Analysis of Natural Forage Feed Vegetation that Grows Among Eucalyptus Plants

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Abstract. This research was conducted in District I of PT WKS which included three research sites to find out forage feed vegetation, important value index, uniformity of forage vegetation that grows under the shade of Eucalyptus of different ages. Vegetation analysis using a 2 × 2 m2 measuring plot, a 146-snippet plot that was determined purposively for the entire location. Vegetation dominance based on the Important Value Index (INP), is 1.5 years old Cledemia hirta (INP = 73.55), age 2.5 years Cledemia hirta (INP = 71.19) and age 3.5 years Asystasia gangetica (INP 57.73). The highest uniformity index was 0.26 at 2.5 years of age.

Keywords: Vegetation · Forage · Index of important values

1 Introduction

Efforts to increase the productivity of ruminant cattle such as cattle are inseparable from the availability of feed. About 70–90% of feed needs are sourced from forage feed, which is classified as forage feed is grass, legume, and other forage that can be consumed by livestock.

Adequate provision of forage feed in an grazing area is affected by factors; microclimate and environmental biophysical factors; soil fertility, water inertia, topography, rainfall, the management of grazing field areas. In the provision of forage feed can be done naturally or cut and carry. In semi-intensive livestock maintenance livestock can consume foraged feed that grows naturally around plantation crops such as Eucalyptus.

In the pattern of space divided into land that serves for cultivation and protected land, then in plantation land such as oil palm plantations, Eucalyptus pellita can still be used for cattle cultivation. This is supported by the forage of feed that grows among eucalyptus pellita plants. Which can be used for the consumption of cattle. The area that can be utilized by livestock as a source of forage feed consists of plantation land (under the shade of oil palm or Eucalyptus plants, vacant land, roadside and natural grazing fields. Land as a source of forage feed has considerable variation between one area and another so it is necessary to know the potential for forage vegetation of feed contained in a certain area.

PT Wirakarya Sakti is one of the companies that grow Eucalyptus as a raw material for paper making. Currently pt WKS concession ±290,378 ha [1]. Eucalyptus pellita.

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The tree cycle is set at an average of 4 years with a planting distance used of 3 × 2 m. Eucalyptus pellita plants have a variation of 1.5 years, 2.5 years and 3.5 years. Vegetation under the shade of Eucalyptus pellita is as diverse as grass components, legumes and weeds. Forage is consumed by cattle herded under the auspices of Eucalyptus pellita. According to data on the number of cattle in West Tanjung Jabung Regency in 2019 is 7,193 [2]. Good forage feed can be seen from its production and quality and availability continuously throughout the year.

One of the factors that need to be considered to maintain productivity and continuous availability of forage feed is to utilize natural-grown forage on grazing fields or land under the auspices of Eucalyptus.

A natural and built ecosystem always consists of two main components, namely biotic and abiotic. Vegetation or plant communities are one of the biotic components that occupy certain habitats such as under oil palm plantations. The structure and composition of vegetation in a region is influenced by other components of ecosystems that interact with each other, so vegetation that grows naturally in a particular region is actually a reflection of the interaction of various environmental factors and can undergo drastic changes due to anthropogenic influences [3].

The presence of vegetation in a landscape will have a positive impact on the balance of ecosystems on a wider scale. In general, the role of vegetation in an ecosystem is for the regulation of the balance of carbon dioxide and oxygen in the air, improvement of the physical, chemical and biological properties of the soil, the regulation of groundwater systems and others. The composition of vegetation can also be used as an indicator of disturbances in vegetation communities by observing patterns of vegetation distribution within the community [4].

Although in general the presence of vegetation in an area has a positive impact, the effect varies depending on the structure and composition of the vegetation that grows. For example, vegetation in general will reduce the rate of soil erosion, but the magnitude depends on the structure and composition of the plants that make up the vegetation formation of the area.

Research aims to find out; (1) Types of forage feed vegetation found under the auspices of Eucalyptus, 2) Index of important values, and 3) Uniformity of forage feed types.

2 Methods

The research was conducted in the Eucalyptus plantation area of PT WKS located in District I (Kempas Village) of West Tanjung Jabung Regency which has a lifespan of 1.5 years, 2.5 years and 3.5 years. District I of Kempas Plain Village astronomically 01°00′29″ - 01°16′28″ LU 103°06′53″ - 103°25′12″ BT, administratively covering Tanjung Jabung Barat Regency and Muaro Jambi Regency. The study was conducted from August to September 2021.

