Household Adaptation and Recovery from Climate Shocks among Pastoral Communities in Mandera County, Kenya

Hassan Issack Hache[1], Peter Gutwa Oino[2] and Dennis M. Mamboleo[3]

[1,2]Department of Sociology, Gender and Development Studies, School of Arts and Social Sciences, Kisii University, Kenya

[3]Department of Geography, School of Arts and Social Sciences, Kisii University, Kenya

DOI: https://doi.org/10.68050/JAMS.2026.875

Received: 30 October 2026; Accepted: 04 November 2026; Published: 12 November 2026

ABSTRACT

Pastoral households use several strategies to manage climate-related shocks, but reported adaptation does not necessarily imply rapid recovery. This study examined adaptation practices and perceived recovery capacity among pastoral and agro-pastoral households in six wards of Mandera County, Kenya. It reports the quantitative component of a wider explanatory sequential mixed-methods study. Of 264 targeted households, 224 completed the survey, giving an overall response rate of 84.8%. Ten items were scored from 1 (strongly disagree) to 5 (strongly agree) and summarised using reported percentages and means. Income diversification received the highest mean (3.43), followed by community-based coping (3.40), food storage (3.35) and water saving or harvesting (3.35). Useful early-warning information scored 2.97, financial support 3.03 and rapid recovery 2.85. Agreement with rapid recovery was 39.3%, compared with 56.3% to 58.9% for the four more strongly endorsed practices. These marginal differences of 17.0 to 19.6 percentage points describe a recovery gap between reported practices and perceived recovery capacity. They do not establish statistical significance, within-household relationships or causal effects. Although 53.6% perceived improved long-term food security, this was not an independently measured outcome. The findings support assessing recovery alongside adaptation activity and considering timely warning, accessible finance, water and livestock services, social protection and viable livelihood opportunities. The cross-sectional self-reports cannot establish whether particular practices protected assets or shortened recovery time.

Keywords: climate adaptation; resilience; pastoral livelihoods; livelihood diversification; early warning; drought; Mandera County; Kenya

1. INTRODUCTION

Pastoral communities have long lived with variable rainfall, scarce water and changing pasture conditions. Mobility, herd management, reciprocal support and flexible use of natural resources are central features of pastoral livelihood systems in northern Kenya (Huho et al., 2023; Mohamed et al., 2023). These practices allow households to respond to environmental uncertainty, but their effectiveness can be weakened when droughts become more frequent, recovery periods shorten, grazing areas contract and the cost of maintaining livestock rises (Huho et al., 2023; Mauerman et al., 2023). In this setting, adaptation is not simply the adoption of a new practice. It is the capacity to sustain livelihoods, protect productive assets and recover after difficult periods (Bostedt et al., 2023; Matata et al., 2023; Opiyo et al., 2015).

In northern Kenya, drought can reduce pasture and water availability, weaken livestock, lower milk production and household income, and force families to sell animals when market conditions are unfavourable. These effects may accumulate across seasons. Evidence from Marsabit shows that pastoral households affected by successive droughts can require several years to rebuild their herds, with larger initial livestock losses associated with longer recovery periods (Mauerman et al., 2023). This makes recovery an important part of resilience analysis. A household may survive a drought yet remain highly vulnerable if livestock, savings and food reserves have not been restored before the next shock.

Pastoral adaptation is diverse. It may involve livestock mobility, changes in herd composition, food preservation, water harvesting, livelihood diversification, climate information, market participation and social support. Research in northern Kenya shows that households increasingly combine pastoral production with non-livestock activities, including petty trade, wage employment, farming and other sources of cash income (Huho et al., 2023). Diversification can spread risk, but it does not always represent improved welfare. Kirui et al. (2022) found that drought can move households between different livelihood pathways, including pathways characterised by smaller herds and low cash income. This matters because movement away from livestock may sometimes reflect opportunity and at other times distress (Bostedt et al., 2023; Adino & Ondiek, 2024).

