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Habitat's biodiversity of endemic and introduction fruit trees in Samboja District Kutai Kartanegara Regency

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Abstract

Rustam Baraq Noor, Habitat's biodiversity of endemic and exotic fruit trees in Samboja District Kutai Kartanegara Regency. Endemic and Exotic fruit biodiversity studied was situated in Salok Api Darat Village and Amborawang Laut Village Samboja District. This research aimed to identify the biodiversity and adaptation capabilities. The execution was in July 2015 to December 2016. The data was collected using survey, exploration, field observation and an interview for the plantation's owner. Fruit species in the habitat of Samboja shore studied were 54 species and what was found in the field was 39 species endemic fruit trees and 21 exotic fruit trees. Species of endemic fruit trees were *Durio zibethinus*, *Mangifera odorata*, *Durio kutejensis*, *Lansium domesticum*, *Nephelium lappaceum*, *Mangifera kemanga*, *Artocarpus champaden*, and eksotik namely *Artocarpus integra*, *Artocarpus altilis*. Adaptation capabilities on the new habitat for *Mangifera indica* exotic fruit tree, it was found that the grafting was prone to stem drill pest. The findings of the research showed that habitat biodiversity of fruit plants growing around the field and plantation were dominated by fruit which were generatively multiplied had the morphological and generative advantages which made them able to live more than 50 years. The conclusion was Habitat's biodiversity of fruit in Samboja District was dominated by endemic fruit by 72.22 (%) percent. Fruit cultivation was recommending using the seeds from quality fruit trees.

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Introduction

Indonesia was a lucky country since it was situated in equator region that had a unique tropical forest with the highest biodiversity in the world (Whitmore, 1980). Plants biodiversity in Indonesia forest had not reached an exact number. Up until now, there were 30,000 species of flowered plants estimated which mostly were still growing wildly in forests across regions in Indonesia.

Rich of Biodiversities of the original fruit from Indonesia was also considered high and most of them had not been exploited well. Biodiversity of fruit plants in Kalimantan according to Uji (2007) was seen from a number of relatives, such as Bombacaceae which had 18 species and 14 of them were endemic, 31 species of Anacardiaceae relative for *Mangifera* and 3 of them were endemic (Kosterman and Bompard, 1993). Meanwhile, Uji (2005) mentioned that 23 species and 4 species of endemic as well as the center of species distribution of *Mangifera* spp. Next, Purwanto (2000) reported that much soil in Kalimantan was planted a number of Mango species, which had a sufficiently high Biodiversity such as *Mangifera pajang*, *M. foetida*, *M. indica*, *M. odorata*. According to Soemarwoto (1989), habitat was a place for organisms (plants and animals). Based on Odum (1993); Heddy and Kurniati (1996), he explained that habitat was a communal place which covered biotic and abiotic environments.

Fruit Plantation was a means of individual or mixed trees or bushes planting. However, it was not for the purposes of harvesting, but to produce food supply (KBBI, 2016). There were also local or native plants known as endemic plants which were plants species that could only be found in one place or region and could not be found in other places (Sudarmono, 2007). Further, Nurbani (2013) demonstrated that Lai fruit (*Durio kutajensis*) was one of the examples of native fruit of Kalimantan, particularly, Kutai Kartanegara.

Furthermore, what was known as introduction species was a species deliberately or accidentally transported and released by humans to an outside

ecosystem beyond its origin (McGinley, 2009). One instance of this species was avocado from Mexico. Samboja as the research site was one of the districts in Kutai Kartanegara Regency, East Kalimantan Province which was a part of Kalimantan Island situated in Equator line 116°50'-117°14' East Longitude and 0°52'-1°08' South Latitude with an area of 1.045.90 square kilometers wide. Whereas, Salok Api Darat Subdistrict was situated in the center of Samboja District and Amborawang Laut Subdistrict was situated by the shore of Balikpapan and Makassar Strait. Both areas were where the research was taking place.

Samboja District was inhabited by Javanese tribe communities on old transmigration region such as Margomulyo, Wonotirto, Amborawang Laut Subdistricts, Banjarnese tribes were on Sungai Seluang Subdistrict, Dayaknese tribes were on Paser in Salok Api Darat Subdistrict, Bugisnese tribes were on Kuala Samboja Subdistrict, Sundanese tribes were in Tanjung Harapan (BPS, 2015). Generally, Samboja District for Salok Api Darat Subdistrict had a rather steep soil surface slope classification while Amborawang Laut had a flat classification with Utlisol kind of soil. Endemic and introduction fruit's biodiversity on the research site was woody fruit plants which grew in Salok Api Darat and Amborawang Laut Subdistrict Samboja District. The purpose of this research was to gather information related to Habit Biodiversity level of endemic and introduction local fruit in Samboja District Kutai Kartanegara Regency East Kalimantan Province.

