Perceptions of Drought Risk Management in Zambia: Reflections from the Historic 2023/2024 Drought

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ABSTRACT

Drought risk management depends not only on understanding the physical characteristics of drought but also on how drought is experienced, interpreted, and anticipated by affected institutions and communities. This study examines perceptions of drought and their implications for risk management in Zambia using the severe 2023/2024 drought as a case study. Guided by Taylor's perception framework encompassing experience, memory, definition, and expectation, semi-structured interviews were conducted with 153 participants, including 67 district government officials and 86 sector representatives across 31 districts in all 10 provinces of Zambia.

Findings reveal broad agreement regarding the severity of drought impacts, but important differences in how drought was recognized and understood across governance levels. While 87.2% of sector representatives and 80.6% of district officials reported drought impacts, participants in some districts classified nationally as unaffected described substantial agricultural, water, energy, and livelihood impacts. National institutions primarily characterized drought using meteorological and hydrological indicators, whereas district officials incorporated observed community impacts and sector representatives largely defined drought through disruptions to livelihoods and sectoral activities. Differences were also evident in expectations for future drought. While 100% of national government officials expected drought frequency and severity to increase, this expectation was shared by 77.6% of district officials but only 17.4% of sector representatives, revealing a substantial gap in perceptions of future drought risk across governance levels.

These findings demonstrate the importance of integrating scientific indicators with local and sector-specific knowledge. Strengthening participatory monitoring, climate communication, vulnerability assessment, and locally grounded preparedness could help Zambia transition from reactive drought response toward more proactive and integrated management of drought risks.

SIGNIFICANCE STATEMENT

Drought management is most effective when scientific information reflects how drought is experienced by the people and sectors affected. This study shows that perceptions of drought in Zambia differ across national institutions, district governments, and sectors, particularly in how drought is defined and how future risk is understood. These differences can influence monitoring, early warning, preparedness, and decisions about when and where action is needed. The findings highlight the importance of combining meteorological and hydrological information with local knowledge and sector-specific impacts. Strengthening communication and participation across governance levels can support more locally relevant, proactive, and inclusive drought risk management in Zambia and other drought-prone, resource-constrained settings.

1. Introduction

Drought is one of the most economically and environmentally consequential climate hazards across the world, affecting hydrological systems, agricultural productivity, ecosystem health, and human livelihoods (Guastello et al., 2025; IPCC, 2023). In 2025, the Global Drought Outlook report reviewed that approximately 40% of the world's land area is currently exposed to increasingly frequent and severe drought conditions, with global drought losses projected to increase by at least 35% by 2035 and the average cost of drought events rising annually by 3-7.5% under continued global warming trends (OECD, 2025). Similarly, the Global Drought Hotspots Report (GDHR) identified such hotspots across multiple continents, highlighting the fact that drought impacts are prevalent across both developed and developing countries. In the Global South (particularly in eastern and southern Africa), the GDHR reviewed that over 90 million people faced acute hunger during the 2023-2024 drought, underscoring the profound humanitarian and food security consequences of water deficits (Guastello et al., 2025). Further, studies have shown that climate change has increasingly intensified drought risks and continues to do so by amplifying precipitation variability, accelerating evaporation, and reducing freshwater availability, thereby escalating risks to food, water, energy, and ecosystem security worldwide (Ayugi et al., 2022; Cai et al., 2025; Otkin et al., 2018).

While drought is a global phenomenon with far-reaching environmental and socioeconomic consequences, its causes, characteristics, and impacts vary significantly across regions depending on local climatic conditions, ecological systems, and socioeconomic vulnerabilities (Guastello et al., 2025). In Southern Africa, drought is among the most recurrent climate hazards and poses significant risks to food security, water resources, and economic stability (Cai et al., 2025; Guastello et al., 2025; Mwape et al., 2025).

Zambia, whose economy and livelihoods remain closely tied to hydropower, rain-fed agriculture and climate-sensitive natural resources, is particularly vulnerable to drought (Mwape et al., 2025). While most drought research in Zambia and the region has focused primarily on the physical and climatic dimensions of drought (Musonda et al., 2020; Ngoma et al., 2021; Sichingabula, 1998; Tendai Marima, 2016), little attention has been given to understanding how drought risks and management practices are perceived by the diverse stakeholders and communities affected by these events. This study contributes to drought policy and scholarship by examining sectoral, governmental, and stakeholder perceptions of drought in Zambia during the 2023-2024 severe drought event.

2. Background

a. Causes of Drought in Zambia

Understanding the climatic drivers and evolving risk dynamics of drought is important for informing effective drought preparedness, planning, and risk management strategies (Hayes et al., 2004; Wickham et al., 2019). In Zambia, drought risks are embedded within the broader climatology of Southern Africa, where drought is shaped by both natural climate variability and longer-term anthropogenic factors. At the immediate level, drought in Zambia is commonly triggered by below-normal rainfall, delayed onset of the rainy season, prolonged intra-seasonal dry spells, and poor rainfall distribution during the main growing season change (Ayugi et al., 2022; Sichingabula, 1998; Tendai Marima, 2016). These conditions produce seasonal or "flash" droughts when crops do not receive sufficient moisture within a single season, while longer-duration droughts emerge when rainfall deficits accumulate across seasons and reduce streamflow, reservoir storage, and soil moisture (Libanda et al., 2019; Ngoma et al., 2021). In the 2023/2024 season, these dynamics were strongly linked to the warm El Niño phase, which produced widespread dry conditions across Southern Africa; regional humanitarian reporting described the season as the driest in over 40 years, while Zambia itself was among the countries that declared a state of emergency (ACAPS, 2025; FAO, 2023; OCHA, 2024).

Although El Niño events depend on the state of the tropical Pacific climate, the literature does not seem to agree on whether climate change will alter the future frequency or severity of El Niño episodes due to the combined influence of internal climate variability and radiative forcings such as greenhouse gases (Goddard, 2011; Musonda et al., 2020; Nicholson, 1997; Vecchi & Wittenberg, 2010). Nevertheless, there is broad scientific agreement that radiative forcings, particularly greenhouse gas emissions, have continued to accelerate global warming, thereby increasing the likelihood and severity of drought events over time (Cook et al., 2019; Guastello et al., 2025; Tangney, 2020). At the continental scale, the IPCC likewise concludes with high confidence that under continued warming conditions drought frequency, duration, and severity will increase across large parts of Southern Africa, as higher temperatures intensify evapotranspiration and reduce soil moisture and water availability even where rainfall changes are modest (IPCC, 2023).

b. Drought Impacts in Zambia

In Zambia, drought is not only a precipitation problem; it is a coupled hydroclimatic and socioeconomic stressor. Given the country's high dependence on precipitation for agriculture and energy generation, any variation to seasonal precipitation causes significant impacts (Libanda et al., 2019; Ngoma et al., 2021; OCHA, 2024). As of 2024, over 80% of Zambia's energy mix is hydro-generated and over 90% of cultivation relies on seasonal precipitation (OCHA, 2024). This climate sensitivity is further compounded by rapid population growth, increasing water demands, and limited policy infrastructures for community level preparedness and planning (Mwape et al., 2025).

During the 2023/2024 El Niño induced severe drought, devastating impacts were reported from several provinces including Central, Eastern, Southern, and Western (Mwape, 2025; WFP, 2024; ZMD, 2024; ZNBC, 2025). Among these were areas considered as the country's main maize-producing areas, illustrating how climatic anomalies become national food and energy crises when they intersect with concentrated agricultural production and hydro-dependent infrastructure. In this sense, Zambia's drought risk resembles that of much of Southern Africa: El Niño-related rainfall deficits create the initial shock, but warming temperatures, high evaporative demand, and growing pressure on limited water resources intensify the scale, duration, and sectoral spread of impacts (Cai et al., 2025; Lottering et al., 2023).

The 2023/2024 drought event, named the worst in 40 years, was exceptional in both extent and severity (ZMD, 2024). Like many parts of the world, drought in Zambia has repeatedly produced severe agricultural and food-security impacts, historical records identify the 1991/1992 event as one of the country's worst droughts, with other notable drought episodes occurring in 1994/1995, 2004/2005, 2015/2016, and 2019/2020 (Kajoba, 1998; Libanda et al., 2019; Musonda et al., 2020). According to government reports, the 2023/2024 drought, however, affected 84 of Zambia's 116 districts, with the World Bank estimating that 9.8 million people were affected and 6.6 million required urgent relief (ZMD, 2024). At the farm level, the drought destroyed about 45% of maize hectarages planted, and subsequent assessments indicated that grain production fell by about 53% relative to the previous season, with the 2023/2024 harvest becoming the lowest in five years (Al Jazeera, 2024; Plan International, 2024). The Food and Agriculture Organization (FAO) reported that 1.8 million smallholder farmers were significantly affected (FAO, 2023). These production losses translated into a rapidly worsening food-security crisis: By August 2024, 5.83 million people were classified in Integrated Food Security Phase Classification Phase 3 (Crisis) or above, including 235,688 in Phase 4 (Emergency), while UNICEF projected that 51,103 children would experience severe wasting in 2024 (UN, 2024; UNICEF, 2024; WFP, 2024).

