



Vegetation and Plant Diversity Analysis in STAIN Madina Grounds

Yusnita Anwar Nasution^{*1}; Rafeah Husni²; Nur Asiah Mtd³; Bella Khairani⁴

^{1,3,4}Biology Education, Faculty of Tarbiyah and Teacher Training, Sekolah Tinggi Agama Islam Negeri Mandailing Natal, Indonesia

²Biology Education, Faculty of Tarbiyah and Teacher Training, Universitas Islam Negeri Syekh Ali Hasan Ahmad Addary, Padangsidempuan, Indonesia

^{*1}yusnitaanwarnasution29@gmail.com, ²rafeah@uinsyahada.ac.id, ³[nasiahmtd@gmail.com](mailto:nasihmtd@gmail.com),
⁴bellakhairani220@gmail.com

Abstract

This study aims to observe the process of vegetation succession in the Campus Park area, Old Building STAIN Mandailing Natal, Faculty of Tarbiyah, and Keguruan Science, focusing on changes in vegetation types that occur during observation and factors that influence the course of succession. The research was conducted using a quantitative observation method, in which data were collected through field surveys by laying plots in parallel. Data collected included species type, dominance analysis, density measurement, relative density, and plant frequency. The results showed that *Asystasia gangetica* was the dominant species during the secondary succession stage, due to its high ability to colonize and adapt to disturbed environmental conditions. Besides *Asystasia gangetica*, other species found include *Digitaria sanguinalis*, *Meryta latifolia*, *Curculigo capitulaca*, *Anthurium crystallinum*, and *Clitoria ternatea*. The dominance of *Asystasia gangetica* is influenced by post-cultivation soil conditions, competition between species, and its ability to adapt. Climatic factors also play an important role in influencing the succession process. The practical implications of the results of this study are recommendations for increasing vegetation diversity and vegetation monitoring in the context of secondary succession.

Keywords: *Vegetation Dynamics, Types of Species, Plant Density.*

INTRODUCTION

Soil is an important component of the earth's crust consisting of minerals and organic matter, serving as a growing medium for plants and habitat for various organisms. Soil is also part of an ecosystem that combines abiotic and biological factors, creating a habitat that supports the life of soil organisms (Saputra and Agustina, 2019).

Soil in agriculture is defined as a medium where plants grow that is formed from weathering of rocks mixed with residual organic matter and organisms, both living on the surface and in the soil. Soil also contains water and air. Water in the soil comes from rainwater that is retained so that it does not seep into other places. The process of soil formation produces layers of soil or horizons consisting of a mixture of mineral materials,

organic materials, water, and air. Soil is a collection of natural objects on the earth's surface arranged in horizons and serves as a medium for plant growth (Mahfud Arifin, 2018).

The ability of soil to serve as a habitat for plants and to produce harvestable material is highly dependent on its fertility. Soil fertility is an important factor that plants need to survive and produce well, which is strongly influenced by the availability and amount of nutrients in the soil. Soil conditions and their quality play an important role in various ecological processes, including ecosystem succession.

Succession is a gradual process of ecosystem change. Succession in general can be defined as a complex process that includes the beginning, development, and finally reaching stability and stability in the climax phase. Climax is a stage of maturity that is final and stable, able to maintain itself, resistant to external disturbances because it has reached internal stability, and able to produce itself in vegetation development. With two main types, primary succession and secondary succession.

Primary succession occurs in previously unoccupied habitats. Primary succession is succession that starts from a completely empty area with no vegetation. If there was vegetation before, all the vegetation has been damaged or died (due to lack of adaptability) and is replaced by new vegetation. Secondary succession according to Jamili and Muksin (2003), Sutomo (2009) occurs due to disturbances such as fire or human activities that damage existing communities. According to Lincoln et al. (1985) in Purnomo's journal (2011), secondary succession refers to the chronological distribution of organisms in an area caused by human activities, such as agriculture, or due to previous community damage. Similarly, Barbour et al. (1987) in Purnomo's journal (2011) define secondary succession as the invasion of plants in areas that previously had vegetation, which was destroyed by natural factors or human intervention. This process involves new plants filling the disturbed land, replacing the earlier vegetation.

