

Beyond Monoculture: Agrarian Adaptation Strategies and Actor-Networks in a Changing Landscape of North Sumatra

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ABSTRACT

The global expansion of cash crops is frequently depicted as a totalizing force that transforms diverse farming systems. This study examines the agrarian adaptation strategies of the community in Sayur Mahincat Village, North Sumatra, Indonesia, within a changing landscape where oil palm has become prominent while rice fields, horticulture, rubber, and other crops remain part of everyday agricultural practice. Employing a qualitative ethnographic case study design, this research analyzes how households organize different land uses and agricultural activities. Data were collected through participant observation and in-depth interviews conducted during two fieldwork periods, from December 2025 to February 2026 and August to September 2026, and analyzed using thematic analysis interpreted through Actor-Network Theory (ANT). The findings reveal three connected dynamics: the coexistence of diverse land uses, divergent management rhythms between seasonal food crops and permanent plantations, and the role of human and non-human entities in shaping agricultural practice. Water availability and crop biology condition land-use possibilities, while Ramadan operates as a cultural-temporal arrangement that mediates the organization of agricultural labor. This study argues that agrarian change in Sayur Mahincat is not adequately understood as a linear replacement of diverse farming by monoculture, but as an ongoing reconfiguration of relations among people, land, crops, material conditions, and culturally structured time.

Keywords: Agrarian Adaptation, Actor-Network Theory, Livelihood Diversification, Cultural Ecology, North Sumatra.

INTRODUCTION

The global expansion of commercial cash crops, particularly oil palm, is frequently depicted as an unstoppable force that homogenizes rural landscapes, erodes biodiversity, and undermines traditional food systems. Yet the presence of oil palm does not necessarily mean that other agricultural practices have disappeared. In Sayur Mahincat Village, North Sumatra, oil palm is prominent, while rice fields, horticulture, rubber, and post-harvest crops remain part of everyday agricultural practice. This study therefore examines how different agricultural practices are organized within a changing landscape rather than assuming a complete transition to monoculture.

Current literature on agrarian transformation often falls short in capturing the micro-level complexities of this coexistence. While numerous studies discuss livelihood diversification as a possible response to uncertainty, the persistence of different land uses also requires attention to the material conditions through which agricultural work is organized. Recent scholarship (Meyfroidt et al., 2022; Figueira et al., 2025) calls for more nuanced approaches to land-use change. This study brings that concern into an ethnographic examination of relations among farmers, land, water, crops, and culturally structured time.

The primary objective of this research is to analyze the relationship between land perception and the diverse agrarian adaptation strategies developed by the community in Sayur Mahincat Village, Padang Lawas Regency. This location serves as an ideal microcosm, characterized by a transitional landscape where dominant oil palm plantations coexist with rice fields, horticulture, and smallholder rubber. By employing a qualitative ethnographic approach, this study investigates how households navigate this pluralistic landscape, focusing on

the specific strategies they employ to manage their land and sustain their livelihoods. This focused inquiry allows for a deep, contextualized understanding of the mechanisms that enable agrarian pluralism to persist.

This study argues that agrarian change in Sayur Mahincat is not a linear shift toward uniform monoculture, but rather a complex, ongoing negotiation within a heterogeneous actor-network. Adaptation strategies are not solely the product of rational human choice; they are entangled with the biological characteristics of crops, the availability of natural resources like water, and socio-cultural rhythms. Preliminary observations indicate that farming practices are dynamically adjusted based on factors such as post-harvest opportunities and the Islamic fasting month of Ramadan. These observations are examined by distinguishing material actants from cultural-temporal arrangements rather than treating all of them as the same type of actor.

The contributions of this research are both theoretically and empirically significant for the field of anthropology and rural sociology. Theoretically, it advances the application of ANT in agrarian studies by providing empirical evidence of how material conditions such as water and crop biology shape agricultural possibilities, while culturally structured time influences the organization of labor. Empirically, it offers a granular case study from a transitional region in Indonesia, describing how mixed agricultural practices persist alongside oil palm. The paper therefore contributes to a more differentiated understanding of agrarian change without treating persistence as proof of measured resilience or organized resistance.