Health, natural-resource, and service-sector impacts of the 2023/2024 drought in Zambia were equally substantial and multi-layered. The drought coincided with the country's worst cholera outbreak in two decades, with over 21,000 cases and 700 deaths reported by March 2024, while ongoing water shortages heightened risks of diarrheal diseases and disrupted schooling for approximately 4.3 million children. At the same time, increased reliance on natural resources led to greater pressure on forests, including intensified fuel-wood collection and illegal timber harvesting. The tourism sector, particularly around the Victoria Falls/Mosi-o-Tunya system, was also affected as significantly reduced water flows (characterized by severe rainfall deficits and record-low river levels) threatened both ecosystem integrity and visitor experiences (FAO, 2023; UNICEF, 2024; WFP, 2024).

c. Drought risk management in Zambia

Drought risk management in Zambia is shaped by a combination of national policy frameworks, institutional arrangements, and local governance structures (such as districts), although, the drought literature consistently points to a gap between policy and implementation (Mwape et al., 2025; Ngoma et al., 2021; Wapamesa et al., 2026). At the national level, Zambia has established key institutions such as the Zambia Meteorological Department (ZMD), the Water Resources Management Authority (WARMA), and the Disaster Management and Mitigation Unit (DMMU), alongside policy instruments intended to support climate adaptation and disaster risk reduction (DRMD, 2026). These efforts broadly align with international frameworks such as the Integrated Drought Management Programme (IDMP), which emphasizes early warning systems, vulnerability and impact assessment, and mitigation and response (IDMP, 2013). In the region, Zambia has some of the best national policies and institutional frameworks for managing drought. However, empirical evidence suggests that these systems are often centralized and insufficiently translated into district-level planning, limiting their effectiveness in proactively addressing localized drought risks (Banda et al., 2022; Mwape et al., 2025; Ngoma et al., 2021).

Across the literature, Zambia's localized drought management approach is widely characterized as reactive, with interventions largely triggered by crisis events rather than guided by anticipatory, proactive, and risk-based planning (Banda et al., 2022; Mwape et al., 2025; Wapamesa et al., 2026). Findings from Mwape et al. (2025) reinforce this position, showing that participation in key components of drought risk management remains limited at both district and sector levels (Figure 1). The study, as supported by others, found that, although early warning information is generated through national systems, it is often inadequately disseminated and insufficiently tailored to support local decision-making. Likewise, limited participation in drought monitoring and vulnerability assessments constrains the ability of institutions to anticipate impacts and implement timely, coordinated interventions (Banda et al., 2022; Mwape et al., 2025; Ngoma et al., 2021). Being a developing country, these challenges are further compounded by financial constraints, limited technical capacity, weak inter-institutional coordination, and bureaucratic inefficiencies that undermine proactive drought preparedness and response (OECD, 2025; WBG, 2023).

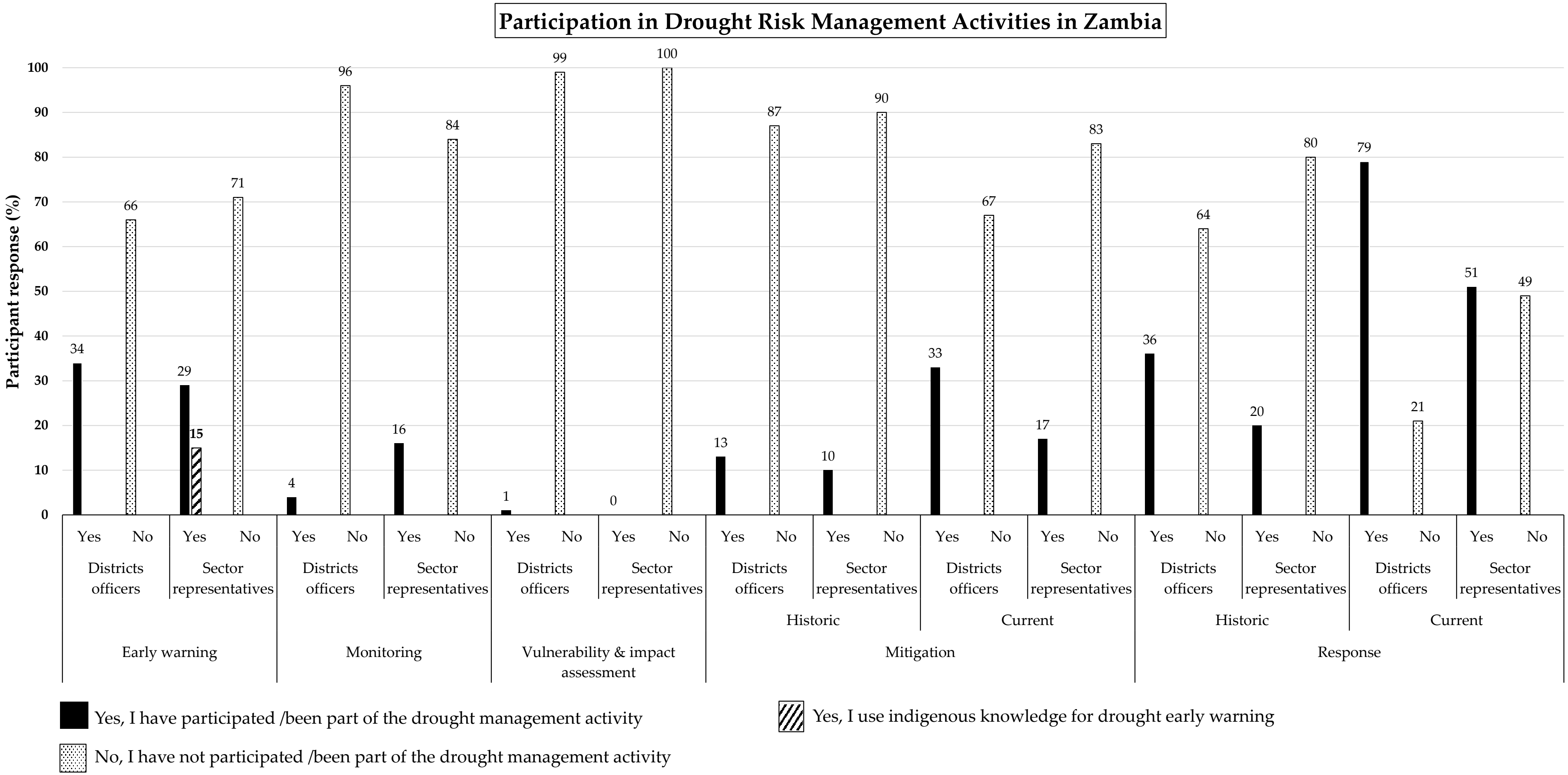

Figure 1: Showing the reactive state of drought management in Zambia, illustrated through district government and sector participation across key drought risk management activities. Source: Mwape et al. (2025)

While previous studies have established the predominantly reactive nature of drought management in Zambia, there has been limited effort to understand the underlying perceptions of government and communities that shape this drought management posture (Figure 1). Building on the work of Mwape et al. (2025), as supported by Hakaloba et al. (2016), Banda et al. (2022) and Wapamesa et al. (2026), this study addresses this gap by assessing drought perceptions among district government officials and sector representatives across Zambia. By exploring how these actors experience, define, remember, and anticipate drought, the study seeks to provide a deeper understanding of the human dimensions that influence drought risk management and to identify opportunities for strengthening more proactive, participatory, and locally-grounded drought governance in Zambia.

