

Responsible scaling for sustainable intensification: Dimensions of land rights and farmer realities in Northern Ghana

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ABSTRACT

Despite efforts to promote Sustainable Intensification (SI) in northern Ghana, adoption remains uneven due to interacting constraints such as farm-level constraints, limited resources, lack of institutional support, and land tenure issues, which influence farmers' willingness and ability to engage in SI. The paper assesses how different land tenure modes are locally understood and experienced within the different pathways of use rights that farmers may derive tenure (in)security in their engagement in Sustainable Intensification in northern Ghana. Moving beyond binary notions of land tenure security, the analysis applies the Theory of Access to examine how socially embedded rights, obligations, and recognition structure farmers' ability to invest in land. The study draws on qualitative evidence from participatory rural appraisal tools, including matrix ranking, focus group discussions, and key informant interviews. The findings indicate that farmers begin by evaluating the land itself, that is, its transfer rights, collateral ability, dispute possibilities, and the extent to which use rights are socially recognized, even before deciding whether and how to engage with Sustainable Intensification (SI) practices. Even where land was held under relatively secure arrangements, including plots with formal title deeds, farmers were reluctant to use land as collateral for formal credit. This reluctance stemmed primarily from heightened climate uncertainty, including rainfall variability, drought risk, and the possibility of crop failure, which made the prospect of losing land through loan default unacceptable. In this context, SI investments were more commonly financed through informal support systems such as kin-based lending and rotating labor and savings associations. Long-term practices, such as agroforestry, were intentionally avoided on conditionally accessed lands, as tree planting was widely interpreted as an implicit ownership claim that could invite disputes or land withdrawal. Where women's access to land was conditional on marital and childbearing status, incentives to undertake long-term investments were further reduced. Overall, farmers' engagement in SI requires not only technical adaptation but institutional sensitivity, recognizing that the sustainability of SI also depends on the alignment between innovation characteristics and the rights through which farmers engage with land.

1. Introduction

Agriculture has historically evolved through successive processes of intensification aimed at increasing crop productivity to meet growing demands for food, feed, and fibre, with Sustainable Intensification (SI) emerging as a framework that seeks to align productivity gains with the maintenance of agricultural and natural capital (Pretty, 2018; Pretty et al., 2018; Reich et al., 2021; Thomson et al., 2019). While a large body

of empirical work documents positive yield, soil, and resilience effects of SI practices under experimental conditions and project-based implementation, these effects often attenuate or disappear when SI is promoted beyond pilot settings (Vanlauwe et al., 2014; Kassie et al., 2015; Kotu et al., 2017; Jones-Garcia and Krishna, 2021). As Pretty et al. (2018) describe, SI seeks to "produce more from the same area of land while reducing negative environmental consequences and increasing contributions to natural capital." On one hand, it offers pathways to

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enhance agricultural productivity while minimizing environmental harm. On the other hand, its success is contingent on dismantling the systemic inequities that shape who can access critical resources and innovations (Pretty, 2018; Pretty et al., 2018). Conservation tillage, integrated soil fertility management, agroforestry, ploughing, and crop diversification, among others, frequently exhibit partial adoption, selective implementation, or abandonment once external project support declines. These patterns are commonly interpreted as adoption failures driven by farmer risk aversion, liquidity constraints, or information deficits. However, such explanations conflate adoption with scaling and obscure the fact that SI practices are introduced through scaling processes that constitute the institutional and social environments in which farmers operate (Pretty et al., 2018; Thomson et al., 2019). Scaling is seen as not merely an increase in the number of adopters; it involves the expansion of intervention logics into heterogeneous contexts where land governance, social relations, and power asymmetries influence who can engage with innovations, under what conditions, and for how long (Wigboldus et al., 2016; Schut et al., 2016, 2024; Woltering et al., 2019). From this perspective, uneven SI outcomes may reflect not isolated farmer-level decisions, but the interaction between SI practices and the contextual socio-institutional conditions under which they are scaled, as informed by Pretty (2018).

According to Schut et al. (2016) SI is particularly vulnerable to institutional misalignment at scale because many of its core practices involve long-term, land-based investments rather than short-term input substitutions. Soil fertility restoration, agroforestry, conservation tillage, and water harvesting require sustained labour inputs and generate benefits that accrue gradually over multiple seasons or generations (Tittone et al., 2016; Adimassu et al., 2016). Engagement with such practices presupposes that farmers can retain control over land and land-based improvements long enough to capture returns on investment. Studies across Africa show that farmers are reluctant to invest in practices with long payoff periods when land access is uncertain, even when agronomic benefits are well understood (Place and Otsuka, 2002; Goldstein and Udry, 2008; Ghebru and Lambrecht, 2017). In such situations, SI is reported to magnify the importance of land relations in scaling processes: where land rights are weak, ambiguous, or socially contingent, SI practices may be technically sound but strategically avoided (Bayne and Renwick, 2021). This makes understanding SI performance at scale require analyzing land rights as a conditioning factor in scaling practices.

Much of the SI literature acknowledges land tenure as relevant but treats it through simplified proxies such as formal title or perceived security in binary forms (Lawry et al., 2014). Such approaches are reported to be insufficient in contexts characterized by legal pluralism and socially embedded property relations (Thomson et al., 2019). In Ghana, land is accessed through multiple tenure modalities, including inheritance, lineage allocation, chieftom grants, rental contracts, gifts, and various forms of purchase with or without documentation (Akaateba et al., 2019; Anafo et al., 2023; Alhola and Gwaindepi, 2024). These modalities differ in the rights they confer, particularly regarding permanent improvements, transferability, and defence against competing claims. Empirical studies show that inherited and lineage-held plots are more likely to attract long-term investment than rented or sharecropped land, while purchased land with documentation often enables greater investment in perennials and soil conservation (Mensah, 2014; Otsuka and Place, 2015; Totin et al., 2021). However, even within inheritance-based tenure, rights are differentiated by social position, political connections, and lineage authority, producing uneven capacities to invest (Berry, 2009; Goldstein and Udry, 2008). As such, treating tenure as a binary condition of security could obscure the mechanisms through which specific tenure modalities determine how farmers engage in SI initiatives.

Land tenure is not only differentiated by modality but is also structured by social relations and power (Moreda, 2023; Nara et al., 2021; Nchanji et al., 2023). Feminist agrarian and political ecology scholarship

documents how women's land access in customary systems is commonly mediated through male relatives and embedded in patriarchal norms that weaken intergenerational claims and constrain decision-making authority (Agarwal, 1998; Chafetz, 1988; Berry, 2008; Tsikata and Yaro, 2014). In northern Ghana, women frequently cultivate land allocated through husbands or lineage heads, with limited authority to plant trees or make permanent soil improvements (Azumah et al., 2023; Michalscheck et al., 2020). Migrant farmers and younger men similarly access land through temporary or negotiated arrangements that permit cultivation but restrict long-term claims (Antwi-Agyei et al., 2015; Yaro, 2010). These differentiated positions matter directly for SI scaling. Practices central to SI, such as agroforestry or soil rehabilitation, are locally interpreted as assertions of ownership and may increase exposure to dispute or loss of access (Amanor, 2008). As a result, farmers' engagement with SI may be determined less by abstract sustainability objectives than by assessments of whether investments can be defended, retained, or passed on.

Despite much evidence linking land tenure to agricultural investment, SI scaling initiatives in Ghana have not assessed how different land tenure modes are locally understood and experienced within the different pathways of use rights that farmers may derive tenure (in)security. This study addresses this gap by conceptualizing land tenure as a bundle of differentiated rights that condition SI performance at scale. Land rights in the context of our study refer to the socially embedded and institutionally mediated claims, entitlements, and powers that individuals or groups hold over land, including rights to access, use, control, transfer, and derive benefits from land while the degree to which individuals or groups have confidence that their land rights will be recognized, protected, and enforceable over time, enabling them to make long-term investments without fear of dispossession is referred to as tenure security (Akaateba, 2019; Alhola and Gwaindepi, 2024; Anafo et al., 2023; Antwi-Agyei et al., 2015; Berry, 2008; Chimhowu, 2019). Differentiated rights ecologies are seen as a conceptual lens capturing the uneven, relational, and context-specific configurations of land rights (e.g., use rights, transfer rights, inheritance rights) that vary across actors, shaping their capacities to adopt and sustain SI practices. Drawing on the Theory of Access (Ribot and Peluso, 2003), land rights are understood not simply as a set of formal rights but as the ability to benefit from land through socially mediated mechanisms, including authority, legitimacy, and social recognition. Building on this framework and empirical insights from Dukou, Ghana, the analysis focuses on three interrelated land-rights dimensions: exposure to dispute, collateral potential, and intergenerational transfer. Exposure to dispute captures land-related contestations, and the likelihood that land improvements may provoke disputes; collateral potential reflects the ability to mobilize land for complementary investments while also introducing risks of dispossession; and intergenerational transfer constitutes farmers' ability to transfer lands to relatives, and whether SI investments are perceived as meaningful beyond the current production cycle.

The study draws on qualitative research conducted within the Sustainable Intensification of Mixed Farming Systems (SI-MFS) initiative by the International Institute of Tropical Agriculture (IITA) in Dukou, northern Ghana, a region characterized by plural land governance, patriarchal authority structures, and pronounced social differentiation (Yaro, 2010; Nchanji et al., 2023). Using participatory matrix ranking, gender-disaggregated focus group discussions, and key informant interviews, the paper assesses how different land tenure modes are locally understood and experienced within the different pathways of use rights that farmers may derive tenure (in)security in their engagement in SI, and hence, addresses three research questions: (1) How do different land tenure modalities constitute farmers' exposure to dispute, collateral potential, and intergenerational transfer rights? (2) How do these differentiated rights configurations influence farmers' engagement with SI practices? (3) What do these dynamics imply for scaling strategies that seek to expand SI without reproducing exclusion, conflict, or unsustainable outcomes?