LITERATURE REVIEW

The discourse on agrarian change has long been anchored in cultural ecology, which posits that human societies actively adapt their livelihood strategies in response to shifting ecological, economic, and social environments. Understanding this adaptation is crucial, as it reveals the agency of rural communities in navigating structural transformations rather than merely being passive victims of macroeconomic forces. Foundational and contemporary scholars (Steward, 1955; Bennett, 1976; Moran, 2016; Suhaeb et al., 2024) emphasize that adaptation is a dynamic, context-specific process shaped by unequal access to resources, knowledge, and opportunities. Therefore, analyzing agrarian adaptation requires moving beyond simplistic economic models to examine the nuanced, localized strategies households deploy to sustain their livelihoods.

A prominent trend in recent rural studies is the emphasis on livelihood diversification as a mechanism through which households combine different productive activities under conditions of uncertainty. Recent empirical studies (Imelda et al., 2025; Kamakaula, 2025; Werdofa et al., 2024) demonstrate that households may combine agriculture, livestock, trade, and non-farm activities. However, diversification should not automatically be equated with resilience or food security. In this study, agrarian diversity is therefore treated descriptively as the coexistence of different productive activities, while implications for food provision and economic security are discussed only where supported by field evidence.

Concurrently, research on land-use transformation highlights that agrarian landscapes are continuously reshaped by complex, multi-scalar interactions. Changes in land cover are rarely driven by a single factor; they emerge from the entanglement of global market demands, local socio-economic conditions, and environmental constraints. Studies by Meyfroidt et al. (2022) and Figueira et al. (2025) reveal that agrarian transitions involve intricate trade-offs, where the expansion of commercial crops interacts with, rather than simply erases, existing land management practices. Consequently, the agrarian landscape must be understood as a dynamic space shaped by overlapping historical and contemporary forces.

Another critical theoretical trajectory is the application of Actor-Network Theory (ANT) to environmental and agrarian studies. Traditional approaches often privilege human agency, treating the environment as a passive backdrop. ANT disrupts this by recognizing the constitutive role of non-human entities in shaping courses of action. As articulated by Latour (2005) and Callon (1986), agrarian change can be examined through heterogeneous networks comprising farmers, crops, soil, water, and other material elements. This perspective provides a lens to examine how material and social elements jointly produce specific agrarian practices.

Despite these advancements, a significant gap remains in the literature regarding the micro-level, socio-material dynamics of adaptation in transitional agrarian landscapes. Most existing studies on agrarian change in Indonesia either focus on macro-level land-use statistics or analyze livelihood strategies purely through a human-centric, socio-economic lens, neglecting the agency of non-human actors. While studies like Pradnyaswari et al. (2022) and Berliana & Sihalo (2023) effectively map livelihood assets, they rarely interrogate how specific non-human elements (e.g., water flow, crop biology, religious cycles) actively constrain or enable these strategies. This study addresses this gap by integrating ANT to reveal the hidden, heterogeneous networks that underpin agrarian adaptation.

Therefore, this research is positioned to bridge cultural ecology and socio-material theory by examining agrarian adaptation in Sayur Mahincat Village. By treating the agrarian landscape as an active network of human and non-human elements, while keeping cultural arrangements analytically distinct, this study offers a more nuanced understanding of how rural communities negotiate the pressures of cash crop expansion. Through ethnographic inquiry, this paper investigates how the interplay of farmers, land, water, crops, and culturally structured work rhythms generates diverse, coexisting agrarian strategies.

METHOD

The unit of analysis for this study is the agrarian household and its land management practices within the specific socio-ecological context of Sayur Mahincat Village, South Barumun District, Padang Lawas Regency, North Sumatra. Focusing on the household level allows for an in-depth examination of the decision-making processes, resource allocation, and daily practices that constitute agrarian adaptation. Sayur Mahincat is purposively selected due to its representative transitional landscape, featuring a mix of dominant oil palm plantations alongside persistent rice fields, horticulture, and smallholder rubber, making it an ideal site to observe coexistence and adaptation. This bounded unit of analysis provides a rich, contextualized foundation for understanding the micro-dynamics of agrarian change.

This research employs a qualitative ethnographic case study design to explore the complex phenomena of agrarian adaptation. Ethnography is uniquely suited to uncover the tacit knowledge, meaning-making processes, and everyday practices of rural communities, which quantitative surveys often fail to capture. As emphasized by contemporary qualitative methodologies, immersive fieldwork allows the researcher to observe not just what people say they do, but what they actually do in relation to their environment and each other. Thus, the ethnographic design enables a nuanced, holistic understanding of how agrarian strategies are lived and negotiated on the ground.