In addition, drought literature in Zambia emphasizes that strengthening drought risk management in Zambia requires a shift toward decentralized, participatory, and integrated approaches that reflect local realities (Banda et al., 2022; Dumenu & Takam Tiamgne, 2020; Hakaloba et al., 2016). These studies highlight the importance of embedding drought risk considerations within district-level planning frameworks, enhancing coordination across local sectors, and improving the accessibility and usability of reliable climate information for local actors. Further, there is growing recognition of the value of integrating indigenous and experiential knowledge systems into formal drought management processes to improve relevance, trust, and usage of drought tools (Dumenu & Takam Tiamgne, 2020; Mwape et al., 2025). Collectively, understanding how drought is perceived by different actors and communities becomes essential for designing drought risk management strategies that are context-specific, participatory, and responsive to local realities and vulnerabilities (Lottering et al., 2023; Wickham et al., 2019).

d. The concept of perception in drought risk management

All drought is local. Although drought is commonly characterized using meteorological, hydrological, agricultural, and socioeconomic indicators, drought impacts are ultimately experienced, interpreted, and acted upon by people (Dumenu & Takam Tiamgne, 2020; Jedd et al., 2018). As a result, effective drought risk management depends not only on understanding the physical characteristics of drought but also on understanding how individuals and institutions perceive drought risks (Wilhite et al., 2000). By definition, perception broadly refers to the process through which people interpret, organize, and assign meaning to information based on their experiences, beliefs, knowledge, values, and surrounding environment (Lottering et al., 2023; Taylor et al., 1988). Because perceptions shape how risks are recognized and prioritized, they influence individual and collective decisions before, during, and after hazard events (Lottering et al., 2023; Wickham et al., 2019).

Within drought risk management, perceptions have been shown to influence nearly every stage of the risk management cycle, including risk recognition, preparedness, mitigation, response, recovery, and long-term adaptation. For example, farmers' perceptions of changing rainfall patterns often determine how easily they are convinced to adopt drought-tolerant crops, diversify livelihoods, or invest in water conservation technologies. Likewise, the perceptions of government agencies and policymakers influence the prioritization of drought within planning processes, allocation of finances, and implementation of preparedness measures (Reguera & De Stefano, 2016; Teutschbein et al., 2023). Additionally, differences in how drought is perceived among communities, scientists, and decision-makers can create barriers to effective communication, delay collective action, and reduce the effectiveness of drought policies and early warning systems (Jedd & Kelly Helm Smith, 2022; Reguera & De Stefano, 2016). As drought increasingly becomes a governance challenge rather than solely a climatic phenomenon, understanding these human dimensions has become an important area of drought research. Important to mention here that the goal of understanding drought perceptions is not to standardize or unify how people perceive drought, rather, to recognize and understand the diversity of perspectives, experiences, knowledge, and expectations that influence decisions, communication, prioritization, participation, and to use these insights to design more inclusive, locally relevant, and effective drought risk management strategies (Lottering et al., 2023; Taylor et al., 1988).

Several frameworks have been developed to help conceptualize hazard perceptions. Among the earliest and most widely applied is the framework proposed by Taylor et al. (1988), which conceptualizes perceptions through four interrelated dimensions: experience, memory, definition, and expectation. Experience reflects how individuals personally encounter drought and its impacts; memory represents how previous drought events shape current understanding and future decision-making; definition captures how people conceptualize and characterize drought; and expectation refers to beliefs regarding future drought occurrence, severity, and consequences. Together, these dimensions provide a comprehensive lens for understanding how people interpret drought risk and why responses vary across individuals, sectors, and governance levels. Given its emphasis on both cognitive and experiential aspects of drought, the Taylor et al. (1988) framework provides an appropriate conceptual foundation for this study, which investigates drought perceptions among district government officials and sector representatives across Zambia during the 2023/2024 drought.

3. Methodology

This study was conducted across Zambia, a Southern African developing country covering approximately 752,618 km². Characterized by a tropical climate with distinct rainy (November-April) and dry (May-October) seasons, Zambia's annual rainfall ranges from less than 800 mm in the south to over 1,400 mm in the north, resulting in varying drought exposure across the country's three Agro-Ecological Regions (Musonda et al., 2020; Ngoma et al., 2021). For this study, data were collected during the 2023/2024 drought. According to the Zambian government national reports, the 2023/2024 drought was the most severe drought in 40 years, affecting 84 of the country's 116 districts with widespread agricultural, water, energy, and socioeconomic impacts (ZMD, 2024). Given its spatial extent and impacts, the drought provided an appropriate context for assessing how different actors perceived drought and its implications for drought risk management.

a. Research Design

The study adopted a mixed-methods research design to assess district government and sector player perceptions of drought and drought risk management in Zambia following the 2023/2024 drought (Braun & Clarke, 2006; Creswell & Creswell, 2018). The qualitative approach was used to explore participants' experiences, definitions, memories, and expectations of future drought, providing an in-depth understanding of how drought is perceived across different institutional, sectoral, and geographical contexts. The quantitative approach was used to summarize and compare participant responses using basic descriptive statistics, such as frequency and distribution of perceptions across respondent groups, provinces, and key thematic areas. The integration of qualitative and quantitative evidence provided a more comprehensive understanding of drought perceptions and their implications for drought risk management in Zambia.

The study was guided by the drought perception framework established by Taylor et al. (1988), which conceptualizes perceptions through four interrelated dimensions: experience, memory, definition, and expectation. This framework provided the analytical lens for understanding how respondents interpreted drought and how these interpretations influenced perspectives on drought risk and management. Figure 2 summarizes the methodological approach used for this study.

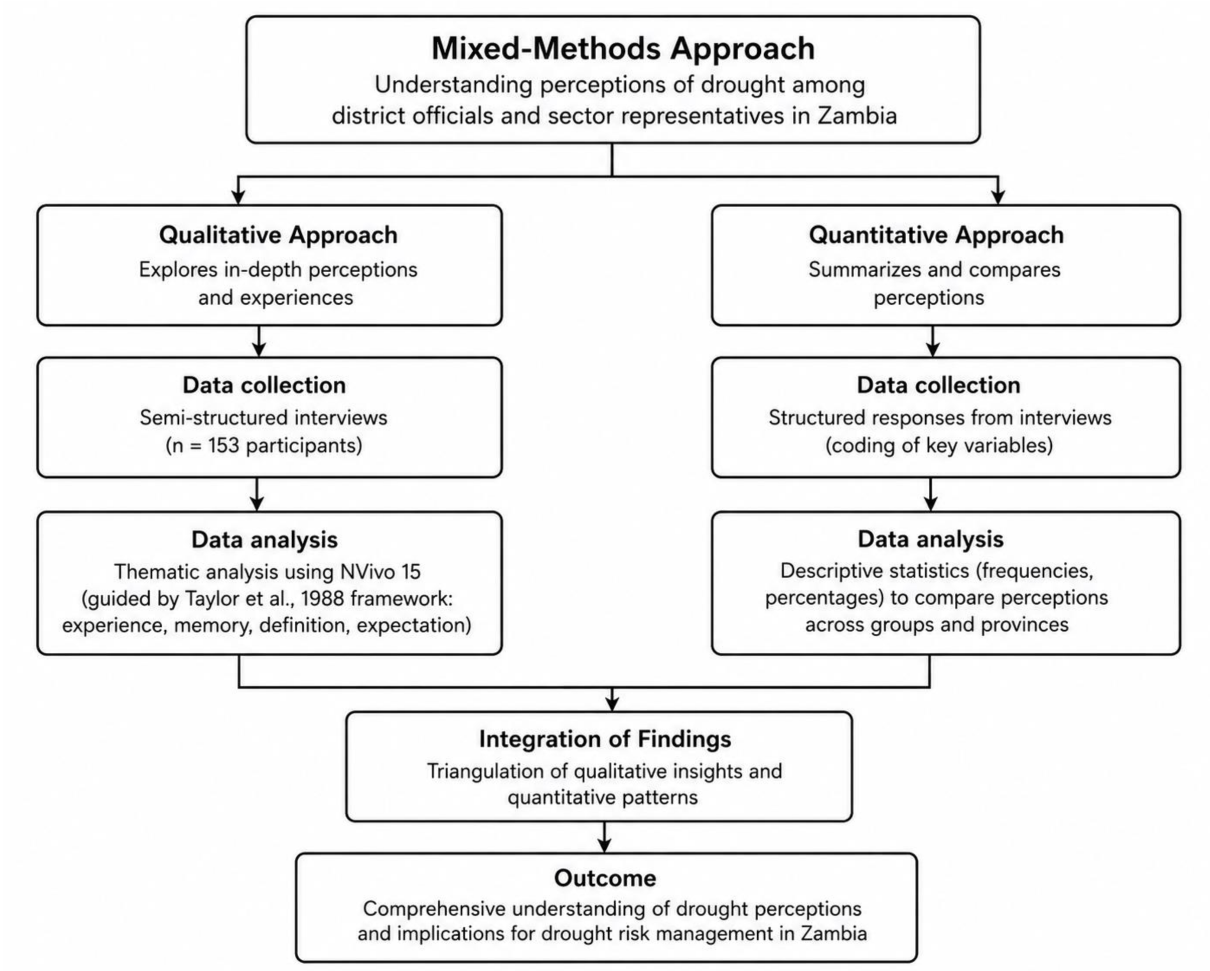

Figure 2: Methodological flow of the study.

b. Data Collection

Primary data were collected using semi-structured interviews, while social media content and unstructured follow-up interviews with national institutions involved in drought and water resources management were used as complementary secondary data sources to provide additional context for interpreting the 2023/2024 drought and participants' responses. A combination of purposive and snowball sampling was employed to recruit participants with direct working knowledge and experience of drought-related planning, management, and response (Creswell & Creswell, 2018). Data were collected between May and September 2024 from 31 districts across all ten provinces of Zambia, with a minimum of two districts sampled per province, including both urban and rural settings where feasible (Figure 3). Priority was initially given to districts within the seven provinces identified by the Zambia Meteorological Department (ZMD) as being most affected by the ongoing drought, after which the remaining three less-affected provinces were included to ensure national representation and capture perceptions across the full spectrum of drought experiences.