Based on topography (altitude of place / elevation), the overall working area of IUPHHKHT PT Wirakarya Sakti is in the lowlands with a height between 3–469 m above sea level which is divided into swampy and dry land areas. Swamp areas have a height between 3–6 m above sea level, while dry land areas have a height between

6–469 m above sea level. In addition to the height of the place, based on the Topographic Map of the scale of 1:250,000, the slope of the working area slope has a slope of slope A (flat) area of 171,187 ha, slope B (ramps) area of 64,810 ha, slope C (rather steep) area of 53,424 ha and slope E (very steep) area of 957 ha. Thus the IUPHHK-HTI area of PT Wirakarya Sakti is mostly on slope A.

Existing (Standing stock) distribution of Eucalyptus sp planting age from 2016 (3,764 ha), in 2017 (18,040 ha), in 2018 (20,002 ha), in 2019 (19,168 ha), and in 2020 (30,409 ha) [1].

The materials used in the study included bottom plants (including grass habitus, legumes and weeds) found in eucalyptus plantation areas. The tools used include location maps, compasses, cameras, machetes, knives, raffia ropes, calculators, computers, raincoats, observation sheets, plant monograph books and/or identification key books, notebooks, and pencils or pens.

The data taken included type, individual density per land area, frequency of lower plant species and species diversity. The data was collected by purposive sampling method with a plot of footage as many as 48 (age 1.5 years), 58 (age 2.5 years) and 40 (age 3.5 years). Each sample plot is rectangular with a size of 2 m × 2 m.

Calculation and Analysis of Data

Vegetation analysis is carried out on the type of vegetation found in oil palm plantations by making observation plots. To find out the composition or type and structure of vegetation used methods of combination of paths and line snapping [4] [5] [6].

$$\text{Density (K)} = \frac{\text{Number of individuals of a kind}}{\text{Size of measuring plot}}$$

$$\text{Relative density (KR\%)} = \frac{\text{Density of a kind} * 100}{\text{Density of all types}}$$

$$\text{Frequencies (F)} = \frac{\text{The number of sub - plots found of a type}}{\text{Total number of all sub - swaths of observations}}$$

$$\text{Relative Frequency (FR\%)} = \frac{\text{Frequency of a type} * 100}{\text{Frequency of all types}}$$

$$\text{Dominance (D)} = \frac{\text{Number of basic LB of a type (Closing Area)}}{\text{Sample area}}$$

$$\text{Relative dominance (DR\%)} = \frac{\text{Dominance of a type} * 100}{\text{Dominance of all types}}$$

$$\text{Index Important Values (INP)} = \text{Relative density} + \text{Relative dominance} + \text{Relative frequency}$$

Uniformity of Plant Types

The uniformity of plant species is the uniformity of species or types of plants in a community, a calculation based on Simpson's formula (1949) in [15]:

$$J' = \frac{H}{H\ \max}$$

J' = type uniformity index

3 Results and Discussions

The analysis of vegetation in general is to study plant communities, which includes species identification, species growth forms. While specifically synecology or ecology of plant communities known as phytososiology or sociology of plants [5]. Vegetation analysis is an analysis that aims to study the character of a community [6]. Quantitative analysis is used as a pattern that can be measured easily [7].

Forage feed that grows naturally under the auspices of Eucalypus found in district I areas such as; Cyperus rotundus, Cleome rutidospermae dc, Boreria alata, Scoparia dulcis, Crassocephalum crepidiodes, Cledemia hirta, Nephrolepis exaltata, Asystasia gangetica, Mikania micrantha, Athrium filix-femina, Melastoma taceae, Branchiaria mutica, Chromolaena odorata, Boreria latifolia, Cyrtomium falcatum, Panicum aquaticum, Phaspalum conjugatum. Vegetation is more dominated by weed components, while superior grass components such as Pennisetum purpureum, Panicum maximum, Pennisetum purphupoides, Setaria spachelata are not found.

At three research sites cattle were released during the day and grounded at night. Cattle consume naturally grown vegetation to meet the needs and productivity of livestock. At the location of the age of eucalyptus plant 1.5 years dominated by Cledemia hirta plant with INP 73.55, eucalyptus plant 2.5 years dominated Cledemia hirta INP 71.1931 and eucalyptus age 3.5 years dominated Asystasia gangetica INP 57.73%. According to [8] the dominant feed forage found in the Bahar River is Ottochloa nodosa (Kunth) with an INP of 46.49%.

The system of integration of livestock with oil palm plantations is able to increase soil fertility and support sustainable agriculture. According to [6] the success of the system of integration of livestock with oil palm plantations by utilizing forage of feed under and around oil palm plantations and intensive livestock maintenance governance. Furthermore, [9] stated that the integration of cattle with oil palm plantations provides a sustainability index value of 52.92% which means crop livestock system activities have a sufficient sustainable level. Conversely, if the oil palm monoculture farming business is carried out then land productivity decreases [6].