Community institutions also remain important. Social networks can provide information, labour, food, livestock support and other forms of assistance. Research on local resilience in northern Kenya has drawn attention to the role of networks linking herd owners, herders, traders, animal-health providers, mobile-money agents and development organisations in managing uncertainty (Mohamed et al., 2023). Such networks may be particularly valuable because they are embedded in everyday pastoral life. Their capacity, however, can be stretched when drought affects many households at the same time.

Early warning and anticipatory action have become increasingly important in Kenya's drought-management system. The Kenya Anticipatory Action Road Map 2024 to 2029 seeks to strengthen action before hazards produce their most damaging effects. Anticipatory action uses forecasts and risk information to trigger pre-arranged measures before a predicted hazard occurs (Food and Agriculture Organization of the United Nations [FAO], 2025). For pastoral households, the value of warning information depends on whether it is timely, understandable and connected to practical options such as livestock treatment, fodder, water, market access, mobility or cash. Information that cannot be acted upon may have limited protective value.

Financial protection is equally important. Cash, savings, credit, insurance and shock-responsive social protection can help households avoid distress sales and maintain consumption during climate shocks. Evidence from northern Kenya indicates that cash transfers can strengthen household resilience to climate shocks, although effects vary with household circumstances and the wider livelihood environment (Matata et al., 2023). Finance should therefore be understood as part of adaptive capacity rather than as a separate welfare issue.

Mandera County provides an important setting for examining the relationship between household adaptation and recovery. Pastoral and agro-pastoral livelihoods remain strongly exposed to drought, water scarcity and changing pasture conditions. Previous research in Mandera has identified both local opportunities for resilience building and constraints in disaster-risk reduction and preparedness (Irungu et al., 2022). The present paper adds household-level evidence by examining which adaptation practices were reported most strongly, how households assessed external support, and whether they felt able to recover after climate shocks.

The paper addresses an important gap in adaptation analysis. Studies of pastoral responses commonly document strategies such as diversification, food preservation, herd management and community support, yet the presence of several strategies does not by itself show that resilience has been achieved (Huho et al., 2023; Mohamed et al., 2023). A household may diversify income, store food, harvest water or participate in community coping arrangements and still be unable to rebuild livestock, savings or food reserves after a severe drought. Evidence that herd recovery after successive droughts can take several years illustrates why post-shock recovery must be considered separately from the adoption of coping or adaptation measures (Mauerman et al., 2023). The main concern is not only whether households take action, but whether those actions protect the productive base needed for recovery. This paper distinguishes reported adaptation practices from perceived recovery capacity and examines the gap between the two. It asks whether the strategies reported by households are accompanied by confidence in longer-term food security and post-shock recovery. By making recovery explicit, the study shifts attention from counting adaptation activities to considering whether households are better positioned for the next shock.

This issue is especially relevant in pastoral settings because the same practice can have different meanings depending on when and why it is used. Livelihood diversification may spread risk, but drought-driven shifts

into low-return activities can also reflect livelihood stress rather than stronger adaptive capacity (Kirui et al., 2022; Huho et al., 2023). Similarly, the consequences of livestock sales depend on whether households are making planned adjustments or disposing of productive assets under pressure. Research on resilience in northern Kenya shows why the protection of productive assets and avoidance of damaging coping responses are important to longer-term recovery (Matata et al., 2023; Mauerman et al., 2023). Adaptation therefore needs to be interpreted in relation to timing, choice and the protection of productive assets. The present paper does not treat the number of reported strategies as a direct measure of resilience. It examines whether reported household and institutional responses are accompanied by a perceived ability to recover after climate shocks.

