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Migration, Agricultural Expansion, and Socio-Environmental Change in Vietnam's Central Highlands

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Abstract. The purpose of this research is to understand how migration, agricultural development, and socio-environmental dynamics work together in the Central Highlands of Vietnam. Over the last thirty years, due to state-sponsored settlement and economic migration, this area has experienced a sudden influx of people and an economic boom in agriculture. Using a mixed-methods approach involving household surveys and interviews, focus group discussions, and policy analysis in the provinces of Dak Lak, Gia Lai, and Kon Tum, this research aims to understand the socio-environmental effects and agrarian frontier reconfiguration induced by migration. The results indicate that migration has been key in the commercialization of agriculture. The cultivation of coffee and pepper has altered land use patterns, and the commercialization of agriculture, alongside providing economic incentives and promoting further integration of the region into the wider economy, has been a significant driver of growing deforestation, soil erosion, and water overexploitation. Additionally, the benefits of agrarian change have been highly unequal. Migrant farmers have greater access to land and market opportunities, while indigenous peoples have increasingly limited access to their traditional lands and forest resources. The research connects migration, agrarian transition, and political ecology to demonstrate the interplay between demographic change, land use, and the environment. The results highlight the need for enhanced land governance, more regulations on the expansion of agricultural frontiers, and stronger policies that promote both sustainable agriculture and the livelihoods of indigenous peoples.

Keywords. Agricultural expansion; Central Highlands Vietnam; Land-use transformation; Migration; Socio-environmental change

1. Introduction

1.1. Regional context

The Central Highlands is one of the country's vital economic and ecological upland areas. This region spans across the five provinces of Kon Tum, Gia Lai, Dak Lak, Dak Nong, and Lam Dong. The region has historically been characterized by its ethnic diversity, rich forestry, and growing agricultural development. Yet, over the last thirty years, the Central Highlands has undergone significant transformation in terms of agrarian change. The region has industrialized with the growing of commercial crops such as coffee, rubber, and pepper, integrating the uplands into national and global market concerns (Meyfroidt et al., 2013; Müller & Zeller, 2002). This change is associated with the rapid expansion of agricultural frontiers,

population movement, and deforestation. The most significant factor driving change in the region since the 1990s has been the surge in coffee production. This transformation has extended to the cultivation of rubber and pepper as well, with the latter expanding into natural forest areas within the agricultural system.

However, the economic growth and market integration of the Central Highlands region have increased pressure on land, water, and forest ecosystems (D'haeze et al., 2005; Meyfroidt et al., 2013). The region, while an agricultural success, is also experiencing profound socio-environmental transformations, including widespread deforestation. Literature highlights the development of infrastructure and agriculture in the Central Highlands, accompanied by the loss of natural forests and increased fragmentation of forest use, particularly in areas dominated by economic activities (Cochard et al., 2017; Meyfroidt et al., 2013). Moreover, the strong demographic shifts in the region are a result of migration to the Central Highlands from various parts of the country. The combination of market-oriented agriculture and migration has caused rapid transformations in land use patterns and heightened competition over limited highland resources (Phan & Coxhead, 2010; Zhang et al., 2006). This justifies the study of the Central Highlands in the context of migration and agricultural development and their impacts on land, livelihoods, and ecosystems.

1.2. Migration and agrarian transformation

The role of migration in agrarian changes in the Central Highlands is crucial. In addition to adding to the population in a changing region, migration has facilitated the expansion of agricultural frontiers, provided a new labor supply, and restructured land use. In the region, migration has increased demand for land, supplied labor for cash crop production, and hastened the clearance of forests for farming. Migration, in this context, should not be seen as an external factor, but as an internal driving force of the agrarian economy of the Central Highlands. Different types of migration have influenced this development. In earlier periods of development planning, state-assisted migration was essential for the even redistribution of the population and the encouragement of settlement in the highland areas. Additionally, spontaneous migration, as families moved to the Central Highlands in pursuit of land, farming prospects, and better economic conditions, has become increasingly significant.

As the region integrated more into the economies of coffee, rubber, and pepper, economic migration (both temporary and permanent) began to increase (Phan & Coxhead, 2010; Zhang et al., 2006). The combined effects of economic migration changed the region's population structure and transformed the social foundation of land use, impacting the agrarian structure on a large scale. While migration helped grow household agriculture and commodity production, it also led to increased land competition, fragmentation of traditional land holdings, and greater encroachment of the agrarian frontier. Migrant settlements also opened up new agricultural land, though in some places, this increased rivalry among the native population, the migrants, and the governing bodies. Therefore, migration, in the context of developing upland agriculture, can be seen as a demographic, labor, and land-making process (Massey et al., 1993; Radel et al., 2018).

