

Indigenous Weather Forecasting Methods among the Kikuyu Community of Kenya

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Abstract

Purpose: This study aimed to identify and document the indigenous knowledge used by the Kikuyu community of Kenya to forecast weather events.

Methodology: The study involved farmers and agricultural officers from Murang'a, Kirinyaga, and Nyeri counties. The study used a convergent parallel mixed-methods approach, underpinned by a pragmatic paradigm. Stratified sampling and simple random sampling were used to select farmers, while agricultural officers with relevant knowledge were selected using purposeful sampling. Questionnaires were administered to 383 farmers, of whom 326 were duly filled out. Qualitative data were analysed using content analysis, while quantitative data were analysed using descriptive statistics in SPSS, and the results were presented in figures and tables.

Findings: The study revealed that the Kikuyu community uses a diverse range of weather forecasting indicators. The most frequently mentioned signs of impending rainfall were heavy, dark clouds (82% of respondents), frog croaking (76%), thunder (74%), and an unusual temperature increase (70%). For predicting dry weather, the most common indicators were persistent clear skies (85%), high daytime temperatures (79%), and constant morning dew (72%). Indicators such as heavy, dark clouds, thunder and lightning, and persistent clear skies were rated highly accurate, with mean scores above 4.5 on a 5-point scale. Collaborative platforms and structured training programs were recommended for enhancing knowledge sharing and weather forecasting.

Implications: The study enriches understanding of indigenous weather forecasting by documenting diverse Kikuyu indicators and demonstrating their reliability alongside scientific methods. Grounded in the theory of knowledge pluralism, it shows that integrating indigenous and scientific knowledge can enhance weather forecasting, support policy development, and preserve traditional wisdom for future generations.

Originality: This study makes an original contribution by documenting previously underexplored indigenous weather-prediction knowledge among the Kikuyu community in Kenya, thereby enriching the understanding of indigenous knowledge systems.

Keywords

Indigenous knowledge systems, traditional weather forecasting, weather prediction methods, climate change adaptation, and climate change.

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Background to the study

Indigenous knowledge encompasses the place-based philosophies, understandings, skills, and problem-solving strategies developed by local communities through sustained interaction with their natural environments (Cajete, 2020; Sioui, 2022; Thakur et al., 2020). According to Mbah et al. (2021), indigenous knowledge emerges from long-term engagement with nature. This knowledge informs practices in social, spiritual, and environmental domains, including weather forecasting (Ford et al., 2020). Within Local and Indigenous Knowledge Systems (LINKS), traditional weather forecasting knowledge stems from keen observations of ecological indicators (Mbewe, 2019). These indicators, which range from plant and animal behaviours to environmental changes, signal impending rainfall and dry weather events (Rankoana, 2022).

LINKS, as observed by Lam et al. (2020), represent comprehensive knowledge systems that have evolved without influence from scientific weather forecasting. Over the years, indigenous knowledge systems have addressed diverse societal needs among many communities, particularly farmers (Baskin, 2022). These systems have evolved over centuries to address needs ranging from agriculture and medicine to spiritual practices and environmental management. Indigenous knowledge fosters comprehensive approaches for understanding weather patterns, which are

critical for survival and livelihoods (Baskin, 2022). The resilience of this knowledge lies in its adaptability and transfer across generations, often orally.

Indigenous weather forecasting relies on place-specific observations and experiential learning. African communities, for instance, have historically used ecological indicators to predict weather events, thus enabling proactive responses to environmental challenges (Lam et al., 2020). Today, indigenous knowledge systems remain vital, particularly in regions where access to modern meteorological technologies remains limited. Their enduring relevance is evident in their application to contemporary issues, such as climate change (Baskin, 2022). Indigenous knowledge plays a vital role in climate change adaptation (Cinner et al., 2018; Reckien et al., 2018; Seddon et al., 2021). Despite perceptions of being outdated, it enhances decision-making and mitigates climate change impacts (Mokhutso, 2021; Oyeshile, 2021).

Scientific weather forecasting information is typically disseminated through the mass media, mobile apps, and government services (Sansa-Otim et al., 2022). However, local communities, especially in Africa, face limited access to such information due to inadequate infrastructure and low internet penetration (Leal Filho et al., 2022). Subsequently, they use inherited knowledge passed down through generations to anticipate weather events. For example, many Kenyan communities have

long employed indigenous knowledge to accurately predict rainfall, floods, and droughts (Ochieng et al., 2021). As documented by Ombati (2021), some communities perform rituals, such as sacrifices led by spiritual leaders, to avert adverse weather events predicted through observation. This reflects the integration of cultural and environmental knowledge.

Indigenous knowledge offers valuable insights for predicting weather and addressing the impacts of climate change (Salick & Ross, 2018; Wyllie de Echeverria et al. & Thornton, 2019). However, its application in weather forecasting remains underexplored in Africa (Leal Filho et al., 2022; Nyadzi et al., 2021). In Kenya, there is limited documented evidence on how local communities, including farmers, use traditional knowledge to predict weather events (Leal Filho et al., 2022; Radeny et al., 2019). Subsequently, this study sought to examine indigenous weather-forecasting knowledge among the Kikuyu community in Kenya, document it, and thereby preserve its value.