The remainder of the paper is organized as follows. The next section is a literature review, followed by the theory and conceptual framework, which draws on the Theory of Access to explain how distinct tenure modalities configure varying pathways of rights, control, and benefit capture. The methodology section then outlines the mixed-methods approach employed in the study, including the participatory rural appraisal exercises employed. The subsequent sections present and discuss the findings, and the final section presents the conclusion.

2. Literature review

2.1. Land tenure modalities in Ghana

The literature on land tenure in Ghana emphasizes the plural and often overlapping nature of customary and statutory systems, which together structure access, security, and investment incentives. Customary tenure remains dominant, covering roughly 80% of land, and is historically premised on lineage-based trusteeship, usufruct rights, and communal principles of access (Anafo et al., 2023). Earlier studies describe this system as originally egalitarian and pro-poor, offering members of the lineage reliable access to farmland while preventing permanent alienation (Obeng-Odoom, 2016). Yet, contemporary dynamics of commodification, land grabbing, and the assertion of chiefly authority have transformed these arrangements. Anafo et al. (2023) share that chiefs and family heads increasingly exercise powers resembling absolute ownership, eroding the traditional trusteeship role and enabling land alienation for private gain. This shift has destabilized the “bundle of rights” traditionally associated with custom, where access and use rights remain relatively stable, but exclusion and alienation rights are increasingly contested. Parallel to these developments, statutory frameworks sought to regulate and harmonize tenure. The Land Act 2020 (Act 1036) codifies six forms of land interest: allodial title, customary law freehold, common law freehold, usufructuary interest, leasehold, and customary tenancy, and stipulates fiduciary responsibilities of chiefs, tendanas, and family heads to manage land in the collective interest. It also introduces Customary Land Secretariats as mechanisms for transparency, record keeping, and dispute resolution. However, the statutory system does not displace customary authority; rather, it overlays it, creating a hybrid governance landscape where multiple institutions hold overlapping powers (Obeng-Odoom, 2016). The literature suggests that such hybridity can generate both opportunities and risks. On one hand, it allows local practices to coexist with state law, offering farmers flexible routes to land access. On the other hand, it produces legal ambiguity and competition between forums, often exploited by elites who engage in ‘forum shopping’ to secure favorable outcomes (Mtero et al., 2023). This duality has been particularly pronounced in the north, where customary authorities such as chiefs and tendanas remain central to land allocation (Anafo et al., 2023).

In Northern Ghana, Mensah (2014) identifies three dominant traditional institutions of land administration: tendana, chieftaincy, and family, each producing distinctive tenure regimes that can be categorized broadly as freehold, leasehold, and lineage-based arrangements. These regimes exist on a continuum of tenure security that translates directly into differentiated conservation outcomes. Freehold arrangements, which confer more durable and individualized rights, are associated with higher levels of investment in soil and water conservation measures, whereas leaseholds, being time-bound and subject to renegotiation, show no significant impact on conservation adoption (Mensah, 2014; Nara et al., 2020; Nara et al., 2021). Lineage-based usufruct rights occupy a middle ground, offering stability for insiders but creating exclusionary barriers for outsiders and weaker incentives for long-term improvements (Mensah, 2014). The literature reflects broader comparative research across West Africa, where tenure regimes with stronger alienation and transfer rights seem to encourage investment in perennial crops and terracing, while insecure or temporary

contracts depress conservation incentives, as documented by Otsuka and Place (2015) in their study of land tenure and agricultural intensification in Sub-Saharan Africa. Akugre et al. (2022) further demonstrate that in semi-arid Ghana, land tenure security, length of occupancy, and farm size all significantly influence farmers’ decisions to adopt practices such as early maturing varieties, zai farming, agroforestry, and crop rotation. Moreover, earlier work by Ghebru and Lambrecht (2017), also showed that political connections and social standing determined the degree of tenure security and thus, the incentive to apply labor and inputs in Ghana, aligning with the “profits of power” study by Goldstein and Udry, (2008) in agrarian Ghana, which highlights that land rights are less decisive than the ability to defend and maintain them.

The role of rental and sharecropping arrangements, though in expanding access for landless farmers, often generates tenure insecurity because contracts are short and conditional (Antwi-Agyei et al., 2015). Farmers on rented land tend to focus on annual returns rather than multi-year soil improvements, a dynamic consistent with Place and Otsuka’s (2001) observation that short-term or fragile rights discourage tree planting or terracing. In Benin, formal demarcation and titling encouraged agricultural investment, which enhanced changes in practices, reflecting greater confidence in long-term rights (Yemadje et al., 2014). In Mali, farmers invested more in maize and cotton cultivation on purchased plots with documentation than on family-allocated land (Totin et al., 2021). Conversely, in Zambia and Zimbabwe, formalization without sensitivity to customary institutions generated elite capture and reduced women’s tenure security (Zamchiya and Musa, 2023; Zamchiya, 2014). In Ghana, Alhola and Gwaindepi (2024) show that while landholders with formal titles tend to report higher perceptions of security, many farmers under customary allocation feel somewhat secure, provided lineage and community recognition are strong. However, this security is contingent, as migrants, women, and youth frequently encounter precarity, with access mediated by tribute payments, seasonal contracts, or patriarchal norms. Asaaga et al. (2020) show that these differentiated experiences of security explain divergent patterns of adoption across households and communities in Ghana. This aligns with Yaro (2010) and Gyapong (2021), who also describe tenure modalities in Ghana as a field of negotiation, where rights are contingent and constantly renegotiated rather than absolute.

2.2. The theory of access

While property is classically defined as “a right in the sense of an enforceable claim to some use or benefit of something” (MacPherson 1978, cited in Ribot and Peluso, 2003, p. 155), this view restricts analysis to the legal or customary recognition of rights, often neglecting the broader social, political-economic, and cultural relations that determine whether and how individuals actually derive benefits from land. Conversely, Ribot and Peluso (2003, p. 155) offer a more capacious lens by informing that the key difference between access and property lies in the difference between “ability” and “right,” and by this, define access as “the ability to derive benefits from things, (p. 153)”. This reconceptualization is relevant in contexts such as Northern Ghana, where land tenure regimes are dynamic, overlapping, and mediated by a variety of institutional and social mechanisms beyond formal ownership (Amanor, 2008; Yaro, 2010). It enables researchers to ask not only who holds land rights, but more critically, who can benefit from land-based resources and under what constellations of mechanisms, identities, and social positions, such benefits are made possible or denied. Ribot and Peluso’s concept of access draws attention to “bundles of powers” rather than only “bundles of rights,” expanding the analytical scope to include social relations, institutions, and processes that configure access to resources (2003, p. 154). These powers are exercised through what the authors call “mechanisms of access”, thus, the means, processes, and relationships by which actors gain, control, or maintain access to resources (2003, p. 160). The theory further asserts that “people and institutions are positioned differently with resources at various historical

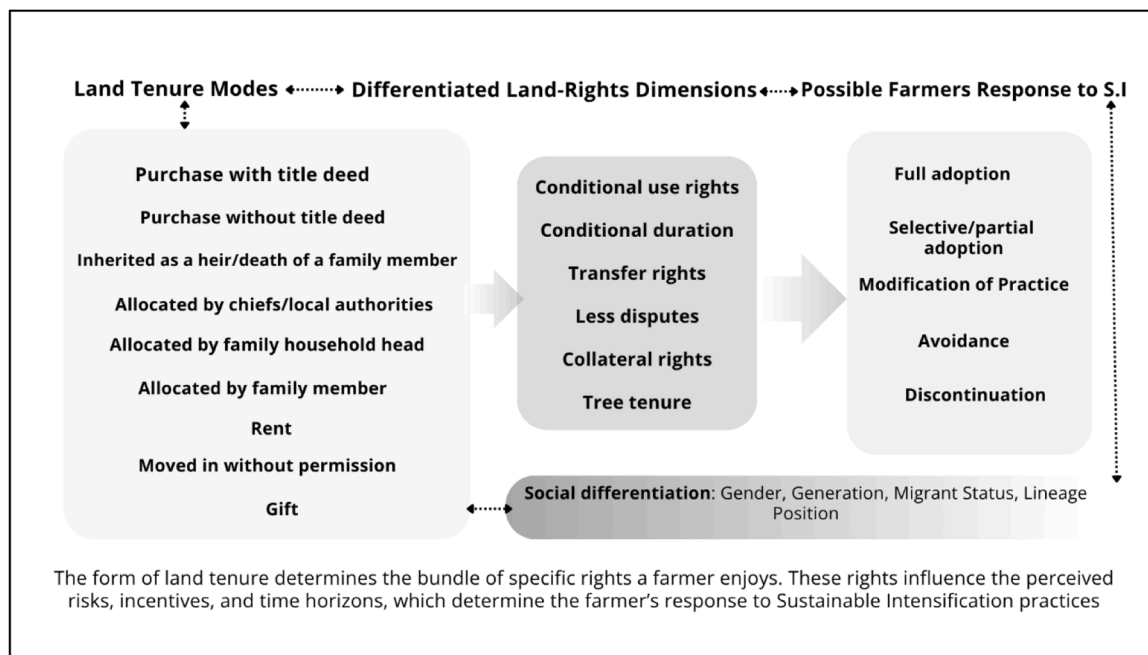


Fig. 1. Conceptual framework. Source: Author's own construct, 2025.

moments and geographical scales,” and that these “strands shift and change over time, changing the nature of power and forms of access” (2003, p. 154).