Materials and methodology

Place and Time

Data collection on the field was running for 6 months started from March 2015 to August 2015 in villagers' plantation and home area in Samboja District especially in Amborawang Laut which represented hilly areas and Salok Api Darat which represented shore areas.

Fruit Plantation Exploration

Data collection techniques used were explorational survey, field observation and interviews with the plantation owner.

The number of respondents involved in this research were 6 people for each district using purposive sampling method which taking samples based on certain considerations. Materials and tools used were profusion table of fruit plants consisting of Name of fruit plants; Family; Criterion; Local endemic/introduction species; Season; Map of area; Camera. Next, to determine the location of the individual trees around the research site, the researched utilized 5 criteria formulated by Indriyanto (2015) by adding the number of trees of every criterion around the research site:

1. Always found : The plants existed in every track and the number was >25 trees
2. Rather rarely found : The plants did not always exist in every track with the number of trees were <25 trees.
3. Rarely found : The plants could only be found in specific places and there were only <10 of them.
4. Extremely rarely found : The plants could only be found in one place and there were only few of them (>5 trees)
5. Not found : The plants were not found in any tracks.

Findings and Discussions

Geographically, Samboja District was located in Equator as an area of 1,045.90 square kilometers

wide and the number of inhabitants of 63,247 which consisted of 33,758 males and 29,489 females (BPS of Kutai Kartanegara, 2017). The habitat of fruit plants in Samboja District had a biodiversity affected by the tribes living in the research site.

In Salok Api Darat Subdistrict, it was inhabited by the indigenous tribe, Dayak Paser and Amborawang Laut Subdistrict was inhabited by transmigrants from Java Island. Therefore, the plants growing in those areas were different in the aspect of propagation and species. In Salok Api Darat Subdistrict, the area was planted by endemic local plants species such as durian, lai and cempedak which came from seeds propagation which in Amborawang Laut Subdistrict was planted by introduction species which grew and produced rapidly like soursop, rambutan, mango from grafting vegetation propagation. Types of soil in this habitat was classified as ultisol soil which was often known as yellow-red podsolid or PMR, known well as the soil with the lowest fertility rate and contained organic materials, low nutrition and pH (Buckman and Brady, 1969; Munir, 1996). The analysis result of soil texture from the soil sample in Samboja District in the following table with clarify the position of the texture.

Table 1. Soil physical attribute in Samboja’s research site.

No	Sample code	TEXTURE %					Total sand	Texture Class
		Silt	Clay	Coarse sand	Med. sand	Fine sand		
1	Amborawang Laut 0 – 20 (Samboja)	25,00	49,30	0,34	0,39	24,97	25,70	Clay
2	Amborawang Laut 20-60 (Samboja)	24,00	54,01	0,05	0,19	21,75	21,99	Clay
3	Amborawang Laut 60-90 (Samboja)	22,72	46,15	0,30	0,30	30,53	31,13	Clay
4	Selok Api Darat 0 – 20 (Samboja)	9,60	16,21	0,15	9,77	64,27	74,19	Sandy loam
5	Selok Api Darat 20-60 (Samboja)	9,93	21,57	0,15	7,92	60,44	68,50	Silty clay loam
6	Selok Api Darat 60-90 (Samboja)	8,12	26,36	0,16	6,81	58,56	65,53	Silty clay loam

The soil of Samboja District could be classified as tropodults soil (Hardjowigeno, 1993). Specifically for the research site of Salok Api Darat Subdistrict, the soil was classified as sandy loam texture class which meant it contained enough sand, stuck when there is dust and dry lumpy clay and eash to break and on wet state, it could get lumpy since it contained clay as shown in Table 1. Discussions related to the analysis of soil nutrient content in Samboja District

particularly in the site where the soil chemical sampling was taking place in Salok Api Darat Subdistrict and Amborawang Laut Subdistrict.

The soil analysis result in Salok Api Darat Subdistrict toward the N nutrient content on 0-20cm depth reached 1.505%, P available was 6.36 ppm and K reached 94.17 ppm. The presence of soil nutrition in Salok Api Darat Subdistrict was classified as Very

High compared to FAO standard in Subroto (2005) with a very sour acid level on pH level of 3.86-4.53. It, according to Munir (1996) was caused by the advanced continuous washing which made the soil reacted sourly and eventually created low base saturation. Such soil's condition had a strong relationship with the soil permeability speed in the area where the samples were taken which was Salok

Api Darat Subdistrict Samboja District. Meanwhile what soil permeability meant based on some experts was the soil ability or planting medium to get liquid substances away, in this case, either perpendicular or flat rainwater in certain period of time in cm/hour unit (Foth, 1978). The role of soil permeability in the research site in Samboja District, Salok Api Darat Subdistrict was shown in the following table.

