

## Coping with Drought in Mastung District, Balochistan: Farmers' Perspectives and Adaptation Strategies

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| ARTICLE INFO                                                                                          |          |          | ABSTRACT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------------|----------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Article History:</b>                                                                               |          |          | <i>Drought is a recurring disaster in Balochistan, significantly affecting agricultural productivity and rural livelihoods. This study explores the farmers' perceptions and adaptation strategies in Mastung District, Balochistan. Using primary data collected through questionnaire surveys and interviews, study analyzes the coping mechanisms adopted by local farmers to mitigate the adverse effects of drought. Findings indicate that storing grain, storing crop residues, use of drought-resistance crop and saving money are the drought coping mechanism. However, there is a need for more comprehensive drought mitigation strategies to ensure long-term resilience. Challenges such as water scarcity, financial constraints, and lack of institutional support hinder effective adaptation. The study highlights the need for sustainable water management policies and diversification of livelihood sources.</i> |
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## Introduction

Drought is a hazard which occurs due to penetrating and persistent shortage of precipitation (Zargar et al., 2011). Droughts occur in nearly all climatic zones and impacts both surface and groundwater resources (Mishra & Singh, 2010). The study of drought is made more complex by the absence of a common definition. This is because there are a variety of types of droughts, including meteorological, agricultural, hydrological, and socioeconomic droughts (Mukherjee et al., 2018). This is what sets droughts apart from other natural disasters; droughts tend to unfold gradually, and the consequences remain long after the immediate situation has improved (Kallis, 2008). Drought impacts the lives of millions of people every year (Wilhite, 2000). According to

Liu et al. (2021) droughts are ranked one of the costliest natural disasters and affected about 1.5 billion people during the period 1998 to 2017 and were responsible for one-third of the impacts of natural disasters. The economic consequences are significant, with drought resulting in lower crop yields, higher food prices, and worsening food insecurity (Zhang et al., 2023).

Balochistan is among the regions in Pakistan that experience drought the most (Rehman & Alamgir, 2018). Balochistan has an arid and hyper-arid climate, due to which it is highly vulnerable to drought. The province's economy is primarily based on agriculture and livestock, which are directly affected by drought (Ambreen et al., 2022; Rehman et al., 2017). Balochistan has endured extreme drought events, and the frequency, intensity, and severity of drought events in the province will be exacerbated by climate change (Naz et al., 2020). Likewise, Ashraf and Routray's (2015) research on Balochistan's spatio-temporal features of precipitation indicates an alarming trend of falling rainfall and growing severity of drought (Ashraf & Routray, 2015). These findings stress the urgent need for drought risk assessments and management strategies.

Drought conditions in Balochistan have far-reaching consequences, primarily for the agricultural sector in the province. Frequent droughts and high-water withdrawal have lowered the water table significantly, creating more challenges for farmers (Naz et al., 2020). To cope with drought, farmers in Balochistan have developed various coping strategies to manage the adverse effects of drought. These strategies include the adoption of drought-resistant crop varieties, crop rotation, selling assets, migration and diversification of income sources (Ashraf & Routray, 2013; Rehman et al., 2019). As droughts increase in Balochistan there is a relative dearth of localized studies in the literature that highlight farmers' perspectives on coping and adaptation. This gap underscores the importance of research to be conducted not only on how farmers practically adapt to drought, but also on the socio-cultural and psychological dimensions of drought coping.

Drought is a significant challenge to agricultural productivity and the livelihoods of local farmers in the Mastung District of Balochistan, which is an agricultural district. With climate change increasing the incidence and severity of drought events, understanding farmer perceptions of and responses to these challenges is critical to developing effective adaptation strategies. Yet, the current literature lacks a holistic view on farmers' perspectives on drought coping strategies in the study region. This study aims to fill the gap by exploring perceptions of farmers and their coping strategies in Mastung. This study seeks to contribute valuable insights into the resilience of farming communities in Balochistan by addressing this gap. Also, this study aims to inform policy interventions aimed at enhancing adaptive capacities in the face of climate-induced challenges.