Furthermore, access is seen as relational and uneven, and its control is embedded in power-laden processes. Ribot and Peluso distinguish between gaining, controlling, and maintaining access, where control is defined as “the ability to mediate others’ access” and maintenance involves “expending resources or powers to keep a particular sort of resource access open” (2003, p. 158). Moreover, the theory foregrounds how access is determined not only by laws or customs but also by structural and relational mechanisms such as access to capital, labor, markets, knowledge, authority, and social identity. This orientation is indispensable when analyzing the differentiated capacity of farmers to adopt SI practices. Equally relevant is Ribot and Peluso’s (2003, p. 170) insight that even “legal, customary, and conventional authorities may also compete or conflict in the sense of having overlapping jurisdictions of authority,” which introduces ambiguity and contestation into land access processes. This amplifies the assertion that laws are often written so that decisions or transfers of powers are to be made by executive decree, thereby creating insecure arrangements or privileges that perpetuate access through coercive, illicit, or extra-legal means, including patronage networks, manipulation of discourses, and strategic identity claims (Ngubane, 2012; Capps, 2016). Also, the presentation of SI as a technical, apolitical endeavor often masks the social differentiation and conflicts it may exacerbate. As the authors argue, “resource access is in this way shaped by the power to produce categories of knowledge” (Ribot and Peluso, 2003, p.169), suggesting that even the framing of SI can serve to entrench existing access asymmetries. In turn, those with privileged access to “authority”, defined as the ability to make or enforce rules, can be seen to manipulate these categories to control land and development resources.

2.3. Conceptual framework: from binary tenure security to differentiated rights ecologies

In northern Ghana, farmers engage SI through differentiated tenure modalities that do not simply vary in “security” but in the specific rights they confer, the conditions attached to use, and the vulnerabilities they generate. The starting point of this study is therefore that tenure is best

approached as differentiated modalities (e.g., inherited/lineage land, allocation by family head, chief/tendana-related grants, rentals/share-cropping, gifts, and purchases with/without documentation) that embed distinct social relations and forms of authority (Amanor, 2008; Yaro, 2010; Anafo et al., 2023; Alhola and Gwaindepi, 2024). Each modality distributes rights unevenly (rights to use, exclude, improve, transfer, pledge, and defend), and these rights are often conditional on identity, status, and compliance with local obligations. SI practices, especially those that are visible and long-horizon, such as agroforestry, soil rehabilitation, and conservation structures, may require not only labor and agronomic knowledge, but an expectation that the farmer can retain the improvement, defend it from contestation, and capture benefits over time (Nara et al., 2020; Nara et al., 2021). The framework (Fig. 1), therefore, locates uneven SI outcomes not in “farmer reluctance,” but in the institutional fact that SI’s investment temporalities may intersect with a tenure landscape where many farmers possess conditional use rights rather than stable and transferable claims (Goldstein and Udry, 2008; Lawry et al., 2014; Place and Otsuka, 2002).

To analyze this intersection, the study draws on the Theory of Access, which distinguishes “rights” from just the ability to benefit from resources and directs attention to the mechanisms through which benefits are enabled, constrained, and mediated by power (Ribot and Peluso, 2003). This perspective is essential in legally plural contexts because formal or customary recognition of rights does not automatically translate into effective control, sustained benefit capture, or protection against dispossession (Nara et al., 2021). Access analysis foregrounds how authority, legitimacy, social identity, and institutional positioning influence farmers’ capacities to use land and to maintain use as conditions change (Ribot and Peluso, 2003; Lund, 2011; Peters, 2013). In this paper, the Theory of Access is operationalized not as a general statement about “power,” but as a structured way to examine how differentiated tenure modalities translate into differentiated rights ecologies that can determine what farmers can do on land without triggering sanctions, renegotiation, or loss. Importantly, these rights ecologies are not static: they are reproduced through lineage authority, chieftaincy, household hierarchies, and local dispute processes, and they are patterned by gender, generation, and migrant status (Tsikata and Yaro, 2014; Michalscheck et al., 2020; Azumah et al., 2023).

Rather than treating tenure as “secure/insecure,” the study traces

how modalities structure (i) transfer and intergenerational pass-on rights, (ii) conditionality of use (including the ease with which land can be withdrawn or renegotiated), (iii) duration and predictability of access (seasonal, multi-year, or open-ended), (iv) collateral potential (whether land can be pledged to mobilize resources, and under what risks), and (v) exposure to dispute (the likelihood that improvements provoke contestation or that claims are vulnerable to competing authority) (Ribot and Peluso, 2003; Berry, 2008, 2009; Amanor, 2008; Ubink, 2018). These dimensions capture how “ability to benefit” is stabilized or undermined across time: transfer rights shape whether farmers invest beyond the season; conditionality and duration shape whether investments are rational under the probability of land withdrawal; collateral potential shapes access to complementary inputs but may also introduce foreclosure risks or elite capture dynamics; dispute exposure shapes whether visible SI investments (trees, bunds, compost pits, permanent structures) are avoided because they can be read as ownership claims. The assertion is that different modalities yield distinct combinations of rights ecologies, creating distinct farmer profiles. In this way, SI may be interpreted as a set of practices whose feasibility may also depend on whether farmers can align ecological investments with the right conditions under which they hold land (Abab et al., 2022; Emerton and Snyder, 2018; Fischer et al., 2021; Goldstein and Udry, 2008).

This conceptualization is operationalized directly in the study design and analysis. First, tenure is approached and discussed as modalities of acquisition/holding (e.g., inheritance/lineage, family-head allocation, rental/sharecropping, chief-related grants, purchase with/without documentation) against the rights dimensions, not as a binary secure tenure variable. Second, the qualitative instruments are structured to elicit farmers’ own evaluations of rights dimensions attached to each modality: through matrix ranking and group discussion, participants compare modalities and articulate how each performs in relation to transferability, duration, conditionality, dispute risk, and collateralizability, and how these features influence their willingness to adopt SI practices. This aligns the framework to the research questions: the first question is answered by mapping how modalities configure differentiated rights dimensions; the second by showing how those configurations could shape engagement with long-term SI practices; and the third by deriving scaling implications from the observed mechanisms (Wigboldus et al., 2016; Jones-Garcia and Krishna, 2021; Otsuka and Place, 2015; Schut et al., 2016, 2024; Ribot and Peluso, 2003).

3. Study area and methodology

3.1. Study area

The study was conducted as part of the CGIAR’s Sustainable Intensification of Mixed Farming Systems (SI-MFS) Initiative led by the International Institute of Tropical Agriculture (IITA) in northern Ghana. Within this framework, Duko, a Dagomba farming community in the Northern Region, serves as one of the project’s key learning sites where researchers collaborate with smallholder farmers to understand how Sustainable Intensification (SI) practices are adopted, adapted, and negotiated in everyday agrarian life. Located just north of Tamale (approximately 9.56° N, 0.83° W), Duko lies within the Guinea Savannah agro-ecological zone, characterised by a unimodal rainfall regime of roughly 1000–1200 mm annually (Michalscheck et al., 2023). Agricultural production is predominantly rainfed, rendering farming households highly dependent on the timing, duration, and distribution of the rainy season. The community practices a mixed crop-livestock farming system: cereals such as maize, millet, and rice are cultivated alongside legumes (cowpea, soybean, groundnut, bambara bean), root and tuber crops (yam, cassava, sweet potato), and, where water access permits, dry-season vegetables including tomato, okra, onion, chili, and leafy greens. Livestock ownership varies across households but commonly includes cattle, goats, sheep, donkeys, and poultry, which

function as assets, buffers against shocks, and sources of manure for soil fertility management (Katic and Ellis, 2018; Padmanabhan, 2007).

According to Michalscheck et al. (2023), Duko consists of approximately 54 large, often polygynous, male-headed households, with Islam being the dominant religion. Agrarian labour roles follow a gendered division of responsibilities: household heads typically cultivate staple crops to secure food for the compound, while women manage vegetable plots and legumes used in soup preparation and trading. Women are widely known as traders who buy, process, and sell produce to cover recurring household expenses such as children’s school fees. Sons, depending on access to land and labour availability, sometimes farm small individual parcels, producing rice or cowpea to accumulate resources for higher education or marriage (Apusigah, 2009; Padmanabhan, 2007). Land relations in Duko are embedded in patrilineal inheritance systems, yet they exhibit considerable variability formed by kinship networks, negotiations with lineage heads, and the socio-institutional norms governing land allocation (Michalscheck et al., 2023). These variations intersect with differences in soil quality, farm size, labour availability, and gendered access rights, producing diverse opportunities and constraints for adopting SI practices. Within the SI-MFS Initiative, Duko also hosts IITA’s experimental site in the Tamale region, therefore functioning as a microcosm for examining how farmers navigate tenure-related uncertainties while attempting to integrate SI practices to enhance their farming systems.

3.2. Methodology

3.2.1. Participatory rural appraisal (PRA)- matrix ranking and focus group discussion

A matrix ranking exercise was employed as the core component of the Participatory Rural Appraisal (PRA) to systematically assess land tenure modalities using criteria identified by farmers. The exercise was designed to elicit participants’ evaluations of different modes of land acquisition in relation to specific land rights dimensions relevant for long-term land-based investment. Two gender-disaggregated focus group discussions (FGDs) were conducted to carry out the ranking exercise: one with 15 men and one with 9 women, making a total of 24 participants. All participants were active farmers formally engaged in ongoing field demonstrations and training activities at the International Institute of Tropical Agriculture (IITA) demonstration site in Duko. The separation of groups was intentional, allowing women and men to articulate tenure experiences and constraints without domination or silencing, and aligning with the framework’s emphasis on socially differentiated access.

