Density Of Soil Macraofauna At Different Level Vegetation In The Gunung Leuser National Park Resort Tenggulun

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Abstract- The litterfall in the forest is the main resource of nutrient cycles in the forest ecosystem. Soil macrofauna is part of the soil biodiversity an important role in the improvement of physical, chemical and biological properties of the soil through the process of immobilization and humification to maintain the availability of nutriens. This research was conducted to determine the density of soil macrofauna at different levels of vegetation density in Gunung Leuser National Park Resort Tenggulun. The results showed that there are 16 types of soil macrofauna found in Gunung Leuser National Forest Forest with details a high and low density of 12 species and medium density of 8 species. At high density obtained soil macrofauna of 17.6 individuls/m^2, medium density 12,96 individuals/m^2 and low density 9,12 individuals/m^2. The higher level of vegetation density than higher macrofauna density of the soil.

Keywords*: Density, Macrofauna, Gunung Leuser National Park*

Introduction

Gunung Leuser National Park (TNGL) Forest with an area of 1,095,592 hectares, located at coordinates 96º35 "- 98º30" BT and 2º50 "- 4º10" LU. Administratively in two provinces, namely Aceh Province and North Sumatra Province (Balai Besar TNGL, 2007). TNGL holds a global status as a Biosphere Reserve in 1981 so it is said to be a life-support system and a nature laboratory rich in biodiversity.

The collapse of litterfall in Gunung Leuser National Forest is a major source of nutrient cycles within the forest ecosystem. Leaves and litter fall gradually collected in the forest soil until the decomposition process begins (Prescott, 2004). Litter decomposition is a very important process in nutrient dynamics in an ecosystem (Regina & Tarazona, 2001). Litter decomposition regulates the flow of energy, especially the productivity and nutrient distribution in the forest ecosystem. The process is vital for the sustainability of nutrient status in forest plants and the rate of decomposition varies for different plant species. Based on research (Tridati et al., 2011) litter produced by natural forest is bigger that is 13,67 t / ha / year compared to production forest like cocoa which only 4,98 t / ha / year.

Various types of soil organisms that commonly include invertebrate members have been widely reported to play an important role in the processes occurring within the ecosystem, especially in the tropics (Lavelle et al., 1994). He explained that macrofauna of soil (fauna> 2 mm) is part of the soil biodiversity that plays an important role in the improvement of physical properties, chemistry and biology of the soil through the process of immobilization and humification. In the process of decomposition of organic matter, soil macrofauna play a role in the process of fragmentation (comminusi) as well as provide better environmental facilities (micro habitat) for further decomposition process conducted by mesophyroid group and micro fauna of soil and various types of bacteria and fungi (Sugiyarto, 2000). Suwondo (2002) explains that if the large soil faunal diversity index (> 3) means high decomposition rate otherwise the decomposition rate will be low if the soil faunal diversity index is low (<1). High diversity index means high soil fertility. Therefore it is necessary to study the density of soil fauna, especially macro fauna of land in the area of Gunung Leuser National Park Tenggulun National Park.

Thus the soil macro fauna is one component of the soil ecosystem. The macro life of the soil fauna is highly dependent on its habitat, since the existence and population density of a type of soil fauna in an area is largely determined by the biotic and abiotic factors of the area. The biotic environment includes surface vegetation and other organisms. In addition to functioning as a producer of litter as well as cover the land. While abiotic environment include temperature and soil moisture, soil chemical properties such as pH, and soil physical properties such as temperature and soil moisture.

Soil macrofauna density and ecosystem function show very complex relationships and not yet known with certainty. However, it has been widely reported that the decreasing of diversity and changes

in the role of macrofauna of land occurs due to changes in land use systems such as from forest ecosystems to agricultural ecosystems. Degraded soils also show a decrease in the complexity and biomass of soil fauna (Lavelle et al., 1994). Given the high role of soil macrofauna and its function specifications, some researchers have promoted soil macrofauna as a bioindicator of soil hygiene (Doube and Schmidt, 1997).

Material and Methods

Site and Sampling

Research on the diversity of soil macrofauna was conducted from April to May 2017 in Gunung Leuser National Forest Resort Resort Tenggulun, Aceh Tamiang District, Aceh Province. This research includes the type of quantitative descriptive research. Data collection using exploration method, ie observation or sampling directly from the location of observation. Determination of location by using line transect along 100 m at each research location with different density. Then at every transect line taken 10 point with Systematic Sampling method that is systematically at 3 (three) research location that have been determined.

The method used in making soil macro fauna is Hand Sorting method (Suin, 2012), using 25x25x30 cm soil sampling which is plugged at ground level up to 30 cm depth. Taking place in the morning is between 06.00 WIB - 09.00 WIB before the temperature of the soil becomes too hot and done at a depth of 0-30 cm (Agustini, 2006., Swift & David, 2001). Then the macro fauna that has been found is cleaned with water and then put into a sample bottle containing 70% alcohol to be preserved and subsequently identified in the Basic Laboratory of the University of Samudra by using the Soil Fauna Identification Book. Physical factors of soil chemistry observed include temperature and soil moisture by using soilthermometer and soil pH using pH meter and light intensity using Lux meter.