Rationale of the Study

Communities can benefit from indigenous knowledge by integrating traditional weather forecasting methods into climate responses. Unfortunately, documentation on traditional weather prediction is scanty (Leal-Filho et al., 2022; Radeny et al., 2019). This is perhaps because indigenous knowledge of weather

forecasting has been gradually declining and degrading due to factors such as education, technology, religious teachings, and the widening generation gap (Guye et al., 2022). The situation seems widespread in Africa. For example, Nyadzi et al. (2021) found that indigenous farmers in Africa have used local knowledge to devise climate change adaptation strategies, including early warning systems for weather changes and farm management practices. They also found that traditional knowledge is slowly disappearing due to modernisation, shifting religious beliefs, changing landscape, and rural-urban migration. The study recommended proper documentation of indigenous knowledge while preserving its unique features, distinguishing it from other types of knowledge.

Another study by Radeny et al. (2019) revealed that indigenous knowledge plays a key supporting role in local weather forecasts and in understanding seasonal climate variability, particularly when downscaled, location-specific forecasts are unavailable. They, however, found that indigenous knowledge of weather forecasting is insufficiently documented. The study noted that the progressive loss of traditional knowledge threatens the ability of farmers in rural and remote areas in Uganda, Tanzania, and Ethiopia to cope with weather variances and adapt to climate change. They recommended documenting traditional knowledge

systematically to preserve its value. Documentation can enhance the understanding of indigenous knowledge practices and promote their use in climate change adaptation and mitigation (Nyadzi et al., 2021). Recent studies in Kenya on indigenous weather-forecasting knowledge have revealed that its documentation is limited (Adero et al., 2024; Kilonzo, 2022; Mugi-Ngenga et al., 2021; Raburu et al., 2024). If this knowledge is not systematically documented, it is at risk of being lost, thereby depriving future generations of its potential to enhance climate adaptation and resilience. This study sought to bridge the knowledge gap by exploring indigenous weather-forecasting knowledge among the Kikuyu community. The objectives of the study were to:

- i. Identify traditional weather forecasting indicators used by the Kikuyu community.
- ii. Document the indigenous weather and climate knowledge among the Kikuyu community.

Literature Review

Many communities worldwide use indigenous weather forecasting to make important farm-based decisions that help them adapt to and cope with climate change. Garay-Barayazarra and Puri (2011) investigated the traditional knowledge used by *Kenyah Badeng* farmers in Malaysia to predict weather and climate changes. They reported that locals forecast weather events by observing indicators such as

wind intensity, cloud cover, and temperature patterns. These observations inform the scheduling of agricultural activities such as planting, threshing, and drying. Indeed, the *Kenyah Badeng* people are among communities worldwide that preserve indigenous knowledge and leverage it to meet their weather-forecasting needs for climate change adaptation. The application of non-scientific weather-forecasting knowledge in the Global South has been identified among different communities, including farmers in Ghana (Nyadzi et al., 2021) and Ethiopian pastoralists (Balehegn et al., 2019).

In East Africa, previous research shows that indigenous knowledge is applied in weather and climate prediction by different communities (Auma, 2016; Nkuba et al., 2023; Orlove et al., 2010; Radeny et al., 2019). For instance, in Uganda, Orlove et al. (2010) found that local people use various observations, such as the presence of black clouds, thunder, and lightning, to foretell the onset of rains. Moreover, these locals complement this knowledge with scientific forecasts from local FM stations. Similarly, Salum et al. (2022) found that smallholder farmers in Tanzania use various local indicators to understand weather conditions and make appropriate decisions based on weather forecasts. Thus, the prediction of weather events using indigenous knowledge enhances farmers' capacity to adapt to climate variability and

improves the management of weather-related risks in farming.

While many African communities have been studied for their indigenous forecasting practices, research focusing on the Kikuyu community remains limited. However, available evidence demonstrates that Kikuyu farmers have historically relied on natural and spiritual indicators to predict rainfall and drought. According to Kwanya (2013), Kikuyu rainmakers traditionally observed ecological cues such as cloud formation, wind direction, and bird behaviour. Further, they complemented these observations with ritualistic rainmaking ceremonies designed to invite or avert rain. These practices reflect a holistic weather interpretation system that combines environmental observation with spirituality and communal decision-making.

Masinde and Bagula (2011) further emphasise the integration of African indigenous knowledge with scientific models through frameworks such as the Information Technology and Indigenous Knowledge with Intelligence (ITI KI). Their study revealed that communities in Kenya, including the Kikuyu, interpret signs like changes in insect activity, wind patterns, and animal movements to forecast droughts. Integrating these observations with digital forecasting systems enhances accuracy and builds community trust in weather information. Similarly, Rochlitz (2023) highlights that smallholder farmers in central Kenya blend experiential and scientific

knowledge when interpreting weather signs. This practice illustrates the continued relevance of Kikuyu ecological knowledge despite scientific advancements. This convergence of traditional and scientific approaches underscores the dynamic nature of Kikuyu indigenous weather forecasting, which merits systematic documentation and integration into modern meteorological frameworks.