The PRA sessions provided an interactive space in which participants could collectively evaluate the various land acquisition modes operating in their community, including inheritance through family death, short-term rental, family member allocation, family head allocation, gift from a non-household member, allocation by local leaders (chiefs), unauthorized land use (encroachment), purchase with title deeds, and purchase without title deeds. Before the ranking began, each group was taken through a 60-minute introductory session, during which we explained and deliberated on each mode with context-specific examples. This orientation was conducted in Dagbani, the dominant local language, with support from a trained facilitator and local translator. Importantly, this session also invited participants to co-develop the ranking framework by suggesting what features of tenure mattered most to them. Their responses were deliberated in the group until consensus was reached on the key priorities to be used as evaluation criteria.

The matrix ranking was executed in three coherent stages, each designed to balance structure with openness to local meaning-making and knowledge co-production. For each group, the activity lasted between 2 and 3 h. In the first stage, while several priority areas initially emerged through these discussions, both groups, following collective deliberation, reached consensus on three key evaluative dimensions: inheritance, collateral use, and dispute risk. Overall tenure security was



Fig. 2. Images from the field by authors, 2025.

added in the third stage to synthesize participants' holistic assessments of land rights across dimensions. In the second stage, participants ranked each land acquisition mode against the three agreed-upon priorities. Each group collectively used a score range of 1–10 to express their collective perception of how well a given mode performed against each criterion, with higher scores reflecting greater satisfaction, security, or reliability. This stage encouraged group deliberation, facilitated and guided through probing to ensure consensus or clarification before assigning scores. Once all scores were assigned, participants moved to the third stage, which involved a broader reflection on how the different criteria combined to influence what they perceived as overall tenure security. At this point, participants were invited to rank what they perceive as the highest form of tenure security as expressed by the form of rights. This stage also enabled participants to articulate how trade-offs and composite judgments influenced their final views on tenure security and rights. Fieldwork was conducted over two months (June–July 2025) with support from a trained facilitator and translator. Visual aids such as charts, stones, and scoring sheets were used to ensure full participation, including by non-literate participants (Fig. 2).

3.2.2. Key informants interviews

To contextualize and triangulate the PRA findings, key informant interviews were conducted with a gender expert and an agricultural extension officer in Duko, and ten additional farmers with diverse tenure experiences. These interviews provided additional insight into how farmers navigate land tenure modes and associated rights, which influence their farming decisions.

3.3. Data analysis

Data analysis followed a three-stage qualitative process. First, matrix scores from each group were synthesized into comparative tables to identify patterns across tenure modalities and gender groups. Second, the rationales underpinning scores and rankings were analyzed using inductive content analysis to identify recurring themes, tensions, and

contradictions in how rights dimensions were interpreted. Third, these findings were interpreted through the lens of the theoretical and conceptual framework to examine how differentiated rights configurations influence land-use decisions and engagement with SI practices. Pseudonyms are used throughout to ensure confidentiality and adherence to ethical protocols.

4. Findings and discussion

4.1. General nature of land tenure modes and rights in Duko

Field interactions and FGDs revealed that landholding in Duko is organized primarily through family and lineage-based control, with household/family heads exercising allocative authority over plots and mediating access for junior males and women; chiefs also allocate land, but such allocations are widely understood to be revocable and contingent. Farmers said there is 'no land sale', especially for subsistence farming purposes, and even for migrants whom the chiefs see as responsible with good character. That land, in this case, is given out 'free' to these farmers. In this case, it was said by the farmers that non-member landholders (especially male migrants and youths) are customarily expected to offer customary tenure 'traditions' which are mostly not transacted in terms of cash payments. That is, either a token gift (in most cases, a portion of the harvest from the land) or labor to landowners during every crop season to renew their utilization and access rights. Respondents reiterated that this "tradition" is also performed unequivocally to acknowledge and honor the authority of the landowner over the settler (i.e., the non-owner). For women, the gender expert revealed a very interesting pathway to land access. The expert explained that:

"When a man gets married, the woman joins the man's household. She is just there to help, and land is not given to her. When you see a woman with access to land, they are usually those who has 2 or more children. Land allocation to these women is sometimes tied to their childbearing, which is linked to their housekeeping responsibilities and the food needs of

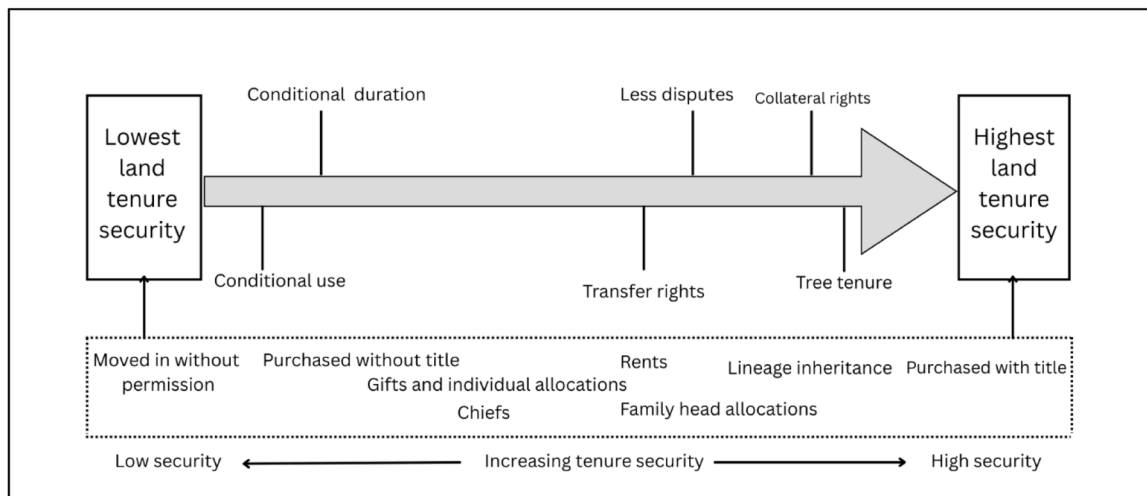


Fig. 3. Continuum of tenure security and use rights by farmers. Source: Author's own construct from fieldwork (June-July 2025, Duko).

the household. If you have not given birth, you are likely not to get a land because you have no or less responsibilities. So, the idea is that once you have more children, your responsibility to now assist the food needs of the household takes effect, and as such, you are given a portion of land to start something. The thing is also that even in these situations, the woman must prioritise the activities on the man's land before hers by supporting activities like planting and harvesting. Besides, they are typically not allowed to plant the 'man's crop' like maize or simply put the typical cash crops but do vegetables and leafy crops to support the household. All or almost every intensive practice is a no go area for a woman. And as such, we need to consider the situated dynamics of men and women in such places as this. I think almost all the acquisition modes favors men because of the cultural dynamics that surround land ownership. Even if you are a woman and you want to purchase a land, see, that woman will need a man to be in the lead for that outright purchase to happen" (Gender expert, 2025)

Typically, the respondents, as already agreed upon during the priority criteria determination, also acknowledged that the customary land tenure modes in this area and use rights are contingent on the perceived

access rights one holds, in relation to a particular mode of access. Across modalities, farmers indicated that conditional use is a pervasive feature of access. Family-head allocations generally confer strong day-to-day use and cultivation rights but limit transferability and collateral use; they are embedded in obligations to the wider family and remain exposed to higher-order customary authority. Restrictions on permanent improvements, especially tree planting, are routinely attached to borrowed or temporarily allocated plots, signaling that such holdings are for use, not for establishing long-term claims. Rentals and gifts similarly permit cultivation but restrict development and transfer and are expected to revert at term or at the owner's discretion. These practical constraints, repeatedly observed in Duko, delineate a gradient from permissioned use to secure, inheritable control, with titled purchase and lineage inheritance sitting nearer the secure end of the continuum (Fig. 3) and untitled purchase, individual-member allocations, gifts, and chief allocations positioned closer to the precarious end.

Moreover, farmers indicated purchase with title concentrates the most complete set: use/occupy, cultivate, develop/improve, transfer (inter vivos and testamentary), and, distinctively, credible collateral potential with formal institutions. Inheritance within the lineage

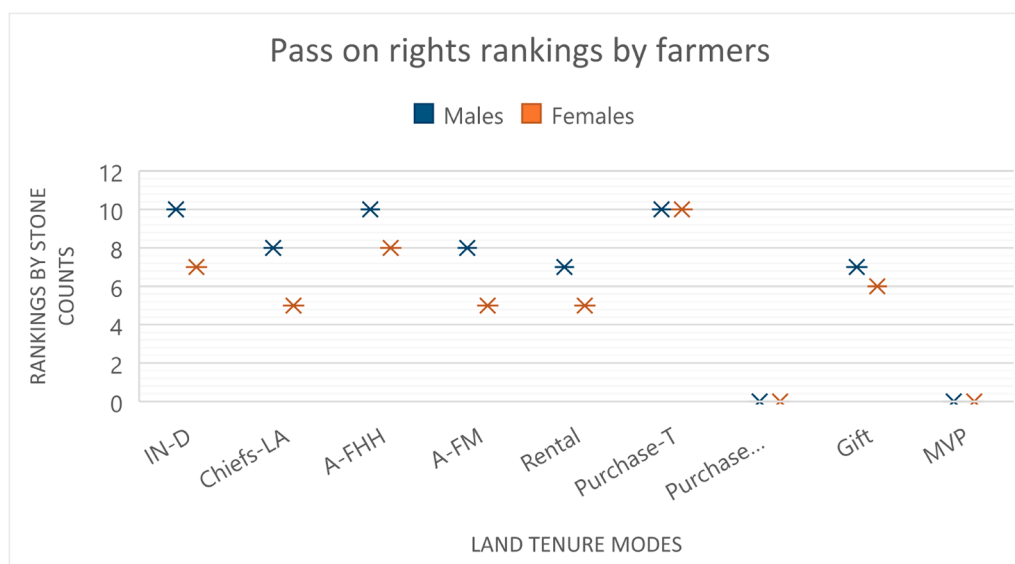


Fig. 4. Pass on rights and tenure modes rankings in the study area. Source: fieldwork, (June-July 2025, Duko), IN-D: inherited as heir/death of a family member, Chiefs-LA: allocated by chiefs/local authorities, A-FHH: allocated by family household head, A-FM: allocated by family member, Purchase-T: purchase with title deed, Purchase-WT: without title deed, MVP- moved in without permission.

similarly confers durable use, cultivation, intergenerational transfer, and improvement rights, but collateralization is socially and institutionally proscribed; the FGDs revealed that claims are strong because they are collectively recognized, not because they are monetizable. Family-head allocations confer robust use/cultivation and often improvement rights, but transfer and collateral rights are curtailed, and improvements may be negotiated. Rentals/leases grant use/cultivation within a defined term, with no independent transfer right and tight limits on improvements.