A total of 153 participants were interviewed, comprising 67 district government officials

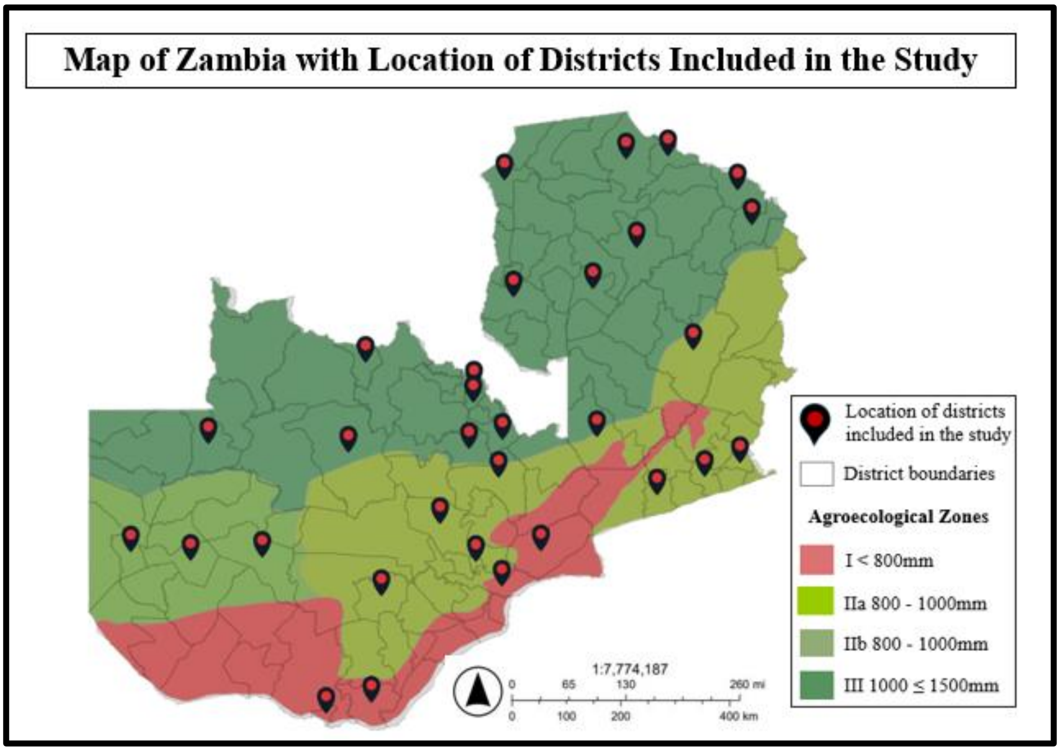

Figure 3: Map of Zambia showing the location of districts included in this study across the four Agroecological Zones of Zambia.

and 86 sector representatives from public, private, academic, civil society, and humanitarian organizations. Participants represented 11 urban and 20 rural districts, with rural districts intentionally emphasized because agriculture (the sector most vulnerable to drought) predominantly takes place in rural Zambia. District officers were purposively selected based on their responsibilities in planning, agriculture, water resources, disaster management, and related sectors (Table 1), while sector representatives were identified through snowball sampling following recommendations from district officials. Conducting interviews during the active drought period enabled participants to draw upon recent experiences and memories, which are recognized as critical dimensions in drought perception research (Bathke et al., 2016).

Table 1: Categories of participants interviewed for the assessment of drought perceptions in Zambia (N = 153).

Participant Group	Category	n
District Government Officials	District Planning Officers	13
	Disaster Management and Mitigation Officers	11
	Agriculture Coordinators/Camp Officers	14
	Forestry Officers	8
	Environmental Officers	5
	Rural Development Officers	7
	Water Development Officers	9
	Subtotal	**67**
Sector Representatives	Agriculture (crop, livestock, and fisheries)	23
	Community Leaders (Residents)	12
	Small and Medium Enterprises	16
	Health	7
	Water Supply	13
	Mining	2
	Aviation	1
	Forestry	8
	Tourism and Recreation	4
	Subtotal	**86**
	Grand Total	**153**

316

Semi-structured interviews provided flexibility to explore participants' perceptions while maintaining consistency through a standardized interview guide. For this study, the analysis focused specifically on interview questions examining the four dimensions of drought perception proposed by Taylor et al. (1988): experience, memory, definition, and expectation.

Secondary data were obtained from two sources. First, a basic social media search was conducted on Facebook (Meta) using keywords including drought, drought impacts, crop failure, load shedding, power cuts, water, water deficits, water shortages, drought relief, drought response, and drought disaster. The search focused on posts from major Zambian media outlets and was used to understand the main issues emphasized in media reporting during the 2023/2024 drought crisis and to provide additional context for participants' reported experiences.

Second, follow-up interviews were conducted with government institutions involved in drought and water resources management, including the Zambia Meteorological Department (ZMD) (n = 3), Water Resources Management Authority (WARMA) (n = 6), water utility companies (n = 3). These interviews provided additional institutional context for understanding policies and interpreting findings from the primary interviews, particularly where perceptions differed between district officials, sector representatives, and national institutions. Participation in all interviews was voluntary, and informed consent was obtained from participants before data collection. Informed consent was obtained from all respondents, and interview data were anonymized to protect participants' identities. All quotations presented in this paper are reported using anonymized participant identifiers to maintain confidentiality.

c. Data Analysis

Interview recordings were transcribed verbatim and imported into NVivo 15, a qualitative analysis software. The analysis employed a deductive-inductive thematic analysis approach (Braun & Clarke, 2006). Initial coding was guided deductively by the four dimensions of drought perception proposed by Taylor et al. (1988); experience, memory, definition, and expectation, which served as the primary analytical categories.

After this initial coding, an inductive analysis was used within each category to identify recurrent themes, patterns, and variations emerging from participants' narratives. This two-stage analytical approach enabled the study to retain a theoretically informed structure while remaining flexible to capture context-specific and relevant perceptions that extended beyond the original framework. Themes were continuously refined through iterative comparison across transcripts until conceptual saturation was achieved. Comparisons were subsequently undertaken between district government officials and sector representatives to identify areas of convergence and divergence in drought perceptions across respondent groups and geographic regions.

4. Results and Discussion

Participants' perceptions of the 2023/2024 historic drought in Zambia revealed both shared experiences and important differences across institutions and sectors. The results and discussions are organized around Taylor et al.'s (1988) four elements of perception: experience and memory, drought impacts, drought definition, and future expectation, with drought impacts assessed as an important component of participants' experience and memory.

a. Experience and Memory of Drought

Experience and memory constitute the foundation upon which individuals interpret environmental hazards and shape future responses (Lottering et al., 2023; Taylor et al., 1988). Participants were therefore first asked about their previous experiences with drought and whether they considered their districts or sectors to have been impacted by the 2023/2024 drought. Although many respondents struggled to recall the exact years in which previous droughts had occurred, virtually all participants reported having either directly experienced or witnessed drought impacts within their districts and communities. These lived experiences provided an important basis for understanding how drought is perceived across Zambia.

Overall, perceptions of the 2023/2024 drought were remarkably consistent across respondent groups. Approximately 87.2% of sector representatives reported that their sectors experienced drought-related impacts, while 80.6% of district government officials indicated that their districts had been affected. Despite this broad agreement, important differences emerged between local perceptions and official national level assessments. For example, while the Zambia Meteorological Department (ZMD) and the Water Resources Management Authority (WARMA) classified parts of the Copperbelt and Northwestern Provinces as not experiencing drought during the drought, district officials and sector representatives from these same provinces described substantial drought-related impacts, including crop losses, declining water availability, reduced forest productivity, and prolonged electricity shortages. Similar disagreements were reported in parts of Northern, Muchinga, Luapula, and

Northwestern Provinces, where some district officials reported no drought while sector representatives described significant disruptions to livelihoods and economic activities.

