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Colliding Ecologies and Forced Adaptation: Tenure Insecurity and Farmer Livelihoods in Ghana's Artisanal and Small-Scale Mining Zones

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Abstract

Expanding extractive frontiers are reshaping rural livelihoods in uneven ways across the Global South. Households under similar environmental pressures often follow quite different paths, but research tends to treat their responses as voluntary adaptations, without sufficient attention to the ways unequal land relations shape adaptive capacity. Using a convergent mixed-method approach involving a survey of 285 farming households, 20 semi-structured interviews, and five focus group discussions across five artisanal and small-scale mining (ASM)-affected communities in Ghana's Western Region, this paper explores how tenure insecurity mediates the livelihood outcomes of ASM expansion. ASM-related pressures such as loss of farmland, declining soil fertility, and water pollution were widely shared, but access to compensation and decision-making authority was highly uneven. Owner-cultivators were much more likely to receive compensation (76.5%) than tenant farmers (22.2%) and sharecroppers (18.8%) ($\chi^2(3) = 73.59$, $p < .001$). Tenure-insecure households also reported significantly higher rates of mining participation, seasonal migration, casual wage labor, and farm-size reduction, alongside sharper declines in food security, agricultural output, and livelihood security. We conceptualize these patterns as forced adaptation: livelihood adjustments that occur under conditions of constrained choice, where households have limited control over the productive resources they depend on. Rather than reflecting adaptation through expanding opportunities, these responses often stabilized consumption in the short term while coinciding with longer-term declines in agricultural production and asset accumulation. The paper contributes to agrarian change and resource governance debates beyond Ghana by demonstrating how tenure insecurity shapes vulnerability and adaptive capacity across extractive zones and calls for interventions that address unequal access to land, authority, and compensation, rather than environmental impacts alone.

Keywords: Tenure insecurity, Artisanal and small-scale mining, Forced adaptation, Colliding ecologies, Access theory, Ghana

1.0 Introduction

Across the Global South, expanding resource frontiers are reshaping agrarian landscapes, with mining, commercial agriculture, and infrastructure development increasingly competing for land, water, and labor with existing rural livelihood systems (Hall et al., 2011). Artisanal and small-scale mining (ASM)—a labor-intensive and mostly informal form of extraction—has grown rapidly in recent times in response to increasing mineral prices, continuous rural poverty, and scarce alternative livelihood opportunities (Hilson, 2016; Besada & Gatune, 2020). In Ghana, where ASM is an essential component of the mining sector, farmland is increasingly converted to mining sites, water sources are degraded, and labor shifts from agriculture toward mining activities that offer more immediate financial returns (Snapir et al., 2017). The literature on ASM has extensively documented these impacts but provides less systematic insight into why households exposed to similar extractive pressures often have markedly different capacities to respond (Baffour-Kyei et al., 2021; Adrany et

al., 2024). In parallel, scholarship on land tenure demonstrates that access to resources is shaped not only by formal rights but also by institutional recognition, authority, and bargaining power (Ribot & Peluso, 2003; Sikor & Lund, 2009). Yet these insights have rarely been explicitly connected to differentiated livelihood outcomes in extractive frontiers. Meanwhile, adaptation scholarship increasingly recognizes that household responses to environmental and economic change are shaped by power, inequality, and social vulnerability (Adger, 2006; Eriksen et al., 2015), but these insights have been less systematically connected to tenure-specific differences in livelihood responses within ASM frontiers. We address this gap by extending Kirsch's (2014) concept of *colliding ecologies*, developed to describe the conflict between a mining company's waste-disposal regime and a downstream community's subsistence ecology in Papua New Guinea, to theorize ASM frontiers as arenas of encounter between two socio-ecological systems with incompatible material logics of resource use. We further develop the concept of *forced adaptation* to describe livelihood adjustments made under conditions of structurally constrained choice, where households respond to disruption but have limited control over the resources on which they depend. From this viewpoint, adaptation may not be a sign of resilience or expanded livelihood opportunity; it may instead reflect responses compelled by deteriorating access to land, compensation, decision-making authority, and viable livelihood options. This paper examines how tenure insecurity mediates the relationship between ASM expansion and household livelihood outcomes in Ghana's Tarkwa-Nsuaem Municipality.

2.0 Material and Methods

The study employed a convergent mixed-methods design combining a household survey, semi-structured interviews, and focus group discussions (FGDs). Primary data were collected between June and August 2025, with follow-up fieldwork conducted between June and August 2026, in five mining-affected communities (Nsuaem, Simpa, Dompem, Benso, and Nsuta) in the Tarkwa-Nsuaem Municipality of Ghana's Western Region. This study area was selected because of the longstanding coexistence of mining and agriculture and the resulting competition for land, labour, and water resources (Tarkwa-Nsuaem Municipal Assembly, 2015). The target farming population was estimated from district-level statistics at approximately 69,019. Using Yamane's (1967) formula at a 5% margin of error yielded a target sample of 397 households. Following eligibility screening and the exclusion of incomplete questionnaires, 285 farming households constituted the final analytical sample. Respondents were classified into four tenure categories namely owner-cultivators, tenant farmers, sharecroppers, and family land users, drawing on access theory and scholarship on authority-centred approaches to property (Ribot & Peluso, 2003; Sikor & Lund, 2009). The household survey was complemented by 20 semi-structured interviews with farmers occupying different tenure positions, traditional authorities, and ASM operators. Five FGDs, each comprising 8-10 participants, were conducted, one in each study community. Quantitative data were analyzed using descriptive statistics and contingency-table analysis. Pearson's chi-square tests of independence and Cramér's V were used to assess statistical associations between tenure status and compensation access, livelihood responses, and livelihood outcomes. Interview and FGD data were analyzed thematically following Braun and Clarke (2006), with coding tracking whether livelihood transitions occurred before or after land loss or exclusion from compensation, to assess whether responses reflected forced or opportunity-driven adaptation.