Purchasing without title is ambiguous: use and cultivation are possible, but transfer and improvement rights are easily challenged, and dispute risks are high. Chief allocations and gifts grant use/cultivation but remain revocable and weak on transfer/improvement; occupation without permission is broadly unrecognized and subject to immediate challenge. This ordered differentiation, evident in the PRA rankings for pass-on rights, collateral, and dispute risk, shows that recognition (social and documentary) is the decisive fulcrum on which the effective bundle of rights turns. In the study area, the social distribution of these rights was also said to vary most clearly by status within the family/lineage and by gender. Men positioned within patrilineal lines tend to hold stronger inheritance and development rights, while women's access is more frequently derivative and negotiated through male relatives, dictating what can be done on the land and with what horizon of certainty.

4.2. Pathways of rights - tenure modalities and their embedded logics

a. Pass-On Rights: Inheritance, Recognition, and Intergenerational Security

In Duko, the right to pass land on to one's descendants does not merely signify legal inheritance. As presented in Fig. 4, pass-on rights vary among tenure modes and between groups. It serves as a window into broader social negotiations of legitimacy, embedded trust, and access, all influenced by the logics of kinship, patriarchy, and tenure security. In line with the material benefit flows of the Theory of Access (Ribot and Peluso, 2003), the ability to benefit from land over time, particularly through intergenerational continuity, is constituted not by singular rights, but by a constellation of institutional, relational, and social mechanisms. Pass-on rights are thus not simply a matter of ownership but of recognition, being seen by others as legitimate to pass on, and ensuring one's successor is too (Akaateba et al., 2018; Akaateba, 2019).

It can be observed from Fig. 4 that women and men both expressed strong preferences for inherited land (men: 10, women: 8), but their narratives diverged in subtle but telling ways. For the women's group, inherited land was positioned as "yours", not just practically, but morally. Collectively agreeing, Madam Aisha affirmed by adding that, "Yes, you can pass it on to him (son) since he is part of the family, besides, as he farms on such land, you will still benefit since you might be older by then, and he can feed you from the harvest, so there won't be any issues at all," attaching the practice to familial duty and shared benefit. The symbolic value of inheritance was underwritten by stability and the absence of contestation. However, their assigned ranking revealed an undercurrent of hesitation: inheritance may be secure, but not immune to future claims, particularly in a context where women's rights to land are often mediated through male relatives (Evans, 2016). This, Madam Fatima, narrates that,

"You see, already we the women by just being a woman alone, are disempowered from the family's inheritance lineage, and it makes it quite a struggle just to say we are giving out a land we have inherited, and for your notice, inherited for we the women is not direct, the man has inherited it, and has given us portions and permission to farm, so we are very careful. As the boy grows and helps us on our farm, we seek permission through the household head, who could be my husband, or his

father, and then we give him a portion. If you don't do this, it can cause problems; you can even lose some marital privileges in the home, because you didn't seek permission before doing things on your own...when it comes to land issues, especially inheritance, we are very careful, because we women don't inherit; the men do"

In comparison, men's voices projected more certainty. From Mr. Mustapha, "What belongs to you also belongs to your children. We are farming lands inherited from our fathers." They gave an inheritance of ten stones, the highest possible score. The rhetorical framing here evokes a patriarchal patriline, where land rights are not just used but inscribed through male succession (Yaro, 2010). But this confidence reveals its own logic: the ability to pass on land is tied to being recognized not only as a user, but as a legitimate link in a patrilineal chain. Here, transfer rights in Duko are not only about having a right but about fitting into a structure that renders one's decisions about land intelligible to others. This intergenerational legitimacy for inherited lands was extended, but with more ambiguity, to land obtained through family heads. While men gave this seven stones, citing that they could "also give the land to their children," women were more cautious. Madam Kukua, an older woman with 4 children, described the situation as;

"You can pass it, but as we told you earlier for the inherited lands, allocations by family heads follow a similar pattern. I need to speak with him (husband, or the father of my husband), that maybe our son is coming of age to farm, and looking at my other responsibilities, for instance, I go to the market to go and sell, so we should give my portion to him to take over. In this way, it will not be like I am rejecting a land I was given when I needed to farm"

Their score (five stones) reflects a conditional recognition, contingent on the authority of the family head remaining intact and not being overturned by new claims. A particularly telling moment occurred when Madam Anita clarified, "A land you had from the family head can still be taken from you when the head is no more." This echoes Berry's (2008) thinking of accumulation without dispossession, where land can be used and even passed on under customary regimes but remains embedded in a web of potential counterclaims and reassignments. Moreover, this ambivalence intensified around land from family members, which men ranked at eight stones, but women gave only two. This seemed interesting, especially for the men's group, which ranked this mode higher than lands allocated by family heads. Mr. Abraham elaborates on their decision,

"For the family head, the reason we gave it seven stones is that you are still living with him and know that you may not be the only one staying with him, and very soon, the younger ones will be of age, and he may decide to take the land back for the young ones. But with a family member you don't live with, and in most cases, they have even migrated out of the town and need their land here to stay active, so he can't easily take it back, unless he is coming back to resettle with his family"

Adding further, Mr. Noah hints that "it was given to me by Joe out of trust, and since my son is also part of the family, and Joe knows him, I can pass it on to him. I only need to inform Joe that my son has completely taken over the land for his farm, and that's enough"

For the men, familial trust ensured passage: "Since my son is also part of the family, I can pass it on to him." For Madam Amina, whose facial expression showed a sign of disappointment, this same kinship bond was unstable: "You have to give it back to him, his son too is also up to that age." Here, gendered tenure insecurities become stark. Women's access is relational and negotiable, often lacking the permanence and moral authority needed to secure a child's future claim (Goldman et al., 2016). The land is simultaneously "family" and not really yours, as it hovers in a zone of semi-possession that makes long-term conservation investment uncertain. Commonly expected, both groups conferred high scores on land acquired through formal purchase with title; ten stones from both. Respondents reiterated that "the land is yours, so you can do anything

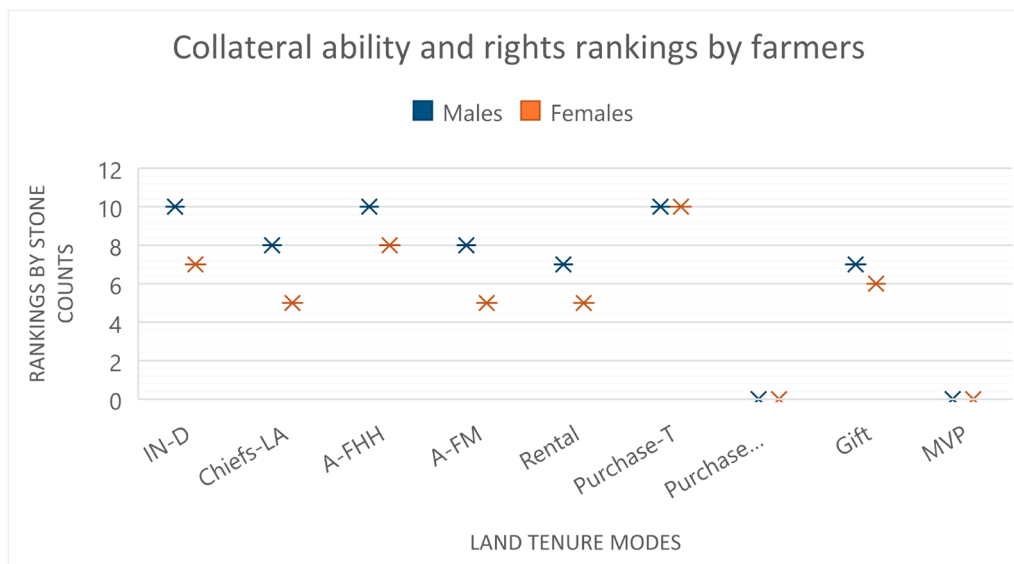


Fig. 5. Collateral Rights and Tenure Modes Ranking. Source: fieldwork, (June–July 2025, Duko), IN-D: inherited as heir/death of a family member, Chiefs-LA: allocated by chiefs/local authorities, A-FHH: allocated by family household head, A-FM: allocated by family member, Purchase-T: purchase with title deed, Purchase-WT: without title deed, MVP- moved in without permission.

with it. (Madam Adjoa)” Men agreed: “You have legal ownership, and it’s fully yours (Mr. Peter).” At first glance, this affirms neoliberal assumptions about title as ultimate tenure security for transfer rights (Haller, 2019; Zuka, 2019). But within the broader conversation, this formal certainty was tempered by local knowledge: titled land, if not recognized by community norms, still faced latent contestation. The value of a title lies not only in its form but in its social traction. As Mr. Henry (Agricultural Extension Officer) puts it,

“I know a man from Accra who came here to buy a land from a particular family, and the sad thing was that, the family did not consult the chief, and went ahead to make the sales, not knowing that the chief has also already sold the land, so just imagine what would happen, even though this man had the title deed, and you see, here too you can’t argue with a chief”

Even with title deeds, there are some levels of contestations, as recounted by Henry. More contestations are for land without title deeds. Both gave it zero stones: “You can’t say you’ve truly bought this kind of land. (Mr. Peter)”. The emphasis was that without documentation or witnesses, the buyer’s ability to pass on land was highly constrained. This reflects Ribot and Peluso’s (2003) distinction between rights-based access and structural access: without recognition from institutions (family, community, state), rights are ineffectual. For rented lands in Duko, “yes, if you hire a land, you can pass it on to your son to farm. But when the rental period is over, he will have to stop and return it. We are giving it eight stones. (Mr. Peter)” Despite its temporary nature, men gave it eight stones and women six, but always with conditions: it could be passed on only if the rental period had not expired. Men elaborated that sons farming rented land were often indistinguishable from the original renter, suggesting that performative continuity could substitute for formal permission: “Even if you give it to someone else, the owner will assume you are still cultivating (Mr. Ben).” This suggests a subtle mechanism of access: opacity as a strategy (Lund, 2011), where social norms allow for continuity in use if transitions remain uncontested and discreet.

