CGIAR CLIMATE ACTION

Alliance Bioversity & CIAT

Rapid Deterioration of Water and Pasture Resources in Ethiopia's Lowlands: A Comparative Analysis of January 2025 and January 2026 Conditions Using a Digital Early Warning System

Abstract

Pastoral and agro-pastoral systems in Ethiopia's lowlands are increasingly exposed to climate variability and recurrent drought. This study analyzes changes in water and pasture availability between January 2025 and January 2026 using outputs from a rangeland monitoring system (ETH - Rangeland). Results showed deterioration in both waterpoint and pasture conditionsin January 2026 compared to January 2025. The number of seasonally dry and near-dry waterpoints doubled between January 2025 and January 2026, while pasture conditions transitioned from predominantly medium productivity to low and very low biomass levels, indicating a substantial decline in forage availability. These changes have severe implications for livestock productivity, food security, and conflict risks over natural resources. The findings demonstrate the value of operational early warning systems for anticipatory action and long-term resilience investments in Ethiopia's pastoral regions.

Authors: Sintayehu Alemayehu, Getachew Tegegne, Sintayehu Workeneh Dejene, Liyuneh Gebre, Tadesse Terefe

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Introduction

Drought remains one of the most significant climate hazards affecting pastoral and agro-pastoral systems in the Horn of Africa. In Ethiopia's lowlands, livelihoods depend heavily on seasonal rainfall patterns that sustain pasture growth and surface water recharge. Failure of these rainfall seasons rapidly translates into livestock stress, income losses, food insecurity, and resource conflicts. The lowland region is enduring a prolonged drought due to below-normal rainfall during the Meher season in January 2026. For instance, Borana receives most of its rainfall during the Belg (March to May) and Meher (September to November) seasons. However, the short rainfall during the Meher season is below normal rainfall in the region, resulting in the shrinkage of water bodies. This failed rainy season (Meher), left the lowland community experiencing food insecurity.

Seasonal climate outlooks issued by the Greater Horn of Africa Climate Outlook Forum (GHACOF) provided early indications of elevated drought risk before the observed deterioration in water and pasture conditions. In particular, the 69th GHACOF (GHACOF69), convened in January 2025, forecast a higher likelihood of below-normal rainfall over southern and southeastern Ethiopia during the March–May 2025 season. These areas include key pastoral zones, such as Borana and parts of the Somali Region, where rainfall during this period is critical for pasture regeneration and surface-water recharge. The poor performance of subsequent rainy seasons aligns closely with these forecasts, reinforcing the role of climate variability as a key driver of the observed drought impacts. Moreover, conflicts in this region frequently arise from resource scarcity, particularly concerning water and pasture. This underscores the necessity for resource mobilization and emergency aid.

Pic 1: Livestock watering concentration at a critical dry-season water source, reflecting water scarcity and high demand

Pic 2: Dry season in the rangelands a clear signal of climate pressure on pastoral systems

The Alliance of Bioversity International and CIAT, in collaboration with the Ethiopian Institute of Agricultural Research and the Ministry of Agriculture, co-developed an interactive web-based digital rangeland monitoring system, accessible at https://rangelandmonitoring.eiar.gov.et/, to provide near-real-time information on water and pasture conditions in pastoral and agro-pastoral regions. This information note provides a comprehensive comparison of water and pasture conditions between January 2025 and January 2026, using data generated by the digital Early Warning System (EWS). The analysis aims to elucidate the severity of the drought conditions experienced in January 2026 by contrasting them with the previous year's data. By examining the outputs from the EWS, we can identify trends in water and pasture availability and conditions over the two periods. This comparison will assist stakeholders in assessing the current drought's impact on agricultural practices, livestock health, and overall ecosystem resilience. Understanding these changes will be crucial for implementing effective responses to mitigate the effects of the ongoing drought and support community resilience in future agricultural planning and resource management.

2.0 Methods
2.1. Data Sources

Data were obtained from the rangeland monitoring system (https://rangelandmonitoring.eiar.gov.et/):

- Waterpoints condition (https://rangelandmonitoring.eiar.gov.et/): Provides near real-time information on the functionality and capacity of waterpoints, including classification into GREY (dry), RED (<30% capacity), GOLD (30–80%), and GREEN (>80%) conditions.
- Forage condition (https://rangelandmonitoring.eiar.gov.et/): Provides estimates of pasture biomass (t/ha) derived from remote sensing indicators, ground truthing, and field surveys. Pasture conditions are categorized as very low (<0.5 t/ha), low (0.5–1 t/ha), medium (1–2 t/ha), and high (>2 t/ha).