It is worth noting that the shortcomings of scientific weather forecasting partly drive the adoption of indigenous weather forecasting for farm-level decision-making. Radeny et al. (2019) synthesised the existing indigenous knowledge of climate prediction in East Africa. They discovered significant gaps in scientific weather forecasting in East Africa. In particular, farmers do not receive location-specific, precise, user-friendly, and timely weather forecast information. They point out that the generalised nature of scientific weather forecasts makes them less effective for making farm-level decisions. Furthermore, they assert that farmers do not always consult weather forecasts when making farming decisions. As a result, farmers turn to indigenous knowledge of weather forecasting to assess and predict local weather conditions. These sentiments concur with those of Nkuba et al. (2023), who conducted a study in Uganda and reported that the use of scientific climate forecasts in the developing world remains low even though climate prediction has improved

over the years. They argue that modern weather forecasting systems lack the temporal and spatial specificity that local farmers need. Additionally, scientific climate forecasts cover broad geographic regions, so the predicted weather may occur only in some areas, not in all. They identify several factors contributing to the limited use of scientific weather forecasts. These include inadequate meteorological stations in Africa, dysfunctional stations, and a lack of trust that develops when predicted weather events do not occur. In light of the challenges of using modern weather forecasts, most farmers resorted to using traditional weather forecasting.

Nonetheless, indigenous knowledge of weather prediction is passed down orally from generation to generation. This suggests it is largely undocumented, which is a significant limitation to its effective preservation and future use. Radeny et al. (2019) argue that indigenous knowledge lacks systematic documentation because it is often shared orally, and thus it is lost when older generations pass away. This loss threatens farmers' ability to cope with and adapt to climate change. Balehegn et al. (2019) suggest that documenting traditional weather-forecasting knowledge can enhance its application and help identify ways to integrate it with modern weather-forecasting systems. Mugi-Ngenga et al. (2021) argue that indigenous knowledge held by the older

generation may be lost if it is not adequately documented. These sentiments align with those of Zachary et al. (2021), who investigated the application of traditional weather-forecasting knowledge by the Nganyi Community in Kenya. They reported that traditional knowledge can strengthen and improve modern weather and climate forecasts. However, this may not be realised if the knowledge remains undocumented.

From the foregoing, indigenous weather forecasting knowledge plays a critical role in predicting approaching rainfall and drought events. Moreover, existing literature emphasises the need to preserve indigenous weather forecasting knowledge by documenting it. This study addressed this gap by exploring traditional weather forecasting knowledge among the Kikuyu community in Kenya to identify and document it.

Theoretical Framework

This study was guided by the Theory of Knowledge Pluralism, which posits that there are multiple legitimate ways of knowing the world and generating knowledge (Harding, 1998; Longino, 2002). The theory recognises that different knowledge systems, including indigenous knowledge systems, contribute valid insights into understanding complex phenomena such as weather and climate variability. The theory advances several key tenets relevant to this study. First, the principle of multiple ways of knowing asserts that

knowledge can be obtained through diverse modes beyond formal scientific methods. These include historical, religious, aesthetic, and experiential ways of understanding. In this study, Kikuyu farmers acquire weather knowledge through prolonged observation of natural patterns, spiritual practices, and collective memory. All these constitute valid epistemic processes parallel to scientific meteorology.

Second, knowledge pluralism recognises the diversity of truths. It argues that different systems of knowing may produce different yet equally valid interpretations of the same phenomenon. For example, both meteorologists and the Kikuyu farmers may correctly predict rainfall, although through distinct interpretive frameworks. Each approach yields meaningful truth within its own epistemological boundaries. Third, the theory disapproves of reductionism, which seeks to explain all knowledge through a single, universal framework such as science. Instead, it promotes coexistence among various epistemologies. In this context, the study does not attempt to validate indigenous weather forecasting solely by scientific standards. Instead, it acknowledges its intrinsic logic, empirical grounding, and cultural coherence. Fourth, knowledge pluralism emphasises context-dependent validity. The credibility of knowledge can be influenced by its cultural and situational context. In the Kikuyu community setting, the accuracy and

usefulness of indigenous weather forecasting are understood within local ecological realities and community goals. Hence, indigenous knowledge remains valid and effective in guiding farming decisions in the central Kenya region.

By adopting the Theory of Knowledge Pluralism, this study affirms that indigenous weather forecasting among the Kikuyu community constitutes a rational and empirically grounded knowledge system. Therefore, this framework legitimises indigenous epistemologies and provides a philosophical foundation for their documentation, preservation, and integration with modern science.

