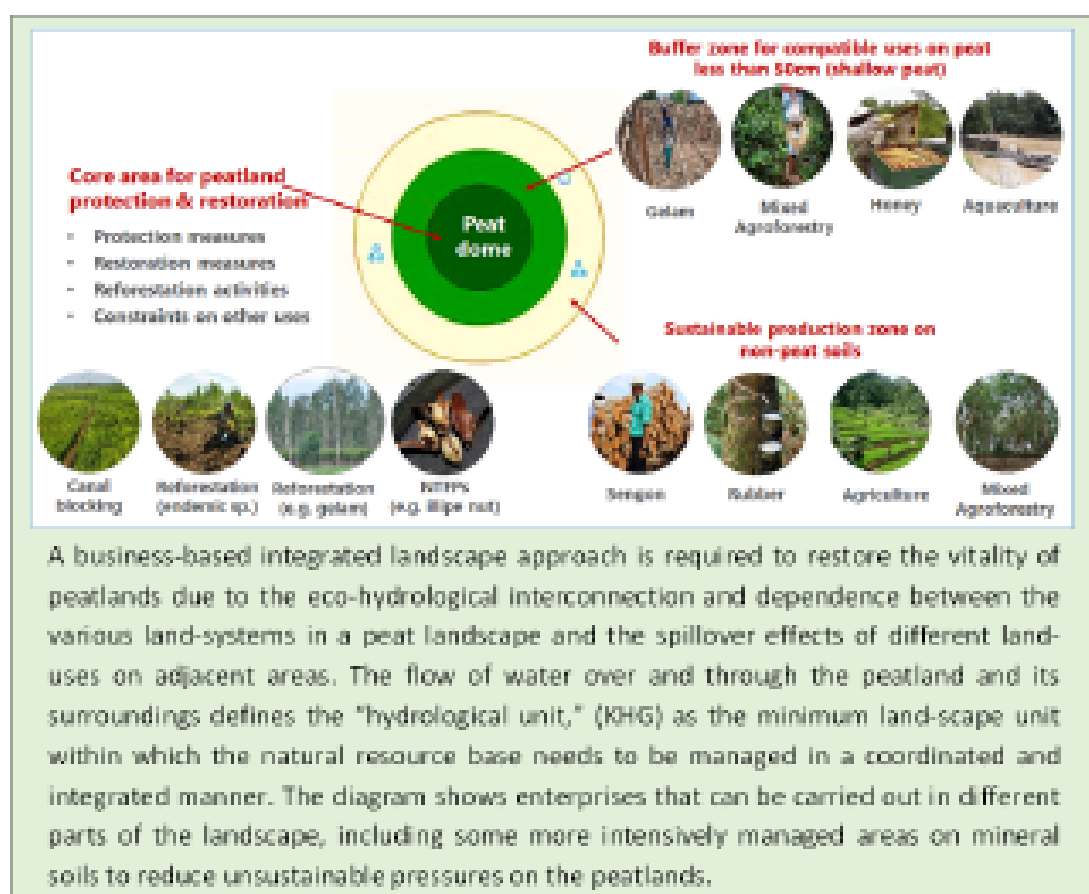


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Study on The Structure of The Trees Population in The Maluka Riverside as A Subject Matter to Development of The Plants Ecological Handouts

Dharmono and Mahrudin

Lambung Mangkurat University, Banjarmasin, Indonesia

ABSTRACT

Understanding the population structure is one of the best ways to recognize the population in a plant as a whole. The riverside Maluka of Tanah Laut District is the swamps and river found herbs having an important role to play in maintaining the structure of the soil from the erosion of the river running on the area. Employing the descriptive method, this research attempts to describe population of structure plants of the riverside Maluka. The sample of structure plants are those on both edges of the riverside, namely: 1500 meters long and 2 meters wide. The data were collected by using the transect. The results showed that there were 13 plants species trees with the different population structure. There are four plants with population structure of polygon namely; *Mangifera indica*, *Flacourtia rukam*, *Antidesma Ghaesembilla*, and *Melaleuca cajuputi*. There are six plants of width-based population structure of width, namely; *Gluta renghas*, *Acacia auriculiformis*, *Syzygium sp.*, *Syzygium guineense*, *Pisonia sp.*, *Cassia alata*. There are two plants in the forms of basin or pitcher, namely; *Mangifera casturi* dan *Fagraea crenulata*. Plants that have population structure of reversed polygon is called *Lagerstroemia speciosa*.

