

**Interactions on Agricultural Land  
between Indigenous People and Immigrants  
and Consumption Patterns of Forest Products  
in the Buffer Zones of Vietnam's Bu Gia Map National Park**

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To my parents, parents in law, my wife and children

### **Statement of Authorship**

"Except where reference is made in the text of the thesis, this thesis contains no material published elsewhere or extracted in whole or in part from a thesis accepted for the award of any other degree or diploma. No other person's work has been used without due acknowledgment in the main text of the thesis. This thesis has not been submitted for the award of any degree or diploma in any other tertiary institution."

A handwritten signature in blue ink, appearing to read 'Toai', followed by a long horizontal underline.

Toai Nguyen

28 February 2020

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## **Abstract**

Protected forests in Vietnam are relatively recent, creating conflicts between villagers who are accustomed to using forest products freely and park managers who are charged with the conservation of areas of significant biodiversity. I interviewed people who lived on the edges of Bu Gia Map National Park, some of whom are indigenous to the area, and some of whom immigrated to the area from other parts of Vietnam. I aim to explore the relationships between consumption of forest products and the socioeconomic profiles of consumers around protected areas. I delve into how the interactions between indigenous people and internal immigrants affect their sources of income and land management, and how this has changed their forest consumption patterns. Previous studies have examined forest consumption regarding socioeconomic factors of consumers, but they have not focused on the consumption patterns under the socioeconomic interaction in the areas of coexistence between local indigenous people and internal immigrants. Cashew nuts are the major agricultural product in this area and an examination of the informal rental market has revealed a divergence between people with different socioeconomic status. Participation in the rental market benefits farmers who can rent-in (gain control over other's crops) and is a considerable disadvantage for those who rent-out (lose control of their own crops). The poorest households are hungry several months each year and will enter the National Park illegally to gather food and products to sell. I compared the impact of socioeconomic factors on the consumption of timber and non-timber forest products. I found different consumption patterns with different socioeconomic factors, and I believe that these results can be used to improve biodiversity conservation programs in this area. Targeted conservation interventions could include changing regulations on the use of some forest products, education programs, food production, and increased use of plantation timbers.



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# **Chapter 1 – Introduction**

## **1.1. Background**

The management of natural forests is confronting numerous factors related to human impacts worldwide that require effective biodiversity conservation programs focusing on both society and nature (Chape et al., 2008; da Silva & Rodgers, 2018). Economic development creates numerous problems such as poverty, overexploitation, and consumption that have harmful impacts on natural forests (Chape et al., 2008; da Silva & Rodgers, 2018; Forester & Machlist, 1996). Anthropogenic activities destroy natural habitats that force many species to the brink of local and international oblivion. This can be seen in Singapore where deforestation for economic development and urbanization has caused the extinction of many taxa such as butterflies, fish, birds and mammals (Brook et al., 2003; Corlett, 1992). The degradation of biodiversity within natural forests require governments to create protected areas that can better preserve species from human impacts. However, the conservation of natural forests within protected areas is still threatened by the interactions between indigenous people and immigrants regarding the exploitation, trade, and usage of products from natural forests (Reyes-García et al., 2012). Socioeconomic interactions lead to the change of consumption patterns, creating a reticulation of complicated relationships between human society and the management of protected areas (Forester & Machlist, 1996). Thus, natural resource management requires multidisciplinary studies to better understand the drivers of consumption patterns that have impacts on the degradation of biodiversity within protected forest areas.

The creation of protected forest areas is one way to preserve natural forest ecosystems worldwide. When governments create protected forest areas on their

territories, they often design a legal system that protects these areas from harmful activities. Laws and regulations prohibit people from exploiting and using natural forests, and they can contribute to conserving species, habitats, and other biological values within these ecosystems (Brockington & Igoe, 2006; Brockington & Wilkie, 2015; Chape et al., 2008; West et al., 2006). The demarcation of natural forests combined with a better legal system for protected areas has contributed to the success of the conservation of many ecosystems that are rich in biodiversity (Chape et al., 2008; Nolte et al., 2013). This can be seen in the Brazilian Amazon where the application of governmental regimes reduce deforestation problems within demarcated forest areas (Nolte et al., 2013). The success of this model has encouraged countries to create a worldwide system that includes around 10,000 protected areas amounting to 13% of land surface on Earth that represents for different ecosystems worldwide (Chape et al., 2008; Le Saout et al., 2013). The success of this worldwide protected area system is a result of the commitment of governments to preserve biodiversity (Miller, 1994; Venter et al., 2014).

Like other countries, the Vietnamese government has demonstrated their commitment in creating a countrywide protected area system over the last six decades. In 1962, the Vietnamese government declared Cuc Phuong as the first national park of the country (Phuong & Dembner, 1994; Stolton et al., 2004). Since then, the Vietnamese government has gradually developed a countrywide protected area system that represents different ecosystems on various geographical locations (Phuong & Dembner, 1994; Rambaldi et al., 2001). Currently, there are more than 100 protected areas across Vietnam that are national parks, nature reserves, and other landscape conservation sites (Rambaldi et al., 2001; Stolton et al., 2004). These protected areas account for 10% of the land surface of the country. These protected areas aim to

preserve various ecosystems that are important landscapes and habitats of wild animals (Phuong & Dembner, 1994; Rambaldi et al., 2001; Stolton et al., 2004). Based on the important level of natural forests, these protected areas are managed by a relevant governmental organization complying with a legal system for protected areas.

In Vietnam, protected areas are named “Special Use Forests”, and they are managed by governmental organizations using a system of laws, decrees, and regulations promulgated by the central and local governments. This legal system strictly prohibits people from collecting and harvesting products from protected forest areas. Currently, all protected forest areas have management boards supervised by the Ministry of Agriculture and Rural Development, provincial governments, or Departments of Agriculture and Rural Development. These organizations implement law enforcement to minimize the impacts of people on natural forests within protected areas. Illegal products are usually confiscated, and violators can face penalties such as fines or years in prisons (McElwee, 2004). This situation is especially sensitive for the management of natural forests that are the former residential areas of local ethnic minorities (dân tộc tại chỗ).

Vietnam is a multicultural society that encompasses 54 ethnic groups. The majority group is the Kinh people accounting for around 86% of the population (Baulch et al., 2007; UNFPA., 2011). This group coexists with 53 other ethnic groups across the country, and they mainly concentrate on the coastal and deltas. Ethnic minorities have their traditional territories within the country confining to a small region or several provinces (UNFPA., 2011). These groups are generally called ethnic minorities. However, since 1975, the Vietnamese government started the New Economic Zone program that moved people from the crowded regions to low population density areas



to remove social disparity among ethnic groups (Lang, 2001; McElwee, 2008a). This plan involved the movement of Kinh and other ethnic minorities to low-density population regions that were dominated by local ethnic minorities (dân tộc tại chỗ) (Desbarats, 1987; Hardy, 2000, 2005; McElwee, 2008a). Since Vietnam has 53 ethnic minorities, I named “local ethnic minorities” as “Indigenous people” to differentiate them from migrated ethnic minorities and Kinh people who are internal immigrants. As a result of the planned and spontaneous movements of people to New Economic Zones, both “indigenous people” and “internal immigrants” are now coexisting in the buffer zones of protected forest areas across Vietnam (Nguyen et al., 2011; Nguyen et al., 2019a; Nguyen et al., 2019b).

Protected areas are often located in remote areas that are important for indigenous people in terms of cultural identities and means of livelihood. For centuries, indigenous people have resided in natural forests and formed spiritual bonds with surrounding environments that define their cultural identities (Oviedo & Jeanrenaud, 2007; Saj et al., 2006; Wild et al., 2008). Many indigenous people believe that trees, mountains, hills and other entities in natural forests are inhabited by the souls of their ancestors (Oviedo & Jeanrenaud, 2007; Wild et al., 2008). Indigenous people have numerous taboos that prevent them from collecting specific products from natural forests, and they worship natural forests as a way to pay respect to their ancestors (Oviedo & Jeanrenaud, 2007; Saj et al., 2006). For example, the taboo against hunting monkeys is a totemic mechanism that protects the cultural world of indigenous people in the Boabeng-Fiema Monkey Sanctuary in central Ghana (Saj et al., 2006). Also, natural forests provide indigenous people with food supplies, construction materials, and social amenities (Oviedo & Jeanrenaud, 2007; Wild et al., 2008). For example, indigenous people use natural forests as their safety-net in Vietnam’s Bu Gia Map

National Park (Nguyen et al., 2019a). Recently, forested areas are not solely inhabited by indigenous people because of the movement of internal immigrants under both planned and spontaneous movement of people from other parts of the country.

After the American war, the Vietnamese government created the New Economic Zones Plan to remove socio-economic disparity among regions and ethnic groups across the country. This plan encouraged people in crowded centres to migrate and resettle in forested areas that had low population densities (Hardy, 2000; Lang & Kolb, 1980). With this plan, the Vietnamese government also hoped that new immigrants could help indigenous people to advance their cultivation techniques and improve their socio-economic activities (Evans, 1992; McElwee, 2008a). This plan led to the clearance of forestland for agriculture in mountainous areas for socio-economic development (Beresford & Fraser, 1992; Lang, 2001). Within this plan, internal immigrants were supported by the government regarding their means of livelihood and accommodations (Lang & Kolb, 1980). Also, they were allocated land by the government for cultivation that allowed them to develop their economic status (Lang & Kolb, 1980). The low population density, fertile soil and economic opportunities in these areas led to success for immigrants and increased spontaneous immigration from different parts of the country (da Silva & Rodgers, 2018; Hardy, 2000; Nguyen et al., 2011; Nguyen et al., 2019b).

Over the last five decades, spontaneous immigrants have increased more pressure on forested areas. Spontaneous immigration can cause rapid and unexpected population growth in many forested areas that are rich in biodiversity (Hardy, 2005; Ichikawa et al., 2014; Meyfroidt et al., 2013; Oglethorpe et al., 2007). This type of rural to rural migration is mainly accessed by poorly educated and poor people who try to

escape poverty, environmental degradation, and other socioecological reasons (da Silva & Rodgers, 2018; Oglethorpe et al., 2007). These people often rely on natural resources for their income and livelihood, and they create impacts on biodiversity in many different ways such as land conversion, forest exploitation, and consumption (da Silva & Rodgers, 2018; Oglethorpe et al., 2007). For instance, internal immigrants significantly changed the population and destroyed natural forests in the Central Highland in Vietnam (Hardy, 2005; McElwee, 2008a; Meyfroidt et al., 2013). New immigrants may compete with indigenous people to exploit and use more natural resources such as agricultural land, timber products, and forest land (Doutriaux et al., 2008; McElwee, 2008a; Meyfroidt et al., 2013; Thai, 2018). These internal immigrants combined with indigenous people often place the management of protected areas in a complex context of interactions between society and nature (Le Saout et al., 2013; Nguyen et al., 2019b). Therefore, socio-economic interactions, land use, and natural resource access should be examined together to better understand the interaction between society and environment in protected forest areas in Vietnam.

Although indigenous people may benefit from socio-economic interactions with internal immigrants in many ways such as acquiring skills and knowledge, they are often vulnerable to these interactions because they have insufficient capabilities for running markets, land use, and economic management (Doutriaux et al., 2008; McElwee, 2008a; Phung & Waibel, 2009; Thai, 2018). Indigenous people and ethnic minorities lag behind immigrants in socioeconomic management (Doutriaux et al., 2008; McElwee, 2008a; Thai, 2018). By 2020, indigenous people and ethnic minorities will account for 84% of persistent poverty in Vietnam (Eckardt et al., 2016). Indigenous and poor people obtain less income from their cultivation activities than their immigrant counterparts (Doutriaux et al., 2008; Imai et al., 2011; Nguyen et al., 2019a), and they

are more vulnerable to economic shocks (Nguyen, 2007). The pressure from a lower socioeconomic status may force indigenous and poor people to find additional ways to secure their food supplies.

Natural forests within protected areas are one of possible ways that may provide safety nets for indigenous and poor people (Cavendish, 2000; McElwee, 2010; Turner & Cocksedge, 2001; Völker & Waibel, 2010). Forest products can be harvested all year long, and villagers use more forest products during periods of insufficient food supplies (Nguyen et al., 2019a; Völker & Waibel, 2010). For example, local people enter natural forests to collect more timber in times of need in the mountainous uplands of Vietnam (Völker & Waibel, 2010). However, managers of protected areas have strengthened their law enforcement and removed indigenous people from these areas (Brockington & Igoe, 2006; Brockington & Wilkie, 2015; West et al., 2006). When the consumption of forest products is critical for the subsistence of households, villagers tend to access natural forests, disregarding the prohibition of the law. Breaking regulations and laws often creates conflicts between villagers and forest managers in protected areas.

Conflicts are occurring between villagers and conservationists regarding the use of natural forests within protected areas (Nguyen, 2001; To, 2009; Zingerli, 2005). While forest managers aim to protect natural forests from human activities, villagers want to collect these products for their survival. Conflicts often occur between villagers and conservationists related to the rights of using natural forests, land resources, conservation priorities, and other tensions (Eckerberg & Sandström, 2013; To, 2009; Zingerli, 2005). There have been numerous conflicts between villagers and managers in protected areas because of the limited access of villagers to natural forests (To, 2009; Zingerli, 2005). These conflicts erode relationships between managers and villagers,

lessening the effectiveness of biodiversity conservation programs for natural forests. Therefore, forest managers need to consider their conservation programs with regards to the consumption patterns under the socioeconomic interactions between indigenous people and immigrants in the buffer zones of protected areas.

In Vietnam, many studies have examined the relationships between local communities and their reliance on natural forests (Dang & Tran, 2006; McElwee, 2008b, 2010; Nguyen et al., 2011). These studies have highlighted the reliance on natural forests for livelihood and the participation of local people and their attitudes toward the conservation of natural forests (McElwee, 2008b, 2010; Nguyen et al., 2011; Nguyen et al., 2019a). However, none of them demonstrate the consumption patterns of forest products with regards to the socioeconomic interactions in the areas of coexistence of indigenous people and immigrants.

## **1.2. Socioeconomic factors, farm rental markets, farm size, and forest consumption patterns**

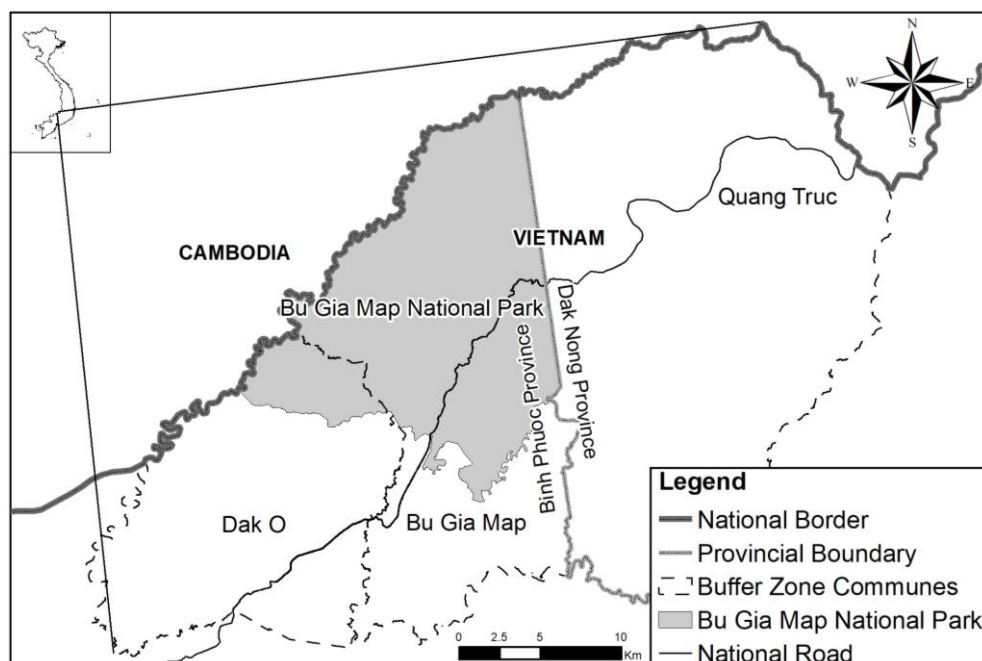
Socioeconomic profiles are important factors that allow managers to identify individuals and groups who are more likely to participate in distress land rental markets. The examination of socioeconomic factors of households usually demonstrates the difference in access to distress land rental markets among households, meaning that practitioners may know who are most likely to participate in this economic relationship (Gebregziabher & Holden, 2011; Holden & Otsuka, 2014; Tesfaye & Adugna, 2004). This can be seen in Ethiopia where farmers with poor non-farm assets have to rent-out their agricultural land to overcome their economic hardships (Gebregziabher & Holden, 2011). Thus, socioeconomic profiles can be used to identify farmers who may be affected by the loss of income sources from their farms.

Operational farm size, the area of land cultivated by households (in hectares), has a strong relationship with both the participation in distress land rental markets and socioeconomic factors. After farmers participate in distress land rental markets, their operational farm size is often changed, and operational farm size depends on which market they participate in. Also, socioeconomic factors often reflect different farming abilities that affect the operational farm sizes of farmers (Akram-Lodhi, 2005; Eastwood et al., 2010; Jerumeh & Omonona, 2018; Makate et al., 2019). This can be seen in Vietnam where rich households with higher farming abilities enlarge their farm size to take advantage of labour force and other available resources (Akram-Lodhi, 2005). Therefore, socioeconomic factors and participation in distress land rental markets affect the operational farm sizes of farmers, leading to a change in their income. In these areas, land is the main source of income of households, and the operational farm size can play an important role in defining the consumption patterns of farmers.

Operational farm size and other socioeconomic factors can define the consumption patterns of households in forested areas. Land is one of the most important income sources in land-based income areas, and it can demonstrate the socioeconomic status of households. For example, farmers with larger farm sizes have better socioeconomic status in a rural district in the Binh Phuoc province (Ha et al., 2006). Since socioeconomic groups have different income levels, they form different consumption patterns of diversity and quantity of forest products (Cavendish, 2000; Shackleton & Shackleton, 2004; Shackleton & Shackleton, 2006; Twine et al., 2003). Together with farm size, other socioeconomic factors may demonstrate farmers' knowledge and preference of forest products that may affect their consumption patterns. Therefore, farm size combined with other socioeconomic factors may affect the consumption patterns of forest products within households in forested areas.

### 1.3. Study site

Figure 1-1 - Map of the study site



The Bu Gia Map National Park is in the north of Binh Phuoc province, 200 km from Ho Chi Minh City (Figure 1-1). The park is located at 12.11 N and 107.24 E, and it is a transitional area from the Central Highland to Southeast Vietnam. Bu Gia Map National Park plays an important role in conserving biodiversity at both national and international levels. The park adjoins six other protected forest areas, creating a green corridor crossing the border between Vietnam and Cambodia. This corridor is one of the largest natural habitats in the Indo-China region that can create the long-term conservation strategy for wild animals.

The buffer zones of the Bu Gia Map National Park have good natural conditions that nurture numerous cash crops. This area has a mild weather condition. The rainy season is from May to October with a total annual precipitation of around 2,500mm while the dry season is from November to April. The average annual temperature is

around 28°C. The area has basalt soil that is good for the cultivation of cash crops such as cacaos, coffees, rubbers, cashew nuts, peppers, and other perennial trees. These natural conditions enable farmers to plant high value cash crops that attract the immigration of people from other parts of the country.

The buffer zones of Bu Gia Map National Park include three communes surrounding the park (Figure 1-2), including Quang Truc (Dak Nong province), Bu Gia Map, and Dak O (Binh Phuoc province), and they are a destination for the spontaneous migration of people. This is a forested area which can support people who want to search for new economic opportunities. Since 1992, there have been a flux of spontaneous immigrants from other parts of Vietnam, mainly from northern provinces. Now, there are different ethnic groups living in these communes. Immigrants from other parts of Vietnam have different ethnic identities. There are more than 10 ethnic groups, two of which are indigenous people with a total population of around 30,000 people.

There are two indigenous groups in the buffer zones of the Bu Gia Map National Park, and they have close relationships with natural forests with regards to their means of livelihood. These indigenous people are Stieng and Mnong who are native to Lam Dong, Binh Phuoc, and Dak Nong provinces, and their cultural identities are strongly linked to natural forests (Hickey, 1964; Schliesinger, 2015). These indigenous people account for 42% of the total population, and they still believe in forest gods who support their prosperity. Also, they keep their traditional relationships with natural forests; as a source of income and food, and as part of their cultural identity and belief system. Indigenous people often have insufficient food supplies during the rainy season from May to October (Nguyen et al., 2019a).



The infrastructure of these communes is still underdeveloped. All communes can be accessed through the national road paved with asphalt. At the village level, these communes have a network of roads that connect all villages to the headquarters of these communes, but many of them are dirt roads that are muddy in the rainy season and dusty in the dry season. Basically, most local people can access the national grid for their daily activities such as cooking, cooling, lighting, and other essential work. Although there are freshwater systems in the headquarters of these communes, people still must use water from wells and streams in remote hamlets. In the dry season, it is still hard for local people to ensure their self-supply. All three communes have primary and secondary schools that enable local students' access to the education system, and the Dak O commune has a high school.

The buffer zones of the Bu Gia Map National Park have fertile soil, and cash crops are the main income source of local people. Villagers plant numerous cash crops such as rubber, coffee, cashew nuts, and other industrial trees. These cash crops are mainly harvested in the dry season, except for the rubber trees. Also, villagers still access the Bu Gia Map National Park to collect forest products for their subsistence and income. Few villagers are employed as government officials, forest rangers, local police, or in social associations. Villagers are often hit by covariate risks (e.g. plague, failure of markets, natural disasters etc.) and idiosyncratic risks such as (illness, death of breadwinners, theft etc.).

#### **1.4. Aim and objectives of the study**

##### **Aim of the dissertation:**

The aim of this dissertation is to examine the relationships between socioeconomic interactions and status with the consumption patterns of forest products to improve my

understanding of the impacts of the consumption patterns of consumers with regards to timber and non-timber forest products and retrofit the current biodiversity conservation programs within protected areas. Ultimately, I aim to contribute to a deeper understanding of interactions between society and environment in the context of coexistence of local indigenous people and internal immigrants.

### **Study objectives**

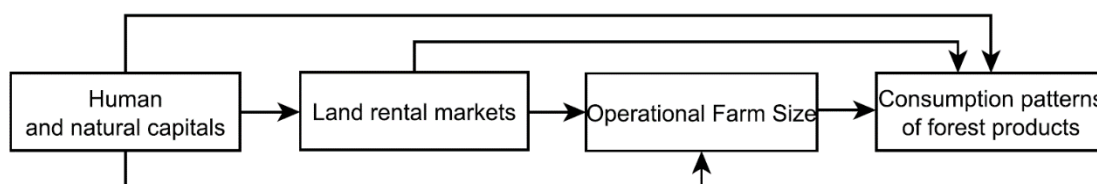
By conducting this study, I will try to address the general question: Do socioeconomic interactions impact the consumption patterns of forest products in the buffer zones of Vietnam's Bu Gia Map National Park?

There are numerous factors that affect the decisions of households to participate in land rental markets which will affect their consumption patterns. These factors include, but are not limited to, social, economic, cultural, human, natural, and political capitals. These factors often have complex relationships that influence how people consume forest products. However, given limited time and available resources, I could not consider all factors that might affect the interrelationships between society and environment. Therefore, with this study, I examine the relationship between socioeconomic factors, distress cashew nut farm rental markets, farm size and consumption pattern as shown in Figure 1-2. I will try to answer the following questions:

- What are the socioeconomic determinants of the participation in the cashew nut farm rental markets of local people in the buffer zones of Vietnam's Bu Gia Map National Park?
- Do socioeconomic factors and the participation in cashew nut rental markets have impacts on the economic status of local people?

- What are relationships between socioeconomic profiles and consumption patterns of timber and non-timber forest products from natural forests?

Figure 1-2 - Hypothesized relationships between socioeconomic factors and consumption patterns of forest products



This study will pursue the following objectives:

- To provide a better picture of the relationship between indigenous people and immigrants in their areas of coexistence.
- To illustrate the economic status of local people with regards to ante- and post- participation in distress land rental markets.
- To provide a picture of the socioeconomic determinants of consumption of forest products in the buffer zones of the Bu Gia Map National Park.

## 1.5. Methodology

The previous section (1.4) provides the research questions of the thesis with an assumption of relationships between socio-economic interactions that affect socioeconomic status of households, and their pattern of consumption of forest products in the buffer zones of Bu Gia Map National Park. This section will present the details of the methodology and fieldwork to collect data to answer the research questions.

The research question is to understand how socioeconomic interactions of households impact their consumption patterns of forest products, and relationships between these factors in the buffer zones of Vietnam's Bu Gia Map National Park. In

this research, I conducted surveys to understand the interrelationships between socioeconomic interactions and patterns of forest consumption. Surveys will reveal a picture of how indigenous people and internal immigrants interact with each other, leading to their reliance on forest products for consumption. Also, surveys will provide villagers with opportunities to express their needs related to the forest products and may enable local authorities and park managers to develop relevant interventions. After that, the data set will be examined by applying statistical packages to analyse the relationships of socioeconomic interactions and potential impacts on the environment. This section details information pertaining to research methods, sampling procedures, questionnaire design, and data analysis techniques.

In this research, I used the family as the unit of analysis. Family is the basic unit that allow governments to make sound economic and social policy decisions (Grosh & Glewwe, 2000). Socioeconomic interactions mainly occur among families, and households can provide all information needed for data analysis because they include social, natural, economic, and human capitals. Also, I could not accurately collect data of every family in all communities because of time constraints. Selecting households allowed me to create a random sample that represents these communities. Also, previous studies used the family as the unit of analysis that allow the results of this research to be compared with other studies (Adhikari et al., 2004; Baba et al., 2016; Fa et al., 2009; Jin & Jayne, 2013; McElwee, 2008b, 2010; Nguyen et al., 2011; Nguyen et al., 2019a; Webb & Dhakal, 2011).

A random sample of 121 families was selected from two communes including Bu Gia Map and Dak O. These communes include 23 hamlets, and I purposely selected hamlets bordering the Bu Gia Map National Park. As I categorized participants into two

groups including indigenous people and internal immigrants, I stratified the population based on their identities rather than geographical areas. The proportionate stratification was applied to keep the sample with the same fraction as the total population in the target communities. The sample size ended up with 121 participants that represent both indigenous people and internal immigrants.

The interviews were carefully scheduled at the most convenience of participants to increase the accuracy of the data collected. Based on the list of participants, I approached local people to obtain their phone numbers that enabled me to arrange and make the interviews. This arrangement included the timeframe that is relevant for the participation of villagers. The interviews were carried out at participants' homes, farms, or other places that are convenient for their participation. Every interview took around one and a half hour.

In this research, I collected primary data by developing a survey forms recommended by the World Bank and Food and Agriculture Organization (Bakkegaard et al., 2016; Grosh & Glewwe, 2000). The survey form covers four main themes including human dimensions, economic status, participation in the land rental markets, and the consumption of forest products. I interviewed local people about their demographic factors pertaining to age, education, identity, schooling, household size, labour structure, and gender structure within the family. In the next section, I asked them about their economic status related to land size, income, income sources, and careers. Next, I interrogated interviewees about their participation in the land rental markets that allowed me to compare the land holding size of households before and after their participation in the land rental markets. Finally, I inquired about their consumption of forest products that included timber and non-timber forest products.

A pilot test was administered to identify incorrect and misleading information of the survey form, problems of data collection, and issues that were not covered by the questionnaire (Kothari, 2004; Neuman, 2014; Saris & Gallhofer, 2007). A random sample of 20 villagers was drawn from the two communes because these respondents needed to be similar to the people in the final surveys (Neuman, 2014). Interviewees were invited to comment on the irrelevant questions, wording problems, clarity, and content of the survey form. After the pilot test, all problems and comments were addressed to make the survey forms and collection methods clearer.

Interviews were conducted by using the revised survey form after the pre-test. I interviewed villagers in the Bu Gia Map and Dak O communes from February to July 2017. The survey form was translated into Vietnamese that was more convenient for asking questions of the villagers. A tour around the home of respondents was conducted to measure and take pictures that increase the accuracy of the information about timber use and type by respondents (Ramos et al., 2014). I achieved 100% (121/121) response rate from participants because of nature of face-to-face interviews that were pre-arranged between interviewer and respondents (Neuman, 2014). Also, the geographical locations of the homes of respondents were collected by using a handheld GPS, making it possible for me to estimate the direct distance from their homes to natural forests and market centres.

After the surveys were completed, all survey forms were carried to La Trobe University for compilation and analysis. I applied ArcMap 10.3 to extract the direct distances from the homes of respondents to natural forests and the main road to obtain geographical data. Interview and geographical data were compiled by using Microsoft Excel and analysed by using Stata 14.0 and SPSS 25.0 packages.

The participation of respondents in land markets and land tenure is binary and it is an ordinal dependent variable. Ordinal regression was applied to model the relationships between demographic factors and the choices of households in selecting the markets or levels of land tenure in the buffer zones of the Bu Gia Map National Park. This regression allows me to estimate the likelihood of the participation of groups in different economic activities (Field, 2013; Hair et al., 1998; Tabachnick & Fidell, 2007). This also allowed me to link to the consumption patterns of forest products that used ANCOVA to distinguish the consumption patterns. I used a Stata package to run ordinal regressions to understand the relationships between independent and dependent variables.

An ANCOVA test was used to test the consistency of the determinants of consumption patterns across communes and indigeneity identities in the general linear model (Field, 2013). Interactions between variables were included to test the difference of socioeconomic factors with regards to communes and indigeneity (Tabachnick & Fidell, 2007). This regression was applied to understand the consumption patterns of timber and non-timber forest products.

A Poisson log-linear regression model was applied to examine the determinants of the count data (Field, 2013; Tabachnick & Fidell, 2007). The Pearson chi-square statistic was used to check the goodness of fit of the model to a Poisson distribution (Hair et al., 1998; Tabachnick & Fidell, 2007). Interactions between variables were added into the Poisson log-linear regression model to test the consistency of socioeconomic determinants across communes and indigeneity identities studied (Field, 2013). The SPSS software package version 25 was used for these statistical analyses.

## **1.6. Significance of the study**

This study examines the relationships between socioeconomic factors and the consumption of forest products in the buffer zones of the Bu Gia Map National Park with an emphasis on the land use management and indigeneity. This study delves into the effects of agricultural land before and after participation in the cashew nut farm rental markets to better understand changes in consumption patterns of forest products. This study can aid the current knowledge of the use of forest products in Vietnam because the understanding of relationships between socioeconomic factors and impacts on natural forests is still incomplete.

## **1.7. Structure of the dissertation**

This thesis contains six chapters including introduction and conclusion chapters and four result chapters. This first chapter provides readers with an overview of the background, research problems, study objectives, and the structure of this dissertation. Four result chapters are independently structured for submission to peer-reviewed publications. The structure of the dissertation can be seen in Figure 1-3.

Chapter 2: Distress Cashew Nut Farm Rental Markets: Evidence from an Area of Coexistence of Indigenous People and Immigrants in Vietnam. This chapter has been submitted to the Journal of Land Use Science and is under review. The participation in distress cashew nut rental markets generally disadvantages poorer people and understanding the causes of their participation may enable local authorities to create relevant interventions that can make the situation fairer or allow farmers to remain in the cashew nut sector. In this Chapter, I aim to understand the socioeconomic determinants of the participation of farmers in informal cashew nut rental markets. Based on the understanding of socioeconomic profiles of farmers who participate in



distress cashew nut rental markets, local governments may develop interventions that support farmers in economic management at the household level.