Methodology

This study adopted a convergent parallel mixed methods design, which involved the simultaneous collection and analysis of qualitative and quantitative data. This design helped gain a comprehensive understanding of indigenous weather forecasting practices among the Kikuyu community. Quantitative data were collected through structured questionnaires administered to farmers, while qualitative data were gathered through interviews with agricultural officers knowledgeable about traditional forecasting methods. The integration of both data types enabled triangulation and validation of findings, ensuring a richer, more holistic interpretation of the indigenous forecasting

systems. The study was conducted in Murang'a, Kirinyaga, and Nyeri counties, where the Kikuyu community is predominant. The target population comprised Kikuyu farmers and agricultural officers with knowledge of indigenous weather forecasting. According to the Kenya National Bureau of Statistics (2019), the three counties had a total of 661,587 households (204,188 in Kirinyaga, 255,696 in Murang'a, and 201,703 in Nyeri). These statistics formed the sampling frame for selecting farmer respondents. To ensure adequate representation, stratified sampling was employed, with the three counties serving as strata. Each stratum consisted of all the households in the respective county. Next, the sample size formula for a finite population was used to determine a total sample of 383 households at 95% confidence and a 5% error margin. Then, for each stratum, a sample was proportionally allocated using the following formula:

$$n_{\text{county}} = \left(\frac{N_{\text{county}}}{N_{\text{total}}} \right) \cdot n_{\text{total}}$$

Where:

- n_{county} = Sample size for each county
- N_{county} = Total households in each county
- N_{total} = Total households in all counties
- n_{total} = Total sample size determined

Once the sample for each county was determined, simple random sampling was employed within each stratum to select households for inclusion in the study. From each selected household, the member actively

engaged in farming was purposively chosen for the sample. This approach minimised bias and ensured equal selection chances and adequate representation. Six (6) agricultural officers, two from each county, were purposively selected as key informants for the study to ensure they possessed relevant knowledge. Qualitative data were analysed using content analysis, while quantitative data were analysed through descriptive statistics using SPSS and presented in tables and figures.

Table 1: Samples of households by county

County	Households	Farmer sample size
Kirinyaga	204,188	118
Murang'a	255,696	148
Nyeri	201,703	117
Total	661,587	383

Findings of the study

Out of the 383 questionnaires that were administered to sampled farmers, 326 questionnaires were duly filled and returned, while 57 were not returned. This was a response rate of 85.1% which was considered adequate and suitable for data analysis according to Kothari (2004).

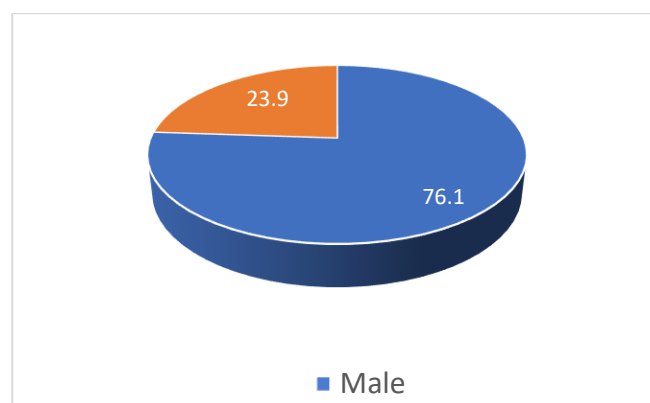


Figure 1: Respondents by gender

The majority of respondents were male (248, 76.1%), while 78 (23.9%) were female. This might be attributed to the fact that men

predominantly own farms in the Kikuyu community.

Table 2: Indigenous weather forecasting indicators for rainfall

<i>Indicator/Sign</i>	<i>Observation/Behaviour</i>	<i>Forecast Interpretation</i>	<i>Predicted Season/Event</i>
Wind	Easterly wind (blowing from east to west)	Imminent rainfall is expected as winds bring moisture-laden clouds.	Onset of the rainy season.
Ants	Movement of brown, black, and white ants on farms	Heavy rainfall is approaching, and ants are reacting to the humidity.	Preparation for planting as the rainy season approaches.
Crickets	Crickets clicking during the day and at night	Persistent rainfall is near; crickets signal moisture.	Start of prolonged wet spells.
Frogs	Frogs croaking in swampy areas	Rainfall is about to begin; frogs sense the presence of water.	Onset of rainfall and wet conditions.
Bird Migration	Migratory birds (Swallows) flying repeatedly	Seasonal rains are close, indicating migratory behaviour.	Start of the main rainy season.
Bird Noises	Birds are making much noise	Rainfall is imminent; birds sense environmental changes.	Sudden downpours or the onset of the rainy season.
Bird Nesting	Birds building nests	Continuous rains are expected as birds prepare for nesting.	Mid rainy season with consistent rains.
Clouds	Heavy dark clouds form in the north-eastern sky	Onset of rains within hours or days; localised storms.	Short-term rainy weather or storms.
Temperature Patterns	Unusual increase in temperatures (scorching sun in daytime)	Rainfall is likely soon; the heat is causing atmospheric instability.	Sudden thunderstorms or rainy onset.
Soil	The smell of soil is felt	Rainfall is imminent as soil moisture rises.	Beginning of the rainy season.
Moon	A dull or unclear moon was observed	Persistent rainfall expected; atmospheric humidity.	Rainy spells over several days.
Thunder and Lightning	Thunder and lightning experienced	Immediate rainfall; electrical activity signals moisture.	Heavy downpours or the beginning of rain.

