ADVANCE SOCIAL SCIENCE ARCHIVE JOURNAL
Available Online: https://assajournal.com
Vol. 03 No. 02. Apr-Jun 2025.Page#.2542-2552
Print ISSN: 3006-2497 Online ISSN: 3006-2500
Platform & Workflow by: Open Journal Systems

Assessing the Socio-Economic Impacts of Drought induced by Climate Change in District Pishin, Balochistan

Shabana Faiz
Assistant Professor, Department of Pakistan Studies, Sardar Behdour Khan Women's University, Quetta.
Anjum Parvez
Associate Professor, Department of Management Sciences, Sardar Behadour khan Womens's University, Quetta.
Syed Ainuddin
Professor, Department of Disaster Management and Development Studies, University of Balochistan, Quetta.

Abstract:
Droughts in Balochistan have adverse socio-economic impacts which exacerbate the existing inequalities and vulnerabilities of the farming communities. The aim of this paper is to assess the socio-economic impacts of drought, using the data of 377 households through questionnaire survey by employing stratified random sampling. The paper utilized paired sample T-test in order to examine the before-after situation of the study area in the context of drought. The results reveal that the major fruits tress in area were severely affected and reduced in number accordingly. The results further highlighted that most of the tress were dryer and their production was also reduced. Further, it also affected the livestock, people's education, occupation and community copy strategies during drought periods. The paper recommends the awareness of farming communities regarding climate change, their preparedness and provision of community safety nets to deal future drought disaster in the area. The paper also recommends the strengthening of agriculture extension offices, by sharing the climatic data to the farmers and communities.

Keywords: *Socio-economic Impacts, Climate Change, Balochistan, Drought*

1 Introduction

Drought has become a common phenomenon in Balochistan due to global environmental change; its occurrence is more frequent and hazardous (Ainuddin & Routray, 2012). The recent drought from 1998-2002 was the worst in history and remained for a long period of time, affecting all the sectors and human life to a considerable level. This drought caused huge economic cost worth then 25 Billion PKR and decreased the economic growth to 2.6 %. Further it has destroyed the agriculture sector particularly the orchards of fruit, vegetables and affected 27 districts out of 34 in the province (NDMC & PMD, 2016). The rainfall from western disturbances in the winter reduced from 74 percent to 60 percent compared to last decade. The

said drought spell affected 1.91 million people in the vulnerable districts (BUITEMS & UNDP, 2015). The livelihoods of the people attached to agriculture suffered the most. Due to communal and controlled cropping pattern `n and poor water management, the effects were widely observed across all vulnerable districts of the province. Furthermore, fifty percent of the crops productivity lost and above 70 percent crop areas were reduced. As a result, springs and Karezes were gone dry, orchard of fruits vanished and dried in the recent drought in the province (Abrar, 2016). In addition to that, poor ground water management and over pumping coupled with effects of climate change, the water table in the upland areas has fallen more than 7 meters per year. These have affected the rural farming communities and their livelihoods on unprecedented scale thought out the norther Balochistan (BUITEMS & UNDP, 2015). Furthermore, the tube wells and other traditional irrigation systems have been terribly affected due to which the agriculture production has decreased rather in most of the districts, the orchards have been dried up making the single source depended farmers and people more vulnerable to the effects of drought (Basharat, 2019). The extended drought in the province has also created a number of secondary effects such as soil salinity, erosion through wind, spring of diseases etc. These secondary effects of the drought have exacerbated the economy of the rural farmers and agriculture farm operation systems that has created the issue of unemployment throughout the province. The persistent drought also affected the livestock sector and rangelands (Ahmed, Hussain et al. 2004). The productivity of the livestock has reduced. Due to hunger and infection of animal disease, most of the people have lost their livestock (FAO, 2019). As result of the low crop production and heavy death toll of animals which are the prime activities of the people living in rural Baluchistan, people have migrated to the city centers or nearby areas for their livelihoods and sustenance of their families. The climatic data of the last four decades of Baluchistan has shown a great variability in the temperature and participation levels (Ashraf & Routray, 2015), which has threatened the agriculture and livestock sectors which contributes more than 50 percent of the GDP of the province. Because most of the populations in Balochistan live in rural areas and agriculture is the only viable source of income for them.

Drought also affects the agriculture economy of the province and farmers who are totally not aware about the impacts of the climate change and they don't have capability to cope and apply the mitigation measures of the disasters because they are depended on the single source of income (Osbahr et al., 2008), therefore it is necessary to increase the awareness and preparedness of these communities to cope with and respond to drought by apply adoptive measures to achieve community resilience in the context of drought hazards (Adger, 2000). In order to devise mitigation policy and enhance farmers' adaptation to drought hazards in Balochistan, as it is evident that the effects of drought on livestock, agriculture production and water resources is inevitable in certain districts of the province.