Table 2. Soil chemical attributes in the research site of Samboja District.

No	Sample Code	Base Cation (NH ₄ - OACL, pH = 7) 1 M (me / 100 g)				Acid Cation (1 N KCl) (me / 100 g)		KTK (me/100g)	KB %	N Total (%)	P Available Bray/ Olsen	K Available Bray/Olsen, Ppm	pH H ₂ O
		Na ⁺	K ⁺	Ca ²⁺	Mg ²⁺	Al ³⁺	H ⁺						
1	Amborawang Laut 0-20 (Samboja)	0,099	0,316	1,132	0,5779	0	0,3	2,426	87,63	0,14	22,52	1437,67	5,57
2	Amborawang Laut20-60 (Samboja)	0,095	0,3172	1,040	0,6974	0	0,5	2,649	81,13	0,175	12,20	1239,13	5,67
3	Amborawang Laut 60-90 (Samboja)	0,094	0,2181	1,334	0,8816	0	0,2	2,728	92,67	1,12	30,18	818,97	6,24
4	Selok Api Darat 0-20 (Samboja)	0,081	0,1478	0,2515	0,0564	2,6	8,5	11,637	4,61	1,505	6,36	94,17	3,85
5	Selok Api Darat 20-60 (Samboja)	0,074	0,0537	0,2368	0,061	2,5	9,4	12,326	3,46	0,105	3,79	144,76	4,22
6	Selok Api Darat 60-90 (Samboja)	0,092	0,1913	0,270	0,0659	3,9	8,6	13,120	4,72	0,07	4,19	100,93	4,53

Table 3. Soil Permeability of the Research Site in Samboja.

No.	Sample Code	Depth	Permeability cm/hour
1	Samboja (Salok Api Darat)	0-20	23,32
		20-40	0,48

Soil permeability served in the aforementioned table 3 by 0-20cm depth was 23.32 cm/hour which was considered fast (12.7-25.40cm/ hour) and by 20-40cm depth was 0.48 cm/hour which was considered slow (0.125 -0.50cm/ hour).

The 0-20cm thick of soil layer or top soil in the research site was categorized as loose since there was litter which made water infiltrate quickly to it lower layers. This meant that rainwater going through.

The top soil layer in the form of infiltration would be sediment on the sub soil layer which therefore caused sour attribute. Rainfall in Samboja District below would explain the real condition of the research site related to soil sensitivity towards erosions.

Table 4. Data of monthly rainfall (mm) in Samboja District Kutai Kartanegara Regency.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Des
2011	298,0	112,0	264,5	415,0	96,5	191,0	25,0	4,0	118,0	164,0	193,0	246,0
2012	337,0	365,0	187,0	151,0	254,0	204,0	406,0	118,0	13,0	157,0	113,0	187,0
2013	233,0	371,0	138,0	156,0	198,0	206,0	290,0	125,0	177,0	149,0	190,0	298,0
2014	195,0	133,0	242,0	364,0	226,0	184,0	50,0	103,0	8,0	35,0	300,0	420,0
2015	190,0	267,0	147,0	225,0	171,0	268,0	17,0	22,0	0,0	43,0	75,0	266,0
Rata2	250,6	249,6	195,7	262,2	189,1	210,6	157,6	74,4	63,2	109,6	174,2	283,4
Min	190,0	112,0	138,0	151,0	96,5	184,0	17,0	4,0	0,0	35,0	75,0	187,0
Max	337,0	371,0	264,5	415,0	254,0	268,0	406,0	125,0	177,0	164,0	300,0	420,0

Source: BMKG Samarinda 2015, Info: Unit in Milimeter (mm)

Rainfall data of observation period of 2011-2015 for Samboja District in the table 5 above showed that the average rainfall was 183.55 mm/month with the highest rainfall was 262.2mm on April and 283.4 on December. Temporarily, the lowest rainfall was 74.4 mm on August and 63.2 mm on September.

With the evenly distributed rainfall throughout the year and ultisol type of soil in clay, sandy loam, silt clay loam texture class, the soil sensitivity towards the erosions were adequately high and making it infertile as well as required an expensive cost for its fix within the large scale (Subroto Yusrani, 2005). Rainfall classification in Samboja District according to Oldeman was in Tipe A class: (Rainfall) 2,500-3,500mm per year, there were 3 dry months Af-Am (Kofppen) and A, B, and C (Smith Ferguson) Mhor and Van Baren (1972). Wet months were consecutively more than 9 months. Dan by Koppen was inserted to Climate A classification (Tropic Climate), indicated by the average temperature of the coldest month was still more than 18°C and the average air humidity was above 70% which were the typical features of tropical rainforest (Bratawinata, 2013). In research site of Salok Api Darat Subdistrict, it had 25 meters altitude above the sea level and

