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Preparedness for Recurrent Drought Disaster: Insights from the Sudano-Sahelian Zone of Cameroon

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Abstract
This study examined drought preparedness of drought-prone communities in the Sudano-Sahelian zone of Cameroon. Qualitative and quantitative data were collected using interviews, household surveys, focused group discussions and field observations. SPSS and content analysis were used to analyse quantitative and qualitative data, respectively. The study revealed that a significant proportion (χ^2 =11.676, *P*= 0.020) of the respondents rely on community leaders for drought information, use indigenous knowledge, plant trees, stockpile food/fodder, and construct boreholes/wells as ways of preparing for droughts. However, the limited government supports, insufficient formal training, and weak drought management institutions limited drought preparedness. There were gender and age differences in the use of indigenous knowledge for drought preparedness whereby older people significantly (P< 0.05) used indigenous knowledge to prepare, whereas there was no relationship (P= 0.766) between gender and the use of indigenous knowledge for drought prediction. The study concludes that local communities are not fully prepared to alleviate the adverse impacts of droughts on their livelihoods. However, with the establishment of drought management committees at the grassroots level and the effective use of local knowledge in combination with scientific knowledge for drought planning and adaptation, communities will be better placed to deal with droughts. Given the geographical variation of climatic stressors, a focus on a specific event such as drought has enhanced understanding of drought disaster preparedness at the community level for effective planning and policy interventions. This study contributes to the literature in the disaster preparedness discipline with a lens on community drought preparedness.
Keywords: Drought Preparedness, Drought, Community preparedness, Disaster, Northern Cameroon

1. Introductio]n
Drought is a recurring climatic hazard with substantial challenging effects on the lives and livelihoods of people living in drought-prone areas. Current drought predictions show that the frequency and intensity of drought have increased in recent years, with enormous adverse impacts on social and environmental systems (Chiang, Mazdiyasni, & AghaKouchak, 2021). The driest zones of the world are expected to become even drier in the future, considering the rate of changes in the climate, indicating a risk of repetitive droughts in many arid, semi-arid and sub-humid regions with expected long-term and adverse consequences (Huang et al., 2016; Solh & Van Ginkel, 2014).

Developing countries, especially in Sub-Saharan Africa, have been noted to be the most vulnerable to the impacts of recurrent droughts (Ayugi et al., 2022) due to their poor experience in planning and preparedness for droughts, poor adaptive capacity, and, most importantly, the poor economic situation of most developing economies (Ayugi et al., 2022). Birkmann (2007) notes that the impacts of droughts are more severe in poor regions, especially Africa, with impacts ranging from fourteen to fifteen times more severe than in countries with strong economies. Australia, for instance, can cope with and adapt to the impacts of frequent droughts due to proper and effective planning and preparedness supported by a robust economy (Belle, Sithabile, & Abiodun, 2017). Lack of resources, in addition to the poor institutional capacity of most governments in

Africa, hinders the efforts of governments to prepare and respond adequately to the impacts of droughts (Belle et al., 2017). In many nations, drought management has mainly focused on reactive crisis management approaches, such as providing aid during a drought event, rather than on proactive preparation and setting of response strategies for proper and timely drought management (Raikes et al., 2019). Proactive preparedness through designing active response plans, including training and knowledge dissemination, establishing early warning systems for drought monitoring, stockpiling of resources, and establishing a drought management committee, is more important and cost-effective than reactive responses (Wilhite, Sivakumar, & Pulwarty, 2014). Future anticipatory disaster risk management approaches should consider nations' and communities' socioeconomic, environmental, and cultural characteristics (Raikes et al., 2019).

Cameroon, being a developing country in Africa, has not been spared from the vagaries of drought disasters over the years. Drought is a major climatic hazard affecting several sectors in the country, with the Northern zone being the most vulnerable (Ntali & Lyimo, 2022; Bang, 2022a). Drought has been frequent in recent decades in many parts of Cameroon and occurs with varying intensities ranging from mild to extreme episodes (Ntali, Lyimo, & Dakyaga, 2023; Guenang & Kamga, 2014), with the most recent and significant incidents occurring between 2012 and 2016 affecting tons of cereal crops (Sixtus, 2016; Epule, 2021). The Sudano-Sahelian northern zone of Cameroon has been experiencing recurrent droughts since the 1960s, with severe incidents in the early 1980s and 1970s that had significant impacts on livestock, water availability, crop yield, electricity supply and human health (Ntali, Lyimo, & Dakyaga, 2023; Bang, 2022a; Ndenecho & Lambi, 2010). Other notable drought events in the Sahel and Savanna with severe and widespread consequences occurred in 1987–1989, 1991–1992, 1994, and 1995 (Masih, Maskey, Mussá, & Trumbauer, 2014). Observations on drought in Cameroon show that drought duration and magnitude increased with time due to low precipitation caused by climate change and variability (Vicente-Serrano, Begueria, & López-Moreno, 2010; Bang, 2022a).

The majority of the population in the Sudano-Sahelian region are farmers who depend on crop and livestock production for their subsistence (Ntali & Lyimo, 2022; Abou et al., 2021) and are often hit by the vagaries of drought. Drought has been reported to cause massive crop failures, water and food shortages, livestock death, locust invasion, poor water quality, famine, and loss of agricultural production income in the Sudano-Sahelian zone of Cameroon (Lambi & Kometa, 2014; Republic of Cameroon (CMR), 2016). Crop failure, which translates into food shortages in families and income reduction, aggravates malnutrition among children under five years of age in the Sudano-Sahelian zone. All these impacts exacerbate households' vulnerability to food and water insecurity in many communities in the semi-arid northern region (Ntali & Lyimo, 2022; Lambi & Kometa, 2014). The increased food insecurity, high malnutrition rate, and poverty are evidence of the lack of proper preparation and planning by institutions and local communities to prepare for the hazard adequately**.** The lack of preparedness calls for urgent actions including research on how communities in drought-fragile environments prepare to deal with droughts for effective policy implementation.

Understanding drought preparedness at the community and household levels is crucial for effective formulation of appropriate drought management plans and adaptation strategies. Despite the criticality of understanding how local communities in drought-prone areas prepare for and deal with the impacts of droughts. Limited studies, including that of Belle et al. (2017) and Solh and Van Ginkel (2014), have shed light on local-level drought preparedness. For instance, Belle et al. (2017) focused on the communal preparedness of farming communities for drought in Zimbabwe. Other studies on drought preparedness have focused on macro level preparedness using secondary data (Wilhite, 2000; Wilhite., 2015; Wilhite et al., 2014). In Cameroon, few studies (Bang, 2022b; Nojang & Jensen, 2020; Bang, 2021; Aka et al., 2016) have focused on disaster preparedness and management at the national level. However, none of them concentrated on drought preparedness at the community level. Thus, this study aims to assess local communities' preparedness in dealing with recurrent drought in the Sudano-Sahelian Diamare division of northern Cameroon. This study is expected to enhance knowledge of local-level preparedness for well-

informed decisions and policymaking. International institutions could also use the results to understand the implementation of the Sendai Framework for Disaster Risk Reduction in Cameroon and other countries.

2. Study Context and Method

2.1 Study area description

The study was conducted in five drought-prone communities in the Diamare division, located in the Sudano-Sahelian zone of Far North Cameroon, within latitudes 10° and 11° north and longitudes 14° and 15° east (Figure 1). The study was conducted in Gazawa, Meri, Yolde Naggue, Balaza Lawane, and Dogba. These communities were selected because they are in drought-prone areas with some level of security and are easily accessible. The high dependence of the population on climate-sensitive livelihoods (crop production and livestock rearing) also influenced its selection for the study. Diamare comprises an agrarian population of approximately 784,910 inhabitants, with a density of 137.7 people/km^2 (Ngom Vougat et al., 2019). The population depends primarily on crop and livestock production for their subsistence, with few engaging in trade and craft. The major crops cultivated are beans, millet, sorghum (dry-and rainy-season varieties), onion, carrot, and groundnut. Livestock reared in the study area includes cattle, sheep, goats, donkeys, and poultry. Diamare divisions are characterized by a Sudano-Sahelian climate like that of the Sahel zone of Africa with semi-arid conditions. Thus, the area experiences similar environmental and social problems inherent to the Sahel environment, such as famine, food shortage, population migration, prolonged drought, and conflicts requiring a high level of adaptation (Balgah et al. 2020; Adaawen et al. 2019). The area receives a minimum of 328 mm and a maximum of 1670 mm of rainfall annually from June to September and a long dry season (October to May). The daily temperature of the area ranges between 25°C and 34°C (Njouenwet et al., 2022). The vegetation comprises of the Sudan-Sahelian Savanna with a dominance of grassy steppes and thorny shrubs (Acacia albida, Acacia Senegal, Faidherbia, Balanites aegyptiaca, Ziziphus mauritania) is under constant stress from high temperatures and repetitive droughts (PNDP, 2016). The overexploitation of the vegetation for firewood, settlement, excessive grazing, and annual burns have thus considerably modified the plant community. Thus, the area is exposed to dissert conditions (Ndenecho & Lambi, 2010).

