

## THE IMPORTANCE OF THE UTILIZATION OF FOREST FRUITS IN BATAK TOBA COMMUNITY

Alfonso H. Harianja<sup>1\*</sup>, Anisse M. Sinaga<sup>2</sup>, Ferry A. Hawari<sup>3</sup> and Ridwan Fauzi<sup>1</sup>

<sup>1</sup>Research and Development Center for Environmental Quality and Laboratory, Research, Development and Innovation Agency, The Ministry of Environment and Forestry, Republic of Indonesia  
PUSPIPTEK, Building 210 Serpong, South Tangerang, Indonesia

<sup>2</sup>Aek Nauli Environmental and Forestry Research and Development Institute,  
Jl. Parapat KM. 10 Sibaganding Village, Parapat City, North Sumatra, 21174 Indonesia

<sup>3</sup>Orangutan Information Centre,  
Jalan Bunga Sedap Malam XVIIIc No. 10 Medan Selayang, North Sumatra, 20131 Indonesia

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THE IMPORTANCE OF THE UTILISATION OF FOREST FRUITS IN BATAK TOBA COMMUNITY. Batak Toba community who live in the surrounding forests utilise forest-fruits that grow around their settlement. This research aims to describe the important value of the forest fruits using the Local Users Value Index (LUVI) assessment as most of the fruits have not yet been traded. The research was conducted in Simardangiang and Sitoluama Villages in North Tapanuli Regency, 2015. Data collection was done by interviewing 65 respondents selected purposively based on gender and age classification. The results showed that there were 29 species of forest fruits utilised by the community. They were categorised into four utilisation types: fresh fruit, flavouring fruit, processed fruit, and medicines. In Simardangiang Village, the five most important fruits were kapundung or menteng (*Baccaurea racemose*) (0.56), hopong (*Macaranga lowii*) (0.52), sotul, santol or sentul (*Sandoricum koetjape*) (0.48), harimonting or kemunting (*Rhodomyrtus tomentosa*) (0.47), and habo or kabau (*Archidendron bubalinum*) (0.42). Meanwhile, in Sitoluama Village, the five most important fruits were kapundung (*Baccaurea racemosa*) (0.50), hopong (*Macaranga lowii*) (0.41), sihim or rotan manau (*Calamus manan*) (0.32), handis or gamboge (*Garcinia xanthochymus*) (0.32), and mobe (*Artocarpus dadah*) (0.19). The numbers in parentheses are the important value based on LUVI. The forest fruits that have domestication potency are kapundung (*Baccaurea racemose*), hopong (*Macaranga lowii*), sihim (*Calamus manan*), handis (*Garcinia xanthochymus*), mobe (*Artocarpus dadah*), harimonting (*Rhodomyrtus tomentosa*), sotul (*Sandoricum koetjape*) and habo (*Archidendron bubalinum*).

Keywords: *Artocarpus dadah*, *Baccaurea racemosa*, *Calamus manan*, forest fruits, *Rhodomyrtus tomentosa*, LUVI

NILAI PENTING PEMANFAATAN BUAH HUTAN DI MASYARAKAT BATAK TOBA. Komunitas Batak Toba yang mayoritas bermukim di sekitar hutan mengkonsumsi buah-buahan di sekitar pemukiman mereka. Penelitian ini bertujuan untuk mengkuantifikasi nilai penting buah-buahan hutan tersebut dengan mempergunakan metode penilaian LUVI (Local User's Value Index) karena sebagian besar buah-buahan tersebut belum diperjualbelikan di pasar. Penelitian dilakukan pada tahun 2015 dengan mengambil sampel penelitian pada Desa Sitoluama dan Simardangiang di wilayah Kabupaten Tapanuli Utara. Responden dipilih secara purposif, berdasarkan umur dan jenis kelamin (n=65 orang). Hasil penelitian menunjukkan bahwa terdapat 29 jenis buah-buahan yang dimanfaatkan, untuk empat kategori, yakni sebagai buah segar, bumbu masak, buah olahan dan obat-obatan. Pada Desa Simardangiang, lima buah yang mempunyai nilai terpenting berdasarkan nilai LUVI adalah kapundung (*Baccaurea racemose*) (0,56), hopong (*Macaranga lowii*) (0,52), sotul (*Sandoricum koetjape*) (0,48), harimonting (*Rhodomyrtus tomentosa*) (0,47) dan habo (*Archidendron bubalinum*) (0,42). Sedangkan untuk Desa Sitoluama adalah kapundung (*Baccaurea racemosa*) (0,50), hopong (*Macaranga lowii*) (0,41), sihim (*Calamus manan*) (0,32), handis (*Garcinia xanthochymus*) (0,32) dan mobe (*Artocarpus dadah*) (0,19). Berdasarkan temuan tersebut, buah-buahan hutan yang mempunyai potensi domestikasi tertinggi adalah kapundung (*Baccaurea racemose*), hopong (*Macaranga lowii*), sihim (*Calamus manan*), handis (*Garcinia xanthochymus*), mobe (*Artocarpus dadah*), harimonting (*Rhodomyrtus tomentosa*), sotul (*Sandoricum koetjape*) dan habo (*Archidendron bubalinum*).

