

*Regular Research Article*

# Potential Economic and Development Prospects of Non Timber Forest Products in Community Agroforestry Land around Sibolangit Tourism Park

Oding Affandi<sup>1\*</sup>, Anita Zaitunah<sup>2</sup>, Ridwanti Batubara<sup>3</sup><sup>1</sup> Forestry Faculty, University of Sumatera Utara; Email: affandio\_usu@yahoo.com<sup>2</sup> Forestry Faculty, University of Sumatera Utara; Email: azaitunah@gmail.com<sup>3</sup> Forestry Faculty, University of Sumatera Utara; Email: ridwantibb@yahoo.com

\* Correspondence author: affandio\_usu@yahoo.com ; oding@usu.ac.id ; Tel.: +62-819-7319-6430

**Abstract:** The communities who live around Sibolangit Tourism Park have developed nontimber forest products (NTFP) in their own agroforestry lands. This research evaluates the potential economic and development prospects from NTFP development in the Park by examining: (1) type of NTFP and economic value from community agroforestry land, (2) contribution of NTFPs on household income, (3) development prospects of NTFP-based agroforestry around Sibolangit Tourism Park. The research was conducted in two selected villages around Sibolangit Tourism Park: Sembahe Village and Batu Mbelin Village. The research took place over a period between June and August 2016. Research data was obtained from in-depth interviews and observations. A descriptive method was used to analyze and describe facts related to the research aims. The type of NTFPs cultivated by communities at the research sites include mangosteen, durian, garcinia, candlenut, lanzones, lansium, bitter bean, and areca nut (as their forestry component) and ginger, turmeric, chili, papaya, etlingera, and banana (as the agriculture component). Most NTFPs are cultivated as a commercial product. The economic value of NTFPs in Batu Mbelin Village has reached IDR. 547,275,000/year or contribute 80.07% of total family income. Meanwhile, the economic value of NTFPs in Sembahe Village has reached IDR 682,100,000/year, contributing to 78.75% of total household income. Therefore, the prospects for supporting and expanding NTFP in agroforestry plots in and around Sibolangit Tourism Park has high potential for supporting household income.

**Keywords:** Economical value; NTFP; NTFP development; Agroforestry; the Tourism Park of Sibolangit

## 1. Introduction

From a national economic context, forests have multiple functions that provide both direct and indirect benefits. Economic studies however, rarely examine these multiple functions holistically and in an integrated fashion. In an ideal condition, sustained forest cultivation could produce both timber forest products (TFPs) and non timber forest products (NTFP<sup>1</sup>). In most cases however, forest resource utilization tends to be conducted partially, oriented to single commodity extraction that is timber production. The singular timber production approach however, is restricted by the knowledge, capability, technology, and local development interests and presents barriers for the potential benefit of forest cultivation in a given area. The singular timber extraction model however, is no longer fit for the context of supporting national development priorities given the expansive logging that has occurred in Indonesia during the past two decades. Government priorities have shifted in the interest of seeking potential multi-dimensional solutions to focus on

<sup>1</sup> Based on Explanation of section 4 subsection (1) Law No.41 Tahun 1999 on Forestry, NTFP can be biological entities (plants and animal products), non biological entities (conservation and service functions, not including mining products) and direct products from processing or called underlying product or see Regulation of Ministry of Forestry No. 35 year 2007 on Non Timber Forest Product

people's welfare, and therefore desire to build the capabilities to support local community livelihood priorities.

NTFPs are part of trees or plants that have special characteristics that can become products to support people's needs, sold as export commodities, or as raw material for industries. NTFP is a byproduct from a tree such as sap, leaves, bark, fruit or plants which have special character such as rattan, bamboo and numerous others. NTFP collection, in general, is a traditional activity conducted by people living in and around the forest. In some locations, the collection of NTFPs are the main activity of people's daily lives. Some examples include rattan collection, timber sap (such as agathis sap), and shorea, also called *damar* (Djajapertjunda, 2001).

Forest resource management systems that support NTFP cultivation are generally conducted by local people as part of their agroforestry plots. There are numerous long-standing practices that continue to function until today in various regions in Indonesia, mainly in Sumatera, such as Repong in Pesisir Krui, Lampung; Parak in Maninjau, West Sumatra; mixed rubber gardens in Jambi and South Sumatera (de Foresta, et al., 2000); and, the Kemenyan gardens in Tapanuli Utara, North Sumatera (Suhardjito, et al, 2000). In the past, forest resource management systems that included these often complex NTFP arrangements were overlooked by government programs and other development institutions. More recently, the government has acknowledged NTFP as an important complement and alternative from classical forest resource management practices.

