PAPER • **OPEN ACCESS**

Analysis Growth and Makro Hara Elements Jabon (*Anthocephalus cadamba*), JATI (*Tectona grandis*) in Gorontalo

To cite this article: D Sandalayuk *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **270** 012045

IOP Conf. Series: Earth and Environmental Science **270** (2019) 012045 doi:10.1088/1755-1315/270/1/012045

Analysis Growth and Makro Hara Elements Jabon (*Anthocephalus cadamba*), JATI (*Tectona grandis*) in Gorontalo

D Sandalayuk[1,3], A M Lahjie[2], and B D A S Simarangkir[2], Y Ruslim[2]

[1]Faculty of forestry, Mulawarman University. Indonesia
[2]Faculty of Forestry Universitas Gorontalo.Jl.Jend.Soedirman No.247 Limboto, Indonesia
[3]Post Graduate Program of Forestry Science, Mulawarman University, East Kalimantan, Indonesia

E-mail: hphsandalayuk@gmail.com

Abstract. To know the growth analysis of Jabon (*Antocephaluscadamba*) and Teak (*Tectona grandis*). Need to measure and see the growth in a certain period where a certain moment of growth will decrease, analyze the soil nutrients in the lab so that the consideration in the maintenance and fertilizer done regularly. Consideration for harvesting as needed in wood or plywood processing. The method used Where all the jabon, mahogany, gmelina, pine, and teak trees in the pathway are measured in height and perimeter for use in the calculation of the basal area and the content or volume of the tree (100% Census). To find out the macronutrients on the soil, the samples were extracted by digging a depth of A. 0-20 cm, depth B, 20 - 40 cm, C depth, 40 - 60 cm at 4 (four) points in each type and mixed evenly each plot or stand as much as 1 kg for the macro elements analyzed namely: N, P, K, Ca, Mg S, to know which element is lacking on each stand of plant forest [1]. Implementation of research. This implementation was carried out to make a plot by using a metering string of raffia for the plot's circumference; the tree began to be measured by using tree labels with sequential numbering. The tree was measured around using a tall meter of trees using Christenmeter with a 4 m. Soil sampling on topsoil using a crowbar to 0-60 cm depth of 1 kg each type of stand at each layer 0-20 m, 20-40 m and 40-60 m to be analyzed in laboratory quantitative and qualitative. Mean Growth at age 3 years and diameter of jabon 4.66 cm of trees, year total volume 52.28 m^3ha^1, MAI 17,43 m^3, CAI 30,95 m^3, Medium point intersection MAI (mean annual increment) 30,52 m^3 and CAI (current annual increment) 30.69 m^3 occurs at the age of 10 years with some of Volume 305,21 m^3 ha^1. In Jabon growing area it can be seen that the availability of macronutrients in Jabon plants, N content, at a depth of 20 cm low 0.1%, medium K element so low at a depth of 20, 40, 60 cm only 0.37, 0.29 and 0.61 me $100gr^1$ (< 10 me 100 gr^1), Slayer 20 is 9.97 me $100gr^1$ (6- 20 me $100gr^1$) neutral soil with pH 7. So the jabon plants still lack N, P, K and S need to be added to the layer of 20 cm depth. Teak growth at age 10 years after the inventory of an area of I ha of 614 trees with a diameter of 13 cm $tahun^1$, volume amount 42.40.m^3 ha^1 and MAI 4.24 and CAI 9.83 m^3. At the time when MAI 10.55 m^3 and CAI 10.26 m^3, intersected at one point then it was allowed to harvest age 32 years the amount of volume 337.45 m^3 ha^1. Analysis of the growth of a tree species and know the nutrient needs of the soil nutrient qualitative nutrients needed Teak plant can be seen element N on the soil is still very low, Mg very high because more than 8 me $100gr^1$ medium

Ca also very high more than 20me 100gr^1, P 0.37 me 100gr^1, K 0.32 me 100gr^1 and S 0.16 depth 20 cm Very low at pH 7.7 So it is necessary to add N, P, K, and S.

