Translating Forest Landscape Restoration (FLR) into practice in the context of climate change: a case study in Northern of Vietnam

by

Le Thi Hai Yen

Submitted in partial fulfilment of the requirements for the degree of
Master of Environment (Advanced)
of the Australian National University
October 2025

Candidate's Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of the author's knowledge, it contains no material previously published or written by another person, except where due reference is made in the text.

Le Thi Hai Yen

Date: 23/10/2025

Acknowledgements

I could not have completed my thesis without the support of many people. First and foremost, I extend my sincere appreciation to my supervisor, Professor Peter Kanowski, for his invaluable guidance, patience, and thoughtful feedback throughout my research journey. I am deeply grateful for the time and care he devoted to supporting international students like me, even outside working hours, to ensure I met each thesis's milestone on time. I still remember his attendance at my evening proposal presentation with the local host university to provide his support, and how he called to share in my excitement when we learnt that my fieldwork had been funded. I also feel very fortunate to have attended his classes during both the first and second semesters of my master's program which provided a strong foundation for my research.

My heartfelt thanks go to Professor Trần Thị Thu Hà from Thai Nguyen University Agriculture and Forestry (TUAF) for her personal support of my fieldwork, for her kind advice throughout my thesis year; and for facilitating fieldwork through TUAF. I am also sincerely grateful to the ANU Fenner School of Environment & Society for providing additional funding to support my fieldwork and institutional assistance during my thesis year.

I would like to acknowledge my colleagues at TUAF - Huyền, Nhung, Đức and Tuân - for their invaluable assistance during fieldwork in Vietnam. I am especially thankful to the village leaders and community members who warmly welcomed me, shared their time, and contributed their valuable perspectives to this study. I also thank Dr Phúc Tô, who kindly connected me with interviewees from in-country NGO representatives.

I wish to extend my appreciation to Dr Pele Cannon, my course convener, whose workshops have been both inspiring and instrumental in broadening my academic understanding. My sincere gratitude also goes to Dr Jillian Schedneck from the ANU Academic Skills team, who spent the past month providing thoughtful feedback on my writing, and to Dr Nguyễn Thị Hồng Yến, Oxford University, my former colleague, dear friend now, for her valuable comments and encouragement on my thesis.

I am also deeply thankful to my Honours & Master's cohort at F.106, as well as the JC members, for their friendship and encouragement, which made this journey enjoyable.

I am profoundly grateful to the Australia Awards Scholarship for funding my two years of study at the Australian National University. This opportunity has been truly transformative, enriching both my academic development and personal experience.

Finally, I wish to express my deepest appreciation to my family back home for their unwavering love, support and belief in me.

Thank you all for being part of this special milestone in my life.

Abstract

Vietnam has long experienced deforestation and forest degradation, leaving it highly exposed to the effects of climate change. Forest Landscape Restoration (FLR) is an important approach internationally to address forest loss, mitigate climate change, and improve human wellbeing. Since the 1990s, the Government of Vietnam has implemented key policies aimed at advancing FLR, primarily through exotic plantation projects. However, there is limited empirical research in Vietnam that examines the social impacts of these tree plantations, the benefits of these programs, and how policies are implemented in practice to achieve FLR goals through tree planting initiatives.

This study draws on an analytical framework adapted from Chazdon and Brancalion (2019) to examine how FLR concepts are interpreted and implemented in Vietnam, by exploring perspectives about FLR policies, and ecological and livelihood outcomes. It used a qualitative case study approach in Thai Nguyen Province, northern Vietnam, to address these issues, paying particular attention to gender, wealth class and intergenerational perspectives. Data were collected between June to July 2025 from interviews of 8 expert stakeholders, and 32 semi-structured interviews and 8 gender-differentiated focus group discussions across four villages. Thematic analysis was used for data interpretation.

Results reveal that FLR using exotic (primarily acacia) monocultures has prioritised a single objective, economic development, over ecological considerations, and this has led to trade-offs in the face of climate change. While acacia plantations provide greater economic benefits, they face pest and disease outbreaks, support less biodiversity, and provide limited ecosystem services and reduced climate resilience. The expansion of exotic plantations also exacerbates and reinforces existing social inequities and limits equitable participation in FLR activities, particularly affecting poor households, women and youth, as their specific needs are not adequately addressed.

The study identifies a number of key implications. The first is strengthening Research and Development (R&D) to ensure sustainable acacia wood supply and management practices in the short term, while exploring the potential for native Vietnamese species to enhance ecosystem services, livelihood resilience, and climate adaptability in the longer term. The second is diversifying people's livelihoods rather than relying mainly on acacia plantations to strengthen community resilience. The third is diversifying FLR based on land use types, by adopting agroforestry systems and fostering natural regeneration, to achieve both ecological and social goals, including food production, improved soil health, and carbon sequestration.

In addressing climate change, it is crucial to balance the social and ecological aspects of FLR. This requires integrated and adaptive management strategies and supportive policies that promote long-term human well-being and environmental health, rather than focusing primarily on short-term gains.

Table of Contents

List of Figures

List of Tables

List of acronyms and abbreviations

CLC Climate Learning Centre

FFS Farmer Field School

FGDs Focus Group Discussions

FLR Forest Landscape Restoration

FSC Forest Stewardship Council

IUCN International Union for Conservation of Nature

NP National Park

PAM Programme Alimentaire Mondial

PFES Payments for forest environmental services

R&D Research and Development

REDD+ Reducing emissions from deforestation and forest degradation in developing countries

TUAF Thai Nguyen University Agriculture and Forestry

UN United Nations

WRI World Resources Institute

Chapter 1: Introduction

1.1 Background

People depend on forests for resources such as wood, medicine, fuel, and other ecological services (FAO and UNEP, 2020; Garrett *et al.*, 2022). However, human activities have been a major contributor to deforestation and forest degradation. Growing concern over forest loss has led to various forest restoration efforts, including tree planting, for purposes such as water retention, food security, energy provision, climate regulation, and biodiversity conservation (IUCN and WRI, 2014). In response to these issues, the term Forest Landscape Restoration (FLR) has emerged to describe the key approaches to achieving a positive outcome from these efforts for human well-being, climate change mitigation, biodiversity conservation, and sustainable development (Fagan *et al.*, 2020). There are many options for implementing FLR, but tree plantations, particularly using exotic species, have been the main approach globally to restoring forests (Katila *et al.*, 2024). Many countries around the world have made voluntary commitments to implement forest landscape restoration through various international initiatives, such as the Bonn Challenge (Mansourian *et al.*, 2017). However, different countries have distinct social-ecological contexts that influence how FLR is, or should be, applied. In addition, the concept of FLR is broad and often lacks clear guidelines for local-level implementation, which contributes to varied interpretations and practices across regions (Stanturf *et al.*, 2019).

Most FLR initiatives are implemented in low-income countries where communities heavily depend on forests for their livelihoods (Katila *et al.*, 2024).While there is a growing body of literature on forest restoration, much of it focuses on technical aspects (Djoudi *et al.*, 2024; Shelton *et al.*, 2024). Less attention has been paid to the social impacts of FLR including social equity, land tenure, livelihood diversification, off-farm employment opportunities, and particularly how restoration activities affect communities that live near and rely on forest resources. For example, Adams *et al.* (2016) provided an example in China, where regulations to protect FLR activities prevented local community from harvesting timber and hunting wild pigs that damaged their annual crops, thereby affecting their food security.

Vietnam is one of the lower-middle-income countries that currently implements FLR activities, is also among the most climate-vulnerable nations, facing both extreme weather and gradual environmental changes. Vietnam has increasingly prioritised reforestation and afforestation over the past 30 years, aiming both to preserve natural forests and to rehabilitate degraded landscapes (Dang, 2022; McElwee, 2009). Since the late 1990s, nationwide forest restoration programs have sought to combat deforestation, improve ecosystem conditions, and enhance rural livelihoods (Ha *et al.*, 2022). These include a series of national policies and major programs promoting large-scale exotic tree plantations, which have significantly increased forest cover under 30% in 1993 to around 42% in 2018 (Crowther *et al.*, 2020; Dang, 2022; Ha *et al.*, 2022; McElwee, 2009).

However, as noted by Ha *et al.* (2022) these FLR programs have emphasised tree plantations rather than the broader range of FLR approaches, and their social implications remain insufficiently understood in Vietnam (Ha *et al.*, 2022; McElwee and Nghi, 2021). Some studies argue that tree plantations disproportionately benefit wealthier individuals, raising concerns about their effectiveness in improving livelihoods for poorer communities (McElwee, 2009; McElwee and Nghi, 2021; Nielsen *et al.*, 2018). Furthermore, the long-term success of FLR depends on greater stakeholder participation, particularly at the community level (McElwee and Nghi, 2021; Shelton *et al.*, 2024). FLR is intended to deliver benefits for both ecosystems and livelihoods (Ha *et al.*, 2022) but empirical research in Vietnam on the social impacts of tree plantations project remains limited. Gaining a clearer understanding of these impacts is essential to guide the future development of FLR programs in the country.

Northern Vietnam was selected as the focal area for this study because it features extensive forest plantations and communities that are already experiencing the impacts of climate change (Ha *et al.*, 2020; Son *et al.*, 2023). The region contains widespread forests and numerous ethnic communities living in midland to highland areas, where livelihoods depend heavily on forest resources (Son *et al.*, 2023). Climate change is already disrupting rural life, reducing livelihood options, threatening food security, and intensifying environmental degradation. These climate impacts are likely to continue shaping both rural livelihoods and the success of FLR activities.

1.2 Research purpose and questions

This thesis aims to contribute to the literature on how FLR is conceptualised from a global perspective, understood and practice in the Vietnam in the face of climate change. It builds on previous studies that examined community perspectives on tree plantations as a primary FLR intervention and their impacts on local livelihoods. Taking a case study approach in Thai Nguyen province in the northern Vietnam, this thesis addresses the following research questions, which were developed on the basis of the literature review reported in Chapter 2:

In the context of climate change:

1. *What is the policy framework for FLR in northern Vietnam, and how is it translated into practice?*

2. *How do community perspectives on FLR in Northern Vietnam?*

3. *What are the potential livelihood impacts of FLR on local communities in northern Vietnam?*

4. *What are the implications of these findings for the effectiveness of FLR policies and strategies in northern Vietnam?*

1.3 Thesis outline

The thesis comprises six chapters, including the Introduction. Chapter 2 explores a review of the relevant literature including the history, concept and implementation of FLR in both the global and Vietnam context. Chapter 3 presents the research methodology, focusing on the qualitative design, approach and introducing the case study area. Chapter 4 presents the results based on data collected in Thai Nguyen province, Vietnam. Chapter 5 discusses the key findings and provide implications of for the effectiveness of FLR policies in the northern of Vietnam and global FLR discourse. Finally, Chapter 6 concludes the thesis by synthesising main findings in relation to the research questions and objectives, discussing the study's limitations, and noticing future research.

Chapter 2: Literature Review

This literature review highlights the importance of researching discussions around the concept of FLR at both the global and Vietnam levels, as well as the gaps in understanding of its social impacts, particularly regarding well-being, livelihoods, community perceptions, and the broader effects of climate change in Vietnam, especially in the Vietnam northern regions.

2.1 Forest landscape restoration - international contexts

This section begins by outlining the history, concept, and global implementation of FLR.

2.1.1 History

Forests play a crucial role for both humans and animals and are a primary source of livelihood for millions who rely on them for food, medicine, and ecosystem services such as water and energy (FAO and UNEP, 2020; Garrett *et al.*, 2022). However, nearly half of tropical forests have been lost since 1960s (IUCN, 2021). Over the past decades, human activities, particularly agricultural expansion to feed growing global population, have been a major driver of deforestation and forest degradation (Adams *et al.*, 2016; FAO and UNEP, 2020; IPBES, 2019; Erbaugh and Oldekop, 2018). As global attention increasingly focuses on climate change mitigation and biodiversity conservation, forest loss has become a central concern in international environmental policy (Katila *et al.,* 2024). In response, various international agreements have been established to encourage both developed and developing countries to take action on global environmental challenges (Chazdon *et al.*, 2020). FLR has emerged as a recognised approach to address these issues, providing multiple social, economic, and ecological benefits while combating deforestation and forest degradation (Chazdon *et al.*, 2017; Di Sacco *et al.*, 2021; Mansourian *et al.*, 2017; Shelton *et al.*, 2024).

International commitments have brought forest landscape restoration (FLR) to the forefront of global discussions on addressing climate change and enhancing human well-being (Fagan *et al.*, 2020). Its formal significance was recognized in 2008 when the United Nations (UN) incorporated forest carbon stock enhancement into the REDD+ framework under the UN Framework Convention on Climate Change (UNFCCC) (Di Sacco *et al.*, 2021), highlighting the importance of biodiversity conservation and local community participation. In 2011, The Bonn Challenge, is a global initiative with the goal of restoring 150 million hectares of degraded and deforested land by 2020 and 350 million hectares by 2030 (Mansourian *et al.*, 2017; Shelton *et al.*, 2024). This effort underscores the role of FLR in promoting ecological restoration for both human and biodiversity benefits, restoring ecosystem functions and services while supporting human well-being (Adams *et al.*, 2016; Garrett *et al.*, 2022; Erbaugh and Oldekop, 2018; Shelton *et al.*, 2024).

FLR also contributes significantly to climate change mitigation by enhancing ecosystem resilience to extreme weather events and improving carbon storage and (Di Sacco *et al.*, 2021; Garrett *et al.*, 2022; Stanturf *et al.*, 2015). Since 2020, the importance of landscape restoration has been further emphasized through the UN Decade on Ecosystem Restoration initiatives and declarations (FAO and UNEP, 2020; Fischer *et al.*, 2021).

2.1.2 Concept and implementation

The concept of FLR is an integrated approach that emphasises not only ecological restoration but also the promotion of sustainable livelihoods and local well-being (Chazdon and Brancalion, 2019; Erbaugh and Oldekop, 2018; Fagan *et al.*, 2020). FLR aims to balance ecological health with social well-being, requiring active collaboration among multiple stakeholders, including governments, organisations, and local people (Erbaugh and Oldekop, 2018; Shelton *et al.*, 2024). Importantly, different FLR strategies can result in varied social and ecological outcomes and contribute to climate change mitigation, depending on the local context and conditions (Erbaugh and Oldekop, 2018). Although the objectives of FLR are broad, a guideline by IUCN and WRI (2014) identified seven categories of FLR interventions based on three main land uses: forest and, agricultural land, and protective areas and buffers (see Figure 2.1).

Land Use	Land sub-type	General category of FLR option	Description
Forest land Land where forest is, or is planned to become the dominant land use **→ Suitable for wide-scale restoration**	If the land is without trees, there are two options:	1. Planted forests and woodlots	Planting of trees on formerly forested land. Native species or exotics and for various purposes, fuelwood, timber, building, poles, fruit production, etc.
		2. Natural regeneration	Natural regeneration of formerly forested land. Often the site is highly degraded and no longer able to fulfil its past function – e.g. agriculture. If the site is heavily degraded and no longer has seed sources, some planting will probably be required.
	If the land is degraded forests:	3. Silviculture	Enhancement of existing forests and woodlands of diminished quality and stocking, e.g., by reducing fire and grazing and by liberation thinning, enrichment planting, etc.
Agricultural land Land which is being managed to produce food **→ Suitable for mosaic restoration**	If the land is under permanent management:	4. Agroforestry	Establishment and management of trees on active agricultural land (under shifting agriculture), either through planting or regeneration, to improve crop productivity, provide dry season fodder, increase soil fertility, enhance water retention, etc.
	If it is under intermittent management:	5. Improved fallow	Establishment and management of trees on fallow agricultural land to improve productivity, e.g. through fire control, extending the fallow period, etc., with the knowledge and intention that eventually this land will revert back to active agriculture.
Protective land and buffers Land that is vulnerable to, or critical in safeguarding against, catastrophic events **→ Suitable for mangrove restoration, watershed protection and erosion control**	If degraded mangrove:	6. Mangrove restoration	Establishment or enhancement of mangroves along coastal areas and in estuaries.
	If other protective land or buffer:	7. Watershed protection and erosion control	Establishment and enhancement of forests on very steep sloping land, along water courses, in areas that naturally flood and around critical water bodies.

Figure 2.1 The FLR options framework (reproduced from IUCN and WRI, 2014, p.39)

For example, forest land with minimal tree cover, restoration options can include planting trees or allowing natural regeneration, depending on the degree of land degradation (IUCN and WRI, 2014). On agricultural land that remains in use, restoration can involve integrating trees through agroforestry or improved fallow practices to enhance crop production and soil fertility (IUCN and WRI, 2014). In particular, IUCN and WRI (2014) also noted that agroforestry is particularly effective in regions practising shifting cultivation, as it can increase crop yields, provide fodder during the dry season, and improve soil quality.

FLR has been recognised by national leaders and made voluntary commitments (Fagan *et al.*, 2020; Katila *et al.*, 2024; Shelton *et al.*, 2024). Most FLR practices, with tree planting as the main strategy, are in low-income and tropical countries (Katila *et al.*, 2024). This is explained by the faster tree growth in the tropics, as well as the availability of land and cheap labour in these countries (Evans and Turnbull, 2004; Fagan *et al.*, 2020). Although FLR requires a comprehensive approach to achieve multiple goals, many debates suggest that FLR focuses primarily on technical aspects (Shelton *et al.*, 2024). Wortley *et al.* (2013) conducted a meta-analysis of academic studies from the past three decades and found that 94% focused solely on ecological factors. Others note that numerous FLR efforts, both in policy and on-the-ground activities, have overlooked the human perspectives that are integral to the concept (Shelton *et al.*, 2024), particularly social justice for people in low-income countries. For instance, Aichi Target 15 aimed to restore at least 15 per cent of degraded lands (CBD, 2020), but the selection of restoration sites has typically been based on biophysical criteria rather than social aspects (Reyes-García *et al.*, 2019). Di Sacco *et al.* (2021) and Shelton *et al.* (2024) highlighted that the success of reforestation programmes depends on long-term management strategies that meaningfully engage local communities who live near and rely on forest resources. Therefore, this highlights the need for a comprehensive framework to capture both the environmental and human dimensions of FLR initiatives.

Chazdon and Brancalion (2019) developed a framework to represent this complexity, as shown in Figure 2.2. The framework offers a holistic perspective on FLR, helping to understand how inputs, such as capital shocks and enabling conditions, and restoration benefits and outcomes are structured and interact in a non-linear way. According to Chazdon and Brancalion (2019), all elements within the framework are interconnected, for example, inputs depend on enabling conditions, which in turn influence restoration outcomes and community livelihoods. Livelihoods are understood through the five types of capital identified in the Sustainable Livelihoods Framework (DFID, 1999). Furthermore, restoration outcomes depend on the costs and benefits of reforestation, which are shaped by forest governance, stakeholder engagement, and institutional support (Chazdon and Brancalion, 2019). Importantly, Chazdon and Brancalion (2019) emphasised that achieving long-term and multiple benefits from restoration programs requires consideration of both social well-being and economic factors.

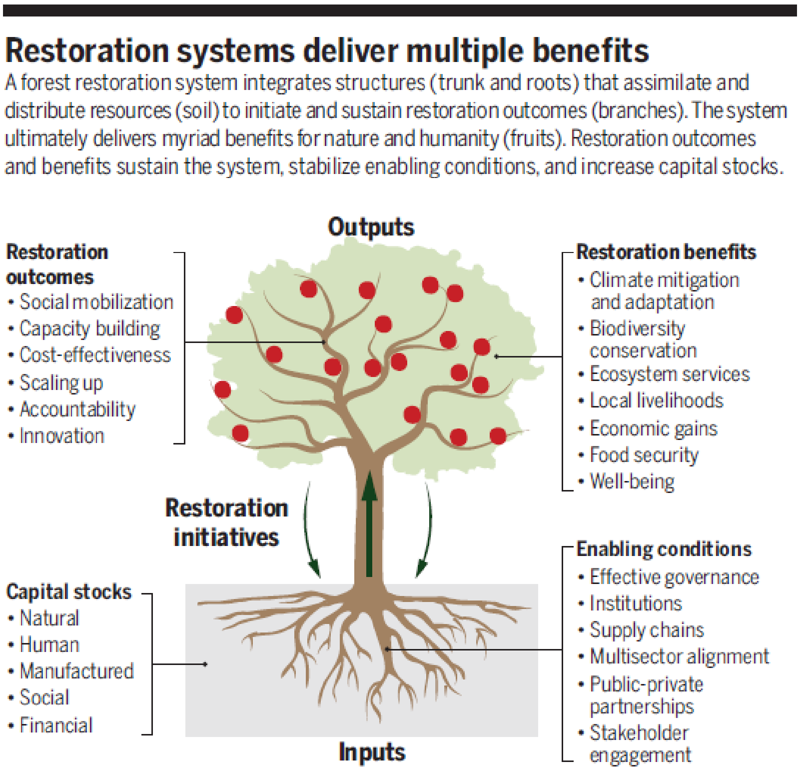

Figure 2.2 Forest Landscape Restoration Framework (reproduced from Chazdon and Brancalion, 2019, p.24)

Despite these limitations in considering trade-off outcomes and unforeseen effects, FLR remains a promising approach, supported by several international frameworks such as those under the Convention on Biological Diversity, the UN Framework Convention on Climate Change, and the United Nations Forum on Forests. Specifically, in line with the Bonn Challenge, the United Nations declared 2021–2030 as the Decade on Ecosystem Restoration to emphasise the role of healthy ecosystems in reversing environmental degradation and improving human well-being (Mansourian *et al.*, 2025). The Kunming-Montreal Global Biodiversity Framework reinforces this commitment by aiming to restore at least 30 per cent of degraded terrestrial, freshwater, coastal, and marine ecosystems by 2030 to enhance biodiversity and ecosystem resilience (DCCEEW, 2025). Similarly, the World Economic Forum's 1 Trillion Trees initiative, launched in 2020, seeks to protect and restore forests to tackle biodiversity loss and climate change (WEF, 2020). At COP 26 in 2021, more than 145 countries also pledged to end forest degradation by 2030 while fostering sustainability rural areas (Keenan *et al.*, 2024).