2. CONCEPTUAL PERSPECTIVE: ADAPTATION, LIVELIHOODS AND RESILIENCE

The Sustainable Livelihoods Framework provides the main basis for understanding household responses to climate stress. In livelihood analysis, household well-being depends on access to and use of productive resources and capabilities, while pastoral resilience is also shaped by social relations, services, markets and other enabling conditions (Mohamed et al., 2023; Matata et al., 2023). Drought can weaken several livelihood assets at the same time: pasture and water decline, livestock lose condition and market value, household income falls, and families may draw down savings or depend more heavily on social networks (Huho et al., 2023; Mauerman et al., 2023). Adaptation involves changing how households use these assets and available opportunities so that basic needs and productive livelihoods can be sustained under changing conditions (Scoones, 1998).

Resilience extends the analysis beyond immediate coping. In this paper it is understood as the capacity to anticipate and absorb shocks, adjust livelihood practices, protect critical productive assets and rebuild what has been lost. This interpretation is consistent with northern Kenya research that links resilience to the ability to manage shocks without progressively undermining the assets required for future livelihoods (Matata et al., 2023; Mauerman et al., 2023). This is particularly relevant in pastoral systems. Selling livestock may provide food during a drought, but repeated distress sales can reduce the herd below a viable level. Casual work or emergency assistance may protect consumption without restoring livestock, savings or other productive resources. A strategy can therefore be useful in the short term while contributing little to longer-term recovery.

The paper links adaptation with asset protection, recovery and, ultimately, resilience. It is an analytical synthesis developed for this paper from evidence that pastoral households use multiple adaptation strategies, that resilience depends partly on maintaining productive assets, and that herd recovery after severe or successive droughts can be prolonged (Huho et al., 2023; Matata et al., 2023; Mauerman et al., 2023). Household and community strategies such as food storage, diversification, water management and reciprocal support represent adaptive action. Their contribution to resilience depends partly on whether they protect livestock, income, food reserves and other assets during a shock. Recovery concerns the household's ability to restore these assets and livelihood functions after the shock. Where recovery is slow and shocks recur before assets are rebuilt, vulnerability can accumulate even when households continue to adapt (Mauerman et al., 2023). Public services, functioning markets, finance, early warning and social protection are treated as enabling conditions that can strengthen this pathway rather than as substitutes for household agency (Irungu et al., 2022; Matata et al., 2023; Mohamed et al., 2023).

The ten survey items cover three analytically distinct domains: reported household and community practices; perceived access to, or benefit from, enabling support; and perceived recovery and food-security outcomes. Practices include food storage, income diversification, drought-tolerant production, water saving or harvesting and community coping. Enabling-support items concern useful early-warning information, government or NGO training and financial support. Outcome items concern rapid recovery and perceived improvement in long-term food security. These categories organise interpretation; they are not validated subscales. No composite adaptation or resilience score is constructed.

Coping, adaptation, recovery and resilience are treated as related but distinct processes. Coping refers here mainly to actions that help households meet immediate needs during stress, while adaptation refers to

adjustments intended to reduce exposure or sensitivity over a longer period. Recovery concerns the restoration of assets, income sources and basic livelihood functions after a shock, whereas resilience is broader because it combines the capacity to absorb disturbance, adjust practices and rebuild without progressively losing the productive base on which future livelihoods depend (Matata et al., 2023; Mauerman et al., 2023). These processes can overlap, but they should not be assumed to be equivalent. A household may cope successfully during one drought yet emerge with fewer animals, depleted savings or greater dependence on assistance, leaving it less able to withstand the next event (Huho et al., 2023; Mauerman et al., 2023). The framework gives particular attention to whether adaptation practices help preserve the assets required for subsequent recovery.

3. METHODOLOGY

3.1 Research design and study area

The wider study adopted an explanatory sequential mixed-methods design in Mandera County and covered Takaba South, Fino, Wargadud, Banissa Town, Shafshafey and Rhamu Town wards. The operational sampling frame reported in the thesis comprised 2,597 households. This article presents a cross-sectional descriptive analysis of the household-survey component; it does not report the subsequent qualitative phase or claim mixed-methods integration. The findings concern respondents in the six study wards and should not be treated as a county-wide prevalence estimate.

