Farmers' Responses to Drivers of Forest Cover Change

The Case of Mae Chaem District, Thailand

By

Antoine Beaulieu

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Department of Geography, Environment and Geomatics
Faculty of Arts
University of Ottawa

ABSTRACT

Empirical forest transition (shift from deforestation to reforestation) literature has historically struggled to establish a single universally-accepted forest transition "theory" due to various knowledge gaps hindering any efforts to do so. One such gap is the fact that very few studies have focused on how and why smallholder farmers respond to commonly accepted forest transition drivers, as well as how these responses impact forest cover and agricultural trends. Also, there remain many parts of the world where forest cover evolution has been insufficiently researched, as is the case of Mae Chaem district (Chiang Mai province, Thailand). Even though there are studies which claim forest loss occurred in the district between the 1990s and mid-2000s, there are few available records of forest cover evolution since then.

To address these research needs, this thesis used secondary literature and spatial data, as well as semi-structured interviews and personal observations gathered during fieldwork in Mae Chaem district. It was first determined that forest cover in the district decreased between the 1990s and mid-2010s due to agricultural expansion. However, it appears that forest cover is expected to increase from 2016 to 2021 due to more strictly-enforced conservation measures set in motion by the Mae Chaem Model (a state-sponsored sustainable development model). These findings first suggest that the district might be currently in the early stages of a forest transition, its drivers being shifting forest policies and economic factors. Second, interviewed farmers resisted forest policies to optimize their crop productions before 2016, before beginning to develop more acceptant responses in early 2016 due to pressure from pro-conservation discourses and cognitive shifts regarding the value of protecting forest at the expense of agriculture. Also, farmers adopted ambiguous responses (motivated by their economic rationality) to pressure stemming from various economic factors, both prior and since 2016.

With both environmental and socioeconomic issues deriving from these responses, the outputs from this study will hopefully help supplement existing forest transition studies on local populations responses to drivers of forest change. It is also expected to provide up-to-date information on existing and anticipated impacts of recent state development efforts, such as those deriving from the establishment of the Mae Chaem Model.

RÉSUMÉ

La littérature empirique sur la transition forestière (passage de la déforestation à la reforestation) a pendant longtemps éprouvé des lacunes dans les connaissances qui entravent le développement d'une seule « théorie » universelle pour ce processus. Par exemple, peu d'études ont décrit comment et pourquoi les petits exploitants agricoles répondent aux moteurs affectant les transitions forestières, ainsi que la façon dont ces réponses affectent le couvert forestier et les tendances agricoles. De plus, il existe de nombreuses régions du monde où l'évolution du couvert forestier n'a pas été suffisamment étudiée, tel que le district de Mae Chaem (province de Chiang Mai, Thaïlande). Bien que des études rapportent la perte de forêt dans le district entre les années 1990 et mi-2000, peu de données ont été recueillies depuis sur ce sujet.

Pour répondre à ces besoins de recherche, cette thèse se base sur la littérature et des données spatiales secondaires, ainsi que sur des entretiens semi-dirigés et des observations personnelles recueillies au cours du travail de terrain dans le district de Mae Chaem. Il a d'abord été déterminé que le couvert forestier du district a diminué entre 1990 et le milieu des années 2010 en raison de l'expansion agricole. Depuis 2016, la croissance observée devrait se poursuivre au cours des cinq prochaines années en raison de l'application de mesures de conservation plus sévères du modèle Mae Chaem (modèle de développement durable soutenu par l'État). Ces résultats suggèrent que le district connaîtra une transition forestière résultant de changements au niveau des politiques forestières et de facteurs économiques. Les agriculteurs interrogés ont généralement résisté avant 2016 aux politiques forestières afin d'optimiser leurs productions agricoles, avant de développer une réponse plus coopérative en raison de la pression exercée par les discours pro-conservation et/ou les changements cognitifs portant sur la valeur de la protection de la forêt face au détriment de l'agriculture. Ces agriculteurs ont également adopté des réponses ambiguës face à la pression de facteurs économiques afin de maximiser leurs profits.

En raison de problèmes environnementaux et socio-économiques découlant de ces réponses il est espéré que les résultats de cette étude aideront à répondre à certains besoins en matière de recherche sur la transition forestière, en plus de présenter aux décideurs une mise-à-jour d'information sur les politiques de développement, tels que ceux dérivant de l'établissement du modèle Mae Chaem.

บทคัดย่อ

ที่ผ่านมาเอกสารเกี่ยวกับการเปลี่ยนแปลงเชิงประจักษ์ของป่าไม้(เปลี่ยนจากการตัดไม้ทำลายป่าไปสู่การปลูกป่า)ยังขาดการพัฒนาไปสู่"ทฤษฎี"หนึ่งเดียวที่เป็นที่ยอมรับเกี่ยวกับการเปลี่ยนแปลงพื้นที่ปาอันเนื่องมาจากการขาดความรู้ต่างๆที่เป็นอุปสรรคต่อความพยายามที่จะทำเช่นนั้นหนึ่งในช่องว่างดังกล่าวคือความจริงที่ว่าการศึกษาน้อยมากได้มุ่งเน้นไปที่วิธีการและเหตุผลที่เกษตรกรผู้เพาะปลูกรายย่อยตอบสนองต่อสิ่งขับเคลื่อนต่างๆที่เป็นที่ยอมรับเกี่ยวกับการเปลี่ยนแปลงพื้นที่ป่าตลอดจนวิธีการตอบสนองเหล่านี้มีผลต่อการปกคลุมของป่าและแนวโน้มทางการเกษตรนอกจากนี้ยังคงมีอยู่หลายส่วนของโลกที่วิวัฒนาการปกคลุมของป่าไม่ได้รับการศึกษาอย่างเพียงพอเช่นในกรณีของอำเภอแม่แจ่มซึ่งตั้งอยู่ในจังหวัดเชียงใหม่ของประเทศไทยแม้ว่าจะมีการศึกษาที่อ้างถึงการสูญเสียป่าที่เกิดขึ้นในเขตอำเภอระหว่างช่วงคริตส์ศตวรรษที่1990sถึงกลางคริตส์ศตวรรษ2000s แต่ก็มีบันทึกการวิวัฒนาการของพื้นที่ป่าที่ไม่เพียงพอตั้งแต่นั้นมา.

เพื่อตอบสนองความต้องการด้านการวิจัยนี้วิทยานิพนธ์ฉบับนี้ใช้ข้อมูลทุติยภูมิและข้อมูลเชิงภูมิศาสตร์การสัมภาษณ์แบบกึ่งโครงสร้างและข้อสังเกตส่วนบุคคลที่ได้จากการทำวิจัยภาคสนามในอำเภอแม่แจ่มก่อนหน้านี้ได้มีการกำหนดว่าการปกคลุมของป่าในเขตอำเภอลดลงระหว่างช่วงปีคริตส์ศตวรรษ1990sถึงกลางปีคริตส์ศตวรรษ2010sนื่องจากการขยายตัวของภาคเกษตรกรรมแม้ว่าจะมีการเริ่มเห็นว่าตั้งแต่ต้นปีพ.ศ.2016การปกคลุมของป่าได้เริ่มขึ้นแล้วคาดว่าจะเพิ่มขึ้นในอีกห้าปีข้างหน้าอันเป็นผลจากมาตรการด้านการอนุรักษ์ที่มีการบังคับใช้ที่เข้มงวดผ่าน“โมเดลแม่แจ่ม”(โมเดลการพัฒนาที่ยั่งยืนที่รัฐบาลสนับสนุนค่าใช้จ่าย)การค้นพบนี้ชี้ให้เห็นว่าเขตนี้อยู่ในขั้นเริ่มต้นของการเปลี่ยนแปลงสภาพป่าไม้ด้วยการขับเคลื่อนของนโยบายที่เปลี่ยนแปลงด้านป่าไม้และปัจจัยทางเศรษฐกิจการสัมภาษณ์เกษตรกรโดยทั่วไปมักขัดขวางนโยบายป่าไม้ที่ต้องการสร้างผลกำไรสูงสุดก่อนปีพ.ศ.2016ก่อนที่จะเริ่มให้การตอบรับที่ยอมรับได้มากขึ้นในช่วงต้นปีพ.ศ.2016เนื่องจากแรงกดดันจากวาทกรรมเพื่อการอนุรักษ์และ/หรือการเปลี่ยนแปลงทางความรู้ความเข้าใจเกี่ยวกับคุณค่าของการปกป้องป่าเกษตรกรยังได้รับการตอบรับที่ไม่ชัดเจนจากแรงกดดันจากปัจจัยทางเศรษฐกิจ(เกิดจากแรงจูงใจในการทำกำไรสูงสุด)ทั้งก่อนและหลัง พ.ศ. 2016.

ด้วยประเด็นต่างๆด้านสิ่งแวดล้อมและเศรษฐสังคมเป็นที่คาดหวังว่าผลลัพธ์จากการศึกษาครั้งนี้จะช่วยเสริมการศึกษาเกี่ยวกับการเปลี่ยนแปลงสภาพป่าที่มีอยู่เกี่ยวกับวิธีที่ประชากรในท้องถิ่นตอบสนองต่อแรงผลักดันการเปลี่ยนแปลงของป่าไม้รวมถึงการให้ข้อมูลที่เป็นปัจจุบันเกี่ยวกับสิ่งที่มีอยู่/ผลกระทบที่คาดว่าจะเกิดขึ้นจากความพยายามในการพัฒนาของรัฐบาลในช่วงใกล้นี้โดยเฉพาะมาตรการที่ดำเนินการเป็นส่วนหนึ่งของโมเดลแม่แจ่ม.

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ALRO	Agricultural Land Reform Office
CMU	Chiang Mai University
CP	Charoen Pokphand
DNP	Department of National Parks, Wildlife and Plant Conservation
FAO	Food and Agriculture Organization of the United Nations
GADM	Global Administrative Areas
GIS	Geographic Information System
ICRAF	International Centre for Research in Agroforestry
LDD	Land Development Department
MCDO	Mae Chaem District Office
NFR	National Forest Reserve
NGO	Non-Governmental Organization
NSO	National Statistical Office
OAE	Office of Agricultural Economics
OECD	Organization for Economic Co-operation and Development
PA	Protected Area
RFD	Royal Forest Department
SAO	Sub-District Administrative Organization
SDF	Sustainable Development Foundation
UNDP	United Nations Development Programme
TRPF	Thai Rak Paa Foundation

CHAPTER 1. INTRODUCTION

Deforestation is a major environmental issue in many parts of the world and at the global scale. The loss of forest cover has been rapid, with a global loss of 129 million hectares (ha) of forest between 1990 and 2015, most of it being in tropical countries (FAO, 2015). Environmental impacts of deforestation include the loss of biodiversity, increased soil erosion, increased landslide and flash flooding incidents and altered regional and global climate. Indeed, deforestation and other land use changes are estimated to cause approximately 10 % of all total anthropogenic carbon dioxide emissions annually (IPCC, 2013). In the past, the consensus on the link between development and environmental degradation, such as deforestation, was pessimistic, with development and development objectives being a cause of environmental degradation. Of late, more optimistic ideas have emerged (e.g., sustainable development, integrated conservation, and development projects). One thesis states that development is first a cause of environmental degradation, but that once a certain level of development is attained, further development could limit deforestation, as well as increase forest cover (Leblond, 2011). This idea can be found in the forest transition literature. The concept of a forest transition was coined by Alexander Mather (1992) to designate a shift from deforestation to reforestation. Mather documented several instances of net forest growth in some, but not all, developed countries. His studies attracted significant attention and researchers began to rapidly record cases of net forest growth in various regions of the Global South (Meyfroidt, 2013). While forest transitions in the North generally date back to the 19th and 20th centuries, those identified in the South largely date from the last quarter of the 20th century, according to Meyfroidt (2013).

Although the literature on forest transitions has rapidly grown, its theoretical underpinnings remain poorly developed (Mather, 2007) and as a result, researchers have difficulty explaining when and how permanent changes in forest trends occur. The micro-social factors and processes of forest transitions have been insufficiently documented, such as those related to the responses of smallholder farmers towards the drivers (conservation pressure and economic factors) of forest transitions. Indeed, most forest transition studies have justified local populations' involvement in both forest loss and growth, as being purely motivated by the need to optimize agricultural productions (economic rationality). However, few studies have been done on the involvement of local populations in

conservation-related activities for reasons other than economic rationality, such as the need to protect forested areas due to attachment to various forest-based activities, sentimental value of land and agricultural practices (Law & McSweeney, 2013; Strijker, 2005; Leblond, 2015). Nevertheless, these studies have been few, and none have specifically explored the precise role of farmers' responses to forest policies and economic factors, as well as their environmental and socioeconomic impacts.

Due to the previously mentioned gaps in forest transition research, this study's general objective is to broaden explanations of forest transitions by disentangling the role of previously understudied micro-social factors and processes, particularly those pertaining to the responses of smallholder farmers towards the drivers of forest transitions, such as forest policies and economic factors. The study's general significance is based around the following question: Why is it important, in general, to study forest transitions? There are two points to answering this question, the first being that forest transitions are seen as a positive environmental change for carbon storage, biodiversity, and soil erosion (Rudel et al., 2005). Second, forest transition explanations can contribute to context-appropriate policies for deforestation control and the encouragement of forest expansion (Angelsen & Rudel, 2013). Analyzing the underlying causes of forest transitions is essential for policy making regarding land use. Forest transition research can provide historical summaries of forest cover changes in certain regions and can ultimately lead to the identification of previously overlooked social and environmental issues (Rudel, Schneider & Uriarte 2010), which would allow decision-makers and policymakers to propose and establish reliable measures to address these challenges.

To meet this project's general objective, fieldwork was carried out in Mae Chaem district (Chiang Mai province, Thailand) during the fall of 2016. According to Delang (2005), between 1930 and 2005, forest cover in Thailand declined from 70% to approximately 15%, this decrease being explained mostly by logging and agricultural expansion. In parts of northern Thailand, such as Mae Chaem district, forest cover loss has occurred (Thomas et al., 2004), its proximate causes being accepted as logging, agricultural expansion and traditional farming practices (Suraswadi et al., 2005). Although no specific studies on the role of farmers' responses to drivers of forest transitions have yet been undertaken in Mae Chaem district, some farmers' responses to profitability issues and

forest policies were documented by Thomas et al. (2004). Unfortunately, it is unclear if these reactions had any other motivations other than the need to optimize agricultural productions. Consequently, this study attempts to fill the knowledge gap by drawing conclusions from (i) an estimate of forest cover and agricultural area changes in Mae Chaem district between 2002 and 2016, as well as from (ii) semi-structured interviews conducted with farmers from two different villages in the district, key informants and secondary actors from various sectors. The communities in question were chosen based on their general involvement in varying forms of responses to economic factors and conservation pressure, which proved to be an appropriate contextual basis to work in while trying to better understand the motivations of farmers' responses towards drivers of forest cover change in Mae Chaem district.

This thesis is organized into seven chapters. Chapter 2 presents the contextual background and theoretical base needed to identify the gaps in forest transition studies. Specifically, the first part of Chapter 2 reviews the key works of forest transition studies, while the second part focuses on the recent history and causes (proximate and underlying) of forest cover change in Thailand. The third part of Chapter 2 describes in detail the research gaps determined from the review of key works, as well as this study's rationale, general objective, research questions and conceptual framework. Chapter 3 explains' this research's methodology and design, while Chapter 4 offers findings from a contextual estimate of past and anticipated changes in forest cover and agricultural areas in Mae Chaem district. Chapter 5 examines a sociodemographic profile of interviewed farmers from both villages, as well farmers' answers to the semi-structured interview questions. Chapter 6 discusses the findings from Chapter 4 and 5 before Chapter 7 offers general concluding thoughts which include the limitations, contributions and future research directions from this study.

CHAPTER 2. LITERATURE REVIEW

2.1 Forest Transitions

The forest transition process is the central topic of this research's theoretical framework. The following section will present the main theorization efforts, key works and research needs of forest transition literature.

2.1.1 Definition and Theorization Efforts

A forest transition is defined in the work of Mather as a shift from deforestation to reforestation (Rudel et al., 2010), a process illustrated in Figure 1[1].

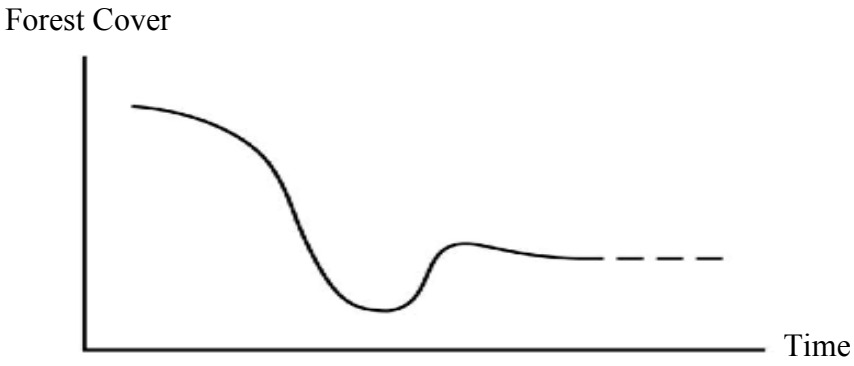

Figure 1-Forest Transition
Source: Modified from Leblond (2011, p.17)

There are two primary theorization efforts in forest transition studies, the first one being a Neoclassical Economic Framework (NEF) approach, which is composed of different works using neoclassical economic assumptions and tools, indicating how land use value influences actors involved in land use and livelihood strategy (urban migration, agriculture, and off-farm income-generating activities) decision-making (Barbier et al., 2010). This approach's purpose is to provide a universal framework for better understanding forest transitions (Barbier et al., 2010). It rests upon the assumption that land users are entirely rational and optimize their use of land between alternative land uses,

[1] In Figure 1, forest cover decreases over time and eventually begins to grow back again. The dotted line represents the indeterminate nature of future forest cover and thus the possibility that it decreases again in the future, ultimately converting into a reversed forest transition (Leblond, 2011).

which are typically restricted to forest and agriculture, as per Barbier et al. (2010). The authors explain that this allocation by land users, as well as government policies, are said to follow calculations of the benefits (economic and environmental) of these land uses and of alternative off-farm income-generating activities. A second argued premise is that as forests become scarce, their value in the eyes of land users (and governments) would increase, thus leading to conservation and reforestation activities.

The second theorization effort uses similar assumptions as the NEF approach, but does not aim at producing a single universal framework, but rather at identifying distinct, yet common, causal pathways to forest transitions (Leblond, 2015). This theorization effort, also known as the "pathways approach", originates from the work of Mather, who developed two models (General Economic Development and Crisis-Response models) used to illustrate the different paths leading to forest transitions, as per Leblond (2015). Based on the case studies identified, the General Economic Development model presented various developmental processes working over prolonged decades, such as multi-level market integration, industrialization, urbanization and the intensification of agriculture (Leblond, 2015). These were argued by Leblond to be the causes of rural exodus, as well as a decrease in agricultural land and an increase in forest cover via natural regeneration or plantations. For its part, the Crisis-Response model indicated how states, notably France, perceived forest cover loss as a threat to environmental and economic prosperity, which prompted governments to respond to the crisis through intense, sometimes violent, conservation and reforestation measures (Leblond, 2015). Mather's work on the causal paths of forest transitions inspired Thomas K. Rudel, who introduced a now familiar interpretation of the main drivers behind forest transitions under the form of two pathways: economic development and forest scarcity (Rudel et al., 2005). The economic development pathway, according to Rudel et al., incorporates both "push" and "pull" factors, which lead to a forest transition, as illustrated in Figure 2[2]. In this context, "push" factors are processes which force actors to stop cultivating land; e.g., when the market price for a type of crop drops, it might force the farmer to abandon his/her land. As for "pull" factors, they consist

[2] Here, industrialization and market changes pull farmers and farm laborers towards urban areas and off-farm income-generating activities, but also push farmers to abandon their less productive lands due to increased production costs and/or declining crop prices, thus causing natural regeneration of forest on the abandoned lands (Rudel et al., 2005).

of processes which attract farmers towards non-farm occupations and might thus lead to land abandonment and reforestation (Leblond, 2015).

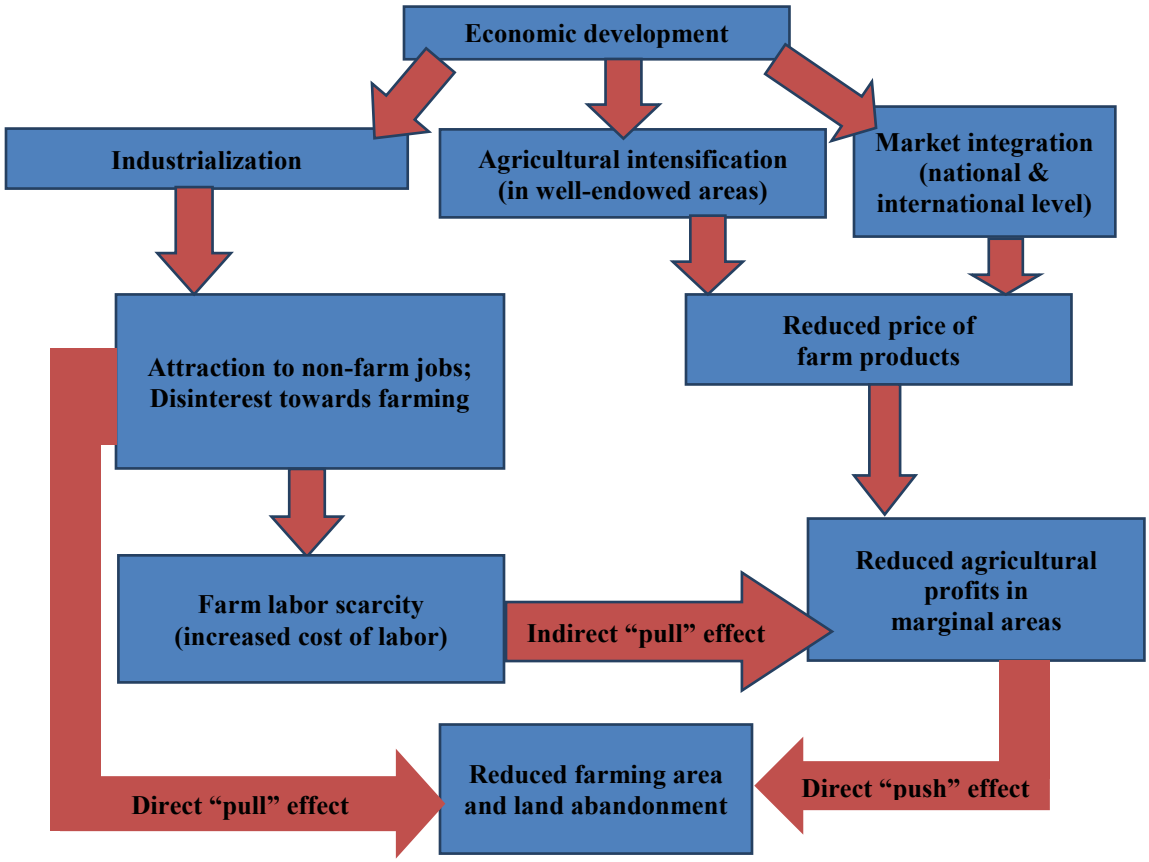

Figure 2-Economic Development Pathway

The forest scarcity pathway is based on changes in the timber market (assuming wood imports are negligible); as forests are depleted, the price of timber and other forest products should increase (provided no significant trade occurs), therefore encouraging farmers or other actors to establish commercial tree plantations (Rudel et al., 2005). Rudel (2010) modified this pathway to include the scarcity of environmental services provided by forests. Responses to such scarcity can take the form of conservation policies and/or reforestation initiatives, ultimately encouraging natural or planted forest growth. Figure 3 illustrates the forest scarcity pathway, according to Rudel (2005; 2010).

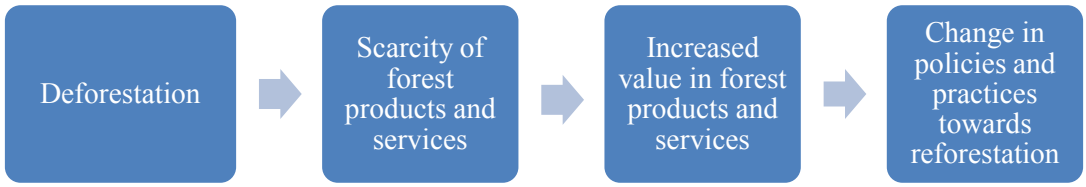

Figure 3-Forest Scarcity Pathway

2.1.2 Empirical Forest Transition Studies

The empirical literature on forest transitions focuses on two tasks: identifying forest transitions (i.e., describing the evolution of forest cover) and explaining forest transitions. Within empirical articles discussing forest cover evolution, one can distinguish national- and subnational-level studies. National-scale studies of forest cover changes initially focused on rapidly industrializing nations, such as France, Switzerland, and Denmark (Mather & Fairbairn, 2000; Mather, Fairbairn & Needle, 1999; Mather, Needle & Coull, 1998). However, studies such as these were affected by forest cover data quality and availability problems. More recently, studies on forest transitions have begun to focus on the process occurring in developing nations; Rudel et al. (2005) proposed that several developing countries, such as Vietnam and India, have experienced significant reforestation, suggesting they have experienced forest transitions, a proposition confirmed by other studies (Grainger, 2008; 2010).

However, there have been studies (Wright & Samaniego, 2008; Hecht & Saatchi, 2007), which have pointed to forest transitions having occurred in developing nations, albeit having used broad definitions of forests, which have led to conclusions to include arguably non-forest vegetation in their analyses of forest cover changes. These types of studies show how complex analyzing and interpreting forest cover changes are and how they necessitate careful consideration of different variables in play, which explain what can be seen through remote sensing. In all cases, national forest cover level studies are based on an amalgamation of sub-national forest cover change information, leading to national trends being proposed (Leblond, 2011).

Sub-national forest transition studies in developing nations are more recent than national studies, many of which were done in Latin American countries, such as Brazil (Baptista, 2008), Argentina (Grau et al., 2008), Costa Rica (Kull et al., 2007) and Mexico

(Klooster, 2003), among others. However, work on sub-national forest transitions has been limited in other areas of the world, notably in Asia. Studies such as Leblond's (2011), suggest that other regions outside of Latin American are experiencing forest growth after long periods of deforestation. Within the ensemble of sub-national studies, some have focused specifically on the temporary nature of forest expansion, where forest expansion becomes subject to renewed deforestation. Such cases have been documented in New England (Acheson, 2008; Jeon, Olofsson & Woodcock, 2014) and the Midwestern United States (Evans, Donnelly & Sweeney, 2010).

With regards to national-scale studies on Thailand, Mather (1992) was among the first to suggest that Thailand was most probably experiencing a forest transition, an idea that was further researched by Grainger (2004), who looked more closely at the economic causes behind forest cover growth. Notably, Grainger proposed that policy changes favoring reforestation are attributed to having caused forest cover growth. As for sub-national studies in Thailand, Leblond (2011) challenged the standard position of experts in Thailand regarding whether forest cover in northern Phetchabun province grew between 1995 and 2005 (he argued that it did indeed grow). Leblond (2015) also argued the following typology explaining forest expansion from the perspective of land users:

- Farmers are active in plantations because of profitable consequences (rational economic).
- Farmers abandon land to limit profit loss (rational economic, but focusing of the minimization of risk and not necessarily the maximization of profits).
- Farmers are forced to abandon land/participate in reforestation (alternative reasons).

Finally, Leblond (2015) recognized the fact that since 2005 there was evidence of renewed deforestation, thus showing that the northern part of the province experienced a fragile forest transition, despite significant conservation pressure. Ultimately, Leblond expressed the need for forest transition research to be more inclusive of overlooked micro-social factors for explaining forest transitions.

2.2 Context of Thailand

To explain changes in forest and agricultural areas in Mae Chaem district, it is important to understand the context of Thailand's land use changes, notably the historical evolution of forest cover change, as well its proximate and underlying causes.

2.2.1 Recent History of Forest Cover Change in Thailand (1960-2014)

As illustrated in Figure 4, Thailand's estimated change in forest cover between 1850 and 1960, as well as officially recorded changes in forest cover between 1961 and 2013, show that before the 1960s, Thailand experienced a steady decrease in forest cover. According to Leblond (2015), this can be explained by agricultural expansion as part of Thailand's industrialization and modernization process.

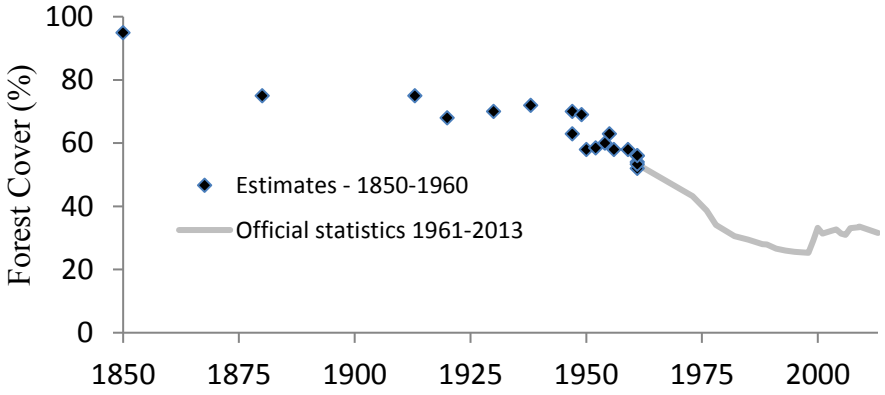

Figure 4-Evolution of Thailand's Forest Cover (1850-2013)
Source: Modified from Leblond (2015, p. 5)

Between the 1950s and 1990s, deforestation rates in Thailand increased substantially, before the country experienced inconsistent increases and decreases in forest cover from the 1990s onwards (Leblond & Pham, 2014). The evolution of forest cover since the 1990s is debated; on the one hand, several Thai political actors reject the idea that there was forest expansion between 1998 and 2000, insisting that high deforestation rates persisted, as argued by Leblond & Pham (2014). The authors criticized this idea, arguing that methodological changes could not explain all reported forest expansion and presented evidence of numerous cases of localized forest expansion throughout Thailand, particularly in northern Phetchabun province. Consequently, recent findings (Leblond, 2015) point to

forest expansion in areas such as northern Phetchabun province in the 1990s and early 2000s, but there also appears to be an even more recent (2009-2013) shift to increased deforestation. According to Thomas et al. (2004), total forest cover arguably decreased by 4% in Thailand and 6% in northern Thailand, between 1994 and 2004 (see Table 1). In this same study, Mae Chaem district was determined proportionally to have lost more forest (8% decrease) than both northern and all of Thailand (see Table 1).

Table 1-Forest Cover Change in Thailand, Northern Thailand and Mae Chaem District (1994-2004)
Source: Modified from Thomas et al. (2004, p.7)

	Thailand	**Northern Thailand**	**Mae Chaem District**
Estimated forest cover in 2004 (% of total land area)	26%	44%	82%
Rate of change (+/-) of forest cover from 1994-2004 (% of total land area)	-4%	-6%	-8%

There have been few attempts to try and predict future forest cover change trends after 2004, other than a study by Thanapakpawin et al. (2006) which proposed four future land cover scenarios in Mae Chaem district. Three of the four scenarios predicted an increase of agricultural areas and a decrease in forest cover, but no evident follow-up research has been done to validate these predictions.

2.2.2 Causes of Forest Cover Change in Thailand (1960-2014)

This section describes both the main proximate and underlying causes of forest cover change in Thailand between 1960 and 2014.

2.2.2.1 Proximate Causes

Deforestation in Thailand between the 1960s and the 1990s increased significantly, its proximate causes commonly accepted as logging activities (see Table 2[3]) and agricultural expansion (see Figure 5).

Table 2-Approximate Size of Commercial Logging Areas in Thailand (1976-1990)
Source: Modified from Leblond (2011, p.160)

Period	Exploited Area (ha/Year)
1976-80	671 048
1981-85	338 525
1986-90	346 506

Note: The statistics are from the Office of Agricultural Economics (OAE), the National Statistical Office (NSO) and the Land Development Department (LDD).

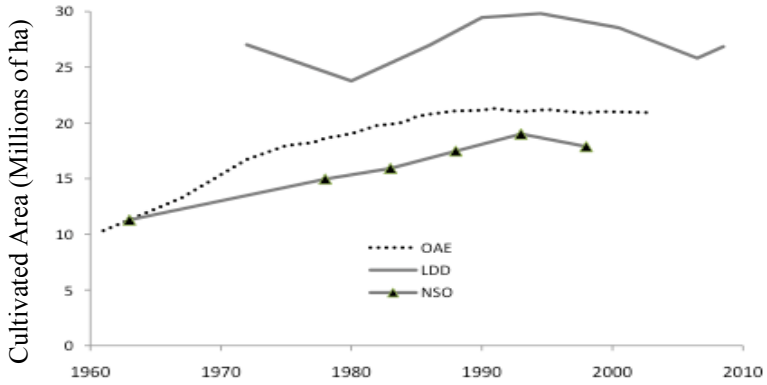

Figure 5-Evolution of Cultivated Areas in Thailand (1963-2009)
Source: Modified from Leblond (2011, p. 235), based on statistics from the OAE, the NSO and the LDD

During Thailand's modernization phase, which began in the 1950s, agricultural expansion was encouraged and facilitated by the state, as per Leblond (2015). In turn, state agricultural policies and, particularly export taxes, were used directly and indirectly to foster industrialization (Leblond, 2015). This growth in agricultural activities was facilitated by the introduction of cash crops (high market valued crops, such as maize, which are quick and easy to cultivate in harsh environments) (Leblond, 2015). Accordingly, Leblond explains that an agricultural expansion occurred between the 1950s

[3] Commercial logging statistics in this table excludes clearing of plantations, as well as the production of paper and firewood (Leblond, 2011).

and 1990s. However, this large-scale expansion ended at the beginning of the 1990s (Kermel-Torrès, 2004). The 1980s ushered a phase of rapid economic growth in the secondary and tertiary sectors which lead to the declining relative importance of agriculture in the economy and employment (Phongpaichit & Baker, 2002) and subsequently a diminishment of cultivated areas (see Figure 5). The end of the agricultural expansion allowed for deforestation rates to diminish and forest expansion to appear in the 1990s and early 2000s (Leblond, 2015). From 2005 to 2014, renewed deforestation was noted by Leblond (2015) in some parts of Thailand, such as northern Phetchabun province. This forest loss could be attributed to increased crop prices and commercialized agriculture ventures (notably rubber plantations[4]) on areas which were reforested before 2009, according to Leblond. In Mae Chaem district, both agricultural expansion and logging have been documented as being proximate causes of forest loss, similarly to the rest of the country, but traditional farming practices within forested areas have also been argued to be a third proximate cause of deforestation in the region (Suraswadi et al., 2005).

