



Farmer's perception on climate change induced drought in Balochistan; A case Study of Tehsil Karezat, District Pishin

Shabana Faiz

Assistant Professor, & Chairman Department of Pakistan Studies Sardar Behadour Khan
 Womens' University Quetta

Syed Ainuddin

Professor of Disaster Management and Development Studies, University of Balochistan, Quetta

Abstract:

Drought is frequently occurring natural hazard, which affects the livelihoods of people across the globe and is considered as one of the most damaging natural disasters in economic, social and environmental terms. The contemporary data on climate in Pakistan indicates that the country has witnessed severity and high frequency of drought due to raise in temperature and the adverse effects of El Nino and decrease in the rainfall intensity over a long period of time. The current study assesses the perception of farmers regarding the climate changed induced drought in the district. The study has used focus-group discussions and a total of 377 households as sample size selected for the primary household survey, using proportionate allocation method. The results reveal that farmer's perceptions confirm that about 75% of the respondents have sold their household assets (Tractor, Livestock, etc.) and about 17% of the farmers have sold even their lands to mitigate the adverse impacts of drought. Around 75% farmers cultivated low delta crops which are resilient in drought condition such as Apricot, Gaja apple, American grapes and vegetables instead of foremost apple varieties like Shin Colo and Tor Colo which consumes more water. The results regarding migration as a coping strategy show that 37% family or their family members migrated from their native places towards urban areas to find out the other sources of income. The study recommends the long and short terms preparedness measures, trainings, support from the government and agriculture extension services to the farmers to combat drought hazard in the study area for sustainable development.

Keywords; Climate Change, Drought, Balochistan, Farmers' Perception

1. Overview of Drought in Pakistan

Droughts are a natural disaster associated with the deficiency of precipitation in an area or region for an extended period of time. Generally, they are most of the time considered as climatic episodes of any region where the precipitation is almost below average (Fathi & Tari, 2016). These periods are often miss-conceptually correlated with the heat waves whereas heat waves don't get longer more than a week or two while drought persists for a longer period of time (Chang & Wallace, 1987). Droughts usually vary from one another in terms of intensity, duration and area coverage depending on many factors (Akinagbe & Irohibe, 2015). The contemporary literature on drought of Pakistan for the last two decades indicates an increase in the frequency, duration and intensity of the climatic events such as floods, droughts. 40% of the country is

vulnerable to the frequent climatic events with variation in the rainfall pattern, droughts and floods (Khan, A.N. and Ali, 2015). According to Pakistan Meteorological Department, most parts of the country suffer droughts due to dry weather and poor precipitation level compared to past records. Due to which Pakistan is ranked 16th among the countries most vulnerable to global environmental change, therefore suffers the most from drought periods (Kakar et al., 2016). Pakistan experienced drought throughout its history and droughts are not any new disaster in this part of the world. It is experienced the worst drought of its history in the last decade that ended in the late 2004. The last drought from 2000-2002 has been considered as the most destructive one causing huge environmental costs, migration, crop failure. The said drought affected nearly 2 million people across the country (Turner, 2010). The drought period of 1998 has been estimated to have led to a negative agricultural growth of 2.6% (Ahmad et al., 2016).

Droughts in Pakistan are obviously caused due to the low precipitation in the area or regions, however in most parts of the country, irrigation infrastructure does not exist due to which droughts affect the agriculture sector to a considerable level. And sometime the surface water flow does not reach to the downstream affecting livelihoods of the people attached to the rivers in the downstream areas (Khair et al., 2015). Apart from that the global warming plays its role by increasing the temperature and reducing the precipitation level is an influential factor making the country more vulnerable to the drought impacts and increased frequency of floods in most parts of the country (Salma et al., 2012). Farooqi et al., (2005) argue that in the context of global climate change, Pakistan's surface temperature is constantly increasing since the beginning of the 20th century. Most of the areas of Sindh and Baluchistan will suffer in the future as they were affected from 1996-2004 drought. The frequency of drought in Pakistan is 2-3 years after every 10 years which affects the arid and semi-arid parts of the country (Fathi & Tari, 2016). The droughts generally have affected the southern parts of the country and northern parts of Balochistan, affecting the agriculture, livestock and livelihoods of the people. These consecutive drought periods have lowered the water table in both the provinces due to over exploitation of ground water and low precipitation which exacerbated the drought vulnerability in the country (Fathi & Tari, 2016). In response, the government of Pakistan has taken an initiative to establish National Drought Monitoring and early warning center after the worst drought of 1999-2001. The prime objective of the drought monitoring center is to issue advisories before the drought strikes (Shabana et al., 2025).