Indigenous weather forecasting methods

An inquiry was made regarding the effects of reduced cloud cover on rainfall. The

respondents were asked to specify weather-forecasting indicators or signs, their associated behaviours, interpretations, and the

corresponding predicted seasons or events. The study revealed a variety of indicators used by the Kikuyu community to predict the onset of rainfall and related seasonal events. Easterly winds that blow from east to west are a reliable signal of the onset of the rainy season. These winds are believed to carry moisture-laden clouds. Insect behaviour also emerged as a key indicator. In particular, the movement of brown, black, and white ants on farms in response to humidity signals that the heavy rainfall season is approaching. This prompts the farmers to begin preparing for planting. The clicking of crickets during the day and night indicates the onset of prolonged wet spells. Similarly, frogs croaking in swampy areas is a precursor to rainfall. Migratory birds such as Swallows flying repeatedly signal the arrival of the main rainy season. Rainfall is imminent when birds are heard making loud noises since they sense environmental changes. Similarly, continuous rains are expected once birds are seen building nests. Furthermore, atmospheric and environmental changes enrich the Kikuyu community's weather forecasting methods. The formation of heavy dark clouds in the northeastern sky precedes localised storms or short-term rains.

An unusual increase in daytime temperatures indicates impending rainfall that thunderstorms may accompany. As one farmer stated:

“When the sky turns very dark toward the east, we know that a downpour is on the way. When we hear thunder rumbling amid the dark clouds, we know the rain is very close.”

Kirinyaga Farmer

The Kikuyu community also recognises that the rainy season is approaching when the smell of soil is felt. This earthy scent is released by soil-dwelling bacteria when the soil becomes moist, either from light rain or increased humidity. Astronomical observations, such as a dull or unclear moon, are linked to persistent rainfall due to high atmospheric humidity. The occurrence of thunder and lightning is recognised as a sign of immediate rainfall and the beginning of the rainy season. Table 2 summarises these findings. The key informants were asked to rate the farmers' feedback on rainfall predictions as poor, fair, good, or very good. A majority (66.7%) rated the feedback as good, while 33.3% rated it as very good.

Table 3: Indigenous weather forecasting indicators for dry weather

Sign/indicator	Behaviour/observation	Forecast interpretation	Predicted season/event
Clear sky	Persisting clear skies are observed	Onset of dry weather	Dry weather onset
Red-like sky at sunrise	Red or orange hues during sunrise	Dry weather expected	Dry weather onset
Shedding of tree leaves	Trees shedding a noticeable number of leaves	Dry weather expected	Dry weather onset
High daytime temperatures	Persistent high temperatures during the day	Dry weather expected	Dry weather onset
Morning dew or mist	Regular early morning dew or mist	Onset of dry season	Transition to dry season
Unusual coldness	Persistent cold temperatures at night	Cessation of rains	Transition to dry season
Northerly winds	Winds blowing from northeast to southwest	Dry weather expected	Dry spell onset
Strong winds	Noticeable increase in wind intensity	Onset of dry spell	Dry weather onset
Bees leaving hives	Swarms of bees leave hives and are seen repeatedly moving around	Cessation of rains	Transition to dry season
Movement of eagles	Eagles are observed flying frequently	Onset of the dry season	Transition to dry season
Reduction in water levels	Significant drop in river or swamp water levels	Dry weather is expected	Dry season onset

The respondents were also asked about their traditional weather signs for predicting the onset of a dry season. They were requested to indicate accompanying observations, interpretations, and expected weather events. A persistently clear sky, with no visible clouds during the day or night, is a reliable indicator for the Kikuyu community that dry weather is imminent. This observation signifies the absence of atmospheric moisture and a high-pressure system, often associated with the onset of a dry season. When the sky turns red or orange at sunrise, it is a sign of approaching dry weather. This phenomenon is linked to the scattering of sunlight by particles in a dry

atmosphere, often preceding prolonged dry spells. The shedding of tree leaves is a sign that a dry spell is approaching and a natural adaptation to conserve water during periods of limited rainfall. Persistent high daytime temperatures indicate the onset of dry weather. This results from reduced cloud cover, allowing more direct sunlight. When dew or mist is consistently observed early in the morning, dry season is imminent. This phenomenon occurs due to reduced moisture in the air. Prolonged nights with clear skies and freezing temperatures are interpreted as a signal that the rainy season has ended. This sudden drop in temperature is believed to

occur as the atmosphere stabilises, marking the end of the rainfall season. Winds blowing from the northeast to the southwest are a strong indication of approaching dry weather. Similarly, strong gusty winds are observed as a precursor to the dry season. The activity of bees leaving their hives in significant numbers is viewed as a sign of the cessation of rains. Bees, being sensitive to environmental changes, provide the Kikuyu community with early warning of the dry spell. Eagles seen flying more frequently and prominently in the sky are linked to the onset of the dry season. This behaviour is thought to be linked to the birds' instinctive responses to environmental changes. A noticeable drop in water levels in rivers and swamps also serves as a clear indication of the impending dry season. This observation reflects reduced rainfall and increased evaporation rates. Table 3 summarises these findings. One farmer highlighted:

“When the sky stays clear for many days and the nights become very cold, we know the rains are over. Some trees begin to shed their leaves, and we see swarms of bees moving around — that is how we know the rainy season has ended.” **Nyeri Farmer**

When the key informants were asked to rate the farmers' feedback regarding predictions for the dry season, 16.7% rated it good, while the majority (83.3%) rated it very good.