2.2 Forest landscape restoration in Vietnam

The second part of this literature review outlines the history of forest cover change and policies related to FLR, and then examines the current challenges of FLR approach through tree planting, along with the impacts of climate change in northern Vietnam. It is structured into four parts: History, current challenges, climate change in northern Vietnam, and summary of the chapter.

2.2.1 History

Vietnam has experienced severe deforestation and forest degradation (Cochard *et al.*, 2020; Dang, 2022; McElwee, 2009). Forest cover reduced sharply from 43% in 1943 to about 16–27% in 1993 (Crowther *et al.*, 2020; Dang, 2022). This decline was driven by many human activities, such as converting forest for agricultural expansion, exploitation of natural resources (Cochard *et al.*, 2020; McElwee, 2009), and the long-term damage caused by the American War in Vietnam. McElwee (2004) described the period from 1954 to 1980 as one of unregulated forest exploitation, during which land governance systems largely collapsed.

In the post-war period, high demand for timber for reconstruction and economic development led to excessive logging. In response, the Vietnamese Government introduced the Doi Moi reform in 1986, shifting toward a market-driven economy (Dang, 2022; McElwee, 2009). This included policies along with the allocation of forestry land to households and other related measures (Crowther *et al.*, 2020; Khuc *et al.*, 2020).

The most important land tenure policy introduced to curb logging and prevent conversion from open-access land was the Vietnamese government's classification of forests into three categories under the Law on Protection and Development of Forests enacted by the National Assembly in 1991 (Clement and Amezaga, 2008; Dang, 2022). According to Clement and Amezaga (2008); Sikor (2001); de Jong *et al.* (2006), these comprise:

- Special-use forests (*rừng đặc dụng*), designated for biodiversity conservation, natural landscape preservation, and the protection of areas with cultural or historical significance.
- Protection forests (*rừng phòng hộ*), established to maintain water resources, prevent soil erosion, and support the stability of special-use forests.
- Production forests (*rừng sản xuất*), designated for commercial purposes and primarily allocated to local communities.

While the management of Special-use and Protection forests remains under state authority, local communities may enter into contracts with government agencies to participate in sustainable forest management activities such as patrolling and tree planting. Notably, Article 3.1 of the Forest Law stipulates that forests comprise both planted forests (*rừng trồng*) and natural forests (*rừng tự nhiên*) (Decree 29/2004/QH11); however, the Law does not provide specific legal definitions for either forest (de Jong *et al.*, 2006).

More specifically, the Vietnamese government implemented significant policies during the 1980s–1990s that led to major reforestation initiatives aimed at increasing forest cover through exotic tree plantations (Dang, 2022; Khuc *et al.*, 2020). The government sets a national target to raise forest cover from under 40% in 2010 achieved over 45% by 2030 (Ha *et al.*, 2022; Dang, 2022). These national initiatives included Project PAM (Programme Alimentaire Mondiale, funded by the UN World Food Programme); Project 327 (Regreening the Bare Hills Project); and Project 661 (Five Million Hectare Reforestation Program) (Crowther *et al.*, 2020; de Jong *et al.*, 2006; McElwee and Nghi, 2021; Vu *et al.*, 2023).

These initiatives played a central role in Vietnam's forest recovery, focusing primarily on restoring degraded lands rather than preserving remaining natural forests through plantations (Clement and Amezaga, 2009; Dang, 2022; Kull *et al.*, 2023; Sandewall *et al.*, 2010). One of the main objectives of Project 661 was to convert degraded areas into smallholder forestry plantations, aiming to provide environmental benefits, economic opportunities, and improved livelihoods for poor rural communities (Dang, 2022; McElwee and Nghi, 2021). Specifically, with the rapid growth in global furniture demand and increasing international investments, the Government identified an opportunity to boost domestic sawlog production (Blackburn *et al.*, 2020). It explored whether farmers could enhance their plantation incomes by cultivating acacia for sawlogs (Blackburn *et al.*, 2020; Tham *et al.*, 2021). As a result, Vietnam has become one of the world's leading wood exporters (Blackburn *et al.*, 2020; Ha *et al.*, 2022; Nambiar, 2021; FAO, 2024). This development led to the expansion of acacia plantations through smallholder participation to meet growing demand.

In addition to these terrestrial initiatives, Vietnam has developed and implemented major programs for mangrove restoration, reflecting the significance and value of these forest systems along the country's extensive coastline. Mangroves play an important role in protecting coasts from soil erosion and storms, and have blue carbon potential as a form of climate mitigation and adaptation via reforestation, support livelihood resilience, and community development along the coastline (Ebeler *et al.*, 2025; Hai *et al.*, 2020). In Vietnam, mangrove restoration has been promoted through tree planting initiatives (Tinh *et al.*, 2022). However, similar to terrestrial restoration initiatives, mangroves restoration in Vietnam still face challenges, since the government focuses more on development than on long-term ecosystem and environmental outcomes, such as the transfer of mangroves to aquaculture for economic purposes, which leads to degradation (Tinh *et al.*, 2022). Therefore, to ensure sustainable outcomes, mangrove management should adopt a holistic and ecological-based framework that harmonises stakeholder interests and strengthens institutional coordination (Ebeler *et al.*, 2025).

2.2.2 Current challenges

Although national tree plantation programs have achieved successes in expanding tree cover, a body of academic literature has criticised elements of the national tree plantation programs in Vietnam (Arnold *et al.*, 2022; Crowther *et al.*, 2020; Dang, 2022; Frey *et al.*, 2018; McElwee and Nghi, 2021)

First, according to Ha *et al.* (2022), Vietnam's FLR initiatives have largely focused on establishing monoculture tree plantations rather than embracing a wider variety of FLR approaches, such as agroforestry or natural regeneration. This is likely because the government prioritises the economic advantages of commercial timber plantations for both farmers and the wider economy (Arnold *et al.*, 2022; Ha *et al.*, 2022), as discussed above. In particular, exotic plantation species are fast-growing and have been promoted to support the country's biomass goals (Blackburn *et al.*, 2020), as they can be harvested in under ten years compared with other native species. However, exotic species are considered controversial due to their lower biodiversity value and higher disease risk compared to native species (Crowther *et al.*, 2020).

Thus, tree plantation expansion is a relatively straightforward way to help meet expanding forest cover targets, which aligns with international reporting frameworks for forests and biodiversity (McElwee and Nghi, 2021). These frameworks tend to emphasise the extent of forest cover as a key goal or indicator, often achieved through tree plantations (Do and Mulia, 2018; Dang, 2022). However, Kull *et al.* (2023) argued that while forest cover calculations include all types of forests, tree plantations function differently from natural forests and do not represent fully functioning ecosystems.

Additionally, while FLR is inherently complex and intended to deliver multiple ecological, social, and economic benefits, as presented in Figure 2.2 (Chazdon and Brancalion, 2019; Shelton *et al.*, 2024). Vietnam's tree plantation implementation often prioritises outcomes which mainly focus on forest cover expansion over multifunctional restoration (Dang, 2022). This narrow focus may be driven by interpretations of international carbon schemes, such as Reducing Emissions from Deforestation and Forest Degradation (REDD+), and Forest Payments for Ecosystem Services (PFES). In addition, the government uses forest cover indicators to support programs including REDD+ and PES, offering financial incentives to encourage participation (Do and Mulia, 2018). While these program has shown promise in mobilising funding for forests based on their carbon sequestration value, its application in restoration contexts has faced significant challenges, as these programs may overlook the broader social and ecological costs and risks (Nielsen *et al.*, 2018). For example, To and Dressler (2019) noted that compensation in PES program in Vietnam is low, which keeps communities trapped in poverty while they lose access to natural forests. In addition, when setting ambitious targets such as the number of hectares reforested or trees planted is linked to substantial financial incentives, the emphasis often shifts from long-term ecological success to short-term achievements (Duguma *et al.*, 2020; Fleischman *et al.*, 2020).

Research on the social implications of tree plantation programs in Vietnam is still inadequate and lacks a comprehensive understanding (Ha *et al.*, 2022; McElwee and Nghi, 2021; Schirmer, 2007). For instance, Vu *et al.* (2023) commented that the land use tenure process, which classified three types of forests, has excluded communities from accessing natural forests, most of which are managed by the government. Nguyen and Kull (2023) further commented that the process creates both winners and losers in tree plantation activities. Some studies suggest that tree plantations often favour wealthier individuals who are able to claim large areas of land, raising questions about the ability of tree plantations to support livelihood goals for poorer communities (McElwee, 2009; McElwee and Nghi, 2021; Nielsen *et al.*, 2018). Although local people may have used land for many years, if they do not hold legal land tenure, the governments might consider it "available land" and take it over for tree plantation projects (Fleischman *et al.*, 2020); McElwee (2009) and Kull *et al.* (2023) argued that converting degraded natural forest land into tree plantations or establishing protected areas has had negative impacts on poorer people, especially women, because they have lost access to non-timber forest products used for immediate food and income, while tree plantations take years to provide returns. Additionally, replacing agricultural lands with tree plantations may result in job losses for farmers and higher food prices (Fleischman *et al.*, 2020). Furthermore, the impact on livelihoods is often oversimplified, focusing mainly on income for local communities (Shelton *et al.*, 2024), which might lead policymakers to lack a comprehensive understanding of community resilience in the face of climate change impacts.

In examining the social objectives of Vietnam's tree plantation initiatives, two main discourses emerge, both underscoring the limited attention given to the socio-economic outcomes for local communities, particularly the poor (Arnold *et al.*, 2022; Crowther *et al.*, 2020; McElwee and Nghi, 2021).

The first discourse concerns shifting cultivation, also referred to as slash-and-burn agriculture. This practice has long been part of the livelihoods of many ethnic minority communities residing in Vietnam's mountainous regions (Catacutan *et al.*, 2017; Vien, 2003). Despite its cultural and subsistence importance, shifting cultivation has often been criticised for contributing to deforestation and land degradation (To and Dressler, 2019; Vien, 2003). As a result, forest plantations have been promoted as a preferable alternative, particularly in upland areas where shifting cultivation is commonly linked with poverty (Van Mai and To, 2015; Vien, 2003). However, shifting cultivation provides immediate food security, while tree plantations take years to yield income (Khuc *et al.*, 2020). Unlike plantations that mainly generate timber revenue, shifting cultivation supports subsistence farming and small income opportunities (McElwee and Nghi, 2021). This leaves poorer households vulnerable when they lose access to land and short-term food sources. Furthermore, government led FLR programs promoting fast-growing exotic species and commercial crops such as acacia *(Acacia species)* have further limited rural land access, disproportionately affecting the poor (Khuc *et al.*, 2020; McElwee, 2009).

The second discourse concerns the expansion of exotic tree plantations in Vietnam, one of the most widely introduced non-native species, has become dominant across the country (Crowther *et al.*, 2020; Frey *et al.*, 2018; Nambiar, 2021). Establishing acacia plantations, however, demands considerable labour and financial investment over long rotation cycles (Frey *et al.*, 2018; Vu *et al.*, 2023). Smallholder farmers often struggle to adopt acacia cultivation compared with large-scale producers, particularly when they lack clarity about the most suitable tree species for their land (McElwee and Nghi, 2021). This issue has long been recognised in the literature, with growing concern that climate change could further intensify the challenges faced by poorer farmers relative to wealthier ones (FAO, 2024; Ha *et al.*, 2022; Keenan *et al.*, 2024) . Continued expansion of exotic plantations may also exacerbate social inequalities, particularly affecting poor households and women if their specific needs are not adequately addressed.

Finally, while the long-term success of FLR relies on increased stakeholder participation, especially at the community level (Erbaugh and Oldekop, 2018; Djoudi *et al.*, 2024), local communities in Vietnam have often been viewed as recipients of tree plantation projects rather than active stakeholders involved in local and national policy development (McElwee and Nghi, 2021). Additionally, it is consistently emphasised that FLR aims to improve both ecosystem functions and livelihoods (Erbaugh and Oldekop, 2018; Ha *et al.*, 2022). Therefore, gaining a clear understanding of the social impacts is crucial for guiding the future development of tree plantation and other FLR programs in Vietnam.

2.2.3 Climate change in Northern Vietnam

Vietnam extends across tropical and temperate climate zones and is influenced by the annual monsoon. The northern region experiences distinct seasonal variations, with average temperatures of 25°C in summer and 17°C in winter (World Bank, 2021). However, Vietnam is among the most vulnerable to climate change in Southeast Asia, experiencing both extreme weather events and gradual climatic shifts (Miller and Dun, 2019; Son *et al.*, 2023). In recent decades, there has been a noticeable rise in average temperatures along with marked changes in rainfall patterns (Schmidt-Thomé *et al.*, 2014). Rainfall has generally increased during the wet seasons, which supports flood control efforts (Schmidt-Thomé *et al.*, 2014)

Northern Vietnam is already experiencing the effects of climate change, including more frequent temperature extremes, droughts, and flooding (Schmidt-Thomé *et al.*, 2014; Son *et al.*, 2023). Most people in this region live in rural areas and belong to ethnic minority groups, with livelihoods largely dependent on agriculture and forestry (Son *et al.*, 2023). This dependence increases their vulnerability to climate impacts, as they are more exposed to rapid temperature changes, shifting weather patterns, and extreme events. Climate change is increasingly influencing all aspects of rural life, including livelihood opportunities, food security, and environmental outcomes (Do and Bui, 2023; Son *et al.*, 2023). These changes will continue to shape rural livelihoods and affect the implementation of FLR initiatives, particularly tree planting (Keenan *et al.*, 2024; Nambiar, 2021). Keenan *et al.* (2024) also noted as climate patterns shift, the suitability of land for different forest types will also change, with projections suggesting an overall increase in areas suitable for emphasised that adapting FLR to climate change requires renewed collaboration among scientists, forest managers, restoration practitioners, and local communities to generate relevant knowledge. This highlights the need to explicitly incorporate community perspectives and livelihood considerations into FLR planning under changing climatic conditions.

2.3 Summary

The literature review begins by outlining the background of FLR in both international and Vietnamese contexts over the past three decades. Despite the recognised importance of FLR through tree planting to combat forest loss and improve social and economic outcomes in Vietnam, and the growing awareness of climate change impacts in the northern regions, there remains limited understanding of the social objectives of government-led tree plantation initiatives.

Overall, this chapter provides a foundation for the thesis by examining the history of policies and projects related to forest restoration activities. It then helps identify research gaps to develop this study's research questions, focusing on understanding how FLR principles are put into practice, its social objectives, related challenges, and the potential impacts of these activities on livelihoods in the context of climate change. The next chapter presents the research methodology, research methods and the case study used to address the study's research questions.

Chapter 3: Methodology

This chapter outlines the qualitative research methods applied in this study and introduces the study area. It is structured into six sections: methodology; analytical framework; the case study area; fieldwork arrangement; research methods; and data analysis.

3.1 Methodology

This study employs a case study approach based in qualitative methodology to address the research questions. A qualitative case study is well-suited for in-depth exploration of contemporary phenomena within their real-life contexts, particularly when the distinction between the phenomenon and its context is unclear (Yin, 2016). This approach enables researchers to examine complex or simple situations and effectively investigate "how" and "why" questions (Baxter and Jack, 2008). Moreover, case studies provide opportunities to gain detailed insights and a comprehensive understanding of a specific case (Baxter and Jack, 2008)

3.2 Analytical framework

The analytical framework used in this study is adapted from the Forest Landscape Restoration Systems Framework developed by Chazdon and Brancalion (2019) (see Figure 2.2). I chose this framework for two reasons. First, it provides a comprehensive approach to representing the relationships between FLR activities and socio-ecological aspects in climate change context. Second, the framework aligns with the main topics addressed in this study's research questions, including understanding enabling policy conditions, assessing restoration benefits related to livelihoods, ecological aspects, and emphasising the five livelihood capitals.

Chazdon and Brancalion's (2019) framework of FLR was adapted for use as the analytical framework in this case study, as presented in Figure 3.2. The adapted framework makes explicit interplay among elements involved in FLR. These elements are adapted from the literature review within the Vietnamese context. This study used this analytical framework for three main purposes. First, the identified codes and potential themes informed the design of both semi-structured interview questions and FGDs used to address the research objectives. Second, they guided the coding process during the thematic analysis of the data. Lastly, this adapted framework gave me a structure for discussing the synergies and trade-offs between different FLR elements (i.e., livelihoods and ecosystems).

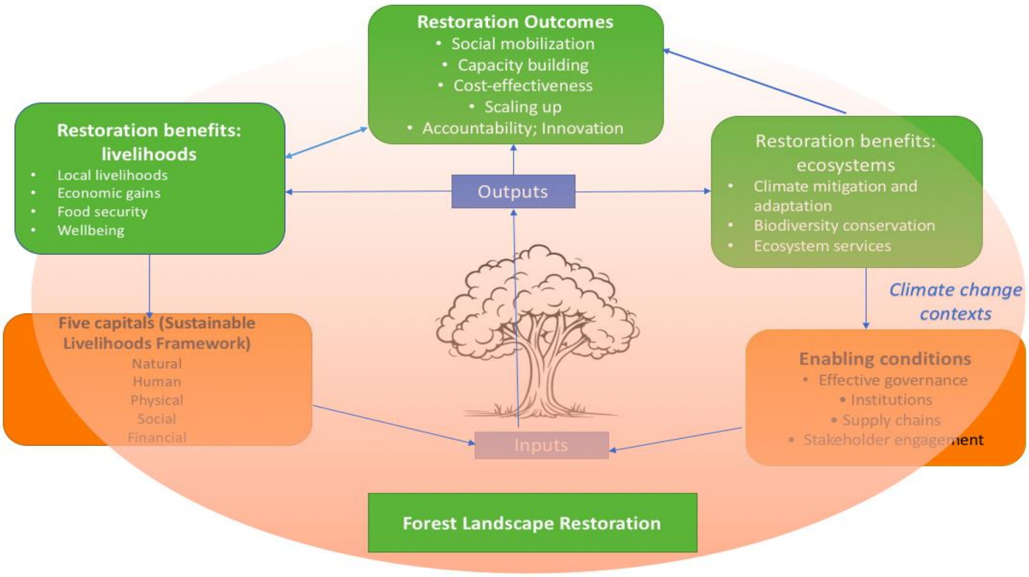

Figure 3.1 Forest Landscape Restoration Analytical Framework used in the case study, adapted from Chazdon and Brancalion (2019).

3.3 *The case study area*

This study was carried out in collaboration with the Climate Learning Centre (CLC) at Thai Nguyen University of Agriculture and Forestry (TUAF) in Northern Vietnam. Founded in 1969, TUAF conducts education, applied research, and technology transfer that promote socioeconomic development in the country's northern mountainous areas (TUAF, 2023). The CLC at TUAF is an initiative focused on capacity building, research, and academic exchange to strengthen community climate resilience and support Vietnam's net-zero emission target by 2050 (TUAF CLC, n.d). Its demonstration projects focus on areas essential to smallholder farmers and local communities, such as agriculture, land use and land-use change, forestry, energy and waste management (TUAF CLC, n.d). My research aims to both build on and contribute to the activities and outcomes of the Centre. TUAF generously provided funding support for the fieldwork conducted as part of this study.

This study took place in rural areas of Thai Nguyen Province, Vietnam, situated roughly 75 km north of Hanoi (Figure 3.3). After 1st July 2025, the Vietnamese Government enacted administrative reforms that merged the neighbouring Bac Kan Province into Thai Nguyen (retaining the name Thai Nguyen) and removed the district-level administrative unit (Decree No. 202/2025/QH15). However, this study presents information about the Province and Districts as it was before this change, as data collection was completed prior to this date.

Located in northern Vietnam, Thai Nguyen is a mountainous province with one of the highest forest cover rates in the Northeast region (Nguyen, 2018). Spanning about 356,000 hectares between latitudes 21°10'–22°04'N and longitudes 103°58'–104°45'E, the province features rugged terrain, a tropical climate, and the Tam Dao mountain range, which rises to 1,592 metres (Dong, 2018). Forests in the region play a key role in water regulation, agriculture, and sustaining rural livelihoods (Nguyen, 2018). According to Nguyen (2018), Thai Nguyen's forest cover is about 48%; between 2005 and 2015, natural forest decreased by 28,000 hectares, while planted forest increased by 44,000 hectares. Thai Nguyen has a population of around 1.3 million, with 30% belonging to ethnic minority groups and about 68% residing in rural areas (Dong, 2018; Ha *et al.*, 2020). Its economy is primarily agricultural, centred on green tea, timber and rice cultivation (Dong, 2018; Ha *et al.*, 2020).

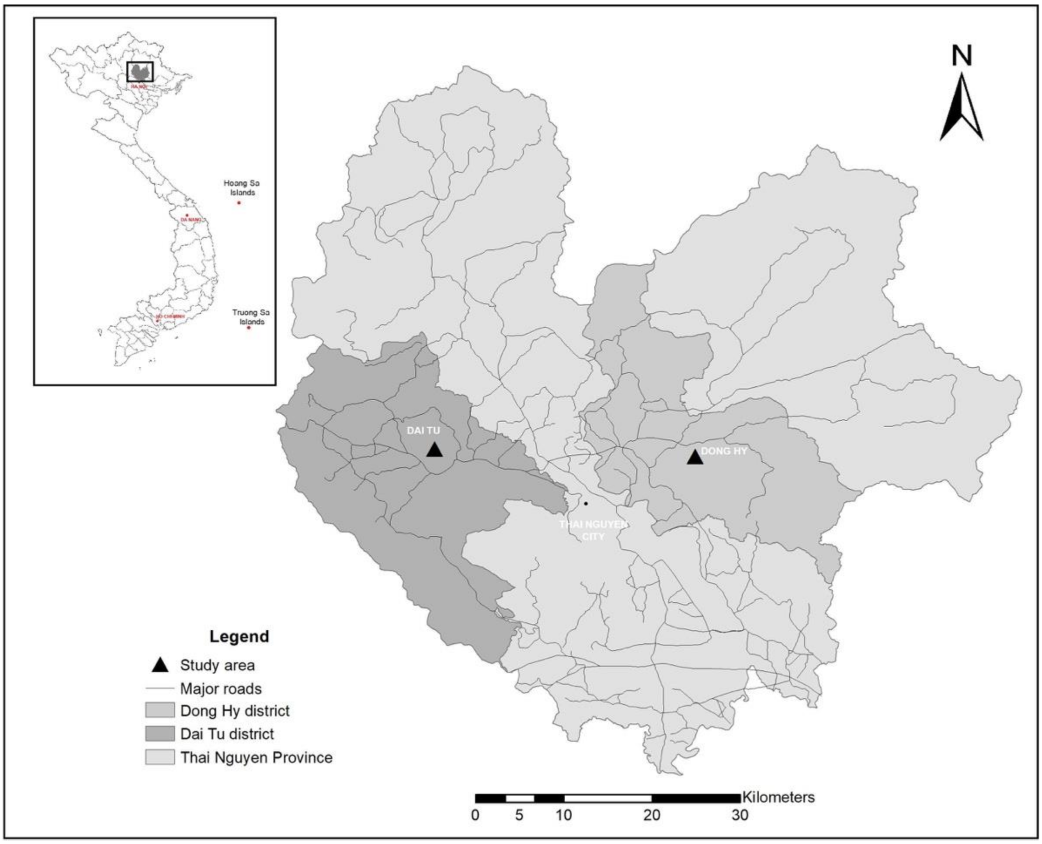

Figure 3.2 Location of Thai Nguyen province and study area in Vietnam (Source: The Climate Learning Centre, TUAF, Thai Nguyen, Vietnam)

Most specifically, the study focused within four villages within Dai Tu and Dong Hy Districts (see Figure 3.3), both of which having substantial forest coverage, accounting for 48% and 49% of their total land areas, respectively (BaoThaiNguyen, 2022; BaoThaiNguyen, 2024). These areas have promoted forest plantation development to reduce poverty, strengthen the rural economy, and create employment opportunities in the wood-processing industry (Nguyen, 2018).