2. Balochistan in the Context of Drought

Balochistan is a mountainous region and has dry and cold climate type. Due to its physical features, the mountainous parts remain dry with less vegetation cover and less precipitation, making the livestock, fruits, vegetables vulnerable to the effects of drought. Balochistan falls in semi-arid and arid continental type of land therefore, droughts occurred in Balochistan are more severe in terms of magnitude and impacts in the recent climatic history of Balochistan (Khan, A.N. and Ali, 2015). The statistics of the provincial government reveal that 1.9 million people got affected from the drought. 9.3 million Livestock were affected out of which 1.76 million perished. A total area of 1.9 million acres' cultivatable land was also affected. A number of studies carried out on drought focusing Balochistan in terms of assessing the capacities to cope with drought, developing drought prone zones and assessing meteorological drought intensity. The study is being conducted by (Ahmad et al., 2004; Shafiq, M., & Kakar, M. A., 2007; Ashraf et al., 2011,

2014: Mazhar and Nawaz (2014). Though droughts have affected the whole Pakistan, but Balochistan has been devastated in terms of livestock, cattle, sheep, goats, camels which has aggravated the agricultural economy of Balochistan to a considerable level (Ashraf & Routray, 2013).

Drought becomes more disastrous, when it occurs in growing season. Furthermore, it occurs every four years out of 10 years in Pakistan however Balochistan is the most drought prone province especially in winter with return period of 16 and 35 years respectively. In addition to that it is also observed that most of the drought occurred in early winter in the north of Balochistan. In the north of Balochistan 58% of the precipitation is received due to western disturbances while the secondary disturbances extract rain falls from Arabian Sea (Ahmed et al., 2016). Monsoon rains enter in Balochistan through its eastern part which receives more precipitation each year compared to the rest of the province. Summer drought occurs in Balochistan when monsoon rain fails to bring precipitation to the province. Most of the early summer droughts occur in Balochistan in the eastern parts of the province, which occur every 8 to 20 and 60 years, while late summer drought occurs in northeast of the province which occurs from 8 to 22 and 65 years (Rasul et al., 2012). These summer droughts affect the province immensely and have negative effects on the local population, ecosystem and particularly on the agricultural depended population. This couple with the ridged topography and arid climate to make the province more vulnerable to the impacts of drought throughout the province (Daboniang et al., 2014). The livestock census indicates that almost 20 million sheep and goat have been affected which are reared in the uplands of the province which receive less rainfall (Khan, A.N. and Ali, 2015).

The provincial governments from time to time tried to respond and mitigate the impacts but failed in addressing the preparedness, early-warning and mitigation measures in the vulnerable districts of the province. These districts in the upland are extremely vulnerable to the effects of drought, which include Loralai, Zhob, Killa Saifullah, Pishin and Killa Abdulahha. Pishin is one the most populous and biggest districts on the upland Balochistan and suffered the most having agro-based economy. Therefore, the present study is indented to evaluate the perception of farmers in the Pishin district particularly in those union councils which are vulnerable and where agriculture is the predominant economic activity of the people. The recommendations of the said study will assist the local governments, Provincial Disaster Management Authority (PDMA) and other organizations for long term mitigation measures of the other districts as well to safe guard the agricultural economy of the province and secure the livelihoods options of the people attached to agriculture in the province (Ainuddin et al. 2025).