3.2 Sampling and data collection

The planned sample comprised 264 households, allocated equally across six wards, with 44 targeted in each ward. The study frame contained 2,597 households. Villages were selected randomly from available lists, and households were selected systematically from an identified central point at an interval of every third household. Trained enumerators conducted face-to-face questionnaire interviews with adults in charge of the household at the time of the visit. The thesis reports community mobilisation and involvement of local leaders to facilitate access. Of the 264 targeted households, 224 completed the survey (84.8%). The remaining 40 were associated with temporary migration, household unavailability and incomplete responses. Equal allocation was not proportional to ward population. Achieved ward totals, a random starting household, travel routes and replacement rules were not reported; ward-specific response rates and survey weights are therefore not estimated (Hache, 2026).

The questionnaire contained ten statements on practices, enabling support and perceived outcomes. Responses were coded 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree. The thesis reports a 15-household pilot in Lagsure Town, face and content review by university supervisors, and revision of unclear or redundant items following pilot feedback. It also describes test–retest and Cronbach's alpha procedures, with 0.70 as the intended alpha threshold, but reports neither an achieved alpha nor a test–retest coefficient. The pilot-exclusion statement is internally contradictory, so exclusion cannot be confirmed. The ten items are analysed separately rather than treated as a validated composite scale (Hache, 2026).

3.3 Data analysis and interpretation

Frequencies, percentages and means were calculated from the five-category integer counts in the thesis adaptation table (Hache, 2026, Table 4.6). All ten rows sum to 224. Agreement combines categories 4 and 5, and disagreement combines categories 1 and 2. Combined percentages were calculated directly from combined counts divided by 224, rather than by adding previously rounded percentages. Means were calculated as the sum of each category score multiplied by its frequency, divided by 224. Percentages are rounded to one decimal place and means to two decimal places, using conventional half-up rounding. These recalculations correct rounding and arithmetic inconsistencies in the source summaries. Means above or below 3 indicate average endorsement above or below the neutral midpoint; no unvalidated low, moderate or high resilience cut-offs are imposed. Ordinal item means are interpreted cautiously and alongside response percentages.

The recovery gap is the descriptive contrast between endorsement of individual practices and endorsement of perceived rapid recovery. Percentage-point contrasts were calculated from unrounded combined counts, with rounding applied only to the final contrast. Mean-score contrasts were also calculated before rounding. No composite gap index is constructed. Marginal category counts do not identify linked responses from the same household; they therefore cannot establish paired statistical significance, within-household associations, Cronbach's alpha or subgroup differences. No inferential or causal claim is made.

3.4 Ethical considerations and reporting scope

The thesis reports that informed consent was obtained after participants received information in English and Somali about the study purpose, voluntary participation and the right to withdraw without penalty. For participants with low literacy, the explanation was oral and verbal consent was recorded in the presence of a witness. Personal identifiers were removed from coded data, results were aggregated, electronic records were password-protected and paper questionnaires were securely stored with access restricted to the research team. The thesis states that the research followed Kisii University institutional ethics requirements and that national research permits and local administrative approvals were obtained (Hache, 2026). It does not provide approval or permit identifiers; the exact approvals and survey dates remain unverified.

4. RESULTS

4.1 Household and community adaptation practices

Table 1 presents all ten indicators. The strongest agreement was reported for income diversification (58.9%; mean 3.43), followed by community-based coping (57.1%; mean 3.40). Food storage attracted 56.3% agreement (mean 3.35), water saving or harvesting 57.1% (mean 3.35), and drought-tolerant crops or livestock 52.7% (mean 3.24). These are separate endorsements of individual practices. The marginal summaries do not show how many strategies any one household used or whether the same households endorsed several practices.

