



# Exploration of Species and Spatial Distribution Non-Timber Forest Products Using Geographic Information System (GIS)

Siti Latifah<sup>1\*</sup>, Agus Purwoko<sup>1</sup>, Jeffry William Siregar<sup>1</sup>

<sup>1</sup>Faculty of Forestry, Universitas Sumatera Utara, Jalan Kampus 2 USU Bekala, Kecamatan Pancur Batu, Kabupaten Deli Serdang, Sumatera Utara 20353, Indonesia

**Abstract.** This study was conducted to look at the types and spatial distribution of non-timber forest products (NTFPs). Data on NTFPs species, distribution, and parts used was obtained through species identification. Meanwhile, NTFP mapping activities use GIS. The results showed that there were 8 types of NTFPs used by the villagers, namely *Arenga pinnata*, *Hevea brasiliensis*, *Durio zibethinus*, *Areca catechu*, *Theobroma cacao*, *Parkia speciosa*, *Lansium parasiticum*, and *Archidendron pauciflorum*. They use it for daily consumption and sell it to collectors in the form of fresh fruit, palm sugar, leaves, roots, seeds, and sap. Non-timber forest products are scattered in clusters and unevenly in the village area.

**Keyword:** Distribution, Forest, Non-Timber, Spatial, Village

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## 1 Introduction

The paradigm shift in forest management now tends to manage forest areas (ecosystems) as a whole and demands diversification of forest products other than wood. The existence of forests with multiple functions in economic, ecological and social terms has made Natural Resources (SDA) an important part of the many contributors to national development in realizing the prosperity of the Indonesian people as a whole [1]. Forests generally produce three kinds of products, including timber, services and Non-Timber Forest Products (NTFPs). Among the three forest products, NTFPs are forest products that directly come into contact with the community and have a large comparative advantage [2]-[3].

According to Nijman [4]-[6], NTFPs derived from parts of trees or plants that have special characteristics that can become goods needed by the community, sold as export commodities or

\*Corresponding author at: Faculty of Forestry, Universitas Sumatera Utara, Jalan Kampus 2 USU Bekala, Kecamatan Pancur Batu, Kabupaten Deli Serdang, Sumatera Utara 20353, Indonesia  
E-mail address: sitalatifah164@usu.ac.id

as raw materials for an industry. These non-timber forest products can be in the form of leaves, bark, sap or resin, fruit, flowers, medicinal plants, or ornamental plants, rattan, bamboo and others. Therefore, the forest must receive special attention, especially in the management and use of it directly, so that it can be expected to be enjoyed to the fullest with the advancement of science and technology (Science and Technology) still referring to sustainable, sustainable use.

According to [4]-[6], NTFPs can be used by the community for domestic and industrial purposes as food or additives, seeds, mushrooms, fungi, fruits, herbs, spices, and herbs; fiber (used for construction, furniture, clothing, or equipment); resin; rubber; plants and animals used for medicine, cosmetics, and ceremonial purposes. Non-Timber Forest Products (HHBK) from forest areas have enormous potential, and have a significant role in increasing community household incomes, improving local economies, and forest sustainability. By utilizing NTFPs, the community can directly reduce the exploitation of timber and forest products [7], [5]. NTFPs play a role and contribute to the daily lives of all people in the world. Almost 80% of the population in development countries get their nutritional and health needs from NTFPs [5]. According to [8], in South Tapanuli, NTFPs have an annual economic value of IDR 2,441,416,000. Local communities depend on NTFPs for income and food.

According to [9], argues that steps should be taken to understand and take an inventory of the non-timber resources of an area before undertaking any activities to develop a forest management plan. According to [10]-[11], by participatory mapping, field checks, and community questionnaires, adjustments in NTFPs collection procedures were evaluated. Mapping or general terms Spatial distribution of NTFPs was carried out in the Sigiring Giring village of Central Tapanuli Regency. This survey was aimed at species inventory and NTFPs mapping.

## **2 Research Method**

The area that became the location of this research was Sigiring Giring Village, Tukka District, Central Tapanuli Regency. Data collection activities were carried out in January-March 2021. Geographically it is located between 1° 40' 19"N 98° 54' 00"E and 1.672°N. 98.9° East, covers an area of 2,194.98 km<sup>2</sup> (219,498 ha).