These contrasting reports appear to reflect differences in how drought is recognized across institutions and sectors. National agencies primarily characterize drought using meteorological and hydrological indicators such as rainfall deficits, streamflow, and groundwater levels, whereas district officials often combine environmental observations with local socioeconomic conditions. Sector representatives, in contrast, primarily recognize drought through its effects on production systems and livelihoods, including reduced agricultural yields, water shortages, declining business activity, and interruptions to power supply. Consequently, areas that may not satisfy meteorological thresholds for drought may nevertheless experience substantial socioeconomic water deficits. Similar observations have been reported elsewhere, where drought impacts frequently extend beyond the geographic boundaries of rainfall deficits because of interconnected water, food, and energy systems (Bergman & Hayes, 2014; Lottering et al., 2023; Taylor et al., 1988).

The observed differences in drought experience have important implications for drought governance. If institutions responsible for monitoring drought perceive hazards differently from the communities(sectors) who experience impacts, opportunities for timely preparedness and coordinated response may be reduced (Lottering et al., 2023; Mwape et al., 2025). These findings reinforce calls for more representative and participatory drought monitoring systems that integrate scientific indicators with local knowledge and sector-specific experiences, thereby improving the credibility and relevance of drought information for decision making (Grainger et al., 2021; Wilhite, 2016). Rather than representing contradictory accounts, these differences show that drought experience is shaped by what is being measured and what is being affected. A district may therefore fall outside a meteorological drought classification while its communities simultaneously experience agricultural, hydrological, energy, or socioeconomic drought.

1) Drought Impacts

According to the Zambia Meteorological Department, the country experiences El Niño-induced droughts approximately every 5 years, with the ongoing 2023/2024 drought being the most severe in 40 years. Beyond confirming the occurrence of drought, both sector representatives and government officials consistently described the 2023/2024 event as one of the most disruptive droughts experienced in recent decades. Across interviews, drought was not perceived simply as a period of below-normal rainfall; instead, respondents described it as a cascading process in which water shortages propagated through interconnected environmental, economic, and social systems. Consistent with this perspective, reported impacts from the 2023/2024 drought in Zambia extended well beyond agriculture and water resources to include energy production, public health, tourism, education, business continuity, forestry, and community wellbeing. Put together with findings presented in section 3(a), these findings illustrate that local perceptions of drought are largely shaped by its consequences(impacts) on communities rather than by meteorological conditions alone. Figure 4 summarizes the drought impacts reported from the 2023/2024 severe drought across sectors in Zambia.

No.	Sector	Drought impacts
1.	Agriculture	Crop failure, reduced pasture for livestock, and increased animal disease, and increased cost of fish farming.
2.	Water supply	Dry streams and wells, reduced water supply, poor water quality, equipment damage, and power cuts.
3.	Small and medium enterprise	Power cuts, increased cost of running business, reduced water supply, reduced income, and job loss.
4.	Health	Increased water related diseases, mental health, heat stress, increased malnutrition, and reduced air quality.
5.	Forestry	Increased wildfires, reduced forest productivity, and increased deforestation.
6.	Tourism and recreation	Increased human animal conflicts, increased cost of running business, power cuts, reduced water levels, and job loss.
7.	Mining	Power cuts, job loss, equipment failure, revenue loss, increased crime.
8.	Resident (village headmen)	Increased land conflicts, increased cost of living, low water levels, food insecurity, increased emigration and immigration, increased crime, and increased early marriages, increased grade-school dropout rate, heat stress.

Figure 4: Summary of drought impacts reported from the 2023/2024 severe drought in Zambia

Primary Drought Impacts

Agriculture and water resources were overwhelmingly identified as the primary sectors affected by the 2023/2024 drought. Participants from almost all provinces reported below-normal rainfall, widespread crop failure, declining pasture availability, reduced livestock productivity, and reduced water levels in rivers, reservoirs, and domestic wells. These findings were consistent with national reports estimating that approximately 43.0% of planted crops were lost during the 2023/2024 growing season (Prime TV Zambia, 2024; ZMD, 2024). Participants further emphasized that reduced water availability affected both rain-fed agriculture and irrigation systems, threatening household food security and rural livelihoods.

Despite broad agreement regarding these impacts, notable differences emerged regarding the spatial extent of drought (Figure 5). While government reports categorized districts within Northern, Muchinga, and Northwestern Provinces, and selected districts in Luapula Province as unaffected by drought, participants from Northern, Muchinga, Northwestern, and selected districts in Northwestern province(s) reported substantial sector-based impacts associated with declining agricultural productivity, reduced water availability, wildfires and power outages as a result of reduced hydropower generation.

Province	District Government	Sector Representatives
Central	■	■
Copperbelt	■	■
Eastern	■	■
Lusaka	■	■
Southern	■	■
Western	■	■
Northern	□	■
Muchinga	□	■
Luapula	▨	□
Northwestern	□	▨

■ = In drought
□ = Not in drought
▨ = Mixed perception

Figure 5: Highlighting differences in perceptions about the spatial extent of the 2023/2024 severe drought across the 10 provinces of Zambia

Participant responses identified two principal reasons for these differences. First, existing drought monitoring systems rely heavily on meteorological observations and crop production reports that are constrained by limited monitoring infrastructure, personnel, and financial resources (confirmed by the ZMD). Several agricultural camp officers reported farmer-to-extension ratios exceeding 500:1, making comprehensive field assessments difficult. Second, participant responses emphasized that many drought impacts were transboundary, extending well beyond areas experiencing rainfall deficits. For example, declining water levels at Kariba Dam located in Southern Province substantially reduced national hydropower generation, resulting in prolonged electricity outages across the country, including provinces reported to have received relatively normal rainfall, such as Luapula, Northern and Muchinga Provinces. Additionally, the El Nino effect on provinces that received normal precipitation may have exacerbated drought conditions by increasing evapotranspiration leading to crop failures and low water levels in surface waters (Kajoba, 1998; Nicholson, 1997). These findings highlight the complexity of drought and further agree with what others have established in literature, that meteorological indicators alone may not adequately capture the drought conditions experienced by communities whose livelihoods depend on interconnected water and energy systems (Bergman & Hayes, 2014; Dracup et al., 1980; Wilhite, 2019; Wilhite et al., 1987).

Secondary Drought Impacts

Drought often compounds existing vulnerabilities, including food insecurity, water scarcity, and poverty, particularly in resource-constrained settings such as Zambia (ACAPS, 2025; Wilhite et al., 2014). During the 2023/2024 drought, primary impacts on agriculture and water resources cascaded across livelihoods, businesses, health, education, energy, and natural ecosystems, illustrating the interconnected nature of drought impacts. The most frequently reported sector-based secondary impacts were associated with food insecurity (87.0%), energy shortages (79.1%), and declining livelihoods (71.2%).

Crop failure, reduced pasture, and increased fish-farming costs contributed to food scarcity, malnutrition, and increased crime, particularly in rural communities dependent on agriculture. Household food expenditure increased by an estimated 6.9% between May 2023 and the first quarter of 2024, with drought being among the major contributors (ACAPS, 2025). Participants also reported increased mental stress and anxiety among agricultural producers (78.3%), especially those facing loan repayments following crop losses, as well as among small and medium enterprise owners (81.3%), traditional leaders (66.7%), and tourism and recreation operators (50.0%). These mental health impacts were reported in Southern, Lusaka, Central, Copperbelt, Muchinga, and Northwestern Provinces. Agricultural losses may also discourage investment in subsequent farming seasons, highlighting the importance of timely and reliable drought monitoring and early warning information for reducing uncertainty and supporting farmer decision-making (Tadesse et al., 2018a).

Water-related impacts were reported across all ten provinces. Low water levels at Kariba Dam reduced hydropower generation, with the facility operating at approximately 12.0% of installed capacity by June 2024, contributing to power cuts of up to 22 hours per day (Prime TV Zambia, 2024). Participants associated these outages with reduced industrial productivity, higher commodity prices, equipment failures, and disruptions to water supply. 82.0% of small-scale business owners interviewed reported being at risk of closing because of unreliable electricity and water, while mining companies faced higher production costs but were generally able to use alternative energy sources such as diesel generators. These economic disruptions were also associated with increased crime and psychological stress as households lost incomes and were forced to pursue alternative livelihoods.