2.2.2.2 Underlying Causes

There are two generally recognized underlying drivers of forest cover changes in Thailand, between 1960 and 2014: Forest policies and economic factors (Leblond, 2015).

2.2.2.2.1 Forest Policies

The military government led by F. M. Sarit (1959-1963) brought discursive and legal changes to forest management, though these did not necessarily translate into practice (Roth, 2004). Deforestation and shifting cultivation came to be regarded as a crime against the nation and its development, as explained by Roth. Throughout the 1960s, several forest protection acts were created, marking a shift towards a regional approach to conservation (Vandergeest, 1996). The acts in question are the Wildlife Conservation and Protection Act in 1960, the National Park Act in 1961 and the National Forest Reserve (NFR) Act in 1964, which resulted in a consistent rise in the number of PAs and NFRs (Roth, 2004).

[4] Rubber is considered an agricultural crop in Thailand.

Before going any further, it is important to consider how both NFRs and PAs are defined in this study. With regards to PAs in Thailand, there are ten categories of areas which fall under the definition of a Protected Area (PA) (Leblond, 2011). National parks, wildlife sanctuaries, and non-hunting areas are the only PAs which have specific legislation attributed to them (1960 Wildlife Conservation and Protection Act and 1961 National Park Act) (Leblond, 2011). National Parks are designated for tourism purposes and protection of landmark landscapes, while Wildlife Sanctuaries are areas reserved for wildlife conservation (Leblond, 2011). The other seven categories of PAs (biosphere reserves, Class 1 (A and B) watersheds[5], botanical gardens, arboreta, mangrove conservation areas and forest parks) are established based on the 1964 National Forest Reserve Act (ICEM, 2003). According to the ICEM, human activity within PAs which is neither recreational nor academic in nature is illegal. A NFR can be defined as a state-designated area where forests are categorized into one of three zones: Zone A, C, and E (see Table 3).

Table 3-National Forest Reserve Zoning System
Source: Modified from RFD (2010, p.10)

National Forest Reserve Zones	General Characteristics
Zone A - Agricultural Forest	Reserved for the allotment of land for agriculture, to farmers without land, as per the Agricultural Land Reform Office (ALRO).
Zone C - Conservation Forest	Reserved for the protection of forests from humans; no settlements or land use of any kind are permitted. It is not a protected area, but it is eligible to be designated that status.
Zone E - Economic Forest	Reserved for the allotment of land suitable for commercially-orientated plantations, to farmers without land, as per the ALRO.

While the previous categories of legal forests are mapped and can thus be relatively easily located, the reverse is true for non-demarcated legal forests (Leblond, 2011). As per Leblond (2011), this ambiguous type of legal forests is called "ordinary forests" or "1941 forests" as they derive from the 1941 Forest Act and the 1954 Land Code. The former act specifies that any area not legally owned is a (legal) forest and limits its occupation and

[5] A watershed is "[…] a geographical area drained by a watercourse […]" (FAO, 2017, para. 1).

cultivation; the 1954 Land Code makes it impossible to emit land title deeds in certain areas, such as mountains and hills (ICEM, 2003). Prior to the 20th century, land could easily be claimed and transferred informally by farmers, and it was not until the 1954 Land Code when formal individual land title deeds (*Chanod Tidin*), which allow the holder full rights to ownership, began to be regulated by the state, as explained by the ICEM. To obtain a land title deed[6], an applicant must have the state certify the land in question (ICEM, 2003). Once the request has been received, there are various temporary certifications[7] (e.g., *Bai Chong* and *Nor Sor*) which can be granted to applicants to allow them to "reserve" and use land, under certain conditions, throughout the certification process, as per the ICEM. For those already living on/using land for which they are trying to obtain a land title deed, "[…] a special occupancy permit (*Sor Kor*) could also be obtained, unless the land was in a permanent reserved forest or otherwise intended for public use" (ICEM, 2003, p.50).

Despite this regulation, many of those holding *Sor Kor* still live on/use NFR lands, as many permits were granted by local governments at different NFR demarcation stages, leading to many ineligible *Sor Kor* holders inadvertently intruding on NFR lands (ICEM, 2003). As part of national land reforms in the 1970s, the ALRO began to address this issue by providing *Sor Por Kor* (permit with strict conditions allowing long-term rentals for a limited amount of land) to *Sor Kor* holders living in restricted areas, such as Zone A NFRs (ICEM, 2003). However, many farmers' lands in northern Thailand were never granted any form of land title deed, since high-elevation areas were generally considered to be poor locations to do agriculture; allocating land title deeds in these areas would, therefore, have been illogical, according to the state, at the time of land reforms (ICEM, 2003).

Even with all the policies created during the 1960s, they were insufficiently capable or reversing increasing deforestation, a trend that continued until the 1980s. Notably, forest laws were rarely implemented, as development and geopolitical objectives superseded forest conservation objectives (Hirsch, 1987). As explained by Hirsch, the Ministry of Interior and military generally disregarded deforestation activities during the 1960s and

[6] Community land title deeds in Thailand differ from individual land title deeds in the sense that land is not transferable and "[…] still belongs to the state, but eligible communities are given the right to access land to farm or harvest natural resources under the control of the community" (Rakyutidharm, 2014, p. 528), have a different application process than an individual land title deed.

[7] None of these permits grant full ownership rights (ICEM, 2003).

1970s, as they wished to use agricultural expansion and development in general as a tool to counter the ongoing communist menace during this period. Furthermore, the Thai government massively expanded the size of logging concessions in the 1960s (Bello et al., 1998). In the 1980s, policies favoring conservation and reforestation became more forcefully implemented, effectively halting to some extent the ongoing agricultural expansion (Leblond, 2015). The Thai state arguably adopted a fortress-conservation approach, which respected both national and international conservation objectives (Roth, 2004), resulting in increased use of force and displacement of populations living within or in proximity to conservation-designated areas in the 1980s and early 1990s (Leblond, 2011). The Royal Forest Department (RFD) progressively redefined its core mission away from managing logging and towards conservation and reforestation, a move which was reinforced by the 1989 logging ban; in northern Thailand, where close to half of the nation's total forest cover is located, there was a significant rise in the number of PAs and NFRs to increase the nation's total forest cover to 40% (Wangpakapattanawong, 2001; Roth, 2004).

The implementation of forest laws from 1993 to 2014 fluctuated widely from government to government (Kurashima & Jamroenprucksa, 2005; Leblond 2015), but a general decline in the most drastic conservation actions was noted, together with several attempts to use alternative approaches to coercive conservation (Leblond 2011; Roth 2004). Since the 2014 change in government, there has seemingly been a revival in the fortress-conservation approach; to increase reforestation and curb deforestation allegedly caused by investors funding rubber plantations on legal forest land, the state seems to be currently returning to the conservation tactics of the past (Leblond, 2015).

2.2.2.2.2 Economic Factors

In addition to shifting forest policies, deforestation in Thailand accelerated between the 1960s and 2000s due to several economic factors: favorable market conditions for the exportation of traditional (e.g., rice) and non-traditional crops (e.g., maize), realization by several actors of the economic potential of dry land for the production of non-traditional crops (Fuglie, 1991), increased penetration of market relations in the countryside and greater motivation of remote farmers in participating in cash crop production to satisfy the "pressure of needs" (Rigg, 1987). Evidence from the 1980s to the late 2000s (Rigg,

Salamanca & Parnwell, 2012) points to an agrarian transition taking place in Thailand. An agrarian transition can be referred to as "[…] the processes of social, technical and economic change associated with developments within agriculture" (Fisher & Hirsch, 2008, p.76). Within this set of processes is arguably the commercialization of crops by farmers wishing to move beyond the financial constraints of subsistence farming, as well as the deagrarianization of the rural landscape (Rigg & Nattapoolwat, 2001). Deagrarianization can be defined as a process composed of "[…] four parallel processes: occupational adjustment, livelihood reorientation, social re-identification, and spatial relocation" (Rigg & Nattapoolwat, 2001, p. 949).

This set of processes illustrates a significant change in Thailand's rural economy; people shift from traditional farming activities to non-farming activities to better their lives (Rigg et al., 2012). In addition to traditional agriculture shifting into commercialized agriculture, a process started long ago but which is still incomplete, Rigg et al. argue that Thailand is also experiencing increasing urban migration of those seeking better income-generating activities due to increased urbanization. Because of this transition, there are cases of people abandoning agricultural land to seize alternative income-generating opportunities (e.g., in urban-based employment), due to poor crop profitability and finally due to negative perceptions of working the land (e.g., it is too difficult, considering the profit) (Leblond, 2015). According to Leblond, this abandonment would explain why some recent episodes of reforestation have occurred in Thailand.

As was previously mentioned, agricultural expansion in northern Thailand during the 1960s and 1970s was initially encouraged by the state so that large areas could be cleared of forest to put pressure on the region's communist strongholds at the time (Hirsch, 1987; Suraswadi et al., 2005). In the 1980s, large-scale development-orientated agricultural expansion continued in parts of northern Thailand, such as Mae Chaem district, where people were persuaded by the state to begin cultivating cash crops (e.g., maize), instead of continuing traditional farming practices (e.g., shifting cultivation) (Thanapakpawin et al., 2006). According to Hoang et al. (2014), this trend of increased crop commercialization in Mae Chaem district continued after the 1980s; both a decrease in the amount of subsistence crops produced from 1989-2000, as well as an increase in the amount of commercial crops from 2000-2007, were reported to have occurred.

2.3 Research Needs of Forest Transition Studies

Forest transitions are not well understood; there is no existing forest transition "theory" (Mather, 2007), which is underlined by the fact that few studies have been done on population responses towards the commonly studied drivers of forest transitions, which include economic factors and conservation pressure. Research on local actors involved in forest transitions was normally limited to their economic rationality[8] to explain their actions regarding forests, whilst other motivations of their involvement remained overlooked (Leblond, 2015). By adopting this assumption, authors focus their explanations on factors which influence the profitability of different land uses (e.g., timber scarcity leading to increasing timber prices and then to plantation establishment; or declining agricultural profitability and increases off-farm opportunities leading to rural exodus and land abandonment) (Leblond, 2015). Early work such as Mather's (1992) began to explore the alternative idea that changes in environmental cognitions could also be used to explain the actions of people with regards to forest management. Cognitions can be referred to as a set of values, perceptions, norms, and beliefs (Meyfroidt, 2013). Using the case of the United States as an example, where forests were originally seen as valuable in the timber trade, a cognitive shift occurred when the population became more urbanized, which restructured their perceptions of forests as a resource to protect, thus adhering to conservation policies, finally resulting in deforestation rates to diminish (Mather, 1992).

With regards to governments, Meyfroidt, Rudel, and Lambin (2010) propose that shifts in conservation policy can derive from ecological knowledge and changes in environmental perceptions. As such, the actions of land users and state policies are a rational response to (the perception of) an environmental problem (Meyfroidt, 2013). The same can be said for the case of Great Britain, where an evident lack of timber resources during the 20th century was perceived as a threat to national security (Mather, 2004). Others, such as Meyfroidt (2013) and Leblond (2015), believe that, in cases such as Thailand, shifts in conservation policy can be explained by geopolitical motives, namely the desire to control suspected pro-insurgent populations in remote territories. Here, the

[8] According to Lupia, McCubbins and Popkin (2000), a "[…] standard definition of economic rationality (also commonly-employed in rational choice theories of politics) equates rational actors with omniscient calculators" (p.8).

objectives of the state depart from economic and environmental concerns. With regards to natural and planted forest expansion, as well as conservation by landowners, Law and McSweeney (2013) showed how Ohio landowners conserve forests and reforest land for reasons besides financial returns, including their deep attachment to forest-based activities and a positive perception of forests; a similar idea is advanced by Strijker (2005) and Leblond (2015), who argued that the degree of attachment to the land and agriculture influences the attitudes and response of actors to conservation pressure and deteriorating profitability. In conclusion, few studies have focused on the idea that changes in cognitions could provide answers to how population responses towards forest transition drivers are formed. Consequently, it remains difficult to understand the exact role population responses towards forest transition drivers, plays in forest and agricultural changes.

Johnson (1992) suggested that some development programs in northern Thailand were partly unsuccessful due to various challenges, such as a "[…] lack of information on the Highlanders, their communities, and their responses to regional development efforts […]" (p.151). The need to better understand how local populations in northern Thailand respond to development efforts was partially addressed by Thomas et al. (2004), who noted that some farmers increased their production of commercial crops as a response to profitability-related problems, while contesting the initially proposed boundaries of MTNP (announced in 1991), which many farmers viewed as a forceful attempt by the state to protect forest at the expense of their traditional income-generating activities. The same study concluded that while many farmers reluctantly complied with the boundaries out of fear of reprisals from the state, others "[…] began looking for a compromise way out of the problem, while others felt pushed to the point of resistance (P.63). Ultimately, the farmers who chose to actively resist the boundaries, legally contested and engaged the Department of National Parks, Wildlife and Plant Conservation (DNP) to renegotiate the park's boundaries, with the help from various organizations from different sectors, notably CARE-Thailand (NGO) (Thomas et al., 2004).

Although Thomas et al. (2004) indirectly provided documentation of farmers' responses towards conservation pressure in Mae Chaem district, there is no obvious mention in the study regarding any possible underlying inducements (e.g., cognitive shift regarding the need to protect forest at the expense of agriculture) for farmers' responses,

other than the need to optimize agricultural productions. In conclusion, little is still known on (i) the nature of recent forest and agricultural area changes in Mae Chaem district as well as (ii) the role of farmers' responses towards the drivers of these changes (economic factors and conservation pressure) and (iii) the impacts of their responses.

2.3.1 Research Objective and Questions

This study's main objective is to broaden explanations of forest transitions, through an analysis of the role micro-social factors play in explaining forest transitions. This type of research goes beyond commonly explored macro-social explanations (economic factors and conservation pressure) and aims at resolving issues in forest transition literature, namely the understudied role of land users' responses towards the common drivers of forest transitions. Furthering this misunderstood research angle would ultimately help build a better forest transition theory. To learn more about the nature of recent forest cover changes in Mae Chaem district, as well as how and why people react to common drivers of such changes, the following research questions will be studied.

1) *How have forest and agricultural areas in Mae Chaem district changed since the turn of the 21st century?*

2) *How have farmers responded to the drivers of forest and agricultural area changes in Mae Chaem district?*
    i) *What induced farmers into developing these responses?*
    ii) *How have farmers' responses impacted forest and agricultural trends?*

2.3.2 Conceptual Framework

This research argues that forest cover and agricultural trends are shaped by farmers' responses towards forest transition drivers (conservation pressure and economic factors). It is also suggested that there are other factors than economic rationality, such as

environmental discourses[9] and personal cognitions, which can influence the responses of citizens towards forest transition drivers. As was previously mentioned, actors' cognitions can mediate their responses (Meyfroidt, 2013), while environmental discourses can also induce actors to respond in certain ways (Fleming et al., 2014). Using the example of climate change discourses, Fleming et al. (2014) argue that such discourses can be "[…] constructed differently by science, the media, politics, environmental education and different groups within society" (p.408). Finally, the responses of people to the macro-social drivers vary from overt acceptance[10] to overt resistance[11], and consequently, these responses can lead to various changes in agricultural and forest cover trends. A diagram (see Figure 6) was designed to organize and illustrate the flow of ideas needed to both structure and answer the research questions. Specifically, Figure 6 shows how forest transition drivers provoke responses from farmers, responses which are induced by one or more influencing factors (economic rationality, cognitive shifts, and environmental discourses) and result in forest cover gain/loss and agricultural area gain/loss.

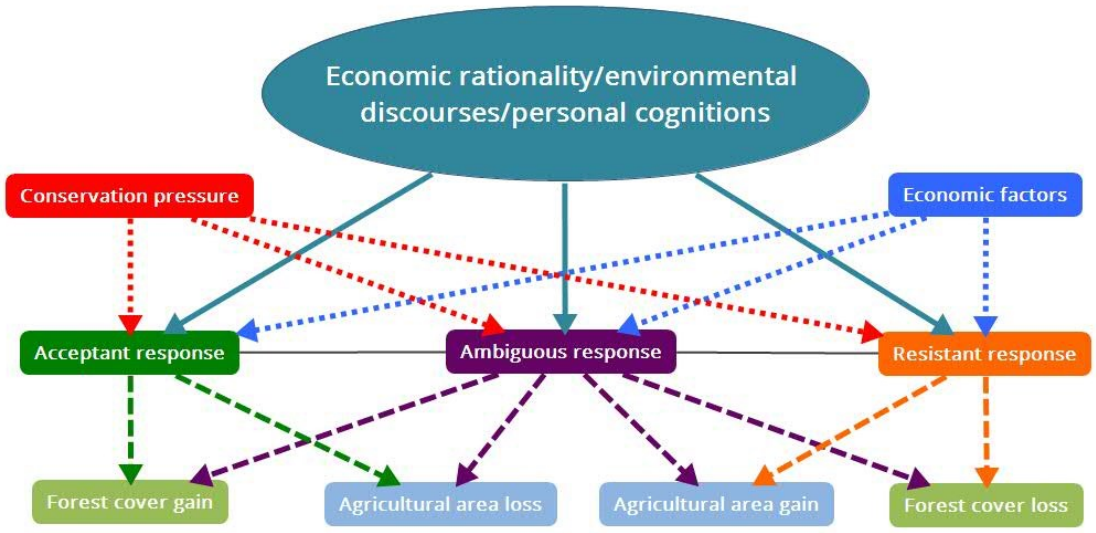

Figure 6-Conceptual Flow Diagram

[9] For this study, an environmental discourse is defined as a set of "[…] linguistic devices articulating arguments about the relationship between humans and the natural environment […]" (Muhlhausler & Peace, 2006, p.458), such as "[…] the endangerment of nature and the human species in a global context […]" (Muhlhausler & Peace, 2006, p.458),).

[10] Here, acceptance is "[…] the lack of noticeable opposition to a project" (Cohen et al., 2014, p.5).

[11] In this study, resistance is understood as "[…] the means through which individuals change social processes and structures and build alternatives […]" (Sage, 2007, p.4707).

Based on conclusions made by Leblond (2015), it is first deduced that if an actor chooses to accept the changes brought by a driver of a forest transition (e.g., accepts forest conservation objectives and decides to be involved in forest monitoring policies aimed at stopping forest encroachment), there will most likely be increased reforestation. In the case of a resistant response, reforestation would be less likely; examples of resistance would include overt refusal to collaborate with forest authorities or various adaptation strategies to reduce costs of production, such as changing crop products (Leblond, 2015). Finally, there are ambiguous responses; these responses lie in-between the extremes of resistant and acceptant responses or would be hard to classify as either acceptance or resistance. Their impact is more abstruse; for example, if a farming household chooses to further engage in off-farm work, this could either facilitate land abandonment or help maintain agricultural activities by subsidizing poor on-farm income with off-farm revenues.

CHAPTER 3. METHODOLOGY

This chapter begins by providing details on this study's site selection process, before explaining the research methods used the fieldwork's design.

3.1 Site Selection Process

Data was collected from two villages in Mae Chaem district to answer the previously stated research questions. The study site selection rationale is detailed below.

3.1.1 Mae Chaem District

At the recommendation of the ICRAF-Thailand Office, Mae Chaem district was selected as a general research site[12]. Since the district is one of ICRAF's long-standing benchmark research sites, it was possible to access several studies carried out in the area. A review of the available literature (see Chapter 2) helped determine that few studies have discussed the nature of forest cover and agricultural area changes in the district since 2004, as well as the significance of farmers' responses to the drivers of these changes. In addition, a preliminary analysis of Landsat images accessible from an online open-source time-series (Hansen et al., 2013) confirmed that both forest cover loss and gain had occurred in various parts of the district, which substantiated ICRAF's suggestion that Mae Chaem district was an appropriate area to conduct fieldwork.

3.1.1.1 Administrative Divisions

One of Chiang Mai province's twenty-five districts, Mae Chaem district is composed of seven sub-districts and 222 villages[13] (see Figure 7).

[12] Permission to conduct research in initial target sites in Phetchabun province was not granted; alternative research sites were found in Mae Chaem district, Chiang Mai province.
[13] In this study, a "village" includes officially recognized groups of households and their neighbouring sub-divisions, which are located completely within district boundaries.

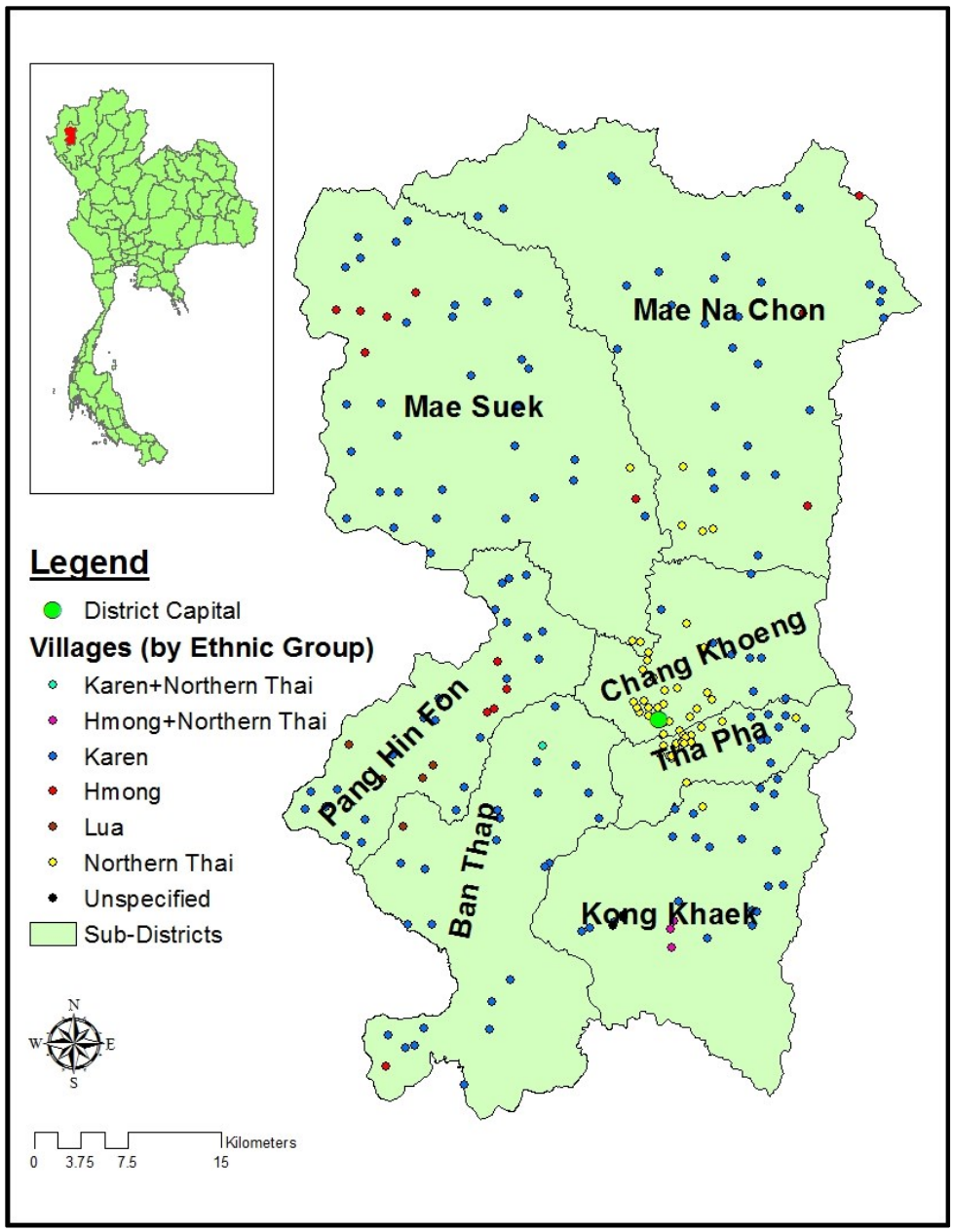

Figure 7-Administrative Divisions of Mae Chaem District
Sources: ICRAF (2016); GADM (2015)

Most of the Mae Chaem watershed, which is a "[…] major upper tributary sub-basin of the Ping River […]" (Thanapakpawin et al., 2006, p.214), is in Mae Chaem district. As explained in Table 4, there are five watershed classes in Thailand, four of which are found in Mae Chaem district (see Figure 8). The majority (63.9%) of the watershed is categorized as Class 1 (A and B), 25% as Class 2, 8.7% as Class 3, 1.8% as Class 4 and 0.7% as Class 5 (Suraswadi et al., 2005).

Table 4-Watershed Classification in Thailand

Source: Modified from UNDP (2012, p.10)

Watershed Classes	Characteristics of Watershed Classes
1A – Protected forest areas	Includes permanent forest and headwater sources located in high elevation/steep slope areas.
1B – Protected forest areas	Includes permanent forest and headwater sources located in high elevation/steep slope areas. Allows for some agricultural concessions, albeit with strict conditions.
2 - Commercial forest areas	Includes permanent and commercially-orientated forest located in high elevation/steep slope areas. Allows for logging, grazing, agriculture, and mining, albeit with certain conditions.
3 - Fruit tree plantation areas	Includes permanent and commercially-orientated forest located in high elevation/steep slope erosion-resistant areas. Allows for agroforestry, agriculture, and grazing, albeit with certain conditions.
4 - Upland farming areas	Includes land suitable for certain types of agriculture, located in gentle slope areas. Allows for agroforestry and grazing, albeit with certain conditions.
5 - Lowland farming areas	Includes land suitable for certain types of agriculture, located in relatively level land and with few conditions.

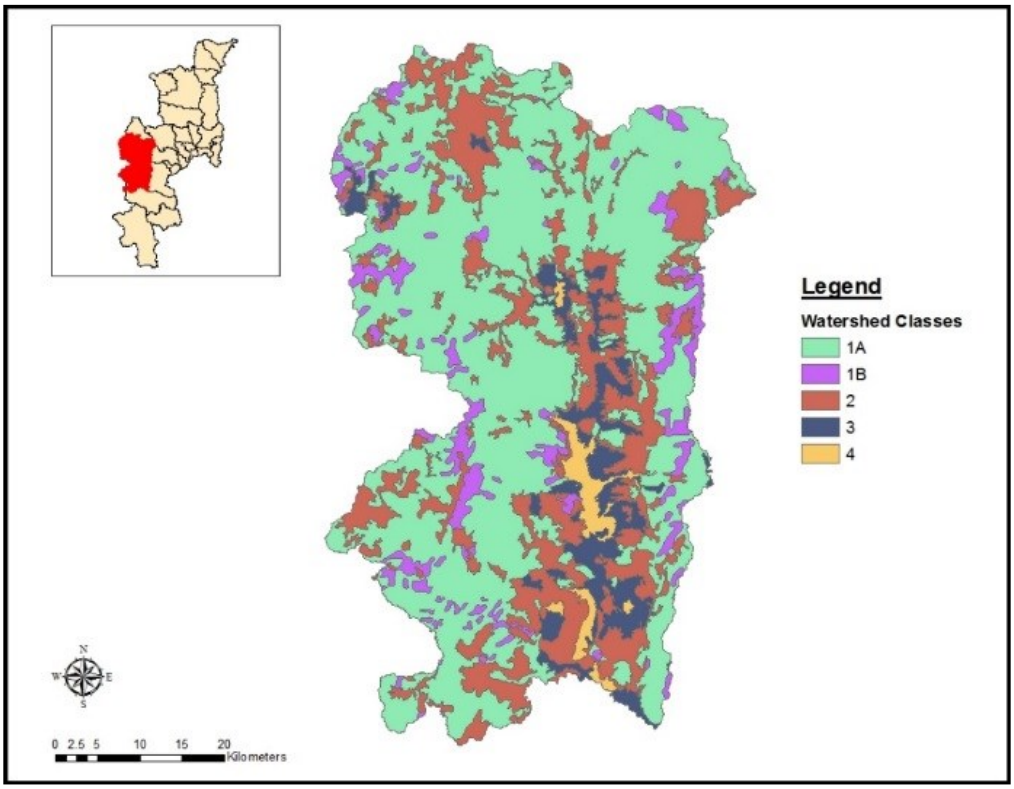

Figure 8-Watershed Classes in Mae Chaem District

Sources: SDF (2016); GADM (2015)

Mae Chaem district's estimated total land area is 2708.3 km^2, among which 38.1 km^2 (1.4%) is categorized as land held under a land title deed (MCDO, 2016). Since formal land tenure[14] is not permitted within NFRs and PAs in Thailand (see Chapter 2) and the fact that 98.6% of Mae Chaem district's total land area is composed of NFRs and PAs[15] (see Figure 9), this would explain why there are so few land title deeds in the district (Thomas et al., 2004; MCDO, 2016). It could also explain why there is a significant amount of land (700.3 km^2 or 25.6% of total land area) occupied for residential and agricultural purposes without any kind of land title deed (see Figure 10[16]). Finally, unoccupied land constitutes 1969.9 km^2 (73%) of the district's total land area (MCDO, 2016).

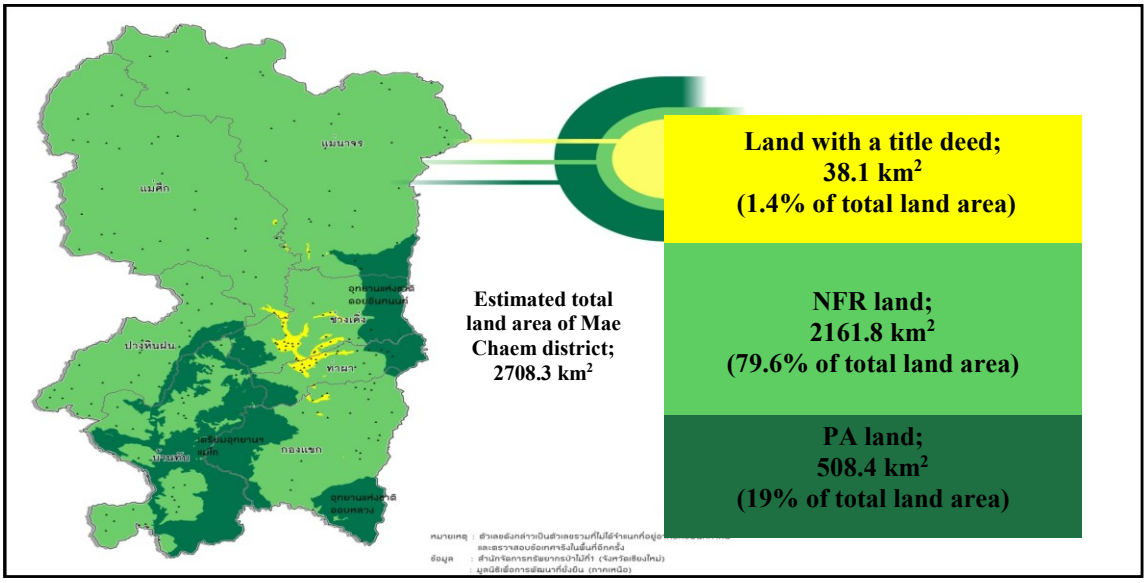

Figure 9-Land Title Deeds, PAs and NFRs in Mae Chaem District
Source: Modified from MCDO (2016)

[14] Land tenure can be interpreted as a formal/informal set of rules which shape the admissible criteria and conditions for managing and using land (FAO, 2002). In the context of this study, land title deeds can arguably be interpreted as being part of formal/informal set of rules of access to land.
[15] All PAs located in Mae Chaem district overlap into other districts.
[16] Figure 10 does not dissociate residential and agricultural lands. Instead, it includes both land-use types under the more general category of land being used w/o a title deed.

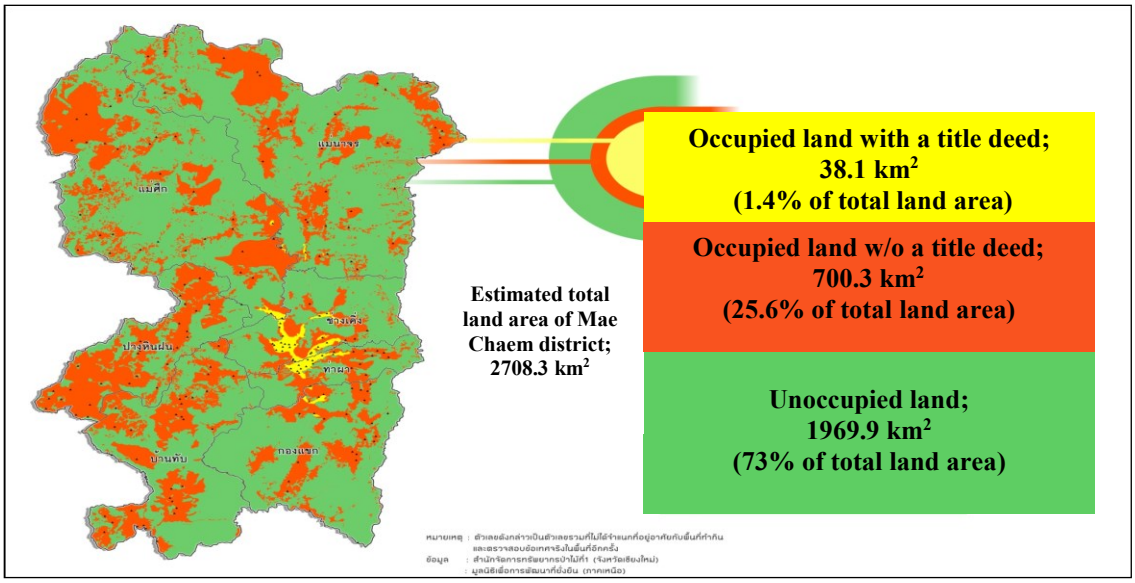

Figure 10-Occupied/Unoccupied Land in Mae Chaem District
Source: Modified from MCDO (2016)

Parts of two officially established PAs are in Mae Chaem district: Doi Inthanon National Park and Op Luang National Park. Although MTNP was announced in 1991 (Roth, 2004), it was not yet officially established at the time of this study's fieldwork, with the park having experienced significant changes to its total land area. Indeed, two different scenarios for MTNP's total land area evolution in between 2004 and 2015 (see Figure 11[17]) both show that there has been a decrease of either 511.6 km^2 (51.7%) or 645.2 km^2 (65.2%) during that period; the range between the two scenarios is 133.6 km^2 (13.5%). Consequently, the park's boundaries have also changed significantly during this same period (see Figure 12[18]).