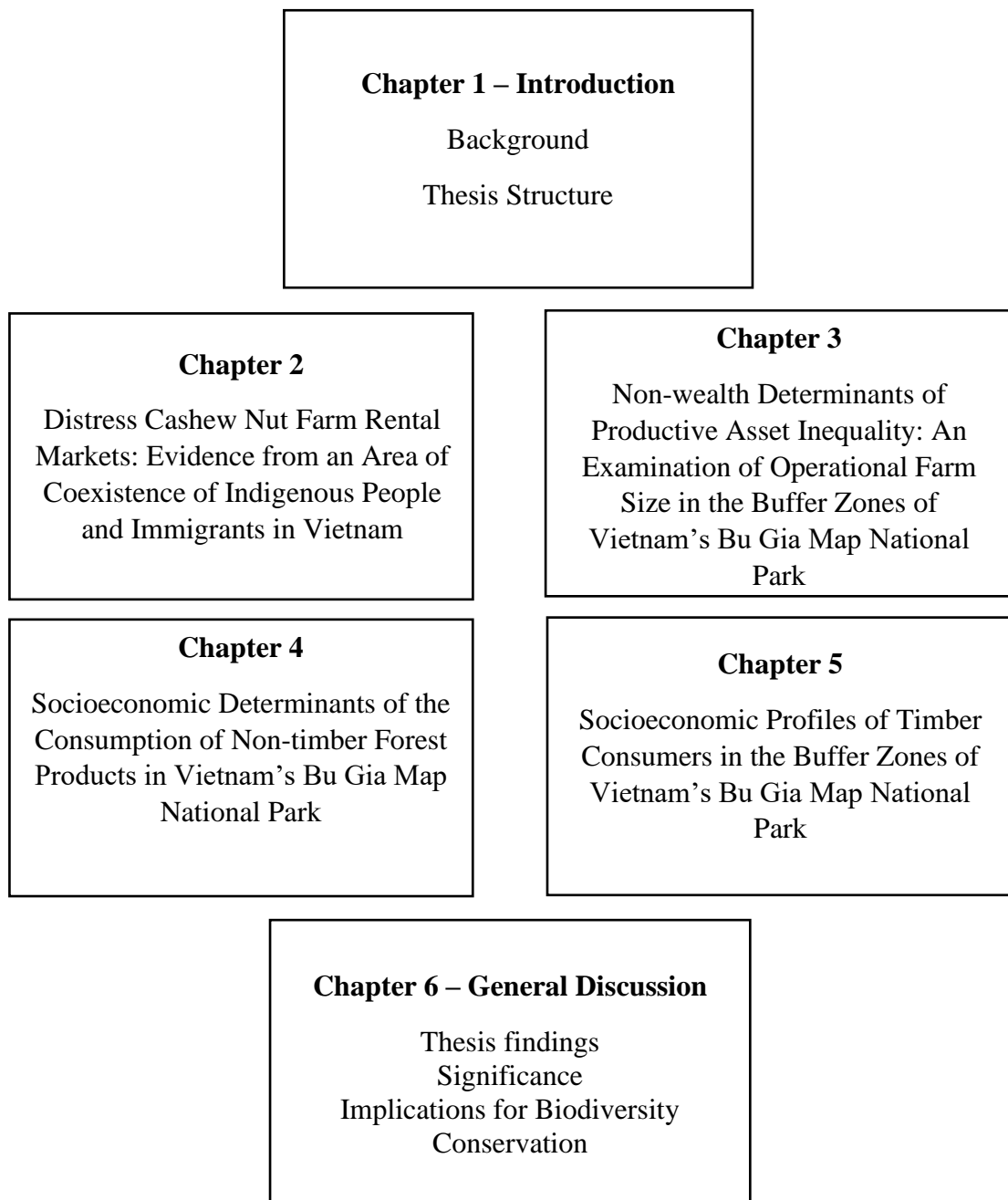
Hypotheses: (1) Smaller landowners are more likely to rent-out their cashew nut farms at fixed and cheap prices while larger landowners are more likely to participate in the cashew nut rent-in market; (2) Indigenous people tend to rent out their cashew nut farms while immigrants tend to rent-in more cashew nut farms; (3) Farmers with higher farming ability are less likely to participate in the cashew nut rent-out market and increase the likelihood to participate in the cashew nut rent-in market; (4) More off-farm job opportunities (with higher education and better market access) reduce the participation in distress cashew nut farm rent-out but increase their participation in rent-in markets.

Chapter 3: Non-wealth Determinants of Productive Asset Inequality: An Examination of Operational Farm Size in the Buffer Zones of Vietnam's Bu Gia Map National Park. This chapter has been submitted to the Journal of Rural Studies and is under review. I aim to demonstrate factors that affect the operational farm size of farmers after they participate in the cashew nut farm rental markets. In rural areas, agricultural land plays an important role in generating income for peasant farmers. Therefore, identifying important factors that affect the operational farm size may enable local governments to effectively support small and landless farmers. Based on socioeconomic profiles, local governments can help farmers to find relevant additional income sources and reduce their reliance on agricultural land.

Hypotheses: 1) indigenous people hold larger operational farm size than their immigrant counterparts; 2) a larger female labour force ratio in the household (the number of female workers/ the number of male workers in a family) has a negative

relationship with the operational farm size of households; 3) formal education has a negative relationship with farm size, while training in agriculture has a positive relationship with operational farm size; 4) villagers in the Dak O commune with easier access to market have smaller farm sizes than those in the Bu Gia Map commune.

Figure 1-3 - Structure of the dissertation



Chapter 4: Socioeconomic Determinants of the Consumption of Non-timber Forest Products in Vietnam's Bu Gia Map National Park. This chapter is already published in the International Journal of Sustainable Development and World Ecology (Appendix 7). The consumption of non-timber forest products creates indiscernible impacts on natural forests, but the abuse of these products may create severe impacts on natural forests. Identifying groups that have the highest impacts may enable park managers to reduce harmful impacts on non-timber species. In this chapter, I aim to understand the relationship between socioeconomic and geographic factors and the consumption patterns of non-timber forest products (NTFPs), in terms of both the amount and diversity of products consumed.

Hypotheses: 1) Socioeconomic factors are associated with the consumption of NTFPs of local people; 2) households proximate to the forest consume more NTFPs; 3) there are differences in the consumption of NTFPs between indigenous people and immigrants in their areas of coexistence, after adjusting for socioeconomic and geographic factors; and 4) the determinants of NTFP consumption patterns are inconsistent across the two communes studied.

Chapter 5: Socioeconomic Profiles of Timber Consumers in the Buffer Zones of Vietnam's Bu Gia Map National Park. This chapter has been submitted to Environmental Conservation and is under review. Woody trees play an important role in maintaining the forest ecosystem within natural forests, and the consumption of timber creates disastrous impacts on the ecosystem. I aim to understand the consumption patterns of timber from natural forests based on the socioeconomic profiles of people with regards to the amount of timber they consume for construction and furniture.

Hypotheses: (1) higher socioeconomic households consume more timber than medium and low socioeconomic families; (2) indigenous people use more timber than their immigrant counterparts; and (3) villagers in the Dak O commune, with easier access to markets, consume less timber than their villager counterparts in the Bu Gia Map commune, with harder access to markets.

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## **Chapter 2 – Distress Cashew Nut Farm Rental Markets: Evidence from an Area of Coexistence of Indigenous People and Immigrants in Vietnam**

### **2.1. Introduction**

Distress land rental markets generally disadvantage poorer people and can widen the gap between poor and rich farmers, leading to social injustice. Poor farmers rent-out land at fixed and cheap prices for several years to overcome economic shocks to meet their immediate needs, but they lose their source of future income (Akram-Lodhi, 2005; Gebregziabher & Holden, 2011; Holden & Ghebru, 2016; Promsopha, 2018; Sadoulet & De Janvry, 1995; Sarap, 1998; Segers et al., 2010; Tesfaye & Adugna, 2004; Thai, 2018). Richer people take advantage of these opportunities to accrue agricultural land at a fixed and cheap price (Amblard & Colin, 2009; Gebregziabher & Holden, 2011; Lunduka et al., 2010; Promsopha, 2018; Tikabo & Holden, 2003). In Vietnam, distress land rental markets are operating in rural areas because some farmers face challenges such as insufficient labour force for land management, illness or death of family members, insufficient food supplies, droughts, and other natural catastrophes (Akram-Lodhi, 2004; Promsopha, 2015; Thai, 2018). Also, these rental markets are now occurring in the cashew nut sector in the area of coexistence of indigenous people and immigrants (Bui, 2010; Nguyen et al., 2019b). Vietnam is one of the largest exporters of cashew nuts in the world, and unfair cashew nut farm rental practices have the potential to disadvantage many peasant farmers (Bui, 2010; Kilama, 2013). It is therefore imperative to understand why peasant farmers are participating in this market and develop policies that will allow farmers to remain in the cashew nut market and/or create fairer land rental practices. One way to understand the drivers of the participation

of farmers in land rental markets is by examining the relationships between socioeconomic factors of households and their likelihood to engage in these markets.

Idiosyncratic and covariate risks are the common causes of the participation in distress land rental markets, usually disadvantaging poorer farmers (Akram-Lodhi, 2005; Promsopha, 2018; Salemin, 2003; Thai, 2018; Walle, 1999). Covariate risks are experiences from which the whole community in a geographic area suffers (droughts, floods, market failures, and plagues) while idiosyncratic risks affect households and/or people individually (e.g. loss of assets, acute diseases, unemployment, death of breadwinners and others) (Ward & Shively, 2015). These risks often lead to high-income fluctuations and consumption volatility among poorer farmers because they usually have a limited ability to manage their household economies, preventing them from building up their savings or accumulating valuable assets (Nguyen, 2007; Phung & Waibel, 2009; Tran, 2015). Poorer farmers have to find ways to ensure their urgent needs, so they spend savings, sell available assets, and/or borrow from relatives and banks (Gebregziabher & Holden, 2011; Holden & Otsuka, 2014; Promsopha, 2018). In forested areas, farmers usually convert forests into farmland, and they often do not have land titles that can enable them to borrow loans from banks (Ha, 2011; Sunderlin & Huynh, 2005). When these options are unavailable or depleted, desperate farmers participate in distress land rental markets where they cannot negotiate with lessees to obtain their expected prices (Gebregziabher & Holden, 2011; Holden & Otsuka, 2014; Lunduka et al., 2010; Segers et al., 2010). In these situations, poorer farmers often find wealthier households to rent out their agricultural land as a way to counteract with their economic hardships (Gebregziabher & Holden, 2011; Thai, 2018). For example, poorer farmers in Ethiopia have to rent out their agricultural land to wealthier people in order to cope with economic shocks at unexpected prices when they have depleted available



assets (Gebregziabher & Holden, 2011). In land-based income areas, landownership of farmers is an important indicator that reflects economic status of households (Mohanty, 2009; Sahn & Stifel, 2003). Therefore, landownership can be a key factor that affects the participation of farmers in the distress land rental markets.

In land-based income areas, landownership is the backbone of household economies and can represent the wealth status of households to understand the participation of farmers in the distress land rental market (Deininger & Feder, 2001; Mohanty, 2009; Sahn & Stifel, 2003). In rural areas with limited access to off-farm job opportunities, people mainly earn their income from land-based sources such as agricultural crops, husbandry, and natural products (Deininger & Feder, 2001; Shackleton et al., 2001), and landownership becomes a strong wealth index indicating the socioeconomic status of farmers (Ha et al., 2006; Makate et al., 2019; Mohanty, 2009; Sahn & Stifel, 2003). This relationship can be seen in rural areas in Zimbabwe and Vietnam where larger landowners have higher wealth status (Ha et al., 2006; Makate et al., 2019). In these areas, farmers often diversify their income sources that seasonally vary, and the accuracy of survey of income from these sources often severely suffers from recall bias, unstable market prices, and other socioeconomic factors (Mohanty, 2009; Sadoulet & De Janvry, 1995). Meanwhile, the records of landownership are often available within families, or can be directly estimated from their farms (Mohanty, 2009; Sahn & Stifel, 2003). As a result, landownership, representing the wealth status of families, may affect the participation of farmers in the land rental markets. The relationship between landownership and the participation of farmers in distress land rental markets can be better understood when it is put in the context of indigenous culture.

Indigeneity can be an important factor that determines how households participate in land rental markets. In remote areas, indigenous people and ethnic minorities receive support from the government related to poverty reduction programs and land allocation (Phung, 2012). However, these land plots may not be relevant to the tradition of indigenous people, leading to the participation in the land sale and rent-out market (Nguyen, 2008). Also, many indigenous people have very strong social and family relationships that affect their farming activities and running business (De Bruin & Mataira, 2018; McElwee, 2008). These relationships may prevent indigenous people from obtaining their expected income from crops and business activities. For example, in the Truong Son mountains of Vietnam (Annamite mountains), indigenous people cannot run their business because they are bothered by their kin and neighbours who request loans, borrow on credit, or expect free gifts (McElwee, 2008). Under the constraints of cultural relationships, many indigenous people voluntarily contact immigrants to form commercial relationships that can increase their income (Panter-Brick et al., 2001; Reyes-García et al., 2012). This can be seen in the case of indigenous people who create commercial relationships with immigrants in the north of Brazil, where they become the providers of natural resources for immigrants (Fisher, 2000). Therefore, indigenous people who want to avoid the burden of social and family relationships may decide to rent out their land to retain their income source even at cheap prices. Together with indigenous identities, farming abilities of farmers may also affect their participation in the distress land rental market.

Farming ability is one of several important factors that may affect the participation of farmers in the distress land rental market. Better farming ability enables farmers to increase their income from cultivating their land, and this can have a relationship with the way they avoid economic risks (Dillon et al., 2016; Kilpatrick,

2000). Farming ability that is represented by the labour force or training in agriculture may enable farmers to cope with economic risks and make an investment if they have available funding. Family size is often associated with the labour force, and it may increase opportunities for households to enlarge their farmland to take advantage of family labour (Akram-Lodhi, 2005; Dillon et al., 2016; Tesfaye & Adugna, 2004; Zhang et al., 2004). For example, larger families rent in more land for their cultivation in the Zhejiang in China (Zhang et al., 2004). Also, training in agricultural practices may contribute to the improvement of income of farmers, reducing their economic risks (Dillon et al., 2016; Kilpatrick, 2000). This can be seen in East Africa where farmers who have higher farming ability significantly increase productivity from their farms (Davis et al., 2012). Thus, farming ability may help farmers to avoid risks by accumulating better income from different agricultural activities, reducing their participation in distress land rental markets. Farming ability of farmers may enhance the socioeconomic status of families who have more money to diversify their off-farm income sources and reduce their economic risks.

The ability of farmers to diversify income sources may reduce their participation in distress land rental markets. The ability to diversify income sources is often associated with education levels and access to markets because these factors may provide households with more chances of gaining off-farm job opportunities (Ellis, 1998; Huffman, 2001; Phung & Waibel, 2009). Educated people have more chances to diversify their income sources, enabling them to cope with economic risks (Deininger & Jin, 2008; Eastwood et al., 2010; Kung, 2002; Nguyen, 2009). In rural areas, higher education levels allow households to participate in multiple business activities such as handicraft, small business, and other services (Babatunde & Qaim, 2009; Ellis, 1998; Escobal, 2001; Luu et al., 2013; Phung & Waibel, 2009). These income sources enable

farmers to cope with economic risks, avoiding participation in distress land rent-out markets while they can have more chances to rent-in more land. For example, farmers with higher education are less likely to participate in the distress land rent-out market but increase their participation in the land rent-in market in Ethiopia (Gebregziabher & Holden, 2011). Together with education, access to markets of villages may play an important role in diversifying income sources and reduce economic risks (Ravallion & Van de Walle, 2008; Van de Walle & Cratty, 2004). For example, farmers with better market access may have more chances to reduce their poverty, reducing their economic risks in Vietnam (Van de Walle & Cratty, 2004). Therefore, education and non-farm market access may represent the ability of farmers in increasing their income, reducing their risks to distress land rent-out markets.

In Vietnam, informal land rental markets are formed under the interactions among farmers without the regulations of local governments. Farmers try to avoid the high costs of registration fees or the prohibition on the land transactions in rural areas (Marsh & MacAulay, 2002; Ravallion & Van de Walle, 2008). For example, in 2010, the Binh Phuoc people's committee promulgated an instruction No. 14/2012/CT-UBND on the prohibition of the transaction of cashew nut farms from indigenous people to immigrants (Bui, 2010). The instruction requires the involvement of local authorities, Department of Police, Committee of Ethnicity Affairs, Department of Natural Resource and Environment, Vietnam Bank for Social Policies, and local media to conduct legal procedures that prevent these unfair cashew nut rental activities while they disseminate information on the prohibition of land transactions between indigenous people and immigrants in the province. Local authorities are not allowed to issue land and cashew nut farm transactions between indigenous people and immigrants. Thus, when the local government imposed this instruction, lessees formed

informal land rental markets without the certification of local authorities. Therefore, the failure of this instruction requires additional interventions that are based on the relationships between socioeconomic profiles and the participation of farmers in distress land rental markets.

In this study, I aimed to understand socioeconomic determinants of the participation of farmers in informal cashew nut rental markets in the area of coexistence of indigenous people and immigrants. I hypothesized that: (1) Smaller landowners are more likely to rent-out their cashew nut farms at fixed and cheap prices while larger landowners are more likely to participate in the cashew nut rent-in market; (2) Indigenous people tend to rent out their cashew nut farms while immigrants tend to rent-in more cashew nut farms; (3) Farmers with higher farming ability are less likely to participate in the cashew nut rent-out market and increase the likelihood to participate in the cashew nut rent-in market; (4) More off-farm job opportunities (with higher education and better market access) reduce the participation in distress cashew nut farm rent-out but increase their participation in rent-in markets. The buffer zones of the Bu Gia Map National Park are a good place for this kind of study because land lease activities are occurring in the context of interactions between indigenous people and immigrants from elsewhere in Vietnam.

## **2.2. Methods and data**

### **2.2.1. Study site**

The buffer zones of Bu Gia Map National Park cover an area of around 1,400km<sup>2</sup> that includes three communes (a commune is the second smallest territorial division for administrative purposes, and it is a group of villages) belonging to Binh Phuoc and Dak Nong provinces. Weather conditions are mild with an annual rainfall of around 2,500

mm, and an average yearly temperature of 28°C. The prevailing topography and fertile basalt soils are relevant for planting cashew nuts, rubber trees, peppers, coffees and other cash crops. The time for the harvest of cashew nuts is four months employing unskilled collectors. This short period of income may make it more difficult to manage expenses for the whole year, especially for poor people who have insufficient skills related to microfinance at the household level. Therefore, informal cashew nut farm rent-in and rent-out markets developed as a way for farmers to overcome financial hardships.

Over the last four decades, the population structure of these communes has changed drastically because of internal migration under governmental policies and spontaneous movements. Before 1975, indigenous people (Stieng and Mnong) whose ancestors were native to this area amounted to 98% of the total population of the area, and the other 2% were immigrant traders, loggers or small retailers. Since then other people have immigrated into this area, leading to a radical change in the demographic composition. There is now an estimated population of around 30,000 people. Indigenous people account for 40% of the total population while 60% of the population are immigrants from 10 ethnic groups. The change of ethnic composition and population has reformed society and agricultural systems in the area.

Indigenous people have had to change from shifting cultivation to settled agricultural systems. Before 1975, indigenous people used to conduct slash and burn activities to clear natural forest land for growing food crops with a rotation of three years on a plot of land. After that, they would clear another forest plot for new cultivation activities. They returned to the first land plot after about ten years to cultivate when the land had recovered naturally. Indigenous people grew upland rice, corn, sesame, and other food crops to satisfy their food demands (Gregerson & Thomas,

1980). They also raised domestic animals such as water buffalos, pigs, ducks for ritual sacrifices, as pets, and as a protein supply (Gregerson & Thomas, 1980). Indigenous people also supplemented their food supplies from wild animals, leaves, fruits and other products collected from natural forests. The immigration of other ethnic groups brought new agricultural cultivation techniques and perennial saplings such as rubber, coffee and cashew nut trees to the area, meaning that permanent plots of land became important. This situation led to competition for agricultural land among local people regardless of their ethnicity (Gregerson & Thomas, 1980). Currently, the main economic activities of local people include crops (rice, corn, rubber, cashew nuts, pepper, coffee, cassava), animal husbandry, grocery retailers, and agricultural services.

### **2.2.2. Sample design**

Twelve villages were selected based on their proximity to the Bu Gia Map National Park so that the results of this study could be used by both park managers and local authorities to improve biodiversity conservation and create economic development programs. These villages are located south and southeast of the park, containing 2,418 households with a population of approximately 13,500 people. The names of all target villagers were obtained to generate a random sample, and the name of indigenous people can be identified by their last name (family name). Local people were stratified to examine the proportion of indigenous people and immigrants to the total population. The proportions of indigenous people and immigrants to the total population were 49.6% and 50.4%, respectively. A proportionate stratified random sampling method was applied to keep the same fraction for each population subgroup. Each villager was randomly numbered, and the numbers were arranged in ascending order of value. The first 60 and 61 respondents were selected for indigenous and immigrant subgroups, respectively. The 121 interviewees in the random sample had the same fraction of

indigenous people and immigrants as the total population in the study site. Fortunately, I received 100% of return rate; therefore, I did not have to conduct further analysis for the comparison between response and non-response participants. This response rate resulted from the good relationships that I have with local farmers because I have worked with these communities for 15 years.

### **2.2.3. Questionnaire design**

This study examined the socioeconomic determinants of crop leasing activities in the context of interactions between indigenous people and immigrants. The survey form was designed based on the method used by the World Bank (WB) (Grosh & Glewwe, 2000). This survey collected household demographics including family size, land use, geographical distance, ethnicity, education, length of residency, agricultural training and workshop attendance, number of people working, and crop leasing activity. Interviewees were conducted with the heads of households in the presence of their partners and other family members to increase the accuracy of information provided. Variables of the study are presented in Table 2-1.

#### **Indigeneity**

In this study, I included the indigeneity variable that represented whether farmers are indigenous people or immigrants. Indigenous people are defined as people who are native to the study site, and they included Stieng and Mnong people. Other ethnic groups who recently move into the study site are immigrants.

#### **Wealth status**

Landowning size can be used as a proxy for wealthy status of farmers because land is the main income source in the study site (Nguyen et al., 2019a; Nguyen et al., 2019b).



### **Farming ability**

Farming ability is often represented by the labour force of households and knowledge of farming activities. Family size often associates labour force of households, and it may affect the desire to participate in conducting more farming activities. Together with family size, training in agriculture provides households with knowledge of planting, fertilizing, and cultivating activities.

### **Ability to obtain off-farm job opportunities**

The ability of farmers in obtaining their off-farm job opportunities can be represented by education and proximity to markets. Education levels represent the ability of households in farming and managing economic activities, and they are represented by the number of formal years in schools. While education of heads of households have direct impacts on economic management activities of households, the highest education level in the family may have impacts on the decision of the head at some levels. Together with education levels, numerous factors affect access to markets of local farmers. Commune, distance to the main road, and distance to natural forests are typical factors that affect the way farmers access to markets. Commune of residents may have clearer impacts on the access to markets because the development of markets is heterogenous across commune. The commune that is closer to the district centre may have better access to markets. Distance to the main road and proximity to natural forests may represent the infrastructure within communes that affects how people access markets. Geographic coordinates of the households were recorded by using a handheld GPS. The distances from interviewees' homes to the main road and natural forests were extracted by applying ArcMap 10.3.3 version.

## **Land rental markets**

In land rental markets, farmers participate in one of three market regimes i.e. either net lessors, autarkic, or net lessees. Net lessors are known as those who rent out their land more than what they rent in. Net lessees are those who rent-in more than what they rent-out. Autarkic are those who are self-sufficient or that the area of land they rent-in is equal to the area they rent-out. These selections are often based on the financial ability of farmers. When they encounter economic risks, they may participate in the distress cashew nut rent-out market. In case they have just sufficient income, they may keep their usual business. When they have more savings, they may opportunistically participate in the rent-in market to enlarge their farmland.

### **2.2.4. Data analysis**

#### **Overview of households in the sample**

Mean and standard deviation of characteristics of households were analysed by applying descriptive statistics.

#### **Reasons for the participation in the cashew nut rent-out market**

Descriptive statistics was applied to analyse the proportion of different reasons why farmers participate in the cashew nut rent-out market.

#### **Indigeneity and socioeconomic determinants of cashew nut farm rental markets**

An ordinal regression was used to identify important socioeconomic factors variables regarding the relationships between socioeconomic factors and the participation in the cashew nut rental markets under three regimes including net lessors, autarkic, and net

lessees. There were 10 explanatory variables including indigeneity identities, residential communes, off-farm income source, distance to natural forests, family size, informal training in agriculture, education of heads, highest education, distance to the main road, and landowning size. Interactions among socioeconomic factors, communes and indigeneity groups were examined to understand their effects on the participation in the cashew nut rental market. All assumptions were checked to ensure that the data were suitable for the application of the ordinal regression for data analysis. Stata version 14.0 was applied to analyse data of the study.

## 2.3. Results

### 2.3.1. Overview of households in the sample

Table 2-1 - Summary of variables in the study

Variables	Mean	SD
Indigeneity (dummy, 1 = Indigenous people; 0 = immigrants)	0.496	0.50
Commune (dummy, 1 = Bu Gia Map, 0 = Dak O)	0.66	0.48
Off-farm income source (dummy, 1 = yes, 0 = no)	0.20	0.40
Livestock (dummy, 1 = yes, 0 = no)	0.07	0.26
Education of head of household (years)	5.85	3.52
Informal Agricultural Training (times)	1.94	1.10
Highest education (years)	9.79	3.50
Land ownership (hectares)	3.88	3.76
Distance to natural forests (km)	2.44	1.72
Family size (people)	5.45	2.36

Table 2-1 presents profiles of households within the sample. Respondents had large families with their average number of people per household that was 5.45. The average education level of heads of households was 5.85 years while the average highest education in their families was 9.79 years. Respondents owned an average of 3.88 hectares of land. The average distance to natural forests was 2.43km, and seven percent of respondents had livestock.

### 2.3.2. Reasons for the participation in the cashew nut rent-out market

Table 2-2 - Reasons for Cash Lease among Local People

Reasons for Leasing Out	Number of Respondents	Percentage
House Construction	9	7.44%
Disease Treatment	8	6.61%
New Vehicles	8	6.61%
Funerals	6	4.96%
Weddings	9	7.44%
Small labour force	1	0.83%
Business (farmers who are playing the rental market for money)	6	4.96%

There were 42 (34.71%) households who were net lessors, and 27 (22.31%) were net lessees. There were 52 (44.63%) households who were autarkic (They did not participate in either rent-in or rent-out markets or their net rent-in and rent-out is equal to zero). Six people (4.96%) rented out their land with negotiable prices (4 net lessees, 1 net lessors, and 1 autarkic). Forty-one respondents rented out their cashew nut crops because of economic hardships with an average of 5.81 (4.53) years of contract period.

The average price for one hectare of cashew nut crop rented out by local people was \$459.40 (210.48) USD/year/ha while people who did not participate in the distress rent-out markets could obtain the average price for rent-out of \$1,066.67 (132.62) USD/year/ha. The reasons that farmers rented out their cashew nuts can be seen in Table 2-2. Respondents rented out their cashew nut orchards when they needed a large sum of money for house construction (7.44%), disease treatment (6.61%), new motorbikes (6.61%), funeral services (4.96%), weddings (7.44%), and due to low labour force in the house (0.83%).

### 2.3.3. Socioeconomic and indigeneity determinants of cashew nut farm rental markets

Table 2-3 - Ordinal logit regression of the roles of local people in cashew nut rental market in the buffer zones of Bu Gia Map National Park (\* = significant at 0.05, \*\* = significant at 0.01, \*\*\* = significant at 0.001)

Variables	B	SE	Wald $\chi^2$	df	Sig.	Exp(B)	Lower	Upper
Rent-out	.453	.8021	.319	1	.572	1.573	.327	7.574
Autarky	4.914	1.0772	20.814	1	.000	136.251	16.497	1125.313
Indigeneity (IP = 0, IM = 1)	3.166	.7099	19.892	1	.000	23.715	5.899	95.339
Commune (BGM = 0, DO = 1)	1.787	.4879	13.411	1	.000	5.970	2.294	15.533
Family size of respondents	-.425	.1363	9.745	1	.002	.653	.500	.854
Land Own	.173	.0734	5.573	1	.018	1.189	1.030	1.373
Agricultural Training	.831	.2401	11.980	1	.001	2.296	1.434	3.675

A cumulative odds ordinal logistic regression was run to determine the effect of indigeneity, education of head of household, highest education in the family, informal

training in agriculture, family size, commune, landowning size, distance to the main road, distance to natural forests on the intent of participation in cashew nut farm rental markets (Table 2-3). After regressing the effects of these variables on the dependent variable, I found that education of heads of households, highest education in the family, distance to the main road, and distance to natural forests were not statistically significant in explaining the participation in the cashew-nut farm rental market of farmers. I removed nonsignificant variables and refitted the model with the five remaining independent variables including indigeneity, commune, family size, training in agriculture, and landowning size.

The deviance goodness-of-fit test ( $\chi^2(11) = 10.094$ ,  $p = 0.522$ ) indicated that the model was a good fit to the observed data. The final model statistically significantly predicted the dependent variable over and above the intercept-only model,  $\chi^2(0) = 111.69$ ,  $p < .001$ . The odds of immigrants belonging to the cashew nut rent-in group, compared to the other groups, were 23.72 times that of indigenous people, with confidence interval (5.90, 95.34). The cumulative odds of farmers in the Dak O Commune belonging to the rent-in market group were 5.97, with confidence interval (2.29, 15.53). One more hectare of landowning of households was associated with an increase in the odds of belonging to cashew nut rent-in market, with an odds ratio of 1.19 times, with confidence interval (1.03, 1.37). One more family member reduces the odds of belonging to the rent-in market by 65%, with confidence interval (0.50, 0.85). The cumulative odds of one more informal training workshop increases by 2.3 times, with confidence interval (1.43, 3.68).

After adjusting for other socioeconomic variables, the predicted probability of being in the cashew nut rent-out market of indigenous people was 0.49 ( $p < 0.001$ ) and

it was not significant for immigrants (0.03,  $p = 0.179$ ). When I move to the autarkic group, the probability of indigenous people was 0.50 ( $p < 0.001$ ), and 0.74 ( $p < 0.001$ ) otherwise. While the probability of immigrants belonging to the rent-in group was 0.23 ( $p < 0.001$ ), the probability of indigenous people belonging to the rent-in group was nonsignificant (0.01,  $p = 0.154$ ).

Controlling other socioeconomic variables at their means, the predicted probability of being in the land rent-out market of farmers in Dak O was not significant (0.04,  $p = 0.051$ ) while the probability of being in the rent-out market of farmers in Bu Gia Map was 0.26 ( $p < 0.001$ ). When I move to the autarkic group, the probability of farmers in Dak O was 0.78 ( $p < 0.001$ ), and 0.71 ( $p < 0.001$ ) otherwise. The probability of being in the rent-in group of farmers in Dak O was 0.16 ( $p = 0.015$ ) while the probability of farmers in Bu Gia Map belonging to the rent-in group was 0.03 ( $p = 0.042$ ).