3.4 Fieldwork arrangement

In consultation with TUAF CLC, I engaged with communities in four villages based on the following criteria: large areas of production forests, strong dependence of local livelihoods on forest-related activities, the presence or proximity of local communities to protection forests or

Tam Dao NP. These communities were already engaged in research activities with the TUAF CLC. A summary of the basic characteristics of the villages is presented in Table 3.1.

Community Characteristics	Village 1	Village 2	Village 3	Village 4
Year of establishment	1967	1962	1975	1975
Number of households	270	88	85	173
Population	1135	347	310	610
Number of near-poor and poor households in 2025	7	6	4	6
Majority ethnicity	Kinh	Kinh, Ngai	Dao	Kinh
Main type of remaining secondary/natural forest bordering the village.	None	Protection Forest	Tam Dao National Park	Tam Dao National Park; Protection Forest.
Total village area (ha)	1600	450	300	400
Total production forest area (ha)	500	200	70	130
Main plantation forest species	Acacia	Acacia	Acacia	Acacia
Main crops	Green tea	Green tea	Green tea	Green tea
Other livelihood systems	Rice, maize, cassava, livestock	Rice, maize, cassava, livestock	Rice, maize, cassava, beekeeping, medicinal plants.	Rice, maize, livestock

Table 3.1 Key characteristics of the four villages sampled in the case study

- *Participant recruitment process:*

To understand community perspectives across different backgrounds, I categorised participants according to the Vietnamese Government's rural wealth classification (poor, near-poor, non-poor households), as shown in Table 3.2. Under the government's Decree on Multi-dimensional Poverty Standards (2021–2025), households with a per capita income below VND 1.5 million per month are classified as poor or near-poor (Vietnamese Ministry of Labour & Invalids and Social Affairs, 2021).

	Poor households	Near-poor households	Non-poor households
Rural area	A household with a per capita monthly income of 1,5 million VND (92 AUD) or less and a deprivation in at least three criteria measuring the level of basic social service shortages.	A household with a per capita monthly income of 1,5 million VND (92 AUD) or less and a deprivation in fewer than three criteria measuring the level of basic social service shortages.	A household with a per capita monthly income of over 1,500,000 VND (92 AUD).

Table 3.2 Definition of the Vietnamese Government's wealth ranking for rural areas for the period 2021 – 2025 (Decree 07/2021/NĐ-CP).

To select community members to join the study, before commencing the fieldwork, I discussed my study with heads of each village, who were asked to provide a list of potential households to interview. I explained the study's purpose and inclusion criteria, which aimed to include households both with and without forest land, ensure equal representation across wealth categories, and capture diversity in gender and age. After the study's criteria were clarified, the village heads contacted potential villagers by phone call or via the Vietnamese Zalo chat app to ask if they were agreed to participate in the study. Each villager involved in this study received 50,000 VND (3 AUD), funded by the TUAF CLC.

To select interviewees from stakeholder groups, I first consulted with staff at the TUAF CLC to identify potential participants. Additional experts working in forestry and familiar with the study areas were later recruited using snowball sampling.

The ethics protocol for the study was approved by the ANU Human Research Ethics Committee (Protocol H/2025/0217). Participant materials, including the information sheet, guiding questions, and consent forms, are provided in the Appendices. The fieldwork was carried out over a period of five weeks, from 3 June to 3 July 2025, with the support of one research assistant from TUAF who helped with logistics and note-taking during FGDs. All participants in both interviews and FGDs provided written informed consent to allow data collection. All data were collected in Vietnamese, and interpreters were unnecessary as participants from ethnic groups were fluent in Vietnamese. In some semi-structured interviews, participants' spouses also took part, and in those cases, both were asked to give a joint response.

3.5 Research methods

The research methods used in this study comprise the literature review presented as Chapter 2, semi-structured interviews, and FGDs with participants contacted method mentioned at Chapter 3.4 above.

3.5.1 Semi-structured interviews

Semi-structured interviews were conducted to obtain detailed, practical, and context-specific information from local communities and stakeholders. The purpose was to understand participants' perceptions, values, and viewpoints regarding FLR activities. This approach provided flexibility in discussion, allowing for follow-up questions and deeper exploration of the factors influencing participants' responses (Gill *et al.*, 2008).

Semi-structured interviews were carried out with government officials, lecturers, and NGO representatives, and local community members. Each interview lasted about 45 minutes to one hour, as detailed below.

- Semi-structured interviews with experts and government officials

Semi-structured interviews were conducted with 8 individuals knowledgeable about FLR in the region to understand Research Question 1, which examines how FLR is framed and translated into practice in the study areas. Participants included 4 provincial-level government officials who manage protection forest, national parks or the forestry sector, 2 university lecturers, and 2 NGO representatives from both international and Vietnamese NGOs. Most interviews were conducted in person, except for one with a local Vietnamese NGO, which was held online. Each interview was conducted individually to allow participants from all stakeholder groups to express their views freely.

- Semi-structured interviews with individual villagers

In-person interviews were conducted with 32 local villagers at their home (8 participants per village × 4 villages). I initially planned to interview at least 5 poor and near-poor households in each village; however, the number of poor and near-poor households were low (see Table 3.1), and some were unavailable at the time of the interviews. Finally, in each village, I interviewed at least 3 households from the poor and near-poor categories, with the remaining participants from non-poor households. I also intended to include participants of different age groups, but most young people (under 35) had migrated out of the villages for work. As a result, participants' ages ranged from 35 to 81 years. 32 Community participants' characteristics were summarised in Table 3.2.

Characteristics of 32 community participants	**Number of participants**
Age	
35 - 39	7
40 - 49	5
50 - 59	9
> 60	11
Gender	
Female	14
Male	18
Wealth ranking	
Poor household	8
Near-poor household	5
Non-poor household	19
Production Forest land	
No forest land	6
Forest land under 1 ha	4
Hold forest land 1 ha <= 5 ha	15
Hold forest land > 5 ha	7

Table 3.3 Characteristics of the 32 individual villagers in the study.

3.5.2 Focus Group Discussions (FGDs)

FGDs are an effective way to gather a range of perspectives in a short period and to promote broader community participation (Yin, 2016). After completing semi-structured interviews with villagers, I conducted eight in-person FGDs across four villages, with two groups in each village (one for men and one for women) to complement individual perspectives on FLR activities and to explore whether there were gender-differentiated views. Separate groups for men and women were held to create a comfortable environment that encouraged rural women to speak openly without feeling inhibited by male dominance. Also, there was not overlap between individual interviews and focus groups. Each FGD included approximately 6–9 community participants with total participants are 61. Each discussion lasted approximately 1.5 hours and took place in community buildings.

3.6 Data analysis

I used thematic analysis to examine qualitative data from both semi-structured interviews and FGDs. All interviews were audio-recorded with participants' written consent, except for three conducted with local government officials, which were documented through note-taking at the participants' preferences. All FGDs were recorded through detailed field notes.

Audio recordings were transcribed in Vietnamese by three research assistants from TUAF after signing confidentiality agreements. I then translated all transcripts from both the semi-structured interviews and FGDs into English. The transcripts were organised in Excel spreadsheets, and participants' identities were kept confidential by assigning codes according to stakeholder categories. Specifically, university lecturers were coded as U; government officials as G; NGO representatives as N; and community members as C1, C2, C3, and C4 for Villages 1, 2, 3, and 4 respectively. Focus groups were code as F1M for the male group and F1F for female group in Village 1, and similarly for Village 2, 3 and 4.

I followed Braun and Clarke (2006)'s thematic analysis steps to systematically move from initial coding to write-up. I first familiarised myself with the transcripts. The transcripts then were then manually coded based on common codes identified in the analytical framework, as well as on new codes that emerged from the interviews and FGDs. Following that, I developed and refined sub-themes and themes to capture meaningful patterns related to my research questions. Specifically, I began with eight expert interviews to identify policy-related themes. I then analysed semi-structured interview data at village level by creating separate spreadsheets for each village; and adding new perspectives from FGDs as they arose. For the write-up, I first produced narratives for each village and then synthesised findings across four villages to identify commonalities and differences. Quotes were selected to be good representative of each finding and to reflect different views across wealth rank, gender, and age. The next chapter presents the results from both interviews and FGDs.

Chapter 4: Results

The chapter outlines the results of individual interviews and focus group discussions. It first describes how government officials, local experts, and NGO representatives understood the policy framework relevant to FLR, and their perceptions of how policy translated into FLR outcomes. Second, it then draws on the perspectives of members of rural communities about how they perceive FLR interventions, and how these affect their livelihoods and other issues of concern. The themes around which the results are structured emerged from both the interviews and focus group discussions.

4.1 External actors' interpretations of the history and practice of FLR Policies

This section presents the responses of eight local government officers, NGO representatives, and university lecturers, explaining how tree plantations have been framed as the main FLR intervention in Thai Nguyen province. This section is organised into two parts: first, favouring tree plantations to meet national forest cover targets, and second, viewing tree plantations as multipurpose to support community.

- *Favouring tree plantations to meet national forest cover targets*

First, tree plantations have been viewed as the main intervention for FLR, in order to meet national forest cover targets. The concept of FLR was considered by interviewees mainly in terms of ecological restoration to increase national forest cover, while livelihood development was seen as a secondary objective. In particular, these respondents explained that FLR interventions depend on the type of forest category defined by the Vietnamese Government; i.e., that restoration in production forests should primarily be based on tree plantations, while both tree plantations and silviculture can be employed in special-use forests. For example, one lecturer stated:

"Artificial restoration has now developed strongly through forms of plantation in production forests; whereas natural forest restoration mainly involves zoning and forest protection designated as special-use forest" (U1)

Based on their understanding of FLR, respondents explained that tree plantations were seen to recover degraded forest land in the context of Vietnam. Most of respondents mentioned that before the 1990s, much of Vietnam's supposed forest resources were actually degraded land with bare hills for three main reasons. First, forest cover declined significantly due to the War. At the same time, the Government prioritised economic recovery though which supported many forestry companies that were harvesting timber intensively for economic development by the 1990s. As one respondent stated:

"Logging was considered an achievement at that time; it was about exploitation, not about planting" (U2).

In addition, local communities cleared forest land to practice shifting agriculture for food security and also cut timber for house construction. Together, these pressures reduced Vietnam's forest cover to below 30 percent (See Chapter 2.2), which prompted the authorities to pay serious attention to restoration. This situation led the Vietnamese government to implement tree plantation programs on degraded forest lands.

Moreover, tree plantations were also seen as a faster method to restore forests and achieve national forest cover targets compared to other FLR interventions. In particular, interviewees stated that the northern region of Vietnam, including Thai Nguyen province, is a critical area of watershed forests (*'rừng đầu nguồn'*) for protecting soil and water and reducing flooding. For this reason, the Government could not allow forest land to remain bare. One respondent explained:

"Natural regeneration has the advantage to conserve indigenous species trees, but this method has the drawback of being very slow. It takes a long process of transformation before the forest is formed". (U1).

Another respondent, a head of a forest agency, gave an example that even though the government once tried aerial seeding of ficus (bồ đề), the survival rate was very low and the method took too long to green the landscape. As a result, exotic species such as acacia were promoted as a practical solution.

Forest coverage was perceived as one of the important indicators of the state of forests and to meet international commitments. Some of the interviewees still considered forest coverage a critical measure of forest health, described by one as a "safe indicator" for forest resources. One respondent explained:

"Forest cover is still an indicator recommended by international agencies such as Global Forest Watch; also, it is easy to measure" (N2).

The interviewees also explained why the Vietnamese Government chose this indicator, noting that it was adopted and committed to international targets, which meant the Vietnamese Government could not reduce the goal. Since adopting forest cover targets, the Government has integrated the percentage of forest cover into forest decrees, which allocate responsibilities to provinces to achieve this target. However, interviewees also expressed concern that while forest cover is used as a useful indicator, it does not reflect forest quality. They noted that the quantity and quality of natural forests are declining, while plantation forests are expanding, yet the Vietnamese Government still calculates forest cover as the total of all forest types. One respondent pointed out:

"*The tricky thing is that neither academic nor international policy specifies what proportion of a country's forest cover should be natural forest versus plantation forest, which allows the Vietnamese Government to continue relying on tree plantations for forest restoration and to increase forest cover"* (N1).

- *Viewing tree plantations as multipurpose to support community*

Second, tree plantations were seen as multipurpose, to support both community livelihoods and food security. Interviewees perceived that shifting agriculture was not a good practice because it involved clearing forest land and did not provide sufficient food security for local people, especially as the population has continued to increase year by year. One respondent emphasised:

"*Fixed cultivation and fixed residence are the best because people no longer move around…. to have stable life"* (G2).

To stop slash-and-burn activities, the Vietnamese Government distributed forest land to local households under the Land Law of 1993, which granted a 20-year right for annual crops and a 50-year right for forest land to households. In addition, tree plantation interventions were supported by a wider range of international donors compared to other FLR options in Vietnam. Most respondents mentioned that the first tree plantation program launched in Thai Nguyen was the national Programme Alimentaire Mondial (PAM) funded by World Food Programme to restore greener landscapes. This program introduced exotic Australian acacia (*Acacia species*) and eucalypt *(Eucalyptus species)*, along with a few native tree species. Participants commented that local communities participated in the first tree plantations because they received rice in exchange for planting trees, although they did not yet realise the economic benefits of these species. However, later, when state programs ended, households decided to plant acacia because it had advantages such as being a fast-growing species and the most marketable tree for income. The policy framework for forest restoration and tree planting in the study area is shown in Table. 4.1.

Project/Policy	**Year of implementation**	**Description**
PAM	1990 - 1995	On the policy for the management and use of plantation forests under Decision 145/1998/QĐ-TTg by the Prime Minister, funded by the World Food Programme.
Land Law	1993	Granted 20-year usufruct rights for annual crops and 50-year rights for forest land.
Project 327	1993 -1998	Decision 327-CT (15th September1992)- Issued by the Chairman of the Ministers' Council for regreening barren lands and denuded hills.
Project 661	1998 - 2010	Decision 661/QĐ-TTg (29th July 1998) – Issued by the Prime Minister, this program aimed to establish five million hectares of new forests nationwide.
Project 147	2007 - 2015	Decision 147/2007/QĐ-TTg (10th September 2007), issued by the Prime Minister for seting out Vietnam's policy for developing production forests.
Forests and sustainable forest management plan	2000 - present	Annual plan for each province in the Development of Plantation Forests and Sustainable Forest Management.

Table 4.1 Synthesis of the key policy framework for FLR and tree planting in the study area

4.2 Community perspectives on tree planting and FLR

This section presents the results from 32 semi-structured interviews and 8 focus group discussions (FGDs) conducted across four villages to understand community perspectives based on wealth ranking, gender differences, and youth views on tree planting and other FLR options.

This section is organised into the following parts:

4.2.1. Changes in forest cover and forest clearance;

4.2.2 History of government-led tree planting programs and their implementation;

4.2.3. Motivation and participation in plantation programs;

4.2.4. Crop and species selection;

4.2.5. Differences in perspectives among households of different wealth classes; and

4.2.6. Gender perspectives; and

4.2.7. Youth perspectives.

4.2.1 Forest coverage and forest clearance change

In the four villages surveyed there was a consistent view among villagers about how forest clearance and forest cover had changed across different stages, before and after the 1980s–1990s; this is similar to the views of officials and other external actors discussed in Chapter 4.1. Participants generally recalled that, in the past, natural forests were rich in biodiversity, wildlife, and native tree species. However, while forests were open access at that time, human activities gradually increased. Villagers benefited from the natural forest by collecting bamboo shoots, honey, and firewood for both self-use and sale in nearby markets, as well as cutting timber for house construction. They also cleared forest land to practice slash-and-burn cultivation for rice and other crops such as cassava and maize. One farmer noted: *"We wouldn't plant two rice crops in a row"* (C2.2, 71-year-old male, non-poor).

As a result, villagers continued clearing new land for swidden agriculture to combat hunger. Respondents also observed that, during this period, the Government allowed private forestry companies to harvest timber for economic development. Along with logging, participants perceived that the forest became increasingly bare due to land clearance for shifting agriculture, which they identified as the main reason why the Vietnamese authorities initiated the forest restoration program. Consequently, respondents stated that forest cover changed drastically, with human activities leaving behind barren hills, since no one was responsible for managing forest land.

4.2.2 History of government-led tree planting programs in the study area

- *Land tenure, and land rights*

Most respondents reported that, as noted in Chapter 2, forest land was not allocated to households before the 1990s. However, since forest clearance increased dramatically, interviewees mentioned that the Vietnamese Government began allocating 50-year land-use rights over forest land to local households. In practice, land allocation varied. Although villagers confirmed that the Government divided land among families based on their area of swidden fields, some respondents said land was also divided equally, with an initial cap of 10 hectares per household. However, the results show that there were two main concerns regarding land allocation: the perceived lack of value or benefits of tree planting compared to other jobs, and unclear information related to land rights and taxes on the extra land.

First, while villagers confirmed that they did not see benefits to tree planting at the time, some families did not want to receive more land for tree planting due to personal circumstances such as less labour to take care of plantation. For example, one villager explained why his family joined the PAM program later and with a little land to claim:

"I have many children to feed, and I felt that payment for each stage of the tree planting program came late and required government approval, whereas collecting firewood from the forest to sell provided daily cash to cover household expenses" (C2.1, 68-year-old male, non-poor).

Second, most interviewees thought that receiving more land might require paying high land taxes, which led many families to choose to receive less land. Respondents explained that, since they did not see economic benefits from tree planting, when one family member went to cities for temporary work, they sometimes transferred their land to other neighbours or family members. Respondents also mentioned that, since a number of families did not receive lots of land to plant trees, a few elite groups, such as the village head or families with educated members, registered for more land. This led to further consequences, such as intensified inequality in land resources and determining who could participate in the tree plantation program later.

- *Tree planting as the main intervention in forest landscape restoration*

The first tree plantations in the four villages were the PAM program, as mentioned in Chapter 4.1. However, there were slight differences in how the PAM program was implemented in these villages after the land allocation movement. From 1990 to 1995, the PAM program in Villages 1 and 2 was directly implemented by the villagers. Respondents from these villages were introduced to tree species such as acacia (keo), eucalypt (bạch đàn), and several native trees such as *manglietia (*mỡ) and *senna siamea* (muồng). People who participated in the program received rice; for example, interviewees recalled receiving 50 kg of rice for one plantation hectare.

Unlike other villages, the PAM program in Village 3 was implemented by a forestry company. When the PAM program in Village 3 was phased out, the company returned the land to the authorities, and villagers began following the forestry company's model by planting acacia and eucalypt. Although this village did not formally participate in PAM, many respondents reported that they understood the main purpose of the tree plantation program was to *"green bare hills"*.

Notably, after 1994, the Vietnamese Government implemented a land reclamation policy to establish special-use and protection forests aimed at conserving biodiversity and preserving the remaining "*rich forests*". This reclamation affected Villages 2, 3, and 4. Consequently, many households in these villages lost access to the tree plantations they had established during the PAM program in 1990. In particular, in Village 2, the Government began reclaiming PAM forest to establish protection forests. In Villages 3 and 4, the government established Tam Dao NP in 1997. These protection forests and Tam Dao NP were managed by government management boards, and local people were contracted for continued planting of both acacia and some native species on "*bare hills*" not covered by the PAM program. However, interviewees stated that the compensation for planted trees was relatively low, from 300,000 VND to 500,000 VND per hectare. Only Village 1 was not affected by this land reclamation program and subsequently transitioned from the remaining natural forest to mostly acacia plantations by 2016. This land reclamation policy has impacted poorer households, including women and youth who participated in tree plantation activities, negatively affecting their livelihoods later on.

4.2.3 Motivation and participation in the plantation program

There were consistent reasons identified in interviews and FGDs for people's motivation and participation in the tree plantation program. This includes participating in government top-down programs, receiving rice incentives, and claiming land for future ownership certificates.

First, at the beginning of the FLR initiative, participants generally stated that they followed the government-led program, and then everyone in the village became involved in the PAM program. *"The government had an acacia program, so we just planted according to that"* (C 4.4, 71-year-old male, non-poor).

Second, although participants confirmed that they did not see benefits from the trees, they explained that the main motivation for participating in the PAM program was to receive rice, which was very scarce at the time. Because participants reported shifting agriculture did not provide food security. Specially, a few interviewees in Village 4 were directly involved in tree nurseries for the PAM program, which led them to participate for earning income. One respondent stated: *"Trees were planted under programs like PAM just to get rice to eat, without having to spend any money"* (C1.2, 56-year-old male, non-poor).