2.2 STUDY DESIGN

This study employs a comparative temporal analysis to examine changes in water and pasture condition between January 2025 and January 2026. The design involves:

- Extracting waterpoint status and pasture biomass data for both time points.
- Classifying waterpoints according to their condition (GREY, RED, GOLD, GREEN).
- Classifying pastures based on biomass thresholds (very low, low, medium, high).
- Conducting spatial and temporal comparisons to assess deterioration trends and areas of critical concern.

2.3 DATA ANALYSIS

- Waterpoints: The proportion of waterpoints in each condition category was calculated for January 2025 and January 2026. Changes in functional status were analyzed to identify trends in water availability.
- Pasture: Pasture biomass values were aggregated and classified by zone. Statistical analyses, including paired t-tests, were used to assess significant differences in biomass between the two time points. Spatial analysis was performed to map pasture degradation patterns across the study area.
- Trend Assessment: Graphical and tabular representations (Figures 1–8, Tables 1–2) were used to visualize changes in waterpoint functionality and pasture biomass. Temporal trends were evaluated to identify areas experiencing severe deterioration.
- Implications for Livelihoods: Data were interpreted in the context of livestock productivity, pastoral mobility, and food security to inform emergency response and long-term planning

3.0 Results

3.1. Waterpoints condition comparison in January 2025 and January 2026 for data-driven decision making

The data clearly indicate a significant deterioration in water availability in the Borana zone from January 2025 to January 2026 (see Figure 1 and Table 1). In 2026, a staggering 74% of water points are dry (GREY condition), compared to only 37.03% in 2025. Furthermore, the percentage of waterpoints in good condition (GREEN) has completely disappeared, and the percentage of waterpoints in RED condition (less than 30% capacity) has decreased slightly, but this is likely due to more waterpoints drying up completely.

Region	Waterpoint Condition	January 2025 (%)	January 2026 (%)	Change (%)
Borana	GREEN (Above 80% capacity)	18.51	0	-18.51
	YELLOW (50-80% capacity)	25.93	7.4	-18.53
	GOLD (30-50% capacity)	7.4	15.5	+8.1
	RED (Less than 30% capacity)	11.11	3.7	-7.41
	GREY (Zero water depth)	37.03	74	+36.97
Somali	GREEN (Above 80% capacity)	45.45	0	-45.45
	YELLOW (50-80% capacity)	18.18	0	-18.18
	GOLD (30-50% capacity)	9.1	0	-9.1
	RED (Less than 30% capacity)	9.1	0	-9.1
	GREY (Zero water depth)	18.18	100	+81.82

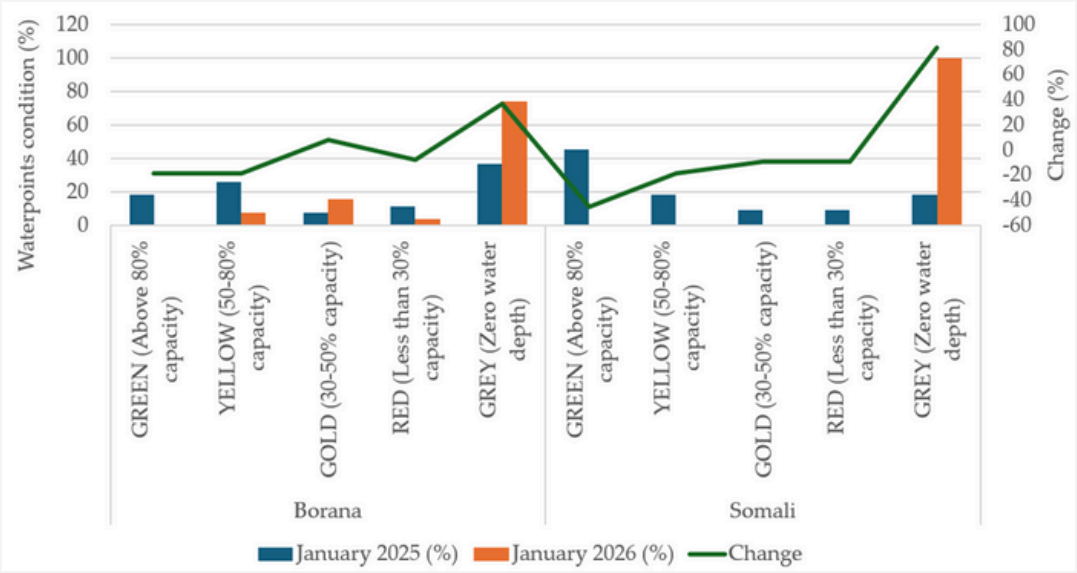

Figure 1. comparison of waterpoints condition from January 2025 to January 2026.