Kata kunci: *Artocarpus dadah*, *Baccaurea racemosa*, buah-buahan hutan, *Calamus manan*, *Rhodomyrtus tomentosa*, LUVI

\* Corresponding author: alfonso\_hrj@yahoo.com

## I. INTRODUCTION

Forest fruits are widely spread in the tropical forests (Abdel-rahman, Nawal, Awad, & Babiker, 2014b), including in Indonesia, such as in the Tapanuli forests in North Sumatera Province (Noviady & Siwi, 2015). Because of their great variety, forest fruits have enormous potential to meet humans' nutritional needs. Containing excellent quality and high nutritive value such as minerals, amino acids, and vitamins (Abdel-rahman et al., 2014b; Abdel-rahman, Innam, & Elshafe, 2014a; Ayessou Ndiaye, Cissé, Gueye, & Sakho, 2011; Basyuni, Siagian, Wati, Putri, Yusraini, & Lesmana, 2019; Tokairin, da Silva, Spricigo, de Alencar, & Jacomino, 2018), forest fruits are commonly used in the human's dietary, medicinal and industrial processes (Bošnjaković et al., 2012; Fungo et al., 2019; Okan, Serencam, Baltas, & Can, 2019; Smanalieva, Iskakova, Ozbekova, Oskonbaeva, & Darr, 2018).

Indonesia although known as an agricultural country cultivating lots of fruit plants (Istiqamah, 2017), but still imports fruits. Fruits ranked as the most significant imported agricultural products in 2018, worth US\$ 1.28 million (Satriana & Prayoga, 2019). It is mainly caused by the insufficient production and supply of local fruits. Secondly, the price of some of the local fruits is more expensive than the cost of imported fruits. Therefore, production of local fruits, including forest fruits, has great potential to succeed and meet the demand.

The local community in Indonesia has developed the utilisation of forest fruits for a long time. Some researchers noted that the use of forest fruits is usually done by the community in the surrounding forest. They consume forest fruits as fresh fruit, processed fruit, flavours, and medicines (Fitmawati, Saputra, Sinaga, Roza, & Isda, 2018; Jemi et al., 2015; Rujehan, 2012; Silalahi & Nisyawati, 2015; 2018; Utami, Rahayuningsih, Abdullah, & Haka, 2019). There are many studies in Indonesia that explore the distribution of forest fruits (Noviady & Siwi, 2015; Suwardi & Harmawan, 2019), ethnobotany (Ibo & Arimukti, 2019; Jemi et al.,

2015; Murniati, Padmanaba, & Basuki, 2009; Silalahi & Nisyawati, 2015, 2018; Suwardi & Harmawan, 2019; Utami et al., 2019) and its benefit value (Murniati, Padmanaba, Basuki, 2009; Rujehan, 2012). However, the study of the importance of the value of the forest fruits is still minimal. On the contrary, it has been widely studied by other researchers abroad. They concluded that harvesting and domesticating various fruit plants emerge significant economic benefits (Agbelade & Onyekwelu, 2013; Man & Januszewska, 2010; Onyekwelu, Olusola, Stimm, Mosandl, & Agbelade, 2014). Besides, forest fruit plants also provide ecological benefits for species conservation (Bolakhe & Ghimire, 2019; Estoque et al., 2019; De Souza et al., 2018) and the environment (Khair, Purnomo, & Sumaryoto, 2017; Sardeshpande & Shackleton, 2019; Wang, Sun, Xiong, Yang, Hou, & Sheng, 2019).