Third, some households planted trees because they wanted to claim their land to ensure they would receive a land ownership certificate in the future. One respondent reflected:

"I saw the government's program with acacia and erythrophleum fordii (lim), so I bought seedlings and planted them because I wanted to keep the PAM land that I had cleared for land ownership certificate. I still think it belongs to me, I still keep it, and now if anyone tries to cut trees there, they don't allow it. It's only my forest." (C4.5, 66-year-old male, non-poor).

4.2.4 Crop and species selection

Interviewees generally had a view on which trees and crops were suitable for each type of forest category.

- *For production forest land:*

Although crop and tree selection varied depending on the expected outcomes of the plantations, most decisions were based primarily on economic factors, especially short-term benefits, while some also considered ecological benefits and land suitability.

Because considering income, green tea and acacia are the most popular crops and tree species in the study area. For green tea, most respondents emphasised its long history across generations, beginning with natural tea found in forests, and noted that it could generate income more quickly than other tree species such as acacia.

For acacia, most participants stated it was easy to sell for timber, and people began planting it widely around 2000. Respondents generally preferred acacia with certain characteristics: fast-growing for quicker harvest, easy to plant, requiring minimal care, and providing high income. Based on those characteristics, interviewees compared that that acacia could be harvested in 5–7 years, while native trees take at least 10–20 years to reach a similar size and might not have a clear market. Beyond income generation, *acacia* preferred particularly soil suitable across 4 villages, especially on higher slopes and poorer soil, while eucalypt can grow on rocky soil. On lower land, many residents instead reported planting other trees such as tea, jackfruit, and banana.

The village head of Village 3 commented:

"*Acacia must be planted on high land. there's no other option. It's a forestry tree, harvested every 6–7 years, requires little care, and little investment. Just clear the grass once in the first year, then again in the second and third year. After that, people can harvest without much input… depending on the forest, you cannot plant jackfruit on high hills. It won't grow*". (C3.5, 39-year-old male, non-poor).

Beside of acacia, participants stated they tried to plant different species to diversity income. For example, cinnamon was tested because it was believed that cinnamon oil could be sold at a high price. However, these attempts were unsuccessful, as the trees did not produce oil of the same quality as in other places.

Thus, a few participants considered tree selection based on the ecological benefits of tree planting and cultural practices. For example, a few respondents in village 3 with a Dao ethnic minority background and traditional medicinal knowledge expressed that they preferred growing medicinal plants or fruit trees for both economic purposes, preserving their culture, and achieving ecological outcomes.

- *For protection forest and national parks:*

When asked about planting exotic species such as acacia and eucalypt in protection forests or natural forests, participants in Villages 2, 3, and 4, who had experience with these types of forests, thought that these exotics were not suitable, as they have short life cycles and deplete the nutrients needed for native species. They suggested that mixed planting with native trees should be implemented to improve soil, retain water, reduce erosion, and provide habitat for animals. With a slightly different experience, although participants in Village 1 preferred some native species because they were familiar with these native species but they though both type of species can be planted in these types of forest.

4.2.5 Different perspectives among household wealth classes

There are four main sets of different perspectives among household wealth classes: first, differing views on the PAM program; second, differences in income from acacia plantations; third, differences in acacia cultivation practices; and fourth, differences in tree selection.

First, there were different views between respondents about the PAM program. While poorer interviewees thought this program did not bring enough rice for them, wealthier households saw it more positively. This difference might be because poor families did not plant many trees, as they had less land available for planting which led to receive less rice. Poor households also felt that the timber income from the PAM program did not meet their expectations because timber could not be sold at the time. A few poor participants also mentioned that this program paid rice at the end of the year, while they needed food security throughout the year. In contrast, wealthier families expressed more positive views about the PAM program, which met three objectives: greening bare hills, maintaining water, and reducing poverty.

Second, poorer households generally reported that income from acacia plantation, of around 10–40 million VND per hectare, was lower compared to wealthier households, who achieved 60–140 million VND per hectare. They noticed that because poorer families have less land, less working labour, and less care for their plantations. In this study, participants perceived that the size of plantation land determined whether acacia income was considered good, with an optimal holding being 5–7 hectares, and that it should be at least 2–3 hectares; however, most of poorer participants confirmed they have less 2 hectares. Specially, respondents without forest land - since the Government reclaimed forest land in Villages 2, 3 and 4 - expressed that their family income was lower than that of families with acacia plantations. This led most of them to find casual jobs to supplement daily expenses.

Third, there were different practices between wealth class groups in growing acacia plantation. Poorer households often do not use fertilizer like wealthier households and undertake less weeding to remove grass, which affects acacia growth. In addition, poor families tended to plant acacia more densely (2,500–3,000 trees per hectare) compared to wealthier households (around 2,000 trees per hectare). Poorer households explained this was because if some acacia died, they would still have many trees left to harvest, or if the acacia did not grow well, they could still collect it as firewood. In contrast, wealthier families thought that planting less densely allowed each tree to have more nutrients, grow larger canopies, and increase its value, making it worth as much as ten densely planted trees.

One interviewee from a nearly poor household with less than 1 ha forest land explained:

"Fertilizing depends on money - families with more money apply more, families with less apply less. If you don't weed properly, the acacia becomes stunted. The smaller ones lose their leaves and die". (C1.4, 50-year-old male, near-poor).

Poor households also tended to sell acacia earlier, after about 3–4 years, because they needed immediate income, while wealthier households expected to sell after 7–10 years for higher timber value. In parallel, many poorer households relied on part-time jobs to supplement their income. One non-poor participant explained:

"At about 7 years, acacia is mature enough for wood harvest. If they are only 3-4 years old, acacia is too small, not worth much and can't be weighed or sold as timber. Around 7 years, the trees are large enough for wood. If they had conditions to let them grow longer, the wood would be bigger and sold by piece, not by weight". (C2.1, 68-year-old-male, non-poor)

Lastly, participants' species choices also reflect differences in household background and resources. For instance, wealthier households are more likely to experiment with a variety of species. Some now plant native trees not only for timber but also for fruit and soil conservation purposes. A few have even started planting eucalypt because they think high potential economic and other native species including medicinal trees to meet multiple purposes. Some wealthy households also considered experimenting with mixed planting of acacia and other multipurpose trees such as jackfruit.

"*We are thinking of planting acacia mixed with other trees like jackfruit and michelia mediocris (dổi). After 5–7 years, the jackfruit and michelia mediocris can be harvested for fruit, and the acacia can be pruned in the same period. Then, while harvesting the fruit trees, new trees will be ready to replace the harvested ones*." (C3.5, 39-year-old male, non-poor)

One non-poor respondent compared the incomes from acacia versus medicinal plants, explaining why he replaced some acacia areas with *millettia speciose* (cát sâm - a native medicinal species):

"My land area is not large about 2 hectares of acacia, which takes 8 years to harvest and generates only around 160 million VND. But if I use about one-third of that land, around 6,000 m², to plant cát sâm, the calculation is different. With 10,000 seedlings, each root weighing at

least 2 kg, that would be about 20 tons in total. Even though the scale is smaller, the income is much higher". (C3.8, 38-year-old-male, non-poor).

4.2.6 Different perspectives based on gender

There are three main sets of different perspectives based on gender. These include: first, women preferred immediate income than men; second, women favoured work that required less physical labour; and third, some negative consequences of tree plantations were observed among poor women.

First, interviews revealed that women generally preferred crops and tree plantation that provided immediate income and ensure food security. Although most women thought acacia could bring higher returns than other crops, but female interviewees relied mainly on rice, green tea, and vegetables to secure their monthly income. While both husbands and wives were responsible for acacia plantations, men typically did not take part in tea cultivation. Green tea was often preferred by women, as it can be cultivated in lowland areas where acacia cannot grow. Monthly income from green tea could reach 2–3 million VND. However, its higher maintenance requirements were viewed as a drawback compared to timber plantations. As one woman explained:

"*Acacia is low-maintenance, whereas tea plants need weeding once a month, fertilising 1-2 times, watering if there's no rain, and spraying pesticides 3-4 times per harvest"*. (C2.6, 42-year-old female, near-poor).

Second, women favoured work that required less physical labour. Female interviewees expressed those physical limitations created barriers for them to participate in the PAM program compared to men. For example, one woman from a poor household mentioned that, because she was a single mother, some acacia trees were stolen since her family had no male labour to protect them. Another woman expressed concern that the PAM forest was far from her home, so she did not visit or take care of the tree plantations as regularly as households with male labour. Because they are aware of their physical limitations, women also emphasised more than men that the development of machinery had made their work easier than before. For example, one female participant in an FGD in Village 1 said:

"*Now we have sawing and excavating machines and people in the village who can easily help with processing. In the past, we had to do everything ourselves, cutting and transporting was very hard*".

Third, despite positive benefits of tree planting reported by both women and men, there were some negative consequences observed. First, regarding PAM program, although women thought this program provided some rice for their families, it was still not sufficient to ensure food security. Some of them explained that this was because they had less land to participate in the PAM program, which led them to receive less rice. Second, a few female respondents from poor households without forest land shared a negative view. This is because natural forest had transitioned to acacia plantations, causing them to lose the opportunity to collect non-timber products such as bamboo shoots and firewood. As a result, these women reported that they are likely to struggle to find doing seasonal work to supplement their daily income compared with households that participated in tree plantation projects.

One woman without forest land explained:

"*In the past, during bamboo shoot season, I could earn more because they grew naturally and didn't require care. I went to the natural forest to gather them and sell them at the market. Now, I have to go far away to collect bamboo shoots. I just find some firewood once a year. Now, it's mostly eucalypt and acacia plantations owned by others. I am not allowed to go in and collect anything anymore*". (C1.3, 45-year-old female, poor)

4.2.7 Youth perspectives

Youth migration was frequently cited by participants. As younger people moving to off-farm jobs to earn income. Due to the population has grown, respondents reported that young people do not have much forest land to plant tree. A male participant in FGD from village 4 explained "*Households with many children divide the land, so the next generation has very little*". However, concerns were expressed that the working life cycle in factories is short, and this generation tends to return to the village after the age of 40 without much forest land to plant trees.

4.3 Tree planting benefits

This section presents the benefits of tree planting, divided into three parts: the first is ecological benefits, and the second is livelihood benefits and the third is on drivers to support tree plantation. More specifically, findings from interviews and FGDs conducted across four villages summarise a range of commonly tree species and crops, highlighting their perceived ecological and livelihood benefits (see Table 4.2 below).

Species	Economic value	Biodiversity	Water needs	Soil impact	Storm, flood, and drought resistance	Suitable land type
Acacia (Keo)	Seedlings easy to buy; easy to sell; grows quickly but needs care for the first 3 years; suitable for highland areas; harvestable from 4–12 years (mostly 7 years); susceptible to pests; prices fluctuate but can be sold anytime. Often affected by pests and diseases in the first year	No wildlife left (only a few birds remain)	High water demand	Depletes soil nutrients quickly after 3 rotations.	Breaks easily in storms; quite drought-tolerant.	Not suitable for special use forests because it grows over native trees and dies after 10 years.
Eucalypt (Bạch đàn)	Seedlings are expensive and imported from China; Might higher price than acacia but less common market.	Does not support wildlife.	High demand of water.	Can grow in rocky soil but dries soil, reduces fertility; soil becomes shallow.	Weak and brittle trunk; breaks more easily in storms than acacia, especially under 3 years; drought tolerance better than acacia.	Not suitable for special use forests.
Erythrophleum fordii (Lim xanh)	Native tree; takes several decades to grow; no market to sell; long life cycle	Supports wildlife; better carbon storage; cool climate and protection genetic resources.	Good water retention;	Does not destroy land	Reduces erosion and flood risk; drought-tolerant; durable	Recommended for protection and national parks for ecological restoration purpose.
Canarium tramdenum **(**Trám đen)	Native tree; expensive seedlings; requires high skills; can harvest fruits from 3 years; perennial tree; market limited.	Support wildlife, better carbon storage	Good water retention	Does not destroy land fertility	Better adapted to floods and storm than acacia becuase of its flexible and durable trunk.	Can be planted for plantations and agroforestry systems.
Manglietia (mỡ); Chukrasia tabularis (lát); ***Senna siamea*** (muồng)	Takes several decades to grow (15–20 years); muồng has no economic value; lát does not grow; can used for house construction only; very low market value.	Support wildlife; better carbon storage. Protection genetic resources.	Good water retention	Conserves soil fertility	Better adapted to floods and storms than acacia becuase of its flexible and durable trunk.	Recommended for protection and national parks for ecological restoration purpose.
Ficus (Bồ đề)	High economic value; requires suitable soil; seeds regenerate naturally; harvestable after 7 years; cannot grow in very poor soil.	Not yet clear	Likely retains more water than exotic species	Conserves soil fertility	Better adapted to floods and storm because of its shorter trunk	Can be planted for plantations and special use forests, also for agroforestry systems
Cinnamon (Quế)	Cinnamon oil here was of lower quality. Unsuitable soil in the study area; seedlings more expensive than acacia	Not yet clear	Not yet clear but should be retain water than exotic species	Conserves soil fertility	Not yet clear	Plantation forest and agroforestry systems.
Jackfruit (Mít)	Provides timber and fruit; requires little care; timber market unclear; takes at least 5 years to grow.	Not yet clear but should be support ecological than exotic species	Likely retains more water than exotic species	Conserves soil fertility	Resistant in storms and drought	Plantation forest and agroforestry systems for economic proposes
Other Vietnamese medicinal plants	Require high technical skill and maintenance; need fertile soil; preserve traditional value; high economic value but market uncertain; potential for tourism; harvest from 2–10 years depending on species; can grow under forest canopy.	Support biodiversity wildlife	Low demand of water than exotics.	Conserves soil fertility	Resistant in storms	Plantations and special use forest, agroforestry systems.
Green tea (Chè xanh)	Planted near homes; suitable for women's labour; provides monthly income; requires chemical fertilizer and regular maintenance; easy to sell; susceptible to pest.	Does not support wildlife	High demand of water	Can degrade soil	Easily dies during drought	Agroforestry systems for economic proposes. Not suitable for special-use forests.

Table 4.2 Synthesis of crops and tree species characteristics based on the interviews and Focus Group Discussions across the 4 villages

4.3.1 Ecological benefits in the context of climate change.

Regarding ecological benefits, this section first presents community perceptions of ecological benefits and then discusses community views on environmental and climate-related risks.

4.3.1.1 Perceptions of ecological benefits

There was a consistent view among participants, expressed during the interviews and FGDs, that tree plantations had both positive and negative ecological impacts. The positive benefits included improved water availability and greener landscapes, while the negative aspects were noted when comparing plantations with natural forests.

First, respondents valued tree plantations because tree-covered landscapes retained water more effectively than in the past. They compared the current landscape with shifting agriculture. This slash-and-burn practice had negative impacts on biodiversity and the ecosystem; for example, it killed many snakes, turtles, and geckos. Additionally, while shifting agriculture left hills bare, soil exposed, and water poorly retained, most respondents from Villages 2, 3, and 4 now reported using water from forests for both drinking and agriculture. Additionally, some participants valued acacia plantations for the aesthetic benefits of green landscapes, describing them as beautiful, orderly, and peaceful, unlike the chaotic forests or bare hills of the past.

Second, although respondents generally agreed that tree plantation programs provided these benefits, they clearly distinguished between restoration benefits of plantations inside protection forests and Tam Dao NP and those outside it. For example, acacia plantations were established both within these special-use forests and on villagers' production forest land, but respondents were aware of differences in forest structure and benefits. Forests in Tam Dao NP retained water better and supported more wildlife than acacia plantations on production land. These natural forests helped protect soil and prevent erosion and flooding more effectively than plantation forests located further away from the NP. A respondent explained:

"National Park forests function better because the trees cannot be exploited or disturbed, even if the same acacia species is planted." (C4.3, 73-year-old male, non-poor)

Respondents were also aware of the differences between acacia plantations and native trees regardless of where they were planted. Most interviewees thought native trees, such as *erythrophleum fordii* (lim xanh), were better adapted to the forest environment and climate change. In contrast, acacia and eucalypt were perceived as more brittle and prone to breakage during storms. A few respondents observed that acacia grows quickly but has a shorter lifespan than native trees, dying after about ten years, while native trees live much longer. One respondent said:

"*Acacia trees planted under the PAM program in 1990s almost completely decayed in the National Park; at best, they lasted 20 years. As they aged, storms broke most of them*". (C4.3, 73-years-old-male, non-poor).

Thus, pests and diseases in tree plantation were also mentioned as emerging themes through interviews and FGDs. For instance, participants mentioned that there are more diseases in the third rotation than in the first rotation because of the way acacia is managed. In particular, harvesting after 4-8 years, burning the residue, and replanting immediately destroys beneficial insects and prevents soil recovery. One interviewee explained that when planting medicinal trees, he needs to leave the soil fallow for a couple of years to allow it to recover. In addition, respondents highlighted that continuous planting reduces yields. One villager who replaced all acacia with medicinal trees explained:

"*Acacia makes the soil poor. I feel the soil loses its nutrients very quickly. After planting three cycles, the productivity decreases. Continuous planting without resting the land greatly reduces yields. In acacia plantation, there are still birds, but all the wild animals are gone"*. (C3.8, 36-years-old male, non-poor)

Compared with natural forests, plantations were valued less in terms of cultural and ecological significance. Some participants recalled experiences such as bathing in forest streams or hearing bird songs and animal sounds in the past. In particular, one participant from the female FGD in Village 1 expressed regret:

"*I feel regret because the younger generation might not truly know what a natural forest looks like"*.

A few respondents from Village 3 also stated that to develop ecotourism, they need to conserve natural forests because tourists enjoy experiencing them; no-one visits for acacia plantations.

4.3.1.2 Perceptions of environmental and climate-related risks

Most participants highlighted concerns about increase in extreme weather events compared to the past, which they considered negative effects of climate change which potential impacts on plantations. As mentioned in Chapter 4.3.1.1, exotic species such as acacia and eucalypt cannot withstand strong winds and are often blown down, after which squirrels sometimes feed on the fallen trees during storms. Some farmers reported disasters such as heavy rain causing landslides that damage trees, or heat wave and storms, drought affecting the soil. They also observed fungal diseases have become more common during these extreme weather events.

However, there were different views on level of climate change impact across the four villages. Participants from villages near Tam Dao NP expressed that extreme weather had less impact than in Village 1. For example, both women and men FGDs participant from village 3 and 4 noted that natural forests in the NP help mitigate climate change, prevent soil erosion, provide water use; In contrast, participants from Village 1 expressed negative views about environmental risks in the village, including water scarcity. One middle-aged man in the male FGD in village 1 said:

"*Nowadays, the water has become scarce because forests have been cleared. In the past, there were still natural forests that protected the streams; now it's all plantations*".

4.3.2 Livelihood benefits

There was a consistent view among community participants, expressed that tree plantations firstly improved livelihoods and secondly provided better benefits than shifting agriculture and non-timber products, although some concerns about acacia plantations were also shared.

First, in comparison with shifting agriculture and collect non-timber products was mentioned as not being able to bring enough food security, with local villagers stating they had to mix rice and cassava to eat. This was highlighted by one respondent:

"*Shifting cultivation was unpredictable; some years were good, some were bad. Acacia is more stable; once planted, it grows well."* (C2.3, 75-year-old-male, non-poor)

Second, regarding tree plantations especially acacia, they helped avoid hunger, generate income, and gradually improve livelihoods, changing participants' lives. Acacia plantation income is used especially for major expenses such as building new houses, buying motorbikes or cars, healthcare, and agricultural machinery and contributed to build village road. One respondent from a male FGD in Village 1 noticed:

"*In 1995, 50% of households in my village were ranked as poor; right now, only 2%".*

Third, although acacia remains the most commonly planted species, participants have begun expressing concerns about its long-term suitability. This is particularly due to disease and pest issues (see Chapter 4.3.1), which lead to lower productivity, and concerns about converting natural forests to plantations, resulting in the loss of livelihoods dependent on medicinal and traditional trees.

Regarding lower productivity, several villagers noted that acacia was productive during the first rotation without the use of pesticides or fertilizers, but productivity has since decreased due to soil degradation. A female from FGD in Village 2 explained:

"*During storms, acacia easily dies after 3 - 4 years. My household planted 1,000 trees, but 500 died, so we had to sell at a low price*".

Some are reconsidering their planting choices after repeated tree crop failures:

"*My family still plants eucalypt, even though it grows tall and is prone to toppling over, because all the acacia died. Every week I pour termite pesticide at the base of the acacia, but after a few months it still dies. In the first crop, it didn't die, which made me overconfident, so I* *kept planting acacia because acacia seedlings are cheaper"*. (C1.7, 35-year-old-female, non-poor)

Thus, there was a concern that traditional medicinal practices are at risk of being lost due to the conversion of natural forests to plantations, particularly in Village 3, where the Dao ethnic minority community has historically practiced traditional medicine. This concern has encouraged some respondents to plant medicinal trees for additional income, support ecotourism, and eventually replace acacia in the future. However, since natural forests have been reduced and acacia planted, both men's and women's FGD in village 3 stated that traditional medicinal plants are now scarce, and there is a need to consider planting them to conserve knowledge for the next generation. One older woman from an FGD in the village 3 expressed:

"*In the past, we went to the natural forest to collect medicinal leaves to treat simple illnesses, but now they are scarce*".

Villagers living close to the park can engage in beekeeping more easily than those living farther away. They stated that this is because there are many natural forests around their homes that support pollination.

4.3.3 Tree planting drivers

It is clear that the tree plantation program led by the Vietnamese Government has played a central role in introducing tree plantations. Results also show that main drivers that led to the widespread adoption of acacia, such as market driven, improved road access, and machinery.