1.1 Climate Change and Drought Impacts

Global environmental change including climate change are resulting in extreme weather events such as droughts, floods, storms, heat and cold waves etc. (Skoglund & Jensen, 2013). IPCC's in its 5th assessment report also confirms that the agriculture production is likely to reduce due to climate change impacts around the globe. Asian countries are most vulnerable in the context of climate change. The frequency of drought and floods has increased drastically, which are resulting in food disruption. Pakistan is one of the most severally affected countries and ranks 5th in the world, affected by climate change. Balochistan province is particularly vulnerable to

climate change impacts as it falls in semi-arid and arid agro-ecology type of land therefore, droughts occurrence in Balochistan are more sever in terms of magnitude and impacts in the recent climatic history of the province (Ahmed et al., 2016). District Pishin is one the most vulnerable districts in the upland Balochistan and suffered the most having agro-based economy. The drought history of the district dates back to 13th century where most of the people migrated to neighboring districts.

2 Methodology

This research is exploratory in nature, based on primary and secondary data sources. The primary data collection includes the household questionnaire survey and field observations in order to achieve the set objectives of the study under investigation. The questionnaire was carefully designed to align with the specific research objective of the paper, ensuring that the data collected would directly contribute to achieve the research objectives. Extensive literature review was conducted to identify relevant themes, variables, and previous survey instruments. The questionnaire incorporated insights from existing studies, adapting and refining questions based on the knowledge gained from the literature. A total of 377 questionnaires were filled from the farming households with proportionate allocation method in the three Patwar Circles and Municipal Corporation of khanozai. The questionnaire was pre-tested trough 10 questionnaire in the study area before the actual survey was conducted. Randomly selected households participated in the pre-testing of questionnaire to cheek the responses that could be anticipated in the field finally. After the pre-testing phase, the questionnaire was modified and irrelevant questions were removed. Secondary data is important to understand the past history and trend of the drought impacts and farmers coping strategies during drought periods. The secondary data was collected from the published scientific journals, Books, Policy documents, online achieves, UN reports etc.

2.1 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 stratified 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 Mugha Patwar Cirle and 116 for Khanozai Municipal Corporation.

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

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

$$\boldsymbol{n = 377}$$

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

Z = Confidence Interval (95 %) = 1.96

P = Degree of Variation = 50% = 0.50

E = Margin of error = 5 % = 0.05

3 Results and Discussion

3.1 Socio-Economic Impacts of Drought

Climate change is the sum of atmospheric elements such as rainfall, humidity, pressure and temperature of any locality, region or country for a longer period of time which ranges from 35-40 years (Brown, 2013). Of all the other natural disasters, drought affects the maximum number of people around the globe causing devastating impacts, reducing water resources, crop failure, increase in food stuffs, reduction in livestock production, decline in prices of livestock are the most immediate impacts of drought worldwide (Briceño, 2015). The socio-economic impacts induced by climate change in the most vulnerable areas of district Pishin are observed, hence this paper tries to evaluate the social and economic impacts on farmers and its long-term impacts on the livelihood and agricultural economy of the people living in the area. This evaluation is highly important for any kind of drought hazard mitigation under changing climate (Vogt et al., 2018). The social impacts are analyzed through indicators of Health (disabilities), Education, Migration, and Social Capital. While economic impacts are assessed through Income, Dependency on agriculture, Agriculture production, irrigated area and livestock production.

The socio-economic impacts of the drought are determined by using the Paired Sample T-Test. Paired Sample T-Test is a parametric test sometimes called the dependent sample t-test, is a statistical procedure used to determine whether the mean difference between two sets of observations is zero. In a paired sample t-test, each entity or subject is measured twice, resulting in pairs of observations. In this study paired sample test is used to determine the loss of agricultural trees in the study area in first phase, as shown in table 1, while in second phase the paired test is used to identify the effect of drought in the context of agriculture production as in table 2. Lastly the paired sample T-Test is used to identify the drought impact on livestock production as in table 3. Pre-and post-drought condition in term of agriculture and livestock production was asked from Respondents. T-test is particularly used for before and after drought situation to determine the socio-economic impact of drought in the study area. People of tehsil Karezat were mainly depending on agriculture Sector. Apple, Apricot, Plunm and Peach were the main major fruits production of the farmers. Goats, sheep's, and cows were the main livestock production of the people in the study area. Therefore T-Test is used to identify the overall impacts of drought in the study area.