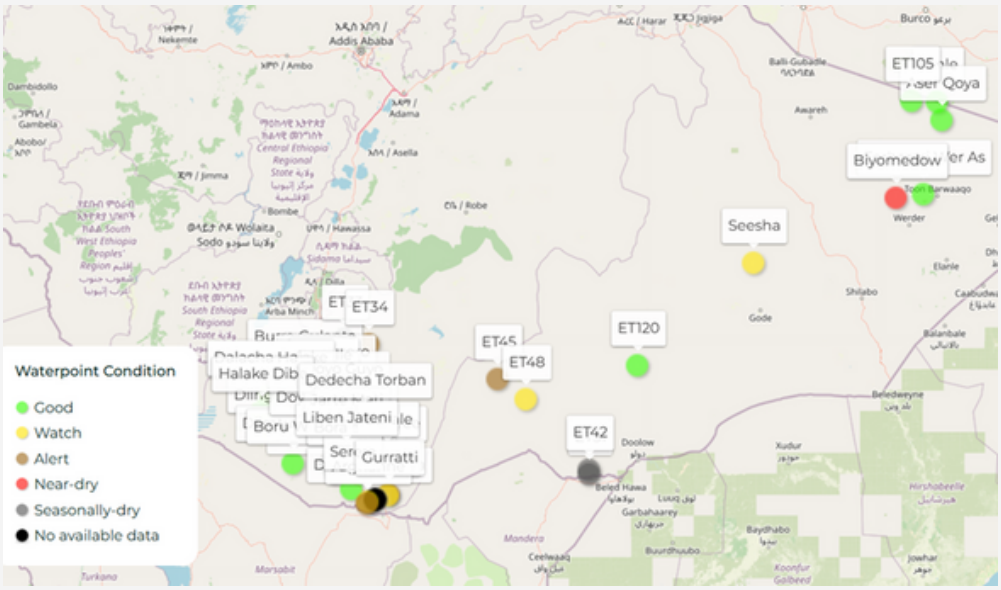

Figure 2. Waterpoints condition in January 2025

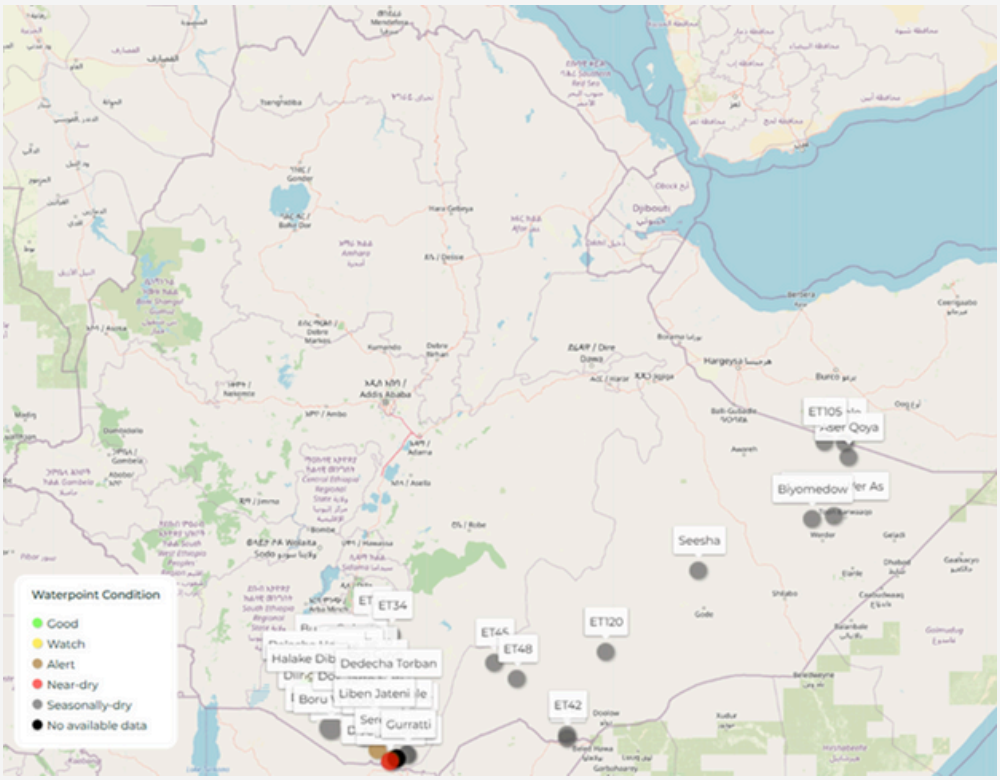

Figure 3. Waterpoints condition in January 2026

3.2. Trend Analysis

Figures 2 - 3 illustrate trends in waterpoint conditions between January 2025 and January 2026. The data indicate:

- A clear upward trend in completely dry (GREY) waterpoints.
- Decline and disappearance of waterpoints in GREEN condition.
- Transitional increase in "GOLD" waterpoints, likely reflecting waterpoints deteriorating from YELLOW to GOLD before complete drying.

These trends demonstrate accelerating stress on water resources, highlighting areas of critical concern for emergency response.

Key Observations for Informed Decision-Making:

- The fact that nearly three-quarters of the monitored waterpoints are completely dry is an alarming indicator. This signifies an extreme water shortage, making it difficult for both human and livestock consumption.
- The complete absence of water points with over 80% capacity in 2026, compared to 18.51% in 2025, demonstrates a drastic depletion of water reserves. This suggests that even previously reliable water sources have been exhausted.
- While the percentage of waterpoints in "GOLD" condition has increased [see Figures 2 and 3], this could indicate that waterpoints are drying up, transitioning from "YELLOW" to "GOLD" before becoming dry. This further supports the argument that the water situation is worsening.