Knowledge and utilisation of forest fruits by the local community vary based on the location and experience living in the area. Ecology and culture are two important factors that influence its utilisation (Pinedo-Vasquez, Zarin, Jipp, & Chota-Inuma, 1990; Prance, Balee, Boom, & Carneiro, 1987). Batak Toba communities, a sub-ethnic of Batakese in North Sumatera Province (Borualogo & Vijver, 2016) that are living in the Bukit Barisan mountains and surrounding forests, historically used to utilise many forest fruits for many purposes, including for medicine in their daily life (Silalahi, Nisyawati, & Anggraeni, 2018). However, nowadays, the utilisation of forest fruits is rarely done by the community. Modernisation has influenced young age villagers to go to the city to increase their standard of living (Borualogo & Vijver, 2016; Chandra, 2004) and it has resulted in that much local wisdom is slowly diminishing and affect the sustainability and existence of plants and fruits.

Research or efforts to preserve local wisdom and the potential of forest fruits is limited. In contrast, the pressure on the forest and its surrounding communities tend to increase. It is essential to provide data and transparent

information about the local wisdom and the potential of forest fruits. This study describes the critical value of forest fruits in Batak Toba society. The research aims to record the types of forest fruits using the ethnobotany framework (Ibo & Arimukti, 2019; Murniati et al., 2009; Shigaeva, Darr, Sulaiman, & Polesny, 2019), with the approach of the valuation of the direct benefits of forest (Rujehan, 2012) obtained from the local community living around the forests.

## II. MATERIAL AND METHOD

### A. Location and Time of the Study

This research was done in 2015, employing field data collection in Pahae Julu Sub-district, Tapanuli Regency, North Sumatera Province. Research focused on two villages, Sitoulama and Simardangiang, in Pahae Julu Sub-district, selected purposively, based on the distance to the adjacent forest (Figure 1). Sitoluama and Simardangiang villages are located nearby primary and secondary forests in Pahae Julu Sub-district. Located 6,5 km from Onan Hasang (the capital of Pahae Julu Sub-district), Sitoluama is closer than Simardangiang. The agricultural system has been more developed in

Sitoluama than in Simardangiang, although the total area of Sitoluama is smaller (600 hectares) than Simardangiang's (859 hectares). On the contrary, Sitoluama has a higher population (713 persons) than Simardangiang (664 persons).

Cultivation of fruit trees is commonly found in the Pahae Julu subdistrict. Statistical Bureau of North Tapanuli Regency in 2015 reported that the horticulture system was commonly developed in the form of home gardens. The six highest fruit production in this area were alpukat (*Persea americana*), duku (*Lansium parasiticum*), durian (*Durio zibethinus*), jambu air (*Syzygium aqueum*), papaya (*Carica papaya*), pisang (*Musa* sp.), and nenas (*Ananas comosus*). The products of cultivated fruits were sold in the local market, namely in Onan Hasang or in Tarutung. Forest fruit production is not recorded since the products have not yet been traded in the market, although commonly consumed in all villages, especially those living in nearby forests such as Sitoluama and Simardangiang.

The community in Simardangiang Village is still very dependent on the forest to meet their daily needs. Their ancestors were used to be frankincense farmers with high productivity. Today, the household income of some villagers

