Changes in Upland and Lowland Peoples' Livelihood in Northern Laos

（ラオス北部における山地および低地住民の生業変化）

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SUMMARY

The purpose of the study is to investigate and understand how the livelihood of upland and lowland people in northern Laos changes as the result of influence from economic growth and the climate change. Two different livelihood systems in northern Laos were investigated. Research site A was selected upland people in Kachet village, Nam Bak District, Luang Prabang Province as representative of highland swidden cultivation where the livelihood of local people were affected by climate change; while research site B, including Yo, Deua, and Chiangpee villages in the Boun Neua District, Phongsaly Province was selected as representative of agrarian livelihood in lowland areas, where livelihood activities were changed in response to the influence of economic growth in China.

A framework for sustainable livelihood is applied to estimate rural livelihood assets associated with differences in climate conditions, such as normal climate and climate event years, and to compare household strategies in response to and to cope with climate and economic changes. Household data were collected via a household survey as well as semi-structured and structured interviews in addition to participatory group discussions. The household data are quantitative and qualitative. A field observation survey was made in order to understand the situation in each village. Household interviews focused on farmers' basic socioeconomic characteristics. Interviews were conducted with the head of each household. Sixty-three households were interviewed at research site A and 50 households at research site B. Respondents were randomly selected for interview.

People in northern Laos are experiencing rapid changes as a result of climate change and economic growth in neighboring countries. People in the research villages have lived with significant climate change in the past and expect frequent and increased

changes in the future. Coping strategies were shaped by the level of impact of the climate event and households' needs toward achieving their livelihood objectives. People had good access to natural capital, but less access to financial capital. People had transferred the value of one asset to another and the value of some assets are decrease while others are increase. People had limited to access to livelihood assets due to a lack of capital for sustainable livelihoods, which is the case for most farmers in poor rural areas of northern Laos. However, the study concludes that with the onset of the wet season the livelihood strategies of local people were unable to be shaped at the research site. In fact the proportion of households undertaking each different livelihood strategy was different. At the same time changes in China influenced by global economic development were shaping people's livelihood strategies in lowland areas of the research sites. Their livelihoods had changed from subsistent agricultural production to commercial production in response to market demand. Chinese direct investment was providing positive livelihood options, but the Lao government needed to channel sufficient information and feedback about market opportunities to producers and investment companies. On the other hand, Chinese influence had negative impacts due to weak policy implementation and inadequate investment law. Beside influence from the Chinese, change in agricultural production in lowland areas is dependent on suitable geography, culture, and social capital of local people.

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ACMECS	Ayerwaddi-Chao Phraya-Mekong Economic Cooperation Strategy
AEZ	Agro-ecological Zone
ADB	Asia Development Bank
AFTA	ASEAN free trade area
ALOS	Advanced Land Observing Satellite
ASEAN	Association of Southeast Asian Nations
CAFTA	China-ASEAN Free Trade Agreement
DAFO	District agriculture and forestry office
DFID	Department of International Development
FAO	Food and Agriculture Organization of the United Nations
FDI	Foreign direct investment
GMS	Greater Mekong Sub-region
JICA	Japan International Cooperation Agency
IDS	Institute of Development Studies
LDCs	Least developed countries
LFAP	Land and Forest Allocation Program
MAF	Ministry of Agriculture and Forestry
NAFRI	National Agriculture and Forestry Research Institute
NAPA	National Action Plan for Climate Change Adaptation
NEM	New Economic Mechanism
NSEC	North-South Economic Corridor
PRA	Participatory rural appraisal
UNDP	United Nations Development Programme

NPEP	National Poverty Eradication Programme
NTFPs	Non-timer forest products
TIG	Trade in goods
SDC	Swiss Agency for Development and Cooperation
SIDA	Swedish International Development Agency
SLF	Sustainable livelihood framework

Chapter I Introduction

1.1 Livelihoods and sustainable livelihoods

1.1.1 The concepts of livelihoods and sustainability

The concept of livelihood has been debated and discussed for the last few decades. In the 1970s and 1980s, after the concepts of dependencies and neo-Marxism, many scholars increasingly adopted an actor-oriented perspective in rural development research and studies (de Haan and Zoomers 2005). An actor-oriented perspective is focused on the distribution of assets and power. The approach is a primary concern and point of economic discussions. The concept of actor-oriented was recognized principally in various networks, namely community, family, and rural livelihoods (Johnston 1993). The informal sector and survival strategies of the poor were explored in economic and geographic studies during the 1970s and 1980s by Latin American social scientists (Schmink 1984).

In the 1980s and 1990s environment links and economic development emphasized poverty alleviation and rural development to better adapt to long-term environmental change such as shocks and stresses (Scoones 2009). In 1987, the Brundtland Commission on Environment and Development introduced the term "sustainability." It became an import policy within the UN Conference on Environment and Development in 1992 (Krantz 2001). The sustainable development agenda of the 21st century concerns livelihoods of communities, and global environmental issues such as climate change, biodiversity preservation, and desertification (Scoones 2009). Also in 1992, the UK Institute of Development Studies (IDS) presented the idea of "Sustainable Rural Livelihoods" through a working paper by R. Chambers and G. Conway. Chambers and Conway (1992) stated the following:

> "A livelihood comprises the capabilities, assets (stores, resources,

claims and access) and activities required for a means of living. It will be sustainable when it can cope with and recover from stresses and shocks, maintain or enhance its capabilities and assets, and provide sustainable opportunities for the next generation; and which contributes net benefits to other livelihood at local and global levels and in the short and long term".

There are many approaches from scholars of natural and social sciences that have been applied including rapid and participatory appraisal, village studies, farming systems research, agro-ecosystem analyses, studies of socio-environmental change, household economic analyses, gender analyses, and political ecology assessments, in response to concerns of the agenda for the 21st century (Scoones 2009). In the 1980s, village studies, household analyses, and farming systems research were an important part of research for rural and urban development (Moock 1986). The concept of household strategies was highlighted by Guyer and Peters (1987) on intra-household dynamics; another is Humphries (1982) on the title "the class struggle and the persistence of the working-class family". These themes contributed to elaborating "new household economics", with a focus on household income strategies, household labor, and land allocation. They used a variety of concepts of survival strategies or livelihood strategies (de Haan and Zoomers 2005).

Concerns about poverty reduction and environmental policies changed in the 1990s and the 2000s. A white paper by the Unite Kingdom (UK) government selected sustainable rural livelihoods as a core priority for development sectors in 1997 (Scoones 2009). The UK government cooperated with the Institute of Development Studies (IDS) to undertake research in Bangladesh, Ethiopia and Mali with the purpose of developing an approach and checklists for a livelihood framework, which attempted to analyze livelihood change (Scoones 1998). The IDS's activities provided a platform for

discussions about environmental change and the organizational and institutional dimensions of rural development.

As mentioned above, the concept of livelihood is not new; it has been debated and discussed for the past several decades. More recently the concept of livelihood gained popularity among both scholars of poverty and development as well as policy makers (Kaag et al. 2003). Thus, livelihood studies aim to develop more effective policies to poverty reduction. The study on livelihood of local people aims to identify appropriate methods to support communities, focusing on daily livelihood activities and survival needs (Appendini 2001). Current livelihood studies concentrate "on the actions and strategies of people trying to make a living in adverse circumstances" (Kaag et al. 2003). Many people in the world, especially in Southeast Asia remain poor, as defined by global organizations, in terms of economic growth, use of modern technologies, and facility of communications. Clearly defining the term "livelihood" can help us understand problems related to poverty and economic development. This study hopes to support this endeavor and to provide some answers. However, an appropriate approach for examining current livelihood practices and proposing ideas for future research also needs to be defined.

1.1.2 Sustainable livelihood framework

As mentioned above, the Brundtland Commission on Environment and Development presented the concept of sustainable livelihoods. Later, the UN expanded the concept again in the Conference on Environment and Development, especially in the context of Agenda 21 (Krantz 2001). Many institutions and development agencies, including the UK Department for International Development (DFID), the United Nations Development Programme (UNDP), international non-governmental organizations (NGOs) such as Care and Oxfam adopted the sustainable livelihood

framework (SLF) for their programs, activities, and developmental approach (Brocklesby and Fisher 2003, Knutsson 2006). The SLF approach consists of the concept of well-being, security, and capability; it establishes an in-depth analysis of natural resources in terms of resilience, poverty, and vulnerability. SLF is used to understand the ability of rural people to respond and cope with impacts of shocks, stresses, and global trends; it is usually set in the form of a framework that combines the basic components of livelihood and demonstrates the function of each component (Allison and Ellis 2001).

The SLF is a tool that provides necessary information about households at the local level. The SLF was developed by DFID as a starting point for analyzing the context of vulnerability to direct and external environmental impacts; impacts that influence livelihood outcomes. The livelihood outcomes refer to household finances; the well-being of individual members of a household through access to public services such as health, education, water, electricity; improved food security in terms of consumption; and other factors. The level of receiving these outcomes depends on the livelihood strategies that they adopted and combinations of activities undertaken, including productive activities, investment, and others factors to achieve these outcomes (DFID 2001). The SLF presents the external and internal factors that influence household livelihoods, and includes the relationship between those factors (Figure 1).

1) The vulnerability context

This section describes external impacts that people may face. People's livelihoods and the wider availability of assets are fundamentally affected by critical trends (DFID 1999). Those that have longer-term impacts include technological or population trends. They also include shocks that cannot be predicted such as outbreaks

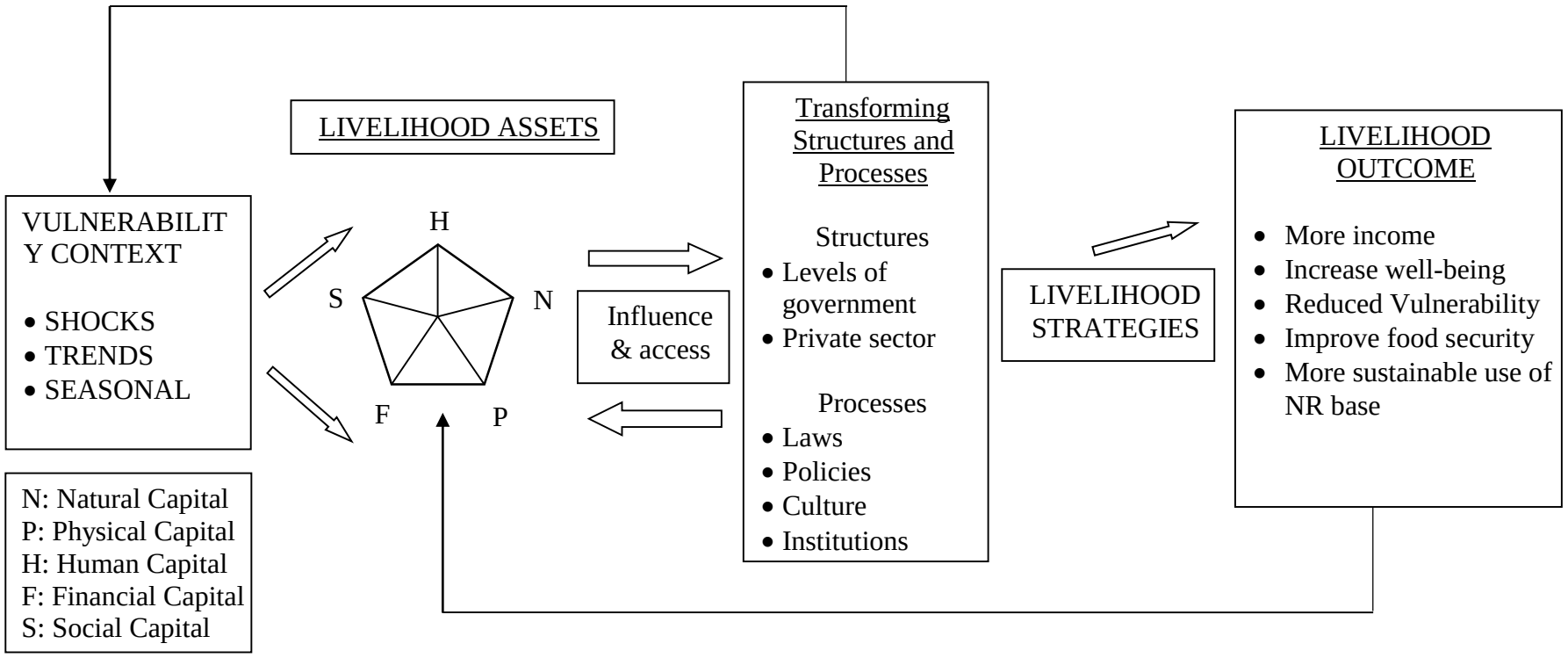


Figure 1 A Sustainable Livelihood Framework

Source: DFID 1999.

of diseases and natural disasters such as storms, among other such events; and, seasonality, which refers to the way prices, employment opportunities and production might shift with the seasons. All of those impacts will affect the assets that people have and thereby the sustainability of their livelihoods.

2) Livelihood assets

The sustainable livelihood framework is concerned with an understanding of people's strengths and how they attempt to convert their assets into positive livelihood outcomes (DFID 1999). The SLF is based on a belief that people need assets to achieve a positive livelihood outcome. People have different kinds of assets that they combine to help them achieve the livelihood that they seek.

Livelihood assets consist of five capital assets that can be adapted to meet the needs of understanding livelihood (DFID 1999, Ellis 2000). Human capital is one of these assets, and refers to the skills, knowledge, ability to labor and good health that enable people to achieve their desired livelihoods. Human capital is required as a supportive factor for the other four kinds of capital assets. Natural capital is understood in a very broad manner, since it covers both tangible factors, like natural resources including trees (containing non-timber forest products that poor people collect to supplement their staple food and provide cash income to households) and land that most poor people cultivate for agricultural production; and, more intangible products such as atmosphere and biodiversity. Natural resources are of special importance for those who derive all or part of their livelihood from natural resource-based activities, as is often the case for the poor; and, since clean air and water are needed for good health and other aspects of livelihood. Social capital is taken to mean the social resources upon which people draw in pursuit of livelihood objectives. These social resources refer to networks, membership of groups, relationships of trust, and access to wider institutions

of society. Physical capital describes the basic infrastructure and farm inputs that are needed to support the livelihood that people pursue. Infrastructure consists of changes to the physical environment that help people meet basic needs and to be more productive. Farm inputs are the tools and equipment that people use to create more products. Financial capital refers to the financial resources that people can use to achieve their livelihood objectives; important since it enables people to overcome different shocks and external trends.

3) Transforming structures and processes

This section represents a selection of state components that shape peoples' livelihoods, namely: government policies, laws, and culture. These components operate at both the household and international levels; from the most private to the most public, and at all levels (DFID 1999). Those processes and structures determine the access that people have to different kinds of assets.

4) Livelihood strategies

Livelihood strategies combine with a range of choices and activities that people accept and undertake in order to achieve livelihood goals. Scoones (1998) and Ellis (1998) suggested categories of livelihood improvement strategies, namely: intensification, commercialization, migration, and diversification. People can achieve livelihood objectives from agricultural production, including aquaculture, livestock, and forestry among others, by intensifying production using increased inputs per unit area, such as tools, labor, and others; or, by intensifying production by placing more land into production. Alternatively, people may choose to increase household income by participating in off-farm activities.

5) Livelihood outcomes

Livelihood outcomes are the results or outputs of livelihood strategies. They are the impacts derived from rural livelihood analysis. It is important to understand the strengths of each livelihood approach and the impacts of outcomes with links to other components of the livelihood framework (DFID 2001). If outcomes are positive they are likely to expand the asset base. On the other hand, if outcomes are negative, they might be damaging to capital assets. Analysis of livelihood outcomes is used to understand which goals are being achieved.

As noted above, applying a SLF is useful for conducting development work in order to successfully eradicate poverty (Petersen and Pedersen 2010) among the poor (Krantz 2001) and to "provide a foundation for creativity in applying holistic analysis to a variety of issues" at the local level (Hussein 2002). SLF focuses on the manner in which people develop livelihood strategies, such as coping and adapting strategies to achieve livelihood outcomes generally in response to vulnerability or external factors (Krantz 2001). Besides having strengths, a SLF also has a number of weaknesses including the large number of components to be addressed. Thus, it is difficult to conduct sufficient in-depth analysis into any component. The SLF can be too broad and superficial to undertake an adequate analysis of anything (Clark and Carney, 2008 cited Petersen 2010). Petersen and Pedersen (2010) also states that although the SLF is mainly an analytical tool, it should not be used to formulate detailed development activities. Instead, SLF focuses on the local poverty situation of people rather than at a macro level (Krantz 2001, Knutsson and Ostwald 2006, Petersen and Pedersen 2010). Micro level activities are best formulated within the context of policy implementation and applicable laws, and linked to institutions at the macro level (Farrington et al. 1999). SLF is conceptual rather than analytical. A distinct checklist of livelihood factors

can be created that can be used as analytical tools (Scoones 1998, Krantz 2001).

Many studies on the livelihood assets component of SLF are used as qualitative or relative resources (Krantz 2001). However, the study's results are limited in terms of qualitative aspects of local livelihoods. Thus, integrated qualitative and qualitative approaches have been applied to assess vulnerability so that the results can be used by researchers, policy makers, and development practitioners, to capture a diversity of capital being generated and to reveal different livelihood strategies implemented in response to external change factors.

1.2 Livelihoods and development in northern Laos

This section provides a brief statement of Lao Government policies on rural development, poverty alleviation, upland development, and sustainable development as well as a description of rural livelihood systems, changes in agricultural production in upland areas, land use, forest allocation, and market integration.

1.2.1 Rural development and poverty alleviation

The Lao People Democratic Republic (Lao PDR) is covered by mountainous landscapes with many areas of dense forests. These landscapes are shaped by a diversity of ethnic minorities, all making a living through age-old activities and self-subsistence economy (Lestrelin 2009). Currently, the political, socioeconomic, and environmental sectors are experiencing rapid changes (Moser 2008). However, Laos is still remains a poor and one of the least developed countries (LDC) in Asia (UNDP 2007). The 2013 UNDP human development report stated that Laos was ranked 138th out of 187 countries in the world (UNDP 2013). The gross national income in Lao PDR increased from US$390 in 2004 to US$1,270 per capita in 2012 (World Bank 2014). However, the country still lacks infrastructure and remains poorly developed. In 1998, 39% of the people lived below the poverty line (ADB 2004), resulting from poor infrastructure in

rural areas. About 80% of rural households live in upland areas where shifting cultivation is still practiced. (Rigg 2006).

The concept of poverty is not easily understood in the Lao language, but it is easily understood in terms of international development (ADB 2004). However, an official Lao definition of poverty was provided by an Instruction from the Prime Minister's Office in 2001 as follows:

"Poverty is the lack of ability to fulfill basic needs, such as: not having enough food (less than 2,100 calories per day/capita), lack of adequate clothing, not having permanent housing, not capable of meeting expenses for health care, not capable of meeting educational expenses for one's self and other family members, and lack of access to transport routes".

In addition, poverty indicators were issued for households, villages, and districts. In rural areas, if a rural household has income below 180,000 kip per person per month, that household is considered as poor; the figure is 240,000 kip in urban areas; and, 192,000 kip is the national average (NCRDPE 2011). A village is considered as poor if it lacks the fundamental conditions for development as follows:

1) Poverty rate: 51% or more households within the village are poor.
2) No primary school; children being schooled in the nearest village that takes more than one walking-hour.
3) No health care safety-net such as a drugs revolving fund or local pharmacy; with villagers required to walk more than two hours to the nearest health center or district hospital.
4) No clean water available.
5) No all-weather road access.

A district is considered poor where in the poverty rate is 51% or more of the

villages within that district.

1.2.2 Government policy on upland development in Laos

In 1986, the government introduced the New Economic Mechanism (NEM) policy. This policy has reformed a socialist economy to become a market economy (Evans 2002). As a result, free enterprise and private ownership of production are the driving forces of economic development (Ducourtieux et al. 2005). In 2001, the 7th Congress of the Lao Peoples' Revolutionary Party adopted quantified objectives, one of which was to reduce poverty by half by 2005 and to eradicate poverty by 2010 and exit from LDC status by 2020 (MFA 2004). Poverty reduction was to be achieved through the equitable distribution of benefits consisting of land use, agricultural production, and forest and natural resource management. The Sixth National Social and Economic Development Plan, 2006-2010 defined five agricultural policies. These policies aimed to (i) develop rural areas; (ii) eradicate poverty among upland rural people whose livelihoods are based on agricultural production and natural resource use; and, (iii) improve peoples' livelihoods overall in upland areas. These policies include the following:

1) Swidden cultivation

In the year 2000, the Lao Government estimated that 39% of the population practiced shifting cultivation (swidden agriculture) as a major livelihood strategy (Thomas 2005). Upland farmers have used swidden as a traditional agricultural production technology for many generations. However, the Government defined swidden as an unsustainable activity resulting from population growth and a shortage of land. In fact, sustainable swidden requires rotational fallow and recovery periods of 20 years. In northern Laos, cultivation shifts from place to place approximately every three years; one year under cultivation followed by two years of a fallow (NAFRI et al.

2005). Swidden areas require a long fallow period to regenerate and recover before replanting. Therefore, people are required to open new areas in order to extend the fallow period of the rotation cycle. For this reason, policy makers identified swidden as the main cause of deforestation and an unsustainable farming system. As a result, the Lao Government aimed to eliminate swidden and stabilize upland agricultural production by 2010. National plan targets aimed to transform subsistence farming into sedentary market-oriented commercial agricultural production that would ensure food security in rural upland areas. Cultivation of upland crops and commercial tree crops are alternatives to swidden. The original policy aimed to halt pioneering swidden in natural forest areas. This policy objective later was changed, wherein a complete ban was placed on swidden, with a strong bias against cultivating upland rice. Implementation of this policy increased vulnerabilities and rice shortages in upland communities. Nevertheless, the Government was committed to halting all forms of swidden by 2010 (MFA 2004).

2) Opium eradication

In the Golden Triangle, the border area where Myanmar (Burma), northern Thailand, and northwestern Laos share a common border, has produced about 40 percent of the total opium of the world's illicit opium since the early 1970s (Cohen 2000). Most opium is cultivated by ethnic minority groups in the Golden Triangle, including Hmong, Akha, Yao, Wa, Lisu, and Lahu groups, who occupy mountainous areas and cultivate opium as part of their livelihood system (Cohen 2000). The Lao Government often viewed opium cultivation in the context of swidden agricultural practices since the crop was cultivated in deforested areas. The Seventh Congress of the Lao Peopoles' Revolutionary Party ordered the elimination of opium cultivation by 2005, a decision that received strong support from international development agencies.

Development projects in mountainous areas received high priority consideration. Most development agencies promoted sub-tropical and temperate tree crops to replace opium cultivation that aimed to generate increased cash to supplement other household income sources. However, access to markets from remote rural areas is limited and temperate climate fruit trees require five to ten years (some up to 20 years) to mature (Thomas 2005). On the other hand, many scholars found that opium cultivation substituted for rice when there was a shortage for consumption; with opium providing cash income used to purchase rice (Cohen 2000). In 2006 the United Nations Office on Drugs and Crime declared that opium production in Laos was eradicated, but a resurgence in recent years has required the Lao Government to pursue activities to eradicate opium cultivation.

3) Land and forest allocation

The Lao Government's Land and Forest Allocation Program (LFAP) was initiated in 1993 as an exercise in rural land zoning. Implementation of LFAP has been largely completed in the northern uplands. A similar land allocation programme was first launched in Phongsaly Province in 1997 (Ducourtieux et al. 2005) with the aim of increasing land tenure security, helping farmers manage their land, encouraging communities to protect the forest environment, and limiting shifting cultivation to controlled areas (Ducourtieux et al. 2005). Policy implementation also promoted improved management of natural resources, reduction and elimination of swidden, and commercial agricultural production. The program was implemented at the village level, with a focus on forest and agricultural land use zoning, land suitability assessments, demarcation of village boundaries, participatory formulation of regulations for improved resource management, hand-over of management responsibilities to villagers, and accurate measurement and allocation of permanently used land plots. Government

regulations authorize land plots for paddy fields, gardens, orchards, plantations, and residential areas to rural households (Thomas 2005). Protecting village forest lands also is a goal of the land allocation policy.

4) Village clusters and relocation

The Lao Government indicates that village consolidation and relocation in remote rural areas aims to accelerate development and access to modernization and to reduce poverty. Its long-term development objective is to improve the provision of public services, including education, health, electricity, market access, and communications. Rural communities will more easily receive these public services when roads and/or highways serve villages. The National Development Programme detailed a "focal site" or "village cluster" strategy in 1994 (Thomas 2005). Village cluster development also was seen as a way of further decentralizing administrative support from the district level to the grassroots level. By 1997, there were 62 focal development sites established consisting of 16 villages and 5,200 people per site on average (Thomas 2005). In 2002, 87 of all focal development sites had been established throughout the country consisting of 1,200 villages and 450,000 people, accounting for 12% of the rural population (Evrard and Goudineau 2004).

In recent years, the relocation and consolidation of upland communities closer to road infrastructure and other public services was closely associated with government policies related to stabilization of swidden agriculture and land and forest allocation. Evrard and Goudineau (2004) state that many villages became vulnerable during the initial years following the relocation program; wherein some villages had been moved from mountainous to lowland areas, requiring that people adapt to new environments, new pathological conditions, and learn new agricultural activities. In addition, land allocation continued to be a contentious issue in implementing the village cluster

program, especially since most fertile and arable land suited for paddy rice production had been occupied for many generations predominantly by ethnic lowland Lao. Resettled households often did not have access to agricultural land or paddy areas suited for lowland rice production. Therefore, resettled households faced a serious problem of food security and access to water resources (Evrard and Goudineau 2004). Some households often returned to old swidden areas and reverted to upland rice cultivation to ensure food for household consumption.

5) Decentralization

Decentralization is defined as the relationship between central government and local government (Thomas 2005). Administration at the provincial level operates as a strategic planning unit; the district level formulates plans and budgets; and, village administration implements activities. This policy aims to provide a certain level of autonomy at the provincial level, giving provincial administrations responsibility for socioeconomic and agro-economic development. In the agriculture sector, the Ministry of Agriculture and Forestry (MAF) assigned responsibilities to provincial, district, and village levels (Thomas 2005). Most activities at the village level are supported by staff from district offices with guidance or advice from provincial offices.

1.2.3 Sustainable livelihood and livelihood systems in Lao PDR

Most people in rural upland areas of northern Laos practice multiple livelihood strategies, engaging in a diversity of subsistence and income generating activities (Bounthong et al. 2003). Livelihood systems in upland areas are based on (1) traditional culture; (2) land use; (3) upland and lowland rice cultivation; (4) rearing of large livestock (cattle and buffalo); (5) cultivation of cash crops (e.g., vegetables) in upland fields and home gardens; and, (6) hunting and gathering of forest and non-forest resources, including fish, wildlife, and other non-timber forest products (NTFPs)

(Alexander and Khounsy 2006). Table 1 shows livelihood classification by geographical situation and ethnic group (Bounthong et al. 2003, Yokoyama 2003). Raintree (2004) pointed out that biodiversity is the foundation of traditional livelihood systems in rural areas. Similarly livelihood activities are based on traditional, natural farming systems and forest-based resources. Forest access, home gardens, and extensive management of livestock (i.e., open grazing) support these systems to varying degrees, providing diverse sources of income and a level of subsistence needed to survive. Forest resources provide the basis for an agro-forestry based livelihood system; one that plays a critical role in rural livelihoods, especially among ethnic minorities (UNDP 2001).

However, such traditional livelihood systems often differ from government policy, particularly on issues of conservation and forest use. The differences have short-term impacts on rural livelihood development; but long-term impacts on forest management. Traditional livelihood systems also hinder the development plans of powerful special interest groups that pursue economic development and conversion of forest resources. As a result, traditional livelihoods are changing rapidly as a result of Lao Government policy interventions, including the reduction of swidden agriculture, elimination of opium production, and village consolidation and relocation, among other factors (Bounthong et al. 2003).

1.2.4 Farming systems and agricultural production change

1) Farming systems in Laos

Farming systems in Laos, including enterprises, are classified in a variety of ways, based on climate, geography, and crop combinations; with as many as ten types being identified. However, Douangsavanh (2006), referring to the Ministry of Agriculture and Forestry's report issued in 2001, has combined these farming system

Table 1 Livelihood systems with classify by Lao ethnic groups

Increasing land use and labor intensity				
	Low level →			High level
Livelihood systems (combinations of components)	Forest gathering + incipient swidden	Swidden + NTFPs & livestock for household income	Swidden & wet rice + livestock & NFTPs for cash income	Wet rice, with cash crops, livestock & trading
Ethnic groups in the Nakai Plateau who practice the system	Vietic groups:	Vietic groups: Brou, Hmong, Tai	Vietic groups: Brou, Hmong, Tai, Sek	Brou, Hmong, Tai, Sek

Source: Bounthong et al. (2003)

into three major categories, namely: paddy production, swidden cultivation, and plateau agriculture systems (Table 2).

Farmers have responded to government policies to stabilize swidden by investing labor and time in producing upland crops and rearing livestock (Alexander et al. 2006). Both intensive and extensive farming systems have changed; with a reduction in upland rice production and an increase in the cultivation of alternative upland crops and livestock grazing. Diversification strategies include the use of a mixed farming approach and migration out of agriculture in response to government policy to reduce upland rice production (Alexander 2007).

2) Change in agricultural production

There are many factors that influence changes in agricultural production or farming systems. Marten (1986) states that a household is a social unit that makes decisions on the crops to be produced. Households will adjust and combine efforts to execute the household's chosen farming system based on the household's ability (Marten 1986). Social interactions of one household may influence the farming systems of other households (Douangsavanh 2006). In addition, government policy, market conditions, knowledge, access to technologies, and other external factors influence local people, causing them to change their way of living, including their agricultural production practices.

In the late 1980s, the government's campaign on food self-sufficiency and food security involved returning land to former owners (pre-1975 revolution). Farmers were allowed to sell surplus products through market cooperatives (Thalemann 1997). In the Second Five Year Development Plan (1986-90), the role of agriculture in achieving national self-sufficiency and food security was emphasized. Rice was the focus of development initiatives; policy shifted from livestock to crops (Worner 1997). Higher

Table 2 Farming systems in Laos with classify by Agro-Ecological Zone (AEZ)

AEZ	Farming Systems	Characteristics	Livelihood problems
Lowland			
1	Rainfed production	Single cropping of traditional glutinous paddy rice varieties (80%), 2-4 varieties of different maturation, yield: 2.5-3 tons/ha. Buffalo and cattle for draft, cash income and occasional meat, free ranging in the dry season. Pigs, poultry, fish and NTFP important for food and cash income	Rice shortage of 1-4 months and low household income
1	Irrigated production	Double cropping of traditional sensitive paddy varieties, with higher use of improved varieties, fertilizer, etc. Yeild: 1-3 t/ha in the wet season and 2-4 t/ha in the dry season. Dry season vegetables grown in areas near urban centers. A shortage of grazing for livestock. Buffalo and cattle use for stock meat and cash income	Better off than unirrigated farmers, but lack cash, especially for investment.
Upland			
2 3 5	Rainfed production	Upland rice intercropped with chili, cucumber, sesame, taro, etc. on sloping land, with fallow periods of 2-10 years, yield of 1.4-1.5 t/ha. Maize of livestock is 2nd most important crop. Other crops: cassava, sweet potato, ginger, groundnut, soybean, sugarcane, cotton, coconut, mango, banana, tamarind, and citrus (lower altitudes species). Melon and watermelon grown in the dry season in some areas. Pigs, cattle and poultry are the principle livestock. High dependence on NTFPs for household income to purchase rice, etc. Paddy production is progressing where possible.	
6	Highland production	Similar to upland rainfed production, but with high altitude crops as well as opium. Sometimes intercropped with mustard and lettuce. Temperate fruit trees such as peach, plum and local apple are adapted.	As above.
Plateau			
4	Plateau production	Coffee, tea and cardamom have largely produced, supplemented by fruit trees and vegetables as a home gardens. Poor varieties, no fertilizer, poor harvest, poor management, weed problems due to poor quality and yields. Pigs and poultry also kept.	- Commercial strategy - No problems with food security - Household income still only moderate.

Source: Douangsavanh (2006)

priority was given to diversification of upland plantations and other cash crops such as coffee, maize, tobacco, soybeans, mungbeans, sugarcane, tea, and cardamom. During the initial stage of the NEM both the domestic private sector and foreign direct investment played a role in agricultural production (Stuart-Fox 2005). However, Laos still was not able to meet the rice production target of 1.8 million tons. Some 1.5 million tons of rice was produced in 1990, because of low productivity, which was an average of about 2.25 tons per hectare (Worner 1997). Laos did finally become self-sufficient in rice in 1995 (MAF 1999).

Privately owned land with secure land titles is an important factor that ensures efficient agricultural production. It also is a standard in market economies (Phanvilay 2010). To ensure that the agriculture sector can provide food security and meet emerging market demand for Lao products, the Government launched a land and forest land allocation program in 1993 (Ducourtieux et al. 2005). It allowed private ownership in order to stimulate private investment in land development. The Government anticipated that this policy would generate more tax to support the national budget, encourage permanent settlement, and stabilize swidden in the uplands (Phengsopha and Morimoto 2004).

To attract foreign direct investment, the Government granted land concessions to agribusiness investors for tree plantations, and for mining and hydropower in 2002 (Schopenweger and Ullenberg 2009). In October 2005, the provincial governors of three northern provinces, namely Oudomxai, Bokeo, and Luang Namtha reached a consensus that land concessions should not be allocated for additional investments in rubber plantations. Instead, contract farming with profit-sharing based on a formula of investors 30% and villagers 70% of net profits, should be implemented (Shi 2008). In addition to land concessions, contract farming also is a factor in the agriculture sector.

Contract farming is accepted as an important means of integrating Lao agriculture products into national and regional commodity markets. The concept is that contract farming will (1) modernize the agriculture sector through the introduction of innovative technology; and, (2) promote agricultural growth (Leung et al. 2008). Furthermore, contract farming ensures that framers have markets for their products. Contract farming was introduced as part of the land concession process, setting the basis for future agro-industry and expanded tree plantations in the early 2000s (Thongmanivong et al. 2009).

1.2.5 Land cover/use change and deforestation

1) Land cover and land use

The Lao government aims to have the country graduate from the United Nations' LDC status before 2020. Agricultural production is expected to play an important role in economic development of the country to attain this goal. The Government has implemented a land titling program that leads to secure land tenure in the form of land allocation. More secure land tenure is expected to increase productivity and give responsibility for natural resource management to farmers (Ducourtieux et al. 2005). The reform was introduced to Luang Prabang and Sayabury provinces in 1990, with support from ADB, FAO, and SDC (Ducourtieux et al. 2005). This tentative policy played an important role in defining local agricultural production. At the same time, increased production was seen as the main process for changing land use and land cover. Land use related to the human employment of land was a primary focus of social scientists, while land cover related to the physical state of the landscape was a concern of natural scientists (Turner and Meyer 1994). Changes in land cover also may influence land conservation and existing land cover. Land frequently changed from one cover class to another thus changing the land use category. Agricultural expansion and intensification also were key change factors leading to reduced forest cover and

expanded land use. Expansion of agriculture to uncultivated areas was seen as reducing production input costs, including the need to use expensive high yielding crop varieties, chemical fertilizer, and pesticides. Expanding on to new uncultivated areas also could increase productivity per unit area (Phanvilay 2010).

2) Deforestation

Population pressure and an increase in public and private land-based development projects have led to a decline in natural forest areas. In the 1940s, about 70% of the land was covered in natural forest. This declined to 47% by 1992 and 41.5% by 2002 (DOF 2003). Deforestation was caused by illegal and poorly managed state logging, infrastructure development projects such as hydropower development, road construction, and mining (Phanvilay 2010), and the traditional practice of swidden by various ethnic groups (MAF 1999). The Government concludes that today swidden is an unsustainable agriculture practice and intends to make all farming sedentary. This practice can cause land degradation as population increases and fallow periods are shorter than 10 years. During the 1990s, about 218,900 ha or 10% of total land in the country was under swidden, It covered of one third of the total national population or 1.24 million people (Phanvilay 2010 Cited Pravongviengkham 1998). Therefore, the Government outlined a strategy to stabilized swidden by (1) promoting crop diversification sloped land; (2) helping farmers to access markets through improved market access roads and by providing market information; (3) allocating land based on zoning; (4) promoting household savings and improving access to agricultural production credit; and, (5) completing land use planning and land allocation throughout the country (MAF 1999).

In addition, MAF prepared a draft forestry strategy to the year 2020. Forests are classified into five categories, namely: 1) production forests for timber and forest

products for national and local needs; 2) conservation forests to conserve species, habitats and other entities; 3) protection forests to protect watersheds and areas for national security and the environment; 4) regeneration forests which consist of fallow land or other areas targeted for regeneration into permanent forest; and, 5) degraded forests that have little forest cover and that are targeted for tree plantations or land allocation (Thomas 2005). Forest categories 1, 2 and 3 are delineated on large-scale maps, while 4 and 5 are considered areas for swidden cultivation; they are identified as village land for village use (Thomas 2005).

On the other hand, Nye and Greenland (1960) and Ramakrishnan (1984) conclude that swidden is an environmentally suitable land use. It is considered to be sustainable where the rotation cycle is long enough to recover the soil fertility and vegetation. Lao population densities average 27 persons/km^2 (NSC 2012); varying greatly depending on urbanization and land use. Continued low population densities in Laos allow swidden cultivation to continue to provide staple foods, supplemental food, and income from commercial crops. On the other hand, swidden systems cannot support production when population densities are higher than 32 persons/km^2 (Nye and Greenland 1960).

1.2.6 Market integration

Laos is a land locked country that is consequently at a geographic disadvantage in trade and market access. Market systems rely on the rapid dissemination of price and supply and demand information. Marketing information systems have been designed to support farmer decision making for select crops and livestock (Alexander and Khounsy 2006 cited Binayee 2005). Market information also is used to promote production and the sale of agriculture products. However, target markets for Lao products are linked largely to the economies of southwest China (Yunnan Province), northeast Thailand,

Vietnam, and northern Cambodia. The Thai market seems to have the highest potential for development as an outlet for goods and commodities produced in Laos (Goto 2011).

Regional market dynamics as well as traditional cross-border trade with neighboring counties are the principal drivers in the transition toward market-oriented agriculture in the northern uplands (World Bank 2008). Regional and domestic traders and agri-businesses are increasingly an important factor in the demand for agricultural products in expanding markets in China, Thailand, and Vietnam (World Bank 2008). The demand is for food crops, agricultural raw materials, livestock, NTFPs, and other niche products.

As mentioned above, the Lao government first adopted market orientation through NEM in 1986 (Joiner 1988). In 1992 Laos joined the Greater Mekong Sub-region (GMS), a sub-regional economic cooperation program that facilitated trade and economic relations for Laos with Thailand and China (Yunnan Province and Guangxi Zhuang Autonomous Region), supported mainly by ADB (Goto 2011). In 1997, Laos become a full member of the Association of Southeast Asian Nations (ASEAN) and began accession to the ASEAN free trade area (AFTA) which was implemented through the CEPT in 1998 (UNDP 2006). Following an agreed time frame, 98% of tariff lines were reduced to 5% or less by 2008; and, a zero tariff rate would be in place by 2015 (UNDP 2006). In 2003, Laos jointed the Ayerwaddi-Chao Phraya-Mekong Economic Cooperation Strategy (ACMECS), which aimed to promote trade and investment between five countries, including Thailand, Cambodia, Vietnam, Lao PDR, and Myanmar (Pimprapai and Watana 2011). Investments in the form of contract farming have been the major vehicle for producing agricultural products. Under ACMECS, nine Lao agricultural exports were assigned a zero tariff rate, including sweet corn, field corn, cashew nuts, eucalyptus logs, castor oil beans, potatoes, pearl

barley, soy beans and groundnuts (UNDP 2006). These trade agreements have led to a significant increase in trade in agricultural commodities through foreign investment in food processing and contract farming. The China-ASEAN Trade in Goods (TIG) Agreement was signed in 2005 marking an important step toward forming a China-ASEAN Free Trade Agreement (CAFTA) by 2010. Under the TIG Agreement, China eliminated tariffs for approximately 600 agricultural products imported from Laos as raw materials as of 1 January 2006 (World Bank 2008). In fact, the TIG Agreement and the zero tariff policy for Lao products are not aimed specifically at promoting contract farming. They serve as important incentives for Chinese traders, investors, and agro-processors to source agriculture products, livestock, NTFPs and other products from northern Laos for export (World Bank 2008).