Amborawang Laut Subdistrict with a topography of 0-3 meters above the sea level. Such condition aligned with Munir statement (1996) that commonly ultisol soil had various topography from bumpy to hilly with the altitude more than 3 meters above the sea level. Soil surface topography in Salok Api Darat Subdistrict was rather steep while in Amborawang Laut Subdistrict, it was flat but overall the slope in Samboja District was below 10 percent. The bumpy soil surface topography in Samboja District was the shore and swamp area plus hilly lands on 0-25 meters above the sea level, which could be defined as there was no real difference between shore and hilly areas in terms of altitude between them. Further, Kurniawan and Parikesit (2008), claimed that area's altitude and humidity were strongly related with the types of trees growing above the its surface. As had been known that the average air humidity in Samboja District was approximately 80 – 85% (BPS Kaltim, 2015). Fruit plants found in Samboja District were only 39 species spread through farmers' plantations and villagers' yard in Samboja District. There was no difference between the presence of plant's types caused by topography factors and edafic on altitude below 50 meters above the sea level (Syafei, 1994) as would be made clear by below's map of land cover.

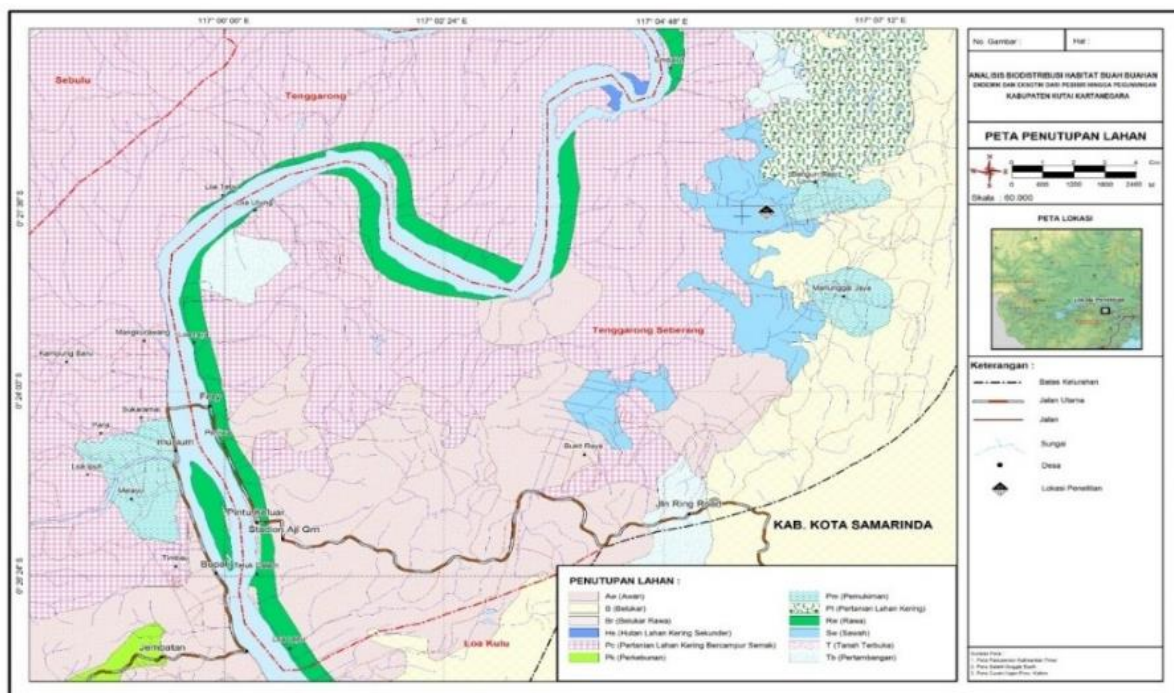


Fig. 1. Map of Land Cover in Samboja.

The plants surveyed were limited to woody fruit plants while in the field there were also cereal plants like rice, corn, secondary crops like cassava, horticultural plants such as vegetables, pineapples and deagon fruit and falmae plant type like sugar palm, coconut plus pseudo trunked plants such as banana as what had been shown on land cover map in Samboja District above.

Other than the plants mentioned previously, land on the map above, other plants for instance shrubs, swamp thicket, secondary forest in addition to palm oil and rubber. Profusion Table of local and introduction fruit plants types on the same land in Samboja District served below would explicate types of plants found in the field as well as their criteria, presence status, origin and fruiting season.

Table 5. The Profusion of Local and Exotic Plants types in Samboja District Kutai Kartanegara Regency.