1.3. Socio-environmental consequences

The socio-environmental consequences in the Highlands are alarming. Deforestation is one of the most serious results of this activity. The conversion of forests to coffee, rubber, and pepper plantations, along with the construction of infrastructure corridors, has further weakened the ecological integrity of the upland landscape. Forest fragmentation has decreased

biodiversity, impaired water regulation, and increased the local farming systems' vulnerability to drought and soil degradation (Cochard et al., 2017; McElwee, 2022). These changes reveal the significant ecological costs associated with modern agrarian growth. Moreover, land inequity remains a serious issue. The benefits of land tenure security, access to markets, and administrative capital have, unfortunately, been the purview of a few land-owning households. In contrast, many indigenous households have observed a decline in access to their customary land, a decline in tenure security, and increased competition from migrant settlers and commercial actors. The unequal distribution of costs and benefits is the most prominent feature of land use change and is a clear demonstration of the nexus between social power and unequal resource access (Lambin & Meyfroidt, 2010; McElwee, 2022). The most important outcome remains the transformation of indigenous lives.

Over the years, many ethnic minority communities in the Central Highlands have integrated engagement with the forest, shifting cultivation, braided management of communal resources, and culturally integrated relations to land. As agricultural frontiers have pushed outward, these livelihood systems have been replaced or constricted by market-based farming, wage labor, and externally controlled land systems. Concurrently, the ecological footprint of these systems has intensified. Soil degradation, water scarcity, and deforestation are clearly visible and exacerbate the impacts of climate variability in monocrop farming systems in developed regions (D'haeze et al., 2005; McElwee, 2022). This describes a socio-environmental context that captures the integrated phenomena of economic growth, land-based inequity, livelihood transformation, and ecological pressure.

1.4. Research objectives

Against this background, this article has three main objectives. First, it analyzes the role of migration in driving agricultural expansion in Vietnam's Central Highlands. Second, it evaluates the socio-environmental impacts of land-use change, particularly in relation to deforestation, land inequality, livelihood change, and ecological stress. Third, it clarifies the interaction between migration, agriculture, and forest governance, with particular attention to how these processes affect indigenous communities and local institutional arrangements.

1.5. Research questions

This study is guided by three interrelated research questions. First, how has migration influenced agricultural expansion in the Central Highlands? Second, what socio-environmental changes have resulted from this transformation? Third, how do these changes affect indigenous communities and local governance systems?

2. Literature Review

2.1. Migration and frontier expansion

The Global South's remote and rural frontier regions have always witnessed migration as a primary driver of first-order change in the frontier or the expansion of the frontier's first-order economic activities. Migration not only alters the distribution of the population but also restructures land-utilization patterns, available labor, and agrarian relations. In frontier regions where land is perceived as available or under-utilized, migrants are known to drive the upsurge in agricultural activities and the economic conversion of previously forested or sparsely populated regions. This is why migration is associated with rural economic transformation and the remodeling of rural environments. In migration studies, a structural perspective is used to understand the causes of population movements and the interaction between migration,

structural changes, and opportunities in economic activities and land availability. Therefore, it is important to understand rural economic opportunities and land availability in underdeveloped areas as a “pull factor” and also recognize economically induced population movement as a “push factor.” Once a migration network is established, it reduces the costs and risks of moving, almost functioning like chain migration. This is especially true in the economic expansion of frontier agricultural areas. Most land-use change studies have focused on migration. Most recently, Radel et al. (2018) state that migration can affect environmental change in numerous ways, such as creating further demand for land, new methods of land use, and restructuring local labor markets. Migration often speeds up agricultural frontier expansion by offering the labor and population growth needed to transform forested or marginal lands into agriculturally productive lands. Therefore, migration is not only a demographic process but also a significant process of land-use change.