[17] It was not possible to obtain any data for MTNP's total land area in 1991, as well as for the park's proposed boundaries between 1991 and 2009; these omissions prevented a more complete calculation of the park's land area evolution and boundary changes.
[18] In Figure 16, the coordinate system for MTNP's proposed boundaries in 2009 could not be determined and corrected. As a result, this layer does not align exactly with the map's other layers.

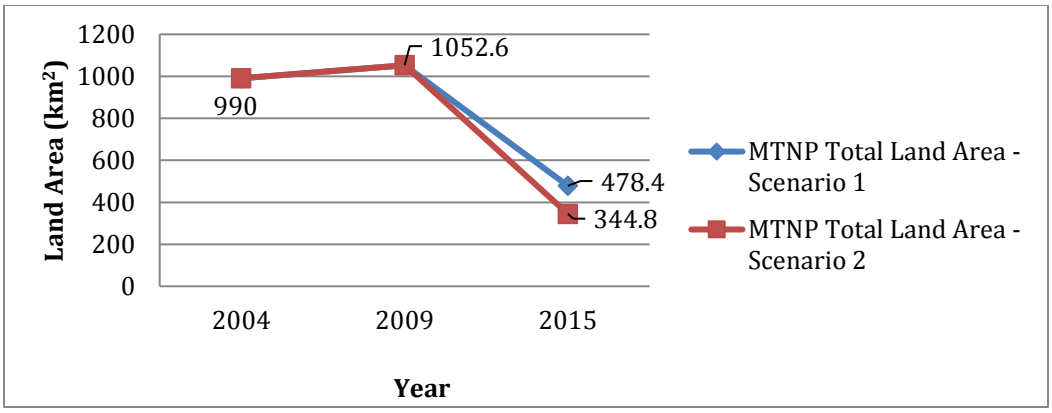

Figure 11-Evolution of MTNP's Total Land Area
Sources: SDF (2016); ICRAF (2016); Roth (2004); MCDO (2016)

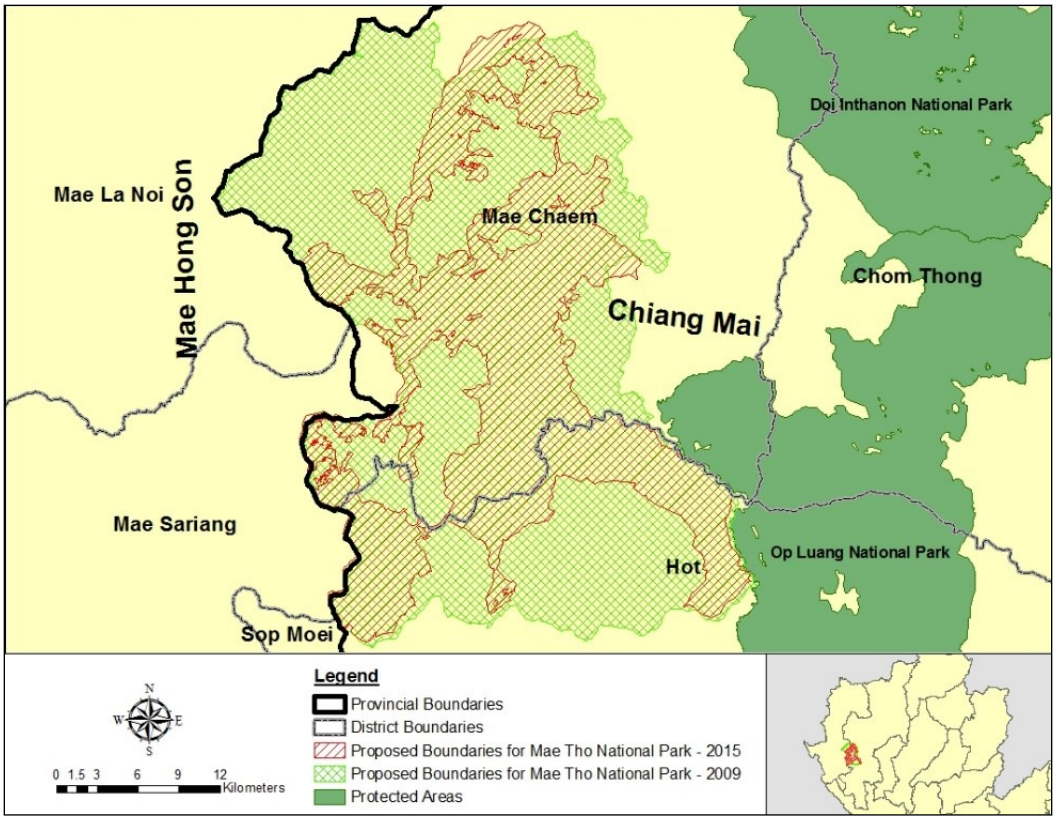

Figure 12-MTNP Boundaries in 2009 and 2015
Sources: ICRAF (2016); SDF (2016); GADM (2015)

3.1.1.2 Elevation, Soil, Vegetation and Climate

Similarly to much of northern Thailand, Mae Chaem district's landscape can be categorized as mountainous, with close to 90% of its total land area having an altitude range >600 m.a.s.l. (Thomas et al., 2004), with numerous steep hills and "[…] rates of soil

erosion that prevent advanced soil development […]" (Thanapakpawin et al., 2006, p. 216), which results in the district's soils to be "[…] relatively shallow and have limited water-holding capacity […]" (Thanapakpawin et al., 2006, p. 216), while the more prominent "[…] soil textures are sandy clay loam and clay loam" (Thanapakpawin et al., 2006, p. 216). As illustrated by Figure 13[19], the three categories of elevation zones in the district are (i) highlands (1000-1800 m.a.s.l.), (ii) midlands (600-1200 m.a.s.l.) and (iii) lowlands (<600 m.a.s.l.), with the highest point[20] at 2565 m.a.s.l. (Mount Inthanon) and the lowest being 282 m.a.s.l. (Suraswadi et al., 2005).

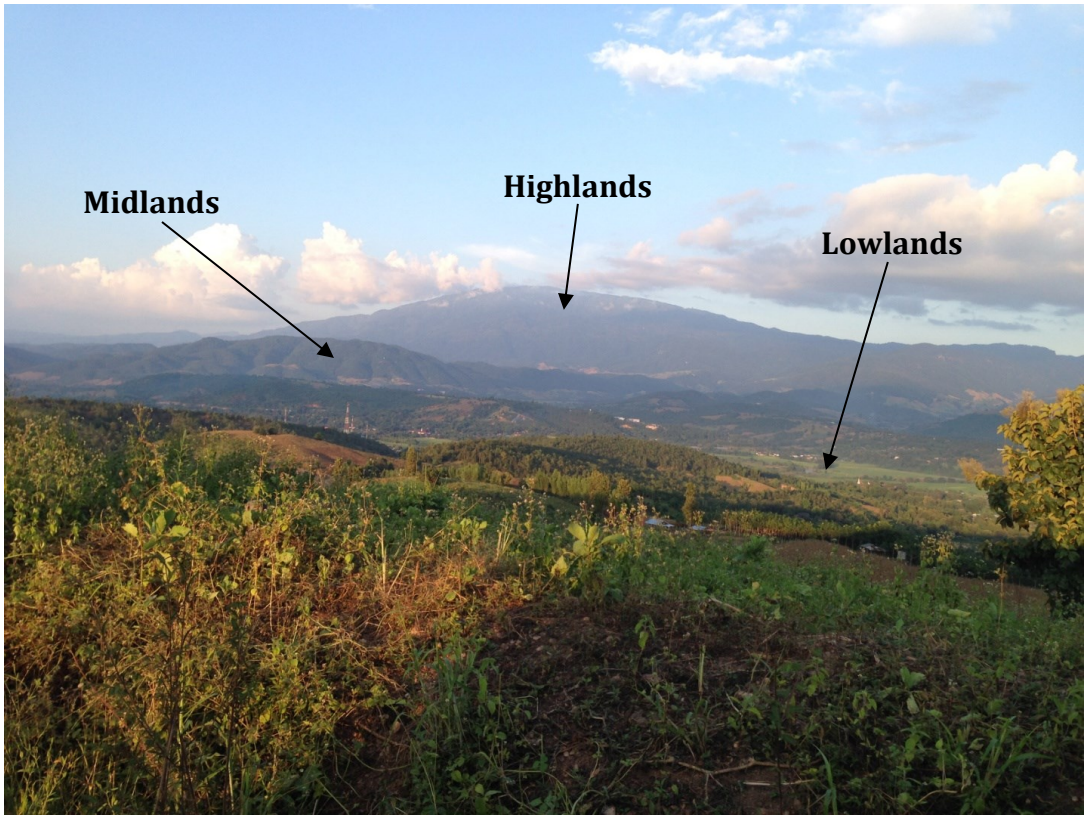

Figure 13-Landscape of Mae Chaem District

With regards to vegetation diversity in Mae Chaem district (see Figure 15), moist temperate forests can be found in areas with an altitude level >1800 m.a.s.l., while

[19] Mount Ithanon (where the highlands arrow is located) was used as a reference point to determine altitude zone examples. The clearly less elevated hills directly below Mount Ithanon are deduced to be the midlands, while lowland areas were designated based on the visibility of rice paddies in the valley.
[20] In addition to being Mae Chaem district's highest peak, Mount Ithanon (located in Ithanon National Park) is also Thailand's highest peak.

coniferous and evergreen forests can be found in highland areas, with mixed deciduous forests generally found in midland areas and finally dry dipterocarp forests in lowland areas (Thomas et al., 2004; Suraswadi et al., 2005; Thanapakpawin et al., 2006). As Mae Chaem district is in a mountainous area of Thailand, its climate reflects its location; as explained by Thanapakpawin et al. (2006, p.216), the district is subject to:

> "[…] *large variations in seasonal and annual rainfall that are influenced by Pacific-born typhoons, superimposed on the south-west monsoon. The orographic effect induces an altitudinal increase of spatial rainfall distribution. The average annual temperature ranges from 20 to 34 °C and the rainy season is from May to October*".

3.1.1.3 Demographics

Mae Chaem district has experienced a decrease in population between 1997 and 2015 (see Figure 14); the district's total population numbered 67 912 in 1997, 63 008 in 2002 and 59 203 in 2015, meaning there has been a decrease of 12.8% (8 709) in total population size during this period. Although no official explanation for this decrease was determined during fieldwork, it is likely that the population decline between 2002 and 2015 was in part affected by the creation of Galyani Vadhana district; in 2009, the government delimited a part of northern Mae Chaem district to form Galyani Vadhana district. It is therefore likely that this administrative detachment caused a sudden population loss in what remained of Mae Chaem district, though the exact amount could also not be determined.

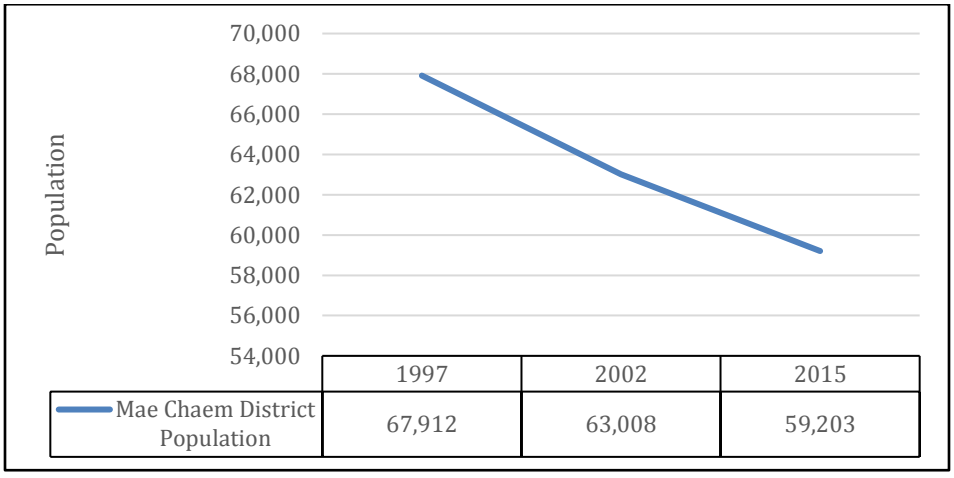

Figure 14-Population of Mae Chaem District (1997-2015)
Sources: Suraswadi et al. (2005); RFD (2016); MCDO (2016)

In 1997, 53% of the total population of Mae Chaem district consisted of ethnic minorities (Karen, Lua, and Hmong peoples), while northern Thais made up the remaining 47% (Suraswadi et al. 2005). While most ethnic northern Thais in Mae Chaem district live in lowland zones close to the district capital in Chang Khoeng sub-district, ethnic minority communities are scattered throughout the seven sub-districts with Hmong communities usually located in highland zones, while Karen and Lua villages tend to be in midland areas (Thanapakpawin et al., 2006). Although northern Thais have been settled in the region since the 1950s (Sturgeon et al., 2013), many ethnic minority communities were established long before then. Indeed, many Karens settled in the region hundreds of years ago, while other ethnic minority groups began to populate the region during in the mid-19th century (Johnson, 1992).

3.1.1.4 Main Economic Activities

Mae Chaem district's main economic activity is agriculture (Thomas et al., 2004). Before the 1960s, there existed three agricultural land use systems throughout northern Thailand, although these patterns[21] changed significantly between the 1960s and the 2000s (see Figure 15). Pre-1960s highland land use patterns were commonly known as pioneer shifting cultivation systems, characterized by lengthy cultivation and forest fallowing cycles, while midlands and lowlands experienced rotational shifting cultivation systems with shorter cultivation and forest fallowing cycles than highlands (Thomas et al., 2004; Suraswadi et al. 2005; Thanapakpawin et al., 2006). Between the 1960s and 2000s, state policies (particularly during the 1980s) pressured local populations to replace their traditional subsistence-orientated land use systems with more commercially orientated ones. In highland areas, these changes consisted of pioneer shifting cultivation systems being largely replaced by a variety of different land use systems, such as cash crop intensification. In midland zones, rotational shifting cultivation and forest fallowing period intervals decreased, and permanent cultivation areas with crop rotations became widespread, while short cultivation and forest fallowing cycles in lowlands were replaced

[21] Each land use system from each period (pre-1960s and the year 2000) is attributed to a specific altitude zone, type(s) of vegetation and ethnic group(s).

with permanent and uninterrupted cultivation (Thomas et al., 2004; Suraswadi et al. 2005; Thanapakpawin et al., 2006).

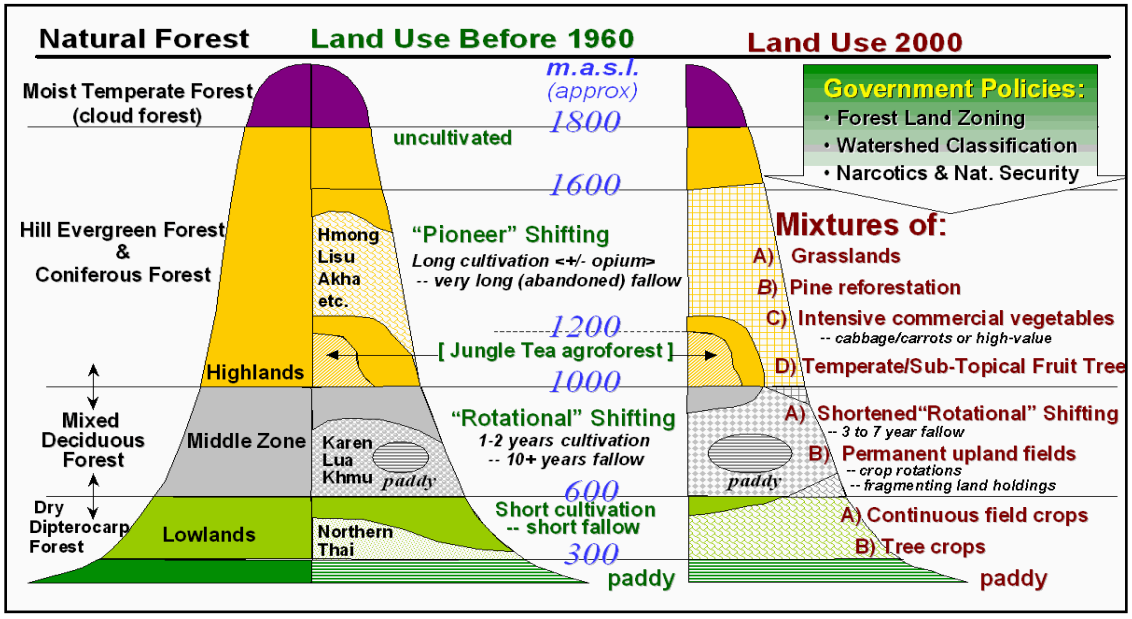

Figure 15-Changing Land Use Patterns in Northern Thailand
Source: Thomas et al. (2004, p.10)

3.1.2 Village Selection

Following a surveying trip to Mae Chaem district, two villages (V1 and V2) were identified as this research's study sites. The two communities respected a set of pre-established criteria used to determine where fieldwork would be conducted. The main condition for selection was that both villages be from Mae Chaem district and in relative proximity to one another to facilitate visits between them. Among the villages respecting these criteria, two were selected after further screening (two stages). First, interviews with various key informants helped identify two villages in Mae Chaem district which shifted their general response towards conservation pressure from a resistant to a more cooperative attitude. Second, a preliminary contextual land cover analysis of both villages' lands was performed (Hansen et al., 2013), confirming that sufficiently relevant forest cover and agricultural changes occurred in proximity to the villages in question. To respect confidentiality and anonymity agreements with those interviewed in the villages, the exact location of both communities cannot be directly divulged. This study can, however, provide

a general idea where the villages are located (see Figure 20); both communities are within a 10-km radius of the district capital (research team's base of operations). While V1 is in a highland area, V2 is in a midland zone. The soil, vegetation and climate found in both villages are the same and resemble those which characterize Mae Chaem district in general (see earlier in this chapter). Regarding ethnic composition, V1 is a Karen village, and V2 is a northern Thai village, with the main economic activity in both villages being agriculture. The villages' other sociodemographic characteristics are found in Chapter 5.

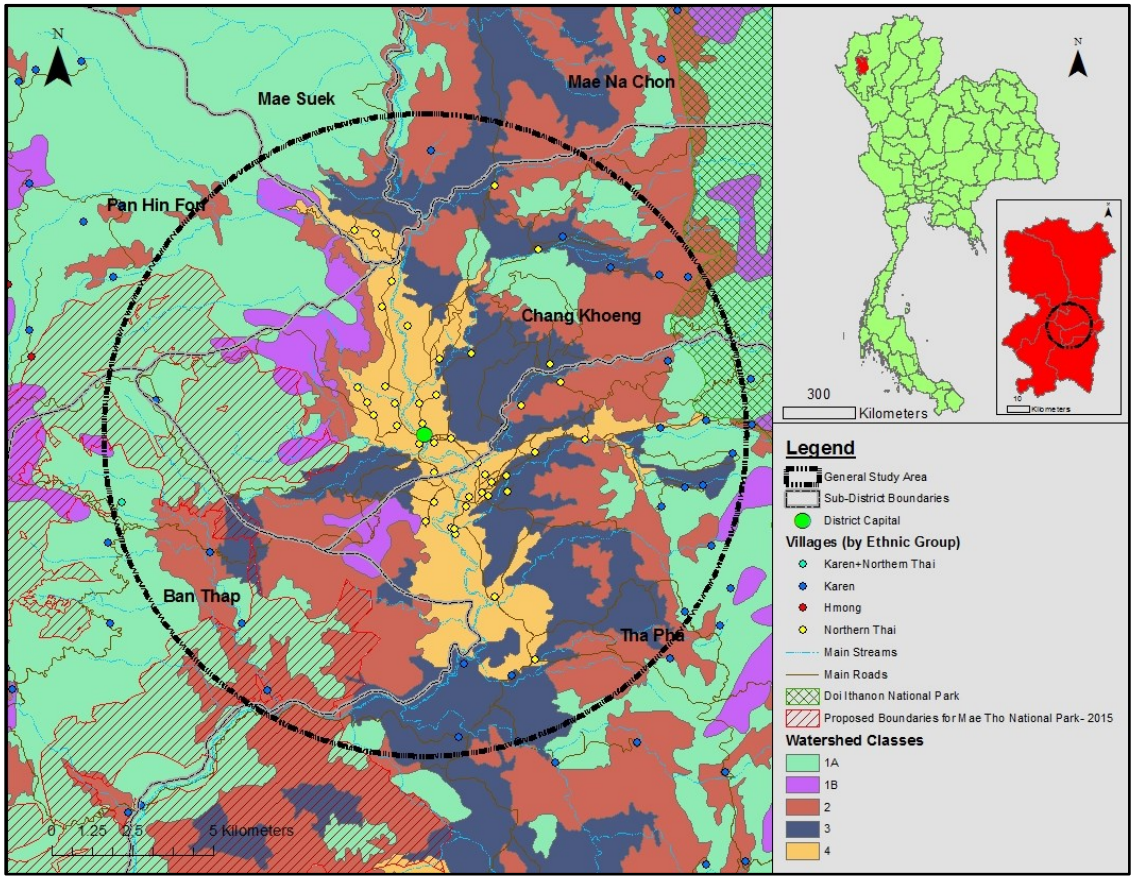

Figure 16-General Study Area
Sources: ICRAF (2016); GADM (2015); SDF (2016)

Note: ICRAF (2016) data's coordinate systems could not be determined and corrected, meaning that they do not align exactly with the map's other layers from GADM (2015) and SDF (2016).

3.2 Research Methods

This thesis's methodology is based on a comparative case study design between two villages in Mae Chaem district. A comparative case study can be defined as a research

which covers "[…] two or more cases in a way that produces more generalizable knowledge about causal questions […]" (Goodrick, 2014, p.1), particularly regarding the "[…] similarities, differences and patterns […]" (Goodrick, 2014, p.1) between the cases. Usually employing mixed methods to collect both qualitative and quantitative data, comparative case studies are appropriate to use when looking "[…] to answer questions about causal attribution and contribution […]" (Goodrick, 2014, p.1). Since this study looks to answer causal questions on forest and agricultural changes surrounding two villages in Mae Chaem district with similar and yet different sociodemographic characteristics, a mixed method (contextual land cover analysis and semi-structured interviews) comparison was deemed an appropriate design for this research.

A common limitation of comparative case studies is that time, and resource constraints can result in smaller-than-anticipated sampling pools to be researched in a very short period of time (Goodrick, 2014). Given the limited time-frame and budget for this study's fieldwork, original population samples were reduced, and the selection of study sites was mostly based on villages' proximity to one another and the research team's base of operations. This study used process-tracing[22] to test this research's causal claim that farmers' responses to drivers of forest transitions play a significant role in forest cover and agricultural area changes. The main methods employed as part of this technique consisted of a contextual land cover analysis and semi-structured interviews.

3.2.1 Contextual Land Cover Analysis

To determine a contextual estimate of recent forest cover and agricultural area changes in Mae Chaem district, different types of secondary quantitative data, particularly land cover maps[23], needed to be collected and analyzed. As argued by Temudo & Silva (2012), the comparison of land cover maps is essential when discussing the causes and

[22] According to Leblond (2015), process-tracing can be understood as a research technique which tests "[…] causal claims through the rich documentation and localization in time and space of the specific actions, actors, contextual factors, and processes (pathways), which allowed, favor or work against the emergence of the phenomenon to be explained" (p.9).

[23] Unless specified otherwise, the maps in this thesis were made with ArcGIS® software by Esri. ArcGIS® and ArcMap™ are the intellectual property of Esri and are used herein under license. Copyright © Esri. All rights reserved.

scale of forest cover and agricultural area changes. Consequently, secondary land use and forest cover maps, statistics and geospatial datasets were acquired from different sources to allow for statistical and visual comparisons of agricultural and forested areas in Mae Chaem district, over different time periods. Specifically, data acquired from ICRAF (2016) was used to design both detailed (Figure 17) and aggregated (Figure 18) land use classification maps.

To create Figure 17, a shapefile of land use classes was first imported into ArcMap to serve as a reference layer, before using the "clip" geoprocessing tool to create a "clipped" layer[24] of land use classes. Land use classes which held a similar label name were then grouped together; for example, all classes whose label name started with the word "Cabbage" (e.g., "Cabbage-Soybean" and "Cabbage (Swidden cultivation)-Upland rice (Swidden cultivation)") were grouped together. Classes that could not evidently be categorized as either agricultural or forested land (e.g., "Mine") were merged into more general class groups, such as "Other land use" and "Other forest". Land use classes included in the "Unspecified" class group were grouped together based on unclear descriptions in their attribute tables.

For Figure 18, land use classes from Figure 17 were aggregated into three final land use classes: "Agriculture", "Forest" and "Other" (see Table 5). Changes in the amount of land area used for each of the aggregated between the two dates (2002 and 2010) of Figure 18, were calculated in Excel by using all three classes' attribute data. For triangulation purposes and generalization assessment, the resulting land use maps were analyzed together with (i) land cover maps/statistics[25] obtained from the Mae Chaem District Office (MCDO), as well as with (ii) photographs[26] and notes pertaining to observable changes in forest cover and agricultural areas (taken while visiting farmers' lands during fieldwork) and finally (iii) existing land cover maps/statistics (see Chapter 2).

[24] A shapefile of sub-district administrative boundaries (GADM, 2015) was used as an input layer to extract the land use classes from the reference layer. It should also be noted that the 2002 map found in both Figures 17 and 18 is not an accurate portrayal of the district's administrative boundaries in 2002, since the boundaries had not yet been re-drawn (see page 29). To facilitate comparisons with both the 2010 maps in Figures 17 and 18, as well as with other maps used by the MCDO, the 2002 maps were clipped using post-2009 district administrative boundaries.

[25] These maps/statistics provide the most recent and officially recognized documentation of forest cover and agricultural area changes in Mae Chaem district.

[26] Unless specified otherwise, all photographs included in this thesis were taken by the author.

Table 5-Land Use Aggregations of Figure 18
Source: ICRAF, 2016

Aggregated Land Use Classes (2002 and 2010)	Land Use Classes (2002)	Land Use Classes (2010)
Agriculture	Cabbage; Maize; Mixed field crop; Soybean; Rice paddy; Upland rice	Cabbage; Coffee; Flowers; Fruit; Maize; Mixed field crop; Peanut; Rice paddy; Rubber; Soybean; Upland rice; Tea
Forest	Deciduous dipterocarp forest-Mixed deciduous forest; Degraded deciduous forest; Degraded evergreen forest; Hill evergreen forest; Mixed deciduous forest-Deciduous dipterocarp forest	Dense deciduous forest; Dense evergreen forest; Degraded deciduous forest; Degraded evergreen forest
Other	Other land use; Urban; Village; Fallow; Pine forest; Mixed forest plantation; Unspecified	Dense forest plantation; Other forest; Fallow; Farm pond; Marsh and swamp; Grass; Pasture; Scrub; Government buildings; Village; Urban; Other land use; Unspecified

When analyzing land cover changes in Mae Chaem district, it is important to properly define certain key terms such as "forest cover" and "agricultural areas". Forest cover in this study is understood to include all areas not being used for agricultural/residential purposes, a similar definition seemingly used by the MCDO (2016) in Figure 20. The choice for this definition was based on the need to facilitate comparisons between maps from the MCDO and other sources. Accordingly, Figure 18 categorizes all land use classes whose label name includes the word "forest" (e.g., "Hill evergreen forest"), as forest cover. However, some classes' label names which included the term "forest" were not aggregated under the final aggregated "Forest" classification. The "Pine forest" [27], "Other forest" [28], "Mixed forest plantation" and "Dense forest plantation" classes[29] were not included as it was unclear in their attribute table description whether they do in fact constitute as forest cover or were used for other purposes such as plantations or logging. They were subsequently grouped under the "Other" aggregated land use class. To avoid

[27] Since the "Pine forest" class from the 2002 map constituted only a small parcel of land and was not recorded in the detailed 2010 map, it is possible it could have been used for logging purposes, although to validate this claim would require a more detailed analysis.
[28] The "Other forest" class in the detailed 2010 map included classes of certain tree species (rain and teak trees) which had unclear descriptions on what type of forests they were.
[29] It was unclear what species of trees constituted the "Mixed forest plantation" and "Dense forest plantation" classes and what were the purposes of the plantations.

confusion over different interpretations of forest cover during interviews, the definition described earlier was used in conversations. The term "agricultural areas" was understood, during the analysis of maps and interviews, to include "[…] arable land, land under permanent crops and land under permanent meadows and pastures" (OECD, 2003).

There exist four significant limitations for Figures 17 and 18. First, it was not possible to determine the source and the accuracy of the ICRAF data used in both figures. Therefore, those wishing to consult these figures need to consider this limitation and understand that the purpose of these maps is to offer a general and contextual estimate of land cover changes in Mae Chaem district, rather than a precise depiction of the district's land cover evolution. Second, ICRAF did not possess land use classification data for any year between 2002 and 2010, meaning annual changes in between those years could not be estimated. Third, it was not possible to acquire any other land use classification maps, statistics or datasets which could be used to compare with Figures 17 and 18. Finally, the fact that that there were unclear descriptions in some land use classes' attribute tables meant that grouping them together under broader aggregated classes could result in misinterpretations of what constitutes as "Forest", "Agriculture" and "Other" land uses. Despite such limitations, Figures 17, 18, 19, 20 and 21 help provide a general and contextual estimate of forest cover and agricultural area changes in Mae Chaem district between 2002 and 2016; forest cover loss and gain have both seemingly occurred during this period, although significantly more loss than gain. In addition, forest cover is expected to increase between 2016 and 2020.

3.2.2 Semi-Structured Interviews

To learn more about farmers' responses to drivers of forest cover changes in Mae Chaem district, semi-structured interviews were conducted with three categories of actors. First, key informants (e.g., district, sub-district and village officials) were informally interviewed during a survey trip to learn where significant recent changes in forest and agriculture occurred and which communities responded positively/negatively to conservation pressure/economic factors. Second, twenty land users (ten in each village) were interviewed once the study sites were determined. Participants were selected through

purposive and snowball sampling based on their direct involvement in, or at least their knowledge of, a diversity of forest/agricultural changes. The third and final category of actors consisted of eleven secondary actors directly/indirectly involved in land use changes. This category included (i) actors involved in forest/agricultural area changes, who are not ordinary villagers (representatives from NGOs and the private sector), as well as (ii) officials involved in forest policy implementation (RFD, DNP, district and sub-district representatives) and finally (iii) community leaders (village headmen and village committee members).

The interview guide conceived for farmers (see Appendix II) consisted of questions focused on the personal situations of farmers, as well as their perceptions of land use changes and their/other farmers' responses towards conservation/economic pressure in the wider community. The questions in the key informant/secondary actor interview guide (see Appendix III) focused more on their general knowledge of forest and agricultural area changes within the district, as well as their perceptions on what the causes and impacts of the changes in question. Both guides were originally developed in English before being translated into Thai. However, team members later reviewed the guides at the onset of fieldwork and determined that only the English-language interview guides would be used[30]. Following the designing of the interview guides, a Microsoft Excel[31] spreadsheet was used to facilitate the compilation of translated interview transcriptions; spreadsheet columns consisted of the interview guide questions, while the rows were made up of each participant's code number to ensure the anonymity and confidentiality of their answers.

For the interviewing process, the venues and times of interviews were always chosen at the convenience of the interviewee. Key informants and secondary actors usually wished to be interviewed at their work office during local office/work hours, while farmers generally requested to be interviewed in their homes after local working hours. Yet, some farmers requested to meet with the team in their village headmen's home (in cases such as these, no one else was present other than team members and the interviewee). Interviewed farmers whose livelihoods were affected by the time they spent being interviewed, were

[30] As this study's principal investigator, it was deemed appropriate for me to ask questions (in English first, translated into northern Thai afterwards) directly to participants to build trust within the community.
[31] Text and tabular data was done with Microsoft Word and Excel, Copyright © Microsoft Corporation.

awarded a financial compensation based on appropriate local compensation norms. The interviews themselves generally lasted between one and two hours while being conducted under a consistent structure. Interviews began with personal introductions by research team members and an explanation of the study and its main objective. Participants were then provided with Thai-language consent forms, which the team read aloud in both English and northern Thai to ensure participants fully understood the consent process. Interviewees were then finally asked to give their consent to being interviewed, as well as their permission for the team to record the interview.