Several decades ago agroforestry began to develop around Sibolangit Tourism Park. The system is known as *Reba Juma* (from the local Karo language; *Reba* means house, *Juma* means field). In other words, this means that the fields are easily accessed from cultivator homes (Affandi and Siregar, 2010). When examining *Reba Juma* more closely, it can also be described as an agrisilviculture pattern. According to Sardjono, et al. (2003), an agrosilviculture system combines the forest component (or timber) with the agricultural component (or non-timber plants). Timber refers to long cycle crops (*tree crops*) and non-timber plants are any seasonal crops (*annual crops*). Based on the research site, *Reba Juma* consists of forestry plants such as mangosteen, durian, garcinia, candlenut, lanzones, lansium, bitter bean, areca nut, combined with agriculture plants, including ginger, turmeric, chili, papaya, etlingera, and banana.

The economic potential of NTFPs are from both state forest areas and from private land ownership areas. The potential coverage area is assumed to be quite vast, even though the information on values is imprecise due to the lack of data availability. NTFPs are also assumed to provide a key component for realizing the potential growth of the 'green economy' concept (Andayani, 2015).

Local people acknowledge the benefit of NTFP management in agroforestry areas around Sibolangit Tourism Park, in terms of economic, ecological, and socio culture forms. The important role of NTFPs in agroforestry areas around the park continues to be maintained until now. The agroforestry practices around Sibolangit Tourism Park is also acknowledged by numerous stakeholder to serve as an important function as a buffer zone. Not only do the agroforestry areas around the Park provide an ecological buffer, they also serve as a safeguard against encroaching population expansion to the Sibolangit region. Population expansion into these areas would have a negative impact on both the forests and the existing communities. However, such land management practices rarely receive the attention and acknowledgement from parties with formal management responsibilities. Furthermore, there is still limited information on how agroforestry management systems are sustained, the relationship to local cultural practices, and especially lacking information on the way local forest management practices contribute to people's welfare. On the other hand, although NTFPs in agroforestry practices provide additional value for local incomes, custom, and subsistence, it is still far from optimal in achieving welfare standards for people around the forest. Therefore, in this research we present comprehensive information on the economic potential of NTFPs in agroforestry management in order to support the development of agroforestry systems that are in accordance with local interests.

As such, the problem this research aims to address are multiple, and include: (1) examining the type and economic value of NTFPs and the uses among agroforestry practitioners at the case

study sites, (2) assessing NTFP and their relationship to household income, (3) analyzing the prospect of NTFPs development in agroforestry system around Sibolangit Tourism Park.

## **2. Materials and Methods**

### *2.1. Time and Location*

This research was conducted in two selected villages around Sibolangit Tourism Park, which are Sembahe Village and Batu Mbelin Village in June - August 2016. Other people find their livelihoods as workers, trader/entrepreneurs, government officers, army, police officers, and others. The ethnicity of both villages is dominated by Karo, including some people who identify as Batak from the neighboring region, and also others that are Javanese.

### *2.2. Data collection methodology and data analysis*

The research was explorative, and data collection was conducted using a combination of documentation approaches from various secondary data sources. Direct data collection was through primary data collection in the field through interviews, focus group discussions, and field observation. Direct data collection in the field consisted mainly of collecting data directly at the study sites and crosschecking with secondary data in the field and elsewhere.

Primary data collection included inventorying different species, surveying the number of forest products being utilized, gathering baseline socio-economic data; cataloging the period and time of forest product collection; compiling cost and forest product utilization information; and, returning for several iterations of data collection. Secondary data, such as the general condition of the research area or general data from the village office and regency was also included for analytical considerations.

The field data on forest product value of each species per year was calculated to estimate the price of the product using a market approach. There are information on quantity of product per species, total collection per year, percentage of economical value and contribution of the product.

The sample in this study is the community who live around the Sibolangit Tourism Park area in the Batu Mbelin village and Sembahe Village of Sibolangit Sub District, Deli Serdang District as many as 30 samples of household heads, 5-8 persons for FGDs and key informants from each village. The sample in this study is selected by purposive sampling, which means the subject is not based on strata, random, or region distribution, but rather conducted with a specific purpose (Arikunto, 2006).