Key words: *Population Structure, Crops, The riverside.*

INTRODUCTION

The population of plants can be identified through population structure and morphology of their individuals. According to Odum (1993), based on age structure, population structure has three basic patterns namely; 1) pyramid with the wide base, 2) pyramid in the form of polygon or clapper, and 3) pyramid in the form of pitcher or jar. Ecologically, the population generally has three forms of age-based distribution, namely: pre-reproductive, reproductive, and post-reproductive ages. The length of the ecological age period when compared to the length of living age varies greatly depending on the type of organism and environmental conditions that surround it. According to Solue 1987 (Subahar, 1998) population structure is influenced by several factors, i.e the environment as a place or habitat, natality and mortality, and human activities.

The study on population structure is very important to determine what is the status or

the state of being a given population plants in a habitats has the crisis, threatened, or secure. Research of the structure of the population at several species of plants in South Kalimantan has been carried out in all regions and the riversides of the highlands and the lowlands of the riverside. The research on the riversides of the highland conducted by Syahdi et al (2016) elaborated the population structure of *Arenga pinnata* Merr in the form of base pyramid bushy with uncritical status. Meanwhile, the research result of Dharmono *et al* (2016) elaborated that the population structure of the original 93 plant stands in the different shapes pyramids of each plant, all of which are non-critical statuses.

The Maluka River is one of the lowland rivers flowing between peat swamp forests on the right and left sides. The such location of rives makes it have a special feature, namely: riverbanks are parallel to the surface of river water and swamp forest around it. The Maluka River is highly vulnerable to threats, either from natural disturbances or human activities. Also, the housing development around the river and the opening of forests around the watershed may

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cause narrowing and silting of the river. So that the existence of plant populations being able to grow on the banks of the river is very important for maintaining the river banks from the erosion as a result of flowing river water.

Based on the description, it is necessary to research about plants at the Maluka river bank both from their population structure which aims to find out the status of plants on the Maluka river bank and efforts to utilize the area as a potential local-based learning resource.

RESEARCH METHOD

This research used descriptive research. A research to know the structure of plant population is a descriptive research using the transect data collection technique. The population of this research was all the plants in the Maluka riverbanks; the samples of which were systematically determined on both banks of the river along the 1500 m in the width of 2 m. Each river was led by 15 points with distance between the points of 100 m. In each point of observation was made a quadrant with the size of 100 m² modified into 2 m x 50 m with the distance between the quadrants in 50 m.

The population structure depends of the density on pre-reproductive phase (not flowering/fruitful), reproductive phase (flowering / fruitful), and post-reproductive (no longer flowering / fruitful, die or damaged). The determination of the structure of the population and density depends on Odum's formula (1993). The status of the scarcity used was based on International Union For the Conservartion of Nature and Natural Resources (IUCN) (2014), that was modified as follows: if > 25 individual adult / km² is critical, if individual 5-25 adult / km² is critical, and when < 5 individual adult / km² is critical.

RESULTS

A total of 13 structured population plants were found in the Maluka river namely *Mangifera indica*, *Mangifera casturi*, *Gluta renghas*, *Acacia auriculiformis*, *Cassia device*, *Flacourtia rukam*, *Fagraea crenulata*, *Lagerstroemia speciosa*, *Syzygium guineense*, *Syzygium sp.*, *Melaleuca cajuputi*, *Pisonia sp.*, and *Antidesma ghaesembilla* shown in 3 phase age at Maluka riverside as on a Table 1.