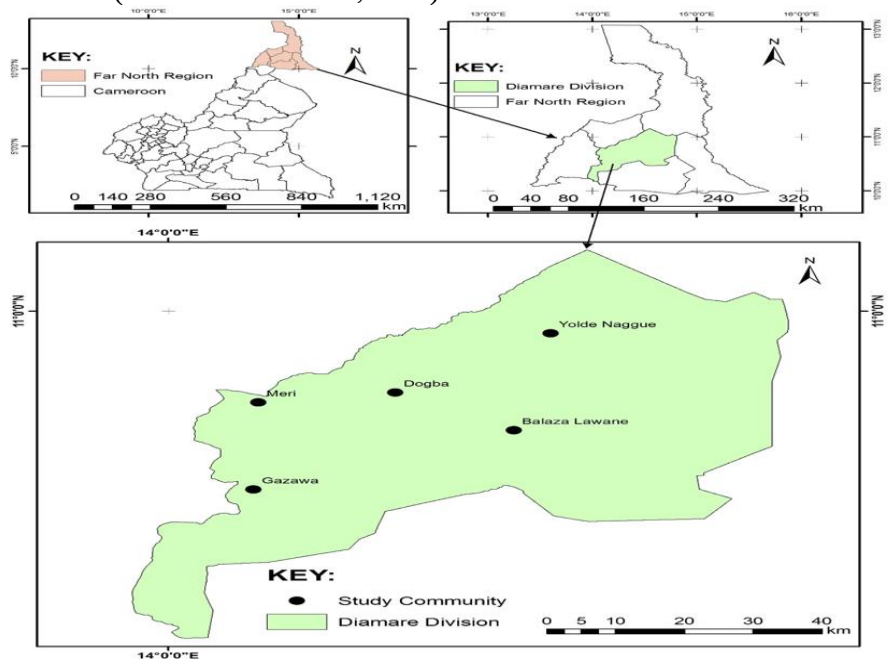

Figure 1: Map of Diamare Division, Northern Cameroon, showing the study sites
Source: Authors' construction from GPS coordinates obtained during field survey, 2020

2.2 Research design and data collection

A cross-sectional study design was employed to gather relevant information that met the objectives of the current study. Both qualitative and quantitative data were collected through household questionnaires and interviews with key informants. Secondary information was sourced from published articles and government reports to support the study's findings. Random and purposive sampling techniques (Kothari, 2004) were used to select household respondents and key informants. Purposive sampling was necessary to ensure that those with in-depth knowledge of drought experience were included in the study. Primary data were collected face to face by the researcher and four research assistants in French and Fulfulde Languages (the main languages spoken by the respondents). Household surveys were conducted solely in Fulfulde, while interviews were conducted in both Fulfulde and French languages. 384 household heads or their representatives were included in the study. The sampled households were determined using the formula proposed by Bartlett, Kotrlik, and Higgins, (2001), where 50% of the population of Diamare was estimated to be exposed to drought and depended on climate-sensitive livelihoods (crop production and livestock). A 95% confidence interval was used as the margin of error in determining the total study sample size. Only adult participants (≥18 years old) who gave consent to participate in the interviews were included in the study and questioned. Key informant interviews were guided by written questions to ensure that the study's objectives were met. Key themes in questions asked included respondents' sociodemographic profile, drivers of drought, levels of household drought preparedness, existence and knowledge of drought policies/plans and committee in enhancing preparedness, institutional plans for household preparedness, and sources of drought information for household preparedness. Data were collected during the dry season in 2020, where some people were engaged in dry season farming and crops including dry season sorghum, onions, and tomatoes were grown. This permitted the smooth collection of data and allowed the researcher to witness the impact of drought on lives and livelihoods in the studied area. Before conducting field investigations, ethical permission was obtained from the University of Dar es Salaam (Ref.No:AB3/12(B), and the Maroua divisional office in 2019 and 2020, respectively. Verbal concerned was also sort from the local chiefs of all the study communities before data collection.

2.3 Data analysis

Collected quantitative data were edited, coded and processed for descriptive and inferential statistics using the Statistical Product and Service Solutions (SPSS) version 20 and Excel version 2013. Inferential and descriptive statistics were used to examine drivers of drought and respondents preparedness for droughts. A chi-square test at a 5% significance level was used to show the relationship between variables and their influence on drought preparedness, such as age and use of indigenous knowledge. Qualitative data obtained through focused group discussions (FGDs) and interviews were analysed using content analysis approach to establish themes. This enabled a deeper understanding of drought occurrence and preparedness. Triangulation of empirical and secondary data was used in reporting the findings to enhance the validity of the findings.

3. Results and Discussion

3.1 Socioeconomic and Demographic Drought-related Preparedness

3.1.1 Educational attainment and drought preparedness

Education level has a role in determining preparedness strategies that households can implement. The northern region, in general, is host to people with low primary school enrolment, with the lowest literacy rate in Cameroon (Bang, Miles, & Gordon, 2019a). The low school attainment rate in the division can be attributed to the population's traditional and religious (Muslim) norms, which encourage polygyny and early marriages among girls. This inhibits many households from educating their female children (Bang et al., 2019a), thus reducing the high rate of uneducated people. Lack of formal education implies that most respondents are illiterate and can barely understand complex scientific management measures that could be implemented to prepare for and respond to drought effectively. Higher education attainment increases the capacity of family heads to obtain, decode and comprehend information for innovative decision-making (Molua, 2012). None of the respondents had tertiary education, implying a lack of comprehension of

sophisticated scientific innovations such as weather data interpretation, changes in agricultural practices, and food consumption patterns in times of climatic shocks. Similarly, Nji and Balgah (2019) and Molua (2012) also noted lack of tertiary education attainment in their studies in northern Cameroon. Ngaka (2012) notes that without tertiary education attainment, primary and secondary education is not enough for one to adapt to climate change shocks adequately. Hence, the lack of tertiary education by the respondents in Diamare indicates challenges in their understanding of scientific issues such as drought preparedness. This is likely to increase respondents' vulnerability to drought impacts. Bang et al. (2019a) also reported that low education attainment in Northern Cameroon increased the vulnerability of households to climatic hazards due to insufficient ability to tackle the threats. Education can equally influence the household's preparedness for drought through its potential to influence the income earned by the household head. The low education attainment of respondents could be attributed to early marriages which is facilitated by the cultural and religious norms and practices favouring polygyny (Bang et al., 2019a). Early marriages among residents in the Sudano-Sahelian zone should be discouraged while encouraging tertiary education to increase households' understanding of scientific drought management measures and livelihood diversification.

3.1.2 Family size and drought preparedness

The majority, 97% of the respondents, were married or cohabiting. The household sizes ranged from 1 to 20 persons per household. Most of the respondents in the study area had large family sizes of 6 to 10 persons living and feeding in a home. A large family size, especially in poor African settings, means large mouths to feed during drought, with a heavy burden on family financial stability, especially those with large dependants. Household size also determines the number of people at risk of food and water insecurity when a drought strikes. The large household size in the study area can be explained by the religious and cultural practices explained above as well as agricultural practices, where a large family can be a source of labour for crop and livestock production (Molua, 2012). However, this can only be true if there are more energetic adults than dependants in a family to provide the required labour and income for household sustenance. Ntali and Lyimo (2022), in their study conducted in the Diamare division, indicate a more dependent population who cannot provide the required farm labour. Although large household sizes in African countries have been presumed to be an essential source of labour, they affect food consumption needs and resources for family sustenance during droughts (Ndlovu, 2010; Molua, 2012).