There are several factors that can lead to succession, including: 1) Climate, plants will not grow well if there are significant climate variations that occur over a long period of time. Climate change can destroy vegetation, either partially or completely. Eventually, bare land that is new will develop better, increase its adaptability, and change climatic conditions. Some conditions such as drought, rain and snow often have a negative impact on vegetation; 2) topography, changes in soil conditions are divided into two: a) erosion, is the process of eroding or losing soil from a location that is then carried by water or wind to another place. Soil that is eroded and carried away by water will settle in areas where the flow of water slows down, such as in rivers, irrigation canals, reservoirs, lakes or estuaries. As a result,

rivers become shallow, which can increase the frequency of flooding during the rainy season and drought during the dry season (I Gusti, 2012). Erosion can be caused by wind, water and rain. In the process of erosion, the soil becomes bare, then the spread of seeds by the wind (migration) occurs, and in the end the succession process starts from the beginning; b) deposition, which is caused by strong currents, glacial drift, snowfall, and soil exfoliation. If precipitation occurs where there is vegetation, the vegetation can be damaged, so succession begins anew in that place; 3) biotic, the presence of certain life forms can also cause damage to vegetation. Examples are repeated mowing of grass, grazing of livestock, cutting of forests for agriculture, all of which cause vegetation turnover.

The current study aims to observe secondary succession in the STAIN Mandailing Natal Campus Park after land cultivation/clearing by students, focusing on changes in vegetation before and after succession and factors that influence the process.

RESEARCH METHODS

The method used in this research is the observation method using plots with the laying of plots divided by 4 in parallel.



Figure 1. Succession Practicum Plot

This research was conducted in Campus Park, Old Building of STAIN Mandailing Natal, Faculty of Tarbiyah and Teacher Science on May 16, 2024. Tools and materials consist of: 1) Meter, this tool is used to measure and determine the dimensions of the plot, ensuring the area matches the planned size; 2) Hoe, used to clean and prepare the land by digging and removing unwanted plants; 3) machete, functions to cut wild plants or shrubs, making the land ready for further work; 4) camera, used to document each stage of the process and results, providing visual evidence for evaluation and reporting; 5) raffia rope, used to mark the boundaries of the vegetation area, helping to keep it clearly organized; 6) stakes, serves as

supports for the raffia string, ensuring the boundaries remain stable and secure; 7) label, used to mark group names or other essential information, facilitating identification of participating groups; 8) natural land, the site where vegetation management activities are conducted, serving as the location for applying learned techniques.

The object of this practicum is the vegetation found in the observation plot. An overview of succession is obtained from the results of data analysis by calculating Density (K), Relative Density (KR) and Frequency (F). The procedure includes clearing the cultivated land, mapping the cultivated land with a size of $2 \times 2 \text{ m}^2$, bound it with raffia rope, leave the plot for 3-4 weeks, observe and record the plant species that grow in the plot, and record changes in the composition of the plants.

RESULTS AND DISCUSSION

The overall results of observations in the garden land area before cleaning there were 8 types of plants, namely rambutan, horse jotang, red creeping, Israeli grass, candlenut, typonium, jarji grass and dichondra. Meanwhile, after cleaning and waiting for about 4 weeks, 6 types of plants grew, namely jarji grass, M. Latifolia leaves, Israeli grass, palm grass, anthurium and telang flowers.

From the above observations, it can be concluded that the plant groups found are as follows tree (rambutan, andlenut), herb (jotang kuda, typhonium, anthuriums, dichondra), grass (asystasia gangetica, jarji grass, plam grass), vines (tinospora crispa, melicope latifolia, clitoria ternatea).

1. Tree

a. Rambutan



Figure 2. Rambutan tree

Rambutan fruits contain various nutrients that contribute positively to the health of the body. Here are some of the main nutritional components found in rambutan fruit : vitamin C, which functions as an antioxidant to protect cells from free radical damage and support the body's immune system (Rangkuti, 2024), iron content in rambutan plays a role in hemoglobin synthesis and prevention of anemia, fiber, dietary fiber contained in this fruit supports a healthy digestive tract and prevents constipation. Although the amount is relatively small, vitamin A in rambutan is important for maintaining eye health and supporting good vision. The potassium element in rambutan helps maintain the body's electrolyte balance and supports cardiovascular function. Magnesium in rambutan contributes to muscle and nerve function, and regulates blood sugar levels. The calcium in this fruit is important for maintaining strong bones and teeth. In combination with calcium, phosphorus plays a role in the formation and maintenance of bone and tooth structure. Flavonoid compounds in rambutan have antioxidant activity, support anti-inflammatory function, and play a role in maintaining heart health. Although in small amounts, the protein content of hair is still significant for the repair and regeneration of body tissues. These nutrients make rambutan a fruit that is beneficial for supporting overall health.

b. Candlenut



Figure 3. Candlenut tree

Hazelnut oil has been widely recognized as an effective natural ingredient in supporting hair growth, especially in application as a hair tonic. Hazelnut oil's main content of essential fatty acids, such as linoleic acid and oleic acid, contribute to the stimulation of hair follicles.