As noted above, economic reform implemented in combination with strong policies and better road infrastructure facilitated investments by the Chinese private sector which introduced cross-border production in northern Laos, especially in border areas and also at research sites. This process led to an increase of Chinese imported products and Lao agriculture exports as well as production by Lao farmers (Yokoyama 2010) that feeds the expanding industrial sector in China.

Most recently economic developments in neighboring countries have been affecting household livelihoods as well as farming systems; changing agricultural activities from subsistence to commercial production. These changes have not been significant only in Phongsaly Province (the research site), but also in Luang Namtha and Oudomxay provinces (Goto 2011). The expansion of dry season crop production, including corn, green beans, red and long pumpkin, and other crops, was initiated through Chinese foreign investment, the aim being to supply Chinese consumers and agro-industrial demands. Economic growth in neighboring countries has had both

positive and negative impacts. The influence of Chinese investments is positive wherein local farmers have gained access to modern agricultural production technologies and are earning more stable incomes, demonstrated most clearly in villages where poverty reduction has been achieved (Khontaphane et al. 2006). On the other hand, Thongmanivong et al. (2009) indicate that Chinese investment has had more negative impacts than positive ones. Thongmanivong et al. (2009) found that farmers in northern Laos were increasingly losing access to Chinese markets while also losing access to their land. Most household income is derived from the sale of agricultural labor. On the one hand, a large number of Chinese laborers as well as machinery and other production inputs are imported from China through foreign direct investment and Chinese private sector networks (Goto 2011). On the other hand, Chinese laborers are replacing local Lao laborers who had expected to gain livelihood benefits from Chinese investments.

The results of a review of literature related to northern Laos also revealed several factors driving change in upland and lowland peoples' livelihoods (Phanvilay 2010) including, changing lifestyles and natural conditions in upland areas (Lestrelin 2009); political change (Soukamneuth 2006); Government policy changes (Moser 2008); and, changes in agricultural development (Alexander 2007), among others. However, the results of the literature review indicate that economic growth in China has influenced rural people in lowland areas also, particularly people living in border areas. The findings conclude that climate change also is an important driving factor in northern Laos. These factors raise real issues that have not yet been examined.

1.3 Livelihood perspective and previous studies

The basic concept of livelihood is being further developed through contributions made by scholars from different disciplines. "Livelihood approaches" are being applied to many sectors and sub-sectors, namely: agriculture, including livestock, crops,

fisheries, and forestry; health; rural and urban development; and, other rural development disciplines. Livelihood has become an essential element of socio-economic and rural development programs, being linked to operational indicators that are monitored and evaluated; and, to sector and sub-sector strategies related to poverty reduction. In addition, interesting applications have emerged from a livelihood perspective, such as livelihood diversification, livelihood strategies, and livelihood change, among others, as discussed below.

1.3.1 Livelihood diversification

Ellis (1998) defined "livelihood diversification as the process by which households construct a diverse portfolio of activities and social support capabilities for survival and in order to improve their standard of living". In recent years, many academic studies have examined livelihood diversification. For example, Ellis (2000) found multiple reasons for livelihood diversification, including seasonality, risk, labor and credit markets, assets, and the need to adopt coping strategies. These are standard reasons for livelihood diversification in low income developing countries. The level of diversification is determined by social relations and the degree of control by external and internal institutions. Ellis argues that resistance to livelihood diversification in low income countries impedes efforts to reduce poverty. Later, Carswell (2002) found that trading is an important activity that generates household income. Carswell, G. argues that off-farm activities are important to livelihood diversification and a main factor of livelihood change in Southern Ethiopia (Carswell 2002). Elmqvist and Olsson (2007) studied livelihood diversification in central Sudan. They found that during the dry season, people could not continue producing as a result of drought, resulting in seeking work outside the village; a common livelihood strategy during that period. The objective of livelihood diversification studies is to identify the most important activities

that support and improve the standard of living. Several studies on livelihood diversification reported that the variety of livelihood activities increased, including off-farm income generating activities, trading, and working outside the village. However, these were not the only reasons for changes in peoples' livelihoods. Climate change also is seen as a complication and a driving force for livelihood change, one that causes large variability in household incomes (Elmqvist and Olsson 2007).

1.3.2 Livelihood strategies

Livelihood strategies provide processes and the mix of activities needed to achieve specific livelihood outcomes. Many scholars have conducted research on livelihood strategies trying to understand the dynamic of the processes in which people participate in activities to meet their objectives and to fulfill their needs.

Valdivia and Quiroz (2001) studied rural livelihood strategies in the Bolivian Andes. They found that markets, new technologies, and climate disruptions are the driving force of change in household livelihood strategies. People in Bolivia were coping with and adapting to climate change through non-market institutions and accessing networks (Valdivia and Quiroz 2001). At the same time, Walker et al. (2001) explained six key factors used to evaluate livelihood strategies in anticipation of tourism development in Indonesia, namely: social, economic, cultural, psychological, biophysical and political/legal. Walker indicated that livelihood strategies are important or are an essential basis for environmental planning and management. Using a different approach, Nigel (2009) studied livelihoods during a conflict in Sri Lanka. Nigel identified and discussed impacts on household livelihoods resulting from a conflict between ethnic groups living in southeastern Sri Lanka. The findings found that people create their livelihood strategies by using different assets to which they have access under conflict conditions. Similarly, Ozturk (2009) examined a community in Northeast

Thailand that adopted new livelihood strategies in which land ownership and farming became gradually less important. The results of the study showed that land ownership, access to water resources, and institutional financial resources have significant effects on the average income of people who own land and those who do not. The respondents stressed that agricultural production was not a viable income-generating strategy for most households in the area, where farming gradually had become less important. Ozturk suggests that a purely economic or natural approach is not sufficient to explain livelihood strategy changes, especially in rural communities.

1.3.3 Livelihood changes

Changes in livelihood as a result of rapid globalization currently are of significant interest to researchers. Bury (2004) adopted a livelihoods approach to evaluate sources of household income during a transitional phase among rural inhabitants of the Cajamarca region of Peru. The findings show that access to products, natural resources, human capital, and social capital are experiencing transformation and significant changes. Access to products and human capital has increased slightly, while access to natural resources and social capital has declined in the area where mining is a major economic activity. Bury indicated a livelihood framework can provide insights into the transformation of local situations in geographic studies, and introduced geography as a factor to better understand local, regional and global changes. Cramb et al. (2009) explored the transformation of swidden livelihood systems in the uplands of Southeast Asia. The findings showed that external trends, including broad political change, population growth, and social and cultural factors affect the choice of livelihood strategies. Although the expansion of crop production in upland areas often has improved the livelihood of upland people, frequently new crops also increase market vulnerability. At the community level, people are adopting new crops and

engaging with markets, but in many cases swidden cultivation continues to be an important source of food for subsistence, traditional medicines, and cash income from natural resources (mostly NTFPs) for their households (Cramb et al. 2009).

Shivakoti and Schmidt-Vogt (2009) used SLF to understand livelihood changes and sustainable livelihoods in West Sumatra, Indonesia, by measuring access to five forms of assets including natural, human, social, physical and capital, and by analyzing livelihood strategies in different years: 1996 and 2006. The study found that upland people gained increased access to human, natural, physical and financial resources while access to social capital declined. Low income households had less access to these assets than those from middle and high income groups. Social capital in groups of poor households was reduced and inequity increased. Although economic sustainability improved, environmental sustainability was directly impacted from the expansion of agricultural production. The inequity of household income increased over time but social exclusion was reduced. This indicated that income generation was more important than social relationships at the community level. Institutions were still unsustainable due to limitations and failure to manage natural resources at the local level (Shivakoti and Schmidt-Vogt 2009).

As mentioned above, livelihood studies aim to formulate policies that are more effective in reducing poverty, identifying cases of poverty, and finding appropriate methods to support peoples' ability to earn a living. Livelihood studies often exemplify livelihoods of common people. However, the results of some studies have limited scope with no effect on changing livelihoods. Thus, livelihood studies are more effective in understanding the factors that influence people's lives and to understanding differences in the capacity of rural people to cope with and respond to external factors such as shocks and global trends, among others. On the other hand, if people adopt new

livelihood strategies to cope with and respond to external factors, the usefulness of some strategies may decrease while others could increase. However, indicators that are useful in capturing livelihood changes are scarce. Therefore, livelihood changes need to be quantified.

1.3.4 Climate change and livelihood

Climate change adversely affects water resources, agriculture, forestry, human settlements, ecology, and human life in many parts of the world (Elasha et al. 2005). Climate change is also a challenging issue in rural development and impacts on agricultural production, ecosystem services, and livelihoods (Sivakumar et al. 2005). These problems arise due to limited resilience, which involves the inherent abilities and adaptive responses of local people to outside impacts, subsistence food production, and natural production potential (Mertz et al. 2009). Adger (2000b) defined resilience as the ability of individuals and households or families to cope with external shocks, trends and stresses such as social, economic, political, and environmental changes. Resilience is thus the ability of people to cope with or respond to unpredictable events or sudden change (Pike et al. 2010). Climate constitutes one aspect of vulnerability: it frames the external setting in which people live and encompasses aspects that are far beyond their control (DFID 1999). People in developing areas of Southeast Asia face multiple climate stresses, including increased drought in northwest and eastern coastal regions of Vietnam (Yusuf and Francisco 2009); early season typhoons in northern Vietnam (Adger 1999); and, increased flooding in Thailand (Duan et al. 2009, Lebel et al. 2011). In addition to climate stress, economic, political, and social factors are major driving forces of change in local livelihoods (Mertz et al. 2009).

However, most inhabitants of developing countries still depend on traditional agriculture (Marten 1986). Such places are characterized by high dependence on natural

resources for livelihoods, low productivity (Hoekman et al. 2005), and lack of education in rural areas (Jansen 2003). Measuring the direct impact of climate change on local livelihoods is therefore important for sustainable development in such countries. At the local level, agricultural surpluses are small, and a major climate event may seriously diminish agricultural production (Shrestha et al. 2012). Accordingly, it is necessary for local inhabitants to adopt a strategy of risk management to sustain their livelihoods. Sustainable development in developing countries demands a clarification of how people respond and successfully adapt to local environmental change (Adger et al. 2005).

1) Adaptation strategies

Recently, many authors have focused on adaptation strategies with respect to adaptation and response of local inhabitants to the long-term impacts of multiple stress factors, such as drought (Ali 1999, Kurukulasuriya et al. 2006, Thomas et al. 2007, Paavola 2008, Stringer et al. 2009, Sissoko et al. 2011), flooding (Schreider et al. 2000, Booij 2005, Lebel et al. 2011), and weather hazards (Adger 2001, Gaillard et al. 2009, Nguyen et al. 2013). These studies have examined livelihoods in the context of local response mechanisms and vulnerability to climate change, aiming to understand their implications for adaptation to such change. Many efforts have been directed at reducing vulnerability by means of local adaptation strategies in response to climate change. Adaptation strategies are when local inhabitants reduce overall vulnerability to climate events or change (Morton 2007); these strategies aim to reduce vulnerability to such events or longer-term change (Eriksen and Silva 2009). Adaptation offers effective measures to reduce climate sensitivity (Eriksen et al. 2005).

Empirical studies have examined adaptation, with particular focus on conditions needed for change to actually occur within social and economic systems (Smithers and Smit 1997). Morton (2007) stated that farmers decreased contacts with markets for

agricultural products as a result of changes in global socioeconomic conditions and population growth, resulting in increased fragmentation of landholdings. These trends resulted in smallholders having less capacity to adapt to climate change. People in areas with high rainfall variability, weather hazards, and climate shocks applied various livelihood strategies to reduce overall vulnerability from these impacts. Adger (2001) introduced the concept of social capital and demonstrated that collective action is needed to cope with weather extremes caused by climate change. Adger showed that social capital—both bonding and networking—played an important role in recovery from the impacts of hazards in coastal areas of northern Vietnam. In central Vietnam, Nguyen et al. (2013) found that adaptation strategies applied by farmers in response to high climate variability and frequent weather hazards depended on their ability access natural and social resources; the strategies were diverse owing to differences in access. That study also demonstrated the importance of home and forest gardens as potential food sources to cope with climate variability, providing an important safety net.

Reducing overall vulnerability to climatic events includes the impact of extreme events (Downing 1991). Smit and Wandel noted that the "vulnerability of any system is reflective of the exposure and sensitivity of that system to hazardous conditions and the ability or capacity or resilience of the system to cope, adapt or recover from the effects of those conditions" (Smit and Wandel 2006). Adger (1999) defined vulnerability as "the exposure of individuals or collective groups to livelihood stress as a result of the impacts of such environmental change." Kelly and Adger (2000) defined vulnerability as the ability of people or social groupings to recover from, adapt to, respond to, and cope with any external stress placed on people livelihoods. Vulnerability is an indication of peoples' ability to cope with impacts of external trends, shocks, and stresses (DFID 2004). Vulnerability has a longer-term impact, resulting

from technological or population trends. Shocks cannot be predicted at all; they include such events as floods and storms; they are in contrast to seasonality, which refers to the shifting of prices, employment opportunities, and production with the seasons (DFID 2001).

2) Coping strategy

In addition to adaptation strategies, coping is often considered a short-term survival strategy (Eriksen and Silva 2009). A coping strategy involves local inhabitants managing the impacts of climate events (Morton 2007). Coping strategies are actions and activities taken when people are faced with each crisis or extreme event (Adger 1996). On the one hand, Eriksen et al. (2005) conclude that "coping strategies are a prime means of facilitating adaptation" (Eriksen et al. 2005). Eriksen et al. (2005), Daskon and Binns (2009), Eriksen and Silva (2009), and others have considered household coping strategies to climate stress. In a study on areas affected by drought in Kenya and Tanzania, Eriksen et al. (2005) found that households in which the members were engaged in a range of unspecialized activities were more vulnerable than households in which the members were able to undertake a specialized activity, such as employment or charcoal burning. They observed that households had limited access to favored coping options owing to a lack of skills, labor, and capital during the drought.

Reid and Vogel (2006) reported that the ability of farmers to access to infrastructure and social capital were important factors enhancing farmers' abilities to respond to climate stress. The capacity of local people to cope with and adapt to long-term impacts of climate change is becoming increasingly clear (Adger et al. 2005). It is evident in the literature that adaptation strategies have been employed to reduce the longer-term impact of climate events; by contrast, coping strategies are used to manage the immediate, short-term impact of such events (Morton 2007). Studies have found

that when facing similar impacts of climate events, people may adopt similar or different livelihood strategies to cope with them (Eriksen and Silva 2009). Climate events may even lead to different levels of impacts within the same household. However, differences in coping strategies that are adopted in response to different impact levels of climate events remain unclear and require further investigation.

The study of climate change has attracted many researchers over recent decades, including those who have attempted to understand variability and adaptation to climate change (Thomas et al. 2007, Crane et al. 2011), coping with climate change (Cooper et al. 2008), and improvement of adaptation strategies to climate change (Hallegatte 2009). There continue to be studies on the correlation between rural livelihoods and climate change (Ziervogel and Calder 2003), impacts of climate change on agriculture and livelihoods (Sissoko et al. 2011), impacts of climate change and variability in fishery-based livelihoods (Badjeck et al. 2010), and others. However, there is less confidence in the impacts of climate change on livelihood assets, and in particular on the types of assets of rural inhabitants who are most affected by climate events; and, the status of those assets.

1.3.5 Economic growth and livelihood

Farmers in upland areas of Southeast Asia are responding to political and economic changes by taking responsibility for their own development creating another major change factor in the region (Cramb et al. 2009). Revised socioeconomic policies and environmental deviations are accelerating the disappearance of subsistence livelihood and natural resource-based ways of living (Padoch et al. 2007). Farmers are adopting new and more appropriate forms of development supported by publically-supported schemes and programs. However, in some cases farmers continue to practice traditional livelihood strategies when they face confusing changes (Cramb et al. 2009).

People in the northern uplands of Laos are not an exception. They are adjusting rapidly as the result factors related to market penetration and integration (Phanvilay 2010), regional economic growth (Thongmanivong and Fujita 2006), and improved government policies; transforming their lives from subsistence livelihoods to a monetized lifestyle (Alexander et al. 2006).

As noted above, the results of the literature review found several factors driving livelihood changes in northern Laos. These factors have impacted livelihood and land use in northern Laos, changing lives and ecosystems in upland areas (Lestrelin 2009). In addition political adjustments (Soukamneuth 2006), government policy changes (Moser 2008), and agricultural innovations (Alexander 2007), and other factors all influence livelihood development. However, economic growth in China and climate change have emerged as important driving factors that influence the dynamic situation in northern Laos. However, these factors have yet to be investigated. Therefore, the main argument of this research is based on the assumption that the influence of economic growth in China is a significant driving factor for lowland people. Similarly, climate change is an important influence on livelihood changes in upland areas. My research aims to investigate and understand how the livelihoods of upland and lowland people in northern Laos are changing as a result of their vulnerability, focusing on the impacts of economic growth in China and climate change. In order to explain the livelihood changes of upland and lowland people in northern Laos, the research will examine household adaptation strategies, access to livelihood assets, and agrarian livelihood activities. This research is focused on households and communities that are affected by economic growth in China and climate change.

1.4 Research questions

As mentioned above, the study is focused on two important external factors that are expected to cause livelihood changes in northern Laos: (1) influence from economic growth in China; and, (2) climate change. These factors impact people differently at different locations. Economic growth in neighboring China influences the livelihoods of lowland people which are based on modern rice-based farming systems. Similarly, climate change affects the lives of upland people whose livelihoods are based more on traditional swidden cultivation. The study aims to understand the ability of both groups to cope with and respond to these forces that drive changes in lowland and upland livelihoods in northern Laos. The assumption of the study is that people with a lower ability to access capital are obligated to modify their livelihood strategies to achieve livelihood objectives. In other words, a lower level of household capital leads to negative livelihood outcomes. In contrast, households with subsistent capital find it easier to achieve positive livelihood outcomes. Three research questions were the focus of the study:

1) How do local people modify livelihood strategies in response to and to cope with external factors that drive changes, including the influence of economic growth and climate change?
2) How do driving forces and external factors affect household livelihoods? Which livelihood assets are affected by those factors?
3) How are inhabitants modifying farming systems, from subsistence production to commercial production?

These questions are examined in chapters two, three, and four. However, each case study also has specific objectives and research questions.

1.5 Methodology

Research methods used to examine livelihood changes among upland and lowland communities included both qualitative and quantitative approaches. The descriptive and qualitative approach used Participatory Rural Appraisal (PRA) methods. Quantitative methods were applied to understand spatial, demographic and livelihood changes overtime. To understand household livelihood conditions at the research sites the author used semi-structured and structured interviews. Household surveys with face to face interviews were conducted with head of the household. Data acquired in the study area included general statistics of each village, economic activities of each household, forest use, agricultural commodities produced, and land use. I also interviewed key informants at the village, district and provincial levels who are involved and have experience on the related matters. My research also reviewed secondary data such as national development policies on livelihood and rural development in northern Laos.

1.6 Research site

Research objectives include exploring and describing changes in people's livelihoods in northern Laos under climate change and the influence of economic growth in China. As noted in section 1.4 above, climate change and the influence of economic growth in China occurred in different places; wherein upland areas faced problems related to climate event and lowland areas were impacted by economic growth in China. Hence, two research sites were selected as representative of upland and lowland areas. The criteria for selection of the research sites included the regional representativeness of upland people in Luang Prabang Province and lowland people in Phongsaly Province. These provinces are located in northern Laos. Luang Prabang province is representative of highland swidden cultivation where livelihoods are

increasingly affected by climate change; and, Phongsaly Province is representative of smallholder farmers in lowland areas who change their livelihood as a result of the influence of economic growth in China.

1.6.1 Research site (A)

Luang Prabang Province has a sloping land area of about 16,875 square kilometers (km^2) and a population of 416,000 in 2000. Land use is primarily for rice and other short duration upland crops using swidden practices. When compared with other land uses such as grazing, permanent crops, other crops, and fallow, together these totaled less than rice. About 59,200 households or 72% of the total of 98,100 households were practicing agriculture in the province (NSC 2000). Nam Bak District is one of 11 districts in Luang Prabang Province. It has only a small area of paddy fields. Most people have upland holdings on which they still practice swidden for their livelihood, with low productivity and little experience in adapting to climate change events. Nam Bak District was selected because it is the poorest district in province. It is a priority area for development and livelihood improvement by provincial and central government authorities. One village that practices mostly swidden cultivation was selected for the case study in order to investigate the influence of climate change on livelihood systems.

The research was undertaken in the village of Kachet, Nam Bak District, Luang Prabang Province, Lao People's Democratic Republic (Figure 2). The residential area of the village is located at an altitude of about 750 m, and the village is surrounded by mountains about 900 m high. The village is at 20°34′N, 102°18′E, about 27 km west of Nam Bak area (the district capital) and 130 km northwest of Luang Prabang (the provincial capital). The average temperature in the wet season from April to October is over 20°C. However, during the dry season, from November to March, the temperature

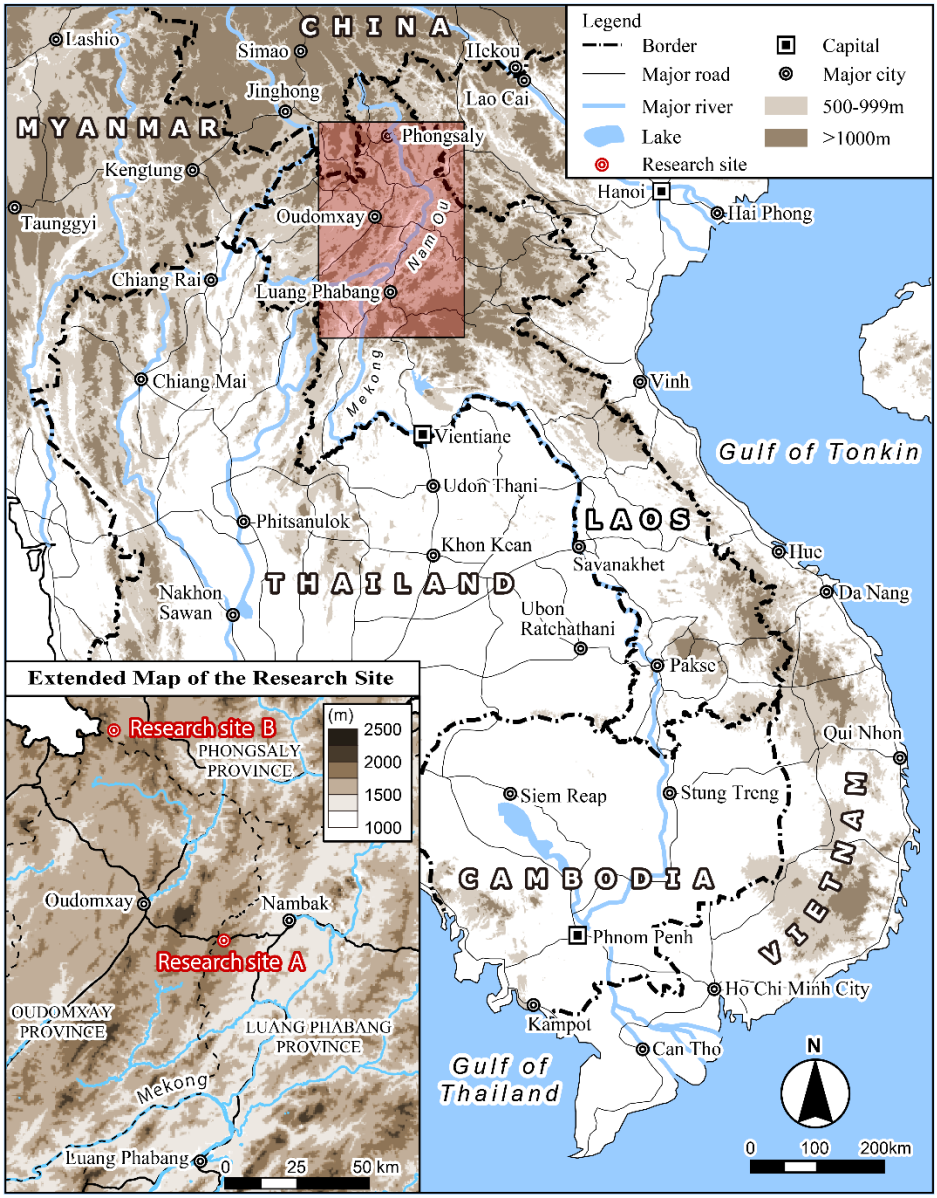


Figure 2 Research site (A) and (B) map

Source: Drawing by the author based on Mekong GIS Data

is under 20°C. The mean annual rainfall in the province is usually 1,500–2,000 mm (DMH 2012). Luang Prabang Province consists of three main ethnic groups: Khamu (46.8% of the total population); Lao Loum or lowland Lao (29%); Hmong (16.1%); and other ethnic groups that account for 8.1% (NSC 2005). The research site was selected because Kachet is a typical swidden-based village in northern Laos; farmers there still work in their mountain fields, and upland rice is the major food staple. Additional food is collected from the mountain forests. The village is located at a high altitude, and it has low temperatures; therefore, unlike other northern Lao villages, dry season crops such as corn and rubber trees cannot be cultivated. Kachet may be taken as representative of a village in an upland setting.

In 2011, the village had 95 households and 486 residents, of whom 258 were female. The inhabitants all belong to the Khamu ethnic group, one of the original Indochinese ethnic groups in Laos (Simana and Preisig 1997). Currently, the Khamu are spread throughout northern Laos and in highland areas bordering Vietnam, Thailand, China, and Myanmar. In Laos, most Khamu still build their villages and houses in mountainous areas, where agricultural production depends on rainfall. They do not have separate fields for upland crops and for paddy fields as do the other ethnic groups. Upland rice cultivation is the main livelihood activity to meet rice sufficiency in Kachet village. Rice sufficiency refers to a household being able to meet household consumption needs from production within the village rather than by buying or borrowing. The Kachet villagers do not cultivate rice in flooded paddies; they cultivate only upland glutinous rice on dry soil in the wet season.

In Kachet, upland crop production systems are based on rotational cycle systems or traditional swidden practices. In northern Laos, the swidden fallow period in 1950 was about 40 years, but had decline to five years by 1993 as a result of increased

population density and forestry policies limiting the access of local people to land (Roder 1997). This resulted in significantly less land being available for swidden agriculture. In addition, government policies had indirectly influenced the local economy. The government promoted foreign investment in northern Laos, and foreign investors began planting rubber trees there beginning in 2005. Rubber plantations require significant labor inputs and provide rural people with a new means of income. The Kachet villagers also began doing plantation work then.

The Kachet villagers faced two major problems brought about by climate change—early and reduced rainfall. Reduced rainfall from May to June affected crop yields, mainly upland rice and NTFPs. This reduced upland crop production at the research site. As noted above, upland rice cultivation is sensitive to climate events. The early onset of the wet season in March (Figure 3) had major impacts on swidden practices by reducing the area of upland rice cultivated in 2011. Most households were unable to burn fallow forest after having slashed it in February and therefore failed to plant any crops. In addition, some important NTFPs, such as benzoin resin, could not be collected owing to the early onset of the wet season.

The Kachat village research site contributed the first and second important questions of the study. As mentioned above in section 1.4, the objective is to identify important factors that enhance the ability for local people to cope with impacts from the early onset of rainfall; and, to identify local strategies emerging due to impacts from an unexpected climate event. Chapter III focuses on the livelihood assets component of the SLF, specifically the estimated value of the assets and how those assets shaped livelihoods under different climate conditions; including normal climate years and years with climate events. There also is a comparison of household strategies that people selected under each climate condition.

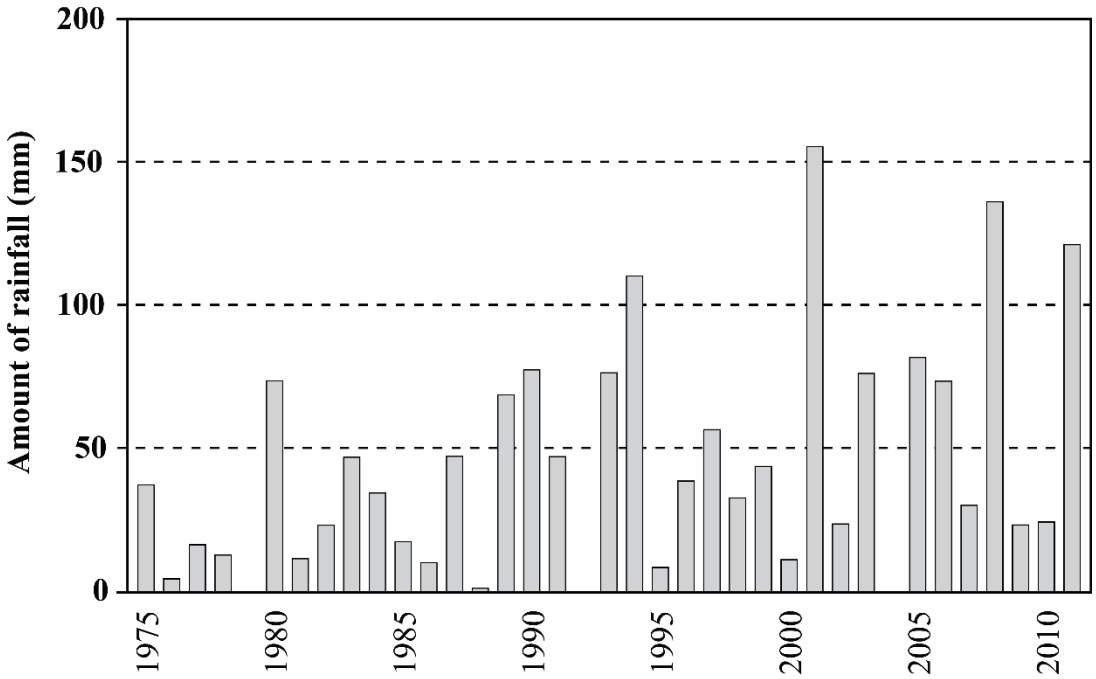


Figure 3 Average rainfall in March from 1975 to 2011 in Luang Prabang Province, Laos

Source: DMH (2012)

1.6.2 Research site (B)

Phongsaly Province is a mountainous and remote province in northern Lao PDR. Phongsaly represents a region with good opportunities for market expansion in China and Vietnam. It is populated almost entirely by ethnic minority groups and remains as one of the poorest provinces in the north. Provincial authorities pursue activities to alleviate poverty and promote the replacement of swidden farming, including irrigation development for paddy rice to improve food security; improved varieties of hybrid rice and other crops are imported from China and Vietnam; and, the promotion of livestock. Local authorizes also encourage the production of cash crops in upland areas. Rubber is becoming more prominent as the province simultaneously seeks to meet market demand and to increase forest cover at 21 percent to 58 percent by 2010 (PAFO 2010) by replanting degraded secondary forest areas with rubber. Other important emerging cash crops include maize, sesame, pigeon pea, watermelon, fruit trees, vegetables, tea, and domesticated non-timber forest products, namely galangal and cardamom.

The study selected Boun Neua District as the research site because it shares a border with China and has good road linkages with a local border checkpoint (Pakha) between Phongsaly Province, Laos, and Xishuangbanna Prefecture, China. Boun Neua District lies on the Lao-China border, with good trade connections to Chinese markets. Since, the border with China was opened for trade, the number of investment companies has increased. Most investors are interested in cash crops and dry season crops such as sugarcane, green beans, red and long pumpkin, and chili peppers, among others. The demand for commodities in China continues to grow steadily. In 2011, nine companies were operating in Phongsaly, seven of which were Chinese and two were Lao. Three villages were selected as representative of the livelihood systems in Phongsaly

Province, including Yo, Deua and Chiangpee villages (Figure 2). These villages are located on road No. 1A that provides a direct link to markets in Mengla District, Xishuangbanna Dai Autonomous Prefecture, Yunnan Province, China. In 2008, district officials instructed these villages to produce dry season crops for domestic and foreign companies under contract farming arrangements. Most production areas are flat and surrounded by mountains that range from 750 to 1,700 meters a.m.s.l. The average annual temperature in the study area is 17 °C and average rainfall is about 1,778 mm. There are many ethnic groups in Boun Neua District. However, the population at the research site is ethnic Tai Lue, which mainly cultivates paddy rice in the wet season. However, the paddy fields were not being used in the dry season. Chinese entrepreneurs introduced dry season crops to local farmers for which markets exist in China. Subsequently crops were cultivated under contract to Chinese and Lao companies, including sugar cane, rubber, chili peppers, and passion fruit, among others.

The study selected households that produced green beans, maize, red pumpkins, and long pumpkins. These crops covered the largest area and had high market demand. All products produced by farmers under contract farming with Chinese investors were exported to China. The overall objective in the chapter is to identify agrarian livelihood changes as the result of influence from economic growth in China. At this research site the study aims to investigate and understand the driving forces that cause households to make decisions resulting in changed livelihood systems; from subsistence livelihoods to a monetized lifestyle or a cash economy; and, to understand how farmers respond and adapt to these changes by modifying their livelihood strategies to achieve improved livelihoods.

1.7 Research framework

From a review of the literature on livelihood and sustainable livelihood, attention is focused on three main elements: 1) the history of livelihood studies, including the concept of livelihood and definition of the term; 2) an understanding of the Sustainable Livelihood Framework, with particular focus on internal and external factors that affect the livelihoods of rural people and typical interactions between these important factors; and, 3) livelihood perspective and previous studies by scholars from different disciplines. The literature review is intended to clarify concepts, information, and results from previous experience, research, and studies undertaken in many developing countries including Southeast Asia. The literature review also identifies the research gaps in "rural livelihood".

This section provides the most appropriate framework for objectively describing, understanding, and explaining livelihood changes in northern Laos, where rural livelihoods face uncertainty and is rapidly changing as the result of vulnerability to climate change and economic growth.

The study uses the concept of livelihood with a particular focus on rural livelihood changes. Understanding livelihood changes is challenging since it rarely affects all households equally. ODI (1999) argues that there are two causes of changes, namely: 1) External factors that are seen as shocks, trends and cycles. Shock has a rapid result and immediate impacts. For example, diseases and storms among others. Trends have a longer impact, such as land productivity declining as a result of soil erosion and lower fertility. Changes result from outside the household, including changes in market prices and the structure of the economy among others. 2) Factors that occur at different levels. This refers to internal household factors such as the natural cycle of the family, illness, and changes in preferences, priorities, and management abilities of a family. On

the one hand, the combination of the internal and the external factors determine livelihood strategies and impact livelihood outcomes. Internal factors include household capital assets which poor households try to access including both material and social resources. External factors refer to the vulnerability context, which comprises trends, stress, and shocks to which a household can be exposed. For the purposes of this study, trends refer to the influence of economic growth in China, and shock refers to climate change (Figure 4). These are real factors of changes in upland and lowland situations in northern Laos. However, land use and environmental changes, market integration, policy change, and other issues also are important. Internal factors refer to livelihood in which poor households attempt to access resources, including both material and social resources.

The research framework identifies the changes in lowland areas resulting from external factors such as economic growth; and, the changes in access to livelihood assets (internal factors) in upland areas resulting from climate change at both locations. External factors and internal factors then jointly influence the change in household strategies. Changes in external factors, internal factors, and household strategies at the same time affect livelihood outcomes. People with less ability to access to capital assets experienced negative outcomes. Conversely, people with sufficient access to capital assets tended to have better or positive outcomes.

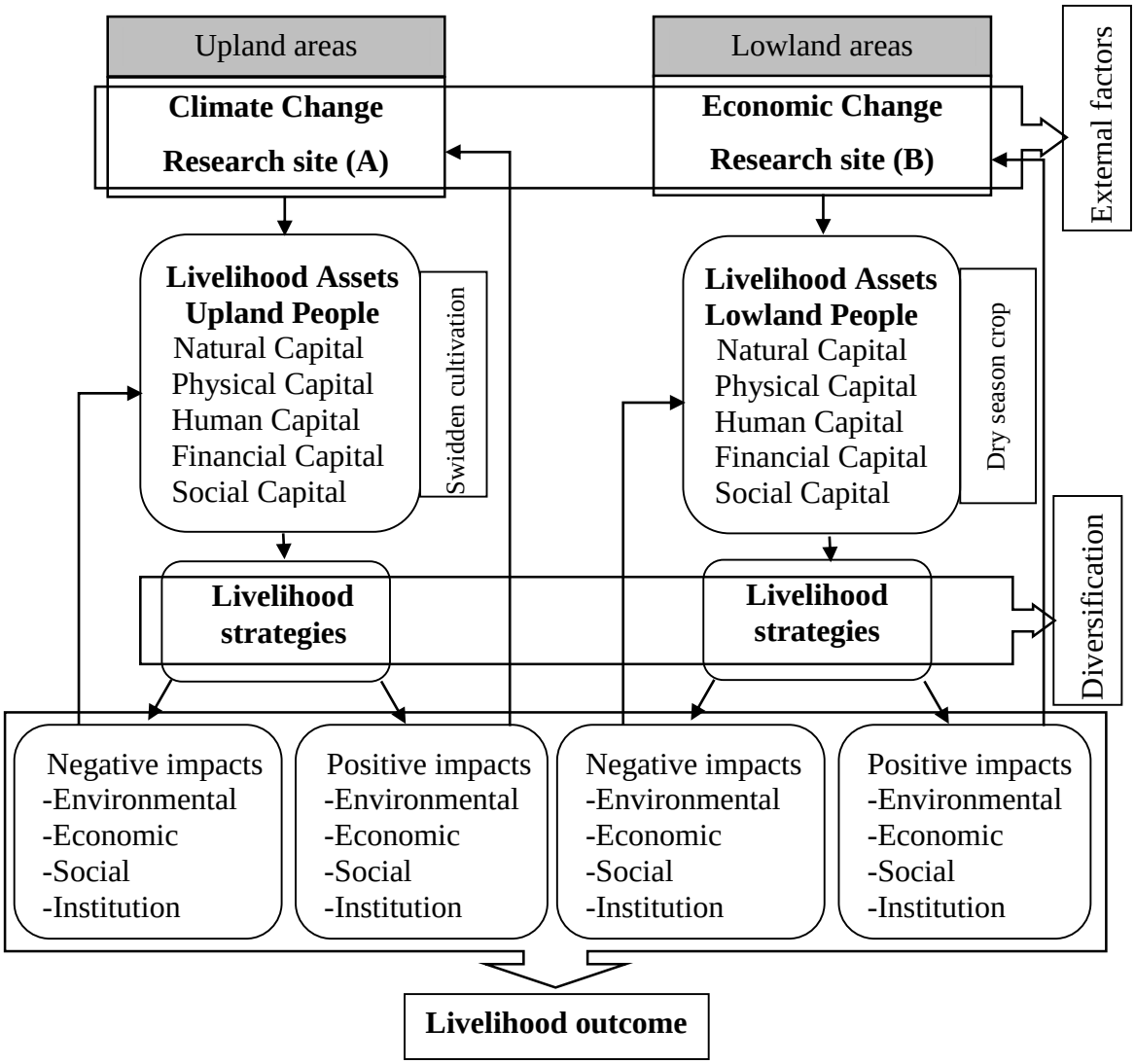


Figure 4 A research framework

Source: Drawing by the author

Chapter II Livelihood Factors and Household Strategy for an Unexpected Climate Event in Upland Northern Laos

Chapter II introduces a case study on changes in upland livelihood as a result of climate events. This chapter focuses on household coping strategies in response to the early onset of the wet season (short-term impacts from a climate event). The coping strategies aim to secure food and income during climate event years. The important factors that enhance the ability for rural people to cope with the early onset of rainfall, and the strategies they adopt in response to the influence of an unexpected climate event are discussed.