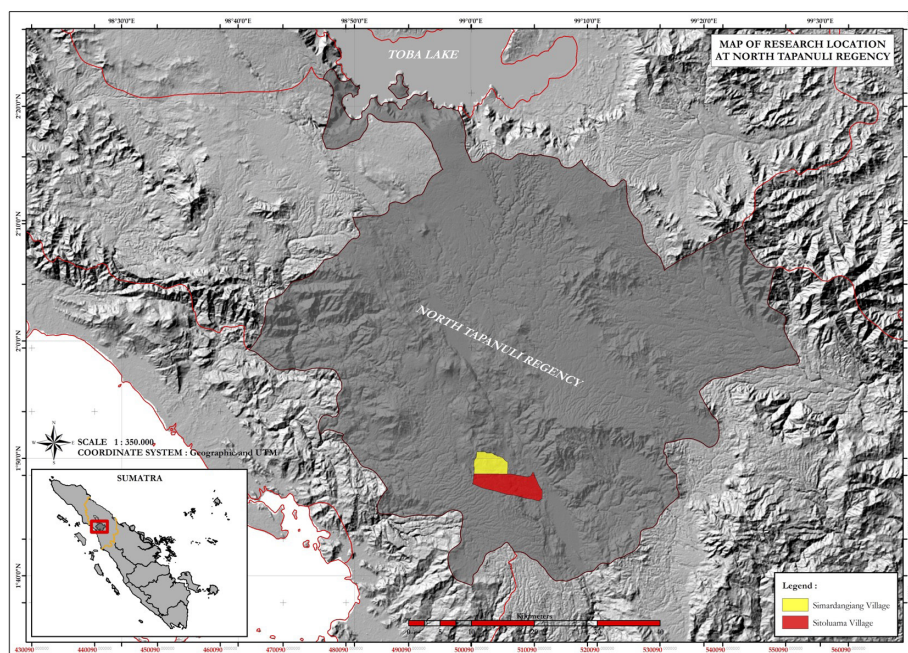


Figure 1. Research location

still depend on the income from incense even though their forest productivity started to decline (Ambarita & Sitorus, 2015; Phanith, 2019). Forest conservation based on indigenous knowledge of this community was still very high, as commonly found in the social forestry system (Bolakhe & Ghimire, 2019). Land clearing by cutting down trees and destroying the forest almost did not happen in this village.

A different situation occurred in Sitoluama Village. Community's dependency upon the forest in Sitoluama is less than of Simardangiang Village. The community in Sitoluama Village is more familiar with the developed farming system. Thus, the forest's condition is more open, and a lot of forest fruit trees began to be scarce.

**B. Methods**

Some assessments were used to obtain data and information. Since the forest fruits are not yet traded in the market, we constructed an important valuation based on the ethnobotany process. First, we traced the significance of forest fruits by interviewing critical respondents in Sitoulama and Simardangiang Villages. This interview was done using a semi-structured questionnaire and observation to identify plants of forest fruits in the forest. The information gathered included the local name of the forest fruits, fruiting season, utilisation, and plants description. The observation was done to explore the fruits' availability in the forests and the plants' description was cross-checked.

The second phase was Focused Group Discussion (FGD). FGD was set up in both villages, involving four groups of villagers. This grouping has adopted the local user valuation system methods, developed by (Sheil et al., 2003) and has also been employed by Murniati et al.(2009. In Batak Toba culture, preservation of food such as vegetable and fruit are commonly done by women in a family. Man, normally has the responsibility for harvesting them from the garden or forest. Based on this situation, we assume that different knowledge exists according to gender; thus, the valuation

of fruit is also related to gender and age, as suggested by previous research (Murniati et al., 2009; Sheil et al., 2003). Then, the group of FGD was divided into four groups, namely older men (OM), older women (OW), young men (YM) and young women (YW). Each group consisted of 8-12 persons.

During the FGD, participants were facilitated to resume forest fruits, followed by an important valuation based on four categories: fresh fruit, flavoring fruit, processed fruit, and medicine. The valuation was ranked using the Local User's Valuation Index (LUVI); the method is named Pebble Distribution Method (PDM), developed by Sheil et al. (2003). In this method, each participant has valued the significance of forest fruits by distributing 100 counters (small stones or nuts) over labelled cards (using the names of the forest fruits). This judgment resulted in the important value of the forest fruits based on the valuation of the villagers.

**C. Analysis**

The forest fruit's important value was calculated and analysed using LUVI (Sheil et al., 2003). This method is started by scoring the important value of a type of use (j) of a species (i) represented as an individual value (Gij). Every respondent valued every species' importance by putting a pebble on the species they thought was the most important based on their daily utilisation of the fruit. The Gij value represents the important value of one species for one purpose or cumulative value for several purposes. LUVI then was calculated as the sum of all species, based on Gij values, using the following formula:

$$LUVI = \sum_{i=species\ for\ all\ j}^j Gij \dots\dots\dots(1)$$

The calculated values were then tabulated and analysed using the hierarchy of important value. The score or rank of the forest fruits based on LUVI can be used as scientific evidence of species conservation or domestication for increasing its future availability.

### III. RESULT AND DISCUSSION

#### A. Utilisation of Forest Fruits in Sitoluama and Simardangiang Villages

The criteria of respondents based on age and gender were met in Simardangiang Village. While in the Sitoluama Village, the age group of young men (YM) was not present since YM in this village tends to work outside the village. The number of respondents in both villages is presented in Table 1.

Based on FGD, both villagers identified the same species of forest fruits obtained from the surrounding forest. There are four means of forest fruits utilisation. Those which are consumed directly, processed or mixed with other ingredients, used as flavours or spices and used for medicines. A list of the forest fruits is presented in Table 2.