1. Introduction

Jabon plants have been planted by the people of Indonesia for a long time, but its popularity just emerged after the disease attack on sengon plants that cause damage to the quality of wood, even make the plants die. This plant grows in a natural forest. This plant grows to a height of 45 m and a diameter of about 100 cm to 160 cm has a cylindrical rod that is suitable for use as a raw material of the Plywood industry and can be harvested at the age of 8-10 years this is what causes Jabon as one type of wood that can be considered as industrial raw materials. This plant is known in 1970, due to the development of exploitation in natural forests so that the wood is getting a step. Jabon is a pioneer plant and can grow in clay, brown podzolic clay soil, or rocky soil. Jabon leafy lightweight and durable wood class V and strong class III-IV. Critical land commonly found teak as a plant of the people, this plant has been developed in Java as an industrial plant outside Java was developed as a community forest, but this plant has also been developed for industrial plants or the needs of furniture n because it has a wooden pattern which is good for the needs of the community besides it can be a crop conservation. . At planting distance 3 m x 4 m Bakti Wonosari Village 614 trees at coordinate position N.00°37'57,5 "And E.122°43'37,4." Location

Figure 1. Location of jabon plant

Jabon Systematics

The spread of this jabon plant Starting from East Java, Central Java, West Java, Sumatra, East Kalimantan, South Kalimantan, Sulawesi, West Nusa Tenggara and Papua.Kingdom Plantae, Sub.KindomTracheobionta, Division Spermatophyta, Class Magnoliopsida, SubClass Asteridae, Order Rubiales, Family Rubiaceae Genus Anthocephalus dan Species *Anthocephalus cadamba*. Jabon plants are from tropical monsoon regions, preferring tropical climates to valleys such as rivers and swamps. The height can reach 45 m with a diameter of 100 cm to 160 cm has a straight and cylindrical rod that is suitable for industrial raw materials. Teak Plant. Teak plants have a variety of teak (Indian), Sagun (Indian), sag (Bombay), wood (Burma), Malay and Java called Teak, teak. Teak System, Kindom Plantae, Sub. Kingdom Tracheobionta, Division Spermatophyta Subdivision Angiospermae, Class Dicotyledonae, SubClass Asteridae, Order Lamiales, Family Lamiaceae Genus Tectona dan species *Tectona grandis* L.F.

Soil suitable for teak is fertilized alluvial well-fertilized with soil pH 6.5-8.0 and Ca and P content is high enough, teak cannot stand waterlogging, or poor nutmeg laterite is a long-lived pioneer. The distribution of teak in Asia lies at 25°, LU to 9° LS in Indonesia of extensive teak plants in Java, Muna, Sumba, and Bali. Roots of long teak, tree trunk reaches 45 m in diameter reaches 220 cm and generally

50 cm, in the dry season abort leaves — macronutrient elements. Macronutrient elements are needed nutrients in amounts, Much as follows: Nitrogen (N). Nitrogen element with N elemental symbol is very important in the formation of plant cells, tissues, and plant organs. Stimulates vegetative growth (green leaf color) slow growth of dwarfs.N deficiency: Yellowish yellow color, dwarf fruit, fibrous leaves, dried leaves. Excess N: Leaf color is too green, easy to collapse, decreased flower production. Passport (P) serves the transport of energy from metabolism, stimulates flowering and fertilization, stimulates the growth of roots and seeds. Stimulates cell division and growth of fungus, reduced fruit and seed growth, stunted growth of roots, stems, leaves decreases, leaf color turns grayish green, there is a purple-red color gradually turns yellow. Dwarfs and old fast. Excess P causes the absorption of disturbed microelements such as Fe, Cu and Zn Potassium (K). Functions in the photosynthesis process of transporting assimilation, mineral and water enzymes. Increase immunity to disease. Disadvantages K: Stem, leaves become limp, dark green leaves, yellowing, and dry leaves, brown leaf spot, spots. Lack of potassium nutrients K: Leaves puckered or curled, short stems weak fruit is not good, can not stand saved, fruit easily fall. Calcium (Ca) - calcium as chlorophyl compiler, cell wall composer. The deficiency of calcium causes the tip of stems, fruits, dried roots to finally die. Easy shoots usually grow abnormally. The deficiency of calcium nutrients, leaves are easy to wrinkle and chlorosis, easy buds usually die and weak growth. Excess ca: causes Mg absorption to disrupted so that growth is disrupted and deficient. Magnesium (Mg).The main constituents of clorofil and the rate of photosynthesis and carbohydrate formation. Creates a green color on the leaves. Mg deficiency leads to yellowing leaves starting at the end and bottom of the leaves. Mg deficiency causes chlorosis to turn yellow with brownish red spots. Easily flammable leaves blaze the eyes of the day because there is no layer of wax and turns dark brown or blackish. Seeds become seedlings so weak.