2.1 Introduction

In northern Laos, there are few areas of flatland and many steep mountains. The inhabitants often engage in subsistence upland rice farming using swidden agriculture practices. Upland rice is the major crop for household consumption. Therefore, securing a sufficient supply of rice dominates the livelihood strategy adopted rural areas (Ingxay 2005). Swidden agriculture practices reflect an agricultural production system that consists of slashing and burning of regenerating forest land, planting rice, weeding-out grass, and harvesting the rice. Among these activities in northern Laos, land preparation, such as slashing and burning of fallow forests or shrub vegetation annually in March (at the end of the dry season), is an activity that is sensitive to climatic events. This is because villagers must burn-off shrubs during the driest period at the end of the dry season, before the onset of the wet season.

From an analysis of the climate in northern Laos, Kanemaru et al. (2014) found that the onset of the wet season has begun to arrive earlier and that its variability increased between 1951 and 2007. This phenomenon, caused by climate change, has

been generally observed in mainland Southeast Asia under the influence of the monsoon. If the sea surface temperature (SST) of the Indian Ocean increases and that of the western Pacific Ocean SST decreases, the summer monsoon becomes weaker. If the situation is reversed, the result is a strong summer monsoon (Kanemaru et al. 2014).

Climate change has become remarkably evident in northern Laos. Some households were able to cope with the changed situation caused by early onset of the wet season in 2011, particularly adjusting rice cultivation activities; while others could not. Identifying different strategies to cope with rice insufficiency as a result of climate events is important to rural development in the northern region. Understanding the specific climate event and adjusting to the early onset of the wet season are important for comprehending vulnerability in response to future climate change. This is because some social factors may have similar impacts in the future (Kelly and Adger 2000, Eriksen and Silva 2009). However, the stress caused by climate change (including drought and flooding) and early onset of the wet season require consideration. In addition, stress occurs only once a year in most cases, and determining how inhabitants address those issues within a short period is necessary.

The impacts of climate change and early onset of the wet season are increasing in northern Laos. However, not only northern Laos is affected by the early onset of the wet season, affects not only northern Laos but also other countries where inhabitants are heavily dependent on natural resources and traditional rainfed agriculture for their livelihoods. The present study focuses on household coping strategies in response to an earlier wet season (with short-term impacts from a climate event); the strategies were aimed at obtaining rice sufficiency and income for a one-year period. The objectives of the study are to: (1) identify important factors that enhance the ability of people to cope and to achieve rice self-sufficiency; and, (2) identify strategies people employed in

response to rice insufficiency resulting from an unexpected climate event and the early wet season. In this study, "coping with the climate event" refers to responding to rice insufficiency as a result of the early onset of the wet season.

2.2 Methodology

Household data were collected via a household survey as well as semi-structured and structured interviews. In addition, participatory group discussions also were carried out. The household data are quantitative and qualitative. The household interviews focused on farmers' basic socioeconomic characteristics. In June 2011, the first interviews were held with heads of 63 households that were randomly selected from the 95 households in the village. Data relating to the households in 2010 were collected during interviews in June 2011. In February 2012, a second set of interviews was conducted with the same interviewees to obtain household data for 2011. Two group discussions were held after the interviews. Separate discussions took place for participants who had sufficient rice and those who did not. The group discussions were held to hear farmers' perceptions of climate events at the research site.

As mentioned above, the 2011 climate event, an early onset of the wet season in March, had important impacts on upland rice cultivation. Most households could not burn fallow forest after slashing and therefore failed to plant any crops for consumption. Therefore, household rice sufficiency is more important than the normal climate. Fundamentally, the main objective of local livelihoods in the study area is to produce sufficient rice for the household. In this sense, coping with rice insufficiency is strongly dependent on whether local people can conduct swidden cultivation.

In order to identify important factors that enhance the ability of local people to achieve rice self-sufficiency (i.e., rice sourced from their own production) given the early onset of the wet season, the 63 households were divided into two household

situations: those who successfully cultivated upland rice with early onset of the wet season (group (a), 19 households); and, those who did not (group (b), 44 households) in (Table 3).

Households that successfully cultivated upland rice were able to harvest a rice crop even with early onset of the wet season. On the other hand, those who could not cultivate rice had to engage in other activities to achieve rice sufficiency. Consequently, producing upland rice is not undertaken for cash income, but to produce rice for household consumption. Whether rice production is successful is an important outcome for the local people. Discriminant analysis was used to indicate the relative importance of variable factors that were significant in determining whether a household could cope with the 2011 climate event, and to find correlations of each variable with each discriminant function between households that successfully cultivated rice under the climate event and those that did not. The goal was to find a linear combination of ratios that best discriminated household groups (a) and (b). The study used Model-based Discriminant Analysis with Variable Selection from Raftery and Dean (2006) to develop a stepwise variable selection procedure to find a subset of variables that gives favorable classification results. This method considers the inclusion of extra variables and the removal of existing variables in the model, based on their importance for classification (Murphy et al. 2008).

The result of this stepwise variable selection shows that 12 variables produced favorable classifications; about 87.3% of grouped cases were correctly classified. In general, the percentage of grouped cases correctly classified should be higher than 80% for favorable predictor variables. The 12 variables included the following: age, education, occupation, household members, primary and secondary labor activity (referring to part-time work, such as for students and older people), outside workers,

Table 3 Sample size of households with successfully cultivate rice under climate event

Situation of Upland rice cultivation	Household groups	
	Group (a)	Group (b)
Household numbers	19	44
Total sample	63	

Source: Classify by author

Note: Group (a) successfully cultivate rice under climate event and group (b) did not

paddy field area, livestock production, number of agricultural plots, total agriculture land, and market access. These variables created a linear combination of the weighting and scores by a discriminant function. Factor loading (Rank) and significance of difference (F value) were used to indicate the most important variables.

In addition, if villagers could cultivate upland rice, they only need to collect food for side dishes. If they cannot cultivate this rice, they must earn money to buy rice, which is the second objective of this chapter. In other words, to determine how people cope with rice insufficiency caused by the early onset of the wet season. In order to respond to this objective, 63 household samples were again divided into three household groups based on the impact of the 2011 climate event. These groups are the following: self-sufficient in rice production; rice shortage equal or lower than 3 months; and, rice shortage more than three months. The rice self-sufficiency production group consisted of households who could cultivate rice, even with early onset of the wet season (group I, 12 households). They had rice self-sufficiency from their own production (Table 4). The second group consisted of households with a rice shortage up to 3 months (group II, 34 households). The third group consisted of households facing a shortage of rice for over 3 months (group III, 17 households), which was similar to group II, but the period of rice shortage was longer. Households with different situations had different livelihood strategies to cope with impacts from climate events.

In 2010, most households sampled had sufficient rice: only some households faced a rice shortage of 1–3 months. In a normal climate year, it was usual for some households to face a rice shortage of up to 3 months. The author used the Statistical Package for the Social Sciences (SPSS, ver. 20) to perform two statistical analyses. A paired sample t test was conducted to examine the significance of the differences between a normal year (2010) and a climate event year (2011), sorted by groups I, II

Table 4 Sample size with classified by rice sufficiency

Rice security	Household groups		
	Group I	Group II	Group III
Household numbers	12	34	17
Total sample	63		

Source: Classify by the author

Note: Group I had rice self-sufficiency from their own production, group II had a shortage of rice of up to 3 months and group III faced a shortage of rice for over 3 months

and III, and compared household income sources. Second, I performed a one-way ANOVA to examine the significance of the differences in the livelihood strategies used by each of the three groups. The study also examined the factors that enhanced villagers' ability to cultivate rice successfully despite the early onset of the wet season.

2.3 Socioeconomic characteristic and demography

Among the 63 households sampled, the average age in group I was 50.4 years; 46.7 years old for group II; and, 47.8 years old for group III. The average number of members in each household group was 6.5 people in group I, following by group II with 5.8 people, and 4.9 people for group III. More than one-half (57.1%) of all respondents had received only primary school education; 38.1% had no education; and 4.8% had received secondary school education. The average agricultural land area was highest in group I, about 6.9 ha; followed by group III, 5.12 ha; and, 5.09 ha for group II (Table 5). All the households cultivated upland crops (including rice) as a major activity. They consumed rice as a staple food and earned their income from upland crops and livestock. In 2011, villagers who were unable to cultivate rice owing to the climate event engaged in other work and activities. The average number of people in a household who undertook outside work in 2011 was 1 person per household in group I; 1.09 people in group II; and, 0.65 person for group III. As mentioned above, the labor in each household is important for rice production. The average labor available was highest in group I, about 4.67 people; followed by group III, 2.82; and, 2.71 for group II. In addition to rice cultivation, the villagers generally raise cattle and water buffalo: on average, there were 1.65 cattle and 0.27 water buffalo per household in 2011.

2.3.1 Livelihood systems

Upland rice cultivation is the main livelihood strategy as a response to household food security. After rice cultivation for a year, the farmers let the field go to

Table 5 Basic socioeconomic characteristics classified by rice sufficiency in 2011

Independent variable	Group I	Group II	Group III
Household members (person)			
Max.	10	11	8
Min.	4	3	2
Mean	6.50	5.76	4.94
Age (year old)			
Max.	65	70	80
Min.	33	32	28
Mean	50.42	46.68	47.82
Education (person)			
Non-educated	2	14	8
Grade 1 primary school	1	2	1
Grade 2 primary school	2	6	3
Grade 3 primary school	3	2	3
Grade 4 primary school	1	1	
Grade 5 primary school	3	7	1
Grade 1 Secondary school		1	1
Grade 2 Secondary school		1	
Total number of agricultural plots (plot)			
Max.	8	10	9
Min.	2	0	0
Mean	4.33	3.44	3.35
Total agricultural land area (ha)			
Max.	13.88	22.50	15.25
Min.	2.25	0	0
Mean	6.88	5.09	5.12
Number of outside workers (person)			
Max.	2	4	4
Min.	0	0	0
Mean	1.00	1.09	0.65
Labor in household (person)			
Max.	7	4	6
Min.	3	1	1
Mean	4.67	2.71	2.82
Number of animals (cattle and buffalos)			
Max.	18	8	5
Min.	0	0	0
Mean	4.75	1.03	1.18

Source: Analysis by the author

fallow. Many types of non-timber forest products (NTFPs) may be found in the fallow forests, and they are important as a source of income during rice shortages. All these activities related to the swidden system support the rural livelihoods. The people also reared livestock such as buffalo, cattle, and poultry. Livestock is important for the household economy, especially when used as a means of generating cash to purchase agricultural tools, equipment, and clothes, and for paying for education and health services. In these cases, some households must sell their animals for cash income. If people become ill or have accidents, income from the sale of livestock is a critical source of cash. Moreover, the Khamu depend on finding additional food from fallow forest and forests with edible and medicinal plants, mushrooms, bamboo shoots, and fruit (Table 6). They also hunt and fish. People at the research site have subsistence livelihoods and consume food such as fish, chicken, small wild animals, and vegetables from their own villages and small home gardens. They buy cattle and buffalo meat once every 2 weeks from peddlers.

2.3.2 Swidden cultivation

At the research site, agricultural production systems are based on rotational systems or swidden practices. Swidden is the dominant farming system, in which dry biomass obtained by felling fallow forest or shrub vegetation is burned before the beginning of the wet season (Fox 2000). People cultivate and harvest for one or more years, and then leave the land to regenerate secondary forest (Fox 2000). On the one hand, swidden is a form of agricultural system that involves moving from one plot to another; slash-and-burn also is known as swidden (Spencer 1966). In northern Laos, agricultural production systems are based on rotational cycle systems or traditional swidden practices. As mentioned earlier, swidden fallow periods in the 1950s was about 40 years between plantings. This declined to five years in 1993 as a result of increased

Table 6 Livelihood activities and NTFPs collection at the research site

Purpose of livelihood activities		
For sell	For self-consumption	For sell and consumption
Cardamom (*Amomum* spp.)	Upland rice	Rattan shoots (*Calamus* spp.)
Peuak-meuak (*Boehmeria* spp.)	Chili	Bamboo shoots (*Indosasa sinica, Dendrocalamus* spp.)
Benzoin (*Styrax tonkinesis* spp.)	Sesame	Livestock
Broom grass (*Thysanolaena maxima*)	Taro Sweet corn Vegetable Ginger Pumpkin Fishing Hunting	Cucumber

Source: Field survey by the author in July, 2011

Note: Scientific name of NTFPs in this study had been checked based on Non-timber Forest Products handbook by NAFRI, NUoL and SNV (2007).

population density and forestry policies limiting the peoples' access to land (Roder 1997). In this context, land that is available for swidden has been decreasing. Farmers cultivate upland crops such as maize (*Zea mays*), sesame (*Sesamum indicum*), Job's tears (*Coix lacryma-jobi*), and other crops within the upland rice fields for only 1 year then move to other plots in the next season.

Farmers first select the longest fallow forest and begin to slash it in February. This is followed by burning in March and early April. After burning, they clear the land once more before planting rice in May to early June. Farmers must weed plots two to four times during the rice-growing period. Upland rice is always harvested in late September for early maturity varieties, and October and early November for late and medium maturity varieties, respectively (Figure 5).

2.3.3 Land use systems

Several decades ago swidden cultivators managed fallow periods for 20–30 years. Current fallow periods are for only 3-5 years in northern Laos. In recent years, swidden cultivation has become "short cultivation -- short fallow." Land use at the research site also changed after land and forest allocation was implemented by the Lao Government in 1996. As a result, the fallow period declined from about 10-15 years to 6-7 years. Half of the land farmers used for swidden to produce rice for their own consumption was allocated for multiple purpose forest types such as protection forest, conservation forest, regeneration forest, production forest, and degraded forest. The resulted in a significant reduction in fallow land for swidden cultivation. Most households received 3-4 plots of fallow area. During this period, people only sparsely cultivated upland rice on their own land.

However, only three or four years of fallow period are insufficient for producing forest species, vegetation, NTFPs, and other traditional crops. Long fallow periods

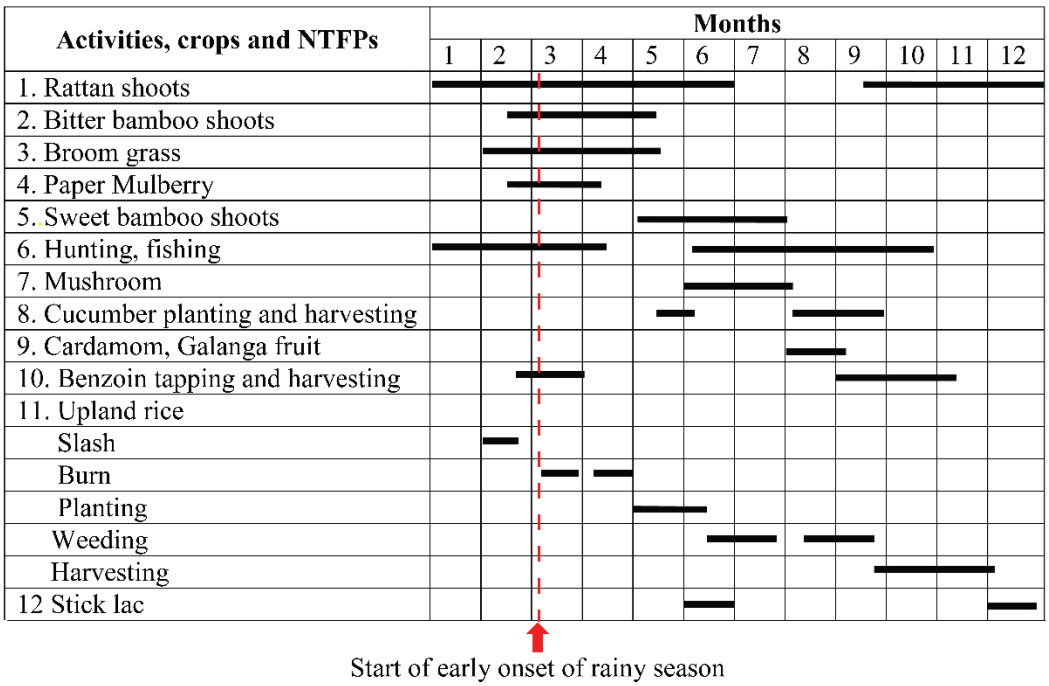


Figure 5 Seasonal calendar for Kachet village in Northern Laos

Source: Field survey by author in July, 2011

allow for the regeneration of NTFPs that are an important source of income in rural areas (Douangsavanh 2006). Thus, the long fallow period is an important indicator of sustainable swidden cultivation (Fujisaka 1991). Short fallow periods tend to decrease soil fertility and increase weed problems (Roder 1997). Therefore, land use management at the research site is considered a higher priority than production of cash crops. People at the research site divided swidden agriculture areas into seven zones and to establish the direction of the rotation cycle for the whole village. All households have to do swidden agriculture with the same direction or within the same zone each year and then move together into a new zone. People with more land must share their land with other households, even with households that have no land in each zone. This practice occurred each year. A "short cultivation–long fallow" has been practiced since 2003 until the present time. The cultivation period is only one year followed by a relatively long fallow period of at least seven years (Figure 6) at the research site.

A fallow is an important component of swidden or shifting agriculture, with multiple objectives for farmers' livelihoods. Fallows exist for a number of biological and socioeconomic reasons. For example, the restoration of soil fertility after cropping; the decrease of erosion; and, providing products from the fallow vegetation for sustaining household livelihoods. There are many products found in the fallow forest, including wood, timber, and NTFPs, among others. These products sustain livelihoods by providing food, fodder, firewood, and cash income through the sale of products. Results of the study in Kachet village showed that most farmers had important reasons for managing fallow areas. The first objective was to manage fallow land for agricultural production as well as to improve soil fertility with the aim of increasing productivity during the next cultivation cycle. The second objective is to get more benefits from the fallow field by gathering food, timber, wild animals, and NTFPs.

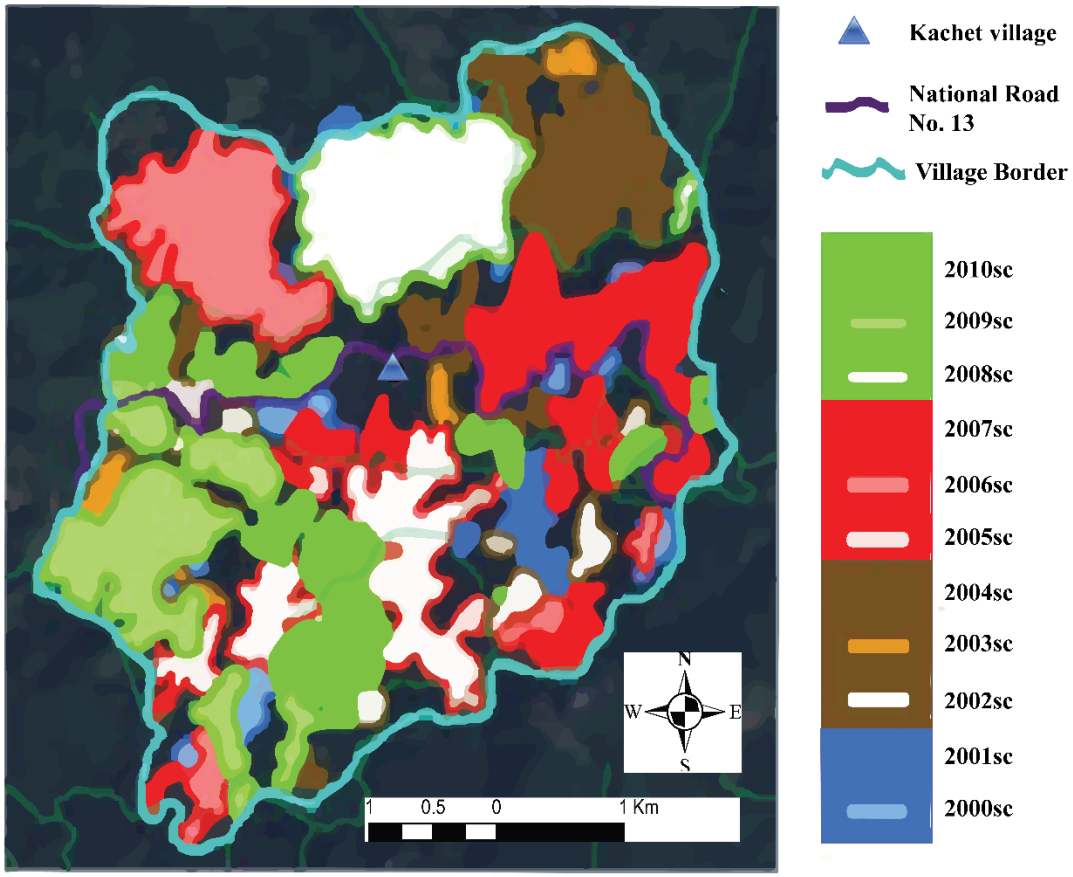


Figure 6 Swidden cultivation area at the Kachet village from 2000 to 2010

Source: Author base on Jin et al (2012)

Finally, to obtain resins produced by benzoin trees (*Nyan* in Lao or *Styrax tonkinesis* spp.). It can produce resin within six years of land being returned to fallow.

2.3.4 Collection of non-timber forest products (NTFPs)

Traditionally, after rice has been cultivated for one season, farmers move to other fields and the field most recently harvested returns to fallow. Many types of non-timber forest products (NTFPs) can be found in the fallow forests (Table 7), which are important as a source of income during rice shortages. These activities characterize the swidden system that supports rural livelihoods. There are many kinds of NTFPs at Kachet village. It is impossible to discuss all of them. However, this study has selected the main NTFPs that have economic value. Based on farmer interviews, eight NTFPs were defined as important and that are gathered and produced to generate cash income by Kachet people.

1) **Broom grass** (*Thysanolaena maxima*)

Broom grass is found in many areas including on land that has been fallow for from one to four years, but are less abundant on fallowed swidden of more than four years. Normally, boom grass is harvested between February and April. In addition, flowering stems should be harvested within a month, before they become too old. One farmer can collect 10 kg per day, twice each week. In 2010, broom grass had a high price and strong market demand, thus local people planted broom grass on fallow land where it is more easily collected than from stands of natural growth. There are 5.7 hectares of boom grass plantation in Kachet village.

2) **Bamboo shoots** (*Indosasa sinica*, *Dendrocalamus* spp.)

Bamboo shoots are an important of food and also generate income. They are found not only in Kachet village but throughout the country. There are many species of

Table 7 The most importance NTFPs and cash income products in Kachet village

Kinds of NTFPs		Local price (Kip/kg)	Fallow period (years)								
Local name	English name		1	2	3	4	5	6	7	8	9
Dok Kaen	Boom grass	3,500									
Nor mai	Bamboo shoot	5,000									
Houa Ka buk	Elephant foot yam	25,000									
Nha hak deing	-	45,000									
Mak naeng	Cardamom	60,000									
Mak kha	Galangal fruit	5,000									
Mak kha Kom	Alpinia	10,000									
Nyan	Benzoin tree	70,000									

Source: Interviewed Kachet villagers in July, 2011

Note: One U. S. Dollar (USD) was equivalent to 8,029 kip on average in 2011, and 8,269 kip in 2010 (NSC 2012).

bamboo thus making it an important source of food and use for other products in Kachet village. Farmers usually harvest only five species of bamboo, including bitter bamboo (*Indosasa sinica*), sweet bamboo (*Dendrocalamus* spp.), and others. They produce shoots during different times Bitter bamboo is harvested in February, for example, while sweet bamboo and others are harvested in May to July. Some species are harvested beginning in July to the end of August. Kachet villagers have easy access to the bamboo market because one trader who represents a Chinese bamboo drying factory located in Pak Mong village, Nam Bak District, comes to buy bamboo shoots every day during the harvesting period. There is a high demand for bitter bamboo among urban residents in Laos, causing its price to be higher than other species of bamboo in the early part of the season; it is 5,000 kip per kg, while other species is 500 kip per kg of husked shoots.

3) **Elephant foot yam** (*Amorphophallus* spp.)

This root known as *Houa Ka Buk* in Lao is a relatively new potential cash crop, harvested for only the past ten years. Famers have long known about this root as a food crop eaten when rice was insufficient in some years. Normally it is found in areas left fallow for four years or more. The tubers can be harvested year-round, but the local market is best in January when Chinese traders come to buy. The tuber weighs from four to ten kilograms or 0.8-1 kg per dried slice.

4) **Cardamom** (*Amomum* spp.)

The author conducted a field survey from the end of July to the beginning August 2012. During this period cardamom is an important cash product. Cardamom usually is harvested from July to early October. However, in Kachet village harvesting is controlled by the village headman, who informs villagers of days for the harvest. In 2013, farmers could collect cardamom every day in July only, even though cardamom

can be harvested from July to October. The number of cardamom trees continues to decline compared to five years ago. Therefore, villagers decided to harvest cardamom only in July in order to protect the cardamom species. One person can collect an average of four to six kilograms of cardamom seeds (dry) per year.

5) **Galangal fruit** (*Alpinia galanga*)

This fruit is used also as an herb. Galangal fruits are sold mainly to Chinese traders. The roots and shoots also are local food items, known locally as *Mak Kha*. They usually are collected and harvested toward the end of July until early October. Galangal is planted in upland fields mixed with rice. However, some grow naturally in areas that are fallow for at least four years. In recent years, Galangal roots and fruits have brought high prices, resulting in people cultivating Galangal as a commercial crop. The average local price is 5,000 kip/kg for dry fruit.

6) **Benzoin resin** (*Styrax tonkinesis* spp.)

From a case study by FAO, only two districts in Luang Prabang Province, including Nam Bak and Ngoy districts have benzoin trees (Kashio and Johnson 2001). The trees emerge after upland rice fields are slashed and burned. One month following the planting of upland rice, young Styrax seedlings are allowed to grow mixed with weeds during upland rice production (Takeda 2004). After upland rice is harvested, farmers abandon the benzoin trees to grow on the fallow fields.

Normally, benzoin can be harvested from Styrax trees that are five or six years old. Kachet villagers traditionally have collected benzoin from Styrax trees integrated with swidden. They do not cultivate Styrax as a commercial tree. Benzoin is a NTFP that serves as a source of cash income for villagers. More recently, population pressure has caused land degradation and some government policies have reduced fallow periods. When land use planning was carried out in 1996, most households in Kachet

village received a limited number of plots. In some case, the fallow period has been reduced from 15 to seven years, while in some areas fallow has been reduced to only two or four years. Thus, not all households have Styrax trees.

Based on interviews of local residents, four years ago benzoin became a less important NTFP for villagers' incomes when the price of resin decreased. As a result, Kachet villagers stopped tapping benzoin. Benzoin became an important source of income again in 2010 when the domestic price increased to about 60,000 to 70,000 kip/kg and the owners of benzoin trees start tapping the Styrax trees once again.

Based on household data, some 30-40 kg of benzoin is collected per hectare each year by each household from Styrax stands in fallows of six to seven years. Some 2.1-2.8 million kip/ha/year can be earned. Benzoin from Styrax trees on land of eight to ten years fallow have one-third greater productivity from 250-300 trees/ha or about 70-100 kg or 5-7 million kip/ha/year. One kilogram of resin was 70,000 kip in 2011.

2.4 Impact of climate events on livelihoods

2.4.1 Rice shortage

Villagers had clear memories of 2011, which was marked by an unexpected and significant disturbance in village food production. According to interviews in 2011, 19 of the 63 households successfully cultivated rice despite early onset of the wet season. However, 44 households stated that the March onset of the rainy season badly affected their swidden cultivation: they were unable to burn slashed forest on fallow land to create upland fields. Compared with 2010, the dry season upland crops of rice, maize, taro, pumpkins, and cucumbers decreased by 92% (142 ha). In 2011, among the 19 households that successfully cultivated rice, 12 households had sufficient rice from their own production (Table 8); while the remaining seven households were unable to produce sufficient rice. The respondents indicated that the average rice yield was

Table 8 Rice insufficiency at the research site

Household groups	The 2010 normal climate		The 2011 climate event	
	Month of shortage rice	HHs	Month of shortage rice	HHs
Group I	None	12	None	12**
Group II	None	29	None	-
	1	4	1	17
	2	-	2	6(1*)
	3	1	3	11(2*)
Group III	None	9	None	-
	1	4	1	-
	2	3	2	-
	3	1	3	-
	4	-	4	7(2*)
	5	-	5	5(1*)
	6	-	6	2(1*)
	7	-	7	1
	8	-	8	-
	9	-	9	2

Source: Household survey by the author in July, 2012

Notes: * households could cultivate rice, but not sufficient rice in the 2011 climate event; ** households could cultivate rice and had sufficient rice in the 2011 climate event.

about 1.4 tons/ha in 2010; compared to only about 0.9 tons/ha in 2011. The latter amount would be sufficient for seven or eight months for households with four to five members. The respondents stated that a major reason for the low rice yield was lack of labor for weeding.

In 2011, 51 households faced a rice shortage; the range was from one to nine months deficit. This was the reverse situation to the normal year of 2010, when 50 of the 63 households had sufficient rice (Table 8); then, only 13 households had insufficient rice, and the range was one to three months. In 2010, respondents explained their low rice yield as being due to a shortage of labor for weeding. Another reason was a lack of land for cultivation. Such households normally obtained rice from relatives and repaid them by providing labor.

The rice shortages continued until September 2012—especially among households that were unable to cultivate rice in 2011. In 2011, the villagers still had rice left over from 2010. In 2012, 12 households had rice because they had been able to cultivate it in 2011. However, other households faced a rice shortage from September 2011 to September 2012.

2.4.2 Livestock production

In the study area, livestock production is an important activity for Khamu male heads of households and the household economy. Villagers generally raise cattle, water buffalo, pigs, chickens, and ducks. Cattle and water buffalo are raised in traditional fashion, particularly in fallow forests and forested areas after the harvest (Photo 1), with villagers providing care for them two or three times a week. In all, 42% of the households raised cattle: 10% raised water buffalo, 59% poultry, and 59% pigs. The respondents reported that in the early start of the wet season heavy rain fell from March to June 2011. This resulted in outbreaks of foot-and-mouth and other livestock diseases

Photo 1 Livestock system based on traditional production

Source: Taking by Yokoyama (2011)

following which about 415 of the 619 poultry, 43 of the 96 cattle, 20 of the 99 pigs, and 4 of the 17 water buffalo died. Temperature and rainfall have a statistically significant correlation with foot-and-mouth disease (Hii et al. 2011). The villagers have access to veterinary medicine, but do not use it owing to the expense; they also lack knowledge about animal nutrition and health maintenance.

2.4.3 Collection of NTFPs

In addition to the rice shortage and animal health problems, the early onset of the wet season in March 2011 reduced income earned from the sale of NTFPs, which represents an important part of household income. However, NTFPs accounted for 42% of total household income in 2011, a slight increase over 40% in 2010. The most important NTFPs—benzoin resin and broom grass—could not be harvested owing to the early rain. Benzoin trees are tapped from August to September, and the resin harvested from March to April (sometimes as late as May) the following year. Almost 60% of respondents stated that they owned Styrax trees that produced benzoin on fallow forest land, but only five households were able to harvest benzoin resin before the onset of the wet season (Photo 2). Broom grass is a fallow plant rather than a typical NTFP, but it is important as a source of income during rice shortages. In Kachet, cardamom, bark of *boehmeria malabarica (Boehmeria* spp.) or peuak-meuak (local name), benzoin, and broom grass are harvested for sale in local markets, whereas bamboo and rattan shoots are collected for both consumption and sale.

Group discussions with the respondents and village authorities revealed that the locals had a very clear memory of years when the wet season came early; which had occurred a long time earlier. The villagers said that such years were associated with shorter cold periods of about one or two months, while three to four months is the normal cold season at the research site. The group discussions suggested that the main

(a) The 2010 normal climate (b) The 2011 climate event

Photo 2 Benzoin resin in normal climate (a) and benzoin resin in climate event (b)

Source: Taking by author in June, 2010 (a) and July, 2011 (b)

concern among the villagers was about crop production rather than climate change. That was because many other villages around Kachet had adopted hybrid maize production introduced by outside investors. Such villages were able to generate income mainly from agriculture, whereas the Kachet villagers earned money mainly through NTFP collection.

2.5 Factors that enhance the ability of rural people to cope with climate change

A summary of discriminant analysis (Table 9) provides descriptive statistics of 12 independent/predictor variables for each outcome group (a) and (b), separately and for the entire sample. The Tests of Equality of Group Means showed that 12 independent or predictor variables were statistically viable, namely: age, education, occupation, household members, primary and secondary labor activity (referring to part-time work, such as students and older people), outside workers, paddy field area, livestock production, number of agricultural plots, total agriculture land, and market access; because $\lambda = 0.518$, $x2 = 36.19$, and $P < .001$ under the discriminant function. Of the 12 variables, three had statistically significant relationships between groups (a) and (b): primary and secondary labor within the household and livestock production. This indicates that the model with 12 predictor variables was able to discriminate between the two groups with significance.

F values indicate the probability of significant separation between the scores of groups (a) and (b) under the climate event, and are shown in Table 9 with the level of significance. These values are significant at the 0.001 level for primary labor in the household, 0.01 level for secondary labor in the household, and 0.05 level for livestock production variables. Household primary labor had the highest F value at 36.836, followed by secondary labor at 7.179 and 6.380 for livestock production.

The unstandardized and standardized canonical discriminant functions show

Table 9 Summary of interpretation for discriminant analysis

Independent variable	Unstandardized	Standardized	Discriminant loading (rank)	F value
Household members	−.143	−.283	.167 (7)	1.579
Age	−.012	−.147	−.021 (12)	.025
Education	.075	.156	.179 (4)	1.811
Occupation	−.153	−.077	−.087 (10)	.428
Total number of agricultural plots	−.070	−.156	.177 (6)	1.787
Total agricultural land area (ha)	.050	.244	.143 (8)	1.156
Number of outside workers	−.388	−.412	−.038 (11)	.080
Primary labor in household	1.137	1.228	.805 (1)	36.836***
Secondary labor in household	.071	.093	−.356 (2)	7.179**
Irrigation paddy field area (ha)	−.594	−.238	.178 (5)	1.801
Number of cattle and buffalos	.039	.131	.335 (3)	6.380*
Access to market	−.021	−.312	−.094 (9)	.498

Source: Analysis by author

* mean significant difference at < 0.05, ** at < 0.01, and *** at < 0.001.

Percentage of grouped cases correctly classified: 87.3%

Note: Primary labor refers to full-time household activities, and secondary labor is part-time household activities, including children and elderly

that only household primary labor was weighted heavily towards maximizing discrimination between the two groups. The paddy field area variable was the second weight factor for the unstandardized canonical discriminant function, and the number of workers outside the household was the second factor for maximizing the standardized canonical discriminant function between the two groups. However, the structure matrix or discriminant loading performed well at isolating the most important variables for determining whether local people could cultivate rice as a response to the climate event. The structure matrix suggests that primary household labor (0.81), secondary household labor (−0.36), and livestock production (0.34) were the most important independent/predictor variables for determining whether respondents could cope with the climate event. These variables are considered factors that enhance the ability of local people to successfully cultivate upland rice for self-sufficiency under early rainfall onset. Other independent variables are poor predictors, and they did not play a role in discriminating successfully cultivated rice under the early onset of the wet season at the research site. I believe that independent variables that had no significant difference (such as age, education, and others) are important factors for local livelihoods in a normal climate, but they were not important factors that enhance the ability of locals to cope with early wet season onset.

The discriminant function shows 48.21% of group variance between group (a) and (b). However, structure matrix suggests that household primary and secondary labor and livestock production had the highest discriminant loadings, whereas other independent variables were poor predictors. The classification results show that 87.3% of favorable predictor variables were correctly classified.

2.6 Livelihood strategies under the influence of unexpected climate events

Examining household livelihood strategies is a means of understanding how

people at the research site responded to the early onset of the wet season. In this section, the author describes and compares livelihood strategies of three household groups I, II and III between the 2010 normal climate and 2011 climate event.

2.6.1 Changes in labor force and outside workers

The average household labor force was largest in group I: 3.42 people in 2010 and 4.67 in 2011; group III had 2.53 people in 2010 and 2.82 in 2011; and, group II had 2.41 people in 2010 and 2.71 in 2011. Thus, the labor force per household showed no significant difference between 2010 and 2011 for groups I and III. The average household labor force in group II showed a significant difference at the 0.05 level during the same period. However, the results of statistical analyses showed that the average number in the labor force was significantly different among the three household groups at <0.001 for both 2010 and 2011 (Table 10). Labor exchange is commonly practiced in northern Laos in rice production activities such as slashing, planting, weeding, and harvesting. In 2011, that system was not applied owing to the shortage of labor and difficulty for villagers to conduct swidden farming. Another reason for the shortage of labor in Kachet was outside work in urban areas.

The average numbers of outside workers in group I households showed a significant difference at 0.01 between 2010 and 2011: there were 0.58 workers per household in 2010 and 1.00 worker in 2011. Those figures for group II also displayed a significant difference between the years at the 0.05 level: 0.68 workers per household in 2010 and 1.09 in 2011. However, the average number of outside workers did show a significant difference in group III households: 0.47 workers in 2010 and 0.65 in 2011. There was no significant difference among the three household groups for the average number of outside workers in both 2010 and 2011. Normally, the villagers start outside work after planting rice from May to June. However, in 2011, the early start of the rainy

Table 10 Comparison of livelihood strategies among group I, II, and III in 2010 and 2011

Livelihood Strategies		Group I		T-Test	Group II		T-Test	Group III		T-Test	One-way ANOVA
		Mean	SD		Mean	SD		Mean	SD		
Total NTFPs income (kip)	2010	3,498,446	1,072,254	4.125**	2,757,368	1,076,265	1.562	3,089,794	1,357,878	2.879*	1.908
	2011	2,846,529	685,951		2,572,265	760,138		2,521,412	978,421		0.64
Total crop production income (kip)	2010	950,000	889,842	1.925	1,079,412	997,810	6.255***	1,123,529	2,064,743	2.165*	0.61
	2011	625,000	864,581		8,824	51,450		88,235	196,476		11.592***
Total animals income (kip)	2010	1,295,000	1,525,048	1.915	1,543,529	2,050,444	2.777*	873,529	1,707,714	1.512	0.724
	2011	739,167	968,527		859,412	1,037,511		511,765	945,140		0.683
Total off-farm income (kip)	2010	691,667	955,804	1.798	1,791,765	2,565,760	1.729	2,119,118	2,622,581	-0.027	1.371
	2011	208,333	320,393		1,529,412	2,121,692		2,124,471	2,409,624		2.602
Total outside work income (kip)	2010	895,833	1,388,665	-1.598	1,335,882	2,573,081	-1.341	894,118	1,417,070	0.594	0.336
	2011	1,800,000	2,242,158		2,008,824	2,522,429		641,176	1,090,332		2.300
Total household income (kip)	2010	7,330,946	3,506,178	1.418	8,507,956	4,166,211	2.517*	8,100,088	4,904,955	2.832*	0.341
	2011	6,219,029	2,757,273		6,978,735	3,007,893		5,671,118	2,458,826		1.278
Number of household labors (person)	2010	3.42	1.16	-2.159	2.41	0.70	-2.693*	2.53	1.01	-0.677	5.834***
	2011	4.67	1.50		2.71	0.80		2.82	1.42		13.821***
Number of outside workers (person)	2010	0.58	0.79	-4.486**	0.68	1.15	2.963*	0.47	0.62	-1.319	0.774
	2011	1.00	0.95		1.09	1.06		0.65	1.11		1.009
Number of livestock (cattle and buffalos)	2010	6.42	9.63	1.530	2.15	3.23	3.753**	1.53	2.40	1.461	6.885**
	2011	4.75	6.15		1.03	1.78		1.18	1.78		4.094*

Source: Analysis by the author

Note: * Mean significant difference at 0.05 level, ** at 0.01 level, and *** at 0.001 level. One U. S. Dollar (USD) was equivalent to 8,029 kip on average in 2011, and 8,269 kip in 2010 (2010 had normal climate condition, and 2011 early onset of rainy season)

season in March resulted in a failure to burn forest, and so the villagers had to start outside work earlier. As noted above, 44 of the households were unable to cultivate rice in 2011, and so household labor was available to earn additional income outside the village; the other households devoted their labor to rice cultivation. In 2011, the daily income outside Kachet was about 50,000 kip (6.2 USD), whereas in the village it was about 30,000 kip (3.7 USD). The income outside the village was thus higher than in the village. In addition, interviews indicated that the villagers began working outside Kachet in 2005, when the daily rate for labor increased slightly to 15,000 kip (0.7 USD); that figure increased to about 50,000 kip (6.2 USD) in 2011 along with commodity prices.