## **3. Results and Discussion**

### *3.1. Type and category of NTFP*

Agroforestry systems at the research site produce two categories of results including the forestry component and agriculture component. The forestry component consists of TFPs and NTFPs. Therefore, the management of each component is important to defining the overall agroforestry system. Management of plots determine the value of agroforestry products to be sold in the market. Appropriate technologies, requisite processing systems, access to markets, and product diversification will support the optimization of forest products.

In the forestry context, the main product of modern agroforestry is TFP and NTFP from wood plants. The Sibolangit Tourism Park case is different because local communities have developed agroforestry systems traditionally utilizing various plant types, mainly NTFPs that have a close relationship with local socio-cultural meanings passed down and practiced from generation to

generation by individual land owners and under other land tenure regimes (Sardjono, et al., 2003; Widiyanto, 2013).<sup>2</sup>

NTFP species that are utilized by people around the Park mainly cultivate their own land under a common agroforestry pattern. Forest products vary from fruit trees to vegetables plants. Collection of NTFPs by people is an ongoing traditional activity. NTFP utilization by people can be grouped into two categories: (a) productive, being sold at market (commercial), and (b) consumptive, that is self consumed and not being sold (subsistent) (Ngakan, et al., 2006). Data on NTFP species utilized in the study area is shown in Table 1.

**Table 1. Species and category of NTFP utilized by communities in agroforestry practices around Sibolangit Tourism Park**

No.	Species of NTFP	Category	Notes
1	Areca nut ( <i>Areca catechu</i> )	Productive, consumptive	Cultivation, unseasonal
2	Garcinia ( <i>Garcinia atroviridis</i> )	Productive, consumptive	Cultivation, unseasonal
3	Mangosteen ( <i>Garcinia mangostana</i> )	Productive, consumptive	Cultivation, seasonal
4	Durian ( <i>Durio zibethinus</i> )	Productive, consumptive	Natural <sup>3</sup> , seasonal
5	Lansium ( <i>Lansium domesticum var</i> )	Productive, consumptive	Natural, seasonal
6	Lanzones ( <i>Lansium domesticum var domesticum</i> )	Productive, consumptive	Natural, seasonal
7	Bitter bean ( <i>Parkia speciosa</i> )	Productive, consumptive	Natural, seasonal
8	Candlenut ( <i>Aleurites moluccana</i> )	Productive, consumptive	Natural, seasonal
9	Ginger ( <i>Zingiber officinale</i> )	Productive, consumptive	Cultivation, unseasonal
10	Turmeric ( <i>Curcuma domestica</i> )	Productive, consumptive	Cultivation, unseasonal
11	Banana ( <i>Musa paradisiaca</i> )	Productive, consumptive	Cultivation, unseasonal
12	Chili ( <i>Capsicum annum L.</i> )	Productive, consumptive	Cultivation, unseasonal
13	Papaya ( <i>Carica papaya L.</i> )	Productive, consumptive	Cultivation, unseasonal
14	Etlingera ( <i>Etlingera elatior</i> )	Productive, consumptive	Cultivation, unseasonal
15	Corn ( <i>Zea mays</i> )	Productive, consumptive	Cultivation, unseasonal

Based on research results, Table 1 highlights NTFP utilization by people around the Park. The categories also relate directly to the main source of the household economy. The household economy is characterized by all the NTFP categories listed above that are mainly to be sold as commercial products (productive) and also for its local uses (categorized as consumptive).

### 3.2. Economic value of NTFP

The economic value of NTFPs are obtained from a multiplication between “total collection” per species per year and “price” of forest product per species. Based on research results in the two villages around Sibolangit Park the economic value from utilization of NTFPs from agroforestry is 547,275,000 rupiahs per year for Batu Mbelin Village and 682,100,000 rupiahs per year for Sembahe Village. The specific breakdowns from the calculations are provided in Table 2 and Table 3.

<sup>2</sup> Traditional Agroforestry or classic agroforestry is ‘every agriculture system, where trees from planting or maintenance of stand/plant is integrated as part of the socio-economic system and forms the ecological whole of the system (*agroecosystem*)’ (Sardjono, et al., 2003)