2.2. Agricultural expansion and land-use change

Agricultural expansion is one of the main causes of deforestation and land-use change across the globe. With the ever-increasing global market demand for agricultural products, new frontiers are opened for commercial agriculture. This process of economic frontiers includes the clearing of forests, natural grasslands, and other ecosystems for farming. Although the changes are of economic importance and offer some rural development advantages, they are also significant ecologically. According to Lambin & Meyfroidt (2010), the expansion of agriculture is closely linked to the current phenomena of economic globalization, technological advancement, and other incentivizing policies aimed at increasing the production of agricultural commodities. This is clear in areas of agricultural expansion, where there are weak or absent land-use control systems. Areas deforested for the cultivation of agricultural commodities (e.g., coffee, rubber, oil palm, and soy) experience a significant decline in biodiversity. The rural areas also undergo significant changes due to agricultural expansion. The demand for commercially valuable land for farming increases competition for it, and the unequal distribution of opportunities to utilize land intensifies.

With the advancement of large-scale agricultural investments and migrant farming systems, smallholders and indigenous communities may face pressure as these systems extend into areas that have previously been managed under customary practices. Therefore, changing land use is not solely an ecological phenomenon but also a socio-economic one, driven by markets, institutions, and relations of power.

2.3. Migration and environmental change in Southeast Asia

Migration, agricultural growth, and environmental alteration are interlinked processes that have been most extensively examined in Southeast Asia. The rapid expansion of agriculture in many Southeast Asian countries, and more recently the growth of commodity crops, is attributed to the combination of population movement, the development of cash crops, and state-led rural development initiatives. Migration into upland and forested areas has been particularly significant, as new agricultural settlers cultivate and build new agrarian communities. Researchers have demonstrated the role of migration in environmental change due to the increased pressure on forests and land, as well as the expansion of the agricultural frontier. Migrants in frontier areas clear forests, plant cash crops, and engage in smallholder farming, and through these activities, contribute to the incremental alteration of nature from primarily forested landscapes into agricultural ones. This transformation progressively advances deforestation, renders the soil, and agricultural systems hydrologically inactivated.

Moreover, migration changes social relations and governing arrangements by introducing new actors, structures, and economic relations into sparsely populated regions. The relationships between migration and environmental change are complex and need to be understood in context. While migration encourages economic development and rural transformation, it also exerts environmental stress and social conflict in regions where the land governance system is inadequate to manage competing land claims.

2.4. Research gap

Although there is an expanding body of literature on land-use changes and the governance of forests in Vietnam, there is a notable absence of studies focusing on the intersection of migration, agricultural expansion, and socio-environmental changes in the Central Highlands. Most existing literature examines reforms in forest policies, conservation measures, and the effects of various governance structures on the environment, particularly the Payment for Ecological Services (PES) programs. While valuable information is gleaned from these studies about conservation policies and practices, migration and agrarian change are often treated as peripheral rather than primary elements in the study of environmental change. Conversely, studies on migration in the Central Highlands predominantly focus on demographic shifts and livelihood changes resulting from migration, often neglecting environmental aspects. This gap in research reflects the insufficient studies on the inter-related processes of migration, agrarian change, and socio-environmental transformation. This study attempts to address this gap by using a unified framework that will permit a more comprehensive focus on various facets of migration and agrarian development and how these factors interact to cause environmental changes in the Central Highlands.

3. Theoretical Framework

This study employs a combined theoretical framework that links agrarian transition theory, political ecology, and socio-environmental systems analysis. This integrated approach is appropriate for examining migration, agricultural expansion, and socio-environmental change in Vietnam's Central Highlands because the transformation of the region cannot be explained through a single economic, ecological, or policy lens. Instead, it requires attention to changing agrarian structures, unequal access to land and resources, and the interaction between social transformation and ecological pressure.

3.1. Agrarian transition theory

The theory of agrarian transition is useful for explaining the shift from subsistence farming to farming for markets. Agrarian transition, in the broadest terms, refers to changes in rural production, labor, and land use within the context of commercialization and the integration of production into wider markets. In the upland areas of the Central Highlands, mixed subsistence farming, shifting cultivation, and forest-based livelihoods are being replaced by the cultivation of commercial crops such as coffee, rubber, and pepper. This approach is beneficial as it emphasizes that agricultural change involves more than just the replacement of crops. It also entails changes in labor relations, household strategies, and social relations to land. In the Central Highlands, the shift to market-oriented agriculture has led some households to intensify production and pursue cash income, while others have had to take on more precarious labor or experience decreased access to customary land. The theory of agrarian transition provides the most useful framework for understanding the Central Highlands as a region undergoing systemic rural transformation, rather than merely agricultural modernization.