2.6.2 Change in household income

In a normal climate year, Kachet villagers frequently made use of their natural environment for such materials as NTFPs, mainly for local markets and household consumption. As noted, rice cultivation was the main household activity, and achieving rice sufficiency based on swidden agriculture was the principal livelihood strategy in Kachet. The villagers also raised livestock to support household income. Livestock are considered a means of short-term saving, and they are sold when the owners need money. The heads of households commonly undertake off-farm activities, such as carpentry, tree planting, and roadside trading, after the rice harvest in September. Outside work is also important for generating income. The villagers work in construction sites, factories, and restaurants in urban areas. Most children in Kachet drop out of school to work outside the village: the main reasons are that households lack the financial resources to support their children's education and that those children want to avoid agricultural work.

In 2010, the greatest contribution to total household income was NTFPs. In

group I, NTFPs contributed approximately 48% of income followed by livestock raising at 18%, crop production at 13%, outside work at 12%, and off-farm activities at 9% (Figure 7). In group II households, NTFPs assumed the greatest proportion of total income at about 32%; this was followed by off-farm activities at 21%, livestock production at 18%, outside work at 16%, and crop production at 13%. Group III households showed the highest proportion of income from NTFPs at about 38%; that was followed by off-farm activities at 26%, crop production at 14%, and livestock and outside work at 11% each.

At the early onset of the wet season, households with different livelihood conditions adopted varying livelihood strategies to cope with the unexpected circumstances. The villagers modified their livelihood activities in response to the climate event; some households combined two or three activities. The climate event affected the sources of income in each household group. In group I households, NTFPs again assumed the greatest proportion of total income—at about 46%; followed by outside work at 29%, livestock production at 12%, crop production at 10%, and off-farm activities at 3%. In group II, the leading source of income was also NTFPs—about 37% of the total; followed by outside work at about 29%, off-farm activities at 22%, and livestock production at 12% (Figure 7). Crop production was absent in this group as an income source. In group III, there was little change in the income proportions: NTFP income remained the highest component at about 44%; off-farm activities accounted for 34%, outside work 11%, livestock production 9%, and crop production 2%.

In 2010, there were differences in the size of the labor force among the three household groups, though there were no differences in the sources of income. In 2011, however, each household group showed differences in both the size of the labor force

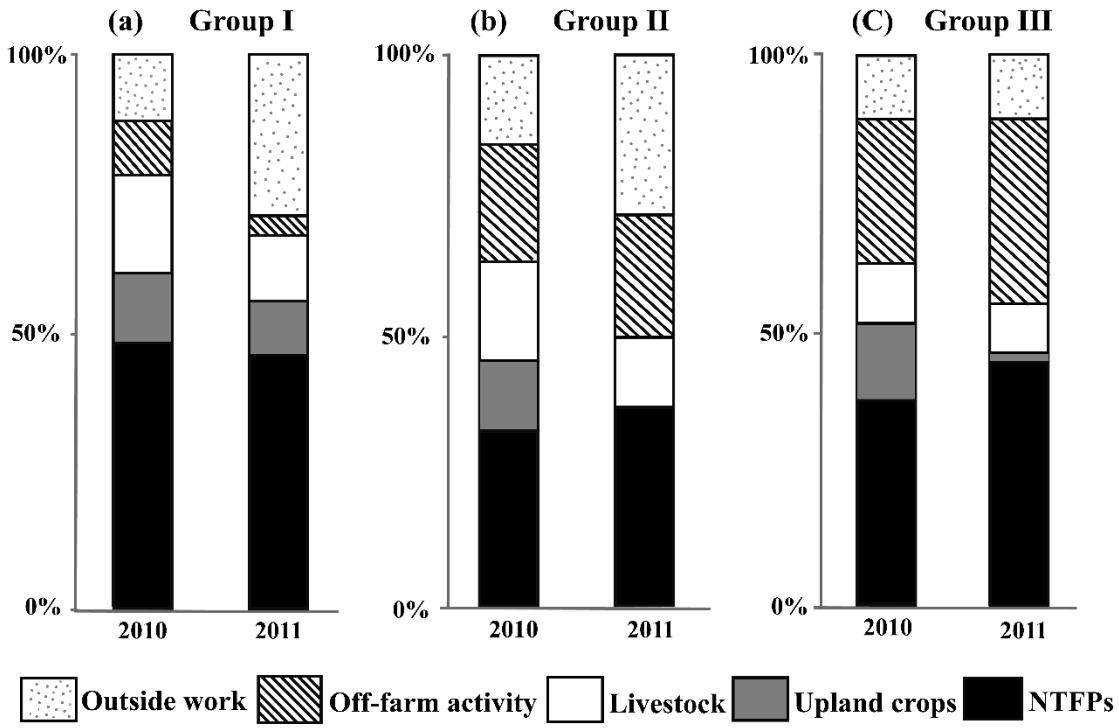


Figure 7 Proportion of incomes by economic activity in 2010 and 2011

Source: Analysis by the author

and in income sources. Despite the early onset of the wet season, there were no changes in the source of household income in group I between 2010 and 2011. In group II, time and labor were devoted to NTFP collection, outside work, and off-farm activities, but not on upland crop production. Accordingly, income from crop production vanished in group II, and it almost disappeared in group III. This result indicates that the climate event exerted a direct change on livelihood activities in households with a lower labor force; however, households with a greater labor force were unaffected. Thus, the number of household activities declined in groups II and III, though it was the same in group I. However, the proportion of activities in each household group changed.

2.6.3 Changes in livelihood strategies

Modifications in household livelihood strategies offer a means of analyzing how the villagers responded to the early onset of the wet season. This section examines the livelihood strategies of the three household groups following the unexpected climate event in 2011.

1) Group I changes

The paired sample t test showed a significant difference in the average income from NTFPs between 2010 and 2011 at <0.01; however, there were no significant differences in crop and livestock production, off-farm activities, and outside work between 2010 and 2011 (Table 10). Income from NTFPs, crop and livestock production, and off-farm activities displayed a slight decline from 2010 to 2011. Income from outside work showed no significant difference between 2010 and 2011; however, remittances were high in 2011—approximately 1,800,000 kip (224 USD)—compared to 895,833 kip (111 USD) in 2010 (Figure 8).

More villagers left Kachet to earn money by working in urban areas or other provinces in 2011 than in 2010. Income from NTFPs decreased from 3,498,446 kip

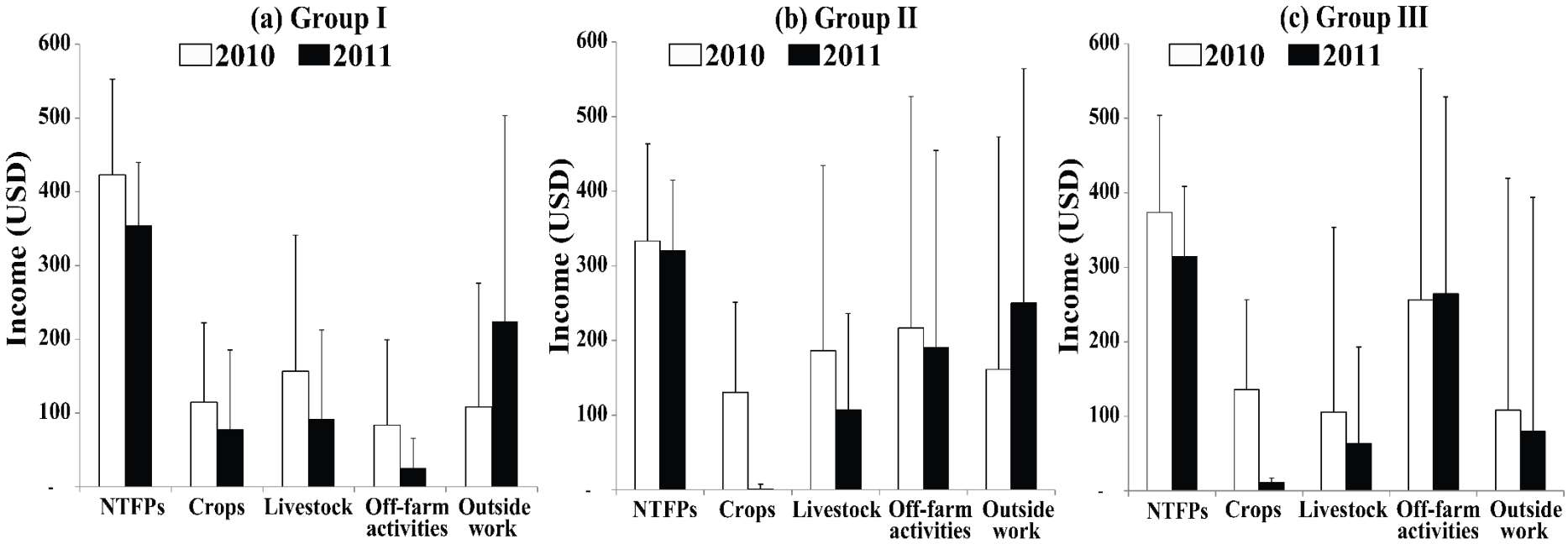


Figure 8 Average household incomes by economic activity in 2010 and 2011

Source: Analysis by the author

Note: One U. S. Dollar (USD) was equivalent to 8,029 kip on average in 2011, and 8,269 kip in 2010 (NSC 2012).

(435 USD) in 2010, to 2,846,529 (355 USD) in 2011. This was because group I respondents put more labor into rice cultivation activities, especially on land preparation: in 2011, on average 100 person-days/ha were required for land preparation by hand rather than by burning. The group I respondents also devoted time to crop production and engaged in outside work. The reason for the lower income from NTFPs was that the early start of the wet season in March prevented harvesting of important NTFPs, such as benzoin and broom grass, from March to April. Accordingly, household income from NTFPs declined slightly in each group from 2010 to 2011; however, the proportion of such income showed an increase in groups II and III. Group I households—with rice self-sufficiency—had greater access to NTFPs and more opportunities to earn income from outside work. They still tended to work on agricultural activities, including crop and livestock production, following the climate event. NTFP collection and livestock production were the principal means for group I households to cope with non-climatic factors such as food consumption.

2) Group II changes

In group II households, which suffered a rice shortage of up to 3 months, there was no significant difference in income from NTFPs, off-farm activities, and outside work between 2010 and 2011. During that period, however, there were significant differences in crop production at <0.001 and livestock production at 0.05. As noted above, such upland crops as rice, taro, large gourds, chilies, pumpkins, cassava, and cucumbers are commonly produced in the same plots. In Kachet, only cucumbers are cultivated for sale in markets. In 2011, group II households were unable to cultivate rice or plant any other crops for their own consumption or market sale. Income from livestock also showed a significant change following the 2011 climate event. After the climate event, foot-and-mouth disease killed almost 50% of village cattle, which were

more widely raised in Kachet than buffalo. Some owners were still able to sell their cattle at market, but at a reduced price because of the disease. Income from livestock production therefore decreased slightly in each household group. Group II households combined many activities to achieve their livelihood objectives by responding to economic changes in the normal climate year and coping with the rice insufficiency in 2011. Those households showed a greater likelihood to work outside the village and engage in off-farm activities to generate income as well as gain income from livestock production to cope with the climate event.

3) Group III changes

In group III households, income from NTFPs and crop production between 2010 and 2011 was significantly different at the 0.05 level, whereas income from livestock, off-farm activities, and outside work did not show a significant difference. There was a slight decrease in income from NTFPs—from 3,089,794 kip (385 USD) in 2010 to 2,521,412 kip (314 USD) in 2011. Kachet villagers normally collect bamboo and rattan shoots for their own consumption and for sale to markets. In 2011, the villagers sold those shoots rather than consuming them. During a rice shortage, the villagers usually eat maize or cassava instead of shoots and rice. In both 2011 and 2010, off-farm activities were more important in group III households than in the other groups. Such activities included logging, carpentry, and NTFP trading and were a common means of generating household income in Kachet. The average income from off-farm activities in group III showed no statistically significant difference from 2010—2,119,118 kip (264 USD)—to 2011—2,124,471 kip (265 USD). Other sources of household income also declined slightly. Group III households tended to engage in off-farm activities such as tree planting, carpentry, and unskilled work. However, this group had greater access to NTFPs. This group used a combination of activities to cope with unexpected events.

They did not undertake different livelihood activities in the normal climate year compared with 2011, but the proportion of each activity differed.

In 2010, there was no significant difference in the sources of income among the three household groups. In 2011, income from crop production showed a significant difference at <0.001, though there were no significant differences in other sources of income among the three households groups. The average income from crop production was highest in group I, followed by groups III and II (Table 10). Total household income was highest in group II, though group II had a smaller labor force than the other groups. This indicates that households with a smaller labor force tended to engage in more intensive activities rather than livelihood activities following the climate event.

2.7 Discussion

There was a clear reduction in upland rice cultivation as a result of the climate event in northern Laos. The present study on upland livelihoods examined the immediate impacts of the early start of the wet season and the response of local people using short-term coping strategies. The findings raise important issues related to short-term coping strategies, which are as important as long-term adaptation strategies. I identified the factors that enhanced the villagers' ability to cope with short-term impacts, particularly rice insufficiency, and the factors that may also be useful with respect to long-term changes. The findings suggest that diversity of local activities is a fundamental characteristic for coping with short-term impacts, especially for rural households whose livelihoods are heavily dependent on swidden agriculture.

2.7.1 Household factors

Many case studies have dealt with climate change and rural livelihoods. They include sustainable livelihoods and inhabitants' vulnerability in the face of coastal hazards in Borongan, Philippines (Gaillard et al. 2009); multipurpose agroforestry as

an option for farmers to adapt to climate change in Ha Tinh Province, Vietnam (Nguyen et al. 2013); and, adaptation to environmental risks in coastal northern Vietnam (Adger 2000a). These studies identify options for responding to climate events and other impacts. In the coastal area of Borongan, skills and knowledge were important factors that enabled households to participate in activities other than fishing during bad weather. Rigg (1997) found that non-farm income allowed farmers to change practices in order to cope with environmental degradation.

The current study found that the most important factor that enhanced the ability of local people to cope with early wet season onset was the household labor force, both primary and secondary (human capital). Table 9 shows that the highest discriminant loadings of 12 independent variables between households that could or could not cultivate upland rice under early wet season onset included: 1) primary labor within the household; 2) secondary labor within the household; and, 3) livestock production. The study indicates that household labor (internal household factor) is more important than land (an external factor) following the early onset of the wet season. However, land is an important factor for swidden cultivators facing population pressure, urbanization, and limited availability of land. This study found that the most important factor that enhanced the ability of Kachet villagers to produce sufficient rice after the wet season's early start was household labor (human capital). The household labor force was the most important factor, especially in sloping or upland areas. Villagers were unable to prepare land by burning in the wet conditions of 2011: to plant rice, they had to clear the area by hand. Because group (a) had greater labor resources than the other groups, group (a) households could plant sufficient rice even in bad weather conditions.

In 2011, some households could cultivate rice, but the amount was insufficient, because they had limited labor and could not cultivate the largest rice fields in 2011 as

they did in 2010. Roder (2001) found that total labor in a normal year requires about 300 person-days/ha/year; the labor required to burn dry biomass in swidden cultivation is 20 person-days/ha/year. In 2011, land preparation took 100 person-days/ha/year by hand. In 2011, labor therefore was more important in Kachet than in the normal year of 2010.

Labor exchange has an important effect on cultivation practices in Kachet. In 2010, many labor exchange groups were formed among the households to cultivate rice efficiently. In 2011, however, only a few such groups were organized because many households were unable to plant rice. The lack of labor exchange increased the burden of farm work for planting, weeding, and harvesting. If the villagers wanted a labor, they had to pay for it. The price of daily labor in Kachet was low—about 30,000 kip (3.7 USD), compared with 50,000 kip (6.2 USD) outside the village. The role of labor exchange became less important and outside work more important in 2011 than in 2010.

Interestingly, land was not found to be a major factor in Kachet after the early onset of the wet season. Households with different numbers of plots and sizes of land were not differentially impacted by the climate event. Thus, land was not a factor that significantly enhanced villagers' ability to cope with rice insufficiency following the wet season's early onset. The interviews in 2010 indicated that land was important for the villagers when an increase in the volume of upland products were required: a larger farm size could yield greater produce. This finding corresponds with that of Roder (1997), who demonstrated that in northern Laos, a short fallow period reduces organic matter and decreases product yield; so increasing farm size is commonly prioritized over boosting yield per unit of land. This result is similar with to that of a case study of maize production in Bokeo Province, Lao PDR (Southavilay et al. 2013). These findings are in partial agreement with those of a study in which land was identified as

the single most important asset for local people in Ban Non Sao-e village, Thailand (Ozturk 2009). The findings in Kachet for 2010 are in line with these, though they differ in the climate event year of 2011.

2.7.2 Livelihood strategies to cope with rice insufficiency

The climate event in the present study had a direct impact on component proportions of household income—from NTFPs, agriculture, livestock, off-farm activities, and outside work—for each household group. Statistical analysis showed that the climate event resulted in an increase in the number of outside workers in each household group in both 2010 and 2011. However, outside work had begun before the early onset of the wet season in March 2011. Villagers started working outside Kachet in 2005, when the price of labor increased slightly to 15,000 kip (0.7 USD); this had increased to about 50,000 kip (6.2 USD) per day in 2011, along with commodity prices. This study found that livelihoods gradually changed under the influence of socioeconomic and political conditions. These changes gave villagers options for earning additional income in urban areas other than from collecting NTFPs, agriculture, and off-farm activities. This concurs with Morton (2007), who stated that socioeconomic factors such as "non-market relations in production and marketing increase the complexity of both impacts and subsequent adaptations, relative to commercial farms with more restricted crop ranges".

Lestrelin and Giordano (2007) concluded that economic change provides significant incentives and opportunities for farmers to change their areas of employment, such as to small-scale roadside trading and off-farm work in urban areas. In addition to the influence of socioeconomic change, political change affects the livelihoods of upland people, who are heavily dependent on swidden practices. Lao government policies aim to discourage swidden agriculture and increase forest cover

(Thongmanivong and Fujita 2006). These policies negatively affect local inhabitants by limiting access to land for cultivation. A short fallow period restrains the restoration of soil fertility and reduction of weed pressure, resulting in low rice yields (Roder 1997); the locals also have limited access to NTFPs. The main source of income for upland inhabitants is from collecting NTFPs (Yokoyama 2010).

The change and reduction in livelihood activities in 2011 were coping strategies for climate change: in response, the villagers modified such strategies related to agriculture, livestock production, off-farm activities, and outside work. These practices are similar to ones adopted in Vietnam (Adger 2000a, Nguyen et al. 2013, Bastakoti et al. 2014), Thailand (Lebel et al. 2009), and the Philippines (Gaillard et al. 2009). Those studies also found that the local environment was important for inhabitants in coping with short-term events. For example, the people of Ha Tinh Province, central Vietnam, undertook home gardening as a strategy to cope with strong climate variability and frequent weather hazards causing food shortages. The fishermen of Borongan, Philippines, combined fishing and farming in response to cyclones and storm surges. The study found that households faced different levels of impacts from the climate event and adopted different coping strategies. Households with rice self-sufficiency had greater access to NTFPs and more opportunities to obtain remittances as the economic crisis forced them to find alternative source of income, including factory employment in urban areas. Such household engaged in many activities, such as NTFP collection, crop and livestock production, off-farm activities, and outside work, in response to non-climate stressors more related to economic growth than to climate factors. Thus, households with substantial labor engaged more easily in many activities to meet subsistence needs and augment income levels. Ellis noted that "the causes and consequences of diversification are differentiated in practice by location, assets,

income, opportunity, and social relations" (Ellis 1998).

Livestock production was another important factor that helped the Kachet villagers overcome the climate event. This finding conflicts with that of Kazianga and Udry (2006), who found that livestock production is not an effective buffer of households in rural Burkina Faso during a drought. Conversely, Nganga et al. (2011) observed that activities dominated by livestock production were important for livelihood welfare in Gaza Province of Mozambique. Household income and asset shocks influence livestock sales in northern Kenya (McPeak 2004). Livestock markets play an important economic and ecological role during droughts in dryland Africa even though livestock prices are low in local markets (Turner and Williams 2002).

In the case of Kachet, we found that livestock production was related to outside work: if household members wanted to work outside the village, almost all the household's animals had to be sold. This is because raising livestock there follows a traditional system based on free-grazing conditions. Animals were left in forests after the harvest season, and villagers would go to care for them two or three times a week. Group II households, which had a lower labor force, chose to sell all their animals immediately in response to their rice insufficiency. Therefore, the average number of livestock differed significantly between 2011 and 2010. Group II households engaged in off-farm activities to generate income. Outside work was a long-term strategy for group II households to cope with non-climate factors such as education, health service, equipment, and clothing. Conversely, group III households chose to undertake off-farm activities around Kachet and sell one or two animals if they lacked money. This group suffered a heavy impact from the climate event—particularly the rice shortage of over 3 months. Thus, group III tended to support their livelihoods in the form of off-farm activities, particularly unskilled jobs.

Off-farm activities in the area around Kachet included carpentry, tree planting, and roadside trading. Household heads and young household members lacking experience and education commonly participate in these jobs. Such off-farm activities result in high income despite a lower labor input and demand less time than other activities. Outside work was a strategy for groups I and II to achieve their livelihood goals under economic change. Engaging in outside work is possible for educated adult household members with work experience. However, 38% of respondents lacked education. Thus, those individuals had limited access to work in urban areas. Lack of skills and education results in limited access to coping options with climate stressors (Eriksen et al. 2005). In general, people create new coping strategies for climate variability. However, the findings do not indicate new livelihood activities for coping with the climate event in Kachet. The villagers did not adopt new livelihood strategies to deal with the rice shortage. They engaged in various activities, including NTFP collection, agriculture, livestock production, off-farm activities, and outside work, but the proportion of households undertaking each activity differed. The important finding here is that households undertaking a limited number of activities were less vulnerable than households engaged to a lesser degree in many activities.

In Kachet, NTFP collection constituted the largest component of household income. With a normal climate, upland crop production was important for household consumption and created a small surplus for market sale. NTFP collection was the principle livelihood strategy in each household group. However, the most important NTFPs are found during long fallow periods of four years or more (Yokoyama 2004). This implies a negative effect on villager livelihoods when population pressure and forest policy in the near future will dictate shorter fallow periods.

In northern Laos, the government, development agencies, and other sectors,

such as non-government organizations, currently promote long-term development strategies; they include commercial forestry, long-term investment in rubber plantations, and upland agriculture programs (Alexander et al. 2009). Although these activities can improve economic conditions in rural areas, they are not intended to assist coping with short-term climate events. The present study suggests that agricultural policy should promote economic development that permits farmer access to a range of options—not only for adaptation to long-term vulnerability but also for coping strategies in dealing with the short-term impact of climate events. Such a policy is in contrast to one that promotes certain crop varieties for drought and specific climates as well as other planting techniques and short fallow improvement strategies. These schemes are not suitable for livelihoods from swidden farming in response to climate events.

2.8 Conclusion

This chapter evaluated the livelihoods of upland people in northern Laos following an unexpected climate event—early onset of the rainy season. The study helps to explain the effects of that event and indicates the relative importance of variables that are significant in supporting farmers' capacity to respond to and cope with such events. The author also examined local livelihood strategies in dealing with the effects of the climate event. The findings show that the wet season's early onset in March 2011 greatly impacted agricultural households that practiced swidden cultivation of rice and other crops for their own consumption. The findings also indicate that the labor variable was the most important factor in enhancing the villagers' ability to deal with rice insufficiency following the climate event. Households with a large labor force had greater options for coping strategies: households with substantial labor tended to manage better after the climate event than those with a small labor force.

Therefore, to improve household coping capacity in dealing with climate events, internal household factors such as labor, skills and education (human capital) should be considered rather than external factors such as farmland.

The Kachet villagers have lived with significant climate change in the past and tends to frequently increased in the future. Coping strategies were shaped by the level of impact of the climate event and households' needs toward achieving their livelihood objectives. NTFP collection was the most important coping strategy in both the climate event year of 2011 and the normal climate year of 2010. The villagers were highly dependent on natural resources, which were reflected by their weak coping capacity. Intensive activities were also important in helping the villagers overcome the rice insufficiency after the climate event. A lack of additional income activities for sustainable livelihoods is likely to result in limited capital assets, which is the case for most farmers in poor rural areas of northern Laos. However, the study believed that the Kachet villagers can achieve their livelihood objectives under extreme climate conditions by embracing a range of adaptive options. The author identified changes in household strategies in response to the climate event, but research into adaptation to socioeconomic and political change was limited in this study. The study suggests that this issue be investigated further because the livelihood strategies of the Kachet villagers could become more complex in the future.

Chapter III Access to Capital Assets under the Influence of a Climate Event

Chapter III continues to focus on upland livelihood changes, with special focus on change is access to household capital assets as the result of the climate events in Kachet village, Luang Prabang Province, northern Laos. The chapter mainly focuses on impacts from climate events to the household capital of each household.

3.1 Introduction

As mentioned in chapter II, agricultural production on sloping land is unstable and usually influenced by climate. Land preparation, such as slashing fallow forest or shrub vegetation and burning the dry fallow forest or shrub vegetation (Roder 1997) at the end of the dry season in March, is an important activity and sensitive to climate events. The wet season in northern Laos has begun earlier and its variability has also increased over 56 years and climate change has become apparent, as was seen in the 2011 climate event at the research site. These climate events pose a major problem for upland farmers, namely preventing them from burning biomass to begin swidden cultivation to support their traditional livelihoods. Some households may be able to adjust to the change and others may not. Therefore, clarifying the access to types of household capital in normal climate and climate event years is key to rural development.

In the chapter III has adapted a livelihoods framework to evaluate people's capability, especially on access to five types of livelihood assets, namely: human capital, natural capital, social capital, physical capital and financial capital; and, to analyses of how these assets are converted to achieve livelihood outcomes. Assets are important to achieving livelihood goals; a single asset is not sufficient to produce all livelihood outcomes (DFID 2001). Assets are considered to be direct or indirect stocks

of different types of capital that people can use to generate livelihood outcomes (Carney 1998). Assets provide a flow of outputs, which accumulate as a surplus to be endowed in livelihood outcomes. People have different types of assets that they combine to help them seek and realize their livelihood goals, and they attempt to convert assets into their livelihood outcomes (DFID 1999). This chapter focuses on the livelihood assets component of the Sustainable Livelihoods Framework (SLF) to estimate livelihood assets under differences in climate, including the 2010 normal climate and the 2011 climate event. There is also a comparison of household strategies that people choose under each climate condition.

3.2 Methodology

3.2.1 Data collection

Household data were collected using a household survey, and by holding semi-structured and structured interviews and participatory rural appraisal group discussions (Murray 2001: 8). In June 2011, a first field observation survey was made, and the villagers' situation under the influence of the climate event at the research site was considered. Interviews were held with a heads of each household. Sixty-three of the 95 households in the village were randomly selected for interviews in February 2012. Sample households were categorized into two groups: those with an insufficient labor force (group A = 25 households) and households with a substantial labor force (group B = 38 households). An insufficient labor force refers to a household with the equivalent of two or fewer than two laborers. A sufficient-labor force refers to more than two laborers in a household. In this study, 'laborer' refers to adults, but not to students or those over 60 years of age. During interviews, all respondents provided information about the household in the 2010 normal year and in the climate event year of 2011. Household information contained quantitative and qualitative data. In addition to

household interviews, group discussions were held with members of the local community. The group discussion technique was applied to assess farmers' perceptions and awareness of climate change issues.

3.2.2 Framework of analysis

The livelihood approach comprises the ideas of capability and well-being, particularly through in-depth analysis of rural poverty, vulnerability, resilience, and natural resource. The SLF is adapted to allow an understanding of the differential capabilities of rural people to cope with extreme climate, crises and other events. It is usually set in the form of a framework which consists of the principal components derived from the livelihood definition (Figure 9).

The SLF has already been described in chapter I. However, the results of the literature review show that people at different locations, sources of income, opportunities, and culture have different livelihoods (Ellis 1998). An alternative and efficient way of contributing to the research on rural livelihoods would be by studying the specific people residing in a specific location. It is probable that different indicators are also needed to increase the number of indicators to understand local people's livelihoods. Thus, new indicators to evaluate livelihood assets in northern Laos have been identified.

Livelihood assets comprise five types of capital (DFID 2001): 1) Human capital concerns the level of education, household labor, and good health that enable people to achieve their desired livelihoods; 2) Natural capital refers to natural resource stocks and includes both tangible and intangible factors; tangible natural resources may include forest resource as well as NTFPs that local people gather for food and cash income, and land. Land is obviously an important natural resource, on which farmers undertake agriculture. Intangible products include the atmosphere and biodiversity, but this study

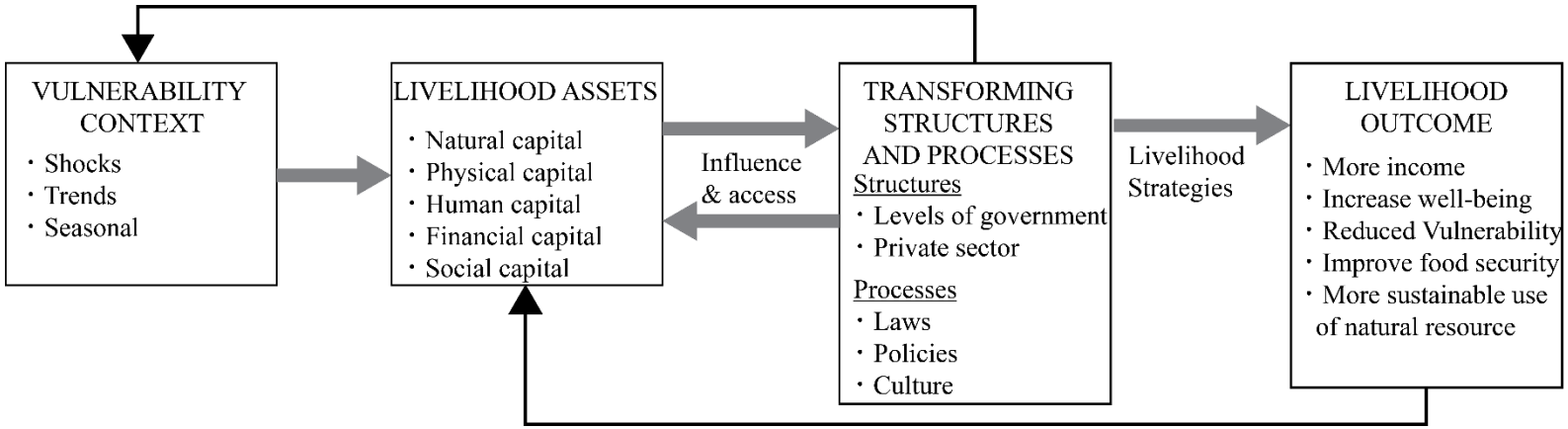


Figure 9 A sustainable livelihood framework based on DFID 1999

Source: Drawing by the author based on DFID (1999)

does not address these; 3) Social capital means social resources with which people plan their livelihood goals. Social resources include networks, group memberships, trust relationships, and access to wider societal institutions; 4) Physical capital describes the basic infrastructure and farm inputs that are needed to support the livelihoods that people seek. The infrastructure consists of physical environments, basic needs such as roads and electricity. Farm inputs refer to the tools and equipment that people apply to increase productivity; 5) Financial capital refers to the fund resources that people use to achieve livelihood objectives; financial capital also means cash or cash equivalents that enhance the ability of people to overcome or respond to an unexpected event (Kollmair and Gamper 2002).

3.2.3 Data analysis

In this chapter, the five forms of capital were calculated by using various types of data, and the analysis comprised three steps. In step 1, raw data was used from household interviews and on which basic processing was conducted. In step 2, these data were normalized by using a formula (see below). In step 3, two statistical analyses using Statistical Package for Social Science (SPSS) were carried out: first, a paired sample t-test, followed by an independent sample t-test. In step 1, the basic calculation was conducted for step 2. Each component of the five capital indicators is explained below.

Human capital had three indicators: labor, education, and health. To digitalize labor, the ratio of the number of laborers to the total number of household members was used. For education, the ratio of the number of students to the total number of children from 8 to 17 years old in a household was used. For health, the ratio of the number of household members with chronic disease to the total number of household members was used.

Natural capital had two indicators: NTFPs and land. For NTFPs, the ratio of income from NTFPs to total income was used. For land, the area of all agricultural land owned by each household was used.

Physical capital had four indicators: paddy fields, external facilities, farm input, and electricity. For paddy fields, the paddy area of each household was used. For external facilities, data was acquired by digitalizing the frequency of access by each household to markets, hospitals, and schools. In the interviews, zero (0) was used to indicate that household members never accessed these facilities; 0.333 was used to indicate that they sometimes did; 0.666 was used to indicate that they often did; and, one (1) was used to indicate that they always did. For farm input, I used the amounts of chemical fertilizer, organic fertilizer, pesticides, and high-yield variety of rice seed. For electricity, I used the annual sum paid for electricity for each household.

Financial capital had six indicators: agriculture income, livestock income, off-farm activity income, working outside income, credit, and savings. For agricultural income, livestock income, off-farm activity income, and working outside income, the ratio of each income source to total household income was used. For credit, the total amount of debt from banks or other sources was used. For savings, the total amount of cash savings in each household was used.

Social capital had three indicators: equity, participation, and social relations. For equity, the income per capita in a household was used. For participation, data was acquired by digitalizing the frequency of participation in community activities such as planting, implementing, sharing of benefits, and monitoring and evaluation. In the interview, I used zero (0) when household members had never joined in any of these activities; 0.333 when they sometimes did; 0.666 when they often did; and, one (1) when they always did. For social relations, I used the support by money and rice inside

the village each year.

After finishing the basic analysis in step 1, in step 2, the different values in each indicator (e.g., labor, education, health, NTFPs) were converted into the same scale by applying a simple linear scaling technique. Because of the different scale of each household characteristic treated as an indicator, it was necessary to standardize them before computing livelihood indices. The linear scale used minimum and maximum values as scaling points of 0–1, except for access to external facilities and participation variables as mentioned in step 1.

According to the linear scale technique:

$Xi = (Ri – Vmin)/(Vmax – Vmin)$

Where, Xi = computed value, Ri = raw value to be normalized, Vmin = minimum values of the variable, and Vmax = maximum value of the variable.

In step 3, two statistical analyses were carried out using SPSS. First, a paired sample t-test was used to examine the significances of difference in access to livelihood assets at two separate points in the 2010 normal climate and the 2011 climate events. Second, an independent sample t-test was used to examine the significances of difference in access to source income between two household groups, including insufficient labor (group A) and sufficient labor (group B).

In order to classify household categories at the village, five types of household capital such as human, natural, physical, financial and social capitals in step 2 were divided into three interval levels including low, middle and high levels calculated by using the equation below.

$$\text{Interval level} = \frac{\text{Highest values} - \text{Lowest values}}{\text{Numbers of Interval Level}}$$

Higher values are the highest values of total respondent and lowest values is lowest values of the total sample. The highest point of first level = the lowest score level + Interval level – 0.01 (Chantrasouvan 2002). After that a three score level was used for 1 is less access to capitals, 2 for middle access to capitals and 3 is a high level of access to capitals in each household capital. All five types of household capitals were averaged and then resulted the livelihood situation as follow:

Level of access to capitals	Score mean
Low access to capitals	1.00 – 1.66
Middle access to capitals	1.67 – 2.33
High access to capitals	2.34 – 3.00

To compare the livelihood of different household groups, group comparison methods by Cramb et al. (2004), Thennakoon (2004), Pensuk and Shrestha (2008) and Shivakoti and Schmidt-Vogt (2009) were applied. These researchers used the average mean value to be the score of livelihood assets. In this study, each capital (human, natural, physical, financial, and social) was derived from the average mean in each group of variable indicator. The livelihood pentagon presents the pattern of change in each household group between the 2010 normal climate and the 2011 climate event.

3.3 Socioeconomic characteristics of respondents

3.3.1 General socioeconomic

From a total of 63 respondent households, 82.5% of total respondents were male. The average age was 47.7 years, and the range was 28–80. More than half (57.1%) of the respondents had primary school education, 38.1% had no education, and only 4.8% graduated from secondary school. The average number of members in each household was 5.68, with a range of 2–11. About 98.4% of respondents had the

principal occupation of farming and of upland rice production and livestock production; only one person was an employee of a private business. Most household respondents had sole land ownership. The average agricultural land area was 5.43 hectares (ha), with a range of 0–22.5 ha (Table 11). Twenty-eight percent of respondents were renting farmland from others.

The average total cash income was 6,481,180 kip per household annually (2011 climate event). The largest component was NTFPs, which constituted 40% or 2,610,783 kip of total income, followed by outside work at 25% or 1,600,000 kip. Off-farm income at 21% or 1,380,079 kip, livestock at 12% or 742,698 kip, and agricultural production at 2% or 147,619 kip. In the study village, off-farm works such as construction in urban areas, planting trees, and roadside trading were regarded as important off-farm activities. In addition to off-farm activity, common outside work included employment in factories in the urban area far from the village.

3.3.2 Characteristics of household livelihoods classified by type of household capital

This section presents the results of classification of levels of the livelihood situation at the research site based on their access to household capitals. Each level of livelihood situation needs to shape their characteristics by using statistical analysis as mentioned in section 3.2.3 in the chapter. Local people with different characteristics may have different or similar levels of access to their capability, capital types and activities. The results of statistical analysis show that three levels of households access low level of access to capital types; middle level and high level of access to household capital have different household typologies (Table 12).

In this study, households with low levels of access to their capital types were defined as “Shortage Households”. This households group tends to own very little land and other capital assets. In some cases they do not have any land. Most of the land that

Table 11 Basic socioeconomic characteristics of respondents in 2011

	Social Background	Frequencies (n = 63)	Percentages (%)
1)	Sex		
	Male	52	82.5
	Female	11	17.5
2)	Age		
	Min. = 28 years old		
	Max.= 80 years old		
	Mean = 47.7 years old		
3)	Education level		
	No formal education	24	38.1
	Primary school and lower	36	57.1
	Secondary school	3	4.8
4)	Household size		
	Min. = 2 persons		
	Max. = 11 persons		
	Mean = 5.68 persons		
5)	Main occupation		
	Farmer	62	98.4
	Others (trader)	1	1.6
6)	Total number of plots		
	Min. = 0 plots		
	Max. = 10 plots		
	Mean = 3.1 plots		
7)	Total agricultural land		
	Min. = 0 ha		
	Max. = 22.5 ha		
	Mean = 5.43 ha		
8)	Number of laborers		
	Average in 2010 = 2.65 laborers		
	Average in 2011 = 3.11 laborers		

Source: Households survey by author in July 2012

Table 12 Livelihood situation with classify by household capitals in 2011

Independent Variables	Livelihood situation		
	Low level (N=21)	Middle level (N=35)	High level (N=7)
Sex	Female (19%)	Female (20%)	Female (0%)
Age (avg.)	48 years old	46 years old	50 years old
Education (avg.)	Primary 2	Primary 2	Primary 4
Labor (avg.)	2.4 persons	2.9 person	5 person
Household member (avg.)	5 persons	5.9 person	6.7 person
Outside work	(Yes) 62%	(Yes) 34%	(Yes) 71%
Number of work outside (avg.)	0.95 person	0.94 person	1 person
Ag. Land (avg.)	2.9 ha	6.3 ha	8.7 ha
Number of children from 8-17 years old	1.62 persons	2.51 persons	2.57 persons
Number of student	0.57 persons	1.46 persons	2 persons

Source: Analysis by the author

Note: “N” refers to number of respondent. “Primary 2” and “primary 4” refer to grade 2 primary school and grade 4 primary school. Ag. Land means agricultural land. Avg. means average

they cultivate is rented from relatives and their agricultural production is based on their own labor with limited skills and experience. Agricultural production such rice and other upland crops are consumed by household members. Limited land results in rice shortage for more than three months a year. This household group always buys rice with money earned from NTFPs collection and sells their labor for agriculture work and outside the village. This group lives in impermanent houses (Photo 3). Table 12 shows that the ratio of household education was low; about 35% of the children could enter primary school. This indicates that the shortage household group could not support their children's education.