Accuracy of Indigenous weather forecasting indicators

An inquiry was made regarding the accuracy of indigenous knowledge indicators for predicting rainfall and dry-weather events. The respondents had several options, ranging from very accurate to very inaccurate. The mean accuracy score for each indigenous knowledge indicator was calculated from participants' responses.

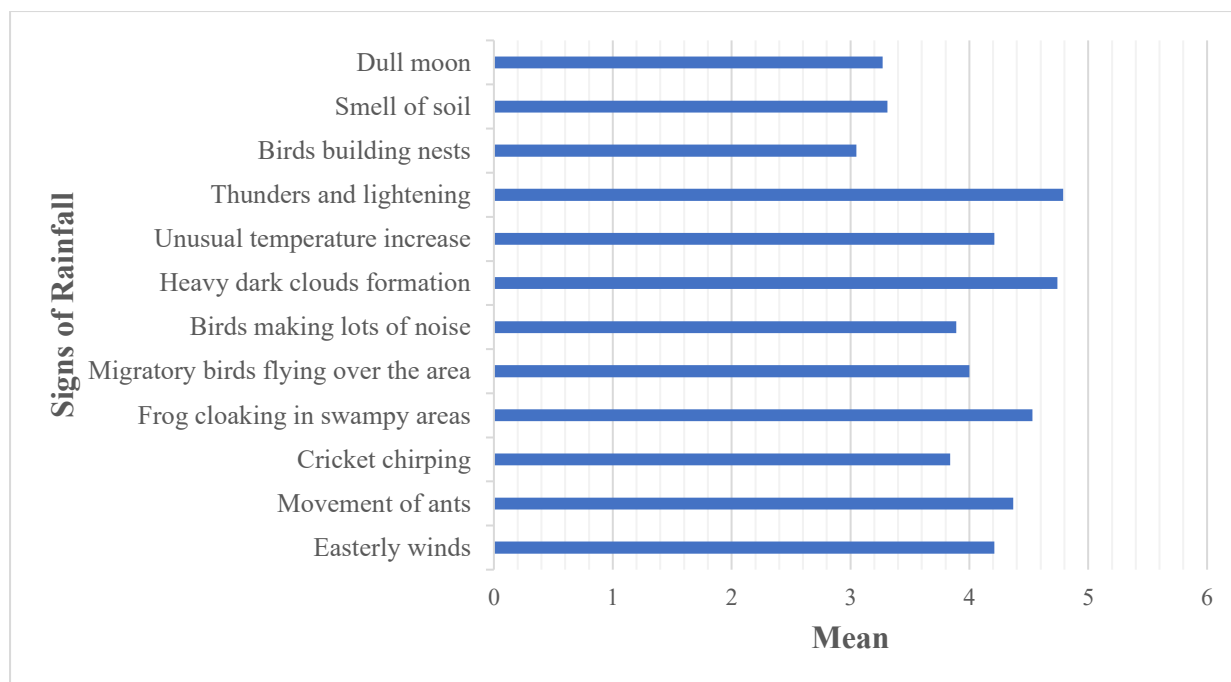


Figure 2: Accuracy of IK indicators in predicting the onset of the rainy season

The findings on the accuracy of rainfall prediction signs, as presented in Figure 2, showed that thunder and lightning (4.79), movement of ants (4.37), easterly winds (4.21), unusual temperature increase (4.21), heavy dark clouds formation (4.74), and frog croaking in swamps (4.53) were very accurate. This signifies a strong reliability of these indicators in forecasting rainfall. Further, the

findings showed that bird noises (3.89), cricket chirping (3.84), and the flight of migratory birds (4.0) were considered accurate. Birds building nests (3.05), soil scent (3.31), and dull moon (3.27) were regarded as moderately accurate. Indeed, one farmer explained:

“When the soil gives off that strong smell and the moon looks dull, we know rain is coming, though these days it may delay or fall in small amounts.” **Murang’a Farmer**