Fist, respondents generally agreed that the presence of a market for acacia is a major factor driving the development of acacia plantations over other tree species. The establishment of several woodchip factories was highlighted as key support for the local acacia value chain. All villagers reported that there were no barriers to selling acacia, as it was easy to contact local traders either online, by phone, or through traders visiting villages directly to negotiate purchases. Buyers would collect acacia of any age and any part of the tree, such as branches the size of a wrist, harvest it from the farmers' fields, and transport it to woodchip factories. Iinterviewees revealed that previously, with no market, they left acacia for 13–14 years; now, they typically sell it around 6–7 years. Although a few villagers expressed concerns about price fluctuations depending on the Chinese market, most still felt that acacia could be sold at any time. One respondent commented:

"*Prices just fluctuate. Sometimes high, sometimes low. But prices today are higher than in the past, and it's easier to sell*". (C2.6, 42-year-old-female, near-poor)

Other factors mentioned by villagers include the easy availability and low cost of acacia seedlings around 2000 – 3500 VND/ nursery. Local government programs also support the distribution of seedlings, provide guidance to farmers.

Second, improved road access in the villages was also highly valued by interviewees from all four villages. They reported that access used to be difficult, with no clear roads. Villagers recalled that in the early 2000s, due to the difficulty of reaching forest land, they had to use buffalo to carry timber. Since some roads were improved during the PAM program and afterwards, an interviewee mentioned that trucks can now reach the acacia plantation plots.

Third, together with road and market development, machinery has played a vital role in supporting plantations by reducing labour requirements. As reported, to cut grass, local farmers now hire machines, which makes the work much easier. Previously, an interviewee confirmed:

"*In the past, cultivating 1 hectare by hand took 20 days, but now, with machines, it only takes 8 days*". (C1.7, 35-year-old-female, non-poor)

4.4 Future plans

This section presents how interviewees think about future plans to make their livelihood, tree plantations more sustainable in the face of climate change. It is divided into two parts. The first presents the views of government officials and local experts, and the second presents the community's views.

4.4.1 Government officials and local experts

While most interviewees in this group acknowledged some negative impacts of acacia and it would be difficult to replace this species in the next five to ten years because economic benefits, they emphasised three pathways that should be considered.

First, interviewees suggested identifying alternative tree species, particularly promoting "*multi-purpose tree species*" that can bring economic gains similar to acacia. For example, one respondent stated: "*In production forests, multi-purpose trees should be planted. For instance, species that can provide fruit as well as timber*" (U1).

Second, participants proposed policies to guide farmers in transitioning from monocultures to mixed-species plantations. Another respondent emphasised:

"*Multiple species should be planted on the same plot, not monocultures; natural regeneration must also be promoted. For example, three tree species should be planted in one area of a plantation forest*" (G2).

Third, interviewees highlighted the need to mobilise more resources to create higher economic value for local people compared to acacia plantations. For example, respondents mentioned financial support through PES or carbon credit markets. However, several government officials noted that while PES only paid 70,000 VND (4.1 AUD) for one hectare in this study area and carbon credits pay high rates in the EU, the payments are much lower in Vietnam which was not attractive community.

4.4.2 Community members

Although most participants were concerned about the sustainability of acacia plantations under changing weather conditions, their approaches to future adaptation varied based on their values regarding natural forests, gender, or wealth class.

First, in general, respondents who live near protected and national parks emphasised the need for policies that balance preserving the national park and protected areas with maintaining acacia plantations. This might because they have experienced the positive value of natural forests. They also see an opportunity to gain income from ecotourism and traditional medicinal. One female respondent said:

"*I think the government should plant natural forests on higher elevations and acacia according to the plan. On the high land, let natural forest grow so no one can exploit it. On lower land, plant acacia for economic benefit. Keep the land fully green to prevent erosion and provide water for the community".* (C4.8, 56-year-old female, near-poor)

Second, there are different views based on gender. While a few female participants in FGDs and women from poorer households mentioned that they did not have any specific plans and would simply continue their current practices, or rely on government decisions to introduce new species, they were more concerned about having a reliable market to sell tree species. They expected the Government to have a clear plan to support farmers and ensure that companies would buy the products. Since women noted that acacia still has a stable market, they preferred to continue planting it.

"*If the government changes the tree species, then we'll plant something else. If there's no new policy, we just keep doing what we're doing. If eucalypt replaces acacia, we'll grow eucalypt. If it's still acacia, we'll keep planting acacia. And when one batch is harvested, we plant another"*. (C2.5, 65-year-old female, near-poor)

Third, there is a different future plan among wealthy groups. While poor households without forest land explained that, if they had land, they would prefer to plant acacia to earn income, other interviewees from non-poor households suggested finding new species that could meet multiple objectives, such as providing timber, fruit, and delivering better environmental benefits (see more at Chapter 4.2.5).

4.5 Summary

The interviews with 8 stakeholders revealed that the Vietnamese government favours tree plantations as the main intervention for forest landscape restoration. This is because tree plantations help meet both national forest cover targets and international commitments, while also aims to stop slash-and-burn activities, supporting local communities to avoid food insecurity and develop livelihoods. They also provide historical records of natural forest changes, and land tenure changes since the plantations were established.

Through 32 semi-structured interviews and 8 focus groups across four villages in Thai Nguyen, Vietnam, this study reveals participants' perspectives on tree plantations and highlighted differences in views based on wealth, gender, and age. These differences may contribute to inequality among groups. The interviews and focus groups also explored livelihood changes since the development of acacia plantations. While acacia has brought economic benefits, participants expressed concerns about long-term sustainability due to pests and diseases, soil fertility issues, and the impacts of climate change.

In summary, most participants believed that acacia plantations provide better economic outcomes compared to previous shifting agriculture and non-timber forest product collection. However, they also noted several drawbacks compared with natural forests, such as lower support for biodiversity and reduced ecosystem services. These issues will be explored in the next chapter.

Chapter 5: Discussion

The discussion synthesises the results presented in Chapter 4 and situates them within the broader context identified by the literature review. It does so by focusing on the following key findings:

5.1 Why tree plantations are favoured by the Vietnamese government for FLR, and key issues that arise from this.

5.2. Livelihood impacts of tree plantations on local communities in the context of climate change.

5.3. The multidimensionality and complexity of FLR.

5.4. Implications for FLR policies, including those for tree plantations.

5.1 Tree plantations as the favoured Vietnamese government strategy for FLR.

This section speaks to the first research question, '*What is the policy framework for FLR in Northern Vietnam, and how is it being translated into practice?'* It will first provide an overview explaining why the Government favours tree planting to address multiple problems, such as vegetating bare hills, boosting food security, promoting economic development, and increasing forest cover; but also highlight some key issues affecting tree planting outcomes.

The section is organised into four sections: The Government's preference for tree plantations over other FLR options; forest cover targets; and land tenure and land rights, and community participation.

5.1.1 The Government's preference for tree plantations

The results showed that the Vietnamese government strongly favours tree plantations as the main FLR strategy though a serious of policies (see Table 4.1). The results of interviews align with those of the literature review (see Chapter 2.2), which highlights the country's extensive national tree plantation programs from the 1990s to the present in response to deforestation and land degradation. This suggests a prioritisation of rapid methods to increase forest cover and achieve visible outcomes. This approach is also consistent with global FLR trends, where tree plantations are often the preferred FLR intervention, as noted by (Djoudi *et al.*, 2024).

The results suggest that selecting FLR approaches based on a careful assessment is essential prior to implementation. The Vietnamese Government views tree plantations as a faster means to rehabilitate degraded forest lands than alternatives such as natural regeneration or agroforestry (see Table 3.1), while also providing quick economic benefits. Arnold *et al.* (2022) and Ha *et al.* (2022) reported similarly, noting that authorities aim to leverage the economic advantages of commercial tree plantations for both farmers and the wider economy.

In contrast to the more flexible guidance provided by IUCN and WRI (2014), which envisages both natural regeneration and tree planting on forest land without trees, the Vietnamese Government's approach applies a single solution as tree plantations across all degraded forest, including bare hills, degraded forests, and abandoned areas. This blanket classification treats all forest land as degraded due to human activities such as logging and slash-and-burn agriculture (See Chapter 2.2.2). Erbaugh and Oldekop (2018) highlighted that these human activities affect forest land differently and that different FLR approaches can produce varying social and ecological outcomes. Although severely degraded areas may not recover through natural regeneration alone (César *et al.*, 2021), many sites are less degraded, and the benefits and risks of acacia plantations are not always fully assessed (Kull *et al.*, 2023). Many degraded sites may remain suitable for natural regeneration, which is often recommended because it can enhance habitat quality at lower cost than tree planting (Chazdon and Guariguata, 2016). For example, in areas previously affected by slash-and-burn agriculture, natural regeneration may be more appropriate than tree planting. Table 5.1 summarises the characteristics of tree plantations and natural regeneration as FLR approaches in Northern Vietnam. This study suggests that careful site management assessments are necessary to determine the most suitable FLR method for each location, balancing ecological, social, and economic considerations.

Land use	**FLR options**	**Justification**	**Drawbacks**
Forest land: if the land is without trees, two main ways are suggested (IUCN and WRI, 2014)	Tree plantation	• Faster growth, large biomass. greater short -term income. • To achieve faster forest cover indicators for protecting watershed protection (*rừng đầu nguồn*) and international commitments.	• Expensive but attracts external funding • Exotic species grow faster than native species, outcompeting the latter.
	Natural regeneration	• Functions as a complex adaptive system • Lower cost • Supports native species recovery • Contributes to biodiversity conservation and long-term carbon mitigation.	• Slower growth (may take several decades) with income gains only in the long-term • Does not attract financial support from donors or the government.

Table 5.1 Comparisons between two FLR options: tree plantation and natural regeneration

5.1.2 Targeting an increase in forest cover over forest quality

This study finds that the central government's approach to forest landscape restoration (FLR) continues to prioritise expanding forest cover through large-scale exotic tree plantations. This focus aligns with broader trends identified in the literature, where forest cover has often been treated as the primary indicator of restoration success (Clement and Amezaga, 2009). For example, national initiatives such as Project 661 aimed to restore five million hectares primarily through tree planting. While such efforts have successfully increased overall forest cover in

Vietnam, this emphasis on quantitative targets focuses on meeting short-term forest extent goals at the cost of greater diversity and resilience over the longer term.

However, this approach has attracted considerable criticism. Chazdon and Brancalion (2019) argued that increases in tree cover may represent short-term fixes that fail to achieve the broader ecological and social objectives envisioned by the FLR concept. Similarly, this study finds that the expansion of forest cover through monoculture plantations, particularly of exotic species, has led to several unintended consequences, including reduced water availability and limited biodiversity gains. These outcomes highlight the limitations of equating forest cover with ecosystem recovery. Supporting this perspective, Kull *et al.* (2023) contended that acacia plantations perform fundamentally different ecological functions from natural forests, despite government assumptions that they can serve equivalent roles in restoring forest landscapes. This tension between quantitative targets and more qualitative ecological outcomes is further explored below.

The Government's focus on expanding forest cover through exotic tree plantations reflects its commitment to meeting international restoration targets. This emphasis was evident both in interviews with local government officials and in the literature review. Vietnam's forest cover targets include all forest types, as reported by Dang (2022) and Kull *et al.* (2023). However, Kull *et al.* (2023) noted that treating plantations and natural forests as equivalent can obscure important ecological differences. Furthermore, Crowther *et al.* (2020) highlighted that the ongoing loss of natural forests in Vietnam continues to reduce native species richness, despite overall increases in forest area. These findings suggest that the lack of distinction between plantations and natural forests within Vietnam's forest cover targets may inadvertently encourage the conversion of natural or secondary forests into monoculture plantation, and similarly promote restoration of degraded forest land to plantations rather than natural forest. In addition, Evans and Turnbull (2004) emphasised that forest cover is a crucial indicator for measuring the health of forest ecosystems, but it is not sufficient on its own. This suggest that measuring forest quality, not just the number of trees or total hectares planted, is essential for tree plantation program and other FLR activities.

5.1.3 Land tenure and land rights

Results identified two main sets of tenure issues.

The first issue was inequities between households in their capacity to claim land that was being allocated for plantation establishment. As widely recognised in the literature, land tenure has long been recognised as a critical factor influencing the successful implementation of tree plantations and FLR more generally (Adams *et al.*, 2016; Shelton *et al.*, 2024). Unclear land tenure can be interpreted as allowing land to be available for tree plantations Schirmer (2007) even where traditional rights have been exercised for many generations. In the case study, changes in forest tenure since the 1990s have determined who holds the authority to participate in tree planting, as discussed by Sandewall *et al.* (2010). These shifts have frequently disadvantaged poorer or less-informed households, as documented in other studies (Clement and Amezaga, 2009; McElwee, 2009; Nielsen *et al.*, 2018). In this study, some households with limited labour resources were unable to claim land due to insufficient information about the benefits of tree planting and the need for immediate cash income.

The second issue was the subsequent reclamation of land previously allocated for tree plantations to establish national parks and protection forests. Despite efforts to implement plantation programs, the early stages of this process faced considerable criticism. In many cases, forest land was reclaimed for conservation purposes without adequate compensation to local communities. In this study, although some villagers received small cash from PFES scheme from trees planted in protection forests or within Tam Dao NP, the compensation was minimal and disproportionately affected poorer households in villages 2, 3, and 4. To and Dressler (2019) pointed out that small and improper PFES compensation further reduces villagers' opportunities to benefit from the forest, thereby sustaining poverty in the highlands**.** Similar concerns have been raised by Nguyen and Kull (2023), who criticised land reclamation for protected areas that displaced local people, particularly poorer and younger community members, leading some to attempt to reoccupy or cultivate plantation land as available land became increasingly scarce.

5.1.4 Community participation

The results identified two broad categories of challenges affecting community participation in tree planting programs: limited active involvement and insufficient access to information about tree plantation outcomes.

First, local communities had limited decision-making power in plantation programs. Initiatives such as PAM primarily targeted small-scale farmers, yet community involvement in decisions about which species to plant, where to plant them, and discussions of potential benefits and risks was restricted during the early stages. While communities have rich traditional knowledge of native species and local landscapes; however, most tree plantation programs were designed in a 'top-down' manner by government authorities, most tree plantation programs were designed 'top down' by government authorities, providing limited species choice and technical guidance along pre-determined land allocations. This aligns with findings by Clement and Amezaga (2009), who observed that in Project 661 provincial governments offered technical advice and tree species selection without effectively building local capacity, leaving most households as passive recipients rather than active participants. Actively involving communities could be a key contributor to the success of FLR, from site preparation and species selection to planning and monitoring (Reyes-García *et al.*, 2019). This study identifies that the lack of consultation, regarding key decisions, such as introducing new exotic species like acacia, limited community engagement and may have reduced long-term ecological and social benefits.

Second, communities often lacked adequate information to make informed decisions. Awareness of land tenure implications, potential ecological benefits, market opportunities, and contractual terms was limited. In practice, unclear guidance on land taxes and benefit distribution discouraged participation, particularly among poorer households who prioritised immediate income for food security. These findings align with those of Clement and Amezaga (2008) who similarly observed that unclear land-use procedures constrained community engagement in Vietnam. In the absence of such clarity, poorer households often prioritised immediate income due to food security concerns, particularly when incentives were delayed and access to non-timber forest products was restricted after ceasing shifting agriculture.

Overall, these results point out the limitations of short-term, top-down incentive tree plantation approaches. Evidence from Djoudi *et al.* (2024) and Fleischman *et al.* (2020) suggests that FLR programs are more effective when they foster long-term rural livelihoods rather than relying solely on immediate compensation for project participation. However, most programs, including PAM which was implemented from 1990–1995 in this case, adopted short-term approaches, ceasing incentives after the program period, which led communities to revert to their previous livelihoods.

5.2 Livelihood and social equity impacts

This section first discusses *Research Question 3,* focusing on the livelihood impacts and potential economic challenges related to current acacia practices. The second addresses *Research Question 2,* which examines the social equity impacts across three categories: wealth differences, gender differences, and youth.

5.2.1 Changes in rural livelihoods and potential economic challenges through acacia plantations

The economic benefits of acacia plantations have been confirmed both in this study (see Chapter 4.3.2) and consistently reported in the literature (e.g., (Mendham and White, 2019; Tham *et al.*, 2021)). These plantations contribute to local economic development and increased rural wealth. As a result, farmers have shifted from traditional shifting agriculture and reliance on timber and non-timber forest products to cultivating acacia and other exotic species, primarily for pulp and woodchip production.

However, the study identified potential economic challenges associated with current acacia plantation practices, particularly related to pest and disease outbreaks and declining soil fertility.

First, pest and disease pressures appear to increase in acacia monocultures compared with earlier rotations, which aligns with observations from previous studies and may contribute to reduced plantation productivity. Harwood and Nambiar (2014) noted that disease incidence was higher during periods of above-average rainfall, a pattern also observed in this study. The expansion of acacia monocultures likely provides abundant resources for pests and pathogens, which can adapt to these plantations over time. Research by Huong *et al.* (2015) and Nambiar *et al.* (2015) further highlighted that single-species tree plantations are particularly vulnerable to insect pests and plant diseases. This study also observes farmers tend to increase the use of pesticides and fertilisers to maintain yields. While this may temporarily sustain production, it can exacerbate soil degradation and increase production costs, ultimately reducing net income. Nambiar *et al.* (2015) emphasised that growth responses to management interventions, including the use of improved planting stock or fertiliser, are dependent on adequate soil moisture and root access. This suggests that further research is needed to understand economic and environmental implications of agrochemical use over successive rotations under variable climatic conditions.

Second, the study identified soil fertility as a major factor contributing to low productivity, which is also consistent with reported by Harwood and Nambiar (2014) and Mendham and White (2019). The case study pointed out that due to the preference for shorter acacia rotations, farmers often remove all other vegetation and grasses, burning the remaining biomass after harvesting. This practice prevents soil recovery, reduces beneficial soil microorganisms, and results in the loss of organic matter, surface soil, and nutrient content, as confirmed by Mendham and White (2019). Site clearing, particularly on steep slopes in northern Vietnam, may exacerbate soil erosion and further reduce fertility compared with lowland areas exposed to rainfall (Mendham and White, 2019; Nambiar *et al.*, 2015). de Jong *et al.* (2024) further suggested that appropriate soil preparation is crucial for successful tree establishment in FLR.

5.2.2 Social equity impacts of tree plantations

This section discusses community perspectives in terms of wealth class, gender, and youth to address Research Question 2, *What are community perspectives on FLR in Northern Vietnam?*

5.2.2.1 Differences among households of different wealth classes

As discussed in the Literature Review (see Chapter 2.2.2), the social impacts of tree plantations remain poorly understood. This study revealed that changes in the starting point of land tenure processes have differently affected households of different wealth classes, primarily by determining who can participate in tree plantations programs. This finding is consistent with the literature, which shows that this process has tended to benefit wealthier households while marginalising poorer ones, thereby reinforcing existing social inequities and limiting equitable participation in forest plantation activities (McElwee and Nghi, 2021; Nielsen *et al.*, 2018; Sikor and Baggio, 2014). Rural communities depend on non-timber forest products, medicinal plants, and other cultural resources (Djoudi *et al.*, 2024; Shelton *et al.*, 2024). The replacement of natural forests with plantations has disproportionately constrained access for poorer households, especially women, who typically hold less land and fewer plantations than wealthier households.

As noted in the literature, establishing tree plantations requires substantial labour and investment Frey *et al.* (2018). Consistent with this, the study found that poorer households, with limited labour, time, and access to assets such as fertiliser and machinery, were less able to invest in plantations. These households often preferred shorter rotations to secure quicker returns, but this strategy resulted in lower long-term financial gains. Shorter rotations were also favoured by poorer households due to the perceived risks of and disease and typhoons affecting trees under three to four years old. This aligns with findings by Maraseni *et al.* (2017), who further recommend longer acacia rotations of around ten years to achieve higher financial returns compared with short-term rotations.

In addition, poorer households generally have lower income diversity and reduced resilience, as insecure land tenure limits their access to additional forest resources. Wealthier families, by contrast, often accumulate assets over time and may acquire land from poorer households, further exacerbating inequality (Sikor and Baggio, 2014). These socio-economic dynamics are particularly significant under the projected adverse climate change in northern Vietnam. Poorer households with lower adaptive capacity are less able to protect plantations or recover from extreme weather events than wealthier households, highlighting the intersection of socio-economic status, plantation management, and climate vulnerability.

5.2.2.2 Gender differences

This study identifies gender differences in tree and crop planting practices, particularly emphasising the physical constraints faced by women, which limit their ability to initiate tree plantations. These findings align with previous research; for example, Thulstrup (2014) emphasised that labour availability is important in acacia plantations. In this case study, it was evident that the challenge becomes even more pronounced households headed by female or where labour is scarce. Similarly, a survey conducted by Vu *et al.* (2023) found that women often join tree planting activities later and have less tree plantations than men, particularly among older and longer-established household owners.

Immediate economic considerations also play a key role in women's participation and motivation compared to men. The results indicate that women, who frequently manage family finances, prioritise immediate income, whereas tree plantations typically require several years before yielding returns. This observation is consistent with those in the literature review (see Chapter 2.2) and highlights the tension between short-term household needs and long-term FLR goals. Thus, this study raises a question regarding the broader impacts of land-use policies. For instance, the forced cessation of shifting cultivation may have disproportionately affected food security for female-headed households, as discussed by Khuc *et al.* (2020); Van Mai and To (2015).

While both men and women participants perceived the risk of extreme weather affecting trees, women were less ready or able to make plans to adapt to these climate change situations. For example, they did not suggest any changes, such as proposing different tree species, as the men did. This might be because women have less decision-making power in tree plantation activities than men. Further research should consider these issues and explore them in greater depth. A study by Garrett *et al.* (2022) emphasised that promoting women's empowerment and gender equality across diverse cultural contexts have significant implications for forest restoration. This empowerment might focus on capacity building initiatives such as the TUAF CLC, which has established a Climate Learning Park with a gender-sensitive design to engage local women, and investment in innovative technologies or machinery to reduce barriers for women in tree plantation and other FLR activities.

5.2.2.3 Youth

One of the core objectives of FLR is to improve local well-being, as emphasised in the literature review. However, young people in the study area face several challenges in participating in tree plantation activities, as young people often inherit very little land from their parents due to limited land availability. This constraint might reduce their opportunities, prompting many to migrate temporarily to cities in search of unskilled work. When they return, they probably possess little or no forest land to cultivate. Similar patterns have been also observed elsewhere in Vietnam (Nguyen and Kull, 2023); This suggest that further alter local power dynamics, displace young people from forest-based livelihoods, and weaken their sense of belonging and the value they place on forests.

