

A Study on Livelihood Diversification in Forest Resource Dependent Villages of Northern Laos

メタデータ	言語: English 出版者: 公開日: 2022-12-12 キーワード (Ja): キーワード (En): 作成者: CAHYO WISNU RUBIYANTO メールアドレス: 所属:
URL	http://hdl.handle.net/20.500.12099/88954

A Study on Livelihood Diversification in Forest Resource

Dependent Villages of Northern Laos

(ラオス北部の森林資源に依存する村落における生業多様
化に関する研究)

2022

The United Graduate School of Agriculture Science, Gifu

University

Science of Biological Environment

(Gifu University)

CAHYO WISNU RUBIYANTO

A Study on Livelihood Diversification in Forest Resource

Dependent Villages of Northern Laos

(ラオス北部の森林資源に依存する村落における生業多様
化に関する研究)

CAHYO WISNU RUBIYANTO

CONTENTS

Contents	1
List of Tables	5
List of Figures.....	6
Summary.....	7
Summary (in Japanese)	12
 Chapter 1: General introduction	 14
1-1 Background.....	14
1-2 Objectives	15
1-3 Overview of dissertation.....	16
 Chapter 2: Previous studies on livelihood diversification in Montane	
Mainland Southeast Asia (MMSEA).....	17
2-1 Introduction	17
2-2 General historical dynamics of society and livelihoods, and its diversification	
.....	19
2-2-1 Globalization, political background, and related livelihood changes in	
MMSEA	19
2-2-2 General livelihood dynamics in MMSEA.....	23
2-3 Approach to studying livelihood diversification	25
2-3-1 Concept of livelihood diversification.....	25
2-3-2 Measurement of livelihood diversity	30

2-4 Case studies: pattern of livelihood diversification in MMSEA.....	31
2-4-1 Distress Diversification	33
2-4-2 Progressive Diversification	36
2-5. Conclusion	40

Chapter 3: Framing of field survey and study site setting for research

objectives.....	45
3-1 Projects of road developments and the highest globalization region in Laos	45
3-2 Preliminary survey and study site setting	46
3-2-1 Data collection in Sone district Houaphan Province.....	47
3-2-2 Socio-economic status.....	49
3-2-3 Agriculture production, livestock and NTFPs	50

Chapter 4: Historical transition of livelihood under road development

in Northern Laos	55
4-1 Introduction	55
4-2 Methodology.....	56
4-2-1 Study site.....	56
4-2-2 Data collection	57
4-3 Results and discussion	58
4-3-1 Shift in rice fields and maintenance of rice production amid globalization	59

4-3-2 Commercialization of NTFPs and agriculture products: Influence of Chinese and Vietnamese merchant	61
4-3-3 “New Cash Crops”: Adaptation to social and economic changes caused by external and internal motivation	63
 Chapter 5: Combination of livelihood activities and livelihood strategies	 72
5-1 Introduction	72
5-2 Methodology.....	75
5-2-2 Data collection	75
5-2-3 Data analysis	75
5-3 Results and discussion	77
5-3-1 Balance of subsistent and economic activities.....	77
5-3-2 Contribution of NTFPs to livelihood	81
5-3-3 Flexible role of livestock	83
 Chapter 6: General Discussion and Conclusion.....	 90
6-1 Progressive income diversification from agricultural and forest ecosystems	90
6-2 Perspective for future studies.....	92
 References	 93
Acknowledgements	102

LIST OF TABLES

Table 2-1 Chronology of changes in political systems in MMSEA	41
Table 2-2 Livelihood dynamics of a rural village in northern Laos	42
Table 2-3 Index to measure livelihood diversity	43
Table 3-1 Road construction in Houaphan Province	53
Table 3-2 Characteristics of preliminary survey villages	54
Table 4-1 Population and household composition of the study villages in 2018.....	57
Table 4-2 Characteristics of target villages.....	67
Table 4-3 Summary of socio-economic condition	69
Table 4-4 Livelihood activities and income of the household	70
Table 5-1 Description of independent variables and categories of household strategy	86
Table 5-2 Strategy of livelihood for income diversity (Simpson index)	87
Table 5-3 Strategy of livelihood for total income.....	88

LIST OF FIGURES

Figure 2-1 Representation of U-shaped relationship in livelihood diversification	31
Figure 3-1 Road Project in Laos 2009	45
Figure 3-2 Map of study site	48
Figure 3-3 Population Change in Sone district	49
Figure 3-4 Population in the study area in December 2017.....	50
Figure 4-1 History of the main road in the study site	69
Figure 4-2 Livelihood transition under road development in different road access (a) bad road access, (b) middle-bad access, (c) middle-good access, and (d) good road access.....	71
Figure 5-1: Relationship between income diversity and total income.....	89

SUMMARY

In the process of globalization, diversification of livelihoods activities at household level is the norm where many people are still depending on subsistence activities in mountainous villages of mainland Southeast Asia. However, there are few studies about livelihood diversification in this area. Recently, previous studies described that livelihood diversification was observed in a process of shifting from subsistence-based to market-oriented livelihood, mostly focusing on income diversification and often counting sectors (agricultural, industrial, services) or non-farm, off-farm and on-farm activities, so understanding livelihood diversification has been often oversimplified. Moreover, livelihood diversity on subsistence activities has often been neglected in previous studies, which have mainly focused on deagrarianization process. Yet in this context, capturing and understanding livelihood diversity and its dynamics (and especially that of “livelihood diversification”) is a key to sustainable development of this area.

Previous studies highlighted that diverse livelihood dynamics can be seen from two viewpoints of livelihood diversification called distress diversification and progressive diversification. However, the studies on the pattern of livelihood diversification are still not enough and identification of diversification process and its transition remains unclear, so this issue needs further research. In this thesis, I focused on historical dynamics of livelihood transition and effectiveness of livelihood strategy to livelihood diversification and tried to show the direction of the pattern of livelihood diversification on forest resources-dependent villages in northern Laos.

This thesis is divided into six chapters. The first chapter described the background and objectives of this thesis. In chapter 2, it reviewed approach to studying livelihood diversification and followed by case studies to show the pattern of livelihood diversification in montane mainland Southeast Asia (MMSEA). In chapter 3, a description of study site is given; first, general background of Laos and road development project in Laos, and second, overview of preliminary survey of general area information. In chapter 4, it explained the present conditions of rural livelihoods in selected villages, historical transition of rural livelihood under road development, adaptation to social and economic changes are discussed based on intensive field survey and interview with local farmers. In chapter 5, the focus is livelihood strategy in relation to livelihood diversification; first, balance of subsistent and economic activities, contribution of non-timber forest product (NTFPs) to livelihoods and flexible role of livestock are discussed. Finally, in chapter 6, conclusion and perspective for the future studies are discussed.

In this thesis, at first, I summarized the historical social dynamics with respect to globalization and the political background and the general livelihoods dynamics in MMSEA to understand the relationship between globalization and the livelihood dynamics. It seems that road development in rural areas is one of the most influential factors of globalization on the livelihood of rural communities. For examples, commercialization of forest products and cash crops were drastically introduced to local people by Chinese and Vietnamese merchants and local company. Along with this, local people also tried to intensify their total agricultural system and became to be engaged in diverse livelihood activities.

Second, I tried to show livelihood transition under road development as a case study. The field survey was carried out in Sone district, Houaphan province in northern Laos. Sone district partly includes Nam Et Phou Leuy National Protected Areas which is the largest protected area in Laos and is covered by mixed evergreen deciduous forest up to 1,500 m asl. I chose 4 villages in three different conditions of road accessibility; bad (Bong village), medium (Houasy Su and Houay Sanguan village), and good (Houay Lao) accessibility to compare how different livelihood strategies local people chose. I conducted in-depth survey during the period April-June 2018 and January-March 2019 and I interviewed 125 households. I also conducted focus group discussion, participatory observation and interview to local elders to support household-level interview survey.

Next, I categorized the livelihood activities into six principal activities (upland rice cultivation, paddy rice cultivation, maize cultivation, other cash crops cultivation, red mushroom collection and other NTFPs collection) of each household in each village, and traced total number of households for around twenty years. I added the information of history of road development in this study area to know the relationship between road and livelihood changes. The results showed that agricultural and forest products became more commercialized drastically after road development, but household in poor accessibility village was more vulnerable due to high price fluctuation. Moreover, NTFPs were important activities for cash in more poor and middle accessibility villages. Based on the results, it is concluded that rapid road development brought drastic changes of livelihood system in

montane villages of Laos, and especially households in poor accessibility villages were observed to be more vulnerable to globalization.

Third, I focused on the effectiveness of livelihood strategy in different situations to livelihood diversification. Most of previous studies on livelihood diversification overlooked subsistence activities. So, I tried to identify livelihood strategy including subsistence and economic activities by using 13 independent variables in multiple linear regression analysis and I compared livelihood strategies in the four villages. This analysis provided information of contribution of livelihood activities to the total income and also its diversification. This study revealed that local people who still maintained subsistence activities in upland rice cultivation, their livelihood activities tended to have been more diversified. Balance of subsistence and economic activities was highlighted in this study where households in good accessibility village were the most benefited with the potential of an increase in cultivation of cash crops and low risk of price fluctuation. The new cash crops might offer an alternative to the goal of livelihood diversification, not only farm productivity or risk reduction but also better income sources. While NTFPs greatly contributed to total income and its diversity in the poor and middle accessibility villages, households in these villages which were the most vulnerable to globalization desired to keep diverse livelihood activities on NTFPs. In addition, this study reported that livestock had flexible role to the livelihood in this study area. In poor accessibility village, livestock was acted as savings, and in good accessibility village, livestock was acted as an investment. Livestock was considered as an effective strategy in all villages in the face of rapid globalization.

I also explored the relationship between total income and income diversity to clarify the pattern of livelihood diversification among the farmers who depend on forest resources. The findings showed that the direction of livelihood diversification in all villages tended to be progressive, where the more diverse livelihood activities, the higher income received by households. Livelihood strategies in different situations of villages had been identified and this study confirms concerns about globalization and the vulnerability of rural households in mountain villages. These findings can contribute to sustainable development in this area.

日本語要旨

東南アジア大陸山地部の自給的活動に依存した村落では、グローバル化の過程において世帯レベルの生業活動の多様化は広くみられるものの、これに関する研究は依然として限られている。近年の研究には、自給的活動に依存した生業から経済的活動に依存した生業への移行を記述する研究がいくつかみられるが、ほとんど収入源の多様化に関するもの、あるいは脱農化に関するもので、また分析枠組みも単純化されたものになっており、現状を必ずしも反映しているとはいえない。本来この地域で活動のかなりを占めるはずの自給的活動も見過ごされており、生業全体を分析した研究が不可欠であるとともに、生業の多様性やその動態を理解することは、この地域の安定的かつ持続的な発展にとって重要である。

先行研究から、生業の多様化は追いやられた多様化（*distress diversification*）と前進的な多様化（*progressive diversification*）の二つに分けて理解することができる。しかしこれらの動態は依然として不明なところが多い。本論文では、森林資源に大きく依存しつつも道路建設が急速に拡大するラオス北部を対象とし、生業の歴史的変遷および生業の多様化を含む住民の生業戦略に着目し、急速なグローバル化への対応および村落が置かれている社会経済的条件ごとの生業戦略の有効性について明らかにしようとした。

本論文は6つの章からなる。第1章では背景と目的を説明し、第2章では生業多様化に関する先行研究をレビューし、様々な事例を用いて東南アジア大陸山地部にみられるパターンについて述べている。第3章では、本研究の調査地周辺の予備的調査から得られた広域的な情報と道路交通網整備の過程について記述した。第4章では、集中的な調査を行った村落の現状と歴史的変遷を、道路交通網整備と関連させつつ議論を行った。第5章では、生業多様化と住民の生業戦略について議論した。自給的活動と経済的活動の組み合わせ、非木材林産物の役割や家畜の役割の柔軟性について議論を行った。6章ではこれらの議論をまとめ、本地域の安定的かつ持続的な生業について論じた。

本論文ではまず、東南アジア大陸山地部の村落におけるここ50年ほどの生業の変遷を本地域のグローバル化および社会経済的な変化と絡め、先行研究の知見も含めて記述した。山地部の生業の変遷には近年の道路交通網整備の影響が非常に大きく、例えば換金作物の導入、非木材林産物の商品化が急速に広がったことがわかった。中国やベトナム商人の影響が強く、経済活動の活発化が顕著であった。農業の集約化も進み、これまでの生業活動に新しい活動が加わり、住民は多様な生業活動を組み合わせることで急速な市場経済化に対応していた。

次に本論文では事例研究として、調査地に道路交通網が山村に到達した20年ほど前からの生業の変遷を描いた。現地調査はラオスで道路交

通網整備を最も活発に行っている地域の一つであるラオス北部フアパン県ソーン郡とした。ソーン郡は、ナムエットプルーイ国立保護区を含み、丘陵性常緑林がほとんどを占める広大な森林を有している、多くの住民は林産物採取等、この森林と関係を持ちつつ生活を行っている。申請者はこの地域において、アクセスのしやすさに応じて、良好な村（フアイラオ村）、中間の村（フアイスー村、フアイサングアン村）、悪い村（ボン村）の4カ村を選定した。これらの村に2018年4月～6月、2019年1月～3月に滞在し、合計125世帯に対し集中的な調査を実施した。また世帯ごとの調査に加えて、必要に応じて参与観察や古老への聞き取り調査を行い、情報を補完した。

およそ20年間の生業の変遷を追跡するため、村の生業活動のうち主な6つ、すなわち陸稲栽培、水稻栽培、トウモロコシ栽培、その他の換金作物栽培、赤いキノコ採取、その他の非木材林産物採取について、聞き取り調査を行い過去の情報を収集した。これと併せて道路交通網整備の状況を聞き取った。その結果、道路交通網整備によって非木材林産物の商品化が近年急速に進んでいることが明らかとなった。一方で中間および悪いアクセスの村は、商品作物の価格変動の影響を受けやすく、またこの影響を緩和するように生業活動の中で非木材林産物が貢献している可能性が明らかとなった。

住民の生業戦略の有効性を検証するため、世帯の経済状況と収入減の多様性の関係について分析を行った。先行研究の多くは自給的活動を見過ごしているものが多いため、ここにも留意した。生業活動を自給的活動と経済的活動のバランスを考慮しつつ13の活動に分けて独立変数とし、従属変数を世帯の総収入および生業活動の多様度指数とし、重回帰分析を用いてそれぞれ分析した。分析の結果、住民は依然として自給的活動を主要な生業活動として行っており特に陸稲生産を行っている世帯はより生業活動を多様化させていることが明らかとなった。アクセスの良好な村の世帯は最も道路交通網整備の恩恵を受けており換金作物の新たな導入も積極的に行っていた。アクセスが悪い村と中間の村は、非木材林産物が総収入と生業活動の多様性に多く貢献しており、商人の到達頻度が低く商品作物の価格変動を受けやすい環境を緩和するため住民によって活発に行われていることがわかった。さらに家畜の役割が村落によって異なることも明らかとなった、アクセスが悪い村、中間の村では家畜は住民の資産を維持するための動産としての役割を持った一方で、アクセスが良好な村では家畜は投資の対象として資産を増加させる役割を有しており、グローバル化の進む本地域において家畜は、生業安定化および本格的経済的活動を始めるための最初の資産として機能し、本地域において重要な役割を果たしていることが明らかとなった。また本地域では前進的な生業多様化が観察され、それには林産物が大きく貢献していることが明らかとなった。

Chapter 1: General introduction

1-1. Background

Mainland Southeast Asian countries such as Cambodia, Laos, Myanmar, Thailand, and Vietnam have recently experienced strong growth of economy, and the growth is often affected by intensification of regional connectivity (McKinsey Global Institute, 2014; Oliva, 2017). These countries have strongly promoted major road projects such as One Belt One Road by China (Maguire *et al.*, 2015; Tsui *et al.*, 2017), and the projects have brought impacts on local trade network.

The most noticeable impact of these trades is related to change in agricultural system such as introduction of new crop plantation and commercialization of agricultural and forest products (Goto, 2011). These impacts also strongly affect local people's livelihood in mountainous area which have relied on agriculture and forest resources (Berkes and Folke, 1998). Jodha and Shrestha (1994) pointed out that inaccessibility of mountainous villages such as poor roads and mobility, limited relations especially to traders in global market, and high-level isolation has brought local communities into a strategy of direct and total dependence on diverse natural environment and resources. Many studies also reported the local people enhanced economic activities through crop plantation (Ngoc and Yokoyama, 2019; Rerkasem, 2005; Rigg, 2005; Thanichanon *et al.*, 2013). For example, in northern Laos, large-scale cultivation of maize, rubber, or sugarcane has been introduced (Cole, 2021), and its expansion might bring great impacts not only on local livelihood but also on environment (Hurni and Fox, 2018).

Utilization of the natural environment by mountain people is important in supporting their subsistence needs. A lot of their activities coupled with the recent acceleration of development became to be newly observed, and some studies pointed out that their livelihood activities became more diverse (e.g. Scoone, 2009), however, as mentioned in following chapters, the actual dynamics of livelihood activities have failed to be pursued because of the difficulty of its quantification and still remain unclear. One of effective way to understand the dynamics is considered to explore the history of all their livelihood activities in detail and analyze their diversity by reasonable segmentation from intensive field survey. In mainland Southeast Asia, northern Laos is a center of rapid road development especially by Chinese road construction projects and is well known as a hotspot of biodiversity. Thus, this study focused on mountainous areas of northern Laos as a study site to observe dynamic change of livelihood activities.

1.2 Objective of this study

The main objectives of this study are (1) to review and identify problems of previous studies on livelihood dynamics, (2) to identify livelihood activities through description of historical transition and present situation of livelihood from intensive field survey, and (3) to quantify livelihood diversity and analyze livelihood strategies. Through these analysis, this study tried to reveal the role of multi-functional aspects of livelihood activities and relationship between environment and local society, and finally provide new perspective of livelihood dynamics for sustainable development of rural society in MMSEA.

1.3 Overview of dissertation

This thesis is divided into six chapters. The first chapter described the background and objectives of this thesis. In chapter 2, the author reviewed studies on livelihood diversification and presented several informative case studies to show the pattern of livelihood diversification in MMSEA. Chapter 3 provides the information of basic framing of field survey and study site setting for research objectives. In chapter 4, the author explained historical transition and the present conditions in selected villages, and discussed adaptation to social and economic changes. In chapter 5, the focus is on livelihood strategy in relation to livelihood diversification, especially for balance of subsistent and economic activities, contribution of NTFPs to livelihoods and flexible role of livestock. Finally, in chapter 6, conclusion and perspective for the future studies are provided.

Chapter 2: Previous studies on livelihood diversification in MMSEA

2-1. Introduction

Montane mainland Southeast Asia (MMSEA) is a remote inland area and comprises the mountainous areas of Cambodia, Laos, Myanmar, Thailand and Vietnam; sometimes southern China is included. Livelihoods in MMSEA are often characterized by subsistence-based mountain agriculture with less practice and management of modern technologies and tend to have low productivity (Hasan *et al.*, 2020), especially shifting cultivation with upland rice as the staple food, on steep slopes and incorporating various kinds of livelihood activities (Rerkasem and Rerkasem, 1995). Although shifting cultivation has been the principal activity in local livelihood systems (Mertz *et al.*, 2009; Ziegler *et al.*, 2009), market-oriented non-agricultural activities – as well as subsistence-based agricultural activities – have also been carried out. Combining these activities is the norm in rural livelihoods in MMSEA (Dzanku, 2015; Martin and Lorenzen, 2016), and capturing and understanding livelihood diversity and its dynamics (and especially that of “livelihood diversification”) is key to the sustainable development of this area.