Vegetation Analysis

The results of vegetation analysis of the number of forage feed types at three research sites in livestock rearing areas are presented in Table 1. The results of the analysis of type number data showed that the number of types for each location varied.

Table 1 shows that the types of vegetation or forage found in three locations vary. Varying amounts and types of vegetation suggest that although the research site is in the Eucalyptus plantation area, the environmental conditions of the vegetation of each research site are different.

Based on the Important Value Index (INP), which describes the dominance of a plant type, shows that consecutively from the age of 1.5 years (INP = 73.55), age 2.5 years (INP 71.19%) and eucalyptus age 3.5 years (INP = 57.73%). Types of vegetation based on INP across the research site are presented in Table 2. The results of vegetation analysis on eucalypus land aged 1.5 years, 2.5 years and 3.5 can be seen in Table 3, Table 4 and Table 5.

Table 1. Types of forage feed found in three research sites

Eucalyptus age 1.5 years	Eucalyptus age 2.5 years	Eucalyptus age 1.5 years
Cyperus rotundus	*Cledemia hirta*	*Boreria alata*
Cleome rutidospermae dc	*Asystasia gangetica*	*Asystasia gangetica*
Boreria alata	*Mikania micrantha*	*Ageratum conyzoides*
Scoparia dulcis	*Cleome rutidosperma dc*	*Boreria latifolia*
Crassocephalum crepidiodes	*Cyperus rotundus*	*Cledemia hirta*
Cledemia hirta	*Branchiaria mutica*	*Cleome rotidusperma dc*
Nephrolepis exaltata	*Chromolaena odorata*	*Nephrolepis exaltata*
Asystasia gangetica	*Boreria alata*	*Mikania micrantha*
Mikania micrantha	*Melastoma taceae*	*Chromolaena odorata*
Athrium filix-femina	*Cyrtomium falcatum*	*Melastoma taceae*
Melastoma taceae	*Nephrolepis exaltata*	
Branchiaria mutica	*Phaspalum commersoni*	
Chromolaena odorata	*Boreria latifolia*	
Boreria latifolia	*Setaria spacelata*	
Cyrtomium falcatum		
Panicum aquaticum		
Phaspalum conjugatum		

Table 2. Dominant vegetation types throughout the research site

Research Location	Types of Vegetation
Age 1.5 years	Cledemia hirta with INP 73,55%
Age 2.5 years	Cledemia hirta with INP 71,19%
Age 3.5 years	Asystasia gangetica with INP 57,73%

From the results of the analysis of forage feed vegetation found in three research sites (District I) of PT WKS West Tanjung Jabung Regency showed that the highest INP was found in location 1 (Cledemia hirta with INP 73.55466), 2 (Cledemia hirta with INP 71.1931), then location 3 (Asystasia gangetica with INP 57.73%)) and. The difference in INP between research locations is related to differences in eucalyptus governance. For Eucalyptus aged 1.5 years get more intensive treatment and treatment in the form of spraying using herbicides, so that the vegetation that grows is vegetation that is able to adapt to the surrounding environment. At the age of 1.5 years more sunlight infiltration reaches the ground surface. The intensity of light at the location of 1.5 years of age reached 1610 lx. The dominance of weeds causes the growth of grass components, legumes become slower. For locations aged 1.5 and 2.5 years dominated by

Table 3. Results of vegetation analysis on Eucalypus land aged 1.5 years

Types of Vegetation	K	KR (%)	F	FR (%)	INP
Cyperus rotundus	41666,67	0,70922	0,5	0,862069	1,571289
Cleome rutidospermae dc	229166,7	3,900709	2,5	4,310345	8,211054
Boreria alata	525000	8,93617	6	10,34483	19,281
Scoparia dulcis	54166,67	0,921986	1	1,724138	2,646124
Crassocephalum crepidiodes	54166,67	0,921986	1,5	2,586207	3,508193
Cledemia hirta	2650000	45,10638	16,5	28,44828	73,55466
Nephrolepis exaltata	266666,7	4,539007	6	10,34483	14,88383
Asystasia gangetica	691666,7	11,77305	6,5	11,2069	22,97995
Mikania micrantha	300000	5,106383	3,5	6,034483	11,14087
Athrium filix-femina	33333,33	0,567376	1	1,724138	2,291514
Melastoma taceae	379166,7	6,453901	5	8,62069	15,07459
Branchiaria mutica	54166,67	0,921986	1,5	2,586207	3,508193
Chromolaena odorata	62500	1,06383	0,5	0,862069	1,925899
Boreria latifolia	466666,7	7,943262	4,5	7,758621	15,70188
Cyrtomium falcatum	12500	0,212766	0,5	0,862069	1,074835
Panicum aquaticum	12500	0,212766	0,5	0,862069	1,074835
Phaspalum conjugatum	41666,67	0,70922	0,5	0,862069	1,571289

the vegetation Cledemia hirta. Vegetation Cledemia hirta if the young can be consumed by cattle. The high INP value of a vegetation in a particular area indicates that the vegetation is dominant and able to adapt to the local area [9].