3.1 ***Steps Involved in Paired Sample T-test***

The following steps of the paired sample T-Test are used to analyze the before-after situation of drought in the study area

Step 1. To formulate the null and alternative hypothesis as:

H_0: Drought has no significant impact on agriculture and livestock production in the study area

H_1: Drought has a significant negative impact on agriculture and livestock production in the study area.

OR

H_0: $\mu_B = \mu_A$

H_1: $\mu_B \neq \mu_A$

Where **μ_B** is the agriculture production before drought and **μ_A** is the agriculture production after drought situation in the study area.

Similarly,

H_0: $\mu_{LB} = \mu_{LA}$

H_1: $H_{LB} \neq \mu_{LA}$

Where: μ_{LB} is the livestock production before drought and μ_{LA} is the livestock production after drought situation in the study area.

Step 2. Significance level $\alpha = 0.05$

Step 3. Critical region, if P-value is greater than significance level then we need to accept the null hypothesis

Step 4. Test statistic

Paired T-test = $\frac{XbarD - \mu\mathbf{o}}{SD/\sqrt{n}}$; D-F = n-1

Where X bar D, is the mean of the paired differences

$\mu\mathbf{o}$, is the is the population mean of all paired differences

SD is the standard deviation of the paired differences

D.F is the degree of freedom which is 377-1= 376

And n is the sample size of the respondents which is 377.

Table 1Comparative Analysis of Fruits trees before-after drought situation

Paired Samples Statistics

Pairs		Mean	N	S.D	S.E	T-Test	D.F	Sig.
Pair 1	Average Area irrigated before drought in acre	1.29	377	0.751	0.039	9.469	376	.000***
	Average Area irrigated after drought in acre	0.92	=	0.777	0.040			
Pair 2	Average Number of Apple trees before drought	288.79	=	163.386	8.415	23.539	=	.000***
	Average Number of Apple trees after drought	141.65	=	82.517	4.250			
Pair 3	Average number of Peach tree before drought	106.71	=	39.790	2.049	23.539	=	.006***
	Average number of Peach tree after drought	4.14	=	10.975	0.565			
Pair 4	Average Number of Apricot trees before drought	200.05	=	183.306	9.441	17.465	=	0.02*
	Average Number of Apricot trees after drought	48.35	=	60.546	3.118			
Pair 5	Average Number of Plum trees before drought	6.38	=	13.110	0.675	17.465	=	0.003***
	Average Number of Plum trees after drought	0.68	=	3.099	0.160			

Before drought condition the average irrigated area in acre was 1.29 while such figure decreased as 0.92 after hitting the study area by drought. The average number of Apple trees were almost recorded 289 before drought condition. Due to drought stress condition 51% reduction has been observed in the study area. The mean number of Peach trees converted from 141 to 106, due to effects of drought. The average numbers of Apricot trees were 200 before drought situation, while this number has reduced by drought till 48 trees; it means 76% reduction is observed in Apricot production. Similarly, the numbers of Plum trees were recorded 6.38 before drought situation and after drought situation this number has significantly decreased to 0.68. The differences among all the five pairs are statistically significant as p-values is less than 0.05, significance level in all fairs. Hence, we can conclude that drought has severally affected all the major fruits Trees in the study area. Results from table 5.1 indicate that, more than half of major fruits trees were dryer in the study area due to low precipitation in the study area.

Table 2Comparative Analysis of Agriculture production before-after drought

Paired Samples Statistics								
Pairs		**Mean**	**N**	**S.D**	**S.E**	**T-Test**	**D.F**	**Sig. value**
Pair 1	Apple production before drought in term of crates	2310.34	377	1307.085	67.31	31.681	376	.000***
	Apple production in term of crates after drought	504.49	=	365.050	18.80			
Pair 2	Peach production in term of crates before drought	315.45	=	125.214	6.44	34.536	=	.005***
	Peach production in term of crates after drought	98.71	=	47.572	2.45			
Pair 3	Apricot production in term of crates before drought	394.47	=	373.776	19.25	8.740	=	.008***
	Apricot production in term of crates after drought	226.55	=	174.986	9.01			
Pair 4	Plum production in term of crates before drought Plum production in term of crates before drought	12.70 4.00	=	25.964 23.05	1.33 1.23	8.873	=	.000***