3.1.3 Economic status and drought preparedness

The respondents' economic status is crucial for decision-making and the adoption of drought preparedness actions. The results showed that most respondents (75%) had a monthly income below 25,000 CFA (Approximately 42 United States Dollars (USD)), 12% had from 25,001 to 50,000 CFA, 9% had from 50,001 to 75,000, while 2% had income between 75,001 to 100,000 and 2% had above 100.0001 CFA. This indicates that a large proportion of the respondents are poor with low income and living below 2 USD per day. Low income among households in the study region has also been reported by Balgah et al. (2020). Results of the chi-square analysis between income and respondents' perceived preparedness showed a statistically significant relationship between income and preparedness level ($\chi^2 = 48.132$, df, 4, $p < 0.05$), where those with higher income were more prepared than those with lower income. This implies that higher income plays a role in drought preparedness, as perceived by the respondents. Hence, the study area needs more income generating activities to boost drought preparedness activities. Similarly, Ning et al. (2021) found an association between the economic status of households and disaster preparedness, where those with higher income were more prepared to deal with disasters. This also concurs with the findings of Cvetkovic (2016), who revealed that households with higher incomes were more prepared and took preventive actions than those with lower income in Serbia.

3.1.4 Age and drought preparedness

Generally, the survey comprised male (58%) and female (42%) respondents aged 20 and above 60 years who have lived in the study communities for more than ten years. Respondents who were 50 years and

above constituted the majority (47%), followed by those between 30-39 years (23%). Those within the age bracket 40-49 were observed to be (19%), while the least represented were those between 20-30 years (11%) (Figure 2). In northern Sudano-Sahelian Cameroon, agriculture is the respondents' major livelihood activity, especially for older people with little educational attainment that could enable respondents to secure wage or salaried jobs. Thus, most of the old age group usually stay in their area of birth to practice crop production and livestock rearing for their subsistence; hence, the high number of the aged population observed in the study area. Similarly, Molua (2012), Nji and Balgah (2019), in their studies in Northern Cameroon, found that most of the respondents were adults with a a mean age of 40 and above. The results imply that the views and opinions discussed in this study were primarily from adult men who were above 30 years and have experienced droughts for many years.

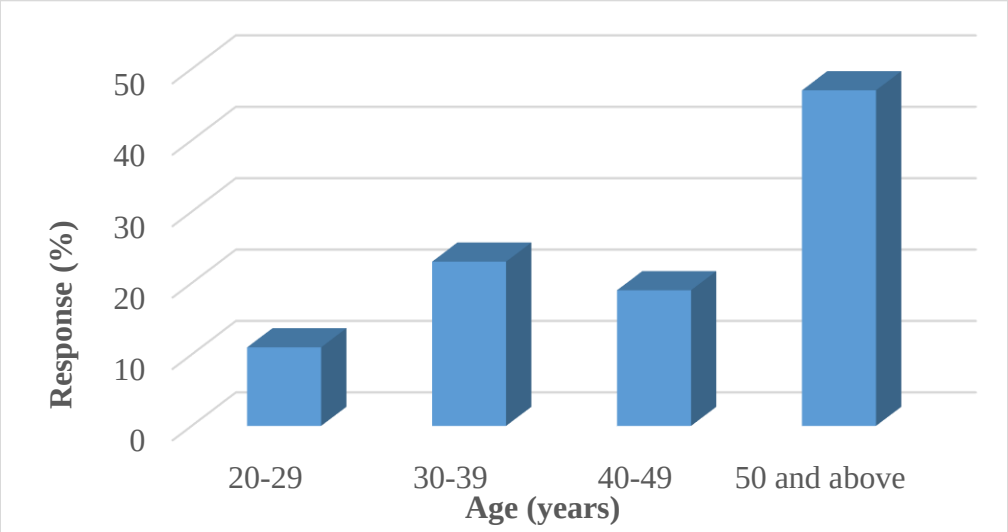

Figure 2: Age of respondents
Source: Field survey, 2020

The chi-square results (Table 1) showed a significant relationship between age and drought preparedness (χ^2 =14.62, df =4, P =0.006), with older respondents being more prepared than the younger respondents. Hence age is perceived as one of the factors of drought preparedness, which can be associated with skills and local adaption knowledge acquired over time. They are also believed to have good knowledge of the problems and management practices being undertaken in the study area.

Table 1: Cross-tabulation between age and drought preparedness

Variable	Sub-variable	Response (%)		Statistics		
		Highly prepared	Lowly/not prepared	χ^2	df	P-value
Age (years)	20-29	0	100	14.62	4	0.006**
	30-39	7	93			
	40-49	4	95			
	50-59	18	82			
	≥ 60	12	88			

3.2 Perceived Drivers of Drought

It was vital to study local perceptions of drought indicators in the study area (Figure 2). The findings indicated that more than 90% of the respondents noted a decrease in rainfall as an indicator of drought occurrence. A respondent supported this view in an interview at the Balaza Lawane community. He reported that low rainfall (drought) experienced in 2017 and 2018 resulted in complete crop failure in the Karakai

locality. Furthermore, 84.6% of the respondents perceived crop drying before maturity, which resulted in decreased crop yields (92.6%) due to the loss of soil moisture (Figure 3). A respondent lamented that farmers in the area did all they could on their farms to improve yields, but the crops all failed due to a lack of rainfall. Related studies show that persistent droughts in the region have increased stress on crops, resulting in complete crop failure and decreasing yields (Epule et al., 2021; Lambi & Kometa, 2014). From 2012-2016, droughts in Cameroon destroyed tons of several crop seeds and seedlings in many parts of the country (Epule et al., 2021). The late start of rainfall was also perceived by 90.6% of the informants as an indicator of drought in the study communities. Rainfall is the primary water source for agricultural activities of the rural Sahelian communities of northern Cameroon. Thus, the late start and decrease in rainfall amounts in this area signify a threat to the economic livelihoods of the farming population, as the majority depend on rain-fed agriculture. Poor crop yields due to late and poor rainfall evolution can lead to food shortages and starvation in households. Although food shortages may result predominantly from droughts, it is worth noting that sporadic floods that are significant to the water-stressed study area may also pose the same threat to households (Nji & Balgah, 2019; Bang, Miles, & Gordon, 2017).

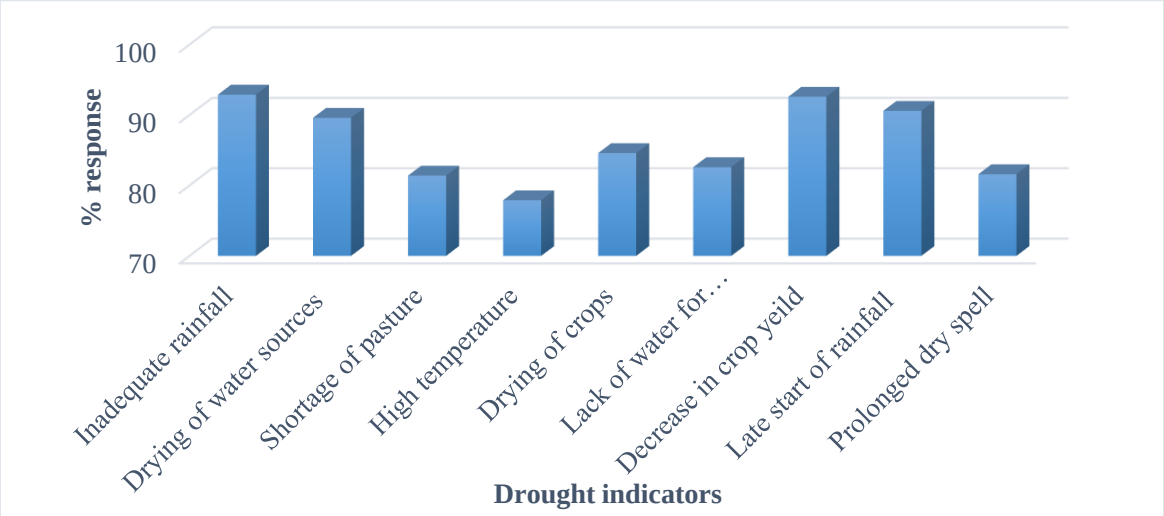

Figure 3: Perceptions of drought indicators computed from multiple responses
Source: Field survey, 2020

