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The role of mobile pastoralism in sustaining household food security in arid lands

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Abstract
Mobile pastoralism remains a critical livelihood strategy for communities residing in arid and semi-arid lands (ASALs), where environmental unpredictability, limited arable land, and recurrent droughts render sedentary agriculture unsustainable. This study explores the role of mobile pastoralism in sustaining household food security among pastoralist communities in arid regions, with a focus on mobility as an adaptive mechanism to climate variability and resource scarcity. Drawing on both qualitative and quantitative data collected from pastoral households in Northern Kenya, the study analyzes the extent to which seasonal livestock movement contributes to food access, income stability, and dietary diversity.
Findings indicate that mobile pastoralism enhances food security by enabling efficient use of dispersed grazing resources, maintaining herd productivity, and facilitating market access for livestock and livestock products. Households practicing seasonal migration reported higher livestock survival rates during droughts, greater milk availability, and more stable income streams compared to their sedentary counterparts. However, challenges such as land fragmentation, insecurity, and restrictive policies increasingly constrain mobility, undermining pastoral resilience and food security outcomes.
The study concludes that supporting mobile pastoralism through policy recognition, secure grazing corridors, and conflict mitigation can strengthen household food security and livelihoods in ASALs. It recommends integrating traditional mobility patterns into regional development planning and ensuring that food security interventions align with pastoralist systems and values.

Keywords: Mobile pastoralism, food security, arid lands, livelihood resilience, climate adaptation, pastoral communities, livestock mobility, dryland development

Introduction

1. Background

Arid and semi-arid lands (ASALs) constitute over 40% of the global land area and are home to approximately two billion people, many of whom depend on livestock-based livelihoods (FAO, 2018) [3]. These ecosystems are characterized by low and erratic rainfall, frequent droughts, limited natural resources, and fragile soils, rendering conventional agriculture highly risky. In such contexts, mobile pastoralism—the seasonal movement of livestock in search of water and pasture—has emerged as a time-tested and resilient livelihood strategy that allows households to adapt to ecological variability and maintain food security.
In regions such as the Sahel, the Horn of Africa, and parts of Central Asia, pastoralism supports millions of households by providing direct access to food through livestock products such as milk, meat, and blood, as well as income through the sale of live animals and animal by-products. This livelihood system not only contributes to dietary diversity but also enables the efficient use of rangeland resources that are otherwise too marginal for sedentary farming. Despite its importance, pastoralism—particularly its mobile forms—has been increasingly marginalized in policy, development planning, and research discourse (Scoones, 2021) [8].

2. Defining Mobile Pastoralism

Mobile pastoralism, often referred to as transhumance or nomadic pastoralism, involves the deliberate and cyclical movement of herders and their livestock to access spatially and temporally variable grazing resources. Unlike sedentary livestock production systems, mobile pastoralism is not random but follows established seasonal patterns, often governed by indigenous knowledge systems, customary rights, and social networks. The mobility aspect is a central adaptive strategy that reduces pressure on localized grazing lands, enhances herd survival during climatic shocks, and fosters ecological sustainability through rotational grazing (Catley *et al*., 2013) [1].

3. Food Security in ASALs

Food security, as defined by the Food and Agriculture Organization (FAO), exists when all people at all times have physical, social, and economic access to sufficient, safe, and nutritious food to meet their dietary needs. In ASALs, food security is often threatened by a confluence of factors, including climate variability, market volatility, land degradation, and conflict. For pastoral households, food security is intrinsically linked to livestock health, herd mobility, and access to grazing corridors and water points (Swift, 2004) [5]. Livestock not only provide food but serve as a store of wealth, a form of insurance, and a cultural asset, particularly among pastoral communities in Kenya, Ethiopia, Niger, and Mali.
However, increasing demographic pressure, infrastructural expansion, state-driven sedentarization, and environmental degradation have contributed to the erosion of traditional mobility patterns, forcing many pastoralists into marginal, non-viable livelihoods. As a result, food insecurity in these areas is often misunderstood and misdiagnosed, with interventions focusing narrowly on crop production or food aid rather than addressing the structural support required for sustaining mobile pastoralism.

4. The Role of Mobility in Food Security

Numerous studies have shown that mobility is not simply a way of life for pastoralists but a rational ecological strategy. It allows herders to track spatial and temporal changes in pasture and water availability, minimize the risk of overgrazing, and mitigate the impact of droughts. Through strategic migration, pastoralists can enhance livestock productivity, increase milk yields, and ensure a more stable food supply (Krätli & Schareika, 2010) [2].