## **2.4. Discussion**

In this study, I observed that smaller landowners rented out their cashew nut farms because of economic hardships while larger landowners enlarge their cashew nut farms via the informal land rental markets. Immigrants tend to rent-in more cashew nut farms while indigenous people tend to rent-out more cashew nut farmland. Farmers who have easier access to markets tend to rent-in more cashew nut farms than those who have limited access to markets. While the number of informal training workshops in agriculture has a positive relationship with the likelihood of participation in the cashew nut rent-in market, larger family size reduces the likelihood of farmer's participation in the cashew nut rent-in market.

My observations supported the first hypothesis that smaller landowners are more likely to participate in the cashew nut rent-out market at fixed and cheap price while larger landowners are more likely to participate in the cashew nut rent-in market. In land-based income areas, smaller landowners are often poorer and have limited assets that can enable them to overcome economic risks while larger landowners are often richer and may have available savings to enlarge their farmland (Akram-Lodhi, 2005; Gebregziabher & Holden, 2011; Ha et al., 2006; Tran, 2015). The findings of this study are similar to previous studies that state the movement of land from poorer to richer households when poor farmers encounter economic hardships via the distress land rental market (Gebregziabher & Holden, 2011; Promsopha, 2018; Thai, 2018; Tikabo & Holden, 2003). In this study I examined the reasons why smaller landowners rented out their cashew nut farmland, but I did not collect data on the consumption need of farmers in the context of encountering economic hardships. Also, I only examined the determinants of the participation of farmers in their cashew nut farmland rental markets regardless of their long-term impacts on incomes. I do believe that the participation in distress cashew nut rent-out market affects future income and food security of small landowners. Further studies need to examine the cashew nut rental market together with the income volatility of local farmers and the delayed effects of distress cashew nut rental markets on future income of farmers. In this study, I found that the cashew nut rental market is contributing to the gap between rich and poor people, meaning that the rich may accrue land through the distress land rental markets while the poor lose their land to others. Agricultural land is the main income source of rural residents and renting-out land can make poorer households landless, and they can confront food insecurity for years to come (Gebregziabher & Holden, 2011). The findings of this study suggest that the management of distress cashew nut farmland rental market is very important for reducing the rich and poor gap among farmers in forested areas.



The findings of this study supported the second hypothesis that indigenous people tend to rent out their cashew nut farms while immigrants tend to rent in more cashew nut farms. Spontaneous immigrants are those who come to the areas later and need to find ways that allow them to obtain viable means of livelihood (Hardy, 2005; McElwee, 2008). Renting in land is a strategy that immigrants apply to have enough land for cultivation, and this resource is mainly owned by indigenous people. Indigenous people, however, may suffer financially from their cultural relationships (McElwee, 2008), and renting out their land could be the best choice. The findings of this study demonstrate that there was a redistribution of land from indigenous people to immigrants in their areas of coexistence. The results of this study agree with other researchers regarding the sensitivity of ethnicity and migration status in the participation of farmers in land rental markets (Awasthi, 2009; Codjoe, 2006; Hall, 2011; Min et al., 2017; Trieu et al., 2016). I acknowledge that diversification of income sources may play an important role in determining the participation of indigenous people and immigrants in the land rental markets, but I did not collect detailed information about income. Further studies need to examine the distress land rental market with risk coping strategies of farmers and income diversification to better understand the relationships between risk coping strategies and cashew nut rental markets. These findings also indicate that the distress cashew nut rental market widens the socio-economic gap between indigenous people and immigrants in Vietnam where there is already a large gap among ethnic groups (Baulch et al., 2007; Thai, 2018). At the national level, indigenous and minority people hold larger land size than internal immigrants and majority groups, and this is the result of the comparison of households among regions across the countries (Baulch et al., 2007; Baulch, 2008; Doutriaux et al., 2008; Katsushi et al., 2011). However, in new resettlement areas, there is a movement of land from indigenous people to immigrants (Thai, 2018), and the

adjustment of support should be applied to address this problem in the coexistence areas of indigenous people and immigrants. The support from the government should not only focus on the landownership of households because some household own their land in name only. If local authorities support villagers based on the existing landownership, this may mislead them in making relevant decisions pertaining to social equality among rural communities. Therefore, local governments should focus on the real land area cultivated by villagers that may better demonstrate the economic status of these communities.

My study partially supported the third hypothesis that higher farming ability reduces the chance to participate in the cashew nut rent-out market and increase the likelihood to participate in the cashew nut rent-in market. Better farming ability may enable households to boost their income that can reduce their shocks from economic risks, lessening their likelihood of participation in distress land rent-out market. The findings of this study concur with previous studies that farming ability of households may enable farmers to reduce their participation in the land rent-out markets (Gebregziabher & Holden, 2011; Holden & Ghebru, 2016). I acknowledge that I only collected information related to how often respondents participated in informal training in agriculture provided by local government and agricultural service companies disregarding how they apply their knowledge from these training workshops into their farming activities. I believe that collecting information on how knowledge of farmers is applied to farming activities may provide a better understanding of the relationship between farming ability and the participation in the distress land rental market. This study has a clear implication for local governments who need to provide more farming workshops for farmers because these informal training may reduce the participation of farmers in distress cashew nut farm rental market.

I also found, however, that family size had a negative relationship with the participation in the cashew nut rent-in market. In developing countries, households often employ children for farm work (Rena, 2009), and family size often has positive relationships with working ability, meaning that it can be a proxy for the labour force of households. The results of this study seem to contradict previous studies indicating that labour force has positive correlations with the participation in the land rent-in market (Akram-Lodhi, 2005; Tan et al., 2017; Zhang et al., 2004). These studies categorized labour force based on the number of family members and the age at which people are involved in the work force (Tan et al., 2017; Zhang et al., 2004). Therefore, they may have better relationships between labour force and the participation in the land rent-in market. In this study, however, family size may have a positive relationship with food demand and higher probability to be affected by diseases, high bride price for traditional weddings, funerals, and other cultural events. When the frequency of shocks reaches a critical point, usual activities could no longer support the family (Gebregziabher & Holden, 2011; Promsopha, 2018). Therefore, households with a larger family size tended to lease out their land more than smaller families. I acknowledge that I did not examine the proportion of labour force in households and its relationships with the participation in the land rental markets. Also, I did not examine the age at which farmers start and stop participating in the workforce at the household level. Therefore, relationships between labour force and the participation in the cashew nut rental markets are unclear. Further studies need to examine these relationships and may assist local governments in providing job opportunities for relevant age groups that can enable them to remain in the cashew nut rental market.

My findings partially supported the last hypothesis that more off-farm job opportunities (with higher education and better market access) reduce the participation

in distress cashew nut farm rent-out but increase their participation in rent-in markets. Farmers who live in the Dak O commune were less likely to participate in the cashew nut farm rent-out market than those in the Bu Gia Map commune, but education was not statistically significant in explaining the participation of farmers in distress cashew nut rental markets. These findings are similar to previous studies stating that easier access to markets with more off-farm job opportunities reduce their economic risks, lessening their participation in land rental markets (Ellis, 1998; Promsopha, 2018; Ravallion & Van de Walle, 2008; Van de Walle & Cratty, 2004). I acknowledge that in this study I used communes as a proxy for the access to markets of local people disregarding the access to credit markets where they can borrow loans. Credit markets may have impacts on the participation in the cashew nut rental market of farmers. Further studies need to include the access to credit markets to better understand the role of both off-farm markets and credit markets on the participation of farmers in the distress cashew nut rental market. In this study I found that access to markets may provide more opportunities for farmers to reduce their risks, lessening their participation in the distress cashew nut farm rental market. Therefore, the provision of additional job opportunities for people who live in remote areas may reduce the risks of farmers to involve in the distress cashew nut farmland rental markets.

Local governments need to support poor households and indigenous people in remote areas to reduce the the gap between rich and poor people. Although the Vietnamese government has imposed numerous programs to support ethnic groups in remote areas such as 134, 135, and sedentarization programs, and they also allocate land for disadvantaged ethnic minorities. However, these programs are believed to be unsuccessful in supporting people in poor communes across the countries (Salemink,

2000; Van de Walle & Gunewardena, 2001). The failure of these programs is caused by the lack of the participation of ethnic minorities in the decision-making process (Van de Walle & Gunewardena, 2001). Therefore, local governments must examine the needs of ethnic minorities by getting them involved in assessing the needs for land and other support to make sure that programs ensure relevant support for villagers in land access for all ethnic groups.

This study suggests that less informal training in agriculture tended to increase the likelihood of renting out land, meaning that more training workshops for poor indigenous farmers could be a viable intervention because it has successfully lifted farmers out of poverty in Iran (Karbasioun et al., 2005). Also, previous studies indicate that indigenous people have fewer sources of income than immigrants, reducing their ability in coping with economic shocks (Nguyen, 2007; Phung & Waibel, 2009). Local government may support small landowners and indigenous people in diversifying their income sources to reduce their vulnerability to the distress cashew nut rental market. In addition, local governments need to pay their attention to support households with large family size to reduce their economic shocks.

## **2.5. Conclusion**

Informal cashew nut rental markets perpetrate social injustice and enlarge the gap between small and large landowners in the areas of coexistence of indigenous people and immigrants. Land is the main income source in many rural areas (McElwee, 2010; Nguyen et al., 2019b), and it can be a major factor that defines the social class of families. As a result, participating in informal cashew-nut rental markets is a source of inequal access to land, leading to social injustice for villagers regarding their economic development. Since landownership is a good proxy for economic status of farmers, the

findings of this study indicate that there is a movement of cashew nut farmland from poor to rich families and from indigenous people to immigrants. Less training in agriculture tends to increase their participation in the cashew nut rent-out market while larger families are more likely to participate in the distress cashew nut farm rent-out market. Easier access to markets increases the likelihood of the participation of farmers in the cashew nut rent-in market. Therefore, there is a clear movement of income source from the lower to higher socioeconomic groups and between indigenous people and immigrants. Diversifying income sources for small landowners and indigenous people with the support for their access to markets may reduce the involvement of farmers in the distress cashew nut rent-out market. Also, intensive informal training in agriculture is one possible solution that could help farmers to reduce their participation in distress cashew nut rent-out markets. Further studies need to examine the participation in the cashew nut rental market with the diversification of income sources, consumption patterns, access to credit markets, and structure of labour force of families in order to better understand the determinants of the participation in the cashew nut rental markets of farmers. In addition, longitudinal data should be collected to understand the impacts of the distress cashew nut rental market on future income of farmers.

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## **Chapter 3 – Non-wealth Determinants of Productive Asset Inequality: An Examination of Operational Farm Size in the Buffer Zones of Vietnam’s Bu Gia Map National Park**

### **3.1. Introduction**

In Vietnam, there is substantial wage inequality among people living in rural areas with regards to their ethnic identities across the country (Akram-Lodhi, 2005; Katsushi et al., 2011; Molini & Wan, 2008; Nguyen, 2008a; Singhal & Beck, 2015). The Vietnamese government has paid attention to this problem and imposed numerous policies to remove income disparity and other social inequalities among ethnic groups (Benjamin et al., 2012, 2018; Nguyen et al., 2015; Singhal & Beck, 2015). Although these policies have reduced gaps related to education, health insurance, and asset ownership, there remains considerable income disparity among ethnic groups (Dang, 2019; Pham & Reilly, 2009; Singhal & Beck, 2015). This income inequality is observed when researchers compare local indigenous people and internal immigrant groups in their areas of coexistence (Doutriaux et al., 2008; Nguyen et al., 2019a; Thai, 2018). Although indigenous people and immigrants often have different income sources (McElwee, 2008; Nguyen, 2007; Phung & Waibel, 2009), researchers demonstrate that agricultural land is still one of the most important income sources of farmers in Vietnam, and the disparity in access to land may perpetuate wage inequality among peasant farmers in rural areas (Adger, 1997; Akram-Lodhi, 2005; Deininger & Jin, 2008; Doutriaux et al., 2008; Katsushi et al., 2011; Kerkvliet & Selden, 1998; Molini & Wan, 2008). Therefore, it is critically important for local authorities to understand factors that affect the operational farm size of farmers in the areas of coexistence of indigenous people and immigrants, so they can create better policies to reduce social inequality and build a harmonious society.

Operational farm size, the area of farms cultivated by households (in hectares), is one of the most important assets that generates income for rural residents in forested areas. People who live in remote areas often have limited off-farm job opportunities, and they have to rely on land-based income sources (Akram-Lodhi, 2005; Deininger & Feder, 2001). The difference in operational farm size may lead to income inequality among farmers (Akram-Lodhi, 2005; Stewart, 2011). This problem can be seen in the Mekong Delta of Vietnam where disparity in operational farm size perpetuates income inequality among farmers (Akram-Lodhi, 2005). In land-based income areas, operational farm size can be a robust proxy for the socioeconomic status of households because information is available in households or estimated from their farms (Mohanty, 2009; Sahn & Stifel, 2003). The operational farm size may be affected by various socioeconomic factors such as the participation in the land rental markets, off-farm job opportunities, and indigenous identities.

Indigeneity is one of important factors that may affect the operational farm size of peasant farmers in mountainous rural areas. There is a difference in the way indigenous people and immigrants obtain and enlarge their land (Molini & Wan, 2008; Sadoulet et al., 2002). For centuries, indigenous people have resided in natural forests and implemented a system of slash and burn farming practices (Gregerson & Thomas, 1980; Hickey, 1964). Indigenous people cultivate their ancestral land, so it is easy for them to claim land they had settled on (Doutriaux et al., 2008; Sadoulet et al., 2002). Unlike indigenous people, immigrants recently moved into these areas, and had fewer chances to convert natural forests into farmland (Hardy, 2005; Molini & Wan, 2008; Sadoulet et al., 2002; Zhang et al., 2006). Recently, the Vietnamese government has prohibited the conversion of natural forests into farmland which may prevent newcomers from obtaining their agricultural land (Molini & Wan, 2008; Sadoulet et al.,

2002). Previous studies indicate that ethnic minority and indigenous groups have larger farm size than the majority ethnic groups and immigrant counterparts (Baulch et al., 2007; Baulch, 2008; Doutriaux et al., 2008; Katsushi et al., 2011). This difference can be seen in the Dak Lak province where indigenous people hold larger operational farm size than immigrants (Doutriaux et al., 2008). Thus, indigeneity identity may demonstrate the difference in operational farm size of farmers in the areas of coexistence of indigenous people and immigrants. Indigenous cultures often have different family structures related to gender that may have impacts on the farm size of households.

The gender ratio within households may have impacts on the operational farm size held by households. Males and females have different opinions and preferences for farm management at the household level, which may affect operational farm size (Doss et al., 2015; Quisumbing et al., 2014). Households with a larger male labour force often have a better ability to manage larger farms, and they often increase their farms to take advantage of their available labour force. As a result, female-headed families hold smaller land sizes than male-headed households (Doss et al., 2015; Morrison et al., 2007; Quisumbing et al., 2014). This difference can be seen in Africa where women hold much smaller land sizes (Doss et al., 2015). Therefore, sex ratio may affect the operational farm size, and it may also have a link to the human capital of households.

Human capital, represented by the education level of the heads of households and their informal training in agriculture, may impact the operational farm size of farmers in rural areas. Higher education may enable famers to increase their ability to migrate to urban areas where they have more off-farm job opportunities (Escobal, 2001; Huffman, 2001; Mariana, 2015; Taylor & Martin, 2001; Wang & Liu, 2016). Also,

higher education often enables households to access off-farm jobs such as teachers, local officers, and other services. Since human capital enables households to exploit more income sources, they need to reduce their time for agricultural activities, which leads to a decrease in farm size. This relationship can be seen in Vietnam and Nigeria where the increase of education negatively relates to the farm size of farmers (Jerumeh & Omonona, 2018; Tran et al., 2000). Also, participating in informal training in agriculture may increase knowledge of farming in households because they learn new information and techniques. When farmers have good knowledge of farming practices, they are able to manage larger farms, and they may enlarge their farm size by buying or renting more agricultural land (Akram-Lodhi, 2005; Bizimana et al., 2004; Deininger & Jin, 2005). For example, informal training in agriculture has a positive relationship with the farm size of farmers in Rusatira and Muyira districts in Rwanda (Bizimana et al., 2004). Therefore, the increase of formal education at school may reduce farm size while the increase of informal training in agriculture may increase farm sizes. The impacts of human capital on farm size can be better understood when examining the proximity of households to markets.

Access to markets may also affect the operational farm size of farmers in land based-income areas. People who live near markets often have more opportunities to run their owned business that generate additional income (Müller et al., 2009; Ravallion & Van de Walle, 2008; Van de Walle & Cratty, 2004). When people run a business, they tend to have limited time for their farms. In these situations, farmers may reduce their farm size to run a business because this economic activity is not severely affected by weather conditions. This relationship can be seen in Romania where farmers with better access to markets tend to reduce their farmland size (Müller et al., 2009). Therefore, the proximity to markets may reduce the operational farm size of households. The

relationship between business opportunities and farm size can be better understood when it is put in the context of indigenous culture, gender, and human capital.

In this study, I aim to examine factors that affect the operational farm size of households to understand the causes of land inequality in the areas of coexistence of indigenous people and immigrants in the buffer zones of Vietnam's Bu Gia Map National Park. I hypothesize that: 1) indigenous people hold larger operational farm size than their immigrant counterparts; 2) larger female labour force ratio in the household (the number of female workers/ the number of male workers in a family) has a negative relationship with the operational farm size of households; 3) formal education has a negative relationship with farm size while training in agriculture has a positive relationship with operational farm size; 4) villagers in Dak O commune with easier access to market has smaller farm size than those in Bu Gia Map commune. I focus on farmers in the buffer zones of Vietnam's Bu Gia Map National Park to understand the distribution of farmland because it is experiencing a period of transition of the mix populations of indigenous people and immigrants.

### **3.2. Materials and method**

#### **3.2.1. Study area**

This study was conducted in the buffer zones of Vietnam's Bu Gia Map National Park where the topography is complex. The study site is in the southernmost tip of the Annamite range that is a transitional area between the Central Highland and the Southeast of Vietnam. It includes forested hills and a stream network that interleave each other, creating a complicated topography. Also, the buffer zones cover an area of around 1,400 km<sup>2</sup> including three communes (Bu Gia Map, Dako (Binh Phuoc province) and Quang Truc (Dak Nong province)).

The buffer zones of the Bu Gia Map National Park are good for agricultural cultivation. There are wet and dry seasons during the year, and weather conditions are mild with an annual rainfall of around 2,500 mm. The area has a tropical climate with an average yearly temperature of 28°C. Fertile basalt soils are the dominant soil types in the buffer zones of the Bu Gia Map National Park. Mild weather combined with fertile soils provides good natural conditions that nurture many cash crops such as cashew nuts, rubbers, peppers, and coffees. These conditions are also the target of the movement of people from other parts of the country to search for new economic opportunities.

Since the end of the American war in 1975, the population composition has had a significant change because of the exodus of immigrants from other parts of the country. The population increased at a rate of up to around 10% in 2000 (government documents). Immigrants have moved into the buffer zones of the park to search for new economic opportunities. Over the last four decades, the population of this area has changed significantly regarding ethnicity composition. There are approximately 30,000 people from twelve ethnic groups residing in the buffer zones of Bu Gia Map National Park (Nguyen et al., 2019b). The buffer zones of the Bu Gia Map National Park are now including both indigenous people and immigrants such as Stieng, Mnong, Kinh, Muong, Ede, Dao, Cho Ro, Cham, Nung, and Tay. Immigrants moved into the buffer zones of the Bu Gia Map National Park, and they diversify their ways to obtain agricultural land such as conversion of natural forests, purchases, or running land rental markets. This movement of immigrants is the start of social changes of indigenous people in this forested area.

In the buffer zones of the Bu Gia Map National Park, Stieng and Mnong groups are indigenous people whose ancestors resided in this area for centuries. These two

groups exchange numerous cultural and economic factors, and they have a quite similar social structure related to marriage, festivals, and other cultural activities. These groups used to reside in natural forests, and they conducted slash and burn cultivation to grow food crops. They planted upland rice, corn, bean and other food crops for their sustenance since these crops are relevant to the swidden cultivating system. They also used to rely on natural forests for food supplies and cultural amenities. They mainly collected natural forest products for their consumption at the household level (Gregerson & Thomas, 1980). Before 1975, indigenous people cut down bamboo to generate their income or pointed out the location of hardwood trees for immigrants (Gregerson & Thomas, 1980). Recently, indigenous people have switched from slash and burn to intensive farming systems, and food crops have been replaced by cash crops such as rubber trees, cashew nuts, pepper, coffee and cassava (Gregerson & Thomas, 1980; Nguyen et al., 2019b).

### **3.2.2. Sample design**

The sample was selected based on the geographical locations of villages that is close to the Bu Gia Map National Park. The Quang Truc commune is far from the border of the park, and it was excluded from the sample. Four and eight villages were selected as the target populations from Dak O and Bu Gia Map, respectively. There were around 2,400 households with about 13,500 people who belong to 12 ethnic groups in these villages. The full lists of villages that named the heads of households were collected to form the sampling frame in which the random sample was drawn. Indigenous people and immigrants accounted for 49.4% and 50.4% of the total population of these villages, respectively. A proportionate stratified sampling method was used to draw a sample with the same fractions of indigeneity as the total population. Names of heads of

households were randomly numbered, they were numerically ordered. Sixty indigenous people and 61 immigrants were selected as the same fraction of the total population. Thus, the sample included 121 participants that amount to 5% of the total population of the target villages. Fortunately, all interviewees responded to the surveys conducted in the field because the first author has worked in local communities for 15 years and is respected. That means I achieved a 100% response rate from participants, and I did not have to do further analysis with regards to the response rate of respondents.

### **3.2.3. Questionnaire design**

Interview questions were designed based on two survey forms developed by the World Bank and the Food and Agriculture Organization (Bakkegaard et al., 2016; Grosh & Glewwe, 2000). The survey was designed to include various aspects of households, but I only extracted essential information for the analysis of the landholding size in this article. Information of households includes age of the head of household, number of family members, education levels, land size, crop diversity, whether the family was indigenous or of immigrant origin, residential commune, occupation, their length of residency, distance to natural forests, and distance to the main road. Definition of variables can be seen in Table 3-1.

Time for surveys was carefully scheduled to obtain the most accurate and relevant information from participants. Before surveys were conducted, participants were contacted to schedule at the most convenient time for all respondents at their homes when they were free from work. All interviewees were the heads of households with the support of their spouses and/or other family members. During the interviews, I obtained permission from respondents to examine the records of income, land size, land certificates, land rental contracts, birth certificates, and other information related



to socioeconomic factors of their households if they are available. The collection of these document is to increase the accuracy of information of the study.

Table 3-1 - Definitions of variables

Variables	Definitions
Landowning size	The area of land owned by households, which includes untitled, titled land that is currently cultivating or renting out (Large > 4 hectares, medium 2 – 4 hectares, small < 2 hectares)
Operational Farm Size	The total land size that is currently farmed by households, and this landholding size plus the land rented in by farmers or exclude land rented out by household
Indigenous people	People native to the study site including Stieng and Mnong people
Immigrants	Other ethnic groups move into the study site from other areas
Education	The number of school years attended by the head of households
Highest education	The highest education of family members in the household
Family size	The number of people in a family
Occupation	Career of people (farmers, local staff, teachers, etc.)
Commune	The second smallest administrative territory in Vietnam
Distance to main road	Direct distance from home of respondents to the main road
Distance to forests	Direct distance from home of respondents to natural forests
Age	The number of years old
Crop diversity	The number of crops grown by households
Female labour ratio	The ratio between female and male labour force (1 = female less than male; 2 = female equal to male; 3 = female larger than male)

## Indigeneity

People were from different ethnic groups, but I categorize them into two main groups including indigenous people and immigrants. Indigenous people are native to the study site, and they have close relationship with the surrounding environment related to their culture and livelihood. Indigenous people are Stieng and Mnong groups. Immigrants are people who recently move into the study site, and they do not have strong tie with the surrounding environment. Since indigenous identities have strong relationships with

the distress cashew nut farm rental market (refer to Chapter 2), the land rental market variable was removed because of their high multicollinearity.

### **Female work force ratio**

Gender may play an important role in the decision of households in enlarging farm size, and female labour force ratio may have impacts on the farm size of households.

### **Human capital**

Education is one of the most important human capital because it is related to knowledge and skills of households. Education affects the ability of farmers in numerous ways such as off-farm job opportunities and their application of advanced technologies. Education levels are represented by the number of formal years in schools. Together with formal education, training in agriculture provides households with knowledge of planting, fertilizing, and cultivating activities.

### **Access to markets**

Residential communes represent for farmer's access to markets because these communes have different distances to the district centre. In addition, direct distances from home of respondents to the main road and natural forests are considered as the level of access to markets at the household level.

### **Operational farm size**

In this study, the term "operational farm size" represents for the total land size that is currently farmed by households, and this operational farm size includes the land rented in by farmers and excludes land rented-out. In Vietnam, farm size varies because population density is unevenly distributed across regions and provinces (Ha et al., 2006;

Marsh & MacAulay, 2003; Tran et al., 2000). A study in Nghia Trung commune that is near the Bu Gia Map National Park found that poor households hold less than two hectares of land while rich households hold more than four hectares of land (Ha et al., 2006). Thus, I divided operational farm size into three categories: small (less than 2 hectares), medium (from 2 to 4 hectares), and large (larger than 4 hectares).

#### **3.2.4. Data analysis**

##### **Household overview**

Socioeconomic profiles of respondents were described by using descriptive statistics to provide an overview of the households. These socioeconomic profiles include indigeneity, age of the head of households, landholding size, length of residency, education level, family size, and other socioeconomic factors.

##### **Sources of land held by local people**

Land of respondents was from different sources including dowry, purchase, rent, conversion, and allocation from the government. The sources of land were described to provide a picture of the composition of this resource in the study site.

##### **Socioeconomic and indigeneity determinants of operational farm size**

An ordinal regression was used to identify important socioeconomic factors variables with regard to the relationships between socioeconomic factors and the operational farm size of farmers. Also, interactions among socioeconomic factors, communes and indigeneity groups were examined to understand their effects on the operational farm size of farmers. There were eight explanatory variables including indigeneity identities, residential communes, family size, education, training in agriculture, direct distance to the main road, direct distance to natural forests, and off-farm income source. The

operational farm size of respondents was categorized into three groups including small, medium, and large. All assumptions were checked to ensure that the data are relevant to use ordinal regression for data analysis.

### 3.3. Results

#### 3.3.1. Household overview

Table 3-2 - Socioeconomic characteristics of households of the sample in the buffer zones of Vietnam's Bu Gia Map National Park (N = 121)

Variables	Mean	Std. Deviation
Age of the head of household (year)	45.29	10.90
Family size of respondents (people)	5.45	2.36
Highest education level in household (year)	9.79	3.50
Education level of heads (year)	5.85	3.52
Crop diversity (number of crops on their farm)	1.74	1.09
Road distance (km)	2.35	1.76
Distance to natural forests (km)	2.44	1.72
Land ownership (hectare)	3.88	3.76
Operational farm size (hectare)	3.37	4.7
Number of motorbikes	2.14	1.11
Number of training workshops	1.88	1.16

Families have a patriarchal structure because 107 families were led by men while 14 families were led by women who were divorced or widowed (Table 3-2). Respondents had relatively large families with an average number of people per household that was 5.45. The average education level of heads of households was 5.85 years while the average highest education in their families was 9.79 years. Respondents used motorbikes as their main vehicles for their travels, and the average number of motorbikes owned by respondents is 2.14. Three families owned cars for their daily use. One family owned three trucks that serves for their business in construction and

excavation activities while there were four households who own tractors for tillage and cultivation services. Villagers participated in farming workshops as a way to develop their farming abilities, and the average number of farming workshops participated in by villagers was 1.94.

### **3.3.2. Sources of farmland**

Agricultural land of farmers came from five main sources including forestland conversion, purchase, dowry, rent-in, and state land allocation. Thirteen households did not have any titled land while 108 households have fully or partially titled land of which 71 households partially owned untitled land that they bought or converted from natural forests. There were 27 households who were net lessees (the area of rent-in was larger than rent-out) while 41 households were net lessors (the area of cashew nut rented-out was larger than rented-in). Respondents owned an average of 3.88 (3.76) hectares of land while their average operational farm size was only 3.37 (4.70) hectares (including net rent-in or excluding net rent-out).

### **3.3.3. Socioeconomic determinants of operational farm size**

A cumulative odds ordinal logistic regression was run to determine the effect of indigeneity identities, residential communes, family size, education, informal training in agriculture, direct distance to the main road, direct distance to natural forests, and female labour force on the operational farm size (Table 3-3). After regressing the effects of these variables on the dependent variable, I found that direct distance to the main road, direct distance to natural forests, and family size were not statistically significant in explaining the operational farm size of farmers. I removed the nonsignificant variables and refitted the model with the remaining independent variables.

Table 3-3 - Ordinal regression with a logit link of operational farm size against socioeconomic factors

Variables	B	SE	z	Sig.	Exp (B)	Lower	Upper
Small landholding size	1.58	0.62					
Medium landholding size	3.27	0.69					
Indigeneity (Indigenous People = 0, Immigrant = 1)	1.05	0.50	2.12	0.034	2.86	1.08	7.57
Commune (BGM = 0, DO = 1)	-1.16	0.46	-2.51	0.012	0.31	0.13	0.77
Female labour force ratio (Reference group = Female is larger than male)							
Female less than male	-0.85	0.61	-1.40	0.161	0.43	0.13	1.40
Female is equal to male	-1.28	0.55	-2.32	0.021	0.28	0.09	0.82
Education level of respondents	0.14	0.07	1.98	0.047	1.14	1.00	1.32
Training in agriculture	0.87	0.20	4.18	0.000	2.38	1.59	3.58

The deviance goodness-of-fit test ( $\chi^2(42) = 46.522$ ,  $p = 0.292$ ) indicated that the model was a good fit to the observed data. The final model statistically significantly predicted the dependent variable over and above the intercept-only model,  $\chi^2(6) = 59.01$ ,  $p < .001$ . The cumulative odds of being in a large operational farm size group were estimated at 286% that of farmers who belong to the immigrant group, with 95% of confidence interval (1.08, 7.57). The cumulative odds of group of female labour force equal to male labour force belong to the large farm size group were 28% as much of the group with female labour force larger than male labour force, with confidence interval (0.09, 0.82). One more year of education of the head of households was associated with an increase in the odds of belonging to the larger farm size, with an odds ratio of 115%, with confidence interval (1.00, 1.32). The increase of every unit of informal training in agriculture increase the cumulative odds by 238%, with confidence interval (1.59, 3.58). The cumulative odds of villagers in Dak O commune belonging to the large operational farm size group were 31% as much of villagers in Bu Gia Map commune, with confidence interval (0.13, 0.77).

After adjusting other socioeconomic factors, the predicted probability of being in the small landholding size group of indigenous people was 0.613 ( $p < 0.001$ ) and immigrants 0.356 ( $p < 0.001$ ). When I move to the medium landholding size group, the probability of indigenous people and immigrants were 0.283 ( $p < 0.001$ ) and 0.395 ( $p < 0.001$ ), respectively. The probability of being in the large landholding size group of indigenous people was 0.104 ( $p = 0.005$ ) and 0.249 ( $p < 0.001$ ) otherwise.