Excess Mg. not very visible. Sulfur, sulfur (S). Sulfur plays a role in the formation of amino acids, the formation of shoots and root nodules play a role in the formation of chloroil and resistance to fungi. There are some plants that form oil compounds that cause oil scents. Also, the enzyme activator forms papain, Symptoms of sulfur element deficiency similar to nitrogen elements, eg pale green leaves to yellowish. Thin plants and slow development dwarfs.Sulfur nutrient deficiency (S): easy leaves chlorosis turns yellow change usually in all leaves easy sometimes whitish leaf color can also leave all yellow, short-stems plant grow short and thin, plant fibrous small diameter, a limited number of tillers.

2. Material and Method

The method used Where all the jabon, mahogany, gmelina, pine, and teak trees in the pathway are measured in height and perimeter for use in the calculation of the basal area and the content or volume of the tree (100% Census). To find out the macronutrients on the soil, the samples were extracted by digging a depth of A. 0-20 cm, depth B, 20 - 40 cm, C depth, 40 - 60 cm at 4 (four) points in each type and mixed evenly each plot or stand as much as 1 kg for the macro elements analyzed namely: N, P, K, Ca, Mg S, to know which element is lacking on each stand of plant forest [1]. Implementation of research. This implementation was carried out to make a plot by using a meter and string of raffia for the plot's circumference; the tree began to be measured by using tree labels with sequential numbering. The tree was measured around using a tall meter of trees using Christenmeter with a 4 m. Soil sampling on topsoil using a crowbar to 0-60 cm depth of 1 kg each type of stand at each layer 0-20 m, 20-40 m and 40-60 m to be analyzed in laboratory quantitative and qualitative.

3. Results and discussion

3.1 Growth analysis

Calculation of tree volume, using the following general formula:

$$V = \frac{1}{4} \times 3.14 \times d^2 \times h \times f$$

Where.

V: Tree Volume (m^3)
d: Diameter of Trees (cm)
h: Tree Height (m)
f: Tree shape factor (assumed 0.8)

$$d = K / \Pi$$

d = Diameter
K = circumference
Π = 3.14

Determination of tree biomass using the formula in [2]

Average growth (MAI)

The mean growth diameter and volume of trees (MAI = Mean Anual Increment) results between total production and age, i.e., like a ripening tree of all trees, including trees that are felled in the annual thinning or increment activity achieved in a certain age [3]

$$MAI = TV / n.$$

TV = Total Volume (m3)
n = age of trees

Jabon

Is a difference or difference between the growth of trees or stands in a certain period (CAI = Current Anual Increment).

$$CAI = \frac{(TV2 - TV1)}{(Y2 - Y1)}$$

Where

CAI = Average Annual Increment (Current Year Increase)
TV2 = Total production volume now
TV1 = Total previous production volume
Y2 = Current year
Y1 = The previous year.

Jabon. At the time of measurement Jabon A total Volume 52.28 m^3 and previous measurements the previous volume of 21.28 m^3 and the difference in an age before 1 year so.

$$CAI = \frac{52.28 - 21.28}{3 - 2}\ 31\ m^3$$

Table 1. Added VOLUME MAI and CAI Type Jabon at a certain growth at plant spacing 3 x 4 m and age 3 years year n dh f TV MAI CAI

year	n	d	h	f	TV	MAI	CAI
1	780	5	3	0,8	3.67	3.67	
2	695	9.4	5.6	0,79	21.33	10.66	17.65
3	660	14	6.6	0,78	52.28	17.43	30.95
5	640	21	8	0,77	136.48	27.3	42.1
8	620	26.8	9.3	0,75	243.82	30.48	35.78
10	600	30	10	0,72	305.21	30.52	30.69
12	540	33	10.7	0,70	345.76	28.81	20.28

Primary data after 2018 processed
In table 1 above, it can be seen that Jabon 3 years after the measurement. There are 660 trees with a total area of 52,28 m³ ha¹, MAI 17,43 and CAI 30,95. At a time when MAI and CAI are at one point then it is allowed to harvest at age 10 with total vo
Lume of 305.21 m³.