More recent climate outlooks from the 72nd GHACOF (January 2026) indicate continued rainfall variability across the Greater Horn of Africa, with mixed prospects for the March–May 2026 season. While some areas may experience near- or above-normal rainfall, significant uncertainty remains for southern Ethiopia and adjacent pastoral zones. This outlook suggests that, despite potential short-term improvements, drought risk is likely to persist in localized areas already experiencing severe resource depletion, reinforcing the need for sustained emergency support alongside longer-term resilience and rangeland recovery strategies.

The stark contrast between the water availability in January 2025 and January 2026 provides a clear and compelling case for the urgent mobilization of emergency resources. These observed patterns are consistent with GHACOF seasonal climate outlooks that indicated suppressed rainfall over southern Ethiopia during 2025. The close alignment between forecasted rainfall deficits and monitored waterpoint collapse highlights the value of integrating regional climate outlooks with operational early warning systems to inform anticipatory and emergency response decisions. The data highlights a rapid decline in water resources within a single year, emphasizing the escalating severity of the drought.

4.0 Pasture Conditions

4.1.Pasture condition comparison in January 2025 and January 2026

The data indicate a substantial deterioration in pasture conditions from January 2025 to January 2026. The impact of prolonged dry seasons and increased grazing pressure has led to more severe conditions in 2026, ultimately affecting livestock health and pastoralist livelihoods.