The prolonged dry spell was another drought indicator perceived by (81.6%) of the respondents in the study communities. Meanwhile, 77.9% mentioned increasing high temperatures as another indicator of droughts. Prolonged dry spells coupled with rising temperatures can lead to the drying of crops, water sources, and pastures that could have been used for livestock feeding and healthy growth. Irrigation is an essential buffer against climatic hazards such as drought. However, croplands in the Diamare division are sparsely irrigated using traditional irrigation methods and motor pumps. The results show that drying of water sources (89.6% of respondents) and insufficient water for irrigation farming (82.6% of respondents) were perceived indicators of droughts in the water-stressed study area. The drying up of water sources in the study area was observed as a constraint to the practice of extensive irrigation for improved crop yields. The limited use of irrigation can be attributed perhaps to the cost of investing in irrigation systems in the study area. The extended dry season of approximately eight months with little or no rainfall (Ngom Vougat et al., 2019) leaves the major water bodies thirsty. This situation may be even worse during droughts where water for domestic uses is difficult; thus, irrigation becomes a nightmare for households. Studies conducted by Abou et al. (2021) and Marie et al. (2022), Okpara et al. (2015) in Cameroon, Belle et al. (2017) in Zimbabwe, Maliki and Pauline (2022) in Tanzania, and Fanadzo, Ncube, French, and Belete (2021) in South Africa equally reported similar combinations of drought indicators perceived by local communities. The finding entails that drought-prone communities are not ignorant of drought and are expected to take proactive

measures to prepare and respond effectively to current and future droughts. The respondents anticipated more intensive and threatening hazard to their lives and livelihoods. However, when asked to rate their preparedness for current and future droughts, the majority (81% of respondents) reported being moderately prepared, as they usually save cereals and dried food during good years that can survive them for a while. Another 10 percent were lowly or not prepared at all for current and future droughts and said, there is nothing they can do when a drought is expected but to prepare their farms and pray to God for the rains. Only nine percent claimed to be highly prepared for drought. This implies that in the event of drought, very few households will be able to effectively respond and recover quickly from drought impacts. A similar finding was revealed by Fanadzo et al. (2021), who found that the majority of respondents in South Africa were ill prepared for the 2015-2018 West Cape drought.

3.3 Community Preparedness Measures for Drought

3.1 Drought policies and plans

The availability of a drought policy and plan is an appropriate measure for successful drought management and adaptation at the institutional and community levels. The majority of the respondents (60%) claimed that their communities had no policy or plans to deal with droughts, while only 26% reported that drought policies/plans exist. The remaining 14 percent were unaware of any policy or plan on drought preparedness and management. Interviews with the study respondents confirm that there are no strategic plans and policies for drought preparedness and management at the community level in the Diamare division**.** The repeated droughts of the 1970s and 1980s led the government of Cameroon to set up regulations and decrees on drought control measures in Cameroon, particularly in the northern part of the country, which experiences the highest rate of drought and desertification events noted by the Republic of Cameroun (CMR) (CMR, 2016). These regulations, decrees, and texts exist in isolation in government documents such as decree No. 2019/166 of April 2, 2019, reorganizing the Interregional Committee for Drought Control in the North, Decree No. 98/031 of March 9 1998 on the organization of emergency and relief plans in the event of disasters or major risks. These policies are based on the Desertification, Land Degradation, and Drought (DLDD) approach. In addition to these regulations and policies, institutional and functional entities are responsible for providing support services and assistance to people exposed to drought. The structures include the planning structure made up of various ministries, functional structures (e.g., Cereal office, interregional drought control committee), monitoring and early warning structures, and effect monitoring structures (Global Water Partnership, 2017)(CMR, 2016). Despite the highly stated plans and decrees on drought preparedness and management, they are merely paper and crisis disasters based with little implementation. Few respondents knew of the policies and programs to guide their preparedness for drought. The reorganization of the interregional drought committee in April 2019 resulted from a lack of operationalization and visibility of the structure to the general northern population. Studies conducted by Bang et al. (2019b) and Belle et al. (2017) in Cameroon and Zimbabwe, respectively, also showed a lack of awareness of a comprehensive disaster reduction policy and plans for the countries. The poor functionality of the various drought structures can explain the lack of community preparedness policies and plans. The governments' strategies towards drought and disaster preparedness have remained theoretical instead of practical (Bang et al., 2019b).

In general, the result suggests that communities had no plans to deal with droughts, and even if there were plans, community members did not widely know them. According to Sivakumar et al. (2014), drought management policy and preparedness plans are crucial for managing drought and ensuring an effective and timely response. This suggests a lack of commitment of local authorities in the study division to put in place appropriate measures to better equip the exposed population with what should be done in a drought situation. The low level of awareness of the respondents of the existence of the policy and plan indicates a low level of institutional measures to enhance drought preparedness in the study communities. This means there is a low level of initiative toward formalizing and publicizing the available drought management interventions.

3.2 Drought management committee and respondents' preparedness

The availability and access to drought committee members at all levels of government, including the local communities, are crucial for effective drought preparedness and risk reduction, as they serve as avenues for promoting resilience practices. The majority (54.4%) of the respondents claimed that there was no permanent drought risk reduction committee in their area and/or communities and were not aware of any member of a drought management committee that assists people in preparing for droughts, while 20.3% accepted that there was a permanent drought risk reduction committee in their area. The remaining percentage (25.3%) were unaware if there was a permanent drought reduction committee or not, and they did not know any member of the drought management committee. The result concurs with a similar study done by Nojang and Jensen (2020), who found that local chiefs (Fako division, Cameroon) who are expected by law to carry out disaster management roles in their communities were unaware of any disaster management agency in the country they could look up to for disaster assistance. The presence of an active drought management committee influences the implementation of drought risk reduction interventions in local communities to ensure a high level of preparedness (Sivakumar et al., 2014). An interview with an agricultural field officer in Gazawa showed that the activities of the Interregional drought control committee created by the government to combat drought in northern Cameroon have not trickled down to the local communities. As such, there were no community drought control and preparedness committees at the local level. The results imply that local communities or their leaders are not involved in the drought control committee and have no say in planning and implementing preparedness and mitigation activities. It can be deduced that the interregional drought control committee, whose activity is to prepare and make plans for combating drought in drought-prone communities, especially in the north, is not performing its duties effectively in sensitizing local communities on what to do to address repeated droughts. This could be explained by the lack of resources to implement drought management practices (Nojang & Jensen, 2020). Financial, human capital, and material resources have been highlighted (Bang, 2021; Ndille & Belle, 2014; Bang et al., 2019) as one of the major constraints to effective preparedness and implementation of disaster risk reduction initiatives at all levels in Cameroon and other parts of Africa. Then, the structure would struggle to make an impactful influence in addressing the impacts of recurrent drought on lives and livelihoods. In all communities, the functions of the Interregional Drought Control Committee and the Department of Civil Protection should be made known so that people are aware of the assistance they are entitled to obtain from the committee. There is a need for more trained and qualified disaster managers in the drought control committee with expertise in drought. Additionally, funds and material support for drought preparedness and management activities at all levels should be allocated to properly manage disasters in the country.