Controlling other socioeconomic variables at their means, the predicted probability of being in the small operational farm size group of small, equal, and large female labour force ratio groups were 0.463 ( $p < 0.001$ ), 0.569 ( $p < 0.001$ ), and 0.269 ( $p = 0.004$ ), respectively. Moving to the medium operational farm size, the probability of the small female labour force group was 0.361 ( $p < 0.001$ ), equal male labour force group was 0.309 ( $p < 0.001$ ), and large female labour force group was 0.398 ( $p < 0.001$ ). The probability of being in the large farm size group of farmers belonging in small, equal, and large female labour force ratio groups were 0.176 ( $p = 0.004$ ), 0.122 ( $p = 0.001$ ), 0.332 ( $p = 0.001$ ), respectively.

After adjusting other socioeconomic factors, the predicted probability of being in the small landholding size group of farmers in Dak O was 0.668 ( $p < 0.001$ ) while the probability of being in the small landholding size of farmers in Bu Gia Map was 0.386 ( $p < 0.001$ ). When I move to the medium landholding size group, the probability of farmers in Dak O was 0.248 ( $p < 0.001$ ), and 0.388 ( $p < 0.001$ ) otherwise. The probability of being in the large landholding size group of farmers in Dak O was 0.083 ( $p = 0.017$ ) while the probability of farmers in Bu Gia Map belonging to the large landholding size group was 0.226 ( $p < 0.001$ ).

### **3.4. Discussion**

In this study I found that socioeconomic factors affect the operational farm size of local farmers in the buffer zones of the Bu Gia Map National Park. Indigenous people have smaller operational farm size than their immigrant counterparts. The large female labour force ratio group has larger farm sizes than the group with female labour force equal to male labour force. Higher education increases the operational farm size of households, and participation in agricultural training workshops has a positive relationship with the operational farm size. Farmers who live in Dak O commune with easier access to market have smaller operational farm sizes than those in Bu Gia Map commune.

My findings did not support the first hypothesis that indigenous people hold larger operational farm size than their immigrant counterparts. Indigenous people operated smaller farms than their immigrant counterparts. Previous studies state that indigenous people in mountainous areas hold larger land sizes than ethnic majorities and immigrant people in Vietnam (Baulch et al., 2007; Doutriaux et al., 2008; Katsushi et al., 2011). These studies compare the operational farm size between indigenous people and immigrants with regards to their geographic regions between delta and mountainous areas across the country using the Vietnam Household Living Standards Survey (Baulch et al., 2007; Baulch, 2008; Katsushi et al., 2011). The findings of my study indicate that national development policies should be adjusted at the local level to make better interventions for farmers with regards to indigeneity and ethnic identities. This phenomenon can be understood from the perspective of cultural expenses and economic management regarding indigeneity identities. Indigenous people often receive much lower returns on their education and agricultural land than immigrant and majority groups (Baulch et al., 2007; Baulch, 2008; Doutriaux et al.,



2008; Katsushi et al., 2011; Nguyen et al., 2019a). Immigrants, however, are newcomers and have smaller operational farm size, but they are good at diversifying their income sources to cope with economic hardships, and they may have additional savings to buy agricultural land (McElwee, 2008; Molini & Wan, 2008; Nguyen, 2007; Sadoulet et al., 2002). Also, indigenous people are burdened with traditional ceremonies such as funerals, festivals, and other cultural activities which can be expensive (Doutriaux et al., 2008; Nguyen et al., 2019a; Thai, 2018). Natural disasters combined with cultural burdens often put economic pressures on indigenous people. As a result, indigenous people have to sell or rent-out their agricultural land to more affluent people who can provide them with money for immediate needs, reducing their operational farm size (refer to Chapter 2). The findings of this study indicate that local indigenous people are much more lagged behind immigrants and ethnic majority groups in land management in Vietnam than previous findings because previous studies mainly focus on the difference of ethnic groups at the national level while they state that minority groups hold larger land size than majority groups (Baulch et al., 2007; Baulch, 2008; Doutriaux et al., 2008; Katsushi et al., 2011). This may be because of the different cultural relationships between ethnic groups and land management (Nguyen, 2008b). Although indigenous people owned more land than their immigrant counterparts, they have sold or rented out their land to internal immigrants for reasons such as diseases, cultural activities, market failures, and natural disasters (Imai et al., 2011; Thai, 2018). My study has implications for local authorities that interventions based on operational land size are still important to reduce gaps between rich and poor in the areas of coexistence of indigenous people and immigrants.

My findings did not support the second hypothesis that larger female labour force ratio in households has a negative relationship with the operational farm size.

Larger female labour force ratio group has larger operational farm sizes than the equal male-female labour force ratio group. Previous studies indicated that females often hold smaller farm size than males, and these studies used different measurements to examine the relationship between gender and operational farm size (Doss et al., 2015; Morrison et al., 2007; Quisumbing et al., 2014). Some researchers used female-headed households while others used female labour force to represent the disparity of gender in the relationship with operational farm size (Doss et al., 2015; Quisumbing et al., 2014). In my study, however, I used the ratio between female and male labour force to understand the relationship between gender and operational farm size. This may be because the equal female-male labour force group are often new couples who are in new marriage lives, and they had not had chances to accumulate their agricultural land. Also, the matriarchal system of indigenous people that requires sons-in-law to live with their wives' families (Gregerson & Thomas, 1980; Hickey, 1964), means that female families had larger operational farm size. I acknowledge that I did not examine relationships between the marriage time of farmers and farm size. I believe that the examination of this issue may provide a better understanding of the relationship between gender and operational farm size of farmers. The findings of this study suggest that local governments need to support new couples in accessing agricultural land and income sources because these people often have limited assets.

The results of this study partially support the third hypothesis that formal education has a negative relationship with operational farm size while training in agriculture has a positive relationship with operational farm size. Informal training in agriculture is positively associated with operational farm size because this training affects how farmers manage their land, economic relationships, and cultivation

activities, meaning that they can avoid selling or renting-out their land in times of need. The findings of this study are in agreement with previous studies indicating that knowledge of farming have positive relationships with operational farm size of farmers (Akram-Lodhi, 2005; Deininger & Jin, 2005, 2008; Huang et al., 2019; Jin & Jayne, 2013). The findings of this study imply that the investment in informal training in agriculture enables farmers to have larger operational farm sizes, and local governments need to provide informal training in agriculture for poor and small farm owners to reduce wage inequality among farmers in the areas of coexistence of indigenous people and immigrants.

I found that the education of the heads of households has a positive relationship with the operational farm size of farmers. This finding contradicts previous studies indicating that the increase of education levels leads to the reduction of farm size operated by farmers (Jerumeh & Omonona, 2018; Jin & Jayne, 2013; Tran et al., 2000). Previous studies examine the data at a regional or national level that may include the different geographical areas with different off-farm job opportunities, meaning that farmers may have more choices for their livelihood rather than relying only on land-based income sources (Jerumeh & Omonona, 2018; Jin & Jayne, 2013; Tran et al., 2000). In this study, however, I only examined a small forested area with limited alternatives for farmers. In addition, education must achieve a specific level that can create clear effects on economic growth (Huffman, 2001; Tran et al., 2000; Wang & Liu, 2016). Most of heads of households did not participate in professional or vocational training, meaning that it is hard for farmers to migrate and find good off-farm jobs in urban areas. This means that education might be helpful for their families in the management of farming activities, and education can help them to run business and

obtain more agricultural land. Further studies need to examine the relationships between education and the management of farm to have a better understanding of the role of education in the land-based income area. The findings of this study suggest that illiterate and low educated farmers could be the most vulnerable group because they may have the hardest access to all kinds of income sources in the area.

My observations supported the last hypothesis that villagers in Dak O commune with easier access to market has smaller farm size than those in Bu Gia Map commune. Farmers who live in Dak O commune with easier access to markets operate smaller farm size than those in Bu Gia Map commune. The findings of this study are consistent with previous studies stating that the proximity to markets reduce the operational farm size of farmers (Ravallion & Van de Walle, 2008; Van de Walle & Cratty, 2004). In this study, I examine the easy access to markets of families, but I did not examine how farmers participate in running business (small shops, groceries, butchers, etc.) that may have impacts on the time for farming activities, reducing their operational farm size. This issue should be addressed by future studies to better understand the relationships between running business and the operational farm size of farmers. The findings of this study suggest that local governments should encourage more small business activities because they may contribute to solving income inequality among farmers in the context of scared agricultural land resource.

Local governments need to support indigenous, young, and low educated farmers in accessing new income sources based on local available resources. Interventions should be developed based on the assets owned by local people that can provide them with off-farm income while they can reduce their reliance on agricultural land. Indigenous culture often attracts the attentions of tourists, and this assets can be

exploit to create economic development program for indigenous people (Hinch, 2001, 2004). Local governments need to create an assets-based community development program that encourage indigenous people to boost their culture and create a sustainable ecotourism in the areas. Also, local people should be trained in community-based ecotourism programs because training in ecotourism has gained success in supporting people in boosting their household economies in Uganda (Victurine, 2000). Together with training in ecotourism, local governments need to support young farmers in running their own business related to their traditional products for souvenirs because they can contribute to the income of local people (Goss, 2004; Hinch, 2004). In addition, local governments need to provide more intensive training in agriculture to support farmers while they need to encourage the next generation to continue their formal education because it can help them to reduce their reliance on agricultural land (Huffman, 2001; Taylor & Martin, 2001).

### **3.5. Conclusion**

In this study, I hypothesized that indigenous people hold larger operational farm size than their immigrant counterparts, larger female labour force ratio in the household (the number of female workers/ the number of male workers in a family) has a negative relationship with the operational farm size of households, formal education has a negative relationship with farm size while training in agriculture has a positive relationship with operational farm size, and villagers in Dak O commune with easier access to market has smaller farm size than those in Bu Gia Map commune. The observations of this study indicated that indigenous people operated smaller farm size than their immigrant counterparts. Households with more female labour ratio operate larger farm size than the group of equal male-female labour ratio. Education of heads

of households has a negative relationship with the operational farm size while informal training in agriculture has a positive relationship with operational farm size. Finally, villagers in Dak O commune with easier access to market has smaller farm size than those in Bu Gia Map commune. Local governments need to take the advantage of available assets of local people such as cultural aspects and traditional products to boost household economies for local communities. In order to boost their available resources, local governments need to train farmers in running tourism and business activities. Also, short-term and informal training in agriculture is essential while formal education is strongly encouraged to reduce the reliance of current children on agricultural land. Further studies should examine more relationships between indigeneity, gender, and formal education and operational farm size of farmers.

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## **Chapter 4 – Socioeconomic Determinants of the Consumption of Non-timber Forest Products in Vietnam’s Bu Gia Map National Park**

### **4.1. Introduction**

In Vietnam, forested areas have witnessed a significant change in population structure because of mass internal migration due to both governmental policies and spontaneous movements. After the American war in 1975, the Vietnamese government encouraged people to migrate from lowland to highland areas to remove socioeconomic discrepancy among ethnic groups (Hardy, 2005). Since then people have continued to move into forested areas in search of new economic opportunities (Hardy, 2005; McElwee, 2008a). Population growth in the vicinity of natural forests is contributing to the over-harvesting of NTFPs. The increase of immigrants combined with the decline of NTFPs reduces the consumption of NTFPs for poor and indigenous people. Local people make use of these natural resources for both their subsistence and income, and natural forests are more important for villagers who encounter economic shocks (Dang & Tran, 2006; McElwee, 2008b, 2010; Völker & Waibel, 2010). The reliance of local people on NTFPs can be the result of socioeconomic, cultural, and geographic factors, and understanding which factors are most important can inform policies that aim to achieve the sustainable use of these products.

Non-timber forest products (NTFPs) play an important role in reducing poverty across the world because they provide essential amenities for the poor in times of need (Arnold & Pérez, 2001; Cavendish, 2000; Fa et al., 2002; Fa et al., 2000). This natural resource includes food supplies, medicinal herbs, cultural products, and income sources for people who depend on it (Alves et al., 2013; Cavendish, 2000;

Paumgarten, 2005; Paumgarten & Shackleton, 2009; Twine et al., 2003). Poor people who encounter economic hardships collect NTFPs for consumption and for sale in times of need (Völker & Waibel, 2010). Recently, scientists and conservationists have found different relationships between consumption patterns of NTFPs of people and their socioeconomic status in Asia, Africa and Latin America (Cavendish, 2000; Dang & Tran, 2006; Godoy et al., 2010; McElwee, 2008b; Paumgarten & Shackleton, 2009). The heterogeneity of the relationships between socioeconomic status and levels of reliance on natural forests may result in inappropriate interventions for biodiversity conservation and development programs at the local level.

Socioeconomic factors – including family size, education level, and land area available for farming – have been used to explain the consumption of NTFPs (Brashares et al., 2011; De Merode et al., 2004; Lacuna-Richman, 2003; Mitra & Mishra, 2011; Morsello et al., 2014; Paumgarten & Shackleton, 2009). Family size has a positive relationship with the consumption of NTFPs because it increases household food demands (Chukwuone & Okeke, 2012; Lacuna-Richman, 2003; Mitra & Mishra, 2011). Better educated people reduce their consumption of forest products because they have more job opportunities (Chukwuone & Okeke, 2012; Mitra & Mishra, 2011; Morsello et al., 2014; Sakai et al., 2016). The area of land available for farming can reduce the use of forest products by improving the income of households (Debela et al., 2012; Mgawe et al., 2012; Shackleton et al., 2001). However, Lacuna-Richman (2003) and Mitra and Mishra (2011) found that the relationship between the area of land used by villagers and the consumption of NTFPs is nonsignificant in the Philippines and India. The age of the head of household often changes consumption patterns of NTFPs (Chukwuone & Okeke, 2012; Luiselli et al., 2017; Paumgarten, 2005; Sakai et al., 2016). For example, young people likely consume less bushmeat

than people who are older than twenty-five in Africa (Luiselli et al., 2017). In Vietnam, previous studies have shown mixed results for the relationships between socioeconomic factors and the levels of dependence on natural forests (Dang & Tran, 2006; McElwee, 2008b). While Dang and Tran (2006) state that poor people rely more on natural forests in Nghe An province, McElwee (2008b) shows that the middle income group exploit more forest products than rich and poor groups in Ha Tinh province. The examination of socioeconomic factors with geographical and cultural issues may enable local managers to make relevant solutions for biodiversity conservation and poverty reduction.

Geographical features may play an important role in explaining the consumption of NTFPs of people who live near natural forests (Paumgarten, 2005). The distance from the houses to woodlands has an inverse relationship with the consumption of NTFPs from natural woodlands in Africa (Brashares et al., 2011; Chukwuone & Okeke, 2012). Locations of households have different levels of reliance and consumption patterns of NTFPs from natural forests (Chukwuone & Okeke, 2012; Dang & Tran, 2006). Also, there is an inconsistency of wealth determinants of consumption patterns across rural sites in Africa (Brashares et al., 2011; Fa et al., 2009). In Vietnam, there is also a different level of reliance on natural forests with regards to administrative locations (Dang & Tran, 2006). Thus, geographical features of households may form different relationships with the consumption of NTFPs from natural forests.

Indigenous people have their own cultural identities and knowledge of natural forests (Gadgil et al., 1993; Narendran et al., 2001), and it might therefore be expected that indigenous groups have a particular consumption pattern of species from natural forests, as others have found (Dash & Behera, 2016; De Caluwé et al., 2009; Fa et al.,



2002; Narendran et al., 2001). Indigenous people have close relationships with their environment which is linked to their culture and identity (McElwee, 2008a). Internal immigrants come from other parts of the country, so the surrounding environment does not contain their ancestors or dictate their cultural activities (Hardy, 2005; McElwee, 2008a). However, the impacts of indigeneity cannot be easily predicted on a global scale (Coulibaly-Lingani et al., 2009; Lacuna-Richman, 2003; Laird et al., 2011). While studies found that indigenous people use more NTFPs than their counterpart immigrants (Coulibaly-Lingani et al., 2009; Laird et al., 2011), there is no difference in the diversity of forest products used between indigenous people and immigrants in the Philippines (Lacuna-Richman, 2003). Thus, different usages of NTFPs should be analysed on the regional or country basis in the area of coexistence between indigenous people and immigrants.

The consumption of NTFPs can be a proxy for the level of impacts on natural forests. This problem can be caused by the demand from villagers who live in the buffer zones of protected areas and users in cities via commercial trading activities (Dang & Tran, 2006; Drury, 2011; McElwee, 2008b, 2010). A study that examined the consumption of forest products highlighted the profile of users in a city of Vietnam (Drury, 2011). Previous studies also delve into the collection of these products in rural areas, but the consumption of these products in households is unclear (McElwee, 2008b, 2010; Nguyen et al., 2019). The consumption of NTFPs in the buffer zones represents the demand of local people that may represent for the need for food supplies and the urgent need of local people (Shackleton & Shackleton, 2004; Shackleton & Shackleton, 2006). Therefore, examining the consumption of households around protected areas may enable forest managers to understand both the impacts on natural forests and the role of NTFPs in food security of local people.

The consumption of NTFPs encourages people to collect products from natural forests, degrading the biodiversity value of protected areas. Therefore, identifying relationships between socioeconomic factors and the consumption patterns of NTFPs may enable local managers to identify the key socioeconomic determinants of consumer needs (Carpenter et al., 2009; Dang & Tran, 2006; Sakai et al., 2016). There have been numerous studies of relationships between socioeconomic status and consumption patterns for NTFPs in Asia, Africa and Latin America (Brashares et al., 2011; Godoy et al., 2010; Hegde & Enters, 2000; Paumgarten & Shackleton, 2009). In Vietnam, there remain gaps in understanding the relationships between socioeconomic status and consumption patterns of NTFPs from protected forests (Dang & Tran, 2006; McElwee, 2008b, 2010).

In this study, I aim to understand the relationship between socioeconomic and geographic factors and the consumption patterns of NTFPs, in terms of both the amount and diversity of products consumed, in an area where indigenous people and immigrants coexist. The study population included two communes, Bu Gia Map and Dak O, in the buffer zones of Vietnam's Bu Gia Map National Park. This park has seen a long coexistence of indigenous people and immigrants, which enables us to understand differences or similarities that have developed over time. I collected information related to socioeconomic factors, indigeneity identities and geographical features from a random sample of 121 households. It was hypothesized that: 1) socioeconomic factors are associated with the consumption of NTFPs of local people; 2) households proximate to the forest consume more NTFPs; 3) there are differences in the consumption of NTFPs between indigenous people and immigrants in their areas of coexistence, after adjusting for socioeconomic and geographic factors; and 4) the determinants of NTFP consumption patterns are inconsistent across the two

communes studied. These two communes are both near Bu Gia Map National Park, but they have different access to markets. These geographical features may lead to the difference in the consumption of NTFPs with regards to their amount and diversity. Generally, current policies on forest protection concern villagers regardless of their specific economic status and indigeneity identities, and these policies need to be adjusted to be relevant to local situations. This study will help local managers identify socioeconomic groups that are vulnerable to the restriction of collection and consumption of NTFPs to create suitable alternatives and conservation strategies for these target groups.

## **4.2. Materials and methods**

### **4.2.1. Study Site**

This study was conducted in the buffer zones of Bu Gia Map National Park in the north of Binh Phuoc province (Vietnam). The buffer zones of the park comprise three administrative communes including Bu Gia Map, Dak O (Binh Phuoc province), and Quang Truc (Dak Nong province) and cover an area of around 1,400 km<sup>2</sup>. The total population of these communes is around 30,000 people who come from all over Vietnam. The buffer zones of the Bu Gia Map National Park have a tropical climate pattern, and the wet season occurs from May to October. Bu Gia Map National Park has been a target of internal immigrants because of its fertile soil and abundant natural forests. Currently, the buffer zones of the park still attract people from across the country. The population is composed of the indigenous ethnic groups of Stieng and Mnong, and the immigrant ethnic groups of Kinh, Tay, Nung, Dao, Muong, Cao Lan, Cham, Cho Ro, Mong, and Thai. Indigenous people whose ancestors are native to the study site comprise 42% of the total population.

The spontaneous movement of immigrants into the buffer zones of the Bu Gia Map National Park changed the residential models of indigenous people. Indigenous people used to live near natural forests connecting their current residential areas and the park. Later, immigrants reclaimed natural forests between residential areas of indigenous people and the Bu Gia Map National Park. Thus, some groups of indigenous people live further from the border of the park in comparison to their counterpart immigrants. Currently, these communes have both primary and secondary schools with a good infrastructure at their centres. There is a high school that is located in the Dak O commune. People live in villages that are near the centres of these buffer zone communes and can access national services such as electricity, water, and markets. However, villages that are far from the centres of communes have limited access to national services such as electricity and clean water. The villages that are near natural forests have more difficulty accessing these services, and they still use water from wells and/or streams.

Local people have complex economic patterns regarding their farming and trading activities. Land-based activities are the main income source of local people in the buffer zones of Vietnam's Bu Gia Map National Park. They plant cash crops such as pepper, rubber, cashew nut, cassava, and coffee trees for their income. Some people buy these agricultural products from farmers and sell to factories or wholesalers. Some communities participate in forest protection activities under the program named "Payment for Forest Environment Services." People also collect forest products for their subsistence and for selling to markets as a way of generating income. The consumption of forest product is popular in the buffer zones of the park, which can either be collected directly from the forest or bought from the local market.

This park adjoins six other protected areas in Vietnam and Cambodia,

creating a large natural habitat for wild animals. There are two types of forest management areas in Vietnam including protected forests (called “special use forest” by the Vietnamese people) and watershed protection forests. The Bu Gia Map National Park is a protected forest covering a total area of 25,925 hectares. All collection activities are prohibited in the core and rehabilitation zones of the park. The Bu Gia Map National Park is adjacent to two watershed protection forests belonging to the Management Boards of Watershed Protection Forests with an area of roughly 12,000 hectares, and they are less strictly protected. People are allowed to harvest dead trees and NTFPs when these collection activities do not affect these forests.

#### **4.2.2. Methods**

##### **4.2.2.1. Sample design**

There are 32 villages in the three communes of the buffer zones of the Bu Gia Map National Park, and only twelve villages border the park. Most of the cases of prosecution for illegal collection activities was concentrated in these villages. Park managers prioritised these villages for their biodiversity conservation programs, and they requested a formal study for a better conservation program in these areas. Based on discussion with park managers about their forest conservation priority, twelve villages bordering with the park were selected to study the consumption patterns of NTFPs. The total population of these target villages was 2,418 households with around 13,500 people. A full list of residents of these villages was compiled to draw a random sample of participants. The names of heads of households were typed into an excel file which could then be stratified by indigeneity. Immigrants and indigenous people amounted to 50.4% and 49.6% of the total population of the villages, respectively. A proportional allocation method was used, with samples sizes from each stratum chosen

to be in proportion to the population sizes. After stratifying the population by indigeneity, all households were assigned random numbers. These numbers were arranged in ascending order of value, and the first 60 and 61 householders were selected for indigenous and immigrant subgroups, respectively. Therefore, the sample consisted of 121 householders, all of whom responded to the questionnaire.

#### **4.2.2.2. Questionnaire design**

The survey of socioeconomic measures was based on the method used by the World Bank (WB) (Grosh & Glewwe, 2000), while the consumption of NTFPs was measured using a questionnaire developed by the Food and Agriculture Organization (FAO) (Bakkegaard et al., 2016). Participants were asked about the categories and amount of NTFPs used, the number of family members and their age, education levels, the area of land used by the household (rent and/or own), crop diversity, indigeneity identity, and their income sources (Characteristics of respondents are given in Table 4-1).

#### **4.2.2.3. Supplementary variables**

A GPS was used to record the location of participants' houses. GPS coordinates were entered the ArcMap 10.3 software package to extract the distances from their houses to the border of the park.

#### **4.2.3. Data analysis**

##### **4.2.3.1. Household overview**

Descriptive statistics, including the sample mean and standard deviation, were calculated for the socioeconomic measures of respondents. The profile of households

was presented as their education levels, age, and family size. Summary statistics of the ethnic composition and income sources of the sample were also presented.

#### **4.2.3.2. Socioeconomic determinants of the amount of NTFPs and consistency**

An ANCOVA test was used to test the consistency of the determinants of consumption patterns across communes and indigeneity identities in the general linear model. Interactions between variables were included to test the difference of socioeconomic factors with regards to communes and indigeneity.

This analysis aims to understand which socioeconomic factors determine the amount of NTFPs consumed. The amount of NTFPs was measured in kilograms, and the natural logarithm of the amount was used as a dependent variable in a general linear regression model that contained seven explanatory variables including ethnicity, commune, family size, age, distance, education level, agricultural income, and the area of land used (rent and/or own). The area of land used by respondents was categorized into three groups: small land use group (less than two hectares), medium land use group (from two to four), and large land use group (larger than four hectares). Scatterplots of all variables were initially examined to check that the general linear model might be appropriate for the data. Collinearity diagnostics were used to detect possible issues with multicollinearity in the fitted model, and residual diagnostics were checked to ensure that the data were consistent with the assumptions of the general linear model, including normally distributed errors, linear relationships, and homogenous variance across the range of fitted values.

#### **4.2.3.3. Socioeconomic determinants of the diversity of NTFPs**

A Poisson log-linear regression model was applied to examine the determinants of the diversity of NTFPs consumed by local people. The diversity is known as the number

of different types of natural forest products, and these categories of NTFPs with their consumption purposes are presented in Table 3. The independent variables used to explain the amount of NTFPs consumed were also used to model the diversity of NTFPs consumed. The Pearson chi-square statistic was used to check the goodness of fit of the model to a Poisson distribution. Interactions between variables were added into the Poisson log-linear regression model to test the consistency of socioeconomic determinants across communes and indigeneity identities studied. The SPSS software package version 25 was used for all statistical analyses.

### 4.3. Results

#### 4.3.1. Overview of households

Table 4-1 - Characteristics of respondents residing in the buffer zones of Vietnam's Bu Gia Map National Park (IP: Indigenous People; IM: Immigrants; N = 121)

Variables	Bu Gia Map		Dak O		Sample Mean (SD) (N = 121)
	IP	IM	IP	IM	
	(n = 39)	(n=41)	(n=21)	(n=20)	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
Amount of NTFPs (kg)	98.84(79.60)	19.62(23.68)	99.67(77.52)	10.08(7.76)	57.47(70.3)
Diversity of NTFP	4.67 (1.69)	3.59 (2.00)	5.05(2.16)	2.35(1.50)	3.96 (2.10)
Distance from homes to the park (km)	1.56 (0.94)	2.09(1.95)	4.24(0.76)	2.97(1.61)	2.44(1.72)
Age of respondents (year)	46.49 (12.18)	47.90(9.19)	40.71(11.88)	42.40(8.77)	45.29(10.9)
Family size of respondents (people)	6.79 (2.62)	4.41(1.41)	6.14(2.65)	4.20(1.28)	5.45 (2.36)
Education level of respondents (year)	3.46 (2.90)	8.27(2.58)	3.95(2.54)	7.55(3.03)	5.85 (3.52)
Land area (rented and/or owned (ha)	1.82 (1.99)	5.76(6.40)	1.01(1.17)	3.87(4.15)	3.93 (3.88)
Agricultural income (\$1,000.00USD)	2.58 (1.92)	8.35(10.81)	2.07(3.34)	9.11(9.92)	5.53 (8.21)

Indigeneity and socioeconomic profiles of respondents are presented in Table 4-1. All respondents were the head of household whose average age was 45.29. The



average family size was around 5.45 people. The indigenous people included Stieng (37.2%) and Mnong (12.4%) while immigrant groups encompassed Kinh (28.9%), Tay (12.4%), Nung (4.1%), Cao Lan (3.3%), Dao (1%), and Muong (1%). The average education level was 5.85 years at school. The main sources of income were farming, daily farm wages, livestock sales, the sale of forest products, retail, and off-farm jobs. A few people were employed by the government as teachers, local officers, and village staff.

#### 4.3.2. Socioeconomic determinants of the amount of NTFPs and consistency

Table 4-2 - Tests of Between-Subjects Effects among Socioeconomic Factors and the Natural Log of Amount of NTFPs consumed ( $R^2 = 0.667$  (Adjusted  $R^2 = 0.643$ ))

Variables	Type III SS	df	Mean Square	F	Sig.	Partial $\eta^2$
Corrected Model	115.237 <sup>a</sup>	8	14.405	28.027	.000	.667
Intercept	21.750	1	21.750	42.320	.000	.274
Education	3.032	1	3.032	5.900	.017	.050
Age of respondents	2.300	1	2.300	4.476	.037	.038
Family size of the household	3.055	1	3.055	5.943	.016	.050
Indigeneity (IP = 0, IM = 1)	13.092	1	13.092	25.473	.000	.185
Land size (Small = 1, Medium = 2, Large = 3)	2.612	2	1.306	2.541	.083	.043
Indigeneity * Land use groups	3.636	2	1.818	3.537	.032	.059
Error	57.562	112	.514			
Total	1564.338	121				
Corrected Total	172.799	120				

An ANCOVA model explained 66.7% of the variation in the amount of NTFPs consumed (Table 4-2). The ANCOVA revealed a significant interaction between indigeneity and land use groups  $F(2, 112) = 3.537$ ,  $p = 0.032$ , partial  $\eta^2 = 0.059$ . This

result indicates that the interaction between indigeneity and land use explained 5.9% of the variation in the amount of NTFPs consumed.

After adjusting for age, education, and family size (by setting them equal to their respective means), there was evidence that indigenous people on small and medium land holdings consumed more NTFPs. The 95% confidence interval for the effect of indigeneity in the small and medium land use groups were 4.889 kg (95% CI, 2.986 kg to 8.004 kg) and 2.455 kg (95% CI, 1.415 kg to 4.259 kg). The effect of indigeneity in the large land use group was not statistically significant, with a difference in adjusted mean of 1.933 kg (95% CI, 0.888 kg to 4.208 kg).

Table 4-3 - Parameter Estimates of the Fitted Model for the Dependent Variable of the Natural Log of Amount of NTFPs Consumed, with the Referent Category Corresponding to Indigenous People on Large Land Holdings

Parameter	$\beta$	SE	t	Sig.	Partial $\eta^2$
Intercept	2.622	.497	5.278	.000	.199
Education	-.062	.025	-2.429	.017	.050
Age of respondents	.014	.006	2.116	.037	.038
Family size of the household	.083	.034	2.438	.016	.050
[Indigeneity = Immigrants]	-.659	.393	-1.679	.096	.025
[Land use group = Small]	.929	.344	2.701	.008	.061
[Land use group = Medium]	.378	.392	.965	.337	.008
[Indigeneity = Immigrants]*[Land use group = Small]	-.928	.411	-2.258	.026	.044
[Indigeneity = Immigrants]*[Land use group = Medium]	-.239	.452	-.528	.599	.002

A general linear model was fitted to the data to test for relationships between socioeconomic factors and the natural logarithm of the amount of NTFPs consumed by local people (Table 4-3). Results for the fitted model ( $R^2 = 0.667$ ,  $p < 0.001$ )

indicated that there was an association between the amount of NTFPs and family size ( $p = 0.016$ ), age of respondents ( $p = 0.037$ ), education level ( $p = 0.017$ ), family size ( $p = 0.016$ ), and the interactions between indigeneity and the small land use group ( $p = 0.026$ ). Parameter estimates for the fitted model can be seen in Table 4-3. These parameter estimates show that the amount of NTFPs used increases 2.53 times if they use less than two hectares of land. One more year of age of the head of household increased the amount of NTFPs by 115.01%. If local people have one more year of education, they reduce their consumption of NTFPs by 93.98%. One additional family member increased the amount of NTFPs by 108.65%. Immigrants who have less than two hectares of land reduced the amount of NTFPs consumed by 39.53%.