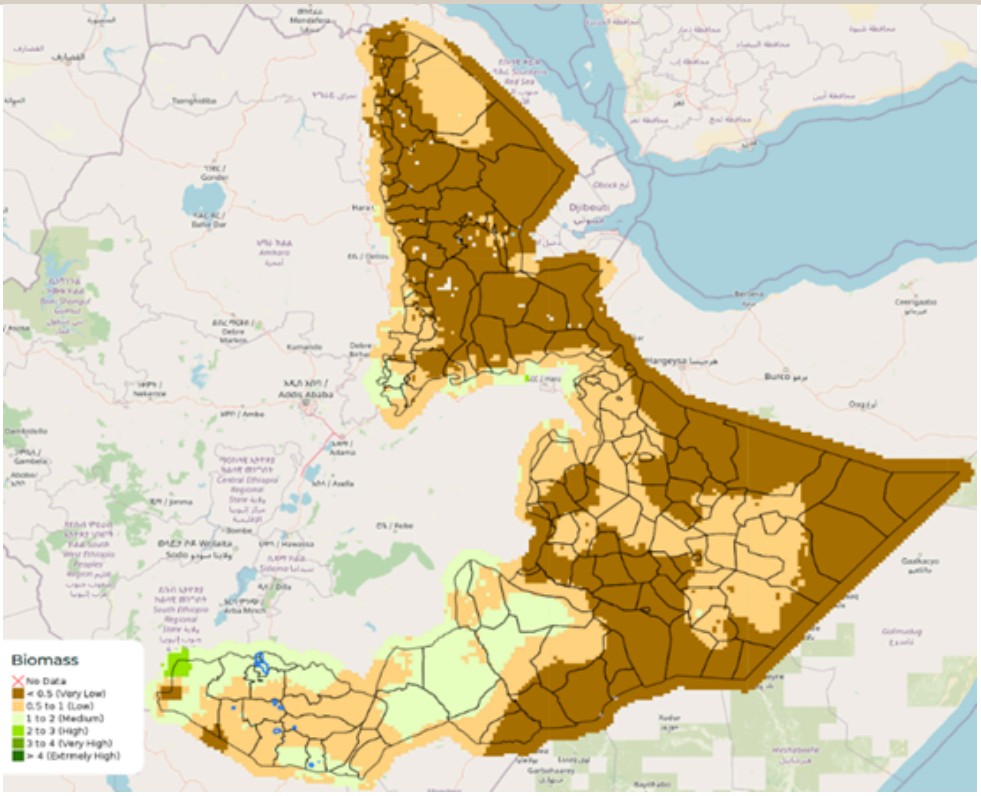

Figure 4. Pasture condition in January 2025

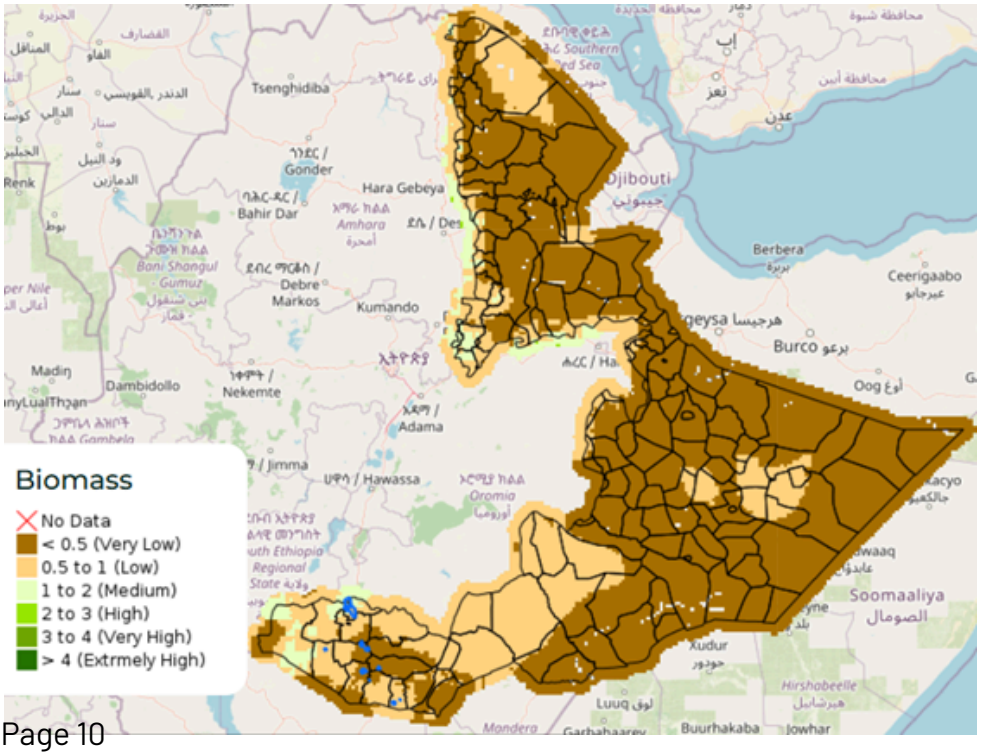

Figure 5. Pasture condition in January 2026

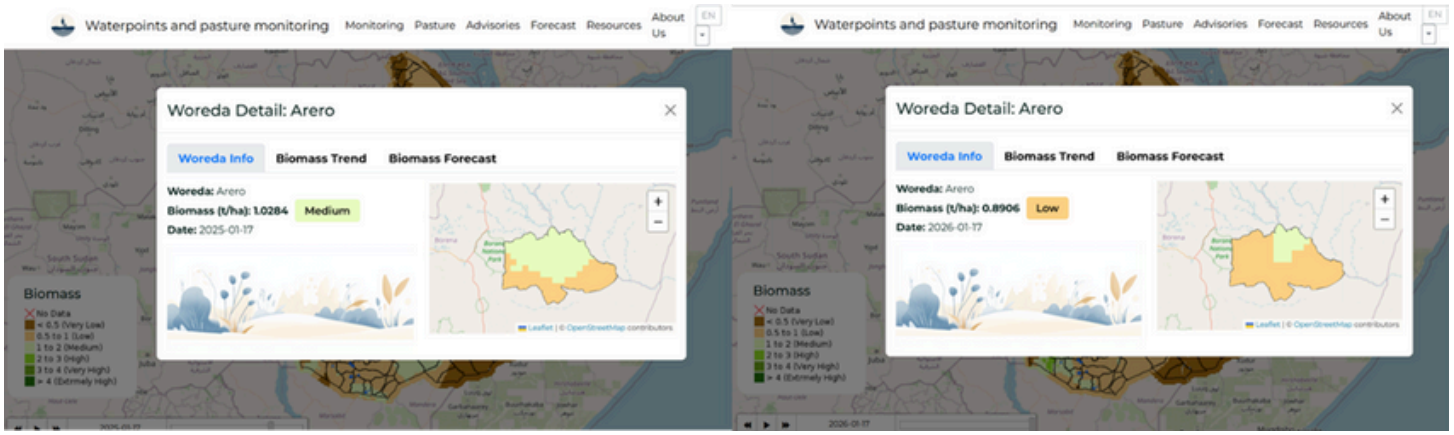

Figure 6. Pasture condition of Arero woreda in January 2025 (figure a) and January 2026 (figure b)

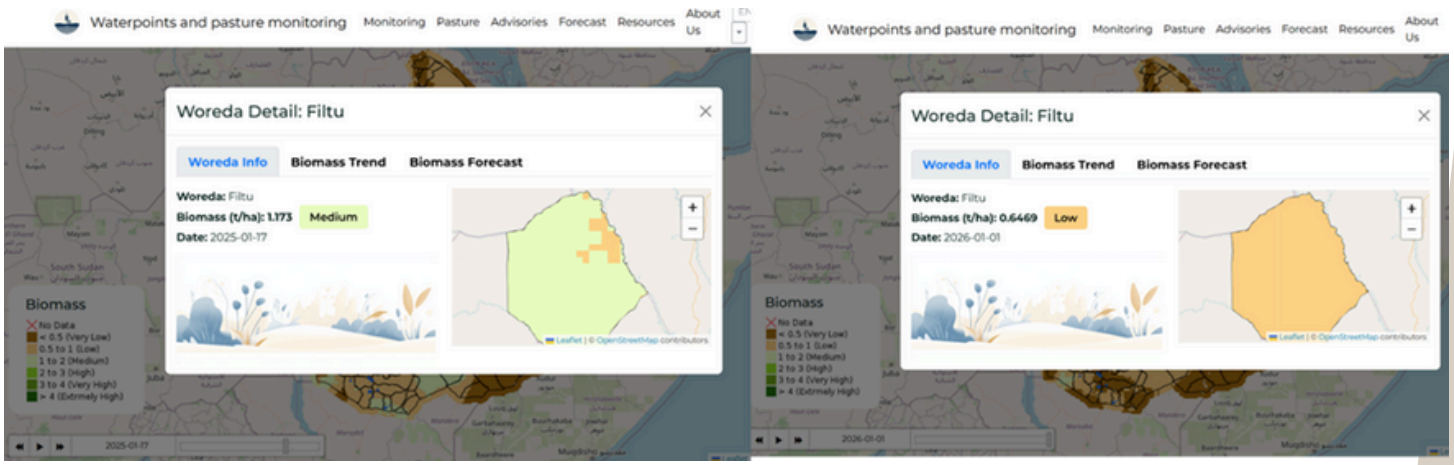

Figure 7. Pasture condition of Filtu woreda in January 2025 (figure a) and January 2026 (figure b)

Figures 5 - 7 present the results of the trend analysis of pasture availability and conditions. As shown in Figure 8, there was a statistically significant difference in pasture amount (t/ha) between January 2025 and January 2026 in both woredas. Compared to January 2025, in January 2026, pasture availability declined markedly from a medium level to a low level. This indicates a clear shortage of pasture availability in January 2026. The observed downward trend suggests increasing stress on grazing resources, likely affecting livestock productivity and livelihoods. Therefore, the findings highlight the need for urgent and timely interventions to prevent further degradation and to support sustainable pasture management in the affected areas.