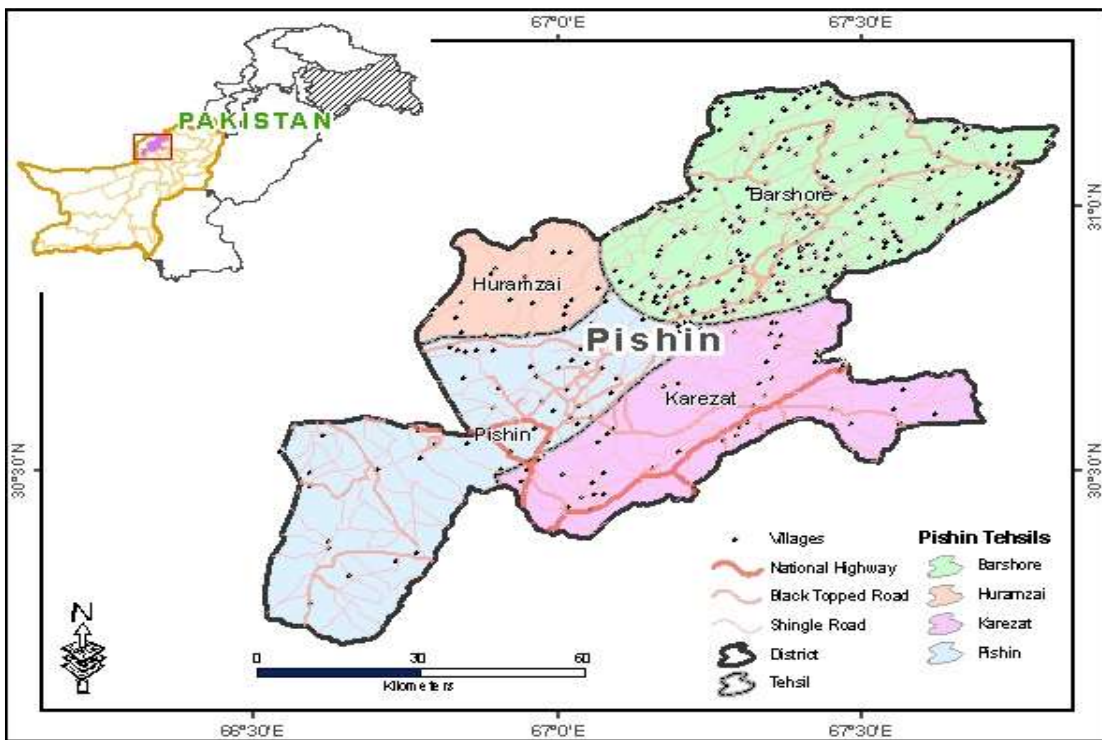
3. Research Methodology

Research type is always depended on the nature of the issue under study; however, this particular research is basically exploratory in nature. The prime aim of the research study is to understand the farmer perception on climate change induced drought in district Pishin. To achieve the above, this study utilized both the secondary and primary data and information. Secondary data is very important for any research and plays very vital role to know the past history and dynamics of the research topic selected. The secondary data was collected through journals, books, webs and archives related to the study. Primary data was collected from the field through questionnaire survey, field visits, group discussion.

3.1 Selection of the Study Area

Tehsil Karezat is located in District Pishin as shown in Figure 3.1 and has been selected as study area for this research work. This tehsil is most affected among other tehsils of the district and is still under the influence of drought spell. The tehsil lies in the north of capital Quetta. It shares borders with Pishin and Huramzi tehsils on the West, Killa Safilullah district on East, Barshore tehsil in north and Quetta district in south. The district has a number of valleys and its elevation from sea level is 1,370–1,680 meters. Lor River is the main river along with its tributaries flowing through Pishin district.

The name Karezat is referred to Karezes (Underground channels of water used to transport water in from the hilly areas to the settled areas in Balochistan). In the past this area was irrigated by these Krezes but by the passage of time due to low precipitation and drought conditions the rest of the karezes gone dry leaving two karezes which are present today. One is located in village khusab and other one is located in village Murgha.



3.1. Figure 3.1 Study Area Map

3.2. Sample Size Selection

Tehsil karezat was selected for the primary data and household survey. Tehsil Karezat is administratively divided into three patwar circles and Municipal corporation khanozai according to Pakistan Census department. A total of 377 households were selected for the primary household survey according to Arkin and Colton (1963) Formula. A random sampling technique is employed using proportionate allocation method because of the heterogeneity of the area in terms of population in the three Patwar Circles and Municipal Corporation. The calculation of the sample size is given below with proportionate allocation method. Out of 377 households 115

households were selected for Bostan Patwar Circle, 25 for Khanozai Patwar Circle, 121 for Murgha Patwar Circle and 116 for Khanozai Municipal Corporation.