#### **4.3.3. Determinants of the diversity of categories of NTFPs**

Respondents used up to 12 different types of non-timber forest products from natural forests. They reported that they consume these forest products for three main purposes: food supplies, medicinal treatments, and rituals. They used bamboo shoots, fruits, leaves, rattan sprouts, fish, insects, amphibians, and crustacean for their daily food supplies because these products were easy to collect. These products were also available on local markets. Large reptiles, birds, and mammals are less common either because they can be sold at expensive prices or require complicated hunting techniques. The bark of trees, fruits, roots, leaves, and mammals are used by local people to make traditional medicine. These NTFPs were also used for rituals and believes such as festivals and worship. Local people also used NTFPs to treat their diseases because they cannot afford access to the modern healthcare system. In short, the use of these products is interchangeable regarding their purpose of consumption because these products can produce daily meals, medicinal treatments, and products essential for cultural identity.

Table 4-4 - Poisson Regression for the Diversity of Categories of NTFPs, with the referent category corresponding to indigenous people on large land holdings

Variables	$\beta$	SE	Sig.	Exp ( $\beta$ )
Intercept	1.832***	.1180	.000	6.246
[Indigeneity = Immigrants]	-.507***	.1036	.000	.602
[Land use group = Small]	-.164	.1220	.179	.849
[Land use group = Medium]	-.277*	.1325	.037	.758

The diversity of NTFPs was modelled as a function of socioeconomic measures using Poisson log-linear regression. The results are summarized in Table 4-4. The scaled Pearson chi-square statistic had a value of 0.995 which is close to one and therefore indicative of a reasonably well-fitting model (Gardner et al., 1995). Interactions between communes, indigeneity and socioeconomic factors were tested, but they were statistically nonsignificant. Statistically significant relationships were found between the number of categories of NTFPs and indigeneity ( $p < 0.001$ ) and land area used by respondents ( $p = 0.011$ ). Immigrants use 60.5% less of the categories of NTFPs compared to indigenous people. The medium land use group reduce their diversity of categories of NTFPs by 75.8%.

#### 4.4. Discussion

In this study, I found that socioeconomic factors and indigeneity identities play an important role in determining the consumption patterns of NTFPs. Socioeconomic factors can explain the consumption of the amount of NTFPs in the buffer zones of Vietnam's Bu Gia Map National Park. Indigenous people who belong to small and medium land use groups are different from others in the consumption of NTFP while small land use immigrants consumed the least NTFPs. The medium land use group used a smaller number of categories of NTFPs than the small and large land use

groups. Consumption also decreased with increasing education levels but increased with family size and the age of the head of households. Finally, indigenous people and immigrants had different consumption patterns in terms of both amount and diversity, in the buffer zones of the Bu Gia Map National Park. Indigenous people consumed more NTFPs than their counterpart immigrants as measured by both amount and diversity.

The first hypothesis assumed that socioeconomic factors are associated with the amount of NTFPs consumed. My observations showed that socioeconomic factors can be used to understand the consumption of the amount of NTFPs. Four important socioeconomic factors that explained the consumption of the amount of NTFPs include family size, land area, education level and the age of the head of household. NTFPs play an important role in providing food supplies, and larger families consume more products than smaller households (Arnold & Pérez, 2001; Byron & Arnold, 1999). This relationship has been observed by researchers in Asia and Africa where family size increases the consumption of natural forest products (Hegde & Enters, 2000; Masozera & Alavalapati, 2004). In addition, the small land use group consumed much more NTFPs than the large and medium land use groups. Land area is an important factor that determines the socioeconomic status of people who rely on land-based income sources. In land-based income communities, smaller land holdings do not allow them to cover their basic needs and they rely on forest products for food supplies or to earn additional income (Dash & Behera, 2016; Heubach et al., 2011). Other researchers found similar trends in Ethiopia, Benin and India where small land use groups consumed more NTFPs (Dash & Behera, 2016; Heubach et al., 2011; Melaku et al., 2014). Education levels also had a negative relationship with the amount of NTFPs consumed. Increased education helps local people better manage their

household economies and increases off-farm job opportunities, reducing their reliance on products from natural forests for food security. Also, the increase of education level may raise villagers' awareness of existing laws and regulations on the extraction of NTFPs, meaning that people are less likely to exploit natural forests for their consumption. This result corroborates the findings of many studies that found education attainments reduce the amount of NTFPs consumed in India and Nigeria (Chukwuone & Okeke, 2012; Mitra & Mishra, 2011). The age of the head of household had a positive relationship with the amount of consumption of NTFPs. This finding agrees with other studies that the age of the head of household often changes consumption patterns of NTFPs (Chukwuone & Okeke, 2012; Luiselli et al., 2017; Paumgarten, 2005; Sakai et al., 2016). Together with previous studies, the findings of this study suggest that socioeconomic factors are robust determinants of the consumption of the amount of NTFPs regardless of the mixed population of indigenous people and immigrants. However, I did not focus on the way people obtained these products (buying or collecting from natural forests). Examining the link from consumption patterns to the exploitation of these NTFPs within natural forests may better illustrate the impacts of local people on protected areas. Future studies should identify the determinants of the collection and purchase of these products to identify the links from consumption patterns to their impacts on natural forests.

Surprisingly, the medium land use group was statistically significantly different from the small and large land use groups in the number of categories of NTFPs consumed. While the increase of socioeconomic factors may reduce the amount of NTFPs consumed because of food demand, it does not necessarily reduce the diversity of NTFPs used because these products may be luxury food for wealthy people (Cavendish, 2000; Drury, 2011; Twine et al., 2003). Vietnam is a status

conscious society where people demonstrate their social position by consuming luxury food and expensive goods (Drury, 2011). When people are poor, they consume NTFPs because they are a source of cheap food, but when they have more money they still use these products as fresh food supplies, although they may increase the diversity of food types used (Cavendish, 2000; Drury, 2011; Paumgarten & Shackleton, 2009). This study contradicts observations from Ke Go Nature Reserve in Ha Tinh province in Vietnam where the medium land use group relies more on natural forest products (McElwee, 2008b). In Bu Gia Map National Park, the medium land use group may devote time and money to land cultivation, while the small land use group may spend more time collecting forest products for their consumption. In the meantime, the large land use group may spend money to buy forest products as luxury goods to show off their social status (Cavendish, 2000; Drury, 2011; Twine et al., 2003). Therefore, further studies need to examine the reasons why there was no difference in the diversity of NTFPs consumed between the small and large land use groups.

My second hypothesis assumed that households proximate to the forest consume more NTFPs. Unpredictably, geographical features (distance to the park and residential communes of households) are not statistically significant in explaining the consumption of NTFPs. These findings appear to contradict to other studies that indicate the significance of geographical features (Brashares et al., 2011; Chukwuone & Okeke, 2012; Dang & Tran, 2006). This may be because previous studies examined the direct collection of NTFPs for sales, meaning that access may allow people to have different gathering levels (Adhikari et al., 2004; Brashares et al., 2011). My results agree with the study conducted by Mitra and Mishra (2011) that found no difference in the amount and diversity of categories of NTFPs consumed by local people with regards to distance between respondents' homes and forests. The findings of this study

suggest that geographical factors may be unstable predictors in understanding and predicting the NTFPs consumed by local people. This result demonstrates that applying geographical features is not robust for the management of natural forests because of the consumption of these products beyond the buffer zones of protected areas. Conservation activities should be applied beyond the border of the buffer zones of protected areas.

After adjusting for socioeconomic and geographical factors, the results of this study supported my hypothesis that there are differences in the consumption of NTFPs, in terms of amount and diversity, between indigenous people and immigrants in their areas of coexistence. Indigenous people have a good knowledge of their surrounding environment regarding the consumption of species for food supplies, medicinal treatments, and culture. This study concurs with many studies that found a difference in forest utilization based on indigeneity across the world (Coulibaly-Lingani et al., 2009; Laird et al., 2011). For example, in Cameroon, indigenous people consume more NTFPs than their counterpart immigrants (Laird et al., 2011). There may be several explanations for the differing results. The main goal of immigrants is to boost their economic status, and forest products may play an important role when initially resettled (Gubbi & MacMillan, 2008; Reyes-García et al., 2012). But once they are settled in their new environment, they use less NTFPs than their counterpart indigenous people because they can make their living from farming activities. Indigenous people live in their native land and inherit knowledge of the surrounding environment from their ancestors (Gadgil et al., 1993). Traditional knowledge combined with their close cultural relationship with natural forests means that they know which species are edible or useful for medicine or worship (De Caluwé et al., 2009; Gadgil et al., 1993; Laird et al., 2011; Narendran et al., 2001). This study joins



the literature that shows the difference in the consumption of NTFPs between indigenous people and immigrants (Coulibaly-Lingani et al., 2009; Laird et al., 2011).

Interestingly, the immigrants with small land holdings consumed less NTFPs than indigenous people who had large land holdings. Immigrants have less access to NTFPs than indigenous people because they have limited rights for making use of natural resources (Coulibaly-Lingani et al., 2009). In the Philippines, immigrants use even more NTFPs for their families as income sources (Lacuna-Richman, 2003). Unfortunately, forest policies often prioritize access to natural forests for indigenous people regardless of the important role of forests in providing food security for poor immigrants. Therefore, further study needs to examine the impact of current forest policies on immigrants to better understand their consumption patterns regarding their reliance on NTFPs.

The effects of the interactions of land use and indigeneity on the consumption of NTFPs is one of the important issues that should be used to make a better intervention. Land area may play an important role in determining the income of farmers (Dash & Behera, 2016; Heubach et al., 2011) while indigenous people who lease out their land may reduce their cultivation outputs (Codjoe, 2006). The consumption of NTFPs is especially important for indigenous people who belong to the small and medium land use groups. This may be because the movement of income from the small to large land use groups occurs via informal cashew nut rental markets in the buffer zones of the Bu Gia Map National Park where indigenous people and immigrants play the roles of lessors and lessees, respectively. Therefore, current interactions between indigeneity and land used by local people should be the target for interventions to ensure the long-term biodiversity conservation and economic development programs at the local level.

My observations do not support the last hypothesis that assumed the determinants of consumption patterns were inconsistent across communes. None of the interactions between the commune and indigeneity, or the commune and socioeconomic factors were statistically significant. The findings of this study contradict the conclusions of other studies in Africa where consumption was not consistent with geographic location (Brashares et al., 2011; Fa et al., 2009). The two communes near Bu Gia Map National Park have similar demographic structures and economic activities. Therefore, they have invariant socioeconomic determinants of the consumption patterns of NTFPs.

Local policymakers need to create interventions based on indigeneity identities and socioeconomic factors. First, as interactions between indigeneity and land use are current issues, forest managers need to support indigenous people with small and medium land holdings and immigrants with small land holdings when they create protected areas because these products may be meaningful for cultural activities and subsistence (Becker & Ghimire, 2003). This problem is especially sensitive for people in the protected areas where buffer zones exist in name only because they have no place to secure their food supplies rather than the national park, and conflicts may arise when they collect NTFPs from protected areas (McElwee, 2010). Second, it is important for local managers to use socioeconomic factors including family size, education and the area of land used by respondents to inform their interventions for the reduction of NTFP consumption (Dollacker & Rhodes, 2007; Meyfroidt & Lambin, 2008; Şekercioğlu, 2012; Völker & Waibel, 2010). Possible economic support should focus on land management because the success of integration of land into biodiversity conservation has been observed by other authors (Dollacker & Rhodes, 2007; Meyfroidt & Lambin, 2008). Four hectares of cultivation land should

be a critical ceiling for future economic support for indigenous people at the local level. Viable support activities could be the improvement of their land cultivation or restructuring their crop compositions to gain enough income that covers their yearly expenses (Dollacker & Rhodes, 2007; Meyfroidt & Lambin, 2008). Education should be the focus in the longer term because this factor can provide more off-farm job opportunities and increase people's ability to manage their household economy. However, short-term interventions could provide additional unskilled off-farm job opportunities, reducing demand on the consumption of NTFPs (Şekercioğlu, 2012).

#### **4.5. Conclusion**

In this study, I assumed that socioeconomic factors, geographical features and indigeneity are important determinants of the consumption of NTFPs in the buffer zones of Vietnam's Bu Gia Map National Park while these determinants are inconsistent across buffer zone communes. My observations supported two hypotheses that socioeconomic factors and indigeneity determine the consumption of NTFPs. The interactions between indigeneity and land area used help explain the variations of the consumption of NTFPs. While NTFPs are important for indigenous people belonging to the medium and small land use groups, immigrants with small land holdings use the least amount of NTFPs. In addition, the small and large land use groups use a much higher diversity of NTFPs than the medium land use group. This study highlights the role of interactions of indigeneity and land use in the consumption of NTFPs. Further studies need to examine the interactions between land use and indigeneity with consumption and the reason why the medium land use group uses fewer categories of NTFPs than their counterpart small and large land use groups. My results highlight the need for policies that support immigrants who have less than two hectares of land, and agricultural training for all villagers with less than four hectares.

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## **Chapter 5 – Socioeconomic Profiles of Timber Consumers in the Buffer Zones of Vietnam’s Bu Gia Map National Park**

### **5.1. Introduction**

The demand for timber created by end users encourages villagers, wholesalers, and local officials to participate in illegal logging and trafficking activities (Gunes & Elvan, 2005; Harrison et al., 2015; McElwee, 2004; Sikor & To, 2011; To & Sikor, 2006). Since 1993, the Vietnamese government has promulgated logging bans in all natural forests, but this approach failed to curb illegal logging in the country, and more than half of timber for sale (mainly for construction and furniture) in the market is provided by illegal logging (Lang, 2001; McElwee, 2004; Sikor & To, 2011; To & Sikor, 2006). In 2014, the government applied a logging ban to prohibit the cutting of trees from natural forests, and this ban was extended to include the Forest Certification Scheme for certified forests in the Central Highlands, a deforestation hotspot in Vietnam (Crowther et al., 2020). Also, the government promulgated the new Forestry Law and signed the Vietnam – EU Voluntary Partnership Agreement to comply with the Forest Law Enforcement, Governance and Trade (FLEGT) Action Plan of the EU signed in 2003 (Crowther et al., 2020; Pham et al., 2019). However, small-scale illegal logging has been observed in many protected areas across Vietnam because of insufficient law enforcement in these areas (Hoang et al., 2011; Jestrzanski et al., 2013; Pham et al., 2019; Wikle & Nguyen, 2013). The timber is then legalized before local carpenters use it to produce furniture, where legalization is a process where loggers and traders bribe local officials with money to make sure that illegal timber is safely transported to and processed in local carpenters’ workshops (McElwee, 2004, 2010; To, 2015; To & Sikor, 2006). The failure of the logging ban requires local forest managers and conservationists to find additional approaches to restrict the demand for illegally

harvested timber from natural forests. Since socioeconomic factors may be linked to the consumption patterns of timber from natural forests (De Medeiros et al., 2012; Gunes & Elvan, 2005; Haripriya & Parikh, 1998), one possible approach is to develop interventions based on the socioeconomic profiles of consumers. However, not enough is known about the relationships between socioeconomic factors and consumption patterns of timber at the household level in Vietnam and more generally (De Medeiros et al., 2012; Ramos et al., 2014; Ramos et al., 2015).

In Vietnam, households prefer to use timber from natural forests rather than from plantations. Timber from natural forests often has eye catching grain texture, a high level of strength and durability, and a high level of rarity. The demand for natural timber is created by consumers from both rural and urban areas, leading to high pressure on natural forests (McElwee, 2010; Nguyen, 2008). The demand for timber from natural forests encourages villagers and traders to traffic logs from these sources to satisfy the devour market (McElwee, 2004; To & Sikor, 2006). The consumption of timber in urban areas is exclusive to rich families, and urban citizens prefer rare and precious timber (Nguyen, 2008). Rural people, however, use different species that are at a lower level of rarity, and the exclusive product is mainly consumed by rich households (McElwee, 2010; Nguyen, 2008). Therefore, the consumption of diversity of species in rural areas may provide another picture of impacts on the environment in comparing to urban citizens, and their consumption may have close relationships with the socioeconomic status of households.

Socioeconomic profiles are important indicators that distinguish between different forest consumer populations, enabling managers to develop targeted and relevant intervention strategies. Forest products may be exotic and exclusive, enabling richer people to demonstrate their social status, or they can provide important basic

needs for poorer households (Cavendish, 2000; Nguyen, 2008; Sunderlin & Huynh, 2005). Based on this understanding, forest managers can develop interventions such as economic development, biodiversity conservation education or law enforcement programs for different socioeconomic groups. Socioeconomic profiles are used as important criteria for the targets of integrated conservation and development projects in Asia, Africa, and Latin America (Hughes & Flintan, 2001). Therefore, examining timber consumed by households by using socioeconomic profiles can be useful for forest managers to define the groups that may have the highest impact on illegal logging.

Socioeconomic factors such as land ownership and income have been successfully used to understand the consumption patterns of timber at the household level (Baba et al., 2016; De Medeiros et al., 2012; Mitra & Mishra, 2011). Previous studies indicate that land sizes are a good proxy of wealth status in land-based economies, and they have a positive relationship with the utilization of timber from natural forests (Baba et al., 2016; Mitra & Mishra, 2011). In the Delta of Red River in Vietnam, timber is usually consumed more by richer and higher social classes because they can afford to buy artistic furniture and woodcarving products (Nguyen, 2008). Household income has also been found to have a close relationship with the demand for timber, but the pattern is inconsistent at the global scale (Baba et al., 2016; De Medeiros et al., 2012; Mitra & Mishra, 2011). For example, in the Northeast of Brazil, an increase of household income reduces the consumption of timber from natural forests (De Medeiros et al., 2012) while income is positively correlated with the demand for timber in India (Baba et al., 2016; Mitra & Mishra, 2011). The inconsistency of timber usage patterns may result from the differences in cultural contexts. Therefore, it can be useful to examine the relationships between socioeconomic factors and the utilization

of timber at the household level around protected areas under the context of mixed cultural identities.

Social and cultural milieus can influence the use of timber from natural forests. Wooden furniture styles and designs can illustrate the spirit and cultural identities of households (Liu et al., 2013; Puspita et al., 2016), and different cultural styles of wooden furniture may require different amounts of timber because they vary in size (Liu et al., 2013; Nguyen, 2008; Ramos et al., 2016; Suprobo & Santosa, 2017). Styles and sizes of wooden items may differ between indigenous people and immigrants because they have different knowledge of and relationships with woody species from natural forests (Laird et al., 2011). Furthermore, indigenous people have a long period of coexistence with natural forests, and some studies indicate that indigenous people consume more forest goods than their immigrant counterparts (Laird et al., 2011; McElwee, 2010; Nguyen et al., 2019b). Indigenous people make use of these resources for income, food supplies, construction materials, and other domestic utilities (Huynh et al., 2003; Laird et al., 2011; Nguyen et al., 2019a). Since indigenous people rely on natural forests for their livelihood, they may also consume more timber for their households to build houses and make domestic furniture items.

The proximity of villages to markets may also play an important role in determining the consumption of timber from natural forests. People who live nearer markets may have more options to substitute forest products by using goods that are available for purchase, reducing their reliance on natural resources (Howell et al., 2010; Masozera & Alavalapati, 2004; Schaafsma et al., 2014). Empirical studies indicate that distances from households to markets have a close relationship with the use of forest products (Masozera & Alavalapati, 2004; Mitra & Mishra, 2011; Schaafsma et al.,



2014). For instance, in India, people who live near markets consumed less timber than those who live far from these areas (Mitra & Mishra, 2011). The role of proximity to markets may be better understood when it is considered in the context of socioeconomic status and cultural identity of consumers.

Studies on timber at the household level have not distinguished between timbers collected for the different usage purposes of construction and furniture. Research on timber is often mixed in with other forest products such as edible food, medical plants, fodders, and general knowledge of plants among villagers at the household level (De Medeiros et al., 2012; Mitra & Mishra, 2011; Ramos et al., 2014). While these studies have contributed significantly to the understanding of the consumption of timber, they are incomplete with regards to the consumption purposes in cultural and social contexts. In India, several studies analyse the consumption of timber, but they do not examine the usage purposes of this product within households (Baba et al., 2016; Mitra & Mishra, 2011). In Brazil, one study analyses the relationship between socioeconomic factors and the consumption of timber for different purposes at the household level, but furniture is mixed with tools (De Medeiros et al., 2012). None of these studies consider the consumption of timber in the cultural context that may affect consumption purposes (Baba et al., 2016; De Medeiros et al., 2012; Mitra & Mishra, 2011). In Vietnam, previous studies only estimate the average amount of timber used by households for their domestic use (McElwee, 2010; Nguyen & Harwood, 2017). Several studies indicate that woodcarving products are used by the rich and higher social status classes (Nguyen & Harwood, 2017; Nguyen, 2008). These studies did not segment families by examining the relationships between their socioeconomic factors and the consumption purposes of timber products for construction and furniture. Therefore, it is worthwhile to understand the consumption purposes of timber for construction and furniture in

cultural contexts because it may represent different dynamics of use and collection (Ramos et al., 2014).

In this study, I conducted interviews with local people in the buffer zones of Vietnam's Bu Gia Map National Park in order to quantify the relationships between socioeconomic factors and timber consumption in an area of coexistence of indigenous people and internal immigrants. I examined the use of timber for construction and furniture based on socioeconomic factors with the following hypotheses: (1) higher socioeconomic households consume more timber than medium and low socioeconomic families; (2) indigenous people use more timber than their immigrant counterparts; and (3) villagers in the Dak O commune, with easier access to markets, consume less timber than their villager counterparts in the Bu Gia Map commune, with harder access to markets. This study was conducted in the buffer zones of Vietnam's Bu Gia Map National Park because this area has experienced a long period of coexistence of indigenous people and immigrants, and because the forest managers are concerned about illegal harvest in these protected forests.

## **5.2. Materials and methods**

### **5.2.1. Study site**

In 2002, Bu Gia Map National Park was upgraded from a Nature Reserve in order to better protect the remaining natural forests in a transitional area from the Central Highlands to Southeast of Vietnam. The park is located at (12.1154° N, 107.2430° E) in a mountainous area at an altitude of around 300m above sea level, which is in the North of Binh Phuoc province. Bu Gia Map National Park is within the home range of many hardwood trees that provide natural habitat for many endangered wild animals such as yellow-cheeked crested gibbons, black-shanked douc langurs, Asian elephants,

and other globally threatened species. There are many endangered hardwood species in the park such as *Dalbergia oliveri*, *Afzelia xylocarpa*, *Pterocarpus macrocarpus*, *Hopea odorata*, and other globally threatened plants. They are threatened due to the demand among locals for high-quality timber with eye-catching grain texture and durability.

Bu Gia Map National Park plays an important role in conserving biodiversity and maintaining the environment at the national and international levels. The park combined with six other protected forest areas in the region creates a green corridor crossing the border between Vietnam and Cambodia. The park has a total area of 25,925 hectares of protected forests, and Management Boards of Protection Forest manage roughly 12,000 hectares of watershed protection forests. These forests contribute to protecting the upstream forests of dams and hydropower plants in the region.

Since the end of the American war in 1975, the demography of the buffer zones of the Bu Gia Map National Park has been radically changed by the migration policy of the Vietnamese government and spontaneous movement of people from across the country. Before 1975, indigenous people, Stieng and Mnong, resided in the buffer zones of the Bu Gia Map National Park, and they relied on natural forests for food supplies and cultural amenities. Indigenous people cut down bamboo to generate their income or pointed out the location of hardwood trees for immigrants (Gregerson & Thomas, 1980). They planted upland rice, corn, bean and other food crops for their sustenance. Since 1975, immigrants have moved into the buffer zones of the park to search for new economic opportunities. Over the last four decades, the population of this area has changed significantly regarding ethnicity composition and demographic. There are approximately 30,000 people from twelve ethnic groups residing in the buffer zones of

Bu Gia Map National Park (Nguyen et al., 2019b). Indigenous people have also switched from slash and burn to intensive farming systems. Food crops have been replaced by cash crops such as rubber trees, cashew nuts, pepper, coffee and cassava (Gregerson & Thomas, 1980; Nguyen et al., 2019b).

In this study site, there have been no observations of people using fuelwood from natural forests because of the availability of alternatives. Local people use electricity, gas, and pruned branches of coffee, rubber, and cashew nut trees for cooking and heating. Some wooden items are important for ritual and worship, but because the study site includes people of different cultures, I use the term wooden furniture to represent items used for both furniture and rituals. I examined timber from natural forests for use in construction and to make wooden furniture.

### **5.2.2. Sample design**

There are three communes in the buffer zones of the Bu Gia Map National Park including Bu Gia Map, Dak O (Binh Phuoc province), and Quang Truc (Dak Nong province). Quang Truc is much further away from the border of the Bu Gia Map National Park, so it was excluded from the study. Twelve villages bordering Bu Gia Map National Park were selected for the study because park managers reported that people who violate the forest law mainly live in these areas. I selected eight and four villages in Bu Gia Map and Dak O, respectively. These villages are the target of current biodiversity conservation efforts by park managers. There were 2,418 households with about 13,500 people in these villages from 12 ethnic groups. The names of the heads of all households were collected from the heads of villages to create the full list of the population. This list formed the sampling frame from which a random sample of households was drawn. Indigenous people and immigrants accounted for 49.4% and

50.4% of the total population of these villages, respectively. A proportionate stratified sampling method was employed to create a sample with the same fractions of indigeneity as the total population. The individuals of the list of each population subgroup were randomly numbered, and they were numerically ordered. Respondents were selected for indigenous and immigrant population subgroups with 60 and 61 households, respectively. As a result, the sample had 121 participants accounting for 5% of the total population of the study site. All interviewees responded to the surveys conducted in the field because I have worked in local communities for 15 years and is respected. That is, I achieved a 100% response rate from participants, all of whom answered all questions about their households' consumption of timber.

### **5.2.3. Questionnaire design**

The survey was developed using survey forms designed by the World Bank and the Food and Agriculture Organization (Bakkegaard et al., 2016; Grosh & Glewwe, 2000). The survey included information related to the amount of timber used for wooden furniture and construction, origin of wooden items, wooden furniture categories, age of the head of household, number of family members, education levels, landowning sizes, crop diversity, whether the family was indigenous or of immigrant origin, occupation, and their length of residency. In the land-based income areas, agricultural land and crops significantly affect income of farmers, and they were used as indicators of the economic status of households. In Vietnam, farm size varies because population density is unevenly distributed across regions and provinces (Ha et al., 2006; Marsh & MacAulay, 2003; Tran et al., 2000). A study in Nghia Trung commune that is near the Bu Gia Map National Park found that poor households own less than two hectares of land while rich households own more than four hectares of land (Ha et al., 2006). Thus,

I divided landowning size into three categories: small (less than 2 hectares), medium (from 2 to 4 hectares), and large (larger than 4 hectares). Like landowning size, diversity of crops is also a strong indicator for the income of farmers (Chand, 1996; Di Falco & Perrings, 2003; Pellegrini & Tasciotti, 2014); therefore it was also included as a predictor for the consumption of timber (Definitions of variables are in Table 5-1).

Table 5-1 - Definitions of variables

Variables	Definitions
Landowning size	The area of land owned by households, which includes untitled, titled land that is currently under cultivation or rented out (Large > 4 hectares, medium 2 – 4 hectares, small < 2 hectares)
Indigenous people	People native to the study site including Stieng and Mnong people
Immigrants	Other ethnic groups that have moved into the study site from other areas
Diversity of crops	The number of crops grown by households
Family size	The number of people in a family
Furniture timber	Timber used for wooden furniture such as tables, chairs, beds, stools, wardrobes etc.
Construction timber	Timber used for construction such as poles, fences, windows, roofs etc.
Commune	The second smallest territory for administrative purposes in Vietnam
Distance to the park	Direct distance from home of respondents to the border of the park
Distance to the main road	Direct distance from home of respondents to the main road

Surveys were conducted in person at the most convenient time for all respondents at their homes when they were free from work. All interviewees were the heads of households, with the support of their spouses and/or other family members. The data for this article were extracted from a larger study and not all the data collected

in the interviews is presented in this article. A camera was used to take pictures of timber and wooden furniture items used by respondents. Guided tours of houses are a good technique for the survey of wood use at the local level (Ramos et al., 2014). Before each survey, I took a tour around the home of respondents. Fortunately, no one refused the tour, and I could go everywhere within their houses. During the tour, a camera and a tape measure were used to collect essential information related to dimensions of wooden furniture items which is to determine the volume in cubic meters. The camera was used to take pictures of wooden furniture items in every room. The dimensions of furniture items, raw timber, and wooden houses were measured to estimate the volume of timber. Some wooden columns were buried under the ground, and respondents were asked about the depth of the hole. For natural shaped or stump-based furniture items, all dimensions were measured, and their pictures were taken at different angles. After that, the amount of timber in cubic meters was calculated based on the information provided by interviewees. When people build their houses, they often use a notebook to record all required materials and expenses. The contents of these notebooks were captured using a camera to determine the amount of timber used if it was available. After the tour (around one and a half hours), respondents were asked about the species of wood, origin of wooden furniture, timber, and the amount of timber that was used. Wooden furniture items made of non-native species were excluded. In addition, the photographs and dimensions of wooden furniture items, houses, timber stacks, and round wood were shown to three local carpenters who assisted with the estimates of the amount of timber reported by participants.

### **Supplementary variables**

A handheld GPS was used to record the coordinates of the locations of the houses of participants. These coordinates were analysed using ArcGIS v.10.3 to determine the

distances from the houses of respondents to the border of the park and to the main road. The former represents access to forests while the latter represents access to goods, commodities, and other services.

#### **5.2.4. Data analysis**

##### **Household overview**

Descriptive statistics were calculated to provide an overview of households in the study. These descriptive statistics illustrate income, education levels, family size, indigeneity, age of the head of the household, land size ownership, and the length of residency.

##### **Sources of timber consumed by respondents**

Descriptive statistics were applied to understand the proportion of timber used by local people from different sources. Also, the number of woody species was listed based on information reported by respondents in the surveys.

##### **Socioeconomic and indigeneity determinants of furniture and construction timber**

An ANCOVA was used to identify important socioeconomic factors variables with regard to timber consumption, as well as interactions among those socioeconomic factors and commune and indigeneity groups. The amount of timber was calculated in cubic meters, and common logarithms of furniture and construction timber volumes that normalize the distribution of timber consumption among households were used as response variables. There were eight explanatory variables including indigeneity identities, residential communes, family size, age of the head of the household, distance to the national park, distance to the main road, highest education in the family, diversity of crops, and land size owned by respondents. Scatterplots were used to check that the



general linear model was appropriate for the data. Multicollinearity was checked by applying collinearity diagnostics. Residual diagnostics were checked to see if the data were consistent with the assumptions of the general linear model, including normally distributed errors, linear relationships, and homogenous variance across the range of fitted values.