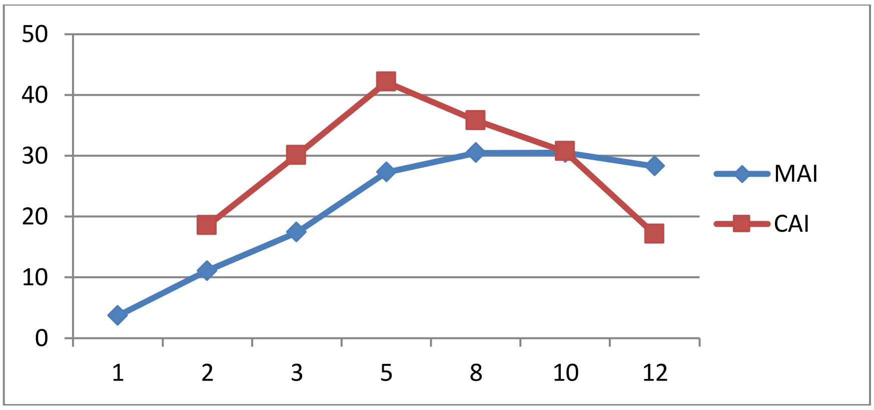

Figure 2: MAI intersections 30.52 m³ and CAI 30.69 m³ at age 10 years
Average growth

Tectona grandis. At the time of the meeting between the MAI-CAI Teak a total volume of 42.40 m³ and previous measurements of previous volumes was 32.57 m³ and age difference Previous year 1 year so.

$$CA = \frac{42.40-32.57}{10-9} = 9.83 \text{ m}^3$$

Table 2: Increase VOLUME MAI and CAI Teak type on a particular growth at plant spacing 3 m x 3 m and age 10 years

year	n	d	h	f	TV	MAI	CAI
2	920	3	2	0.8	1.04	0.52	
4	890	6	3.5	0.8	6.78	1.69	2.87
7	756	9	5.4	0.8	19.73	2.82	4.32
9	705	11	6.4	0.8	32.57	3.62	6.42
10	614	13	6.94	0.8	42.4	4.24	9.83
15	610	19.5	7.3	0.7	95.7	6.38	10.66
20	580	25	7.83	0.7	155.97	7.8	12.05
25	570	32	7.8	0.7	232.3	9.29	15.27
30	560	39	7.9	0.6	316.93	10.56	16.93
32	520	41.5	8	0.6	337.45	10.55	10.26
34	490	42	8.5	0.6	346.05	10.18	4.3
35	450	43.5	8.7	0.6	348.92	9.97	2.88

Primary data after 2018 processed In table 2 above it can be seen that teak at age 10 years after measurement in field with area I ha number 614 trees with volume amount 42,40 m³ / ha and at MAI 10,55 and CAI 10,26 At the time where MAI and CAI Be at one point then it was allowed to harvest at age 32 years diameter 41.5 cm with total volume of 337.45 m3. As in the picture below [4]

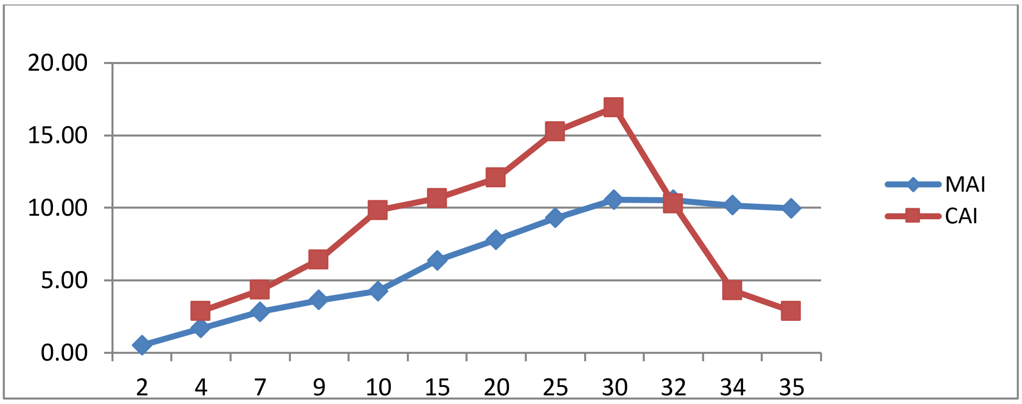

Figure 3 Graph of MAI and CAI Type of Teak Plant (Sidodadi Village) Gorontalo. That harvesting should be at the age of 32 years where MAI and CAI are balanced. At the point 10.55 m³ and CAI 10.26 m³.

Macronutrient availability Criteria assessment of chemical soil Seat according to LPPT Land Research Institute Bogor.