<sup>3</sup> existing in or caused by nature

**Table 2. NTFP economic value per year from agroforestry practices in Batu Mbelin Village (Year 2016)**

No.	NTFP species	Number of collection (Unit/year)	CF	Total collection	Unit	Price (IDR)	Economic value (IDR)
1	Areca nut	790	2	1,580	Kg	15,000	23,700,000
2	Garcinia	5,830	3	17,490	Kg	5,000	87,450,000
3	Mangosteen	10,650	1	10,650	Kg	20,000	213,000,000
4	Durio	10,350	1	10,350	Piece	7,000	72,450,000
5	Lansium	3,350	1	3,350	Kg	10,000	33,500,000
6	Lanzones	10,200	1	10,200	Kg	5,000	51,000,000
7	Bitter bean	850	1	850	Bundle	20,000	17,000,000
8	Candlenut	2,550	4	10,200	Kg	5,000	51,000,000
9	Ginger	4,900	1	4,900	Kg	8,000	39,200,000
10	Turmeric	880	1	880	Kg	12,000	10,560,000
11	Banana	190	1	190	bunch	35,000	6,650,000
12	Chili	25	15	375	Kg	30,000	11,250,000
13	Papaya	79	36	2,844	Piece	5,000	14,220,000
14	Etlingera	158	24	3,792	Kg	10,000	37,920,000
15	Corn	4,400	1	4,400	Kg	3,000	13,200,000
<b>TOTAL</b>							<b>547,275,000</b>

Notes: CF = Collection Frequency

**Table 3. NTFP economic value per year from agroforestry practices in Sembahe Village (Year 2016)**

No.	Type of NTFP	Number of collection (Unit/year)	CF	Total Collection	Unit	Price (IDR)	Economical value (IDR)
1	Areca nut	1,214	2	2,428	Kg	15,000	36,420,000
2	Garcinia	4,110	3	12,330	Kg	5,000	61,650,000
3	Mangosteen	6,550	1	6,550	Kg	20,000	131,000,000
4	Durio	18,200	1	18,200	Piece	7,000	127,400,000
5	Lansium	4,050	1	4,050	Kg	10,000	40,500,000
6	Lanzones	4,230	1	4,230	Kg	5,000	21,150,000
7	Bitter bean	1,050	1	1,050	Bundle	20,000	21,000,000
8	Candlenut	1,500	4	6,000	Kg	5,000	30,000,000
9	Ginger	4,900	1	4,900	Kg	8,000	39,200,000
10	Turmeric	1,050	1	1,050	Kg	12,000	12,600,000
11	Banana	57	1	57	Bunch	35,000	1,995,000
12	Chili	24	15	360	Kg	30,000	10,800,000
13	Papaya	58	36	2,088	Piece	5,000	10,440,000
14	Etlingera	13	24	312	Kg	10,000	3,120,000
<b>TOTAL</b>							<b>682,100,000</b>

Note: CF = Collection Frequency

Table 2 and Table 3 show that NTFP economic value per year among agroforestry practices in Batu Mbelin Village and Sembahe Village are derived largely from the forestry component. As for the NTFP with the highest economic value, mangosteen holds the highest value, followed by durian and garcinia. In general, economic value of NTFP is influenced by the number collected, collection frequency, and price of each type of NTFP. The number of collection depends on productivity from each species, which is related to land management intensity in agroforestry practices. Collection frequency depends most on harvest time and fruiting system of each species. Furthermore, the price depends on market chain (*tengkulak*, or middlemen/collectors, or direct sourcing), difference of selling time and quality of product sale (Awang, et.al., 2002).

Research results show that most NTFPs are still sold in its raw material form, so the nominal financial value for producers is still low. It is also assumed that to increase product sale in the form of an intermediate product there are still disconnects between the commercialized forms for the downstream product. Therefore, the strategy and opportunities to influence price determination needs to accommodate the existing market system and ways to anticipate the probability of product export potential.

The economic value of various types of NTFPs in agroforestry practices in general also yield various values in accordance to the area of land and commodity type. Therefore, there is a variation of harvesting for each agroforestry product that also results in variation time of collecting income from the given agroforestry product. Findings about cost variation are detailed more specifically in Widiarti and Prajadinata (2008) that shows mixed garden planting patterns provide a variety of incomes that are routine, daily, weekly, monthly, seasonal and yearly. Therefore, the mixed garden provides for approaches to sustainable incomes at certain intervals for every farmer.

Mangosteen is one of the main commodity in agroforestry practices in Batu Mbelin and Sembahe villages. It has a high economic value because of its relatively high selling price in the market. According to Qosim (2013) mangosteen has high economic value and good prospects to be developed as a commodity export crop because of the lack of competitors. As a main commodity, mangosteen has been managed intensively by people in various agroforestry settings. This is in accordance with the research by Setiawan (2014) that shows high income in agroforestry practices is a function of the variation of plant types and the main commodity crops having high commercial value in the market. According to interviews at the research sites, respondents noted that mangosteen grew naturally without any special treatment and although previously had low harvesting yields, but the increasing prospect and value for mangosteen, farmers in Batu Mbelin and Sembahe began to cultivate for more intensive treatments that provided improved contributions to their income.