Table 1. Population Structure of the Plants

No	Scientific names	The Structure of The Population	Ind/Ha
1	<i>Mangifera indica</i>	Pre-Reproductive	177.3
		Reproductive	98.5
		Post- Reproductive	37.6
2	<i>Mangifera casturi</i> .	Pre-Reproductive	98.0
		Reproductive	135.7
		Post- Reproductive	27.7
3	<i>Gluta renghas</i>	Pre-Reproductive	253.3
		Reproductive	123.0
		Post- Reproductive	45.3
4	<i>Lagerstroemia speciosa</i>	Pre-Reproductive	9.5
		Reproductive	23.3
		Post- Reproductive	43.3
5	<i>Acacia auriculiformis</i>	Pre-Reproductive	73.5
		Reproductive	26.3
		Post- Reproductive	12.5

6	<i>Syzygium guineense</i>	Pre-Reproductive	243.3
		Reproductive	110.0
		Post- Reproductive	33.3
7	<i>Flacourtia rukam</i>	Pre-Reproductive	286.7
		Reproductive	200.0
		Post- Reproductive	73.3
8	<i>Cassia alata L.</i>	Pre-Reproductive	336.7
		Reproductive	53.3
		Post- Reproductive	66.7
9	<i>Pisonia sp.</i>	Pre-Reproductive	336.7
		Reproductive	143.3
		Post- Reproductive	53.3
10	<i>Syzygium sp.</i>	Pre-Reproductive	420.0
		Reproductive	253.3
		Post- Reproductive	90.0
11	<i>Antidesma Ghaesembilla</i>	Pre-Reproductive	360.0
		Reproductive	280.0
		Post- Reproductive	120.0
12	<i>Fagraea crenulata</i>	Pre-Reproductive	10.5
		Reproductive	23.3
		Post- Reproductive	63.3
13	<i>Melaleuca cajuputi</i>	Pre-Reproductive	435.0
		Reproductive	263.3
		Post- Reproductive	88.0

Table 1 shows. that the number of individual at pre-reproductive fase is greater than the reproductive fase. and the number of reproductive fase larger in size than indicated by plants post-reproductive *Mangifera indica*. *Gluta renghas*. *Acacia auriculiformis*. *Flacourtia rukam*. *Syzygium guineense*. *Syzygium sp* .. *Melaleuca cajuputi*. *Pisonia sp* .. *Antidesma ghaesembilla*. While *Mangifera casturi* and *Pisonia sp.* shows that the number of individuals on pre-reproductive phase are smaller than reproductive one, and the reproductive quantity is greater than the post-reproductive one. For *Lagerstroemia speciosa*, the number of individuals on pre-reproductive phase is greater than reproductive one, and the reproductive quantity is greater than the post-reproductive one. In *Cassia alata*, the number of individuals on pre-reproductive phase is greater than reproductive one, and the reproductive quantity is less than the post-reproductive one. Meanwhile, in *Fagraea crenulata*, the number of individuals on the

pre-reproductive phase is less than the reproductive one, and the reproductive quantity is less than the post-reproductive one.

DISCUSSION

Based on the results of data analysis on the population structure of 13 species of standing plants in the Maluka River area on the basis of the pyramid of age and calculation of the number of individuals per hectare using Odum's criterion (1993), they have different pyramid shapes.

The Pyramid of Polygon

There were four plant populations that have polygon-shaped structures, namely: *Mangifera indica*. *Flacourtia rukam*. *Antidesma ghaesembilla*. and *Melaleuca cajuputi*. The polygon pyramid shape showed that younger individuals are larger than the elderly individuals (Fig. 1).

According to Odum (1993) polygon pyramid showed a moderate percentage between young and old group of ages. The population that contained large portions of young (pre-reproductive and reproductive) individuals were usually the growing population.

According to Hardjosuwarno (1990), in a simple way the age structure of population can be regarded as the quietly growing population, marked by the number of young individuals with very large proportions. These are also called the young population.