Many studies have been carried out on livelihood diversification, especially in Sub-Saharan Africa (SSA) (Ellis, 1999; Martin and Lorenzen, 2016). Previous studies of SSA have analyzed the basic dynamics of diversification of assets, activities and income sources commonly observed in rural households experiencing economic development (Barret *et al.*, 2001). However, many studies focus too heavily on income diversification and often just count sectors (agricultural,

industrial and service) or nonfarm, off-farm and on-farm activities (and their combinations), and previous livelihood diversification studies have been oversimplified. Subsistence-based agricultural activities are still carried out in many rural areas, and their diversity has often been neglected in previous studies, which have mainly focused on the shift in the deagrarianization process (Barret *et al.*, 2001; Bryceson, 1996, Nielsen *et al.*, 2013). Influential studies of this subject have revealed that an important part of the rural economy in respect of livelihood diversification to non-agricultural activities is from subsistence activities (Martin and Lorenzen, 2016). A holistic understanding of livelihood dynamics is insufficient, however, especially in MMSEA where there have been few studies of livelihood diversification and subsistence activities are still widely found (Martin and Lorenzen, 2016; Nakatsuji, 2005). There has been a dramatic change in livelihoods in MMSEA as a result of rapid globalization under the influence of surrounding countries such as China (Mertz *et al.*, 2009; Goto, 2011).

In addition, massive road development in the area also has been the major agent in globalization context. The numerous roads have linked local livelihoods in remote area to local, to regional and even to global markets (Rerkasem, 2005). Various people such as traders, merchants, and businessmen have become to visit rural areas and bring great economic impacts on local livelihoods, and then the road development has induced changes in agricultural land use and its surrounding environment (Zimmerer, 2007; Sidle and Ziegler, 2012). The change in livelihoods is the result of not only present conditions, but also historical context, and the

trajectory of livelihood diversification and more sustainable development in MMSEA needs to be understood from both of these perspectives.

We examined the historical social dynamics with respect to globalization and the political background, and the general livelihoods dynamics in MMSEA. The concept and history of livelihood studies were reviewed to understand the relationship between globalization and the livelihoods dynamics. We then discuss the gaps in livelihood diversification in a number of case studies, and also how to measure the livelihood diversity and diversification. The author's summary examines the direction of livelihood diversification in MMSEA, based on these studies, focuses on the lack of current studies and provides a foundation for further research.

2-2. General historical dynamics of society and livelihoods, and its diversification

Globalization, political background, and related livelihood changes in MMSEA

Many workers have researched livelihoods and agriculture in MMSEA and one of the classic topics has been that of shifting cultivation which is well known as traditional agricultural system that has long been widely practiced (Rerkasem and Rerkasem, 1995). Livelihood changes in MMSEA in recent decades can basically be understood through the changes from shifting cultivation to permanent agricultural fields (e.g., coffee, maize, rubber, sugarcane) and non-agricultural land uses (e.g., construction of transportation networks, houses, hydropower dams, factories) (Mertz *et al*, 2009; Rerkasem, 2005). Drastic changes at the country level have taken place in MMSEA for around 50 years and they have exerted

considerable influence on the livelihoods of local people (Rerkasem and Rerkasem, 1995; Mertz *et al*, 2009).

The changes have mainly been influenced by external factors such as the regime in each country, government policy and development of transportation networks (Ellis, 1999). MMSEA has experienced major social changes and their chronology is shown in Table 2-1. In the 1970s, after the Second Indochina War, Laos and Vietnam became established as socialist nations. The Khmer Rouge formed ‘Democratic Kampuchea’ in 1975. Although Myanmar was not a communist country, it implemented a planned economy like other countries, during the Ne Win administration. Under this planned economy, farmers had to provide paddy rice to government. In the period of planned economy, shifting cultivation temporarily increased on slope land because temporary shortages in rice production meant there was insufficient rice for local people. Although political regime of Thailand was stable, Thai government started to establish national park for forest conservation. Establishment of the Doi Inthanon National Park resulted in prohibition of shifting cultivation by local Karen people, who constituted the majority of the ethnic minorities in Thailand, and they were forced to change their livelihoods.

Generally, socialism and planned economies were found widely in MMSEA until the middle of 1970s. However, around the 1980s, planned economies gradually collapsed and governments introduced free economies. One example was the policy of *Doi Moi* (renewal) in Vietnam and the *Chintanakaan Mai* (new thinking) in Laos. These policies promoted commercial activities in rural as well as

in urban areas. Many cash crops were introduced and biological resources became commercialized. In Vietnam, the objective of Resolution No. 10 was to allocate land for each household to cultivate and sell crops without government control. In Myanmar the collective system ended with the collapse of the Ne Win administration and its planned economy. Social confusion in Cambodia led to a slight delay in the opening of the economy compared with other countries.

Policies for forest conservation and land law in Cambodia, Laos and Vietnam were implemented around the 1990s, and available land for shifting cultivation became limited. Community forestry was introduced into Cambodia, and the use of forest resources was subject to participatory management by residents and local organizations. In Vietnam, land law had three main purposes: stabilizing shifting cultivators; increasing agricultural production by giving incentives to farmers to plant perennial crops; and conserving forest resources. As a result of these policies, people began to rely economically on forests and to become engaged in income-generating activities (McElwee, 2008).

In addition, instead of political background, road development is one of factors to increase in new livelihood activities in highland. Two large development projects began at the start of the 21st century. One was the Great Mekong Sub-Region (GMS) program, initiated by the Asian Development Bank, and the other was the One Belt One Road (OBOR) initiated by China. In 2015 about 5,700 km of road development projects were started with the purpose of connecting all countries in MMSEA, resulting in considerable impact to isolated villages near borders (ADB, 2015). Land concessions also influenced the changes in livelihood strategy choices

and outcomes in rural communities (Jiao *et al*, 2017). Globalization may continue to impact the livelihoods of rural communities in MMSEA.

To know the rural livelihood dynamics of MMSEA in village level, a case study in northern Laos (see Table 2-2), which illustrates historical transition and relationships between livelihood and several factors, is introduced in following part (Hirota *et al*, 2014). In the studied village (Kachet village, Luang Phabang province, northern Laos) before 1975, the village was isolated and local people lived in subsistent condition. Farming practices were traditional and they maintained the production system to meet their basic needs. Despite their isolation, they were already familiar with commercial products to be historically distributed to kings of Luang Phabang such as Benzoin, cardamom and *khii sii* (resin of *Depterocarpaceous* trees). With the end of civil war after 1975, the opening access to rural market, and paving road, bamboo shoots and rattan trade had become commonplace. Subsequently, other commercial forest products also had become diversified such as *peuak meuak* (*Boehmeria malabarica*), paper mulberry, broom grass from early 1990s and *Gle* (*Alpinia* sp.), *konjak* (*Amorphophallus* sp1.), and *yaa hua* (*Amorphophallus* sp2.) from 2010. All the products were sold to Chinese and Vietnamese merchants, and they played a key role of commercialization of forest products through direct visit to the village.

In the beginning of 21st century, crops plantation was introduced to local people by Chinese and Laotian company such as tea, castor oil plant, and tung-oil tree. However, due to the sudden termination of contract with company, price of commercial crops became unstable. This kind of poor-organized economic system

is common in rural MMSEA and this increases vulnerability of local livelihoods in globalization context. Along with the commercialized crops, local people also has tried to intensify their total agricultural system. Land reclamation for paddy is an example of intensified utilization of land, and consequently people become to be engaged in diverse livelihood activities.

General livelihood dynamics in MMSEA

Many researchers have discussed the dynamics of livelihoods in MMSEA for a considerable time, revealing that livelihoods in rural areas are complex and dynamic (Martin and Lorenzen, 2016; Marchke *et al*, 2006; Padoch *et al*, 2007; Paumgarten, 2005). Generally, a well-known previous research (Chambers and Conway, 1991) pointed out that “a livelihood is sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets both now and in the future”. Globalization following changes in a political system has had considerable impact on agricultural practices, land use and livelihoods in MMSEA (Castella *et al*, 2005; Castella *et al*, 2013; Cramb *et al*, 2009; Fox *et al*, 2009) where shifting cultivation has been the major agricultural system, providing livelihood choices such as NTFPs. At the household level, NTFPs are important sources of income when the household is in a rice deficit. In previous studies, income from NTFPs was found to account for more than 40% of total household income in Laos and represented the greatest contribution to total household income, providing “income smoothing” in years when food supplies were inadequate (Ingxay *et al*, 2015; Shackleton *et al*, 2011). This indicates that households depend

not only on agricultural production activities but also on collection of natural resources, including NTFPs, in fallow forests in shifting cultivation systems. At the national level, NTFPs also play a key role in international trade and market chains among the countries in mainland Southeast Asia (Phounvisouk *et al*, 2013).

The number of farmers who still engage in shifting cultivation in MMSEA is estimated to be more than 200 million (The World Bank, 2007). However, Mertz *et al.* (2009) have claimed that the real number is probably much less than 50 million. In fact, shifting cultivation is disappearing in many parts of mainland Southeast Asia, and a decline has been reported over a period of 25 years, from 1990 to 2015 ([Padoch *et al*, 2007; Paumgarten, 2005). This decline was followed by an increase in permanent agricultural activities and non-agricultural activities to generate income, and livelihoods shifted from subsistence to market-oriented ones (Fox *et al.*, 2009; Ellis, 2008). Permanent agriculture in MMSEA is often associated with a boom in cash crop cultivation. Many cash crops are grown on slope land after the change from shifting cultivation, and Schmidt-vogt *et al.*, (2009) reported the introduction of cash crops such as coffee, vegetables, oil palm, fruit trees, timber, maize, paddy, sugarcane and tea in MMSEA as a result of the change. A previous study has reported that this change also had negative impacts on rural livelihoods. Fox (2000) pointed out the change was of long-term disadvantage to farmers, especially in respect of price fluctuations for cash crops, connecting to a more competitive global market, decreasing self-sufficiency and increasing environmental vulnerability. Diversifying livelihood activities can enhance the security of farmers.

In some MMSEA countries non-agricultural activities such as rural wage labor has become more ubiquitous as the main means of survival (Ellis, 1999). In Thailand, the role of forests in livelihoods has gradually decreased, and non-agricultural activities such as working in textile factories, construction, “entertainment”, food processing and domestic work have become the main source of income (Rigg, 2006). A similar increase in non-agricultural activities was also found in Laos and Cambodia, although agriculture remains a key component of local livelihoods and welfare (Jiao *et al.*, 2017; Martin and Lorenzen, 2016). Increasing dependence on non-agricultural activities reflects their importance in local livelihoods, particularly in strengthening resilience and reducing risks in adapting to globalization. In Myanmar, for example, dependence on agriculture is not associated with greater probabilities of food security (Pritchard *et al.*, 2019). When households meet their food and nutrition requirements at an acceptable level, the capacity for more engagement in non-agricultural activities becomes more important for food security and dietary diversity. Although engaging in non-agricultural activities is a common livelihood strategy for local people in MMSEA, not all households can take part in high-return livelihood activities, and some are still engaged in low-return livelihood activities from necessity and not from choice (Bouahoum *et al.*, 2004).

2-3. Approach to studying livelihood diversification

Concept of livelihood diversification

The definition of “livelihood” has been developed by many researchers in livelihood studies. In their most cited paper, Chambers and Conway (1991) proposed that livelihood comprises the activities, assets (including material and social resources) and capabilities required as a means of living. At the beginning of the 1990s more attention began to be paid in development studies to the analysis of entire rural livelihoods, rather than just focusing on economic or agricultural activities: an holistic perspective often known as the sustainable livelihood approach (SLA). It became more important in development practice (Start and Johnson, 2004) and was strongly promoted by the Department for International Development (DFID), the British state development cooperation agency (DFID, 1997). Livelihoods are considered to be sustainable if households can recover from “stress and shocks”, but they must also be able to maintain and enhance various activities and assets into the future (Morse and McNamara, 2013). In this sense, the diversification of elements comprising “livelihood” can be regarded as one of solutions in resistance to stress and shocks and, therefore, livelihood diversification has often been discussed in livelihood studies.

Between the 1990s and the present, an influential framework for analyzing livelihood diversification from an holistic viewpoint was proposed by Ellis (1999). Livelihood diversification has been known as the process by which households construct a diverse portfolio of activities and social support capabilities for survival and to improve their standard of living. In the past, diversification was seen as a result of the growth of agricultural output, thus creating many opportunities in the rural economy. In fact, many poor households, even in regions where agricultural

techniques had improved dramatically, failed to maintain their livelihoods, and the assumption is no longer considered to be tenable.

Diversification of livelihoods in rural areas can be more clearly understood from agricultural and non-agricultural viewpoints, which together provide a variety of procurement strategies for subsistence and income to a household. Start and Johnson (2004) stated that the term “diversification” can refer either to increasing the diversity of activities, or to a tendency to shift away from traditional rural sectors such as agriculture to non-traditional activities in either rural or urban areas. Loison (2015) considered that components of livelihood diversification were commonly divided into three classifications: sector (agricultural or non-agricultural), function (wage employment or self-employment) and location (on-farm or off-farm), and this has been useful in large-scale analyses. However, these kinds of classifications are too simplified, and sometimes confusing, and fail to capture the diversification of rural livelihoods. For example, local people in MMSEA commonly collect NTFPs, and the types of commercial NTFPs are varied. Since each product is also seasonal, it is difficult to capture each activity (such as collection, processing and trading of NTFPs) from a sectoral perspective. Sectoral groupings may be useful if agriculture is more developed and where local people no longer rely on subsistence economic activities and have shifted to market-oriented economic activities. Nielsen *et al.* (2013), however, have pointed out that sectoral grouping is problematic owing to the changeable nature of income, which risks over- or under-valuing certain income sources. They proposed the quantitative activity choice approach, which is based on the identification of activities, and its

combinations better represent the diversity of the livelihood portfolio in rural societies. Perz *et al.* (2013) also considered that the number of activities and their relative importance described livelihood diversity in a household.

Various motives may drive the diversification of assets, income and activities (Barret *et al.*, 2001), and they may be negative or positive. Barret *et al.*, (2001) called the negative motives “push factors” and positive motives “pull factors”. Negative motives are closely related to need: for example, if people experience some kind of environmental degradation, they will need to change their livelihoods and reduce risks (Bryceson, 1996; Hussein & Nelson, 1998). These processes diversify livelihoods by “pushing” people into engagement in low-return activities. However, positive motives are closely related to better choices. If people have comparative advantages, such as special knowledge, skills or better market access, they can positively turn better activities into profitable jobs. These external and internal factors can “pull” people to be engaged in relatively high-return activities, and their livelihoods become progressively more diversified.

In addition, since motives for diversification of activities, assets and income sources are varied, livelihood diversification in rural areas should be seen from an holistic viewpoint. In previous studies, however, livelihood diversification in rural areas was often regarded as being associated with an increase in non-agricultural activities, which tend to lead deagrarianization (Bryceson, 1996; Bouahom *et al.*, 2004; Liao *et al.*, 2015), and the non-agricultural income was often linked to the welfare of rural households (Barret *et al.*, 2001; Ellis, 1999). These analyses mainly discussed “sectoral dynamics”, which placed too much focus on sectoral shifts to

non-agricultural sector. For example, studies in African countries found positive relationships between non-agricultural income and household “welfare” indicators such as household income, agricultural land, livestock, commodity consumption and dietary level (Barret *et al.*, 2001; Ellis, 1999; Reardon, 1997; Reardon, 2000). Using this style of analysis can make it difficult to understand the holistic livelihood dynamics, but it can support our understanding of sectoral dynamics as providing background information on livelihood dynamics and diversification. Loison (2015) outlined five patterns of sectoral dynamics: negative pattern; positive pattern; U-shaped pattern; inverted U-shaped pattern; or otherwise, with no clear relationship. A negative pattern is observed when total household income increases and the share of non-agricultural income declines. The second, positive pattern is observed when total household income increases and the share of non-agricultural income also increases. The third, a U-shaped pattern, is observed when relatively poor and relatively rich households have a higher share of non-agricultural income. The inverted U-shaped pattern is observed when middle-income households have a higher share of non-agricultural income. The fifth pattern is found when there is no clear relationship between the non-agricultural income and total household income. In the context of livelihood diversification, there has often been most focus on the U-shaped pattern. In MMSEA there are many low-return and labor-intensive activities with low entry barriers for relatively poor people, and there are capital-intensive activities for relatively richer people with more assets to invest (Loison, 2015; Reardon *et al.*, 2000). Although various subsistence activities have been overlooked in many previous studies on livelihood diversification, this kind of

information on sectoral dynamics is helpful in promoting, to some extent, our understanding of total livelihood dynamics.

Measurement of livelihood diversity

Previous studies from various disciplines have discussed the measurement of livelihood diversity (Gibbs and Poston, 1975; Haughton *et al.*, 1995; Magurran, 2003). Conceptually, “diversity” has two components: structural diversity and relative distribution, and this concept can be applied to studies of livelihood diversification (Perz, 2005). Structural diversity refers to a number of categories, such as types of livelihood activities or of agricultural products. The livelihood of a household is more structurally diverse if a household carries out more types of activities and produces more (and different) products. Distributive diversity refers to the relative distribution of units among the categories (i.e., amount, dominance or evenness of each product generated from each activity). The livelihood of a household is more diverse if the household produces similar quantities of many products from different activities.

Indices to measure livelihood diversity are summarized in Table 3. The Herfindahl index and the Simpson index are popular indices mainly from economic and ecological research, respectively, for measurement of diversity and these two are inverse indices. Although all indices can capture structural and distributional diversity, the characteristics of each are different. The M6 index, proposed by Gibbs and Poston (1975) is the most sensitive to distributional diversity among these indices. The entropy index and modified entropy index are also common indices

(often known as the Shannon index in the field of ecology) and they are more sensitive than other indices when there is only a small number of categories. The modified entropy index puts population size at the base of the logarithm and tries to standardize the population size of samples (Shyani and Pandya, 1998). The composite entropy index puts more weight on the lower quantity and less weight on the higher quantity to adjust for extreme distribution of population. The Ogive index controls deviation and the calculation comes from the accumulation of difference from equi-proportional values as a benchmark; it is sensitive to structural diversity (Siegel *et al.*, 1995)]. The index chosen will depend on the situation.

2-4. Case studies: pattern of livelihood diversification in MMSEA

Livelihood diversification can be found in many developing countries as a survival strategy for rural households (Ellis, 1999). The motivations of rural people vary widely because of their multiple combinations of livelihood activities (section 4.1), resulting in many different patterns and roles of livelihood diversification. With respect to MMSEA, Martin and Lorenzen (2016) pointed out that the major types of diversification pattern can be reduced to two: distress and progressive. They defined distress diversification as a change in the livelihood strategies of households to more difficult ones, from an economic viewpoint, forcing households to “push off” in low-return activities through low entry barriers. Progressive diversification is a change in the livelihood strategies of households to more profitable and risk-taking ones, which motivate households to “pull off” in high-return activities with high entry barriers.

Conceptually, these two types of diversification show a U-shaped relationship between economic level (e.g., major indicators are income, physical assets, savings) and livelihood diversification (Figure 1), and analysis of the pattern is considered to be useful in understanding livelihood dynamics. Many previous researchers, however, have only analyzed “sectoral dynamics”, and not field-level livelihood activities (section 4.1).