Table 1 Reported practices enabling support and perceived outcomes

Practice support or outcome item	Agree or strongly agree (%)	Disagree or strongly disagree (%)	Mean
Stores food during surplus periods	56.3	32.1	3.35
Diversifies income sources	58.9	27.7	3.43
Adopts drought-tolerant crops/livestock	52.7	34.8	3.24
Practises water-saving/harvesting techniques	57.1	31.3	3.35
Receives useful early-warning information	42.9	42.9	2.97
Participates in community-based coping strategies	57.1	27.7	3.4
Government/NGO training improved adaptation	47.3	36.6	3.12
Can quickly recover from climate shocks	39.3	46.4	2.85
Access to financial support mechanisms	45.5	41.1	3.03
Adaptive strategies improved long-term food security	53.6	31.3	3.29

Note. n = 224 for every item, verified by summing the five category counts in Hache (2026, Table 4.6). Agreement combines scores 4 and 5; disagreement combines scores 1 and 2. Percentages are calculated from integer counts and rounded once. Means are recalculated from the same counts. Items address different constructs and are not a composite resilience scale.

All five practice items received agreement from more than half of respondents, although none reached two-thirds. Their means ranged from 3.24 to 3.43, above the neutral midpoint but below the agree category of 4. These results indicate endorsement of the practices among respondents; they do not establish their intensity,

technical quality, effectiveness or distribution across livelihood groups.

Food storage and water saving or harvesting each recorded a mean of 3.35. The survey did not measure storage volumes, infrastructure condition, duration of coverage or drought severity. Their protective contribution therefore cannot be quantified from the reported ratings.

4.2 Early warning, training and financial support

Enabling support received lower endorsement than the more strongly rated practice items. Useful early-warning information attracted 42.9% agreement and 42.9% disagreement (mean 2.97). The statement that government or NGO training improved adaptation attracted 47.3% agreement (mean 3.12); this measures perceived benefit and should not be read as a training participation rate. Financial support attracted 45.5% agreement and 41.1% disagreement (mean 3.03). These distributions suggest uneven perceived support among respondents, but they do not identify the timing, adequacy, provider or actual use of assistance.

4.3 The recovery gap

Rapid recovery had the lowest mean (2.85): 39.3% agreed and 46.4% disagreed that their household could recover quickly after a climate shock. Agreement exceeded rapid recovery by 19.6 percentage points for income diversification, 17.9 for community coping, 17.0 for food storage and 17.9 for water saving or harvesting. Mean-score contrasts calculated before rounding were 0.58, 0.55, 0.50 and 0.50, respectively. These arithmetic contrasts describe a pattern in marginal item summaries; they are not statistical tests, a validated index or evidence that individual adopters failed to recover. “Quickly” was not anchored to a specified number of months, and no observed recovery time was measured.

Agreement that adaptation strategies had improved long-term food security was 53.6% (mean 3.29). This reflects respondents’ attribution of benefit, rather than a longitudinal change in food security. No standardised food-security measure, pre-shock baseline or comparison group is reported. The result cannot establish that adaptation improved food security or secured resilience.

5. DISCUSSION

The descriptive pattern separates endorsement of adaptation practices from perceived rapid recovery. Agreement with four prominent practices exceeded agreement with rapid recovery by 17.0 to 19.6 percentage points. This supports treating recovery as a separate concern in adaptation assessment. It does not show a statistically significant association between any practice and recovery, or identify which households both adapted and struggled to recover. Differences in assets, shock exposure and enabling support are plausible explanations to examine in further research, rather than mechanisms demonstrated by this survey.

Income diversification was the most strongly reported strategy. Similar patterns have been reported in research showing that pastoral households increasingly combine livestock with trade, wage employment, farming and other income sources. Huho et al. (2023) found that pastoralists in semi-arid northern Kenya use both traditional and non-pastoral strategies, with diversification becoming more important as drought severity and constraints on mobility increase. Diversification can reduce dependence on a single climate-sensitive livelihood and provide cash when livestock production falls (Bostedt et al., 2023; Awuonda et al., 2026).

However, diversification should not automatically be treated as evidence of successful adaptation. Kirui et al. (2022) showed that drought can push pastoral households between livelihood pathways, including movement into situations characterised by small herds and low cash income. A household that begins petty trade after losing most of its livestock is in a different position from one that adds a profitable enterprise while retaining a viable herd. The Mandera survey does not distinguish these pathways. The low recovery score cautions against assuming that a diversified livelihood portfolio necessarily reflects stronger resilience.