To obtain data, interviews and discussions were conducted with respondents who collect NTFP's around the forest. The informant selection technique used is a purposive sampling technique, the respondents are selected based on communities that utilize NTFPs in research locations. Respondents in this study totaling 98 people. This research uses stationery, a digital camera for documentation, a laptop or computer as a data processor, a compass for direction, GPS (Global Positioning System) for the field survey, and a tally sheet. The materials used in this research are NTFPs, administrative maps of the research locations, reports and theses of

previous studies, as well as various supporting libraries as secondary data sources to help complete direct observations in the field. The following are the data gathering techniques employed in this study: observation, interviews, and documentation.

1. Observation: using observation guidelines regarding the types and coordinates of the distribution of NTFPs around Sigiring Giring village [12]. The area of Sigiring Giring village is 7.04 km<sup>2</sup>. Several coordinates representing the presence of NTFP species found in the field were taken to determine their spatial distribution.
2. Interview: Direct interview with closed questions to key respondents, namely people who are considered important such as religious leaders, and community leaders or others, as well as general respondents as community users of NTFPs.
3. Documentation is a way of collecting data in the form of visualizations taken from phenomena that exist within the object of research. This documentation study is needed to strengthen the research results, which are based on actual conditions in the field.

Determination of coordinate points to see the type and distribution pattern of NTFPs used by the community. The coordinate points are determined using GPS (Global Positioning System), which will then be managed using the ArcGIS application, where the data will be presented in the form of a distribution map [11]. The processing of coordinate point data obtained from the field is as follows:

1. Coordinate point data is processed from GPS data and transferred to a computer using Garmin DNR software.
2. The file is converted into shp form, which can then be processed using GIS software.
3. After obtaining a map of the coordinates of the NTFPs, these points are then overlaid with the administrative map of the Tukka District.
4. Enter the NTFPs overlay result shapefile data.
5. Click arctoolbox-analysis-tools-overlay-intersect.
6. Open the intersect shapefile attribute table.
7. Create a new field and enter the appropriate result data, namely the type of NTFPs.
8. Design the layout and format of the map, namely the title, legend, geographic coordinates, and scale [12].

### **3 Result and Discussion**

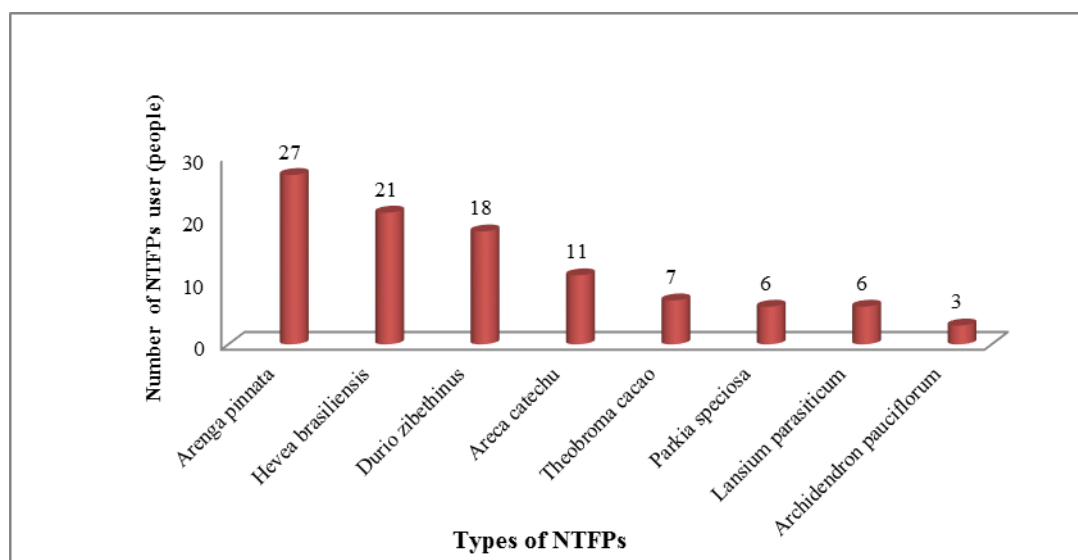
#### **3.1 Non-Timber Forest Product Identification**

Rural communities around the forest use NTFPs as an important resource to sustain their livelihoods. NTFPs are marketed in large quantities in regional, national, and international

markets, with yearly earnings in the billions of dollars [13]. In their daily lives, the people who live around the forest area fulfill their needs by relying on the existence of the forest. This is clarified by [14], which states that the interaction of communities around the forest is marked by activities to collect forest products in the form of food, firewood, animal feed, tubers, and products from other types of forest services.