3.2. Political ecology

Examining agrarian transitions alone is insufficient to account for the diverse ways social groups experience land-use change. In this regard, the study also incorporates political ecology. Political ecology argues that land-use change is determined more by broader political-economic contexts and struggles for access to and control of resources than by ecological factors alone. State policy, market demand, and the migration and imbalanced power relations of land and resource controllers shape the conversion of forests, the expansion of plantations, and the growth of agricultural frontiers. In the Central Highlands, political ecology is particularly relevant because land-use change involves the control of land, the locus of administrative power, and the uneven distribution of resources. Migrant farmers, private investors, local authorities, and indigenous peoples do not participate equally in agrarian change. While some actors can more easily acquire land, benefit from state development initiatives, or take advantage of market opportunities, others suffer from reduced access to forests, communal lands, and livelihoods. Political ecology provides insight into the interconnectedness of economic growth and environmental decline through the lens of social inequities in resource control.

3.3. Socio-environmental systems

The Central Highlands theory incorporates socio-environmental systems analysis as a key element. This approach emphasizes the dual ecological and social change and transformation. Such changes affect both the environment and social structure and are inherently inclusive. Agricultural expansion in the Central Highlands modifies the environment and alters the organization of labor, migration, livelihoods, and governance. Furthermore, social changes such as migration, commerce, and shifts in social structure also increase the demand for and degradation of the environment. These social changes have feedback effects within the ecological systems, such as deforestation, water degradation, and soil exhaustion. A socio-environmental systems analysis moves the study away from a simplistic, unidirectional view of society and the environment towards a more complex understanding of the environment. These dynamic systems include ecological degradation resulting from changes in livelihood strategies that demand, and are responsive to, changes in population structure. This phenomenon is particularly evident in the Central Highlands of Vietnam, where the social organization of settlement, agriculture, and the environment converge to trigger changes in deforestation, monocrop expansion, and climate-induced stresses. These three perspectives of ecological systems provide a comprehensive framework for understanding migration-driven agrarian transformation socio-environmentally.

4. Methods

4.1. Research design

This research utilizes a mixed-method approach to study migration, agricultural expansion, and socio-environmental change in Vietnam's Central Highlands. A mixed-methods approach is particularly valuable when studying socio-environmental changes, as it provides a comprehensive understanding of measurable changes, such as alterations in land use and people's livelihoods, as well as changes in households, migration experiences, and perceptions of the environment. This strategy helps in understanding large-scale socio-environmental changes and the local meanings and institutional factors that drive them. This research employs four methods: household surveys, semi-structured interviews, focus group discussions, and policy analysis. Household surveys were used to collect quantitative data on landownership,

livelihoods, migration histories, and agricultural production. Semi-structured interviews provided rich data on land use, migration, local environmental changes, and community responses. Focus group discussions encouraged reflection on local socio-environmental changes and provided space for participants to compare perceptions and experiences of agrarian and ecological changes. Policy analysis helped contextualize local phenomena within wider governance structures affecting land, migration, and forest governance.

4.2. Study sites

Fieldwork was carried out in three provinces of the Central Highlands: Dak Lak, Gia Lai, and Kon Tum. These provinces were chosen as they illustrate different, yet interconnected, patterns of socio-environmental transformation. Dak Lak is strongly associated with coffee expansion and commercialization, Gia Lai has both agricultural expansion and migrant pressure, and Kon Tum provides a pertinent example of the interplay between forested and non-forested landscapes, hydropower development, and ethnic minorities. Combined, the provinces illustrate the full range of agrarian change in these highland areas. They include places of intensive commodity production, frontier land conversion, and various degrees of migration- and settlement-induced demographic changes. They also have significant populations of ethnic minorities who have traditionally relied on forest and communal land-based mixed farming systems. These considerations allow the research to focus on both common regional patterns and particular local differences.

4.3. Data sources

The research employs three primary categories of data. First, data concerning the livelihoods of directly interviewed households were analyzed in terms of land utilization patterns, income sources, crop production quantities, the level of each household's dependence on the forest, and the methods employed by households to adapt. Second, migration histories were collected through survey questions and interviews to capture variations in migration, including the establishment of long-term settlements, involuntary migration, and migration for work. Third, data on changes in land use were gathered through recollections/reports of households, community stories, and policies to document variations in agricultural expansion, forest reduction, and land access. These data sources were selected to analyze migration and land use in relation to their social ramifications. The use of household-level data, along with community data and archival data, enables the study to capture local experiences and relate them to regional changes.