Statistical analysis

Data Analysis From the result of identification and quantification of soil macrofauna, calculation of diversity / diversity index. The diversity index is calculated as the Shanon-Wiener diversity index with the formula H` = Σ pi ln pi; where pi: is the ratio of the number / dominance of an individual of a species to the total number / total dominance of all species (Cox, 1972). To find out the important value of the soil macrofauna species found, it is calculated its importance value based on its relative density and relative frequency.

$$\textbf{Density (K)} = \frac{n}{A}$$

Ki = Density of species (Individu/m^2)
n = Total of species (Individu)
A = Sampling of area (m^2)

$$\textbf{Relative Density (KR)} = \frac{ni}{\Sigma n} \times 100$$

KR = Relative Density
ni = Totall of species i (individual)
n = Totall number of species

To compare the diversity / diversity of soil macrofauna at different densities, an index similarity analysis was performed, ie the ratio of the number of species found in the three different densities to the total number of species in the three comparable densities.

$$\textbf{IS} = \frac{2C}{A+B}$$

Result

Density of Macrofauna

In the research results for observation of soil macro fauna on all types of different densities obtained 16 species with details on high density of 12 species, medium density of 8 types and low density of 12 species. From the total observation plot, the macrofauna density value of land was 39.68 ind / m2. The largest soil macro fauna types are found in Macrotermes gilvus with 14.08 ind / m2 and the lowest species are found in Gryllus rubens, Gryllus stigma and Locusta species of 0.16 ind / m2 each. In the three different observation plots, the highest density was found in the observation plot with high vegetation density of 17.6 ind / m2, medium vegetation density of 12.96 ind / m2 and low vegetation density of 9.12 ind / m2 **(Table 1, Figure 1).**

Table 1. Density (ind / m2) and Relative Density (%) On Each Plot of Observation

No.	Species	Sampling Observation						Totally Abudance
		High Abudance		Midle Abudance		Low Abudance		
		K	KR	K	KR	K	KR	
1	*Arenivaga bolliana*	0.64	3.636	0.32	2.469	0.48	5.263	1.44
2	*Camponotus carnelius*	1.76	10	7.68	59.259	0	0	9.44
3	*Crematogastrini hespa*	0	0	1.76	13.58	1.76	19.298	3.52
4	*Ctenolapisma lineata*	0	0	0.16	1.235	0.16	1.754	0.32
5	*Formica yessensis*	0.32	1.818	0.32	2.469	0.8	8.772	1.44
6	*Gephilus hadesi*	0.96	5.455	0	0	0.32	3.509	1.28
7	*Gryllus rubens*	0.16	0.909	0	0	0	0	0.16
8	*Gryllus stigma*	0	0	0	0	0.16	1.754	0.16
9	*Lepidiota stigma*	0.32	1.818	0	0	0.32	3.509	0.64
10	*Locusta*	0	0	0	0	0.16	1.754	0.16
11	*Lumbricus terrestris*	0.8	4.545	0	0	0.64	7.018	1.44
12	*Macrotermes gilvus*	8.32	47.273	1.76	13.58	4	43.86	14.08
13	*Ocephylla*	3.04	17.273	0	0	0.16	1.754	3.2
14	*Odenteus thoracicornis*	0.16	0.909	0	0	0.16	1.754	0.32
15	*Pholcus pholangioides*	0.16	0.909	0.48	3.704	0	0	0.64
16	*Solenopsis*	0.96	5.455	0.48	3.074	0	0	1.44
Totally		**17.6**	**100**	**12.96**	**100**	**9.12**	**100**	**39.68**

