nidus* is commonly known as the bird's nest fern. Habitat *Asplenium nidus* is on terrestrial and epiphytic trees, found at altitudes of 1,100 m asl to 1,500 m asl. Having a variety of sizes, a small size of about 7 cm long, with a width of 3 cm. While the large length can reach 120-150 cm, with a width of 26-30 cm. This type of nail plant has erect rhizome. Colored petiole black. The simple leaf blade shape, tufted, rosette shape with a pointed end.

					place that provides nutrients or other elements such as the availability of water and sunlight. *Asplenium nidus* spores that are blown by the wind not only fall on the ground there are also attached to the tree then the spores that attach to the right tree can also grow and develop then the ental - the enthrall of *Asplenium nidus* will dry to form a kind of nest that hitches a ride on tree branches and this nest is storing water so *Asplenium nidus* does not lack water *Asplenium nidus* that lives on other trees is called epiphytic plants or plants that are riding on other plants as their place of life.	hard and slippery texture. Leaf color part the paler bottom with brown stripes along with the leaf bone child. On the lines, these are spores attached. The stalk is very short and invisible because it is covered by fine hairs. The layout of leaves arranged in very short, circular stems forms a basket. Planting a leaf which is circular on the stem when viewed from the side looks like a bird's nest.

Arenga pinnata	Sunlight, water, soil, and insects	• Temperature • Humidity	• pH	• *Arenga pinnata* Plant Classification • Plant Morphology of *Arenga pinnata* • How to breed *Arenga pinnata* plants • Benefits of *Arenga pinnata* Plants	Sugar palm or areca palm (*Arenga pinnata) is a* part of the areca nut branch that breeds by seed. Like other plants, sugar palm also needs sunlight, water, and soil for survival such as photosynthesis and growth and development of seeds. Sugar palm also needs help from insects in the process of pollinating male and female flowers to produce palm fruit. Ripe fruit has a brownish yellow color and will fall to the ground. Each fruit has 3 seeds in its fruit. After falling, the flesh of the fruit will rot and only the seeds remain and the seeds will grow young shoots and continue to develop until they become mature sugar palm. Sugar palm plants do not need special soil conditions, so they can grow on clay (clay), calcareous and sandy soil, or soil conditions that are nest or can continue the excess water.	Aren (*Arenga pinnata*) belongs to the *Arecaceae* tribe (areca nut), a closed seed plant (Angiospermae). Palm trees can be found starting from the west coast of India, to the south of China and the Guam islands. Sugar palm habitat is also widely found in the Philippines, Malaysia, the Assam Plain in India, Laos, Cambodia, Vietnam, Burma (Myanmar), Sri Lanka, and Thailand. In Indonesia, there are many palm plants and are scattered throughout the archipelago, especially in humid hilly areas. Enau or palm (*Arenga pinnata*) is the most important palm after coconut (palm) because it is a multipurpose plant. This plant is known by various names such as nau, hanau, pululuk, biluluk, mourn, juk, or palm fiber. Palm sugar is a type of annual plant, sized large, solitary tree shaped up to 12 m high, diameter at breast height (DBH) up to 60 cm (Ramadani. 2008). Palm trees can grow to reach a height with a stem diameter of up to 65 cm and a height of 15 m and even reach 20 m with a canopy that rises above the stem (Soeseno, 1992). When the tree is still young the sugar palm tree has not been seen because it is covered by the base of the leaf midrib, when the lowest leaf has fallen, the trunk starts to appear. The surface

						of the stem is covered by black fibers that come from the base of the petiole. According to Ramadani in 2008 stated that pollination of sugar palm was allegedly not done by angina but by insects.

Facts or phenomena are determined from the object of research, namely the dominant plants in each of these fields and the researcher determines the variables that affect the dominant plants. From the facts or phenomena and variables that have been determined are further explored into science concepts and science processes. The results of the exploration of concepts and scientific processes are then analyzed for synthesis through measurement or observation and reference analysis in the form of books, research results or journals, and related internet sources. Facts or phenomena are bankruptcy plants (*Spathodea campanulata*), forest betel (*Piper aducum L*), bird's nest nails (*Asplenium nidus*) and sugar palm (*Arenga* pinnata), variables that affect these plants, namely sunlight, wind, water, and soil, as well as the concepts of science could be found such as temperature, humidity, pH, tum classification harbor, plants morphology, how to breed plants and benefit of plants.

IV. CONCLUSION

Based on the results of research and discussion, it can be concluded:

(1) The dominant plants in the forest ecosystem in front of the Unima Workshop veil are bankruptcy plants (Spathodea campanulata) at the tree and sapling level, forest betel plant (Piper aducum) at the seedling and plant level bird's nest nails (Asplenium nidus L) on the lower level. Whereas on the land under the Unima Auditorium the dominant plants are sugar palm (Arenga pinnata) at the level of trees, saplings, and seedlings. For lower plants, no plants are found.

(2) From the results of the exploration of concepts and scientific processes in dominant plants and the synthesis analysis obtained, they have been used as a reference in the explorative learning process in the target student group.

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(ETS) **Missing ","** Review the rules for using punctuation marks.

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Confused You have used either an imprecise word or an incorrect word.

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Frag. This sentence may be a fragment or may have incorrect punctuation. Proofread the sentence to be sure that it has correct punctuation and that it has an independent clause with a complete subject and predicate.

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Missing ","

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Proofread This part of the sentence contains an error or misspelling that makes your meaning unclear.

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