Community-based coping also received relatively strong support. This reflects the important role of social capital in pastoral societies. Local networks can circulate information, labour, food, livestock support and

access to services. Mohamed et al. (2023) argue that resilience in northern Kenyan pastoral areas is partly sustained by networks of people and services that respond to uncertainty in real time. Such systems can be flexible and locally trusted. Their limitation is that widespread drought is a covariate shock: when many households are affected simultaneously, the resources available for reciprocal support may decline just when they are most needed.

Useful early-warning information received agreement from less than half of respondents. Kenya's Anticipatory Action Road Map 2024 to 2029 promotes action before hazards cause serious harm (FAO, 2025). Warnings may inform decisions about herd movement, livestock sales, animal health, fodder, water storage and food planning. The Mandera result concerns respondents' assessment of usefulness; it cannot distinguish non-receipt from late delivery, unclear communication or limited capacity to act. These possibilities warrant separate investigation (Opiyo et al., 2014).

Information alone, however, cannot create resilience. A household may receive an accurate warning but lack cash, transport, fodder, water storage, veterinary support or access to a functioning market. Limited capacity to act on warnings may also be related to the modest rating for financial support. Matata et al. (2023) found that cash transfers can contribute to household resilience in northern Kenya's arid and semi-arid counties. Financial support can protect consumption, reduce pressure for distress sales and allow households to act before livestock condition deteriorates. Its value is greatest when it arrives at the right time and is connected to viable livelihood choices.

The relatively weak rapid-recovery rating is consistent with the broader concern raised by longitudinal evidence from Marsabit on herd restoration after successive droughts (Mauerman et al., 2023). That study follows livestock holdings over time, whereas the Mandera item captures a general perception. The two measures should not be treated as equivalent, and recovery durations observed elsewhere cannot be assigned to these households. The comparison nevertheless supports examining recovery as a distinct outcome rather than assuming it follows from immediate coping.

The item summaries show stronger endorsement of several practices than of rapid recovery. Whether food storage, community assistance, diversification or water management actually preserved assets remains untested here. A recovery-oriented interpretation therefore separates reported action, perceived benefit and observed livelihood outcomes.

Household initiative appears to operate within an uneven enabling environment. Early-warning information, finance, markets and public services can determine whether local strategies protect productive assets when drought simultaneously affects pasture, livestock condition and purchasing power. Evidence from northern Kenya that repeated drought can prolong recovery reinforces the importance of protecting productive assets before losses become difficult to reverse (Mauerman et al., 2023; Kirui et al., 2022).

This has practical implications for programme design. An intervention may be judged successful because households received training, adopted a water practice or accessed a cash transfer. These are useful outputs, but they do not show whether households retained viable herds, avoided damaging asset sales, maintained adequate food consumption or recovered more quickly after drought. Monitoring systems should include recovery indicators alongside measures of programme reach and strategy adoption.

A recovery-oriented approach asks different questions from one focused mainly on adoption. In addition to recording whether households received training, used water-harvesting measures or diversified income, programmes would examine whether livestock mortality and distress sales were reduced, whether households retained access to markets and water, and whether savings, food reserves and productive assets could be restored after the shock. Such measures would make it easier to distinguish activities that are widely adopted from those that materially strengthen the capacity to face the next drought. They would also help identify where household effort requires complementary public or institutional support, particularly where individual families cannot independently maintain water infrastructure, market access, veterinary services or emergency finance.

The findings also caution against adaptation approaches that treat pastoralism itself as the problem. Pastoral mobility, flexible herd management and livestock-based social relations have long enabled people to use highly variable dryland environments. Climate-resilience programmes should protect viable pastoral systems while widening household choices. Diversification is most useful when it expands opportunity rather than simply recording livelihood displacement after livestock loss. Similarly, investments in water, animal health, fodder, market infrastructure and climate information should strengthen households' capacity to make timely decisions without unnecessarily undermining mobility (Osano et al., 2013; Opiyo et al., 2015).