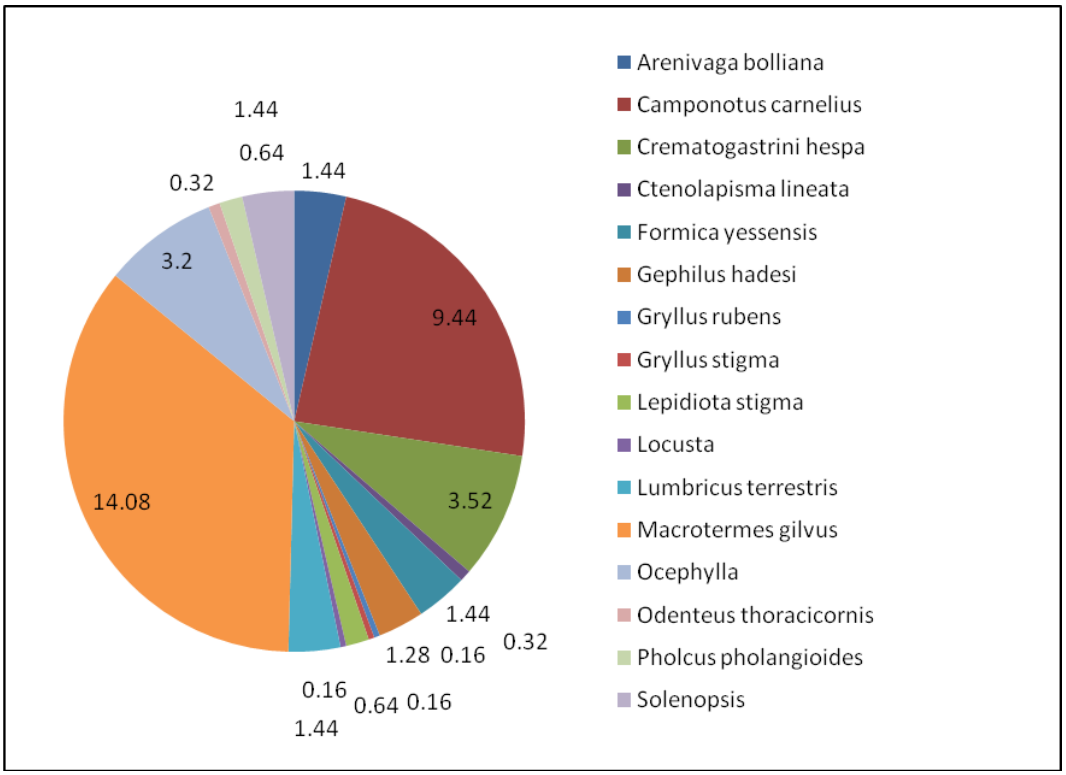

Figure 1. Totally Abudance of Macrofauna

Density of soil macro fauna based on vegetation density obtained data showing that the higher the density of vegetation the higher the density of macrofauna of the soil contained therein. this is evidenced by the observation that at high density obtained the macro fauna density of soil is 17.6 ind / m2, medium density 12,96 ind / m2 and low density 9,12 ind / m2 (Figure 2).

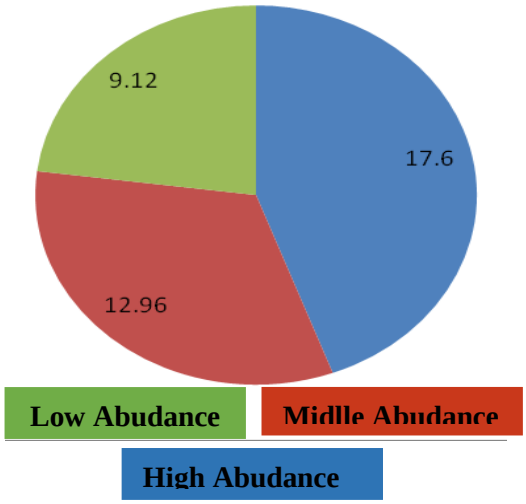

Figure 2. Density Macrofauna for abudance (Ind/m^2)

Land fauna is the inhabitant of the soil environment that contributes energy from an ecosystem. This is because the soil fauna species can do the destruction of dead plant and fauna materials and soil insects serve as a remodel of plant material and wood destruction. Soil macrofauna have an important role in the process of recycling the material in the biogeochemical cycle through the transformation and decomposition of litter, decayed wood, faeces and animal carcasses. Most of the members of the soil Macrofauna play the role of plant-eaters or the remains of other living things so as to have a function as a soil decomposer, in the process of decomposition of organic matter, soil macrofauna acts as an organic breaker into a smaller fraction to be further reformed by decomposer organisms smaller, other than that the macrofauna of the soil also play a role in facilitating the decomposition process by microbes through the expenditure of certain enzymes, the distribution of organic materials and decomposer biota, increased aeration and soil moisture.

Enviromental Phisical Factor

On observation of physical chemical factors in the environment of the study sites obtained results that are not much different. At high density level is plot 2, air temperature is 26 0C, air humidity 80%, soil pH 5.4, soil temperature 25 0C and light intensity 188 Candella. While at the level of medium temperatures are plot 4 air temperature of 25 0C, humidity 85%, soil pH 6.1, soil temperature 24 0C and light intensity 195 Candella. As well as for low density of observation plot 3 air temperature of 26 0C, humidity 85%, soil pH 6, soil temperature 25 0C and light intensity 215 Candella (**Table 4**).

Table 4. Enviromental Phisical Factor in the Research Station

No	Parameter	Unit	Density/station		
			High (2)	Midle (4)	Low (3)
Phisical and Chemical Enviromental					
1	Air Temperature	^{0}C	26	25	26
2	Air Humidity	%	80	85	85
3	Soil Temperature	^{0}C	25	24	25
4	Light Intensity	K	118	195	215
5	Soil pH	-	5,6	5,5	5,3

Data on macrofauna density at each different vegetation density showed different results. where the data show the higher the level of vegetation density, the greater the macro fauna density of soil contained therein. This is also supported by the chemical fifth factor in each observation plot. Where the observation plot with high vegetation density has physical and chemical factors that support for the survival of organism (macrofauna) contained therein.

Conclusions

The conclusions of this study are:
1. There are 16 types of macrofauna diversity of land in Gunung Leuser National Forest Forest in observation plots with different density levels.
2. The highest macrofauna density is found in the plot with the highest vegetation density of 17.6 ind / m2.

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