Following the interviews, the content of the audio-recordings was translated and transcribed from northern Thai into English, which was then directly integrated into the Excel spreadsheet. However, there were some limitations observed during the data collection process. One such limitation was that it was not possible to visit more than two villages and interview more than twenty participants due to time and resource constraints. Another restraint was that studied villages were selected partly on their proximity to the research's team's base in the district capital; during the rainy season, access to certain remote communities can be very difficult, if not impossible, due to dangerous driving and road conditions. These limitations restricted the scope of this study to a specific area of Mae Chaem district, preventing the team from researching other areas for triangulation purposes. There were also a few issues regarding the interviewing process:

- Some participants had limited to no knowledge on some interview topics (e.g., forest laws) and were thus unable to not properly answer some questions.
- The research team was unable to interview any representatives from academic institutions who were involved in research or development efforts in the district.
- Some farmers were unable to be interviewed because either their homes were too far to walk to or they were off working and living in faraway fields.
- When asked on the number of registered household members, many interviewees only referred to those who were currently residing in the household, thus excluding other possible family members living elsewhere during certain periods of the year.

Using Excel spreadsheets, identified questions deemed most useful to help better understand (i) how exactly farmers have responded to conservation pressure/economic

factors and (ii) what the impacts of these responses have been. The identification was based on deductive logic; for example, to determine what a farmer's response(s) to forest policies has been, interview guide questions concerning specific actions towards forest policies (e.g., "Have you ever responded to the NFR/DNP limits?") were further analyzed. As for the impacts of the response(s), questions which investigate changes in forest cover/agricultural trends (e.g., "Has forest quality in the area changed?") were singled out. Participants' interview answers were then manually extracted from the spreadsheets and inserted into a Microsoft Word document for further analysis. Again, using the example of farmers' responses to forest policies, response(s) (as well as their causes and impacts) were determined through deductive reasoning. Specifically, this could be determined by considering, within a participant's answers, the (i) context (e.g., it is illegal for farmers in the area to clear forest for farming), (ii) action taken (e.g., a farmer cleared forest for farming), (iii) awareness of the interplay between the context and the action (e.g., a farmer knowingly/unknowingly broke the law) and finally (iv) observed impact on forest cover/agricultural trends (e.g., forest cover decreased because of land being cleared).

In this example, it can be concluded that the participant claimed land in a context where doing so is forbidden, even though the participant was fully aware of the illegal nature of the action, thus constituting evidence of a resistant response to conservation pressure. To more easily identify trends in participants' answers, key word queries (e.g., more/less forest, claimed/stopped claiming land) were conducted while using sociodemographic indicators (e.g., village code and ethnic group) to distinguish responses and their impacts between participants.

3.3 Fieldwork Design

3.3.1 Survey Trip Preparation

In early September 2016, the research team[32] met in the municipality of Chiang Mai (Chiang Mai province) to discuss the study's general objective and data collection strategy. It was determined from this meeting that the general objective could be met, but

[32] The research team was composed of Mr. Kunakorn Boonsai, Mrs. Chatchaya Pongsopa and myself.

not before addressing some methodological issues which were brought up. The main concern was that there was insufficient time[33] for the team to (i) gain enough trust[34] from communities for research to be allowed to be conducted on their lands, as well as to (ii) meet the research proposal's original population sample target (forty total participants; twenty per village). It was decided to reduce the target to twenty total participants (ten per village). The team then proceeded to thoroughly review the interview guides, consent forms, and introductory scripts; minor corrections were made to all documents to ensure their structure, translation, coherence were adequate and contextually appropriate. The team also reached out to the ICRAF-Thailand Office in Chiang Mai for advice as to which areas would be of interest to this study. Mae Chaem district had already been proposed by ICRAF as a possible site of interest, and this suggestion was corroborated with previously mentioned analyses of (i) existing studies on forest and agricultural area changes, as well as (ii) land cover changes in the district. Both analyses were deemed to have provided enough evidence to plan a survey trip in the district to assess the analyses' findings.

3.3.2 Survey Trip

Using contact information (e.g., list of villages' names, addresses and headmen phone numbers) provided by ICRAF, the research team spent three days in Mae Chaem district during the beginning of October 2016 visiting the offices of various levels of government (e.g., DNP and Sub-District Administrative Organization (SAO) offices) and different villages to announce our presence and research intentions to local authorities, as is the custom in Thailand. It was during these first visits that the interview guides were tested on key informants. While visiting one SAO office, key informants advised the team to investigate the situations of two accessible villages (V1 and V2) which had allegedly experienced recent changes in land boundaries due to conservation pressure. It was also during the visit of the SAO office that the research team met, by chance, the headman of V2 who, after being informed of our research intentions, invited the team members to stay and conduct research in the village. Finally, the team could visit V1 for the first time at the

[33] Fieldwork needed to be completed within a two-month time frame (October-November 2016)
[34] When conducting research in rural Thailand, obtaining a community's trust normally requires a gradual introduction of both the research's purpose and team members themselves, to the community members.

end of the survey trip and gain permission from village authorities to allow us to conduct research in the village. For V2, the first visit was done after the survey trip, during the main data collection stage.

3.3.3 Survey Trip Assessment and Data Collection Preparation

Following the survey trip (end of October 2016), the research team undertook one final contextual land cover analysis of Hansen et al. (2013) images, this time focusing on changes having occurred in both V1 and V2. Results showed episodes of both forest cover loss and gain, albeit much more loss between 2000 and 2014. Based on this contextual land cover analysis and the fact that both villages were in the same district and in relative proximity to one another result, V1 and V2 were confirmed as the two case studies for this research. Once this decision was reached, the team began preparing the fieldwork's logistics and scheduling interviews with various secondary actors.

CHAPTER 4. FOREST COVER AND AGRICULUTRAL AREA CHANGE IN MAE CHAEM DISTRICT

This chapter presents, in two sections, a contextual estimate of land cover evolution in Mae Chaem district. The first section will describe land use change which occurred between 2002 and 2010, while the second examines both documented and anticipated land cover change between 2002 and 2020.

4.1 Land Use Change in Mae Chaem District (2002-2010)

In Figure 17, it can be first observed that both similar and yet different land use classes are found in both 2002 and 2010 maps. Notably, there is a wider variety of classes in 2010 than in 2002; some land use classes are found in both dates while others have seemingly appeared/disappeared in between the two years. For example, cabbage, maize, mixed field crop, soybean, rice paddy and upland rice areas were present in both years.

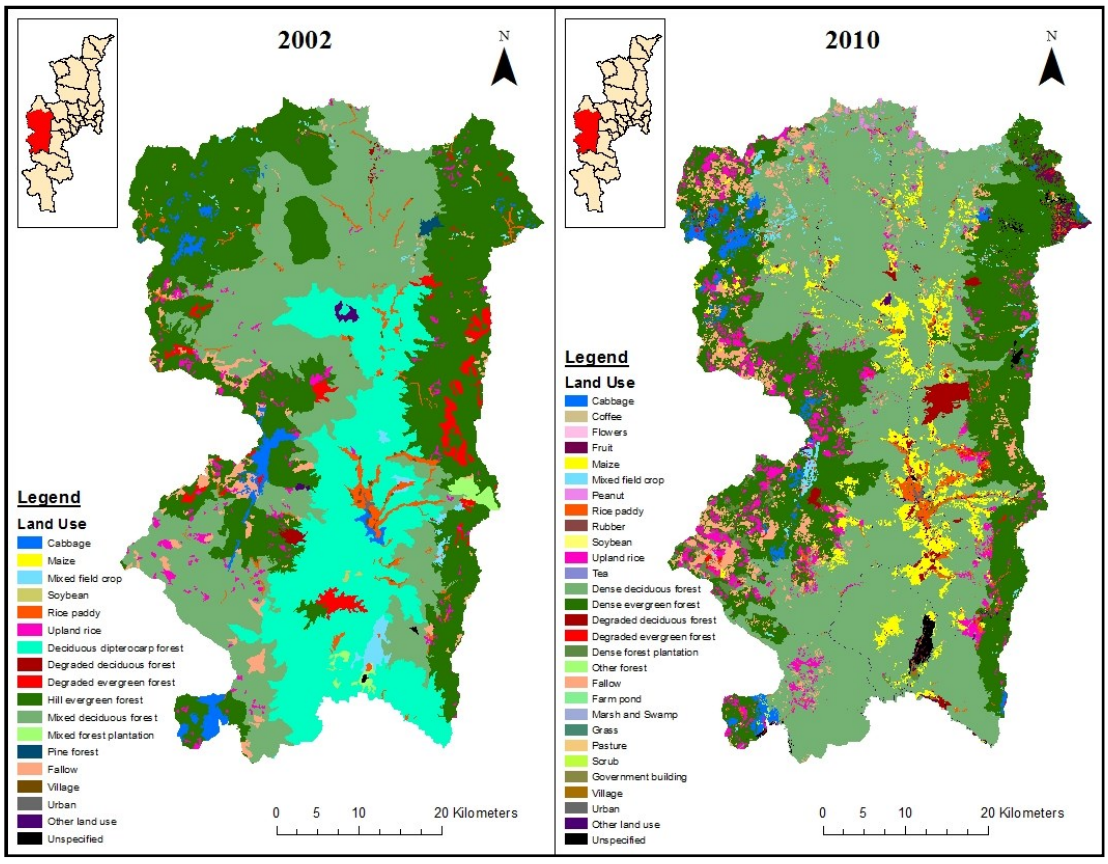

Figure 17-Detailed Land Use Classification of Mae Chaem District (2002-2010)
Sources: ICRAF (2016); GADM (2015)

However, many land use classes in the 2010 map (Coffee, Tea, Rubber, Peanut, Flowers, Tropical Fruit, Grass, Marsh, Swamp, Scrub, Pasture, Farm Pond and Government Building) were missing[35] from the 2002 map. There also appears to have been changes in some forest classes' label names; for example, the 2002 "Deciduous dipterocarp forest" class label was seemingly changed to "Dense deciduous forest". There are also significant changes in the land area of certain classes found in both periods. One of the biggest visible changes is an increase in land used for agricultural purposes, particularly for growing maize; the total land area used to grow maize in 2002 was 0.1 km^2 (0.004%) and 138.6 km^2 (5.1%) in 2010.

The aggregation of land use classes (see Figure 18 and Table 6) clearly shows that there was significantly more land in 2010 used for agriculture and other types of land use than in 2002. Indeed, 166.9 km^2 (6.1% of total land cover[36]) of Mae Chaem district was used for agriculture in 2002 before increasing to 392.9 km^2 (14.4%) in 2010, while forest cover decreased from 2472 km^2 (90.6%) in 2002 to 2148 km^2 (78.7%) in 2010. Lastly, land used for other purposes than agriculture and forest numbered 90.6 km^2 (3.3%) in 2002 and increased to 188.5 km^2 (6.9%) in 2010. Based on the above findings, it can, therefore, be concluded that Mae Chaem district experienced an increase in agricultural areas (+8.3% of the total land area) and other types of land use (+3.6%), while forest cover decreased (-11.9%) between 2002 and 2010.

[35] It is possible that these types of land use existed in 2002 but were included under more general classes by ICRAF, although to validate this claim would require a more detailed analysis.
[36] According to ICRAF, the estimated total land area of Mae Chaem district is 2729.4 km^2; this amount differs from the one estimated by the MCDO (2708.3 km^2).

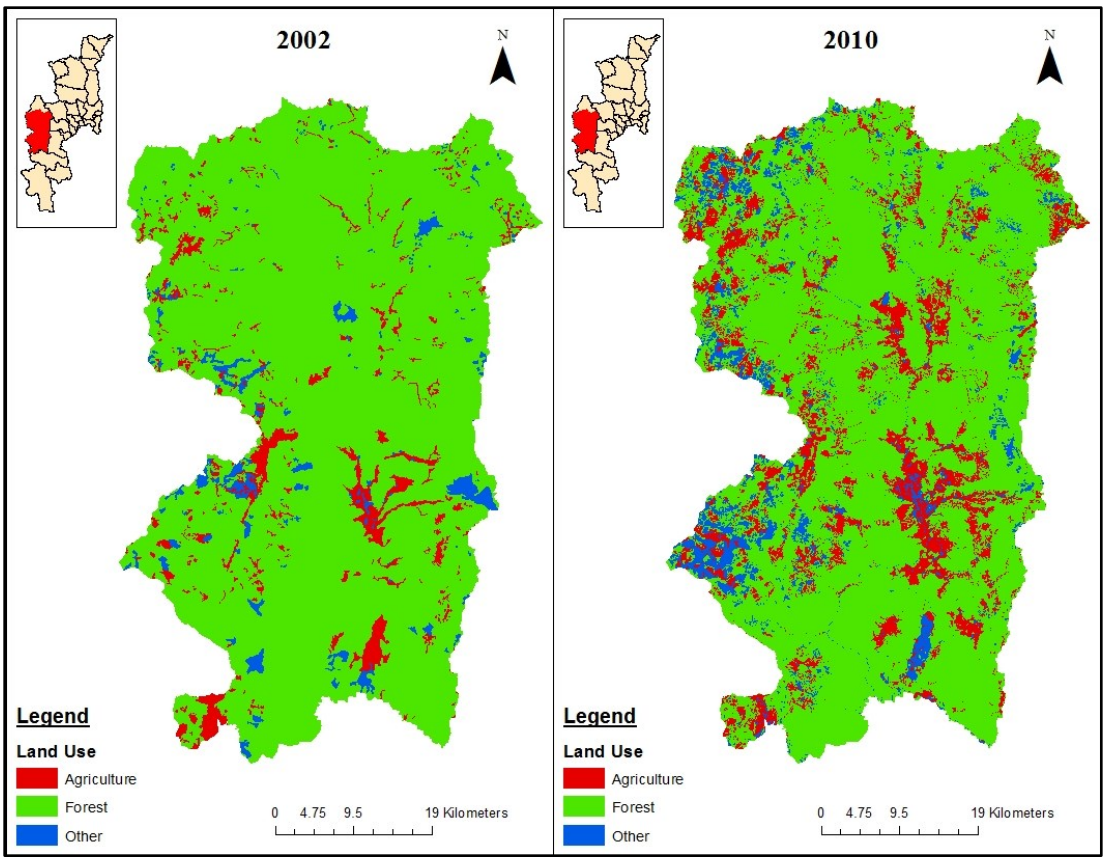

Figure 18-Aggregated Land Use Classification of Mae Chaem District (2002-2010)
Sources: ICRAF (2016); GADM (2015)

Table 6-Land Use Change in Mae Chaem District (2002-2010)
Source: ICRAF (2016)

Aggregated land use classes	Total land area (%) in 2002	Total land area (%) in 2010	Total land area (%) change (+/-) 2002-2010
Agriculture	6.1	14.4	+8.3
Forest	90.6	78.7	-11.9
Other	3.3	6.9	+3.6

ICRAF (2016b, p.36) believes that the drivers of land use changes in Mae Chaem district between the 1960s and 2000s, were (i) "population growth and migration", (ii) "agricultural expansion, commercialization & capitalization", (iii) "infrastructure and public services", (iv) "urbanization, industrialization and tourism", (v) "forest policy and administration" and (vi) environmentalism. Agricultural expansion (particularly intensified commercial crop production) had previously been suggested by Hoang et al. (2014), as a significant driver of deforestation in Mae Chaem district in the 2000s. Consequently, the main proximate cause of deforestation in the district was arguably agricultural expansion.

4.2 Land Cover Change in Mae Chaem District (2002-2020)

According to the MCDO (2016), there exist several critical issues in the district, notably (i) a poor record for land rights (e.g., few land title deeds granted), (ii) a significant number of "stateless" (those with no Thai citizenship) constituents, (iii) a degraded basic infrastructure, (iv) a poor quality of life for many constituents (e.g., many are not capable of accessing various social services), (v) various social issues (e.g., high rates of substance abuse) and finally (vi) a variety of environmental problems (e.g., high rates of deforestation and high levels of smog). Solving the smog issue has recently become a state development priority in the district. According to Schweikle et al. (2015), the burning of maize stover during the hot/dry season is the main cause of smog in the district. Schweikle explains that many farmers practice this to provide their lands' soil with an easily obtainable and inexpensive fertilizer. The author argues that despite its cost-benefit advantages, burning maize stover can ultimately lead to two major issues, the first being that ashes from the fires are often easily dispersed by natural causes and are consequently unable to properly fertilize the soil. Second, smog arising from the fires have serious repercussions with regards to both peoples' health (e.g., increase in respiratory and cardiac problems) and the environment (e.g., increase in carbon emissions).

The MCDO (2016) estimates that between January and May 2015, there were 427 "hot spots" (or burning zones) in the district, which the highest number of zones among all other districts in the province. In 2015, the MCDO (2016) proposed to decrease smog levels within a two-year window; the MCDO was pressured into doing so by provincial authorities, as part of a nation-wide objective to decrease the number of hotspots (20% decrease in 2016 and a planned 30% decrease in 2017) (Public Relations Department, 2016). The approach consisted of sustainably preventing and mitigating fires through various actions (MCDO, 2016). With regards to preventing fires, the MCDO (2016) publicly requested farmers to stop burning maize stover for a consecutive period of 60 days and establish fire breaks in their communities. The MCDO noted that fire mitigation consisted of encouraging citizens to voluntarily commit themselves to be increasingly vigilant to identify the early stages of fires, as well as working together to put out fires when they occur. To ensure the sustainability of this anti-smog approach, the MCDO encouraged communities to follow the late King Bhumibol Adulyadej's "sufficiency

economy philosophy"[37]. According to the MCDO (2016), the actions listed above were successfully implemented and have helped reduce the number of hot spots in the district[38]. However, to ensure that fires can be better controlled and prevented, as well as address the district's other critical issues, the MCDO introduced an innovative sustainable development model otherwise known as the Mae Chaem Model.

4.2.1 Rationale of the Mae Chaem Model

The Mae Chaem Model's main objectives are to sustainably stop (i) smog, (ii) agricultural expansion in NFRs, (iii) monocroping in NFRs and (iv) the general use of chemical pesticides and fertilizers. To meet the model's objectives, seven goals (see below) and various actions needed to achieve these goals, were determined by a working group[39].

1. Ensure that communities understand the critical issues of Mae Chaem district, as well as the Mae Chaem Model's objectives and strategies.
2. Improve community-based forest management.
3. Ensure the sustainable preservation of community and other types of forest.
4. Restore degraded ecological systems.
5. Develop and support existing/alternative income-generating activities.
6. Raise awareness of ethnic minority issues.
7. Encourage all sectors to participate in the Mae Chaem Model's implementation.

According to the MCDO (2016), the model is a public participatory ("bottom-up") approach which requires detailed baseline information to efficiently attain the seven goals. Particularly, sound land cover maps allow for more accurate portrayals of land cover changes needed to improve community-based forest management and ensure the

[37] This development approach encourages individuals to abide to three main principles: "[…] moderation, reasonableness and self-immunity […]" (Mongsawad, 2010, p. 123).
[38] The exact amount and year(s) of this decrease were not clearly indicated, but the results were allegedly satisfactory for the Ministry of the Interior, according to a district official.
[39] To the best of the research team's knowledge, the principal actors of the working group were the MCDO, RFD, DNP, TRPF, CP, SDF, CMU, Maejo University and the Hug Mae Chaem Foundation.

sustainable preservation of community and other types of forest. To make these maps, the working group collected[40] information needed to quantify lands held under title deeds, as well as lands designated as PAs, NFRs (Figure 9) and those used for agriculture/residences and general forest cover (Figure 10). In addition, the working group designed[41] a series of maps which depict the land cover changes (from 2002 to 2016) of sixteen villages in Mae Chaem district (see Figure 19). The working group also created a map of the district's land cover changes between 2002 and 2016 (see Figure 20), as well as a map of changes expected to occur between 2016 to 2020 (see Figure 21).

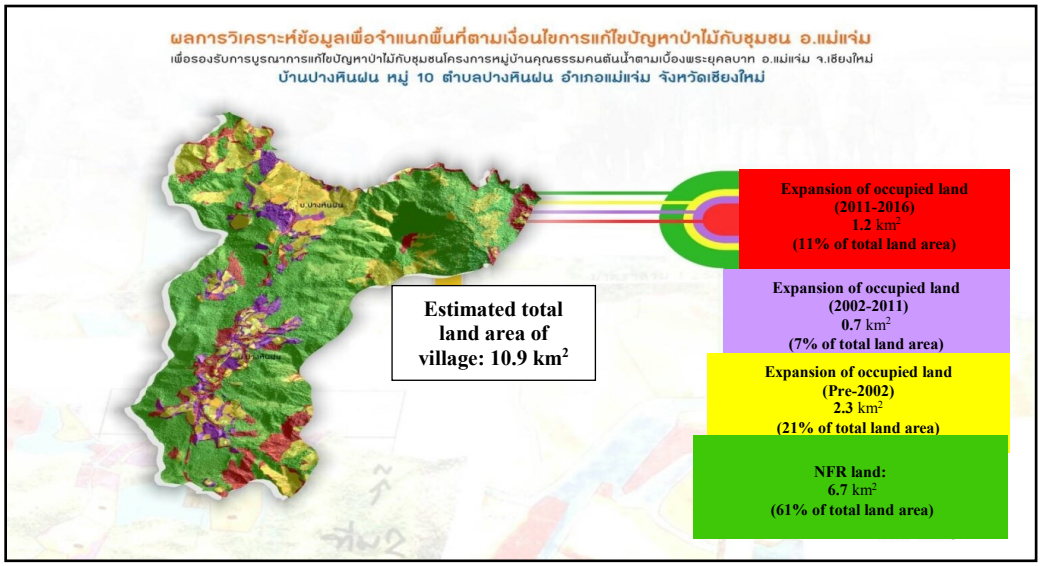

Figure 19-Example of a Village's Land Cover Changes (2002-2016)
Source: Modified from MCDO (2016)

Figure 19 is an example of a village-level land demarcation; such maps are part of a sixteen-village land demarcation project used to obtain the necessary baseline land cover information to attain the Mae Chaem Model's second and third goals. According to an official from the Sustainable Development Foundation (SDF), initial mapping of all sixteen villages' lands was done by state officials (it is unclear from which department exactly, but assumed to be RFD/DNP staff) between 2011 and 2016. The officials allegedly first asked land users to clearly indicate their lands boundaries during visits to their fields. Using

[40] It is unclear as to how exactly data was collected by MCDO for Figures 9 and 10.
[41] It is unclear as to how precisely the data used to design the maps in Figures 19 and 20 was collected, as well as how and why exactly the dates used to separate land cover zones in Figures 19, 20 and 21, were determined as such.

handheld GPSs, the officials then mapped the boundaries and inputted the geographic coordinates into Google Earth, from which the coordinates of villagers' lands were transformed into polygons and superposed on historical Google Earth imagery of the lands to identify boundary changes in each of the three pre-determined time periods (pre-2002, 2002-2011, and 2011-2016). This project was considered, according to the SDF official, a legitimate way of helping communities gather information on lands eligible to be included in community land title deed proposals; accurate mapping of these lands is crucial to authenticate their eligibility for such applications.

Within the framework of the Mae Chaem Model, land cover changes in Mae Chaem district were divided into four zones, each being attributed a different color based on the period when changes occurred. The "Yellow Zones" consist of land claimed before 2002 for agricultural/residential purposes; the total land area of this zone is 341.5 km^2 (12.5% of 2708.3 km^2), according to the MCDO (2016). Land claimed for agricultural/residential purposes between 2002 and 2011 are classified as "Purple Zones" (258.7 km^2 (9.5%)), while "Red Zones" include land last claimed for agricultural/residential purposes between 2011 and 2016 (138.2 km^2 (5%). The combined total land area of yellow, purple and red zones in 2016 amounts to 738.4 km^2 (27%), while merged NFR and PA[42] land areas (also known as "Green Zones", which are generally classified as "forested" areas) consist of 1969.9 km^2 (73%) in 2016. As can be concluded from Figure 20, agricultural/residential areas increased by 396.9 km^2 (14.7%), at the expense of forested land. Unfortunately, insufficient information, aside from agricultural/residential expansion, was given by the MCDO regarding proximate or underlying drivers of these changes.

[42]As explained earlier, MTNP's boundaries have changed since 2002, meaning a comparison of changes in forest and non-forest areas since then requires merging the surface areas of PAs and NFRs together.

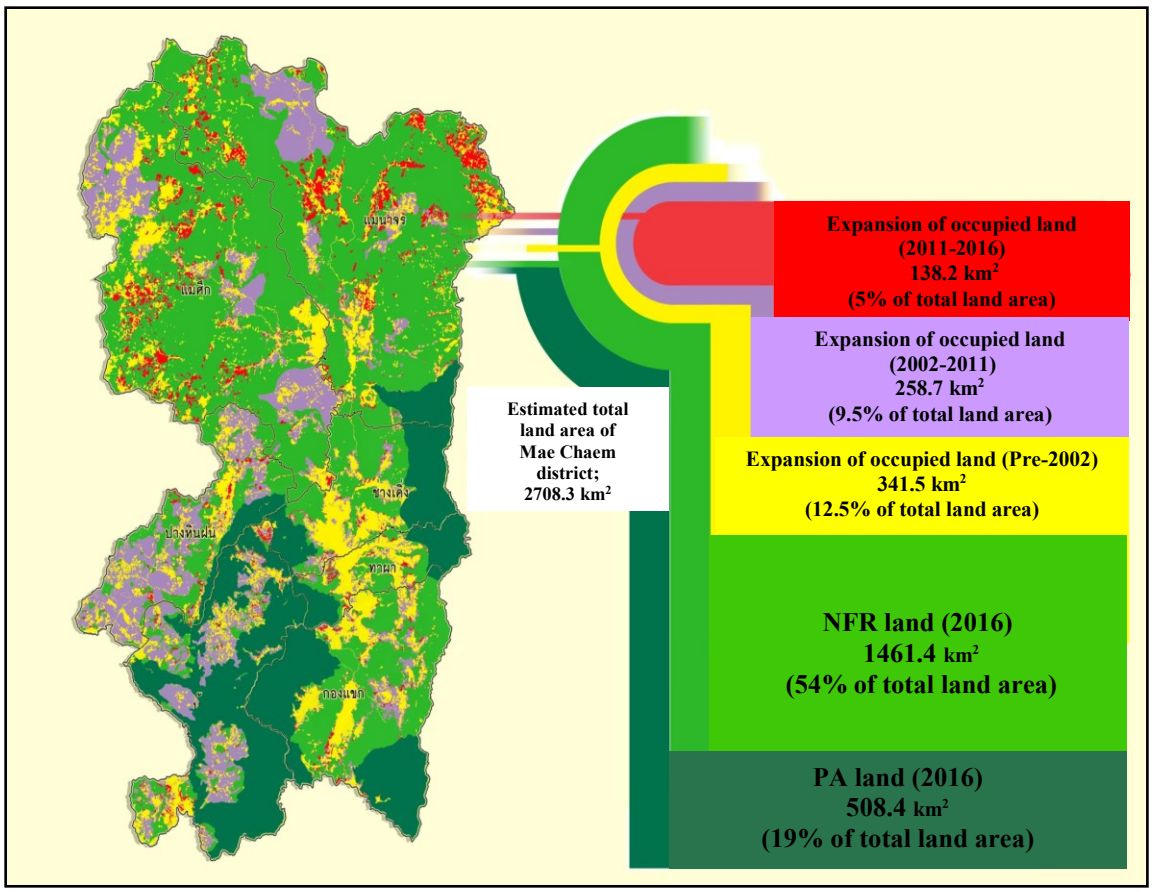

Figure 20-Land Cover Change in Mae Chaem District (2002-2016)
Source: Modified from MCDO (2016)

4.2.2 Results of the Mae Chaem Model (2016-2020)

Using the same spatial data from Figure 20, the Mae Chaem Model's working group developed a map (Figure 21) portraying the model's targets for each of the land cover zones. The actions needed to attain the targets for each land cover zone are outlined in Table 7. It can be interpreted from Figures 20 and 21 that by 2020, approximately 2366.8 km^2 (87.5%) of the total surface of Mae Chaem district is expected to consist of forested areas (this includes green, red and purple zones), while the amount of agricultural/residential areas (yellow zones) is expected to decrease to 341.5 km^2 (12.5%). Therefore, the MCDO's main target is to recover enough land so that the district's forest cover can increase to the same amount which existed in 2002.

Table 7-Measures Needed to Meet the Mae Chaem Model's Land Cover Zone Targets

Source: MCDO (2016)

	Red Zone	Purple Zone	Yellow Zone	Green Zone
Targets (2016-2020)	Permanently reclaim/restore 17 million trees. Land users lose all rights of access to lands, which become natural forested areas.	Permanently reclaim/restore 2.4 million trees. Land users lose all rights of access to lands, apart from practicing agroforestry.	Allow land users to maintain their rights of access to land.	Natural forest must be preserved.
Measures needed to attain targets	(i) Negotiate the return of land with villagers. (ii) Hire land users to plant and maintain seedlings/facilitate and maintain naturally regenerated trees. The budget allocated for this measure is 800 million THB; land users are paid a yearly sum of 2000 THB per Rai, for a minimal period of five years. (iii) Prevent agricultural expansion and ensure reforestation occurs in these areas.	(i) Negotiate the return of lands with villagers. (ii) Request and obtain approval from the government to allow farmers to sustainably use forests for NTFP. (iii) Hire farmers to produce, plant and maintain a minimum of 40 trees per Rai; this contract allows land users to collect NTFP in these areas. (iv) Provide perennial agricultural irrigation systems for land users in these areas. (v) Delay by five years the reimbursement of agricultural debt for land users in these areas. (vi) Provide training to land users who wish to improve their existing cultivation skills/learn new skills for highland agriculture and/or agroforestry. (vii) Promote cooperative markets and encourage land users to limit/end the practice of monocropping.	(i) Request and obtain approval from the National Land Policy Committee to emit community land title deeds to eligible villages in these areas. (ii) Encourage land users to invest in more advanced agro-technology to ensure the optimization of agricultural outputs in limited land parcels. (iii) Provide perennial agricultural irrigation systems for land users in these areas. (iv) Delay by five years the reimbursement of agricultural debt for land users in these areas. (v) Promote cooperative markets and encourage land users to limit/end the practice of monocropping. (vi) Promote organic farming as an alternative to monocropping. (vii) Invest in the improvement of the district's general infrastructure and improve the quality of life of all citizens.	(i) Monitor the state the of forests in these areas through ground/satellite/drone patrols. (i) Enforce forests laws (e.g., NFR/PA laws) by encouraging all sectors (citizens, different levels of government, NGOs, private corporations, academic institutions) to work collaboratively on monitoring, reporting and finally prosecuting those involved in forest encroachment. (i) Help support sustainable community regulations on forest conservation and management.

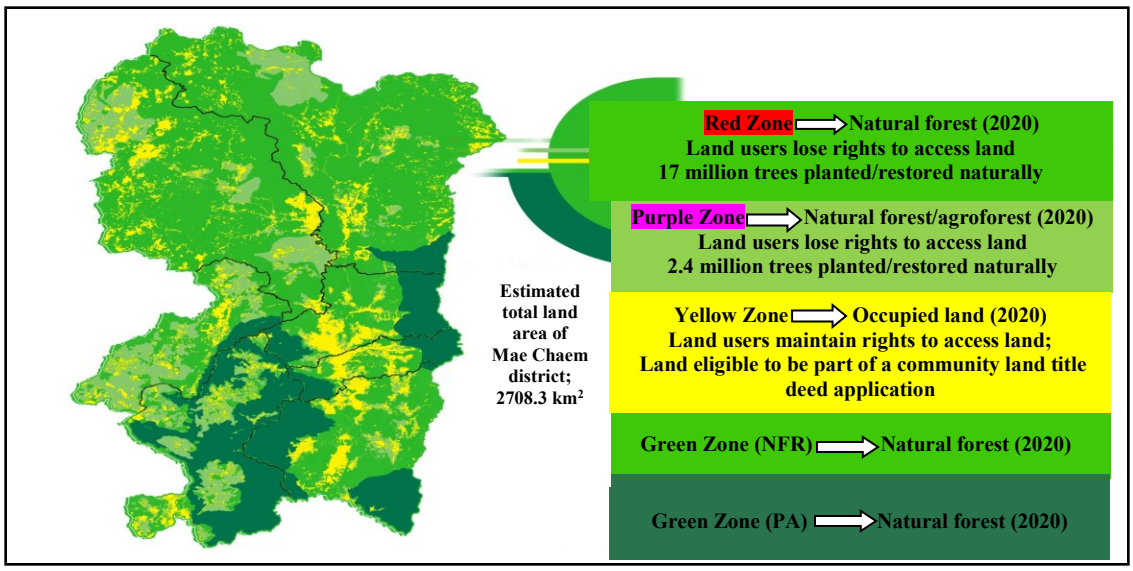

Figure 21-Projected Land Cover Changes in Mae Chaem District (2016-2020)
Source: Modified from MCDO (2016)

Figure 22-Forest Encroachment/Fire Monitoring and Prevention Measures

There is already evidence some of the actions described in Table 7 have begun to be implemented and have even produced results. For example, the research team observed visible efforts of forest encroachment/fire monitoring and prevention measures, carried out in green zones (see Figure 22). The photograph on the left of Figure 22 depicts a GIS centre in the district capital of Mae Chaem, the construction of which was requested by the Mae Chaem Model's working group and funded by Charoen Pokphand (CP), Thailand's biggest conglomerate company. The centre's purpose is to accurately map and monitor land cover and land use at the district, sub-district and village levels to improve community-based forest management and ensure the sustainable preservation of community and other types

of forests in the district. As for the picture on the right of Figure 22, there are two visible types of signage: The first one is a state-sponsored sign (located at the top) delimiting a NFR boundary and the second sign (located below the NFR sign; the promoter of which is unknown) which reads: “Forest fires are caused by humans - Please stop destroying the forest”. Both signs clearly share the same goal of protecting the forest, but project different philosophies with regards to ensuring that forest laws are respected. The NFR sign offers a more official warning that this area is off-limits, while the sign below arguably displays a more informative message appealing to would-be encroachers’ reason, logic, and even feelings to prevent law infringement. Other implemented actions observed during fieldwork are those taken to clearly and directly demarcate the district’s land cover zones (see Figure 23).