4.4. Analytical approach

This study focuses on three core themes: the dynamics of migration, the expansion of the agricultural frontier, and the socio-environmental consequences of both. The first theme examines patterns of mobility, settlement, and labor movement to assess the role of migration in shaping a particular socio-demographic and agrarian context. The second theme analyzes the role of commercial agriculture, particularly the cultivation of coffee, rubber, and pepper, in transforming the socio- and biophysical configurations of land use and the conversion of forests. The final theme addresses the socio-environmental consequences of expanding the agricultural frontier, such as land inequities, the restructuring of livelihoods, deforestation, and the intensification of ecological crises. The study provides evidence to support the argument that migration and the expansion of the agricultural frontier foster similar, synergistic, and interdependent socio-environmental changes in the Central Highlands. It offers an integrative

framework to understand the interdependence of demographic change, land-use change, and environmental change in this rapidly transforming upland area.

5. Results

5.1. Migration patterns in the Central Highlands

Migration in the Central Highlands should not be viewed as a singular phenomenon. It has various layers, developed over time, and has had a direct impact on the agrarian and socio-environmental changes occurring in the region. In the case of Dak Lak, Gia Lai, and Kon Tum, three types of migration were identified in the data: migration due to government initiatives and support, voluntary migration, and migration associated with short- or part-time work. While each of these migration types has a different cause, duration, and level of support, all of them have impacted changing patterns of land use, work, and population dynamics.

Government initiatives to support migration have included, in the earlier phases of the agrarian expansion cycle, the opening of new administrative zones and settlements, as well as the development of permanent agricultural systems within previously forested and traditionally utilized land areas. These movements were often linked to the state's agricultural modernization, territorial consolidation, and rural development efforts. In the case of the Central Highlands, these movements focused on establishing new agricultural settlement zones and developing agricultural activities in previously forested areas (De Koninck, 2000; Doutriaux et al., 2008). In many areas, unplanned or spontaneous migration has had a more transformative impact.

In contrast to planned settlement, spontaneous migration often occurs for economic reasons at the household level, such as seeking opportunities for land acquisition, better crops, and improved overall income. Research has shown that during the rapid expansion of coffee, the Central Highlands received a significant number of migrants, particularly from land-scarce lowland provinces (Phan & Coxhead, 2010; Zhang et al., 2006). This article corroborates that spontaneous migrants, from the perspective of local respondents, are the primary agents of the expansion of cultivation frontiers and the rise of competition for land. In many community stories, spontaneous migration was linked to the establishment of new coffee and pepper cultivation areas, the encroachment on forest boundaries, and greater settlement fragmentation.

Seasonal migration represents a distinct pattern of movement. It differs from permanent or semi-permanent settlement as it is more closely tied to labor flows. It includes worker movement for a short duration for specific activities such as planting, harvesting, or agricultural wage labor, particularly in regions with dominant coffee and pepper production. Although seasonal migrants may not establish permanent ties to the land, they integrate within the regional agrarian economy by facilitating labor-intensive production systems and connecting rural communities to broader agrarian labor circuits. This type of mobility illustrates the evolving livelihood strategies in the Central Highlands, where, for some households, wage labor increasingly supplements or even replaces traditional farming (Massey et al., 1993; Radel et al., 2018).

Table 1. Main migration patterns in the Central Highlands

Type of migration	Main characteristics	Primary role in regional change
State-sponsored migration	Planned settlement under development policy	Expansion of cultivation zones, territorial integration, permanent settlement
Spontaneous migration	Household-driven economic migration	Land clearing, frontier expansion, population pressure
Seasonal migration	Temporary labor mobility	Support for commercial agriculture, labor market integration

Taken together, these migration forms show that demographic change in the Central Highlands has been closely tied to agrarian restructuring. Migration has increased rural population density, diversified the labor supply, and intensified the pressure to convert land into commercially productive use. It has therefore functioned as both a demographic and territorial force in the making of the region's agricultural frontier.

5.2. Migration-driven agricultural expansion

The increasing scale of cultivation in the Central Highlands can largely be credited to migration. In all research sites, migration influenced both population growth and the cultivation of coffee, the expansion of pepper production, and the clearing of new lands. Here, migration influenced not just the agrarian opportunity but also the location itself. Coffee, of course, is the most telling example. Migration is closely associated with coffee cultivation in Dak Lak and Gia Lai, especially during the coffee boom years. Migrants were considered the most active participants in frontier settlement, new plot investments, and cash-crop cultivation. This is consistent with previous research on the settlement of the Central Highlands coffee frontier, alongside the increasing commercialization of the uplands (Müller & Zeller, 2002; D'haeze et al., 2005). In the highlands, coffee represented both an economic opportunity and a reason for land use, which attracted migrants to previously wooded areas. The increase in the cultivation of pepper occurred in both the highlands and the middle of the forest after a few years.