Forage feed vegetation found at three research sites had uniformity index values (Evenness = J') for ages 1.5 years (0.24) and Shannon-Wiener index (H') = 0.81, 2.5 years old J' = 0.26 and H' = 0.86, age 3.5 years J' = 0.19 and H' = 0.62. According to [15] the index value of uniformity ranges from 0 - 1 with the provision if $E > 0.6$ then the uniformity of the type is high, if $0.6 \geq E \geq 0.4$ then the uniformity of the type is moderate and if $E < 0.4$ then the uniformity of the type is low.

The diversity of forage vegetation types at the research site is due to natural factors and human intervention. For example, diversity can be formed by introduction of types of grass and legumes that are able to adapt to oil palm plantations. The types of leguminose commonly used as cover plants at a young age are Centrosema pubescens, Stylosanthes guianensis, Pueraria phaseoloides, Leucaena leucocephala, Desmodium heterophylum, Macroptillium atropurpureum and Desmodium intortum. While the common types of grass are Panicum maximum, Setaria anceps, Digitaria decumbens, Brachiaria mutica, Digitaria spp, Beta spp and Brachiaria humidicola [10] [11].

Grass or leguminose is useful to reduce soil erosicity. There was a negative correlation between daily soil loss and daily rainfall while the soil loss was negatively correlated with the time of the regrowth period after the plant was harvested. Thus, the maintenance

Table 4. Results of vegetation analysis on Eucalypus land aged 2.5 years

Types of Vegetation	K	KR (%)	F	FR (%)	INP
Cledemia hirta	2994048	41,36853	25,5	29,82456	71,1931
Asystasia gangetica	1496429	20,67604	18	21,05263	41,72867
Mikania micrantha	252976,2	3,495353	4,5	5,263158	8,758511
Cleome rutidosperma dc	76190,48	1,052718	2	2,339181	3,391899
Cyperus rotundus	53571,43	0,740192	2	2,339181	3,079374
Branchiaria mutica	1414286	19,54108	19	22,22222	41,7633
Chromolaena odorata	70833,33	0,978699	1,5	1,754386	2,733085
Boreria alata	158333,3	2,18768	3,5	4,093567	6,281247
Melastoma taceae	366666,7	5,066206	5	5,847953	10,91416
Cyrtomium falcatum	58333,33	0,805987	1	1,169591	1,975578
Nephrolepis exaltata	20833,33	0,287853	0,5	0,584795	0,872648
Phaspalum commersoni	12500	0,172712	0,5	0,584795	0,757507
Boreria latifolia	83333,33	1,15141	1	1,169591	2,321001
Setaria spacelata	179166,7	2,475533	1,5	1,754386	4,229918

Table 5. Results of vegetation analysis on Eucalypus land aged 3.5 years

Types of Vegetation	K	KR (%)	F	FR (%)	INP
Boreria alata	1079167	21,58333	11,5	19,82759	41,41092
Asystasia gangetica	1420833	28,41667	17	29,31034	57,72701
Ageratum conyzoides	441666,7	8,833333	6	10,34483	19,17816
Boreria latifolia	370833,3	7,416667	4,5	7,758621	15,17529
Cledemia hirta	1012500	20,25	9	15,51724	35,76724
Cleome rotidusperma dc	283333,3	5,666667	4	6,896552	12,56322
Nephrolepis exaltata	95833,33	1,916667	2,5	4,310345	6,227011
Mikania micrantha	158333,3	3,166667	2	3,448276	6,614943
Chromolaena odorata	83333,33	1,666667	0,5	0,862069	2,528736
Melastoma taceae	54166,67	1,083333	1	1,724138	2,807471

of grass can reduce the risk of erosion. Factors of soil erosivitas and growth of feed forage feed are air temperature and rainfall controlled by the energy balance between the earth and the atmosphere [12] [13]. Radiation that reaches the earth's surface in the form of visible light is partially absorbed by the earth's surface and the atmosphere above it. According to I [14] The use of forage under oil palm plantations is a series of clean production activities (Reuse, reduce and recycle).

4 Conclusions

The types of forages found at the three research sites varied, forage dominantly based on the INP. Cledemia hirta, and Asystasia gangetica. The highest type uniformity value of 0.26 is found at the location of 2.5 years of age.

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