During the FGD, both villages' respondents stated that almost all the fruits were not sold

Table 1. Respondents' distribution in both villages

No.	Group	Simardangiang Village	Sitoluama Village
1.	Young Men (YM)	8	-
2.	Older Men (OM)	21	8
3.	Young Women (YW)	6	8
4.	Older Women (OW)	8	6

Table 2. Utilised forest fruits.

No	Local Name	Scientific Name	Fruiting Season	Mean of utilisation
1.	Rau	<i>Ficus</i> sp.	Once a year	Fr
2.	Torop	<i>Artocarpus elasticus</i>	Once a year, in December	Pr
3.	Dumon-dumon	<i>Ficus carica</i>	Twice a year	Fr
4.	Mobe	<i>Artocarpus dadab</i>	Once a year	Fr, Fv or Pr
5.	Sihim	<i>Calamus manan</i>	Once a year, April	Fr, Fv, Pr or Md
6.	Hopong	<i>Macaranga Iowii</i>	Twice a year	Fv, Pr or Md
7.	Cempedak hutan	<i>Artocarpus integer</i>	Once a year	Fr or Pr
8.	Habo	<i>Archidendron bubalinum</i>	Once a year	Fr, Fv, Pr or Md
9.	Bosi-bosi	<i>Timonius flavescens</i>	Twice a year	Fr, Fv, Pr or Md
10.	Attarudan	<i>n.a</i>	Once a year	Fr
11.	Ruham	<i>Flacourtia rukam</i>	Once a year	Fr, Pr or Md
12.	Buah baja	<i>Rhodannia</i> sp.	Once a year	Fr
13.	Tungir-tungir	<i>Baccaurea polynaura</i>	Once a year	Fr, Pr or Md
14.	Hau dolok	<i>Syzigium</i> sp.	Once a year	Fr
15.	Rambutan ramba	<i>Nepbelium juglandifolium</i>	Once a year	Fr
16.	Sotul	<i>Sandorium koetjape</i>	Once a year	Fr, Fv, Pr or Md
17.	Baruas	<i>Garcinia celebica</i>	Once a year	Fr
18.	Hapundung	<i>Baccaurea racemosa</i>	Once a year	Fr, Fv, Pr or Md
19.	Gorbus	<i>Mangifera caesia</i>	Once a year	Fr
20.	Pirdot	<i>Saurauia bracteosa</i>	Along the year	Fr
21.	Riuk-riuk	<i>n.a.</i>	Once a year	Fr
22.	Mayang	<i>Areca catechu</i>	Once a year	Fr
23.	Handis	<i>Garcinia xanthochymus</i>	Once a year	Fr, Fv, Pr or Md
24.	Durian hutan	<i>Durio</i> sp.	Once a year	Fr
25.	Pining bodat	<i>Pinanga kublii</i>	Once a year	Fr, Pr or Md
26.	Handuduk	<i>Clidemia birta</i>	Along the year	Fr
27.	Harimonting	<i>Rhodomyrtus tomentosa</i>	Along the year	Fr, Pr or Md
28.	Barangan	<i>Castanea</i> sp.	Once a year	Fr
29.	Gabura	<i>n.a.</i>	Twice a year	Fr

Remarks: Fr = Fresh fruit, Fv = Flavoring fruit, Pr = Processed fruit and Md = Medicine

in the market yet, except for *Baccaurea polyneura*, *Artocarpus dadab*, and *Archidendron bubalinum*. The market price of *Baccaurea polyneura* was IDR 12,000/kg, while the price of *Artocarpus dadab* and *Archidendron bubalinum* were IDR 5,000/kg and IDR 8,000/kg, respectively. Fruit availability depends on the fruiting season where the majority of the fruits are only available once a year, except for dumon-dumon, hopong, bosibosi, and gabura which has two fruit seasons in one year or pirdot, handuduk, and harimonting that bear the fruit throughout the year. All the forest fruits listed in Table 2 also have not yet been cultivated. The villagers harvest them directly from the nearby forest.

**B. Important Value**

The important value that LUVI presents were differentiated using age and gender category, namely older men (OM), older women (OW), young men (YM), and young women (YW) in both villages. Respondents below 40 years old

age are categorised as young, and  $\geq 40$  years old are classified as older. The means of utilisation are divided into four groups, namely fresh fruit (Fr), processed fruit (Pr), flavouring fruit (Fv), or medicine fruit (Md). During the FGD, the respondents were asked to rank the ten most important forest fruits based on PDM's four means. The value given is presented in Table 3.