With land granted by chiefs, men, perhaps due to closer ties to traditional structures, assigned it ten stones: “He (the chief) can also give it to your son, both of you can benefit. (Mr. Budu.)” Women, in contrast, were cautious: “It doesn’t even happen easily that the chief will give you a land, if you are a woman, without any man being the lead, so how do

you even transfer without obtaining the favors of these men? You will let your son understand that the land is not yours (Madam Amina).” The difference here reveals not just access to land, but access to narratives of entitlement. Chiefs grant land, but not necessarily the inheritance scripts that make that land passable across generations, especially for women or those outside elite lineages (Ubink, 2018). Land gained through gifts or self-appropriation received the lowest scores. For gifted lands, it was understood that before the start of every farming season, you could seek the permission of someone, be it a friend or a particular family, to offer a parcel to you for the upcoming season. If you succeed in getting land, you use it purposefully for farming activities, and most especially for the season. This makes transferability challenging, but with some level of possibility, especially in cases where the person you have had the land from is not staying in the area, but also needs someone to guard the land. In most cases, these types of land are walled, since most of the owners purposefully buy this land for construction purposes. In this light, the pass on rights are situated in land guardianship or benevolence. Madam Amina shares her experience farming on a gifted land;

“The owner is in Kumasi, so where he bought the land is not far from my husband’s farming land, so he came and spoke with my husband that we should help him by protecting it for him, and based on that, we should farm on an acre out of the four acres that he has bought, so my husband offered me that portion to also do some vegetables, and in this case, should I become weak, I just transfer the portion to my son, who also would be introduced to the owner, and for all you know, the owner can just gift it for many seasons, this can happen, you know, someone can even buy a land and for about five to ten years, and they have not come to develop it and the same as my husband, he can get a portion of land to farm by protecting it, so for such plots, we can give to our children to farm”

b. Collateral Use: The Fiction of Formalization and the Reality of Embedded Value

The question of whether land can be used to secure credit or loans surfaces broader anxieties about who an owner is truly, what counts as evidence of that ownership, and how different types of claims are viewed not only by the community but by external institutions. In Ribot and Peluso’s (2003) terms, this is where access mechanisms intersect

with structural and institutional power; the ability to benefit from land becomes not only about holding rights but about having one's rights recognized by others with authority. For the farmers (Fig. 5), both groups recounted how they have lost trust in financial institutions that only claim land as the sole collateral for loans, because in most instances, defaults set in, and it becomes a struggle. They speak of the changing climate, rainfall variability, and lack of control over yield, which, all put together, can make their farming activities quite risky. In as much as their interest and incentive in allowing their lands to be used as collateral for loans has reduced, they still offered their respective perceptions.

The clearest pattern across both focus groups was that purchased land with a formal title remains the only modality widely perceived as usable for collateral. "We are giving it ten stones because you have the papers and you have full control of the land," Madam Amala explained. Mr. Peter echoed this: "Since you are the owner and have the land papers, you can do anything with it." Here, collateralization hinges on documentation, a stark contrast to all other tenure forms, which, while socially accepted, lack the bureaucratic visibility required by banks or financial institutions. This aligns with the findings of Domeher and Abdulai (2011), who argue that titled land increases investment potential primarily because it enables access to credit, though only if the titling process is respected by both local and formal actors. In as much as this mode was ranked as the highest, the farmers didn't hesitate to speak about their disinterest. The possibility of collateralization did not translate into practical willingness. This gap between formal rights and lived use reflects what Ribot and Peluso (2003) characterize as the distinction between rights-based access and structural access: land may be titled, yet entrenched risk, institutional distrust, and the moral geography of family responsibility render such rights unusable. The narration by Madam Ama sheds some light.

"Even if I bought it with papers, I don't want to take it to the bank. These days, the banks are too risky. If you miss one or two payments, they can take everything and keep disturbing you with the police. That land is for my children. I'd rather look for other ways to raise money. Land is not for gambling here; it is a family's last hope for livelihood. And now, farming itself is risky. The rains are not reliable, inputs are expensive, and even when you harvest, the market prices can disappoint you. So what is the point? You go for a loan, they give you a small amount, but your land is worth far more. It doesn't make sense. We are just small farmers, what if the farming fails? Then you lose everything? There was this man who farmed a lot of rice, and birds ate everything, you know he landed in the hospital, because of the huge investments, so assuming he has used a portion of land as collateral, so in that state, he would be losing his harvest, his land, and his health, all at once"

Customary modalities present these realities further. Inherited land, despite being the most valued in terms of pass-on rights, scored two (men) and zero (women) in its perceived collateral value. For the women, even though they do not hold property rights in customary land conversations, it is a no-go area, Madam Amala explained bluntly, "You can't just use such land as collateral because it will be passed to the next generation." For men, the obstacle was both moral and legal: "Your brothers and children will not allow you to. Besides, the chief is the original owner of the land (Mr. Ben)". These narratives reflect what Joshi (2024) studied on 'Land for my children', revealing the gendered moral geographies of land as spaces where claims are relational and collective, rather than individual and commodified. The impossibility of collateralizing inherited land is not merely technical; it reflects the tension between communal stewardship and individual monetization, as also observed by Edwin et al. (2023). The farmer's refusal also reveals not a lack of financial literacy but a deliberate resistance to instrumentalizing land in a manner that threatens household continuity and lineage obligations (Prosnitz, 2024).

Similarly, land obtained through the family head was seen as non-collateralizable. Women scored it zero, noting that "the family head

may not even have the papers of the land, which means you don't have any legal ownership to it, and besides, the chief can even sell it at any time. (Madam Ama)" Men gave it two, still emphasizing the lack of rightful authority: "You are not the original owner of the land (Mr Peter)." This aligns with findings by Ubink (2018), who points out that customary authority often overrides individual claims, even in cases where families have long used specific plots. Without a formal deed, land granted by family heads in the context of Dukou remains embedded in systems of negotiable tenure, making it unsuitable for the fixed expectations of lending institutions. For land obtained from family members, women gave it two stones, justifying that sometimes,

"The family member, if he or she is very close to you and trusts you, will not just abandon you if [creditors] come and you have nothing to pay back, but it may have some challenges (Madam Rashida)."

For the men's group, scoring it one was enough, because such a situation would hardly happen. For them, such a decision comes with several complications, and they would not like to have any issues with a trusted family member, so they will rather protect their trust than use such land for collateral. Mr. Mubarak puts it this way,

"Ah, you can't take that kind of land to the bank. It is not even about the paper; it is about the relationship. If your uncle or elder gave you that land because he trusts you, why would you risk turning around to use it for a loan? What if something goes wrong? You will spoil the family bond. For me, I would rather leave it empty than bring confusion. Some things are bigger than money"

The case of gifted land also followed a similar pattern of perception. Women assigned it no stones, and from Madam Amala, "the person gifted you the land to farm, you do not do that behind, that is not acceptable." Men also rejected its legitimacy for collateral: "If you use it as collateral and the owner hears about it, he will come for it at the time you are using" and in addition, such lands are purposively given for you to farm for a season or two so "one day he will take it back, so you can't use it (Mr. Kay)". As Amanor (2008) reflects, gifts in customary contexts rarely transfer full ownership; they often signal ongoing relationships of reciprocity, which are antithetical to alienable transactions such as collateralization. More negative responses were reserved for land acquired through self-appropriation, plots "seen lying idle" and cultivated without formal or customary approval. Both groups gave these lands zero stones. Madam Amina warned, "If you attempt to use it as collateral, and they do their checks and the owner finds out, they can even beat you." Mr. Peter added, "You will be penalized for even farming on it, let alone using it as collateral."

Rental lands, too, were uniformly rejected as collateral. "You are not the owner of the land," said Peter flatly, collectively assigning it zero stones. This fits with prevailing understandings across sub-Saharan Africa, where short-term leaseholds are rarely seen as stable or bankable assets (Holden and Otsuka, 2014). Even if the lease agreement is respected, the absence of transferability and ownership disqualifies rented land from credit use. As for land granted by chiefs, both groups were skeptical unless accompanied by formal documents. "The only way you can use it is if the chief gives you the land papers," said Mr. Ibrahim, who nonetheless sided with the group's zero stones. This reveals an inherent irony: traditional authorities, though powerful in allocating land, do not confer the kind of authority that financial institutions recognize. In Ribot and Peluso's (2003) terms, this is a failure of both relational and structural access; traditional recognition doesn't unlock broader formal systems of value unless formalized.