The Overall sample size (Karizat tehsil) is as given under:

$$n = \frac{NZ^2 \times P \times (1 - P)}{Ne^2 + \{Z^2 \times P \times (1 - P)\}}$$

$$n = 377$$

Proportionate Allocation method, based on administrative unit

Bostan Patwar Circle

$$n_k = \frac{N_k}{N} \times n$$

$$n_{BP} = \frac{7126}{23314} \times 377$$

$$n_{BP} = 115$$

Khanozai Patwar Circle

$$n_{kP} = \frac{1532}{23314} \times 377$$

$$n_{kP} = 25$$

Murgha Patwar Circle

$$n_{MP} = \frac{7507}{23314} \times 377$$

$$n_{MP} = 121$$

Khanozai Municipal Corporation

$$n_{KM} = \frac{7149}{23314} \times 377$$

$$n_{KM} = 116$$

Where,

N = Total number of Households = 23314

4. Results and Discussions

4.1 Farmers Perception about Climate Change

The assessment of current climate change impacts in the study area requires a historical perspective and a base line farming data is significant for establishing a reference point to examine the overall perspective of farmers regarding climate change impacts (Khan et al. 2015). Farmer's perception plays an important role for drought mitigation and adaptation planning in developing countries particularly. Therefore, this section tries to analyze the farmer's expectations, experiences and perception on drought related measures. Farmers who experienced the severe drought in 1998-2002, know the real situation of drought and these farmers explained and expressed that what they have experienced about drought. The field data reveals that according to the farmers, "a situation can be called drought when both Kharif and Rabi seasons fail in a year". Kharif and Rabi are the two seasons for crops growing seasons in Pakistan. Kharif starts from May and ends in October and Rabi start from October and ends in May. People of the study area were mainly dependent on Karif season. When the Kharif production is failed, the year is considered to be a drought affected year. Such situation usually causes famine and food insecurity for both livestock and human beings.

4.2. Farmers Perception about Drought

Farmers play a very important role to manage water related issues at all levels and their role becomes very vital when water system is under pressure particularly in drought condition (Devisti & Motamed, 2012). The results from the farmer's perceptions regarding climate change are presented in the following tables. Questionnaire survey is used to perceive the farmers perception about climate change's variability, impacts and causes.

Table 4.1 Respondents Perception about Temperature

Temperature in the region has	Frequency	Percent
Increased	318	84.4
Decreased	17	4.5
No Change	20	5.3
Don't Know	22	5.8

The intergovernmental Panel on Climate Change IPCC, (Vogel et al., 2007) In its 4th assessment report confirms that average global temperature increased by 0.750C over the last ten decades and the expected rise in temperature by 2100 will be 1.7-4.80C. Similar opinion among respondents has been observed regarding the increase of temperature in the study area due to climate change impacts. Majority (85%) of the farmers accept that temperature has increased since last two decades due to global warming and climate change impacts. Whereas, 4% respondents said that temperature has decreased due to snow falling especially in the year of 2018 and 2019. Farmers have perceived no change and don't know that reported 5.3% and 5.8 respectively see table 5.6. Hence it can be inferred from the results that the average temperature condition for the last two decades in the study area and surroundings has been increased as the summers are extended and winters are shrunked which indicates a major shift in the global environmental Patten.

Table 4.2 Respondents Perception about Availability of Ground Water

Availability of ground water has	Frequency	Percent
Decreased	350	92.8
No Change	27	7.2

Source: Field Survey 2024-25

The analysis of the data regarding the availability of ground water confirms that large majority 93% of the respondents perceived that the availability of ground water has decreased due to drought severity in the region. Respondents argue that the current level of water does not fulfill the demand of the water required for their agriculture purposes even in some areas people were facing water demand issues for their domestic purposes. However, in few areas people didn't see any harmful change regarding availability of ground water. It is also an observable fact through the study area and its surroundings that most of the farmers have left different farming practices due to non-availability of water for irrigation purposes and they have shifted to nearby cities for engaging themselves in other economic activities for their living. The field data also confirms that most of the apple orchards in the study area have gone dry due to poor water availability.