Table 3 indicated that some of the ten important forest fruits were different in the two villages. It is influenced by the village's forest and the forest fruit species that still exist in it. The inhabitant's knowledge also characterises it. The villagers of Simardangiang know the forest fruits and their utilisation better than those of Sitoluama. This research also quantified the value of the utilization of the ten most important forest fruits across gender and age (Table 4).

Table 4 shows the different values of forest fruits for each group of respondents in Simardangiang Village. The older men group

Table 3. The ten most important forest fruits.

No.	Simardangiang Village	Sitoluama Village
1.	<i>Bosi-Bosi</i>	<i>Barangan</i>
2.	<i>Cempedak Hutan</i>	<i>Handis</i>
3.	<i>Habo</i>	<i>Hopong</i>
4.	<i>Harimonting</i>	<i>Kapundung</i>
5.	<i>Hopong</i>	<i>Mobe</i>
6.	<i>Kapundung</i>	<i>Rambutan Hutan</i>
7.	<i>Pining Bodat</i>	<i>Riuk-Riuk</i>
8.	<i>Rubam</i>	<i>Rubam</i>
9.	<i>Sotul</i>	<i>Sibim</i>
10.	<i>Tungir-Tungir</i>	<i>Tungir-Tungir</i>

Table 4. Value of forest fruit utilisation

No	Means of utilisation	Simardangiang				Sitoluama		
		OM	YM	OW	YW	OM	OW	YW
1.	Fresh fruit	0.30	0.22	0.28	0.20	0.26	0.32	0.36
2.	Processed fruit	0.20	0.22	0.24	0.40	0.29	0.22	0.21
3.	Flavoring fruit	0.29	0.20	0.11	0.30	0.22	0.20	0.21
4.	Medicine	0.21	0.36	0.37	0.10	0.23	0.26	0.22
	Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Remarks: OM = Older men, YM = Young men, OW = Older women, YW = Young women

knows the ten fruits mainly as fresh fruit (30%). The younger men and older women know them as medicines, 36% and 37%, respectively. Different from all groups, the younger women group dominantly knows them as processed fruits (40%). The contrary situation was found in Sitoluama. In this village, the older men group knows the ten fruits mainly as processed fruits (29%). Meanwhile, both women groups recognise the ten fruits as fresh fruit (32% in older women and 36 % in younger women) (see Table 4).

This different value is influenced by a different level of knowledge and experience of each age group. Older age groups certainly have broadened understanding than the younger age groups. According to (Sembiring, Utomo, & Batubara, 2013), community knowledge of medicinal plants is inherited from their ancestors and developed well in a particular community. People obtain medicinal plants from their home garden, and if not found, they will look for it in the forest. In some cases, the younger age groups also do not recognise some types of fruit trees. This knowledge is also likely to disappear along with the changed lifestyle (Man & Januszewska, 2010). The communities are no longer relying on forest resources, as occurring in Sitoluama.

Ethnobotany knowledge is widely found in Indonesia's traditional life, resulting from interacting, working, and utilising forest plants. Knowledge of ethnobotany is an indication of sustainable utilisation of forest plants (Murniati

et al., 2009; Sheil et al., 2003; Suwardi et al., 2019). The declining knowledge of ethnobotany is the beginning of forest degradation because of the declining role of a local institution in sustainable forest utilisation (Milow, Ramli, & Chooi, 2010).

Knowledge in utilisation of forest fruits is vital to develop conservation or domestication strategy. It also provides the benchmark of fruit commercialisation in form of agribusiness system in the future (Onyekwelu et al., 2014; Phanith, 2019; Subhilhar, 2018). Based on the LUVI, the important value of ten forest fruits is presented in Table 5 (Simardangiang) and Table 6 (Sitoluama).

The majority of respondents of Simardangiang Village have chosen kapundung (*Baccaurea racemose*) (0.56), hopong (0.52), sotul (*Sandorium koetjape*) (0.48), harimonting (*Rhodomyrtus tomentosa*) (0.47), and habo (*Archidendron bubalinum*) (0.42) as essential fruits based on LUVI. The highest value of the five-forest fruit is likely related to the abundance of those fruits in nearby forests and means of utilisation. Table 5 indicated that each age group could utilise one fruit in two categories. The high LUVI show high demand for the fruit, then the fruit is vital to be conserved or domesticated.