Data for this study were sourced from a triangulation of primary ethnographic materials and secondary contextual documents. Combining multiple data sources enhances the validity and depth of the findings, ensuring that interpretations are grounded in both lived experience and broader structural contexts. Primary data were generated through participant observation and in-depth interviews, while secondary data included field notes, photographic documentation, and local agricultural reports detailing historical land-use changes in the Barumun river basin. This comprehensive data sourcing guarantees a robust, multi-layered empirical foundation for the analysis.

The technique of data collection relied on purposive and snowball sampling to engage key informants deeply embedded in the village's agrarian activities. To capture the diversity of agrarian strategies, it was essential to include perspectives from various actors who interact with the land differently. In-depth interviews were conducted with rice farmers, oil palm smallholders, horticulture growers, plantation workers, and community leaders who possess historical knowledge of land-use transitions. Participant observation was also conducted during daily farming activities to observe the practical realities of land management. This targeted data collection ensures that the study captures a wide spectrum of agrarian experiences and strategic responses.

The study involved 10 key informants selected purposively according to their positions and involvement in different agrarian practices. They consisted of the Village Head, the Raja Pamusuk, two owners who also cultivated rice fields and post-harvest and horticultural crops, three oil-palm plantation owners, two owners of

oil-palm plantations who also owned rice and horticultural land, and one coffee plantation owner. Ownership and cultivation were not necessarily held by the same person: some oil-palm owners participated directly in cultivation, while others provided land and capital and relied on hired workers for plantation activities. This composition was intended to capture variation in agrarian positions and practices rather than statistical representativeness.

Interviews were conducted as in-depth, semi-structured conversations guided by themes of land use, crop selection, agricultural work rhythms, harvesting and post-harvest practices, access to water, relations between owners and workers, and changes associated with oil palm expansion. Follow-up questions were used to clarify practices and accounts encountered during observation. Quotations presented in the findings are anonymized and identified only as informant statements from field interviews.

Thematic analysis followed Braun and Clarke (2021). Interview materials and field notes were reviewed, coded, and organized around recurring themes concerning land use, crop selection, temporal organization of work, material constraints, ownership and cultivation relations, and relations among actors. Analysis proceeded iteratively by comparing interview accounts with observations. The adequacy of the qualitative material was considered through the relevance and diversity of the informants and the recurrence of themes across interviews and observations, rather than through a statistical criterion of sample size. The resulting themes were then read through ANT concepts, particularly actants, relations, and translation. The study distinguishes direct observation, informant accounts, and secondary contextual information; no numerical estimate of the proportion of village land occupied by oil palm is made.

Data analysis was conducted using a thematic analysis framework, interpreted through the lens of Actor-Network Theory (ANT). This hybrid analytical approach allows for the systematic identification of patterns in the data while providing a robust theoretical framework to understand the relational dynamics between human and non-human elements. Following Braun and Clarke's (2021) guidelines, data were transcribed, coded, and categorized into themes related to land use, management flexibility, and relational dynamics. These themes were then analyzed using ANT concepts (e.g., actants, translation, networks) to map how strategies are co-produced. Through this rigorous analytical process, raw ethnographic data are transformed into a compelling narrative about the socio-material nature of agrarian adaptation.

RESULTS

1. The Persistence of Agrarian Pluralism Amidst Cash Crop Dominance

Table 1: Typology of Agrarian Land Use in Sayur Mahincat Village

Land Type	Primary Commodities	Characteristics & Spatial Logic
Plantation	Oil palm, Rubber	Dominant land use; represents long-term capital investment.
Rice Fields	Paddy rice	Maintained in areas with reliable, year-round water access.
Post-Harvest Fields	Peanuts, mung beans, corn, cassava	Utilized immediately after rice harvest to maximize land productivity.
Horticulture	Chili, cucumber, spinach, scallions	Planted based on market demand, available capital, and soil conditions.
Hilly Areas	Coffee	Cultivated in cooler, elevated microclimates.
Field Margins	Areca nut	Maintained as a supplementary, low-maintenance income source.

Source: Field research data, 2025-2026

The empirical data show that the agrarian landscape of Sayur Mahincat is not a monolithic oil palm frontier. While oil palm is a prominent commodity, introduced through large-scale expansion and nucleus-plasma (PIR) programs since the 1980s, it has not entirely erased pre-existing agricultural forms. Informants described the continued use of rice fields and diverse garden crops for everyday consumption and other household needs. As

one informant explained, "Sawit is for our children's future, but the rice field and vegetables are for our stomach today." The statement illustrates the different temporal and practical meanings attached to these crops, but does not by itself establish household-level food security.