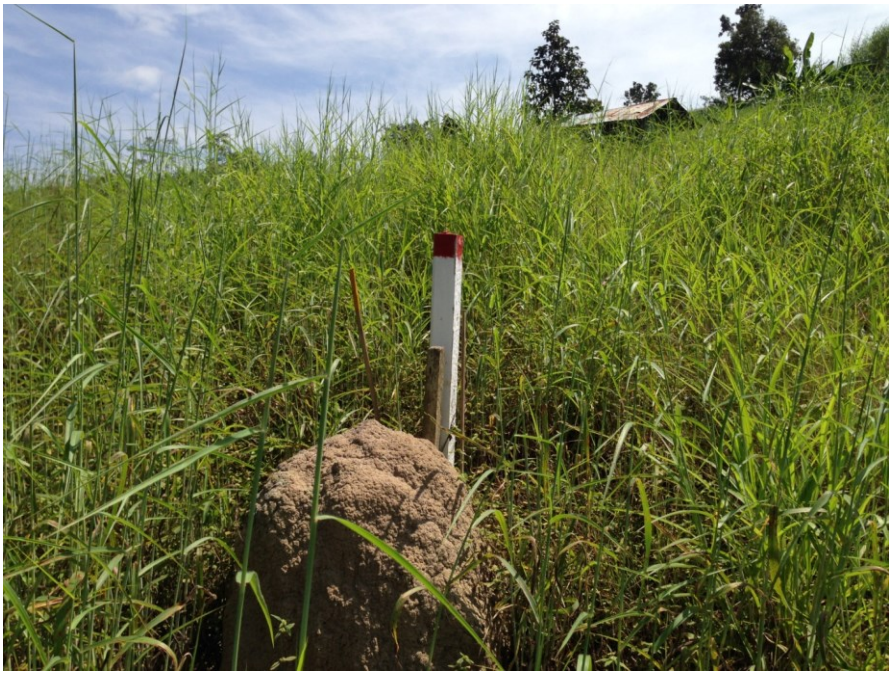

Figure 23-Red Zone Boundary Marker

With regards to the impacts of land cover demarcations, the research team observed forest fallows in red and purple zones (see Figures 23, 25 and 26), although most of what was visible at the time of the visits to these sites was long grass. Trees are only expected to appear within the next five years due to natural regrowth permitted by undisturbed fallowing and/or the planting of indigenous tree seedlings by the former land users (as per the targets and actions in Table 7). In the case of Figure 23, the land behind the red zone

marker was “abandoned” by the land user, after agreeing to plant and maintain tree seedlings for a maximum of five years/until they achieve maturity. These seedlings are provided free-of-charge by the RFD and the Thai Rak Paa Foundation (TRPF) from their joint tree nursery (see Figure 24) located near the district capital. In addition to Figure 23, Figures 25 and 26 demonstrate how land cover demarcations have clearly resulted in the “successful” reclamation of certain areas, as some have already begun to show signs of fallowing. Case in point, the tall grass characterizing the red zone in Figure 25 suggests that, barring any future disturbance, forest cover is expected to appear in this zone within the next five years.

Figure 24-RFD and TRPF Tree Nursery

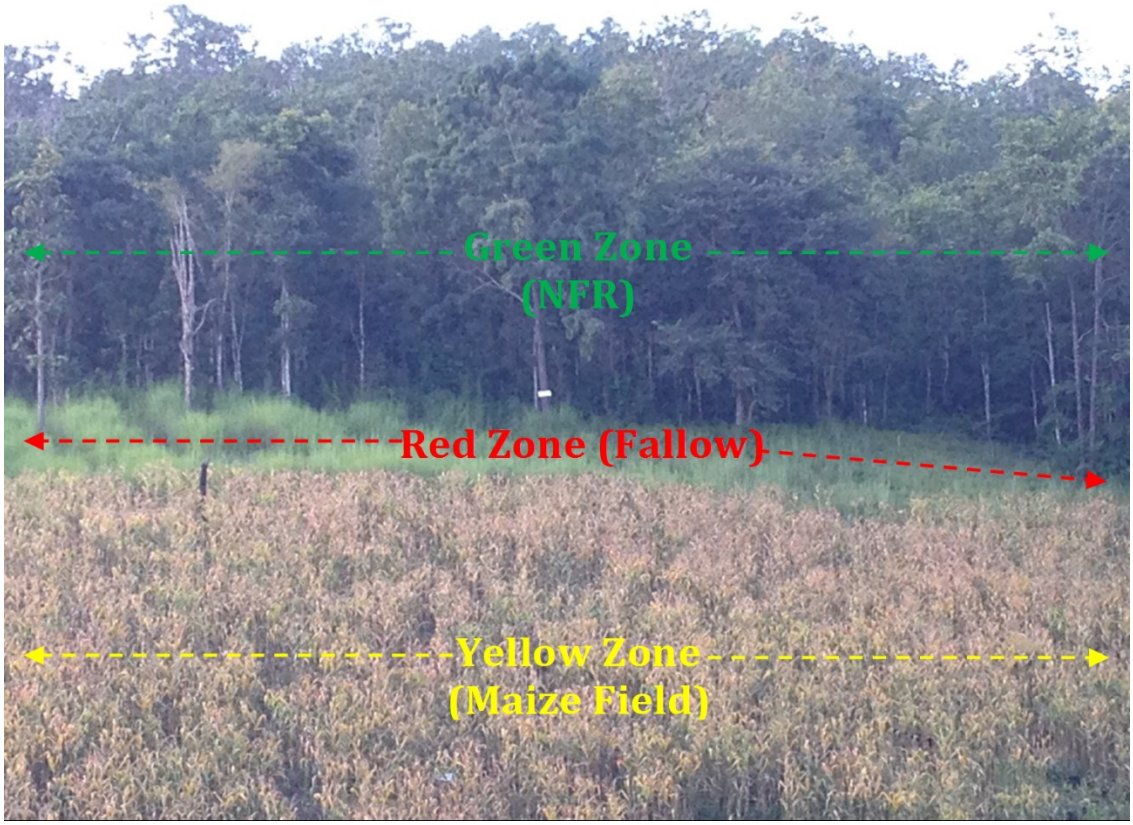

Figure 25-Green Zone, Red Zone, and Yellow Zone Demarcations

Although the research team was unable to learn the exact criteria used to delimit land, interviews with officials from the working group confirmed that some red zones were determined based on the need for buffer strips to separate (3-5 meters in between, on average) crop areas from trees at the top of hills, as well as from streams and roads. Despite having been unable to learn the exact conditions used to determine buffer zone areas, it can be assumed that they were deemed necessary areas to be reclaimed due to their commonly accepted benefits. As argued by Dosskey et al. (1997), the vegetation found in buffer rips can help hold back eroding sediments from streambanks and thus diminish the risks of (i) streambanks collapsing and causing landslides, as well as (ii) filtrating agricultural-related chemicals (e.g., pesticides and fertilizers) and eroded sediments which would otherwise contaminate water catchments.

Many buffer rips in red zones were observed during fieldwork, an example of which can be seen in Figure 26 as the rip is clearly located between a green zone (forest) and yellow zone (crop area) and appears to measure (approximately) between three and five

meters. In addition, fallowing is apparent in the purple zone of Figure 26[43]. Despite losing land to the purple zone, the farmer can grow and sell fruit from this area indefinitely. As for the yellow zone in Figure 26, it was used to grow maize until 2016; when the working group encouraged the farmer to stop growing maize and instead grow other types of mixed field crops/fruit orchards, the land user heeded the suggestions and decided to grow the same fruit trees planned in the purple zone. However, the tree seedlings donated by the RFD/TRPF only came into the possession of the farmer late in the rainy season; the farmer feared that the trees would not survive the dryer periods of the year with a late planting. A request to the RFD to fund and build a private reservoir to help provide enough water until the next rainy season was granted, as can be seen in Figure 26.

Figure 26-Purple Zone and Yellow Zone Demarcations

To conclude, historical land cover mapping by the MCDO and personal observations by the research team show that between 2002 and 2016, forest cover decreased significantly throughout the district, while the number of agricultural/residential areas have expanded. However, forest cover is expected to increase to the same amount

[43] In this case, the land user is waiting for the working group to provide seedlings of durian, banana, cacao and other indigenous trees, as well as training on how to grow these species.

which existed in 2002 at the expense of agricultural areas, within the next five years. Based on the research team's observations, this process has seemingly begun to take place.

4.2.3 Estimated Forest Cover Change in Mae Chaem District (2002-2020)

To estimate the evolution of forest cover change in Mae Chaem district since 2002, as well as anticipated changes expected to occur between 2016 and 2020, forest cover estimates from the three different sources[44] (Thomas et al., 2004; ICRAF, 2016; MCDO, 2016) were incorporated into Figure 27 to cross-verify each of the estimates.

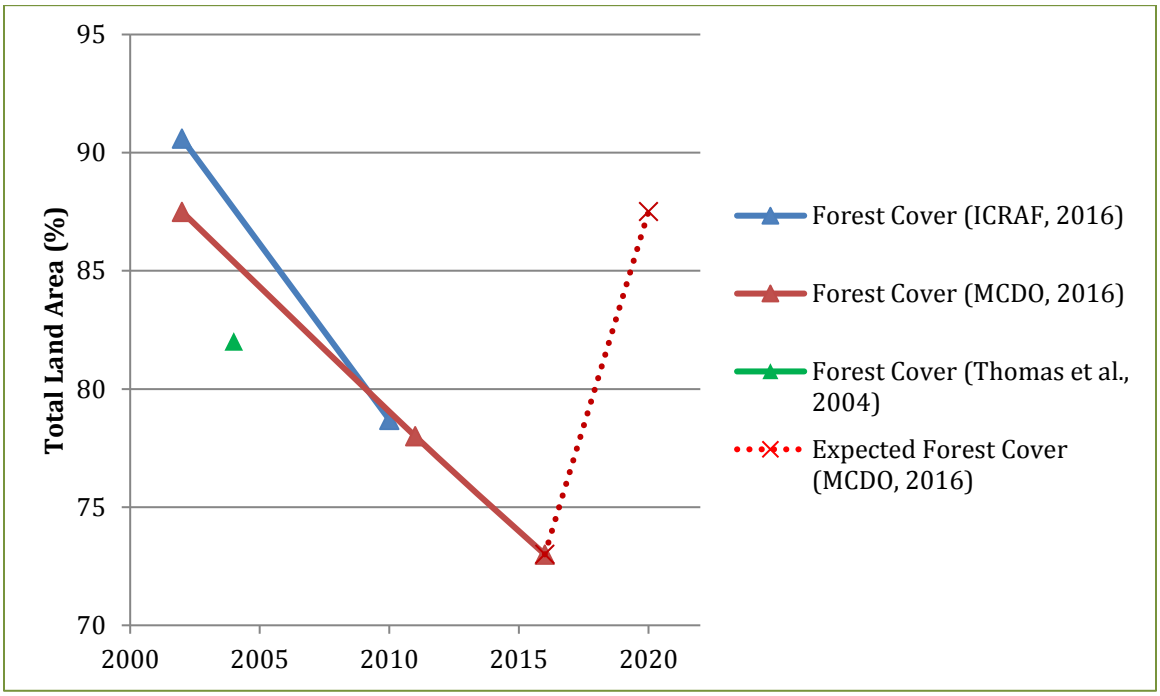

Figure 27-Estimated Evolution of Forest Cover in Mae Chaem District (2002-2020)

As can be observed in Figure 27, there is a clear and consistent trend of forest cover decreasing between 2002 and 2010. However, the only source which estimated change after 2010 is the MCDO and therefore it is not possible, within this study, to cross-verify the accuracy of these estimates. Although statistics and photographs of forest cover and

[44] It is important to remember that all three sources each use different total surface areas numbers, as well as use different definitions with regards to what constitutes forest cover. For these reasons, Figure 27 must be understood as an approximate estimation of forest cover change in Mae Chaem district.

agricultural area change in V1 and V2 could not be shared in this thesis, for anonymity purposes, the research team can confirm that the same general forest cover change trend shown in Figure 27, also applies to the situation of both villages.

As was explained earlier, the main proximate cause of forest cover loss in Mae Chaem district between 2002 and 2016, was likely the expansion of agricultural areas. Conversely, an anticipated increase in forest cover between 2016 and 2020 is expected to occur at the expense of agricultural areas. Therefore, it is reasonable to suggest that if the anticipated land cover zone targets shown in Figure 21 are in the process of being met, Mae Chaem district is arguably experiencing a forest transition driven by both enhanced conservation pressure and new economic factors deriving from the implementation of the Mae Chaem Model.

CHAPTER 5. FARMERS' RESPONSES TO DRIVERS OF FOREST COVER CHANGE IN MAE CHAEM DISTRICT

This chapter describes data gathered from semi-structured interviews with farmers from two villages in Mae Chaem district. It begins by presenting the sociodemographic profile of both villages, before explaining how and why farmers have responded to commonly-accepted drivers of forest change, as well as the resulting impacts.

5.1 Sociodemographic Profile of Villages and Interviewees

The population range of V1 and V2 is 100-200 people, and the total number of interviewees from both V1 and V2 is 20 (10 in each village). With regards to the ethnic diversity of participants, all V1 respondents identified themselves as Karen, whereas all V2 interviewees were northern Thais. All participants from both villages are Thai citizens, none of whom have any form of land title deed. There is an average of 7 registered members among V1 participants' households, with the average age per household being 32 years old. In V2, the average number of registered people per household is 3 and the average age 40 years old. Plainly, there are more and younger household members among the households of V1 participants, than those of V2 respondents.

Most participants in both villages are males (see Figure 28), the main reason for this imbalance is because this study's sampling method mainly targets individuals with knowledge of land use history in the area. In most cases, these individuals are most likely to be the oldest male in each household, who are traditionally heads of their household. Since 70% (7) of respondents in V1 and 90% (9) in V2 were heads of their respective households, this would explain why more males than females were interviewed in both villages. All interviewed females from both villages indicated that they were present on behalf of the heads of their respective households, who were all unavailable to be interviewed due to the fact they were away from the village working and living on their lands for extended periods of time. Despite not being heads of households, all interviewed females from both villages capably answered questions on land use history in the area.

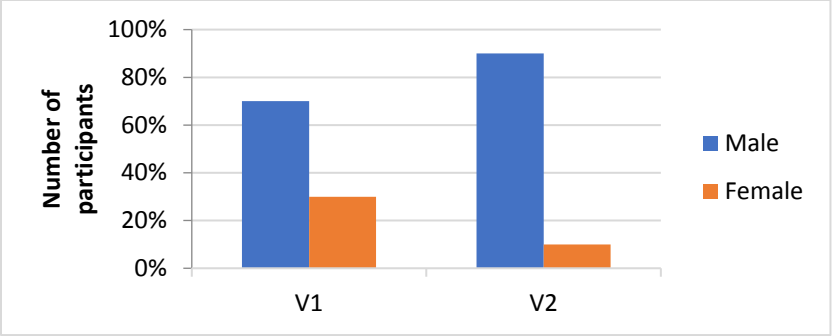

Figure 28-Gender of Participants by Village

When asked about their religious and spiritual beliefs/views, all respondents in V1 identified themselves as Christians and as Buddhists in V2. According to Platz (2003), it is common for members of ethnic minority communities in northern Thailand (such the Karen) to be converted Christians and for northern Thai communities to be Buddhists. No respondent from either village admitted having any Animist beliefs, despite informal discussions with some participants indicating that these types of traditional beliefs are still present within the community (e.g., the belief that forests are filled with various spirits). Most participants from both villages (60% (6) in V1 and 90% (9) in V2) were aged 45 and older (see Figure 29), with the average age being 47 years old in V1 and 55 years old in V2. During discussions with both villages' headmen, it became clear that one of the main reasons why there were fewer participants aged under 45 years old in both villages, was that many of the younger farmers were out working in their fields during the interviewing period, leaving many of the older farmers available to be interviewed. There were very farmers aged under 25 years old left in both villages, as most live away from the villages for most of the year to further their education or work in cities/towns.

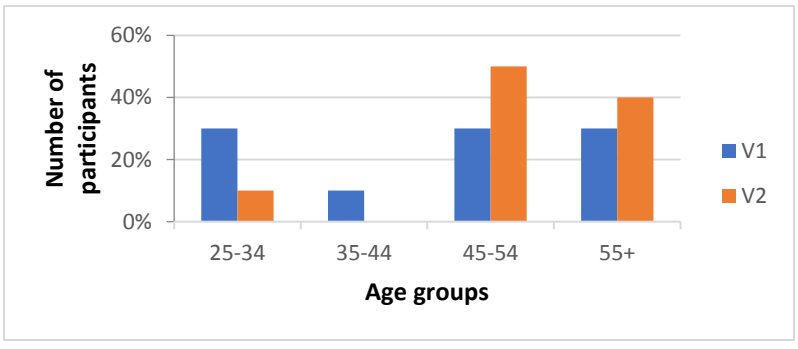

Figure 29-Participant Age Groups by Village

The main occupation and source of income of all but one[45] of the interviewed farmers from both villages is farming. The main subsistence crop produced in both villages is mountain rice, which all respondents from both communities grow. Maize is the primary commercial crop of almost all V1 participants, all of whom stated that the main reason they started growing it was based on rumors that it was a profitable crop to grow. As for secondary commercial crops in V1, 40% (4) of participants grew cabbage, 10% (1) pumpkin and 10% (1) cacao, all of which were also grown based on rumors that they would be profitable productions. Maize is also the primary commercial crop grown by all V2 participants, with 80% (8) stating that they first started growing maize based on rumors it was a profitable crop to grow, 10% (1) claiming it was because they did not know what else to grow and the remaining 10% (1) saying that it was because it is easy to grow. In V2, 40% (4) of participants grow organic bananas as a secondary commercial crop, while 10% (1) grow organic coffee and 10% (1) grow organic sweet corn as secondary commercial crops. All V2 participants who grow secondary crops explained that they were encouraged to do so by various actors[46] who argued that these crops would be more profitable and sustainable to produce than maize.

To summarize, most participants from both V1 (see Figure 30) and V2 (see Figure 31) grow mountain rice as a subsistence crop, maize as their primary commercial crop and have a secondary crop. However, the reason for growing a secondary crop differs between villages, as participants from V1 based their choice on rumors, while participants in V2 were encouraged by various actors to grow secondary crops.

[45] The farmer in question is from V1.
[46] The actors mentioned in question were representatives from the local SAO, district and RFD offices, as well as from NGOs (undetermined), Maejo University, CMU, Kasikorn Bank and CP.

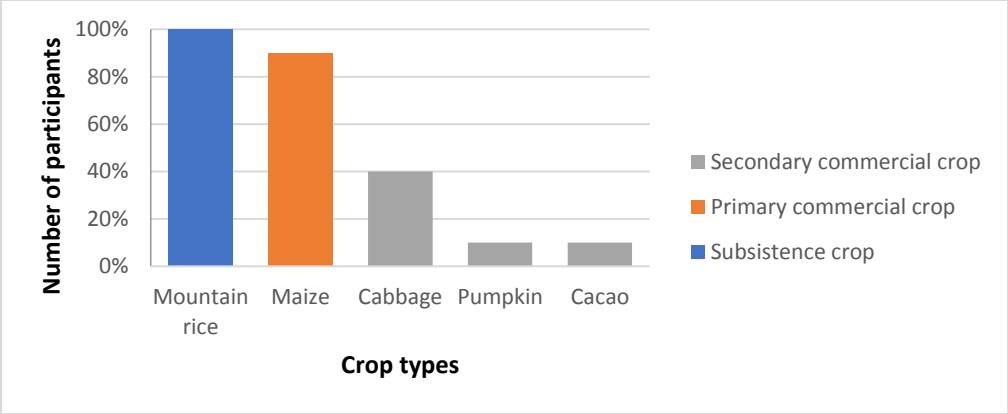

Figure 30-Subsistence, Primary and Secondary Crops among V1 Participants

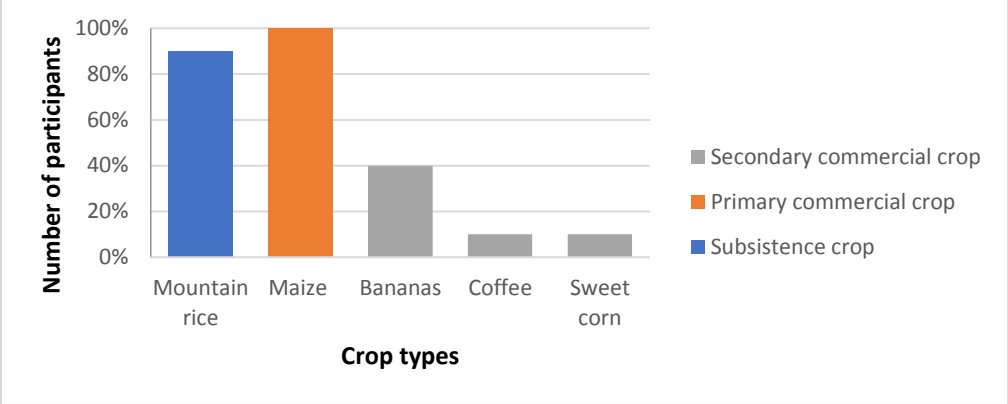

Figure 31-Subsistence, Primary and Secondary Crops among V2 Participants

Most land users from both villages have a secondary source of income (see Table 8). In V1, 50% (5) said that it under the form of remittances and 20% (2) from being an agricultural/industrial laborer. In V2, 50% (5) of secondary income is from a small business[47], 30% (3) from being an agricultural/industrial laborer and 10% (1) from remittances. The main reason for having a secondary source of income among participants from both villages is to help reduce household debt (see Table 9). Evidently, V2 has more participants with alternative sources of income than in V1, as well as a wider variety of alternative sources of income. However, it is worth noting that there are more V1 respondents than in V2 who rely on remittances as a secondary source of income.

[47] The businesses here consist of producing and selling traditional northern Thai weaving products.

Table 8-Secondary Sources of Income

Villages	Remittances (%)	Working as a laborer (%)	Business (%)
V1	50	20	0
V2	10	30	50

Table 9-Reasons for Secondary Sources of Income

Villages	Helps reduce debt (%)	Helps to "get by" (%)	Pays tuition (%)
V1	40	20	10
V2	50	0	40

In V1 (Karen), 30% (3) of respondents have no education, 10% (1) completed primary school, 20% (2) completed secondary school, 30% (3) completed high school and 10% (1) completed a bachelor's degree. In V2 (Northern Thai), no participants are completely uneducated, 80% (8) completed a primary school degree, 10% (1) completed a secondary school degree, no one has completed a high school degree, and 10% (1) completed a bachelor's degree. Hence, more participants from V2 have at least completed primary school than in V1. However V1 has more participants who have at least completed secondary school (see Figure 32).

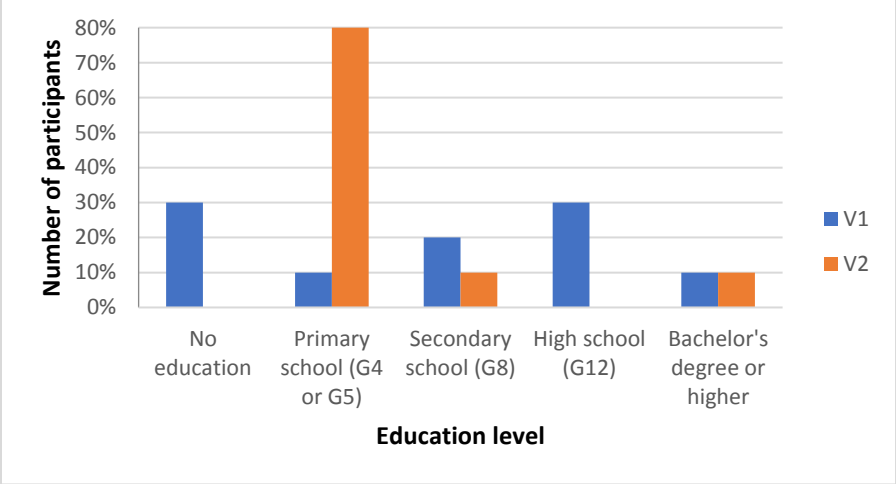

Figure 32-Education Level of Participants by Village

In conclusion, the sociodemographic data described above was collected using a purposive sampling method, as it proved to be the best method to use in a context where the preferred characteristics of participants were known before selecting the candidates. This made it easier to find people with the preferred sociodemographic characteristics, such as being a farmer and having either/both primary and secondary commercial crops.

Unfortunately, it was not possible to access any kind of official census data for both V1 and V2, meaning it was not possible to measure the proportionality of participant's sociodemographic data with sub-district, district, provincial or national data.

5.2 Farmers' Responses to Conservation Pressure

In this section, interviewed farmers' responses (including their influencing factors and impacts) towards conservation pressure are divided into two periods: pre-2016 and post-2016. The reason for this division is due to an apparent shift in participants' responses to conservation pressure since the year 2016.

5.2.1 Farmers' Responses to Conservation Pressure (Pre-2016)

5.2.1.1 Responses and Influencing Factors

To assess how both villages have generally responded to conservation pressure prior to 2016, participants were first questioned on the local context of past forest policies. Specifically, respondents were asked whether they lived within any kind of area under government control (e.g., a PA, NFR or watershed area) before 2016, to determine if their presence in the area has been subject to state conservation laws. As displayed in Figure 33, 60% (6) of V1 participants responded "yes" to this question (all of which stated that they lived in a NFR area). In V2, participants answered quite differently than those from V1; only 30% in V2 (3) answered "yes", all of which stated that they lived in a NFR. One reason why many participants from both villages answered "no" could be because they did not know/properly understand the meaning of a conservation area[48].

[48] It is possible some participants, from both villages, do not consider a NFR as a conservation area, as opposed to a nearby PA such as MTNP. It is also possible some participants feigned ignorance on the subject out of fear of reprisals, by acknowledging their own/others' "illegal" actions in a conservation area.

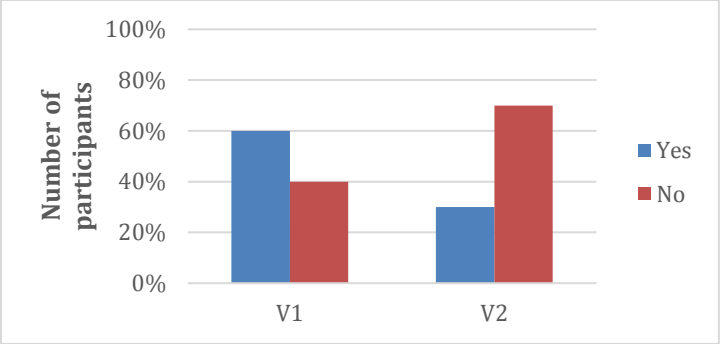

Figure 33-"Were you living within any kind of area under government control (e.g., a PA, NFR or watershed area) before 2016?"

To verify the above premise, participants from both villages were also questioned on whether they knew which exact areas were off-limits for claiming land, before 2016. Most farmers from V1 (80% (8) and all those from V2 said that they did indeed know about these areas and where they were located prior to 2016. The most common reason expressed by most respondents regarding as to how they were knowledgeable of these boundaries, was that farmers have "always known" their lands' boundaries. When asked whether they could claim land before 2016, every respondent from both villages answered "no" and clarified that it was due to forest laws. Yet, all participants from both villages admitted to having claimed land before 2016 because of the need to increase crop productivity and ultimately their household income. Based on such conclusions, as well as the previously mentioned fact that none of the participants from both villages have any kind of land title deed, it can be deduced that farmers in both villages knowingly claimed land illegally to increase their household income. Consequently, both villages adopted a "resistant" response towards conservation pressure, prior to 2016.

5.2.1.2 Impacts

Further questioning emphasized how this resistant response impacted both forest and agricultural trends significantly. When asked about the production history of their maize crops, almost all respondents from both villages mentioned that their maize production increased between the 1990s and 2016, which correlates with Figures 30 and 31, as well as with the previously indicated district-level trend of commercial crop intensification and the resulting expansion of agricultural areas. Despite this

intensification, maize cultivation experienced a shift in profitability between 1990-2016, as 90% (18) of participants from both villages claimed that maize was more profitable to grow before 2016, meaning maize likely lost its market value at some point before 2016.

The most common reason for this shift in profitability (see Figure 34), according to most respondents in V1 and V2, was that growing maize gradually diminished the surrounding area's soil quality and therefore required additional chemical fertilizer to maintain its profitability. This increased need for fertilizers forced farmers into procuring bank loans to obtain the products, eventually increasing their household debt and leading some to adopt alternative sources of income (see Tables 9 and 10). As one participant from V1 stated, growing maize is "[...] less profitable than before because products (fertilizers and pesticides) are more and more expensive […]", while a V2 respondent echoed this by saying that maize cultivation resulted in "[…] soil quality getting worse and more fertilizer needed to keep crops profitable, but money for fertilizer was borrowed from the bank, and now we (the family) are in debt[49] (approximately 700 000 THB) […]". Secondary reasons for this decline in profitability were mentioned as being (i) ageing land users being unable to physically maintain their crops enough to retain desired profitability levels[50], (ii) insufficient access to water resources (rain/water management systems) and (iii) shifts in maize's market price.

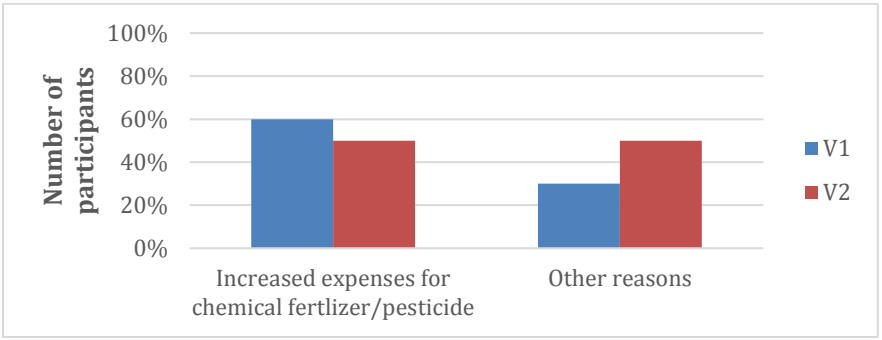

Figure 34-Reasons for a Decrease in Maize Profitability (Pre-2016)

Another significant impact of both villages' resistant responses to conservation pressure, was forest cover loss. Every participant from both villages expressed that forest

[49] It should be noted that all participants from both villages indicated that they all have significant amounts of agricultural debt.
[50] This correlates with the fact that most participants from both villages are aged 45 and up (see Figure 29).

cover decreased due to agricultural expansion and that there are similar environmental issues deriving from deforestation, which affect both villages. Such issues were said to be (i) biodiversity loss, a (ii) decrease in air quality, a (iii) decrease in soil quality and (iv) insufficient access to water (see Figure 35). As explained by one V1 farmer, "[…] there is less forest now than in the past because of agriculture […]" and "[…] because there is less forest now, there are water shortages [...]". Similarly, a V2 respondent stated that "[…] there is now less water and worse soil because of less forest […]". Clearly, the issues brought up the most by farmers from both villages are a lack of access to water and a decrease is soil quality. Although most environmental issues are acknowledged by participants from both villages, there are issues not commonly recognised by respondents from both villages, such as warmer temperatures (V1) and landslides (V2).

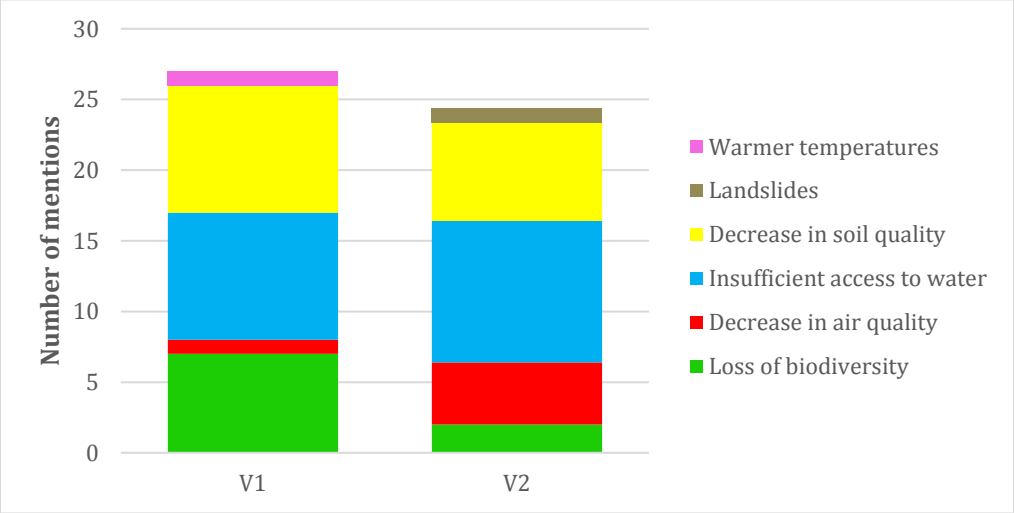

Figure 35-Environmental Impacts of Pre-2016 Agricultural Expansion

To conclude, conservation pressure provoked a resistant response motivated by the need to increase household income, by both villages prior to 2016. This caused both an increase and decrease in household income before 2016, as well as an increase in agricultural areas and a decrease in forest cover.

5.2.2 Farmers' Responses to Conservation Pressure (Post-2016)

5.2.2.1 Responses

Questions were asked to determine whether villages' pre-2106 resistant response to conservation has changed since then[51]. For example, respondents from both villages were asked whether their presence in the area was still (at the time of fieldwork) subject to state conservation pressure (see Figure 36), to which 60% (6) of V1 participants and 30% (3) in V2 responded "yes" (all of whom stated that they currently live in a NFR area). When comparing Figures 33 and 36, there is little difference in how participants from both villages view the official status of their villages' lands before and after 2016. Farmers from both villages were also questioned on their knowledge of off-limit areas for agricultural expansion since 2016, to which all participants from both villages are saying that there has been no change.