A different situation was found in Sitoluama. The five highest LUVI of forest fruits in this village are kapundung (*Baccaurea racemosa*) (0.50), hopong (0.41), sihim (*Calamus manan*) (0.32), handis (*Garcinia xanthochymus*) (0.31) and

Table 5. LUVI of the ten most important forest fruits in Simardangiang

No	Species	Gender and age group																Total LUVI
		Older Men				Young Men				Older Women				Young Women				
		Fr	Fv	Pr	Md	Fr	Fv	Pr	Md	Fr	Fv	Pr	Md	Fr	Fv	Pr	Md	
1.	<i>Baccaurea polynetra</i>	0.08	0.00	0.02	0.00	0.03	0.00	0.00	0.00	0.01	0.02	0.02	0.01	0.07	0.00	0.00	0.00	0.26
2.	<i>Archidendron bubalinum</i>	0.00	0.00	0.08	0.00	0.02	0.09	0.06	0.00	0.02	0.00	0.00	0.04	0.00	0.00	0.12	0.00	0.42
3.	<i>Baccaurea racemosa</i>	0.06	0.08	0.00	0.00	0.04	0.02	0.06	0.00	0.01	0.02	0.04	0.03	0.01	0.10	0.10	0.00	0.56
4.	<i>Hopong</i>	0.00	0.13	0.05	0.00	0.00	0.09	0.03	0.00	0.03	0.00	0.01	0.10	0.03	0.00	0.00	0.03	0.52
5.	<i>Pinanga kublilii</i>	0.00	0.00	0.00	0.03	0.02	0.00	0.02	0.00	0.02	0.00	0.02	0.09	0.01	0.00	0.00	0.00	0.20
6.	<i>Rhodomyrtus tomentosa</i>	0.05	0.00	0.00	0.08	0.02	0.00	0.02	0.22	0.02	0.00	0.03	0.00	0.01	0.00	0.00	0.04	0.47
7.	<i>Bosi-bosi</i>	0.00	0.00	0.00	0.10	0.01	0.00	0.03	0.14	0.03	0.02	0.05	0.00	0.00	0.00	0.00	0.03	0.39
8.	<i>Artocarpus integer</i>	0.02	0.00	0.05	0.00	0.05	0.00	0.04	0.00	0.04	0.02	0.03	0.04	0.01	0.00	0.00	0.00	0.34
9.	<i>Flacourtia rukam</i>	0.04	0.00	0.00	0.00	0.01	0.00	0.05	0.00	0.05	0.00	0.04	0.00	0.10	0.10	0.00	0.00	0.34
10.	<i>Sandorium koetjape</i>	0.05	0.06	0.00	0.00	0.02	0.00	0.05	0.00	0.05	0.03	0.03	0.02	0.10	0.10	0.08	0.00	0.48

Table 6. LUVI of the ten most important forest fruits in Sitoluama

No	Species	Gender and Age Group												Total LUVI
		Older Men				Older Women				Young Women				
		Fr	Fv	Pr	Md	Fr	Fv	Pr	Md	Fr	Fv	Pr	Md	
1.	<i>Calamus manan</i>	0.05	0.00	0.00	0.00	0.05	0.03	0.03	0.00	0.04	0.07	0.12	0.07	0.32
2.	<i>Rink-rink</i>	0.06	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.06	0.00	0.07	0.00	0.14
3.	<i>Nepheleium juglandifolium</i>	0.02	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.07	0.01	0.00	0.01	0.17
4.	<i>Baccaurea polynetra</i>	0.02	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.04	0.03	0.01	0.03	0.08
5.	<i>Flacourtia rukam</i>	0.02	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.06	0.01	0.03	0.01	0.11
6.	<i>Garcinia xanthochymus</i>	0.01	0.04	0.00	0.00	0.03	0.04	0.04	0.00	0.03	0.05	0.01	0.01	0.31
7.	<i>Hopong</i>	0.01	0.09	0.07	0.00	0.03	0.06	0.06	0.00	0.00	0.06	0.01	0.00	0.41
8.	<i>Baccaurea racemosa</i>	0.06	0.08	0.10	0.00	0.03	0.06	0.06	0.00	0.06	0.05	0.09	0.01	0.50
9.	<i>Artocarpus dadab</i>	0.00	0.02	0.06	0.00	0.01	0.03	0.03	0.00	0.07	0.05	0.00	0.00	0.19
10.	<i>Castanea sp.</i>	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.03

Remarks: Fr = Fresh fruit, Fv = Flavoring fruit, Pr = Processed fruit and Md = Medicine

mobe (*Artocarpus dadab*) (0.19). Having lower dependence on forest resources, the villagers in Sitoluama also have more inadequate knowledge and utilisation value of forest fruits expressed in LUVI of forest fruits. Situated nearby the main road of Pahae Julu, Sitoluama tends to be influenced by a more modernised lifestyle. This is the cause of the disappearing local knowledge, which is also exacerbated by deforestation (Estoque et al., 2019).