No	Plants Type	Scientific Name	Family	Criteria					Endemic / Introduction	Seas on
				1	2	3	4	5		
1	Asam Kendis	<i>Garcinia atrovorodos</i>	Clusiaceae					✓	Endemic	NS
2	Asam Payang	<i>Mangifera pajang</i>	Anacardiaceae					✓	Endemic	S
3	Asam Putar	<i>Mangifera torquenda</i>	Anacardiaceae					✓	Endemic	S
4	Avocado	<i>Persea americana</i> Mill.	Lauraceae				✓		Introduction	S
5	Bangkinang	<i>Elaeocarpus glabar</i> Bl.	Elaeocarpaceae					✓	Endemic	S
6	Star Fruit	<i>Averrhoa carambola</i> L.	Oxalidaceae			✓			Introduction	NS
7	Tunjuk Star Fruit	<i>Averrhoa bilimbi</i> L.	Oxalidaceae			✓			Introduction	NS
8	Belinju	<i>Gnetum gnemon</i>	Gnetaceae		✓				Introduction	NS
9	Bemotong	<i>Nephelium sp</i>	Sapindaceae					✓	Endemic	S
10	Binjai	<i>Mangifera kemanga</i>	Anacardiaceae					✓	Endemic	S
11	Babuku	<i>Dimocarpus longan</i> subsp. <i>malesianus</i> var. <i>malesianus</i> "isau"	Sapindaceae					✓	Endemic	S
12	Cempedak	<i>Artocarpus champaden</i>	Moraceae	✓					Endemic	S
13	Durian	<i>Durio zibethinus</i> Murr.	Bombacaceae	✓					Endemic	S
14	Hambawang	<i>Mangifera foetida</i>	Anacardiaceae					✓	Endemic	S
15	Hampalam	<i>Mangifera laurina</i>	Anacardiaceae			✓			Endemic	S
16	Ihau	<i>Dimocarpus longan</i> subsp. <i>malesianus</i> var. <i>malesianus</i> "ihau"	Sapindaceae					✓	Endemic	S
17	Water Apple	<i>Sizygyum aquem</i>	Myrtaceae		✓				Introduction	NS
18	Guava	<i>Psidium guajava</i>	Myrtaceae		✓				Introduction	NS
19	Pomelo	<i>Citrus maxima</i>	Rutaceae				✓		Introduction	S
20	Tangerine	<i>Citrus reticulata</i>	Rutaceae			✓			Introduction	NS
21	Chili Orange	<i>Citrus amblycarpa</i>	Rutaceae			✓			Introduction	NS
22	Lime	<i>Citrus aurantifolia</i> Swingle	Rutaceae			✓			Introduction	NS
23	Jinalun	<i>Syzygium polycephalum</i>	Myrtaceae					✓	Endemic	NS
24	Kalangkala	<i>Litsea sebifera</i>	Lauraceae					✓	Endemic	S
25	Kapul	<i>Baccaurea macrocarpa</i>	Euphorbiaceae					✓	Endemic	S
26	Karantongan	<i>Durio oxleyanus</i>	Bombacaceae					✓	Endemic	S
27	Kasturi	<i>Mangifera kasturi</i>	Anacardiaceae					✓	Endemic	S
28	Kedondong	<i>Spondias dulcis</i> Forst	Anacardiaceae			✓			Introduction	S
29	Keledang	<i>Artocarpus lanceifolius</i>	Moraceae					✓	Endemic	S
30	Longan	<i>Dimocarpus longan</i> Lour.	Sapindaceae				✓		Introduction	NS
31	Kulur	<i>Artocarpus camansi</i>	Moraceae					✓	Endemic	NS
32	Kuranji	<i>Dialium indum</i>	Leguminosae					✓	Endemic	S
33	Kuwini	<i>Mangifera odorata</i>	Anacardiaceae	✓		✓			Endemic	S
34	Lahung	<i>Durio dulcis</i>	Bombacaceae					✓	Endemic	S
35	Lai	<i>Durio kutejensis</i>	Bombacaceae	✓					Endemic	S
36	Langsat	<i>Lansium domesticum</i>	Meliaceae	✓					Endemic	S
37	Mango	<i>Mangifera indica</i>	Anacardiaceae	✓					Introduction	S
38	Mangosteen	<i>Garcinia mangostana</i> L.	Clusiaceae		✓				Endemic	S
39	Maritam	<i>Nephelium mutabile</i>	Sapindaceae					✓	Endemic	S
40	Matoa	<i>Pometia pinnata</i> Foster	Sapindaceae				✓		Introduction	S
41	Jackfruit	<i>Artocarpus heterophyllus</i> Lam.	Moraceae	✓					Introduction	NS
42	Petai	<i>Parkia speciose</i>	Fabaceae		✓				Introduction	NS
43	Ramania	<i>Bouea macrophylla</i>	Anacardiaceae					✓	Endemic	S
44	Rambai (Menteng)	<i>Baccaurea motleyana</i>	Euphorbiaceae			✓			Endemic	S
45	Rambutan	<i>Nephelium lapaceum</i> L.	Sapindaceae	✓					Endemic	S
46	Rawa – rawa	<i>Mangifera griffithii</i>	Anacardiaceae					✓	Endemic	S
47	Rukam	<i>Flacourtia rukam</i>	Salicaceae					✓	Endemic	S
48	Sapodilla	<i>Manilkara zapota</i> van Royen)	Sapotaceae		✓				Introduction	NS
49	Soursop	<i>Annona muricata</i>	Annonaceae		✓				Introduction	NS
50	Sontol	<i>Sandoricum koetjape</i>	Meliaceae					✓	Endemic	NS
51	Srikaya	<i>Annona squamosa</i> L.	Annonaceae			✓			Introduction	NS
52	Breadfruit	<i>Artocarpus communis</i>	Moraceae	✓					Introduction	NS
53	Tarap	<i>Artocarpus elasticus</i>	Moraceae				✓		Endemic	NS
54	Wanyi	<i>Mangifera kemanga</i>	Anacardiaceae	✓					Endemic	S