Water and pasture shortages also produced broader social impacts. Participants in Southern and Central Provinces reported increased school dropout and absenteeism as children traveled long distances to find water and pasture for livestock. Village leaders in Northwestern, Luapula, and Northern Provinces reported increased livestock theft and land conflicts associated with movement in search of more habitable areas. High temperatures and dry conditions also contributed to wildfires in 74.0% of the districts included in the study, damaging thatched homes, crops, irrigation and water infrastructure. Participants further reported reduced water quality from wildfire ash and reduced highway visibility, increasing road-traffic risks.

Reduced forest productivity and increased deforestation were also reported. Crop losses and electricity shortages increased reliance on charcoal as both an energy source and livelihood strategy in the Central, Copperbelt, Muchinga, Northwestern, and Luapula Provinces. This can create a reinforcing cycle in which drought increases pressure on forests, while forest loss reduces carbon sequestration, increases land-use emissions, and disrupts moisture recycling, potentially worsening future drought risk (Tendai Marima, 2016; Wilhite et al., 2014). Drought management should therefore integrate adaptation with mitigation measures that reduce both current vulnerability and longer-term climate risk (Mwape et al., 2025; Wilhite, 2019).

Further, WARMA reported increased applications for groundwater permits following declining surface-water levels and the drying of wells in the Kafue, Luangwa, Chambishi, and Zambezi River Catchments. Because groundwater recharge may occur over periods longer than a single water year, increasing abstraction could place cumulative pressure on groundwater reserves, while overextraction may contribute to land subsidence, declining water quality, and disruption of groundwater-dependent ecosystems (Fu & Tang, 2013). These cascading impacts highlight the need for drought risk management that integrates surface and groundwater planning, improved monitoring, public participation, and sector-specific interventions (Banda et al., 2022; IDMP, 2013; Wilhite, 2019).

Finally, the social-media analysis provided additional context for understanding participants' experiences and media priorities for drought reporting during the 2023/2024 drought in Zambia. Out of the six media platforms reviewed, five showed no evidence of drought reporting before the 2023/2024 event, despite having considerably larger Facebook audiences (approximately 230,000 to 1.7 million followers). Their coverage increased once drought impacts became visible and focused primarily on drought impact reporting, mainly, crop losses, water shortages, electricity disruptions, and food insecurity. In contrast, the ZMD Facebook page (national level government institution) was the only platform that routinely provided risk-facing information through seasonal and weekly forecasts before the drought, yet its Facebook page had the smallest audience, with approximately 2,400 followers (Table 2). While this analysis was not designed to systematically measure media exposure or engagement, the findings suggest a communication gap in which drought-risk information was available but received limited amplification through the media platforms with substantially larger audiences.

This finding presents an opportunity for stronger partnerships between government institutions, and mainstream and/or community media to shift drought reporting toward preparedness and anticipatory action (Kreibich et al., 2022). Forecasts, early warnings, and practical drought-management information should be translated into accessible formats and distributed through platforms communities already use, particularly radio in rural areas where digital access may be limited. Radio has been used elsewhere in Africa to extend climate information to rural populations; for example, climate information disseminated through radio and SMS reached an estimated 740,000 rural households in Senegal (Hansen et al., 2019). In the past, Zambia has also used local radio alongside extension services to communicate seasonal climate information to farmers in Monze (Walker, 2021). Government could therefore consider optimizing national and community radio, television, social media, and extension networks as components of the drought early-warning system, enabling the media to not only report drought impacts but also help communities understand risks and prepare before drought develops into a crisis.

Table 2: Showing media focus for drought reporting in Zambia

No.	Media Institution Facebook Page	Coverage	Following	Pre-Drought Focus	In-Drought Focus
1.	Prime TV Zambia: https://www.facebook.com/primetelevisionzambia	National	615K	None	Impact reports
2.	The Mast: https://www.facebook.com/themastzambia	National	343K	None	Impact reports
3.	Muvi TV: https://www.facebook.com/askmuvi	National	1.2M	None	Impact reports
4.	Zambia Reports: https://www.facebook.com/ZambiaReports	National	1.7M	None	Impact reports
5.	Zambia National Broadcasting Corporation (ZNBC): https://www.facebook.com/groups/2395638674042095/	National	230.4K	None	Impact reports
6.	Zambia Meteorological Department (ZMD): https://www.facebook.com/profile.php?id=61556313256348	National	2.4K	Published the ZMD Seasonal and Weekly Forecasts	Impact reports and weakly weather forecasts

b. Varied Definition of Drought

Participants defined drought through multiple perspectives that reflected their institutional mandates, sectoral responsibilities, and lived experiences. Rather than converging on a single definition, respondents described drought according to the specific ways in which water deficits affected their work and communities. These findings reinforce the view that drought is a multidimensional phenomenon whose meaning varies depending on the environmental, socioeconomic, and institutional context in which it is experienced (Dracup et al., 1980).

At the national level, government institutions responsible for drought monitoring primarily adopted hazard-based definitions. The ZMD characterized drought as prolonged periods of below-normal precipitation relative to historical averages, while the WARMA emphasized declining surface and groundwater levels as the principal indicators of drought. These definitions correspond closely with the conventional meteorological and hydrological classifications widely adopted in drought science (Svoboda et al., 2002; Wilhite & Glantz, 1985).

At the local government level, district officials generally adopted broader definitions that combined climatic indicators with observed community impacts. For instance, agricultural officers frequently defined drought in terms of declining crop yields, livestock stress, and food insecurity, while planning and disaster management officers emphasized disruptions to livelihoods, water supply, and public services. Sector representatives, however, defined drought almost exclusively through the impacts experienced within their respective sectors. Farmers associated drought with crop failure and pasture shortages; water utilities emphasized declining water availability; small and medium enterprises viewed drought through prolonged electricity outages and declining business productivity; forestry representatives described reduced forest productivity and increased wildfire occurrence; and tourism operators associated drought with reduced visitor numbers and the cancellation of cultural events. These findings suggest that communities perceived drought less as a meteorological phenomenon and more as a condition of insufficient water to sustain sector-specific functions (Figure 6).