Mobile herders typically report higher livestock survival rates during periods of climatic stress and greater resilience to food shortages compared to their sedentary counterparts (Fratkin, 2004) [4]. Moreover, by maintaining herd diversity and spreading risk across ecological zones, mobility facilitates adaptive management of resources and supports the nutritional needs of pastoral households.

Yet despite this evidence, development interventions and national policies often treat mobility as backward or inefficient, advocating for sedentarization, ranching, or "modernized" alternatives that undermine traditional systems. This has led to the fragmentation of grazing routes, land tenure insecurity, and a decline in livestock productivity, all of which compromise food security.

5. Regional Focus: Marsabit and Comparable ASALs

Marsabit County in northern Kenya exemplifies the challenges and opportunities associated with mobile pastoralism in ASALs. The county is predominantly arid, with over 90% of the population engaged in pastoralism. Livestock is the main source of food and income, and traditional migratory routes span national borders into Ethiopia. However, increasing frequency of droughts, conflict over pasture and water, and development pressures have reduced herd mobility, increasing household vulnerability to food insecurity.

Despite its marginalization, mobile pastoralism remains a vital livelihood system that needs to be recognized and supported through informed policy and targeted interventions. Understanding the connection between mobility and food security is essential for designing sustainable solutions in ASALs.

6. Research Problem

While numerous studies have explored food security and pastoralism separately, there remains a significant gap in understanding how mobility specifically contributes to food security outcomes in ASALs. Existing literature often overlooks the nuanced relationships between seasonal movement patterns, herd productivity, dietary access, and resilience. Furthermore, few empirical studies have explored the constraints that hinder mobility and their direct impact on household food security.

7. Research Objectives

This study aims to fill this gap by examining the role of mobile pastoralism in sustaining household food security in arid lands. The specific objectives are to:

1. Analyze the relationship between seasonal mobility patterns and food availability in pastoral households.
2. Examine the contribution of livestock products (milk, meat, blood) to dietary diversity.
3. Identify challenges that restrict pastoral mobility and assess their impact on household food security.
4. Provide policy recommendations to strengthen food security through support for mobile pastoralism.

8. Significance of the Study

This study contributes to the growing discourse on sustainable pastoralism and food systems resilience in the face of climate change. By focusing on mobility as a form of adaptation rather than a relic of the past, the research aims to shift the policy narrative toward more inclusive and contextually appropriate development strategies. The findings will be valuable for policymakers, development practitioners, and scholars working on food security, pastoralism, and dryland governance.

Methods

1. Study Area

The research was conducted in Marsabit County, an arid region in northern Kenya known for its large pastoral population. The county experiences low and erratic rainfall (250–500 mm/year) and frequent droughts. Livestock production is the dominant livelihood, with communities practicing seasonal migration in search of pasture and water. Marsabit is home to diverse ethnic groups, including the Rendille, Borana, Gabra, and Samburu, all of whom depend heavily on livestock for food and income.

2. Research Design

This study employed a **mixed-methods approach**, combining quantitative household surveys with qualitative data from focus group discussions (FGDs), key informant interviews (KIIs), and participatory mapping. The design was chosen to capture both the measurable aspects of food security and the contextual, lived experiences of pastoralists.

3. Sampling Procedure

A multi-stage sampling strategy was used. First, Marsabit County was stratified into four ecological zones based on rainfall and vegetation. From each zone, two wards were randomly selected. Within each ward, three villages were selected through purposive sampling based on accessibility and the presence of mobile pastoralist populations.

From each village, 15 households were randomly selected, resulting in a total sample of 360 households. Participants were household heads or their spouses actively engaged in mobile pastoralism.

4. Data Collection Methods

4.1 Household Survey

A structured questionnaire was administered to collect quantitative data on:

- Household demographics
- Livestock numbers and migration patterns
- Food sources and dietary diversity (24-hour recall method)
- Coping strategies during food shortages
- Income from livestock and non-livestock sources

The questionnaire was translated into local languages and pre-tested in a neighboring village.

4.2 Focus Group Discussions

A total of 12 FGDs were conducted (3 per ecological zone), comprising male and female pastoralists. Discussions focused on:

- Seasonal migration routes
- Access to grazing and water resources
- Changes in mobility patterns

- Cultural practices related to livestock and food

FGDs were facilitated using participatory tools such as seasonal calendars and mobility mapping.

4.3 Key Informant Interviews
Key informants included:
- Local government officials
- Elders and clan leaders
- NGO staff working on pastoral livelihoods
- Veterinary officers

Interviews were semi-structured, focusing on policy constraints, livestock health, and food aid interventions.

5. Data Analysis
5.1 Quantitative Data
Data from household surveys were entered into SPSS v26 and analyzed using descriptive statistics (means, frequencies, percentages) and inferential statistics such as chi-square tests and logistic regression to determine associations between mobility and food security indicators.
Dietary diversity was measured using the Household Dietary Diversity Score (HDDS), while food security status was assessed using the Household Food Insecurity Access Scale (HFIAS).