Rising pepper prices made the crop more profitable, resulting in further land conversion, often by expanding smallholder agriculture or seizing land through opportunistic land conversions. Interviewees noted that among migrants, pepper production was most pronounced in areas with available irrigation, markets, and land. The rapid spread of pepper further commercialized land use and reduced the areas available for mixed subsistence farming, swidden farming, and forest foraging. The most direct manifestation of migration-induced agricultural expansion was land clearing. Respondents from all three provinces identified a consistent pattern among new migrants—both permanent settlers and those with economic mobility—of clearing land for crops. In some cases, this was observed as formal land clearing, while in others, it was seen as encroachment into the forest or the clearing of communal land that was legally unregulated. These observations align with findings on agricultural frontier expansion, which show that migration provides both labor and the demographic pressure needed to change land use (Lambin & Meyfroidt, 2010; Meyfroidt et al., 2013).

Nonetheless, the effects of migration-led expansion varied across different households. While some households gained improved income opportunities and better market integration, others, including indigenous households with weaker formal land claims, experienced loss of access, heightened wage labor dependency, and reduced cultivation space. Therefore, the rise of production in the Central Highlands should not be seen as a neutral phenomenon. It

demonstrates the social differentiation of processes in which migration is a dominant factor in distributing both opportunities and burdens across the landscape.

5.3. Environmental consequences

In all the research sites, the environmental effects of migrant-induced agrarian expansion were considerable. Through the lens of household surveys, interviews, and document analysis, the most frequently mentioned effects include deforestation, soil degradation, and water stress. These effects were interconnected. Collectively, they indicate that agrarian expansion in the Central Highlands has often occurred through land-use practices that exert escalating pressure on the environment. The most evident of these effects is deforestation. The conversion of forest land into coffee, pepper, and rubber plantations, as well as settler's land and related infrastructure, has contributed both to the reduction and fragmentation of natural forest cover. Respondents in Dak Lak and Gia Lai often referred to the agricultural expansion and the associated clearing of forest margins, as well as the loss of places that had formerly been used for gathering, swidden cultivation, and communal activities. This is consistent with previous studies that illustrated changes in land use in the Central Highlands as the encroachment of commodity-driven agriculture into forested areas (Meyfroidt et al., 2013; Cochard et al., 2017). Even when certain forest designations exist on maps, local accounts indicate that the ecological condition and social accessibility of the forest have often diminished.

Soil degradation is another major issue. Respondents in regions of heavy cash crop cultivation, especially those focused on coffee and pepper, reported decreasing soil quality, increased reliance on fertilizers, and greater challenges in sustaining productivity over time. While some respondents blamed erosion and nutrient depletion on monocrop systems, repeated cultivation, and increasing bare soil, others demonstrated that rapid commercialization tends to increase ecological strain under several intense cultivation practices without adequate soil management or crop diversification (D'haeze et al., 2005).

Water stress emerged as the third significant environmental impact. In several communities, respondents linked the expansion of coffee and pepper to increased water consumption, decreased stream flow, and heightened dry-season water stress. This was especially concerning because coffee cultivation is often heavily reliant on irrigation, and the deforestation and forest fragmentation that typically accompany coffee cultivation exacerbate upland water stress. Over the last decade, water insecurity has increasingly impacted household and agricultural use for many families. This aligns with the socio-ecological conundrum often associated with emerging agricultural frontiers, where short-term economic benefits are attained at the expense of the long-term ecological sustainability of the area (McElwee, 2022).

Table 2. Major environmental consequences of migration-driven agricultural expansion

Environmental outcome	Main associated drivers	Local effects
Deforestation	Land clearing, crop expansion, settlement growth	Forest loss, habitat fragmentation, reduced access to forest resources

Soil degradation	Monocropping, intensive input use, erosion	Lower soil quality, declining productivity, greater input dependence
Water stress	Irrigation demand, forest loss, hydrological disruption	Dry-season scarcity, production risk, household vulnerability

These findings suggest that migration and agricultural expansion have jointly intensified ecological pressure in the Central Highlands. Environmental change in the region is therefore not simply a by-product of development, but one of its core outcomes.