In addition, the isoflavone genistein found in hazelnut oil as well as fatty acids from soybeans also play an important role in strengthening hair roots and supporting the hair

regeneration process. These compounds work synergistically to improve hair health and reduce shedding (Bonifasia Carrolina Laka, 2021).

2. Herbs

a. Jotang Kuda



Figure 4. Jotang Kuda

Various parts of this plant, including roots, stems, leaves, and flowers, are utilized by people as traditional medicinal ingredients. The flowers are often used to treat bleeding gums and relieve toothache. Meanwhile, the roots are known to have medicinal properties for diarrhea, and the leaves are often used to treat skin diseases. The roots, pistils, and other parts contain an active compound known as spilantol, which has strong stimulant properties and acts as an effective local analgesic to reduce pain topically (Thomas, 2011).

b. Thyponium

c.



Figure 5. Thyponium

Typonium flagelliforme Lodd., which has long been used in traditional medicine, is known to have benefits in the therapy of various cancers, including breast, lung, colon,

rectum, liver, prostate, kidney, cervical, throat, bone, brain, spleen, gallbladder, leukemia, and pancreatic cancer. Research shows that the ethanol extract of this plant contains bioactive compounds, such as saponins and phenols, which play a role in inhibiting cancer cell proliferation.

These active components work through various biological mechanisms, including antioxidant activity and inhibition of cancer cell signaling pathways, thus having potential as anticancer agents. (Himmaturajuli Rosyid Ridlo, 2012).

d. Anthurium



Figure 6. Typhonium

Anthuriums are often used as houseplants and have a significant role in improving indoor air quality and the mental health of occupants. Their visual beauty and ability to absorb air pollutants and release fresh oxygen contribute to a more positive and productive atmosphere. (Tiarno, 2021).

e. Dichondra



Figure 7. Dichondra

Traditionally used in folk medicine, telang flower (*Clitoria ternatea*) has been the subject of intensive research in recent decades. Phytochemical analysis of the flower petals of this plant has identified a wide array of bioactive compounds, such as flavonoids, terpenoids, and cyclotides, which contribute to its broad pharmacological activities, including antioxidant, anti-inflammatory, and hepatoprotective properties. (PictureThis, 2024).

3. Grass

a. Israel Grass



Figure 8. Israeli grass

Asystasia gangetica, widely distributed in the African, Arabian, and Asian continents, has significant pharmacological potential. The plant is traditionally used as an empirical treatment for a variety of conditions, including asthma, rheumatism, dry cough, and gastrointestinal disorders. (Adi, 2015).

b. Jarji Grass

Weeds are often considered as nuisance plants because they can compete with cultivated plants for nutrients, sunlight and water. However, despite interfering with plant growth, some types of weeds, such as finger grass (*Digitaria sanguinalis*), can be utilized as a source of animal feed to replace forage.



Figure 9. Jarji Grass

Finger grass contains various active compounds, including flavonoids, alkaloids, tannins, glucose, and saponins, which function as antimicrobials, antifungals, and antioxidants. This content has the potential to improve livestock health and support the increase in livestock body weight. The utilization of finger grass also has the advantage of being easy to find and can reduce animal feed costs. (Agnesia Nadia Bau, 2024).

c. Palm Grass



Figure 10. Palm Grass

Palm Grass is a group of monocotyledonous plants that have great economic potential. The fibers, stems, and other plant parts of this genus have been traditionally used as raw materials in a variety of industries, including construction, crafts, and food. (Sukoco, 2010).

4. Vines

a. *Tinospora crispa* L.

Figure 11. *Tinospora crispa* L.

The leaf parts of *Tinospora crispa* L. are traditionally used as herbal medicine to treat various complaints, including constipation, wounds, and diabetes mellitus. The diverse phytochemical contents in brotowali leaves, such as flavonoids, alkaloids, saponins, and tannins, are thought to contribute to its pharmacological activities, especially in managing blood glucose levels. (Mutia Putri Mawaddah, 2019).

b. *M. Latifolia* leaf

Figure 12. *M. Latifolia* Leaf

Melicope latifolia, is a forest plant of the Rutaceae family. The plant has health benefits, especially as an anti-hepatitis C virus agent. In addition, its fruit shows activity against hepatitis C, and other parts, such as leaves and stems, are often researched for medicinal purposes. The plant is also useful in ecological studies and plant classification research using technologies such as CNN (Convolutional Neural Networks) for image classification. (Resty Annisa, 2024).

c. Telang Flower



Figure 13. Telang Flower

Traditionally used in folk medicine, telang flower (*Clitoria ternatea*) has been the subject of intensive research in recent decades. Phytochemical analysis of the flower petals of this plant has identified a wide array of bioactive compounds, such as flavonoids, terpenoids, and cyclotides, which contribute to its broad pharmacological activities, including antioxidant, anti-inflammatory, and hepatoprotective properties. (Marpaung, 2020).