Middle level of access to household capital types appear to be a "reasonable household" group; they have sufficient land and access to five household assets to support their subsistent needs. Their agricultural land is about 6 ha on average. This group has better jobs and higher social status than households with shortage. They produce upland rice for house consumption. Normally, rice is sufficient for one year. Reasonable households use their primary labor for various activities making it hard for them to work alone on rice production, especially on planting, weeding and harvesting. Labor availability in this group is better than in shortage households, about 2.9 persons on average. Their income is based on agriculture and non-agriculture activities. Collecting of NTFPs is mainly for consuming and selling a little to markets. Their housing is not different from the shortage households group (Photo 4). More than half of the children in this household group have access to school.

High access to types of household capital are defined as "better-off households." They have larger land holdings and forest fallows, more than 6 ha on average. Better-off households are able to access to their types of capital more easily than other household groups. Labor availability was high, about 6.7 persons. This household group

Photo 3 Shortage households' house style

Source: Taking by the author

Photo 4 Reasonable households' house style

Source: Taking by the author

also has household assets, namely: televisions, radios, compact disk players, among others. Moreover, they have transportation and communication assets that are not generally owned by villagers such as motorcycles and mobile phones. Their houses look different from other household groups (Photo 5). They have permanent houses with cement on the ground floor and wood on the second floor. The better-off households group produces sufficient rice and sells any surplus. This group can afford conspicuous consumption goods, house improvements, children's education, and health services. Their household income is not only from agricultural investments such livestock and commercial upland crops, but also from trade and investment in NTFPs.

The comparative analysis shows that livelihood situations at the Kachet village have changed little (Table 13). The number of shortage households declined from 23 households in 2010 to 21 in 2011 (Table 13), even though climate change impacted their livelihoods. Reasonable households also declined slightly from 36 in 2010 to 35 in 2011. Better-off households increased by 4 households in 2010 and 7 more in 2011. In 2010 the largest livelihood group was the reasonable households group which comprised 57.1% of total respondents; shortage households group was 36.5%; and, 6.4% were the better-off households group. In 2011, the reasonable households group were still the largest group, 55.6%; the shortage households group was 33.3%; and, 11.1% in the better-off households group.

3.4 Change in access to livelihood assets

In this section the author investigates five types of capital accessed by rural people under different climate conditions: the 2010 normal climate and 2011 climate event. The five capital types were scored and analyzed by comparing their mean values to shape livelihood assets between the 2010 normal climate and the 2011 climate event. The results of the analysis showed that the highest index value of the entire study was

Photo 5 Better-off households' house style

Source: Taking by the author

Table 13 Livelihood situation in the normal climate and the climate event years

Household categories	2010		2011	
	HHs number	Percentage	HHs number	Percentage
Shortage households	23	36.5	21	33.3
Reasonable households	36	57.1	35	55.6
Better-off households	4	6.4	7	11.1
Total household	63	100	63	100

Source: Classify by the author

Note: HHs refers to households

for natural capital (0.43), followed by human (0.38), social (0.35), physical (0.25), and financial (0.14) capital. In the 2011 climate event, human capital became more important (0.40), followed by natural (0.34), social (0.31), physical (0.27), and financial (0.14) (Figure 10).

3.4.1 Human capital

Human capital discussed here includes three indicators, namely labor, education, and health. Overall human capital had a significant difference at a <0.001 level between the 2010 normal climate and the 2011 climate event (Table 14). The most significant difference was for the labor force in the household at a <0.001 level, while education and health quality did not show any significant difference between 2010 and 2011. Statistical analysis shows that the climate event did not directly impact education and health quality capitals at the research site. However, the results clearly indicate that the labor is important for human capital. However, overall human capital showed no significant difference between household groups A and B in the 2010 normal climate and the 2011 climate event (Table 14).

1) Labor force

Household labor is partly related to house size, which provides the labor in a household. From 63 respondent households, the average number of household members in each household was 5.71 persons in 2010 and 5.68 people in 2011, ranging from 2 to 11 people (Table 15). The number laborers in a household consists of the number of adult members including husband and wife. The average labor within a household was greater in group B, about 3.89 in the 2011 climate event compared with 3.16 in the 2010 normal climate. Group A had less labor per household, 1.84 persons in 2010 during the normal climate, and 1.92 in the 2011 climate event.

Labor is important for upland rice cultivation, NTFPs collecting, outside work,

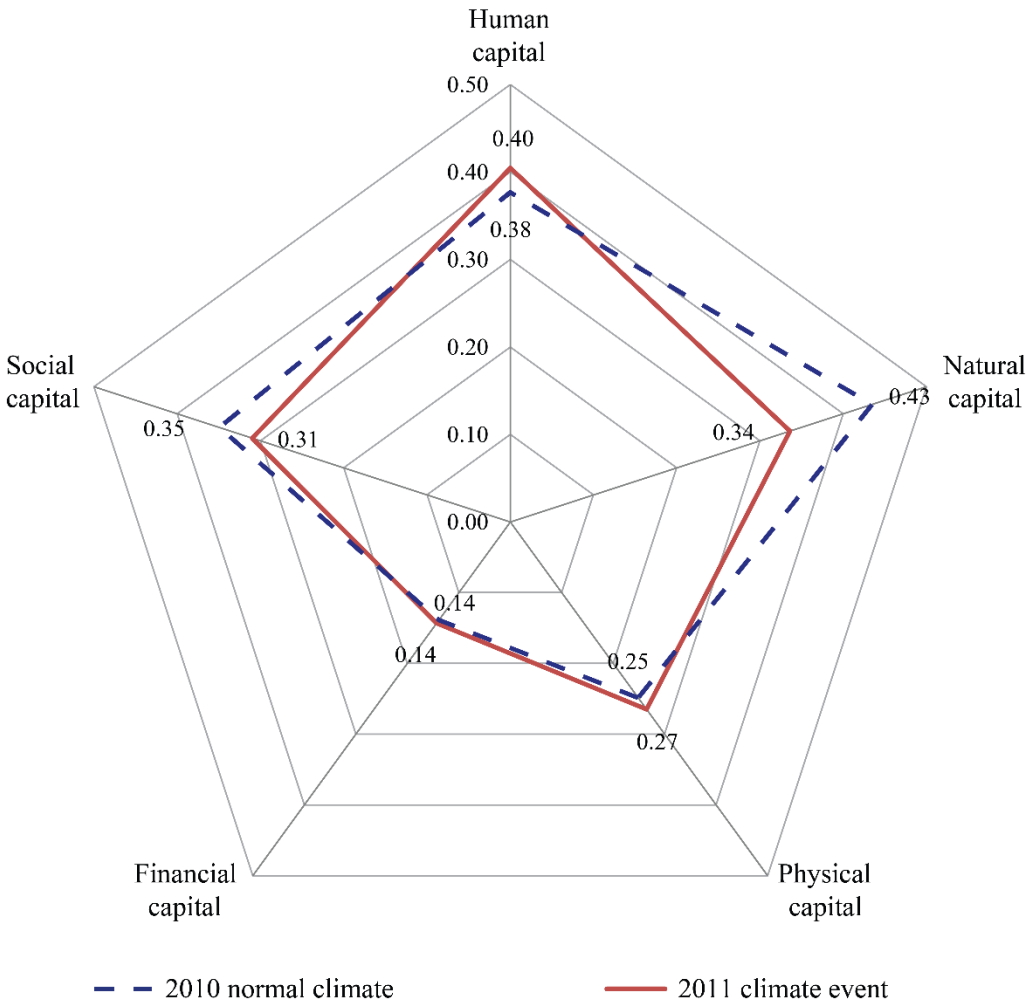


Figure 10 Livelihood asset pentagons under normal climate and climate event years

Source: Drawing by the author

Table 14 Comparison of livelihood assets between group I and group II during period of 2010 to 2011

Livelihood Assets	Year	Group A		Group B		T-test (A&B)	Paired Simple	
		Mean	SD	Mean	SD		Mean	T-test (2010&2011)
1. Human capital	2010	0.340	0.144	0.401	0.107	-1.942	0.38	-4.088***
	2011	0.352	0.152	0.439	0.126	-2.458	0.40	
1.1 Labor	2010	0.456	0.199	0.507	0.133	-1.219	0.49	-4.655***
	2011	0.478	0.190	0.631	0.185	-3.185	0.57	
1.2 Education	2010	0.420	0.428	0.540	0.378	-1.169	0.49	-0.279
	2011	0.440	0.443	0.532	0.367	-0.892	0.50	
1.3 Health	2010	0.142	0.238	0.157	0.153	-0.305	0.15	0.785
	2011	0.139	0.236	0.155	0.152	-0.326	0.15	
2. Natural capital	2010	0.366	0.122	0.479	0.139	-3.328	0.43	5.097***
	2011	0.241	0.137	0.398	0.195	-3.763*	0.34	
2.1 Forest resources	2010	0.434	0.264	0.460	0.207	-0.439	0.45	-1.451
	2011	0.462	0.257	0.495	0.205	-0.557	0.48	
2.2 Land	2010	0.292	0.110	0.494	0.134	-5.016*	0.41	7.277***
	2011	0.013	0.067	0.296	0.115	-4.730***	0.18	
3. Physical capital	2010	0.198	0.101	0.282	0.101	-2.655	0.25	-2.946**
	2011	0.214	0.076	0.299	0.076	-3.506*	0.27	
3.1 Irrigation infrastructure	2010	0.040	0.113	0.145	0.235	-2.075**	0.10	-1.426
	2011	0.040	0.113	0.145	0.235	-2.370	0.10	
3.2 External facility	2010	0.452	0.189	0.450	0.168	0.050	0.45	-2.935**
	2011	0.449	0.177	0.527	0.195	-1.623	0.50	
3.3 Farm input	2010	0.009	0.044	0.070	0.121	-2.413***	0.05	0.186
	2011	0.009	0.044	0.068	0.114	-2.868***	0.04	
3.4 Electricity	2010	0.292	0.212	0.463	0.261	-2.724	0.39	-5.372***
	2011	0.323	0.220	0.501	0.295	-2.576	0.43	
4. Financial capital	2010	0.141	0.077	0.137	0.071	0.196	0.14	-0.475
	2011	0.141	0.064	0.144	0.058	-0.211	0.14	
4.1 Agricultural income	2010	0.106	0.088	0.148	0.149	-1.382*	0.13	6.270***
	2011	0.003	0.017	0.037	0.074	-2.654***	0.02	
4.2 Livestock income	2010	0.132	0.158	0.136	0.172	-0.085	0.13	2.152*
	2011	0.106	0.141	0.106	0.134	0.006	0.11	
4.3 Off-farm income	2010	0.224	0.253	0.162	0.188	1.129	0.19	-1.412
	2011	0.269	0.273	0.159	0.190	1.755*	0.20	
4.4 Working outside	2010	0.104	0.196	0.096	0.148	-1.156	0.10	-3.578***
	2011	0.165	0.249	0.224	0.215	-0.990	0.20	
4.5 Credit	2010	0.026	0.064	0.079	0.222	-1.382*	0.06	-2.122*
	2011	0.081	0.150	0.130	0.225	-0.959	0.11	
4.6 Saving	2010	0.247	0.276	0.198	0.243	0.738	0.22	0.104
	2011	0.219	0.258	0.210	0.256	0.139	0.21	
5. Social capital	2010	0.380	0.120	0.329	0.103	1.727	0.35	3.953***
	2011	0.340	0.112	0.289	0.095	1.941	0.31	
5.1 Equity	2010	0.520	0.253	0.360	0.171	3.000*	0.42	6.229***
	2011	0.367	0.161	0.246	0.102	3.339	0.29	
5.2 Institutional	2010	0.564	0.146	0.628	0.225	-1.251	0.60	9.907***
	2011	0.453	0.190	0.529	0.257	-1.262	0.50	
5.3 Social relationship	2010	0.057	0.199	0.002	0.014	1.685**	0.02	-5.642***
	2011	0.202	0.256	0.094	0.135	1.941***	0.14	

Source: Analysis by the author

* Mean significant difference at < .05 level, ** at < .01 level, and *** at < .001 level

Table 15 The average household member and labor force

Items	Group A (N=25)		Group B (N=38)		Total 63 HH	
	2010	2011	2010	2011	2010	2011
Number of household member	4.52	4.52	6.50	6.45	5.71	5.68
Number of labor	1.84	1.92	3.16	3.89	2.65	3.11

Source: Household survey by author in July, 2012

livestock production, and off-farm activities. Based on household interviews, labor availability at the research site was sufficient until 2005 when local people first started working outside the village. They have been working at rubber plantations in Luang Namtha Province located in northwestern-most Laos, which shares a border with China. Married persons stayed for 2 months, while single people stayed more than 2 months.

At the research site, labor exchange among households is commonly practiced. Labor exchange is a traditional form of facilitating work among families. Some households merge their labor together to form labor groups that rotate among households to provide labor services. The number of members of each exchange group depends on those who participate in the field work. In Kachet village there were 95 households that had organized seven labor exchange groups. In each group there were about 13 people that work together on rice cultivation, including slashing, planting, weeding, and harvesting; and, also on garden lands. Labor exchange groups also cooperate on community activities; if a household is building a new house, other households send members to help. Using more labor will result in a house being built more quickly. Thus, traditional labor exchange operates like a social function at village and community levels. Labor exchange members always meet each other after a day of field work in the house of field owner. They eat and drink in the evening being hosted by the field owner. During the gathering, people discuss different topics, including field work and other village issues.

In the 2011 climate event, labor exchange was not used because of the shortage of labor and lack of people to conduct swidden in the village. The early onset of the wet season had significant impacts on upland swidden cultivation, reducing the area of upland rice cultivation. Because of the early rains, most households could not burn fallow forest after slashing in February, and therefore failed to plant any crops for

consumption. Many households went outside the village to earn additional income to prevent rice insufficiency. The labor exchange system has disappeared as the result of the climate event that also impacted on households with insufficient rice and food. In the case of rice shortage households, they are obligated to sometimes borrow rice from relatives or they exchange labor for money, allowing them also to eat for free.

Labor exchange was an important activity for rural families. During the interview, besides facilitating field work, local people were joining the labor exchange to ensure that they would benefit, because they did not have sufficient family labor, particularly for weeding and harvesting of upland rice. Some households have many young children who are not yet able to help their parents in the swidden cultivation. Another reason is that old people are unable to work in agriculture. Thus, husbands and wives are the main labor in swidden cultivation.

Another reason for labor shortages in the village is the increasing number of people leaving for outside work. In 2011, daily wage rates outside the village were high, about 50,000 kip (6.2 USD) per day, compared with the wage rates in the village, about 30,000 kip (3.7 USD). Over six years the price of labor increased more than three times, from about 15,000 kip (0.7 USD) per day in 2005 to about 50,000 kip (6.2 USD) in 2011, following the rise in commodity prices. In addition, young people prefer not to work in agriculture. They want to find a new livelihood with other communities in lowland areas such as daily laborers, factory workers, and in services, among others.

2) Education

Kachat villagers are ethnic Khamu. They do not have their own writing system, but they have their own language dialect. They are educated in Lao language in school. The household survey revealed that household members had a high education level when compared to ten years ago. This educational opportunity has been made possible

through funding and allowances provided by the Lao Government and rural development agencies. Most respondents had achieved the highest primary school education level at grade five.

The primary school at Kachat village was established by the Lao Government in 2005 with support from JICA with grades one to five. But the school has only three rooms (Photo 6). Grades two and three are combined into the same classroom; grades four and five share a classroom; while grade one had an individual classroom.

In 2011, household members had access to middle school (grades 6-8), but only one female student was attending the middle school. Figure 11 presents 24 households showing that 38 percent had no education. Of the 68 households, only 16% attained grades two and four. During the same period, the percentage of students dropping out of school was high. Most households cannot support their children's education after grade five at primary school because of insufficient income. A shortage of labor is a second reason for children not attending school, wherein 25 percent of all households faced a labor shortage for production related activities. Further, traveling to school is a challenge for local residents. One secondary school is located six kilometers north of the village and another secondary school is located 27 kilometers away at Nam Bak District.

3) Health services

At the research site, access to health services has changed recently. A decade ago many villagers believed that the cause of sickness and death was bad spirits having broken some cultural taboo. Villagers often treated themselves using local medicine from forests surrounding the village. Today villagers have access to a hospital for medical checks and to receive modern medicines from a doctor. However, as Table 14 shows, access to health services is lower than education and labor variables. According

Photo 6 Primary school at Kachet village

Source: Taking by author in July, 2011

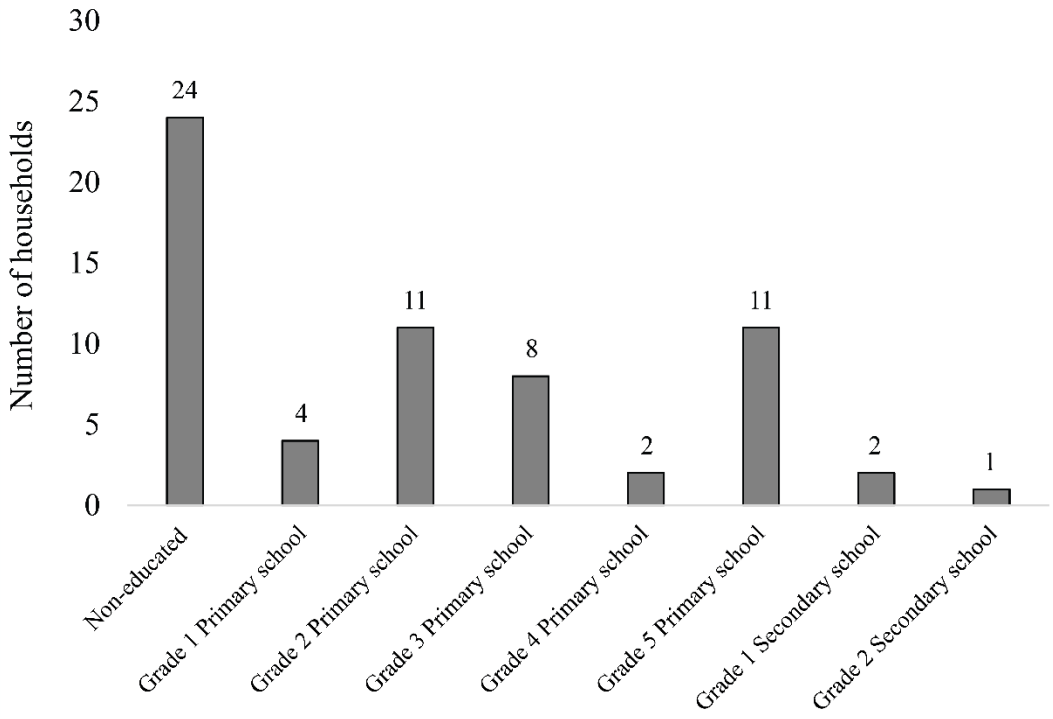


Figure 11 Respondents' education level at the research site

Source: Household survey by the author in July, 2011

to household interviews, villagers went to a hospital only for a serious health issue. For example, villagers afflicted with malaria or other dangerous diseases. Most women prefer to give birth in the district hospital at Nam Bak. Villagers prefer to use the health center in a nearby village, which is closer and cheaper than a hospital. Access to health services was not significantly different between groups A and B. The result of the study indicates that the short-term climate event was not a factor that reduced access to health services. The cost of medical services and distance from the village were the factors influencing access to medical services by villagers.

3.4.2 Natural capital

The overall natural capital showed a significant difference at a <0.001 level. The natural capital index value slightly decreased, from 0.43 in 2010 to 0.34 in 2011. Regarding the two variables of natural capital indicators, only access to farmland had a significant difference at a <0.001 level; access to forest resources had no significant difference between the 2010 normal climate and the 2011 climate event. However, access to forest resources increased, with scores of 0.45 in 2010 and 0.48 in 2011. Access to farmland, however, declined from 0.41 to 0.18 over the period.

Classifying access to natural capital by labor groups had a significant difference in the 2011 climate event at a 0.5 level (Table 14). However, access to natural capital resulted in no significant difference between groups I and II in the normal 2010 climate. Access to land for two labor groups showed a significant difference at a 0.5 level in the 2010 normal climate and at a 0.001 level in the 2011 climate event. However, access to the natural capital index was higher in group B than in group A (Figure 12).

1) Forest resources

Income from NTFPs is the largest component of total household income, contributing 39% of total household income in 2010 and 42% in 2011. The percentage

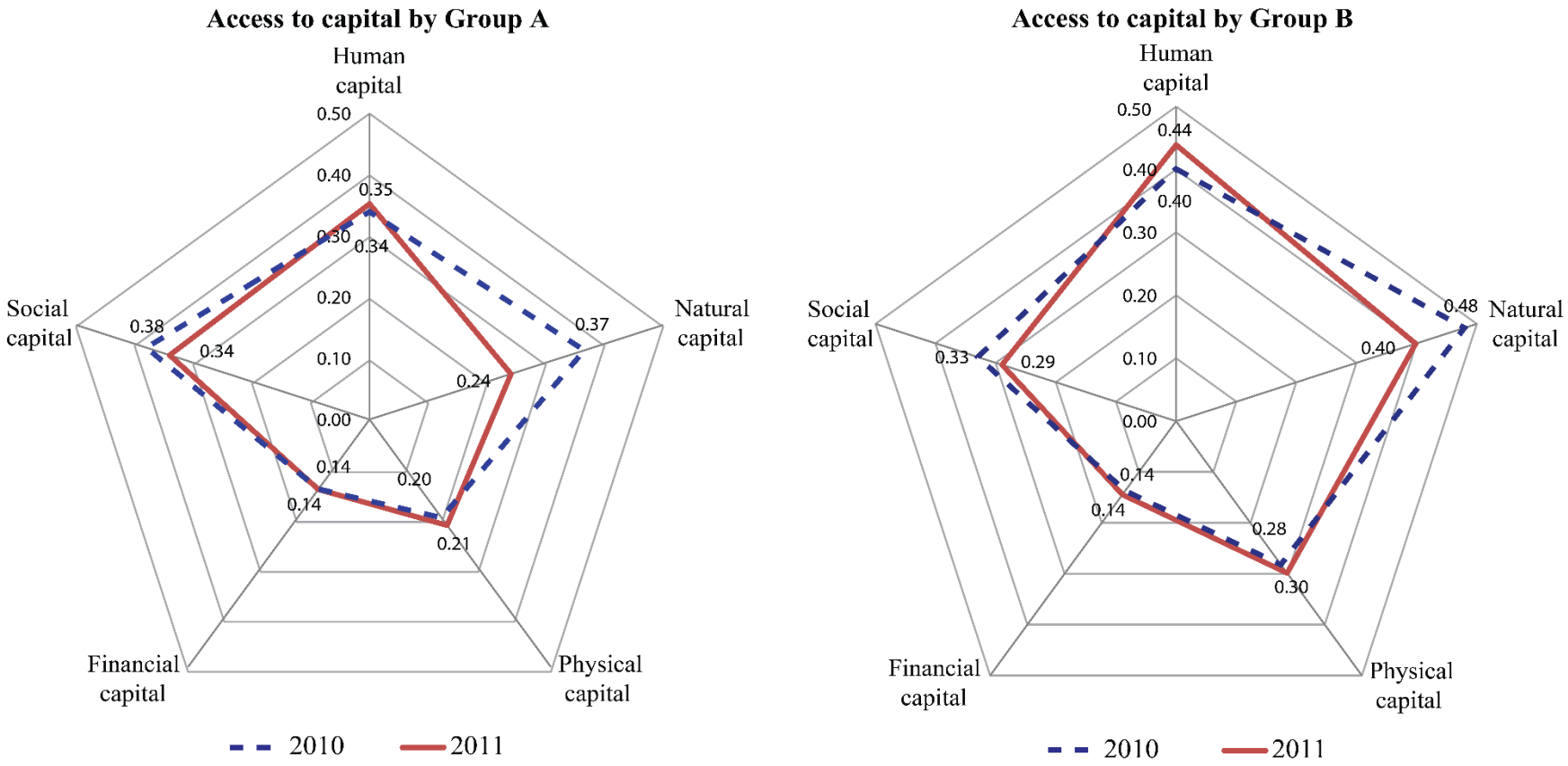


Figure 12 Comparison of livelihood assets between group A and group B under normal climate and climate event years

Source: Drawing by author

of income from NTFPs increased slightly, but the amount of income declined. As mentioned at the chapter II, the 2011climate event impacted the most important NTFPs—benzoin resin and broom grass—which could not be harvested owing to the early rain. Income from other NTFPs also declined (Figure 13).

In addition to the 2011 climate event, income from NTFPs has been affected by shorter fallow periods, land allocation, and population pressure. On the other hand, the prices offered for benzoin and cardamom increased since they require a long fallow period of six years or more.

2) Land holding

When settlers first arrived at Kachat village, land was easily available for swidden cultivation, especially for upland rice production. Settlers cleared areas for upland rice cultivation on the same plot for five or six years and then claimed ownership on the land as private land. Traditionally, other farmers could not cultivate on land where a land owner left the land for a long time. Although no official documents certified that the land was owned, villagers understood that private land ownership was derived from management of the land. In addition, families were large and many plots of land could be selected and managed thus facilitating cultivation of rice and other upland crops over a large area (Figure 14).

Traditional land use and cultivated land are not allocated by the Lao Government, but forest land was allocated beginning in 1996 by local authorities. Households' fallow periods changed as a result. Half of all swidden land used for home consumption was allocated as five categories of multipurpose forests. As a result farmers had less land to cultivate than before. Villagers did not exactly understand the function and restriction on each category of forests because there were not marked and there were no forest boundaries. Some conservation forest was cut down as a result of

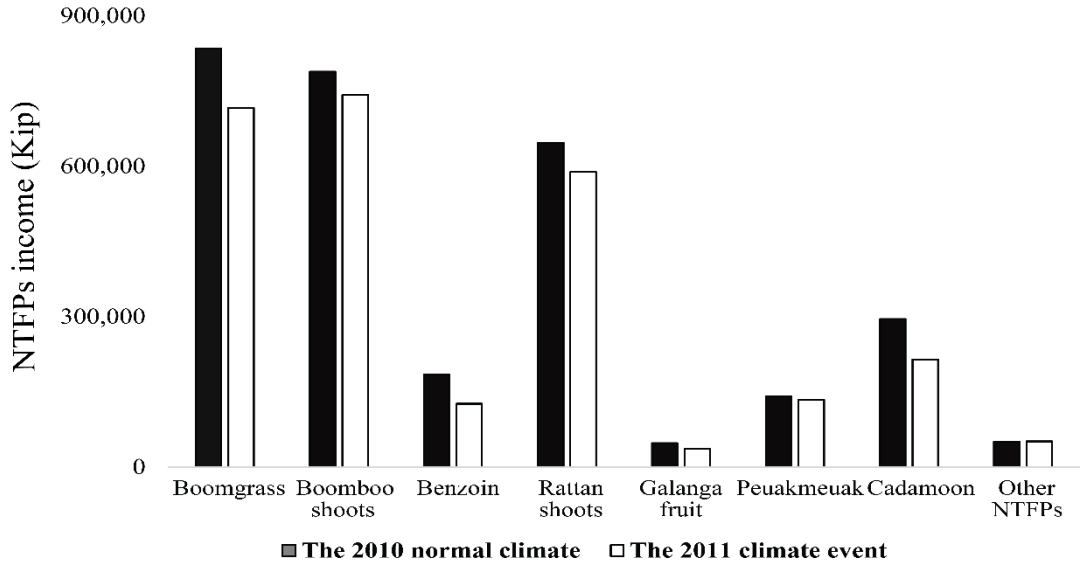


Figure 13 NTFPs income in 2010 and 2011 at the research site

Source: Household survey by author in July, 2012

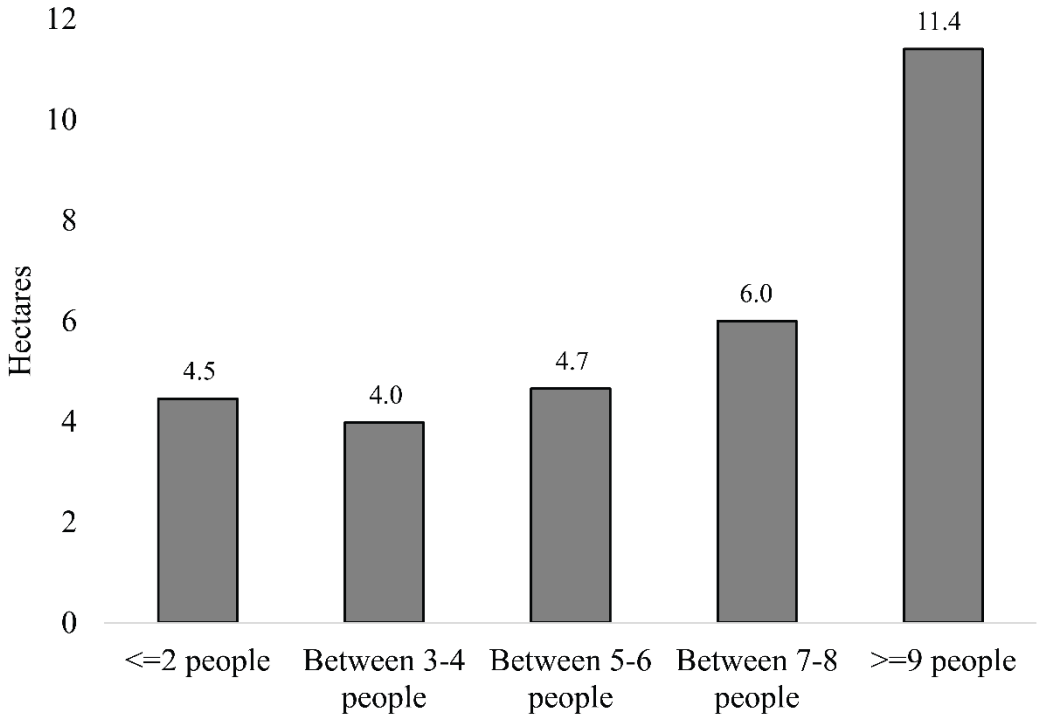


Figure 14 Average land holding classify by the number of household members in 2011

Source: Household survey by the author in July, 2012

poor forest management.

Most households at the research site could not use their farmland to produce upland rice during the 2011 climate event (Photo 7). Heavy rain, together with early onset of the wet season affected 76 of a total 95 households (80%), who could not burn fallow to begin rice production. The upland cultivation area declined by 92% or 142 ha in 2011 compared with 2010.

3.4.3 Physical capital

The physical capital index value increased slightly from 0.25 to 0.27, a significant difference at a <0.001 level between 2010 and 2011 (Table 14). Two variables of the physical capital index, access to irrigated paddy fields and farm inputs, did not show any significant differences. However, access to external facilities and electricity did have significant differences, at the <0.01 and <0.001 levels, respectively. The external facility index increased, with scores of 0.45 in 2010 and 0.50 in 2011. Access to electricity increased during the period, from 0.39 to 0.43.

Overall physical capital showed no significant difference between groups A and B in the normal 2010 climate. However, there was a significant difference in the 2011 climate event year at a 0.5 level. Access to the physical capital index was higher in group B than in group A in both the normal 2010 climate year and the 2011 climate event (Figure 12). Two household groups had significant differences in access to irrigated paddy fields at a 0.01 level and farm input at a 0.001 level, while the external facility and electricity variables showed no significant differences in 2010. In the 2011 climate event, only farm inputs showed a significant difference at a 0.001 level, while other variables showed no significant differences between groups A and B.

1) Irrigation infrastructure

Before 2009, there were no irrigated paddy fields in the Kachet village. Paddy

(a) Fail to burn fallow

(b) Successfully burned fallow

Photo 7 Fail to burning fallow under climate event figure (a) and successfully burn fallow in normal climate

Source: Photo (a) by Hirota in May, 2011 and photo (b) by author in 2012

cultivation is a new livelihood activity for the ethnic Khamu, who have excellent experience in swidden cultivation. Villagers needed to learn about cultivating paddy fields and fishponds using stream irrigation. However, not all households could learn because of biophysical conditions. Today, villagers cultivate paddy in terraces on sloped lands.

2) External facilities

In the village, public goods such as a school, health center, and market are available. Children at the village can access the primary school only. While, a secondary school is located in Song Cha village, some 12 km to the north. Therefore, students could not travel back and forth daily. Parents would need to pay for their children's accommodation, including food and a dormitory. For high school and higher education, the children have to go to Nam Bak town located some 27 km from the village.

Common health problems in the village include diarrhea, coughs, and malaria. With common ailments people prefer to use the health center at Song Cha village. However, the health center cannot handle malaria cases, requiring that villagers to to the hospital in Nam Bak town.

As for market access, people access the closest market in Ban Pak Mong located on the way from Luang Prabang Province to Oudomxay Province and closer to the border with China. People prefer to go to the Oudomxay market rather than Luang Prabang, because Oudomxay is located about 60 km from the village while Luang Prabang is some130 km from the village.

3) Farm inputs

Kachat village livelihoods are based on swidden cultivation and collecting NTFPs. Villagers use traditional agricultural tools to cultivate upland rice and other upland crops. Agricultural production is based on natural conditions, for which there is

no need for external farm inputs such as chemical fertilizer and pesticides. From 2000 to 2008 Kachat people used only traditional varieties of seeds, including upland rice, cucumber, corn, sesame, and others. When paddy rice was introduced by a neighboring village in 2009, initially only five households cultivated paddy rice, although they had never cultivated paddy rice before. Eventually the head of one family paid one buffalo to a neighboring villager to teach and help him learn to cultivate paddy rice. Currently 15 households produce paddy rice on eight hectares using an improved variety of rice, Ta Dok Kham 15 (TDK15).

Traditionally farmers used a mortar to mill rice for consumption, with the work being done by women and children. Kachat people stopped using the mortar to pound their rice when electricity came to the village in 2005. The old traditional rice pounding activity was changed to a small modern mill that used electric power. In 2011, seven mills were milling rice for about 2,000 kip per 20 kg of unhusked rice. The average index for access to farm inputs for only one year, 2010 and 2011, is changed little. There are two main reasons for the changes: upland rice and upland cucumber are probably planted under natural conditions, thus needing no chemical fertilizer or pesticide; and, agricultural production at the Kachat village is subsistence production, with most upland crops cultivated for household consumption and any small surpluses being sold.

4) Access to electricity

Road infrastructure that has been supported by international development agencies and foreign investors are beneficial in facilitating access to education, health, transportation and markets, as well as electricity. With electricity, rural people can access to television, radio, refrigerators, and cell phones, among other electrical equipment.

3.4.4 Financial capital

Figure 12 shows that financial capital had the lowest index value overall when compared with other capital indices for both the normal 2010 climate and the 2011 climate event, showing no significant difference. However, income from agricultural production, livestock, outside work, and credit changed significantly at the <0.001, <0.05, <0.001, and <0.05 levels, respectively, between 2010 and 2011 (Table 14). The average index of agricultural income dropped from 0.13 to 0.02, and livestock income dropped from 0.13 to 0.11. In contrast, income from outside work increased from 0.10 to 0.20, and access to credit from 0.06 to 0.11.

As a result of the 2011 climate event, income from agriculture and livestock decreased, largely because people could not cultivate upland rice. Normally, food crops for consumption and sale in local markets are planted in the same plot as upland rice. But neither food crops nor upland crops could be cultivated. Livestock also are important to the household economy, especially when they are used as a form of savings. Generally, rural people raise cattle, water buffalo, pigs, chickens, and ducks. Cattle and buffalo are raised using traditional systems on fallow land and in forests. The household survey showed that early and heavy rainfall occurred from March to June, leading to an outbreak of foot and mouth disease that killed about 45% of the 96 cows, and 24% of the 17 buffalo in the village. In addition, 67% of the 619 poultry, and 20% of the 99 pigs also succumbed to undetermined diseases in 2011.

The overall financial capital index showed no significant difference between groups A and B in both 2010 and 2011; the financial capital index overall was similar at 0.14 for both groups. Under the normal 2010 climate, access to agricultural income, and credit were significantly different between the two groups at a 0.5 levels, while livestock income, off-farm income, working outside, and saving variables were not

significantly different. In the 2011 climate event year, there were two variables: agricultural income and off-farm income, both of which had significant differences at the 0.001 and 0.5 levels, respectively. However, livestock income, working outside, credit, and savings variables showed no significant difference.

3.4.5 Social capital

At the research site, villagers have strongly social relationship with each other. Borrowing money and sharing basic family needs for food are a common practice. They often borrow rice from their relatives, if their families face rice insufficiency. They return the same amount of borrowed without interest. They can also pay back for their rice by farm labors, which equivalent with their borrowed.

A pentagonal diagram of livelihood assets shows that the overall social capital index was higher in the normal 2010 climate (about 0.35) than in the 2011 climate event (0.31) (Figure 12), with a significant difference at a <0.001 level. The overall social capital was assessed through three variables: equity, participation, and social relations. There was significant change at the <0.001 level between 2010 and 2011. The social relationship index increased from 0.02 in 2010 to 0.15 in 2011, but the equity and institutional participation index decreased. This is because many heads of household went outside the village to earn more additional income, in response to food insecurity, so could not always attend village and community activities during the period. In addition to institutional participation, equity index also decreased from 0.42 in 2010 to 0.29 in 2011. As mentioned above, the climate event in March influenced NTFPs, agriculture, livestock, and off-farm income, which all decreased. Therefore, the average total household income was higher in 2010 at about 8,173,704 kip or 1,438,389 kip per capita in 2010, compared with 6,481,180 kip of total household income or 1,134,207 per capita in 2011.

The overall social capital index showed no significant difference between groups I and II in both the 2010 normal climate year and the 2011 climate event year. Interestingly, a household with insufficient labor (group A) had higher index values than a household with sufficient labor (group B) in both years (Figure 12). In the 2010 normal climate year, two variables were significantly different at a 0.5 level for equity and a 0.01 level for social relationship, while the institutional variable showed no significant difference between groups I and II. In 2011, social relationship variable had significant differences at a 0.001 level, while others had no significant difference between two groups.

3.5 Change in household income sources under the climate event

Household strategies are a way to understand how people at the research site responded to an early onset of the rainy season. This section provided results of the study on livelihood situations for groups A and B in different years. In Figure 15, I compared each source of income in different years for each group. In contrast, I compared each income source for the two groups in the same year in Figure 16. Residents there engaged in a combination of activities and choices to achieve their livelihood goals.

The comparison of income source revealed significant differences in agriculture at a <0.001 level and livestock income at a <0.5 level for group A. However, income from NTFPs, off-farm activity, outside work, and total income did not show a significant difference between the normal 2010 year and the 2011 climate event (Figure 15). For group B, each income showed a significant difference: NTFP income and agricultural income had significant differences at <0.001 levels; livestock income at <0.01 level; and off-farm activity and outside work had significant differences at <0.5 levels. However, total income in group B showed a significant difference at <0.5 level.