5.4. Social consequences

The social impacts of these changes were just as significant. Using the data, the three most illustrative patterns were: land inequality, marginalization of indigenous peoples, and restructuring of labor. All three processes were eventually linked to migration and the expansion of agriculture, although the processes were not the same everywhere. Of all the processes under consideration, land inequality was the most pronounced. With the transformation of agriculture in the region, land began to be valued as a resource. Furthermore, access to land became differentially available to the various occupants of the region. Those households that possessed capital, knowledge of administration, and a stronger market presence were able to buy and retain land. Others were forced to lose the access to land they had. In several interview locations, indigenous households mentioned that land that was once communal and used for agriculture had become private, either turning into a market commodity or being bought for commercial agricultural production. This process of land privatization and commercialization deepened inequalities, not just between households, but also between indigenous peoples and newcomers. The unequal restructuring of indigenous peoples' access to land was inextricably linked to the unequal restructuring of marginalization. The majority of the smaller ethnic communities in the Central Highlands have traditionally relied on a system of mixed farming, forest utilization, and communal land. This system of livelihood was systematically displaced by market-oriented land uses as the agricultural frontier expanded. Respondents from Indigenous Peoples communities expressed that they perceived themselves as having little to no power to determine the distribution of land resources, limited access to information related to policies and market opportunities, and decreased ability to legally defend and assert their customary rights. In this way, migration and agrarian transformation had differential impacts on various groups, and in this case, agrarian transformation and migration reinforced already existing ethnic hierarchies in the regional development continuum.

The inequities in land access due to the expansion of commercial agriculture resulted in changes in the nature of labor relations, which is the third consequence of the phenomenon. While some families turned to more intensive forms of family farming, others relied on hired labor or sent family members to work as wage earners. Seasonal labor migration became more common, especially among younger adults, and hired work on coffee or pepper plantations became an important supplementary livelihood activity. For families losing land, wage labor did not constitute an improvement in economic status; rather, it involved more work with less autonomy and greater reliance on unstable sources of income. This shows that the agrarian transformation triggered by migration in the Central Highlands is not merely about an increase in production. It indicates a more complex phenomenon involving changes in class relations,

labor relations, and social relations. The central argument of the study is that the combination of migration, agricultural expansion, and socio-environmental changes is not a linear, simple phenomenon. It shows that migration has expanded the agricultural frontier, that agricultural growth has intensified societal and environmental pressures, and that the combined effects have radically changed social relations in an unequal manner across social strata. This characterizes the Central Highlands as a region of layered complexity, where demographics, agrarian capitalism, and ecology are intricately related.

6. Discussion

6.1. Migration as a driver of agrarian frontier expansion

The study illustrates that migration is central to understanding the agricultural frontier of Vietnam's Central Highlands. Instead of understanding migration as a simple demographic phenomenon, it is better viewed as a mechanism of agrarian expansion. The forest-commodity production of coffee, and subsequently, pepper, forest transformation, and production zone migration-enterprise households (whether state-sponsored or self-settled). In this way, migration complements the region's market-based agricultural transformation. This is also true in relation to broader theories of frontier expansion. In the South, a migrating population often provides the needed labor, entrepreneurial, and demographic impetus to facilitate the transformation of forested areas into agricultural zones (Lambin & Meyfroidt, 2010). Additionally, in the Central Highlands, migration-driven agrarian transformation has gone beyond merely increasing the scale of agricultural production. It has also transformed the rural population distribution, land-use patterns, and the economic integration of the region. The region's economic focus has shifted from subsistence agriculture and forest-based systems toward a more developed economic system, including cash-crop agriculture and a market-based economy.

The impact of migration on the frontier expansion of agrarian economies reveals the intricate nexus between development policy, market demand, and environmental control. The interaction of migration with policy triggers and the commodity market has further accelerated the velocity and magnitude of land-use/legal changes. Therefore, agrarian expansion in the Central Highlands must be viewed not merely as an agricultural process but as a socio-political and economic transformation.