It was seen that the same modalities that provide social security (like inheritance or family-granted land) are often invisible or invalid in the eyes of formal institutions. Meanwhile, modes that come with a formal title, though often difficult or expensive to obtain, are singularly legible to banks and credit systems. In navigating financial access, the farmers have developed alternative strategies that reduce reliance on formal credit systems. Instead of risking land, especially titled or family-trusted

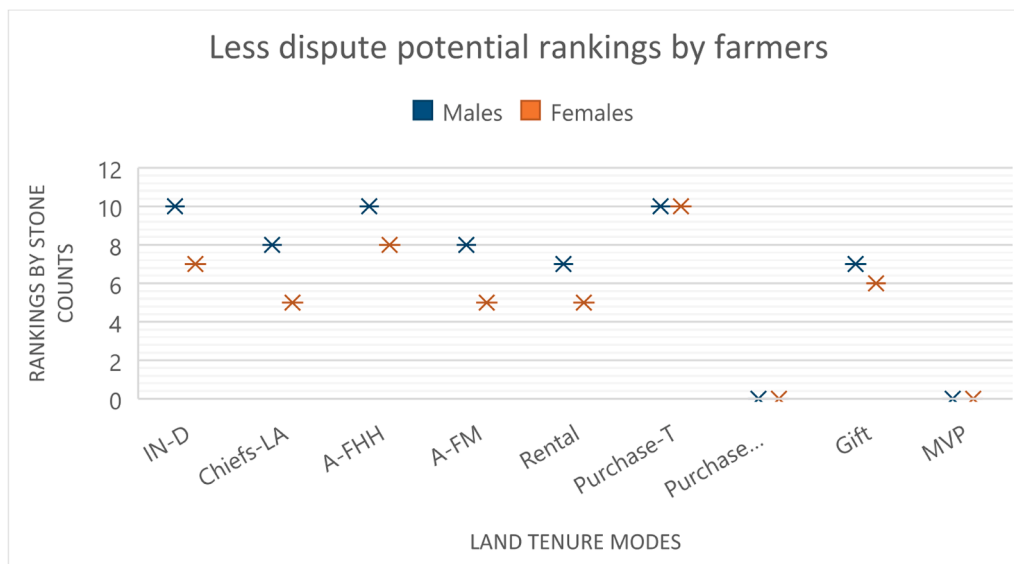


Fig. 6. Less Dispute and Tenure Modes ranking by groups. Source: fieldwork, (June–July 2025, Duko), IN-D: inherited as heir/death of a family member, Chiefs-LA: allocated by chiefs/local authorities, A-FHH: allocated by family household head, A-FM: allocated by family member, Purchase-T: purchase with title deed, Purchase-WT: without title deed, MWP- moved in without permission.

land as collateral, they often turn to informal networks such as relatives, close friends, and cooperative arrangements. This social capital becomes a vital resource in times of need. For essential expenses such as hiring labor or tractor services for land preparation, planting, and harvesting, farmers frequently rely on collective labor-sharing arrangements and rotational work systems within the community. In the light of this, Mr. Nurudeen narrates;

“We don’t always need cash. Sometimes we just join hands. Today we all work on my farm, next week we move to Kwame’s. That way, we all survive without owing anybody or risking our land. If I really need money, I will rather ask my brother or a trusted friend. At least they understand if something delays. But the banks, hm, sometimes they don’t care. You default small, they come for your land or valuable property. And in farming, you can’t always be sure the harvest will go well. So we help each other, we sometimes rotate labor, and we manage ourselves. That is what keeps us going.”

c. Dispute Risk: Contested Claims and the Fragility of Unwitnessed Transactions

From Fig. 6, inherited land was one of the tenure forms with the least dispute risk. For the men, this mode earned a full ten stones: “When you inherit land, it becomes yours, and your children will also inherit it from you. Land that is inherited usually comes with no or few disputes. (Mr. Paul)” Women were slightly more cautious but still affirmed its relative safety, scoring it seven stones: “Since it was the decision of the family and they gave that plot to you, there won’t be much dispute. (Madam Akua).” But even here, women’s narratives carried hesitation: “We are very careful... because we women don’t inherit; the men do.” And as such, they recounted how they sometimes hesitate to farm the “man’s crop” and do their best to offer labor support to their husband’s or family head’s plot before attending to their own, to avoid any form of deprivation. This reveals how social legitimacy, accumulated over generations, fortifies claims, especially when anchored in patrilineal lines (Kansanga et al., 2018, 2019).

Land allocated by the family head similarly scored high in both groups, especially among men, who gave it ten stones: “There are no disputes when the family head gives you land, because he owns the land and you are under his care. (Mr. Seidu)” Women gave it eight stones,

acknowledging some vulnerability: “He would create the awareness of the family, and even after he is no more, no one can argue with you on that land till the time the chief might sell it or unless there is some contention in the family (Madam Anita)” This reveals a telling layer of conditionality; thus, while the family head’s allocation enjoys intra-family legitimacy, it remains potentially exposed to external overrides by customary authorities like chiefs. Thus, the durability of claims is mediated not only by interpersonal trust but also by multi-level land politics, in which recognition is both vertically and horizontally negotiated (Sikor and Lund, 2008; Obeng-Odoom, 2016; Olofsson, 2021). This caveat signals not only internal family dynamics but the broader multi-level tenure authority that renders even stable claims susceptible to external overrides. The gender expert clarified this dynamic of layered authority and legal pluralism: “The constitution has good land rights regulations, but in reality, these local systems have their own regulations... the chief can commodify your family land, and you cannot contest.” This is an illustration of what Sikor and Lund (2008) describe as the “politics of recognition,” where legitimacy emerges not from statutory entitlement alone, but from who has the socially recognized power to define rights at a given moment. Chiefs’ ability to reinterpret land boundaries, authorize surveys, and reallocate parcels, even when buyers hold paperwork, renders dispute risk not an anomaly but a predictable part of agrarian governance (Kansanga et al., 2018).

“In conflict situations, you start at the family level through the family head. If you are not able to solve it, you move it to a community elder or the sub chiefs. If it is still not resolved, you then move to the Chief himself. At that place, whatever be the outcome, you cannot contest. You know, these traditional people have their own way of doing things, and it usually becomes difficult to enforce the government’s land tenure or use laws and regulations. The constitution has good land rights regulations, but in reality, these local systems have their own regulations. They hardly go about land business in accordance with the constitution’s regulations. For instance, the chief can tell your family that he is going to commodify your family’s land and that he is bringing a surveyor. The actual size could be 10 acres, but he can tell you it is 5 acres, and you cannot do or say anything other than to accept it like that. So you can imagine, in situations like this, the women don’t even show up, because they are sidelined, as the 5 acres left has to be shared among the men, well, if some is left, the woman will get it, but I doubt some would be left” (Gender expert, 2025)

For lands acquired through the chiefs, Madam Anita shared her experience: “The chief gave the land to you to farm without any paper, but for all you know, he has sold it to someone with papers upon realizing the land has increased in value. Someone can come and pour sand on your crops. You have no choice but to abandon it.” This is not simply a case of land conflict but an illustration of how improvements under SI can become politically observable acts. For the men, they perceived fewer disputes on such lands, just that “When the chief later wants the land back, you will no longer be happy. He can just come one day and say he needs the land (Mr. Ahmed).” The core issue here is unilateral reallocation: chiefs, while trusted allocators, are also empowered to rescind or override prior claims, especially in pursuit of monetized transactions. This dynamic aligns with Simião and Silva's (2020) and Capps (2016) insight that customary authorities often draw their power from ambiguity, using their discretion to mediate and reassign land based on shifting interests. Similarly, gifted land was viewed as a bit stable as far as disputes are concerned. From Madam Joyce, “If the person who gifts you the land needs it, he will pre-inform you,” suggesting a degree of relational courtesy but no binding obligation. More fragile are claims to land obtained from individual family members, outside of formal inheritance or family head allocation. Disputes surfaced sometimes. Madam Amala explained, “If you have a misunderstanding with the person, he might tell you he wants his land or when he sees you are getting a good yield, he may say he also wants the land.” With this, “Another family member, can be the son, especially if the father who gave you the land passes on, may also come to claim it, which can lead to misunderstandings (Mr. Noah).” These examples illuminate how access granted through interpersonal trust, unmediated by wider family consensus, can be quickly revoked when relations sour or perceived benefits shift.

Rental lands, while seemingly transactional, also carried nuanced forms of dispute risk. Madam Bernice narrated that “Before you start farming on it, you will pay (in the form of a tradition; offer of cola) the person, but if the person realizes you are benefiting more, he can ask you not to farm on it the following season. It sounds surprising, but it can happen. The most common reason being that someone might have offered some huge sums of money for the land since the observed value of the land was seen to have increased.” The logic here is that fairness and mutuality must be continuously renegotiated. The men were slightly more optimistic, Mr. Paul, on behalf of the group, said, “There aren't many disputes. If the period expires, the owner will take it back.” These accounts suggest that rental agreements offer clarity of terms but lack emotional insulation. As soon as perceived fairness shifts, especially when tenants are seen to profit disproportionately, the tenure can become contested. This reflects the argument by Chimhowu and Woodhouse (2006) and Chimhowu (2019) that commodified land access, while seemingly neutral, often reintroduces power asymmetries, especially where legal protections for tenants are weak or absent.