1. Always found : The plants existed in every track and the number was >25 trees
2. Rather rarely found : The plants did not always exist in every track with the number of trees were <25 trees.
3. Rarely found : The plants could only be found in specific places and there were only <10 of them.
4. Extremely rarely found : The plants could only be found in one place and there were only few of them (>5 trees)
5. Not found : The plants were not found in any tracks.

The presence of local and introduction fruit plants in Samboja research site as shown in Table 5 was woody fruit plants in the research site which were Salok Api Darat and Amborawang Laut Subdistrict. Salok Api Darat Subdistrict was situated in the center of Samboja while Amborawang Laut Subdistrict was in borders of Balikpapan and Makassar Strait.

In Salok Api Darat Subdistrict, which was located in a hill rather far from the beach, was inhabited by the indigenous tribe of Dayak Paser and Banjarnese which still preserved traditional ways of cultivation, like using the seeds from trees they thought as quality seeds around the location for propagation. Plants they plant like durian (*Durio zibethinus*), lai (*Durio kutejensis*), from the family of fruit plants, from Bombacaceae family; cempedak (*Artocarpus champaden*), from the family like durian (*Durio zibethinus*), lai (*Durio kutejensis*), from the family of Moraceae, cempedak (*Artocarpus champaden*), from the family of Moraceae; langsung (*Lansium domesticum*) the family of Meliaceae; rambutan (*Nephelium lappaceum*), from the family of Sapindaceae; kuwuni (*Mangifera odorata*), hambawang (*Mangifera foetida*), hampalam (*Mangifera laurina*) the family of Anacardiaceae which were categorized as endemic local fruit. This particular type of fruit had the similarities with the ones planted in Lembo (Matius *et al.*, 2014).

For the time being, Amborawang Laut Subdistrict were planted by fruit with rapid-growing rate within less than 5 years and were able to be sold in the market. The difference of the plants' biodiversity was caused by the locals, who were originated from Java island, whose habit was to plant fruit in a yard pattern (Zulkarnain, 2009).

Field survey results displayed there were 39 out of 54 planned species of fruit plants in Samboja District as shown in table 5. This disclosed a strong correlation with the above statement which explained that Samboja District with its 0-25 meters above the sea level lowland had a high rate of diversity which was 72.22% from all the surveyed fruit plants.

Fruit habitat in Salok Api Darat Subdistrict and Amborawang Laut Subdistrict in Samboja District presented in table 5 above showed that there were 7 species of local fruit which were durian (*Durio zibethinus*), kuwuni (*Mangifera odorata*), lai (*Durio kutejensis*), langsung (*Lansium domesticum*), rambutan (*Nephelium lappaceum*), wanyi (*Mangifera kemanga*), cempedak (*Artocarpus champaden*). In addition, 2 species of introduction fruit that could always be found in every track and their total was >25 trees.

Eleven local fruit plants included in the fifth criteria (Not found) around the research site, such as asam kendis (*Garcinia atrovorodo*), asam payang (*Mangifera pajang*), asam putar (*Mangifera torquenda*), jinalun (*Syzygium polycephalum*), karantongan (*Durio oxleyanus*), kasturi (*Mangifera kasturi*), lahung (*Durio dulcis*), maritam (*Nephelium mutabile*), rawa-rawa (*Mangifera griffithii*), rukam (*Flacourtia rukam*), kuranji (*Dialium indum*) were fruit plants whose fruiting season was more than 10 years and it would bear fruit on certain period within a year. As an example, *Mangifera kasturi* (kasturi), in South Kalimantan, was discovered to be >50 years old and the word of Kasturi trees were more valuable than their fruit (Noor and Agus, 2014). Another example was rawa-rawa fruit (*Mangifera griffithii*) which had sour flavor, thin flesh, black skin appearance and smaller fruit size compared to Kasturi. Therefore, people were not interested to buy it. Same went to fruit plants of durian karantongan (*Durio oxleyanus*) From the relatives of Bombacaceae as reported by Uji (2003) that its presence in nature was in vulnerable state and experiencing high level of extinction in nature (IUN Red List 3.1, 2001)