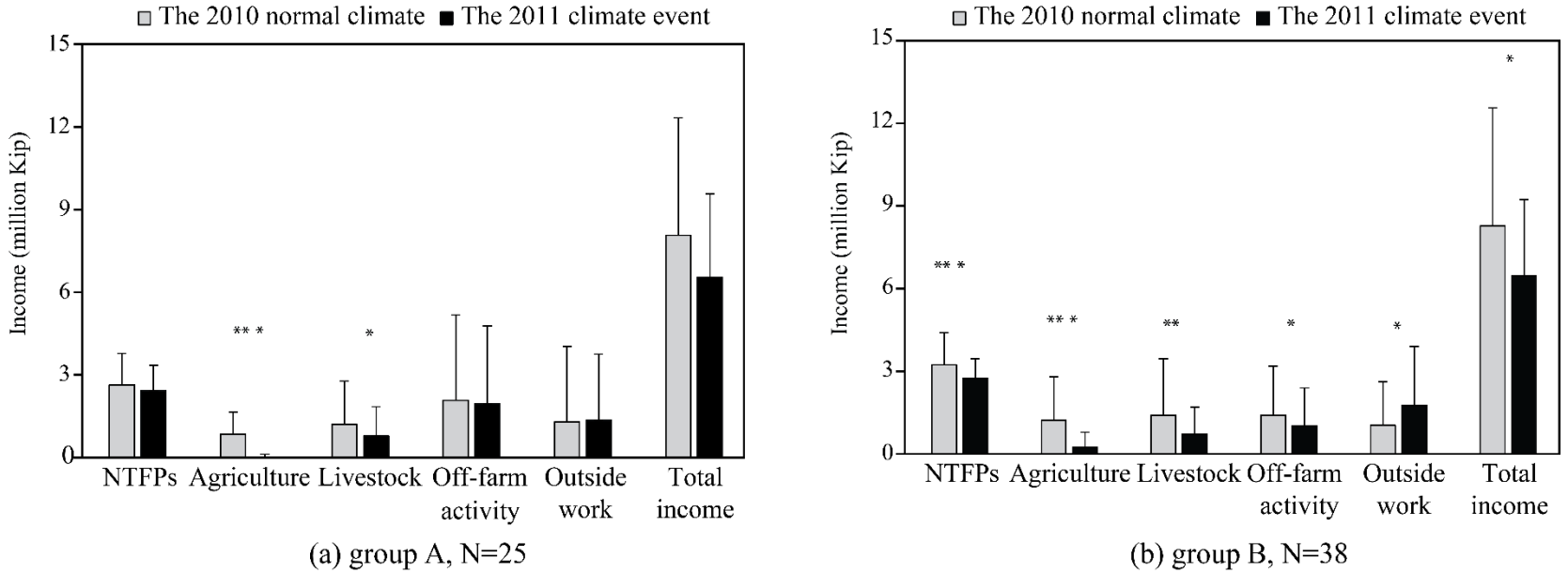


Figure 15 Average household incomes in 2010 and 2011 of (a) group A and (b) group B

Source: Household survey by author in July, 2011 and March 2012

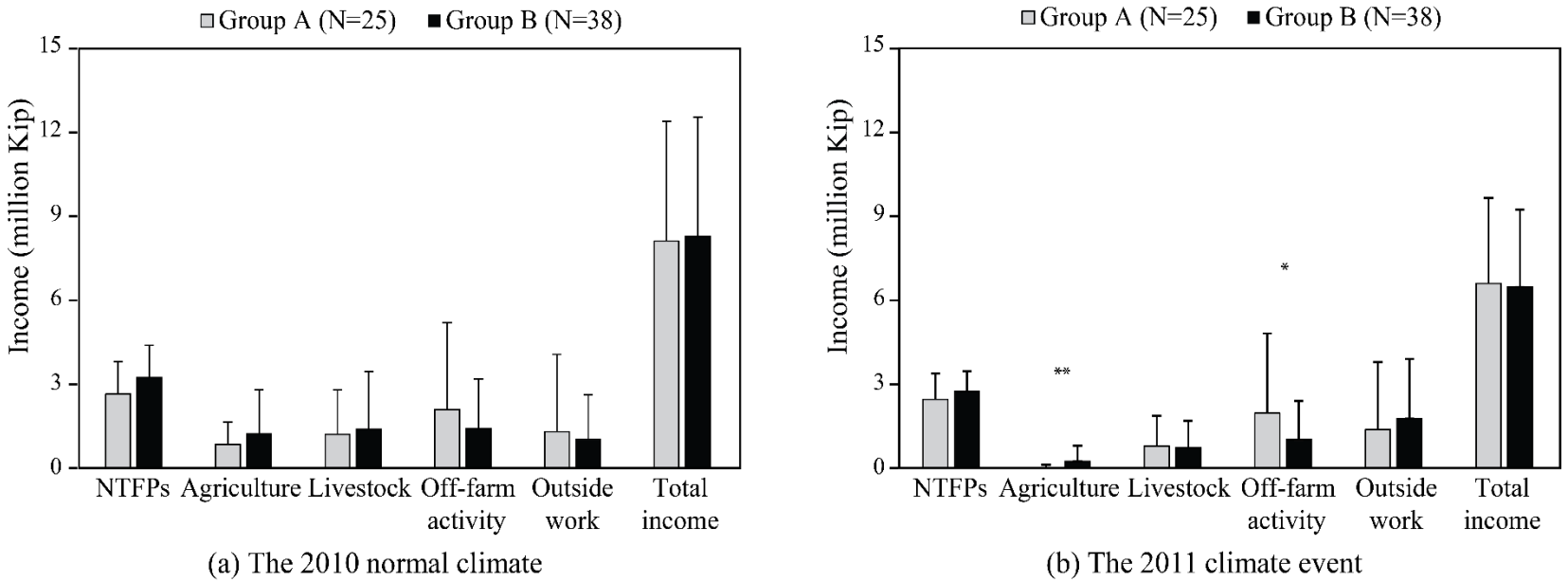
Note: * the mean significant difference at <.05 level, ** at <.01 level, and *** at <.001 level.

One U. S. Dollar (USD) was equivalent to 8,029 kip on average in 2011, and 8,269 kip in 2010 (NSC 2012).

The results indicate that households with sufficient labor (group B) had changed in income compared with those with insufficient labor (group A) between the normal climate year and the climate event year.

The comparison of household income in the normal climate year between groups A and B did not present any significant difference in NTFPs, agriculture, livestock, off-farm activity, outside work, and total income between groups A and B (Figure 16). In the 2011 climate event year, there was a significant difference between the two groups for agricultural income at a 0.01 level and at a 0.5 level for off-farm activity. However, NTFP income, livestock, outside work, and total income had no significant difference between the two groups in the 2011 climate event.

For group A, in 2010, NTFP income was the largest component of household income, followed by off-farm income, outside work, and income from livestock and agriculture (Figure 17). In the 2011 climate event, NTFP income was still the highest component, followed by off-farm income, outside work, livestock income, and agricultural income. The percentage of total income declined slightly. NTFP income declined from 2,637,860 kip or 33% of total household income in 2010, to 2,440,280 kip or 37% in 2011; agricultural income declined from 848,000 kip or 11% in 2010, to 20,000 kip or 0.3 % in 2011; livestock income declined from 1,205,200 kip or 15% to 784,800 kip or 12%; off-farm income declined from about 2,087,000 kip or 26% to 1,951,400 kip or 30%; and, outside work income increased from 1,296,800 kip or 26% to 1,364,000 kip or 30%, during the same period. Household income group A declined from 8,074,860 kip in 2010 to 6,560,480 kip in 2011, but income from outside work increased. Group B households also showed NTFPs to be the largest proportion of total income at 39%, followed by livestock and off-farm activity income at 17%, agriculture at 15%, and outside work at 12% in the normal 2010 year. Income sources changed in



(a) The 2010 normal climate

(b) The 2011 climate event

Figure 16 Comparison of average household incomes between group A and group B in (a) 2010 and (b) 2011

Source: Household survey by author in July, 2011 and March 2012

Note: * the mean significant difference at <.05 level, ** at <.01 level, and *** at <.001 level.

One U. S. Dollar (USD) was equivalent to 8,029 kip on average in 2011, and 8,269 kip in 2010 (NSC 2012).

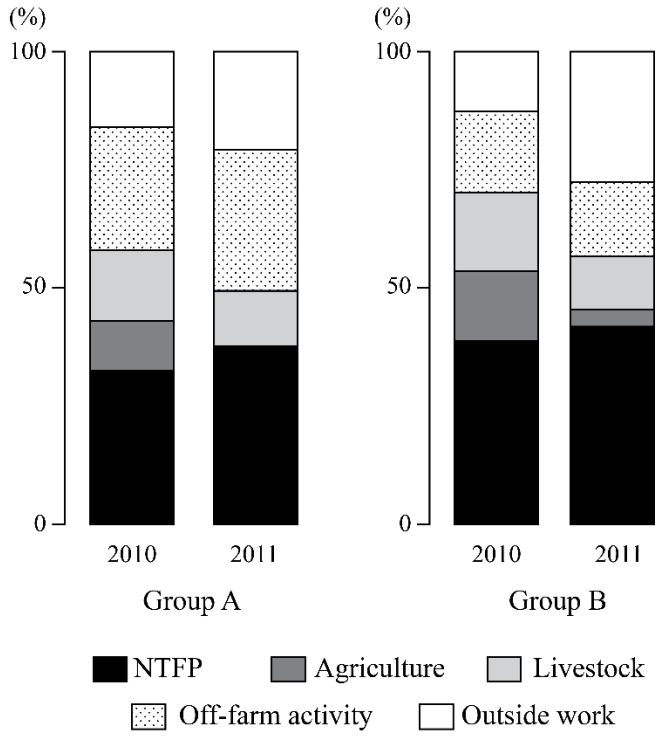


Figure 17 Proportion of incomes by economic activity in 2010 and 2011

Source: Drawing by the author based on household income

the 2011climate event. Group B again had NTFPs as the largest proportion of total income, at 42%. The remaining proportions were outside work at 27%, followed by off-farm activity at 16%, livestock at 11%, and agriculture income at 4%. NTFP income declined from 3,218,733 kip in 2010 to 2,722,957 kip in 2011. Agricultural income declined from 1,210,526 kip to 231,579 kip, livestock income from 1,387,895 kip to 715,000 kip, and off-farm activity income declined from 1,396,579 kip to 1,004,211 kip between 2010 and 2011. However, outside work income increased from 1,025,000 kip to 1,755,263 kip during the same period, but total household income declined from 8,238,733 kip in 2010 to 6,429,003 kip in 2011.

At the research site, livelihood strategies for both household groups did not differ between the normal climate and climate event years. In the normal climate year, all households in the village paid attention to cultivating upland crops including rice as a major household activity. Upland rice was the staple food and income was earned from upland crops. In the 2011 climate event, local people engaged in various activities including collecting NTFPs, agriculture, livestock, off-farm activities, and outside work. There were no different livelihood activities between the normal climate and climate event years, but the ratio of labor input to each activity was different between the two household groups.

3.6 Discussion

3.6.1 Change in access to household capitals

The pentagonal diagram of five capital types shows change in access to resource capital between the normal 2010 climate and the 2011 climate event years. Every livelihood index value indicated poor access, except for natural capital, which was the primary source of income in both climate conditions. Residents at the research site generated household income by gathering NTFP such as bamboo and rattan shoots,

broom grass, cardamom, peuak-meuak, and benzoin. Most important NTFPs are found during long fallow periods of 4 years or more (Yokoyama 2004). Currently, population pressure, land use policy, and promotion of commercial crops are the main causes of forest degradation (Thongmanivong and Fujita 2006, Fujita and Phanvilay 2008). The fallow period has become critically short, and fallow rotations are down to 3 years (NAFRI 2005). Therefore, if local residents lack optimum fallow management, long-term access to natural resources will be uncertain in the future. The study suggests that long fallow period management should be promoted together with natural resource management where land resources are available.

In addition to NTFPs, the land variable of natural capital shows that local residents had a different number of plots and an average land size of about 5.43 ha per household (range, 0–22.5 ha). These figures were not substantially impacted by the climate event. The findings indicate that land is not a significant factor in helping local people cope with and overcome the early onset of a wet season. In other words, land area was an important capital during a normal climate year, but not under during a climate event year. However, land size is an important factor related to product volume; larger farm size means greater amounts of produce (Roder 1997, Southavilay et al. 2013).

The human capital and household labor availability became more important in the 2011 climate event. At the research site, upland rice is a major crop for household consumption, and is based on slash-and-burn systems. As noted in chapter II, in a normal year, upland rice production requires about 300 person days/ha/year, including 20 person days/ha/year for burning dry biomass (Roder 2001). Normally, land for swidden is prepared by cutting fallow forest or shrub forest and by burning the dry biomass before planting. On the other hand, in the 2011 climate event and early onset

of the rainy season at the beginning of March, farmers missed the timing of burning and the biomass became wet. Therefore, farmers had to remove the biomass from the farmland by hand. In the village, about 100-person days/ha are needed for land preparation by hand for cultivation. Therefore, many households with less family labor were unable to cultivate upland rice, while households with sufficient labor could do so. This indicates that labor became more important in the climate event year, emphasizing that access to labor is a challenging type of capital for households during climate events. Moreover, the demand for labor in a household affected the education of children. In the climate event year, about 50% of children research site households dropped out of school to respond to labor shortages in household activities and agricultural production.

The overall physical capital index was significantly different between 2010 and 2011. Two variables of the physical capital index, access to irrigation paddy fields and farm input, did not show any significant difference. This is because paddy areas are limited on sloped areas at the research site. In addition, the research site lacks support from agricultural extension, local authorities, and private investment.

Access to external facilities and electricity has improved in the short period between 2010 and 2011. Laos became a member of the Association of South East Asian Nations (ASEAN) in 1997, requiring changes in the legal framework for investment including providing incentives for investors to form joint ventures and promoting foreign direct investment in the country (Phanvilay 2010). Vietnamese and Chinese investors established shops selling electrical equipment and appliances along National Route 13, from central Laos through the northern provinces, beginning near the borders with China and Vietnam. Color televisions, CD-DVD players, refrigerators, and mobile phones are available at the research site. In addition to electricity, facilities including

hospitals and schools were provided loans and financial support by the World Bank and Asian Development Bank (ADB) to increase infrastructure and human resource development in rural areas. However, some variables were significantly different. Changes in overall physical capital likely were influenced by the rural development program of the Lao Government rather than by the climate event. The present findings indicate that political and development programs were associated with changes in physical capital at the research site.

Residents at the research site were better off in terms of natural capital but worse off in terms of financial capital. The findings show that the education level did not contribute to residents' wages and salaries, but experience was a more important indicator. According to interviews with factory employees in 2011, people with more experience earned higher monthly salaries, about 800,000 kip, compared with 600,000 kip for those less experienced. These findings contradict those of Morse et al. (2009) who asserted that education was important in augmenting off-farm sources of income; they stated that educated persons had increased opportunities to earn a wage or salary (Morse et al. 2009). However, this was not the case for the rural uplands of the research site. The pentagonal diagram of livelihood revealed that most residents were dependent on natural resources as part of their livelihoods, while income-generating activities were limited in both the normal climate and climate event years. The study recommends that access to sources of income and short-term income-generating activities should be encouraged, rather than promoting commercial trees and long-term investment in rubber plantations (Manivong and Cramb 2008) and forest land allocation. The latter activities have impacted upland farmers in mountainous areas, where people are heavily dependent on swidden cultivation (Yokoyama 2014).

Interestingly, Figure 12 shows that the overall social capital index of group A

was higher than that of group B in both climate conditions. This is because neither group A nor group B made a significant difference in the level of participation in village activities, including decision making, planning, meetings, and implementation; however, different social relationships arose including mutual assistance activities. Villagers frequently exchanged labor in the swidden agriculture system, including planting, weeding, and harvesting. In the climate event year, the role of labor exchange became less important, while food sharing, rice, and borrowing money became more important when compared with a normal year. This indicates that households with a substantial labor force tended to be better adapted to the climate event, but had fewer social relationships in a climate event year.

In fact, household decision making remained a driving force behind change in social capital between 2010 and 2011. Heads of households strongly influenced decisions related to crop production, livestock production, and farm management. In some cases, heads of households went outside the village to earn additional income in response to food insecurity. As a result, women and children lost the opportunity to make decisions and provide their opportunities. The social capital of any society is very important, because mutual trust and relationships help people to cope with shocks when they are in a vulnerable situation (Shah et al. 2005). Therefore, the related policy sector response to this issue should be to strengthen social capital and local institutions, together with providing income-generating activities in the village rather than outside.

3.6.2 Change in livelihood activities

The study indicates that households at the research site changed their livelihood strategies and sources of income in response to early onset of the wet season in 2011. This corresponds with the meaning of livelihood: “A livelihood comprises the capabilities, assets (stores, resources, claims, and access), and activities required for a

means of living" (Chambers and Conway 1992). Figure 15 shows that NTFP gathering and outside work were important income sources under the 2011 climate event for households with sufficient labor. NTFP gathering and off-farm activity were the most important strategies in households with insufficient labor during the climate event and the normal climate year. Outside work was a strategy implemented by local people in order to cope with the lack of food security during the climate event year, and when the price of labor increased, there was a corresponding increase in the number of outside workers. Labor shortages and less attention to community activities were challenges. However, household strategies were mainly short-term responses to meet consumption needs, rather than a response that changed production practices. Consumption responses ensure income needs and food sufficiency of the household (Satanto 2008).

The current findings indicate that diversity of local activities is a fundamental characteristic to cope with short-term impacts from climate change. People did not create new livelihood strategies for coping with the climate event; they dealt with the early onset of the wet season by increasing the ratio of labor input to time spent on each activity during the climate event.

3.7 Conclusion

This study analyzed differences in peoples' livelihoods under different climate conditions; a normal climate in 2010 and a climate even in 2011. The study adapted the SLF approach to analysis (developed by DFID), with selected livelihood assets, and formed a pentagonal diagram of five forms of capital of respondents, to determine any change between the normal climate and climate event years (2010 and 2011, respectively). The study concludes that households with substantial labor tended to cope better with the climate event than those with a small number of family laborers. They had good access to natural capital but less access to financial capital. The study

found several factors that enhance the ability of local people to cope with short-term impacts and most of the factors are also useful in understanding long-term change. Those factors play different roles in short- and long-term events.

The author also concludes that livestock plays an important role in the household economy, especially when it is used as a means of cash income and savings. Agricultural production and collection of NTFPs are a response to ensuring household food security, with any surplus being sold in the local market. Off-farm and outside work are a way to earn income or to generate savings. The finding concludes that there were no different livelihood activities in the normal climate and climate event years, but the ratio of labor input and time spent on each activity was different between the normal climate year of 2010, and the climate event year of 2011.

Changes in the livelihood assets of local people at the research site resulted from the climate event. However, socioeconomic and political factors also are relevant in changing livelihood strategies. The author suggests that this issue should be investigated further.

Chapter IV Agrarian Livelihood Change in Lowland Areas: From Subsistence Livelihoods to a Cash Economy

Chapter IV described agrarian livelihood changes caused by changes in neighboring China. The expansion of commercial production affected household livelihoods, promoting the change from subsistence to commercial production. The expansion of dry season crop production was to supply increased demand from Chinese consumers. This chapter identifies changes in the area planted for commercial production with a particular focus on dry season crops. Factors influencing household decisions to produce crops under contract with investment companies is discussed.

4.1 Introduction

The Lao government introduced NEM in 1986, as an important step away from the command economy toward a market-oriented economy; moving away from state-owned enterprises toward private business and Foreign Direct Investment (FDI) (Stuart-Fox 2005). Through the Lao Government's FDI policies, private investors from China introduced new crops in northern provinces through contract farming and land concessions, especially in border areas with China. The expansion of dry season crop production, including corn, green beans, red and long pumpkin, and other crops, increased annually. A review of literature revealed that Chinese investors were a positive influence on some farmers. Khontaphane et al. (2006) stated that ethnic minority groups tended to move away from swidden and opium production to cultivate cash crops as a permanent source of income, including maize, sesame, and Job's tears; commercial crops for processing such as sugarcane; as well as dry season crops such as beans, pumpkins, and chili, among others, for Chinese markets. Producers also gained access to modern agricultural technologies such as machines, high yield varieties, and

agricultural chemicals. As a result, agricultural trade at the Chinese border in contributed to poverty reduction. On the other hand, Chinese influence also generates negative impacts. For example, rubber trees replaced traditional upland swidden practices; with fallow forests being converted into rubber plantations. This change significantly affected the Akha and Khamu ethnic groups, whose livelihoods traditionally have been based on subsistence agriculture; including cultivating upland rice and other crops for home consumption and collecting NTFPs for market (Thongmanivong et al. 2009, Goto 2011).

Earlier studies describe both positive and negative impacts from Chinese investments on rural inhabitants in northern Laos. However, no conclusions are offered on the impacts of new dry season crops introduced by investment companies; including which crops are most appropriate, given the limited abilities of rural households in northern Laos. This study thus aims to (1) detect changes in the size of commercial production areas, with particular focus on dry season crops between 2007 and 2012; and, (2) investigate and understand how households decide to select particular varieties that were introduced by domestic and Chinese investors into their family farms.

4.2 Methodology

In order to detect changes in dry season crop areas, high-resolution satellite images for 2007 and 2012 were compared. The images were obtained from the Advanced Land Observing Satellite (ALOS) and were manually interpreted and classified into wet season paddy fields and dry season cash crops. Satellite images were selected to classify different dry season crops and to estimate field areas. Maps were created using the ArcGIS program. In addition to satellite images, GPS data also were used to verify each land use class. The study adapted image overlay and classification comparisons of land cover and used statistical methods to evaluate changes in dry

season crop areas during the period 2007 and 2012.

Household surveys were carried out in three villages. Interviews were conducted with representatives of households cultivating dry season crops in 2012. Households in each of the three villages were divided into four production groups: green beans, red pumpkin, long pumpkin, and corn. In fact, households at the research site cultivate many different dry season crops in the dry season. However, they select one crop as a major crop for their households. Therefore, the largest area of the main crop in the household was selected for the interview.

The sample was based on the random selection of five representative households from each crop variety in the three villages (Table 16). The sample households were divided into four groups: green beans (GB) (group GB = 15 households); red pumpkin (RP) (group RP = 15 households); long pumpkin (LP) (group LP = 15 households); and, corn (C) (group C = 5 households). According to the members of the corn production group, only one village was still cultivating corn. Therefore, only five households were interviewed for corn. A one-way ANOVA was conducted to examine the significance of differences in decision making about selecting a crop among four household groups. Sex, age, education, number of household members, main labor in household, number of paddy plots, number of agricultural plots, number of crop varieties, and household income were used to test the null-hypothesis on dry season crop production for four household groups.

In addition, the study assumed that high economic returns from dry season crop production is one reason that people at the research site select a specific dry season crop for their household. The economic feasibility of dry season crop production was evaluated. Descriptive and qualitative approaches were used to evaluate economic returns, and the results were presented in the form of sample means and ratios.

Table 16 Samples size of dry season crops production

	Villages			Total
Crop varieties	Deua (hh)	Yo (hh)	Chaingpii (hh)	households
Green bean (group GB)	5	5	5	15
Rad pumpkin (group RP)	5	5	5	15
Long pumpkin (group LP)	5	5	5	15
Corn (group C)			5	5
Total				50

Source: Classify by the author

Note: hh refers household

Economic efficiency was assessed based on three objectives:

1) Output yield: Output yield is the realized output that was sold to market only. Output yield estimate in tons per hectare.
2) Returns to land (gross margins per hectare): Returns to land was calculated by multiplying the output and selling price minus farm input costs divided by produced land area in one hectare.
3) Returns to labor (gross margins per person-day): Returns to labor were estimated by dividing returns to land by labor input person-days. Labor input refers to number of adult-equivalents working for 8 hours per day.

4.3 Driving force behind changes in agrarian livelihoods

As mentioned above, people's livelihoods in rural northern Laos changed rapidly from a subsistence to a cash economy as the result of several factors. These factors are discussed in this chapter, namely: political, regional development policy, Economic Corridor Project under the framework of the GMS, and foreign direct investment. In addition, the impacts and implications of Lao Government policy are discussed.

4.3.1 Political relationship between Laos and China

The political relationship between the two counties has stimulated changes in economic relations after President Jiang Zemin became the first general secretary of the Chinese Communist Party to visit Vientiane in November 2000; in return for a visit of Lao President Khamtay Siphandone to Beijing in July 2000 (Stuart-Fox 2009). The Lao-Chinese relationship earlier was enhanced by an agreement establishing an Economic, Trade, and Technical Cooperation Commission on 11 June 1997 (Lintner 2008). Both were important steps in strengthening the relationship between two countries that had been weakened since 1979, when Laos established closer political

connections with Vietnam. Originally the Lao relationship with China was restored during the transition to a market-oriented economy in 1987 (Stuart-Fox 2009). In 2004, Premier Wen Jibao attended an ASEAN Summit in Vientiane and again in 2008, the GMS summit. These visits were indications by the Chinese of their interest in having closer relations with Lao PDR. As a sign of change, development activities were intensified under a cooperation agreement, focusing on infrastructure and trade development in northern Laos. Roads connecting northern Laos and southern Chinese provinces were constructed supported by the Chinese Government and ADB.

Chinese influence in Laos was enhanced particularly through aid and substantial loans that China provided to enable Laos to weather the Asian economic crisis in 1999. The Lao were grateful for the assistance, and the relations warmed between two countries (Stuart-Fox 2009). The Chinese aid program has focused on improving transport links between the two countries with roads and bridges as priorities. China joined with Thailand to finance one-half of the cost of building a bridge connecting Houayxay District, Bokeo Province, Laos, and Chiang Saen District, Chiangrai Province, Thailand, that was completed in 2011. China also constructed Lao National Route 3 from the China-Lao border at Boten village, to Xay District, Oudomxay Province. In addition, China constructed part of the GMS Northern Economic Corridor highway in Laos.

4.3.2 Regional economic corridor in the GMS

The ADB supported Greater Mekong Sub-region Economic Cooperation has introduced the concept of the North-South Economic Corridor (NSEC) (Tsuneishi 2009). The objective of the NSEC project was to improve infrastructure and promote regional economic cooperation between member countries of the GMS (Goto 2011). An important aspect of the NSEC is to link Kunming, Yunnan Province, southern

China, to Bangkok, Thailand. This is achieved through Lao National Route 3A that connects Houayxay District, Bokeo Province, Laos, with Chiang Khong District, Chiangrai Province, Thailand; and, Boten, Luang Namtha Province, Laos with Mohan, Yunnan Province, China. Each district town has an international immigration checkpoint through which foreign nationals can pass. The NSEC project aims to build transportation infrastructure such as roads, bridges and a railway, as well as to promote border trade and investment along the corridor in northern Laos.

In support of the NSEC project, Boten village was selected as the main gate for promoting international cross-border trade in northern Laos, a major policy objective of the GMS framework. Chinese influence has accelerated economic development along the NSEC and in adjacent areas. Cross-border trade between northern Laos and Yunnan Province, China (Figure 18), was developed by the Chinese Government at the provincial level, focusing on: Phanhai, Luang Namtha Province; Meochay, Oudomxay Province; and, Pakha, Boun Neua District, and Pacha, Lantoui, and Menkeuapong, Boun Tai District, Phongsaly Province. Chinese products went first to northern provinces and later on to Vientiane. Light industrial goods were sold along Lao National Route 13, from Luang Namtha Province to Vientiane Capital, and on to southern Laos.

4.3.3 Foreign direct investment

Since the mid-1980s, following the Lao Government's introduction of the New Economic Mechanism, economic reform has been shaped by expanded links to regional and global markets and by FDI (Stuart-Fox 2005). The NEM, announced in 1986, was an important step in changing from a command economy to a market-oriented economy; and, from state-owned enterprises to both private enterprises and FDI (Stuart-Fox 2005). Laos has experienced intense FDI activity during the economic transition

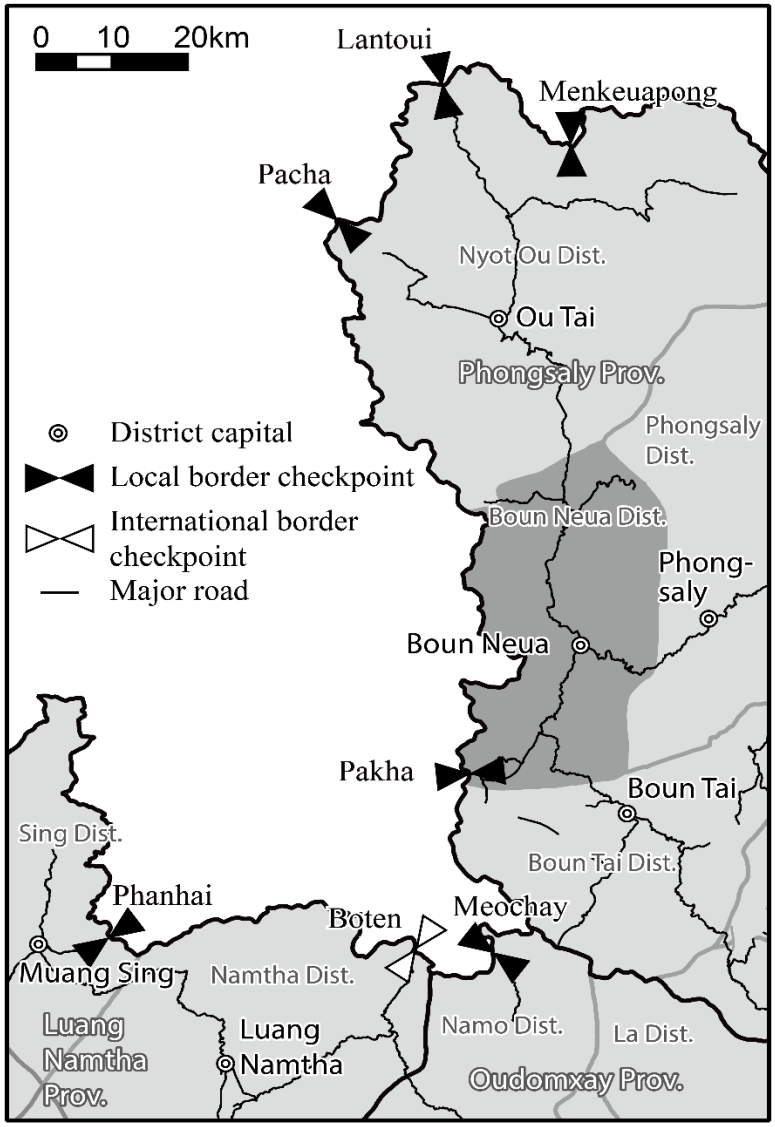


Figure 18 Cross-border checkpoint between three northern provinces, Laos and Xishuangbanna prefecture, China

Source: Drawing by Yokoyama based on Mekong GIS Data

period. In the 1990s FDI in Laos was heavily dominated by Thailand, especially in the energy sector, particularly hydroelectric power development. Over the past ten years China also became a major investor in Laos and now has a significant role in Lao development (Lintner 2008). However, China was ranked the second largest investor after Vietnam; with a large approved cumulative amount of FDI from 2000-09 (Goto 2011).

Implementation of the Lao "open door" policy, combined with strong political relation and improved road infrastructure, facilitated access of Chinese investors to Laos, allowing them to expand production and distribution networks across borders. The sale, distribution, and use of many Chinese products have expanded beyond northern areas and includes the research site. This situation led to a significant increase in Chinese products being imported to Laos, and Lao primary agricultural products being exported to China, usually to provide raw materials to the Chinese agro-industrial sector. The increased Chinese demand for natural resources and agriculture raw materials has affected rural development in northern Laos.

4.4 How farmers were innovatively introduced to dry season crop production

4.4.1 Expansion of dry season crop production area

The Chinese demand for large volumes of natural resources and agriculture products has affected rural development in northern Laos. The effect has meant a change of rural livelihoods, from subsistence agriculture to market-oriented and commercial agricultural production. In this context, many types of dry season crops were introduced at the research site, from 1996 to the present day (Figure 19). During the field survey in February 2012, the area used to cultivate dry season crops had increased rapidly overtime at the research site. Green beans, red pumpkin, long pumpkin, and corn were commonly produced under contract farming arrangements

Crop varieties	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Sugarcane*																		
Chili pepper																		
Watermelon																		
Green bean																		
Red and Long pumpkin																		
Maize																		
Large gourd																		
Rubber tree*																		
Corn*																		

Note: * means crop variety for upland areas

Yo village, Deua village, and Chiangpee village

Figure 19 Crop varieties introduced by Chinese investment companies

Source: Household survey by the author in March, 2011

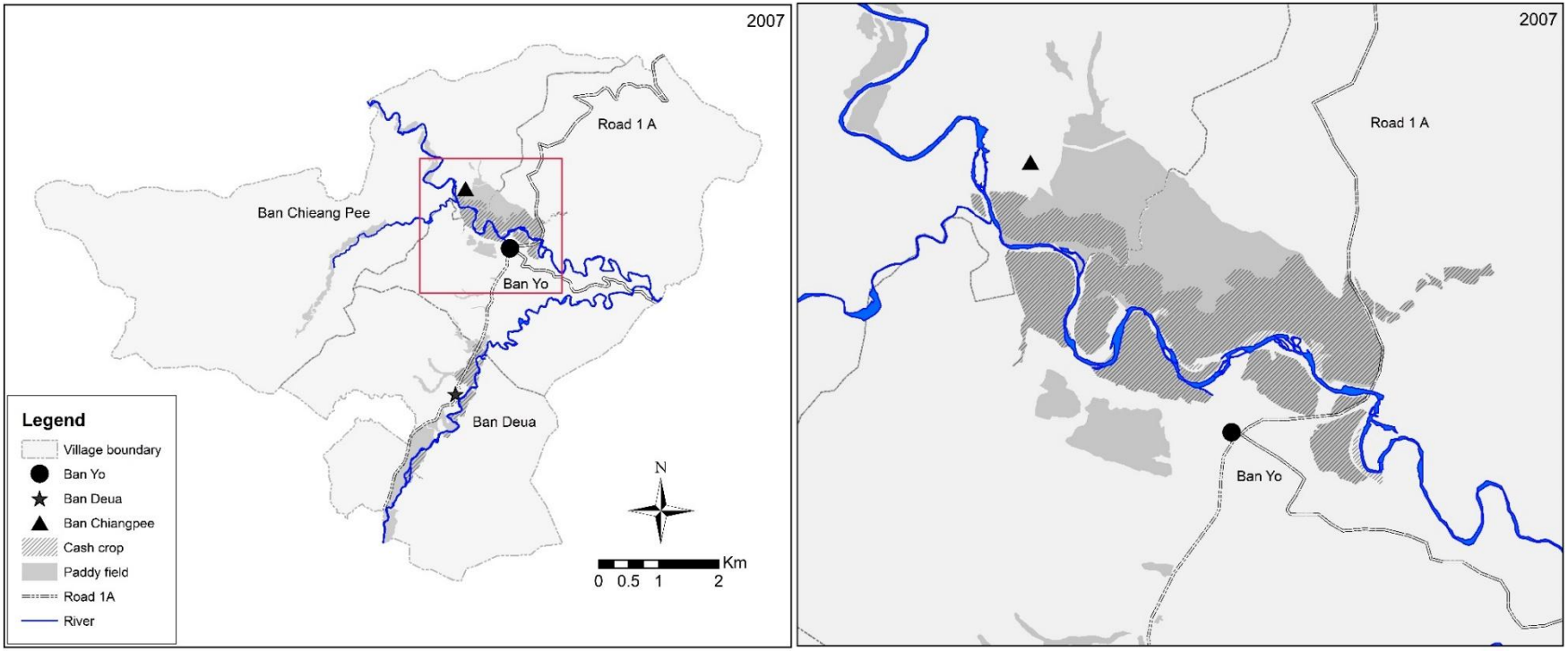
between agribusiness companies and producers. Most crops are cultivated in paddy fields following the rice harvest at the end of the wet season in October.

During a five year period from 2007 to 2012, three villages, including Yo, Deua and Chiangpee had quickly expanded dry season cash crop production in paddy fields (Figure 20). The largest area was in Yo village where about 40.5 ha covered 62% of the total paddy fields. This was followed by Deua village where 27.7 ha or about 37.7% of the paddy fields were cultivated; and, about 5.4 ha or 11.4% of the paddy fields were cultivated in Chiangpee village in 2007. In 2012, Deua village had the largest area in dry season crops, about 67.1 ha or about 80.3% of the paddy fields; while Yo village had about 53.6 ha consisting of about 71.9% of the paddy fields; and, Chiangpee with 32.9 ha, which covered 65.4% of the paddy field (Figure 21).

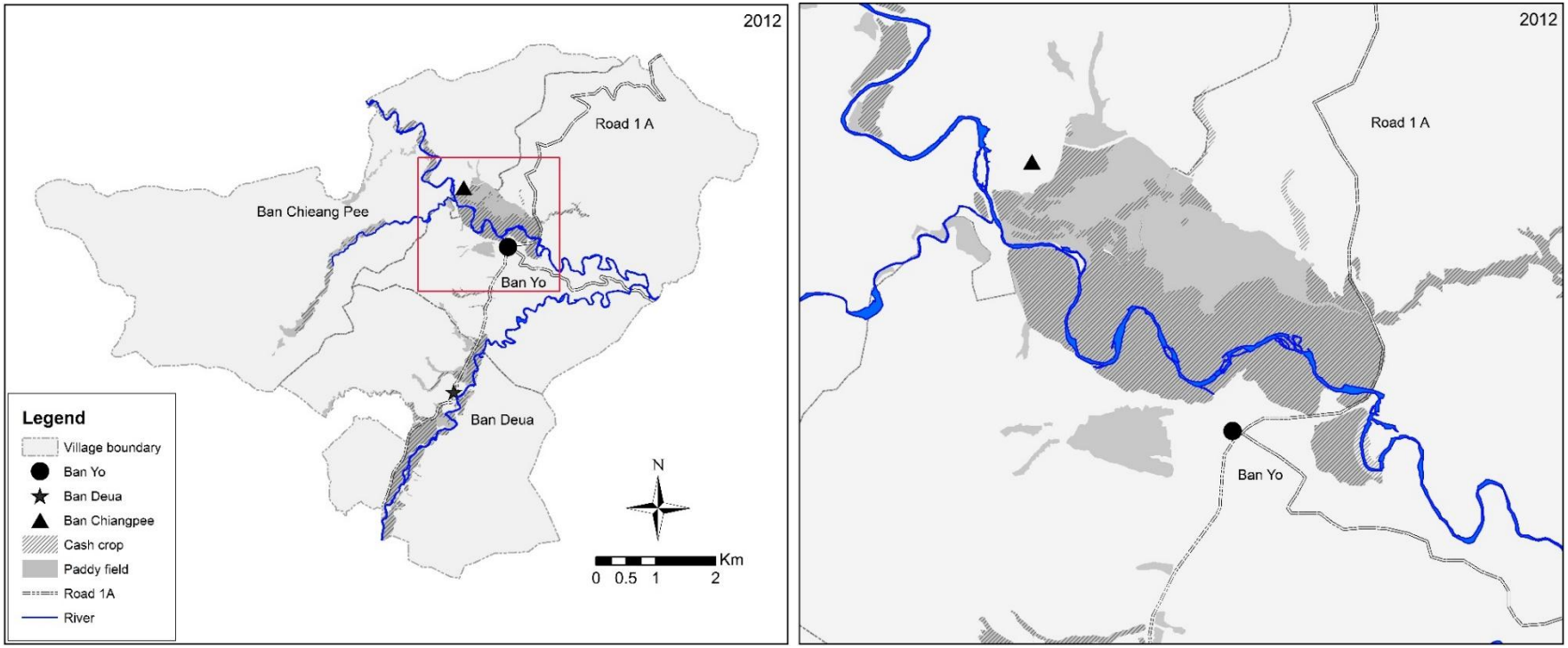
Chiangpee village rapidly expanded dry season cropping, increasing 83.6% between 2007 and 2012; followed by Deau village, increasing about 58.7%; and, Yo village increasing 24.4%. In addition to an increase in the area of dry season cropping, the area of paddy fields also increased during the same period. Local authorities decided to promote wet and dry season rice cultivation as a tactic to reduce sugarcane plantations, since this crop was considered as a major cause of deforestation at the research site. Investments in irrigation infrastructure have been a priority since 2007.