The number of respondents who used NTFPs in this study was 98, which were dominated by men, with a percentage of 94%. We know that men are the head of the family, so they have an obligation to earn a living and meet the daily economic needs of the family [15]. Men have a responsibility to work and provide for their families on a daily basis because they are the family's head. According to the findings of the respondents' interviews, 35 households, or those between the ages of 41 and 55, used NTFPs the most (36%). It is clear from this data that the productive age group makes the greatest use of the forest's resources. The fact that so many people who use forest resources are in the prime of their lives suggests that there aren't many jobs available nearby in industries other than forestry [16],[5].

The results of a survey of 98 respondents at the study site indicated that most of the people living around the forest made use of palm sugar, namely 27 households or 28% of the total respondents. A total of 21 households or 21% of respondents used rubber, followed by *D. zibethinus* which was used by 18 families or 18% of respondents; 11 families, or 11% of respondents, use *A. catechu*. Meanwhile, cocoa pods are used by 7 families or 7% of respondents; while *Parkia speciosa* was used by 6 families or 6% of respondents; and *L. parasiticum* used by 6 families or 6% of respondents. The NTFP that was used the least by the community at the research location was *A. pauciflorum*, with the local name jengkol, namely 2 families (3%). The scarcity of jengkol is not only due to reduced supply or because there is no demand for it. Jengkol trees are also very rare. Many residents' jengkol trees have been cut down and the tree trunks are sold to be used as boards. In Figure 1, the types of NTFPs and the number of household heads who use them can be seen.



**Figure 1** Types NTFP's in the study site

The results showed that the villagers used NTFPs for their daily consumption and sold them to collectors in the form of fresh fruit, palm sugar, leaves, roots, and seeds [15]. Non-timber forest products are harvested at all times of the year, except for durian fruit, which is harvested in October–January [17] (Table 1).

One of the forest ecosystem products is NTFP's with various types, both in their production sources and their products and derivatives. In accordance with the Regulation of the Minister of Forestry Number P.35/Menhut-II/2007 concerning NTFP's, in the context of developing the cultivation and utilization of NTFPs, NTFPs are divided into vegetable NTFPs and animal NTFPs. At the research site, the Sigiring Giring Village Community utilizes vegetable NTFPs. Most of the people who live around the forest are farmers and collect NTFPs. They can optimally utilize NTFPs with more diverse types of NTFPs, so that more processed products can be marketed.

Non-timber forest products are a valuable resource and a basic necessity. People take advantage of the non-timber forest's results as food (fruits and vegetables), latex (rubber sap), and drugs. Non-timber forest products are used in traditional ways by society, such as crafts, traditional medicine, and food ingredients.

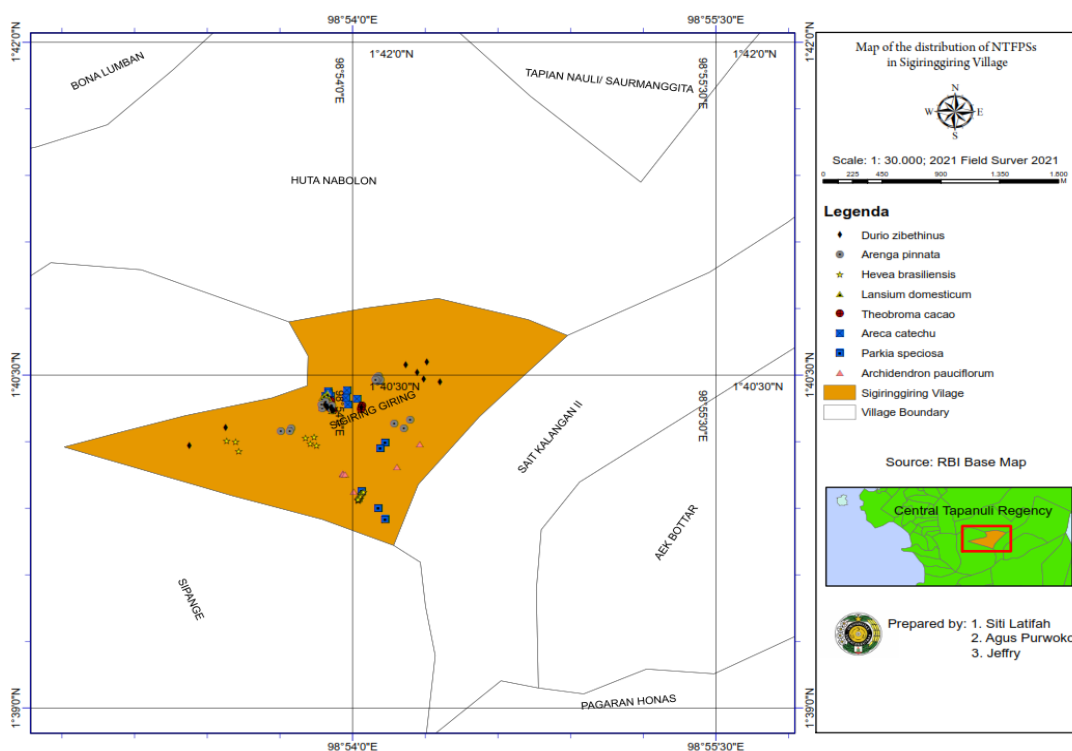
**Table 1** Utilization of NTFPs in Siring Giring Village