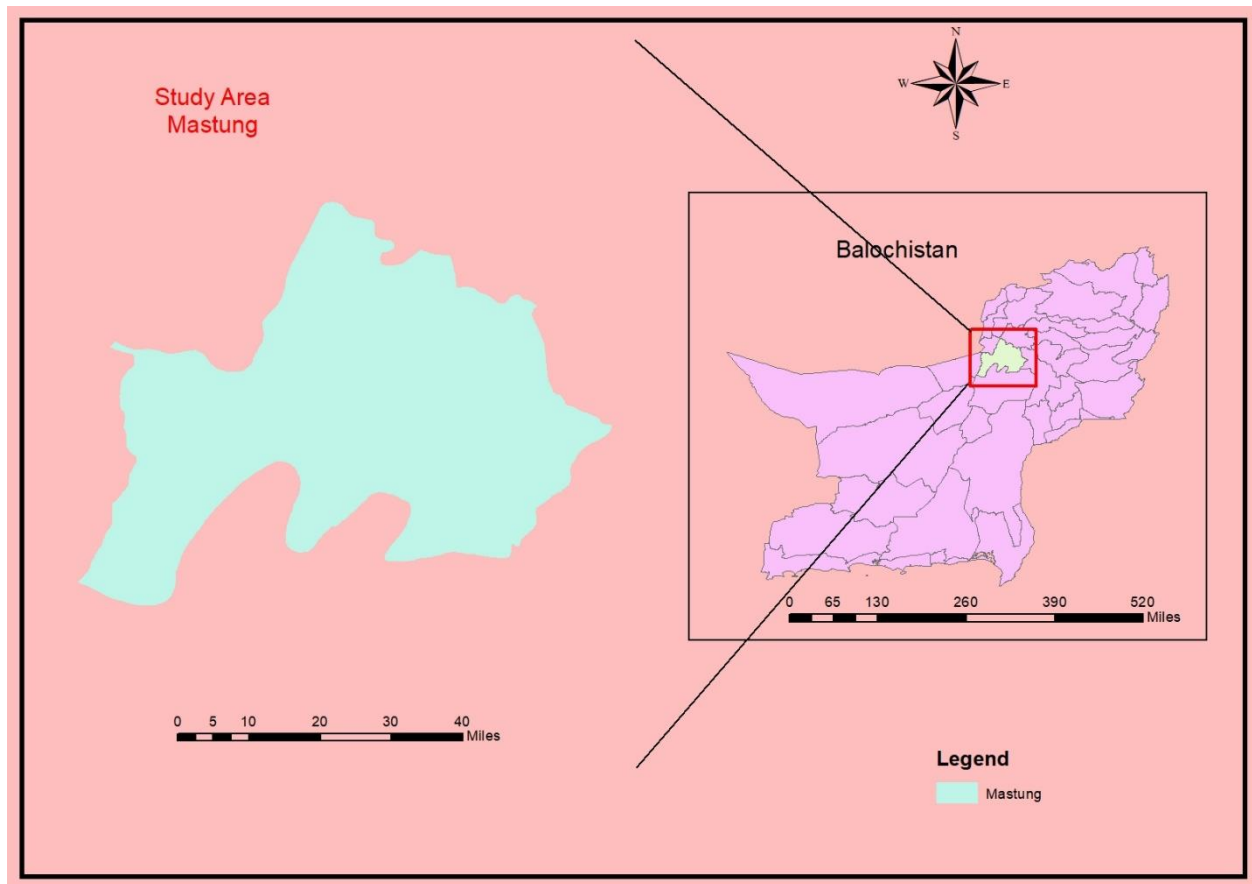
## **Methodology**

### **Study design**

This study follows a case study design, using a mixed-method approach that combines both quantitative and qualitative methods for data collection and analysis.

### **Study area**

This research focuses on Mastung District in Balochistan Province as the study area (Fig. 1). Its geographical location is 66°11'34" - 67°25'59" East longitudes and 29°20'13" - 30°15'8" North latitudes. It has a total population of 313,271 (Pakistan Bureau of Statistics, 2023). The district has a total area of 3,308 km<sup>2</sup>. It consists of three Tehsils i.e. Kirdgap, Dasht and Mastung. Total Union Councils in the district are 13 (Government of Balochistan, 2011). Agriculture is main industry of the district and apples are produced in substantial amounts.