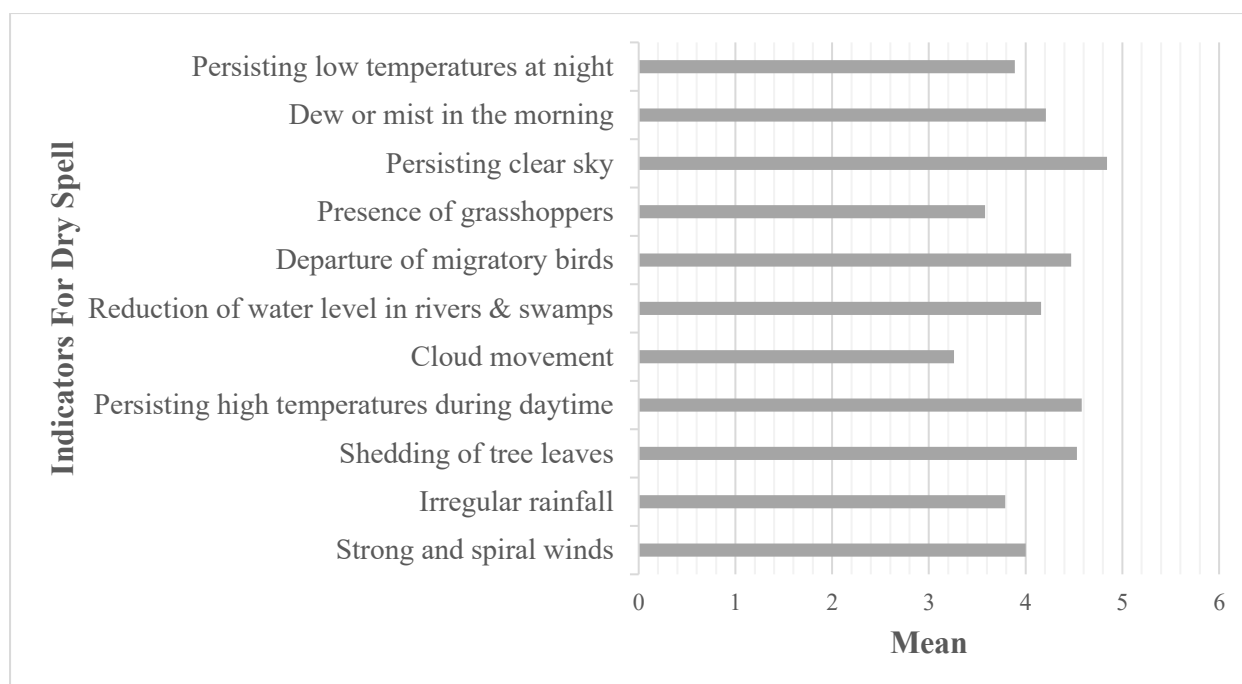


Figure 3: Accuracy of IK indicators in predicting the onset of the dry season

Regarding the accuracy of indigenous weather prediction indicators for dry weather, persistent clear skies (4.84), morning dew (4.21), persistent high daytime temperatures (4.58), migratory birds' departure (4.47), and trees shedding leaves (4.53) were considered very accurate. These findings indicate that the Kikuyu community has a greater trust in these indicators when used to predict dry weather. Strong and spiral winds (4.0), irregular rainfall (3.79), reduction of water level in rivers & swamps (4.16), presence of grasshoppers (3.58), and persisting low temperatures at night (3.89) were rated as accurate. At the same time, cloud movement (3.26) was moderately accurate. Figure 3 presents a summary of these findings.

The key informants were requested to respond to the feedback from the Kikuyu community

farmers regarding the accuracy of various traditional weather prediction indicators. All the informants opined that the formation of heavy, dark clouds; thunder and lightning; frog croaking in swamps; easterly winds; ant movement; and an unusual increase in temperature were highly accurate predictors of rainy weather events. Similarly, they concurred that persistent high daytime temperatures and clear skies, trees shedding leaves, morning mist or dew, and the departure of migratory birds are very accurate signs of an approaching dry spell. The informants were also asked to explain why some indicators had reduced accuracy. The majority (66.7%) attributed the moderate accuracy of certain indicators to ecological factors, such as climate variability, habitat changes, and regional differences, while 33.3% highlighted behavioural factors, including changes in animal behaviour and

human interference. One agricultural officer stated:

“Some signs are no longer as reliable as before because the weather keeps changing. Even the birds and insects behave differently since their habitats have been disturbed. Long ago, we could tell when the rains were nearby by watching their movements, but now, sometimes the signs appear, and the rains fail to come, or they come when we least expect.”

Kirinyaga Farmer

Indigenous weather forecasting knowledge and climate change

The respondents were asked whether they had noticed changes in weather patterns over the past few years. All the respondents acknowledged changes in climatic conditions. This response indicated widespread awareness of climate change among farmers. Regarding whether traditional weather-forecasting knowledge helps cope with climate change, all respondents indicated that it was beneficial. Hereunder is a verbatim statement that summarises the opinion of the respondents on this issue:

“It is indeed useful as it helps to prepare for the upcoming weather. For example, we can use it to know when to prepare the land for planting.” **Nyeri Farmer**