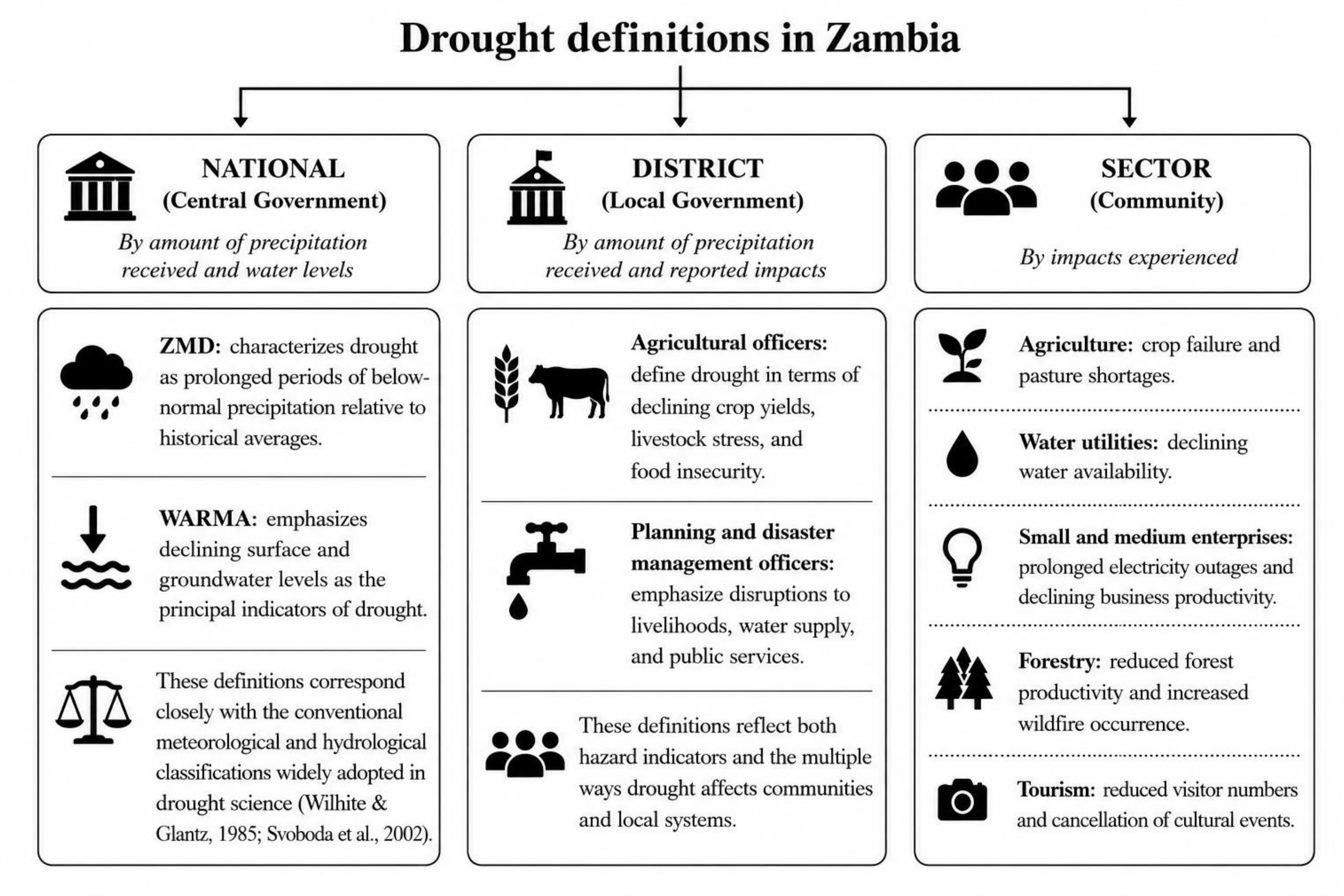

Figure 6: Reported drought definitions in Zambia at the national, district and community levels.

The diversity of definitions reported in this study is consistent with decades of drought literature demonstrating that drought lacks a universally accepted definition because its manifestation depends on the systems being affected (Crausbay et al., 2017; Dracup et al., 1980). More recently, scholars have expanded these perspectives to include ecological, flash, anthropogenic, and socioeconomic droughts, recognizing that no single indicator adequately captures the complexity of drought (Otkin et al., 2018). The findings from Zambia reinforce this understanding by demonstrating that institutional definitions often differ from community experiences, particularly where drought impacts propagate through interconnected food, water, and energy systems. Whereas each of the different definitions may be critical for drought early warning and monitoring, their isolated outlook may not fully capture the broader socio-economic and ecological impacts of drought. Therefore, integrating meteorological data with hydrological, agricultural, and socio-economic indicators could provide a more comprehensive understanding of drought and its impact on communities and natural ecosystems in Zambia (Svoboda et al., 2002; Tadesse et al., 2018; Wilhite et al., 2014).

Participants also identified important limitations in the mobilization of information used to characterize drought nationally. Officials from ZMD reported that limited financial resources, sparse meteorological station coverage, and inadequate technical capacity constrain nationwide monitoring efforts. Similarly, the WARMA indicated that their water level measurements are conducted from stations in the six major river catchments across the country, but currently, only four of these stations are operational. Further, district officials reported challenges such as limited expertise and extension staff, limited logistics, and inadequate inter-agency coordination that reduce the ability to comprehensively document localized drought data and impacts. These limitations raise important questions regarding the representativeness of the information used to support drought declarations and response planning.

The observed differences between institutional and sectoral definitions have important implications for drought governance. As the saying goes “all drought is local”, decisions based exclusively on regional meteorological or hydrological indicators may overlook communities experiencing significant socioeconomic drought, resulting in delayed or misdirected interventions. Integrating scientific observations with local knowledge and sector-specific indicators could therefore provide a more comprehensive understanding of drought conditions and improve the targeting of preparedness and response strategies

(Svoboda et al., 2002). Such approaches are increasingly recommended within integrated drought management frameworks that advocate combining physical and social indicators to support more inclusive drought decision-making (IDMP, 2013; Mwape et al., 2025).

c. Drought Expectations

Knowledge about future drought expectations is crucial for proactive planning and risk management, enabling communities and policymakers to anticipate and prepare for potential impacts (Lottering et al., 2023). In this study, participant expectations regarding the severity and frequency of future droughts revealed important differences in awareness and preparedness across governance levels and sectors (Figure 7). Understanding these expectations is critical because perceptions of future risk influence investment decisions, preparedness actions, community participation and support for drought mitigation policies (Lottering et al., 2023; Taylor et al., 1988).

No.	**Participant**	**Are you Expecting Increased Drought Frequency and Severity for Future Drought Events?**		
		Yes (%)	**No (%)**	**Not sure (%)**
1.	National level institutions (ZMD, WARMA)	100	0	0
2.	District officers	77	0	23
3.	Sector representatives	17	0	83

Figure 7: Participant expectations for the frequency and severity of future droughts in Zambia

At the national level, all officials 100% (n = 9) interviewed from both the ZMD and WARMA agreed with the broader scientific evidence indicating that climate change, increasing temperatures, and growing water demands are likely to increase drought risks across Southern Africa (IPCC, 2023; Tangney, 2020). At the district level, 77.6% of district officials reported that they expect more frequent and severe drought events in the future, while 22.4% were uncertain. In contrast, expectations among sector representatives were considerably more uncertain. Only 17.4% expected increases in future drought frequency and severity, while 82.6% indicated that they were uncertain about future drought trends. Rather than expressing confidence in long-term climatic projections, many respondents focused on immediate livelihood concerns and described future droughts as unpredictable. This uncertainty suggests that although many sectors experience the impacts of drought directly, access to drought forecasts and longer-term climate information remains limited outside government institutions. The social-media analysis provides additional context for this communication gap. While ZMD disseminated seasonal and weekly forecasts before the drought, the major media platforms reviewed primarily emphasized drought once impacts were occurring (Table 2). This suggests that strengthening early warning may require not only producing accurate forecasts but also expanding partnerships with widely accessed media platforms to translate and amplify drought information before impacts become severe.

Further, the contrasting expectations observed between district officials and sector representatives appear to reflect differences in access to scientific information and institutional communication between government and local communities. District officers regularly receive seasonal climate outlooks and technical briefings from the Zambia Meteorological Department through district coordination mechanisms, whereas sector representatives often rely on personal experience, local observations, or informal information networks. Several district officials further acknowledged that coordination challenges limit the effective dissemination of climate information within district institutions themselves, resulting in inconsistent understanding of future drought risks even among government departments.

These findings highlight an important gap between scientific expectations and public expectations of drought. Previous studies have shown that awareness of future climate risks is essential for encouraging preparedness, strengthening public support for drought mitigation measures, and improving the effectiveness of early warning systems (Grainger et al., 2021; Hakaloba et al., 2016). Where stakeholders possess different expectations regarding future drought occurrence, opportunities for collaborative planning may be reduced because preparedness actions are often shaped by perceived rather than objective risk (Ciocco et al., 2024).

From a drought risk management perspective, managing expectations is therefore as important as communicating forecasts (Cai et al., 2025; Tendai Marima, 2016). Effective drought governance requires not only accurate climate information but also communication strategies that enable diverse stakeholder groups to understand, trust, and act upon that information. Increasing stakeholder participation in drought planning, strengthening district- and -community-level climate communication, and integrating local knowledge with scientific forecasts could help reduce uncertainty, improve preparedness, and foster greater collective ownership of drought risk reduction strategies in Zambia (Ciocco et al., 2024; Grainger et al., 2021).

d. Recent Developments and Implications for Drought Management in Zambia

Zambia is about to enter the 2026/2027 water year while still recovering from the historic 2023/2024 El Niño-induced drought (MIM, 2026; ZMD, 2026). Since this drought event, two favorable agricultural seasons have provided some relief, with maize production estimated at approximately 3.7 and 4.9 million metric tons during the 2024/2025 and 2025/2026 farming seasons, respectively, contributing to a substantial decline in acute food insecurity (Gyuse, 2026). However, emerging forecasts indicate renewed El Niño conditions and increased risk of below-normal rainfall and above-normal temperatures during the 2026/2027 season (ZMD, 2026). This is particularly notable because ZMD officials interviewed in this study described El Niño-induced droughts as historically occurring approximately every five years. Although another drought threat within only a few years does not establish a shortened recurrence cycle, it raises concerns about increasingly cumulative and compounding impacts as recovery periods between major climate shocks become shorter (Dumenu & Takam Tiamgne, 2020; Mwape et al., 2025; Tendai Marima, 2016).