4.4.2 Contract farming

Rapidly increasing dry season crop production at the research site was initiated by Chinese investors. Results of the field survey show that dry season crop production was introduced to farmers through two channels. The first is contract farming, wherein farmers were contracted by Chinese private sector investors; and, the second is land concessions, wherein local authorities granted land to Chinese companies to carry out farming by themselves. Since 2003, informal land concessions had been made to



(a) Expansion of dry season crop production area in 2007



(b) Expansion of dry season crop production area in 2012

Figure 20 Expansion of dry season crop production area in 2007 (a) and 2012 (b)

Source: Drawing by the author based on satellite image in 2007 and 2012

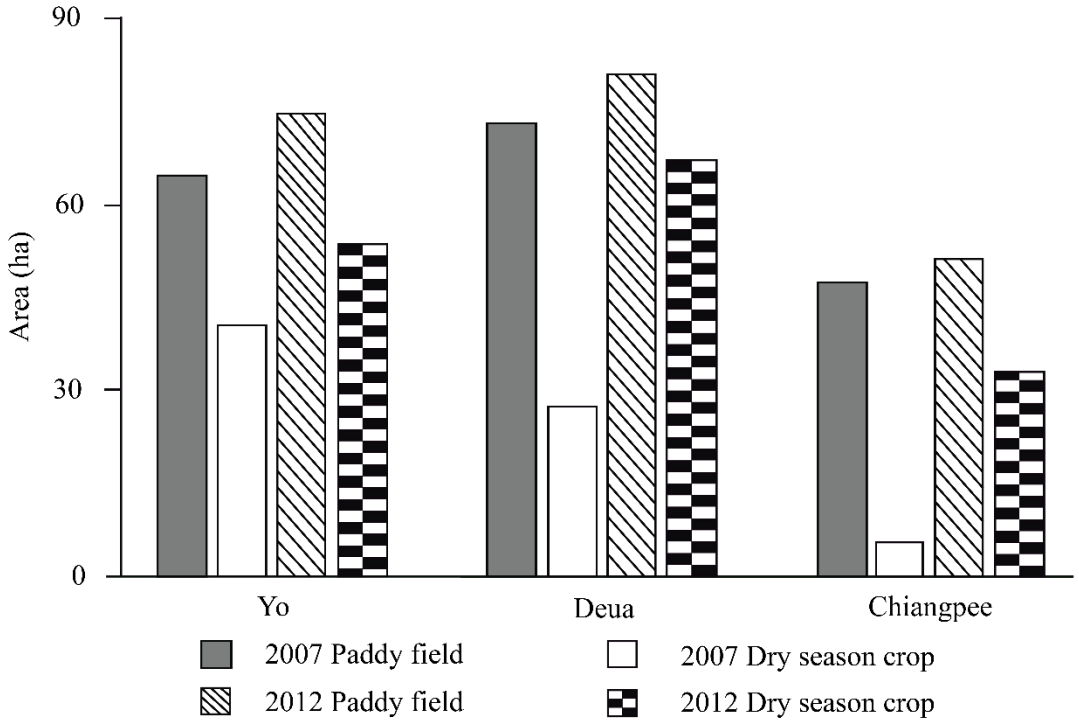


Figure 21 Increasing of the dry season crops in paddy field in 2007 and 2012

Source: Drawing by author based on satellite image of 2007 and 2012

Chinese farmers who had relatives among local ethnic Chinese Tai Lue and Lao Tai Lue people at the research site. Three Chinese households went to Yo village. These migrant farmers rented land from Lao landowners initially to plant watermelon, but later planted many other dry season crops, including chili peppers, red pumpkin, and long pumpkin; all of which used plant husbandry practices similar to watermelon.

Before 2008, there were three types of contract farming in Boun Neua District, Phongsaly Province. The first type was direct contracting wherein a Chinese company would contract individual farmers directly; but there were many weaknesses in such contracts, including companies not paying farmers for harvested products. This arrangement was discontinued by authorities, leaving only two kinds of contract farming, namely: Chinese companies pay for land concessions and operate their own farms; and, a second type wherein Chinese companies sign contracts with district agriculture and forestry offices (DAFOs) and the companies buy crops from producers under a DAFO contract. Contract farming in the research area is referred to as "2+3" in which the 2 designates the land and labor provided by farmers, and the 3 consists of capital (investment and credit), production inputs (seeds, fertilizers, pesticides), and market access, including transportation, provided by the investing company. Contract farming provides a guaranteed selling price to producers. For example, green beans from the first to third harvests (60% of total production) was 1,914 kip (0.24 USD) per kg (kilogram), and the fourth or subsequent harvests (about 40% of production) was 1,531 kip (0.19 USD) per kg, without having yet repaid input costs, namely seeds, fertilizers and pesticides. Red pumpkins were 1,021 kip (0.13 USD) per kg for a size of at least 0.8 kg and up, and 638 kip (0.08 USD) per kg for a size less than 0.8 kg. Long pumpkin was 638 kip (0.08USD) per kg for a product weighing more than 2 kg and 255 kip (0.03USD) for products weighing less than 2 kg. However, dry season corn had no

guaranteed price; selling for 2,000 kip/kg (0.25 USD) (market price in 2012). According to farmer interviews in Deua village, the cost of seed for long pumpkin produced under contract was about 89,320 kip (11.2 USD) per can, containing about 150 seeds (Table 17); fertilizer was 280,720 kip (35.2 USD) for 60 kg; plastic sheeting was 95,700 kip (11.9 USD) for 5 kg; and, 638 kip (0.08 USD) per kg being the selling price for long pumpkins. In the Chinese market (cross-border) seeds were selling for 76,560 kip (9.6 USD) (Table 17); chemical fertilizer was 255,200 kip (32 USD); and, plastic sheeting was 89,320 kip (11.2 USD); while the price offered for long pumpkin was 1,531 Kip (0.19 USD) per kg.

4.4.3 Dry season crop selection by farm households

Four groups of producers were evaluated by comparing the means of several factors, namely: sex, age, education, household members, main labor, number of paddy plots, number of agricultural plots, types of crops cultivated, total agricultural land, and household income. Statistical analysis shows that sex, number of household members, number of paddy plots, and types of crops cultivated were significantly different among the four groups, while other variables showed no significant difference. Among groups GB and C, 100% of households had a male head of household. Conversely, among group RP households, some 13.33% had female heads of household, and group LP had 33.33% with female heads of households. The four groups were significantly different in gender, at the 0.05 level (Table 18). This indicates that the gender of the head of the household made a difference in the crop selected for production. From the results of household interviews, husbands select the type of crop to be produced based on a husband's ability. In other words, households select crops based on the level of activity.

In addition to gender, the number of household members also was significantly different among the four groups, at the 0.01 level. The group with the highest average

Table 17 Comparative the cost of inputs on pumpkin production under contract framing and Chinese market

Farm inputs	Cost (kip)	
	Contract framing	Chinese market
Seed	89,320 kip/can	76,560 kip/can
Fertilizer	280,720 kip/60 kg	255,200 kip/60 kg
Plastic cover	95,700 kip of 5 kg	89,320 kip of 5 kg
Pumpkin product	638 kip/kg	1,531 kip/kg

Source: Household survey by the author in March, 2013

Note: One U. S. Dollar (USD) was equivalent to 7,981 kip on average in 2012 (NSC)

One can of seed contents 150 seeds

Table 18 Significance of difference on crop verity selection in the household

Variables	Categories of crop cultivation								F value
	Beans (Group GB)		Red pumpkin (Group RP)		Long pumpkin (Group LP)		Corn (Group C)		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Sex	2.00	0.00	1.87	0.35	1.67	0.49	2.00	0.00	2.885*
Age	44.93	9.92	45.53	11.15	45.87	10.22	37.80	1.64	0.901
Education	4.80	2.70	4.33	2.85	5.20	1.21	3.80	1.64	0.618
Household member	6.07	1.83	5.80	1.61	4.60	1.18	3.60	0.55	5.060**
Main labor in household	2.93	1.03	2.73	0.80	2.47	0.64	2.40	0.55	1.035
Number of paddy plot	2.13	0.83	2.47	1.13	1.93	0.70	1.20	0.45	2.823*
Number of agricultural plot	6.07	0.88	5.60	2.16	5.13	0.99	4.60	0.89	1.810
Number of crop variety	3.13	0.64	2.73	0.80	2.27	0.80	2.40	0.55	3.759*
Total agricultural land (ha)	4.26	1.55	4.05	1.99	3.67	2.25	3.00	0.40	0.686
Total household income (kip)	24,273,000	13,867,547	28,507,467	14,279,668	35,157,047	44,554,956	32,806,000	12,499,507	0.432

Source: Analysis by author

Note: * Mean significant difference at < .05 level and ** at < .01 level. One U. S. Dollar (USD) was equivalent to 7,981 kip on average in 2012 (NSC). Sex: 1 Male and 2 Female. Education levels: 1 means non-educated, 2 means primary 1, 3 means primary 2, 4 means primary 3, 5 means primary 4 and 6 means primary 5

number of household members was group GB, about 6.07 people in each household; the average number of members in other groups were: 5.8 people in group RP; 4.60 in group LP; and, 3.60 in group C. The average number of paddy plots in each household was statistically significantly different, at the 0.05 level among the four groups. Group RP had more paddy plots than other groups, 2.47 plots of paddy field; followed by group GB with 2.13 plots; group LP with 1.93 plots; and, 1.20 plots for group C. In addition, the types of crops variable was significantly different at 0.05 among the four groups. Table 18 shows that group GB cultivated the most number of crop varieties on their farms, about 3.13 different crops; followed by group RP, about 2.73; group C cultivated 2.40 crop types; and, 2.27 crop types for group LP (Photo 8).

The results of the study indicate that heads of household of a different gender, number of household members, number of paddy plots, and number of crop types influenced the selection of dry season crops produced by the household. On the other hand, variables related to age differences, education, number of main labor in the household, number of agricultural plots, agricultural landholding, and household income had no influence on the crop varieties selected for production.

4.4.4 Economy of dry season crops production

The cost and benefits associated with producing dry season crops at the research site were studied, focusing on: green beans, red pumpkin, long pumpkin, and corn, on a typical one hectare plot. Economic analysis was based on local prices in 2012. The costs consisted of both farm and labor inputs. The benefits are the outputs from each crop that was sold from one hectare of land. The costs of seeds, fertilizers, pesticides, and plastic sheeting were not included as farm input costs (Table 19) because the inputs were provided by the company under contract farming arrangements. In addition, land tax also was not included as an input cost. The value of dry season crops was estimated

Photo 8 A farmer cultivate two crop variety in the same plot and at the same time

Source: Taking by the author

Table 19 Cost of inputs in dry season crops production in 2012

Equivalent of inputs and outputs in dry season crop production						
	Unit	Green bean	Rad pumpkin	Long pumpkin	Maize	Note
1 Human Labor (Person-day)		298	174	170	87	
1.1 Land preparation	Ha	47	42	37	22	
1.2 Planting	Ha	24	31	20	17	
1.3 Fertilization	Ha	9	8	10		
1.4 Irrigation	Ha	10	8	8		
1.5 Spraying	Ha	23	15	15	25	
1.6 Weeding	Ha	20	40	43		
1.7 Harvesting	Ha	158	27	34	18	
1.8 Transporting	Ha	7	3	4	4	
2 Inputs (No cost)						
2.1 Seeds	Sheets	76	166	21 (kg)		
2.2 Fertilizer	Kg	617	555	448		
2.3 Pesticide	Kg	75	55	22		
2.4 Plastic cover plant	Kg	45	33	26		
2.5 Machinery	Issue	1	1	1		
2.6 Sprayer	Issue	1	1	1	1	
2.7 Water pump	Issue	1	1	1		
3 Total Inputs Cost (kip)		4,465,959	2,572,341	2,638,852	765,338	
3.1 Fuel	L	21	20	26	7	10,300 kip/L
3.2Tillage	Cash	2,299,099	2,299,099	2,299,099		
3.3Metherials	Cash	1,951,952	67,726	68,070		
3.4 Seeds	Kg				20	17,000kip/kg
3.5 Herbicides	Kg				23	15,000kip/kg
Yields (Kg/ha)	Kg	22,074	14,441	24,443	5,160	
Local price (Kip/kg)		1,914	1,021	638	2,000	

Source: Households survey by the author in March, 2012

Note: U. S. Dollar (USD) was equivalent to 7,981 kip on average in 2012 (NSC)

based on 2012 prices of 1,914 kip (0.24 USD) per kg of green beans; 1,021 kip (0.13 USD) per kg for red pumpkin; 638 kip(0.08 USD) per kg for long pumpkin; and, 2,000 kip (0.25 USD) per kg for corn. Prices were set by contract farming agreements. In addition, the 2012 cost of labor inputs for agricultural activities at the research site was 30,000 kip (3.8USD) per person-day, while the wage rate for construction in the district was 35,000-40,000 kip per person-day. One person-day refers to an adult working for eight hours in one day.

Table 19 shows that long pumpkin provided the highest yield per unit, about 24 tons/ha; followed by green beans, 22 tons/ha; red pumpkin, 14 tons/ha; and, corn, 5 tons/ha. Most crops were planted using furrow irrigation, while corn cultivation was on sloped lands. At the research site, field maize was commonly cultivated on sloped areas. Fertilizers and pesticides were not applied, but herbicide was used. Land preparation for green beans and for red and long pumpkins was undertaken in October and November, after the rainfed paddy has been harvested. The planting of long pumpkin started in early November, while green beans and red pumpkin were planted in December. These crops are harvested in February and March. Corn is planted in April and harvested in September.

The monetary return to land was estimated based on actual yield measurements obtained through the household survey. The results show that, expressed in financial returns to land, green beans had the highest return, obtaining 37,783,357 kip (4,734 USD) per hectare during the dry season. This was followed by long pumpkin at 12,955,763 kip (1,623 USD) and red pumpkin at 12,168,578 kip (1,524 USD). The lowest return to land was corn produced on sloped land, which was 9,555,437 kip (1,197 USD) per hectare (Table 20). Thus, the return to labor was high for green beans, about 124,534 kip (15.6 USD) per person-day, compared to 110,798 kip (13.9 USD) for corn;

Table 20 Estimate of dry season crop economic

Crop varieties	Yield (T/ha)	Return to land (Kip/ha)	Return to labor (Kip/person-day)
Green bean	22.074	37,783,357	124,534
Rad pumpkin	14.441	12,168,578	73,825
Long pumpkin	24.443	12,955,763	79,550
Maize	5.160	9,555,438	110,798

Source: Households survey by the author in March, 2012

Note: One U. S. Dollar (USD) was equivalent to 7,981 kip on average in 2012.

The wage rate for agricultural work was 30,000 kip per person-day in 2012

followed by long pumpkin, 79,550 kip (10 USD); and, red pumpkin, about 73,825 kip (9.3 USD) per person-day, which was the lowest return to labor. However, labor inputs were highest for green beans, using nearly 300 person-days; red pumpkin, 174 person-days; long pumpkin, 170 person-days; and, corn, 87 person-days.

The results of the economic analysis shows that cultivating green beans provided the highest level of productivity per unit; the highest financial returns to land; and, better returns to labor. On the other hand, red pumpkin generated a low level of benefits in terms of return to labor compared to other crops. Based on household income at the research site in 2012, 78% of household income was from agricultural production or about 2,797 USD; followed by livestock raising, about 13.7%, or about (493 USD); off-farm income, 5.6% or (201 USD); and, NTFPs, 2.7% (97.1 USD) (Figure 22).

4.4.5 Social networks between Lao and Chinese people in the border area

After the NEM policy was promoted by the Lao Government, opportunities were created for farmers to gain secure rights to land based on user's rights. Farmers at the research site were free to choose the staple and cash, commercial, and dry season crops to grow. Boun Neua District consisted of many ethnic minority groups, one of which is Lue or Tai Lue, who speak the original Lao language. This ethnic group lives near the Lao border with China. Their language is extremely close to the national Lao language. In 2011, there were seven Chinese companies and two domestic Lao companies in Boun Neua District. However, only three companies engaged in contract farming at the research site (Table 21) in 2013.

Table 21 shows that two companies have Chinese workers who can speak the Lao (Lue) language, while most Lao workers can speak some Chinese. Most Chinese workers are from the Tai Lue ethnic group that reside in areas along the Lao-China border in Phongsaly Province. The Tai Lue in both Laos and China speak the same

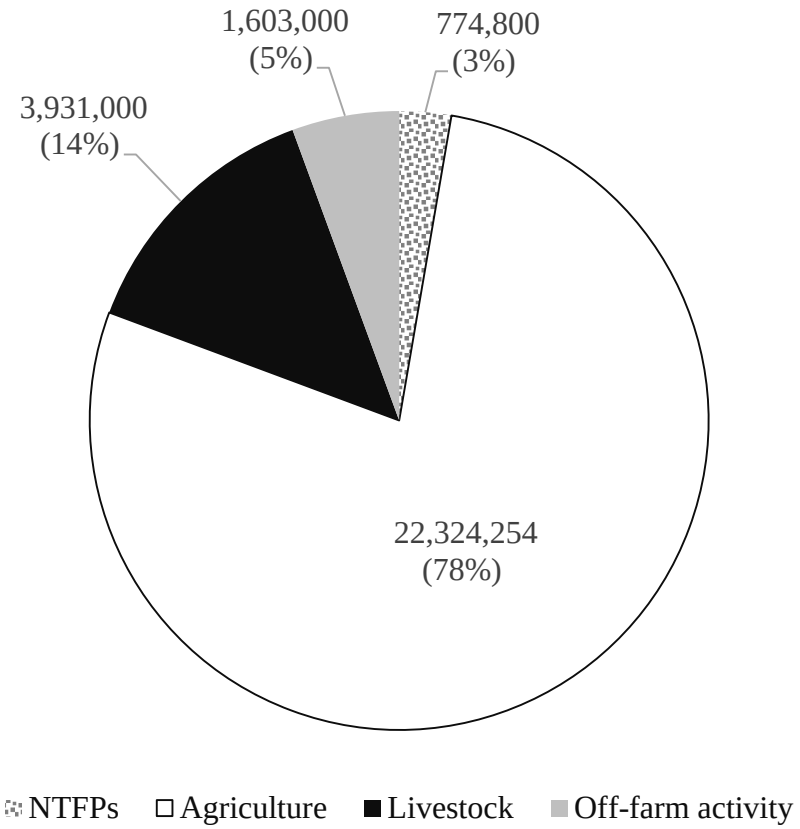


Figure 22 Proportion of household income in three villages of research site

Source: Household survey by the author in March, 2013

Table 21 List of companies engage a contract farming in 2013

Companies Name	Lao worker (Person) and Language		Chinese worker (Person) and Language		Total
	Lao	Speak China	Chinese	Lao (Lue)	
Commercial Crop Production Extension	4	4	3	3	7
Maijoy Import and Export Limited	4	4			4
Shy sone Aer Mei San	1	1	3	1	4

Source: Boun Neua DAFO (2014)

language. As mentioned above, the Tai Lue people who reside in the three villages at the research site obtained crucial assistance from outside the country through their social networks; an important factor that allowed households to adapt to the changing economic environment.

Based on the interviews, most respondents reported having relatives (*phi - nong*) who have Chinese nationality. Their relatives are Tai Lue relatives, but this does not mean that they are blood relations with Chinese nationality, but part of a social network. Social networks, in terms of Tai Lue relatives, were important in sourcing financial capital to investment in rubber and sugarcane plantations, as well as in dry season and other cash crops. Technical advisors working for Chinese companies transferred modern agricultural techniques and provided guidance to producers using the Tai Lue language. As a result, farmers at the research site were able to introduce new varieties of dry season crops, new techniques, and even economic relationships between Chinese Han and Lue investors.

4.5 Discussion

4.5.1 Expansion of dry season crops in lowland areas of northern Laos

In the mid-1980s, economic reform in Laos was guided by NEM, which was the most important factor in transitioning from the command economy to a market-oriented economy. In addition, an open door policy, improved economic relations between Laos and China, and upgraded infrastructure facilitated the Lao domestic private sector and Chinese investors to expand trade and investment across borders, particularly between Xishuangbanna, Dai Autonomous Prefecture, Yunnan Province, China and the northern provinces of Laos. Access to regional markets and an improved network of roads were key factors and a driving force for facilitating agricultural development including at the research site.

The results of the study show that Chinese direct investment in agriculture led to a rapid expansion of dry season cropping in the area. The Chinese introduced dry season crop production in two forms. The first was direct contract farming between a company and producers through DAFO. The second form was through land concessions. The findings are clear on the return to producers under contract framing. The results correspond with Leung et al. (2008) who stated that contract farmers earn significantly higher profits and can earn more income than non-contract farmers. Thus, contract farming has been beneficial to both the private sector and to farmers, while improving commercial agricultural production in Laos (Leung et al., 2008). However, there is as yet no clear view on whether the value-added to agricultural products is shared by farmers, or if the investment companies benefit solely. Farmers lack financial support and have little access to alternative markets in the investors' countries, namely: China, Thailand, and Vietnam.

There also are some risks to contract farming. Normally, companies buy products from producers at guaranteed fixed prices, even when market prices are falling or rising. In the case of the first to third harvests of green beans, the price was guaranteed at 0.24 USD per kg, and the price for products from the fourth to final harvests was 0.19 USD per kg, without repayment for the costs of seeds, fertilizers and pesticides. In practice, the company bought a mix of product grades at a price of about 0.24 USD per kg, even when market prices had increased. Producers were satisfied with this arrangement because they did not know the market price in China. An alternative was to have the company buy products at the market price; but farmers would need to repay the costs of seeds, fertilizers and pesticides. Transferring the cost of the inputs to farmers would be fair if the price is adjusted to reflect the risk and costs. These findings correspond with Fullbrook (2007) who concludes that contract farming, known locally

as 2+3, is moving to 3+2 to overcome the high costs of inputs that are transferred to producers, including seeds, fertilizers, and insecticides.

Chinese investors at the research site covered the cost of farm inputs, including seeds, fertilizer, pesticides, and other materials. Therefore, farmers earned relatively low returns after repaying the cost of farm inputs. In the case of dry season production of long pumpkin, investment costs were about 64 USD per ha, somewhat less than production costs under contract farming. The investment costs are equivalent to 17 labor-days for working on the farm. Producers could save about 27 USD on seed, 5.6 USD for plastic sheeting, 7.2 USD for pesticides, and 24 USD for fertilizers per ha. The costs of most farm inputs are interest charges. In fact, agricultural inputs including seeds, fertilizers and pesticides are imported from neighboring countries tax free. Seeds for most dry season crops are imported only from China. Hybrid varieties introduced by Chinese companies will be used to replace local varieties at the research site in the future. The study suggests that farmers organize producer groups in rural areas, especially in border areas. Farmer organizations can support agricultural production systems including facilitating access to markets and delivering production credit, as well as demonstrating new technologies and extending techniques to group members.

The study concludes that Chinese direct investment has been positive. The Lao Government now has access to additional information about cross-border markets and can provide guidance to producers and domestic agribusiness investment companies. On the other hand, Chinese influence resulted in negative impacts due to poor policy implementation and unclear regulations for implementing the investment law. The study suggests that related sectors should identify and screen investors who seek secure, stable, long-term supplies of quality raw materials, and who are willing to pay at least market prices.

4.5.2 Crop production in households under contract farming

Statistical analysis (Table 18) shows that four variables out of ten household factors were significantly different among the four household groups, namely: gender, number of household members, number of paddy plots, and number of crop types selected by a household. The economic analysis of crop production shows that green beans and corn production require high amounts of labor for pesticide spraying for green beans and herbicides for corn. These activities are implemented mainly by men. In addition to gender, the number of household members is one of the most important indicators in selecting a crop type for a household. There was a high significant difference among the four groups on this variable. On the other hand, main labor in households was not significantly different among the four groups, ranging between 2.40 to 2.97 laborers in the four groups; sufficient for land preparation, planting, fertilizing, irrigating, spraying, weeding, transporting, and harvesting of corn, red pumpkin, and long pumpkin, but not sufficient for green bean harvesting. The main reason was that harvesting of green beans required about 158 person-days; greater than red pumpkin by about 5.8 times; by 4.7 times for long pumpkin; and, by 8.8 times for corn. Therefore, households with sufficient labor can adjust during the harvesting period for green beans.

The results of statistical analysis shows that the number of paddy fields and the number of crop types were not correlated. The average number of paddy fields in each group was lower than the average number of crop types in the household. This indicates that households at the research site cultivate dry season crops using intercropping rather than a monoculture planting system. Sinoquet and Bonhomme (1992) described intercropping as “an agricultural practice widely used in the tropics which consists of growing several crops simultaneously on the same field”. Shipton (1977) explained that a “monoculture farming system is the practice of cultivating the same crop in the same

soil, producing or growing a single crop or plant species over a wide area and for a large number of consecutive years". The farming systems at the research site use an intercropping system. Importantly for farmers, two or more crops are planted on the same plot; when one crop fails from unexpected events such insects, plant diseases, or a price collapse, they still have other crops to provide income for the household. However, Miah and Carangal (1980) conclude that monoculture systems tend to have higher yields when compared with intercropping systems. In other words, yields of crops grown as a monoculture were slightly higher than yields obtained from any intercrop combination (Abdel Motagally and Metwally 2014).

However, households of different ages, education, number of main labor in the household, number of agricultural plots, agricultural land, and household income had no impacts on the selection of crop types for households. On the other hand, households that have a different gender and the number of household members, number of paddy plots, and number of crop types, tend to select different crop types at the study site. The study concludes that household's typologies such as gender, number of household members, and number of paddy plots are important factors to which farmers respond under the influence of economic growth in China. However, education, main labor in the household, agricultural land, and household income generation also are taken into consideration when formulating a long-term rural development strategy.

4.5.3 Economics of dry season crop production

Economic return, especially the return to labor from dry season crops was highest on green beans, about 16 USD; followed by corn, about 14 USD; long pumpkin, 10 USD; and, red pumpkin, about 9.3 USD per person-day. Thus, when compared, dry season crops provide a higher income than agricultural work, where the wage was 3.8 USD per person-day. Moreover, the economic returns from dry season crops were also

higher than subsistence agriculture. Upland rice cultivation provides economic returns to labor of about 5 kg of rice or 3.1 USD per person-day and about 13 kg of rice or 8 USD per person-day for lowland paddy field (Roder, 1997). But, higher returns also require greater labor inputs; the highest was green bean production, followed by red pumpkin, long pumpkin, and corn. The study suggests that green beans was the best option for households with sufficient labor. On the other hand, long pumpkin was a better choice than green beans, red pumpkin, and corn for households with insufficient labor. In addition to long pumpkin, corn presented high returns when compared to red and long pumpkin. In fact, the price of corn was high, about 2,000 kip (0.25 USD) per kg in 2012, declining to 1,200 kip (0.15 USD) per kg in 2013. Therefore, corn production should not be considered when the price is low.

The study concluded that the high and efficient return to labor expended on dry season crop production is a key factor in the adoption of new farming systems for the transition from subsistence to commercial agriculture at the research site. As mentioned above, dry season cropping provides high yields per unit and products for markets that are guaranteed by Chinese companies. The finding corresponds with Negatu and Parikh (1999) who state that yields and marketability of products are the two most important factors affecting the decision to adopt a new farming system. Fujisawa and Kobayashi (2013) conclude that the high market price of a product is an important factor influencing farmers' decisions and making it easier to change from subsistence agriculture to cash crop production.

Many development projects in Southeast Asia question why producers do not adopt new innovations. Fujisaka (1994) states that innovation is unnecessary for farmers to deal with problems they face; any innovation is not necessarily better than local knowledge; in addition there is little promotion of new farming systems and

innovations often come at a high cost, among others. On the one hand, Lestrelin et al. (2011) concludes that insufficient land and lack of technical knowledge were the most important reasons for some farmers not adopting innovations in upland northern Laos. It means that these schemes provide many livelihood activities, but less intensely. The findings of the study conclude that innovations introduced by Chinese companies did not replace the major livelihood activities of local people at the research site. They provided alternative livelihood opportunities rather than a major change in existing livelihoods. Farmers still do their major livelihood activities and engage in other livelihood activities such as dry season crop production.

4.6 Conclusion

Laos remains one of the poorest countries in Southeast Asia despite the Lao economy experiencing rapid growth over the past decade. Global economic changes as well as Chinese influence have significantly impacted many rural areas. Chinese influence has impacted on Lao farming systems, contributing to the transition from subsistence agriculture to commercial production. The results of the study reveal that expanded dry season cropping in lowland areas of northern Laos has been brought about by the influence of economic growth in China. The agricultural sector has been affected by a rapid increase in dry season cropping, with many new crops being introduced, for which producers have adopted new innovations induced by four factors. The first factor was through national and international development policies, including an open door policy and foreign direct investment in a form of contract farming and land concessions. The second factor was through social networks in terms of the Tai Lue ethnic group having relatives in both Laos and China wherein the network was an important channel for introducing new innovations supported by Chinese investors. The third factor was basic local knowledge. Innovations by Chinese investors were not necessarily new, but

they were an improvement over the technologies farmers had been using. Thus, applying local knowledge, producers changed from subsistence agriculture to dry season cropping more easily. The final factor was efficiency of labor and high income returns from dry season crop production; this being a key factor in changing farming systems from subsistence agriculture to commercial production at the research site. Dry season crops provided different levels of return, but they also required different input factors. Therefore, policy makers or extension workers should be sensitive to local people's abilities, particularly related to internal household factors and external factors including land, water, and weather, among others, in order to promote and allocate space for the production of dry season crops.

Rural households at the research site have different household typologies, influenced by factors of age, education, main labor in households, number of agricultural plots, agricultural land, and household income. But none of these factors made a difference when selecting crops for production. On the other hand, households are influenced by factors including leadership by different genders, the number of household members, number of paddy plots, and number of crop types; all of which make a difference in adopting crop types for production. However, there are many households in northern Laos that lack the understanding needed to select a crop appropriate for their households' ability due mainly to having experienced previous crop failures and low benefits and returns. Therefore, the selection of an appropriate crop based on a household's ability should be taken into consideration.

Chinese influence has had positive impacts, but only if concerned sectors such as local government and rural development agencies had sufficient information about markets and provided guidance to producers and investment companies. Chinese influence also has had negative impacts resulting from poor Lao Government policy

implementation and an incomplete legal framework for investment.

Chapter V Discussion and Policy Implication

The purpose of the study has been to determine how upland farmers coped with an unexpected climate event as the result of climate change. The research also investigates lowland farmer responses to economic influence from a neighboring country. Chapters II, III, and IV analyze how households cope and adapt their livelihoods to external factors such as climate change and agricultural demand by markets in a neighboring country to feed economic growth. This chapter addresses the three research questions used to assess livelihood changes. A first component relates to the analysis of external factors and drivers of change in upland and lowland areas of northern Laos. A second component relates to the analysis of how those changes affect household livelihood. A final component relates to the analysis of recent livelihood changes in upland and lowland areas of northern Laos and how they have been shaped by external factors.

5.1 External factors and driving forces of change

Summaries on livelihood changes and the factors that have influenced the changes in northern Laos have been identified in the results of the study. The factors driving the changes are divided into three broad categories, namely: national rural development policies, changes in national and regional economy, and environmental trends.

5.1.1 Political factors

This section asked whether political factors had an influence on people's livelihoods. Questions asked included the influence of Lao Government policy on resources used such as land and forests.

People in northern Laos have changed their livelihoods in order to respond to

political change. Rural development policies were mainly strategies formulated at the top level of government that focused mainly on land allocation and land use, which aimed at stabilization of swidden agricultural practices that was defined as the main cause of deforestation, opium production, and persistent poverty in Laos (see chapter I). The expansion of cash crops including dry season cropping and commercial tree cultivation were alternatives promoted to replace swidden practices in northern Laos. At the same time, these policies had negative impacts (Table 22). The two case study sites are particularly illustrative of this process. Land allocation was used as a major regulatory instrument to reorganize local access to land, reducing the allocation of fallow land per capita and designating conservation and swidden areas. Kachet villagers were impacted by significantly reduced access to land after implementation of the land allocation program.

However, policies promoting cash crops, including dry season cropping and commercial tree crops, did not take the place of swidden cultivation for several reasons, even though the land allocation program had been carried out in the village. The first reason is that the village is located at a high altitude of about 750 meters and it is not suitable for cultivating permanent crops such as rubber. Villagers were still doing swidden as their livelihood strategies. Normally, swidden cultivation is sustainable when the rotation and recovery cycles are sufficiently long. Kachet villagers did not reject the government policy, which aimed to reduce swidden area. Villagers continued to cultivate short-duration crops with a long fallow period using their own fallow management practices, on the limited land allocated to the village (see 2.3.3 section in the chapter II). This research found that villagers remained primarily concerned with swidden cultivation for subsistence. The study concludes that improving swidden rotational systems by applying local knowledge allows farmers to better maintain food

Table 22 Driving forces of change for rural livelihood

	Driving factors	Causes	Impacts
Government policies	• Land use and land allocation	• Land tenure conflict • Limited land	• Open new land use • Return to forest
	• Forest policy	• Less common land use • Short fallow period	• Limited NTFPs income and natural foods
	• Swidden reduction	• Short rotation cycle 1-3 years • Small plot of land • Short fallow period	• Lack food diversities • Small amount of products • Low productivity
	• Cash crop production, including dry season crop	• Lack investment fund • Limited market	• Low quality • Low prices
	• Commercial trees	• Convert land use • Long-term investment	• Less forest diversity • Less ability of land
Socioeconomic factors	• Economic growth	• Labors market increased in industry sector	• Shortage labors in agriculture sector
	• Population growth	• High density	• Limited land
	• Road infrastructure	• Easily export raw natural resources	• Low price of products export
	• Trade (border trade)	• Niche market • Lack market information • Monopoly market	• Low price • Value added fall into investments' hands
	• FDI	• Poor investment policy and inappropriate contract farming model	• Low benefit return
Environmental trends	• Climate (Early rainy season)	• Crop failure • Livestock diseases	• Food shortage
	• Drought (Less rainfall)	• Crop failure	• Low productivity • Food insufficiency
	• Water	• Limited water • A single plant per year	• Less diversification
	• Deforestation	• Land concession • Increase production areas	• Open new land • Convert land to other land type

Source: Analysis by the author

security, household income, and livelihood, but will reduce innovations being introduced through state policies. In other words, people are responding to government policies in their own manner; creating a major driver of change in the northern uplands.

In addition to land, forest resources also are effected by political trends. The Lao Government's policies on natural resources management had a direct effect on access to forest resources and people's daily livelihoods. In order to increase the country's forest cover from 40% to 70% by 2020 using the Government's strategy, the land and forest allocation policy delineated village boundaries thereby restricting access to forests traditionally used for swidden and fallow forest land. Land and forest allocation created more conservation forest. But it also limited villagers' access to traditionally common lands such as fallow and conserved forests. The fallow and forested areas customarily were used as a source of non-timber forest products and timber for both sale and household consumption, and as grazing areas for buffalo and cattle. This was the case in Kachet village, where 50% of the common land was designated as protection and production forests. As mentioned above, limited availability of land together with population pressure resulted in shortened fallow periods as discussed in Chapter II. The study found that Government policies aimed at reducing swidden led to a decrease of agriculture land available to farmers by categorizing each forest area. Furthermore, these policies reduced the availability of good agriculture land since some land was degraded. This led to food insecurity and reduced income from NTFPs (Lestrelin and Giordano 2007).

Lowland villages, namely Yo, Deua and Chiangpee, also were impacted by land use and allocation policies. As a result, access to forest resources such as timber and NTFPs was reduced. However, since paddy rice and crops are more important sources of income for them, the restrictions on access to forest resources had less of an impact

on the income of lowland people (see 4.4.4 section in the chapter IV). Theoretically changing from subsistence cultivation to more intense production systems created incentives for lowland farmers. These policies thus resulted in decreasing the sustainable use of resources for poor farmers in upland areas.

5.1.2 Socioeconomic factors

International and national economic factors in terms of trade and market development play a critical role in agricultural development. Trade expansion and market efficiencies combine to generate changes at all levels, impacting on rural and urban economies. International markets have had important impacts on rural development in Laos, driven largely by economic growth in China, through an increased demand for several products. High demand for NTFPs from outside Laos has increased prices, making NTFPs an important source of rural income and driving farmers to seek more NTFPs from the forest. This trend has led to endangering and even eliminating some varieties of upland NTFPs. Similarly, the two research sites faced problems with the disappearance of traditionally important NTFPs, particularly cardamom that grew naturally in local forests. Therefore, Chinese cardamom species were introduced to the northern provinces to support high demand from Chinese markets. Other NTFPs also continue to disappear as a result of poor natural resources management in remote areas.

Another change induced by international and national events is the introduction of dry season cropping. The extent of change in agrarian livelihoods was investigated in chapter IV, which describes how economic growth in China provided opportunities for villagers to diversify livelihood activities and rural household incomes. The study found that economic trends in neighboring countries directly affected people living in border areas. They benefitted from opportunities to grow cash crops and dry season

crops in upland and lowland areas. At research site B, farmers cultivate paddy rice in the wet season and cash crops in the dry season. They also converted swidden and fallow land into rubber, sugarcane, and other types of plantations. Economic factors had a major impact on dry season crop production.

The temperature at research site B, Boun Neus District, is low particularly in the cool season, which does not permit double cropping of paddy rice even when water is available (Yokoyama and Ingxay 2013). People plant garlic and onion in small home gardens but only for the local market because Boun Neua District and the Phongsaly area have a low population density with limited demand from urban and local markets. The high demand for natural resources and agricultural products in neighboring countries, combined with a strong foreign direct investment policy by the Lao Government led to significant agro-economic development. Paddy fields that were unused in the dry season provided a good opportunity for producers to diversify, innovate, and expand production of dry season crops for markets in China. Chinese agribusiness companies expanded into Laos to establish a supply chain of agricultural products to meet Chinese demand that were operated through various commercial arrangements, namely contract farming and land concessions (see chapter IV). However, Katchet village, located at a high elevation and with steep-sloped land was unable to take advantage of these opportunities. This village demonstrates one reason that policies promoting dry season cropping and permanent plantations have not been successful in some areas of the northern uplands. Geographical, natural, and environmental factors do not always support the transformation from swidden to permanent agricultural production.

In addition to economic factors, the study also revealed that social factors were important in stimulating agro-economic development. The most prominent social factor

was an ethnic group with cross-border connections being influential in initiating commercial cultivation of tree crops and the adoption of dry season crops. Thus, farmers were able to benefit from potential effects on livelihood. These changes are explained by both the influence of the market economy and social factors. Lao people in the border area had access to capital, technical knowledge, and farm inputs through relatives and social networks living in China.

In addition to positive impacts, there are negative impacts from economic factors that also were explored by Fujita et al. (2007) and Thongmanivong et al. (2009). They reported that negative impacts were greater than the positive ones. Conversely, Goto (2011) pointed out that Chinese-supported agricultural development activities and investments will be critical factors leading to the replacement of subsistence livelihoods of poor people in northern Laos.

5.1.3 Environmental trends

Besides global and regional economic trends and Lao Government policies, climate change also has played an important role in stimulating changes in rural livelihood development. Potential impacts from climate change on biophysical conditions and human livelihoods have become an important issue, not only in the northern uplands of Laos, but throughout Southeast Asia. Many researchers suggest that these impacts will accelerate overtime. The research site at the Kachet village is not an exception. The effects of climate change presented in chapter III focus on changes in the ability of farmers to access several categories of household capital in light of climate events (i.e., the early onset of the wet season in 2011). The study found that average rainfall can be expected to rise and the frequency of climatic extremes can be expected to increase. Unpredictable climate events also pose biophysical problems for farmers who practice swidden as a livelihood strategy. Thus, short-term strategy

options are needed for upland farmers to cope with climate events. On the other hand, the National Action Plan for Climate Change Adaptation (NAPA) states that the impacts of climate change will affect low income households whose livelihoods depend on traditional farming systems. The Lao Government's climate change policies for the agriculture sector appear to be long-term, such as a policy on soil erosion protection and fertilizer applications on steep slopes. In fact, local farmers are experiencing reduced income due to increased drought and flooding and reduced productivity of livestock due to a reduction in fodder availability.