This study found that villagers' preference for utilisation of forest fruits in the two villages has both similarities and differences. However, they come from the same sub-ethnic community, Batak Toba. The similarity is that the respondents in Simardangiang and Sitoluama rank kapundung and hopong as the most valuable forest fruit. The difference is the use of some medicinal fruits such as hopong and harimonting. These fruits are used as a medicinal plant in Simardangiang but not in Sitoluama.

It can be resumed that the important forest fruits to be conserved and domesticated are kapundung (*Baccaurea racemose*), hopong, sihim (*Calamus manan*), handis (*Garcinia xanthochymus*), mobe (*Artocarpus dadab*), harimonting (*Rhodomyrtus tomentosa*), sotul (*Sandorium koetjapè*), and habo (*Archidendron bubalinum*). If the important factor is considered as the main factor, forest fruits that have the highest potential are kapundung (*Baccaurea racemose*),

hopong, sotul (*Sandorium koetjapè*), harimonting (*Rhodomyrtus tomentosa*), and habo (*Archidendron bubalinum*). These research findings can be used to determine the basis for domestication of forest fruit (Isik, Kumar, Martínez-García, Iwata, & Yamamoto, 2015; Milow, Ramli, & Chooi, 2010). The results of the research will contribute to the strategy of forest fruit preservation (Čurović, Jovančević, & Balijagić, 2019; Man & Januszewska, 2010) to meet human needs. Development of forest fruits can be carried out in the agroforestry system, as most forest fruits need a forest ecosystem to grow (Sundawati, Purnaningsih, & Purwakusumah, 2012).

This study indicates that based on villagers' utilisation, forest fruits have important value. Forest fruit consumption may add a variety to their daily intake and contribute to their improved health (Bosnjakovic et al., 2012). However, the villagers have not cultivated these trees yet; they harvest them from the forest around their settlement. Considering the high rate of deforestation, the existence of these fruits in the future will likely not be sustainable. Therefore, domestication is needed to increase availability and ensure future generations' sustainability (Murniati et al., 2009).

The other benefits of domesticating forest fruits are to support biodiversity conservation (Čurović, Jovančević, & Balijagić, 2019; de Souza, Maurício, Dias-Guimarães, Guimarães, & Braga,



2018), to diversify rural products, to sustain local wisdom and culture (Man & Januszewska, 2010), to develop local economy (Agbelade & Onyekwelu, 2013; Jemi et al., 2015; Schunko, Lechthaler, & Vogl, 2019), and to preserve the forested landscape and environment (Čurović et al., 2019). Domestication requires more research on various topics such as selection of fruit trees, germplasm collection, tree planting, integration to existing farming systems such as agroforestry, as well as economic and social benefits (Onyekwelu et al., 2014).

The findings of this research are necessary as the baseline for the domestication of forest fruits, although it provides the potential economic value of the fruits. On the policy side essential support from the government is needed to initiate the stages of domestication of forest fruit trees. The government also needs to build a system that accommodates participation of the communities (Onyekwelu et al., 2014), both in decision making and in the implementation process.

#### IV. CONCLUSION

Important value consideration is useful to provide a benchmark for domestication strategies and the development of utilisation of forest fruits on Toba, sub-ethnic community. Fruits are utilised as fresh fruit, flavouring fruit, processed fruit, and medicinal fruit. Based on LUVI the important forest fruits are kapundung (*Baccaurea racemose*), hopong, sihim (*Calamus manan*), handis (*Garcinia xanthochymus*), mobe (*Artocarpus dadah*), harimonting (*Rhodomyrtus tomentosa*), sotul (*Sandorium koetjape*), and habo (*Archidendron bubalinum*). Domestication is important to maintain the availability of the fruits because not all fruit types are available all year round, most of them fruiting once up to twice a year. The benefits generated by the forest fruits align with the values of social importance in the community and provision of nutrition value. Future research in various topics related to the domestication of fruit trees such as selection of trees, germplasm collection,

silviculture, farming system, and socio-economic feasibility, are needed to conserve the important forest fruits. The government needs to support it by providing necessary policies and systems that ensure local communities' participation and rights in assessing these forest resources.

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