Table 3. Soil chemical Properties Assessment criteria According to the Institute for the Bogor Research Center (LPPT) Bogor

No	Nature of the soil	Very low	Low	Medium	High	Very high
1	N (%)	< 0,1	0,1 -0,2	0,21-0,5	0,51-0,75	> 0,75
2	P2O5 (me/100gr)	< 10	10-20	21-30	31-60	> 60
3	K2O (me/100gr)	<10	10-20	21-40	41-60	> 60
4	Ca (me/100gr)	< 2	2-5	6-10	11-20	> 20
5	Mg (me/100gr)	< 0,04	0,4-1,0	1,1 -2,0	2,1-8,0	> 8,0
6	S (me/100gr)	< 3	3-5 ppm	20-May	21-60	> 60

Source, LPPT Land Capability Survey Bogor.

Table 4. Availability of macronutrients in Jabon plants can be seen on. macronutrients N, Mg, Ca, P, K, S, and pH in Jabon plants

Depth of soil cm	N	MgO	CaO (me 100gr¹)	P2O5	K2O	S	pH
0 - 20	18.43	20.83	121	0.31	0.37	9.97	7.7
20 - 40	9	20	105	0.3	0.29	365.6	7.27
40 - 60	7.86	235	3	0.33	0.61	0.64	7.01

In table 4 the primary data after being processed in Fahutan unmul laboratory of soil

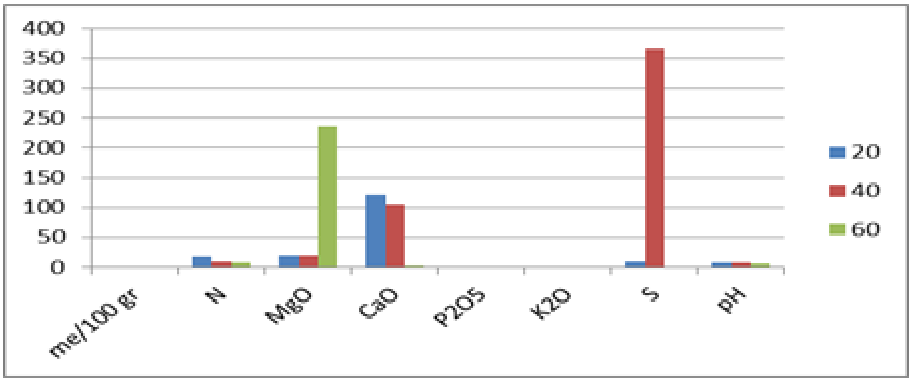

Figure 4. Macronutrient primary data (after processing from table 4.2018)

In Figure 4 above it can be seen that the availability of macronutrients in Jabon plants, N content, at a depth of 20 cm low 0.1%, depth 40 - 60 is very low 0.06%, and 0.05%. At very high Mg content is 20 me 100 gram^1 (> 8,0 me 100 gr^1). Medium nutrient Ca is very high at depth 20 - 40 cm is 121, 105 me 100 gr^1 (> 20 me 100 gr^{-1}), at depth of 60 m of low nut content 3 me 100 gr^{-1} (2-5 me 100gr^{-1}). [5] The nutrient P element at a depth of 20, 40, 60 cm is very low 0.31, 0.30 and 0.33 me 100gr^1 (< 10 me 100gr^{-1}).Medium K element is very low at depth 20, 40, 60 cm only 0,37, 0,29 and 0,61 me 100 gr^1 (< 10 me 100 gr^1). Medium at a depth of 20 cm, very high at a depth of 40, very low depth of 60 cm. The S layer layer 20 is 9.97 me 100gr^1 (6- 20 me 100gr^1) medium. The 40-gram layer of S 365 me 100gr^1 and the 60 cm layer content of S 0.64 me 100gr^1 (< 3 me 100gr^1) is very low on the soil acidity neutral with pH 7. So plants Jabon still lack N, P, K and S need to add to the layer of 20 cm depth.
Nutrients on teak

Table 5. Nature of the teak plant as below can be seen on
Macro Elements on Teak Ground

Depth of soil cm	N	MgO	CaO (me 100gr^1)	P2O5	K2O	S	pH
0 - 20	16.29	9.17	73	0.37	0.32	0.16	7.7
20 - 40	12.29	10.83	32	0.35	0.27	0.09	7.27
40 - 60	8.71	12.5	22.5	0.27	0.6	1.61	7.01