Table 4.3 Respondents Perception about Effects of the Drought Hazard

Effects of the drought hazard most you have faced	Frequency	Percent
Social	135	35.8
Economical	240	63.7
Infrastructural	2	.5

Drought is a slow onset disaster, being part of climate change and global warming in every region of the world. Drought effects result from the communication between the resultant natural variance in rainfall conditions, and the present requirement of human activities on natural resources and water (Wilhite et al., 2007). According to (Maia et al., 2015) drought has direct social and economic impacts on communities whereas having indirect impact in the form of infrastructure. The result from the farmer’s perception regarding drought effects shows that drought has severally affected the economy of the people in the study area. Because mostly of the people were completely dependent on agriculture sector and usually agriculture sector is always based on water availability. Due to shortage of water for agriculture purpose in the study area have made the people more vulnerable in the context of income generating activities. Similarly, the social consequences are also observed in the study area as people were facing problems regarding their health, children education and other necessary demands of the ordinary life. The field data also reveals that people and farmers in the study area do not have any other subsequent sources of income which impacted their social well-being to a larger extent. It can be inferred that people have migrated from their native areas for substance.

Table 4.4 Respondents Perception about Drought Occurrence

Drought occurrence is the result of	Frequency	Percent
Manmade problem	17	4.5
Increase in temperature	64	17.0
lack of rainfall	216	57.3
God's Punishment	80	21.2

Different questions regarding drought occurrence were asked from respondents. More than half of the respondents perceived that low precipitation and lack of rainfall is the main cause of drought occurrence in the study area and its surroundings. Since Balochistan receives rainfall from two major sources such as Monsoon in summer and western disturbances in winter. From the past five to ten years the decrease has been observed in these two sources which ultimately put pressure on ground water. It is evident in the study area that ground water is depleting which leads to water scarcity and poor agriculture production. Finally, agricultural and social droughts result in migration. One-fifth of the respondents argue that drought occurrence is the God’s punishment (optimistic bias). They perceived that, Allah is un-happy from our bad actions and deeds. Similar results were shown by (Ashraf & Routray, 2013; Durrani et al., 2021), where certain elements were associated with religious opinions. According to (Osbahr et al., 2008) religious opinions of the people are one of the important elements in responding and understanding to natural disasters. On the other hand, only 5% and 17% respondents argue that, drought occurrence is the result of man-made problem and increase in temperature respectively. From the results of table 5.9, we can conclude that there is a strong religious belief of people

regarding drought occurrence rather than focusing on proper planning and mitigation measure to minimize the impacts of drought.

Table 4.5 Source of Information on Drought

What is the source of information on drought	Frequency	Percent
TV	13	3.4
Radio	34	9.0
Dish	10	2.7
Internet	176	46.7
Newspaper	144	38.2

Drought planning often make difficult by political, institutional, human resource, and budgetary, constraints (Wilhite, 2021). The major problem which exists globally is the lack of drought understanding by technical staff, policy makers, the general public and politicians. Lack of cooperation and communication among the relevant stockholders on the importance of drought planning also make difficulties towards drought preparedness (Wilhite et al., 2007). According to (Cutter & Finch, 2008) knowing Prior information regarding drought for effective emergency response is very important. Respondents were asked how they get information regarding drought and from which sources. Internet and newspaper have found most commonly used sources with 47% and 38% respectively to get information regarding drought in the study area. In the areas where Internet and Newspaper facilities were not available the Radio was the main source to get information regarding drought that areas.

4. Results of the focus-group Discussion

During the data collection phase, two focus group discussions were arranged for more in-depth information about the topic under investigation. The first focus group discussion was with ten (10) farmers in the study area and their inputs, understanding about climate change were receded. The community focus group discussion outputs regarding drought and climate change are in the line with the results achieved by questionnaire survey during primary data collection. Results of the focus group discussion reveal that due to low precipitation level, the water level significantly decreases down (5-10) meter each year and resulting in the reduction of crop production has led to 50% in the study area. Some of the farmers' pointed out that due to drought condition they sold their assets, livestock and land to cope with drought hazard. Whereas some of the farmers argue that, they receive widespread impacts due to changing of climate in the form of thunderstorm and hails before and after monsoon season on their orchards. Due to climate change and drought impacts some of the farmers have completely left their native places. Farmers' also described that the recurrent climatic events such as drought, floods, heat waves and health problems are not getting more consideration from government and other relevant agencies. The farmers demanded that the provision of credit extension services, solar system and employment opportunities by government for them can enhance their financial and social capacities as well as such services can enhance farmers' skills, knowledge and improved yield production in the area.