Purchased land with a formal title was widely viewed as the least disputable, earning ten stones from both groups. “There won't be any disputes at all because you have the papers,” Joyce noted. However, this clarity was starkly absent for purchased land without a title, which drew no stones. “You don't have the papers, and that's when the fight begins,” Peter admitted. This divergence reveals that purchasing land alone is not sufficient; rather, its power lies in whether that purchase is recognized and documented within the broader tenure system. Another precarious claim was on land appropriated without permission. Both groups gave this zero stone. Safiya said, “You can't just start farming on it. If you do that, it will lead to a serious dispute. You may think the land is there and has no owner, but eyes are all over it.” Noah highlighted: “It wouldn't even cross your mind just to start farming on such lands; you can be hurt easily by doing that if the community finds out.” Such statements reflect Amanor's (2010) argument that “unclaimed land” does not exist; it is always embedded within moral geographies that discipline unauthorized use. These statements reinforce the idea that informal occupation lacks both legitimacy and protection, making such land the most

dispute-prone of all. The community acts as a gatekeeper in these instances, quickly exposing and disciplining unauthorized claims.

Disputes also arose, especially where there were perceived claims through SI engagement, particularly tree planting. The gender expert iterated by saying that “There is no intention for you to invest in the land... what happens if the owners come for the land? It's a waste of time, labour, and resources.” Her example of the dawadawa and shea trees reveals why agroforestry for some groups becomes fraught. She informed that trees have custodians, histories, and institutions that supersede the planter's intentions, revealing that a tree on a farm plot may carry traditional rights that may supersede the cultivar's rights. This suggests that innovations must align more with local institutions rather than destabilize them (Wigboldus et al., 2016), since dispute risk in such contexts influences where farmers will, or will never, commit to long-term ecological improvement.

“Agroforestry, hm, you see, we have to be real. There should be a realistic balance between incentives and farmer realities. Would farmers actually plant trees to occupy a space where a food crop could be planted, looking at how precarious your household's food insecurity needs are? Already, by planting the tree, you are seen to be claiming ownership of the land. For example, if I plant a dawadawa tree, does it go under the custody of the dawadawa chief or is it for me? Certainly, for the dawadawa chief, so why do I have to worry about nurturing a tree? The conditions are not that favourable at all. We need to rethink our approach to scaling some of these intensification practices. You cannot even go and harvest from the tree. He decides who should harvest from the tree and where. If he doesn't permit you, you have to wait for him to come and harvest. If you are allocated a farmland by an indigene, the fact that the trees are on the land doesn't mean you can harvest from it. The family head, whom the Chief recognizes as the deed to that portion of land, with which his family's ancestors have connections with, will decide if you can harvest from the tree or not, even though he and his household are not farming on that land. He might be benevolent enough to tell you that you can harvest, but if he doesn't give you that permission, you have to leave it till his wives come to harvest it. There is also the shea tree. With this, the family doesn't joke with it at all, because it has high economic value. So imagine investing much time to nurture these trees, and you cannot even harvest from them” (Gender expert, 2025)

5. Implications for responsible scaling of SI: designing tenure-sensitive pathways

Reflecting on the highlighted situatedness, the narratives in Duko show that ecological practices are not merely adopted or resisted in isolation from the social fields through which land is accessed, defended, and transmitted. SI interacts with tenure, family, and authority in ways that may exceed its technical design. Scaling SI without holistically attending to these interactions risks reinforcing existing exclusions, exacerbating tenure conflicts, and placing the burden of ecological transformation on those whose rights remain the most fragile. The results reveal that the three mechanisms (pass-on rights, collateral capacity, and dispute exposure) fundamentally mediate farmers' capacity to engage in the long-term horizon of SI. These mechanisms operate simultaneously, (re)producing differentiated possibilities for adoption even within the same community. This aligns with Ribot and Peluso's (2003) central assertion that access is constituted not by rights alone but by the relational and structural conditions that constitute the ability to benefit from resources. SI's ecological promises (Pretty, 2018; Xie et al., 2019) presuppose access mechanisms that many farmers, particularly women, younger farmers, migrants, renters, and those farming on socially negotiated land, do not possess.

First, SI strategies must be tenure-sensitive, aligning specific practices with tenure forms that can sustain their temporal demands. Tree-based SI, for instance, is viable only on land where long-term claims are widely recognized and protected. As both farmers and the gender

Table 1

Access-sensitive guiding questions for researchers and scaling initiatives.

1. Who are the actors and institutions (family heads, chiefs, lineage groups, financial actors, women, youth, migrants) and what land access and rights mechanisms (pass-on rights, dispute authority, documentation, permission) do they control that shape how SI unfolds at micro, meso, and macro levels?
2. What power relations structure these differentiated rights ecologies, and how do actors express, negotiate, or contest authority over land through recognition, revocation, dispute, or endorsement of SI practices?
3. What forms of vulnerability or exclusion emerge from these power relations, such as gendered dispossession, revocable access, inability to transfer land, or exposure to dispute, and how do these shape farmers' possibilities for long-term ecological investment?
4. How do SI practices risk amplifying inequalities, for example, by increasing land value, signaling ownership, or altering landscapes, and in what ways might they expose vulnerable farmers to new forms of contestation or dispossession?
6. How might researchers and practitioners inadvertently reproduce these inequalities through assumptions about tenure security, collateral, or household decision-making, and what positional responsibilities do we hold to mitigate harm and redistribute recognition, support, and safeguards?

Source: Author's formulation, 2025

expert explained, planting a tree is read locally as an assertion of ownership, an act that can trigger conflict, loss of access, or punitive responses. The politics of tree planting under customary regimes, including the custodianship of dawadawa and shea trees, make it clear that certain agroforestry interventions may inadvertently threaten rather than support tenure security (Amanor, 2008; Antwi-Agyei et al., 2015; Lawry et al., 2014; Otsuka and Place, 2015). Responsible scaling, therefore, requires differentiating SI practices: some may be appropriate for inherited or titled land; others must be reimagined for short-term or relational forms of access.

Second, scaling must acknowledge farmers' deliberate refusal of financialization. Collateral-based models that rely on titling or credit provisioning overlook the moral geographies and risk environments that shape farmers' caution. Their rejection of collateralization is not evidence of resistance to innovation but a recognition that financial instruments may jeopardize intergenerational continuity, the very logic underpinning long-term land care. This challenges policy narratives that equate formalization with investment potential (Lawry et al., 2014; Lawry et al., 2017) and calls for supporting the informal, reciprocal, and socially embedded mechanisms, such as shared labour, kin support, and cooperative work, that farmers already use to mitigate risk. Initiatives should strengthen these existing local infrastructures rather than replace them with debt-based pathways.

Third, scaling efforts must engage seriously with gendered and generational inequalities. Women's and youth's constrained ability to plant, improve, or pass on land is not an incidental hurdle but a fundamental structuring condition. SI interventions premised on individual property rights inadvertently privilege those who already sit closest to lineage authority. If women's access is conditional, revocable, or tied to childbearing, and if youth must wait for land or rely on rentals governed by restrictions on improvements, SI practices will reproduce rather than alleviate these inequalities. A responsible scaling approach must therefore work with the institutions that constitute recognition: family heads, chiefs, and elders, rather than bypass them. This may involve negotiated agreements, community protocols for tree planting, or multi-year rental arrangements that protect both landowners and tenants. The promotion of women's collective land rights and cooperative farming should also be considered to enable collective land rights to enhance long-term land investments.

The question is not whether SI "works," but whether its material and symbolic demands fit within existing regimes of authority, recognition, and dispute resolution in pluralized land tenure systems. As seen in cases where chiefs override family allocations or reinterpret boundaries, formal documentation alone cannot guarantee stability in certain situations. Scaling SI thus requires a relational approach that considers how innovations may shift the social meanings of land, reconfigure power within families, or heighten the visibility of claims in ways that invite conflict. This also means that responsible scaling is not simply a question of broadening reach but of enhancing contextual fit. To support more context-responsive SI efforts, we offer the following questions (Table 1) to guide researchers and scaling initiatives. Grounded in the differentiated land rights dimensions revealed in this study, these questions will

help make visible the assumptions, blind spots, and potential unintended consequences that inform farmers' ability to invest in long-term practices.

6. Conclusion

This study examined how different land tenure modalities in Duko characterize farmers' ability to engage in Sustainable Intensification, focusing on the three dimensions of land rights: pass-on rights, collateral potential, and dispute exposure. By combining matrix ranking exercises, focus group discussions, and expert insights, the study showed that tenure security is not uniform but differentiated across inheritance, family allocations, chief-granted plots, rentals, gifts, and purchased land. These tenure forms carry distinct social expectations, vulnerabilities, and recognition, which influence farmers' evaluation of long-term ecological investments. The findings revealed that pass-on rights are common in family allocated plots, yet these rights are unevenly distributed and gendered. Collateral use was almost universally rejected, not only because most tenure modes lack formal documentation, but because farmers see land as a collective asset too risky to stake in unpredictable farming conditions. Dispute exposure emerged as a persistent concern, especially for women, youth, migrants, and those farming on relational or temporary land, making practices such as tree planting or soil improvement politically and socially risky. Overall, the study shows that farmers' decisions around SI are also equally shaped by their perceptions of the practices themselves and the social environments that determine whether they can secure the future benefits of their labour.

CRedit authorship contribution statement

Bekele Hundie Kotu: Writing – review & editing, Supervision, Methodology, Formal analysis, Data curation, Conceptualization. **Mirja Michalscheck:** Writing – review & editing, Validation, Supervision, Conceptualization. **Martina Padmanabhan:** Writing – review & editing, Supervision, Conceptualization. **Birhanu Zemadim Birhanu:** Writing – review & editing, Supervision, Methodology, Data curation, Conceptualization. **Prince Asiedu:** Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Formal analysis, Data curation, Conceptualization. **Osei-Amponsah Charity:** Writing – review & editing, Supervision, Conceptualization.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data availability

Data will be made available on request.

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