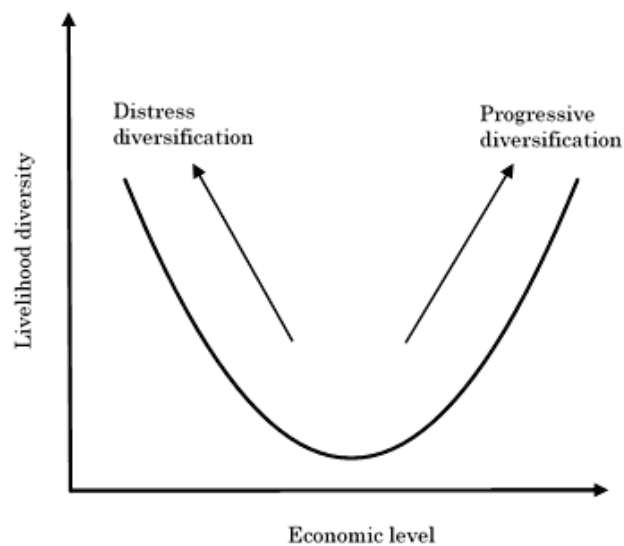


Figure 2-1: Representation of U-shaped relationship in livelihood diversification

The basic livelihoods in rural villages come from agriculture, and there is considerable livelihood diversification. Previous researchers have mainly understood these dynamics of diversification as a strategy from agricultural to non-agricultural activities against the background of village development. However, the motivations of villagers may be varied and the dynamics of livelihood diversification also include its two directions. For example, the non-agricultural activities of environmental resource collection and processing are especially important in mountainous areas (Vedeld, 2004). Villagers are, however, engaged in

these activities from motivations of both distress and progressive diversification. If these two patterns are understood in same analytic framework, the researcher fails to understand the real dynamics of livelihood diversification: it is necessary to separate these two concepts. Studies of livelihood dynamics in MMSEA have also become more important under recent dramatic globalization, but they remain limited. For this reasons the author used case studies to illustrate the process of livelihood diversification in this region and to provide information for future research.

Distress diversification

The market economy has drastically infiltrated montane villages and the economic level of local communities is considerably higher than before this change, and so basically progressive diversification can be observed. However, the drastic change does not always bring sustainable development to these villages because of various factors such as radical policies, government intervention and environmental degradation by intensive agriculture. The author's case study from Laos illustrates this kind of dynamics.

The case study was conducted in Nong Hai Kham village, Tulakhom district, Vientiane province (Bouahom *et al.*, 2004). Land in this village was scarce, and the majority of households were in food deficit. In the 1980s the village was self-reliant in food and produced a modest rice surplus for commercial sale. After government policy resulted in resettlement in 2000, households experienced food insecurity and relied on wage laboring to meet their most basic needs. The availability of this wage

labor came from a foreign funded irrigation project and from agricultural laboring in neighboring villages and nearby commercial farms, which provided temporary work. In this case, resettlement had adversely affected livelihoods, making households more vulnerable from an economic viewpoint. Since per capita income was insufficient (around USD1.5 per day), local people were very concerned to have high, stable incomes. They also came to realize that lack of education and opportunities for earning were barriers to obtaining profitable jobs. Numerous young people took informal education in English, French and other languages to upgrade their skills. In addition, because productive land was scarce, and their need was great, many households began to engage in various non-agricultural activities. This kind of situation has been found in many areas in Laos (Green and Baird, 2016; Lestrelin *et al.*, 2012; Sayatham and Suhardiman, 2015). In rural communities, if people can no longer carry out agricultural activities as their main livelihoods through external impacts, they are forced to engage in low-return activities because of their low levels of skill for economic activities. Retaining their subsistence activity and combining activities, even as society changes, supports stable development.

In distress diversification, earlier studies found that low-return activities have often been connected to the collection or use of environmental resources such as wild vegetables, fishing or hunting (Angelsen *et al.*, 2011; Aung *et al.*, 2015; McElwee, 2008; Nguyen *et al.*, 2015). In MMSEA, retaining a high level of diversity of livelihood activities is closely related to the use of environmental resources. These low-return activities, however, are not only activities for

environmental resources but also for various kinds of activities at a village level. Nguyen *et al.* (2015) analyzed this mixture of various activities in Cambodia. Their case study was conducted in Stung Treng province, northeastern Cambodia, where livelihoods were based on agriculture and extraction of environmental resources from forests and rivers. Households were divided into three groups: group 1 (low-skilled non-permanent wage employment and farming); group 2 (environmental resource extraction and farming); and group 3 (high-skilled or permanent wage employment and farming). The authors tried to identify livelihood strategies in each group. In group 1, low-return agricultural and non-agricultural activities, and use of environmental resources, were the main livelihoods. Low-skilled employment in this group involved plowing, caring for livestock or weeding as agricultural activities; and casual employment such as construction activities as non-agricultural activities. This group was vulnerable to unexpected shocks over 5 years such as floods, storms, droughts and health problems in families, and was in a lower level of income and consumption. However, income from environmental resources was relatively important for households (22% contribution to household income). Households in groups 2 and 3 also obtained income from environmental resources (50% and 8% contribution, respectively). Although low-return agricultural and non-agricultural activities contributed mainly to group 1 livelihoods, this indicated that environmental resources have the potential to engage a wider range of households than generally imagined. Thus, it is necessary to reconsider the potential of environmental resources in the process of distress diversification in MMSEA.

Progressive diversification

Although environmental resources are mainly important for low-income households, in the process of progressive diversification they also contribute to the total income of richer households (Vedeld, 2004). Several case studies related to this point of view in the MMSEA. In one case study in Myanmar, Aung *et al.* (2015) analyzed household factors to determine their dependency on environmental resources, and especially on forest products in this case. The study was conducted in Ton Nge and Hee Laung village, Chin state, northwestern Myanmar, which is close to Natma Taung National Park. The major livelihood activities were agricultural production, raising livestock, forest products collection and limited off-farm employment. The authors divided the households into three wealth groups: group 1 (better-off), group 2 (medium) and group 3 (poor). The authors considered the value of forest resources not only in commerce, but also as important for subsistence. They tried to estimate the value of forest resources for subsistence use from the substituted price by referencing barter trade with commercial commodities, and so set the value as environmental income or forest income. Forest income was found to be the most important in Ton Nge and Hee Laung village, contributing 55% and 50%, respectively, of the total household annual income including environmental income. Forest income was mainly from fuelwood, wild vegetables and fodder for livestock. In contrast to many previous case studies, households in group 1 received more forest income than those in groups 2 and 3, and absolute income from the forest was also the highest. The influencing factors were family size and livestock. The family size was related to the amount of forest resources

collected, and also to the potential of using the environmental resources. In this case, forest resources were strongly related to wealth level and considered to induce progressive diversification for richer people.

In MMSEA, governments have implemented policies that are targeted to conserve forests by controlling access by rural people, and also to improve their livelihoods at the same time. Although the value of environmental resources is sometimes considerably higher in MMSEA than in other regions, the conservation policies have sometimes impacted rural livelihoods that mainly depended on environmental resources. McElwee (2008) reported such impacts in a case study in Vietnam, conducted in rural villages in the buffer zone of Ke Go Nature Reserve (KGNR), located in Ha Tinh province, northern Vietnam. The livelihoods of the villages were mainly agriculture, raising livestock, and collecting NTFPs. In the study villages, lower-income households had received less income from forest products. The forest products in this study were mainly timber, charcoal, fuelwood and NTFPs such as rattan and medicinal plants. Among these, profitable forest products were charcoal, timber and fuelwood, and collecting these products was labor consuming. Generally, lower-income households were engaged in small-scale activities and richer households had enough surplus to expand their activities. In this case, richer households hired labor to exploit forest resources in the KGNR buffer zone, and sometimes within the reserve itself. In addition, one international project aimed at forest conservation and poverty reduction was introduced to the study villages. It targeted lower-income households by promoting new cash crops such as rattan and medicinal plants in their home gardens to produce more income.

The aims of the forest conservation policy and the project were also to control the access of local people to the forest resources of the KGNR. The study found, however, that the richer households exploited forest resources heavily, and it was suggested that both policy and project should target not only lower-income households but also the richer households to conserve the forest. The study found that, although the project and policy aimed to lead to progressive diversification of rural livelihoods by promoting new activities, their targeting was not really effective for their objectives. There are rich environmental resources in many MMSEA regions. To induce progressive diversification when implementing policies for rural livelihoods, attention must be paid to the considerable risk of developing extraordinarily commercially profitable enterprises that destroy the surrounding environment.

Our final case study (Shirai and Rambo, 2017) in this section introduces a characteristic aspect of progressive livelihood diversification associated with the development process in mainland Southeast Asia. Since there are insufficient studies on livelihood diversification and limited sources of literature, the author decided not to carry out this case study in a montane area, nor did the author focus on subsistence activities but in the dynamics of sectoral shift. The case study was conducted in Nong Ben village, Non Thon sub-district, Khon Khaen province, northeastern Thailand. The majority of households in the study village were engaged in agriculture, raising livestock and self-employment, and in waged work such as salaried employment or as workers for casual hire. The authors divided the households into four groups by household structure: group 1 (nuclear household:

single spouse with children); group 2 (extended household: single spouse with children and one or more of parents of one of the spouse); group 3 (skipped generation household: elderly person and one or more of their own or someone else's grandchildren); and group 4 (truncated households: a widow or widower or an elderly married couple living alone). Although agricultural activities were important, more than two-thirds of total income was from non-agricultural activities at village level. For groups 1, 2 and 3 the share was 87.9%, 73.5% and 84.9%, respectively, whereas the share for group 4 was 66.7%, and the village was considered to be in the process of deagrarianization. The authors analyzed the non-agricultural income to have come mainly from local nonfarm activities, self-employment, remittances and government support and pensions. Among groups 1, 2 and 3, which had high incomes from non-agricultural activities, the non-agricultural incomes of groups 1 and 2 showed a higher share of local nonfarm and self-employment. Group 3 had a relatively high share of remittances. There was no active labor in group 3 households, and the children's parents migrated to other regions to work in such places as manufactories and electricity power plants, near the central area of Khon Khaen (Shirai *et al.*, 2017). The field survey showed that 64% of all households were in debt from investments in agriculture, groceries, car and motorbike purchases, and for living expenses such as child education, and needed to obtain income from the non-agricultural sector. Results suggested that the shift seemed to be sectoral and connected to progressive diversification; however, and especially for group 3, they often needed to work in industrial sectors under "distress" conditions. Thus, to understand the dynamics of livelihood

diversification the author need to observe the dynamics closely, not only from a sectoral perspective, but also by obtaining field-level (e.g. village, household and individual) information through intensive surveys.

2-5. Conclusion

Livelihood diversification has been understood from various perspectives. Most commonly, the diversification has been reported from sectoral dynamics, such as switching from agricultural to non-agricultural activities. The problem in many previous studies has been that they have failed to capture diversity in the field and have often overlooked subsistence activities that are common in rural villages in MMSEA. They have also mainly focused on financial activities. Actually, in many studies, income diversification is mostly used to measure livelihood diversification (Abdulai & CroleRees, 2001; Barret *et al.*, 2001; Demissie & Legesse, 2013; Kassie, Kim, & Fellizar, 2017; Reardon, 1997).. Although there are many methods for measuring livelihood diversity, it is necessary to consider the structure of the society and household carefully. Otherwise, an attempt to obtain a measurement easily will fail to capture the dynamics, and integrating information from detailed field surveys is indispensable.

The case studies illustrated that rural people in MMSEA have experienced dramatic changes in recent decades. Throughout these changes, they had to adapt their livelihoods to new situations and to diversify their livelihood activities, even under conditions of distress or progressive diversification. The transportation network in MMSEA has recently become dense and its impacts will be greater in

isolated villages that have never experienced sweeping globalization, and it is important to balance rural livelihoods and the surrounding environment. Studies of livelihood dynamics are essential in this situation, and intensified focus on livelihood diversification is needed to promote sustainable development in this region.

Table 2-1: Chronology of changes in political systems in MMSEA

Years	Vietnam	Laos	Cambodia	Thailand	Myanmar
1970– 1979	1975 Second Indochina End of war 1976 Vietnam Socialism Republic established*	1975 Lao People's Democratic Republic established	1975 Democratic Cambodia established	1972 Doi Inthanon National Park established	1975 Implementation of planned economy by Ne Win administration*
1980– 1989	1981 Decree 100 1986 Doi Moi (Renovation)** 1988 Resolution No. 10	1986 Chintanakaan Mai (New Thinking)**		1986 Slash and burn regulations***	1987 Abolition of rice procurement and distribution system**
1990– 1999	1992 Program 327*** 1993 Land Law***		1990 Initiation of community forestry***		

Source: Adopted from Hirota (2008)

*Starting of communistic system

**Starting of capitalistic system

***Reinforcement of official management of land and forest

Table 2-2: Livelihood dynamics of a rural village in northern Laos

Year	Social events	Infrastructure	Main Livelihood		
			Commercial crops	Commercial forest products	Swidden and paddy practice
-1975		Road construction (1973-74)	Cucumber (from ancient to the present)	Benzoin, cardammon and <i>Khii sii</i> (resin of <i>Depterocarpaceous</i> trees) (from ancient to the present)	Using hands for harvest (from ancient to 1990s)
1975-2000	End of civil war (1975)	Opening access to market in Pak Mong and Nam Thoam village (1975)		Bamboo shoots and rattan	
	Chintanakaan Mai (New Thinking) (1986)	Pavement or road (1977)			
	Land and Forest Allocation Program (LFAP) (1994)	Health facility (1984)			
	Land Law (1997)	Electricity by generator (1990s)		peuak meuak (<i>Boehmeria malabarica</i>), paper mulberry, broom grass (from early 1990s to until the present)	
				Fruits of wild galangal (from late 1990s to the present)	Sickle for harvest (from middle 1990s)
2000-		Water supply (2001)			
		Primary school to fifth year (2004)			
		Electricity (2007)	Tea (about 10 households) (around 2005)	Gle (<i>Alpinia</i> sp.), konjak (<i>Amorphophallus</i> sp1.), yaa hua (<i>Amorphophallus</i> sp2.) (from 2010 to the present)	Land reclamation for paddy (from 2006 to the present)
			Castor oil plant (about 20 households) (around 2008)		
			Tung-oil tree (near future)		

Source: Adopted from Hirota *et al.* (2014)

Table 2-3: Index to measure livelihood diversity

Index name	Formula	Full concentration	Full diversification	Remarks
Herfindahl Index (H.I.)	$H.I = \sum_{i=1}^N P_i^2$	1	0	Measures concentration and diversification. It cannot assume theoretical minimum, i.e., zero.
Simpson Index (S.I.)	$S.I = 1 - \sum_{i=1}^N P_i^2$	0	1	The most widely used; the inverse of H.I.
M6 Index	$M6 = N \left[1 - \frac{\sum_{i=1}^N \left \left(P_i - \frac{1}{N} \right) \right / 2}{\sum_{i=1}^N P_i} \right]$	1	Maximum as set by N	Sensitive to distributional diversity.
Entropy Index (E.I.)	$E.I = - \sum_{i=1}^N P_i \log P_i$	0	log N	Upper limit is based on base of logarithms; does not give standard scale for assessing diversification if sampling population is different.
Modified Entropy Index (M.E.I.)	$M.E.I = - \sum_{i=1}^N P_i \log_N P_i$	0	1	Base of logarithm is modified for adjustment of various sizes of sampling population.
Composite Entropy Index (C.E.I.)	$C.E.I = M.E.I * \left(1 - \frac{1}{N} \right)$	0	$1 - 1/N$	$\log_N P_i$ in $M.E.I$ assigns more weight to lower values and less weight to higher values of P_i .
Ogive Index (O.I.)	$O.I = \frac{\sum_{i=1}^N \left\{ P_i - \left(\frac{1}{N} \right) \right\}^2}{\left(\frac{1}{N} \right)}$	Maximum as set by N	0	Sensitive to structural diversity.

Sources: Modified from Khatun and Roy (2016) and Perz et al. (2013). P_i represents the proportion of the i-th unit in the total number of units

Chapter 3: Framing of field survey and study site setting for research objectives

3-1. Projects of road developments and the highest globalization region in Laos

Laos is landlocked country, which is the only country has no sea in Southeast Asia. Laos is largely mountainous, particularly in northern Laos. Agricultural activities in mountainous area is the norm, mostly swidden agriculture continues to be practiced widely as main livelihood for montane people. The national population is about 7.2 million (2019 census), with a comparatively low population density compared to neighboring countries of about 30 people/km². More than 40 ethnic groups are found in Laos, with three ethnic groups, Lao, Khmu, and Hmong, dominating the study area (Table 3-2).

The government of Laos effort to boost the road project have focusing on reducing poverty, increasing productivity, reducing the distribution cost and develop human capital. Improvement of road makes an important solution to economic growth in Laos. Especially rural road can improve welfare and reduce the poverty by opening access to the market and livelihood opportunities in rural area part of Laos. Its project to benefit isolated villagers by improving their access to the markets, social services, and health facilities, and by expanding their livelihoods to cover off-farm jobs including provision of transport services and road maintenance. In addition, the road is one of factors of deforestation and degradation and also new road can lead the market and access to logging, NTFP collection, illegal mining and many more.

Fig.3-1 shows the projects of road construction in Laos in 2009 (Northern, Central and Southern of Laos). Houaphan province was the most developing province in Laos by seeing many road projects still under construction to link another village and another district. Table 3-1 shows the longest road construction in Houaphan province is in Sone district to linked between Laos and Vietnam, about 61 km form Ban Son Tai village to Lengbang (border of Vietnam). Therefore, we selected these areas for preliminary survey.

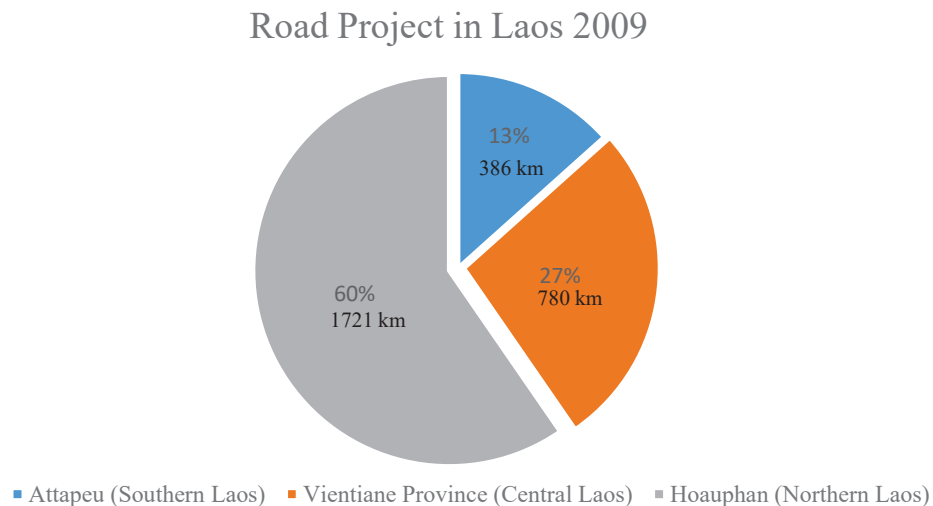


Figure 3-1: Road Project in Laos 2009

3-2. Preliminary survey and study site setting

This survey was carried out in Sone district, Houaphan province, in northern Laos. The accessibility in 90's of this area was very poor, many villages could be reached on foot or by horse and cart. The main road from the district center to Laos border was the first time opened for the car around 2004, but that was still small dirt road for truck to bring agricultural products. In 2013, the Lao government started to construct the paved main road to improve the local economy and to

control illegal logging in Sone district (WCS, 2015). Sone district is located in the north western side of Houaphan province and 5 hours by car from the center of Xamneua, the capital city of Houaphan province.