## 5.3. Results

### 5.3.1. Overview of households

Table 5-2 - Socioeconomic characteristics of households of the sample in the buffer zones of Vietnam's Bu Gia Map National Park (N = 121)

Variables	Mean	Std. Deviation
Age of the head of household (year)	45.29	10.90
Family size of respondents (people)	5.45	2.36
Highest education level in household (year)	9.79	3.50
Education level of heads (year)	5.85	3.52
Diversity of crops (number of crops on their land)	1.74	1.09
Park Distance (km)	2.44	1.72
Road Distance (km)	2.35	1.76
Land Ownership (hectare)	3.93	3.87
Diversity of wooden furniture categories (number)	6.93	4.85
Amount of timber for furniture (m <sup>3</sup> )	1.81	2.12
Amount of timber for construction (m <sup>3</sup> )	5.37	4.65

Variables measured by the survey and the means and standard deviations of household characteristics are presented in Table 5-2. The average age of the head of households in the sample was 45.29 years, with an average education level of 5.89 years

of formal schooling. Family sizes across the sample averaged 5.45 members. Family members earned their incomes from cash crops, husbandry, forest activities, and daily labour wage. A few people were employed by the government, but their salary had little contribution to their household economies.

### **5.3.2. Sources of timber consumed by respondents**

All interviewees reported that they owned furniture made of timber from hardwood trees that grow in natural forests. Respondents reported that they made use of timber from 18 woody species that are native to Bu Gia Map National Park and its surrounding vicinities (Appendix 1). These trees are slow-growing species with long planting rotations. They used timber from stumps, roots, trunks, and branches to create wooden items. No respondents could show certificates that present any evidence of the legal status of the timber or wooden products within their houses.

Respondents reported that their timber was provided by five sources including the Bu Gia Map National Park, forests in the buffer zones, local carpenters, sawmills, and illegal loggers. Most of the respondents used more than one source of timber, and some of them consumed timber from all five sources. While 39 (32.2%) respondents said that their timber originated from the national park, 80 (66.1%) people reported that they collected timber from forests in the buffer zones. Respondents also said that their timber was provided by local carpenters, and 102 (84.3%) people used wooden furniture from this source. Forty (33.1%) people responded that they bought their timber from local sawmills. Finally, 32 (26.5%) respondents used timber provided by illegal loggers.

### **5.3.3. Socioeconomic, indigeneity, and geographic determinants of furniture timer**

An ANCOVA was used to test the effects of socioeconomic, indigeneity, and geographic factors on the consumption of timber for furniture (Table 5-3) and

construction (Table 5-4). Eta squared ( $\eta^2$ ) indicates the proportion of variance associated with one or more main effects, errors or interactions of variables in ANCOVA. For both furniture and construction timber consumption, the socioeconomic factors land-size owned, and diversity of crops were statistically significant at the 0.05 level. After controlling for socioeconomic factors, indigeneity and commune were found to be related to the consumption of furniture timber, whereas only indigeneity was related to the consumption of construction timber. Interactions among the socioeconomic factors and both indigeneity and commune were found to be nonsignificant, indicating that the effects of the socioeconomic variables were consistent across these groups.

Table 5-3 - ANCOVA test of between-subject effects on the consumption of timber for furniture ( $R^2 = 0.467$  (Adjusted  $R^2 = 0.444$ ),  $F = 20.174$ ,  $p < 0.001$ )

Source	Type III SS	df	Mean Square	F	Sig	Partial $\eta^2$
Corrected Model	11.106	5	2.221	20.174	.000	.467
Intercept	.501	1	.501	4.553	.035	.038
Indigeneity	1.972	1	1.972	17.907	.000	.135
Commune	.608	1	.608	5.518	.021	.046
Landowner Groups	1.519	2	.760	6.898	.001	.107
Diversity of Crops	.902	1	.902	8.196	.005	.067
Error	12.662	115	.110			
Total	24.309	121				
Corrected Total	23.769	120				

Table 5-4 - ANCOVA test of between-subject effects on the consumption of timber for construction ( $R^2 = 0.405$  (Adjusted  $R^2 = 0.385$ ),  $F = 19.756$ ,  $p < 0.001$ )

Source	Type III SS	df	Mean Square	F	Sig.	Partial $\eta^2$
Corrected Model	20.452	4	5.113	19.756	.000	.405
Intercept	.123	1	.123	.474	.492	.004
Indigeneity	10.106	1	10.106	39.048	.000	.252
Landowner Groups	3.352	2	1.676	6.477	.002	.100
Diversity of Crops	4.131	1	4.131	15.961	.000	.121
Error	30.022	116	.259			
Total	72.669	121				
Corrected Total	50.474	120				

The ANCOVA model explained 46.7% of the variation in the amount of furniture timber consumed by villagers, indicating that there may be other important determinants of consumption that were not included in the present study. The parameter estimates for the ANCOVA model (Table 5-5) indicate that immigrants use almost twice (190%) as much timber for furniture construction than indigenous people. People who live in the Bu Gia Map commune used 45% more (145%) timber than people who lived in the Dak O commune. For every unit increase in crop diversity the consumption of timber for furniture increased by 26% (126%). The difference in the amount of furniture timber consumed by the small and medium landowner groups, compared to the large landowner group, was statistically significant, though there was no discernible difference in consumption between these two groups. The small landowner group was estimated to use 48% as much timber as the large landowner group, and the medium landowner group used 68% as much.

Table 5-5 - Fitted ANCOVA models with common log transformation of furniture and construction timber as dependent variables (n=121). \* = significant at 0.05 level, \*\* = significant at 0.01 level, \*\*\* = significant at 0.001 level, coefficient (standard deviation)

Variables	Furniture Timber	Construction Timber
(Constant)	-0.040 (0.090)	0.489 (0.135)***
Indigeneity (IP = 0, IM = 1)	0.279 (0.066)***	-0.631 (0.101)***
Commune (Dak O = 0, Bu Gia Map = 1)	0.162 (0.069)*	N/A
Small Landowner	-0.315 (0.085)***	-0.368 (0.127)**
Medium Landowner	-0.169 (0.080)*	0.059 (0.122)
Diversity of crops	0.100 (0.035)**	0.212 (0.053)***

The ANCOVA model for the consumption of timber for construction shows that independent variables explained 40.5% of the variation. The parameter estimates for the ANCOVA model (Table 5-5) indicate that immigrants use 23% (123%) as much timber as indigenous people. For every unit increase in crop diversity the consumption of timber for construction increased by 63% (163%). Finally, the small landowner group used 43% as much construction timber as the large landowner group.

## 5.4. Discussion

In this study I found that the consumption patterns differed between timber used for construction and timber used for wooden furniture. The large landowner group used more timber for furniture while both the large and medium landowner groups used more timber for construction. When I compared the number of crops grown, which is a different proxy for the socioeconomic status of households, I found that more crops led to an increase in timber used for both construction and furniture. Indigenous people did use more timber for construction, but they used less timber for furniture. Finally, the

village with better access to markets used less timber for furniture. There was no difference between villages in the use of construction timber.

My observations confirmed the first hypothesis that higher socioeconomic households consume more timber, especially if it was used for wooden furniture. In areas such as this with land-based incomes, land size and crop diversity are robust proxies for the socioeconomic status of people because they significantly contribute to the income of households (Di Falco & Perrings, 2003; Pellegrini & Tasciotti, 2014). Land is a robust indicator for the economic status of households because this productive asset often associates with the increase of income. Also, more crops lead to the higher consumption of timber from natural forests because the diversity of crops also has positive relationships with the income of households (Di Falco & Perrings, 2003; Pellegrini & Tasciotti, 2014). Timber from natural forests is often expensive, and wooden products from these resources are exclusive to richer people (Bui et al., 2005; Nguyen & Harwood, 2017; Nguyen, 2008). The results of this study are consistent with previous findings that found positive relationships between the socioeconomic status and consumption of timber products from natural forests (Baba et al., 2016; Mitra & Mishra, 2011; Nguyen & Harwood, 2017; Nguyen, 2008). These results suggest that managers of forests and conservation projects need to target higher socioeconomic households to induce them to abandon their consumption of timber from natural forests. Because the collection of timber from protected areas is illegal, respondents may not have been completely truthful about where their timber came from. Although some people admitted their direct collection of timber from the Bu Gia Map National Park, other people may have hesitated to reveal their illegal logging activities. This problem can be solved by conducting indirect questions to probe for better information in future studies.

There was no difference between the large and medium landowner groups in the consumption of timber for construction. This may be explained by the lower costs associated with construction as compared to furniture making, both in labour and in the types of timber required. Construction materials do not require timber with good grain texture, and buildings often have a simple, low price design, meaning that the medium landowner group can afford these products (Bui et al., 2005; Nguyen & Harwood, 2017; Nguyen, 2008).

The findings of this study supported my second hypothesis in part by showing that indigenous people consume more timber for construction than immigrants. Indigenous people are native to natural forests and have close relationships with their surrounding environment (Gadgil et al., 1993). They possess a good knowledge of natural forests that enables them to use more products in general (Gadgil et al., 1993; McElwee, 2010). Indigenous people often consider forest plants as their main source of food supplies, herbal remedies, construction materials, and cultural amenities (Gadgil et al., 1993; Lawrence et al., 2005; McElwee, 2010). Lawrence et al. (2005) indicate that indigenous people value forest plants for their construction materials more than their immigrant counterparts in Madre de Dios in Peru. Although immigrants who participated in the program of New Economic Zones might use more timber to build houses and other basic needs, spontaneous immigrants have less chances to use timber for their basic needs because they did not receive any support from the government. Spontaneous immigrants had to find their own ways to build their houses and secure their means of livelihood (Hardy, 2000). The results of this study are in agreement with the findings of other researchers indicating that indigenous people consume more forest products than immigrants in many parts of the world (Coulibaly-Lingani et al., 2009; Lacuna-Richman, 2003; Laird et al., 2011; Nguyen et al., 2019b; Sah & Heinen, 2001; Webb & Dhakal, 2011).

I also found, however, that indigenous people used less timber than immigrants for furniture. Previous studies only examined the use of non-timber forest products or combined timber and non-timber products without comparing the use of timber for furniture and construction (Coulibaly-Lingani et al., 2009; Lacuna-Richman, 2003; Laird et al., 2011; Nguyen et al., 2019b; Sah & Heinen, 2001; Webb & Dhakal, 2011). There are several possible reasons why immigrants consumed more furniture timber than indigenous people. Immigrants may have a preference for artistic woodcarving and highly decorated furniture items (Nguyen & Harwood, 2017). Indigenous people may have cultural customs that prevent them from using specific species (Dudley et al., 2009; Pungetti, 2012; Saj et al., 2006). These findings have clear implications for park managers that they need to create interventions based on the consumption purposes of indigenous people and immigrants.

My observations partially supported the last hypothesis by showing that villagers in the Dak O commune consumed less furniture timber than villagers in the Bu Gia Map commune, although there was no difference between the communes with respect to construction timber. The easy access to markets allows people to find alternative products that reduce their reliance on natural forests (Masozera & Alavalapati, 2004; Schaafsma et al., 2014). The Dak O commune has better access to markets because it is nearer to the district centre. This relationship is also seen in India where people with better access to the market consumed less timber (Mitra & Mishra, 2011). This finding is in agreement with other studies that highlight the importance of better access to markets in reducing consumption of products from natural forests (Masozera & Alavalapati, 2004; Mitra & Mishra, 2011). These findings suggest that when alternatives are available, people can choose not to consume timber from the forest.



Park managers and local governors need to create interventions based on socioeconomic factors including landowning sizes, diversity of crops, indigeneity identities, and communes. The heterogeneous distribution of timber consumption among socioeconomic groups requires local managers to design conservation programs such as timber verification regulations, conservation education programs, and the provision of alternative materials. First, at the national level, a policy that develops a certification program to verify wooden products is essential; the effectiveness of this program has been successfully applied in other countries (Bass, 2001). Second, environmental education programs need to direct rich villagers (people who own more than four hectares of agricultural land) toward compliance with the law related to the conservation of woody species within natural forests; this approach has been applied to protect bird species in Costa Rica and Ethiopia (Şekercioğlu, 2012). Finally, timber sourced from forest plantations may provide alternative materials for villagers. Silviculture methods are available for woody trees such as acacias and eucalypts to be grown in forest plantations, and timber from these species is cheap and can be harvested in a short period of time (Bui et al., 2005; Nguyen & Harwood, 2017). Timber from forest plantations has been used in the Northwest of Vietnam and the Philippines, the use of which contributes to the conservation of natural forests (Nguyen & Harwood, 2017; Walters, 2004). Therefore, park managers may help indigenous and poor people with limited access to plant these trees on their marginal land that can support themselves. In addition, park managers may support immigrants and richer families to secure timber for their artistic, wood-carved furniture from plantations.

## **5.5. Conclusion**

In this study, I hypothesized that people who belong to higher socioeconomic status, indigenous groups, and those who live farther from markets consume more furniture

and construction timber. The observations of this study indicated that people belonging to higher socioeconomic groups (people who own larger than four hectares of land), immigrants, and with less access to markets consume more timber for furniture while higher socioeconomic groups and indigenous people consumed more timber for construction. Further studies need to examine the sources of timber, cultural contexts, and the priority of wood used for different purposes. Finally, my results suggest that park managers need to find alternative construction material resources for poor and indigenous people while they need to design an awareness education programs for rich people and immigrants. In addition, immigrants often maintain their relationships with relatives and friends from their former homeland, and they may transport and sell timber products to these networks (Hardy, 2000; To & Sikor, 2006). Managers need to examine and prevent the movement of timber from natural forest through these networks. At the national level, the Vietnamese government should employ a certification policy that verifies the origins of wooden products used by consumers at the household level.

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## Chapter 6 – General Conclusion

In this study, I hypothesized that socioeconomic traits and indigeneity of villagers affected their participation in the distress cashew nut land rental market, leading to changes in the farm sizes of households. Eventually, farm size, the area of land cultivated by households, affected the consumption patterns of forest products. The findings of this study reveal that socioeconomic factors and indigeneity identities are important determinants of the participation in distress land rental markets. Indigeneity (this variable has high multicollinearity with the participation in the distress land rental market) combined with socioeconomic factors affect the farm size operated by villagers. Landownership is known as the area of land owned by households that includes both titled and untitled land while farm size encompasses both owned land and rented-in land and excludes rented-out land. I found that landownership and other socioeconomic factors were statistically significant in explaining the consumption of timber while farm size and socioeconomic factors statistically significantly explained the consumption of non-timber forest products. The interactions between indigeneity and farm size had impacts on the consumption of NTFPs while they did not have impacts on the consumption of timber. This demonstrates that the interaction of socioeconomic factors has impacts on changes in the consumption of timber and NTFPs in the buffer zones of Bu Gia Map National Park. The relationships between socioeconomic interactions between indigenous people and immigrants and their consumption patterns of forest products can be seen in Figure 6-1.

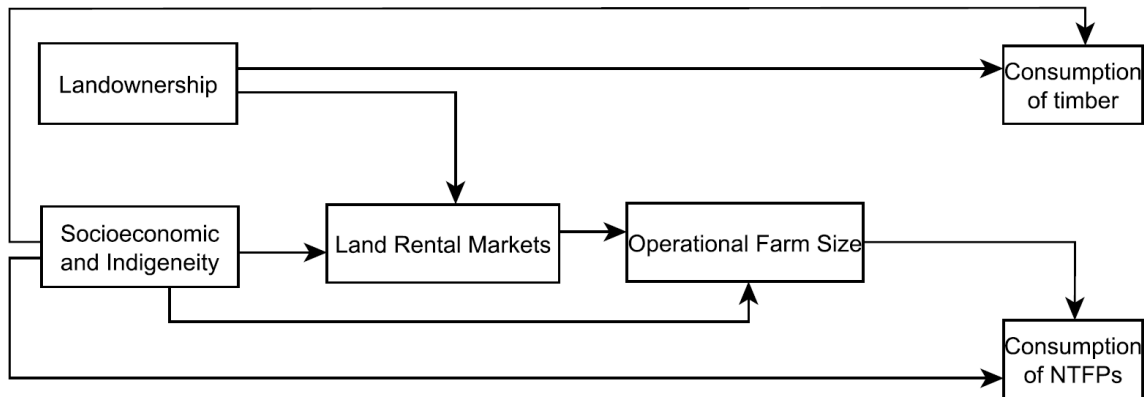
**Chapter 2:** I observed that economic shocks forced smaller landowners to rent out their cashew nut farms in times of need while larger landowners enlarged their cashew nut

farms via this market. Several people participated in both rent-in and rent-out activities as sublessors to earn money from these markets. Lessors earned much less than sublessors who participated in the cashew nut rental market to earn income from renting in and renting out. Immigrants tended to rent-in more cashew nut farmland while indigenous people were more likely to participate in the distress cashew nut rent-out market. Farmers with easier access to markets tended to rent-in more cashew nut farmland for their additional income source. While the number of informal training workshops in agriculture had a positive relationship with the likelihood of participation in the cashew nut rent-in market, larger family size reduced participation of farmers in the cashew nut rent-in market. This study provides a vivid picture of cultural identity and other socioeconomic profiles of farmers who participated in the distress cashew nut rental market. The findings of this study enable local governments to create better policies that ensure social justice at the local level based on farmer's socioeconomic profiles.

**Recommendations:**

- Since this study suggests that less informal training in agriculture tended to increase the likelihood of renting out land, more training workshops for farmers could be a viable intervention for poor and indigenous people.
- Diversifying income sources and crops will enable poor and indigenous people to avoid their involvement in the distress cashew nut rental markets. These solutions may include, but are not limited to, crop diversification and additional off-farm job employment opportunities to avoid distress cashew nut rent out markets in the buffer zones of Vietnam's Bu Gia Map National Park.

Figure 6-1 - Interrelationships between socioeconomic factors and consumption patterns of forest products



**Chapter 3:** Agricultural land plays an important role in providing a means of livelihood of farmers, and the disparity in access to agricultural land can be a source of social inequality in rural areas in developing countries. Examining socioeconomic determinants of operational farm size (the area of agricultural land cultivated by families) of households can be important for policy makers because they can support poor people with small farms to access additional income sources. The findings of this study demonstrated that indigeneity, female-male labour force ratio, education level of heads of households, training in agriculture, and residential communes were statistically significant in explaining the operational farm size of villagers in the buffer zones of the Bu Gia Map National Park. Indigenous people held smaller operational farm size than immigrants. Higher education, limited access to markets, higher female-male labour force ratio, and informal training in agriculture increased the operational farm size of local farmers. This study can assist local governments in developing suitable interventions based on their socioeconomic profiles that support small farm owners and indigenous people in diversifying their sources of income from their available assets such as participating in community-based ecotourism activities and small businesses.

**Recommendations:**

- Local governments need to create an assets-based community development program that encourages indigenous people to take advantage of their culture to create sustainable ecotourism in the area.
- Local people should be trained in community-based ecotourism to boost their household economies.
- Together with training in ecotourism, local government needs to support young farmers in running their own businesses such as creating traditional products for souvenirs.
- Local governments need to encourage the next generation to continue their formal education because it can help them reduce their reliance on agricultural land in the long-term.

**Chapter 4:** Conservation of protected areas requires understanding of the consumption of forest products by rural people who live near protected forests. Socioeconomic factors such as a better education, income, land holding size, have been used to understand the patterns of consumption of non-timber forest products (NTFPs). Ethnicity, and especially whether or not people are indigenous to the forested areas, may also change consumption patterns. In this study, I found that indigeneity, education, family size, and the area of land used were statistically significant in explaining the amount of NTFPs consumed, while indigeneity and the area of land used by local people had positive relationships with the diversity (measured in number of categories) of NTFPs consumed by local people. Interestingly, there were statistically significant effects of interactions between the area of land used and indigeneity on the consumption of NTFPs. The amount

of these products was important for indigenous people who belong to the groups using small and medium areas of land. The medium land use group consumed significantly fewer categories of NTFPs than the small and large land use groups. This data may help local managers to develop interventions that support biodiversity conservation, promote sustainability of these important resources, and improve the social welfare of marginal groups.

**Recommendations:**

- Forest managers need to support indigenous people with small and medium land holdings and immigrants with small land holdings when they create protected areas because these products may be meaningful for cultural activities and subsistence
- Four hectares of cultivation land should be a critical ceiling for future economic support for indigenous people at the local level. Viable support activities could be the improvement of their land cultivation or restructuring their crop compositions to gain enough income that covers their yearly expenses.

**Chapter 5:** Hardwood trees play an important role in maintaining the forest ecosystem within protected areas, and they are threatened by illegal logging activities because of the consumption demand of people worldwide. Socioeconomic factors can be used to compare the patterns of collection and consumption of timber from natural forests. In this study, I analysed the socioeconomic factors and indigeneity traits of local people to understand the key determinants of the consumption patterns of timber with regards to timber volume. I found that indigeneity, landowner group, distance to natural forests, residential communes, and number of crops were statistically significant in explaining

different consumption patterns of timber extracted from 18 native woody species within the Bu Gia Map National Park and its surrounding vicinities. Interestingly, immigrants and the large land area owner group consumed the largest amount of timber for wooden furniture. This study can assist local managers to develop suitable interventions supporting biodiversity conservation and sustainable development programs for years to come.

### **Recommendations:**

- At the national level, a policy that develops a certification program to verify wooden products is essential.
- Environmental education programs need to direct villagers toward the compliance with the law related to the conservation of woody species within natural forests.
- Park managers may help indigenous and poor people with limited access to markets use timber sourced from plantations to reduce their vulnerability regarding basic needs.

### **General Conclusion**

In this study, I found that indigeneity was the most important variable that affects both socioeconomic relationships in distress cashew nut rental markets and the consumption patterns of products from natural forests. Indigeneity was statistically significant in explaining the dependent variables in all four chapters, demonstrating that there are clear patterns differentiating between indigenous people and immigrants with regards to socioeconomic management and consumption within households. These relationships are in agreement with previous studies that demonstrate the difference in economic status and consumption patterns between indigenous people and immigrants (Codjoe, 2006;



Lawrence et al., 2005; Lu et al., 2010; McElwee, 2008). In addition, this study underscores the reticulation of relationships between land rental markets, socioeconomic status, and the consumption patterns of forest products. Therefore, biodiversity conservation cannot be separated from development if conservationists want to effectively protect natural forest from human activities.

There was a change in the consumption patterns of forest products before and after the participation in the distress cashew nut rental market. Landownership was statistically significantly explaining the consumption of timber products from natural forests while farm size was statistically significantly explaining the consumption of non-timber forest products. It is worth to note that landownership demonstrates the land size owned by households before they participate in the land rental markets while farm size is the land size cultivated by farmers after they participate in the land rental markets. The difference between these variables in the consumption patterns of timber and non-timber forest products demonstrates that distress land rental markets may play an important role in changing the consumption patterns of timber and non-timber forest products in the buffer zones of the Bu Gia Map National Park. These findings are important for the design and success of potential integrated conservation and development projects because they can enable managers to create better interventions (Scherl et al., 2004).

Although I did not examine the causal model, I believe that these relationships of distress cashew nut rental markets may cause the change of consumption of timber and non-timber forest products at some level. In order to clarify these relationships, future studies may apply causal or system dynamic modelling to better clarify the starting point of the consumption patterns of forest products. These studies could scrutinize these

relationships with careful examination of sociopsychology, attitudes, aspirations, and the consumption behaviours of local people.

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### Appendix 1 – List of woody species from natural forests (NF) used by local people

No	Scientific name	Vietnamese name	Origin	Conservation Status
1	<i>Dalbergia cochinchinensis</i>	Cắm lai nam	NF	Vulnerable
2	<i>Dalbergia oliveri</i>	Cắm lai Bà Rịa	NF	Endangered
3	<i>Azelia xylocarpa</i>	Gỗ đỏ	NF	Endangered
4	<i>Pterocarpus macrocarpus</i>	Giáng hương	NF	Vulnerable
5	<i>Hopea odorata</i>	Sao đen	NF	Vulnerable
6	<i>Dipterocarpus alatus</i>	Dầu con rái	NF	Vulnerable
7	<i>Lagerstroemia calyculata</i>	Bằng lăng ổi	NF	Unknown
8	<i>Vitex pubescens bahl</i>	Bình linh	NF	Vulnerable
9	<i>Lagerstroemia angustifolia</i>	Bằng lăng cườm	NF	Unknown
10	<i>Caujou sp</i>	Hồng đào	NF	Unknown
11	<i>Disoxylon foureiri pierre</i>	Huỳnh đường	NF	Unknown
12	<i>Erythrophloeum fordii</i>	Lim xanh	NF	Unknown
13	<i>Peltophorum dasyrrachis</i>	Lim vàng	NF	Unknown
14	<i>Hopea recopei</i>	Chò chai	NF	Endangered
15	<i>Artocarpus rigidus</i>	Mít nài	NF	Unknown
16	<i>Styrax annamensis guill</i>	Cứt sắt	NF	Unknown
17	<i>Pagraea ragraans</i>	Trai	NF	Unknown
18	<i>Adina cordifolia</i>	Gáo vàng	NF	Unknown

## **Appendix 2 – Survey form of the study**

**Project title:**  
**Immigrants and their impacts on forest utilization**  
**of indigenous people in Vietnam's Bu Gia Map National Park**

Good day! My name is Nguyen Van Toai, a graduate student in the Department of Ecology, Environment and Evolution at La Trobe University. I am conducting a study under the supervision of Dr. Susan Lawler, Senior Lecturer, La Trobe University, on the Assessment of the Interactions between Immigrants, Indigenous People and Biodiversity Conservation in Vietnam's Bu Gia Map National Park.

I hereby request an interview with you on the above-said subject. I am mainly interested to know your economic status and daily activities, so as to contribute in compiling and documenting good community development practices at the grassroots level in the buffer zone of Bu Gia Map National Park. It will take approximately 1 hour of your time. Participation is voluntary. You may decline to answer any question that you do not wish to answer, and if you wish to end the interview at any time, you are free to do so. Your answers will be kept absolutely confidential. The key linking the code number or/and ID to your name will be stored separately from the consent form.

If you have any question, you can contact me at the Department Ecology, Environment and Evolution at La Trobe University, 133 Mc Koy Street, Wodonga 3690 VIC. +61(0)431-004-378 Australia.

## Survey form for indigenous peoples and immigrants

Date: \_\_\_\_\_

Village: \_\_\_\_\_

### 1. General information

1. What is your name?

\_\_\_\_\_

2. What is the name of your co-interviewee?

\_\_\_\_\_

3. In what year were you born?

\_\_\_\_\_

4. To what ethnicity do you most closely self-ascribe?

\_\_\_\_\_

5. How long have you lived in this village?

\_\_\_\_\_

6. What are the names of other participants (other than the head of household or spouse)?

\_\_\_\_\_

7. What kind of vehicles do you have in your home?

No	Vehicles	Number	Used for	Notes
1	Bicycles			
2	Motorbikes			
3	Cars			
4	Trucks			
5	Vans			
6	Others			

8. What is the type of your house?

☐ Wood

☐ Cottage

☐ Brick

☐ Concrete

☐ Other (Please specify)

9. What materials did you use to build your house?

Item	Materials	Amount/number	How long	Buy or collect (from where)
Columns,				
Roofs				
Walls				
Fences				
Doors				
Door wings				
Door frame				
Windows				
Kitchen cabinets				
Staircase				
Ceiling				
Beam				
Lath				
Floor				
Other:				

10. Could you please list the furniture items in your home? (*Clarify the items made of wood*)

No	Items	Year	Made of	Notes ( <i>Amount of material if from timber</i> )
1	Television			
2	Calendar boards			
3	Wardrobes			
4	Fans			
5	Ornament statues			
6	Tables			
7	DVD			
8	Chairs			
9	Fridges			
10	Vases			
11	Altars			
12	Computer			
13	Beds			
14	Air conditioners			
15	Embossment pictures			
16	Water cooler			
17	Statues of animals			
18	Trunks			
19	Bookshelves			
20	Kitchen cabinets			
21	Water boiler			
22	Cookers			
23	Hotpot			
24	Other:			

11. Over the last twelve months, have you (your family) bought/made any furniture item as the table below?

No	Items	Year	Made of	Notes ( <i>Amount of material if from timber</i> )
1	Television			
2	Calendar plates			



3	Wardrobes			
4	Fans			
5	Ornament statues			
6	Tables			
7	DVD			
8	Chairs			
9	Fridges			
10	Vases			
11	Altars			
12	Computer			
13	Beds			
14	Air conditioners			
15	Embossment pictures			
16	Water cooler			
17	Statues of animals			
18	Trunks			
19	Bookshelves			
20	Kitchen cabinets			
21	Water boiler			
22	Cookers			
23	Hotpot			
24	Other:			

12. Could you please include members who have been with the household in the past 5 years and members who spend limited time at home?

No	Name	Year of Birth	Gender	Relationship with the head of household	Education Level (Highest)	Main labour	Incomes outside agriculture	Absent	Reason
1									
2									

13. Could you please indicate the HH head and other members received income from which sources in 2016? List all income sources in the order of importance?

*Code of sources of incomes: 1. Cash from agricultural crops (Rubber trees, Coffees, Peppers, Cassava, Rice); 2. Other cultural products; 3. Retired; 4. Move to other places; 5. Shopkeepers; 6. Daily labour force; 7. Collector; 8. Carpenter; 9. Lather; 10. Government employees; 11. Driver; 12. Cooking wine; 13. Handicraft; 14. Transportation services; 15. Healer; 16. Local processing factory; 17. Music for wedding/funeral; 18. Repairing bicycles and motorbikes. 19. Forests; 20. Forest protection; 21. Other (Please specify).*

Source ID	Head	Spouse	Main labours	Amount of incomes

## 2. Current Forest Use

### Non timber-forest products

14. Consuming bamboo shoots, leaves, mushrooms, fruits and other non-timber forest products is common in our lives. These products can be used as food, medicine or ornament. Many of them are traditional food of Vietnamese people. Have you ever consumed any bamboo shoots, leaves, rattan sprouts, fruits or other non-timber forest products from natural forests?

☐ Yes ☐ No

14.1. If yes, please proceed to question 15

14.2. If no, have you happened to collect non-timber forest products?

☐ Yes ☐ No

*If yes, please proceed to question 17*

*If no, please proceed to question 25*

15. Thinking of the last twelve months since April 2016, have you consumed any non-timber forest products?

☐ Yes ☐ No

16. From where did you have these non-timber forest products?

☐ Bought ☐ Collected ☐ From other peoples

#### ***If you collected non-timber forest products by yourself:***

- 16.1. Thinking of the last twelve months since April 2016, how many times have you collected these products?

---

- 16.2. Where did you collect these non-timber forest products?

☐ Your village ☐ Your home garden ☐ In the forest

- 16.3. Could you please list the species and amount of non-timber forest products collected?

No	Species	Amount	Part used	Purposes
1				
2				
3				
4				
5				
6				
7				
8				

- 16.4. How did you collect these non-timber forest products?

☐ Cut down trees                      ☐ Pick leaves   ☐ Cut branches                      ☐ Pick fruits   ☐  
 Others (*Specify*)

16.5. What are the techniques that you used to collect these non-timber forest products?

☐ Hand   ☐ Knife   ☐ Hand saw   ☐ Chain saw   ☐ Axes   ☐ Others (*Specify*)

16.6. Thinking of the last twelve months since April 2016, have you given non-timber forest products to anyone? ☐ Yes            ☐ No  
 If yes, who?

☐ Neighbour   ☐ Relative                      ☐ Friend                      ☐ Others

Please list the species and amount.