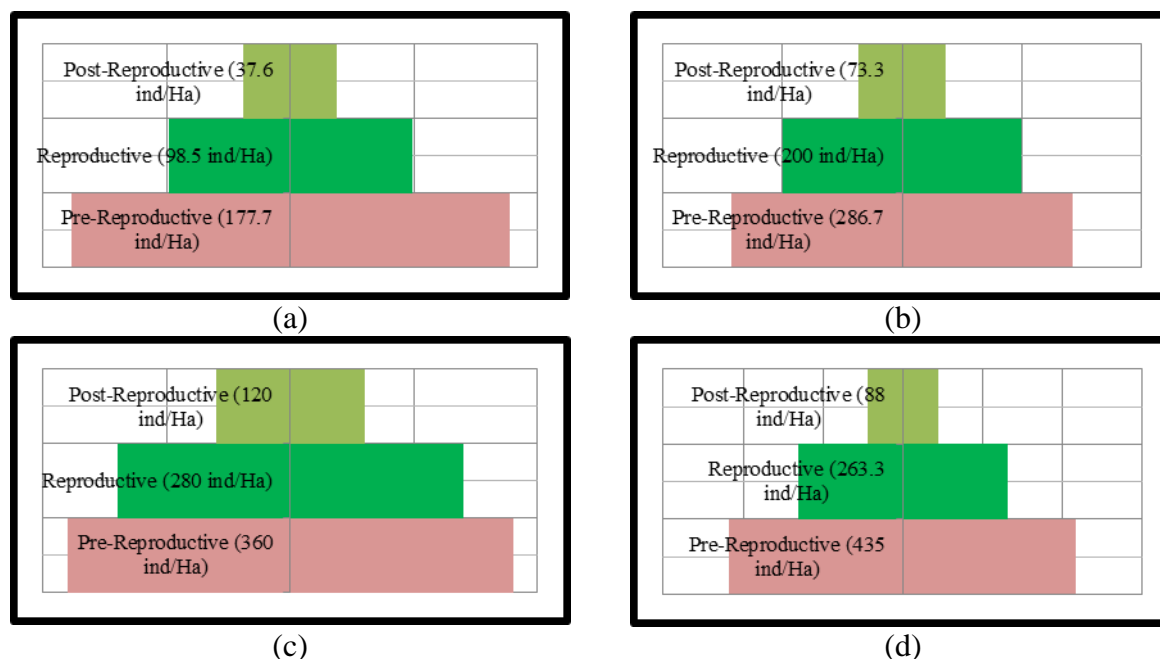


Figure 1. The shape of population structure of (a) *Mangifera indica*, (b) *Flacourtia rukam*, (c) *Antidesma Ghaesembilla*, and (d) *Melaleuca cajuputi*

It was found at the third phase that each of the population (*Mangifera indica*, *Flacourtia rukam*, *Antidesma ghaesembilla*, and *Melaleuca cajuputi*) has a distinctive age structure. This show every plants can survive in place, because adult or old plants can be replaced by plants young. This is shown by the results of the study, that the number of individual at phase pre-reproductive more of phase reproductive and post-reproductive.

The Wide Base Pyramid

There are 6 plants that have a population structure with the wide base, namely; *Gluta*

renghas, *Acacia auriculiformis*, *Syzygium sp.*, *Syzygium guineense*, *Pisonia sp.*, *Cassia alata*. The wide base pyramid (Fig. 2), characterized by pre-reproductive phase is more than that of reproductive phase, and by post-reproductive phase or adult individuals is found fewer than younger individuals. This means that the population of plants in the area of Maluka riverbanks are increasing or developing from time to time. This is because younger individuals are more than adults and older adults. So it can be said that natality is bigger than mortality.