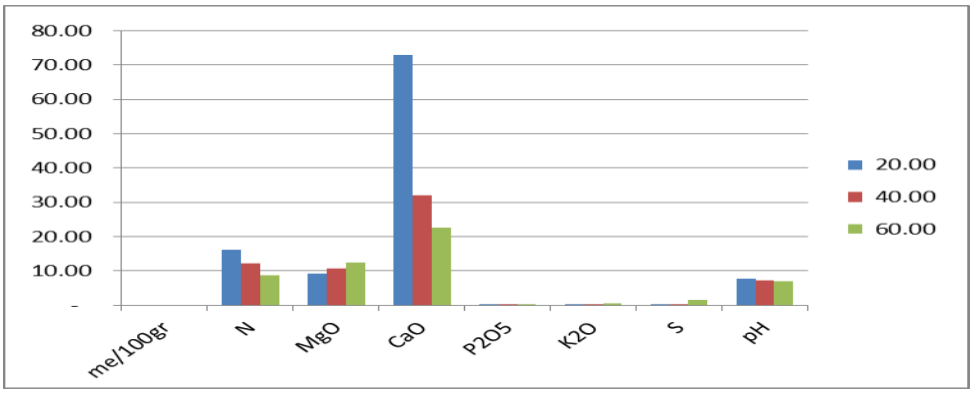

Figure 5 Macronutrient elements in Teak plant (primary data after processing from table 5,2018).

In Figure 5 above it can be seen that the nutrient N in the soil is still very low, Mg is very high because more than 8 me 100gr^{-1} is also very high Ca more than 20me / 100gr, and P 0.37 me 100gr^1, K 0.32 me 100gr^1, and S 0.16 depth 20 cm Very low at pH 7.7 So need to add N, P, K and S.

4. Conclusion

O In table 1 above, it can be seen that Jabon 3 years after the measurement. In the field I ha area of 660 trees with a total volume of 52.28 m^3 ha^{-1} and MAI 17,43 and CAI 30,95. At a time when MAI and CAI are at one point then it is allowed to harvest at age 10 with total voLume of 305.21 m^3. Growth can be seen that teak at age 10 years after measurement in field with area I ha number 614 trees with amount of Volume 42,40 m^3 ha^{-1} and at MAI 10,55 and CAI 10,26 At the time whereMAI and CAI Berada at one point then it was allowed to harvest at age 32 years diameter 41.5 cm with total voLume of 337.45 m^3.

Jabon. K element of soil is very low at a depth of 20, 40, 60 cm only 0.37, 0.29 and 0.61 me 100 gr^1 (< 10 me 100 gr^1). Medium at a depth of 20 cm, very high at a depth of 40, very low depth of 60 cm. Element Slayer 20 is 9.97 me 100gr^1 (6- 20 me 100gr^1) medium. The layer 40 content of S 365 me 100gr^1 and 60 cm layer of the content of S 0,64 me100gr^1 (< 3 me 100gr^1) is very low. On the neutral soil acidity with a pH of 7. So plants Jabon still lack N, P, K and S need to add to the layer of 20 cm depth. Jati is still lack of nutrients N on soil still very low, Mg is very high because more than 8 me 100gr^1 medium Ca is also very high more than 20me 100gr^{-1}, while P 0.37 me 100gr^1, K 0.32 me 100gr^1, and S 0.16 depth 20 cm Very low at pH 7.7 So it is necessary to add N, P, K and S.v

References

[1] Ahmad.Y, 2012.Journal of Soil Hara Macro Analysis on Mountain Protected Forest Sebatung in Kotabaru Regency. Forest Cultivation Program Faculty of Forestry Universitas Lambung Mangkurat Jl.A.Jani Km.36 Banjar Baru South Kalimantan, *Journal of Hutantropis* **12** 6-9

[2] Sandalayuk, D, Samsudin.D, 2013.Journal of Tropical forests, Model Intraks Between Urban Forest Community in Bongohulawa Camping Complex Sub-district Limboto Gorontalo **2** 92 -184

[3] Ruchaemi A, 2013. Ilg Forest Growth.Mulawarman University Press.First Printing. (Mulawarman University Press first printing: Gorontalo) 67-70

[4] Sandalayuk.D.Soedirman.S,Pambudhi,F.2018.Reserves Estimating Carbon in Forest City district Village Bongohulawa Gorontalo.www.ijrtem.com **2** 60-63.

[5] Winarni.B.et.al.2018.Forest Gardens management under traditional ecological knowledge in west Kalimantan,Indonesia.Biodiversitas **19** 77-84.