5.3 The multidimensionality and complexity of FLR

These results highlight the dynamic complexity of tree plantations and FLR observed in the study areas. As evident in the analytical framework adopted in this study (Figure 3.2), FLR is inherently multi-layered and complex, with different components producing diverse outcomes and benefits, often leading to trade-offs. In the time available, this study was only able to focus on the trade-offs between the main FLR elements during the transition from natural forests to acacia plantations. These trade-offs are organised into two main categories: those related to livelihood benefits, and those related to ecosystem benefits, including biodiversity conservation and climate mitigation and adaption.

5.3.1 Livelihoods benefits and five capitals

The result indicates that exotic plantations, particularly acacia, generally provide better livelihood outcomes than those derived from previous land uses; generating quicker and more substantial economic returns. Despite the issues regarding the long-term sustainability of acacia, as discussed in Chapter 2.2.3, this study illustrates how tree plantations play an important role in achieving the FLR objective of livelihood outcomes, compared with other approaches. This is supported by Katila *et al.* (2024), who noted that as most FLR activities are implemented in tropical and low-income countries, tree plantations are often used to improve livelihoods and meet local needs. However, focusing mainly on livelihood outcomes may lead to trade-offs with ecological outcomes, which are discussed in Chapter 5.3.2 below.

As discussed in the literature, livelihood extends beyond income alone (Shelton *et al.*, 2024). Considering the five-capital analytical framework allows for a more comprehensive understanding of how FLR contributes to community wellbeing and resilience. This perspective implies that FLR activities should aim not only to increase income but also to strengthen all five livelihood capitals, particularly for vulnerable households. For example, to empower poorer households in restoration activities, policy interventions should help enhance both their natural capital (e.g. through greater access to land-use rights and increasing soil fertility) and social capital (e.g. by improving skills and learning opportunities). For instance, to build community capacity, the Farmer Field School (FFS) approach has been developed in Vietnam and globally to help farmers achieve positive outcomes by improving their knowledge and adoption of beneficial practices (Waddington *et al.*, 2014). Considering all five livelihood capitals would enhance long-term resilience and ensure that restoration efforts contribute to more inclusive and equitable development.

5.3.2 Ecosystem services benefits

The results are consistent with the literature (e.g., (Chazdon and Brancalion, 2019; Ha *et al.*, 2022; Kull *et al.*, 2023)) which suggested that while acacia plantations contribute to restoring tree cover and supporting economic development, they provide fewer ecosystem services than natural forests. Natural forests offer greater benefits in terms of shade, soil erosion control, water regulation, and climate moderation. Importantly, this study also finds that the conversion of natural forests to acacia plantations leads to the loss of indigenous tree genetic diversity and non-timber forest products, as observed in Village 3, where traditional leaf collection has declined compared with the past (see Chapter 4.3.2).

Respondents reported that fast-growing exotic species like acacia and eucalypt require more water than native species and intensive harvesting can lead to soil degradation as highlighted in previous research (Evans and Turnbull, 2004; Harwood and Nambiar, 2014; Mendham and White, 2019). Although these species grow quickly under harsh conditions, they access groundwater that is less available to other plants, reducing overall ecosystem functionality (Mendham and White, 2019). This explains why participants from Village 1 were more concerned about water availability than those from other villages closer to natural forest.

The study also reveals that natural forests provide a broader range of benefits than exotic plantations, including recreational, cultural, and ecotourism opportunities for local communities, consistent with (Bauhus *et al.*, 2012; McElwee, 2009; McElwee *et al.*, 2022) and issue with young group (Chapter 2.3.2). Younger generations grew up without direct experience of natural forests. This, in turn, could influence how they and future generations perceive the value of forests and their role in sustaining both cultural and ecological well-being, shaping the priorities and outcomes of future FLR programs. Additionally, although FLR outcomes emphasise local well-being, research on recreational, cultural, and aesthetic values remains limited and should be further developed.

5.3.2.1 Biodiversity conservation

The impact of FLR on biodiversity depends on what is replaced during tree planting, and the biodiversity values of the restored forest. Plantations can provide habitat for some wildlife (Horák *et al.*, 2019; Pawson *et al.*, 2013); however, this case study shows that acacia plantations support wildlife far less than the original natural forests, as reported in previous studies (Di Sacco *et al.*, 2021; Ha *et al.*, 2022; Wang *et al.*, 2022). Monocultures provide limited food and fail to sustain complex food webs, in part because weeds are removed to promote acacia growth, reducing habitat diversity.

While FLR is promoted for climate mitigation (Garrett *et al.*, 2022; Stanturf *et al.*, 2015); many studies argued that acacia plantations also store less carbon than native forests (Chazdon and Guariguata, 2016; Di Sacco *et al.*, 2021), limiting opportunities for carbon payments. Exotic plantations are usually harvested after a relatively short period, reducing carbon accumulation in the forest landscape, whereas natural forests continue to store carbon over much longer periods (Fagan *et al.*, 2020). A full life analysis would be necessary to assess the status of the full carbon cycle associated with different forest types and management regimes.

5.3.2.2 Climate mitigation and adaption

In terms of climate mitigation and adaptation, non-native species are generally less resilient to extreme weather than native species, consistent with previous studies (Di Sacco *et al.*, 2021; Shelton *et al.*, 2024). Respondents reported that both acacia and eucalypt plantations are particularly vulnerable to storms and drought due to their shallow root systems, which can lead to structural collapse. These species also retain less water, increasing the risk of soil erosion during heavy rainfall, and lack the structural complexity and resilience of natural or old-growth forests, making them more prone during extreme events, consistent with results reported by Griffin *et al.* (2015). Another significant climate-related impact is the rise in pests and fungal diseases, which further stress plantation trees and undermine their productivity and ecological functions. Collectively, these factors pose serious climatic risks, as extreme weather can reduce growth, increase mortality, and ultimately reduce overall forest cover.

5.4 Implications for the effectiveness of FLR policies

This section discusses the implications of these findings, addressing Research Question 4 '*What are the implications of these findings for the effectiveness of FLR policies and strategies in Northern Vietnam*?' The discussion is organised into two main parts: implications for FLR in Vietnam and for the wider FLR discourse.

5.4.1 Implications for Northern Vietnam

Northern Vietnam, and the country more broadly, has successfully increased forest cover and supported economic development through tree plantations, but challenges remain that need to be addressed. As discussed above, there is a need to balance ecological health with social well-being, including community livelihoods (Erbaugh and Oldekop, 2018; Shelton *et al.*, 2024). Overall, the study identified that tree plantations have prioritised a single objective - economic development over other ecological considerations to compromises that may affect outcomes.

Although both international programs such as the Bonn Challenge, and the Vietnamese Government's tree planting and other FLR activities, are framed to promote positive outcomes, these approaches often require trade-offs, and their effectiveness may be limited under climate change. The mitigation and adaptation potential of FLR depends on factors such as the specific activities and methods employed, implementation timeframes, carbon pools, and the assumed use of wood products (Kübler and Günter, 2024). Additionally, the relationship between climate change and forests is closely interconnected: forests help human adapt to climate change, and adaptation measures may also benefit forests. In northern Vietnam, climate change has already impacted forests and communities through extreme events like typhoons and droughts, as well as through changes in rainfall patterns, temperature, and disease outbreaks. Therefore, climate change adaptation outcomes should be prioritised in FLR design and planning.

Maximising carbon sequestration through FLR requires long time periods, large areas, and careful implementation. Such trade-offs may not produce immediate visible benefits, such as short-term income, but they can support sustainability for both human and forests. The greatest and most enduring forest carbon stocks will be those associated with restoring and maintaining protection and protected areas. This emphasises the importance of selecting suitable species for FLR, to maximise these climate adaptation benefits and the role of native species as the basis for this. Based on agricultural land and forest land categories in Vietnam, strategies for selecting tree species and FLR options to reduce climate change impacts are recommended, as summarised in Table 5.2 below.

Land Category	Tree species	FLR options	Financial Mechanism	Climate change outcome	Other outcomes	Recommendations for future FLR program
Forest land: protection and special use forests	Native species	Natural regeneration	PES, including for catchment and carbon services	Longer term carbon stocks; improving catchment properties	Benefits for biodiversity, ecotourism, traditional plant products	Needs much greater policy and implementation emphasis than previously
Forest and production forests	Native and/or exotic species	Monoculture and mixed species plantings, including plantations	PES; commercial investments	Shorter term carbon stocks; may be improved by including native species	Use of native species will improve biodiversity	Remains important, but planted forests need to be more diverse and resilient
Agricultural land	Native and/or exotic species, including multipurpose species	Agroforestry compatible with agricultural systems, eg green tea, jackfruits	Farmer or investor	Enhanced carbon stocks; greater resilience of landscapes and production systems	Food crop, Improved productivity and diversified income	Needs much greater policy and implementation emphasis than previously

Table 5.2 Recommendations for FLR in northern Vietnam based on land categories

According to the summary presented in Table 5.2, this study demonstrates detailed strategies based on land categories, including FLR for protection and special-use forests, as well as FLR for production forests as below.

- *FLR for protection and special-use forests (national parks, other protected areas)*

Maintaining healthy forests supports the resilience of tree ecosystems and provides essential ecological services, such as ensuring water availability for communities, conserving biodiversity, and adapting climate change. Therefore, FLR planning must consider both quality and quantity for forest. In the case study, establishing forest corridors linking natural forests and plantations might be needed to consider. Protection and special-use forests should be effectively conserved to serve as corridors between existing and future plantations. Future FLR can use natural regeneration to conserve native genetic species at lower costs, while older forests also help store carbon and preserve biodiversity.

Thus, although the use of forest cover continues to play an important indicator, particularly in meeting national targets and international commitments, this study demonstrates that the Vietnamese Government should more clearly distinguish the value between natural forests and plantation forests in the context of climate change. Furthermore, it is essential to consider additional indicators that reflect forest quality rather than focusing solely on forest cover. Any plans to convert protection and special-use forests into plantations should be carefully evaluated, considering the trade-offs between short-term and long-term outcomes to ensure environmental, social, and economic sustainability.

- *FLR for production forests*

Acacia plays a crucial role in Vietnam's economy, with the country ranking fourth globally in woodchip exports (Cochard *et al.*, 2020; Tham *et al.*, 2021). This significant contribution to economic development makes it challenging to reduce dependence on acacia plantations. Short plantation cycles of around four to seven years prevent the development of mature forest characteristics and limit ecosystem services. Although these plantations can be easily replanted, their emphasis on productivity rather than ecological restoration results in fluctuating forest cover, mitigating climate change and biodiversity loss (Fagan *et al.*, 2020).

There is a need to direct research and development (R&D) efforts toward practical and impact-oriented solutions, particularly in promoting sustainable acacia wood supply; improving pest and disease management; and developing alternative livelihoods for communities. This thesis suggests four pathways outlined below to help make tree plantation and other FLR options more sustainable for both short-term and long-term vision.

1. Sustainable acacia wood supply

Increasing investment in yield gap assessments, supported by adaptive research, can enhance productivity in both the short and medium term. Building local labour capacity is also vital for sustaining productivity. In addition, research on certification schemes such as the Forest Stewardship Council (FSC) and greater community engagement, including the participation of disadvantaged groups, could support the adoption of sustainable management practices (FAO, 2024). In sum, promoting certification and sustainable supply chains may therefore be a national priority in coming years.

2. Pest and disease management

Managing pests and diseases in environmentally acceptable ways needs to be prioritised in R&D. There has been little evaluation of harvesting systems and their biophysical outcomes in plantation forests (Nambiar, 2021) particularly in terms of quantitative assessments of soil – nutrient - water relationships and their links to pest and disease incidence and productivity. Harvesting practices should align with site-specific biophysical conditions to minimise soil disturbance. Beyond short-term income goals, extending rotation lengths and incorporating mixed-species plantings, including native trees, can improve soil quality and reduce pest and disease risks. In addition, raising awareness and providing training for villagers on sustainable management practices are also essential for long-term acacia plantation.

3. Diversifying income and livelihoods for building community resilience

In the context of climate change, diversifying livelihoods provides an important pathway to strengthen community resilience rather than relying primarily for income on acacia plantations Moreover, having several immediate income sources may encourage communities to adopt more sustainable plantation practices, including longer acacia rotation cycles. First, developing long-term funding models that deliver both environmental and social outcomes could provide scalable approaches for sustainable FLR. Financial mechanisms such as PFES, REDD+, and carbon credits should be strengthened, as this study finds funding from tree planning in protected areas is insufficient to fully engage local communities. New schemes should actively include vulnerable groups and ensure equitable benefit-sharing. Second, research on other FLR options such as such as agroforestry model, could support multiple outcomes for community in terms of annual food crops, improving soil health, and sequestering carbon.

4. Towards a long-term transition from acacia to Vietnamese native tree species

In this context, prioritising FLR outcomes that enhance climate adaptation and mitigation is essential. Future research should explore transitioning to species that meet timber demand while offering better ecosystem services and climate resilience than acacia. Greater promotion of native species, including medicinal and high-value trees, is needed to enhance both ecological and livelihood outcomes (Zimmer *et al.*, 2022). Future research should prioritise Vietnamese native trees that are better adapted to local conditions, conserve genetic diversity, resist pests and diseases, and contribute to biodiversity restoration. Building a research value chain to support the development of markets for native tree species will be essential. Further, partnerships with private sectors and international donors, which have supported reforestation for decades, can play a key role in scaling up these initiatives.

5.4.2 Implications for the wider FLR discourse.

First, FLR has been widely promoted through international commitments as noted in literature review. However, these global targets continue to emphasise the quantity of restoration such as the number of trees planted or total area restored over the quality of outcomes. However, greater attention is needed to promote integrate socio-cultural and human considerations alongside ecological indicators. There is a need for clearer guidelines and quality target from international commitments, as the lack of detailed direction on what constitutes ‘quality’ FLR activities has led to differing interpretations among countries regarding what FLR is, who it is for, and how it should be implemented. This has encouraged top-down approaches that prioritise tree cover expansion, as seen in the case study, where the focus has shifted from long-term ecological success to short-term achievements (Duguma *et al.,* 2020; Fleischman *et al.,* 2020).

Thus, context matters deeply in FLR implementation at the local level. Although FLR aims to balance ecological restoration with livelihood improvement through multifunctional design, the relative emphasis varies by setting. As Katila *et al.* (2024) noted, in low-income contexts, livelihoods and food security often take priority over ecological goals, making the design of multifunctional FLR both critical and challenging. Therefore, trade-offs and synergies in FLR activities should be explicitly recognised before implementation to ensure that interventions align with local needs while balancing multiple objectives. Effective and sustainable FLR requires participatory planning, stakeholder capacity-building, and context-specific approaches. The selection of FLR interventions must consider local ecological conditions, community priorities, timing, and long-term objectives. FLR should be viewed as a dynamic, process-oriented strategy rather than a one-off project, requiring resilience, adaptive management, and continuous learning to achieve durable outcomes. In this context, research, learning and demonstration centres, such as the TUAF Climate Learning Centre, can make critical contributions to the understanding, evolution and implementation of locally-appropriate and resilient FLR.

Chapter 6: Conclusions

Overview

Forest Landscape Restoration (FLR) is an approach to achieving multiple goals that are essential for improving local well-being, addressing forest loss, and mitigating climate change, especially in countries of the Global South where people depend heavily on forest resources.

Vietnam has experienced extensive deforestation and forest degradation over many decades, leaving it highly exposed to the effects of climate change, including extreme weather events. To address these challenges, the country has implemented key policies aimed at advancing FLR, primarily through tree plantation projects. However, there is limited empirical research in Vietnam that examines the social impacts of these tree plantations, the benefits of these programs, and how policies are implemented in practice to achieve FLR goals through tree planting initiatives.

Understanding the social impacts of FLR programs is a crucial step toward ensuring that FLR activities achieve outcomes that balance both social and ecological sustainability in the face of climate change. Accordingly, this study aimed to contribute to ongoing efforts and the existing literature by examining how FLR policies are interpreted and implemented in practice in Vietnam. It explored community perspectives based on wealth ranking, gender, and generational differences, and investigates the livelihood impacts of these tree plantations. This study adopts an analytical framework adapted from Chazdon and Brancalion (2019) which has proven useful for understanding the complexity, trade-offs, and logical elements of FLR. A case study in Thai Nguyen Province, located in northern Vietnam, was selected to address these research questions, which are:

1. What is the policy framework for FLR in Northern Vietnam, and how is it being translated into practice?

2. What are community perspectives on FLR in Northern Vietnam?

3. What are the likely livelihood impacts of FLR on local communities in Northern Vietnam?

4. What are the implications of these findings for the effectiveness of FLR policies and strategies in Northern Vietnam?

Key findings

The findings reveal that the Vietnamese Government has implemented a series of policies that strongly promote tree plantations over other FLR options. This policy direction has contributed to a marked increase in tree cover compared to the period before the 1990s. However, the implementation process faces several challenges. These include an emphasis on the quantity rather than the quality of forest, a lack of transparency in land tenure arrangements, and limited community participation in decision-making related to tree plantations.

While exotic tree plantations have provided economic benefits for communities and the national economy, and represent a technically attractive solution for rapid reforestation, they also present notable challenges. Vulnerable groups, particularly poorer households, women, and young people, face disadvantages because they possess less forest land and fewer assets to invest in tree plantations, and are more exposed to negative impact of extreme weather. Moreover, the plantation monocultures face increasing challenges such as pest and disease outbreaks and declining soil fertility, which together lead to reduced productivity.

The study demonstrates that FLR should be viewed as a multidimensional and complex, consistent with the conceptual model presented by Chazdon and Brancalion (2019); it involves various interacting elements that produce diverse outcomes and benefits. Although FLR is often promoted as a universal solution for achieving multiple goals, this study shows that outcomes depend heavily on context and objectives. Different FLR approaches and contexts generate different ecological, social, and economic results. Understanding these complexities, trade-offs, and synergies is crucial for policymakers to design more effective and adaptive FLR interventions that balance short-term and long-term benefits.

In this case, the study clearly illustrates the trade-offs between the main FLR elements during the transition from natural forests to acacia plantations. While acacia plantations provide greater economic benefits, they support less biodiversity, provide fewer ecosystem services, and are less resilient to climate change compared to natural forests. Importantly, without careful consideration of social impacts and environmental outcomes, tree plantations and other FLR initiatives may fail to achieve the long-term objectives of ecosystem restoration.

From a broader policy perspective, these findings have several important implications.

First, for forest and biodiversity management, the study suggests strengthening Research and Development (R&D) to ensure a sustainable supply of acacia wood and to improve sustainable management practices. Thus, promoting longer rotation periods could also enhance ecological outcomes, although there is a trade-off with vulnerability to typhoons. In this context, the urgency of achieving outcomes that support climate change adaptation and mitigation through FLR should be prioritised. Consequently, research should explore the potential for transitioning to other species that meet timber demand while providing better ecosystem services and greater climate resilience than acacia. In particular, native Vietnamese species, including medicinal and high-value trees, show strong potential to meet multiple FLR goals, as they are well adapted to local conditions, conserve genetic diversity, resist pests and diseases, and support biodiversity restoration. A related research issue is the extent to which these native species will maintain their resilience in the face of climate change.

Second, to enhance community resilience, the study demonstrates the importance of diversifying income and livelihoods rather than relying primarily for income on acacia plantations. This approach will help strengthen households and community resilience in the face of climate change. Agroforestry systems, for example, represent a promising prospect by providing food crops, improving soil health, and sequestering carbon, and should therefore be considered in future initiatives.

Finally, the study emphasises the need for stronger financial mechanisms to support both forest restoration and community well-being. Payment for environmental services mechanisms such as PFES, REDD+, and other carbon credit schemes should be expanded and better implemented to ensure that FLR activities are both environmentally sustainable and socially equitable.

This study was conducted in partnership with the TUAF Climate Learning Centre, which was established to contribute to Vietnam’s target of achieving net zero emissions and climate resilience by 2050. It is evident from these results that the TUAF Climate Learning Centre, and other similar initiatives, have an important role to play in strengthening community awareness, facilitating knowledge exchange between researchers and farmers on tree plantation and FLR options, and supporting good sustainable practices for climate change adaptation in northern Vietnam.

Addressing limitations

This research was constrained by the time and resources available within a 9-month period. Gaining a comprehensive understanding of all elements in the analytical framework would have required additional time to provide a more complete picture of the impacts of tree plantation projects. For example, this study did not include an examination of enabling conditions such as the value chain effect on acacia plantations. The analysis of the five livelihood capitals was also not explored in depth, although it is essential for understanding how to empower individual households and strengthen community resilience. These aspects should be examined in greater detail in future research.

Although this study aimed to explore perspectives of younger generation regarding the benefits and challenges of tree plantations and other FLR options, the participation of young people in both interviews and FGDs was limited. This limited the representation of their viewpoints, primarily because many young people temporarily migrate for work and have limited availability in their villages during the research period. Further research consists more diversity young groups in both male and female to promote their decision making in FLR activities.

In conclusion

By incorporating a local perspective, this study offers a critical examination of the assumptions and approaches underlying forest restoration efforts in Vietnam, particularly those focused on tree plantations. In light of the urgent need to address climate change, it is important to recognise and balance both the social and ecological dimensions of FLR activities. Achieving this balance requires integrated and adaptive management strategies that promote policies supporting a more comprehensive view of human well-being and environmental outcomes, ensuring the long-term outcomes of FLR rather than only short-term gains.

References

Adams, C., Rodrigues, S. T., Calmon, M. and Kumar, C., 2016. Impacts of large-scale forest restoration on socioeconomic status and local livelihoodswhat we know and do not know, *Biotropica*, **48**(6): 731-744.

Arnold, R., Midgley, S., Stevens, P., Phimmavong, S., Kien, N. D. and Chen, S., 2022. Profitable partnerships: smallholders, industry, eucalypts and acacias in Asia, *Australian Forestry,* **85**(1): 38-53.

BaoThaiNguyen, 2022. *Giữ màu xanh cho những cánh rừng Đại Từ* [webpage], Thai Nguyen Radio, Televison and Electronic Newspaper. Available at: https://baothainguyen.vn/kinh-te/202204/giu-mau-xanh-cho-nhung-canh-rung-dai-tu-367C51C/ [accessed 15/5/2025].