Species and family findings in Samboja research site had a number of similarities with the exploration findings of the fruit plants in swamp areas in South Kalimantan, Central Kalimantan, South Sumatera and Lampung including: 11 species from the relatives of mangga rawa (*Mangifera* spp), 15 species from the family of durian (*Durio* spp), 7 species from the family of jackfruit (*Artocarpus* spp), 12 species from the family of rambutan (*Nephelium* spp.),

4 species from the family of mangosteen (*Garcinia spp.*), 6 species from the relatives of orange (*Citrus sinensis*), 4 species from the relatives of langsung (*Lansium domesticum*), respectively 2 species from the relatives of ketapi (*Sandoricum koetjape*), ramania (*Bouea macropylla*) from kapul (*Baccauae macrocarpa*), and respectively 1 species from the relatives of sawo (*Cynometra cauliflora*), margarine (*Diospyros philippensis*), rambai (*Baccaurea mutleana*), kacapuri (*Diospyros kortalsian*), kalangkala (*Litsea anquilata*) and srikaya (*Annona squamosa*) (Noor *et al.*, 2015).

The findings provided information that the habitat of the fruit plants relatives could live in a large area of propagation. Similar fruit plants' habitat were also found spreading across archipelago (Indrawan *et al.*, 2007). The correlation existed between the relatives and the fruit plant species shown in table 5 explained that the ability to live of local endemic fruit like, durian (*Durio zibethinus*), lai (*Durio kutejensis*) from the family of Bombacaceae; kuwini (*Mangifera odorata*), wanyi (*Mangifera kemanga*) from the relatives of Anacardiaceae; langsung (*Lansium domesticum*) from the family of Meliaceae; rambutan (*Nephelium lappaceum*) from the family of Sapindaceae; cempedak (*Artocarpus champaden*) from the family of Moraceae were able to live, proliferate and produce on sandy loam soil texture within 0-20cm depth and silty clay loam within 20-60cm depth and 60-90cm depth in Salok Api Darat Subdistrict. In the meantime, the type of soil was ultisol with a rather steep slope for Salok Api Darat Subdistrict and rather flat for Amborawang Laut Subdistrict. Furthermore, permeability state was categorized as rapid within 0-20cm depth and slightly slow within 20-40cm depth. This visibly showed that the soils planted by the fruit plant were very compatible for the species mentioned above.

Introduction fruit plants grouped within criteria 1 for Samboja region such as jackfruit (*Artocarpus integrum*) and breadfruit (*Artocarpus altilis*). Both species of plants had the ability to live in a wide climate and habitat.

Such condition was reinforced by the fruiting period along the year which made its economy value high (Sunarjono, H., 2008). Particularly for jackfruit, the obstacle of its cultivation was stem drill pest attack and fruit flies. Jackfruit needed to be wrapped up while it was still small to avoid fruit flies attack.

When seen from the fruiting season, fruit species from the family of Moraceae which were jackfruit and breadfruit which were classified as introduction and kulur, tarap was classified as local endemic fruit bearing fruit along the year without any seasons. Temporarily, Sawo, melinjo, star fruit had a very short blooming period which made them had a few seasons to bear fruit. That condition gave benefits to the food supplies for local inhabitants independently. Specifically for breadfruit, it had carbohydrate substance that could replace one in rice. As a follow-up action of the findings from Wulandari *et al.*, (2016) who demonstrated that cookies making with flour or rice flour as their basic ingredient could be replaced by breadfruit flour with better quality.

Plants' distribution seen in Samboja District was heavily affected by the inhabitants of the area. For Salok Api Darat Subdistrict, tribes who lived there were indigenous ones such as Paser, Banjar, which made the plants growing around the area were the ones originated from seeds propagation. Their plants were rambutan, cempedak, durian, lai, wanyi and kuwini where all of them were classified as endemic local fruit. They had similarities with fruit in limbo or rondong (Matius *et al.*, 2014 and Noor, 2017). Whereas, the tribes who lived in Amborawang Laut Subdistrict were transmigrants from Java island which made the plants growing around them were introduction plants, for instance orange, jack fruit, mango, breadfruit, sour sop, binjai rambutan and were the typical attribute of fruit plants planted around house's yard in Java island (Zulkarnain, 2009).