6.2. Socio-environmental trade-offs

The socio-environmental impact that comes with the expansion of land for crops is problematic, yet it also provides some positive impacts. The expansion of land use for cash crops like coffee and pepper has provided many economic benefits. For many migrant households, their newly acquired economic and trading opportunities have offered unprecedented prospects. Commercial agriculture has economically developed the region and connected the Central Highlands to national and global markets. However, the economic benefits of this expansion have also created numerous ecological problems. Rapid agricultural expansion has led to deforestation, soil degradation, and increased water stress. The production of monoculture crops has decreased biodiversity and the ecological resilience of the highland region. Additionally, coffee production requires significant amounts of water, increasing the demand for irrigation and water resources during the dry season. These situations highlight the conflict between economic growth and environmental sustainability. On the positive side, frontier agriculture provides opportunities for economic growth, but it also degrades the environmental systems that are essential for rural economies. It is crucial to find the right

balance in order to develop governance approaches that enable economically less-developed rural areas to grow while protecting the environment from the negative effects of agriculture.

6.3. Uneven development

Integrated socio-economic changes in the Central Highlands region show pronounced unevenness, particularly in the positive impacts resulting from agricultural expansion and migration. New opportunities have arisen, but they have not been evenly distributed among social groups. Often, the position of migrant farmers has allowed them to benefit more from market expansion, due to their access to financial resources, supportive networks, and professional experience. In contrast, indigenous local communities have struggled to cope with the rapid changes in agrarian structure and have faced greater challenges. The traditional subsistence and mixed farming, forestry, and customary land use strategies have been largely displaced by the expansion of commercial agriculture and the increasing commercialization of land. When land in the commercial agricultural sector is valued more, indigenous local communities face greater challenges in accessing land and forests. This development explains the unevenness of the broader agrarian transformation in the frontier regions of the Central Highlands. The socio-economic changes in this area have created both beneficiaries and victims, opportunities and constraints. This is essential for understanding the social aspects of land-use changes and for addressing the victimization of marginalized social groups.

6.4. Governance challenges

The results indicate important governance issues related to managing migration-driven agrarian transformation. The rapid expansion of agriculture has made land management and forest governance increasingly difficult in the Central Highlands. The land regulatory framework for various land conversions, migration, and agricultural shifts is still emerging. Effective governance of agricultural expansion frontiers must balance land-use regulation and the control of agricultural expansion. Regulatory land-use planning arrangements for land tenure improve community access to land and reduce land-use conflicts. Furthermore, social forestry governance must address the nexus of migration, land use, and the environment. Ungoverned agricultural expansion frontiers create longitudinal ecological degradation cycles. Strengthening governance and control, especially at the central and community levels, is crucial for achieving equilibrium between environmental and developmental goals.

7. Conclusion

This study examined the relationships among migration, agricultural expansion, and socio-environmental transformation in Vietnam's Central Highlands. The findings show that migration has played a critical role in shaping agrarian change in the region. Through both permanent settlement and labor mobility, migration has contributed to the expansion of commercial agriculture and the transformation of land-use systems.

The results also demonstrate that agricultural expansion has generated significant socio-environmental consequences. While the growth of coffee, pepper, and other commodity crops has improved economic opportunities for many households, it has also contributed to deforestation, soil degradation, and water stress. At the same time, the benefits and costs of agrarian transformation have been unevenly distributed, with indigenous communities often facing greater vulnerability within changing land and livelihood systems. Taken together, these findings indicate that migration and agricultural expansion have jointly driven a broader socio-environmental transformation of the Central Highlands. The region's landscape, economy, and

social relations have been reshaped through the interaction of demographic mobility, market-oriented agriculture, and environmental change.

This study contributes to the literature by connecting migration studies with research on agrarian change and political ecology. By integrating these perspectives, the analysis highlights how demographic mobility, land-use transformation, and environmental pressures are interconnected processes rather than separate phenomena. The study also demonstrates the value of examining agricultural frontier expansion through a socio-environmental lens. Understanding the Central Highlands requires attention not only to economic growth but also to power relations, resource access, and ecological sustainability.

The findings suggest several policy implications. First, stronger regulation of agricultural frontier expansion is necessary to reduce uncontrolled land conversion and environmental degradation. Second, improving land tenure security can help reduce inequality and provide more stable foundations for sustainable land management. Third, development policies should place greater emphasis on supporting indigenous livelihoods and strengthening the resilience of communities whose traditional land-use systems have been disrupted by agrarian transformation.

Future research should further explore the long-term relationship between migration and environmental change in the Central Highlands. In particular, greater attention is needed to the impacts of climate change on agricultural systems and water resources in upland regions. Comparative studies examining how different forms of migration interact with environmental governance could also deepen understanding of the migration–environment nexus and help inform more sustainable development strategies.

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