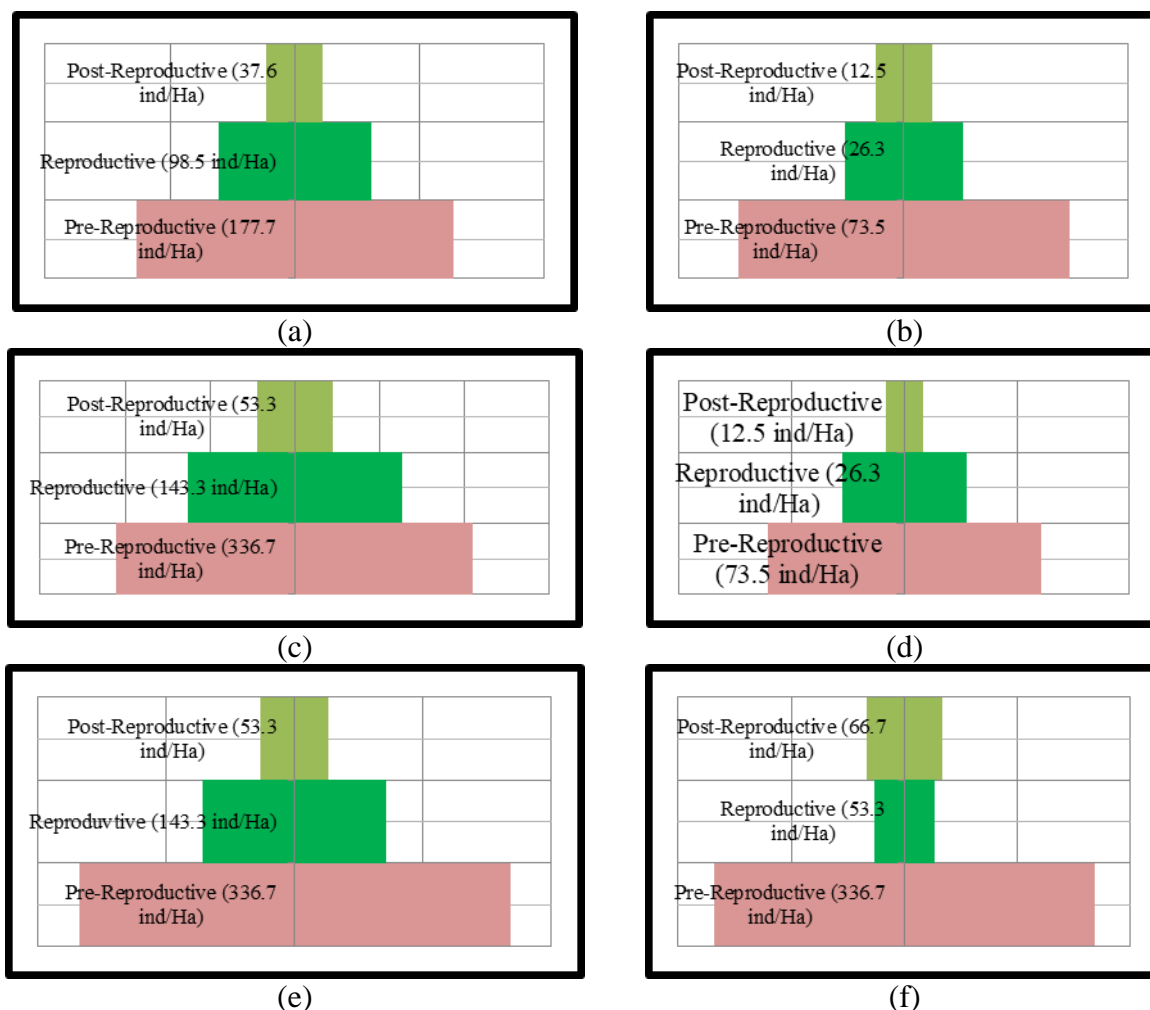


Figure 2. The shape of population structure of (a) *Gluta renghas*, (b) *Acacia auriculiformis*, (c) *Syzygium sp.*, (d) *Syzygium guineense*, (e) *Pisonia sp.*, (f), *Cassia alata*

Usually a population will be growing fast if a part is dispersed from the population consisting of young individuals. Stable population has an even age distribution.. According to the information given by the informants, there were about 6 trees that were cut down and made use for the building materials by the villagers of Sungai Jelai. The plants of *Gluta renghas*, *Acacia auriculiformis*, *Syzygium sp.*, *Syzygium guineense*, *Pisonia sp.*, *Cassia alata* usually grow on the moist soil, especially on the banks of the river. Different environmental conditions do not only change the spread and existence of a plant species, but also these change the rate of growth, fertility, extent, branching, leaf distribution, root range, as well as individual size. Similar research

carried out by setiono, et.al (2015) informed that there was *Alstonia scholaris* (L) R.Br in region South Borneo especially in the bajuin waterfall areas had the shape of a pyramid population structure shape urn that is disturbed.