No	Species	Number	Amount	Purposes
1				
2				

***If you bought non-timber forest products from other people:***

16.7. Thinking of the last twelve months since April 2016, how many times have you bought non-timber forest products?

---

16.8. Whom did you buy these non-timber forest products? (*List as many possible*)

☐ Wholesaler   ☐ Indigenous people   ☐ Neighbour   ☐ Other (*Specify*):

16.9. Thinking of the last twelve months since April 2016, how much non-timber forest products have you bought? (*Please list the species and amount of non-timber forest products*)

No	Species	Number	Amount	Purposes
1				
2				

***If you received non-timber forest products from other people:***

16.10. Thinking of the last twelve months since April 2016, how many times have you received non-timber forest products?

---

16.11. Whom did you receive these products?

☐ Magnates            ☐ Indigenous people   ☐ Neighbour   ☐ Other (*Specify*):

16.12. Could you please list the species and amount of non-timber forest products?

No	Species	Number	Amount	Purposes
1				
2				

17. What non-timber forest products did not you collect in the past?

18. Why do you collect these products now? *(Please list the species)*

No	Species	Purposes	Why
1			
2			

19. Many people consider non-timber forest product from natural forests as their source of incomes. Have you ever collected non-timber forest products from the forest to generate your incomes?

☐ Yes ☐ No

20. Thinking of the last twelve months since April 2016, how many times have you gone into the forest to collect non-timber forest products?

---

21. Thinking of the last twelve months since April 2016, how much non-timber forest products have you obtained?

No	Species	Number	Amount	Purposes
1				
2				

22. What kind of tool did you use to cut down trees?

☐ Hand saws ☐ Chain saws ☐ Axes ☐ Knives ☐ Hands

23. Whom did you sell your non-timber forest products collected from the forest to?

☐ Neighbour ☐ Wholesaler ☐ Other *(Specify)*:

24. Thinking of the last twelve months, how much money have you earned from the collection of non-timber forest products?

---

25. Over the last twelve months, how many percent did this money from non-timber forest products contribute to your total income?

---

26. Was there any area where you never collected forest products?

☐ Sacred forests ☐ National Park ☐ Law enforcement ☐ Other:

**Forest Timber**

27. It is very common that many people use timber for many purposes. Timber is essential for people to make furniture items, build houses and other purposes.

27.1. Have you ever used timber to build your house?

☐ Yes ☐ No

27.2. Did you buy timber or collect by yourself?

☐ Bought ☐ Collected ☐ Received from other peoples

***If you collected timber by yourself:***

27.3. Thinking of the time you built your house, where did you cut down trees to collect timber?

☐ Your village ☐ Your garden ☐ In the forest

27.4. How much did you collect to build your house? Could you please list the species, number of trees and amount of timber collected?

No	Species	Number	Amount	Notes
1				
2				

27.5. Who helped you (probably you hired) cut down trees to collect timber?

☐ Yourself ☐ Neighbour ☐ Indigenous people ☐ Other (*Specify*):

***If you bought timber from other people:***

27.6. Thinking of the time you built your house, from whom did you buy timber?

☐ Magnates ☐ Indigenous people ☐ Neighbour ☐ Others (*Specify*):

27.7. How did you pay for timber?

☐ Cash ☐ Rice ☐ Wine ☐ Others

27.8. Could you please list the species, number of trees and amount of timber bought?

No	Species	Number	Amount	Notes
1				
2				

***If you received timber from other people:***

27.9. Thinking of the time you built your house, from whom did you receive timber?

☐ Magnates ☐ Indigenous people ☐ Neighbour ☐ Other (*Specify*):

27.10. Could you please list the species, number of trees and amount of timber collected?

No	Species	Number	Amount	Notes
1				
2				

27.11. Did you have to give anything to the giver? Please tell me what you gave them and how much?

No	Items	Number	Amount	Notes
1				
2				

28. Using timber to make furniture items is very popular in Vietnam, and many people have used timber to make their furniture items.

28.1. Thinking of the past twelve months, have you ever used timber to make your furniture items such as tables, chairs, beds and other?

☐ Yes

☐ No

28.2. Did you buy timber or collect buy yourself?

☐ Bought

☐ Collected

☐ Received from other peoples

***If you collected timber by yourself:***

28.3. Thinking of the last twelve months since April 2016, where have you cut down trees for timber?

☐ Your village

☐ Your garden

☐ In the forest

28.4. Could you please list the species, number of trees and amount of timber collected?

No	Species	Number	Amount	Notes
1				
2				

28.5. Who helped you (probably you hired) cut down trees to collect timber?

☐ Yourself

☐ Neighbour

☐ Indigenous people

☐ Other (*Specify*):

***If you bought timber from other people:***

28.6. Thinking of the time you made your furniture items, from whom did you buy timber?

☐ Magnates

☐ Indigenous people

☐ Neighbour

☐ Others (*Specify*):

28.7. How did you pay for timber?

☐ Cash

☐ Rice

☐ Wine

☐ Others

28.8. Could you please list the species, number of trees and amount of timber bought?

No	Species	Number	Amount	Notes
1				

***If you received timber from other people:***

28.9. Thinking of the time you made your furniture items, from whom did you receive timber?

☐ Magnates      ☐ Indigenous people      ☐ Neighbour      ☐ Other (*Specify*):

28.10. Could you please list the species, number of trees and amount of timber collected?

No	Species	Number	Amount	Notes
1				
2				

28.11. Did you have to give anything to the giver? Please tell me what you gave them and how much?

No	Items	Number	Amount	Notes
1				
2				

29. Many people consider timber from natural forests as their source of incomes. Have you ever collected timber from the forest to generate your incomes?

☐ Yes      ☐ No

30. Thinking of the time when you moved into the buffer zones of Bu Gia Map National Park. How often did you go into the forest to collect timber?

☐ 1 - 2 /month      ☐ 3 – 4/month      ☐ 5 – 6/month      ☐ 7 – 8/month

31. What kind of tool did you use to cut down trees?

☐ Hand saws      ☐ Chain saws      ☐ Axes      ☐ Knives

32. Whom did you sell your timber collected from the forest to?

☐ Neighbour      ☐ Carpenter      ☐ Wholesaler      ☐ Other (*Specify*):

33. Was there any area where you never collected forest products?

☐ Sacred forests      ☐ National Park      ☐ Law enforcement      ☐ Other:

34. Thinking of the last twelve months since April 2016, how many times have you gone into the forest to collect timber?

---

35. Thinking of the last twelve months since April 2016, how much timber have you obtained?

No	Species	Number	Amount	Purposes
1				
2				

36. Whom did you sell your timber collected from the forest to?

☐ Neighbour      ☐ Wholesaler      ☐ Other (*Specify*):



37. Thinking of the last twelve months, how much money have you earned from the collection of timber?

---

38. Over the last twelve months, how many percent did this money from timber contribute to your total income?

---

39. Was there any area where you never collected forest products?

☐ Sacred forests ☐ National Park ☐ Law enforcement ☐ Other:

### Forest Animals

40. Wild animals can be used for different purposes such as medicine, pet, food, taxidermy. Many people cook wild animals as food for their consumption. Have you ever tried any food from wild animals such as snakes, deer, birds, frogs?

☐ Yes ☐ No

40.1. If yes, could you please list wild animals you have ever consumed?

No	Species	Number		Notes

40.2. Did you cook this food from wild animals by yourself?

☐ Yes ☐ No

*If no, who cooked this food for you?*

*If yes,*

40.3. Where did you have the animals?

☐ Trapped ☐ Bought ☐ Gift

41. If you trapped the animal by yourself, where did you trap?

☐ Forest ☐ Village ☐ Other

42. If you bought the animal, who did you buy from?

☐ Wholesaler ☐ Neighbour ☐ IP ☐ Others (*Specify*):

42.1. Did you pay by cash or use other items to exchange?

☐ Cash ☐ Exchange

42.2. If you exchanged by other items, what did you use to exchange?

☐ Food ☐ Clothes ☐ Alcohol ☐ Other (*Specify*):

42.3. If you received the animal as gift, who gave the animal to you?

☐ Relatives ☐ Friends ☐ Neighbour ☐ Other (*Specify*):

43. Many people must rely on natural forests, and they collect wild animals from natural forests as their source of incomes. Have you ever caught wild animals from the forest to generate your incomes?

☐ Yes ☐ No

44. What kind of tool did you use to catch wild animals?  
☐ Gun ☐ Trap ☐ Net ☐ Other (*Specify*):
45. Whom did you sell your meat collected from the forest to?  
☐ Neighbour ☐ Wholesaler ☐ Traditional doctor ☐ Other (*Specify*):
46. How many percent did money from wild animals contribute to your total income at that time?

### Current Consumption of wild animals

47. Were there any animals you have never hunted before?

No	Species	Reasons

48. Thinking of the past twelve months since April 2016, have you eaten any food from wild animals such as snakes, deer, birds, frogs?

☐ Yes ☐ No

- 48.1. If yes, could you please list wild animals you have consumed over the last twelve months?

No	Species	Number	Notes

- 48.2. Did you cook this food from wild animals by yourself?

☐ Yes ☐ No

*If no, who cooked this food for you?*

*If yes,*

- 48.3. Where did you have the animals?

☐ Trapped ☐ Bought ☐ Gift

49. If you trapped the animal by yourself, where did you trap?

☐ Forest ☐ Village ☐ Other

50. If you bought the animal, who did you buy from?

☐ Wholesaler ☐ Neighbour ☐ Hunters ☐ Others (*Specify*):

- 50.1. Did you pay by cash or use other items to exchange?

☐ Cash ☐ Exchange

- 50.2. If you exchanged by other items, what did you use to exchange?

☐ Food ☐ Clothes ☐ Alcohol ☐ Other (*Specify*):

- 50.3. If you received the animal as gift, who gave the animal to you?

☐ Relatives ☐ Friends ☐ Neighbour ☐ Other (*Specify*):

51. Many people must rely on natural forests, and they collect wild animals from natural forests as their source of incomes. Over the last twelve months, have you caught wild animals from the forest to generate your incomes?

☐ Yes ☐ No

52. What kind of tools did you use to catch wild animals?

☐ Gun ☐ Trap ☐ Net ☐ Other (*Specify*):

53. Whom did you sell your animals?

☐ Neighbour    ☐ Wholesaler ☐ Traditional doctor ☐ Other (*Specify*):

54. How many percent did money from wild animals contribute to your total income at that time?

55. Were there any animals you have never hunted before?

No	Species	Reasons

56. Was there any area where you never trapped or hunted animals?

☐ Sacred forests ☐ National Park    ☐ Law enforcement ☐ Other:

57. Which parts of the region have undergone high levels of deforestation and/or degradation?

58. What are the key drivers of deforestation and/or degradation in each of these areas?

### 3. Land ownership

Each plot is a separate piece of land not connected to another. Collect the following details for each plot ( <i>this does not include land that are rented on a seasonal basis</i> )					
No		Forest	Farm	Residential	Note
1	Type of land				
2	Area (ha)				
3	Red book				
4	How was the land obtained?				
5	Year obtained?				
6	Is this land in the village?				
7	What are the incomes from your land over the last 12 months?				
8	What do you plant on your land?				
9	How many times have you fertilized your crops over the last 12 months?				

1. Over the last 10 years, has your family borrowed land?
  - ☐ Yes      ☐ No
  - 1.1. Whom did you borrow?
    - ☐ Indigenous people   ☐ Internal immigrants   ☐ Others
  - 1.2. How much land have you borrowed?
    - ☐ 1-2 ha    ☐ 3-4 ha    ☐ 5-6 ha    ☐ 7-8 ha    ☐ 9-10 ha    ☐ 11-12 ha
  - 1.3. How long did you borrow your land?
    - ☐ 1-3 years      ☐ 4-6 years      ☐ 7-9 years      ☐ 10-12 years
  - 1.4. Did you have pay anything for the landowner?
    - ☐ Rice ☐ Food      ☐ Wine      ☐ Animals      ☐ Others
2. Has your family rented land over the last 10 years?
  - ☐ Yes      ☐ No
  - 2.1. Whom did you rent?
    - ☐ Indigenous people   ☐ Internal immigrants   ☐ Others
  - 2.2. How much land have you rent?
    - ☐ 1-2 ha    ☐ 3-4 ha    ☐ 5-6 ha    ☐ 7-8 ha    ☐ 9-10 ha    ☐ 11-12 ha
  - 2.3. How long did you rent the land?
    - ☐ 1-3 years      ☐ 4-6 years      ☐ 7-9 years      ☐ 10-12 years
  - 2.4. How much did you have to pay for the rent?
    - ☐ 1-5m/ha    ☐ 6-10m/ha      ☐ 11-15m/ha      ☐ 16-20m/ha
3. Has your family purchased land over the last 10 years?
  - ☐ Yes      ☐ No
  - 3.1. Whom did you buy?
    - ☐ Indigenous people   ☐ Internal immigrants   ☐ Others
  - 3.2. How much land have you sold?
    - ☐ 1-2 ha    ☐ 3-4 ha    ☐ 5-6 ha    ☐ 7-8 ha    ☐ 9-10 ha    ☐ 11-12 ha
  - 3.3. How much did you pay for the purchase?
    - ☐ 1-5m/ha    ☐ 6-10m/ha      ☐ 11-15m/ha      ☐ 16-20m/ha
4. Over the last 10 years:
  - 4.1. Have you sold your land?
    - ☐ Yes      ☐ No
  - 4.2. How much land have you sold?
    - ☐ 1-2 ha    ☐ 3-4 ha    ☐ 5-6 ha    ☐ 7-8 ha    ☐ 9-10 ha    ☐ 11-12 ha
  - 4.3. Whom have you sold your land?
    - ☐ Indigenous people   ☐ Internal immigrants   ☐ Others
  - 4.4. How much money have you received from the sale of land?
    - ☐ 1-20m/ha      ☐ 21-40m/ha   ☐ 41-60m/ha   ☐ 61-80m/ha
    - ☐ 81-100m/ha   ☐ 101-120m/ha   ☐ 121-140m/ha   ☐ 141-160m/ha
    - ☐ 161-180m/ha   ☐ 181-200m/ha   ☐ 201-220m/ha   ☐ Other (*Specify*)
  - 4.5. Why did you have to sell your land?
    - ☐ Sickness      ☐ House construction      ☐ Wedding      ☐ Other

5. Over the last 10 years:
  - 5.1. Have you mortgaged your land?  
☐ Yes      ☐ No
  - 5.2. If yes, when did you mortgage your land?
  - 5.3. How much land have you mortgaged?  
☐ 1-2 ha      ☐ 3-4 ha      ☐ 5-6 ha      ☐ 7-8 ha      ☐ 9-10 ha      ☐ 11-12 ha
  - 5.4. Whom have you mortgaged your land?  
☐ Indigenous people    ☐ Internal immigrants      ☐ Others
  - 5.5. How much money have you received from your land mortgage?  
☐ 1-5m/ha    ☐ 6-10m/ha      ☐ 11-15m/ha      ☐ 16-20m/ha
  - 5.6. How many years did you mortgaged your land?  
☐ 1-2      ☐ 3-4      ☐ 5-6      ☐ 7-8      ☐ 9-10 ☐ 11-12
  - 5.7. Why did you have to mortgage your land?  
☐ Sickness      ☐ House construction      ☐ Wedding      ☐ Other
  - 5.8. Have you received your land back?  
☐ Yes      ☐ No
6. Have you ever sold your land to the land renter when they mortgaged your land in the past?  
☐ Yes      ☐ No
7. How much did you receive from the sale?  
☐ 1-5m/ha    ☐ 6-10m/ha      ☐ 11-15m/ha      ☐ 16-20m/ha
8. Do you know the names and ethnicities of people who loan to you?  
☐ Indigenous people    ☐ Internal immigrants      ☐ Others
9. Did you keep any record of your mortgaged land?  
☐ Yes      ☐ No
10. If yes, could you please present?

#### 4. Land use

1. Do you have a program that regularly tests the soil to determine fertilizer applications?  
☐ Yes      ☐ No
2. Do you keep your farm records?  
☐ Yes      ☐ No  
 If yes, could you present?
3. Do you receive any support from the local government to cultivate your land?  
☐ Yes      ☐ No
4. Have you ever participated in any training for cultivation and crop management?  
☐ Yes      ☐ No  
 If yes,
  - a. How often do you participate in these programs?
  - b. What do you learn from these programs?
  - c. Do you apply techniques from these programs to your cultivation?
5. Over the last twelve months, how many kilograms of products have you harvested from your crops?

No	Farm crops	Amount	Price	Notes
1	Cashew			
2	Pepper			
3	Rice			
4	Cassava			
5	Rubber			
6	Coffee			
Other				

6. Over the last twelve months, how often have you accessed the information system to know the price of your products such as rubber trees, cashew nuts, coffee, and cassava?
- ☐ No      ☐ 1-3/ month ☐ 4-6/month ☐ 7-9/month ☐ 10-12/month ☐ > 12/month
7. Thinking about the last twelve months since April 2016, have you suffered from insufficient food supplies?
- ☐ Yes      ☐ No
8. If yes, how many months did you have insufficient food supplies?
- ☐ 1-2 ☐ 3-4      ☐ 5-6      ☐ 7-8      ☐ 9-10 ☐ 11-12
9. Could you please tell me what do you do to overcome the period of insufficient food supplies?

## 5. Current forest utilization

1. List all of the forest plants (including trees) and other items you can think of that are good to use as firewood/fuelwood.

No	Species	Part used	Collection methods	Use or sale	Where	Price	Usage purposes	Important Order	
1									
2									

2. List all of the forest plants/trees that are good to use in building things like homes and fences and tell me which part(s) of the plant are used.

No	Species	Part used	Collection methods	Use or sale	Where	Price	Usage purposes	Important Order	
1									
2									

3. List all of the forest plants/trees you can recall ever using to make rice wine or other spirits and tell me which part(s) of the plant were used.

No	Species	Part used	Collection methods	Use or sale	Where	Price	Usage purposes	Important Order	
1									
2									

4. List all of the forest animal you can recall ever using to dye or in wine or other spirits and tell me which part(s) of the animal were used.

No	Species	Part used	Collection methods	Use or sale	Where	Price	Usage purposes	Important Order	
1									
2									

5. List all of the forest plants/trees you can recall ever using for ornamental purposes (for decorating your home, garden, grave sites, clothing, hair, etc.).



No	Species	Part used	Collection methods	Use or sale	Where	Price	Usage purposes	Important Order	
1									
2									

6. List all of the forest animals you can recall ever using for pet purposes.

No	Species	Part used	Collection methods	Use or sale	Where	Price	Usage purposes	Important Order	
1									
2									

7. List all of the forest plants/trees that you can recall ever using to feed your domestic animals (chickens, goats, water buffalo, pigs, fish, etc.) and tell me which part(s) of the plant were used.

No	Species	Part used	Collection methods	Use or sale	Where	Price	Usage purposes	Important Order	
1									
2									

8. List all of the forest plants/trees that people in your community like to eat and tell me which part(s) of the plant they eat.

No	Species	Part used	Collection methods	Use or sale	Where	Price	Usage purposes	Important Order	
1									
2									

9. List all of the forest animals that people in your community like to eat and tell me which part(s) of the animal they eat.

No	Species	Part used	Collection methods	Use or sale	Where	Price	Usage purposes	Important Order	
1									
2									

10. List all of the forest plants/trees that are good to use when you are sick or not feeling well, tell me what you use each plant for (stomach ache, fever, treating an open wound, etc.) and tell me which part(s) of the plant are used.

No	Species	Part used	Collection methods	Use sale	or	Where	Price	Usage purposes	Important Order	
1										
2										

11. List all of the forest animals that are good to use when you are sick or not feeling well, tell me what you use each animal for and tell me which part(s) of the animal are used.

No	Species	Part used	Collection methods	Use sale	or	Where	Price	Usage purposes	Important Order	
1										
2										

12. List all of the forest plants/trees that people in your community trade or sell to others.

No	Species	Part used	Collection methods	Use sale	or	Where	Price	Usage purposes	Important Order	
1										
2										

13. List all of the forest plants/trees that are easy to grow in your garden.

No	Species	Part used	Collection methods	Use sale	or	Where	Price	Usage purposes	Important Order	
1										
2										

**THANK YOU FOR YOUR PARTICIPATION!**

**Appendix 3 – Typical economic status and activities of local people in the buffer zones of Vietnam's Bu Gia Map National Park**



Cows of an indigenous people



Pigs of an indigenous people



Buffalos of an indigenous household



Fishpond of an immigrant



Cashew nut trees of an immigrant



Cashew nut trees of an indigenous family



Pepper of an immigrant



Pepper of an indigenous household





Rubber trees of an immigrant



Ginseng of an indigenous household



Dry pepper from a farm of an immigrant



Cashew nuts from a farm of an immigrant



Small store of an indigenous household



Electronic store of an immigrant



A hut of an indigenous household



A house of an immigrant family



#### Appendix 4 – Usage of non-timber forest products of local people



NTFPs collected by indigenous people



Processing NTFPs for food



Backpack baskets made of bamboos



Using NTFPs for ritual ceremonies



Traditional wine made from NTFPs  
(Photo: Do Truong Giang)



Using bamboo nodes to cook food  
(Photo: Do Truong Giang)



A trip to collect NTFPs in the forest



Keeping NTFPs for food



## Appendix 5 – Usage of timber products of local people



Chairs, table, and cabinet in the living room



Chairs and table in the dining room



Buddha statue within a household



A typical solid bed in a household



Diversity of wooden items used by a household



Large ornamental cabinet in the living room



Saving timber for future usage



Typical wooden bed in a household

## **Appendix 6 – International conferences during PhD candidature**

**International Primatological Society Congress XXVI, Chicago, United States, 21 to 27 Aug 2016**

### **Abstract**

#### **Community-based primate conservation in Vietnam's Bu Gia Map National Park**

Bu Gia Map National Park is within the home range of six primate species, of which two are endangered, including the yellow-cheeked crested gibbon (*Nomascus gabriellae*) and black-shanked douc langur (*Pygathrix nigripes*). Villagers have insufficient mean of livelihood, and they consider the park as an economic aid in times of need. Local people enter the forest to illegally cut down trees and hunt wild animals, threatening the continued existence of these primates. Conflicts between local people and forest rangers are unavoidable, resulting in unsustainable primate conservation programs in the park. To deal with this problem, I assessed villagers' awareness of primates and their willingness to participate in wildlife conservation activities within the park. With a random sample of 120 participants, I interviewed local people for two months to assess their threats to primates and villagers' needs for alternative incomes. The interviews indicated that local people would give up illegal hunting and logging if they have a relevant alternative for their subsistence. The study also showed that many local people are still isolated from current wildlife conservation programs in the park. In order to tackle these problems, a multidisciplinary program should be applied to balance the benefits of primate conservation and local people's livelihood.

**International Symposium: Socio-ecological transformations of tropical lowland rainforests, Bali, Indonesia, 7-11 October 2018**

**Abstract**

**Socioeconomic status and forest utilization of local people in Bu Gia Map NP**

Social-Ecological System (SES) has been focused by forest managers to deal with the degradation of natural forests caused by human activities. This study delves into the relationship between socioeconomic status of people nearby Vietnam's Bu Gia Map National Park and their utilization of products extracted from woodlands. Using the structural equation modelling to examine the effects of socioeconomic status of local people including ethnicity, education, demographics, and economic status on the utilization of timber and non-timber forest products in the buffer zones of Vietnam's Bu Gia Map National Park. Using data interviewed with 121 local people residing in the buffer zones of Vietnam's Bu Gia Map National Park illustrates the relationship between socioeconomic profiles and the consumption of forest products. On the one hand, poor socioeconomic status encourages local people to extract non-timber forest products for their survival, and the improvement of their socioeconomic status can contribute to the reduction of the extraction of these products from natural forests within the park. On the other hand, there is an increment of the consumption of amount of timber harvested from natural forests when their socioeconomic status is enhanced. This result shows a dilemma between economic development and biodiversity conservation in natural forests which pose a challenge question for sustainability if economic development dovetails with biodiversity conservation. The structural equation model provides local managers with a vivid picture with the roots of forest extraction within the park. An interdisciplinary methodology must be applied to help local managers to balance forest protection and food security for the poor people in the buffer zones of the Bu Gia Map National Park.



**Rufford small grants conference: Strengthening network of the Rufford Foundation recipients in Southeast Asia, Hanoi, Vietnam, 19th – 20th October 2018**

**Abstract**

**Indigenous people vs immigrants: The consumption of non-timber forest products in the buffer zones of Vietnam's Bu Gia Map National Park**

Non-timber forest products play an important role in providing a means of livelihood and cultural amenity for local people around protected areas. There have been plethora studies that concentrate on the consumption of non-timber forest products and impacts on natural forests. However, the use of non-timber forest products by different groups has not been well analysed to ensure the goal of better biodiversity conservation and sustainable development. This study delves into the socioeconomic determinants of the utilization of non-timber products extracted from Vietnam's Bu Gia Map National Park. Using data interviewed with 121 local people residing in the buffer zones of Vietnam's Bu Gia Map National Park illustrates the relationship between socioeconomic factors and the consumption of non-timber forest products. A multiple linear regression indicates a strong association between the consumption of non-timber forest products and ethnicity, family size, age of respondents, education levels, diversity of NTFPs, and land use. A Poisson regression was applied to differentiate the diversity of NTFPs used by local people. There was a difference between indigenous people and migrants. However, there were not any differences in economic status, age of respondents, education level, and insufficient food supplies. The understanding of the socioeconomic determinants of non-timber forest products will enable conservationists and park managers to have suitable intervention in the current conservation programs in protected areas. This study enables local managers to identify target socioeconomic factors that need more help to reduce their hungers and reliance on natural forests.

**Sustainable Development Conference 2019: Green technology, Renewable energy and Environmental protection, Bangkok, Thailand, 7th to 9th of July 2019**

**Abstract:**

**Informal cashew nut farm rental markets in the area of coexistence of indigenous people and immigrants in the buffer zones of Vietnam's Bu Gia Map National Park**

One way that farmers in remote communities can alleviate economic hardship is to lease their crops to others. Such transactions are often informal and exploitative, yet there are many possible reasons people enter into these arrangements. In this study I analyse the interactions between indigenous people and migrants and the socioeconomic determinants of the cashew nut garden rental market in Vietnam. I conducted 121 interviews with local people from the buffer zones of Vietnam's Bu Gia Map National Park, and the results indicate significant differences in socioeconomic status between indigenous people and immigrants. Economic shocks forced people to rent out their cashew nut gardens in times of need, and indigeneity, family size, and education as measured by the number of informal agricultural training workshops predicted who would rent out their crops (become lessors) while indigeneity, residential commune, distance to natural forests, land area owned by, and informal agricultural training predicted who would rent in (become lessees). This study provides a vivid picture of cultural identity and other socioeconomic determinants of the participation in the cashew nut rental market that may enable local forest managers to include social justice in their development policies.

**SCB's 29th International Congress for Conservation Biology (ICCB 2019), Kuala Lumpur, Malaysia from 21-25 July 2019**

**Abstract**

**Indigeneity and socioeconomic determinants of consumption of hardwood timber in the buffer zones of Vietnam's Bu Gia Map National Park**

Socioeconomic factors have been used to understand the consumption of fuelwood and non-timber forest products, but little is known about their role in identifying the utilization of timber and wooden furniture categories. The overall knowledge of the relationship between the socioeconomic status and natural forests is that poor people may rely on these resources for their sustenance. This study explored relationships between the socioeconomic status and the consumption of timber and wooden furniture categories to understand the underlying motivation behind forest degradation. I conducted 121 interviews with local people to collect data related to the socioeconomic status and timber consumption at the household level, and multiple linear and negative binomial regressions were applied to examine their relationships. Indigeneity, residential communes, land size, distance to the main road, crop diversity, and the highest education of the family were statistically significant in explaining the amount of the timber used for furniture while indigeneity and crop diversity determined the utilization of timber for construction. Indigeneity, land use groups, and crop diversity were statistically significant in explaining the diversity of wooden furniture categories. Higher socioeconomic households used more timber from natural forests; therefore, local managers must carefully design their programs when they integrate socioeconomic enhancement into their biodiversity conservation.

## Appendix 7 – Published article on the consumption of NTFPs

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### Socioeconomic and indigeneity determinants of the consumption of non-timber forest products in Vietnam's Bu Gia Map National Park

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#### ABSTRACT

Conservation of protected areas requires understanding of the consumption of forest products by rural people who live near protected forests. Socioeconomic factors such as a better education, income, land holding size, have been used to understand the patterns of consumption of non-timber forest products (NTFPs). Ethnicity, and especially whether or not people are indigenous to the forested areas, may also change consumption patterns. In this study we analysed the socioeconomic factors, indigeneity and geographical locations of people living in the buffer zones of Vietnam's Bu Gia Map National Park to better understand the key determinants of the consumption of NTFPs. We conducted 121 interviews with local households and found that indigeneity, education, family size, and the area of land used were statistically significant in explaining the amount of NTFPs consumed, while indigeneity and area of land used by local people had positive relationships with the diversity (measured in number of categories) of NTFPs consumed by local people. Interestingly, there were statistically significant effects of interactions between the area of land used and indigeneity on the consumption of NTFPs. The amount of these products is important for indigenous people who belong to the groups using small and medium areas of land. The medium land use group consumed significantly fewer categories of NTFPs than the small and large land use groups. This data may help local managers to develop interventions that support biodiversity conservation, promote sustainability of these important resources and improve the social welfare of marginal groups.

#### ARTICLE HISTORY

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#### KEYWORDS

Indigenous people; immigrants; socioeconomic factors; non-timber forest products; consumption of forest products

#### Introduction

In Vietnam, forested areas have witnessed a significant change of population structure because of mass internal migration due to both governmental policies and spontaneous movements. After the American war in 1975, the Vietnamese government encouraged people to migrate from lowland to highland areas to remove socioeconomic discrepancy among ethnic groups (Hardy 2005). Since then people have continued to move into forested areas in search of new economic opportunities (Hardy 2005; McElwee 2008a). Population growth in the vicinity of natural forests is contributing to the over-harvesting of NTFPs. Local people make use of these natural resources for both their subsistence and income, and natural forests are more important for villagers who encounter economic shocks (Dang and Tran 2006; McElwee 2008b, 2010; Völker and Waibel 2010). The reliance of local people on NTFPs can be the result of socioeconomic, cultural, and geographic factors, and understanding which factors are most important can inform policies that aim to achieve the sustainable use of these products.

Non-timber forest products (NTFPs) play an important role in reducing poverty across the world because they provide essential amenities for the

poor in times of need (Cavendish 2000; Fa et al. 2000, 2002; Arnold and Pérez 2001). This natural resource includes food supplies, medicinal herbs, cultural products, and income sources for people who depend on it (Cavendish 2000; Twine et al. 2003; Paumgarten 2005; Paumgarten and Shackleton 2009; Alves et al. 2013). Poor people who encounter economic hardships collect NTFPs for their consumption and livelihood in times of need (Völker and Waibel 2010). Recently, scientists and conservationists have found different relationships between consumption patterns of NTFPs of people and their socioeconomic status in Asia, Africa and Latin America (Cavendish 2000; Dang and Tran 2006; McElwee 2008b; Paumgarten and Shackleton 2009; Godoy et al. 2010). The heterogeneity of the relationships between socioeconomic status and levels of reliance on natural forests may result in inappropriate interventions for biodiversity conservation and development programs at the local level.

Socioeconomic factors – including family size, education level, and land area available for farming – have been used to explain the consumption of NTFPs (Lacuna-Richman 2003; De Merode et al. 2004; Paumgarten and Shackleton 2009; Brashares et al.