### 3.3. NTFP contribution to household income

As noted, people of Sembahe and Batu Mbelin Villages have various professions. Therefore, they do not solely rely on their income from NTFPs in their agroforestry plots. Cultivators also count on income from other occupations such as more conventional farming in other areas, construction work, entrepreneur, broker, government official, wetland agriculture systems, and others. Household income per year from respondents beside NTFP from agroforestry plots in Desa Batu Mbelin and Desa Sembahe are presented in Table 4.

By comparing between total economic value of people from NTFP and total economic value of people from apart of NTFP, it is evident that economic value from NTFPs are higher than economic value from those apart from NTFP (NTFP: 79,41% > apart of NTFP: 20,59). A more general overview is also presented in Table 5. The high economic value of NTFP utilization shows that NTFP provides a very real contribution to people's livelihood around Sibolangit Tourism Park. In other words, communities have a high dependency on the existence of forest resources and agroforestry practices.

**Table 4. Household economic value per year apart from NTFP utilization in agroforestry practices among respondents in Batu Mbelin and Sembahe (Year 2016)**

Source of income	Batu Mbelin Village		Sembahe Village	
	Total (IDR)	%	Total (IDR)	%
1 Entrepreneur	47,400,000	34.80	44,400,000	24.11
2 Construction Worker	28,800,000	21.14	26,000,000	14.12
3 Own business	49,800,000	36.56	76,000,000	41.30
4 Farm Labor	10,200,000	7.50	37,700,000	20.47
Total	136,200,000	100	184,100,000	100

**Table 5. Comparison of economic value between NTFP and apart from NTFP at the research sites (Year 2016)**

Economic value	Batu Mbelin Village		Sembahe Village		Average %
	Sum (IDR)	%	Sum (IDR)	%	
<b>NTFP</b>					
• Forestry component	469,120,000	68.64	549,100,000	63.39	66.02
• Agriculture component	78,155,000	11.43	133,000,000	15.36	13.39
<b>Sub total of NTFP</b>	<b>547,275,000</b>	<b>80.07</b>	<b>682,100,000</b>	<b>78.75</b>	<b>79.41</b>
<b>Apart from NTFP</b>	<b>136,200,000</b>	<b>19.93</b>	<b>184,100,000</b>	<b>21.25</b>	<b>20.59</b>
<b>Total</b>	<b>683,475,000</b>	<b>100</b>	<b>866,200,000</b>	<b>100</b>	

The high contribution value from NTFP utilization in agroforestry for household income in general is due to agroforestry practices that can produce continuously, and which have various harvesting cycles (Indriyanto, 2008). This is in accordance with the results from Ngakan, et.al. (2006) study, which indicates that forest products (mainly NTFP) from natural forest resources present one of the most valuable economic activities for people from around the area. Having the additional economical value, in this way can be viewed as being much more valuable than timber. Furthermore, the collection of NTFP do not contribute to extractive forest destruction, which has grown in public recognition in Indonesia in recent years. Therefore, key environmental services will also continue to be maintained, such as the ecological and hydrological cycles. In other words, including agroforestry as a natural resource and livelihood strategy, presents multiple functions, and forest utilization in these was can contribute to establishing improved welfare for local communities.

The high contribution of agroforestry-based NTFPs (meaning, in plots located outside the TWA forest area) to household income helps to push down the drivers of forest loss, especially in areas where people have a direct impetus in sustaining the local resources. This is clearly the case in the boundary areas around Sibolangit Tourism Park.

It is important to contextualize that the Sibolangit Tourism Park area is a conservation area in North Sumatra Province that has functioned as natural sanctuary and wildlife reserve to protect biodiversity, ecosystems, and natural beauty for the aims of educational development, recreation and tourism. Nurapriyanto, et.al. (2011) research also show that the development of NTFPs can reduce losses of forest function.

### 3.4. Development prospect of agroforestry based NTFP

NTFP are plant species that can grow well inside or outside the forest. With this capability, the role of NTFPs has been accepted by people as one source of income. As we have shown in this research, the area of Sibolangit Tourism Park and surrounding areas function as conservation areas that also provide an important role for local livelihoods. Therefore, in order to provide additional

benefits in the forestry sector and around the area of Sibolangit Tourism Park co-development arrangements of certain plant species as NTFPs that can be supported in particular agroforestry systems. This is an alternative approach to move away from extractive TFP approaches while also supporting local livelihoods. In order to increase productivity and production quality, approaches can be developed to further complement incomes around Sibolangit Tourism Park.