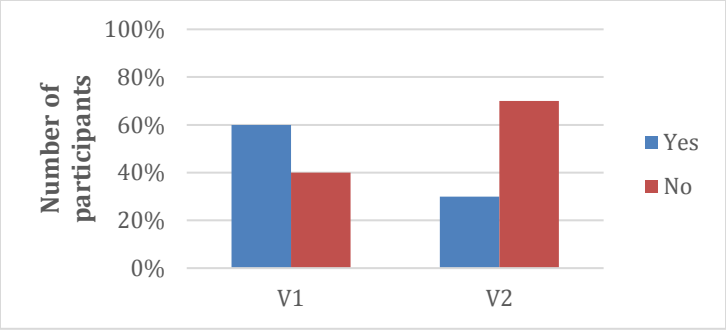

Figure 36-"Have you been living within any kind of area under government control (e.g., a PA, NFR or watershed area) since 2016?"

All respondents from both villages also said that claiming new lands since 2016 is still not legally permitted and that forest laws once again are the reason for this. However, there is an apparent shift regarding how farmers have responded to such pressure; rather than continue resisting forest policies, 90% (9) of V1 participants and all V2 farmers stated that they did not claim any land after 2016. When asked about the main reason for this shift in response, all respondents from both villages answered that it was mainly due to more

[51] Since 2016 is the first year of the Mae Chaem Model, various actions related to improving forest management would have already been implemented, which is why it was important to examine whether farmers had responded towards the same forest policies differently.

strictly enforced forest laws. As claimed by a V1 farmer[52], the claiming of new land "[…] has stopped since officials warned people to not continue doing it in (late) 2015 […]". Such claims are evidence that most participants from both villages began to "accept" and respect forest laws since 2016, out of increased fear of state reprisals for forest encroachment.

Although agricultural expansion occurred before 2016 despite farmers being aware that doing so was illegal and could lead to reprisals, it was still not enough to deter them from breaking the law. This attitude has apparently changed since 2016, as participants' more acceptant responses to conservation pressure would indicate that the fear of reprisals is enough to have made them stop claiming new land. One participant from V1 said that current/future resistance of conservation boundaries "[…] would be problematic for their "relationship" with RFD officials […]", while a respondent from V2 echoed that statement by saying that they have stopped resisting forest policies because the family "[…] would not want to have a bad relationship with RFD […]". The only participant who admitted to having claimed land since 2016, mentioned that the main reason for doing so was that the family was unaware of the claimed being off-limits for doing so[53].

Though participants from both villages clearly mentioned that the main reason for respecting forest laws since 2016 was due to the policies becoming stricter, further questioning helped to better understand the underlying reasons for this shift in response. When asked to explain why they stopped resisting conservation (NFR/PA) limits since 2016 (see Figure 37), 50% (5) of V1 participants and 80% (8) in V2 vaguely repeated the that it was due to more strictly enforced forest laws, while 20% (2) in V1 and 10% (1) in V2 said that because they have no land rights, they cannot contest the limits and consequently have no choice but to stop expanding. Finally, 20% (2) of respondents from V1 and 10% (1) answered that because conservation boundaries are now better monitored due to technology (e.g., satellite images), it is easier to get caught claiming land illegally.

[52] Almost identical claims were made by all participants from both villages.

[53] As this farmer's main language is Karen and had difficulty understanding northern Thai, it is possible that this land user did not fully understand all that was said in conversations with representatives from the Mae Chaem Model's working group, throughout the demarcation process of the family's lands. Therefore, it is not inconceivable that the farmer did in fact illegally claim without having been aware that doing so was illegal. Yet, it is also possible that farmer did understand what was said and still claimed land, while feigning ignorance regarding this encroachment, to forestry officials informing the land user of the situation.

To determine whether this shift in responses was a general response found throughout both villages and not restricted to the interviewees, all participants were specifically asked whether the village had generally cooperated with the government concerning conservation limits, since 2016. To this, all interviewed land users from both villages unanimously answered "yes", and the most common reason (see Figure 38) cited by close to half of all respondents was that good cooperation with the authorities would help their village obtain a community land title deed. Another reason proposed by 30% (3) of participants in V1 and 20% (2) in V2, was that good cooperation with the authorities would ensure that there would be no future conflicts over land. For 10% (1) of respondents in V1 and 10% (1) in V2, it is believed that good cooperation increases the community's chances of obtaining the government's support for training and funding of alternative income-generating activities (e.g., salary for planting and maintaining trees, as well as water management systems). Finally, 20% (2) of participants in V1 and 10% (1) in V2 said that there is no choice but to cooperate with the government, as no one has any land rights to be able to contest the boundaries and laws.

5.2.2.2 Influencing Factors

While it was previously determined that both villages' general response towards conservation pressure prior to 2016 was mainly driven by the need to increase household income, farmers' responses towards conservation pressure since then have arguably been influenced by (i) environmental discourses and ii) cognitive shifts. This was learnt by asking questions to participants regarding possible influencing factors, such as existing environment discourses and their views on forest protection. To evaluate whether participants were ever influenced by environmental discourses (as well as to what extent they may have been influenced by them), respondents from both villages were asked (see Figure 39) whether anyone has tried to convince people to change their actions with regards to the environment (e.g., conserve forest as much as possible, instead of cutting it for agriculture). A clear majority of respondents from V1 claimed that there had been individuals who have tried to encourage people into changing their actions towards the environment, as opposed to only half of V2 participants.

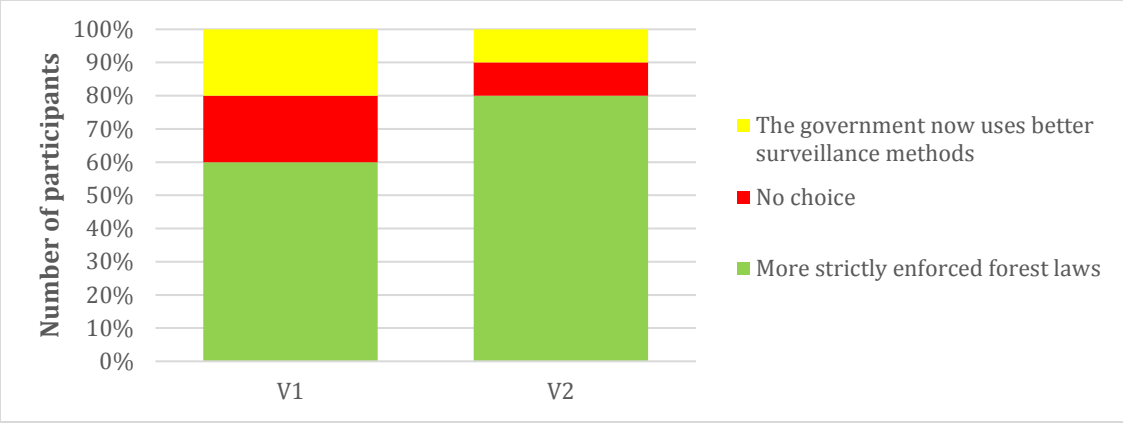

Figure 37-Reasons for Ending Resistance to Conservation Pressure (Post-2016)

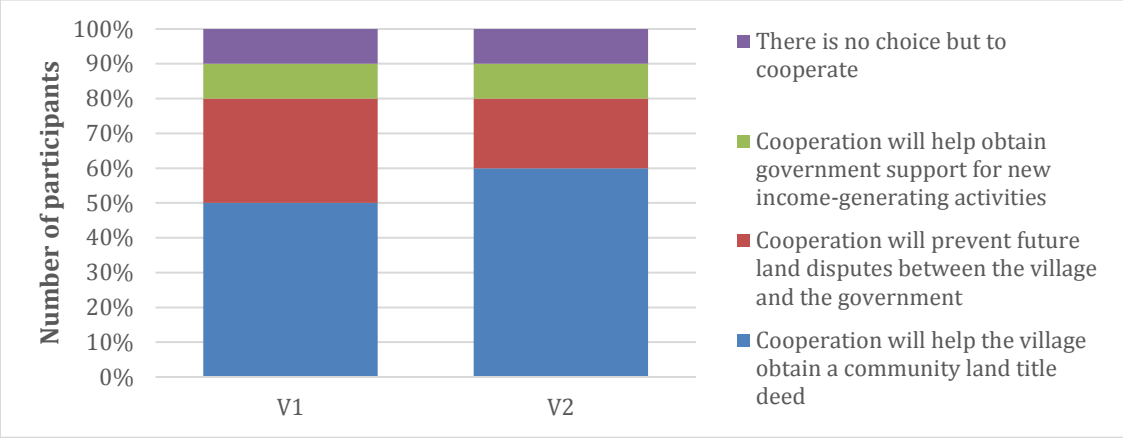

Figure 38-"Please explain why your village has cooperated with the authorities regarding the (NFR/PA) limits since 2016?"

In V1, 70% (7) of participants identified their community's conservation committee as a group promoting conservation which, according to one respondent, holds "[…] a meeting every month to talk about protecting forests and has asked villagers to stop expanding land since last year (late 2015) […]". The remaining participant said that the village's children have been promoting conservation-friendly behavior to their parents, explaining that "[…] children who go to school educate their parents on the importance of protecting forest and how they can find other ways to still make money (with their current crops) […]". In V2, all participants mentioned that their conservation committee was the main group promoting conservation within the village.

Regarding the extent of cognitive shifts having helped shape participants' responses to conservation pressure, most respondents 80% (16) from both villages admitted that their

views had changed to more protection-orientated positions regarding forests, while the rest (20% (4)) claim that views have never changed. All interviewees who said that their views have changed expressed that they now feel the need to protect forests more than before since they associate current environmental issues with forest loss. In V1, one respondent said that "[…] negative environmental changes encourage the family to want to protect forests more, which means that the economy will get better if the forests are in good condition and therefore the family did not contest land demarcations last year (2016) […]". One participant from V2 offered a similar statement by saying that "[…] it is important for the forest to be present as it brings more water and the family has realized this in recent years because of bad water, wildlife and soil quality […]". Clearly, both villages' farmers have experienced a cognitive shift regarding their views on protecting the forest.

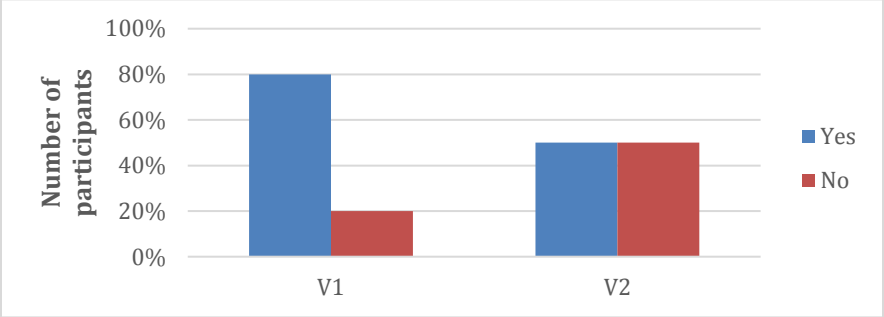

Figure 39-"Is there anyone within/outside your community trying to convince villagers to conserve forests, other than the government?"

Those land users (20% (4)) from both communities claiming that their views on protecting forest have never changed, all said that they have always known the need to protect the forest to maintain a healthy environment due to their respective traditional knowledge systems. For example, one farmer from V1 said that the family "[…] always knew the need to protect forests, because it is important in Karen beliefs to protect forests for future generations […]", while a respondent from V2 stated that "[…] because of local knowledge, the family knows that more forest is needed as it will bring back water and prevent landslide, which is why our family abandoned and donated land to the government for forest to grow back […]". It should be noted that most participants from both villages who claim that they have always known the need to protect forest were aged 25-34 and had at least a secondary education. It could be therefore argued that a higher level of education

among younger community members has led to villages' younger generations being more conscientious regarding the environment at an earlier age than older community members.

Based on the above, it is reasonable to suggest that farmers from both villages stopped claiming land after 2016 mainly due to more strictly enforced forest laws. Most respondents have continued to cooperate, as opposed to renewing a resistant response, with the authorities for various reasons, such as the hope of obtaining a community land title deed in exchange for good cooperation. It is also possible that many farmers from both villages experienced a cognitive shift with regards to their views on environmental protection. Both reasons, as well as environmental discourses, were consequently all contributing factors which shaped participants' responses to conservation pressure, although to what extent exactly remains difficult to measure in this study.

5.2.2.3 Impacts

Even though the post-2016 acceptant response is a relatively recent and ongoing development, participants from both villages had similar views with regards to existing/anticipated socioeconomic and environmental impacts of their cooperative responses towards conservation pressure. Indeed, 80% (8) of V1 and 70% (7) of V2 participants admitted to having lost land because of conservation pressure. One farmer from V1 specified that the family had "[…] stopped claiming new land in 2011 but those lands were demarcated last year (2016) with poles and (family) was told will lose these lands […]". Another farmer, this time from V2, said that "[…] was told in 2015 by the RFD to stop clearing land and give back some lands which were too close to a stream […]".

When asked if the (NFR/PA) limits established in 2015 as part of the Mae Chaem Model land cover demarcation strategy have affected their livelihoods, 40% (4) of V1 respondents answered "yes" and the other 60% (6) said "no", while in V2 70% (7) said "yes" and 30% (3) answered "no". In V1, 50% (5) of the participants did not offer a clear explanation as to how they were affected, compared to 40% (4) in V2. All of those (from both communities) who did provide clarification, said that they have lost or will lose agricultural income from land confiscation resulting from the demarcation process (see Figure 40). As one farmer from V1 claimed, "[…] the family expanded land for rice

cultivation this year (unclear whether 2015 or 2016) but was told by the RFD and the village committee that the family can harvest this year's crop but must abandon it after the harvest; the family will lose income because of this […]". A farmer from V2 similarly explained that the household "[…] lost some income because some land was confiscated in 2015 […]", therefore confirming that comparable situations where land cover demarcations caused income losses, occurred in both villages.

As for existing/anticipated environmental impacts associated with responses to conservation pressure (see Figure 40), 60% (6) of V1 and 90% (9) of V2 participants believe that there already is/will be more forest in the area due to the land cover demarcation process. The same number of participants from both villages also expect that the previously mentioned environmental issues resulting from pre-2016 agricultural expansion will be mitigated with the projected forest cover gain. One V1 participant argued that "[…] there is less forest than before, but since the demarcations there will be more trees and since the recent demarcation and land donations, biodiversity has come back, the air is better, the landscape is more beautiful, and the weather is cooler in those (reforested) areas […]". A V2 respondent reverberated this by saying that in their village there is also "[…] less forest than before and it is dryer because of this, but I am happy forest will return in confiscated areas because it will bring more water and will allow people to plant other crops that need water, such as lettuce and fruit trees […]".

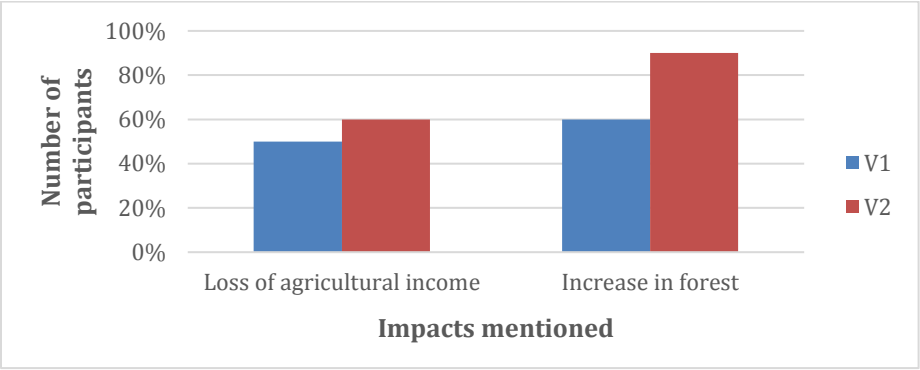

Figure 40-Economic and Environmental Impacts of Farmers' Post-2016 Acceptant Responses Towards Conservation Pressure

In conclusion, conservation pressure, prior to 2016, provoked a resistant response by farmers from both V1 and V2, primarily motivated by the need to optimize agricultural

productions (economic rationality) and resulted in an initial increase in agricultural income before decreasing, as well as forest cover loss which caused various environmental issues. After 2016, both villages shifted from a resistant response into an acceptant one. According to most respondents, this shift occurred mainly because of more strictly-enforced forest laws. It is also probable that environmental discourses and cognitive shifts have also played a role in farmers' decision to change their responses towards conservation pressure. Finally, pre-2106 agricultural expansion resulted in farmers generating varying levels of agricultural income at the expense of forest cover (ultimately causing environmental degradation), while the sudden end to this expansion in 2016 led/is expected to continue causing farmers' agricultural income to decrease and forest cover levels to increase. These findings confirm that documented increases in forest cover following forest cover loss can also be supported by observations from land users. Though both villages had similar responses both before and after 2016, the perception of what the impacts of conservation pressure since 2016 have been, has not been the same between both villages. Despite participants from both villages noting that they have lost/will lose income soon and that forest growth has already occurred/predicted to occur due to conservation pressure, there are more participants from V2 than in V1 who have noted such impacts. This is possibly due to the fact V2 has been more significantly impacted by various actions related to the Mae Chaem Model than V1, a premise that will be further detailed in the flowing section.

5.3 Farmers' Responses to Economic Factors

In this section, interviewed farmers' responses (including their influencing factors and impacts) towards economic factors, are described into the same two periods (pre-2016 and post 2016).

5.3.1 Farmers' Responses to Economic Factors (Pre-2016)

5.3.1.1 Responses

As described earlier, most interview participants from both villages explained that commercial crops (e.g., maize) were more profitable before 2016 than they have been since

then. When asked why they started to grow maize during this period, almost all respondents from both villages said that it was a trendy/profitable crop to grow at the time, which implies that its market price was attractive enough for farmers to begin production[54]. As one participant from V1 explained, maize was originally grown since "[…] it was a trendy and profitable crop to grow twenty years ago […]". Once farmer from V2 similarly said that "[…] villagers followed the trend (growing maize) more than twenty years ago because it was thought to be a sustainable and profitable crop at the time […]". An apparent shift in maize's profitability was also noted to have occurred between 1990 and 2016, caused in part by shifting market prices and rising fertilizer/pesticide costs. One V1 participant reiterated this by stating that maize became "[…] less profitable because of high costs for (chemical) products and a low market price to sell […]", while a V2 respondent argued that maize became less profitable when its "[…] market price dropped […]".

Such conclusions could be construed to show that farmers from both villages adopted similar "ambiguous" responses to maize' shift in profitability. For example, when maize's market price was relatively favorable for farmers in the early 1990s, farmers "accepted" the opportunity to intensify their maize production. In addition, the fact that the amount of land used to grow maize increased substantially prior to 2016, suggests that many farmers from both villages fully embraced opportunistic market prices to increase their agricultural income, seemingly rejecting other types of crop options (e.g., traditional subsistence crops and commercial crops). As was pointed out earlier, even though the market price for maize decreased at some point between 1990 and 2016, most farmers from both communities continued to increase their maize production[55]. This continued intensification can possibly be understood as a "resistant" response to declining market prices for maize; farmers seemingly decided to resist the temptation to stop growing maize/start growing other crops and instead adopted alternative means to keep their maize production profitable. Consequently, the shift from an acceptant to a resistant response between the 1990s and 2016, could be inferred as ambiguous.

[54] It was not possible to learn of the exact market price for maize between the 1990s and 2016.
[55] Since maize was the primary commercial crop of almost all participants from both villages at the time of fieldwork, it is evident that maize production continued after 2016, despite a previous shift in profitability.

Another economic factor which provoked an ambiguous response from V1 and V2 farmers between the 1990s and 2016, is the attraction of non-farming jobs generated by Thailand's ongoing industrialization process. As revealed earlier in this chapter, the main source of income among participants from both villages is agriculture; none of the respondents from both villages mentioned that they had ever seriously considered moving/working long-term for an off-farm job[56]. In this sense, most participants have demonstrated a resistance to the "pull" of off-farm jobs, preferring to stay in their respective village to continue cultivating[57]. However, the fact that some farmers from both villages receive remittances from their children who have off-farm jobs indicates that although many participants themselves resist the attraction of permanent off-farm jobs, their household benefits from other family members who have accepted these opportunities. Since participants from both communities have seemingly both resisted and accepted the attraction of off-farm income activities, the common response from both villages towards this economic factor can be categorized as an ambiguous one.

5.3.1.2 Influencing Factors and Impacts

As explained in the previous section, the main influencing factor behind V1 and V2 farmers' decision to accept favorable market prices for maize and intensify its production between the 1990s and 2016, was farmers' economic rationality. The principal underlying motivation for expanding maize cultivation was, according to most participants from both villages (90% (9) in V1 and 70% (7) in V2), that maize was rumored to be profitable and that many other farmers in the area were growing it. As one V1 participant said, "[…] the family has been growing maize since the 1990s because everyone else was doing it […]", while in V2 a farmer offered a similar justification: "[…] we (household) followed the village trend (of growing maize), because they thought it would be profitable […]".

[56] Some participants mentioned that they do sometimes work as industrial laborers when there is little maintenance left to do for their crops. However, this type of work is often seasonal and in most cases, is not meant to replace agriculture as the main source of income.

[57] Since most participants from both villages are aged 45 and over, as well as not having been educated past the 8th grade, it is possible that some farmers choose to remain in their villages/continue farming, as they may feel that they are too old to move/have insufficient formal training to start a new vocation.

To summarize, farmers from both villages generally accepted favorable market prices for maize and consequently increased their farmlands and agricultural income. However, this intensification resulted in forest loss and associated environmental issues. When market prices for maize dropped, and farmers decided to resist the temptation to change crops, farmers' agricultural debt increased because of bank loans used to maintain minimally required profitability levels. To help pay back their debts, many farming family members have taken on various off-farm income-generating activities (see Table 8).

5.3.2 Farmers' Responses to Economic Factors (Post-2016)

5.3.2.1 Responses

Despite farmers from both villages adopting pre-2016 ambiguous responses to shifts in maize profitability, almost all participants from both villages have stopped claiming new land since 2016 (see section 5.2.2). In addition to conservation pressure being recognized as one of the drivers having provoked this sudden shift in agricultural expansion, new economic factors deriving from the Mae Chaem Model also pressured land users into ending maize intensification.

5.3.2.2 Influencing Factors

According to participants from both villages, one of the main economic factors that has contributed to curbing maize intensification since 2016, has been the adoption/planned adoption by farmers of alternative income-generating activities to maize. The adoption of such activities was, as many farmers from both villages explained, encouraged by various stakeholders involved in the Mae Chaem Model (e.g., the MCDO), who promised to provide various forms of support (e.g., funding and training) to those who both adopt such activities and stop cultivating maize. In V1 (Karen), only 60% (6) of participants acknowledged to have been encouraged as such since 2016, one of whom specified that "[…] representatives from the private sector and NGOs are trying to convince and help people change their agricultural practices to other ways of making money, like growing fruit trees […]". In V2 (Northern Thai) , however, all participants said that they were

encouraged in similar fashion as those from V1; as one respondent claimed, "[…] NGOs, universities and private sector encourage people to stop maize farming and grow fruit trees, since it will be better for peoples' income and environment […]". Although most participants from both villages have been encouraged to stop growing maize and adopt alternative income-generating activities, there are more who have been encouraged to do so in V2 than in V2 (see Figure 41).

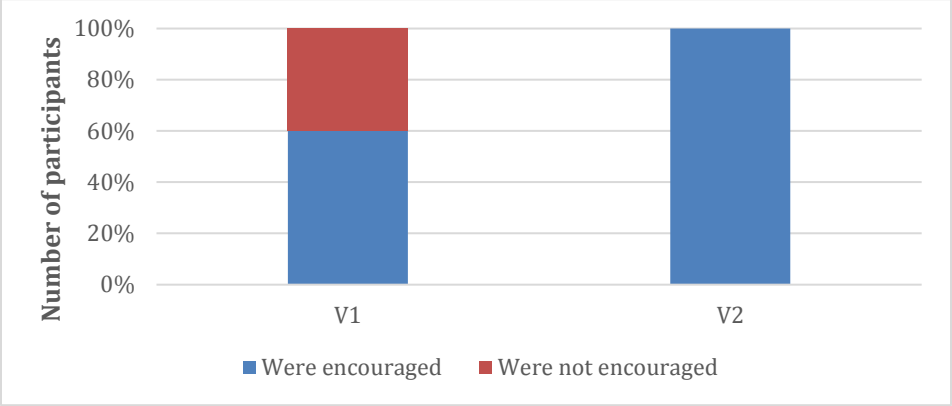

Figure 41-Number of Participants Encouraged to Stop Growing Maize and Adopt Alternative Income-Generating Activities

Regarding the precise alternative income-generating activities proposed to farmers (see Figure 42), all respondents from in V1 said that only one alternative was ever encouraged: Planting fruit trees. In V2, a wider variety of alternatives was proposed to farmers, such as (i) growing fruit trees (40% (4)), (ii) starting a traditional weaving business (40% (4)) and finally (iii) organic home gardening (20% (2)). In addition to having been suggested more variety for alternative income-generating activities, all V2 farmers were cited as having adopted at least one of the previously listed suggestions, whilst none of the participants from V1 were understood to have started growing fruit trees[58]. This dissimilarity was determined after comparing specific comments from participants from both villages. For example, one V2 farmer detailed a successful adoption of an alternative income-generating activity: "[…] (the family) started (organic gardening) this year, was encouraged to do this by various organizations (did not specify which) instead of growing maize because it causes smog and must stop growing […]". In contrast, a V1 farmer

[58] V1 participants explained that these suggestions were future possibilities and of interest to them.

described a desire to adopt an alternative income-generating activity in the future: "[…] (the family) will probably stop growing it (maize) next year because there is a research center which helps train people to grow other things and the family would like to grow mangos […]". The attraction of off-farm jobs has also remained present in both villages since 2016, although there has been no apparent change in participants' situations regarding off-farm employment and remittances from children.

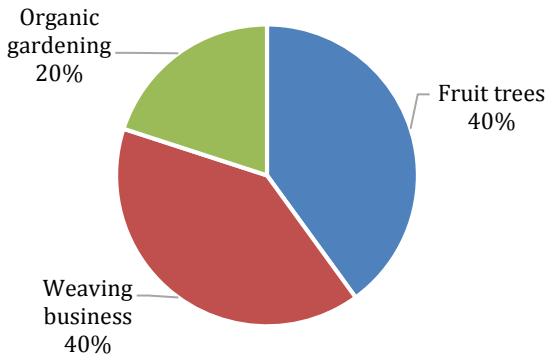

Figure 42-Adopted Alternatives to Growing Maize Among V2 Participants

Despite farmers from both villages having been encouraged to shift their income-generating activities, maize cultivation remains the main source of income (see Section 5.1) for most participants from both villages, including those who successfully adopted alternatives[59]. As exemplified in Figure 43, there are different reasons as to why most farmers from both villages have continued to grow maize. For example, 20% (2) of participants from V1 specified that they still had no choice to continue growing maize despite possible alternatives; one farmer claimed that there were "[…] no suitable conditions to grow other crops than maize […]". Most V1 (50% (5)) and V2 (70% (7)) respondents expressed that despite still grow maize they would, in fact, prefer to adopt an alternative income-generating activity which would financially allow them to stop growing maize. One V1 farmer explained that "[…] maize makes little profit and new ideas introduced by others seem to be more profitable […]", while a V2 participant reiterated

[59] For example, although 40% (4) of V2 respondents (see Figure 42) claim that their weaving businesses started after being encouraged to so and stop growing maize, weaving was still identified by 50% (5) of V2 farmers as a secondary income source (see Table 8), suggesting that the income generated from weaving is not yet profitable enough to completely abandon maize.

this sentiment by affirming that "[…] if the price for maize drops again this year, will participate in organic farming initiative introduced to the village […]". Finally, 30% (3) of V2 farmers stated that they would stop growing maize and adopt more profitable income-generating activities. One interviewee justified this decision by saying "[…] (the family) will stop growing maize, as the price has dropped and it is no longer as profitable as before, and organic gardening is the way forward, as there is more value for organic products […]".

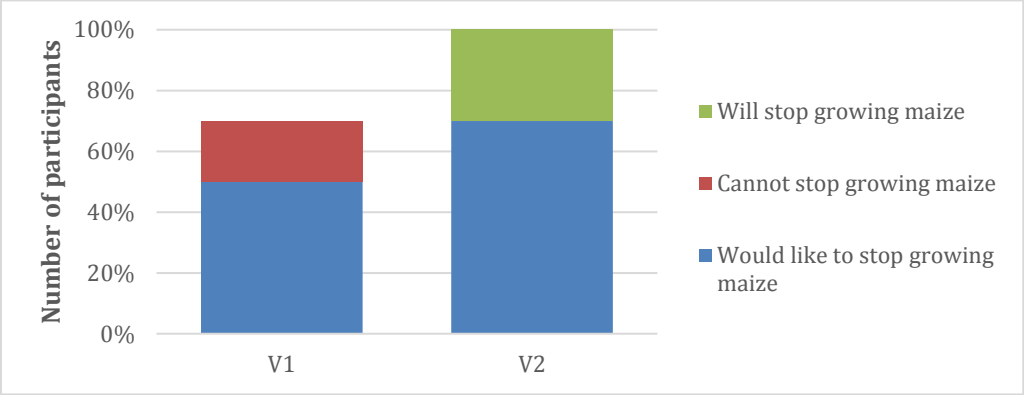

Figure 43-Future Intentions Regarding Maize Cultivation

Among those who were encouraged to stop growing maize, all V1 participants claimed to have not yet received any kind of support to help facilitate the shift, notably by maintaining/increasing basic income amounts normally generated from maize cultivation. One V1 farmer claimed that "[…] (the family) is interested in growing fruit trees, but the government has not yet approached the villagers to support it […]". However, these same V1 participants all admitted to having at least heard of possible support existing in the area, with one farmer saying that the family was "[…] encouraged (to start growing cacao trees) because a company will provide seedlings and will buy the fruit […]". This situation is a stark contrast to the situation of V2 farmers who were asked to end maize cultivation. For example, a V2 farmer discussed how "[…] Chiang Mai University (CMU) introduced the idea (of growing bananas) as an alternative to maize and got seedlings from a community seed bank, which loans seeds to farmers, but they must return the same amount of seeds to the bank next year […]". As illustrated in Figure 44, the forms of actual support (both heard of and received) cited by participants from both villages consist of (i) free training on how to grow alternative crops, the opportunity to (ii) obtain seedling loans for alternative

crops/organic garden products from a local seed bank[60], (iii) funded and built water supply systems, (iv) logistical support for accessing markets to sell alternative crops/organic garden products and finally (v) paid tree planting and maintenance[61]. Figure 44 shows that the provision of seedling for alternative crops/organic gardening is the most common type of support heard of/received by farmers from both villages. In addition to being the only village where funding and construction of water supply systems have been heard of/received by farmers, V2 has clearly has more participants than V1 who are aware of/received any type of support. It can, therefore, be determined that V2 has benefited more from tangible support from the Mae Chaem Model working group, than V1.

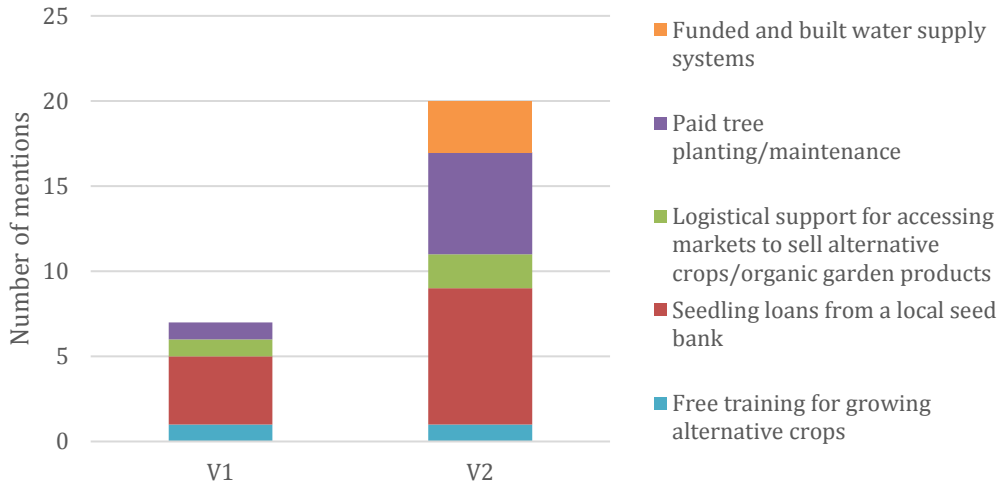

Figure 44-Types of Support Heard of/Received by Farmers to Stop Growing Maize and Adopt Alternative Income-Generating Activities

It can be concluded that V1 is trying to switch from growing maize and adopt alternative income-generating activities, such as growing fruit trees. However, most farmers in the village clearly still grow maize, despite discouragement from others to do so[62]. In addition, there does not seem to have been actual support delivered for farmers in

[60] All concerned participants specified that the seed bank in Mae Chaem district requires seedling loans to be returned (with interest) within the next year.
[61] This type of support is a short term (5-year limit) measure from the RFD to help farmers who have lost land as part of the Mae Chaem Model land cover demarcations. Its purpose is to alleviate income loss caused by land confiscation and encourages farmers to continue investing in fruit tree planting in the future.
[62] All respondents from both villages are pressured by significant amounts of agricultural debt, in addition to everyday living/other expenses. Though there is a willingness in V1 to stop growing maize, farmers likely continue doing so out of a lack of options and/or tangible support. In V2, it is possible that farmers still grow

V1. In contrast, it appears that farmers from V2, have already received actual support to begin ending maize cultivation and adopt various alternative income-generating activities such as growing fruit trees, traditional weaving businesses organic home gardening. The fact that participants from both villages continue to grow maize, despite encouragement to completely stop growing it, can arguably be interpreted as a resistant response from both villages towards pressure from various actors to abandon maize cultivation. Yet, with farmers from both villages having expressed an interest/have already begun to adopt new measures to generate income, it could be argued that both villages are in the early stages of a shift towards an acceptant response towards the same economic pressure. Therefore, both villages arguably displayed an ambiguous response towards economic factors since 2016. However, this ambiguous response could change to either a general resistant or acceptant one depending on the outcome of their intentions to stop growing maize. Finally, regarding the attraction of off-farm jobs, both villages were determined to have displayed another ambiguous response; data shows that both villages have continued to resist this "pull" effect, while also accepting it, as farmers' admissions of having seasonal off-farm employment and receiving remittances from their children, demonstrate.