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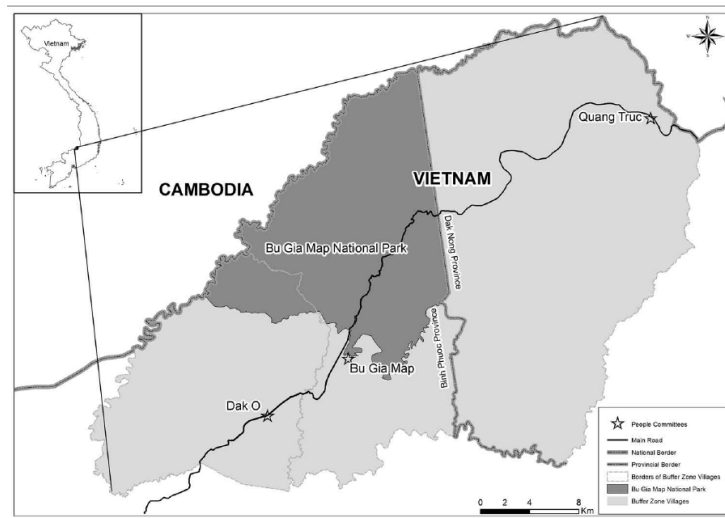


Figure 1. Bu Gia Map National Park and Buffer Zones.

2011; Mitra and Mishra 2011; Morsello et al. 2014). Family size has a positive relationship with the consumption of NTFPs because it increases household food demands (Lacuna-Richman 2003; Mitra and Mishra 2011; Chukwuone and Okeke 2012). Better educated people reduce their consumption of forest products because they have more job opportunities (Mitra and Mishra 2011; Chukwuone and Okeke 2012; Morsello et al. 2014; Sakai et al. 2016). The area of land available for farming can reduce the use of forest products by improving the income of households (Shackleton et al. 2001; Debela et al. 2012; Mgawe et al. 2012). However, Lacuna-Richman (2003) and Mitra and Mishra (2011) found that the relationship between the area of land used by villagers and the consumption of NTFPs is nonsignificant in the Philippines and India. The age of the head of household often changes consumption patterns of NTFPs (Paumgarten 2005; Chukwuone and Okeke 2012; Sakai et al. 2016; Luiselli et al., 2017). For example, young people likely consume less bushmeat than people who are older than twenty-five in Africa (Luiselli et al., 2017). In Vietnam, previous studies have shown mixed results for the relationships between socioeconomic factors and the levels of dependence on natural forests (Dang and Tran 2006; McElwee 2008b). While Dang and Tran (2006) state that poor people rely more on natural forests in Nghe An province, McElwee (2008b) shows that the middle income group exploit more forest products than rich and poor groups in Ha Tinh province. The examination of socioeconomic factors with geographical and cultural issues may enable local managers to make relevant solutions for biodiversity conservation and poverty reduction.

Geographical features may play an important role in explaining the consumption of NTFPs of people who live near natural forests (Paumgarten 2005). The distance from the houses to woodlands has an inverse relationship with the consumption of NTFPs from natural woodlands in Africa (Brashares et al. 2011; Chukwuone and Okeke 2012). Locations of households have different levels of reliance and consumption patterns of NTFPs from natural forests (Dang and Tran 2006; Chukwuone and Okeke 2012). Also, there is an inconsistency of wealth determinants of consumption patterns across rural sites in Africa (Fa et al. 2009; Brashares et al. 2011). In Vietnam, there is also a different level of reliance on natural forests with regards to administrative locations (Dang and Tran 2006). Thus, geographical features of households may form different relationships with the consumption of NTFPs from natural forests.

Indigenous people have their own cultural identities and knowledge of natural forests (Gadgil et al., 1993; Narendran et al. 2001), and it might therefore be expected that indigenous groups have a particular consumption pattern of species from natural forests, as others have found (Narendran et al. 2001; Fa et al. 2002; De Caluwé et al. 2009; Dash and Behera 2016). Indigenous people have close relationships with their environment which is linked to their culture and identity (McElwee 2008a). Internal immigrants come from other parts of the country, so the surrounding environment does not contain their ancestors or dictate their cultural activities (Hardy 2005; McElwee 2008a). However, the impacts of indigeneity cannot be easily predicted on a global scale (Lacuna-Richman 2003; Coulibaly-Lingani et al. 2009; Laird et al. 2011). While

studies found that indigenous people use more NTFPs than their counterpart immigrants (Coulibaly-Lingani et al. 2009; Laird et al. 2011), there is no difference in the diversity of forest products used between indigenous people and immigrants in the Philippines (Lacuna-Richman 2003). Thus, different usages of NTFPs should be analysed on the regional or country basis in the area of coexistence between indigenous people and immigrants.

The consumption of NTFPs can be a proxy of the level of impacts on natural forests by people who live near protected areas. The consumption of NTFPs encourages people to collect products from natural forests, degrading the biodiversity value of protected areas. Therefore, identifying relationships between socioeconomic factors and the consumption patterns of NTFPs may enable local managers to identify the key socioeconomic determinants of consumer needs (Dang and Tran 2006; Carpenter et al. 2009; Sakai et al. 2016). There have been numerous studies of relationships between socioeconomic status and consumption patterns for NTFPs in Asia, Africa and Latin America (Hegde and Enters 2000; Paumgarten and Shackleton 2009; Godoy et al. 2010; Brashares et al. 2011). In Vietnam, there remain gaps in understanding the relationships between socioeconomic status and consumption patterns of NTFPs from protected forests (Dang and Tran 2006; McElwee 2008b, 2010).

In this study, we aim to understand the relationship between socioeconomic and geographic factors and the consumption patterns of NTFPs, in terms of both the amount and diversity of products consumed, in an area where indigenous people and immigrants coexist. The study population included two communes, Bu Gia Map and Dak O, in the buffer zones of Vietnam's Bu Gia Map National Park. This park has seen a long coexistence of indigenous people and immigrants, which enables us to understand differences or similarities that have developed over time. We collected information related to socioeconomic factors, indigeneity identities and geographical features from a random sample of 121 households. It was hypothesized that: 1) socioeconomic factors are associated with the consumption of NTFPs of local people; 2) households proximate to the forest consume more NTFPs; 3) there are differences in the consumption of NTFPs between indigenous people and immigrants in their areas of coexistence, after adjusting for socioeconomic and geographic factors; and 4) the determinants of NTFP consumption patterns are inconsistent across the two communes studied. These two communes are both near Bu Gia Map National Park, but they have different access to markets. These geographical features may lead to the difference in the consumption of NTFPs with regards to their amount and diversity. Generally, current policies on forest protection concern villagers regardless

of their specific economic status and indigeneity identities, and these policies need to be adjusted to be relevant to local situations. This study will help local managers identify socioeconomic groups that are vulnerable to the restriction of collection and consumption of NTFPs to create suitable alternatives and conservation strategies for these target groups.

## Materials and methods

### Study site

This study was conducted in the buffer zones of Bu Gia Map National Park in the north of Binh Phuoc province (Vietnam) (See Figure 1). The buffer zones of the park comprise three administrative communes including Bu Gia Map, Dak O (Binh Phuoc province), and Quang Truc (Dak Nong province) and cover an area of around 1,400 km<sup>2</sup>. The total population of these communes is around 30,000 people who come from all over Vietnam. The buffer zones of the Bu Gia Map National Park have a tropical climate pattern, and the wet season occurs from May to October. Bu Gia Map National Park has been a target of internal immigrants because of its fertile soil and abundant natural forests. Currently, the buffer zones of the park still attract people from across the country. The population is composed of the indigenous ethnic groups of Stieng and Mnong, and the immigrant ethnic groups of Kinh, Tay, Nung, Dao, Muong, Cao Lan, Cham, Cho Ro, Mong, and Thai. Indigenous people whose ancestors are native to the study site comprise 42% of the total population.

The spontaneous movement of immigrants into the buffer zones of the Bu Gia Map National Park changed the residential models of indigenous people. Indigenous people used to live near natural forests connecting their current residential areas and the park. Later, immigrants reclaimed natural forests between residential areas of indigenous people and the Bu Gia Map National Park. Thus, some groups of indigenous people live further from the border of the park in comparison to their counterpart immigrants. Currently, these communes have both primary and secondary schools with a good infrastructure at their centres. There is a high school that is located in the Dak O commune. People live in villages that are near the centres of these buffer zone communes and can access national services such as electricity, water, and markets. However, villages that are far from the centres of communes have limited access to national services such as electricity and clean water. The villages that are near natural forests have more difficulty accessing these services, and they still use water from wells and/or streams.

Local people have complex economic patterns regarding their farming and trading activities. Land-



based activities are the main income source of local people in the buffer zones of Vietnam's Bu Gia Map National Park. They plant cash crops such as pepper, rubber, cashew nut, cassava, and coffee trees for their income. Some people buy these agricultural products from gardeners and sell to factories or wholesalers. Some communities participate in forest protection activities under the program named 'Payment for Forest Environment Services.' People also collect forest products for their subsistence and for selling to markets as a way of generating income. The consumption of forest product is popular in the buffer zones of the Bu Gia Map National Park, which can either be collected directly from the forest or bought from the local market.

This park adjoins six other protected areas in Vietnam and Cambodia, creating a large natural habitat for wild animals. There are two types of forest management areas in Vietnam including protected forests (called 'special use forest' by the Vietnamese people) and watershed protection forests. The Bu Gia Map National Park is a protected forest covering a total area of 25,925 hectares. All collection activities are prohibited in the core and rehabilitation zones of the park. The Bu Gia Map National Park is adjacent to two watershed protection forests belonging to the Management Boards of Watershed Protection Forests with an area of roughly 12,000 hectares, and they are less strictly protected. People are allowed to harvest dead trees and NTFPs when these collection activities do not affect the protective functions of these forests.

## Methods

### Sample design

There are 32 villages in the three communes of the buffer zones of the Bu Gia Map National Park, and only twelve villages border the park. Most of the cases of prosecution for illegal collection activities was concentrated in these villages. Park managers prioritised these villages for their biodiversity conservation programs, and they requested a formal study for a better conservation program in these areas. Based on discussion with park managers

about their forest conservation priority, twelve villages bordering with the park were selected to study the consumption patterns of NTFPs. The total population of these target villages was 2,418 households with around 13,500 people. A full list of residents of these villages was compiled to draw a random sample of participants. The names of heads of households were typed into an excel file which could then be stratified by indigeneity. Immigrants and indigenous people amounted to 50.4% and 49.6% of the total population of the villages, respectively. A proportional allocation method was used, with samples sizes from each stratum chosen to be in proportion to the population sizes. After stratifying the population by indigeneity, all households were assigned random numbers. These numbers were arranged in ascending order of value, and the first 60 and 61 households were selected for indigenous and immigrant subgroups, respectively. Therefore, the sample consisted of 121 householders, all of whom responded to the questionnaire.

### Questionnaire design

The survey of socioeconomic measures was based on the method used by the World Bank (WB) (Grosh and Glewwe 2000), while the consumption of NTFPs was measured using a questionnaire developed by the Food and Agriculture Organization (FAO) (Bakkegaard et al., 2016). Participants were asked about the categories and amount of NTFPs used, the number of family members and their age, education levels, the area of land used by the household (rent and/or own), crop diversity, indigeneity identity, and their income sources (*Characteristics of respondents residing in the buffer zones of Vietnam's Bu Gia Map National Park are given in Table 1*).

### Supplementary variables

A GPS was used to record the location of participants' houses. GPS coordinates were entered into the ArcMap 10.3 software package to extract the distances from their houses to the border of the park.

**Table 1.** Characteristics of respondents residing in the buffer zones of Vietnam's Bu Gia Map National Park (IP: Indigenous People; IM: Immigrants; N = 121).

Variables	Bu Gia Map		Dak O		Sample Mean (SD) (N = 121)
	IP (n = 39) Mean (SD)	IM (n = 41) Mean (SD)	IP (n = 21) Mean (SD)	IM (n = 20) Mean (SD)	
Amount of NTFPs (Kg)	98.84 (79.60)	19.62 (23.68)	99.67 (77.52)	10.08 (7.76)	57.47 (70.26)
Diversity of categories of NTFP	4.67 (1.69)	3.59 (2.00)	5.05 (2.16)	2.35 (1.50)	3.96 (2.10)
Distance from homes to the park (Km)	1.56 (0.94)	2.09 (1.95)	4.24 (0.76)	2.97 (1.61)	2.44 (1.72)
Age of respondents (Year)	46.49 (12.18)	47.90 (9.19)	40.71 (11.88)	42.40 (8.77)	45.29 (10.90)
Family size of respondents (People)	6.79 (2.62)	4.41 (1.41)	6.14 (2.65)	4.20 (1.28)	5.45 (2.36)
Education level of respondents (Year)	3.46 (2.90)	8.27 (2.58)	3.95 (2.54)	7.55 (3.03)	5.85 (3.52)
Land area (rented and/or owned (ha)	1.82 (1.99)	5.76 (6.40)	1.01 (1.17)	3.87 (4.15)	3.93 (3.88)
Agricultural income (\$1,000.00USD)	2.58 (1.92)	8.35 (10.81)	2.07 (3.34)	9.11 (9.92)	5.53 (8.21)

### Data analysis

#### Household overview

Descriptive statistics, including the sample mean and standard deviation, were calculated for the socioeconomic measures of respondents. The profile of households was presented as their education levels, age, and family size. Summary statistics of the ethnic composition and income sources of the sample were also presented.

#### Socioeconomic determinants of the amount of NTFPs and consistency

An ANCOVA test was used to test the consistency of the determinants of consumption patterns across communes and indigeneity identities in the general linear model. Interactions between variables were included to test the difference of socioeconomic factors with regards to communes and indigeneity.

This analysis aims to understand which socioeconomic factors determine the amount of NTFPs consumed. The amount of NTFPs was measured in kilograms, and the natural logarithm of the amount was used as a dependent variable in a general linear regression model that contained seven explanatory variables including ethnicity, commune, family size, age, distance, education level, agricultural income, and the area of land used (rent and/or own). The area of land used by respondents was categorized into three groups: small land use group (less than two hectares), medium land use group (from two to four), and large land use group (larger than four hectares). Scatterplots of all variables were initially examined to check that the general linear model might be appropriate for the data. Collinearity diagnostics were used to detect possible issues with multicollinearity in the fitted model, and residual diagnostics were checked to ensure that the data were consistent with the assumptions of the general linear model, including normally distributed errors, linear relationships, and homogenous variance across the range of fitted values.

#### Socioeconomic determinants of the diversity of NTFPs

A Poisson log-linear regression model was applied to examine the determinants of the diversity of NTFPs consumed by local people. The diversity is known as the number of different types of natural forest products, and these categories of NTFPs with their consumption purposes are presented in Table 3. The independent variables used to explain the amount of NTFPs consumed were also used to model the diversity of NTFPs consumed. The Pearson chi-square statistic was used to check the goodness of fit of the model to a Poisson distribution. Interactions between variables were added into the Poisson log-linear regression model to test the consistency of socioeconomic determinants across communes and indigeneity identities studied. The SPSS software package version 25 was used for all statistical analyses.

### Results

#### Overview of households

Indigeneity and socioeconomic profiles of respondents are presented in Table 1. All respondents were the head of household whose average age was 45.29. The average family size was around 5.45 people. The indigenous people included Stieng (37.2%) and Mnong (12.4%) while immigrant groups encompassed Kinh (28.9%), Tay (12.4%), Nung (4.1%), Cao Lan (3.3%), Dao (1%), and Muong (1%). The average education level was 5.85 years at school. The main sources of income were farming, daily farm wages, livestock sales, the sale of forest products, retail, and off-farm jobs. A few people were employed by the government as teachers, local officers, and village staff.

#### Socioeconomic determinants of the amount of NTFPs and consistency

An ANCOVA model explained 66.7% of the variation in the amount of NTFPs consumed (Table 2). The ANCOVA revealed a significant interaction between indigeneity and land use groups  $F(2, 112) = 3.537$ ,

**Table 2.** Tests of between-subjects effects among socioeconomic factors and the natural log of amount of NTFPs consumed ( $R^2 = 0.667$  (Adjusted R Squared = 0.643)).

Variables	Type III SS	df	Mean Square	F	Sig.	Partial $\eta^2$
Corrected Model	115.237 <sup>a</sup>	8	14.405	28.027	.000	.667
Intercept	21.750	1	21.750	42.320	.000	.274
Education	3.032	1	3.032	5.900	.017	.050
Age of respondents	2.300	1	2.300	4.476	.037	.038
Family size of the household	3.055	1	3.055	5.943	.016	.050
Indigeneity (Indigenous People = 0, Immigrants = 1)	13.092	1	13.092	25.473	.000	.185
Land use groups (Small = 1, Medium = 2, Large = 3)	2.612	2	1.306	2.541	.083	.043
Indigeneity * Land use groups	3.636	2	1.818	3.537	.032	.059
Error	57.562	112	.514			
Total	1564.338	121				
Corrected Total	172.799	120				



**Table 3.** Parameter estimates of the fitted model for the dependent variable of the natural log of amount of NTFPs consumed, with the referent category corresponding to indigenous people on large land holdings.

Parameter	$\beta$	SE	t	Sig.	Partial $\eta^2$
Intercept	2.622	.497	5.278	.000	.199
Education	-.062	.025	-2.429	.017	.050
Age of respondents	.014	.006	2.116	.037	.038
Family size of the household	.083	.034	2.438	.016	.050
[Indigeneity = Immigrants]	-.659	.393	-1.679	.096	.025
[Land use group = Small]	.929	.344	2.701	.008	.061
[Land use group = Medium]	.378	.392	.965	.337	.008
[Indigeneity = Immigrants]*[Land use group = Small]	-.928	.411	-2.258	.026	.044
[Indigeneity = Immigrants]*[Land use group = Medium]	-.239	.452	-.528	.599	.002

$p = 0.032$ , partial  $\eta^2 = 0.059$ . This result indicates that the interaction between indigeneity and land use explained 5.9% of the variation in the amount of NTFPs consumed.

After adjusting for age, education, and family size (by setting them equal to their respective means), there was evidence that indigenous people on small and medium land holdings consumed more NTFPs. The 95% confidence interval for the effect of indigeneity in the small and medium land use groups were 4.889 kg (95% CI, 2.986 kg to 8.004 kg) and 2.455 kg (95% CI, 1.415 kg to 4.259 kg). The effect of indigeneity in the large land use group was not statistically significant, with a difference in adjusted mean of 1.933 kg (95% CI, 0.888 kg to 4.208 kg).

A general linear model was fitted to the data to test for relationships between socioeconomic factors and the natural logarithm of the amount of NTFPs consumed by local people (Table 3). Results for the fitted model ( $R^2 = 0.667$ ,  $p < 0.001$ ) indicated that there was an association between the amount of NTFPs and family size ( $p = 0.016$ ), age of respondents ( $p = 0.037$ ), education level ( $p = 0.017$ ), family size ( $p = 0.016$ ), and the interactions between indigeneity and the small land use group ( $p = 0.026$ ). Parameter estimates for the fitted model can be seen in Table 3. These parameter estimates show that the amount of NTFPs used increases 2.53 times if they use less than two hectares of land. One more year of age of the head of household increased the amount of NTFPs by 115.01%. If local people have one more year of education, they reduce their consumption of NTFPs by 93.98%. One additional family member increased the amount of NTFPs by 108.65%. Immigrants who have less than two hectares of land reduced the amount of NTFPs consumed by 39.53%.

#### Determinants of the diversity of categories of NTFPs

Respondents used up to 12 different types of non-timber forest products from natural forests. They reported that they consume these forest products

for three main purposes: food supplies, medicinal treatments, and rituals. They used bamboo shoots, fruits, leaves, rattan sprouts, fish, insects, amphibians, and crustacean for their daily food supplies because these products were easy to collect. These products were also available on local markets. Large reptiles, birds, and mammals are less common either because they can be sold at expensive prices or require complicated hunting techniques. The bark of trees, fruits, roots, leaves, and mammals are used by local people to make traditional medicine. These NTFPs were also used for rituals such as festivals and worship. In short, the use of these products is interchangeable regarding their purpose of consumption because these products can produce daily meals, medicinal treatments, and products essential for cultural identity.

The diversity of NTFPs was modelled as a function of socioeconomic measures using Poisson log-linear regression. The results are summarized in Table 4. The scaled Pearson chi-square statistic had a value of 0.995 which is close to one and therefore indicative of a reasonably well-fitting model (Gardner et al. 1995). Interactions between communes, indigeneity and socioeconomic factors were tested, but they were statistically nonsignificant. Statistically significant relationships were found between the number of categories of NTFPs and indigeneity ( $p < 0.001$ ) and land area used by respondents ( $p = 0.011$ ). Immigrants use 60.5% less of the categories of NTFPs compared to indigenous people. The medium land use group reduce their diversity of categories of NTFPs by 75.8%.

#### Discussion

In this study, we found that socioeconomic factors and indigeneity identities play an important role in determining the consumption patterns of NTFPs. Socioeconomic factors can explain the consumption of the amount of NTFPs in the buffer zones of Vietnam's Bu Gia Map National Park. Indigenous people who belong to small and medium land use groups are different from others in the consumption of NTFP while small land use immigrants consumed the least NTFPs. The medium land use group used a smaller number of categories of NTFPs than the small and large land use groups. Consumption also decreased with increasing education levels but increased with

**Table 4.** Poisson regression for the diversity of categories of NTFPs, with the referent category corresponding to indigenous people on large land holdings.

Variables	$\beta$	SE	Sig.	Exp ( $\beta$ )
Intercept	1.832***	.1180	.000	6.246
[Indigeneity = Immigrants]	-.507***	.1036	.000	.602
[Land use group = Small]	-.164	.1220	.179	.849
[Land use group = Medium]	-.277*	.1325	.037	.758

family size and the age of the head of households. Finally, indigenous people and immigrants had different consumption patterns in terms of both amount and diversity, in the buffer zones of the Bu Gia Map National Park. Indigenous people consumed more NTFPs than their counterpart immigrants as measured by both amount and diversity.

The first hypothesis assumed that socioeconomic factors are associated with the amount of NTFPs consumed. Our observations showed that socioeconomic factors can be used to understand the consumption of the amount of NTFPs. Four important socioeconomic factors that explained the consumption of the amount of NTFPs include family size, land area, education level and the age of the head of household. NTFPs play an important role in providing food supplies, and larger families consume more products than smaller households (Byron and Arnold 1999; Arnold and Pérez 2001). This relationship has been observed by researchers in Asia and Africa where family size increases the consumption of natural forest products (Hegde and Enters 2000; Masozera and Alavalapati 2004). In addition, the small land use group consumed much more NTFPs than the large and medium land use groups. Land area is an important factor that determines the socioeconomic status of people who rely on land-based income sources. In land-based income communities, smaller land holdings do not allow them to cover their basic needs and they rely on forest products for food supplies or to earn additional income (Heubach et al. 2011; Dash and Behera 2016). Other researchers found similar trends in Ethiopia, Benin and India where small land use groups consumed more NTFPs (Heubach et al. 2011; Melaku et al. 2014; Dash and Behera 2016). Education levels also had a negative relationship with the amount of NTFPs consumed. Increased education helps local people better manage their household economies and increases off-farm job opportunities. This result corroborates the findings of many studies that found education attainments reduce the amount of NTFPs consumed in India and Nigeria (Mitra and Mishra 2011; Chukwuone and Okeke 2012). The age of the head of household had a positive relationship with the amount of consumption of NTFPs. This finding agrees with other studies that the age of the head of household often changes consumption patterns of NTFPs (Paumgarten 2005; Chukwuone and Okeke 2012; Sakai et al. 2016; Luiselli et al., 2017). Together with previous studies, the findings of this study suggest that socioeconomic factors are robust determinants of the consumption of the amount of NTFPs regardless of the mixed population of indigenous people and immigrants. However, we did not focus on the way people obtained these products (buying or collecting from natural forests). Examining the link from consumption patterns to the exploitation of

these NTFPs within natural forests may better illustrate the impacts of local people on protected areas. Future studies should identify the determinants of the collection and purchase of these products to identify the links from consumption patterns to their impacts on natural forests.

Surprisingly, the medium land use group was statistically significantly different from the small and large land use groups in the number of categories of NTFPs consumed. While the increase of socioeconomic factors may reduce the amount of NTFPs consumed because of food demand, it does not necessarily reduce the diversity of NTFPs used because these products may be luxury food for wealthy people (Cavendish 2000; Twine et al., 2003; Drury 2011). Vietnam is a status conscious society where people demonstrate their social position by consuming luxury food and expensive goods (Drury 2011). When people are poor, they consume NTFPs because they are a source of cheap food, but when they have more money they still use these products as fresh food supplies, although they may increase the diversity of food types used (Cavendish 2000; Paumgarten and Shackleton 2009; Drury 2011). This study contradicts observations from Ke Go Nature Reserve in Ha Tinh province in Vietnam where the medium land use group relies more on natural forest products (McElwee 2008b). In Bu Gia Map National Park, the medium land use group may devote time and money to land cultivation, while the small land use group may spend more time collecting forest products for their consumption. In the meantime, the large land use group may spend money to buy forest products as luxury goods to show off their social status (Cavendish 2000; Twine et al., 2003; Drury 2011). Therefore, further studies need to examine the reasons why there was no difference in the diversity of NTFPs consumed between the small and large land use groups.

Our second hypothesis assumed that households proximate to the forest consume more NTFPs. Unpredictably, geographical features (distance to the park and residential communes of households) are not statistically significant in explaining the consumption of NTFPs. These findings appear to contradict to other studies that indicate the significance of geographical features (Dang and Tran 2006; Brashares et al. 2011; Chukwuone and Okeke 2012). This may be because previous studies examined the direct collection of NTFPs for sales, meaning that access may allow people to have different gathering levels (Adhikari et al. 2004; Brashares et al. 2011). Our results agree with the study conducted by Mitra and Mishra (2011) that found no difference in the amount and diversity of categories of NTFPs consumed by local people with regards to distance between respondents' homes and forests. The findings of this study suggest that

geographical factors may be unstable predictors in understanding and predicting the NTFPs consumed by local people.

After adjusting for socioeconomic and geographical factors, the results of this study supported our hypothesis that there are differences in the consumption of NTFPs, in terms of amount and diversity, between indigenous people and immigrants in their areas of coexistence. Indigenous people have a good knowledge of their surrounding environment regarding the consumption of species for food supplies, medicinal treatments, and culture. This study concurs with many studies that found a difference in forest utilization based on indigeneity across the world (Coulibaly-Lingani et al. 2009; Laird et al. 2011). For example, in Cameroon, indigenous people consume more NTFPs than their counterpart immigrants (Laird et al. 2011). There may be several explanations for the differing results. The main goal of immigrants is to boost their economic status, and forest products may play an important role when initially resettled (Gubbi and MacMillan 2008; Reyes-García et al. 2012). But once they are settled in their new environment, they use less NTFPs than their counterpart indigenous people because they can make their living from farming activities. Indigenous people live in their native land and inherit knowledge of the surrounding environment from their ancestors (Gadgil et al., 1993). Traditional knowledge combined with their close cultural relationship with natural forests means that they know which species are edible or useful for medicine or worship (Gadgil et al., 1993; Narendran et al. 2001; De Caluwé et al. 2009; Laird et al. 2011). This study joins the literature that shows the difference in the consumption of NTFPs between indigenous people and immigrants (Coulibaly-Lingani et al. 2009; Laird et al. 2011).

Interestingly, the immigrants with small land holdings consumed less NTFPs than indigenous people who had large land holdings. Immigrants have less access to NTFPs than indigenous people because they have limited rights for making use of natural resources (Coulibaly-Lingani et al. 2009). In the Philippines, immigrants use even more NTFPs for their families as income sources (Lacuna-Richman 2003). Unfortunately, forest policies often prioritize access to natural forests for indigenous people regardless of the important role of forests in providing food security for poor immigrants. Therefore, further study needs to examine the impact of current forest policies on immigrants to better understand their consumption patterns regarding their reliance on NTFPs.

The effects of the interactions of land use and indigeneity on the consumption of NTFPs is one of the important issues that should be used to make a better intervention. Land area may play an important role in determining the income of farmers

(Heubach et al. 2011; Dash and Behera 2016) while indigenous people who lease out their land may reduce their cultivation outputs (Codjoe 2006). The consumption of NTFPs is especially important for indigenous people who belong to the small and medium land use groups. This may be because the movement of income from the small to large land use groups occurs via informal cashew nut rental markets in the buffer zones of the Bu Gia Map National Park where indigenous people and immigrants play the roles of lessors and lessees, respectively. Therefore, current interactions between indigeneity and land used by local people should be the target for interventions to ensure the long-term biodiversity conservation and economic development programs at the local level.

Our observations do not support the last hypothesis that assumed the determinants of consumption patterns were inconsistent across communes. None of the interactions between the commune and indigeneity, or the commune and socioeconomic factors were statistically significant. The findings of this study contradicts the conclusions of other studies in Africa where consumption was not consistent with geographic location (Fa et al. 2009; Brashares et al. 2011). The two communes near Bu Gia Map National Park have similar demographic structures and economic activities. Therefore, they have invariant socioeconomic determinants of the consumption patterns of NTFPs.

Local policymakers need to create interventions based on indigeneity identities and socioeconomic factors. First, as interactions between indigeneity and land use are current issues, forest managers need to support indigenous people with small and medium land holdings and immigrants with small land holdings when they create protected areas because these products may be meaningful for cultural activities and subsistence (Becker and Ghimire 2003). This problem is especially sensitive for people in the protected areas where buffer zones exist in name only because they have no place to secure their food supplies rather than the national park, and conflicts may arise when they collect NTFPs from protected areas (McElwee 2010). Second, it is important for local managers to use socioeconomic factors including family size, education and the area of land used by respondents to inform their interventions for the reduction of NTFP consumption (Dollacker and Rhodes 2007; Meyfroidt and Lambin 2008; Völker and Waibel 2010; Şekercioğlu 2012). Possible economic support should focus on land management because the success of integration of land into biodiversity conservation has been observed by other authors (Dollacker and Rhodes 2007; Meyfroidt and Lambin 2008). Four hectares of cultivation land should be a critical ceiling for future economic support for indigenous people at the



local level. Viable support activities could be the improvement of their land cultivation or restructuring their crop compositions to gain enough income that covers their yearly expenses (Dollacker and Rhodes 2007; Meyfroidt and Lambin 2008). Education should be the focus in the longer term because this factor can provide more off-farm job opportunities and increase people's ability to manage their household economy. However, short-term interventions could provide additional unskilled off-farm job opportunities, reducing demand on the consumption of NTFPs (Şekercioğlu 2012).

### Conclusion

In this study, we assumed that socioeconomic factors, geographical features and indigeneity are important determinants of the consumption of NTFPs in the buffer zones of Vietnam's Bu Gia Map National Park while these determinants are inconsistent across buffer zone communes. Our observations supported two hypotheses that socioeconomic factors and indigeneity determine the consumption of NTFPs. The interactions between indigeneity and land area used help explain the variations of the consumption of NTFPs. While NTFPs are important for indigenous people belonging to the medium and small land use groups, immigrants with small land holdings use the least amount of NTFPs. In addition, the small and large land use groups use a much higher diversity of NTFPs than the medium land use group. This study highlights the role of interactions of indigeneity and land use in the consumption of NTFPs. Further studies need to examine the interactions between land use and indigeneity with consumption and the reason why the medium land use group uses fewer categories of NTFPs than their counterpart small and large land use groups. Our results highlight the need for forest policies that support immigrants who have less than two hectares of land, and agricultural training for all local people with less than four hectares.

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No potential conflict of interest was reported by the authors.

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