Discussion of the findings

The study revealed that the Kikuyu community employs diverse environmental, animal, and atmospheric indicators to predict

both rainfall and dry weather. The most frequently cited rainfall indicators were heavy dark clouds (82%), frog croaking (76%), thunder and lightning (74%), movement of ants (70%), and an increase in temperature (68%). Regarding dry-weather prediction, respondents mentioned persistent clear skies (85%), high daytime temperatures (79%), and constant morning dew (72%) as key indicators. These results affirm that traditional forecasting among the Kikuyu is systematic and evidence-based, relying on observable ecological patterns. While similar indicators have been reported in Southern Africa (Jiri et al., 2016) and Ethiopia (Balehegn et al., 2019), this study uniquely quantified the perceived accuracy of each indicator, showing that some (e.g., thunder and lightning, heavy clouds, clear skies) scored above 4.5 out of 5 in reliability. This empirical validation strengthens the case for integrating indigenous indicators with modern meteorological systems — an approach that has not been widely documented in previous Kenyan studies.

The study documented a rich body of indigenous knowledge among the Kikuyu people that connects environmental signs with weather outcomes. This knowledge is transmitted through generations and remains central to local agricultural planning. For instance, the community associates the smell of soil and bird nesting with the onset of rainfall, while the frequent flight of eagles and the shedding of tree leaves signal the approach

of a dry spell. This documentation provides new contextual insights specific to the Kikuyu people of Kenya. Historically, they have been underrepresented in literature on indigenous weather prediction in Kenya. Unlike studies focusing on pastoralist or coastal communities (e.g., Ochieng et al., 2021; Raburu et al., 2024), this research captures the highland-based, crop-farming perspective. Additionally, it demonstrates that even within Kenya, indigenous forecasting practices vary based on geography, ecology, and culture. Furthermore, respondents indicated that despite modernisation, these indicators remain highly trusted and accurate. These findings challenge the assumptions that indigenous knowledge is outdated and instead show that it is relevant and can complement scientific forecasting.

While previous research across Africa has identified indigenous forecasting indicators, this study provides a localised empirical account of the Kikuyu community's forecasting system. The account includes specific indicators, their accuracy ratings, and frequency of use. By doing so, it contributes to the validation of traditional weather forecasting indicators and demonstrates how they can enhance localised climate adaptation strategies. The study also underscores the need for systematic documentation to safeguard indigenous weather knowledge from erosion due to modernisation and generational gaps.

Conclusion

This study demonstrates the vital role played by indigenous knowledge in predicting weather events among the Kikuyu community. Observations of easterly winds, movement of ants, cricket clicking, singing and nesting of birds, frog croaking, presence of swallow birds, thunder and lightning, heavy dark clouds, and unusual temperature increase indicate that rainfall is approaching. The signs of dry weather are persistent clear skies, trees shedding leaves, consistently high daytime temperatures, reduced water levels, regular morning dew, cold nights, and eagles flying frequently in the area. The application of these indicators of indigenous weather forecasting underscores the essential role of this knowledge in agricultural planning.

Recommendations

Based on the study's findings, the indigenous methods of weather forecasting are still valuable. Acquiring this knowledge is of benefit to farmers and agricultural departments, especially in a modern era characterised by climate variability. The study therefore recommends:

1. **Broaden Documentation Efforts**

Similar documentation efforts should be carried out among other Kenyan communities. This will help build a national repository of indigenous weather forecasting knowledge. Such work is vital for preserving this heritage and

promoting its use in climate adaptation initiatives.

2. **Integration with Modern Forecasting Methods**

Traditional and modern forecasting systems should be integrated to improve accuracy and local relevance. The Kenya Meteorological Department should partner with indigenous knowledge holders to identify and validate reliable traditional indicators. This collaboration will strengthen local forecasting and support informed decision-making.

3. **Policy Recognition and Support**

Policy makers should recognise the value of indigenous forecasting knowledge. Including it in climate and agricultural policies will enhance sustainability and community ownership. Such recognition ensures that traditional practices remain part of long-term climate adaptation strategies.

4. **Capacity Building and Knowledge Transfer**

Farmers, especially the youth, should be trained on both traditional and modern forecasting methods. This will promote the transfer of indigenous knowledge to future generations. It will also strengthen community resilience to climate variability and improve farm-level planning.

Implications of the Study

The study contributes to the body of knowledge on indigenous weather forecasting methods by demonstrating how they are used among the Kikuyu community of Kenya. It supports the theory of knowledge pluralism and epistemological diversity by showing that indigenous weather forecasting methods can align with scientific methods, thereby leading to a balanced weather forecasting model. The study documented the diverse weather-prediction indicators used by the Kikuyu community in Kenya. The identification of these indicators highlights the reliability of indigenous knowledge and challenges conventional assumptions that disregard it. These indicators can complement scientific weather forecasting, especially in areas with limited access to modern meteorological services. The study's findings enrich the discourse on integrating scientific and indigenous knowledge for improved weather forecasting models. Additionally, the study promotes the preservation of indigenous knowledge, thus facilitating its transfer to future generations. The findings provide insights to policymakers on the potential of integrating modern and traditional weather prediction methods and enhancing weather predictions for farming and resource management.

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