Some fruit plants found in Samboja research site provided a picture of fruit plants' morphology like crown diameter and stem circumference. Plants' condition were shown by the age of the plants per tree production.

The means of propagations of plants could be generatively or vegetatively as well as the origin of endemic or introduction plants as the survey findings in Samboja District.



Fig. 2. Keledang fruit (*Artocarpus lanceifolius* Roxb). Survey findings of fruit plants' characteristics in the aspect of morphology and genetic on hampalam, wanyi and keledang fruit as well as matoa in Samboja District showed the adaptation capabilities of the habitat. Endemic fruit plants like hampalam, wanyi and keledang displayed the morphology of stem, crown, and height growth along with genetical characteristics including the blooming age and production. This condition was reinforced by the structure, texture, chemical attributes and rainfall climate in Samboja District as shown in soil table 1, 2, 3 and rainfall table 4.

Consequently, the local endemic fruit plants could live and produce in their original habitat.

Table 6. Data of endemic and introduction fruit plants' attributes in Samboja District Kutai Kartanegara Regency.

No	Fruit type	Stem Circ. (cm)	Ø Crown (m)	Tree's Height (m)	Year planted	Blooming (Thn)	Production (kg)	Propagation	Plant origin	Information
1	Hampalam	125	9,10	14,6	1994	8	250	Seed	endemic	Bear fruit every season
2	Hampalam	160	8	10,3	1993	8	210	„	endemic	„
3	Hampalam	120	6,20	8,5	2003	7	160	„	endemic	„
4	Hampalam	148	7,48	10,60	1994	7	220	„	endemic	„
5	Hampalam	80	6,60	9,40	1999	7	170	„	endemic	„
1	Wanyi	220	13	20	1993	16	200	Seed	endemic	Bear fruit every 4 years
2	Wanyi	190	10,8	17	1995	16	140	„	endemic	„
3	Wanyi	240	16,60	23	1990	17	200	„	endemic	„
4	Wanyi	360	19,60	30	1986	18	300	„	endemic	„
1	Matoa	120	12,80	12	2002	6	36	Seed	introduction	Bear fruit every season
2	Matoa	122	14,20	13	2002	6	40	„	introduction	„
3	Matoa	90	9,40	8	2006	6	30	„	introduction	„
4	Matoa	65	6,60	8	2006	6	24	„	introduction	„
5	Matoa	70	8,20	7,4	2005	6	25	„	introduction	„
1	Keledang	120	9,80	12	2005	6	60	Seed	endemic	Bear fruit every season
2	Keledang	85	4,90	7	2008	6	40	„	endemic	„
3	Keledang	80	9,40	11	2005	6	55	„	endemic	„
4	Keledang	70	7	10	2007	6	44	„	endemic	„

Keledang trees (*Artocarpus lanceifolius* Roxb) as one of the endemic fruit of Kalimantan had grown as an exotic fruit with annual fruiting season. As one of the relatives of Moraceae like jackfruit, cempedak and kulur, keledang tree's morphology in the aspect of height could reach up to 36 meters and stem circumference up to 275cm. it was large enough to be compared with a Tarap tree. Megawati *et al.*,’s research in 2015 in *Kebun Raya Unmul Samarinda* (KRUS) had identified that the

size of stem circumference of keledang tree was 50.80cm with the average height of 15.35 meters. The production of keledang fruit which had reached the age of above 50 years with the stem circumference above 200cm could reach up to 2,000 pcs. For introduction fruit plants, for example matoa that was originated from Irian, Papua, it showed its adaptation capabilities in Samboja habitat thus it could bloom on its sixth year from the seeds propagation.

Conclusions

1. Biodiversity and distribution level of the fruit plants of Samboja habitat were affected by the >2,500mm – 3,000 mm/year rainfall climate and ultisol soil as well as the tribes inhabited in the area.
2. Local endemic fruit plants on criteria 1 that had more dominant adaptation capabilities compared to introductions were: durian (*Durio zibethinus*), kuwini (*Mangifera odorata*), lai (*Durio kutejensis*), langsung (*Lansium domesticum*), rambutan (*Nephelium lappaceum*), wanyi (*Mangifera kemanga*) and cempedak (*Artocarpus champaden*). In addition, species of introduction fruit were jackfruit (*Artocarpus integrata*), breadfruit (*Artocarpus altilis* Parkinson Posberg).
3. There were fruit plants with economic, ecologic and social prospects which was keledang from the family of Moraceae and matoa from the family of Sapindaceae.

Suggestions

1. To preserve Biodiversity, it is advised to use the means of seeds propagation and link it with quality entries to produce high quality fruit and could live up to 50 years.
2. It is advised to plant local endemic and introduction fruit plants which had a high adaptation capabilities

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