The ambiguous responses by farmers from both villages towards economic factors since 2016 are deduced to have been influenced by farming families' need to increase household income, as well and pro-conservation discourses, both of which pressured farmers to maintain/shift their income-generating activities. Those involved in encouraging farmers to end maize cultivation are, according to both V1 and V2 participants[63], representatives from the private sector (CP), the non-profit sector (the TRPF was the only NGO mentioned by name) the national government (the RFD and LDD were the only government branches mentioned by name), the local government (village committee, SAO, and the district office were the only levels of local government mentioned by name) and academic institutions (CMU and Maejo University were the only institutions mentioned).

maize to generate enough income as a "safety net", while waiting for their alternative activities to demonstrate more profitable results than growing maize.

[63] All actors involved in the discourses were mentioned by at least one participant from each village.

5.3.2.3 Impacts

According to farmers from both villages, the main anticipated economic impacts of a shift from maize to alternative income-generating income activities are possibly both increases and decreases in household income. According to 20% (2) of respondents from V1 and 50% (5) from V2, accepting to undertake this shift will result in increased household income (see Figure 45). One V1 farmer believes that growing alternative crops to maize "[…] will be profitable because of organic fertilizer […]". Likewise, a V2 respondent is certain that "[…] if the family can get promised support for alternative income projects, it will improve their livelihood […]". Still, 40% (4) of V1 participants and 50% (5) in V2 fear that the proposed alternatives will not bring more household income; as one V1 explained when referencing the village in general, "[…] some people lost a lot of land and will lose income […]", which can arguably imply that despite support for alternative income-generating activities, farmers will still lose income. In the same way, a V2 farmer expressed concern "[…] that promised help will not come and alternative crops won't be profitable enough […]". As a final note, it was not possible to learn how participants from both villages perceived future environmental impacts of this shift.

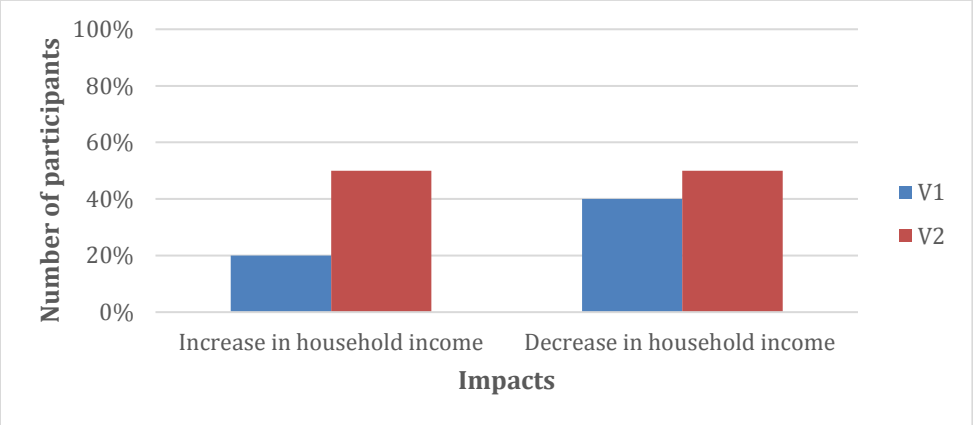

Figure 45-Anticipated Economic Impacts of Ending Maize Cultivation and Adopting Alternative Income-Generating Activities

In conclusion, interviews with farmers confirm that pre-2016 responses towards conservation pressure were similarly resistant in nature for both communities, resulting in forest cover loss. Both villages' general responses towards economic factors during the same period, could be classified as ambiguous and arguably caused variations in household

income. Since 2016, farmers from both villages have generally begun to cooperate with conservation pressure, therefore demonstrating a significant shift from a resistant response to an acceptant one, which ultimately might cause forest cover levels to increase. As for pressure deriving from changing economic factors, farmers from both villages again responded in ambiguous fashion, again resulting in household income increasing and decreasing.

Due to the previously described changes in forest cover and agricultural trends which occurred both prior and after 2016 (see Chapter 4) and the findings in this chapter, it can be argued that farmers' responses have played a significant role in directly shaping these trends (e.g., farmers resisting/accepting conservation pressure has led to decreases/increases in forest cover). Although such responses have seemingly been influenced by various factors such as farmers' economic rationality and cognitive shifts, as well as environmental discourses, the noted shifts in responses towards conservation pressure and economic factors were most likely triggered by the introduction of the Mae Chaem Model. This model has apparently played a big role in pressuring farmers to cooperate with various forest policies and state land demarcation initiatives, in addition to encouraging some farmers to begin changing their income-generating activities.

CHAPTER 6. DISCUSSION

This chapter presents discussion points based on the conclusions drawn from the results described in Chapters 4 and 5. Notably, findings from this study indicate that (i) Mae Chaem district experienced a sudden change in its conservation strategy and that (ii) the ensemble of more strictly-enforced conservation measures was the main influencing factor behind a noted shift in farmers' responses to conservation pressure.

6.1 The Mae Chaem Model: A More Nuanced Fortress-Conservation Approach

As mentioned earlier (see Chapter 2), the Thai government adopted a stricter approach (fortress-conservation) to deal with increasing levels of deforestation between the 1960s and 1980s. Throughout the 1980s and early 1990s, this forceful strategy produced relatively positive results with regards to reducing deforestation, though such efforts were characterized by involuntary population displacement. Such forceful measures decreased in number up until 2014, when the new government began to aggressively implement what could arguably be categorized as a fortress-conservation approach, to attain a set national forest cover target (40% of the country's total land area). This shift in conservation strategy was observed during fieldwork in Mae Chaem district, as the Mae Chaem Model's introduction in late-2015 resulted in more strictly-enforced conservation measures being implemented to meet state forest cover targets. However, these measures differ from those used in past fortress-conservation approaches in the district, therefore suggesting that the Mae Chaem Model adopts a more nuanced approach to meeting conservation targets and as a result, is expected to generate mixed results.

6.1.1 A Poorer Understanding of the Mae Chaem Model in V1 than in V2

Findings from this study's fieldwork show that the Mae Chaem Model's goal of generating awareness of the district's critical issues among the public has been successful. Interviews with V1 and V2 farmers highlighted that most villagers are aware of the majority (if not all) of the critical issues in the district, therefore suggesting this goal has already been met. An example of such awareness would be that all interview participants from both villages acknowledged the existence of the following critical issues: The fact

that no one in their respective village holds a land title deed, as well as the fact that the surrounding area is subject to environmental issues such as soil degradation caused by the intensification of maize cultivation. However, awareness of the existence/purpose of the Mae Chaem Model was not evident among participants from both villages; all V2 (Northern Thai) farmers indirectly acknowledged the existence of the model, while most V1 (Karen) participants did not even appear to know it even existed. As previously noted, many V1 farmers claimed to have never been encouraged to stop growing maize and adopt alternative income-generating activities (measures needed to attain the model's goals), which implies that farmers may not have received information regarding the model or even been notified of its existence.

It could indeed be argued that this lack of understanding from farmers in V1 is due to insufficient efforts by those involved in the Mae Chaem Model to ensure local populations are fully aware that the model is an ongoing process which is establishing measures (e.g., land cover zone demarcations) that directly impact village livelihoods. Another explanation for this issue could be a language barrier impeding interactions between those involved in the implementation of the model and ethnic minority communities (e.g., V1). Since V1 is a Karen community and that some farmers do not speak northern Thai, it is not unreasonable to think that some farmers may have misunderstood information on the Mae Chaem Model communicated to them in northern Thai by representatives from the model's working group (most of whom that were interviewed predominantly spoke in northern Thai). As was expressed by a V1 participant who had difficulty understanding northern Thai (see Chapter 5), "[…] the demarcation process is very confusing, especially for those who don't speak (northern) Thai […]". This statement shows that it is possible that farmers are not always properly informed of the Mae Chaem Model's undertakings, which can be problematic. If farmers do not know about efforts to help mitigate income loss (e.g., from losing land) or do not know who to contact if they have questions/feedback on the model, farmers could, for example, accidently encroach into newly-designated off-limit areas. Farmers who are not aware of the support system in place for livelihood diversification (i.e., switching from maize cultivation to an alternative income-generating activity) could also be unable to fully benefit from such systems.

6.1.2 A Flawed Village-Level Land Demarcation Process in Mae Chaem District?

Mixed results regarding the Mae Chaem Model's village-level boundary demarcations, were observed during fieldwork. One significant benefit from this process, based on discussions with farmers from both villages, is that there are now more clearly indicated village land boundaries and therefore more baseline information which is needed in community land title deed applications. In addition, villages which have completed the most recent demarcation process are eligible to receive support for livelihood diversification, as well as being capable of better managing themselves and in cooperation with the state, their agricultural and forested areas. Moreover, all respondents from both villages mentioned that consultations between farmers and officials involved in the demarcations have made them feel more included in the process. It can, therefore, be concluded that the demarcation process was successful in gathering crucial baseline information on village lands and help villagers have access to better surveillance and monitoring tools for their lands, which arguably permits a more sustainable and precise management of their lands.

Despite the benefits mentioned above, some farmers and NGO workers highlighted possible flaws in the demarcation process. Notably, during a community consultation between SDF, TRPF staff and all farmers from V1, several issues regarding the process were brought to the research team's attention. According to SDF and TRPF representatives, the methods used by the RFD to determine the land cover zones allegedly caused inaccurate demarcations of certain farmers' lands. The NGO representatives alleged that the RFD used too long an interval (more than two years) between historical Google Earth imagery years to properly determine changes, meaning that there were no images of villages' lands in between the years 2002, 2011 and 2015. This makes it difficult to distinguish land cover changes on a yearly basis and identify which areas are permanent or fallowing forests, a methodological concern regarding the use of satellite imagery to detect land cover changes highlighted in existing remote sensing studies (e.g., Temudo & Silva, 2012). According to the same SDF official, some village lands were not classified under the right land cover zone; specifically, the RFD may have classified some areas as permanent forest originally cleared between 2002 and 2015 (both purple and red zones), when in fact they had been originally been cleared prior to 2002 (yellow zone).

This claim was somewhat supported by an interview with one V1 farmer, who said that "[…] some family land had been classified by the RFD as being originally cleared of forest sometime between 2002 and 2011 and needed to be given back […]" to the state (purple zone), when in fact the land had been originally claimed before 2002 (yellow zone). It was further argued that the RFD did not consider the possibility of this being a pre-2002 fallowing area; the farmer alleged that forest had been fallowing for 7+ years before being cut between 2002 and 2011. Though it was acknowledged that this was a longer than usual fallow, the purpose of such a long fallowing period was "[…] to improve the ecosystem by having more trees at the top of the hill to help increase, filter and direct water down to the farmers' other crops at the bottom of the hill". The farmer concluded by saying that the family is "[…] unsure of which status the land will have going forward", due to this alleged inaccuracy. In any case, the family is refraining from re-using the land in question out of fear of breaking the law, though it is hoped the government will review the decision to reclaim the land.

Based on such claims, it is possible that the MCDO land cover maps have inaccurate representations of which areas were/are permanent/fallowing forests. Consequently, it is possible that the previously described V1 farmers' situation is not an isolated one and that other farmers have lost land which would otherwise be permitted for them to keep. According to representatives from the TRPF and SDF, to verify the extent of demarcation inaccuracies throughout the district would require analyses of more historical imagery of village lands than what was previously used (e.g., images for the years before and since 2002), as well as in-person visits to villages to learn about their land use history. Both the TRPF and SDF (which are members of the Mae Chaem Model working group) were mandated to re-visit the land cover zone boundaries of every village in the district. In the case of V1, a community consensus meeting was set up by a GIS technician from SDF and a representative from the TRPF, whose main purpose was to remind villagers how much and which lands they owed to RFD, by obtaining a consensus among farmers as to which lands will be donated to RFD[64]. In addition, the NGOS were there to

[64] It should be noted that during the V1 community consensus, farmers demonstrated solidarity with one another. Indeed, both the NGO workers and villagers made sure no one lost all/too much of their land; farmers with lots of land were often requested (an in some cases volunteered) to donate some of their land in exchange for allowing poorer farmers to keep some and/or all of their land.

find ways to ensure land confiscations did not leave some farmers losing all/too much land. The meeting was divided into three phases, as indicated below:

1. Every single farmer sat down with the NGO workers and, using a computer brought by the SDF which displayed previously designed village land zone polygons in Google Earth, pointed to the areas they would like to keep/give away[65].

2. The NGO workers delimited which lands farmers wished to keep/give away and designed updated polygons of village lands, in Google Earth.

3. These updated polygons were then presented to all villagers to verify if all agreed with the changes. Villagers were then informed that maps would be made with these polygons and then sent to the RFD office in Chiang Mai, for final approval.

However, it should be noted that despite the planned re-designing of MCDO maps, an interviewed RFD official was unaware of this revision effort by NGOs. Rather, the official refuted this information by stating and that the land cover zones determined by the RFD (e.g., Figure 19) are non-negotiable; red zone and purple zone lands must be returned, regardless of the impacts on land users' livelihoods. Therefore, it is possible that such efforts may face administrative/legal challenges once the NGOs submit the re-visited maps for approval, although the exact outcome of this possible issue was unclear at the time of fieldwork and would require further investigation to be determined.

6.1.3 Less Support for Livelihood Diversification in V1 than in V2

Another significant issue regarding the Mae Chaem Model is the extent to which support for alternative income-generating activities, has been limited to some villages in the district. For example, all participants from V2 were encouraged to adopt alternative income-generating activities, all of whom received support from the Mae Chaem Model working group and ultimately adopted new activities as a result. While interviews with V2 farmers demonstrated a successful income diversification throughout the village, V1 farmers offered a stark contrast in terms of their awareness of alternatives to growing

[65] The NGO workers specifically advised farmers to donate land located close to streams, roads, forests, high slope and non-fertile land, as there is a chance such areas may be confiscated by the RFD in the future due to more aggressive state-wise forest reclamation strategies. The reasoning here was that it would be more advantageous to donate the least profitable land most likely to be confiscated in any case.

maize; only 60% (6) of respondents in V1 were aware of the possibility to adopt and/or receive support for alternative income-generating activities. None of the 40% (4) who were encouraged to stop growing maize adopted any alternative or received any support to do so. Such a dissimilarity between the two studied communities indicates that not all villages in the district have yet benefited from the Mae Chaem Model. A precise explanation for this inequality was not identified during fieldwork, though one SAO official explained to the research team that villages located close (there was no mention of a radius) to an administrative center (e.g., the MCDO or an SAO office) were most likely to benefit more quickly from support by the model's working group members. The same SAO official mentioned that it is only a matter of time before all villages begin to receive support, which explains why many villages in the district, particularly those in remote areas, have not yet received any help to adapt. Yet, V1 and V2 are both located relatively close to one another, which raises further questions as to why V2 still received more support than V1. This, however, could not be verified during fieldwork.

6.1.4 Future Scenarios of Forest Cover Change in Mae Chaem District

Mae Chaem district is now arguably in the early stages of a forest transition, the drivers of this process being shifts in conservation pressure and various economic factors. The Mae Chaem Model was earlier identified as a triggering factor behind such shifts, particularly regarding the sudden implementation of conservation objectives, such as increasing the district's forest cover levels. Though the MCDO expects a forest transition to occur by 2020, results from this study arguably indicate two other possible outcomes to this process: An exceeded or reversed forest transition.

6.1.4.1 Exceeded Forest Transition

With forest cover gain in Mae Chaem district expected to occur between 2016 and 2020, the Mae Chaem Model's working group is anticipating such gains to bring the district's forest cover levels back to those from 2002. Though meeting this target is projected to occur by 2020, interviews with farmers suggest that it is also possible that this target is not only met, but also exceeded. Specifically, it is possible that some farmers in

the district could abandon and/or donate more land then what is required by the Mae Chaem Model working group, which would enhance the expected amount of regenerated/reclaimed forest.

With regards to land donations, observations made during the community consensus meeting (see earlier) in V1 between farmers, village officials and representatives of SDF and TRPF, indicate that many villages in the district agreed to "donate" more lands to the RFD than were required (e.g., red and purple zones). Indeed, a TRPF representative claimed that, in the case of V1, the village surpassed the RFD's land donation requirements (e.g., red zones and purple zones); villagers donated more than what was asked for, in the hope that this symbolic gesture would help the community more easily obtain a community land title deed. This type of situation has, according to the same TRPF representative, occurred in most villages affected by the Mae Chaem Model's land cover demarcations. However, such donations need to be approved by the RFD first. If the RFD does approve such revised donations, the amount of reclaimed forest cover will surpass original targets.

Another possible situation where forest regeneration/reclamation could surpass set targets would be though significant voluntary land abandonment (and resulting forest fallows) by farmers. The theoretical framework supporting this scenario is based on the economic development pathway of a forest transition (see Figure 2). Here, if land loses its tangible value, there can be a shortage of labor, therefore forcing land users to abandon land and begin a process of natural forest regeneration. In the case of V1 and V2, interviewed farmers were asked whether their land was currently less valuable than before, to which 90% (18) of participants from both villages answered that they have indeed become less valuable. The main reasons for this perceived decrease in the value of land are the same ones used to explain maize's profitability decrease (see Figure 34): Rising costs in chemical fertilizers and pesticides, insufficient access to water resources, market price shifts and farmers being too old to maintain their lands. Half of the participants from both villages expressed that they were too old to maintain their lands, with one V1 respondent stating that "[…] being older and more tired than before, working on the land is too much hard work, which means there is less productivity than before […]". A V2 participant similarly mentioned that "[…] too much energy not a lot of income from it (working the land), and because of this it is not as valuable and worth the work as before […]".

In V1, 40% (4) of respondents indicated that their children/other children in the village would take over farmlands when the older generation retires, compared to only 20% (2) in V2. Most participants from both villages, therefore, believe younger villagers will not become farmers, of whom 30% (3) in V1 said that they would "donate" their lands for conservation when they retire; one V1 farmer explained that since "[…] the lands have no titles, they cannot be sold, so they will be abandoned for forest can grow back, as it will be beneficial for the environment. There is also evidence that such cases of abandonment have even already occurred; another V1 farmer claimed that "[…] working the land is less profitable than before, so abandoned some land to become forest […]". This type of evidence demonstrates how increased donations and voluntary abandonment of land is expected to occur in at least one of the two villages, meaning that in the case of V1, it is possible that the MCDO forest regeneration targets will be exceeded.

6.1.4.2 Reversed Forest Transition

Interviews with farmers from both villages suggest that there is a general insecurity regarding the future of their livelihoods due to land reclamations by the government. More precisely, some farmers from both villages fear that ending agricultural expansion and maize cultivation would cause income loss (see Figure 40) and that the adoption of alternative income-generating activities might not generate enough revenue for them. In V1, 60% (6) of participants worry that the proposed alternatives to growing maize will not be profitable enough; one V1 farmer mentioned that growing cacao is preferable to maize, but the family is "[…] worried it will not make as much as maize and that trees will die in this environment […]". This sentiment is also similarly felt among 70% (7) of V2 participants, as one farmer stated that "[…] the family is worried because new tree species planted have an uncertain chance of surviving winter and may not be as profitable growing maize […]".

Such statements from both villages' farmers highlight two common fears, the first being that alternative crops/fruit orchards will not as profitable as maize and will result in families losing income they could otherwise maintain by growing maize. The second fear consists of alternative crops and fruit tree species being unable to survive the area's

difficult conditions (e.g., a lack of access to water). Yet, there appears to be more desperation from V1 (Karen) participants than in V2 (Northern Thai) with regards to the outlook of losing land and how they would cope with the loss of income. Indeed, 20% (2) of participants from V1 said that they feel there are no other (more profitable) options than to grow maize, with one participant stating that "[…] we are afraid current lands will not be enough to feed the family […]". Statements such as these indicate that without tangible support from the Mae Chaem Model's working group, farmers could be faced with a dire situation that will logically provoke desperate actions to ensure that their basic needs are met.

One such action could be farmers deciding to continue growing maize on existing lands or even expand their lands, as was done prior to 2016. Forest cover and biodiversity loss would be obvious examples of environmental degradation resulting from such an action, while income generation would be an expected outcome. However, income generated from the continued cultivation of maize may not necessarily prove to be a sustainable outcome; interviews with representatives from the MCDO, SAOs and CP officials indicate that continuing to grow maize in the district will prove more and more difficult to do. The main reason for this is that CP (the company which originally introduced and bought maize on a contract-basis from smallholder farmers) announced in 2015 that it will stop buying maize from farmers with no land title deeds (this includes most of the farmers in Mae Chaem district) to help the Mae Chaem Model working group meet its objective of ending monocropping and ultimately help reduce the number of hot spots. This means that many farmers would face significant challenges to sell maize in the future. Despite this announcement, only three farmers from both villages (all three were from V2) mentioned that had they heard of CP's decision; one participant stated that "[…] CP won't buy maize anymore from untitled land, was told this by the SAO […]". The above suggests most farmers from both villages may not be aware of this decision. Although most interview participants from both villages admitted to still growing maize at the time of fieldwork, it is unclear as to what their current strategy is regarding the sustainability of growing maize in a context where doing so has become more challenging. This uncertainty could result in some farmers being left with few options to make income when it becomes

apparent to them that cultivating maize may not be a viable option to generate a steady income.

It is also possible that farmers could expand/claim new land if they are confused regarding the status and boundaries of their lands. An example of such confusion would be the case of a V1 farmer who claimed to be confused about the status of some land[66]; the farmer in question had been told by the RFD that a land parcel had been cleared of forest illegally and needed to be returned (Red Zone), although the farmer argued that the time when forest was cleared would allow the farmer to keep the land (Yellow Zone). Since no follow-up had been made with the farmer since then, the land user expressed confusion as to what the status of the land is and whether it can be used or not. Another example of possible instances of confusion regarding land boundaries would be that none of the V1 farmers mentioned any specific colors and zones attributed to the recent land demarcations as part of the Mae Chaem Model, as well as any physical land boundary indicators (e.g., posts, signs) in their village. This may mean that, without villagers properly understanding the locations and conditions of the new boundaries, accidental forest encroachment (into purple and red zones) is a possibility. In V2, however, 70% (7) of participants specifically mentioned the existence of color-designated land cover zones. This notable difference between villages in regard to understanding recently established land cover zones is therefore quite evident. Although no official explanations for this knowledge gap were determined during fieldwork, it could be possible that some V1 farmers, whose main language is Karen, may not have properly understood the demarcation process explained to them due to a language barrier. Therefore, there is a risk that future forest encroachment may occur due to misunderstandings between ethnic minority villages and forestry officials, regarding the conditions of recently-established and cover zones. However, it is also possible such encroachment could be done knowingly by farmers, who would feign ignorance.

Within the ensemble of studies on forest growth after long periods of deforestation, there are very few which examine the temporary nature of forest expansion, where forest expansion becomes subject to renewed deforestation. This type of forest transition can be referred to as a "fragile" or "reversed" forest transition, a situation where deforestation

[66] This example will be discussed in more detail further in the chapter.

returns after a forest transition (Pagnutti, Bauch & Anand (2013). Such cases have been documented in New England (Acheson, 2008; Jeon, Olofsson & Woodcock, 2014) and the Midwestern United States (Evans, Donnelly & Sweeney, 2010). It is, therefore, reasonable to suggest that the ongoing forest transition in Mae Chaem district could possibly become a reversed process if farmers interrupt the process by re-claiming past (currently off-limit)/claiming new lands between now and 2020. Forest loss resulting from agricultural expansion/re-expansion would cause both environmental degradation and potential conflicts between RFD officials and farmers (see Chapter 5). It is consequently important for those involved in the Mae Chaem Model to take under consideration such possible forest transition scenarios to help develop ways to ensure farmers in Mae Chaem district do not perceive the need to adopt a renewed resistant response towards forest policies.

6.1.5 Forced Cooperation with Conservation Objectives?

As observed by farmers from both villages (see Figure 37) and according to the MCDO (2016), existing forest policies have been more strictly enforced since the Mae Chaem Model's establishment. The model can, therefore, be attributed to having altered the level of enforcement of forest policies in Mae Chaem district and consequently provoked a change in farmers' responses to conservation pressure. Whereas land users generally resisted forest policies prior to the model's creation, it appears many farmers have now begun to accept the same policies as of 2016. Pro-conservation discourses arguably induced some farmers to cooperate with forest policies more willingly; farmers from both studied villages claimed that their views regarding forest protection had, in some cases, changed due to environmental discourses (e.g., maize cultivation must end to prevent forest fires) promoted by representatives involved in the Mae Chaem Model (e.g., village conservation committee[67]). Thus, representatives from the Mae Chaem Model's working group promoted various environmental discourses which influenced (though difficult to measure to what extent) local populations into changing their responses towards forest policies. The model has also introduced new economic factors which pressured local

[67] These committees act as an intermediary between Mae Chaem Model representatives and villagers; one of the main roles of these committees is to ensure their respective villages' natural resources are managed sustainably and abode to state forest laws and regulations (in addition to designing community rules).

populations to change their livelihoods (e.g., encouraging farmers to end maize cultivation and instead adopt alternative income-generating activities by promising and in some cases supporting farmers to make such changes). Though most farmers from both villages still grew maize, there are some farmers (e.g., all V2 participants) who have begun to diversify their economic activities, albeit with the support of the Mae Chaem Model working group.

The evidence described above can be interpreted as examples of how development approaches, such as the Mae Chaem Model, can help alter both agricultural trends (i.e., encouraging farmers to adopt alternative income-generating activities instead of monoculture) and forest cover trends (i.e., land reclamations leading to an increase in forest cover). However, one area of concern is that the acceptant response by both V1 and V2 towards the model's more strictly-enforced forest policies have likely been the result of farmers being pressured into responding as such. Despite the fact that the model promotes itself as a participatory approach to resource management, there seem to be similarities between the model's approach and the fortress-conservation approach employed in the 1980s and early 1990s. Indeed, forceful conservation tactics were observed in both studied villages. For example, though close to half of all V1 and V2 interview participants indicated that they were satisfied with the land cover zone demarcation process, despite having lost land because of the procedure, 20% (2) of interviewed land users in V1 and 10% (1) in V2 said that their cooperation with the process was based the fact that they had little choice but to do so. It was specified by the same participants from both villages that since they did not hold and any land title deeds, they could consequently not legally challenge the limits and the process. As one V1 farmer said, "[…] it feels necessary to say satisfied (regarding their level of satisfaction with the demarcation process) because there is no choice in deciding land limits anymore as cannot have much of a say because the family needs land rights […]", while a V2 respondent affirmed that "[…] because of no collective land rights, there is no choice but to accept the limits […]". These admissions by farmers and the fact that an RFD official (see earlier in this chapter) explained that land cover demarcation limits are non-negotiable, suggest that the demarcation process may have been forcibly done by taking advantage of the fact that affected farmers could not contest due to a lack of tenure rights, to ensure forest gain targets are met.

Based on conversations with farmers during fieldwork, the Mae Chaem Model arguably constitutes a practical approach to carry out the government's fortress-conservation strategy (i.e., attain the "40% target") in Mae Chaem district. Indeed, land reclamations have already begun, and as data gathered during fieldwork shows, many farmers have lost significant amounts of land as a result. Though attempted land reclamations in Mae Chaem district did occur in the 1990s as part the state's fortress-conservation strategy to demarcate the boundaries of MTNP, the Mae Chaem Model's land cover demarcation process differs in its application. For example, in the early stages of MTNP's creation, villagers located in suddenly drawn-up park boundaries were to be forcibly evicted by the state, though active resistance from both villages, NGOs, and civil societies forced the government to reconsider the application of the park's boundary establishment. Where the Mae Chaem Model's forceful approach to reclaiming land is more nuanced, than that used during MTNP's demarcation process is the use of compromises to incite villagers to "donate" their lands. Instead of confiscating people's lands outright (as was attempted in the past, often in the form of eviction threats), the model's working group has attempted to work directly with villagers to establish a communication channel where the land needing to be reclaimed is clearly indicated, as well as the reason why it needs to be reclaimed. In addition, the working group members have offered farmers an opportunity to voluntarily cede lands with the promise that doing so would help their respective village in its community land title deed application. Also, voluntary cooperation was told to be a pre-requisite condition for farmers to receive support to adopt alternative income-generating activities.

Therefore, the Mae Chaem Model's fortress-conservation approach is more nuanced than the previous one observed in the district. Rather than adopting a simplistic approach to forcing people off their lands, the model looks to offer a compromise regarding land reclamations; instead of outright forcing involuntarily population displacement, the government is attempting to find ways to both meet their conservation objectives and help affected populations adapt their livelihood strategies to more sustainable ones. However, as an RFD official stated (see earlier in the chapter), there is allegedly no possibility of re-negotiating land cover demarcation zones (contrary to the efforts of some NGOs to re-visit

the limits), meaning that opposition to the model's land cover demarcation process would be challenging and therefore can be interpreted as being forceful in nature.

Though issues regarding the Mae Chaem Model have already been identified, there are various types of suggestions as to how these problems could be addressed, which have been proposed by both farmers and representatives of the model's working group. Notably, 30% (3) of V1 participants and 50% (5) in V2 mentioned that those involved in the Mae Chaem Model must take into consideration peoples' livelihoods more in future enforcement of conservation initiatives, since the land cover demarcations and proposed alternatives to growing maize have/will affect peoples' income. An example of a recommendation would be that made by a V1 farmer who said that "[…] the government needs to consider more how the population needs enough land and that it is hard to change livelihoods and not everyone can move to the cities […]". A similar suggestion was made by a V2 land user: "[…] They (the government) must help more with the marketing of alternative proposed products because many farmers want to do something else but there needs more consideration of our needs and more support to find a market (to sell to), which is difficult […]". Another significant recommendation proposed by interview participants from both studied villages is that the working group must consult with farmers more in future demarcation processes (if any), to have more detailed knowledge of villages' land use history and therefore avoid situations where land is wrongfully confiscated. In V1, 20% (2) of respondents made this suggestion, one of whom claimed that "[…] they (the government) need better knowledge on land history, to avoid confiscating land which should not be taken away from people […]". In V2, 30% (3) from V2 made similar suggestions; one land user said that the "[…] people should be able to negotiate directly with the government when it comes to their livelihoods so that demarcations are more precise and just, something NGOs are helping with". To conclude, the Mae Chaem Model has demonstrated that it has been somewhat capable of addressing some of the critical issues facing the district, though some problems persist and could continue to be problematic for both local populations and their surrounding environment.

6.2 Farmers' Responses: A Significant Dynamic of Forest Changes

Though this study determined the influencing factors (economic rationality, environmental discourses, and cognitive shifts) which induced farmers to shift their previously resistant responses to conservation pressure, to more accepting ones, it is suggested here that (i) their responses directly impacted forest cover and agricultural trends and that the (ii) the main influencing factor for this shift in attitudes has been the forceful nature of environmental discourses deriving from the Mae Chaem Model.

6.2.1 Farmers' Responses: Catalysts of Changes in Forest and Agricultural Trends

Findings from interviews conducted with farmers from both V1 and V2 show that farmers' shifting responses to conservation pressure and various economic factors since 2016 have affected forest cover (i.e., an increase in forest cover) and agricultural trends (i.e., a stop to agricultural expansion) in Mae Chaem district. Though the impacts of farmers' responses to conservation pressure and economic factors both prior and since 2016 have been documented, farmers' future responses to these drivers of change were not explicitly discussed during interviews; rather, it was implied during these conversations that land users could maintain or even change their responses and therefore continue to affect forest and agricultural trends.

One possible future shift in response would be farmers deciding to resist forest policies (e.g., land cover zone boundaries) once again, as well as resisting pressure from economic factors (e.g., encouragement to start growing fruit trees instead of maize). This scenario would likely occur if farmers continue accepting current forest policies and do not receive enough support to adopt and maintain profitable alternative income-generating activities, to growing maize. In this situation, farmers would be forced to continue growing maize and/or expand/claim new lands for agriculture. Though this may result in an initial increase in agricultural income, the sustainability of such a decision would be questionable given that there are few options, as of 2016, for selling maize and that renewed agricultural expansion could result in land users facing sanctions from the state, for illegal forest encroachment. Certainly, with CP (the biggest corporation purchasing maize in the district) pledging to stop buying maize from farmers with no land title deeds (most farmers in the

district), it is difficult to imagine to whom farmers will sell their continued maize production to. It is, thus, reasonable to suggest that the amount of income generated from continued maize cultivation/other crop cultivation could vary based on factors such as fewer buyers and shifts in product market value. In addition, renewed forest cover loss would likely occur in the event of renewed agricultural expansion, consequently leading to a reversed forest transition.

Farmers can also choose to continue accepting post-2016 forest policies and economic factors, though this would only likely be possible if land users receive enough support from the Mae Chaem Model working group to diversify/change their income-generating activities. The outcome here would, hence, be an expected forest cover gain and increases in income. The final possible scenario would be that farmers continue cooperating with current forest policies and accept certain economic pressures, resulting in some farmers voluntarily/forcibly donating/abandoning land, which would consequently increase forest cover and enhance targeted forest cover gains. Hence, the above conclusions drawn from interview answers of V1 and V2 participants, suggest that the (pre-2016) general acceptance of state-sponsored commercial crop intensification indirectly affected agricultural trends in the area, and arguably throughout the district. The fact that many farmers from both villages admitted having followed "village trends" (other farmers beginning to grow maize due to rumours of it being profitable and easy to grow), out of fear of "missing out" on an opportunity to increase income, shows how the responses of farmers towards economic factors indirectly influenced others into adopting a similar response and therefore setting an agricultural trend. The same type of "trend-setting" has been observed since 2016, as some participants from both villages (particularly from V2) described how other farmers in their respective village are trying to stop growing maize and adopt alternative income-generating activities, a prospect most participants admitted to being interested in doing, therefore suggesting such a response could set the trend where farmers diversify their income-generating activities. Although both the above scenarios are possible, further research within the next few years would be needed to determine the impacts of existing/future responses to conservation pressure and economic factors.