3.*3 Drought education/training and respondents' preparedness*

Respondents' training and education are critical in drought management. Knowing what to do and at what time is vital for adequate preparation. 21% of the respondents reported having received drought preparedness training in recent years that helped to build their knowledge of the disaster for better response, while the remaining 79% did not participate in any drought training. A similar study conducted by Ndille and Belle (2014) in Limbe, Cameroon, revealed limited disaster preparedness by households due to a lack of disaster awareness and training. This finding is contrary to that of Belle et al. (2017), who noted that most communal farmers in Zimbabwe received training on drought preparedness and management. The fact that many people were not trained implies a lack of adequate drought preparation, which could reduce negative impacts on households since disaster preparedness training is a critical component of the drought preparedness framework. Lian et al., 2021) equally found that farmers who did not receive training could not formulate drought preparedness plans.

Respondents who received training were trained on local methods to manage crop pests (e.g., caterpillars and locusts) and diseases; livestock protection and production; feeding options for livestock; tree planting; health impacts of drought; adoption of new drought-resistant and early maturing crop varieties (e.g., NERICA rice and S 35 sorghum); and engagement in small business activities to supplement losses in case of drought. Women in Gazawa reported to be trained on how to make neem oil from the leaves and fruits of a neem tree (*Azadirachta indica*) to boost their economic conditions and be more resilient to drought

stress. A litter of neem oil in the study area costs 5000 FCFA (about 7.5 USD). The trainings were mostly provided by local leaders, Gazawa health center, and community groups. More preparedness practices, such as conservation farming, agroforestry, and water harvesting techniques, should be encouraged in the study area to enhance the adaptive capacity of the population. Agroforestry, for instance, has been proven to improve crop yield stability, serve as a carbon sequester and greenhouse gas mitigation, and increase household income and drought resilience (Awazi & Quandt, 2021; Zerssa et al., 2021). Agroforestry trees such as Fardherbia albida are recommended for their multipurpose function in increasing soil fertility, reducing soil water loss, fodder and shade for animals, and reducing evapotranspiration rates of crops (Shiferaw et al., 2018). Respondents also reported that the tree is useful for weather predictor and farm decision making. Disaster preparedness and response programs are often more successful if community members participate in planning and training for responses before an emergency event. Hands-on drought preparedness training and education programs should be continuously conducted annually in the study area to increase household preparedness on what should be done to deal with droughts. Bogdan et al. (2021) reported that when at-risk communities participate in disaster planning and training before disaster events, they prepare and respond positively to disasters.

3.4 Drought early warning and respondents' preparedness

Early warning enhances decision-making and is critical for drought planning and preparedness. 32% of the respondents revealed that they had received drought warning information over recent years from various sources. The various sources pf warning across the studied communities were family/friends, radio, community leaders, community meetings, and extension workers (Table 2).

Table 2: Major sources of drought preparedness information

Sources of warning	Responses in percentage (%)						Statistics		
	Meri	Dogba	Balaza Lawane	Yolde Naggue	Gazawa	Total	χ^2	df	P-value
Relatives/Friends	55.3	42.5	35.8	42.5	54.3	46	9.004	4	0.061
Radio	25	20.5	19.8	20.5	14.8	20	2.573	4	0.632
Community meetings	6.6	13.7	17.3	8.2	8.6	11	6.395	4	0.172
Community leaders	5.3	5.5	19.8	15.1	13.6	12	11.676	4	0.020**
Extension workers	7.9	17.8	7.4	13.7	8.6	11	6.306	4	0.177

** Significance at 5% level

Table 2 shows that most respondents (46%) rely on friends and relatives, 20% rely on radio. A significant 12% (χ^2 = 11.676, df = 4, P = 0.020) of the respondents rely on community leaders, and 11% rely on community meetings and extension workers. Most respondents depend on friends and relatives who use indigenous and generational experiences to predict drought, which they find suitable, easy to access, and understood by members compared to extension workers. This finding supports the findings of Nojang and Jensen (2020) and Tume, Kimengsi and Fogwe (2019), who found that households in the Fako division and western highlands of Cameroon, respectively, rely on family and friends for hazard preparedness and adaptation knowledge. This further agrees with Radeny et al. (2019), who found that households in the Borana community in Ethiopia rely on friends, neighbors, and relatives for early weather warning information. Extension workers had the fewest respondents (11%). This can be associated with the fact that extension workers rely on the department of meteorology for weather information that they either do not get or receive late, thereby nullifying the usefulness of the information. Ngaka (2012) also found that extension workers do not provide drought warning information to households in Eastern Cape and Free State, South Africa. The radio was another source of warning information, although few people relied on it. This is because few households had access to electricity, which limits them from owning electronic gadgets such as televisions and radio sets. Field observations show that most people use simple phones that can be charged with a small solar panel. This finding is similar to (Belle et al., 2017), who found that a negligible percentage (11%) of farmers relied on radio and television for warning information, mainly because they could not afford radios and televisions. Community leaders and meeting groups also provided respondents with warning information to assist them in preparing for the disaster. An interview with a

respondent in Balaza Lawane revealed that the community leader usually meets with the population when the dry season is approaching to guide them on what can be done to protect their livestock and improve crop yields. Scientific early warning was lacking in the study communities, which has been recommended as crucial for disaster preparedness and adaptation in drought-prone areas (Mohammed et al., 2018; Wilhite et al., 2014). Early warning is critical because it can reduce the community's vulnerability and allow for early preparation. An interview with a respondent in Meri showed that his household was taken by surprise when the community experienced drought in 2017, and he had to travel to Maroua city to buy extra food. This could have been avoided if communities had been provided with detailed weather information early enough to enable them to act. There is a need to enhance information sharing among community members, which is informed by scientific early forecasts and communicated in local languages understandable to members of exposed communities for proper decision making.

3.5 Indigenous drought forecasting and respondents' preparedness

Indigenous knowledge (IK) of weather forecasting is essential to drought risk reduction, especially in the study area where modern scientific information systems are either weak or limited. Some respondents used indigenous knowledge to predict drought occurrence, which guided them to make decisions on their daily livelihood activities. The various forms of indigenous information practiced by the respondents to predict droughts include plant behavior (26%), wind direction and speed (19%), animal appearance (20%), level of water sources (wells, rivers) (14%), air temperature (11%) and appearance of certain insects (10%) (Table 3). These findings were supported by key informants who confirmed that the presence of caterpillars and locusts in their farms and plant leaves signifies poor rainfall, predicted to affect crop yields negatively. The behavior of certain animal species (e.g. goats, sheep) and changes on tree species where studied by respondents to predict the onset and intensity of dry periods. A respondent during FGD further narrated the significance of indigenous knowledge for drought prediction and preparedness stating that *"we usually observe the wind speed and when the wind blows so strongly and with high speed then, we know there will be droughts' another added that "Additionally, when we see that our animals such as goats and sheep are becoming very clean after grazing the whole day, then we can tell that the dry season is approaching*". The Harmattan wind, which blows over the West and Sahel regions of Africa, causing low rainfall and dust storms, can explain the respondents' view of strong winds causing droughts in the study area.

The use of IK helps respondents not only to predict imminent droughts; however, also to guide them to put in place resources for responding to the event, such as food (cereal, dried vegetables), as noted by 61% of the respondents, livestock feed (crop residues) (56% of respondents), store water in small containers (40%), and sell animals (62%) that are weak and suspect might not survive the drought. These findings are concurrent with other studies conducted in other parts of Cameroon and Africa (Filho et al., 2022; Maliki & Pauline, 2022; Radeny et al., 2019; Tume et al., 2019) that agrarian communities make use of indigenous knowledge for climate disaster planning and preparedness. Equally, Bang (2022c), argues that IK is a pertinent component in strengthening disaster risk management that has fostered progress in achieving the SDGs particularly in developing countries. The results imply that the study communities rely highly on local knowledge shared among family members and friends for decision-making on livelihood adjustments. This is so because the studied communities have been depending on these indigenous knowledge passed down to them from their four fathers. But also because of the absence/limited weather forecast infrastructures in the studied area and the limited ability of respondents to understand scientific weather information reported in various print and other forms of media due to their low educational capacity. This suggests the need to integrate indigenous knowledge and conventional weather forecasting systems for improved rainfall prediction accuracy.