Sone district was officially established as a new district in Houaphan Province in 2014, previously being part of Viengthong district which has now been divided into two districts, namely Sone and Hiem district. Sone and Hiem district which cover more than 3,750 km², approximately 70 % of NEPL national protected area (Cole *et al.*, 2019). The mean annual rainfall is around 1,400-1,800 mm and temperature range from 5°C to 30°C (Johnsons *et al.*, 2009). Sone district is located in surrounding NEPL which is the largest protected area in Laos and is dominated by mixed evergreen deciduous forest up to 1,500 m, transitioning into evergreen forest at 1,500 – 1,800 m. The NEPL provides abundant natural resources which make the local livelihoods are heavily depends on forests, mostly their activities are cultivating rice through shifting cultivation, collecting non-timber forest products, and hunting. In total, there were 34 villages registered in Sone district. One of their main activities was collecting forest product such as NTFPs.

Sone district become urban area, it was proven because the population increasing every year since 2014 (Fig. 3-3). A lot of migrant were coming to Sone district from other district in Laos or even from Vietnam for business or work. Population in Sone district was about 68% in rural area had been connected to the road, 26% of population in rural area is not connected to the road, and 6% population in urban area.

3-2-1. Data collection in Sone district Houaphan Province

We conducted preliminary survey for selecting villages. The survey was conducted from the December 4th to the December 14th 2017. Firstly, we checked the geographical condition, variations, and type of total villages in Sone district. Secondly, with reference to recommendations from officers based on the information on agricultural activities, road accessibility, ethnicity, and NTFPs collection, 14 villages were selected for conducting preliminary survey. Thirdly, we visited these villages and collected data to obtain a general understanding of household's livelihoods and external influence from surrounding countries and road construction. Data was mainly collected through interviewing the key persons; elderly people, the village heads and members of the village committee by semi-structured questionnaire. The main livelihoods of local people in Sone district were agriculture. Maize was a major cash crop in almost all villages, which was collected by Lao traders to export to Vietnam. The ethnic group of this area is dominated by Hmong, and it is the predominant ethnic groups in mountainous area of northern Laos. Three major NTFPs in the study area which exported to Vietnam and China were *Amorphophallus*/mak loklek (*Amorphophallus* sp.) cardamom/mak naeng (*Amomum* spp.) and red mushroom/haed daeng (*Russula lepida*).

3-2-2. Socio-economic status

Population of study site

The author conducted preliminary survey for 14 villages by suggestion from head of DAFO (Departement of Agriculture Forestry officer) in Sone district, namely: Soptiew, Vangkhoang, Bor, Houai Yam, Houai Su, Houay Lao, Nongsai, Houai Sanguan, Bor, Na Caak, Samsoum, Laeng, Nanoum and Namngao village. Based on the author's primary data in 2018 (Table 3-2), there were 801 households in 14 villages (Soptiew 42 HH, Vangkhoang 54 HH, Bong 62 HH, Houai Yam 111, Houai Su 70 HH, Houay lao 35 HH, Nongsai 62 HH, Houai Sanguan 55 HH, Bor 45 HH, Na Caak 66 HH, Samsoum 68 HH, Laeng 38 HH, Nanoum 38 HH, and Namngao 55 HH (Fig. 3-4). Total population was 5,643 people, number of female was 2,877.

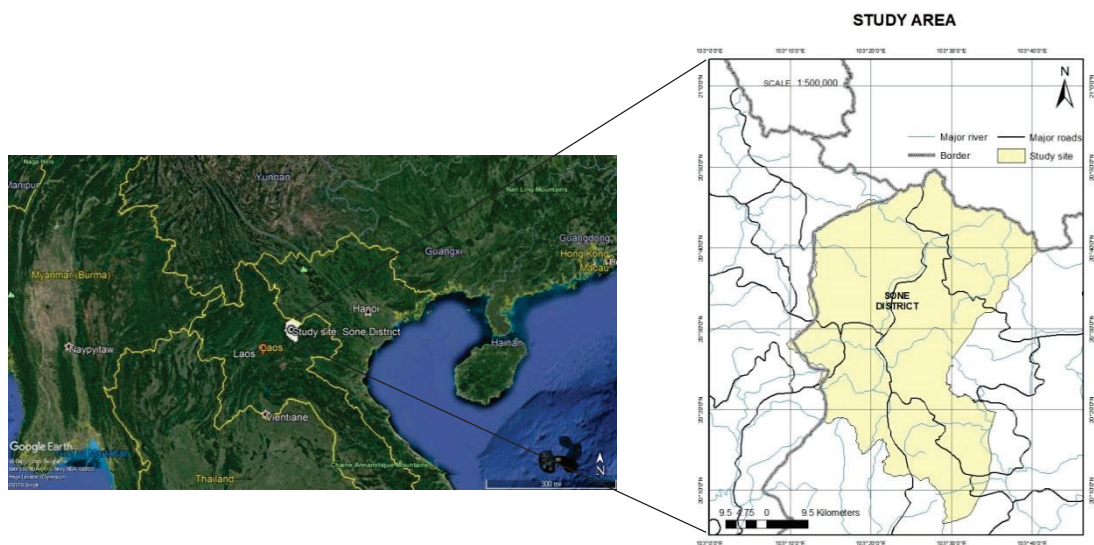


Figure 3-2: Map of study site

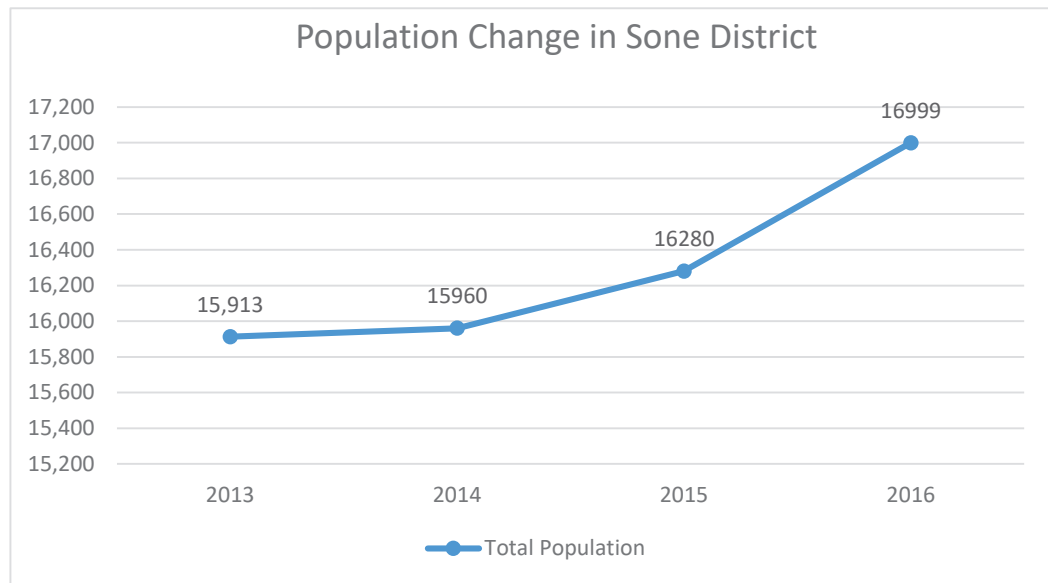


Figure 3-3: Population Change in Sone district

Ethnic composition

The ethnic group in Sone district was diverse, the ethnics were divided into three groups are the Lao Sung (“Lao of the mountaintops”), the Lao theung (“Lao of the mountain slopes”), and the Lao Lum (“Lao of the plains”). Majority in the group Lao Sung was ethnic Hmong; in the group Lao Theung was ethnic Khmu; and in the group Lao Lum were Thai daeng, Thai dam, and Lao. Every ethnic has different culture and activity. The Lao Sung mostly practiced swidden agriculture and raising livestock in the forest of the hills; the Lao Theung practiced swidden agriculture and collected forest products; and the Lao Lum practiced paddy cultivation on the plains. In the area surveyed, majority ethnic is Hmong, 9 from 14 villages occupied by Hmong people. Hmong people living in the mountainous area, mostly they practice shifting cultivation in upland field and raising livestock.

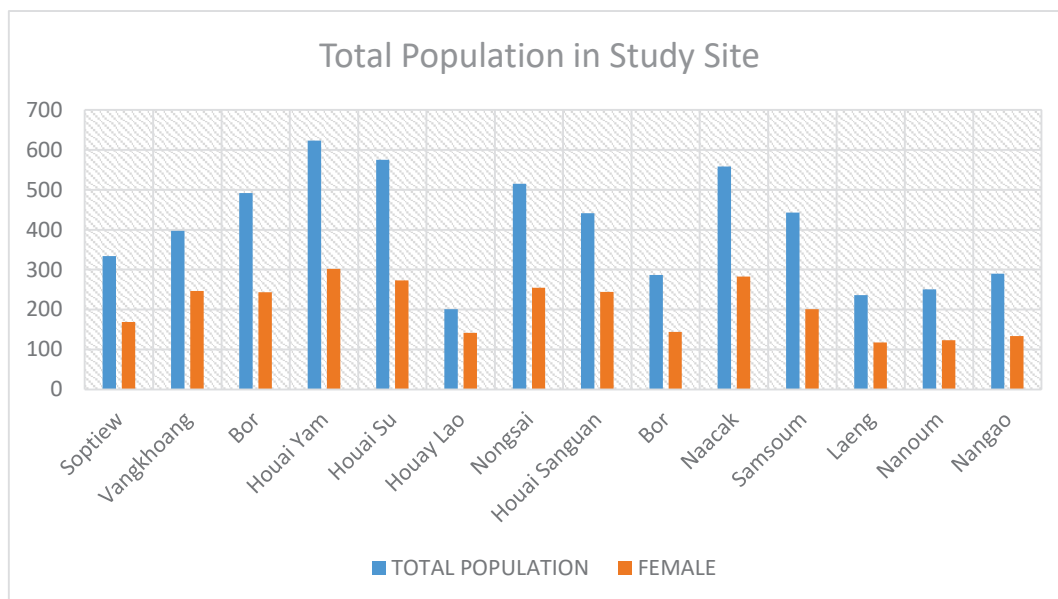


Figure 3-4: Population in the study area in December 2017

3-2-3. Agriculture production, livestock and NTFPs

Table 3-2 shows the characteristic of 14 villages. These 14 villages were characterized by importance of upland rice cultivation as local subsistent activity. Some villages have paddy rice cultivation in low land area, and are mainly located on the main road and close to the center. The main livelihood of local people in these village were agriculture. Maize is a major cash crop in almost all villages, which was produced by local and collected by Lao traders to export to Vietnam. Maize was one of the biggest income sources out of the cash crops. Maize was a booming cash crop in 2010 due to the high demand of Vietnam. In recent years, households in several villages experienced decline in demand for maize and farmers lost interest in cultivating maize due to fluctuating and uncertain price. Variations of road accessibility is one of characteristic of this area, with highly market-integrated areas along the main road, middle market-integrated areas near the main

road, and poorly market-integrated areas in more remote village. The pattern of livelihoods in this village also varies, the author suspect that the livelihood pattern has changed over the last few decades especially after the massive road construction in this area. The ethnic group of this area is dominated by Hmong, and it is the predominant ethnic groups in mountainous area of northern Laos.

As explained above, most of these 14 villages were located in NEPL-NPA. Forests in the area are providing various NTFPs, which are collected by the local people as their important income source. Three major NTFPs in the area are *Amorphophallus/mak loklek* (*Amorphophallus* sp.) cardamom/*mak naeng* (*Amomum villosum*) and *het daen*/red mushroom (*Russula* sp.). Especially, *het daeng* suddenly became commercial NTFP after road construction and getting information from Chinese traders. They had already known the existence of red mushroom in the area long time ago, and, however, previously did not know the commercial value. The red mushroom can only grow in Fagaceae forest (*pa ko*) which is a typical family in potential natural vegetation in this area. Realizing the commercial value of red mushrooms, the local people avoids illegal logging in order to preserve the Fagaceae forest. The massive collection of red mushrooms was part of the sizeable Chinese influence on livelihoods in remote villages in the border area of Laos. Chinese influence on livelihoods was also impacts livestock and many natural resources. Households in several villages started grazing cattle for fattening which were then sold to Lao traders and then exported to China.

Villagers raise cattle, water buffalo, goats, pigs, and poultry almost in all villages of the area surveyed. Soptiew, Laeng and Namngao village did not raise

goat. While in Bor, Nanoum, Laeng, Namngao village did not raise water buffalo. Cows and buffaloes are sold in the villages to other villagers or traders. Livestock owners are responsible for feeding cow which is 2-3 times per month. The pigs are kept in pigsty near the houses all year long. Regularly, farmers feed them with cassava, traditional maize, leaf and vegetables. The traders from other district in Laos or from Vietnam come to the village to buy livestock. Some village, in Houay Lao they did vaccinate their livestock, although they told that only few losses from diseases. In Naa Caak village has the biggest number of livestock in the area survey, in total there is about 3000 cattle and water buffalos. Livestock is the main activity of ethnic *Hmong* and they sold their livestock to the company in Xiengkhoang province.

Influences from surrounding countries such as China and Vietnam have had a profound impact on livelihoods in remote villages in northern Laos. We conducted an intensive survey in 4 villages to serve as the author's research sites which will be explained in chapter 3 and chapter 4.

Table 3-1: Road construction in Houaphan Province

No	Name of the project	Location	Length (km)	Width (km)
1	Road No. 32417	Xamtai - Koaun	33.90	7
2	Xam-Ne District centre - Nongkang airport	Xam Neua	32	9
3	Nongkang - Aet	Xam Neua - Xiengkhor - Aet	28	6.5
4	Nongkang - Hanglong 3 junction	Xam Neua - Viengxay	35	7
5	Pongthai - Tamla	Hiem	31.35	5.5
6	Loongku - Phongtong	Viengxay	36	4.5
7	Viengxay district centre - Ban Na Loaung - Ban Ang Sung - Ban Pa Jai	Viengxay - Xam Neua	48	5.5
8	Ban Houaxieng - Phatee	Xam Neua	45	6
9	Ban Sopsan - Ban Na Deed (Vietnamese border)	Xieng Khor	21.45	7
10	Ban Soplong - Ban Nambong	Sopbao - Xiengkhor	22	7
11	Ban Nam Souy - Ban Souy	Viengxay	13.70	7
12	Ban Sone Tai - LengBang (Vietnamese border)	Sone	61	5.5
13	Ban Na loaung - Ban Yair	Viengxay	20.50	5.5
14	Ban Yair - Ban Chard	Viengxay	18.20	5.5
15	ban Na Man - Ban Kamnang	Viengxay	23.40	4.4
16	Ban Phoonmai - Ban Na Man	Viengxay	10	4.5

Source: Wildlife Conservation Society Lao PDR Program / GIZ 2015

Table 3-2: Characteristics of preliminary survey villages

Village	Location (coordinate) from google earth	Altitude	Ethnic group	Population	Main Livelihood	Accessibility
Soptiew	20°44'36.73"N 103°25'12.00"E	690	Khmu, Hmong	169	upland rice, livestock and NTFPs collection	In the main road
Vangkhoang	20°36'0.36"N 103°24'1.76"E	612	Hmong, thai daeng, khmu	247	upland rice, livestock and NTFPs collection	In the main road
Bong	20°42'6.06"N 103°28'10.48"E	567	Hmong	243	upland rice, maize, livestock and NTFPs collection	8 km form the main road
Houai yam	20°36'15.81"N 103°29'45.51"E	863	Hmong	302	upland rice, maize, livestock and NTFPs collection	10 km from the main road
Houai Su	20°36'46.09"N 103°28'18.00"E	737	Hmong	273	upland rice, maize, livestock and NTFPs collection	5 km from the main road
Houay Lao	20°31'37.59"N 103°22'39.97"E	790	Hmong	142	upland rice, maize, livestock and NTFPs collection	In the main road
Nongsai	20°30'54.81"N 103°23'13.88"E	903	Hmong	255	upland rice, livestock and NTFPs collection	2 km from the main road
Houai Sanguan	20°32'10.39"N 103°19'6.27"E	796	Hmong	244	upland rice, livestock and NTFPs collection	10 km from the main road
Bor	20°31'44.73"N 103°19'15.22"E	768	khmu, lao	143	upland rice, NTFPs collection	8 km form the main road
Na Caak	20°26'19.30"N 103°22'43.69"E	905	Hmong	283	upland rice, livestock, NTFPs collection, and maize crop	5 km from the main road
Samsoum	20°36'2.31"N 103°24'52.75"E	595	Khmu	201	paddy rice, maize, livestock and NTFPs collection	In the main road
Laeng	20°24'6.94"N 103°22'12.22"E	728	Tai daeng	118	paddy rice, maize, livestock and NTFPs collection	In the main road
Nanoum	20°26'39.93"N 103°21'1.32"E	732	Lao, tai daeng	123	paddy rice, livestock, permanent crop	In the main road
Namngao	20°27'30.04"N 103°20'25.31"E	746	Hmong, khmu	134	paddy rice, livestock, and NTFPs collection	2 km from the main road

Source: Primary data 2018

Chapter 4: Historical transition of livelihood activities under road development in mountain villages of northern Laos

4-1. Introduction

Road development is considered as an important strategy for the country to improve economic growth (Gibson and Olivia, 2010; Jacoby, 2000). In many mountain villages of mainland Southeast Asia, many roads are now being constructed and are being upgraded through major initiatives such as establishment of economic corridors as the Greater Mekong Sub-region by the Asian Development Bank and recent development strategy from One Belt One Road by Chinese Government (Heinimann *et al.*, 2013; Thongmanivong *et al.*, 2009; Tsui *et al.*, 2017). The rapid expansion of globalization to mountain villages is mixed-blessing for the local community. Improvement of rural accessibility supports local livelihood system and is considered to be accelerate agricultural commercialization where many people are still living in isolated villages and are mainly depending on subsistence activities. On the other hand, improvement of rural accessibility sometimes also induces local people to be more vulnerable to the economy, especially for farmers (Barrios, 2008).

In the process of rural development, livelihoods in rural area generally have tended to shift from subsistence-based to market-oriented (Thongmanivong & Fujita, 2006), and subsistent agriculture has been transformed (Martin & Lorenzen, 2016; Rigg, 2006; Thanichanon *et al.*, 2013). Other studies also pointed out that subsistent agriculture are still being maintained and local people tend to combine various kinds of activities; not only subsistent agricultural activities but also

cultivating cash crops, raising livestock, collecting forest products, fishing, hunting and so on (Phouyyavong *et al.*, 2020; Shirai & Rambo, 2017). This pattern is widely observed in mountain villages of Southeast Asia and the combination of these subsistence-based and market-oriented activities is an important strategy as risk management (Ellis, 1999), especially for villages experiencing drastic globalization such as mountain villages in northern Laos, which is study area of this paper.

Thus, from the background above, the author investigated livelihood transition through road development process by special focus on the balance between subsistent and economic activities. In order to distinguish the influence of globalization by the level of accessibility, the author compared four villages with different road conditions.

4-2 Methodology

4-2-1. Study site

This field survey was carried out in 4 villages of Sone district in different road accessibilities, namely; poor (Bong village), middle (Houay Su and Houay Sanguan villages), and good (Houay Lao village) accessibility. The villages were established through the resettlement of Hmong hamlets closer to roads and district centers in the beginning of 2000s. Bong, Houay Su, Houay Sanguan, and Houay Lao villages were located 50 km, 35 km, 15 km, and 10 km from district center respectively (Table 4-2). The villages were located at an altitude of about 550 m to 790 m high. The basic livelihood pattern of 4 villages was agriculture, mainly upland rice cultivation and cash crops cultivation such as maize, cardamom,

amorphophallus and coffee. The population in all villages is shown in Table 4-1, and are predominantly Hmong ethnic groups who likely conduct activity in the forest such as collecting NTFPs.