However, a diversity of climate stresses, including drought, flooding, and early onset of the wet season, demand consideration. The findings indicate that short-term impacts of climate change, such as early onset of the wet season occurring at the research site, can be effective as a driver of change. The result was that upland rice, upland crops, livestock, and important NTFPs were impacted and shown to be drivers of change in terms of food security and household income. As was demonstrated in 2011, early onset of the wet season impacted on traditional swidden practices, when cleared fallow could not be burned, showing its sensitivity to climate events. The changing environment also affected some important NTFPs. The findings show that household rice sufficiency is the highest priority of all livelihood strategies. While the generating of supplementary household income is key to accelerating rural development.

5.2 Vulnerability of access to livelihood assets

As mentioned in the introduction to this dissertation (see section 1.4, chapter I), a second set of research questions presented in this study is related to investigating how drivers of change and external factors affect household livelihood. Livelihood is a survival process of households. Livelihood consists of capability, assets, and activities

required to build the means of living (Chambers and Conway 1992, Ellis 2000). Assets consist of ownership of and access to resources. Thus, the components of livelihood assets appear as keywords to describe livelihoods undergoing change due to environmental change and economic growth in a neighboring country.

Over the past ten years, livelihoods at the two case study sites have undergone significant change. Traditional livelihood practices based on producing food for subsistence increasingly has become more commercial oriented, following the introduction of annual crops, vegetable gardens, livestock farming, and commercial tree plantations, both in upland and lowland areas in northern Laos. Collecting traditional NTFPs has become more market-oriented. Outside work, such as factory employment, construction work, and other off-farm work are supplementing household assets.

The findings of the study related to accessing human capital indicate that labor and education variables in the households play a significant role in defining livelihoods in the two case study areas; even though people face different impacts such as climate change and market pull forces. In Kachet village, households faced a shortage of labor for upland rice production that requires labor for planting, weeding, and harvesting. On the other hand, the climate event year required five times the normal level of labor for land preparation. As mentioned in chapter III, labor exchange is commonly practiced at the Kachet village. In 2011, a climate event year, that system was not applied because of a labor shortage due to the lack of villagers to undertake swidden.

In the case of three villages, namely Yo, Deua and Chiangpee, producers are hiring agricultural wage labor from outside. They are hired as daily laborers to work on dry season cropping, especially during harvesting. In general, agricultural wages are 30,000 kip (3.76USD) per person-day. They hire additional labor from neighboring upland villages to work on dry season crops. The need to hire labor from outside

indicates a shortage of family labor for dry season crop production. This shortage of labor has resulted in the increased use of agricultural inputs such as herbicide and pesticide. According to chapter IV, section 4.4.4 reports that cultivating green beans required greater labor inputs when compared to other crops. Moreover, this group of households do not plant green beans only; they also cultivate red pumpkin and long pumpkin. Therefore, the availability of labor is a challenge for development of commercial production. During the early period of dry season cropping, the number of participating households was small and their relatives sometime provided necessary labor to support on farming activities. However, the increase in dry season cropping modified the labor system at the research site. The traditional labor exchange system in the village has been replaced by hired labor. Changes in labor relations have occurred in both case study areas.

Physical capital plays a significant role in changing the livelihoods of rural households. Improved infrastructure such as the road network has contributed to poverty reduction (Khontaphane et al. 2006). Rural people have gained increased access to markets, information, technology, education, and health services through the improved road network (Warr 2006, Warr 2010). People at the two case study sites certainly benefited from improved roads. Kachet village, located along national road No. 13, had easy access to urban consumers and other provinces, facilitating the sale of their products in local and regional markets. Rural communities have changed livelihood strategies because of road improvements as they gained access to labor markets; with Luang Nam Tha Province as an example, where the demand for labor to work on rubber plantations increased significantly over time. Normally, Kachet villagers have gone to work in the Nam Bak area, Luang Prabang Province. But it is a small area and laborer opportunities were limited. But road development also has

negative effects. Improved road access causes young people to seek economic and income generating opportunities outside the village, leaving villages with a shortage of young laborers for agriculture activities. This also can lead to low productivity in upland rice production resulting in rice insufficiency (Roder 2001).

In the case of Boun Neua District, market access strongly effected decisions on household farming systems adopted, especially on selecting crops to cultivate for commercial production. Agribusiness investors however, selected areas in which to invest based on accessibility as a first priority. Besides the three villages at research site B, namely Yo, Deua and Chiangpee, Somboun village, located about 8 kilometers north of Chiangpee with a similar geographical setting, is more remote due to undeveloped road access. Agricultural investors contracted farmers there also, but producers were required to transport their products themselves. This meant that producers were required to pay back the cost of transportation to the investor. The village chief felt that this contract farming arrangement was unfair to his villagers. As a result, only a few households cultivated dry season crops with the company under individual contacts. Contract farming, referred to as 2+3 by the Lao Government, is moving to a 3+2 arrangement, wherein the cost of transportation is transferred to producers. Investors cannot afford to develop roads by themselves with the result that the cost of transportation and total investment cost is increased. The findings indicate that the expansion of dry season cropping has significant effects on poverty reduction where roads are available. However, in remote areas, villages remain below the poverty line (ADB 2004).

Regarding natural capital, land is the most important internal household factor, especially in areas under population pressure and reflecting changes in forestry policy. The importance of land changes in different situations. Chapter III found that larger

upland farms had higher productivity. In fact, upland farmers cultivated upland rice and other crops for subsistence and consumption rather than for commercial purposes, while household income was generated more from NTFPs. The study found that the most important NTFPs were found in regenerating forest areas that have been fallow for four years or more. Larger farms permitted farmers to have longer fallow periods. Farmers with less land depended on NTFPs from land with long fallow periods, even though the land was owned by other villagers. The study also found that under both normal conditions and with climate events, land was not a major household factor in Kachet village, particularly with the early onset of the wet season. Households with different numbers of plots and sizes of land were not impacted differently by the climate event. The climate event resulted in most households being unable to prepare land by burning because of wet conditions. Neither could farmers burn dry fallow, which also significantly affected the decision about which crop to plant on the swidden plot, as described by Marod et al. (2002) and Franklin et al. (2010). Thus, land was not a factor that significantly enhanced villagers' ability to cope with rice insufficiency following the climate event.

As mentioned above, farmers changed their production practices in response to the Lao Government's policy and economic trends in neighboring China. These changes influenced the use of land and natural resources. The effects of government policy on land use planning, land allocation, and rural livelihoods has been described by Alexander (2007); wherein the promotion of commercial tree plantations resulted in land degradation, as noted by Lestrelin and Giordano (2007); and, upland crops were promoted that impacted on rural land use and forest degradation as described by Thongmanivong et al. (2009). These impacts also were observed at lowland areas of Boun Neua District. However, the findings of the study found that the dry season crop

area increased quickly between 2007 and 2012 in the three research villages (see chapter IV, section 4.4.1). As noted above, before dry season crops were introduced to lowland paddy fields in research site B, people cultivated only paddy rice in the wet season and the land remained unused in the dry season, even though irrigation was available. Increased dry season cropping did not impact on land use or forest land, because farmers did not open new lands for dry season crop production. Farmers planted dry season crops on paddy land. The findings indicate that increased demand for dry season products in China was a key factor driving livelihood changes that had positive effects for local people, when compared with commercial tree crops such as rubber, teak, and sugarcane among others.

Social capital is focused on social networks and relationships of households and communities. A social network represents relationships among actors in a household or community (Brass et al. 1998). Households and communities that have stronger social networks have more stability and are better able to cope with their vulnerabilities (Shah et al. 2005, Rigg 2007). However, under pressure from economic growth and environmental trends, social relationships among households at the two research sites are changing. Labor exchange was an important system at both research sites that was based on social relationships among local households. As mentioned above, the demand for labor inputs for agricultural production during the 2011 climate event doubled, compared with a normal climate year. The role of labor exchange is less important and seeking work outside the village is more important in a climate event year. However, labor exchange is still practiced in a normal climate year; and, labor exchange has been replaced by hired labor for commercial crop production.

Households at research site B still used labor exchange for paddy rice production, but not for commercial production. One reason is that the seasonal calendar

for paddy rice production allows farmers to manage their own time, enabling them to help relatives during planting and harvesting of paddy rice. But, the dry season cropping schedule was arranged by investors. A second reason is related to the number of crops cultivated by each household. As was shown in chapter IV, section 4.4.3, farmers cultivated many crops at the same time. Some farmers used a mono-cropping system, while others used inter-cropping systems. Moreover, farmers cultivated the same crops as their relatives resulting in overlapping of planting and harvesting activities and generating a higher demand for labor.

As mentioned above, financial capital refers to funding resources that people use to achieve their livelihood goals. People use different financial capital to achieve different goals or objectives. Both case study sites indicate that cash income is an important household asset used to cope with climate change and to respond to an expansion of dry season cropping. In the case of upland people at the Kachet village, NTFPs were an important source of income for all household categories, including for those that were rice sufficient and those that were rice insufficient, as described in chapter II; and, for households with sufficient labor and insufficient labor as described in chapter III. Upland people had limited access to income generating opportunities when a climate event occurred. On the other hand, in a normal climate year people undertook many activities, both agricultural and non-agricultural; but these activities are low intensity. The findings indicate that upland people lack access to activities of sufficient intensity. Low livelihood diversification is due to less rigorous livelihood strategies that could improve the ability to make a living (Ellis 1996, Ellis 1998, Carswell 2000, Ellis 2000, Elmqvist and Olsson 2007). Diversification plays a significant role in livelihood development, using different resources and assets to pursue more sustainable livelihoods (Niehof 2004).

At lowland research site B, dry season crop production recently become more important as a source of income than livestock, off-farm employment, NTFP collection, and other sources of income. Chapter IV reveals that agriculture income, including dry season cropping and paddy rice comprised 78% of total household income in 2012. People at lowland research site B had commercial production as a major livelihood activity. The study found that economic return to labor from dry season crops was higher than subsistence agriculture. Green bean production provided about 16 USD, corn about 14 USD, long pumpkin was 10 USD, and red pumpkin was about 9.3 USD per person-day. On the other hand, upland rice cultivation was about 3.1 USD and about 8 USD per person-day for lowland paddy rice. The study concludes that lowland households at research site B, under the influence of commercial production, have less livelihood diversification and the number of household activities is limited. On the other hand, a single livelihood strategy of sufficient intensity is more beneficial. Households undertaking a limited number of activities with sufficient intensity were less vulnerable than households engaged to a lesser degree in many activities.

5.3 Recent livelihoods in upland and lowland areas of northern Laos

The answer to the third research question, related to analysis of household strategies to cope with climate change, was described in chapters II and III. In addition, chapter IV explained about the response of local households to the influence of economic growth in China. This section aims to answer and discuss external factors that have shaped livelihoods of upland and lowland people in northern Laos. World Bank (2008) categorized agricultural systems in northern Laos into two traditional systems, swidden and rainfed; and, wet rice cultivation and six emerging production systems, namely: fixed rotational cropping, modern rice-based farming, annual monoculture cash cropping, annual and perennial cash crops in diverse agroforestry,

industrial plantations of perennial tree crops, and intensified production of large livestock. Traditional agricultural systems consist of indigenous land use and forest management by local people. Emerging production systems refer to all non-traditional systems where farmers convert secondary natural forest shrub-land into permanent agricultural land (World Bank 2008). However, livelihood in each system has not been investigate. Thus, this study would like to clarify of two livelihood systems, namely traditional swidden cultivation and modernized rice-based farming.

5.3.1 Households with traditional swidden cultivation

The results of the study in section 3.3.2 of chapter III revealed three livelihood situations: shortage households, reasonable households, and better-off households.

1) Shortage households

This household group is often forced to undertake multiple activities and hence their household members work to overcome only short-term problems such as obtaining food for daily household consumption and cash needs. The findings of the study indicated that shortage households do not have sufficient access to livelihood assets and their low capability makes it difficult for them to improve their socioeconomic position. The limitations of livelihood assets, capabilities, and activities is due to low livelihood diversification and the ability to cope with and respond to external stresses and shocks (Begum and Sen 2004, Pillania et al. 2014). This group always uses short-term responses (coping responses); they create a strategy in response to an unexpected event, including the early onset of the wet season that caused livelihood changes. They manage impacts of an extreme event with a short-term survival strategy (Morton 2007, Eriksen and Silva 2009), but they have difficulty to adapt to definitive changes (Eriksen et al. 2005), such as economic change. They have fewer opportunities to earn income from economic change than other groups due to a lack of education and skills (chapter 2).

Thus, shortage households tend to face negative livelihood outcomes. The results of this study reveals that the number of shortage households in the northern Lao uplands has increased.

This group of households can survive short-term impacts. However, long-term impacts such as economic growth and political change must be further considered. Many scholars concentrate on gaps between rural and urban areas on access to health (Wang 2004), household income (Sicular et al. 2007), education (Gourie-Devi et al. 2003) and other factors. However, the study indicates that many gaps are linked to accessing different categories of rural capital by these households. The gaps also should be considered important for rural development.

2) Reasonable households group

In order to cope with the 2011 climate event households in this group gained access to more resource inflows and reduced consumption. People converted NTFPs to cash for buying rice rather than consuming the NTFPs, while commercial cultivation of cucumber and raising livestock were used to respond to non-food household needs such as clothes, medicine, children's education, and other needs. This group generated income not only in the village but also outside in Nam Bak District and other provinces – as workers and employees. Reasonable households have appliances including television, radio, CD player, and others. The study shows that reasonable households engaged in economic activities other than their own agricultural production in both normal climate years and during a year with a climate event. Thus, this group needs to develop knowledge, skills, and raise education levels in order to participate in livelihood diversification. Lack of skills and education are due to limited access to options to deal with stress factors and shocks (Eriksen et al. 2005). Education was important in augmenting off-farm income; educated persons had more opportunities to

earn off-farm income outside the village (Morse et al. 2009).

3) Better-off households group

This group has larger land holdings and more fallow forest. The land holding size is related to the history of the household and the availability of household laborers. First settlers, those who established Kachat village, claimed as much land as possible for swidden cultivation. Many household members tended to cultivate large areas of upland rice and other crops. This group thus has the most agriculture land. Better-off households are able to develop their categories of capital to a higher level than other household groups. Labor for agricultural production is sufficient. However, exchange labor and hiring labor are still needed for hard work, especially for cultivating upland rice. Better-off households produce sufficient rice and sell any surplus. Household income is not only from investments in agriculture, livestock, and commercial upland crops, but also from trading NTFPs. Thus, the social and economic networks of better-off households are wider than other household groups. Reduced consumption is also a strategic response of this group. Both reasonable households and better-off households more frequently achieve positive livelihood outcomes.

However, the early onset of the wet season is one type of climate event which occurred in 2011. This climate event reduced the area in upland crop production, including rice, and had significant direct impacts on food security and household assets within a short period: only one year. The study concludes that the early onset of the wet season did not shape livelihood strategies of Kachet villagers permanently (Figure 23). Since the early onset of the wet season occurred only once, and the next year was a normal climate year, all villagers returned to their major livelihood activities, including upland crops, upland rice, and raising livestock as normal. Chapters II and III show that households in each group were able to modify their livelihood activities to cope with

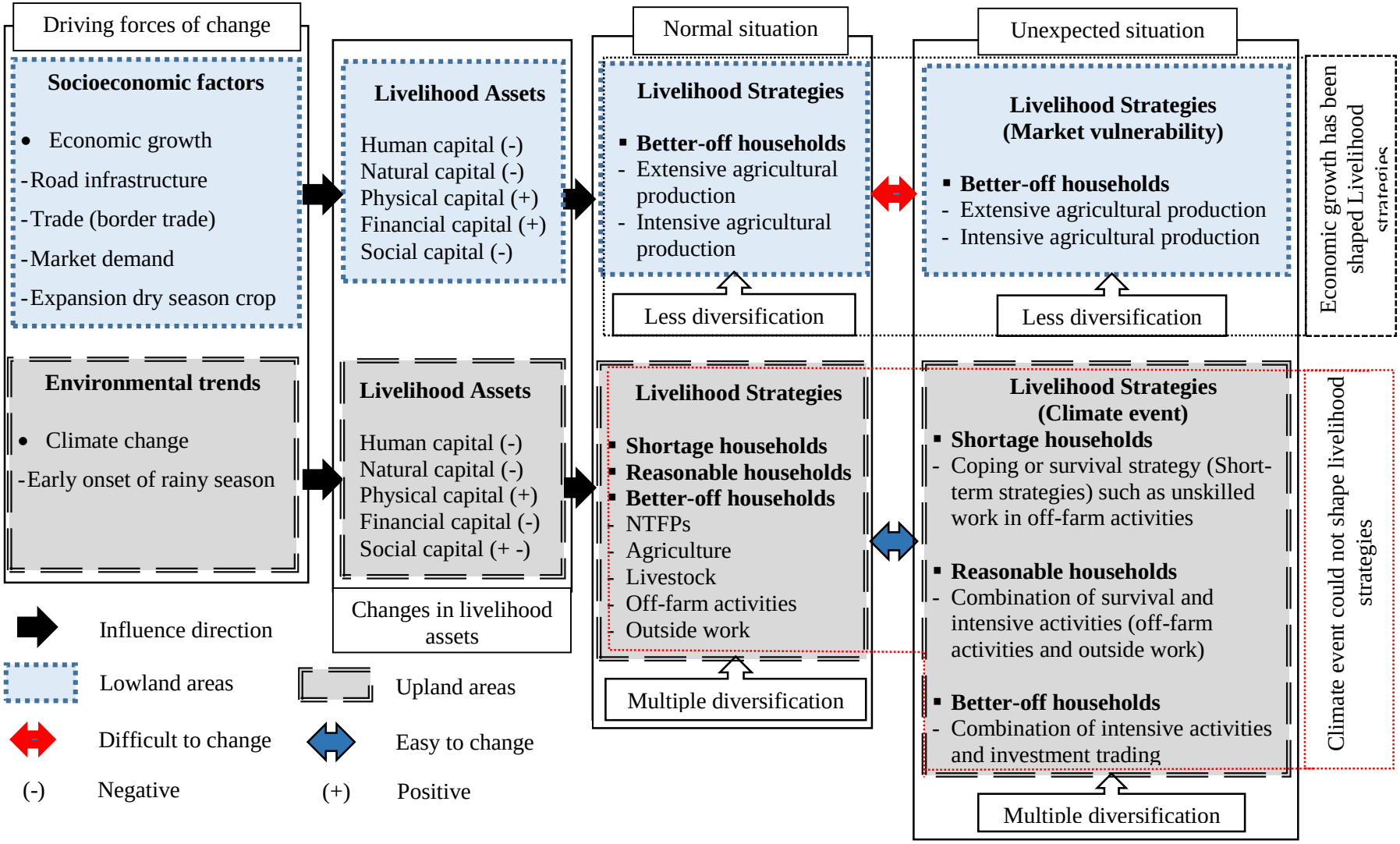


Figure 23 Changes in upland and lowland people livelihood in the Northern Laos

Source: Drawing by the author

the climate event and normal climate years. On the other hand, in case of drought, as occurred in Morogoro, Tanzania, farmers shifted from agriculture to outside work as a permanent livelihood strategy to cope with climate stress (Paavola 2008). In addition, many people faced uncertainty due to drought and the need to shift to other permanent activities. However, if early onset of the wet season becomes a pattern, vulnerability of poor households will increase in the northern Lao uplands and a strategy for coping with future such events is needed.

5.3.2 Households with modernized rice-based farming

Wet season and irrigated dry season rice production are major livelihood activities in three villages at research site B, Boun Neua District, Phongsaly Province, Laos. These activities are found only on a small scale in Phongsaly Province, because of mountainous geography and limited flat land. As mentioned above, dry season vegetable production at research site B has been replaced by dry season cash crops, which have become a major source of income at the research site (see chapter IV). Thus, traditional subsistence agriculture has been changed into commercial production.

The findings of chapter IV show that most households in Yo, Deua and Chiangpee villages practice accumulation strategies or production response strategies. The findings indicate that households with accumulation strategies are driven by motivation and innovation from outside the village, specifically by Chinese investors. Production response strategies generally had positive values but required large investments in inputs that generated large outputs (Baiquni 2008). Production inputs refer to labor, funds, technology, knowledge, and farm equipment that are provided by investors (see section 4.4.2 in the chapter IV). Outputs from commercial production were higher than from subsistence production (see section 4.5.3 in the chapter IV). Thus, accumulation households tended to shift from low and middle investment in

agriculture to high profit agricultural production. These scenarios illustrate social, economic, and environmental transition (Lestrelin 2009), with changes in rural livelihood activities in the northern Lao uplands (Yokoyama 2014) and in agricultural development (Alexander 2007).

Economic growth in China has provided producers with opportunities for diversifying rural household income, undertaking new livelihood activities, and accessing new innovations, including modern technology, farm inputs, and agricultural equipment, among others. People at the research site mainly cultivate dry season crops only for export, with the result that nearly 80 percent of their total income is from dry season cropping. This indicates that meeting the demand for agricultural products that support economic growth in China has shaped people's livelihood strategies at the research site (Figure 23). In other words, livelihood tends to be better when market demand increases for high value products. However, poor livelihood practices are vulnerable to market shocks, particularly when producers are unable to export agricultural products. In some cases, it may be possible to export products, but receive low returns. Changes in the market price of agriculture products may indirectly alter the price of commercial products at the farm gate; with low market prices resulting in reduced returns to production (Dyer et al. 2006). Thus, increasing the production of export products can increase market vulnerability (Cramb et al. 2009). Normally, people combine many activities to achieve their livelihood outcomes rather than undertake a single activity. The lack of livelihood diversification is a challenge for poverty reduction (Ellis 2000). Livelihood diversification is a set of activities that has the potential for livelihood enhancement and poverty reduction (Block and Webb 2001, Smith et al. 2001). Therefore, researchers, developers, government policy makers, development agencies, and others should concentrate on investigating multiple

livelihood strategies.

5.4 Development of approach method

SLF has been developed and adopted by many disciplines around the world. As mentioned above, SLF is applied in many sectors, namely: agriculture, including livestock, cropping, fisheries and forestry; health; and, rural and urban development, among other fields. The study applied SLF from a geographical perspective to evaluate lowland and upland livelihood change in the northern Laos. The SLF provided a comprehensive analytical framework for evaluating and identifying livelihood strategies in response to and to cope with a climate event (see chapter II), impacts of climate change on types of household capital (see chapter III), and to highlight changes in agrarian livelihoods (see chapter IV).

Three chapters present details of an exceptional change in rural livelihoods. The results of the analysis revealed important drivers of change at both the micro level and the macro level, especially political change. The results correspond with Farrington et al. (1999) who concluded that many factors at the macro level affect livelihood characteristics at the micro level (Farrington et al. 1999). Application of SLF has described the external and internal factors that influence livelihood systems adopted by households, and introduced the relationship between macro and micro levels. On the other hand, SLF does not provide guidelines for investigating political change at the macro level. It is important to note this limitation when SLF is applied to changes in government policies, especially in socialist countries. Thus, a sustainable livelihood approach comes from a bottom-up perspective and aims to understand local livelihoods, rather than from analyzing impacts at regional, national and global levels (Knutsson and Ostwald 2006). SLF is a tool for analysis and for formulating an action plan; it cannot solve all problems (Petersen and Pedersen 2010). Intensive field research should

focus on a single discipline or approach. If an approach has been borrowed from other disciplines, the study sometimes results in inconsistency and ambiguity.

Currently, many scholars are developing a Sustainable Livelihoods Approach as a framework for assessing vulnerability to multiple trends, stresses, and shocks. But few academics attempt to use SLF as an analytical tool (Knutsson and Ostwald 2006). One reason is that there are several checklists of livelihood factors rather than a single tool to be used for analyses (Scoones 2004). Most developers and researchers of the Sustainable Livelihoods Approach have focused on qualitative analysis of livelihood assets since each livelihood asset is understood to have a unique value or quality (Knutsson and Ostwald 2006). The study found that people had transferred the value of one asset to another, but the value of some assets are decreasing while others are increasing. The value of each livelihood asset is important and cannot be substituted by another. They should instead be related to one another by contributing similarly to sustainable livelihood development and shaping and capturing the various types of livelihood capital, livelihood strategies, and livelihood outcomes. Many case studies of livelihoods in Laos, including Alexander et al. (2006), Lestrelin (2009), Thongmanivong et al. (2009), and Phanvilay (2010) have not been able to identify how livelihood assets are shaped in the northern Lao uplands.

However, this study has developed a tool based on an understanding of livelihood assets in response to changing agrarian livelihoods and environmental conditions, such as vulnerability to climate change. This dissertation has developed indicators of livelihood assets: all livelihood assets were defined and their value accounted for, aiming to shape and capture livelihoods in the context of current changes. The study also provided guidelines to evaluate livelihood under climate change and agrarian livelihood change. This improved tool aims to efficiently

contribute to related government policies and development agency programs to decrease household vulnerability, and to provide people with the ability to develop effective rural livelihoods that respond to and cope with their vulnerabilities.

Chapter VI Conclusion

The purpose of this dissertation is to investigate and understand how the livelihood of upland and lowland people in northern Laos changes as the result of the influence of economic growth and climate change. In order to clarify upland and lowland livelihood changes in northern Laos, household strategies to access livelihood assets and agrarian livelihood changes have been examined. This study focused on two different rural livelihood situations, namely: swidden cultivation in the uplands; and, dry season crop production in lowland areas of northern Laos. This chapter concludes the findings of the study and briefly discusses policy implications and future research.

The findings of the study revealed clearly the changes that occurred in upland and lowland livelihood in northern Laos. The livelihoods of upland people were examined following an unexpected climate event—the early onset of the wet season. Climate events pose major challenges for food production and the livelihoods of rural inhabitants in northern Laos, where upland rice using swidden practices is important for food security. The findings conclude that the early onset of the wet season is one type of climate event; with rains occurring earlier and with less regularity in recent years. Not all households are able to cope with these changes. The findings also indicate that the labor force variable was the most important factor in enhancing villagers' abilities to deal with rice insufficiency following the climate event. Households with a large labor force had more options for coping strategies: households with a substantial labor force tended to manage better after the climate event than those with a small labor force. Therefore, to improve household coping capacity in dealing with climate events, internal household factors such as labor, skills, and education (human capital) should be considered more carefully, rather than external factors such as farmland.

People at the research sites have lived with significant climate change in the

past. Such events are expected to become more frequent in the future. Coping strategies were shaped by the level of impact of the climate event and households' needs toward achieving their livelihood objectives. Livestock plays an important role in shaping the household economy, especially when used as a means of cash income and savings. Agricultural production and collecting NTFPs are a response to achieving household food security, with any surplus being sold at markets. Collection of NTFPs was the principle livelihood strategy in response to non-climate factors such as education, access to health services, provision of equipment and clothing, and overcoming the impact of the climate event. NTFP collection was the most important coping strategy in both the climate event year of 2011 and the normal climate year of 2010. Households heavily affected by the early onset of the wet season tended to engage in intensive off-farm and outside work activities, rather than their major traditional livelihood activities (i.e., upland crop production and livestock raising). Off-farm and outside work are a way to earn income or to generate savings. The findings concluded that there was no difference in livelihood activities in the normal climate and the climate event years, but the ratio of labor input and time spent on each activity was different between the normal climate and the climate event years. Villagers were highly dependent on natural resources, which reflected their weak coping capacity. Intensive activities also were important in helping villagers overcome rice insufficiency after the climate event.

People had good access to natural capital, but less access to financial capital. Changes in livelihood assets followed the climate event. People transferred the value of one asset to another; with the value of some assets decreasing while others were increasing. The value of each livelihood asset is important and cannot be substituted. However, findings conclude that types of household capital at the upland area in northern Laos were relatively low level. People had limited access to livelihood assets

due to a lack of capital for sustainable livelihoods, which is the case for most farmers in poor rural areas of northern Laos. However, Kachet villagers could achieve their livelihood objectives under extreme climate conditions by embracing a range of adaptive options.

The climate event, the early onset of the wet season, shaped the livelihood situation creating three household conditions, namely: shortage households that did not have sufficient assets and capability, making it difficult for them to improve their socioeconomic position; reasonable households that needed to develop knowledge, skills, and education to achieve their livelihood goals; and, better-off households that had sufficient capital and better livelihoods during both normal climate and climate event conditions. Therefore, shortage households should be given special consideration. However, the study concludes that the early onset of the wet season did not shape livelihood strategies at the research site, but the proportion of households undertaking each livelihood strategy was different. On the other hand, the impact of economic changes in China had a significant impact on the rural area, affecting agricultural systems. The results of the study state that changes in land use patterns in northern Laos were driven by the Lao Government's open door policy and the influence of Chinese direct investment. These changes shaped people's livelihood strategies at the lowland research site. Their livelihood was changed from subsistence agriculture to commercial production linked to market demands. In addition to influence from China, changes in agricultural production in lowland areas were dependent on geographic suitability and the social culture of local people. People paid attention to commercial production, but requested improved access to market information, credit, technologies, extension support, and an appropriate form of contract farming.

The study concludes that socioeconomic, environmental, and political factors

also are relevant in changing livelihoods in northern Laos. The study also concludes that socioeconomic factors and environmental trends both are the most effective drivers of change in people livelihoods. Socioeconomic factors determined the intensity of activities, but reduced livelihood diversification. Thus, the lowland livelihood strategy in border areas under the influence of economic growth in China was to adopt new innovations more easily; but diversification was limited due to uncertainty in cross-border markets. On the other hand, the livelihood strategy of people in upland areas who faced climate change accepted diversification to cope with a climate event, but the level of diversity was low.

The study identified changes in household strategies in response to economic factors and environmental trends, but research into adaptation to political change was limited in this study. The study suggests that this issue should be investigated further because the livelihood strategies of people at both research sites could become more complex in the future. This dissertation has developed a tool based on the understanding of livelihood assets in the face of changing conditions, including climate vulnerability and agrarian livelihoods. These indicators of livelihood assets can shape and capture livelihood modifications resulting from political change. These analytical tools need to be tested in order to identify the important factors that enhance the ability of local people to respond to and cope with political change.

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APPENDIX I HOUSEHOLD SURVEY FORM

Household survey form Household number……..
Name of household head …… Date……..Location …….
When did you move to the village? ..... Where are you from? ..... Why did you move to here (the village)? ……
1. Human Capital
1.1 Number of household members

No.	Name	Status	Age	Sex	Education level	Occupation		Outside work					
						Main	Second	Yes	No	When	Where	How many time a year?	How much income a year?
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													

1.2Household labors

		Household member	Number of Labor	Labor shortage		If not enough, how did you do?
				Yes	No	
2000						
2005						
2010						
2011						
2012						

1.3 How many people cannot work? .....people, Who/Why? .....
1.4 Did you pay for labors? Yes/No, When …….? Who are they?....., What kinds of activities that you need extra labor?..... How much did you pay?.....

2. Natural Capital
2.1 Land
How many plots of land do you have?.....

Kind of land	2000			2010		
	Area (ha)	Ownership	Certificate	Area (ha)	Ownership	Certificate
Paddy field 1						
Paddy field 2						
Paddy field 3						
Paddy field 4						
Paddy field 5						
other						
Fallow 1						
Fallow 2						
Fallow 3						
Fallow 4						
Fallow 5						
Fallow 6						
Fallow 7						
Fallow 8						
Fallow 9						
Fallow 10						
Unused land 1						
Unused land 2						
Unused land 3						
Home Garden 1						
Home Garden 2						
Home Garden 3						
Home Garden 4						
Home Garden 5						
Home Garden 6						
others						
Fish pond 1						
Fish pond 2						
Fish pond 3						
Fish pond 4						
Fish pond 5						
Construction land 1						
Construction land 2						
Construction land 3						
Construction land 4						
Construction land 5						
Other						

Total land ……Ha

2.2 Have you given land to other villagers? Yes / No, When (year)?……, What kind of land did you give to them?....., How much money did you get from land? ....., Who did you give land to he/she?.....
Did you rent the land from other villagers? Yes/No, When? ……., What kind of land?..... , How much did you get?....., Who

did you rent the land from?.....

2.3 Now, Do you have enough land? Yes/No,

If no, What is the main reason to face a shortage of land?. What will you do in next further?.....
.....

2.4 Natural resource

2.4.1 NTFPs income in year of 2010

NTFPs	Season	Time/month	Kg/time	No. people	Cost	Sell (kg)	Eat (kg)
1 Boom grass							
2 Bitter bamboo							
3 Sweet bamboo							
4 Other bamboo							
5 Benzoin							
6 Rattan shoots							
7 Rattan fruit							
8 Galangal fruit							
9 Peuak-meuak							
10 Cardamom							
11 Local medicine							
12 Hunting and fishing							
13 Natural vegetable							
14 others							

2.4.2 NTFPs income in year of 2011

NTFPs	Season	Time/month	Kg/time	No. people	Cost	Sell (kg)	Eat (kg)
1 Boom grass							
2 Bitter bamboo							
3 Sweet bamboo							
4 Other bamboo							
5 Benzoin							
6 Rattan shoots							
7 Rattan fruit							
8 Galangal fruit							
9 Peuak-meuak							
10 Cardamom							
11 Local medicine							
12 Hunting and fishing							
13 Natural vegetable							
14 others							

3. Physical Capital

3.1 Irrigation

Cultivation	**Land under irrigated water (ha)**				Note
	Plant (Y/N)	**Area (ha) 2010**	**Plant (Y/N)**	**Area (ha) 2011**	
Irrigated rice					
Rainy rice					
Vegetable					
Corn					
Bean					
Cucumber					
Pumpkin					
Cassava					
Sweet potato					
Others					

3.2 Access to other facilities

3.2.1 In the past, access to other facilities

		Easy	Difficulty	Time/year	Level of access			
					Never	Some time	Usually	Always
1	Access to market for buying							
2	Access to market for selling							
3	Access to hospital							
4	Access to school							
5	Others……..							

How did you go to these place? ……

3.2.2 In the current, access to other facilities

		Easy	Difficulty	Time/year	Level of access			
					Never	Some time	Usually	Always
1	Access to market for buying							
2	Access to market for selling							
3	Access to hospital							
4	Access to school							
5	Others……..							

How did you go to these place? ……

3.3 Access to agricultural materials

3.3.1 In the year of 2010

	Y	N	Amount	Price	Started	Level of use			
						Never	Some time	Usually	Always
Chemical fertilizer									
Natural fertilizer									
Pesticide									
Improved seed									
Speyer									
Water pump									
Machine									
Tractor									
Others									

3.3.2 In the year of 2011

	Y	N	Amount	Price	Started	Level of use			
						Never	Some time	Usually	Always
Chemical fertilizer									
Natural fertilizer									
Pesticide									
Improved seed									
Speyer									
Water pump									
Machine									
Tractor									
Others									

4. Financial capital

4.1 Agricultural income (year……)

Crop variety	Yield (kg)	Price	Income
Cucumber			
Paddy rice			
Upland rice			
Corn			
Sesame			
Taro			
Sweet potato			
Cassava			
Leaf vegetable			
Large gourd			
Pumpkin			
Chili			
Fruit tree			
Others			
Total			

4.2 Livestock income

Livestock	Total number	Total sell	Income
Cattle			
Buffalo			
Pig			
Goat			
Poultry			
Aquatic animal			
Others			
Total			

4.3 Agricultural income (year……)

Crop variety	Yield (kg)	Price	Income
Cucumber			
Paddy rice			
Upland rice			
Corn			
Sesame			
Taro			
Sweet potato			
Cassava			
Leaf vegetable			
Large gourd			
Pumpkin			
Chili			
Fruit tree			
Others			
Total			

4.4 Livestock income

Livestock	Total number	Total sell	Income
Cattle			
Buffalo			
Pig			
Goat			
Poultry			
Aquatic animal			
Others			
Total			

4.5 Annual non-farm income (Year…….)

Sources	Year ……..	Year …….	Year ……
	Total Income	Total Income	Total Income
Salary			
Factory worker			
Trading			
Wood sawyer			
Handicraft			
Outside support			
Daily labor			
Other			

4.6 Annual non-farm income (Year……)

Sources	Year ……..	Year …….	Year ……
	Total Income	Total Income	Total Income
Salary			
Factory worker			
Trading			
Wood sawyer			
Handicraft			
Outside support			
Daily labor			
Other			

4.7 Expenditure

Household payment in Year 2010 (kip)				Household payment in Year 2011 (kip)		
No.	List of payment	Month	Year	List of payment	Month	Year
1	Rice			Rice		
2	Foods			Foods		
3	Labor			Labor		
4	Cloths			Cloths		
5	Electricity and water			Electricity and water		
6	Land tax			Land tax		
7	Education			Education		
8	Animals			Animals		
9	Medicine or treatment			Medicine or treatment		
10	Tobacco			Tobacco		
11	Full			Full		
12	Mobile phone/phone			Mobile phone/phone		
13	Social festival			Social festival		
14	Others			Others		
	Total			Total		

4.8 Household cash income

Did you have enough money for year …….? Yes/No

Do you save money or cash for emergency? Yes/No. If No, How did you do?

…….

4.9 Saving money, investment and credit

How much do you have in the bank?

Do you have investment activities? Yes/No. What kind of investment activities?……

Your household want to access to money loan service or not?
How about cash money? How much do you want? For what? .
……
Have you ever borrow money or not? In Year……..Yes/No, In Year……..Yes/No. Who did you borrow money? How much did you borrow? How much for interest?

4.10 Food security

Did you face a shortage rice? Yes/No. If yes, How many month of shortage rice?.....

What did you do during shortage rice?

1) Borrow from relative without interest. How many month?.....
2) Borrow rice from relative with return interest. How many month?……..
3) Buy from market or other villagers. How many Kg did you buy?
4) Get rice by exchange labor. How many month?

If you buy, where is your money from?

1) Your own save money
2) NTFPs gathering. What kinds of NTFPs did you collected during shortage of rice?
3) Sell agriculture product. What kinds of product did you sell during shortage of rice?
4) Trading. What kinds of trading did you do?
5) Daily labor. What kinds of work did you do? Where? How long? How much did you earn?
6) Outside work at the urban area. What did you do? Where? How long? How much did you earn?

4.11 Why did you face a shortage of rice?

Problems	Year….	Year…..	Year…..	Comment
Shortage of land				
Climate change (onset/drought)				
Labor shortage for wedding				
Wild animals				
Insects				
Land fertilizer				
Others				

5. Social Capital

5.1 Community participation

5.1.1 The year of 2010

No	Participation	How many time per year	Level of attention			
			None	Some time	Usually	Always
1	Meeting					
2	Planning					
3	Implementing					
4	Evaluation and Monitoring					
5	Idea providing					
5	Other Training					
6	Attend demonstration					
7	others					

5.1.2 The year of 2011

No	Participation	How many time per year	Level of attention			
			None	Some time	Usually	Always
1	Meeting					
2	Planning					
3	Implementing					
4	Evaluation and Monitoring					
5	Idea providing					
5	Other Training					
6	Attend demonstration					
7	others					

5.1.3 Household calendar

Household activities	**Months**											
	1	2	3	4	5	6	7	8	9	10	11	12
Ex. Livestock, outside work, rice cultivation, crop production, NTPFs, trading and others												

APPENDIX II CHECKLIST FOR DISCUSSION WITH KEY PERSONS

Provincial level (Provincial Agriculture and Forestry Office)

- How about Foreign Direct Investment policy by the provincial level?
- How about land concession policy?
- Can you tell me about Contract farming strategy?
- Can you explain me on policy of promotion of dry season crop production?
- Are there any policies on commercial tree production?
- How about land use and land allocation program?
- What is the main strategy for swidden reduction?

District level (District Agriculture and Forestry Office)

- How do the government policies impact the people livelihood? Are there positive or negatives affecting to local people?
- How those policies will successfully in the short or long terms?
- What is the objective of the agricultural production for local people?
- What is the main livelihood strategy of local people? (Crop production, livestock, NTFPs gathering, off-farm work and others). Are there any problems on these activities?
- What factors are important to support local people can adapt to economic change?
- How local people access to external support? (market, finance, information, technology, farm inputs and others)

Foreign and domestic investment companies

- Where is company from? How many works? How many people can speak Lao?
- What is the main investment activity?
- How many villages are under your investment area?
- What kinds of investment form? (land concession or contract farming)
- What kinds of contract farming did you implementation? (2+3, 1+4 and others)
- Where is your main market of the products?
- What kinds of product are you import and export?
- How many ton/kg in each product did you import and export per year?
- How your investment affects to local people?