Three distinct patterns emerge from this spatial coexistence. First, there is a pattern of complementary coexistence, where cash crops and food crops are maintained simultaneously. Second, there is ecological niche utilization, where specific crops are located in relation to micro-environmental conditions, such as coffee in cooler hilly areas and areca nut on field margins. Third, historical land-use practices persist alongside oil palm through repeated everyday cultivation rather than through a single collective decision to oppose oil palm. The evidence therefore supports a description of agrarian pluralism, but not a quantified claim about food security or economic resilience.

The separation between ownership and cultivation was also visible in oil-palm production. One plantation owner explained: "The plantation is mine, but the workers are the ones who work it. I do not go to the plantation every day." (informant, field interview, 2026). This account indicates that land ownership, capital, and day-to-day agricultural labor may be distributed across different actors.

2. Divergent Management Rhythms: Flexible Food Crops vs. Permanent Plantations

Table 2: Comparative Characteristics of Agrarian Management Strategies

Aspect	Food Crops (Rice/Horticulture)	Oil Palm Plantation
Cultivation Nature	Seasonal, cyclical	Perennial, long-term (20-25 years)
Land Use Flexibility	High; allows functional rotation	Low; permanent land commitment
Crop Rotation	High (polyculture/intercropping)	None (strict monoculture)
Labor Rhythm	Intensive, adaptable to cultural calendars (e.g., Ramadan)	Routine, stable (bi-weekly harvesting)
Spatial Utilization	Maximizes multiple species in one area	Canopy limits undergrowth, dominating space

Source: Field research data, 2025-2026

The management of land in Sayur Mahincat is characterized by a divergence in temporal and operational rhythms, related partly to the biological nature of the chosen commodities. For food crops, farmers employ a flexible, cyclical approach. Informants explained that intensive rice cultivation may be scheduled so that demanding stages are completed before Ramadan, with less labor-intensive activities undertaken during the fasting period. Conversely, oil palm management involves a longer-term land commitment and recurring harvesting once the trees reach maturity. These differences illustrate how agricultural work is organized through both material and cultural-temporal conditions.

An informant described post-harvest flexibility in practical terms: "After harvesting rice, if there is still time and the land can be used, we plant peanuts or corn. It does not have to be only one crop." (informant, field interview, 2026).

Three patterns define these divergent management strategies. First, temporal flexibility in food crop systems allows households to adjust agricultural activities according to cultivation stages and immediate circumstances. Second, socio-religious synchronization demonstrates that agricultural labor is intertwined with cultural and religious rhythms. Third, long-term capital commitment characterizes oil palm, where the initial planting decision establishes a longer-term relationship between land, trees, labor, and household expectations.

The adjustment during Ramadan was also expressed by an informant: "When Ramadan comes, the heavier work is usually reduced." (informant, field interview, 2026). This statement is treated as an account of how work was organized rather than as a universal schedule for all households.

3: Agrarian Adaptation as a Heterogeneous Actor-Network

Table 3: Actor-Network Mapping of Agrarian Strategy Formation

Actant (Human/Non-Human)	Form of Relation	Impact on Agrarian Strategy
Farmers	Manage land, select commodities	Initiates and directs the adaptation strategy.
Rice Fields	Provides a space for functional rotation	Enables high flexibility and crop diversification.
Water (River/Hills)	Dictates soil moisture and irrigation	Actively enables or constrains the choice of crops.
Ramadan (Cultural)	Influences physical labor capacity	Forces adjustment of planting/harvesting schedules.
Oil Palm Biology	Requires 20+ years, dense canopy	Enforces permanent land use, limits intercropping.

Source: Field research data, 2025-2026

Viewed through the lens of Actor-Network Theory, the diverse agrarian strategies in Sayur Mahincat are not merely the result of human rational choice, but the outcome of relations within a heterogeneous network. The decision to maintain a rice field, for instance, depends not only on farmer preferences but also on water conditions, labor, and the possibility of subsequent crops. Similarly, the biological characteristics of oil palm—its long lifespan and canopy structure—constrain the possibility of intercropping and create a longer-term land commitment. Ramadan has a different analytical status: it is treated as a cultural-temporal arrangement that mediates the organization of agricultural labor, not as a non-human actant.