**Figure 1: Map of study area**

### **Data types and sources**

Primary data was collected from 200 farmers in Mastung through a semi-structured questionnaire survey. The questionnaire was designed based on key elements from previous research (Ashraf & Routray, 2013; Rehman et al., 2019).

### **Sample design**

The sample size for this study was chosen using a multi-stage sampling process, as adopted by earlier studies. In the 1<sup>st</sup> stage, two most drought affected Tehsils in Mastung District were selected through purposive sampling. In the 2<sup>nd</sup> stage, two drought affected union councils were randomly selected from each of the two selected tehsils. In the 3<sup>rd</sup> stage, two most drought affected villages from each of the four selected Union Councils were selected. In the final stage, 25 farmers were randomly selected from each drought affected village.

### **Data analysis methods**

The collected data from farmers was analyzed using both quantitative and qualitative approaches for this study. Microsoft Excel and SPSS were used to analyze the collected data. Tables, maps, and graphs of the collected data were also created. Numbers and percentages were used to analyze the data.

To enhance the analysis, Google Earth Engine (GEE) was utilized to assess historical rainfall trends using CHIRPS data, including 3-month Standardized Precipitation Index (SPI-3) which is a meteorological drought indicator.

## Results and Discussion

### Socio-economic characteristics of the respondents

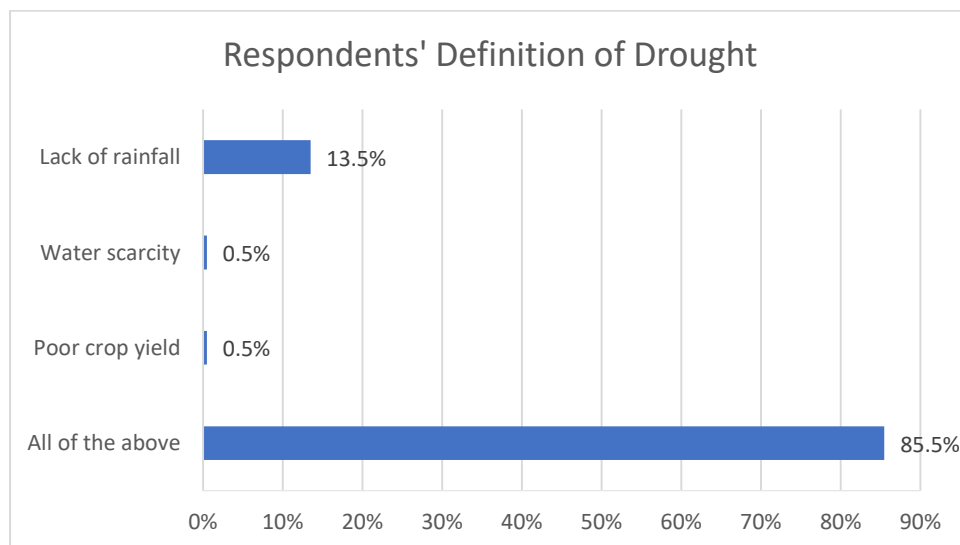
The majority of respondents (47%) were aged 51–60, followed by 37% aged 41–50. While only 16% are aged  $\leq 40$ . Like in many other parts of Balochistan, the education level was also low in Mastung. Majority of respondents (80.5%) had only primary level education. Almost 75% of respondents were farm labor and they are the most vulnerable when drought occurs. This proposes a population vastly vulnerable to drought, as laborers frequently have less control over decision-making and less resources to cope with crop failures in case of drought.