5.2 Qualitative Data
Qualitative data from FGDs and KIIs were transcribed and coded using *NVivo* software. Thematic analysis was employed to identify recurring themes related to mobility,

Results
1. Household Characteristics
The study surveyed 360 pastoralist households across Marsabit County. The average household size was 6.4 members, with 72% of households being male-headed. Livestock was the primary livelihood for 94% of respondents, and 81% reported engaging in seasonal livestock migration in the past year. The average herd size per household was 45 animals, predominantly goats and camels, with fewer cattle and sheep.

2. Mobility Patterns and Resource Access
2.1 Seasonal Migration Routes
Pastoralists reported following distinct dry and wet season migration routes, often spanning up to 150 kilometers. Most households moved livestock during the dry season (October to March), in search of pasture and water, returning during the short rains (April to June). The routes were typically planned based on indigenous knowledge, clan agreements, and prior seasonal performance.

2.2 Grazing and Water Access
90% of mobile households accessed multiple grazing zones annually, while only 38% of sedentary households did. Access to water was also significantly better among mobile households, with 74% reporting adequate water points during dry seasons, compared to only 46% among sedentary households. Focus group discussions indicated that traditional wells and seasonal rivers were often better managed in areas frequented by mobile herders.

3. Food Security Status
3.1 Household Food Insecurity Access Scale (HFIAS)
Food security status varied significantly between mobile and non-mobile households:

Category	Mobile (%)	Sedentary (%)
Food secure	32%	14%
Mildly food insecure	39%	28%
Moderately insecure	21%	34%
Severely insecure	8%	24%

The chi-square test showed a statistically significant association ($p < 0.01$) between mobility and food security status, suggesting that mobile households were less likely to suffer from severe food insecurity.

3.2 Household Dietary Diversity Score (HDDS)
The average HDDS was **6.7** for mobile households and 4.3 for sedentary ones (out of a possible 12 food groups). Mobile households reported higher consumption of animal-based products, especially milk (89%), meat (63%), and blood (21%), which contributed to more nutritionally balanced diets.

3.3 Livestock Productivity and Milk Availability
Mobile households reported significantly higher milk production, especially during the wet season. Daily milk availability per household averaged 4.8 liters for mobile households compared to 2.1 liters for sedentary households. Mobile herders attributed this to better access to pasture and water, which improved animal health and lactation.
Milk contributed to 32% of household food intake (by calorie content) among mobile groups, compared to 14% in sedentary groups. This was especially important for children and lactating mothers, as confirmed during FGDs.

3.4 Income from Livestock
Income from livestock sales (live animals, milk, hides) was notably higher among mobile households. On average, mobile households earned KES 23,000/month from livestock products, while sedentary households earned KES 14,000. This income allowed mobile households to supplement their diets with market-purchased food and access basic services like education and healthcare.

3.5 Constraints to Mobility
Despite the benefits, 61% of households cited serious constraints to mobility. The most common challenges included:
- Insecurity and conflict over grazing land (62%)
- Land fragmentation due to infrastructure and farming (54%)
- Restrictions from protected areas and land tenure issues (48%)
- Poor road access limiting mobility during emergencies (39%)

Elders and clan leaders noted that inter-ethnic conflict and the increasing privatization of rangelands posed major threats to traditional migratory systems.

3.6 Coping Strategies During Food Shortages
Mobile households reported more resilient coping strategies than sedentary ones, including:
- Relocating herds to distant grazing areas (79%)
- Increasing milk preservation (ghee, yogurt) (46%)
- Livestock barter or sale to buy food (38%)

In contrast, sedentary households were more reliant on food aid (58%), casual labor, or reducing meal frequency.

3.7 Summary of Key Findings

- Mobility significantly improves access to pasture, water, and livestock productivity.
- Mobile households are more food secure and nutritionally diverse.
- Mobility is increasingly constrained by insecurity, land use changes, and policy neglect.
- Support for mobile pastoralism could enhance food security outcomes in arid lands.

Discussion

1. Linking Mobility and Food Security

The results of this study demonstrate a clear and consistent relationship between mobile pastoralism and improved food security outcomes in arid environments. Households practicing seasonal migration exhibited better access to grazing resources, higher milk yields, more diverse diets, and greater resilience to climatic shocks compared to sedentary households. These findings reinforce existing evidence that mobility is not only central to pastoral livelihoods but a key pillar of household food security in ASALs (Krätli & Schareika, 2010; Catley *et al*., 2013) [1, 2].