BaoThaiNguyen, 2024. *Đồng Hỷ: Trồng rừng vượt trên 36% kế hoạch năm* [webpage], Thai Nguyen Radio, Televison and Electronic Newspaper. Available at: https://baothainguyen.vn/kinh-te/202411/dong-hy-trong-rung-vuot-tren-36-ke-hoach-nam-c2d1fcc/ [accessed 15/05/2025].

Bauhus, J., Pokorny, B., van der Meer, P. J., Kanowski, P. J., Kanninen, M., Bauhus, J., Kanninen, M. and van der Meer, P. J., 2012. Ecosystem Goods and Services - the Key for Sustainable Plantations. Routledge, pp. 205-227. 10.4324/9781849776417-8

Baxter, P. and Jack, S., 2008. Qualitative case study methodology: study design and implementation for novice researchers, *The Qualitative Report*, **13**: 544+.

Blackburn, D., Huong, V. D. and Mendham, D., 2020. Returns to Vietnamese smallholder farmers from managing acacia plantations for sawn wood over 4-10 year rotations, *Forest Policy and Economics,* **121**: 102318.

Braun, V. and Clarke, V., 2006. Using thematic analysis in psychology, *Qualitative Research in Psychology,* **3**(2): 77-101.

Catacutan, D., Nguyen Thi Hoa, N. T. H., Do Trong Hoan, D. T. H., Simelton, E. and Hoang Thi Lua, H. T. L., 2017. Shifting cultivation in Vietnam: impacts of various policy reforms, *CABI*: 470–485.

CBD, 2020. *Aichi Biodiversity Targets* [webpage], Available at: https://www.cbd.int/sp/targets [accessed 20/10/2025].

César, R. G., Moreno, V. d. S., Coletta, G. D., Schweizer, D., Chazdon, R. L., Barlow, J., Ferraz, S. F. B., Crouzeilles, R. and Brancalion, P. H. S., 2021. It is not just about time: Agricultural practices and surrounding forest cover affect secondary forest recovery in agricultural landscapes, *Biotropica,* **53**(2): 496-508.

Chazdon, R. and Brancalion, P., 2019. Restoring forests as a means to many ends, *Science,* **365**(6448): 24-25.

Chazdon, R. L., Brancalion, P. H. S., Lamb, D., Laestadius, L., Calmon, M. and Kumar, C., 2017. A Policy-Driven Knowledge Agenda for Global Forest and Landscape Restoration, *Conservation Letters,* **10**(1): 125-132.

Chazdon, R. L. and Guariguata, M. R., 2016. Natural regeneration as a tool for large-scale forest restoration in the tropics: prospects and challenges, *Biotropica,* **48**(6): 716-730.

Chazdon, R. L., Gutierrez, V., Brancalion, P. H. S., Laestadius, L. and Guariguata, M. R., 2020. *Co-Creating Conceptual and Working Frameworks for Implementing Forest and Landscape Restoration Based on Core Principles*, Available

Clement, F. and Amezaga, J. M., 2008. Linking reforestation policies with land use change in northern Vietnam: Why local factors matter, *Geoforum,* **39**(1): 265-277.

Clement, F. and Amezaga, J. M., 2009. Afforestation and forestry land allocation in northern Vietnam: Analysing the gap between policy intentions and outcomes, *Land Use Policy,* **26**(2): 458-470.

Cochard, R., Nguyen, V. H. T., Ngo, D. T. and Kull, C. A., 2020. Vietnam's forest cover changes 2005–2016: Veering from transition to (yet more) transaction?, *World Development,* **135**: 105051.

Crowther, J., Zimmer, H., Le Thi, H., Quang, T. L. and Nichols, J. D., 2020. Forestry in Vietnam: The potential role for native timber species, *Forest Policy and Economics,* **116**: 102182.

Dang, T. K. P., 2022. The Discourse of Forest Cover in Vietnam and Its Policy Implications, *Sustainability*, **14**(17): 10976.

DCCEEW, 2025. *A New Global Biodiversity Framework: Kunming-Montreal Global Biodiversity Framework* [webpage], https://www.dcceew.gov.au/environment/biodiversity/international/un-convention-biological-diversity/global-biodiversity-framework. 10/10/2025].

de Jong, W., Pierce Colfer, C. J., Katila, P., Winkel, G., Pacheco, P. and Galloway, G., 2024. Financial, ecological, political, and social feasibility of forest restoration targets. Oxford University Press, Incorporated, United States.

de Jong, w., Sam;, D. D. and Hung;, T. V., 2006. *Forest Rehabilitation in Vietnam Histories, realities and future*, Center for International Forestry Research (CIFOR), Bogor, Indonesia.

DFID, 1999. Sustainable Livelihoods Guidance Sheets.

Di Sacco, A., Hardwick, K. A., Blakesley, D., Brancalion, P. H. S., Breman, E., Cecilio Rebola, L., Chomba, S., Dixon, K., Elliott, S., Ruyonga, G., Shaw, K., Smith, P., Smith, R. J. and Antonelli, A., 2021. Ten golden rules for reforestation to optimize carbon sequestration, biodiversity recovery and livelihood benefits, *Global Change Biology*, **27**(7): 1328-1348.

Djoudi, H., Djenontin, I. N. S. and Pierce Colfer, C. J., 2024. Making forest landscape restoration work for livelihoods and well-being of local communities. In: *Restoring Forests and Trees for Sustainable Development: Policies, Practices, Impacts, and Ways Forward*, (Eds, Katila, P., Pierce Colfer, C. J., de Jong, W., Galloway, G., Pacheco, P. and Winkel, G.), Oxford University Press, pp. 0. 10.1093/9780197683958.003.0008

Do, T. H. and Mulia, R., 2018. Constraints to smallholder tree planting in the northern mountainous regions of Viet Nam a need to extend technical knowledge and skills, *The International Forestry Review*, **20**(1): 43-57.

Do, T. T. H. and Bui, M. H., 2023. Potential of agroforestry for climate change adaptation in the Northwest mountainous region of Vietnam, *APN science bulletin (Online)*, **13**(1): 50-59.

Dong, V. A., 2018. 'Understanding factors influencing non-industrial private forest owners' decisions in planting and harvesting trees : a case study in Thai Nguyen province, Vietnam.', PhD thesis, University of Canterbury, New Zealand.

Duguma, L., Minang, P., Betemariam, E., Carsan, S., Nzyoka, J., Bah, A. and Jamnadass, R., 2020. *From Tree Planting to Tree Growing: Rethinking Ecosystem Restoration Through Trees*,

Ebeler, L., Balke, T., Laurie, E., Le, H., Nguyen, T. and Renaud, F. G., 2025. Local-scale impacts of mangrove restoration and conservation on coastal communities in two Vietnamese deltas: Socio-economic and institutional dynamics, *Ocean & Coastal Management*, **269**: 107812.

Erbaugh, J. T. and Oldekop, J. A., 2018. Forest landscape restoration for livelihoods and well-being, *Current Opinion in Environmental Sustainability*, **32**: 76-83.

Evans, J. and Turnbull, J. W., 2004. Plantation Forestry in the Tropics , The Role, Silviculture, and Use of Planted Forests for Industrial, Social, Environmental, and Agroforestry Purposes, *Forest Policy and Economics*, **11**: 77-77.

Fagan, M. E., Reid, J. L., Holland, M. B., Drew, J. G. and Zahawi, R. A., 2020. How feasible are global forest restoration commitments?, *Conservation Letters*, **13**(3): e12700.

FAO, 2024. *Fostering linkages between sustainable wood supply and forest and landscape restoration in Asia and the Pacific* [webpage], Available at: https://openknowledge.fao.org/items/7ec00f6a-ce7c-4a4d-8b75-e565673878ba [accessed 14/09/2025].

FAO and UNEP, 2020. *The State of the World's Forests 2020. Forests, biodiversity and people*, Rome.

Fischer, J., Riechers, M., Loos, J., Martin-Lopez, B. and Temperton, V. M., 2021. Making the UN Decade on Ecosystem Restoration a Social-Ecological Endeavour, *Trends Ecol Evol*, **36**(1): 20-28.

Fleischman, F., Basant, S., Chhatre, A., Coleman, E. A., Fischer, H. W., Gupta, D., Güneralp, B., Kashwan, P., Khatri, D., Muscarella, R., Powers, J. S., Ramprasad, V., Rana, P., Solorzano, C. R. and Veldman, J. W., 2020. Pitfalls of Tree Planting Show Why We Need People-Centered Natural Climate Solutions, *BioScience*, **70**(11): 947-950.

Frey, G., Cubbage, F., Ha, T. T. T., Davis, R. R., Carle, J., Thon, V. X. and Dzung, N. V., 2018. Financial analysis and comparison of smallholder forest and state forest enterprise plantations in Central Vietnam, *International Forestry Review*, **20**: 181-198.

Garrett, L., Lévite, H., Besacier, C., Alekseeva, N. and Duchelle, M., 2022. *The key role of forest and landscape restoration in climate action*, Rome, FAO.

Gill, P., Stewart, K., Treasure, E. and Chadwick, B., 2008. Methods of data collection in qualitative research: interviews and focus groups, *Br Dent J*, **204**(6): 291-295.

Griffin, A., Nambiar, S., Harwood, C. and See, 2015. Sustaining the future of Acacia plantation forestry - a synopsis INTRODUCTION, *Southern Forests: a Journal of Forest Science*, **77**.

Ha, N. T., Benedikter, S. and Kapp, G., 2022. A Value Chain Approach to Forest Landscape Restoration: Insights from Vietnam's Production-Driven Forest Restoration, *Forest and Society*, **6**(1): 311-334.

Ha, T. M., Kühling, I. and Trautz, D., 2020. A systems approach toward climate resilient livelihoods: A case study in Thai Nguyen province, Vietnam, *Heliyon*, **6**(11): e05541.

Hai, N. T., Dell, B., Phuong, V. T. and Harper, R. J., 2020. Towards a more robust approach for the restoration of mangroves in Vietnam, *Annals of Forest Science*, **77**(1): 18.

Harwood, C. E. and Nambiar, E. K. S., 2014. *Sustainable plantation forestry in South-*

East Asia., Australian Centre for International Agricultural Research, Canberra, Australia.

Horák, J., Brestovanská, T., Mladenović, S., Kout, J., Bogusch, P., Halda, J. P. and Zasadil, P., 2019. Green desert?: Biodiversity patterns in forest plantations, *Forest Ecology and Management*, **433**: 343-348.

Huong, V. D., Nambiar, E. K. S., Quang, L. T., Mendham, D. S. and Dung, P. T., 2015. Improving productivity and sustainability of successive rotations of Acacia auriculiformis plantations in South Vietnam, *Southern Forests: a Journal of Forest Science*, **77**(1): 51-58.

IPBES, 2019. *Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.*, (Ed, E. S. Brondizio, J. S., S. Díaz, and H. T. Ngo), Bonn, Germany.

IUCN, 2021. *Deforestation and forest degradation* [webpage], IUCN issues briefs. IUCN. Available at: https://iucn.org/resources/issues-brief/deforestation-and-forest-degradation [accessed 15/05/2025].

IUCN and WRI, 2014. *A guide to the Restoration Opportunities Assessment Methodology (ROAM): Assessing forest landscape restoration opportunities at the national or sub-national level*, Gland, Switzerland: IUCN.

Katila, P., Pierce Colfer, C. J., de Jong, W., Galloway, G., Pacheco, P. and Winkel, G., 2024. 1Introduction: Restoring forests and trees for sustainable development. In: *Restoring Forests and Trees for Sustainable Development: Policies, Practices, Impacts, and Ways Forward*, (Eds, Katila, P., Pierce Colfer, C. J., de Jong, W., Galloway, G., Pacheco, P. and Winkel, G.), Oxford University Press, pp. 0. 10.1093/9780197683958.003.0001

Keenan, R. J., Louman, B., Brand, D., Ojha, H. and Xi, L., 2024. Financial, ecological, political, and social feasibility of forest restoration targets. In: *Restoring Forests and Trees for Sustainable Development: Policies, Practices, Impacts, and Ways Forward*, (Eds, Katila, P., Pierce Colfer, C. J., de Jong, W., Galloway, G., Pacheco, P. and Winkel, G.), Oxford University Press, pp. 0. 10.1093/9780197683958.003.0010

Khuc, Q. V., Le, T.-A. T., Nguyen, T. H., Nong, D., Tran, B. Q., Meyfroidt, P., Tran, T., Duong, P. B., Nguyen, T. T., Tran, T., Pham, L., Leu, S., Thao, N. T. P., Huu-Dung, N., Dao, T.-K., Van Hong, N., Nguyet, B. T. M., Nguyen, H.-S. and Paschke, M. W., 2020. Forest Cover Change, Households' Livelihoods, Trade-Offs, and Constraints Associated with Plantation Forests in Poor Upland-Rural Landscapes: Evidence from North Central Vietnam, *Forests*, **11**(5): 548.

Kübler, D. and Günter, S., 2024. 135Forest restoration for climate change mitigation and adaptation. In: *Restoring Forests and Trees for Sustainable Development: Policies, Practices, Impacts, and Ways Forward*, (Eds, Katila, P., Pierce Colfer, C. J., de Jong, W., Galloway, G., Pacheco, P. and Winkel, G.), Oxford University Press, pp. 0. 10.1093/9780197683958.003.0006

Kull, C. A., Nguyen, V. H. T., Cochard, R., Ngo, D. T., Pham, T. P. T., Shackleton, R. T., Tran, C. Q. and Tran, T. N., 2023. New Forests and New Forest People in Central Vietnam: The Acacia Boom, *CABI Books*: 399–415.

Mansourian, S., Djenontin, I. N. S., Elias, M., Oldekop, J. A., Derkyi, M. A. A., Kull, C. A. and Pacheco, P., 2025. Situating the "human" in forest landscape restoration, *Frontiers in Environmental Science,* **12**.

Mansourian, S., Dudley, N. and Vallauri, D., 2017. Forest Landscape Restoration: Progress in the Last Decade and Remaining Challenges, *Ecological Restoration,* **35**(4): 281-288.

Maraseni, T. N., Son, H. L., Cockfield, G., Duy, H. V. and Nghia, T. D., 2017. The financial benefits of forest certification: Case studies of acacia growers and a furniture company in Central Vietnam, *Land Use Policy,* **69**: 56-63.

McElwee, P., 2004. You Say Illegal, I Say Legal, *Journal of Sustainable Forestry,* **19**(1-3): 97-135.

McElwee, P., 2009. Reforesting "Bare Hills" in Vietnam: Social and Environmental Consequences of the 5 Million Hectare Reforestation Program, *AMBIO: A Journal of the Human Environment*, **38**(6): 325-333, 329.

McElwee, P., H., ng, Võ, G. and Lê, D., 2022. Patriotism, place, and provisioning: assessing cultural ecosystem services through longitudinal and historical studies in Vietnam, *Ecology and Society,* **27**(1).

McElwee, P. and Nghi, T. H., 2021. Assessing the Social Benefits of Tree Planting by Smallholders in Vietnam: Lessons for Large-Scale Reforestation Programs, *Ecological Restoration*, **39**(1-2): 52-63.

Mendham, D. S. and White, D. A., 2019. A review of nutrient, water and organic matter dynamics of tropical acacias on mineral soils for improved management in Southeast Asia, *Australian Forestry,* **82**(sup1): 45-56.

Miller, F. and Dun, O., 2019. Resettlement and the environment in Vietnam: Implications for climate change adaptation planning, *Asia Pacific Viewpoint,* **60**(2): 132-147.

Nambiar, E. K., 2021. Strengthening Vietnam's forestry sectors and rural development: Higher productivity, value, and access to fairer markets are needed to support small forest growers, *Trees, Forests and People,* **3**: 100052.

Nambiar, E. K. S., Harwood, C. E. and Kien, N. D., 2015. Acacia plantations in Vietnam: research and knowledge application to secure a sustainable future, *Southern Forests: a Journal of Forest Science*, **77**(1): 1-10.

Nguyen, D. C., 2018. 'GIS based land use simulation of sustainable forest management and wood utilization in Thai Nguyen Province, Vietnam', PhD thesis, Universität Hamburg, Hamburg.

Nguyen, V. H. T. and Kull, C. A., 2023. Land acquisition through Bricolage? Politics of smallholder acacia plantation expansion in upland Central Vietnam, *The Journal of Peasant Studies,* **50**(4): 1501-1528.

Nielsen, M. R., Theilade, I., Meilby, H., Nui, N. H. and Lam, N. T., 2018. Can PES and REDD+ match Willingness To Accept payments in contracts for reforestation and avoided forest degradation? The case of farmers in upland Bac Kan, Vietnam, *Land Use Policy,* **79**: 822-833.

Pawson, S. M., Brin, A., Brockerhoff, E. G., Lamb, D., Payn, T. W., Paquette, A. and Parrotta, J. A., 2013. Plantation forests, climate change and biodiversity, *Biodiversity and Conservation,* **22**(5): 1203-1227.

Reyes-García, V., Fernández-Llamazares, Á., McElwee, P., Molnár, Z., Öllerer, K., Wilson, S. J. and Brondizio, E. S., 2019. The contributions of Indigenous Peoples and local communities to ecological restoration, *Restoration Ecology*, **27**(1): 3-8.

Sandewall, M., Ohlsson, B., Sandewall, R. K. and Viet le, S., 2010. The expansion of farm-based plantation forestry in Vietnam, *Ambio,* **39**(8): 567-579.

Schirmer, J., 2007. Plantations and social conflict: exploring the differences between small-scale and large-scale plantation forestry, *Small-scale Forestry,* **6**(1): 19-33.

Schmidt-Thomé, P., Nguyen, T. H., Pham, T. L., Jarva, J. and Nuottimäki, K., 2014. Climate change in Vietnam. In: *climate change adaptation measures in Vietnam: development and implementation*, Springer, pp. 7-15.

Shelton, M., Kanowski, P., Kleinschmit, D. and Ison, R., 2024. Critical social perspectives in forest and landscape restoration – a systematic review, *Frontiers in Environmental Science*, **12**.

Sikor, T., 2001. The allocation of forestry land in Vietnam: did it cause the expansion of forests in the northwest?, *Forest Policy and Economics,* **2**(1): 1-11.

Sikor, T. and Baggio, J. A., 2014. Can Smallholders Engage in Tree Plantations? An Entitlements Analysis from Vietnam, *World Development,* **64**: S101-S112.

Son, H., Kingsbury, A., Bui, T. and Nguyen Dang, C., 2023. Social Vulnerability, Climate Change, and Ethnic Minority Communities in the Northern Mountainous Region of Vietnam, *The International Journal of Climate Change Impacts and Responses,* **16**: 21-44.

Stanturf, J., Kant, P., Lillesø, J.-P. B., Mansourian, S., Kleine, M., Graudal, L. and Madsen, P., 2015. *World Series Vol. 34 - Forest Landscape Restoration as a Key Component of Climate Change Mitigation and Adaptation. By John A. Stanturf, Promode Kant, Jens-Peter Barnekow Lillesø, Stephanie Mansourian, Michael Kleine, Lars Graudal, Palle Madsen,*

Stanturf, J. A., Kleine, M., Mansourian, S., Parrotta, J., Madsen, P., Kant, P., Burns, J. and Bolte, A., 2019. Implementing forest landscape restoration under the Bonn Challenge: a systematic approach, *Annals of Forest Science,* **76**(2): 50.

Tham, L. T., Darr, D. and Pretzsch, J., 2021. Analysis of Acacia hybrid timber value chains: A case study of woodchip and furniture production in central Vietnam, *Forest Policy and Economics,* **125**: 102401.

Thulstrup, A. W., 2014. Plantation livelihoods in central Vietnam: Implications for household vulnerability and community resilience, *Norsk Geografisk Tidsskrift - Norwegian Journal of Geography,* **68**(1): 1-9.

Tinh, P. H., MacKenzie, R. A., Hung, T. D., Hanh, N. T. H., Hanh, N. H., Manh, D. Q., Ha, H. T. and Tuan, M. S., 2022. Distribution and drivers of Vietnam mangrove deforestation from 1995 to 2019, *Mitigation and Adaptation Strategies for Global Change,* **27**(4): 29.

To, P. and Dressler, W., 2019. Rethinking 'Success': The politics of payment for forest ecosystem services in Vietnam, *Land Use Policy,* **81**: 582-593.

TUAF, 2023. *Chào mừng các bạn đến với Trường Đại học Nông Lâm Thái Nguyên* [webpage], Available at: https://tuaf.edu.vn/bai-viet/chao-mung-cac-ban-den-voi-truong-dai-hoc-nong-lam-thai-nguyen-5765.html [accessed 10/10/2025].

TUAF CLC, n.d. *Câu chuyện về chúng tôi* [webpage], Climate Learning Centre. Available at: http://climatelearningcenter.edu.vn/cau-chuyen-ve-chung-toi?cat=596 [accessed 10/10/2025].

Van Mai, T. and To, P. X., 2015. A Systems Thinking Approach for Achieving a Better Understanding of Swidden Cultivation in Vietnam, *Human Ecology,* **43**(1): 169-178.

Vien, T. D., 2003. Culture, envionment, and farming Systems in Vietnam's Northern mountain region, *Japanese Journal of Southeast Asian Studies,* **41**(2): 180-205.

Vietnamese Ministry of Labour & Invalids and Social Affairs, 2021. *Chính phủ ban hành chuẩn nghèo đa chiều giai đoạn 2021-2025* [webpage], MOLISA. Available at: https://www.molisa.gov.vn/baiviet/224791?tintucID=224791 [accessed 20/04/2025].

Vu, B. T., Cochard, R. and Ngo, D. T., 2023. The acacia plantation boom in Thừa Thiên Huế Province, Central Vietnam: A survey of tree farmers' shifting livelihoods, environmental perceptions, and occupational perspectives, *Trees, Forests and People,* **13**: 100405.

Waddington, H., Snilstveit, B., Hombrados, J., Vojtkova, M., Phillips, D., Davies, P. and White, H., 2014. Farmer Field Schools for Improving Farming Practices and Farmer Outcomes: A Systematic Review, *Campbell Systematic Reviews,* **10**(1): i-335.