**Table 1: Socio-economic characteristics of the respondents**

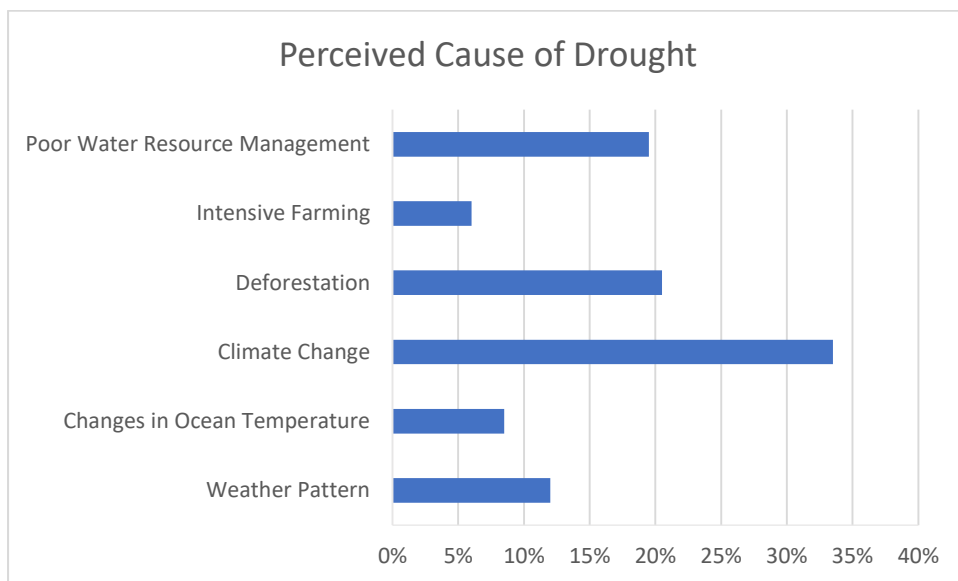
| Socio-economic characteristics | F   | %    |
|--------------------------------|-----|------|
| <b>Age</b>                     |     |      |
| $\leq 40$                      | 32  | 16   |
| 41-50                          | 74  | 37   |
| 51-60                          | 94  | 47   |
| <b>Educational status</b>      |     |      |
| Primary                        | 161 | 80.5 |
| Secondary                      | 38  | 19   |
| Higher secondary               | 1   | 0.5  |
| <b>Source of income</b>        |     |      |
| Agriculture                    | 51  | 25.5 |
| Agriculture labor              | 149 | 74.5 |

### Perception of drought and its causes

study results suggest that most farmers perceive drought as a complicated phenomenon linking interrelated aspects, highlighting the complication of its causes and effects. While analysis of the perceived causes of drought discloses that climate change, deforestation, and poor water resource management are the primary perceived drivers of drought in Mastung as perceived by farmers. Climate change is leading perceived cause of drought as 33.5% respondents in study area selected it.