The second group discussion was recorded with Provincial Disaster Management Authority (PDMA), Agriculture Department, Metrological Department and Balochistan Rural Support

Program (BRSP). According to Regional Metrological Center Quetta, more districts of the province are facing drought because since 2014 most of the areas of the province has been scarcely receiving one fourth of the usual perception level. (BUIITEMS & UNDP, 2015) identified that, the following districts are severally affected by drought Nushki, killa Abdulla, Chaghi, Pishin, Qilla Saifullah, Kharan, Mastung, Awaran, Khuzdar, Lasbela and Kalat. PDMA officials pointed out that People continuously set off from rural to urban area due to pull factors i.e. earning, health and education facilities and for other basic needs. Residents in the drought hit areas like Pishin are confronted with adverse economic conditions which push them to shift from their native areas. In the migration process women and girls commonly face adjustment and countless other social issues. BRSP officials argue that “Climate change is a natural phenomenon but it has impacts on socio-economic conditions, as a result people lose their assets and sources of income which mostly the middle class and poor families may not cope with drought and climate change hazard. Agriculture Department officials argue that, extreme weather patterns, shrinking agriculture, soil erosion, and persistent dry spells have caused widespread socio-economic impacts within the province. In this regard, agriculture department has played its part in spreading awareness pertaining to low delta crops and as well as trickle irrigation system to combat the effect of climate change on socio-economic condition of rural people particularly in areas like Pishin.

5. Conclusion

Drought induced by climate change affects the livelihoods of people across agrarian societies across the world and has been considered as one of the most damaging natural disasters. The current study evaluated the farmers’ perception about climate change induced drought in the district Pishin, Balochistan, using household survey and focused-group dissections. The results revealed that 75% of the respondents have sold their household assets (Tractor, Livestock, etc.) due to the impacts of drought and about 17% of the farmers have sold even their lands to mitigate the adverse impacts of drought. The results further reveal that around 75% farmers cultivated low delta crops which are resilient in drought condition such as Apricot, Gaja apple, American grapes and vegetables instead of foremost apple varieties like Shin Colo and Tor Colo which consumes more water. The results regarding migration as a coping strategy show that 37% family or their family members migrated from their native places towards urban areas to find out the other sources of income. The study recommends the long and short terms preparedness measures, trainings, support from the government and agriculture extension services to the farmers to combat drought hazard in the study area for sustainable development.

References

- Akinnagbe, O., & Irohibe, I. (2015). Agricultural adaptation strategies to climate change impacts in Africa: a review. *Bangladesh Journal of Agricultural Research*, 39(3), 407–418.
<https://doi.org/10.3329/bjar.v39i3.21984>
- Ainuddin, S., Chammawong, S., Ariya, A., Daniel, Abidaa, 2025. Community Level Risk Awareness and Disaster Preparedness: An Exploratory Investigation of Quetta, Balochistan, *Journal of Disaster Resilience in the Built Environment*, vol.16.
- Ashraf, M., & Routray, J. K. (2013). Perception and understanding of drought and coping strategies of farming households in north-west Balochistan. *International Journal of Disaster Risk Reduction*, 5, 49–60.
<https://doi.org/10.1016/j.ijdr.>
- Ahmed, K., Shahid, S., Harun, S. bin, & Wang, X. jun. (2016). Characterization of seasonal droughts in Balochistan Province, Pakistan. *Stochastic Environmental Research and Risk Assessment*, 30(2), 747–762.