Table 4-1. Population and household composition of the study villages in 2018

Name of Villages	Number of Household	Total Population
Bong	32	272
Houay Su	28	315
Houay Sanguan	35	329
Houay Lao	20	150
Total	125	1066

Source: primary data 2018

4-2-2. Data collection and analysis

First, basic information on the household and livelihood activities such as family members, agricultural activities, livestock, and NTFPs, were collected (see Table 4-4). In this study, eight cash crops were recorded: maize, *mak naeng*, *mak lok lek*, *mak man* (*Prunus* sp.), *mak paen* (unidentified), pineapple, cassava, and coffee. The author recorded five types of livestock: cattle, water buffalo, goats, pigs, and poultry. The author recorded 14 NTFPs with a commercial value; *dok khaem* (*Thysanolaena latifolia*), *het daeng* (red mushrooms, *Russula* sp.), *hong pa* (unidentified), *ko kam* (unidentified), *ko kan hom* (unidentified), *mak lok lek*, *mak ka* (*Alpinia galanga*), *mak naeng*, *on ling* (unidentified), *peuak meuak/peuang meuak* (*Boehmeria malabarica*), *pong peng* (*Smilax* sp.), *sam sip* (*Dioscorea* sp.), *mak khaen* (*Zanthoxylum rhets*), and *wan cheu* (*Araliaceae* sp.). The author also recorded other activities such as non-farm activities, including small-scale enterprises (local trader and general store) and employment (e.g., teacher, local

government staff), and off-farm activities including hunting, fishing, and transportation of agricultural products.

To understand the trends in livelihood transitions at a village level, the author categorized the livelihood activities into six principal types (upland rice cultivation, paddy rice cultivation, maize cultivation, other cash crop cultivation, *het daeng* collection and other NTFPs collection) for each household in each village and traced the livelihood activities over approximately 20 years. The author separated maize from other cash crops and *het daeng* from other NTFPs because they were the most important cash crop and NTFP, respectively, and they were both considered to reflect the villagers' reaction to globalization. In this study, the author uses terms such as "other cash crops" or "other NTFPs" hereafter. Because the category of "other cash crops" is strongly related to results and discussion, it is described more fully in the "new cash crop" section.

Although raising livestock was an important livelihood activity, the author did not include it in the analysis of livelihood transition because it was difficult to trace the temporal dynamics per household. The author asked about the beginning and ending year of each livelihood activity in the household, then the author summed the number of households annually from the year of the village's establishment to the present year. To understand the variations in the number of households undertaking each activity in each year, the author calculated the percentage of households undertaking each activity out of the total number of households.

4-3. Results and Discussion

4-3-1. Summary of socio-economic conditions

The summary of socio-economic conditions in the four villages is shown in Table 4-3. The average family size was 8.64, which exceeded the average family size of 5.3 at the national level (Lao Statistic Berau, 2016). The family size among the four villages was not significantly different, nor was the average number of productive age people or females. Households in the four villages combined several agricultural activities for both subsistence and economic purposes. The agricultural activities for subsistence were mainly rice cultivation in upland and paddy fields, and those for economic purposes were mainly cash crop cultivation, including maize and coffee. The most important activity in the four villages was rice cultivation and the higher ratio of rice-sufficient households such as in Houay Su and Houay Lao was considered to be related to the larger area of upland fields in these villages (Table 4-3). While the contribution of paddy fields to rice sufficiency was supplemental, villagers preferred to reclaim new paddy fields because of their higher yield and lower labor requirement than those of upland rice cultivation. The most important cash crop in the study area was maize, followed by coffee, *mak naeng* and *mak lok lek* (see Table 4-4).

The area of other cash crops in Houay Su and Houay Lao was larger than that of the other villages because of coffee growing. Coffee was introduced through the Lao Z49 NGO project run by the United Nations Office on Drugs and Crime, with US\$6 million in funding provided by the United States and Luxemburg for the eradication of opium. Most households raised cattle and water buffalo with an average number of 6.54 and 1.88, respectively; these types of livestock also

contributed most of the total income from livestock. Income from livestock was the highest in Houay Lao, where the level of road accessibility was good. The NTFPs were an important income source, especially in Bong, Houay Su and Houay Sanguan, where the level of road accessibility was lower. *Het daeng* made the most important NTFP contribution to total income, and 92% of total households were engaged in its collection.

Although the income from non-farm activities varied among households, some households were engaged in non-farm activities such as small-scale enterprises (local trader and general store) and employment (e.g., teacher, local government staff). Some households also obtained income from off-farm activities such as hunting, fishing and transportation of agricultural products. Physical assets such as motorbikes, cars, tractors, and rice mills were widely observed in the study area and supported local people's activities. Assets with a high price, such as cars, contributed to the total assets in the household. Houay Su showed highest total asset value, probably because it had the highest activity transporting various products.

4-3-2 Transition of livelihood under road development

Shift in rice fields and maintenance of rice production amid globalization

Since the establishment of the villages in the early 2000s, almost all households had maintained subsistence rice production in upland or paddy fields. There were no paddy fields in Houay Lao, but in Bong, Houay Su and Houay Sanguan a shift from upland fields to paddy fields was observed in many households over the last 20 years. In Bong and Houay Su, almost all households

still maintained some rice production upland. The ratio of households with paddy fields gradually increased from almost none to 40% of households in Bong and 24% of households in Houay Su. In Houay Sanguan, the ratio of households with upland fields decreased from 93% to 71%, while the ratio of households with paddy fields increased from 21% to 45%. This shift was accomplished by wealthier households because they were able to reclaim new paddy fields, which required some financial input. As a result, they could allocate their labor to other activities such as the cultivation of maize or perennial tree crops and raising livestock (Ducourtieux and Catsella, 2006). The pattern of the shift in Houay Sanguan was different from the other two villages, mainly because the availability of water was better in this village and the local people could easily source appropriate land for paddy fields.

Local people in the study area also used rice as a medium of exchange, as well as for their own consumption. For example, local traders of salt, one of essential goods for local people and livestock, were paid using rice. The current study suggested that maintaining rice production contributed to subsistence livelihoods and to obtaining essential daily goods.

Commercialization of NTFPs and agriculture products: Influence of Chinese and Vietnamese merchant

Many NTFPs and agricultural products had become commercialized since the establishment of the villages, and the ratio of households in each village which collected commercial NTFPs and cultivated commercial crops had changed over the 20 years (Fig. 4-2). In Houay Sanguan and Houay Lao, more than 90% of

households had collected other NTFPs (as categorized in Materials and Methods) for commercial purposes since the establishment of the villages. The oldest commercial NTFPs were *sam sip* and *on ling*. In Houay Lao, two households stopped collecting other NTFPs over the 20 years because their activities shifted to cultivating maize and raising livestock which were more profitable. In Houay Su, the ratio of households with other NTFPs increased from 75% to 100%, while that in Bong increased from 0% to 100% of households. Households in Bong did not collect commercial NTFPs immediately after the establishment of the village because of poor accessibility to markets. All NTFPs were sold to Vietnamese and Chinese merchants. In the study area, *het daeng* was the most important of the commercial NTFPs. It was introduced by Chinese merchants and rapidly commercialized with the improvement in the roads. Before the paving of the main road, local people only collected *het daeng* for their own household consumption. Houay Su saw the earliest introduction of *het daeng* because one household was related to Chinese merchants. The influence then expanded to other villagers. Despite the high price of *het daeng*, its ratio of collection in Houay Lao was lower than in other villages because there was no *het daeng* in the village area and households needed to travel almost a day's journey by motorbike and on foot to the border of Houaphan and Luang Prabang Provinces to collect it. It was reported that *het daeng* earned the highest export revenue among all NTFPs (Phounvisouk *et al.*, 2013). In the current study, the commercialization of NTFPs, especially new NTFPs, was related to road accessibility to the villages, and road development brought a rapid change in local livelihood activities in the forest.

The major cash crop in the study area was maize and different transition patterns were observed among the villages. In Houay Sanguan, a lower ratio of households cultivated maize and they preferred to collect commercial NTFPs owing to their easier access to natural resources. In Bong and Houay Su, the transition pattern was similar. The ratio in these villages increased with road improvements, but from 2015 in Bong and from 2017 in Houay Su, the ratio of maize sharply decreased. It is considered that from approximately 2015, demand from Vietnamese merchants declined and the trade area of merchants shrank. The influence of this change appeared more clearly in Bong than in Houay Su. In contrast, in Houay Lao, the ratio increased much earlier and faster than that in the other villages and they continued to cultivate maize. The people of Houay Lao spent three million LAK per household to build feeder roads to maize cultivation fields, which strengthened their dependence on local merchants and their resilience to market uncertainty (Castella and Phaipasith, 2021). Accessibility to the fields became much better, and consequently, the pattern did not show a sharp decline because the influence of the shrinking market was much lower.

“New Cash Crops”: Adaptation to social and economic changes caused by external and internal motivation

In addition to maize, there were seven cash crops in the study site: *mak naeng*, *mak lok lek*, *mak man*, *mak paen*, pineapple, cassava and coffee. These were categorized as “other cash crops” in this study. In recent years, local people in all the villages began to cultivate these cash crops to diversify their incomes (Fig. 4-

2). The ratio of households with other cash crops increased in all villages. The introduction of new cash crops in the study area was observed from the aspects of decreasing natural resources, increasing influence from local and global markets, and outsiders.

As mentioned before, while the oldest NTFPs were *sam sip* and *on ling*, *mak naeng* and *lok lek* began to be collected a few years after the establishment of Houay Su, Houay Sanguan, and Houay Lao. At that time, the trade networks for *mak naeng* and *mak lok lek* were already organized locally, and villagers decided to start to collect them. These NTFPs had previously contributed to household income; however, these products began to decrease over a period of approximately 15 years and partly disappeared several years before the survey. The prices of these products were generally high compared with other products in this region and villagers began to cultivate them. Consequently, the land was set aside for the new cash crops. The crops were easy to cultivate and cultivation was helpful for saving labor compared with collecting NTFPs in the forest.

Although the increasing influence of the global market affected the initial introduction of maize to this region, the influence of global and local markets also led the introduction of new cash crops such as pineapples and cassava. These helped to decrease maize cultivation, assisted by a decrease in the price of maize. The author found many households started to cultivate cassava (13 households (41%) in Bong and 9 households (24%) in Houay Su) and to cultivate pineapples (14 households (40%) in Houay Sanguan). Cassava was newly introduced by

Vietnamese merchants in Bong and Houay Su , while pineapples were introduced by local people because of increasing demand in the local market.

Mak man was also considered to be a new cash crop in this study. Before its commercialization, *mak man* was a common and traditional tree crop, consumed as fresh fruit or used as a raw material for alcohol, and it was planted near residential areas. Demand for *mak man*, like pineapples, increased in the local market and some households expanded its cultivation. This led it to become a new cash crop in the study area.

Mak paen was newly introduced and cultivated by only four households (20%) in Houay Lao from 2017 as a trial for obtaining supplementary income by transplanting wild seedlings from the surrounding forest. The fruit were brought to the local market in small quantities and the average income earned from mak paen was 155,000 LAK per household per year. In northern Laos, many local plants are commonly found in the local markets and these species are considered to contribute to the high diversity of market items from the natural environment (e.g. a case study from central Laos, Kosaka *et al.*, 2006).

Coffee was newly introduced by an NGO as mentioned earlier. First, the NGO conducted a preliminary survey in May 2016, and three villages—Houay Su, Houay Lao and Houay Yam—were chosen as coffee plantation sites because they were at higher elevations (approximately 700–900 m a.s.l.) than other villages in Sone District. In November 2016, the NGO distributed coffee seedlings to farmers with limit of up to 1 ha, and the farmers started to transplant coffee in July 2017. There was no contract for the price of coffee after its first harvest, but the NGO

promised to find a market for future output for all members. In the current study, 32 households (84%) in Houay Su and eight households (40%) in Houay Lao had started to cultivate coffee and consequently, the area of coffee made a high contribution to the area of other cash crops in this study.

Table 4-2: Characteristics of target villages

	Bong	Houay Su	Houay Sanguan	Houay Lao
No. of households	54	70	55	35
Total population	492	575	441	201
Elevation	567	737	796	790
Access to center (km)	50	35	15	10
Road access condition	Bad (isolated)	Middle (close to main road)	Middle (close to main road)	Good (in the main road)
Livelihood pattern	Agriculture (upland rice and cash crops cultivation)	Agriculture (upland rice and cash crops cultivation)	Agriculture (upland rice and cash crops cultivation)	Agriculture (upland rice and cash crops cultivation)
Ethnic	Hmong	Hmong	Hmong	Hmong
Electricity began	2017	2016	2011	2014

Sources: Primary data 2018

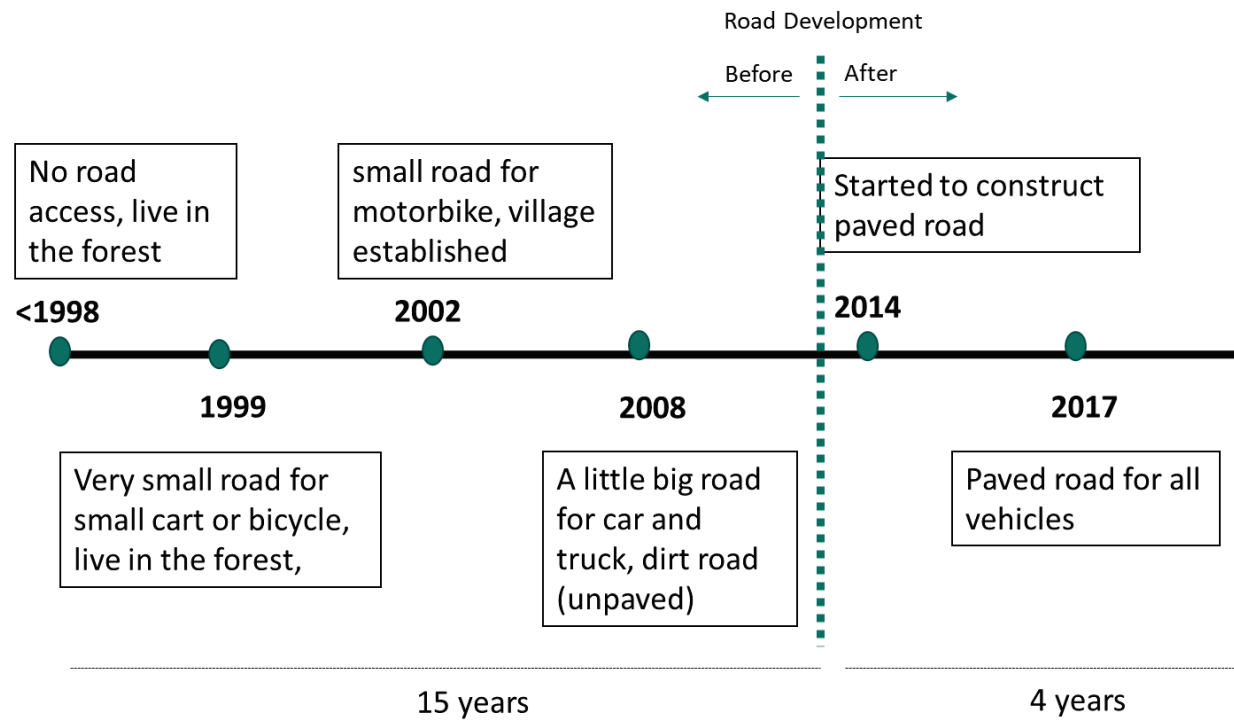


Fig 4-1: History of the main road in the study site

Table 4-3: Summary of socio-economic conditions.

Household Characteristics	Bong (n = 32)	Houay Su (n = 38)	Houay Sanguan (n = 35)	Houay Lao (n = 20)	Total (n = 125)
Family size (no./hh)	8.50	8.45	9.51	7.70	8.64
Productive age (15-65 years old) (no./hh)	4.00	4.37	4.34	3.40	4.112
Females (no./hh)	3.94	4.03	4.91	3.00	4.088
Paddy fields (a)	13.59 ^a	16.05 ^{ab}	21.26 ^{ab}	0.00 ^b	14.312
Upland fields (a)	55.00 ^{ab}	92.11 ^c	42.57 ^a	77.00 ^{bc}	66.32
Maize (a)	22.66 ^a	71.32 ^b	0.00 ^a	96.50 ^b	42.92
Other cash crops (a)	25.84 ^a	157.39 ^b	7.06 ^a	97.30 ^c	72.008
Cattle (no./hh)	2.66 ^a	3.21 ^a	9.71 ^b	13.55 ^b	6.544
Waterbuffalo (no./hh)	2.25	1.61	2.14	1.40	1.888
Income from rice (LAK*)	87,500	78,947	335,714	212,500	174,400
Income from NTFPs (LAK)	9,077,094 ^{ab}	10,412,895 ^a	9,494,573 ^{ab}	4,598,800 ^b	8,883,544
Income from cash Crops (LAK)	985,531 ^{ab}	2,877,632 ^a	633,714 ^b	7,106,000 ^c	2,441,496
Income from livestock (LAK)	4,153,125 ^{ab}	3,865,921 ^a	5,437,619 ^{ab}	10,585,000 ^b	5,454,573
Income from non-farm activities (LAK)	85,938	2,334,211	1,988,571	742,000	1,407,120
Income from off-farm activities (LAK)	-	831,579	880,000	526,316	583,871
Physical assets (LAK)	9,770,313 ^a	32,582,895 ^b	12,668,571 ^a	17,915,000 ^{ab}	18,820,000
Ratio of rice-sufficient Household (%)	69	92	57	85	74

*LAK: Lao Kip, Laos' National Currency (1 USD = 8,592 LAK) according to Bank of the Lao P.D.R, dated 31st March 2019. Non-farm activities include small-scale enterprises (local trader and general store) and employment (e.g., teacher, local government staff). Off-farm activities include hunting, fishing, and transportation of agricultural products. Different superscript letters indicate significant differences by Tukey's HSD test (95 % confidence level).