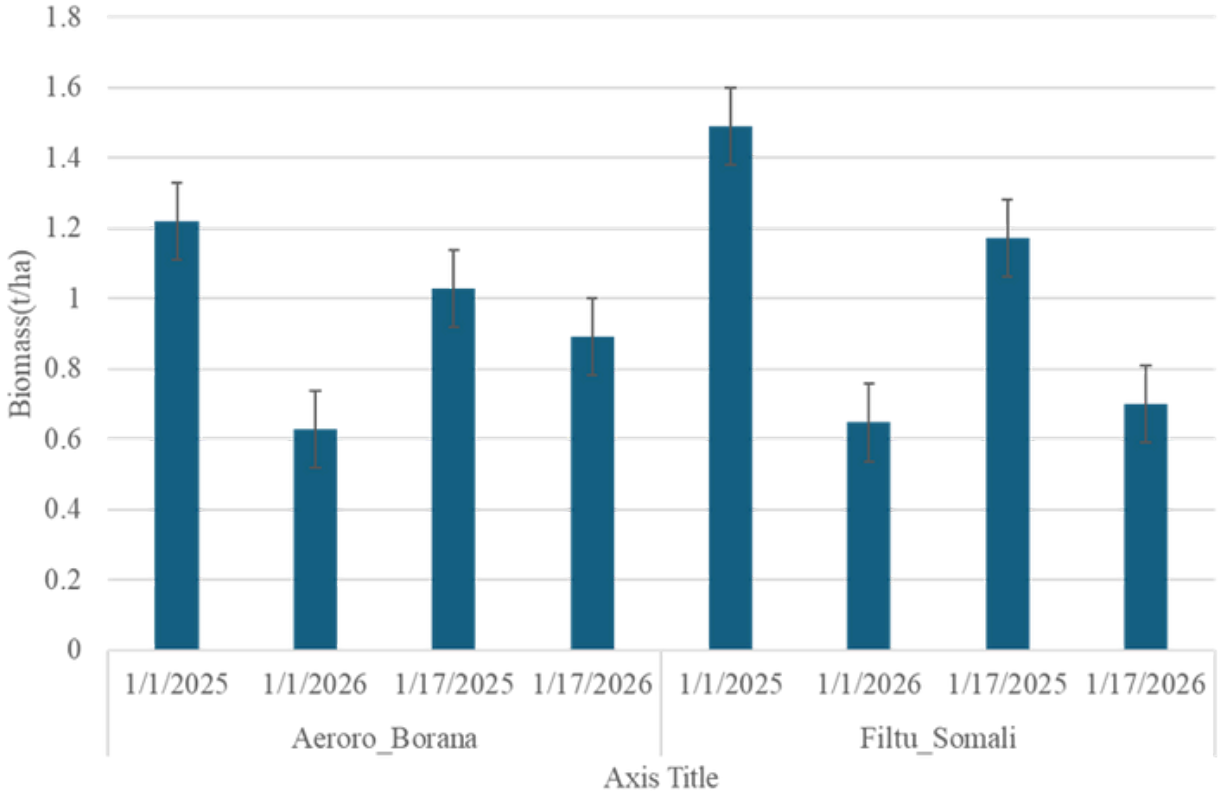

Figure 8. Analysis of pasture availability and condition between January 2025 and January 2026

4.2 Trend Analysis

Trend analysis (Figures 5–8) shows a statistically significant decline in pasture biomass (t/ha) between January 2025 and January 2026 in both woredas. Key observations include:

- Transition of areas from medium to low or very low biomass levels.
- Over 85% of lowland regions now exhibit very low pasture (<0.5 t/ha), compared to 70% in January 2025.
- Downward trends indicate growing stress on grazing resources, likely affecting livestock productivity, mobility, and overall pastoralist livelihoods.

Key Observations for Informed Decision-Making

- Over 85% of lowland regions now demonstrate very low pasture conditions (less than 0.5 tons/ha), showing a significant increase from 70% in the previous year. This highlights that the vast majority of the region's pasture is critically underperforming.

- In January 2025, most areas in the Borana zone exhibited pastures in the medium condition (1-2 tons/ha). By January 2026, these areas have transitioned to low (0.5-1 tons/ha) or even very low conditions [see Figures 4 and 5]. This degradation raises alarm about the availability of food for livestock.