Table 3: Sources of Indigenous weather prediction for household preparedness

Indigenous knowledge of drought predictions	Implications/indication
Animal appearance	The physical appearance of animals (very clean) (e.g., goats and sheep) after returning from grazing indicates the onset of dry periods
Plant behaviour	Delayed shedding and early flourishing of the Faidherbia albida tree leaves signifies delayed rainfall and a long dry spell, while early shedding of Tamarind (*Tamarindus indica*) leaves indicates the onset of a dry spell.
Wind speed	Strong winds accompanied by dust signify the onset of long drier periods
Air Temperature	High temperatures, particularly at night, indicate the beginning of a dry spell
Water volume in water sources	Rapid drying of water sources (wells, boreholes, rivers (locally called Mayo) reflects drought season
Appearance of insects	The occurrence of more grasshoppers, caterpillars, and locusts in a particular year indicates less rainfall and poor crop yields

Source: Field survey, 2020

A chi-square test was used to show the relationship between gender, age, and the use of indigenous knowledge for drought prediction. The results indicate a statistically significant relationship between age and the use of indigenous knowledge at χ^2 =16.665, df =4, P = 0.002 (P < 0.05), whereas there was no relationship between gender and the use of indigenous knowledge for drought prediction at χ^2 = 0.088, df =1, P = 0.766 (P > 0.05). The results show that the older a person is, the more they use local knowledge to make weather-related decisions. Similarly, the use of indigenous knowledge systems is practiced by a good number of smallholder farmers in the Bamenda Highlands of Cameroon (Tume et al., 2019). This suggests that local knowledge is important for pre-disaster planning and resource mobilization in disaster-prone communities.

3.6 Role of government and NGOs in building community preparedness

Respondents were asked if the government employs some measures to assist them in preparing for current and future droughts in their communities. The finding indicates that only 30% of the respondents reported that the local government and some nongovernmental organizations (NGOs) in their communities provide drought assistance, while the remaining (70%) claimed that there are no drought preparedness interventions from the government and NGOs to help them better prepare for droughts. The major drought preparedness interventions implemented by NGOs and local government were the provision of crop seeds, the establishment of boreholes, financial support, and drought awareness. NGOs such as the German corporation for International Cooperation (GIZ), Groupement Ets ETRA Cameroun, and the Cotton Development Corporation (SODECOTTON) assisted the population within the last two years (2018 to 2020). SODECOTTON, for instance, provided fertilizers, pesticides (e.g., Gromoson, Astrasin, Rondap), and quality cotton seeds to farmers, which they were required to pay back with cotton after harvesting, while GIZ and ETRA provided financial and training support. However, respondents stated that financial and material supports are inappropriately and unjustly distributed among community members. A respondent narrated the situation with pity pointing out that the most vulnerable in dire need of assistance are usually not assisted whereas those who are better off and can cope with impacts are those supported. This imply that the most vulnerable people are excluded from drought support.

The government, in collaboration with international NGOs, were revealed to assist in constructing boreholes and wells for public use in the communities. However, respondents noted that for the past five to ten years, they have not received assistance from the government to help them prepare for, respond to drought and recover from drought impacts. They express distrust in the government, local administrators, and some local and international organisations for wasting their time and energy talking for hours occasional on issues related to their livelihoods and climatic stresses on their lives and livelihoods with little or no assistance from them. A respondent in Dogba stated that *"They (NGOs and government officials) often visit us but only to waste our time and energy with several questions. We spend hours talking with them, and when they are done collecting our information, they never return with any assistance or solutions*

to the problems we have raised. We are tired of talking with them without receiving any solution or help. We don't know if the local authorities receive support from the NGOs and do not hand it to community members who are always affected by droughts". However, this finding shows that respondents are unhappy with the frequent visits of NGOs and authorities who do not support them after spending time sharing their challenges with them and feel that authorities might be embezzling emergency items meant for them. This observation is consistent with that of Nojang and Jensen (2020) and Nji (2020), who noted a lack of trust in the government for any support during and after a disaster by respondents in the Fako division and western Highlands of Cameroon. This finding is contrary to that of (Fanadzo et al., 2021), who revealed that about 71% of households in the West Coast district obtained vouchers and fodder support from the government during drought.

3.7 Tree Planting

Tree planting was another mitigation preparedness activity carried out in the study area, as reported by 65% of the respondents. Respondents reported to have at least planted a tree, especially a neem tree around their homes to provide shade against the scorching sun, and wind speed and conserve soil moisture. This practice was initially introduced by the government of Cameroon as a way of mitigating drought occurrence and desertification in the region under the "Green Sahel Revolution" project that was introduced in the 1970s. Literature review showed that the government through "Operation Tree Planting" has planted thousands of trees in some municipalities and is working with local councils to plant more trees. Respondents have continued with this practice as a means to curb the impacts of droughts. However, field observations revealed scanty tree stands, particularly in farmlands in the study communities. This might be due to increased deforestation without replanting for farming, fuel wood, and livestock feed. Trees such as Acacia, Fardherbia, Tamarind, mango (*Mangifera indica*) and neem, were found in many places in public spaces such as schools, local councils and around homes. Afforestation and agroforestry of drought-resistant trees species such as Fardberbia albida is therefore recommended as it has been shown to provide shade, reduce soil erosion while increasing soil moisture and fertility, increase rainfall, and enhanced community drought resilience (Awazi & Quandt, 2021; Zerssa et al., 2021). Respondents also reported that the tree is a weather predictor in guiding drought preparedness decisions.

4. Conclusion

The Far North Sudano-Sahelian zone of Cameroon is prone to recurrent droughts requiring proactive preparedness for effective response and recovery from hazard impacts. The study examined communities' preparedness for droughts to enhance knowledge of community drought preparedness for policy decision-making and general drought management. The study found that although respondents depended on their social connectedness for drought information and local knowledge for drought preparedness decision-making, planted trees, relied on stored food and water, they were not fully prepared to deal with current and future droughts. The lack of government support, inadequate drought training, and extension/scientific support services limited respondents' preparation for and response to drought. The study also revealed little or no assistance from the interregional drought control committee and the government in promoting drought readiness for recurrent droughts. Drought disaster preparedness and management policies and plans in the country are weak, not inclusive, reactive, and mostly paper-driven, with little or no implementation for drought risk reduction.

The study recommends the establishment of community drought disaster management committees that can enhance the formulation and implementation of proactive drought plans at the grassroots level for effective preparedness, response, and recovery from drought when it occurs. This will foster the achievement of the Sendai framework for disaster risk reduction priority 2 (strengthening disaster risk governance to manage disaster risk) and 4 (enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation, and reconstruction), and promote climate action in Cameroon. The lack of awareness of the laws and policies governing drought management in the region, as revealed by the majority of the respondents, and the absence of a community drought management committee deprives communities of critical resources (human, financial, technological, and material) to deal with droughts. This study

contributes to the literature in the disaster risk management discipline by enhancing the understanding of disaster preparedness with a lens on community drought preparedness for effective planning and policy interventions. Further study is recommended on applying indigenous knowledge at all stages of disaster management for drought risk reduction.

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No competing interests to declare

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The data supporting this study's findings are available upon request from the corresponding author.