The Pyramid of Jug

There are two plants which have a population structure in the shape of pasu / jug, namely; *Mangifera casturi* and *Fagraea crenulata*. The population structure of the *Mangifera casturi* and the *Fagraea crenulata* in this region tends to lead to the shape of the age pyramid in the shape of the pasu or jug (Fig. 3), because it indicates the population of individual pre-reproductive phase

numbering lesser than the reproductive and post-reproductive phases, or the number of younger individuals are lesser than those of adult individuals. This means both plants are decreasing. As Odum (1993) points out, the

pyramid in the shape of pasu / jug shows a low percentage of young age groups and generally this one is a characteristic of a declining population.

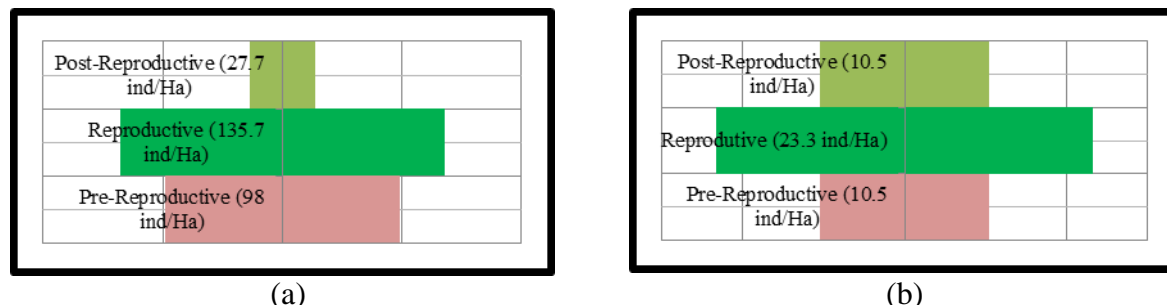


Figure 3. The Shape of structure population of (a) *Mangifera casturi*, and (b) *Fagraea crenulata*

The number of pre-reproductive phase is slightly higher than reproductive and post-reproductive phases. This is assumed that it is caused by the very slow growth from reproductive phase to post-reproductive one. So that pre-reproductive phase that grows up to be a mast reproductive phase collected with a beginning pole phase growing slowly into post-reproductive phase. Its impact is that reproductive phase has a greater amount than pre-reproductive and post-reproductive phases. Similar research carried out by Lestari & Asih (2017) informed that there was *Aglaonema simplex* Blume in Pasatan Protected Forest, Jembrana, Bali, Indonesia that The population structure along the first track was dominated by a mature population of plants without fruit, while fruiting mature plants dominated the structure of the population along the second track.

Inverted of Polygon Pyramid

Plants that have an inverted Polygon-shaped population structure are *Lagerstroemia speciosa*. The shape of an

inverted polygon pyramid shows that younger individuals are fewer than the elder individuals (Figure 4). It is different or it is not found in the classification of population structure as suggested by Odum. According to Odum (1993) polygon pyramid shows a moderate percentage between young and old age groups. A population that contains large portions of young (pre-reproductive and reproductive) individuals is usually a growing population. According to Hardjosuwarno (1990), in a simple way the age structure of a population regarded as a growing population is marked by the number of young individuals with very large proportions. This is also called the young population. Thus the condition of the *Lagerstroemia speciosa* plant is decreasing.

Similar research carried out by Lestari, et.all (2014) informed that there was *Rafflesia zollingeriana* distribution and its population structure in Meru Betiri National Park the success rate of buds to bloom are low, so the population sustainability is threatened and needs to be conserved, either in situ or ex situ.