Table 4-4. Livelihood activities and income of the household

No	Livelihood activities	No. HH	Bong Income (LAK)	No. HH	Houay Su Income (LAK)	No. HH	Houay Sanguan Income (LAK)	No. HH	Houay Lao Income (LAK)
	Rice								
1	Upland rice	27	-	35	52,632	23	335,714	19	212,500
2	Paddy rice	13	215,384	6	26,316	16	-	0	-
	Cash crops								
3	Maize	26	1,467,764	33	1,844,474	0	-	19	6,921,053
4	Coffee	0	-	32	-	0	-	8	-
5	Cassava	13	-	9	-	0	-	0	-
6	<i>Mak naeng</i> /cardamom (<i>Amomum villosum</i>)	8	-	29	315,789	5	5,714	13	175,000
7	<i>Mak lok lek</i> (<i>Amorphophallus</i> sp.)	7	940,714	21	717,368	0	-	2	325,000
8	Pineapples	0	-	0	-	14	212,857	0	-
9	<i>Mak man</i> (<i>Prunus</i> sp.)	0	-	0	-	14	3,005,857	0	-
10	<i>Mak paen</i> (unidentified)	0	-	0	-	0	-	4	31,000
	Livestock								
11	Cattle	22	590,909	22	2,289,474	29	2,641,905	17	9,100,000
12	Water buffalo	15	7,500,000	13	642,105	12	1,885,714	3	1,300,000
13	Goats	2	450,000	5	89,474	13	285,714	8	-
14	Pigs	10	550,000	17	592,105	18	568,571	8	150,000
15	Poultry	8	125,000	23	252,763	31	55,714	4	35,000
	NTFPs								
16	<i>On ling</i> (unidentified)	22	715,909	36	1,571,316	22	434,118	14	468,750
17	<i>Mak lok lek</i> (<i>Amorphophallus</i> sp.)	18	1,013,722	23	568,026	27	618,857	15	997,500
18	<i>Sam sip</i> (<i>Dioscorea</i> sp.)	16	131,250	24	236,579	28	499,143	12	286,750
19	<i>Mak naeng</i> /cardamom (<i>Amomum villosum</i>)	13	1,193,076	20	643,158	13	387,143	0	-
20	<i>Pong peng</i> (<i>Smilax</i> sp.)	6	200,000	6	37,237	3	20,286	0	-
21	<i>Wan cheu</i> (<i>Araliaceae</i> sp.)	3	46,250	1	21,053	8	434,118	0	-
22	<i>Ko kan hom</i> (unidentified)	5	2,740,000	1	210,526	0	-	0	-
23	<i>Ko kam</i> (unidentified)	0	-	5	85,526	0	-	0	-
24	<i>Dok khaem</i> (<i>Thysanolaena latifolia</i>)	1	500,00	7	157,895	20	260,000	6	155,800
25	<i>Hong pa</i> (unidentified)	3	1,266,667	0	-	0	-	0	-
26	<i>Mak khaen</i> (<i>Zanthoxylum</i> <i>rhets</i>)	0	-	2	10,526	0	-	0	-
27	<i>Mak ka</i> (<i>Alpinia</i> <i>galanga</i>)	0	-	1	13,158	2	22,857	0	-
28	<i>Peuak meuak/peuang</i> <i>meuak</i> (<i>Boehmeria</i> <i>malabarica</i>)	5	236,000	1	5,263	0	-	0	-
29	<i>Het daeng</i> /red mushroom (<i>Russula</i> sp.)	32	6,781,250	38	6,852,632	31	6,600,286	14	2,690,000
30	Non-farm: Small-scale enterprise (store, local traders, employment)	2	1,375,250	8	2,297,368	6	1,560,000	3	492,000
31	Off farm (hunting, fishing, and transportation of agricultural products)	0	-	9	871,053	5	1,308,571	3	750,000

Note: LAK: Lao Kip, Laos' National Currency (1 USD = 8,592 LAK) according to Bank of the Lao P.D.R, dated 31st March 2019.

Income of households shown is average of all interviewed households, including both engaged and not engaged in each livelihood activity, in a village.

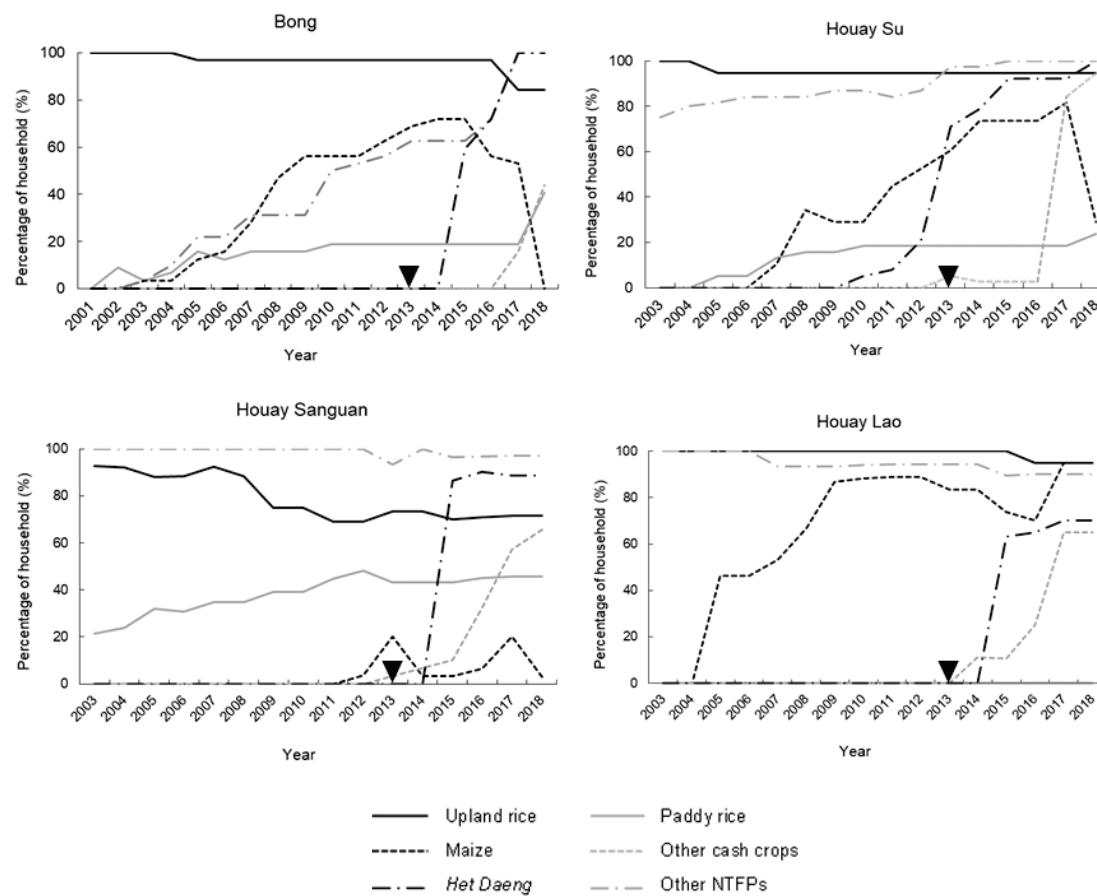


Figure 4-2 Livelihood transition under road development in different road access (a) bad road access, (b) middle-bad access, (c) middle-good access, and (d) good road access.

Chapter 5: Livelihood strategy in livelihood diversification under road development in northern Laos

5-1. Introduction

From Chapter 4, the author can know that the rapid road development brought drastic changes of livelihood system in montane villages of Laos and livelihood of local people become more diverse than before. Ellis (1999) defined livelihood diversification as a process by which rural households construct an increasingly diverse portfolio of activities in order to survive and to improve their standard of living, and diversification strategies commonly include combination of agricultural and non-agricultural activities either for subsistence or commercial purpose. Many studies have observed that livelihood diversity is a norm in rural areas (Dzanku, 2015; Nielsen *et al.*, 2013) and, in Southeast Asia, the livelihoods are mostly diversified from rice-based agricultural system to market-oriented agricultural system such as cultivating annual (e.g., maize, sugarcane, vegetables) or perennial (e.g. rubber, coffee, tea, banana, oil palm, teak) cash crops (Castella *et al.*, 2013; Fox *et al.*, 2014; Vongvisouk *et al.*, 2014) and to other market-oriented systems where many people are engaged in non-agricultural activities (wage labor, trading, self-employment, and salaried jobs). Although livelihood diversity is related to flexibility, resilience and stability for rural farming households (Ellis, 1999), identifying how local people combine various livelihood activities and clarifying contribution of diversity of livelihood activities and incomes to stability of livelihood are a key part of any investigation of sustainable livelihoods (Scoones, 1998).

Several studies show the livelihood diversification from subsistent agricultural activities to non-agricultural activities and their impact on rural income diversification. In Africa, Reardon (1997) reviewed income diversification in non-agricultural activities among rural farming households. Although case studies in the paper showed that farming households became to earn income from wage of non-agricultural activities much more than from that of agricultural activities, richer households with greater initial assets (e.g. land, livestock, migration remittances) mostly could diversify income to non-agricultural activities and the shift did not automatically benefit the poor. In the Amazon, Perz *et al.* (2013) reported that connectivity to local market was related to the diversity of livelihood activities and income diversity. The study showed that livelihoods dependent on non-agricultural activities in more integrated areas were much less diversified with higher incomes while livelihoods dependent on agriculture in less integrated areas were more diversified with lower incomes. In Southeast Asia, there are still many mountain villages that have not yet been integrated and local people are still heavily depending on agriculture and natural environment. In these unintegrated areas, when facing road development, local people become easily to access the market and to be engaged in non-agricultural activities (Castella *et al.*, 2005). Then, a question arises, do livelihoods in remote villages become more diversified due to increase of non-agricultural activities same as in other areas? One study reported concerning the role of non-agricultural activities on diversification in mountain villages of northern Laos. Bouahom (2004) described the local people were engaged in non-agricultural activities where livelihood was subsistent and rice

production was uncertain, farming households were forced to rely on low-income non-agricultural activities such as wage labor on agriculture and collecting NTFPs despite of the shift of livelihood. The study concluded that households were necessary to diversify livelihood activities even though they received modest income, and which is so-called “distress diversification” (Martin and Lorenzen, 2016). On the other hand, from careful observation of the paper, its story is based on only a few samples and they are considered not to fully support their statement and identification of diversification process remains unclear.

In the livelihood studies, livelihood activities have been classified by sector (agricultural and non-agricultural), function (wage and self-employment) and location (on-farm or off-farm) (Loison, 2015), and the classification has been widely applied to measure livelihood diversification (Barret and Reardon, 2005; Start and Johnson, 2004). The classification is indeed effective in analyzing in large scale and sample size, and however, many of these studies have paradoxically tended to overlook diverse activities including subsistent activities and the measured diversity is often too simplified and sometimes confusing to describe the diversification of livelihood activities (Rubiyanto and Hirota, 2021).

Thus, from the above background, the author analyzed variables which represent each livelihood activity and tried to identify household strategies and roles of livelihood activities. The author also explored the relationship between income sources diversity and total income to understand the pattern of livelihood diversification. Finally, this study evaluated the impact of road on rural livelihood as a key for sustainable development in this area.

5-2 Methodology

5-2-1. Data Collection

The author asked the sources of household income, and 31 income sources were recognized. The various sources of income come from agriculture and not agriculture. Therefore, to find out the diversity of 31 income sources, the author categorized into six income sources; rice cultivation, cash crop cultivation, livestock production, NTFPs collection, non-farm activities (which included small-scale enterprise and employment), and off-farm activities (which included driver, hunting and fishing). The author asked about the amount of each income which each household obtained within one year.

5-2-2. Data Analysis

Measurement of livelihood diversity

By following the past studies (Vedeld, 2004; Haughton and Mukerjee, 1995; Nielsen *et al.*, 2013), the author then calculated the income source diversity by using Simpson index (SID) equation (1):

$$SID = 1 - \sum_{i=1}^n P_i^2 \dots\dots\dots(1)$$

Where, P_i as the proportion of income coming from source i (see table 5.1). The index value is between 0 and 1. The index value can be 0, if only one source of income. Accordingly, a higher index value indicates a household with more highly diversified income sources. The index value shows highest when all amount of income sources is even. The Simpson index is affected both by the number of income sources as well as by evenness of income sources.

Identification of factors in livelihood strategy

In this study, 13 variables were selected as independent variables to represent household conditions, subsistence, and economic livelihood activities (Table 5-1). The independent variables in this study were identified based on various types of capital that household possesses and represent household livelihood strategy either for subsistence or economic strategy. Labor is one of category for diversification in rural livelihood (Phoyyavoung *et al.*, 2020), and, family size, number of female and number of productive age were selected as labor in this study. Since, the households still rely on rice production, the land area of upland rice, and paddy rice were categorized as variables to represent subsistence activities. Because the risk of a rice deficit from upland rice often happened, some households rely on livestock as savings to ensure their overall subsistence (Rigg, 2006), but from the author's survey some households also rely on livestock as an investment to get more cash income. Therefore, the author set variables of livestock into two categories; first was number of livestock as subsistence and economic strategy, and second was income from livestock as economic strategy. Area of maize and other cash crops was categorized as on-farm economic activities. While income from red mushroom and other NTFPs was categorized as non-farm economic activities. The other two variables such as physical assets and access to credit were categorized as mechanization and fluidity of cash, respectively, to provide additional information about physical and financial assets of each household.

Two dependent variables were used in this study to understand the direction of household strategies for either total income or income diversity. Because the dependent variables are continuous variable, and independent variable also contains continuous variables, therefore, multiple linear regression was carried out by using following equation (2):

$$Y = a_0 + \sum_{i=1}^n x_i + \varepsilon_i \dots \dots \dots (2)$$

Where, Y is the dependent variable representing income sources diversity and total income per household. a_0 represents the value of Y when all of independent variables are equal to zero, and x_i itself is a vector of exogenous explanatory variables. n represents the number of independent variables in the model ε_i represents model error.

Because the variables for analyzing multiple linear regression were measured into different scales, we standardized to rescale raw data by following equation (3) (Gautam & Andersen, 2016):

$$Z = \frac{x - \mu}{\sigma} \dots \dots \dots (3)$$

Where x is the original value, μ is the variable's mean, and σ is the variable's standard deviation. The absolute value of Z represents the distance between the raw score and the population mean in units of the standard deviation.

5-3. Results and Discussion

Balance of subsistent and economic activities

The relationship between the independent variables of livelihood activities and total income is shown in Table 5-2 and the relationship with income diversity

is shown in Table 5-3. The relationship was different in each village and analysis provided an understanding of villagers' livelihood strategies towards globalization. To adapt to globalization, villagers combined their various activities and tried to achieve a stable development of their livelihoods.

Generally, labor is an important factor for both subsistence and economic livelihood activities. In the current study, family size—one indicator of labor—significantly contributed to total income only in Houay Su but not in the other three villages. This indicated that labor was not optimized for commercial livelihood activities in the three villages and was partly allocated to subsistence activities. In Houay Su, labor, especially by males, was used for income generation and for investment in the future such as the cultivation of new cash crops and reclamation of paddy fields. In contrast, female labor contributed to total income in Houay Sanguan, thanks to easy access to a forest with a substantial amount of *het daeng*. People of all generations were engaged in the collection of NTFPs which were the main income sources. The variable of productive age was not significant in any of the villages.

The contribution of labor to income diversity was not clear (Table 5-3). This indicated that both large and small families had similar packages of options for livelihood activities and that labor allocation to commercial livelihood activities was basically similar in households with different family sizes. In Houay Lao, it was observed that labor contributed to income diversity at the $p < 0.15$ significance level. People in the village were less engaged in NTFPs collection and its contribution to income diversity was low. They were more engaged in other income

generating activities and kept income diversity at a higher level (Simpson Index of 0.594 in Table 5-3).

To sustain or improve livelihoods, a combination of subsistence and income-generating activities is an important livelihood strategy in rural areas (Ellis, 1999). In subsistence livelihoods, the results showed that the area of upland fields did not significantly contribute to total income in any villages (Table 5-2), and upland rice was produced to meet the basic self-consumption needs of households. In northern Laos, a shift from upland fields to paddy fields was common and local people in the study area also reclaimed new paddy fields when they had flat land with available water in the village area. The reclamation often required substantial quantities of labor and sometimes limited time for other activities as well as for engagement in subsistence activities. This is shown by the negative coefficient of the area of paddy fields to total income in Houay Su and the lack of significant coefficients in the other villages (Table 5-2). The coefficient of the area of paddy fields to income diversity was also not significant. A case study in northern Laos reported that local people who had large paddy fields could increase engagement in many income generating activities (Linguist *et al.*, 2007). However, the current study showed that paddy fields did not clearly support local people to enhance their activities. This may be because the area of reclamation was still small.

Although local people maintained their subsistence activities in different villages and variables for subsistence activities did not contribute to total income and income diversity, most of the variables for economic activities did contribute to total income. The variables of NTFPs and livestock contributed more to total

income than that of cash crops, including maize. However, *het daeng* contributed to a decrease in income diversity in Bong and Houay Su because the gathering and processing of *het daeng* required substantial quantities of labor which affected engagement in other activities. Although the maize variable showed a significant contribution to income diversity in Bong, the number of households growing maize had already decreased because of the drop in price and villagers preferred to shift their activity to the collection of NTFPs.

In Houay Lao, the balance of each activity was different from other three villages. People in Houay Lao were engaged in more income generating activities such as maize, livestock, and *het daeng*, and they were less engaged in collecting other NTFPs. Collecting other NTFPs was not as profitable as the other activities and its engagement was related to low income generating activities and “distress diversification” (Martin and Lorenzen, 2016). People in Houay Lao began new activities such as the cultivation of new cash crops and raising livestock, and the situation there was considered to be closer to the concept of “progressive diversification”, in which rural households can leverage themselves into higher-return activities and occupations that lead to improved standards of living (Bouahom *et al.*, 2004). The dynamics of distress and progressive diversification will be discussed in detail later.

The contribution of physical assets to total income was large in Houay Su and Houay Sanguan. In these villages, cars and motorbikes were important for transportation and were related to various kinds of income generating activities. In contrast, in Houay Lao, physical assets were related to income diversity because

physical assets in the village were mainly used for new income generating activities such as coffee plantations which did not yet provide income.

Access to credit did not contribute to total income and income diversity in any of the villages. This indicated that local people in study area did not depend on loans from the bank. Previous studies have mentioned that access to credit is important for local people to expand their commercial livelihood activities (Goto, 2011). However, people in the study site mostly kept their assets as livestock which were easy to exchange for cash, and this is common and widely observed in northern Laos (Ingxay *et al.*, 2015; Phouyyavong *et al.*, 2020; Thanichanon *et al.*, 2018).

Contribution of NTFPs to livelihood

In the study site, NTFPs have long been used by the local people not only for self-consumption but also for commercial purposes. The NTFPs consumed by local people were generally mushrooms, bamboo shoots, wild vegetables, wild fruit and wild animals. Commercial NTFPs contributed highly to the household livelihoods, either to the total income of the household or to income diversity (Arnold and Perez, 2001; Phounvisouk *et al.*, 2013).

Table 5-2 shows that *het daeng* contributed to total income in all villages and was the main income source from NTFPs. It could only be collected in the rainy season from July to August. Other NTFPs were also seasonal and contributed highly to total income in Bong and Houay Su. Although the prices of other NTFPs were lower compared with those for *het daeng*, the variables for other NTFPs were

positively correlated with that of income diversity in Bong, Houay Su and Houay Sanguan (Table 5-3). Local people collected other NTFPs mostly during engagement in other agricultural activities such as the management of upland cultivation fields or taking care of their livestock. The collection of other NTFPs was supplementary activity and contributed to an increase in total income and income diversity.

The study showed that NTFPs were important to all villagers regardless of the combination of livelihood activities, especially *het daeng* which contributed highly to total household income in all villages. However, Table 5-3 shows that *het daeng* was negatively correlated with income diversity in Bong and Houay Su, in contrast with other NTFPs. The negative value indicated that *het daeng* collection and its processing required a substantial amount of labor, especially in Bong and Houay Su where all family members needed to stay in the forest for several weeks to collect *het daeng*. This meant that they did not have time for the more promising and profitable activities carried out in the other villages such as new crop cultivation, grazing livestock, and non-farm activities.

Previous studies have shown that income diversity is important for risk management and for reducing vulnerability (Ellis. 1998; Barret *et al*, 2001; Wan *et al*, 2001). In the current study, the priority for local people was to engage in profitable activities and to earn more income rather than to maintain income diversity. For people in Houay Lao, *het daeng* was not located inside the village and villagers needed to travel outside the village. Thus, the contribution of *het daeng* to total income in Houay Lao was lower when compared with other items of

income source (Table 4). However, the villagers still collected *het daeng*. This indicated that the villagers chose *het daeng* as a profitable income source and it was considered a trustworthy item for “self-insurance” for the villagers (Barret *et al*, 2001; Reardon *et al*, 2000; Start and Johnson, 2004). “Self-insurance” is a behavior “in which people exchange some foregone expected earnings for reduced income variability achieved by selecting a portfolio of assets and activities that have low or negative correlation of incomes” (Barret *et al*, 2001). The concept can be applied to the present case study.