Previous Mandera research identified institutional opportunities and constraints for disaster-risk reduction and resilience building (Irungu et al., 2022). The present results provide complementary descriptive evidence: respondents endorsed several local practices while rating useful early warning, finance and recovery less strongly. This pattern motivates examination of household, community and institutional conditions together; it does not establish which condition explains recovery differences.

The cross-sectional self-reports are subject to recall, social desirability and differences in the interpretation of “quickly” and “long-term”. They measure neither observed asset loss nor actual recovery duration or change in food security. Equal ward allocation, unavailable achieved ward totals and incomplete documentation of the random start and replacement rules constrain representativeness. The overall response rate cannot rule out non-response bias. Although the thesis documents piloting and expert review, achieved reliability coefficients are absent and the pilot-exclusion statement is contradictory. Exact survey dates and approval identifiers are unverified. Recalculation from the source counts establishes internal arithmetic consistency, but does not independently validate the original field records. Marginal counts cannot support household-level associations, paired tests or subgroup analyses by livelihood, assistance or early-warning access. Longitudinal research with linked household records is needed to relate practices and support to asset retention, food consumption and measured recovery time.

6. CONCLUSION AND POLICY IMPLICATIONS

Respondents in six Mandera County wards endorsed income diversification, community coping, food storage and water saving or harvesting more strongly than rapid recovery. This descriptive recovery gap highlights the value of examining perceived recovery separately from reported adaptation activity. It does not establish causal effectiveness, statistically significant relationships or county-wide resilience levels. The findings support further investigation of how household practices and enabling support relate to recovery.

Adaptation support should connect household initiative with the resources needed before, during and after drought. Early-warning information should reach households early enough to guide practical decisions and should be linked to livestock health services, water and fodder support, market access, mobility options and appropriate finance. This creates a more complete resilience pathway: warning supports timely action, timely action helps protect productive assets, and protected assets improve the prospects for recovery. Information is most useful when households possess the means to act on it.

Community-based systems should also be strengthened because they remain important sources of local support, information and reciprocal assistance. At the same time, policy should recognise that widespread drought is a covariate shock that can overwhelm community networks. Public institutions, humanitarian actors, markets and social-protection systems have complementary roles. Shock-responsive cash support, timely livestock services and accessible markets can help households maintain consumption without relying immediately on distress sales, while water and fodder interventions can protect the productive livestock base on which recovery depends (Matata et al., 2023).

Livelihood diversification can reduce exposure to a single climate-sensitive income source, but it should expand viable choices rather than simply record movement out of pastoralism after households lose their herds. Programmes should protect productive livestock assets while supporting suitable complementary income sources. Water infrastructure, animal-health services, strategic fodder systems, market access and financial

inclusion can strengthen the livelihood base from which households diversify. Diversification and pastoral asset protection can therefore reinforce each other rather than compete.

Recovery should be treated as a measurable policy goal. Households that survive a drought but cannot rebuild livestock, savings or food reserves remain vulnerable to the next shock. Monitoring should move beyond counting adaptation activities and assess whether households retain productive assets, maintain food consumption, avoid damaging distress sales and shorten the time required to recover. Evidence from Marsabit shows why this matters: successive droughts can have compounding effects when a new shock occurs before herd recovery is complete (Mauerman et al., 2023).

This study provides a descriptive picture of reported adaptation and perceived recovery in Mandera County; it does not measure the causal effectiveness of individual strategies. Future research should follow households across several seasons and combine repeated household observations with objective rainfall, vegetation and drought measures. It should also examine how herd size, livelihood diversification, market access, gender, income, financial support and social protection relate to asset retention and recovery time. Standardised food-security measures and direct indicators of herd restoration, savings, income stability and dietary quality would help distinguish short-term coping from durable recovery.

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