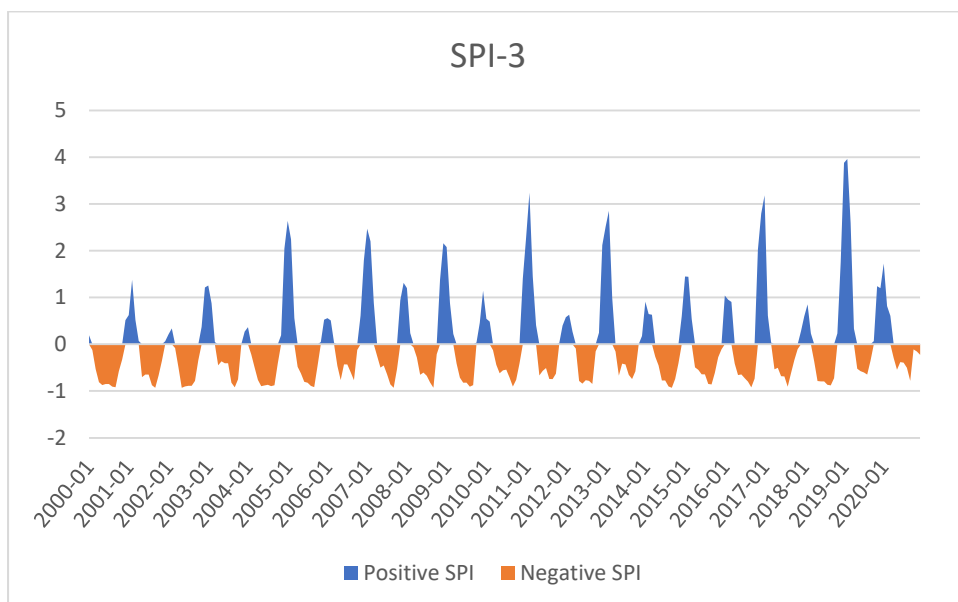
**Figure 2: Drought perception**



**Figure 3: Perceived causes of drought**

Farmers were also asked how often they experience drought. Most of the farmers (95.5%) reported that they experience drought occasionally. Whereas a slight portion of 4.5% showed that they experience drought frequently. The results are not in line with other studies in Balochistan (Ashraf & Routray, 2013; Naz et al., 2020; Rehman et al., 2019) where respondents experienced drought frequently.

Fig 4 shows the standardized precipitation index (SPI) for a 3-month scale from 2000-2020. Positive SPI values ( $>0$ ) show wetter than normal conditions while negative SPI values ( $<0$ ) show drier than normal conditions. The variations indicate seasonal variability in Mastung which means short term dry and wet periods are common in Mastung district.



**Figure 4: 3-month SPI**

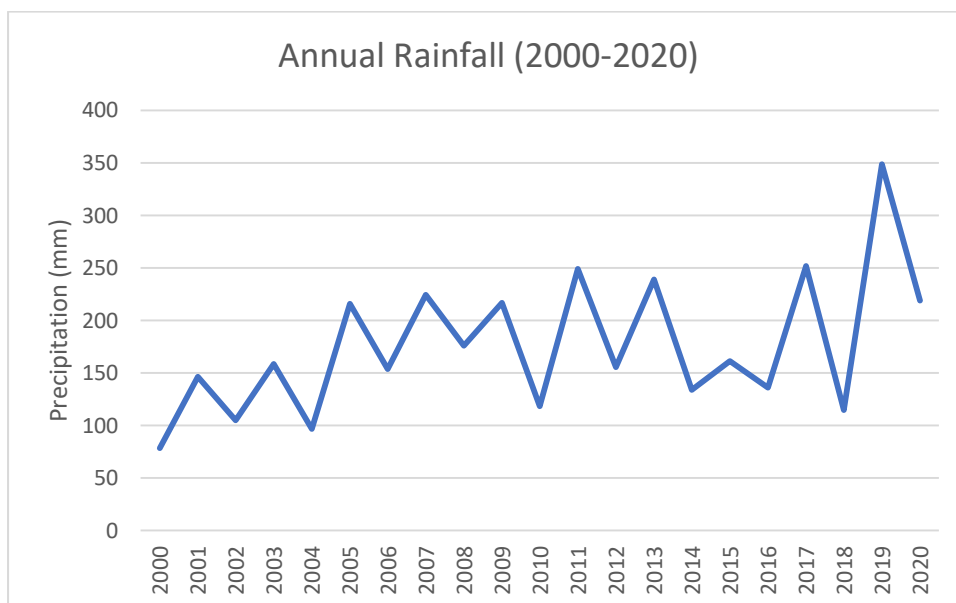
Table 2 shows the perception of farmers regarding the impact of climate change on drought intensity and frequency. The responses were categorized into five levels, showing how strongly

they agree or disagree with the statement. Overwhelming majority (96%) agree that climate change is increasing the intensity and frequency of droughts. This shows a strong awareness of the link between drought climate change.

**Table 2: Climate change effect on drought intensity and frequency**

| Climate change is affecting drought intensity and frequency | F   | %   |
|-------------------------------------------------------------|-----|-----|
| Strongly agree                                              | 1   | 0.5 |
| Agree                                                       | 192 | 96  |
| Neutral                                                     | 7   | 3.5 |
| Disagree                                                    | 0   | 0   |
| Strongly disagree                                           | 0   | 0   |

From the year 2000 to 2020, the amount of rainfall received each year has drastically changed. These findings are in line with those found in the literature, where (Ahmed et al., 2016; Jamro et al., 2020; Naz et al., 2020; Rafiq et al., 2022) reported rainfall variability in Balochistan. In general, there is an upward increase, meaning the total rainfall in a year has increased with time. However, this information is not supportive of consistent rainfall throughout the years, since there seems to be alternating periods of greater and minimal rainfall. Reviewing 2000 to 2015 shows that not much rainfall was received with minor differences occurring from year to year. From the year 2016, the variability increased significantly and peaked in 2019 before lowering in 2020. While rainfall seems to have indeed increased, this information suggests that rainfall variability has also intensified which could have implications for water resource management, agriculture, and drought preparedness.