In more isolated villages such as Bong and Houay Su, other NTFPs contributed to both total income and income diversity. NTFPs generally contribute to the stability of cash income (Hogarth *et al*, 2013; Shackleton *et al*, 2011). The author also found that NTFPs contributed to income diversity in addition to increasing total income. However, the villagers in author’s study preferred to collect *het daeng* and collecting other NTFPs had a lower priority. The villagers mainly collected other NTFPs while they were engaged in other activities such as upland rice cultivation, maize cultivation, or taking care of livestock. The supplementary activity of collecting these NTFPs contributed to increased income diversity, and diversity is considered to help with livelihood stability under not so strong consciousness.

Flexible role of livestock

The main livestock in the study area were cattle, water buffalo, pigs, goats, and poultry. Cattle and water buffalo were raised widely in secondary forest

surrounded by fences, whereas pigs, goats and poultry were raised near residential areas or near isolated huts on mountains within the village boundary. Traditionally, Hmong people are successful at raising livestock and their dependence on livestock, especially on cattle and water buffalo, is higher than that of other ethnic groups (Castella *et al*, 2013). People in the study area raised cattle and water buffalo extensively. They took turns to provide salt one to three times a week to control the herd, and their style of raising livestock consumed little labor.

Income from livestock made a significant contribution to total income in Bong, Houay Sanguan and Houay Lao (Table 5-2), and the major role of livestock in the study area was also considered to have a commercial aspect. While the contribution of the number of cattle and water buffalo to total income was unclear, the values in Houay Su, Houay Sanguan and Houay Lao were negative. This suggested that the villagers were more likely to actively sell this livestock and the livestock rearing activity was mainly commercial as mentioned in previous studies (e.g. Phouyavong *et al*, 2020). In contrast, in Bong, the number of cattle and water buffalo contributed significantly to total income at the $p < 0.15$ level, and the villagers were more likely to keep livestock not only for commercial purposes but also as savings.

The variables of the number of cattle and water buffalo and income from livestock did not clearly contribute to income diversity (Table 5-3). This suggested that because raising livestock did not consume much labor, it did not contribute to the combination and total number of livelihood activities, and that livestock were a useful and convenient asset regardless of the different road accessibility of the

villages. Local people in Houay Sanguan and Houay Lao had recently started to plant pasture grass in fields near residential areas and to graze cattle there. This recent activity was related to a drop in the price of maize and showed that the Hmong people chose livestock grazing as a flexible option for their livelihood strategy.

Table 5-1: Description of independent variables and categories of household strategy

No	Independent Variables (unit)	Category of independent variables	Description
1	Family size	Labor	Number of individual in household
2	Number of female	Labor	Number of individual female in household
3	Number of productive age	Labor	Number of individual between 15 to 65 years old
4	Land of upland rice (a)	subsistence activity	Land size of upland rice operated by household
5	Land of paddy rice (a)	subsistence activity	Land size of paddy rice operated by household
6	Number of cattle and water buffalo	subsistence and economic activity*	Number head of cattle and water buffalo in household
7	Land of maize (a)	On-farm economic activity	Land size of maize operated by household
8	Land of other cash crops (a)	On-farm economic activity	Land size of other cash crops operated by household
9	Income from livestock (LAK)	economic activity*	Value of income of livestock
10	Income from red mushroom (LAK)	Non-farm economic activity	Value of income of Red mushroom
11	Income from other NTFPs (LAK)	Non-farm economic activity	Value of income of all NTFPs collection in household
12	Physical asset (LAK)	Mechanization of household activity	Value of asset (motorbike, car, chainsaw, tractor, etc) in Household
13	Access to credit (dummy)**	Fluidity of cash	Received credit from bank

Table 5-2: Relationship between variables for livelihood activities and total income in the four villages.

Standardize independent variable	Bong (poor)	Houay Su (medium)	Houay Sanguan (medium)	Houay Lao (good)
Mean (million LAK*)	₭ 14.39 ^a	₭ 20.40 ^a	₭ 18.78 ^a	₭ 23.74 ^a
R ²	0.981**	0.777**	0.722**	0.981**
Intercept	0	0	0	0
Labor				
Family size	-0.074	0.760*	-0.284	-0.208
Number of females	-0.025	-0.386*	0.442+	0.076
Number of productive age	0.095	-0.174	-0.238	0.117
Subsistence activity				
Upland fields	-0.03	-0.103	0.065	0.015
Paddy fields	-0.026	-0.432*	0.088	-
Subsistence and economic activity				
Number of cattle and water buffalo	0.085+	-0.218	-0.102	-0.248
On-farm economic activity				
Maize	0.132*	0.049	-	0.187*
Other cash crops	0.016	-0.089	-0.03	-0.087
Economic activity				
Income from livestock	0.933**	0.119	0.559**	1.057**
Non-farm economic activity				
Income from <i>het daeng</i>	0.500**	0.215+	0.645**	0.342**
Income from other NTFPs	0.279**	0.388**	0.014	0.165
Mechanization of household activity				
Physical assets	-0.032	0.867**	0.243+	0.023
Investment				
Access to credit	N/A	N/A	-0.012	0.119

*LAK: Lao Kip, Laos' National Currency (1 US\$=8,592 LAK) according to Bank of the Lao P.D.R, dated 31st March 2019.

Note: Significance in R² indicated by the results of the F test and different superscript letters indicate significant differences by Tukey's HSD test (95 % confidence level). +, *, and ** indicate significant differences at p < 0.15, p < 0.05, and p < 0.01, respectively.

Table 5-3: Relationship between variables of livelihood activities and income diversity (Simpson index).

Independent variable	Bong (poor)	Houay Su (medium)	Houay Sanguan (medium)	Houay Lao (good)
Mean	0.473 ^a	0.64 ^b	0.554 ^{ab}	0.594 ^{ab}
R ²	0.533+	0.529*	0.614*	0.703
Intercept	0.473	0.64	0.554	0.594
Labor				
Family size	0.086	−0.055	−0.114	0.376+
Number of females	−0.026	0.021	0.051	−0.279+
Number of productive age	0.038	0.042	0.036	−0.039
Subsistence activity				
Upland fields	−0.079	−0.019	0.079+	0.045
Paddy fields	0.003	0.006	−0.067	-
Subsistence and economic activity				
Number of cattle and water buffalo	−0.033	0.001	0.011	−0.075
On-farm economic activity				
Maize	0.117*	0.034+	-	−0.026
Other cash crops	−0.022	−0.011	0.046	0.238
Economic activity				
Income from livestock	−0.03	0.034	0.078+	−0.056
Non-farm economic activity				
Income from <i>het daeng</i>	−0.073**	−0.046**	−0.038	0.241
Income from other NTFPs	0.108*	0.065**	0.110*	−0.29
Mechanization of household activity				
Physical assets	0.042	−0.009	0.019	0.167*
Investment				
Access to credit	N/A	N/A	0.024	0.05

Note: Significance in R² indicated by the results of the F test and different superscript letters indicate significant differences by Tukey's HSD test (95 % confidence level). +, *, and ** indicate significant differences at $p < 0.15$, $p < 0.05$, and $p < 0.01$, respectively.

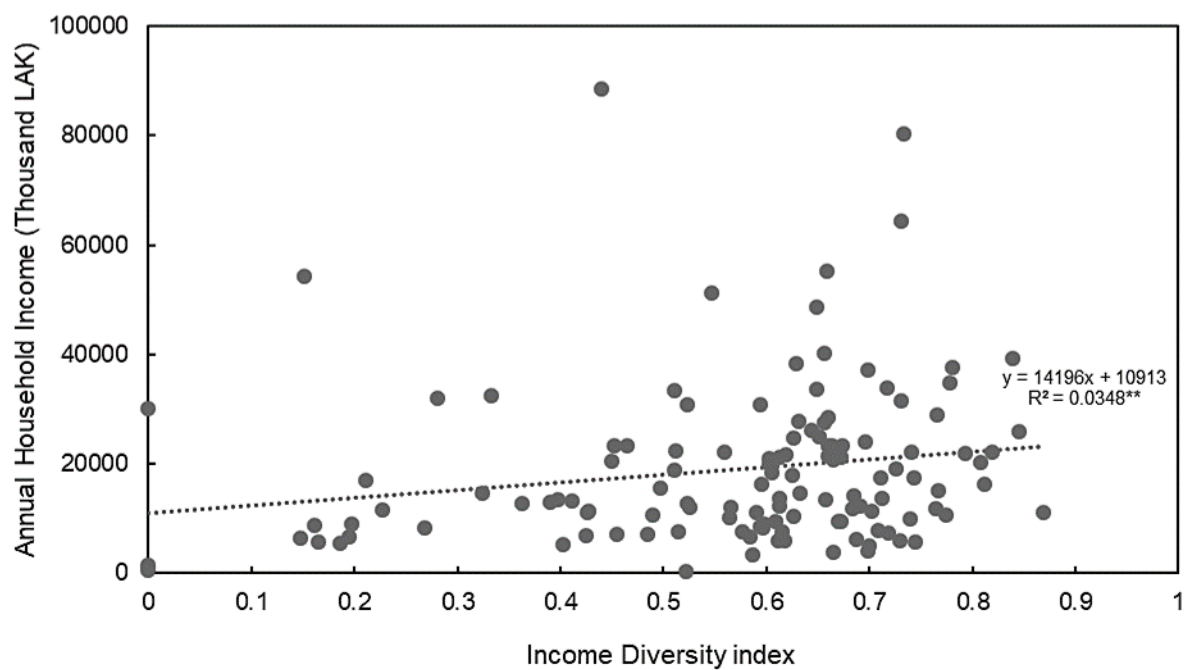


Figure 5-1: Relationship between income diversity and total income

Note: ** indicate significant differences at $p < 0.01$

Chapter 6: General Discussion and Conclusion

6-1. Progressive income diversification from agricultural and forest ecosystems

Many studies have reported that progressive livelihood diversification is related to the diversification of livelihood activities from agricultural to industrial or service sectors (Bryceson, 2008; Fox *et al.*, 2009; Hayami, 2001; Rigg, 1998). In this study, however, recent livelihood changes were related to changes in the agricultural system, especially shifting cultivation, and changed mainly from subsistence activities to commercial activities inside the village areas such as the cultivating new crops, collecting newly commercialized NTFPs, and raising livestock, rather than to activities in other sectors outside the villages. The author aimed to understand the livelihood dynamics by tracing historical transitions and observing the present combinations of both economic and subsistence livelihood activities. These have not been commonly included in the analytic frameworks of previous studies on livelihood diversification.

As mentioned above, local people introduced new activities after the establishment of the villages, especially after the development and paving of roads, and their livelihoods rapidly changed (Fig. 4-2). While the changes were different among the four villages, local people tried to adapt to the impacts of globalization in this study area. Globalization in the area brought various opportunities, but increased the dependency and sensitivity of rural livelihoods to the highly variable global market. In this process, local people chose a combination of various activities (Fig. 4-2, Table 5-2 and Table 5-3). Figure 5-1 shows the relationship between income diversity and total income in all households in all villages. Although it does

not show the changes as a time series nor does it directly show the direction of livelihood diversification in the future, it does demonstrate a significant relationship ($p < 0.01$). Although the R^2 was not high, overall, the households in all the villages showed a positive relationship and this suggests that progressive income diversification was observed in this area. However, the shallowness of the slope of the regression and low R^2 value also indicates that various kinds of livelihood activities were involved in the relationship and the progressive relationship was not clear. The current study also showed that activities in agricultural fields and the forest were strongly related to the overall livelihood strategy of local people (Table 5-2 and Table 5-3) and they used resources from these ecosystems to adapt to rapid globalization.

Local people in the study area used to live in isolated villages and have only recently experienced the dynamic global market. They needed to adapt the new environment promptly and to use, and sometimes commercialize, resources from agricultural and forest ecosystems. This prompt adaptation was achieved through the rich natural resources in their environment. Previous studies pointed out that the redundancy of natural resources and local knowledge for its use are important for the sustainability of local environment and their livelihoods (e.g. Momose, 2005). Further research on the richness of natural resources, local knowledge, and prospective management systems, will be indispensable for sustainable development in this area.

5-2. Perspective for the future studies

This study described livelihood dynamics in the mountainous villages of northern Laos, focusing on rapid globalization and road development. It found that agricultural and forest ecosystems were important for both household income and income diversity and for achieving prompt adaptation. While this study pointed out that the analysis of subsistence activities was necessary to better understand rural livelihoods in Laos, the author could not include several small-scale activities such as subsistence hunting and fishing, collecting wild vegetables, making handicrafts, and apiculture because of the difficulty of quantifying these activities. To understand the nature of all livelihood activities, the quantification and evaluation of these missing elements will be future challenges. This study aimed to evaluate the balance and combination of subsistence and economic activities, but the applicability of the framework used in this study to other regions, especially to other isolated villages that are still found in Southeast Asia, and which are going to be affected by globalization, needs to be validated. In addition, because NTFPs contributed highly to the index of livelihood diversity, it is also necessary to adjust the category of NTFPs for other regions to avoid a biased estimation of livelihood diversity. The current study suggested that the local people in mountain villages of northern Laos use the potential of agricultural and forest ecosystems to progress their development. A detailed evaluation of these ecosystems and various local livelihood activities is necessary for further study.

REFERENCES

- Abdulai, A., & CroleRees, A. (2001). Determinants of income diversification amongst rural households in Southern Mali. *Food Policy*, 26(4), 437–452. [https://doi.org/10.1016/S0306-9192\(01\)00013-6](https://doi.org/10.1016/S0306-9192(01)00013-6)
- ADB and ADB Institute (2015) Regional transport infrastructure: Mapping projects to bridge South Asia and Southeast Asia. <https://www.adb.org/publications/regional-transport-infrastructure-mapping-projects>.
- Alobo Loison, S. (2015). Rural Livelihood Diversification in Sub-Saharan Africa: A Literature Review. *Journal of Development Studies*, 51(9), 1125–1138. <https://doi.org/10.1080/00220388.2015.1046445>
- Arild Angelsen, Helle Overgaard Larsen, Jens Friis Lunc, Carsten Smith-Hall, and S. W. (2011). Measuring livelihoods and environmental dependence: Method for research and field work. Earthscan: London
- Arnold, J. E. M., & Pérez, M. R. (2001). Can non-timber forest products match tropical forest conservation and development objectives? *Ecological Economics*, 39(3), 437–447. [https://doi.org/10.1016/S0921-8009\(01\)00236-1](https://doi.org/10.1016/S0921-8009(01)00236-1)
- Asai, H., Soisouvanh, P., Sengxua, P., Kimura, K., Vongphuthine, B., & Ando, M. (2017). Labour-Saving Practices for the External Expansion of Swidden Agriculture for Upland Rice Production in a Mountainous Area of Laos. *Tropical Agriculture and Development*, 61(4), 166–178. <https://doi.org/10.11248/jsta.61.166>
- Aung, P. S., Adam, Y. O., Pretzsch, J., & Peters, R. (2015). Distribution of forest income among rural households: A case study from Natma Taung national park, Myanmar. *Forests Trees and Livelihoods*, 24(3), 190–201. <https://doi.org/10.1080/14728028.2014.976597>
- Barret, C. B., Reardon, T., & Webb, P. (2001). Nonfarm income diversification and household livelihood strategies in rural Africa: concepts, dynamics, and policy implication. *Food Policy*, 26(12), 315–331. [https://doi.org/10.1074/JBC.274.42.30033.\(51\)](https://doi.org/10.1074/JBC.274.42.30033.(51))
- Barrett, C. B., & Reardon, T. A. (2005). Asset, Activity, and Income Diversification Among African Agriculturalists: Some Practical Issues. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.257344>
- Barrios, E. (2008). Infrastructure and rural development: Household perceptions on rural development. *Progress in Planning*, 70(1), 1–44. <https://doi.org/10.1016/J.PROGRESS.2008.04.001>
- Bouahom, B., Douangsavanh, L., & Rigg, J. (2004). Building sustainable livelihoods in Laos: Untangling farm from non-farm, progress from distress. *Geoforum*, 35(5), 607–619. <https://doi.org/10.1016/j.geoforum.2004.02.002>

- Bryceson, D. F. (1996). Deagrarianization and Rural Employment in sub-Saharan Africa: A Sectoral Perspective. *World Development*, 24(1), 97–111.
- Bryceson, D. F., Bradbury, A., & Bradbury, T. (2008). Roads to Poverty Reduction? Exploring Rural Roads' Impact on Mobility in Africa and Asia. *Development Policy Review*, 26(4), 459–482. <https://doi.org/10.1111/j.1467-7679.2008.00418.x>
- Castella, J.-C., Lestrelin, G., Hett, C., Bourgoin, J., Fitriana, Y. R., Heinimann, A., & Pfund, J.-L. (2013). Effects of Landscape Segregation on Livelihood Vulnerability: Moving From Extensive Shifting Cultivation to Rotational Agriculture and Natural Forests in Northern Laos. *Human Ecology*, 41(1), 63–76. <https://doi.org/10.1007/s10745-012-9538-8>
- Castella, J.-C., Manh, P. H., Kam, S. P., Villano, L., & Tronche, N. R. (2005). Analysis of village accessibility and its impact on land use dynamics in a mountainous province of northern Vietnam. *Applied Geography*, 25(4), 308–326. <https://doi.org/10.1016/J.APGEOG.2005.07.003>
- Castella, J. C. and S. Phaipasith 2021. Rural roads are paving the way for land-use intensification in the uplands of Laos. *Land*. 10: 1-19.
- Chambers R and Conway G (1991) Sustainable rural livelihoods: Practical concepts for the 21st Century. IDS Discussion Paper 296. Institute of Development Studies Sussex, UK.
- Cole, R., Brockhaus, M., Wong, G. Y., Kallio, M. H., & Moeliono, M. (2019). Local Agency in Development, Market, and Forest Conservation Interventions in Lao PDR's Northern Uplands. *Southeast*, 8(2), 173–202. <https://doi.org/10.20495/seas.8.2>
- Cramb, R. A., Colfer, C. J. P., Dressler, W., Laungaramsri, P., Le, Q. T., Mulyoutami, E., ... Wadley, R. L. (2009). Swidden Transformations and Rural Livelihoods in Southeast Asia. *Human Ecology*, 37(3), 323–346. <https://doi.org/10.1007/s10745-009-9241-6>
- Demissie, A., & Legesse, B. (2013). Determinants of income diversification among rural households : The case of smallholder farmers in Fedis district , Eastern hararghe zone , Ethiopia. *Journal of Development and Agricultural Economics*, 5(March), 120–128. <https://doi.org/10.5897/JDAE12.104>
- DFID (1997) Eliminating world poverty: A challenge for the 21st century. White paper on international development, London: DFID.
- Ducourtieux, O. & Castella, J.-C. (2006). Land reforms and impact on land use in the uplands of Vietnam and Laos: Environmental protection or poverty alleviation. *Colloque international "Les frontières de la question foncière – At the frontier of land issues"*. Montpellier.
- Dzanku, F. M. (2015). Transient rural livelihoods and poverty in Ghana. *Journal of Rural Studies*, 40, 102–110. <https://doi.org/10.1016/j.jrurstud.2015.06.009>

- Ellis, F. (1999). Rural Livelihood Diversity in Developing Countries : EvidenceE and Policy Implications, 40(40), 1–10. <https://doi.org/xx>
- Ellis, F. (2008). The Determinants of Rural Livelihood Diversification in Developing Countries. *Journal of Agricultural Economics*, 51(2), 289–302. <https://doi.org/10.1111/j.1477-9552.2000.tb01229.x>
- Fox, J., Fujita, Y., Ngidang, D., Peluso, N., Potter, L., Sakuntaladewi, N., ... Thomas, D. (2009). Policies, Political-Economy, and Swidden in Southeast Asia. *Human Ecology: An Interdisciplinary Journal*, 37(3), 305–322. <https://doi.org/10.1007/s10745-009-9240-7>
- Fox, J. M. (2000). How blaming “slash and burn” farmers is deforesting mainland Southeast Asia. *Asia Pacific Issues*, (47), 3–8.
- Fox, J., J. C. Castella, A. D. Ziegler, and S. B. Westley 2014. Expansion of rubber mono-cropping and its implications for the resilience of ecosystems in the face of climate change in Montane Mainland Southeast Asia. *Glo. Env. Research*. 18: 145–150.
- Gautam, Y., & Andersen, P. (2016). Rural livelihood diversi fi cation and household well-being : Insights from Humla , Nepal. *Journal of Rural Studies*, 44, 239–249. <https://doi.org/10.1016/j.jrurstud.2016.02.001>
- Gibbs, J. P., & Poston, D. L. (1975). The Division of Labor: Conceptualization and Related Measures. *Social Forces*, 53(3), 468. <https://doi.org/10.2307/2576589>
- Gibson, J. and S. Olivia 2010. The effect of infrastructure access and quality on non-farm enterprises in rural Indonesia. *World. Dev.* 38: 717–726.
- Goto, K. (2011). Implications for Laos’ development of its increasing regional integration and Chinese influence. *Asian-Pacific Economic Literature*, 25(2), 68–88. <https://doi.org/10.1111/j.1467-8411.2011.01306.x>
- Green, W. N., Baird, I. G., Green, W. N., & Baird, I. G. (2016). Capitalizing on Compensation : Hydropower Resettlement and the Commodification and Decommodification of Nature – Society Relations in Capitalizing on Compensation : Hydropower Resettlement and the Commodification and Decommodification of Nature – Society , 4452. <https://doi.org/10.1080/24694452.2016.1146570>
- Hasan, M. K., Tanaka, T. S. T., Alam, M. M., Ali, M. R., & Saha, C. K. (2020). Impact of modern rice harvesting practices over traditional ones. *Reviews in Agricultural Science*, 8(2015), 89–108. https://doi.org/10.7831/ras.8.0_89
- Haughton, D. M. A., & Mukerjee, S. (1995). The economic measurement and determinants of diversity. *Social Indicators Research*, 36(3), 201–225. <https://doi.org/10.1007/BF01078814>
- Hayami, Y. 2001. Ecology, history, and development: A perspective from rural Southeast Asia. *The World Bank Research Observer*. 16: 169-198.