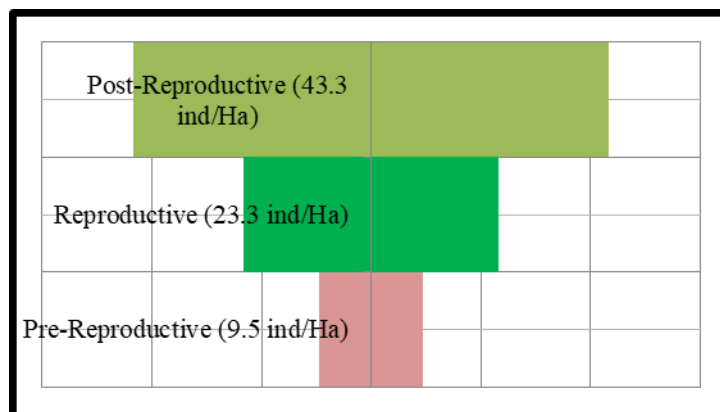


Figure 4. The shape of population structure of *Lagerstroemia speciosa*

The structure of the plant population is influenced by several factors, namely:

Mortality.

Mortality affecting the population structure of plants around the banks of the Maluka river are assumed to be caused by the fire that occurred in the area. According to Resosoedormo, *et. al* (1992) mortality is the death rate in a population of plant. The occurrence of these fires resulted in the reduction in population of plants. This was indicated by the findings of remains of trees due to previous forest fires. According to the Ministry of Environment (2015) the consequences of forest fires can cause death in vegetation. If only the heat occurs as a result of the forest fires, vegetation may still be able to live. If this happens, the vegetation will be injured. Injured vegetation is susceptible to pests and diseases, and then results in permanent disability. Consequently, each forest will decrease and the function of protected forests will disappear. In the pre-reproductive phase, trees with young plants will die immediately when exposed to fire. In addition, both plants have good wooden structures, so they are widely used as boards especially in the post-reproductive phase. This causes the number of individuals in the post-reproductive phase to be low.

Natality

Resosoedormo. *et.al* (1992) the population has characteristics that are unique to groups that are not owned by each individual member. Population grows when natality exceeds mortality. Growth rates in the pre-reproductive phase of the plant population *Mangifera casturi* and *Fagraea crenulata* appear to be less. This is predicted because most of the plant's fruit is used by the community. Therefore, the seeds are not often found under mature trees and if the fruit is taken and taken out of the area. This also influences the birth rate of these plants because of the smaller number of pre-reproductive populations.

Plants around the mother in the pre-reproductive phase do not have enough space to grow properly. So there is competition in finding nutrients and water for growth. "Semai" that get enough nutrients and water will continue to develop into a "sapihan", while seeds that do not get enough nutrients and water will lose and die. Plants around the mother in the pre-reproductive phase do not have enough space to grow properly. So there is competition in finding nutrients and water for growth. "Semai" that get enough nutrients and water will continue to develop into "a sapihan", while seeds that do not get enough nutrients and water will lose and die. In this reproductive phase, these two plants are predicted to proceed in a long time, so

that the growth and development of the pre-reproductive phase are accumulated in this phase. While the mortality rate of these two plants in the reproductive phase is low. This causes the number of individuals in the reproductive phase to always increase in number.

Abiotic factors

An abiotic factor has a significant role for the plants in the research location. It is like the temperature of the air abiotic factors: soil pH, soil moisture, air moisture, velocity of the wind, the intensity of light as well as organic land. Those abiotic factors are very influential and really important for the spread of herbs or distribution. These are in accordance with the opinions of Michael (1995) stated that abiotic factors can serve as restricting factors on the growth of and the distribution of plant. Based on the data environmental factors, there are some research environmental parameters to be restricting factors such as: the intensity of light ranges from 2518-20000 lux; wind speed ranges from 0.0-1.2 m/s; and moisture land ranges from 78-100 %. While the parameters are not be restricting factors for one and the other; the temperature ranges from 28 – 330 °C; moist air ranges from 78-80 %. ph land ranges from 5.2-6.8. N mineral 0.25 %. P mineral the area around 0.01 %.