<https://doi.org/10.1007/s00477-015-1117-2>

- BUITEMS, & UNDP. (2015). Drought Risk Assessment in the Province of Balochistan, Pakistan. 87.
- Cutter, S. L., & Finch, C. (2008). Temporal and spatial changes in social vulnerability to natural hazards. *Proceedings of the National Academy of Sciences of the United States of America*, 105(7), 2301–2306. <https://doi.org/10.1073/pnas>.
- Durrani, H., Syed, A., Khan, A., Tareen, A., Ahmed Durrani, N., & Ahmed Khwajakhail, B. (2021). Understanding farmers' risk perception to drought vulnerability in Balochistan, Pakistan. *AIMS Agriculture and Food*, 6(1), 82–105. <https://doi.org/10.3934/agrfood.2021006>
- Devisti, H., & Motamed, M. (2012). Environmental and Socio-Economic impacts of Drought from the viewpoint of Guilan Paddy farmers, North of Iran. *Caspian Journal of Environmental Sciences*, 10(2), 227–235.
- Dabo-Niang, S., Hamdad, L., Ternynck, C., & Yao, A. F. (2014). A kernel spatial density estimation allowing for the analysis of spatial clustering. Application to Monsoon Asia Drought Atlas data: A kernel spatial density estimation with some applications. *Stochastic Environmental Research and Risk Assessment*, 28(8), 2075–2099. <https://doi.org/10.1007/s00477-014-0903-6>
- Fathi, A., & Tari, D. B. (2016). Effect of Drought Stress and its Mechanism in Plants. *International Journal of Life Sciences*, 10(1), 1–6. <https://doi.org/10.3126/ijls>
- Khair, S. M., Maqsood, A., Rasheed, A., Raziq, A., Salam, A., & Ihsan. (2015). Drought risk assessment in the Province of Balochistan, Pakistan.
- Khan, A.N. and Ali, A. 2015. (2015). Disaster Risk Reduction Methods, Approaches and Practices. In *Disaster Risk Reduction Approaches in Pakistan (Issue July)* available on <https://doi.org/10.1007/978-4-431-55369-4>
- Kakar, Z., Khair, S. M., Khan, M. Z., & Khan, M. A. (2016). Socio-economic Impact of Water Scarcity on the Economy of Pishin Lora Basin in Balochistan. *Journal of Applied and Emerging Sciences*, 5(2), pp90–96. <http://journal.buitms.edu.pk>
- Maia, R., Vivas, E., Serralheiro, R., & de Carvalho, M. (2015). Socioeconomic Evaluation of Drought Effects. Main Principles and Application to Guadiana and Algarve Case Studies. *Water Resources Management*, 29(2), 575–588. <https://doi.org/10.1007/s11269-014-0883>
- Nasrallah, Syed Ainuddin, Khair Mohammad, 2015. Status of community resilience in disaster prone districts of Balochistan, Pakistan, *Earthquake Research Volume 4*, pp 126-135 DOI: 10.4236/ojer.2015.44012
- Osbahr, H., Twyman, C., Neil Adger, W., & Thomas, D. S. G. (2008). Effective livelihood adaptation to climate change disturbance: Scale dimensions of practice in Mozambique. *Geoforum*, 39(6), 1951–1964. <https://doi.org/10.1016/j.geoforum.2008.07.010>
- Rasul, G., Mahmood, A., Sadiq, A., & Khan, S. I. (2012). Vulnerability of the Indus Delta to Climate Change in Pakistan. *Pakistan Journal of Meteorology*, 8(16), 89–107.
- Shabana, F., Ainuddin.S, Chamawong, S., Ariya, A. 2025, Coping with drought in a changing climate: An empirical analysis of farmers' adaptive Behavior in North-West Balochistan, *Journal of Integrated Disaster Risk Management*, 15 (2).
- Salma, S., Rehman, S., & Shah, M. a. (2012). Rainfall Trends in Different Climate Zones of Pakistan. *Pakistan Journal of Meteorology*, 9(17), 37–47.
- Turner, B. L. (2010). Vulnerability and resilience: Coalescing or paralleling approaches for sustainability science? *Global Environmental Change*, 20(4), 570–576.
- Vogel, C., Moser, S. C., Kasperson, R. E., & Dabelko, G. D. (2007). Linking vulnerability, adaptation, and resilience science to practice: Pathways, players, and partnerships. *Global Environmental Change*, 17(3–4), 349–364. <https://doi.org/10.1016/j.gloenvcha.2007.05.002>
- Wilhite, D. A., Svoboda, M. D., & Hayes, M. J. (2007). Understanding the complex impacts of drought: A key to enhancing drought mitigation and preparedness. *Water Resources Management*, 21(5), 763–774. <https://doi.org/10.1007/s11269-006-9076-5>
- Wilhite, D. A. (2021). Drought As a Natural Hazard. *Droughts*, 33–33. <https://doi.org/10.4324/9781315830896-24>
- Wilhite, D. A., Svoboda, M. D., & Hayes, M. J. (2007). Understanding the complex impacts of drought: A key to enhancing drought mitigation and preparedness. *Water Resources Management*, 21(5), 763–774.

<https://doi.org/10.1007/s11269-006-9076-5>