- Heinimann, A., Hett, C., Hurni, K., Messerli, P., Epprecht, M., Jørgensen, L., & Breu, T. (2013). Socio-Economic Perspectives on Shifting Cultivation Landscapes in Northern Laos. *Human Ecology*, 41(1), 51–62. <https://doi.org/10.1007/s10745-013-9564-1>
- Hussein, K., & Nelson, J. (1998). Sustainable Livelihood and Livelihood Diversification.
- Ingxay, P., Yokoyama, S., & Hirota, I. (2015). Livelihood Factors and Household Strategies for an Unexpected Climate Event in Upland Northern Laos. *Journal of Mountain Science*, 12(1), 483–500.
- Jacoby, H. G. (2000). Access to Markets and the Benefits of Rural Roads. *The Economic Journal*, 110, 713–737.
- Jiao, X., Pouliot, M., & Walelign, S. Z. (2017). Livelihood Strategies and Dynamics in Rural Cambodia. *World Development*, 97, 266–278. <https://doi.org/10.1016/j.worlddev.2017.04.019>
- Johnson, A., Vongkhamheng, C., & Saithongdam, T. (2009). The diversity, status and conservation of small carnivores in a montane tropical forest in northern Laos. *Oryx*, 43(4), 626–633. <https://doi.org/10.1017/S0030605309990238>
- Kassie, G. W., Kim, S., & Fellizar, F. P. (2017). Determinant factors of livelihood diversification: Evidence from Ethiopia. *Cogent Social Sciences*, 3(1), 1–16. <https://doi.org/10.1080/23311886.2017.1369490>
- Kosaka, Y., S. Takeda, S. Prixar, S. Sithirajvongsa, and K. Xaydala 2006. Species composition, distribution and management of trees in rice paddy fields in Central Lao, PDR. *Agrof. System*. 67: 1-17.
- Lao Statistic Berau 2016. Results of population and housing census 2015. Vientiane.
- Lestrelin, G., Castella, J., Bourgoïn, J., & Lestrelin, G. (n.d.). Territorialising sustainable development : The politics of land-use planning in the Lao PDR, 1–26.
- Liao, C., Barrett, C., & Kassam, K. A. (2015). Does Diversification Improve Livelihoods? Pastoral Households in Xinjiang, China. *Development and Change*, 46(6), 1302–1330. <https://doi.org/10.1111/dech.12201>
- Linguist, B., Trösch, K., Guenat, D., Pandey, S., & Phouynyavong, K. (2007). Montane paddy rice: Development and effects on food security and livelihood activities of highland Lao farmers. *Mountain Research and Development*, 27(1), 40–47. [https://doi.org/10.1659/0276-4741\(2007\)27\[40:MPRDAE\]2.0.CO;2](https://doi.org/10.1659/0276-4741(2007)27[40:MPRDAE]2.0.CO;2)
- Marschke MJ and Berkes F (2006) Exploring strategies that build livelihood resilience a case from Cambodia. *Ecology and Society*, 11: 42.
- Martin, S. M., & Lorenzen, K. (2016). Livelihood Diversification in Rural Laos. *World Development*, 83, 231–243. <https://doi.org/10.1016/j.worlddev.2016.01.018>

- McKinsey Global Institute. (2014). *Southeast Asia at the crossroads: Three paths to prosperity*. New York: McKinsey & Company.
- McElwee, P. D. (2008). Forest environmental income in Vietnam: Household socioeconomic factors influencing forest use. *Environmental Conservation*, 35(2), 147–159. <https://doi.org/10.1017/S0376892908004736>
- Mertz, O., Padoch, C., Fox, J., Cramb, R. A., Leisz, S. J., Lam, N. T., & Vien, T. D. (2009). Swidden Change in Southeast Asia: Understanding Causes and Consequences. *Human Ecology*, 37(3), 259–264. <https://doi.org/10.1007/s10745-009-9245-2>
- Morse, S., McNamara, N., & Acholo, M. (2013). *Sustainable Livelihood Approach: A Critical Analysis of Theory and Practice*. Geographical Paper 189, University of Reading, November.
- Nakatsuji, S. (2005). Diversification of livelihood activities in the hills of Northern Laos: A case study of an administrative village along main road. *地理学評論*. <https://doi.org/10.4157/grj.78.688>
- Nguyen, T. T., Do, T. L., Bühler, D., Hartje, R., & Grote, U. (2015). Rural livelihoods and environmental resource dependence in Cambodia. *Ecological Economics*, 120, 282–295. <https://doi.org/10.1016/j.ecolecon.2015.11.001>
- Nielsen, Ø. J., Rayamajhi, S., Uberhuaga, P., Meilby, H., & Smith-Hall, C. (2013). Quantifying rural livelihood strategies in developing countries using an activity choice approach. *Agricultural Economics (United Kingdom)*, 44(1), 57–71. <https://doi.org/10.1111/j.1574-0862.2012.00632.x>
- Oliva, J.C. M. (2017). On the road: connectivity infrastructures in Southeast Asia. *Journal of Infrastructure, Policy and Development*.
- Padoch, C., Coffey, K., Mertz, O., Leisz, S. J., Fox, J., & Wadley, R. L. (2007). The demise of Swidden in Southeast Asia? Local realities and regional ambiguities. *Geografisk Tidsskrift*, 107(1), 29–41. <https://doi.org/10.1080/00167223.2007.10801373>
- Paumgarten F (2005) The role of non-timber forest products as safety-nets: A review of evidence with a focus on South Africa. *GeoJournal*, 64: 189–197.
- Perz, S. G. (2005). The Effects of Household Asset Endowments on Agricultural Diversity among Frontier Colonists in the Amazon. *Agroforestry Systems*, 63(3), 263–279. <https://doi.org/10.1007/s10457-005-4164-8>
- Phounvisouk, L., Zuo, T., & Chee Kiat, N. (2013). Non-Timber Forest Products Marketing: Trading Network of trader and Market Chain in Luang Namtha Province, Lao PDR. *IOSR Journal Of Humanities And Social Science (IOSR-JHSS)* (Vol. 18). Retrieved from www.iosrjournals.org
- Phouyyavong, K., Tomita, S., & Yokoyama, S. (2020). Smallholder's labor allocation for livelihood diversification: A case study in an upland village in northern Laos. *Tropics*, 29(1), 9–24. <https://doi.org/10.3759/tropics.ms19-08>

- Pritchard, B., Rammohan, A., & Vicol, M. (2019). The importance of non-farm livelihoods for household food security and dietary diversity in rural Myanmar. *Journal of Rural Studies*, 67(March), 89–100. <https://doi.org/10.1016/j.jrurstud.2019.02.017>
- Reardon, T. (1997). Using Evidence of Household Income Diversification to Inform Study of the Rural Nonfarm Labor Market in Africa. *World Development*, 25(5), 735–747. [https://doi.org/10.1016/S0305-750X\(96\)00137-4](https://doi.org/10.1016/S0305-750X(96)00137-4)
- Reardon, T., Taylor, J. E., Stamoulis, K., & Lanjouw, P. (2000). Effects of Non-Farm Employment. *Journal of Agricultural Economics*, 51(2), 266–288.
- Rerkasem, B. (2005). Transforming subsistence cropping in Asia. *Plant Production Science*, 8(3), 275–287. <https://doi.org/10.1626/pps.8.275>
- Rerkasem, K., & Rerkasem, B. (1995). Montane Mainland South-East Asia: agroecosystems in transition The mountainous regions of mainland South-East Asia have been a classic. *Global Environmental Change* (Vol. 5).
- Rigg, J. (2005). Poverty and livelihoods after full-time farming: Southe-east Asian view.
- Rigg, J. (2006). Forests, Marketization, Livelihoods and the Poor in the Lao PDR. *Land Degradation & Development*, 133, 123–133. <https://doi.org/10.1002/ldr.719>
- Rubiyanto and Hirota (2021). Livelihood diversification in MMSEA: Dynamics, Measurements and Case Studies in Montane Mainland Southeast Asia. *Reviews in Agricultural Science*, 9:128-142.
- Schmidt-Vogt, D., Leisz, S., Mertz, O., Heinimann, A., Thiha, T., & Messerli, P. (2009). An Assessment of Trends in the Extent of Swidden in Southeast Asia. *Hum Ecol*, 37.
- Scoones, I. (1998). Sustainable Rural Livelihoods a Framework for Analysis Ids Working Paper 72.
- Shackleton, S., Shackleton, C., & Shanley, P. (2011). Non-Timber Forest Products in the Global Context (Vol. 39). *Tropical Forestry*.
- Shirai, Y., Fox, J., Leisz, S. J., Fukui, H., & Rambo, A. T. (2017). The influence of local non-farm employment on rural household structure in Northeast Thailand. *Journal of Rural Studies*, 54, 52–59. <https://doi.org/10.1016/j.jrurstud.2017.06.003>
- Shirai Y and Rambo AT (2017) Household structure and sources of income in a rice-growing village in northeast Thailand. *Southeast Asian Studies*, 6: 275–292.
- Shiyani, R. L., & Pandya, H. R. (1998). Diversification of agriculture in Gujarat: A spatio-temporal analysis. *Indian Journal of Agricultural Economics*, 53(4), 627–639.

- Sidle, R. C., & Ziegler, A. D. (2012). The dilemma of mountain roads. *Nature Geoscience*, 5(7), 437–438. <https://doi.org/10.1038/ngeo1512>
- SIEGEL, P. B., JOHNSON, T. G., & ALWANG, J. (1995). Regional Economic Diversity and Diversification. *Growth and Change*, 26(2), 261–284. <https://doi.org/10.1111/j.1468-2257.1995.tb00171.x>
- Start, D., & Johnson, C. (2004). Livelihood Options ? The Political Economy of Access , Opportunity and Diversification. Working Paper 233, (April), 56. <https://doi.org/10.1136/bjo.2008.145912>
- Thanichanon, P., Schmidt-Vogt, D., Messerli, P., Heinimann, A., & Epprecht, M. (2013). Secondary Forests and Local Livelihoods along a Gradient of Accessibility: A Case Study in Northern Laos. *Society & Natural Resources*, 26(11), 1283–1299. <https://doi.org/10.1080/08941920.2013.788429>
- The World Bank (2007) www.worldbank.org; accessed February 2021.
- Thongmanivong, S., & Fujita, Y. (2006). Recent Land Use and Livelihood Transitions in Northern Laos. *Mountain Research and Development*, 26(3), 237–244. [https://doi.org/10.1659/0276-4741\(2006\)26\[237:rlualt\]2.0.co;2](https://doi.org/10.1659/0276-4741(2006)26[237:rlualt]2.0.co;2)
- Thongmanivong, S., Fujita, Y., Phanvilay, K., & Vongvisouk, T. (2009). Agrarian Land Use Transformation in Northern Laos: from swidden to rubber. *Japanese Journal of Southeast Asian Studies*, 47(3), 330–347. https://doi.org/10.20495/tak.47.3_330
- Trankell, I. (1993). On the Road in Laos. An Anthropological Study of Road Construction and Rural Communities. *The Journal of Asian Studies*, 53(4), 1334–1337. Retrieved from <https://www.jstor.org/stable/25133247>
- Tsui, S., Wong, E., Chi, L. K., & Tiejun, W. (2017). One belt, one road: China's Strategy for a New Global financial order. *Monthly Review*, 68(8), 36–45. https://doi.org/10.14452/MR-068-08-2017-01_4
- Vedeld, P. (2004). Counting on the environment - forest income and the rural poor. The World Bank, Paper No.(june), 161–177. https://doi.org/10.4324/9780203309834_chapter_8
- Wildlife Conservation Society Lao (WCS). 2015. Report on the assessment of drivers of deforestation and forest degradation in Houaphan province, [Online] <https://www.giz.de/en/downloads/Houaphan-Divers-of-Deforestation-Report.pdf> (browsed on August 2018).
- Yokoyama, S. (2004). Forest, Ethnicity and Settlement in the Mountainous Area of Northern Laos. *Japanese Journal of Southeast Asian Studies*, 42(2), 132–156. https://doi.org/10.20495/tak.42.2_132
- Yuko, S., & Rambo, A. T. (2017). Household structure and sources of income in a rice-growing village in Northeast Thailand. *Southeast Asian Studies*, 6(2), 275–292. https://doi.org/10.20495/seas.6.2_275
- Ziegler, A. D., Bruun, T. B., Guardiola-Claramonte, M., Giambelluca, T. W., Lawrence, D., & Thanh Lam, N. (2009). Environmental Consequences of the

Demise in Swidden Cultivation in Montane Mainland Southeast Asia: Hydrology and Geomorphology. *Human Ecology*, 37(3), 361–373. <https://doi.org/10.1007/s10745-009-9258-x>

Zimmerer, K. S. (2007). Agriculture, livelihoods, and globalization: The analysis of new trajectories (and avoidance of just-so stories) of human-environment change and conservation. *Agriculture and Human Values*, 24(1), 9–16. <https://doi.org/10.1007/s10460-006-9028-y>

ACKNOWLEDGMENT

I admitted to doctoral course at United Graduate School of Agricultural Science, Gifu University in 2018 and received the opportunity to study through English Program and Basin Water Environmental Leader (BWEL). My fieldwork was fully supported by my supervisor from his own budget. This support would not have been possible without the efforts of all people who always encourage and help me.

First, I wish to greatly thank my supervisor (Dr. Isao Hirota) for accepting me to be his student and a part of the laboratory of field ecology at Faculty of Applied Biological Science. His encouragement was amazing and was able to change my life much better in pursuit of higher academic learning. He always facilitated what I needed even what I didn't ask for. He also tirelessly explained about his research in Laos and also accompanied me on a field survey in Houaphan Province, Laos. His support and advice in writing was incredible and unforgettable.

I wish to extend my sincerest gratitude to Professor Nobumitsu Kawakubo for his support and encouragement in my research progress and presentation skills. He has been acting as the official supervisor to my Ph.D. and his power is able to give me the opportunity to continue learning and growing in academic life. He is also the one who has opened my mind, saw a much greater potential in me. His smile and friendliness also make me more comfortable and eager to learn and make a friends in laboratory.

I am very thankful to Professor Fusheng Li and all committee of BWEL program for the support and willingness to accept me as a master student in 2016

and then be able to continue my doctoral course at Gifu University under this program. The program I joined in was great, I met a lot of friends, exchange knowledge across department, had experience to visited big company and incredible place, and of course got knowledge from intensive class and seminars.

I wish to thank Professor Masateru Senge, I knew him already in 2014 before I joined the laboratory of Field Ecology in 2016. He was Ph.D. supervisor of my senior (Dr. Zuhud Rozaki) which introduce me to my supervisor Dr. Isao Hirota. Without his recommendation, I would have dropped my opportunity study in Gifu University. I will always remember his goodwill, for which I am deeply appreciative.

I wish to thank Dr. Zuhud Rozaki and his wife Sofa Nur Azizah in supporting my life and my study in the first year I came to Japan. Their advice, warning, reminder, and all kindness will never forget. Dr. Zuhud Rozaki is always giving me a big opportunity. Because of his recommendation, I got the honor to have a public lecture at Muhammadiyah Yogyakarta University in 2020. I also wish to thank Dr. Ali Rahmat for supporting me in submitting the manuscript to the Journal and checking carefully the format of my manuscript.

In my fieldwork in Laos, I wish to thank Dr. Singkone, who encouraged me in providing official document to conduct research in Laos. I wish to thank Mr. Salim and the staff of Indonesian Embassy of Laos to fully support in accommodation during learn Lao language in Vientiane. I wish to thank Mr. Hilfus and his family for his hospitality to providing a room and space during my time to study Lao language. I also wish to thank Ajaan Toum to teach me Lao language

very well and introduced me to her friend (Mr. Kamsing) a lecturer at Faculty of Forestry National University of Laos. Because of her, I talked a lot with Mr. Kamsing and get recommendation to conduct study case in Houaphan Province. I wish to thank Mr. Soulinxay (Head of Departement of Agriculture and Forestry office of Sone district), Mr. Kampien (Mayor of Sone district), Mr. Tonh (Staff of public and transportation of Sone district), all villagers for their cooperation of this study. In addition, I am very grateful to have great experience in rural villages and following cultural and their activities.

In my campus life, I wish to thank Mr. Kazu Tsukahara and great fellow lab mates for all kindness and friendship and for making academic life in a foreign county easier.

Finally, I wish to acknowledge my mother and all family members for being the source of my inspiration. I'm very grateful to have my wife during my Ph.D. who never get tired accompanying me in all situations and for constantly motivating me every day to complete my study. Without her support and my cute and beautiful daughter besides me, I would have dropped to complete this research. In particular, I wish to thank all my friends of Indonesian Student Association in Gifu who always support, exchange ideas, share experiences, warmth and friendliness during my study.

Those, both named and unnamed in this acknowledgement, are very kind for offering their time and support.

Thank you very much