References

Abou, S., Ali, M., Wakponou, A., & Sambo, A. (2021). Sorghum Farmers ' Climate Change Adaptation Strategies in the Semiarid Region of Cameroon ´. In I. Oguge, N., Ayal, D., Adeleke, L., da Silva (Ed.), *African Handbook of Climate Change Adaptation* (pp. 147–165). https://doi.org/10.1007/978-3-030-45106-6

Adaawen, S., Rademacher-Schulz, C., Schraven, B., & Segadlo, N. (2019). Drought, migration, and conflict in sub-Saharan Africa: what are the links and policy options? In E. Mapedza, D. Tsegai, M. Brüntrup, & R. McLeman (Eds.), *Drought Challenges: Policy Options for Developing Countries* (2nd ed., pp. 15–31). https://doi.org/10.1016/b978-0-12-814820-4.00002-x

Aka, F. T., Buh, G. W., Fantong, W. Y., Issa, Zouh, I. T., Djomou, S. L. B., … Hell, J. V. (2016). Disaster prevention, disaster preparedness and local community resilience within the context of disaster risk management in Cameroon. *Natural Hazards*, *86*(1), 57–88. https://doi.org/10.1007/s11069-016-2674-5

Awazi, N. P., & Quandt, A. (2021). Livelihood resilience to environmental changes in areas of Kenya and Cameroon: a comparative analysis. *Climatic Change*, *165*(1–2), 1–17. https://doi.org/10.1007/s10584-021-03073-5

Awazi, P. N., Tchamba, M. N., & Temgoua, F. L. (2020). Enhancement of resilience to climate variability and change through agroforestry practices in smallholder farming systems in Cameroon. *Agroforestry Systems*, *94*(3), 687–705. https://doi.org/10.1007/s10457-019-00435-y

Ayugi, B., Eresanya, E. O., Onyango, A. O., Ogou, F. K., Okoro, E. C., Okoye, C. O., & Anoruo, C. M. (2022). Review of Meteorological Drought in Africa : Historical Trends , Impacts , Mitigation Measures , and Prospects. *Pure and Applied Geophysics*, *179*, 1365–1386. https://doi.org/10.1007/s00024-022-02988-z

Balgah, A. R., Mue, T. N., Buchenrieder, G., & Yenshu, E. V. (2020). Factors Influencing Coping Strategies for Drought-Affected Households in Northern Cameroon. *Journal of Ecology and Natural Resources*, *4*(7), 1–7. https://doi.org/10.23880/jenr-16000221

Bang, H., Miles, L., & Gordon, R. (2017). The Irony of Flood Risks in African Dryland Environments: Human Security in North Cameroon. *World Journal of Engineering and Technology*, *05*(03), 109–121. https://doi.org/10.4236/wjet.2017.53b013

Bang, H., Miles, L., & Gordon, R. (2019). Evaluating local vulnerability and organisational resilience to frequent flooding in Africa: the case of Northern Cameroon. *Foresight*, *21*(2), 266–284. https://doi.org/10.1108/FS-06-2018-0068

Bang, H. N. (2021). A gap analysis of the legislative, policy, institutional and crises management frameworks for disaster risk management in Cameroon. *Progress in Disaster Science*, *11*. https://doi.org/10.1016/j.pdisas.2021.100190

Bang, H. N. (2022a). A Concise Appraisal of Cameroon's Hazard Risk Profile: Multi-Hazard Inventories, Causes, Consequences and Implications for Disaster Management. *GeoHazards*, *3*(1), 55–87. https://doi.org/10.3390/geohazards3010004

Bang, H. N. (2022b). Policy and Institutional Frameworks for Disaster Risk Management in Cameroon: Challenges and Prospects. In R. A. Balgah & J. N. Kimengsi (Eds.), *Disaster Management in Sub-Saharan Africa: Policies, Institutions and Processes* (First, pp. 97–122). https://doi.org/DOI: 10.1108/978-1-80262-817-320221004

Bang, H. N., Miles, L. S., & Gordon, R. D. (2019). Disaster Risk Reduction in Cameroon : Are Contemporary Disaster

Management Frameworks Accommodating the Sendai Framework Agenda 2030 ? *International Journal of Disaster Risk Science*, *10*(4), 462–477. https://doi.org/10.1007/s13753-019-00238-w

Bang, N. H. (2022). The Application of Indigenous Knowledge for Disaster Risk Management and Sustainable Development: Insights from Developing Countries. In F. M. Mbah, L. W. Filho, & S. Ajaps (Eds.), *Indigenous Methodologies, Research and Practices for Sustainable Development*. https://doi.org/https://doi.org/10.1007/978-3-031-12326-9_19

Bartlett, J. E., Kotrlik, J. W., & Higgins, C. C. (2001). Organizational Research: Determining Appropriate Sample Size in Survey Research. *Information Technology, Learning, and Performance*, *19*(1), 43–50. https://doi.org/10.1007/BF00471876

Belle, J., Sithabile, M., & Abiodun, A. O. (2017). Assessing communal farmers'preparedness to drought in the Umguza District, Zimbabwe. *International Journal of Disaster Risk Reduction*, *22*, 194–203. https://doi.org/10.1016/j.ijdrr.2017.03.004

Birkmann, J. (2007). Risk and vulnerability indicators at different scales:. Applicability, usefulness and policy implications. *Environmental Hazards*, *7*(1), 20–31. https://doi.org/10.1016/j.envhaz.2007.04.002

Bogdan, E. (Evalyna) A., Roszko, A. M., Beckie, M. A., & Conway, A. (2021). We're ready! Effectiveness of community disaster preparedness workshops across different community groups in Alberta, Canada. *International Journal of Disaster Risk Reduction*, *55*. https://doi.org/10.1016/j.ijdrr.2021.102060

Bring, C., & Mfendoun, M. F. G. (2016). *The Conditions and Strategies for Drought Control in Cameroon*. Retrieved from https://www.droughtmanagement.info/wp-content/uploads/2016/10/WS6-Cameroon-Presentation.pdf

Chiang, F., Mazdiyasni, O., & AghaKouchak, A. (2021). Evidence of anthropogenic impacts on global drought frequency, duration, and intensity. *Nature Communications*, *12*(1), 1–10. https://doi.org/10.1038/s41467-021-22314-w

Cvetkovic, M. V. (2016). Influence of income level on citizen preparedness for response to natural disasters. *Vojno Delo*, *68*(4), 100–127. https://doi.org/10.5937/vojdelo1604100c

Epule, T. E. (2021). Recent patterns of exposure, sensitivity, and adaptive capacity of selected crops in Cameroon. *Agriculture (Switzerland)*, *11*(6). https://doi.org/10.3390/agriculture11060550

Epule, T. E., Chehbouni, A., Dhiba, D., Etongo, D., Driouech, F., Brouziyne, Y., & Peng, C. (2021). Vulnerability of maize, millet, and rice yields to growing season precipitation and socioeconomic proxies in Cameroon. *PLoS ONE*, *16*(6 June), 1–23. https://doi.org/10.1371/journal.pone.0252335

Fanadzo, M., Ncube, B., French, A., & Belete, A. (2021). Smallholder farmer coping and adaptation strategies during the 2015-18 drought in the Western Cape, South Africa. *Physics and Chemistry of the Earth*, *124*(P1), 102986. https://doi.org/10.1016/j.pce.2021.102986

Filho, W. L., Barbir, J., Gwenzi, J., Ayal, D., Simpson, P. N., Adeleke, L., … Yaffa, S. (2022). The role of indigenous knowledge in climate change adaptation in Africa. *Environmental Science & Policy*, *136*, 250–260.

Global Water Partnership. (2017). *Enhancing youth participation to flood and drought disaster risk reduction in developing countries (EYD2R)*.

Guenang, G. M., & Kamga, F. M. (2014). Computation of the standardized precipitation index (SPI) and its use to assess drought occurrences in Cameroon over recent decades. *Journal of Applied Meteorology and Climatology*, *53*(10), 2310–2324. https://doi.org/10.1175/JAMC-D-14-0032.1

Huang, J., Yu, H., Guan, X., Wang, G., & Guo, R. (2016). Accelerated dryland expansion under climate change. *Nature Climate Change*, *6*(2), 166–171. https://doi.org/10.1038/nclimate2837

Kothari, C. R. (2004). *Research Methodology: Methods and Techniques* (2nd Revise). New Dehli: New Age International Publishers.