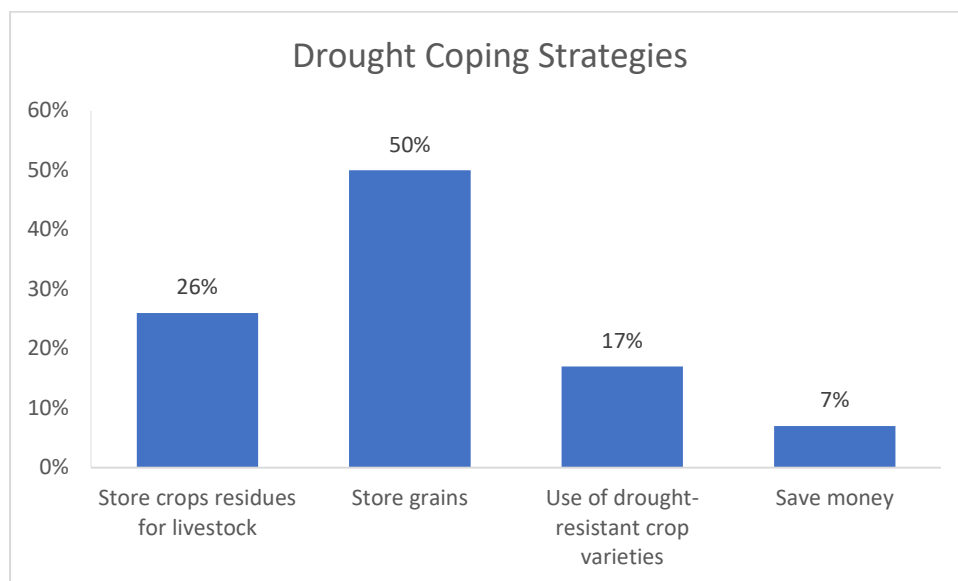


**Figure 5: Annual rainfall in Mastung from 2000-2020**

### **Drought coping strategies**

When farmers were asked about drought coping strategies, they responded differently regarding drought coping strategies with 50% of the respondents reported storing grains as their primary coping strategy. Storing crop residue for livestock and use of drought resistant crop were other

coping strategies with 26% and 17% respectively. A smaller portion of 7% respondents reported money saving as a strategy.



**Figure 6: Drought coping strategies**

Most of these strategies are under normal conditions or non-drought year where farmers adopt it to mitigate the potential impacts of drought. While disposal of assets, reduction in food consumption, migration, alternate source of income, change in cropping patterns and modifying planting practices are key coping strategies for drought, as highlighted in previous research (Adger et al., 2003; Ashraf & Routray, 2013; Corbett, 1988, Rehman et al., 2019) were not practiced in Mastung district. This means that farmers in Mastung rely mostly on pre-drought adaptation strategies rather than emergency coping mechanisms. This suggests maybe they had not experienced extreme droughts, allowing them to prepare in advance.

## Conclusion and Recommendations

The findings from this study offer key understandings about farmers' experiences and responses to drought in Mastung district. Most of the farmers have limited formal education, above 40 years old, mainly depend on agriculture and agricultural labor for their livelihoods. Major portion 96% of farmers agreed that drought intensity and frequency is increasing because of climate change. But still they mostly depend on pre-drought coping strategies such as grain storage (50%), livestock feed storage (26%), and drought-resistant crops (17%). It is interesting to note that commonly cited strategies in literature were not observed in Mastung. This suggests that farmers' coping strategies in Mastung may be inadequate for severe droughts.

To help farmers cope with drought, better water management, such as groundwater recharge and efficient irrigation, is crucial. Climate-smart farming with drought-resistant crops and modern techniques can improve productivity. Support from the government, NGOs, and community cooperatives can provide financial aid, training, and resource-sharing to strengthen resilience.

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