As reported by Shaltout, *et.all* (2015), the plant cover was positively correlated with silt, clay, Ca, altitude, CaCO₃, fine sand and HCO₃; while it was negatively correlated with soil pH and Mg. Besides alison, *et.Al* (2013) reported , that herbivores exerting stronger effects on individual-level performance in arid (stressful) areas, but exerting stronger effects on population size structure and abundance in mesic (nonstressful) areas to Hibiscus meyeri.

Population structure always changes according to time. One of the factors that led to the change was human activity (Surasana & Taufikurrahman, 1994). Based on the

results of interviews, people usually only cut down the old and big plants. The results of the logging of the plants were taken for fuel and building materials, such as boards. Not all fruits of the plant in the forest area are harvested for consumption and sale. This enable the seeds of the fruit to grow into seedlings. The large number of seedlings indicates that the seeds that fall mostly grow into shoots. Mature fruits can also be taken and consumed by monkeys, squirrels, birds and bats. But these animals only eat the flesh, and the seeds are left to the ground, and then fall to the ground. People rarely take and use seeds. Seeds that fall to the ground have the opportunity to grow into shoots in conditions suitable for their growth. Thus there are many buds to be found. The same thing reported by Sarkar and Devi (2014), the anthropogenic activities prevailing in the sanctuary like grazing by cattle and firewood collection by the local people to meet their energy requirements imposed threat to the survival and population structure of the species in tree species in tropical semi-evergreen forest of Hollongapar Gibbon Wildlife Sanctuary, Assam, northeast Indi.

This is also found on plants that live in a swamp shows that of eight plants found in region of Northern Hakurung Daha Hulu Sungai Selatan all structured population disturbed. *Mangifera indica*, *Mangifera casturi*, *Ceiba pentandra* have a structured population by Pyramid the wide disturbed. *Gluta renghas*, *Areca catechu*, *Lagerstroemia speciosa* have a structured population by Pyramid pitcher disturbed. *Vitex pubescens*, *Ceiba pentandra* *Morinda citrifolia*, *Vitex pubescens*, dan *Morinda citrifolia* have a structured population by Pyramid reversed disturbed.

Apart from being caused by factors in the above , the structure of the population is also influenced by genetic factors. As reported by Pourkhaloe, *et.al* (2017), that Population structure analysis detected 3 and 4 gene pools for 27 wild tulip germplasms genotyping indicated that molecular variation

among populations. The results of this study will help the conservation and phylogenetic studies of tulips. The research also indicated by Szczecińska, *et.al* (2016), that average genetic diversity over loci and mean number of alleles in *P. patens* populations were significantly correlated with population size, suggesting severe genetic drift.

IUCN (2014) categorizes scarcity of a plant as seen from a number of individuals than the adults in 1 square kilometers. A critical state if in 1 square kilometers found less than 25 individual adults and when less than 5 individual adult called isthmus. The 13 plants of the the Maluka riverside area of not critical. because they were so many there are a lot of. These conditions show, that the 13 the plant in ledges the maluka still in a state of well-developed. The same thing reported by Sarkar and Devi (2014), Majority of tree species tree species in tropical semi-evergreen forest of Hollongapar Gibbon Wildlife Sanctuary, Assam, northeast India exhibited „fair regeneration“ condition followed by „good regeneration“ status. The overall population structure of tree species shows a reverse J-shaped population curve and “good“ regeneration status which reveals that the future communities may be sustained.

CONCLUSION

The results of the research found 13 plants species crops tree with the different structure population. Plant having structure shaped polygon population of about 4. namely; *Mangifera indica*. *Flacourtia rukam*. *Antidesma ghaesembilla* and *Melaleuca cajuputi*. Plants structured population on the basis of wide is 6 plants namely; *Gluta renghas*, *Acacia auriculiformis*, *Syzygium sp.*, *Syzygium guineense*, *Pisonia sp.*, and *Cassia device*. Plant having the population structure a pitcher namely; *Mangifera casturi* and *Fagraea crenulata*. Plants the structure of the population shaped a inverted of pyramid polygon is *Lagerstroemia speciosa*. Based on this research the potential of the population

in Maluka riverside can be developed to become teaching materials.

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