Three relational patterns are evident in this socio-material network. First, material conditions such as water availability and crop biology enable or constrain human decisions. Second, cultural-temporal arrangements such as Ramadan influence the timing and intensity of labor. Third, agrarian diversity emerges from different combinations of land, water, crops, labor, ownership, and culturally structured time. These patterns show how agricultural practices are produced through relations rather than through an isolated household calculation.

DISCUSSION

The findings of this study collectively reveal that agrarian change in Sayur Mahincat is characterized by persistent pluralism, divergent management rhythms, and complex socio-material networks. Rather than assuming complete displacement by oil palm, the empirical data show the coexistence of rice fields, horticulture, and oil palm, alongside rubber, post-harvest crops, coffee, and areca nut. These practices are organized through different temporal and material conditions, including water availability, crop characteristics, labor arrangements, and culturally structured time. Agrarian adaptation in this context is therefore better understood as an ongoing process of socio-material negotiation.

The social relevance of these findings concerns the continued availability of different forms of production within the agrarian landscape. The maintenance of post-harvest crops and garden crops alongside oil palm means that households are not organized around a single agricultural practice. However, this study does not measure caloric intake, household food expenditure, income volatility, or exposure to market shocks. The evidence therefore does not establish food security or economic resilience in a quantified sense; it shows instead how different forms of production remain practically available within the landscape.

Theoretically, this research advances the application of Actor-Network Theory (ANT) within cultural ecology and agrarian studies by showing how material conditions enter everyday farming decisions. Water availability affects whether rice cultivation can be maintained, while oil palm biology affects the temporal and spatial possibilities of established plantation land. Ramadan is analytically distinct as a cultural-temporal arrangement that mediates labor organization. The contribution therefore lies in tracing how heterogeneous relations shape agricultural practice rather than attributing outcomes solely to human intention.

The case of Sayur Mahincat also shows the importance of flexibility in understanding agrarian practice. Seasonal food crops allow land to be reorganized over shorter intervals, while established oil palm creates longer-term commitments. Households may therefore participate in different agricultural arrangements at the same time, with each involving different requirements for labor, land, water, and capital. The persistence of these arrangements should be understood as an empirical feature of the village rather than as proof that one form of agriculture is universally more resilient or efficient than another.

Compared to previous studies on agrarian change in Indonesia, this research offers a micro-level perspective on how multiple agricultural arrangements coexist in practice. Macro-level land-use studies often depict oil palm expansion through changes in land cover, while socio-economic studies may focus on household assets and diversification. This study aligns with the emphasis of Meyfroidt et al. (2022) and Figueira et al. (2025) on complex land-use interactions, while using ANT to trace how material conditions and relations among actors become consequential in everyday agricultural work.

The practical implications of this study are necessarily context-specific. The findings indicate that rural development interventions should account for the material conditions that allow different agricultural practices to coexist, particularly water access and the organization of agricultural labor. Rather than assuming a single commodity pathway, interventions should recognize that households may organize land, capital, labor, and crops through different combinations. These findings do not by themselves establish a universal policy prescription.

CONCLUSION

The conclusion of this research is that the agrarian landscape of Sayur Mahincat is characterized by the coexistence of prominent oil palm cultivation with rice, horticulture, rubber, post-harvest crops, coffee, and areca nut. The empirical evidence does not support describing the village as a completely homogenized monocultural landscape. At the same time, the persistence of diverse land uses should not be interpreted as proof of measured food security, economic resilience, or resistance to oil palm. What the ethnographic evidence demonstrates more directly is the continued organization of different forms of agricultural practice within the same changing landscape.

The primary contribution of this study lies in its application of Actor-Network Theory to examine the relations through which agrarian adaptation is organized. Water and crop biology are treated as material actants because their properties constrain or enable particular agricultural practices, while Ramadan is treated as a cultural-temporal arrangement that mediates the organization of labor. This distinction allows the analysis to connect ethnographic observations with ANT without collapsing human actors, material entities, and cultural arrangements into a single category.

Despite its contributions, this study is constrained by its focused ethnographic scope on a single village and by the qualitative nature of the evidence. It does not provide a spatially quantified estimate of oil palm dominance, household-level measures of food security, or longitudinal measures of economic resilience. Nor does it examine the full political economy of plantation expansion. Future research could compare several villages and connect ethnographic analysis with spatial land-use data and longer-term economic information.

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