No	NTFP's	Scientific Name	Family	Part used	Harvest time
1	Aren	<i>A. pinnata</i>	Arecaceae	Fruit, rubber, leaf	every year
2	Karet	<i>H. brasiliensis</i>	<i>Euphorbiaceae</i>	Sap	every year
3	Durian	<i>D. zibethinus</i>	<i>Bombaceae</i>	fruit	October-January

4	Pinang	<i>A. catechu</i>	<i>Aracaceae</i>	Fruit, seed, root	every year
5	Kakao	<i>T. cacao</i>	<i>Sterculiaceae</i>	Fruit, seed	every year
6	Petai	<i>P. speciosa</i>	<i>Fabaceae</i>	Fruit	every year
7	Langsat	<i>L. parasiticum</i>	<i>Meliaceae</i>	Fruit	every year
8	Jengkol	<i>A. pauciflorum</i>	<i>Mimosaceae</i>	Fruit	every year

### 3.2 Spatial Distribution of NTFPs

The distribution of NTFPs was carried out to determine the coordinates of NTFPs, which were documented in the form of a map [18]. To see the pattern of distribution of NTFP that are used by communities around the forest, coordinate points are taken using, which is documented in the form of a map. This is following the statement [12], [14]. In terms of its role, a map is a form of presenting spatial information about the earth's surface to be used in retrieval. The number of family members and the distance from the forest to the dwelling have an impact on how much forest product is used. Generally, the farther the distance between the residence location and the forest, the fewer forest products will be obtained. But, when the size of the family grows, there will be a greater need for the obtained NTFPs [14].



**Figure 2** Map of the distribution of NTFPs in Sigiring Giring Village

With the map, when conducting a field review, the community is more likely to find non-timber forest product plants (NTFPs) in Sigiringgiring Village, Tukka District, Central Tapanuli Regency [18]. Figure 2 displays a distribution map of all NTFPs. The distribution of non-timber forest products (NTFPs) in Sigiringgiring Village is spread in clusters with their respective types [17]. This is caused by biotic and abiotic factors, as well as the ability to adapt

these species to their habitat [20]. The cluster distribution in a population is common in nature, both for plants and animals. Generative reproduction using seeds is assisted by wind and insects. Seeds are blown by the windfall not far from their parents because the presence of trees around them can limit the movement of seed dispersal so that each type grows in groups.

Durian plants grow in almost all villages. There are many types of jengkol plants in the southern part of Sigiring Giring Village. Cocoa plants grow in clusters in the east, bordering Sigiring Giring Village. Many rubber plants grow evenly and spread in almost all villages. It's different from the petai plant growing to the south of Sigiringgiring Village. Langsung plants grow in the western part of Sigiring Giring Village in small numbers, while areca nut plants grow in groups in the middle of Sigiring Giring Village.

These species have enormous economic value for the population. Forests have a strategic role in supporting food security in the future. Forest management that is capable of supporting food security can also stimulate local economic activity. NTFPs as an alternative source of food, a source of medicinal ingredients, which are widely used as traditional medicines [8],[21]-[22]. In order to monitor changes in the management status of NTFPs over time, it is advised that ecological and livelihood data on these resources be collected in-depth and often.

#### 4 Conclusion

NTFPs with economic value used at the research site are durian (*Durio zibethinus*), aren (*Arenga pinnata*), rubber (*Hevea brasiliensis*), langsung (*Lansium domesticum*), cocoa (*Theobroma cacao*), areca nut (*Areca catechu*), petai (*Parkia speciosa*), and jengkol (*Archidendron pauciflorum*). *Arenga pinnata* is the NTFPs most often used by the community. The spatial distribution of NTFPs is clustered and evenly distributed in the northern and southern areas of residential areas.

#### 5 Acknowledgment

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