3.0 Results and Discussion

Tenure Status and Unequal Access to Compensation

Tenant farmers constituted the largest tenure category (44.3%), followed by owner-cultivators (29.7%), sharecroppers (16.8%), and family land users (9.2%), indicating the prevalence of secondary or derivative land claims within the study population. Environmental pressures associated with ASM expansion were widespread: 81.6% of households reported farmland loss, 72.4% reported declining soil fertility, and 68.1% reported water pollution. Despite this broadly shared exposure, access to compensation following land acquisition for mining differed sharply by tenure status (Table 1). Owner-cultivators were considerably more likely to receive compensation than tenant farmers or

sharecroppers ($\chi^2(3) = 73.59$, $p < .001$, Cramér's $V = 0.51$), corroborating access theory's proposition that the ability to benefit from resources depends on institutional recognition rather than occupancy or need alone (Ribot & Peluso, 2003; Sikor & Lund, 2009).

Table 1: Compensation outcomes following ASM expansion, by tenure status (N = 285)

Compensation outcome	Owner-cultivators	Tenant farmers	Sharecroppers	Family land users	Total
Received compensation	65 (76.5)	28 (22.2)	9 (18.8)	9 (34.6)	111
Did not receive compensation	20 (23.5)	98 (77.8)	39 (81.2)	17 (65.4)	174
Total, n	85	126	48	26	285

Note. Values are n (%), except totals. Percentages are computed within tenure categories. $\chi^2(3) = 73.59$, $p < .001$, Cramér's $V = 0.51$. (Source: Field survey, 2026).

Livelihood Responses and Forced Adaptation

Livelihood adjustment was widespread but tenure-differentiated. Reduced farm size was the most common response (65.4%), followed by participation in ASM (56.2%), casual wage labour (47.6%), and seasonal migration (37.3%). Tenant farmers (69%) and sharecroppers (64%) were significantly more likely to participate in ASM than owner-cultivators (38%) ($\chi^2 = 23.77$, $p < .001$, Cramér's $V = 0.29$) and to migrate seasonally. Critically, qualitative evidence from sixteen out of twenty interviews indicated that entry into mining, migration, or casual labour followed — rather than preceded — land loss or exclusion from compensation. This temporal ordering distinguishes forced adaptation from opportunity-driven adaptation i.e. households did not diversify because new options had opened, but because prior livelihood options had already closed.

Diverging Livelihood Outcomes

Livelihood adjustment helped many households stabilize consumption in the short term, but this did not translate into improved livelihood outcome in the long term. Declines in food security, agricultural output, and livelihood security were significantly more pronounced among tenant farmers and sharecroppers than among owner-cultivators (Table 2), with moderate effect sizes across all three indicators. These findings resonate with critical vulnerability scholarship, which cautions against equating successful livelihood adjustment with improved well-being (Watts & Bohle, 1993; Eriksen et al., 2015; Ribot, 2014). In these contexts, adaptation may alleviate immediate livelihood pressures while leaving underlying structural drivers like unequal access to land and compensation intact.

Table 2: Declining livelihood outcomes by tenure status (%)

Livelihood outcome (%)	Owner-cultivators	Tenant farmers	Sharecroppers	Family land users
Declining food security	49.0	79.0	75.0	65.0
Declining agricultural output	55.0	84.0	79.0	68.0
Declining livelihood security	51.0	82.0	77.0	69.0

Note. Values are percentages of households within each tenure category reporting a decline. Food security: $\chi^2 = 22.27$, $p < .001$, $V = 0.28$; agricultural output: $\chi^2 = 22.71$, $p < .001$, $V = 0.28$; livelihood security: $\chi^2 = 24.90$, $p < .001$, Cramér's $V = 0.30$. (Source: Field survey, 2026).

4.0 Conclusions and Outlook

This paper demonstrates that vulnerability and adaptive capacity within Ghana's ASM extractive zones are structured by unequal tenure relations rather than environmental exposure alone. Owner-cultivators were consistently better positioned to secure compensation and defend their livelihoods,

while tenant farmers and sharecroppers faced greater land loss, exclusion from compensation processes, and steeper declines in food security and livelihood security. The concept of forced adaptation captures a condition increasingly relevant across extractive frontiers: livelihood adjustment that occurs not because opportunities have expanded, but because prior options have been foreclosed by unequal access to land, authority, and compensation. The paper calls for compensation frameworks and land-use governance reforms that extend recognition beyond landowners to tenant farmers, sharecroppers, and other resource-dependent groups, and for more participatory decision-making processes in mining-affected communities. Future research should test whether forced adaptation travels to other extractive frontiers and tenure regimes across the Global South.

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