Recent developments suggest that Zambia is making efforts to strengthen its preparedness. The recent (2026) transition from the Disaster Management and Mitigation Unit (DMMU) to the National Disaster Risk Management Division (NDRMD) reflects a broader shift toward disaster risk reduction, preparedness, and resilience . In addition, more recent activities include vulnerability and needs assessments across selected provinces, early-warning initiatives, and simulation exercises at the national level, specifically designed to prepare institutions for anticipated El Niño conditions (DRMD/DMMU, 2026). Recovery efforts following the 2023/2024 drought have also promoted climate-smart agriculture, drought-tolerant crops, irrigation, and improved early-warning capacity (Gyuse, 2026). Further, the Zambian government has accelerated efforts to diversify Zambia's energy mix and reduce its vulnerability to drought-related hydropower shortages, setting a target of 1,000 MW of solar capacity by the end of 2026; by mid-2026, installed solar capacity had reached approximately 841 MW, compared with only 88 MW in 2021 (MIM, 2026). These developments are encouraging, but findings from this study emphasize that preparedness must extend from national institutions to local district and community levels, where substantial differences in drought perceptions and expectations remain.

A useful lesson from the 2023/2024 drought response is the potential to better connect relief assistance with long-term resilience building. Zambia's Cash-for-Work program provided important short-term income support to drought-affected households; however, such programs could also strategically direct community labor toward activities that strengthen both adaptation and mitigation. For example, rather than focusing primarily on activities such as street sweeping or roadside waste collection, participating communities could be paid to plant and maintain trees, restore degraded landscapes, construct simple sand dams, or develop rain- and stormwater-harvesting structures. This approach would retain the immediate livelihood benefits of cash assistance while creating assets that reduce vulnerability to future droughts, enhance water security, restore ecosystems, and increase carbon sequestration. In this way, drought relief becomes an investment in resilience rather than solely a response to the impacts of the current disaster.

The approaching 2026/2027 season provides an opportunity to apply lessons from this study across the three pillars of drought risk management. Monitoring and early warning should combine meteorological and hydrological information with district- and sector-level indicators, while communication strategies should ensure that forecasts are translated and amplified through media and other channels commonly accessed by communities before drought impacts emerge; vulnerability and impact assessment should capture differences across locations, sectors, and livelihoods; and mitigation, preparedness, and response should translate forecasts into early actions such as water conservation, irrigation preparedness, drought-tolerant crops, strategic food reserves, livelihood diversification, and energy contingency planning. Strengthening these three areas can help Zambia use the lessons of the 2023/2024 drought to move from being reactive to drought disasters toward proactively managing drought risk (Kreibich et al., 2022; Mwape et al., 2025).

5. Conclusions and Recommendations

This study assessed perceptions of drought risk management in Zambia using experiences from the 2023/2024 severe drought, focusing on how drought is experienced, remembered, defined, and anticipated across national institutions, district governments, and sectors. Findings show broad agreement that the drought caused substantial impacts, but important differences emerged in how those impacts were recognized. While 87.2% of sector representatives reported drought impacts, compared with 80.6% of district officials, some communities reported significant impacts even in districts that national assessments had categorized as unaffected. These differences demonstrate that drought experience is shaped not only by meteorological conditions but also by livelihoods, institutional responsibilities, and dependence on interconnected water, food, and energy systems.

The 2023/2024 drought further demonstrated that drought impacts in Zambia are both multisectoral and cascading. Initial rainfall and water deficits affected agriculture and water availability, but subsequently disrupted food security, hydropower generation, businesses, education, public health, forestry, and community livelihoods. Approximately 43% of planted crops were reportedly lost, while declining water levels at Kariba contributed to electricity outages of up to 22 hours per day. Participants also reported livelihood losses, mental stress, wildfires, increased pressure on groundwater resources, and greater dependence on charcoal production. These findings demonstrate why drought cannot be effectively managed as an isolated meteorological or agricultural hazard; preparedness must account for how impacts propagate across interconnected environmental, social, and economic systems (Hayes et al., 2004; Mwape et al., 2025).

Another important finding of this study is the perception variations across governance levels. National institutions primarily defined drought using meteorological and hydrological indicators, district officials combined these indicators with observed community impacts, while sector representatives largely defined drought through impacts experienced or observed within their livelihoods and activities. A similar difference emerged in future drought expectations: 100% of interviewed ZMD and WARMA officials and 77% of district officials expected drought frequency and severity to increase, compared with only 17% of sector representatives. These differences do not suggest that one perception is necessarily more accurate than another; rather, they demonstrate the importance of connecting scientific drought information with local knowledge and lived experiences. The secondary social-media analysis further contextualizes this challenge: while ZMD disseminated seasonal and weekly forecasts before the drought, the major media platforms reviewed predominantly emphasized drought after impacts were already occurring. Although this analysis does not establish the extent of public exposure to early-warning information, it highlights an opportunity to strengthen partnerships between technical agencies, media organizations, district institutions, and communities so that drought information is communicated more broadly and translated into actionable preparedness messages before impacts escalate.

These lessons are particularly relevant as Zambia prepares for the 2026/2027 water year while still recovering from the 2023/2024 drought. Although two favorable agricultural seasons have provided some level of recovery, emerging drought concerns emphasize the importance of using periods between disasters to build resilience rather than waiting for the next crisis (Mwape et al., 2025). Zambia's recent efforts at the national level to move toward disaster risk management provides an important opportunity to shift from reactive drought response toward locally grounded, anticipatory and participatory risk management. Ultimately, strengthening resilience will require sustained investment across the three pillars of drought risk management: monitoring and early warning; vulnerability and impact assessment; and mitigation, preparedness, and response supported by stronger connections among national institutions, district governments, sectors, and communities. Based on the findings of this study, six priorities are recommended:

i. **Decentralize drought planning from the national to the district level:** Districts should be empowered and resourced to develop locally relevant drought plans that reflect their specific hazards, vulnerabilities, water resources, livelihoods, and sector needs. Provide technical guidance and coordination, while districts lead local planning and implementation with meaningful participation from affected sectors and communities. This would help address the differences between national drought classifications and locally experienced impacts identified in this study.

ii. **Institutionalize community and sector level participation:** District officials, farmers, businesses, water utilities, traditional leaders, and other affected groups should participate routinely in drought monitoring, vulnerability assessment, preparedness planning, and decision-making. This would help bridge the differences in drought definitions and expectations identified across governance levels. This is particularly important because drought preparedness is most effective when decisions reflect both scientific information and the lived experiences, capacities, and priorities of those directly affected (Ciocco et al., 2024; Grainger et al., 2021).

iii. **Strengthen integrated drought monitoring and early warning:** Meteorological and hydrological observations should be complemented by agricultural, socioeconomic, ecological, and locally reported indicators to capture drought conditions that may not be visible through rainfall and water-level measurements alone.

iv. **Translate early warning into early action**: Forecasts should be communicated through accessible and widely used channels and linked to predetermined preparedness measures, including water conservation, drought-tolerant seed distribution, irrigation preparedness, strategic food reserves, livestock support, livelihood protection, and energy contingency planning. Partnerships among ZMD, national and local media, district institutions, and community organizations could help translate technical forecasts into locally relevant information and actions before drought impacts become severe.

v. **Connect drought relief with long-term adaptation and mitigation:** Relief programs should provide immediate assistance while creating assets that reduce future vulnerability. For example, Cash-for-Work programs could support accelerated tree planting and maintenance, landscape restoration, sand dams, and rainwater-harvesting infrastructure, simultaneously providing income, strengthening water security, restoring ecosystems, and supporting climate mitigation. This would allow drought relief to become an investment in resilience rather than solely a response to immediate impacts.

vi. **Plan for cumulative and compounding drought risk:** Preparedness should recognize that another drought may occur before households, ecosystems, infrastructure, and institutions have fully recovered from the previous event. The lessons of 2023/2024 should therefore inform long-term planning across interconnected water-food-energy-ecosystem systems, with recovery periods used proactively to strengthen resilience before the next drought.

Given the outcomes of this study, future drought research in Zambia should examine how risk perceptions, preparedness, and institutional decision-making evolve over time, particularly as recovery periods between major climate shocks potentially shorten. Longitudinal and district-level studies should assess whether early-warning information translates into anticipatory action across vulnerable sectors. Research should also help to develop integrated drought-monitoring and vulnerability indicators combining meteorological and hydrological data with socioeconomic, ecological, indigenous and local knowledge, and community-reported impacts. Finally, studies should further investigate the current status, and also, whether or how decentralized planning, enhanced risk communication, improved community participation, and the overall localized interventions would measurably strengthen resilience across successive droughts.

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DATA AVAILABILITY STATEMENT

The data supporting this study are not readily available because they contain potentially identifiable information, consistent with the requirements and guidelines of the Institutional Review Board (IRB #20240623688EX, Project ID: 23688).

AI USE STATEMENT

Generative artificial intelligence was used solely to assist with language editing, clarity, and organization; all scientific content, analysis, interpretation, and conclusions were developed and verified by the authors.

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