- The increasing pressure on grazing lands and diminishing pasture health have dire consequences for livestock body conditions. With more areas reporting deteriorating health, the overall productivity of livestock, including milk yield and market value, is likely to decline, pushing pastoralist communities into precarious situations.

- The cumulative effects of drought have amplified grazing pressure as pastoralists are forced to rely heavily on dwindling resources. This not only impacts livestock health but can also lead to conflicts as communities compete for the last available grazing spots.

- The worsening pasture conditions directly threaten food security for pastoralists, as less nutritious pasture leads to livestock losses, which in turn affect household sustenance and economic stability. Emergency food assistance may be necessary to alleviate immediate hunger and malnutrition within these communities.

- Knowing that most parts of the Borana zone exhibit low pasture conditions can help direct emergency interventions to where they are most needed. Specific geographic data can support efficient resource allocation.

- The stark contrast between the pasture conditions in January 2025 and January 2026 provides a compelling case for emergency intervention. Immediate action is crucial to mitigate risks associated with livestock losses and subsequent livelihoods for pastoral communities.

5.0 Implications for Livestock and Pastoralist Livelihoods

The concurrent deterioration of waterpoint functionality and pasture biomass represents a compound ecological and socio-economic stressor in the lowlands of Ethiopia. The observed declines have several interrelated implications:

5.1. Livestock Health and Productivity

- Reduced water availability and forage biomass directly compromise livestock body condition, milk yield, reproductive performance, and growth rates.
- Prolonged exposure to nutritional stress can lead to increased susceptibility to disease, higher mortality, and lower market value of livestock assets.

5.2. Pastoral Mobility and Resource Access

- Scarce water and pasture resources are likely to induce longer migration distances and extended grazing cycles, increasing livestock energy expenditure and reducing feed conversion efficiency.
- Altered mobility patterns may concentrate livestock in limited resource areas, exacerbating localized overgrazing and rangeland degradation.

5.3. Food Security and Livelihood Vulnerability

- Livestock losses and reduced productivity directly impact household food security, income generation, and economic resilience.
- Reduced access to animal-source foods (milk, meat) increases nutritional vulnerability, particularly for women and children.

5.4.Resource-Based Conflict and Social Stress

- Concentration of pastoral activity around remaining waterpoints and productive pastures increases the risk of competition and conflict between households or communities.
- Socio-economic pressures may lead to maladaptive coping strategies, such as early livestock sales, distress migration, or reliance on unsafe water sources.

Overall, the observed ecological stress translates into a multi-dimensional threat to pastoralist systems, where environmental, economic, and social vulnerabilities are tightly interconnected. These findings highlight the urgency of integrated interventions targeting both resource management and community resilience.

6.0 Recommendations for Emergency Response and Resilience

Based on the observed water and pasture trends, the following recommendations are proposed:

6.1 Immediate Emergency Interventions

- Targeted Water Supply: Deploy water trucking and rehabilitate critically dry waterpoints to ensure immediate access for livestock and communities.
- Livestock Fodder Provision: Provide supplementary feed and fodder in areas where pasture biomass is critically low to mitigate weight loss, maintain milk production, and reduce mortality.
- Emergency Food Assistance: Implement targeted food support for vulnerable households to buffer against nutritional deficits induced by livestock losses.

6.2 Early Warning and Monitoring

- Data-Driven Decision Making: Strengthen integration of rangeland monitoring outputs into district and regional planning for anticipatory action.
- Capacity Building: Train local authorities and pastoralist community representatives in interpreting monitoring data for timely response and adaptive grazing decisions.
- Threshold-Based Triggers: Develop actionable early-warning thresholds (e.g., % dry waterpoints, biomass t/ha) to guide pre-emptive interventions before resource collapse.

6.3 Medium- and Long-Term Resilience Measures

- Sustainable Rangeland Management: Promote rotational grazing, reseeding of degraded pastures, and protection of critical grazing corridors to maintain biomass regeneration.
- Water Infrastructure Investments: Develop drought-resilient water storage and supply systems, including boreholes, small dams, and rainwater harvesting, to reduce vulnerability to dry seasons.
- Diversification of Livelihoods: Encourage complementary income-generating activities (e.g., small-scale agriculture, value-added livestock products) to reduce dependence on highly variable natural resources.
- Integration with Climate Risk Planning: Align resource management, early-warning data, and emergency preparedness with broader climate adaptation strategies to enhance long-term system resilience.

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