Development of NTFPs in agroforestry systems around Sibolangit Tourism Park has a very high prospect. This can be seen in the practice of NTFP based agroforestry, a practice that has been in place for a long time by people around Sibolangit Tourism Park, continuing their traditional practices from generation to generation. Furthermore, it is also evident that there is significantly additional economic value and contribution to household income from NTFPs (such as mangosteen, durian, garcinia, lansium, candlenut, etc) and from other agricultural commodity crops (such as ginger, turmeric, chili, papaya, etlingera, corn, and others). The high economic value of NTFPs within agroforestry systems can help to diversify local incomes.

Beyond NTFPs role as a market commodity opportunity, they also function as a sustained source of local subsistence needs. For example, rice, corn, tubers, vegetable and fruits also function as NTFPs in agroforestry areas. Such crop examples can be consumed directly, or any surplus can also be sold to market. Such subsistence functions also allow for greater resilience during shocks related to food security considerations.

In the context of conservation and the environment, NTFPs among the agroforestry patterns managed by local people have various compositions and combinations. In general, the species varieties support greater ecological resilience against pests and climatic shocks. According to de Forestra, et.al. (2000), in some cases, agroforestry practices of mixed gardens that do not receive too much owner treatment, have reached more than 50 plant types. This high species diversity has an important role to conservation.

According to Von Maydell (1986: in Hairiah, et.al., 2003) land management practices using agroforestry patterns have higher prospects in developing improved commodity opportunities for NTFPs. This has been confirmed through this research for the following reasons:

- 1) **Productivity:** In this research, it is evident that the total economic value of products from mixed agroforestry systems provides higher returns than mono-systems in the area. This is due to the output from various returns from NTFPs from the land, and also the continued returns that can be harvested throughout the year. Mixed plant systems provide benefits because failure of one component/plant species can be compensated by other component/plants.
- 2) **Diversity:** The existence of a combination of two components or more in agroforestry systems provide high diversity in types of products or services. Therefore, from an economic perspective it can avoid permanent fatal failures that can wipe out livelihoods from single cultivation approaches.
- 3) **Self regulation:** High diversification in agroforestry systems can meet local community needs and also provide a cushion against dependency from particular products. System independence function to reduce requirements from intensive outside inputs (for example fertilizer, pesticide).
- 4) **Stability:** Agroforestry practices provide diversity and optimal productivity and can provide a balance across the land use management system, which can assure stability (and continuity) of farmers' income.

## **4. Conclusions and Recommendations**

### *4.1. Conclusions*

The communities around Sibolangit Tourism Park have long utilized and developed their agroforestry systems for NTFP on their own land. Most NTFPs are for commercial production and others help to fulfil subsistence requirements. Economic value of NTFP across two locations indicate that there is a higher economic value from NTFP, which also garner high values that contribute to 79.41% of total family income.



The prospects for NTFP development based on agroforestry in Sibolangit Tourism Park area is high. As we have shown herein, NTFP expansion can support social-economic needs and ecological functions. Socially, NTFP in agroforest systems are part of a longterm continuity of local traditional practices passed down through generations. Economically, we have highlighted the high returns from NTFP economic value, which provide for the main source of income to local community households. Finally, from an ecological perspective, numerous research also shows that agroforestry systems provide for enhanced biodiversity.

#### 4.2. Recommendations

- 1) In order to develop NTFPs based on agroforestry, support programs can help to enhance local prospects by providing clear and exact price information, potential avenues for achieving market and specie diversification of NTFPs, support for understanding the overall market structure, and support effective marketing strategies that help to shorten market chains and strategy commodity promotion.
- 2) In order to develop NTFP in agroforestry plots to meet market demand in the future a better understanding of farmer production and consumer needs can help involve communities in the decision making process to prioritize mutual actions. This can then help to enhance the capacity and target the appropriate programing and technological transfer.

#### Acknowledgments

We acknowledgements the support from the Direktorat General of Research Strengthening and Development of the Ministry of Research and Technology and Higher Education where this research was part of the 2016 Fundamental research grants. This research was supported by the Ministry of Research and Technology in Higher Education, under a program of the Direktorat General of Strengthening Research and Development. The title of the research was: "Study on Agroforestry Management Practice in order to Maintain Biodiversity by People's Around the forest" and the research took place in 2016.

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