Wang, C., Zhang, W., Li, X. and Wu, J., 2022. A global meta-analysis of the impacts of tree plantations on biodiversity, *Global Ecology and Biogeography,* **31**(3): 576-587.

WEF, 2020. *One trillion trees - World Economic Forum launches plan to help nature and the climate* [webpage], https://www.weforum.org/stories/2020/01/one-trillion-trees-world-economic-forum-launches-plan-to-help-nature-and-the-climate/. 21/10/2025].

World Bank, 2021. *Climate risk country profile: Vietnam* World Bank Publications, Washington, DC, USA.

Wortley, L., Hero, J.-M. and Howes, M., 2013. Evaluating Ecological Restoration Success: A Review of the Literature, *Restoration Ecology*, **21**(5): 537-543.

Yin, R. K., 2016. *Qualitative research from start to finish*, The Guilford P., New York, N.Y.

Zimmer, H., Tran, L. D., Dang, T. T., Le, T. H., Lo, Q. T., Minh, D. L. and Nichols, J. D., 2022. Rehabilitating forest and marginal land using native species in mountainous northern Vietnam, *Trees, Forests and People*, **10**: 100323.

Appendix 1: Field trip photos

Photo 1. Typical landscape in the study area: green tea planted on lowlands and acacia planted on high slopes.

Photo 2. A villager tried planting medicinal plants mixed with fruit trees (e.g., banana) as multipurpose trees to provide potential income, support livelihoods, restore ecological functions and protect traditional medical plants, intending to gradually replace acacia.

Photo 3. The author interviewing a young farmer who showed his maize field; his parents' old forest land was claimed for the establishment of Tam Dao National Park. (Credit: Luu Thuong Huyen – TUAF CLC)

Photo 4. The author visited acacia plantations with an interviewee. (Credit: Luu Thuong Huyen - TUAF CLC)

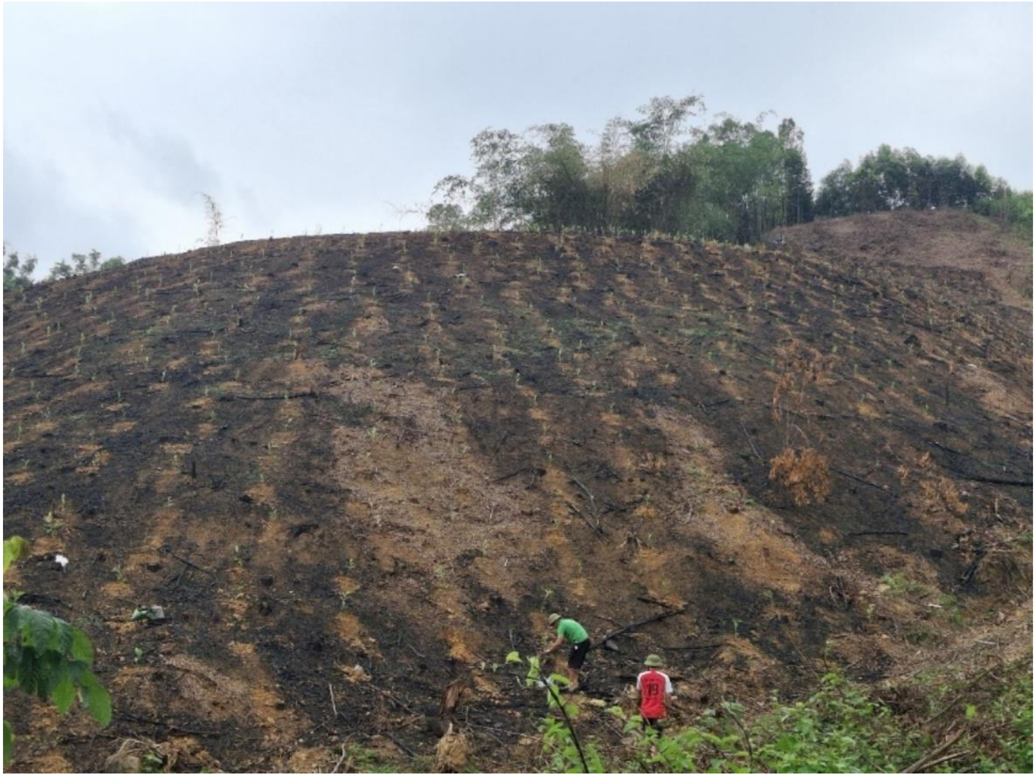

Photo 5. Farmers' preference for shorter acacia rotations. To prepare the site, they remove all other vegetation and grasses, burn the remaining biomass after harvesting, and plant new acacia immediately.

Photo 6. The establishment of several woodchip factories in each village was highlighted as a key enabler for the local acacia value chain.

Appendix 2: List of indicative questions

Indicative questions for participants
(To be translated into Vietnamese)

Project name: Translating Forest Landscape Restoration (FLR) into practice in the context of climate change: a case study in Northern of Vietnam

Yen Le - M Environment (Advanced) candidate (U7843663)
Fenner School of Environment & Society, Australian National University

1. For Government Officials – Interview Guide

Policy Framework for FLR

- Can you describe the types of activities implemented in this area to support forest restoration?
- Which policies have been introduced to support these activities, and why did the government decide to implement Forest Landscape Restoration (FLR) activities?
- What is the role of your office in supporting these programs?

FLR Practices

- Can you explain how forest cover and forest clearance have changed over the past 30 years?
- How do these forest restoration programs aim to support forest management, mitigate climate change, and enhance social well-being?
- What is the main process for involving local community participation and other stakeholders in these programs?
- What challenges and opportunities have arisen in relation to these FLR programs, especially for communities, including women and disadvantaged groups?
- How are partnerships between local communities, NGOs, and government institutions established in these programs? How could these partnerships be improved?

FLR Outcomes and Benefits

- **What outcomes do FLR activities/ policies in this area aim to achieve?** What are the main drivers behind the outcomes of these FLR initiatives?
- What are the key benefits of FLR activities for communities, ecosystems, and climate resilience?

Future Plans

- Are there any ongoing initiatives or future plans to continue supporting forest restoration activities in your province?
- From your perspective, what actions should be taken to improve or adjust FLR activities to achieve better outcomes for climate change mitigation and social well-being?

2. For Local Researchers / Local NGO Staff

Policy Framework for FLR

- Can you describe the types of activities implemented in this area to support forest restoration?
- In your view, why has the government implemented these restoration programs, and what principles are they based on?
- What is the role of your organisation or project, and how do you support these government-led programs?

FLR Practices

- How are these government-implemented activities carried out in practice?
- What are the main mechanisms for involving diverse stakeholders and local communities?
- From your observations, what changes have occurred since the implementation of these restoration programs?
- How have these changes contributed to improving forest management, mitigating climate change, and enhancing social well-being?
- What challenges and opportunities have you observed in relation to these FLR programs, especially for communities, including women and disadvantaged groups?
- How would you describe the partnerships between local communities, NGOs, and government institutions in these programs? How could these partnerships be improved?

FLR Outcomes and Benefits

- What are community perspectives on these FLR programs, and what do you see as the main outcomes of these programs in the context of climate change?
- What are the main drivers behind the success (or lack thereof) of these FLR initiatives?

Future Plans

- From your perspective, what actions or policies should be taken to improve or adjust FLR activities to achieve better outcomes for climate change mitigation, forest management, and social well-being?

3. For Focus Group Discussions

Forest changes and clearance

- Can you explain how forest cover and forest clearance have changed over the past 30 years?
- What kinds of activities have you or the government implemented to positively contribute to forest management?

Community livelihoods and other benefits related to forest Restoration activities

- What are the main seasonal activities in this village?

- What types of forest and agricultural land exist in the village?
- Can you describe the kinds of activities you carry out on this land, and why you do them?
  If villagers mention FLR activities, the following questions will be asked in that context:
- Among the activities you mentioned, which ones are supported by the government? Do you know why the government is promoting these programs?
- Regarding income, what are the village's most important forest and environmental products or income sources from these lands?
- How do you make decisions to participate in these FLR programs?
- What challenges and opportunities have you experienced related to FLR activities? How do you cope with these challenges?
- Besides income, what are the main benefits of participating in FLR programs?

Perceptions of forest management and climate change

- In the past year, has your household been severely affected by any extreme events such as droughts, floods, or crop diseases?
  - If yes, did your household collect or use any forest products to help recover from these impacts?
- In your opinion, how have FLR activities helped to mitigate these events?

- In the near future, do you plan to change how you implement forest restoration activities to better cope with climate change and support local well-being? How can local government and other stakeholders support you in achieving these goals?

4. For individual Interviews (Semi-Structured Interviews)

Forest changes and clearance

- Can you explain how forest cover and forest clearance have changed over the past 30 years?
- What kinds of activities have you or the government implemented to positively contribute to forest management?

Household Profile – livelihoods and other benefits related to forest restoration activities

- What have been your household's most important forest and environmental products or income sources?
  - If so, what are they?
- What types of land provide forest and environmental resources for your family? What activities do you engage in on these lands?
  If the interviewee mentions FLR activities, the following questions will be asked in that context:
- How did you initiate these activities? Are any of them supported by the government? Why do you think the local government wants to implement these programs?
- How does your family make decisions to get involved in forest restoration programs? How have these activities affected your household? How do you deal with challenges?
- Have you or other community members received any support from the government or NGOs to implement these activities? What do you think about that support?
- How do you view the role of government and NGOs in ensuring the success of these programs?

- How have forest restoration programs helped improve your knowledge, skills, food security, income, or cost of living? Have they brought any broader community benefits such as improved roads, infrastructure, or health services?

Perceptions of forest management and climate change

- In the past year, has your household been severely affected by any extreme events such as droughts, floods, or crop diseases?
    - If yes, did your household collect or use any forest products to help recover from these impacts?
- In your opinion, have FLR activities helped to mitigate these events?

Future plans

- What FLR activities would you undertake in the future? – and why?
- How can local government and other stakeholders support you in achieving these goals?

Appendix 3: Participant Information Sheet

Australian National University

Participant Information Sheet

Researcher

My name is Yen, and I am originally from Nghe An Province in central Vietnam. Before moving to Australia for my studies, I worked with local communities in northern Vietnam, including Yen Bai and Son La provinces. I am currently a Master's student in Environment (Advanced) at the Fenner School of Environment and Society, the Australian National University, in Canberra, Australia. This is my third semester, and I am conducting this research as part of my master's thesis, focusing on a project in Dai Tu and Dong Hy District, Thai Nguyen Province, Vietnam.

Project Title

Translating Forest Landscape Restoration (FLR) into practice in the context of climate change: a case study in Northern Vietnam.

Outline of the project

Description and Methodology:

Vietnam has increasingly prioritised reforestation and afforestation efforts over the past 30 years. These efforts have significantly improved forest cover, rising from 27% in 1990 to around 42% in 2018 through the national reforestation program. However, the program has mainly focused on tree plantations rather than a broader range of Forest Landscape Restoration (FLR) approaches, and its wider social implications remain insufficiently understood in Vietnam. Additionally, there is limited research on which FLR approaches provide greater benefits to local communities, particularly smallholders and the poor. The long-term success of FLR depends on ensuring greater stakeholder participation, especially at the community level.

I will conduct this research in partnership with the Thai Nguyen Climate Learning Centre and Thai Nguyen University of Agriculture and Forestry (TUAF). The case study will focus on two districts named Dong Hy and Dai Tu in Thai Nguyen province, Vietnam. The research will primarily use a qualitative approach, including semi-structured interviews and focus group discussions with local farmers, local government officials, and local researchers. The findings of this study are expected to fill a gap in understanding the social impacts of FLR practices and may provide recommendations for further research on FLR in northern Vietnam.

Participants:

I will conduct Interviews with local community members and with experts and government officials.

I will conduct semi-structured interviews and focus group discussions with local communities in case study villages. These villages will be identified in discussion with researchers at Thai Nguyen Agricultural University. Participants will be sampled to ensure that they represent each of the Vietnamese government's wealth rankings (poor, nearly poor, non-poor), and both genders, equally.

Local community members will be invited to take part in either a focus group discussion or a semi-structured interview, depending on their preference and availability. Participation in both is not expected. Participants will be provided with separate consent forms tailored to the type of activity (focus group or interview).

- Focus Group Discussions (FGDs): I will conduct 12 FGDs across six villages (6 villages × 2 groups per village). Each FGD will include approximately 8–10 local people different wealth rankings, with separate groups for men and women. The total number of participants for FGDs is expected to be around 120.
- Semi-structured Interviews: I will conduct interviews with 36 local farmers (6 participants per village × 6 villages). In each village, participants will be sampled based on household wealth ranking, viz. 2 poor, 2 nearly poor, 2 non-poor households.

I will conduct semi-structured interviews with approximately eight experts and government officials (four policymakers at the provincial and district levels, two university lecturers/ researchers, and two NGO staff members), to understand how FLR is translated into local policy.

Use of data and Feedback:

The data collected during fieldwork will be analysed for my thesis and the outcomes of my research will also contribute to the work of the Climate Change Learning Centre at TUAF, Vietnam, for future research. All research partners and other interested individuals will be invited to my seminar, and the thesis will be accessible after the examination process. Once the thesis is completed, a summary of the findings in both Vietnamese and English will be shared with participants via email or other agreed communication methods. The results of this research are anticipated to be published in academic literature, contributing to understand forest landscape restoration practices in northern Vietnam.

Project Funding:

The research is funded by the Fenner School of Environment and Society, with additional financial support for field data collection from the Thai Nguyen Climate Learning Centre at TUAF, Vietnam, and funding for travel from the Australia Awards.

Participant Involvement

Voluntary Participation and Withdrawal: Participation in this research is voluntary, and you can withdraw at any time, without providing a reason, up to two weeks after the interview. You may also skip any questions you don't wish to answer or request to reschedule the interview. If you decide to withdraw, please inform me directly or indirectly via telephone or email, and all data I have recorded from our discussion will be deleted.

What does participation involve: Upon agreeing to participate in the research, participants will take part in either an interview or a focus group discussion, each focusing on a series of key themes. The data collection will focus on inputs (socio-economic contexts and enabling conditions) and outputs (benefits and outcomes) of Forest Landscape Restoration (FLR) in the context of climate change. Livelihoods topics will be examined using the five types of capital (human, natural, physical, financial and social capital) outlined in the Sustainable Livelihoods Framework (DFID, 1999).

The interviews will be audio recorded, and written notes will be taken. The researcher will also make field notes during the fieldwork. One member of the TUAF Climate Learning Centre staff will assist in facilitating focus group discussions and taking notes, but the researcher will collect all notes at the end of the day. Video recording will not be used during data collection. All data will be securely stored by uploading it to ANU OneDrive, ensuring it is accessible only to myself and my research supervisor only.

Location and duration: Semi-structured interviews with village members are expected to last around 60 minutes. Focus group discussions will take 1.5 to 2 hours. Interviews with local government officials will last approximately 45 minutes.

Interviews will be conducted in person at a mutually agreed-upon location and time

Remuneration:

Each participant will receive approximately 100,000 VND for their involvement in the interview or focus group.

Risks:

There will not be a significant risk to physical or mental health, but some questions may cause discomfort for participants. For instance, the researcher will ask about the negative impacts of climate change, such as floods and storms on tree plantations. Questions may also address financial capital, such as income from agriculture and non-timber forest product collection. Discussing these topics may bring strong emotions for some participants, depending on their personal circumstances. If this occurs, the interviewer will pause the interview and ask if you would like to reschedule or move on to a different question.

Benefits:

Although there are no direct personal benefits other than token remuneration for participating in this study, the findings will contribute to the understanding and development of forest landscape restoration strategies in Thai Nguyen Province and across Vietnam. Additionally, the results will support the knowledge generation and sharing of the Climate Change Centre at Thai Nguyen University of Agriculture and Forestry (TUAF).

Confidentiality:

Confidentiality will be upheld throughout data collection and the publication of results, within the limits set by the law. All data will be securely stored on my ANU OneDrive account. Physical documents, including A0 papers and personal notes, will be kept in a locked cabinet. Access to these data will be limited to myself and my supervisor. After five years of inactivity, all electronic data will be deleted and physical documents will be destroyed. My supervisor, Prof. Peter Kanowski, will store the data after I graduate. The data will not be used by research partners outside ANU. Any published materials will not include information that could identify individuals.

Privacy Notice

In collecting your personal information within this research, the ANU must comply with the Privacy Act 1988. The ANU Privacy Policy is available at https://policies.anu.edu.au/ppl/document/ANUP 010007. It contains information about how a person can:

- Access or seek correction to their personal information;
- Complain about a breach of an Australian Privacy Principle by ANU, and how ANU will handle the complaint

Data Storage

Where: Physical documents, including A0 papers and personal notes, will be kept in a locked cabinet. All written documents will be transcribed into electronic files by the researcher.

Data from interviews saved on my personal laptop will be uploaded to the ANU server daily. Additionally, electronic data, including audio recordings and photos, will be transferred from the recording device and camera to the researcher's ANU desktop.

All computers used for data collection and storage will be encrypted and password protected.

How long: All data used in this research will be stored for a period of at least five years from the date of any publication arising from the research.

Handling of data following the required storage period: Should the data remain unused after this storage period, all electronic data will be deleted, and written data will be destroyed.

Queries and Concerns

Contact details for more information:

If you have any questions or concerns regarding this research, please contact me as the Principal Investigator:

Yen Le

Fenner School of Environment and Society

The Australian National University

Canberra, ACT, Australia

Phone: +61 461 267 617, Email: Yen.Le@anu.edu.au

Or my supervisor:

Professor Peter Kanowski, Canberra ACT 2601 Australia
Email: peter.kanowski@anu.edu.au;

Or the project host partner in Vietnam

Professor Ha Tran

Head of Department of Medicinal Plants and Natural Products

Thai Nguyen University of Agriculture and Forestry

Thai Nguyen City, Vietnam.

Tel: (+84)2803854005; tranthithuhaptln@tuaf.edu.vn

Contact details if in distress:

In case participants feel distressed and wish to seek free support services in Vietnam, they are free to contact the following sources:

- Local hospital: Thai Nguyen National General Hospital; Address: 479 Luong Ngoc Quyen street, Thai Nguyen city, Thai Nguyen, Vietnam; Phone number: (+84) 208 3855 125 (open 24 hours).

- Emergency telephone numbers in Vietnam:

+ Ambulance – First Aid: 115

+ Police: 113.

Ethics Committee Clearance

The ethical aspects of this research have been approved by the ANU Human Research Ethics Committee (Protocol 2025/217).

If you have any concerns or complaints about how this research has been conducted, please contact:
Ethics Manager
The ANU Human Research Ethics Committee
The Australian National University
Telephone: +61 2 6125 3427
Email: Human.Ethics.Officer@anu.edu.au

Appendix 4: Consent forms

(All consent forms were provided in the Vietnamese language version for participation)

Australian National University

ORAL CONSENT SCRIPT for research participants

(This will be translated into Vietnamese)

Translating Forest and Landscape Restoration into practice in Northern Vietnam

I have read to you/You have read the Information Sheet about the research project.

Was this information clear? Do you have any questions about the project?

Do you agree to participate in this project? (Record the answer as Yes/No)

- Do you agree for this interview to be audio-recorded? (Record the answer as Yes/No)

When I prepare the research outputs, I can attribute information to you in three ways: full name, pseudonym, or I can use NO attribution and hold your information confidentially.

- Would you like information attributed using your full name? (Record Yes/No)
- Would you like to be referred to using a pseudonym (false name)? (Record Yes/No)
- Would you prefer that your information be not attributed to anyone at all? (Record Yes/No)

May we start the interview now?

Date of script being read:..

The Australian National University Canberra 2600, ACT Australia CRICOS Provider No. 00120C 1 of 1

Australian National University

CONSENT FORM for research participants

(This will be translated into Vietnamese)

Translating Forest and Landscape Restoration into practice in Northern Vietnam

I have read and understood the Information Sheet you have given me about the research project, and I have had any questions and concerns about the project (listed here

____

____)

addressed to my satisfaction.

I agree to participate in the project. YES ☐ NO ☐

I agree to this interview being audio-recorded YES ☐ NO ☐

I agree to be identified in the following way within research outputs:

Full name	YES ☐	NO ☐
Pseudonym	YES ☐	NO ☐
No attribution	YES ☐	NO ☐

Signature:.. Date:..

The Australian National University Canberra 2600, ACT Australia CRICOS Provider No. 00120C 1 of 1

Australian
National
University

ORAL CONSENT SCRIPT for Focus Group research participants

(To be translated into Vietnamese)

Translating Forest and Landscape Restoration into practice in Northern Vietnam

I have read to you the Information Sheet about the research project.

Was this information clear? Do you have any questions about the project?

Do you agree to participate in this project? (Record the answer as Yes/No)

Do you agree that your data can be used for the purpose of this research (Record the answer as Yes/No)

Do you agree that your data can be archived for future research uses (Record the answer as Yes/No)

When I prepare the research outputs, I can attribute information to you in the following ways (select one):

- Would you like information attributed using your full name? (Record Yes/No)
- Would you like to be referred to using a pseudonym (false name)? (Record Yes/No)
- Would you prefer that your information be not attributed to anyone at all? (Record Yes/No)
- Would you like information attributed using your village name with general descriptor?* (Record Yes/No)

May we start the focus group discussion now?

Date of script being read:...

Address / Building Details
The Australian National University

Canberra 2600, ACT Australia
CRICOS Provider No. 00120C

1 of 1

Australian National University

CONSENT FORM for Focus Group research participants

(To be translated into Vietnamese)

Translating Forest and Landscape Restoration into practice in Northern Vietnam

I have read and understood the Information Sheet you have given me about the research project, and I have had any questions and concerns about the project (listed here

____

____)

addressed to my satisfaction.

I agree to participate in the project. YES ☐ NO ☐

I agree that my data can be used for the purpose of this research YES ☐ NO ☐

I agree that my data can be archived for future research uses YES ☐ NO ☐

I agree to be identified in the following way within research outputs (select one):

Full name YES ☐ NO ☐

Pseudonym YES ☐ NO ☐

No attribution YES ☐ NO ☐

Village name with general descriptor YES ☐ NO ☐

Signature:... Date:..