Lambi, M. C., & Kometa, S. S. (2014). Climate Change in Cameroon and Its Impacts on Agriculture. In S. Albrecht, E., Schmidt, M., Mißler-Behr, M., Spyra (Ed.), *Implementing Adaptation Strategies by Legal, Economic and Planning Instruments on Climate Change. Environmental Protection in the European Union* (pp. 237–254). https://doi.org/10.1007/978-3-540-77614-7_15

Lian, P., Zhuo, Z., Qi, Y., Xu, D., & Deng, X. (2021). The impacts of training on farmers' preparedness behaviors of earthquake disaster—evidence from earthquake-prone settlements in rural China. *Agriculture (Switzerland)*, *11*(726), 1–17. https://doi.org/10.3390/agriculture11080726

Maliki, M. A., & Pauline, M. N. (2022). Living and Responding to Climatic Stresses : Perspectives from Smallholder Farmers in Hanang ' District , Tanzania. *Environmental Management*, 1–14. https://doi.org/10.1007/s00267-021-01588-2

Marie, P., Armand, W., Louis, J., Manga, F., Aimé, J., Ii, M., … Martin, J. (2022). Climate change perception and local adaptation of natural resource management in a farming community of Cameroon : A case study. *Environmental Challenges*, *8*(December 2021), 100539. https://doi.org/10.1016/j.envc.2022.100539

Masih, I., Maskey, S., Mussá, F. E. F., & Trambauer, P. (2014). A review of droughts on the African continent: A geospatial and long-term perspective. *Hydrology and Earth System Sciences*, *18*(9), 3635–3649. https://doi.org/10.5194/hess-18-3635-2014

Mohammed, Y., Yimer, F., Tadesse, M., & Tesfaye, K. (2018). Meteorological drought assessment in north east highlands of Ethiopia. *International Journal of Climate Change Strategies and Management*, *10*(1), 142–160. https://doi.org/10.1108/IJCCSM-12-2016-0179

Molua, E. L. (2012). Gendered response and risk-coping capacity to climate variability for sustained food security in Northern Cameroon. *International Journal of Climate Change Strategies and Management*, *4*(3), 277–307. https://doi.org/10.1108/17568691211248739

Ndenecho, E. N., & Lambi, C. M. (2010). Cameroons Arid Lands in Transition: A Case study of a Fragile Environment at the Ante-room of Desertification. *Journal of Aplied Social Sciences*, *9*(1), 6–22. Retrieved from https://www.jstor.org/stable/24326362

Ndille, R., & Belle, J. A. (2014). Managing the Limbe Floods : Considerations for Disaster Risk Reduction in Cameroon. *International Journal of Disaster Risk Science*, *5*, 147–156. https://doi.org/10.1007/s13753-014-0019-0

Ngaka, M. J. (2012). Drought preparedness, impact and response: A case of the Eastern Cape and Free State provinces of South Africa. *Jàmbá: Journal of Disaster Risk Studies*, *4*(1), 1–10. https://doi.org/10.4102/jamba.v4i1.47

Ngom Vougat, R. R. B., Chouto, S., Aoudou Doua, S., Garabed, R., Zoli Pagnah, A., & Gonne, B. (2019). Using Google Earth™ and Geographical Information System data as method to delineate sample domains for an urban household surveys: The case of Maroua (Far North Region-Cameroon). *International Journal of Health Geographics*, *18*(1), 1–12. https://doi.org/10.1186/s12942-019-0186-8

Ning, N., Hu, M., Qiao, J., Liu, C., Zhao, X., Xu, W., & Xu, W. (2021). Factors Associated With Individual Emergency Preparedness Behaviors : A Cross-Sectional Survey Among the Public in Three Chinese Provinces. *Frontiers in Public Health*, *9*, 1–8. https://doi.org/10.3389/fpubh.2021.644421

Nji, M. T., & Balgah, R. A. (2019). Determinants of Coping Strategies to Floods and Droughts in Multiple Geo-Ecological Zones. In J. P. Tiefenbacher (Ed.), *Natural Hazards - Risk, Exposure, Response, and Resilience* (pp. 1–21). https://doi.org/http://dx.doi.org/10.5772/intechopen.84571

Njouenwet, I., Djiotang Tchotchou, L. A., Ayugi, B. O., Guenang, G. M., Vondou, D. A., & Nouayou, R. (2022). Spatiotemporal Variability, Trends, and Potential Impacts of Extreme Rainfall Events in the Sudano-Sahelian Region of Cameroon. *Atmosphere*, *13*(10), 1–24. https://doi.org/10.3390/atmos13101599

Nojang, E. N., & Jensen, J. (2020). Conceptualizing Individual and Household Disaster Preparedness : The Perspective from Cameroon. *International Journal of Disaster Risk Science*, *11*, 333–346. https://doi.org/10.1007/s13753-020-00258-x

Ntali, M. Y., & Lyimo, G. J. (2022). Discover Sustainability Community livelihood vulnerability to drought in semi - arid areas of northern Cameroon. *Discover Sustainability*, *3*(22). https://doi.org/10.1007/s43621-022-00089-4

Ntali, Y. M., Lyimo, J. G., & Dakyaga, F. (2023). Trends , impacts , and local responses to drought stress in Diamare Division , Northern Cameroon. *World Development Sustainabilit*, *2*, 1–11. https://doi.org/10.1016/j.wds.2022.100040

Okpara, U. T., Stringer, L. C., Dougill, A. J., & Bila, M. D. (2015). Conflicts about water in Lake Chad: Are environmental, vulnerability and security issues linked? *Progress in Development Studies*, *15*(4), 308–325. https://doi.org/10.1177/1464993415592738

PNDP. (2016). *Plan Communal De Developpement de la Commune D'arrondissement de Maroua 2ème*. Retrieved from https://s1084e755aa436055.jimcontent.com/download/version/1615730713/module/12375663557/name/PCD_Maroua_2_FINAL_REVU.pdf (Accessed in March 2020

Radeny, M., Desalegn, A., Mubiru, D., Kyazze, F., Mahoo, H., Recha, J., … Solomon, D. (2019). Indigenous knowledge for seasonal weather and climate forecasting across East Africa. *Climatic Change*, (156), 509–526.

Raikes, J., Smith, T. F., Jacobson, C., & Baldwin, C. (2019). Pre-disaster planning and preparedness for floods and droughts: A systematic review. *International Journal of Disaster Risk Reduction*, *38*(January). https://doi.org/10.1016/j.ijdrr.2019.101207

Shiferaw, T., Baudron, F., Kim, H., & Giller, K. E. (2018). Agricultural and Forest Meteorology Climate-smart agroforestry : Faidherbia albida trees bu ff er wheat against climatic extremes in the Central Rift Valley of Ethiopia. *Agricultural and Forest Meteorology*, *248*(March 2017), 339–347. https://doi.org/10.1016/j.agrformet.2017.10.013

Sivakumar, M. V. K., Stefanski, R., Bazza, M., Zelaya, S., Wilhite, D., & Magalhaes, A. R. (2014). High Level meeting on national drought policy: Summary and major outcomes. *Weather and Climate Extremes*, *3*, 126–

132. https://doi.org/10.1016/j.wace.2014.03.007
Sixtus, M. (2016). *Drought Deals Harsh Blow to Cameroon's Cocoa Farmers*. Retrieved from http://www.ipsnews.net/2016/08/%0Adrought-deals-harsh-blow-to-cameroons-cocoa-farmers/ (
Solh, M., & Van Ginkel, M. (2014). Drought preparedness and drought mitigation in the developing world's drylands. *Weather and Climate Extremes*, *3*, 62–66. https://doi.org/10.1016/j.wace.2014.03.003
Tume, S. J. P., Kimengsi, J. N., & Fogwe, Z. N. (2019). Indigenous Knowledge and Farmer Perceptions of Climate and Ecological Changes in the Bamenda Highlands of Cameroon : Insights from the Bui Plateau. *Climate*, *7*(138), 1–18.
Vicente-Serrano, S. M., Begueria, S., & López-Moreno, J. (2010). A multiscalar drought index sensitive to global warming: The standardized precipitation evapotranspiration index. *J. Clim*, *23*, 1696–1718.
Wilhite, D. A. (2000). Drought preparedness and response in the context of Sub-Saharan Africa. *Journal of Contingencies and Crisis Management*, *8*(2), 81–92. https://doi.org/10.1111/1468-5973.00127
Wilhite, D. A., Sivakumar, M. V. K., & Pulwarty, R. (2014). Managing drought risk in a changing climate : The role of national drought policy. *Weather and Climate Extremes*, *3*(March 2013), 4–13. https://doi.org/10.1016/j.wace.2014.01.002
Zerssa, G., Feyssa, D., Kim, D. G., & Eichler-Löbermann, B. (2021). Challenges of smallholder farming in Ethiopia and opportunities by adopting climate-smart agriculture. *Agriculture (Switzerland)*, *11*(3), 1–26. https://doi.org/10.3390/agriculture11030192