6.2.2 The Mae Chaem Model: A Triggering Factor of Farmers' Shift in Responses

The results from Chapter 5 show that farmers' pre-2016 resistant response to conservation pressure was primarily motivated by a need to increase household income, a common explanation for forest cover loss in existing forest transition studies. It can also be argued that farmers' cognitions towards the value of protecting the forest, as well as existing environmental discourses, were insufficiently capable of preventing farmers from clearing forest for agriculture (all interviewed farmers admitted to having knowingly broken forest laws). Since 2016, farmers have adopted a more acceptant response to forest policies, which have become more strictly monitored and enforced. This shift in response was not primarily motivated by a need to increase household income, however. Instead, pro-conservation discourses promoted by representatives of the Mae Chaem Model working group significantly influenced land users into adhering to forest policy objectives (e.g., end agricultural expansion), limit/end maize monoculture and adopting alternative income-generating activities. There is also evidence that some farmers' views on the value of agricultural and forest land, have changed over the years (e.g., admissions by farmers that it is now more important than ever to protect forest than before), suggesting that some farmers have felt less inclined to resist conservation pressure due to a cognitive shift regarding the importance of protecting forests, albeit at the expense of agriculture. However, since farmers' general shift in response to conservation pressure occurred at the onset of the Mae Chaem Model's creation, this study proposes that the introduction of the model was the main triggering factor of a shift in farmers' responses to conservation pressure; the model not only set in motion pro-conservation discourses, but its implemented measures directly pressured land users into changing/wanting to change their income-generating activities.

Still, it remains challenging to measure the level of impact each influencing factor (economic rationality, environmental discourses, and cognitive shifts) has had on the development process of farmers' responses to drivers of forest cover changes. For example, if a farmer mainly justifies his/her decision to stop expanding crop areas out of fear of future conflicts with the government, but also indicates that he/she understands and agrees with the government's need to protect forests more, it is difficult to determine which of these factors played the biggest role in shaping a resistant response to conservation

pressure. Such a challenge makes it difficult for policy-makers to know which exact development strategies can be best designed and employed to solicit cooperative responses from farmers towards forest policies and to adopt alternative income-generating activities to growing maize.

CHAPTER 7. CONCLUSION

This research tested a hypothesis in forest transition studies, based on previously-mentioned research questions; a shift in farmers' responses to conservation pressure and economic factors was determined to have played a significant role in shaping current (and possible future) forest cover and agricultural trends in Mae Chaem district. It was also determined that factors other than farmers' economic rationality (i.e., environmental discourses and cognitive shifts), significantly influenced the responses from land users. The theoretical and empirical contributions of this study's findings, as well as proposed future research directions, are described in this chapter.

7.1 Study Findings

Results presented in Chapters 4 and 5 show that pre-2016 forest cover levels in Mae Chaem district were deemed to have decreased due to agricultural expansion. Since 2016, however, forest cover is expected to increase to the same levels which existed in 2002 because of more-strictly enforced forest policies that have ended agricultural expansion in the district. This reversal in forest cover trend is evidence that the district in currently in the early stages of a forest transitions. Accordingly, farmers in Mae Chaem district generally seem to have resisted conservation pressure prior to 2016, before shifting to a more acceptant response since 2016 mainly due to fear of prosecution for any future forest encroachment. This change in attitude was noted in both studied villages. As for responses to economic pressure, ambiguous responses were reported to have occurred both prior and since 2016. This is due to perceived needs to maintain maize cultivation, despite some farmers adopting alternative primary income-generating activities/secondary income-generating activities.

Pre-2016 resistant responses to conservation pressure, according to interviewed farmers from both villages, facilitated agricultural area expansion and forest cover loss, which respectively (somewhat) increased farmers' household income and caused various environmental issues. Since 2016, acceptant responses towards conservation pressure are expected to help increase forest cover (at the expense of agricultural land and household income) and consequently support the restoration of environmental systems in the district.

If, however, there is an insufficient level of support to help discourage farmers from re-expanding agricultural land, an increase (at least in the short-term) in income would likely be observed, though at the cost of renewed forest loss and degraded ecosystems. Prior to 2016, farmers' ambiguous responses to pressure from economic factors caused both increases and decreases in household income. Similar outputs are expected since 2016, although there is a risk that income could decrease significantly if farmers do not switch from growing maize and adopt alternative income-generating activities. Even if farmers do adopt these measures, it may not necessarily prove as profitable as growing maize if they do not have sufficient support from those encouraging this shift.

Though farmers' economic rationality and cognitive shifts, as well as environmental discourses, were all identified as being influencing factors behind farmers' responses to the drivers of an ongoing forest transition, the factor which had the most influence in triggering a shift in response to conservation pressure was the ensemble of environmental discourses promoted by the Mae Chaem Model. Although some of the model's objectives have/are on course of being met (e.g., a diminishment in the number of hot spots in the district), various actions set in motion by the model (e.g., land cover demarcations) have produced mixed results in relation to their goals. Indeed, there are many benefits which have already been observed, such as (i) clearer land cover demarcations, (ii) an end to agricultural expansion, (iii) observed forest regeneration, (iv) the adoption of alternative income-generating activities and finally (v) a more visible participatory sustainable development approach than those approaches used in the past, among other successes.

Nevertheless, there are also issues concerning the model' impacts on peoples' livelihoods and the environment. For example, not all farmers or even villages (i.e., V1) are fully aware of the model's existence, objectives, goals, and action, meaning there it is possible decisions were made, and actions carried out without the full understanding and consent from farmers. In addition, there are also possible errors in the precision of land cover demarcations, which have means some farmers may have lost land they should otherwise have been allowed to keep. As a result, it is possible some farmers have, and will, lose income unnecessarily due to imprecise data used by the model's working group. Finally, not all villages have seemingly benefited equally from the available support from

the Mae Chaem working group, as V1 clearly has not benefited in the same ways as V2 has; all V2 participants were supported by the working group to switch from growing maize and adopt alternative income-generating activities, while no respondents from V1 have received such support, many of which claiming to have never even heard of these measures.

Regarding future forest cover and agricultural area trends, it can be deduced from research findings that there are three possible outcomes regarding forest cover evolution. The first is that the expected forest transition occurs (i.e., forest cover levels reach the same ones as in 2002). The second scenario would be a reverse transition (renewed forest cover loss), caused by agricultural re-expansion from desperate farmers looking to recoup income lost from land confiscations, particularly if there is insufficient support from the Mae Chaem Model working group to alleviate such needs. The final scenario would be an exceeded forest transition (a bigger than expected increase in forest cover), which could be caused by land users voluntarily donating/abandoning agricultural land for conservation purposes. There are various possible reasons which could explain such a decision, the main one being that as farmers grow older and the younger generation is not likely to keep farming, the land would be donated or abandoned. This scenario is likely to occur, as most farmers in the district do not have any land title deeds and cannot sell their lands, making land abandonment possible. It is also possible that some land will be donated for conservation purposes, many interviewed farmers have recognized the need to have more forest so that the state of the environment can improve and that they would willingly donate land for conservation.

7.2 Research Contributions

7.2.1 Theoretical Contributions

Even though several academics studied forest cover changes in Thailand (Grainger, 2004; Grainger, Francisco, & Tiraswat, 2003; Leblond, 2011; Leblond, 2014; Leblond, 2015), several aspects of these dynamics remain only partially examined. One such need to conduct research in Thailand is that there is, as previously mentioned, a poor understanding of the role of farmers' responses to forest transition drivers. Indeed, there is evidence (Leblond, 2011) of diverging responses to the drivers in different areas

throughout the country, such as northern Phetchabun province, responses about which little is known about how and why they are formed. In addition, Thailand has a diversity of approaches to forest conservation and is subject to important economic changes, both of which are common drivers of forest transitions (Leblond, 2015), making the country a perfect case study to further research on the effects of forest transition drivers on local populations.

The most significant academic contribution of this study is regarding farmers' responses to common drivers of forest transitions. The impacts and influencing factors of farmers' responses have been seldom researched enough to suggest they can significantly affect forest cover and agricultural trends. This research notably supports existing claims in forest transition literature that cognitive shifts and environmental discourses are overlooked, yet significant, underlying factors which influence the responses of actors. As can be observed from the results of this study, economic rationality, cognitive shifts, and environmental discourses were all influencing factors which induced farmers into responding (the responses observed were acceptant, resistant or ambiguous in nature) to conservation pressure and economic factors. Though the economic rationality of farmers was determined to have been the main influencing factor behind farmers' resistant responses to forest policies prior to 2016, a shift to more acceptant responses has been noted since. This shift in response was not, however, triggered by economic rationality, but instead by a combination of all three previously mentioned influencing factors. Still, environmental discourses were learned to have played the biggest role in inducing farmers into accepting forest policies which they had, until recently, continued to resist. Conversations with farmers and secondary actors indicate that the decision from land users to end agricultural expansion and cede land to the state for conservation was forced due to a lack of tenure rights needed to contest such measures. Since the measures employed by the Mae Chaem Model working group members to more-strictly enforce forest policies are forceful in nature, it can be concluded that this development strategy fits within the Thai state's fortress-conservation approach to attain desired forest cover targets. Therefore, the Mae Chaem Model (and future models of similar nature) arguably plays an indirect, yet significant, role in shaping forest and agricultural trends.

This study has, therefore, demonstrated that there are indeed direct and tangible economic and environmental consequences of farmers' responses, suggesting that it is possible to look beyond the two common pathways (economic development and forest scarcity) often used to explain forest transitions.

7.2.2 Empirical Contributions

This thesis situates itself as an empirical, sub-national study on forest transitions since it both describes the evolution of forest cover in Mae Chaem district, as well as offering causal explanations to these changes. Because there are still relatively few sub-national forest transition studies in Thailand, this thesis's results can contribute to this need for additional literature by helping to better understand the causes and impacts of a sub-national forest transition in Thailand, therefore helping to improve predictions of when forest changes are expected to occur, as well as determine the environmental and social impacts of forest policies, which can facilitate the establishment of well-founded policies to address these issues (Angelsen & Rudel, 2013). Such information can then ideally be consulted by policy and decision-makers, which would allow them to design and implement up-to-date and inclusive policies, which reflect current social and environmental issues, such as deforestation (Leblond, 2015). Indeed, Leblond argued that to tackle this problem in Thailand, there needs to be more consideration of forest transitions in the planning of anti-deforestation policies, which must base themselves on empirical evidence of known forest transitions and their proximate/underlying causes, as well as an understanding of the process's social and environmental consequences. If these elements are not properly understood, it will be difficult to know when forest transitions are expected to occur in Thailand and to determine which policies are likely to succeed with minimal negative social impacts (Leblond, 2015). This research is thus capable of contributing to the knowledge base needed for sustainable development policies in Thailand, specifically providing a recent perspective on recently observed impacts of the Mae Chaem Model.

This research, through interviews with land users, compared the responses of two different villages and identified both similar trends and some differences regarding their general responses to drivers of forest cover change, as well as their influencing factors and

impacts on forest cover and agricultural trends. Although both villages adopted similar responses to both drivers before and since 2016, a significant difference could be noted regarding the level of support each village received for livelihood diversification. Most interviewed farmers from V2 clearly stated that they had received at least some kind of support for adopting alternative income-generating activities to growing maize, something no V1 participant had yet received and in some cases never even heard of. Because V1 is a Karen community, and that V2 is northern Thai, it was proposed that this disparity between villages may be due to a language barrier between Mae Chaem Model working group representatives and Karen farmers, which has impeded important the communication of the Mae Chaem Model's purpose, implemented measures and support systems in place. As a result, this type of observed issue can arguably be used to develop future inquiries into whether an intentional/unintentional marginalization of ethnic minorities has/is taking place.

The use of semi-structured interviews proved to be an appropriate way to allow farmers to discuss topics related to how and why their responses to forest cover changes were developed, as well as permitting them to reveal useful information on land user history (e.g., observations of forest loss/gain) which proved helpful in complementing and verifying conclusions drawn from this study's contextual land cover analysis (e.g., validating if observed forest cover loss was indeed caused by agricultural expansion).

7.3 Research Limitations and Future Directions

7.3.1 Limitations

The main limitation of this study is its scale. Since only two villages were studied, such a small sample size makes it difficult to generalize findings from interviews with farmers. However, this study can still offer a general understanding of how some farmers in the district have responded to forest change drivers over the years. Also, it is difficult to assess whether V1's apparent disparity regarding access to livelihood diversification support opportunities is in fact due to intentional/unintentional marginalization based on their ethnicity and/or culture, without broadening the study's population sample to include more villages and participants from all four of the district's ethnic groups. Other important

limitations were difficulties encountered when trying to measure the impact influencing factors (e.g., environmental discourses) on farmers' responses, as well as the lack of precision in this study's contextual land cover analysis (see Chapter 3). The other notable challenge throughout this study concerned the research team's depth of knowledge on the Mae Chaem Model; since it is a "first-of-its-kind" development approach (according to a MCDO official), the research team members were initially unfamiliar with its purpose and who the stakeholders were. A final test was that the research team did not have any contacts in the study area prior to fieldwork, making it initially difficult to gain the farmers' trust, although the extensive experience of both Mrs. Pongsopa and Mr. Boonsai in conducting research in similar contexts helped facilitate the introduction of the team and its objective.

Despite remote sensing being originally planned to identify forest and agricultural area changes in Mae Chaem district, it was ultimately not employed in this study due to concerns that methodological issues could hinder its accuracy. Many academics have been critical of this technique's change detection correctness in some contexts (Temudo & Silva, 2012; Bruggeman, Meyfroidt & Lambin, 2016). An example of one such challenge in land cover change detection is the integration of traditional land use systems, such as shifting cultivation, into remote sensing analyses. According to Temudo & Silva (2012) a "[…] wide range of variation in both crop and fallow periods constitutes a methodological problem in quantitative research related to studies about the impact of shifting cultivation on forest cover and about patterns of agricultural intensification" (p. 430). Indeed, it can be difficult to distinguish which areas are permanent forest or fallowing forest, an issue which can arguably be applied to any remote sensing work set in northern Thailand. Therefore, given this study's time constraints, it was not possible to resolve the methodological issues related to using remote sensing in the context of Mae Chaem district.

7.3.2 Future Directions

Although this study has helped address some research needs in forest transition studies, these gaps remain still largely in need of additional studies to further explore the role of farmers' responses to drivers of forest cover change. More empirical studies at the sub-national level, particularly in Mae Chaem district but also other parts of Thailand,

should thus be done to triangulate and build on the findings from this study. Specifically, it would be important to verify whether the unequal support (to end maize cultivation) observed between V1 and V2, is an isolated case or if it is part of a widespread trend of ethnic minority communities being intentionally/unintentionally marginalized as part of a clearly more aggressive nation-wide conservation objective than which existed prior to 2014. Finally, a future study in 2020 (or beyond) focused on estimating forest cover and agricultural changes in Mae Chaem district (ideally using a contextually-sensitive remote sensing analysis to more accurately measure such changes), would be ideal to verify the outcome of the ongoing forest transition.

Such findings could help support the Mae Chaem Model working group in assessing whether their forest cover gain targets have been met/exceeded or not, as well as what the causes of any land cover changes. As proposed by Leblond (2015), the design of successful forest policies "[…] must rest upon firm empirical understanding of historical and current instances of forest transitions as well as robust causal generalizations whose context of validity is clearly established and social consequences well understood" (p.32). Finally, this study should serve as a reminder that it is important to understand the role of population responses to forest transition drivers, because people can counteract forest policies, actively resist them or make them successful by accepting and participating in their establishment. It is therefore imperative to understand why people develop such responses for sound policy discussions, thus reiterating the need for further studies to be done on the subject.

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APPENDIX I

File Number: 01-16-24 **Date (mm/dd/yyyy):** 07/14/2016

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

Ethics Approval Notice

Social Science and Humanities REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

First Name	Last Name	Affiliation	Role
Jean-Philippe	Leblond	Social Sciences / Others	Supervisor
Antoine	Beaulieu	Arts / Geography	Student Researcher

File Number: 01-16-24

Type of Project: Master's Thesis

Title: Farmers' Responses to Drivers of Forest Transitions: A Comparative Case Study of Lom Kao District, Phetchabun Province, Thailand

Approval Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
07/14/2016	07/13/2017	Approved

Special Conditions / Comments:
N/A

APPENDIX II

Interview Guide for Farmers

Participant code: ……
Village code: …….
Interview date:……

Personal History and General Household Characteristics

1. About yourself
    a. Gender (observe) □ Male □ Female
    b. How old are you? ……. years old
    c. What is your nationality and race?
        i. Nationality □ Thai □ Other……..
        ii. Race □ Northern Thai □ Karen □ Lua □ Hmong
            □ Other……
    d. What language(s) do you speak?
        □ (Central) Thai □ (Northern) Thai □ Karen □ Lua □ Hmong
        □ Other…..
    e. What is/are your religious belief system(s)?
        □ Animism □ Buddhism □ Christianism
        □ Other …….
    f. Are you literate? □ Yes □ No, I cannot read & write
        i. *If literate*; What is your education level?
            □ Primary (G4or G6) □ Secondary (G9) □ High (G12)
            □ Bachelor's degree □ Master's degree or higher
    g. Where are you from originally?
        □ Born here (village)
        □ Not born here*;* Originally from …….
        i. Why did you move here?
            ……
        ii. How long have you lived here?
            .....

2. What is your role in the household?
    □ Head of the household
    □ Other role…….....
    a. How many people are members of your household?.....
    b. How old is each member (please exclude yourself)?.....

iii.……...years old ii.……years old
iv.……years old ix.……years old
v.……years old x.……years old
vi.……years old xi.……years old
vii.……years old ii.……years old

    c. What is the highest education in your household at present?

□ Primary (G4or G6) □ Secondary (G9) □ High (G12)
□ Bachelor's degree □ Master's degree or higher

d. What language(s) is/are used mainly in your household?
□ (Central) Thai □ (Northern) Thai □ Karen □ Lua
□ Hmong □ Other……..…..

Forest Change Causes – Economic Factors (Farm Profitability, Alternative Sources of Income); Responses towards Shifts in Profitability

2. What do you do for a living/what is/are your occupation(s)?
   a. □ Farmer
   b. □ Labourer
      □ Labourer in the agricultural sector
      □ Labourer in another sector (e.g., industrial)
   c. □ Other……

3. *If a farmer*; How long have you been a farmer?……...

4. Please describe your crop production (*fill table below*).

	Crop 1	Crop 2	Crop 3
Crop Type	……...	……...	……...
(a) Amount of land (Rai)	……...	……...	……...
(b) Annual production (kg)	……...	……...	……...
(c) Reason for growing	……... ……. ……. ……. …….	……... ……. ……. ……. …….	……... ……. ……. ……. …….
(d) Profitability	□ Yes □ No	□ Yes □ No	□ Yes □ No
(i) Past profitability	□ More □ Less	□ More □ Less	□ More □ Less
(ii) Measures taken/need to take to keep crop profitable	……... ……. ……. ……. …….	……... ……. ……. ……. …….	……... ……. ……. ……. …….
	Crop 4	Crop 5	Crop 6
Crop Type	……...	……...	……...
(a) Amount of land (Rai)	……...	……...	……...
(b) Annual production (kg)	……...	……...	……...
(c) Reason for	……...	……...	……...

growing	…… …… …… ……	…… …… …… ……	…… …… …… ……
(d) Profitability	□ Yes □ No	□ Yes □ No	□ Yes □ No
(i) Past profitability	□ More □ Less	□ More □ Less	□ More □ Less
(ii) Measures taken/need to take to keep crop profitable	…… …… …… …… ……	…… …… …… …… ……	…… …… …… …… ……

5. Do you have any other income source(s) than farming?
   □ Yes □ No
   a. *If yes;* What are your other income sources?
      □ Job/business in city □ Livestock □ Tourism
      □Other(s)……
   b. Why do you need other income sources?
      ……
      ……

6. Has any of your land become more/less valuable in your eyes?
      □ Yes, some of my land has become: □ More valuable □ Less valuable
      □ No
      (Please explain your answer)
      ……
      ……
   a. Have you ever sold/permanently abandoned/contributed land for conservation because of low profits?
      □ Yes □ No
   (Please explain your answer)
   ……
   ……
   ……

7. Do you think young people/your children want to farm/take over your land when you/parents retire?
      □ Yes (Please explain)
      ……
      ……
      ……
      □ No (Please explain)
      ……
      ……
      ……
   a. How do you feel about this?
      ……

……
……
……

b. *If a parent;* Do you wish that your children become/continue as farmers?
□ Yes □ No

(Please explain your answer)

……
……
……

c. Would you sell/permanently abandon/contribute land for conservation if your children will not be farmers/have no one to pass it on to?
□ Sell □ Permanently abandon
□ Contribute land for conservation □ Other…….

(Please explain your answer)

……
……
……

Forest Change Causes - Conservation Pressure (Forest Policies);
Responses towards Forest Policies (Impacts of Conservation Pressure)

8. Do you have any land title deeds? □ Yes □ No
   a. *If yes;* Which one(s) and how many?
      i. House land title deed □ Yes □ No
         1. *If yes;* Size of land
            …….....
      ii. Farm land title deed □ Yes □ No
         1. *If yes;* Size of land title deed
            …….....
   b. *If no;* Why?
      ……
      ……...……...
      ……...…….
9. Have you ever heard of community land deeds? □ Yes □ No
   a. Do you know how to apply for a community land deed?
      □ Yes □ No
   b. Have you ever received training for the application process?
      □ Yes □ No
      i. *If yes;*
         1. When was that?.....
         2. From who?.....
      ii. *If no;* Would you be interested in being trained?
         □ Yes □ No
         1. Why?.....
            .....……
10. Were you/are you allowed to claim land before/since 2016?

□ Yes □ No □ Don't know

a. *If yes;* Are there any conditions (e.g., from the RFD/DNP)?
   □ Yes □ No □ Don't know
   i. *If yes*; What are they?
      .....
      .....
      .....
   ii. Have the conditions changed over time?
      □ Yes □ No □ Don't know
   iii. How have they changed?
      .....
      .....
      .....
   iv. What do you think of the conditions?
      .....
      .....
      .....
      .....

b. *If no;* Why?
   .....
   .....

11. Have you/others ever:
   a. Claimed new land before/since 2016? □ Yes
      □ No
      i. How much land?
         .....
      ii. Why?.....
         .....
         .....
   b. Stopped claiming new land before/since 2016? □ Yes
      □ No
      i. How much land? (in Rai)
         .....
      ii. Why?.....
         .....
         .....

12. Have you/others ever:
   a. Permanently stopped cultivation of any fields before/since 2016?
      □ Yes □ No
      i. How much land? (in Rai)
         .....
      ii. Why?.....
         .....
         .....
   b. Renewed cultivation of any fields before/since 2016?
      □ Yes □ No

i. How much land? (in Rai)

……

ii. Why?.....

.....

.....

13. Were you/have you been living:
    a. In any kind of protected area before/since 2016?
        □ Yes □ No
        i. *If yes*; What kind of protected area?
            □ National Park □ Wildlife Sanctuary
            □ National Forest Reserve □ Land Reform Project
            □Other……
    b. Close to any kind of protected area before/since 2016?
        □ Yes □ No
        i. *If yes*; What kind of protected area?
            □ National Park □ Wildlife Sanctuary
            □ National Forest Reserve □ Land Reform Project
            □Other……

14. Do you know which areas around here (village) have been/are off-limits for claiming land? □ Yes □ No
    a. Do you know exactly where the limits were before/since 2016/?
        □ Yes □ No
        i. How do you know this (e.g., are there/lack of signs, fences to demarcate restricted areas)?

            ……

            ……

            ……
    b. Do you know when the limits were decided? □ Yes □ No
        i. *If yes*; When?

            ……....
    c. Have the limits ever changed? □ Yes □ No
        i. Has the enforcement of these limits changed since as long as you can remember (e.g., more/less warnings, fines, land confiscation, arrests)? □ Yes □ No
        ii. *If yes;* How?

            .....

            ……

            ……

            ……

    d. Do you know who was responsible for deciding the limits?
        □ Yes □ No
        i. Did the Sub-District Administrative Organization have a role?
            □ Yes □ No
            (Please explain your answer)

            ……..

……..

ii. Did the *Kamnan* have a role?
□ Yes □ No
(Please explain your answer)
……..
……..

iii. Did the *Phu Yai Ban* have a role?
□ Yes □ No
(Please explain your answer)
……...
……..

1. Did his assistant(s) have a role?
□ Yes □ No

(Please explain your answer)
……...
……..

iv. Did the village committee have a role?
□ Yes □ No

(Please explain your answer)
……..
……..

v. Was anyone else involved?
□ Yes □ No
1. *If yes;* Who, and what was their role?
.....
.....

e. Were you/others ever consulted regarding the establishment of the limits?
□ Yes □ No
i. *If yes;* How was this done?
……
……
……
……
……
……

ii. *If no;* Why not?
……
……
……
……..

f. How have you/others responded to the establishment of the limits?
……

……
……
……
……

iii. Have you/others ever (officially/unofficially) resisted the limits?
□ Yes □ No
(Please explain your answer)
.....
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.....
.....

iv. Have you/others had any conflict(s) about the limits with the government? □ Yes □ No
(Please explain your answer)
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.....
.....

i. Have you/others ever had any conflict(s) about the limits within your/other villages? □ Yes □ No
(Please explain your answer)
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i. Have you/others cooperated with the authorities regarding the limits?
□ Yes □ No
(Please explain your answer)
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.....

b. Do you know if there any rewards for helping to monitor the limits?
□ Yes □ No
(Please explain your answer)
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.....
.....

b. Do the limits affect your livelihood?
□ Yes □ No

i. *If yes*; How?
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……

……..……..……...
……

ii. *If no*; Why not?

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..……..……..……...
……

c. How satisfied are you/others regarding the limits (*please choose one*)?

(a) Very satisfied
(b) Satisfied
(c) Somewhat satisfied
(d) Neutral
(e) Somewhat unsatisfied
(f) Unsatisfied
(g) Very unsatisfied

i. Why do you feel this way?

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ii. What would you like to see changed/maintained in future land cover demarcation processes?

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……

Causes - Personal Cognitions and Environmental Discourses;
Discussion of Personal Responses towards Specific Land Use Changes

15. Have your views on clearing forests for agriculture changed since you were a child? □ Yes □ No
(Please explain your answer)
.....
.....
.....

16. Are there people inside/outside your community trying to convince villagers to conserve forests, other than the government?
□ Yes □ No

a. *If yes;* Who are they and what do they do?

.....
.....

17. Has forest quality in the area changed (e.g., more/less trees than before)?

□ Yes □ No

(Please explain your answer)

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……

APPENDIX III

Interview Guide for Key Informants and Secondary Actors

Participant code: ……
Interview date: ……

Causes of Forest/Agricultural Changes – Economic Factors (Farm Profitability, Alternative Sources of Income); Responses Towards Shifts in Profitability

1. Do you know of any profitability problems for farmers in the area?
   □ Yes □ No
   a. *If yes;* (Explain)
      ……
      ……
      ……
      ……
      ……
   b. What do you think are the causes?
      .....
      ……
      ……
      ……
   c. What do you think the consequences (positive/negative) have been?
      i. Positive consequences
         ……
         ……
         ……
         ……
      ii. Negative consequences
         ……
         ……
         ……
         ……
   d. How have farmers responded to profitability problems (e.g., finding off-farm jobs, selling/permanently abandoning land, claiming more land)?
      ……
      ……
      ……
      ……
      ……
      i. Why do you think they have responded this/these way(s)?
         ……
         ……
         ……
         ……

ii. What do you think of this/these response(s) (e.g., it/they had positive/negative impact(s), were/weren't necessary)?
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Causes of Forest/Agricultural Changes - Conservation Pressure (Forest Policies); Responses towards Forest Policies

2. *If the interviewee is a village official;* is the village situated (*ask to point on a map*):

a. In any kind of protected area?
□ Yes □ No
i. *If yes*; What kind of protected area?
□ National Park □ Wildlife Sanctuary
□ National Forest Reserve □ Land Reform Project
□Other……

b. Close to any kind of protected area?
□ Yes □ No
i. *If yes*; What kind of protected area?
□ National Park □ Wildlife Sanctuary
□ National Forest Reserve □ Land Reform Project
□Other……

3. *If the interviewee is not a village official;* Which areas in Mae Chaem district are in/close to a protected area (*ask to point on a map*)?
……
……

4. Has forest quality in the area (village/district) changed (e.g., more/less trees)?
□ Yes □ No

a. *If Yes*; How?
……
……

b. Which areas have been deforested (*ask to point on a map*)?
……

c. What are the causes?
……
……
……

d. Which areas have been reforested (*ask to point on a map*)?
……

e. What are the causes?
……
……
……

5. What forest laws/regulations exist in the area (village/district)?

……
……
……

   a. How have they changed, as far back as you can remember?

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……
……
……

6. What do you think of the forest laws/regulations in the area (village/district)?

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……
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……..……..

   a. Have your views on these laws/regulations changed over time?

□ Yes □ No

      i. *If yes;* How and why?

……....
……
……
……

      ii. *If no;* Why?

……
……
……

7. What year was Mae Tho National Park founded?.....

8. Can you explain the demarcation process of Mae Tho National Park?

.....
……
…….....
.....
.....

9. Are there any kind of land title deeds which exist in the area (village/district)?

□ Yes □ No

   a. *If yes;* What kind of individual/community land title deeds exist in the area?

……..……
.....
.....

   b. *If no;* Why?

……..……
……..…….....
.....

   c. How can people apply for an individual/community land title deed?

……

……
……

d. Have people/villages in the area ever applied for an individual/community land title deed?

□ Yes □ No

10. Are people living within Mae Tho National Park allowed to claim land?

□ Yes □ No

a. *If yes;* Are there any conditions (e.g., giving back land for reforestation) from the government?

□ Yes □ No

i. What are they?

……
……
……

ii. Have the conditions changed over time?

□ Yes □ No

1. *If yes*; How?

……
……
……

2. What do you think of the conditions?

……
……
……
……
……

3. *If no;* Why not?

……
……
……
……

b. Have there ever been any conflicts in the district regarding permanently abandoned land?

□ Yes □ No

(Please explain your answer)

……
……
……
……

c. Have there ever been any conflicts in the district regarding forest regeneration/reforestation?

□ Yes □ No

(Please explain your answer)

……
……

……
……

d. Has there ever been a case in the district where reforested/regenerated land was illegally claimed?
□ Yes □ No
(Please explain your answer)
……
……
……
……

18. Do you know which areas in the district are off-limits for claiming land?
□ Yes □ No

a. Do you know exactly where the limits are? □ Yes □ No
   i. How do you know this (e.g., are there/lack of signs, fences to demarcate restricted areas)?
   ……
   ……
   ……

b. Do you know when the limits were decided? □ Yes □ No
   i. *If yes*; When?
   ……....

c. Have the limits ever changed? □ Yes □ No
   i. Has the enforcement of these limits changed since as long as you can remember (e.g., more/less warnings, fines, land confiscation, arrests)? □ Yes □ No
   ii. *If yes*; How?
   .....
   ……
   ……
   ……
   ……

d. Do you know who was responsible for deciding the limits?
□ Yes □ No
   i. Did the Sub-District Administrative Organization have a role?
   □ Yes □ No
   (Please explain your answer)
   ……..
   ……..
   ii. Did the *Kamnan* have a role?
   □ Yes □ No
   (Please explain your answer)
   ……..
   ……..
   iii. Did the *Phu Yai Ban* have a role?
   □ Yes □ No

(Please explain your answer)

……...

……..

2. Did his assistant(s) have a role?

□ Yes □ No

(Please explain your answer)

……...

……..

iv. Did the village committee have a role?

□ Yes □ No

(Please explain your answer)

……..

……..

v. Was anyone else involved?

□ Yes □ No

3. *If yes;* Who, and what was their role?

.....

.....

.....……

e. Were you/villagers ever consulted regarding the establishment of the limits?

□ Yes □ No

i. *If yes;* How was this done?

……

……

……

……

ii. *If no;* Why not?

……

……

.....……

……..

f. How have farmers responded to the establishment of the limits?

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……

i. Have farmers (officially/unofficially) resisted the limits?

□ Yes □ No

(Please explain your answer)

……..

……..

……

ii. Have there been any conflict(s) between villagers/other villages and the government? □ Yes □ No
(Please explain your answer)
.....
.....
.....
.....

i. Have there been any conflict(s) between villagers/other villages regarding the limits? □ Yes □ No
(Please explain your answer)
.....
.....
.....
.....

iii. Have farmers cooperated with the authorities regarding the limits?
□ Yes □ No
(Please explain your answer)
……..
……..
……

d. Do the limits affect farmers' livelihoods?
□ Yes □ No

i. *If yes*; How?
……
……
……
..……..…….……...
……

ii. *If no*; Why not?
……
……
……
..……..…….……...
……

e. Do you know if there any rewards for helping to monitor the limits?
□ Yes □ No
(Please explain your answer)
……...……
……..……
……...

e. How satisfied are you/others regarding the limits (*please choose one*)?

(a) Very satisfied
(b) Satisfied
(c) Somewhat satisfied
(d) Neutral

(e) Somewhat unsatisfied
(f) Unsatisfied
(g) Very unsatisfied

i. Why do you feel this way?
……
……
……
……

ii. What would you like to see changed/maintained in future land cover demarcation processes?
……
……
……
……

Causes of Forest/Agricultural Changes - Personal Cognitions and Environmental Discourses; Discussion of Personal Attitudes Towards Specific Land Use Changes

11. Have your views/communities' views on clearing forests for agriculture changed over time?
□ Yes □ No

a. (Please explain)
.....
.....
.....

12. Are there people/organizations, other than the government, who try to convince villagers to conserve forests?
□ Yes □ No

a. *If yes;* Who are they, what and how do they encourage?
.....
.....
.....