Milk availability, in particular, emerged as a critical food security determinant. With better herd health and access to forage, mobile households produced significantly more milk, enabling not only improved caloric intake but also enhanced nutritional quality, particularly for children. This aligns with findings from Ethiopia and Niger, where milk is often the cornerstone of nutrition in pastoral diets (Sadler *et al*., 2012) [7].

2. Adaptive Strategy to Climate Variability

In the context of increasing climate variability and recurrent droughts, mobility provides a flexible and low-cost adaptation strategy that allows pastoralists to buffer against localized resource failures. By moving livestock to where resources are available, mobile herders avoid overgrazing, maintain herd productivity, and ensure continuous food access. These adaptive advantages were evident during periods of food shortage, where mobile households relied less on humanitarian aid and instead used indigenous strategies such as herd relocation and milk preservation.

This contradicts dominant narratives in some policy spheres that view mobility as a sign of underdevelopment or chaos. Rather, this study supports the growing recognition that mobility is a rational and sophisticated response to a highly variable environment (Turner & Schlecht, 2019) [11].

3. Constraints Undermining Mobility and Food Security

Despite its benefits, mobile pastoralism is increasingly under threat. The study identified several structural and systemic challenges, including land fragmentation, insecurity, and policy neglect. Infrastructure development, such as roads and fencing, often cuts across traditional grazing corridors. Protected areas and sedentarization programs further restrict access to key resources, undermining the very basis of pastoral resilience.

Insecurity—often driven by competition over scarce resources—remains a major impediment. As grazing lands shrink and migration routes become contested, inter-community conflict has escalated, forcing many households to limit their mobility. These constraints not only reduce livestock productivity but directly compromise household food security by limiting access to both food and income.

4. Gender Dimensions

While the study did not focus exclusively on gender, FGDs revealed important gendered patterns. Women in mobile households had better access to milk, which is often their responsibility to manage and distribute. In contrast, women in sedentary households reported reduced dietary options and increased burden in finding alternative food sources. This suggests that supporting mobility can also improve gender outcomes, particularly in terms of household nutrition and labor division.

5. Policy Implications

The findings of this study call for a paradigm shift in policy and development approaches toward pastoralism. Rather than promoting sedentarization or "modernized" livestock practices that ignore ecological realities, governments and development actors must recognize and facilitate mobility as a productive and sustainable livelihood system.

Policy recommendations include:

1. Protecting and formalizing grazing corridors and migratory routes, including cross-border agreements where applicable.
2. Integrating mobile pastoralism into land-use planning and infrastructure development.
3. Investing in mobile services such as mobile veterinary clinics, water trucking, and education.
4. Strengthening conflict mitigation and peacebuilding mechanisms to secure migration pathways.

6. Contribution to Existing Literature

This study adds empirical weight to the growing body of literature that challenges sedentary-centric views of development in drylands. It supports the work of Krätli *et al*. (2015) [3], who argue that mobility is not a problem to be solved but a solution to be supported. It also complements earlier findings from the Intergovernmental Authority on Development (IGAD), which calls for greater regional cooperation in supporting pastoral mobility.

7. Limitations

The study had some limitations. First, it relied on self-reported data, which may be subject to recall bias. Second, it was cross-sectional, capturing a single point in time and not the full dynamics of mobility and food security over seasons or years. Third, the study focused on one geographic

Conclusion

This study highlights the central role of mobile pastoralism in sustaining household food security in arid and semi-arid lands (ASALs), using Marsabit County as a case example. Evidence from household surveys and qualitative data demonstrates that pastoral mobility significantly enhances access to grazing resources, increases livestock productivity—particularly milk—and leads to higher dietary diversity and improved food security outcomes.

Mobile pastoralists were found to be more resilient to climatic shocks, relying less on food aid and demonstrating more robust coping strategies during droughts. Their ability to navigate ecological variability through seasonal migration allows for the efficient use of dispersed natural resources, supporting both livelihoods and nutritional needs.

However, the increasing constraints on mobility—due to land fragmentation, insecurity, restrictive policies, and sedentarization pressures—pose serious threats to pastoral food security and long-term sustainability. These findings

call for urgent policy reforms that recognize and protect mobility as a legitimate and necessary livelihood strategy, rather than a relic of the past.

Supporting mobile pastoralism requires an enabling environment that includes secure grazing corridors, cross-border agreements, conflict resolution mechanisms, and mobile service delivery models. By aligning development planning with pastoralist realities, governments and development actors can better address food insecurity in dryland regions.

In conclusion, mobility is not the problem; it is part of the solution. Promoting and safeguarding mobile pastoral systems is essential for achieving sustainable food security and resilience in the face of climate variability and socio-economic change in ASALs.

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