Table 1. Types of plants that grew before the land was cleared

No	Species	Latin Name	Family
1	Rambutan	<i>Nephelium lappacum</i>	Sapindaceae
2	Jotang Kuda	<i>Synedrela nodiflora</i>	Asteraceae
3	Red Creeper	<i>Ipomeae hederifolia</i>	Convolvulaceae
4	Israeli Grass	<i>Asystasia gangetica</i>	Achantaceae
5	Candlenut	<i>Aleuritas moluccanus</i>	Euphorbiaceae
6	Typhonium	<i>Typhonium blume</i>	Araceae
7	Jarji Grass	<i>Digitaria sanguinalis</i>	Poaceae
8	Dichondra	<i>Dichondra micratha</i>	Convolvulaceae

Table 2. Plant species that grow after land clearing

No	Species	Latin Name	Family	Plot			
				1	2	3	4
1	Jarji Grass	<i>Digitaria sanguinalis</i>	Convolvulaceae	1	-	-	-
2	<i>M. Latifolia</i> Leaf	<i>Meryta latifolia</i>	Araliaceae	1	-	-	-
3	Israeli Grass	<i>Asystasia gangetica</i>	Achantaceae	7	4	3	9
4	Palm Grass	<i>Curculigo capi tulaca</i>	Liliaceae	-	-	1	-
5	Anthurium	<i>Anthurium crys talium</i>	Araceae	-	-	2	-
6	Telang Flower	<i>Clitoria ternateae</i>	Fabaceae	-	-	-	1
Total				29 Plants			

Researchers observed secondary succession in the STAIN Mandailing Natal Campus Park. Plants on the land are quite fertile because the soil is moist enough to make it easier for vegetation to thrive and the sunlight is good because it goes directly to the vegetation.

Before land clearing, there were 8 types of plants: rambutan, horse jotang, red creeper, Israeli grass, candlenut, typonium, jarji grass, and dichondra. After 4 weeks, 6 plant species grew, namely jarji grass, *M. latifolia* leaves, Israeli grass, palm grass, anthurium, and telang flower.

After succession occurred and a new community was formed, there were 29 individual plants. The jarji grass and Israeli grass that grew in the new community came from the original community. This shows that the succession that occurs is secondary succession, where new communities appear in habitats that have been overgrown by other communities. The seeds of jarji grass and Israeli grass came from the original habitat. Land disturbance plots are the fastest to grow vegetation because soil structure, fertility, and nutrients are still maintained, triggering rapid vegetation growth. Land clearing without burning protects humus and mulch, maintains soil moisture and pH, and preserves the environment (Onrizal (2005).

During the observation, it was seen that although the number of species decreased, the population of individuals increased. This is in accordance with Sutomo's (2009) statement that ecological succession is a change in the species component of a community within a certain time, developing from a simple community to a complex community after disturbance. The first vegetation to emerge was grasses, such as jarji grass, indicating grass as a pioneer plant capable of growing in restricted environments (Michael, 2005).



Figure 14. Jarji Grass

Israeli grass dominates because it has good environmental adaptation, fast growth, reproductive efficiency, high nutrient competition, low maintenance, and resistance to disturbance. The relative density of Israeli grass is higher than other species. From the observation results, the relative density of Israeli grass is as follows: plot 1 by 24.13%, plot 2 by 13.79%, plot 3 by 10.34%, and plot 4 by 31.03%. The relative density of jarji grass was only present in plot 1 at 3.44%.



Figure 15. Israeli Grass

Overall, this practicum shows that secondary succession produces new communities with species that are more adaptive to new environmental conditions. Israeli grass becomes dominant due to characteristics that allow it to grow faster and be more competitive.

CONCLUSION

Based on the results of research related to natural succession after the cultivation that we conducted on the garden of the Old Building of STAIN Mandailing Natal by making plot plots, we can conclude that the succession that occurs is secondary succession. During the observation, it was seen that although the number of species decreased, the individual population increased. There were 29 individual plants. The first vegetation to appear was grasses, such as jarji grass. Israeli grass dominates because it has good environmental adaptation, fast growth, reproductive efficiency, high competition for nutrients, low maintenance, and resistance to disturbance. Factors that influence this succession process are

climate, topography and biotics. At the time of observation, the most influential factor was climate, where good rainfall, humidity and direct sunlight to the vegetation. Inference must be sharp with new findings in the form of theories, postulates, formulas, rules, methods, models, prototypes, or equivalent.

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