In Table 2, the study measured the fruits production in the terms of Crate quantity. Carte is a local quantity using for fruits packing. One crate of apple production may take 100 apples or almost having 20 Kilogram weight of apples. The packing of Peach, Apricot and Plum was comparatively in small quantity of carte. The mean weight of a Plum, Peach and Apricot Crate may be 6 to 8 Kilogram. The apple production before drought situation was 2310 Crates; this huge number has a reduction of 78% to just 504 crates after hitting down the study area by severe drought. Similarly, the number of Peach, Apricot and Plum has reduced from 315, 394 and 12.70 have a reduction of 68%, 42% and 66% to just 98, 226 and 4.0 respectively by the severity of drought and climate change impacts. The differences among the major fruits production have been observed statistically significant at five percent alpha. Based on the results it can be concluded that the current drought spell has severally affected the study area to a considerable level.

Table 3Comparative Analysis of Livestock Before-After Drought Situation

Paired Samples Statistics								
Pairs		**Mean**	**N**	**S.D**	**S.E**	**T-Test**	**D.F**	**Sig. value**
Pair 1	Number of goats before drought	55.87	377	65.67	3.38	12.61	376	.000***
	Number of goats after drought	21.32	=	32.20	1.65			
Pair 2	Number of sheep before drought	51.44	=	65.04	3.35	13.19	=	.000***
	Number of sheep's after drought	14.10	=	25.28	1.30			
Pair 3	Number of sheep's after drought	0.79	=	0.95	0.49	13.46	=	.006***
	Number of cows after drought	0.27	=	0.49	0.26			

In table 3, we measured the average number of livestock ownership before-after drought situation in the study area. The average number of Goats, Sheep's and Cows before drought was recorded 56, 51 and 0.79, while this huge number has a reduction of 62%, 72% and 65% to just 21, 14 and 0.27 respectively due to drought severity and climate change impacts. The differences among the livestock ownership have been observed statistically significant at five percent alpha. We can conclude that the current drought spell has severally affected the livestock production in the study area.

Table 4Comparative Analysis of Education Before-After Drought Situation

Paired Samples Statistics								
Pairs		**Mean**	**N**	**S.D**	**S.E**	**T-Test**	**D.F**	**Sig. value**
Pair 1	Enrolment rate of boy's students before drought	40.25	377	28.67	2.38	09.61	376	.007***
	Enrolment rate of boy's students after drought	26.50	=	19.20	1.05			
Pair 2	Enrolment rate of girls students before drought	28.44	=	33.04	2.35	11.19	=	.000***
	Enrolment rate of girls students after drought	17.10	=	22.28	1.30			
Pair 3	No of children at home without schooling before drought	1.00	=	0.15	0.49	03.46	=	.006***
	No of children at home without schooling after drought	2.00	=	0.11	0.26			

Education is one of the most important indicator of social component. In this study, we also highlighted the education status of the children in the study area. In table 4, we measured the average number of enrolled and drop-out student's before and after drought situation. Based on the given result (32% and 39%) reduction have been observed in the students' enrolment rate after drought situation for both boys and girls respectively. The differences among the enrolled and drop-out students have been observed statistically significant at five percent alpha. We can conclude that the current drought spell has severally affected the education sector in the study area.

Table 5Comparative Analysis of Occupation Before-After Drought Situation

Paired Samples Statistics								
Occupation status Before and after drought situation		**Mean**	**N**	**S.D**	**S.E**	**T-Test**	**D.F**	**Sig. value**
Pair 1	Agriculture as a major occupation before drought in the study area	68.87	377	57.67	3.38	14.61	376	.005***
	Agriculture as a major occupation after drought in the study area	31.32	=	32.20	1.65			
Pair 2	Wage as a major occupation before drought	12.44	=	60.04	3.35	11.19	=	.000***
	Wage as a major occupation after drought	58.10	=	25.28	1.30			

Pair 3	Business as a major occupation before drought	20.79	=	0.95	0.49	12.46	=	.007***
	Business as a major occupation after drought	13.27	=	0.49	0.26			

In table 5, we measured the average number of three major occupations (agriculture, wage and business) before-after drought situation in the study area. The average number of people who were engaged with agriculture occupation was almost 69, a 55% reduction has observed in this occupation after drought situation. Similarly, one 10th of the people were engaged in wage occupation. Due to drought stress condition, more than half of the people are currently depending on wage occupation. Lastly the adverse impact of drought has also observed on business and business-related sectors in the study area. The differences among the major occupations have been observed statistically significant at five percent alpha. We can conclude that the current drought spell has severally affected the people in the study area in term of their normal routine occupation.

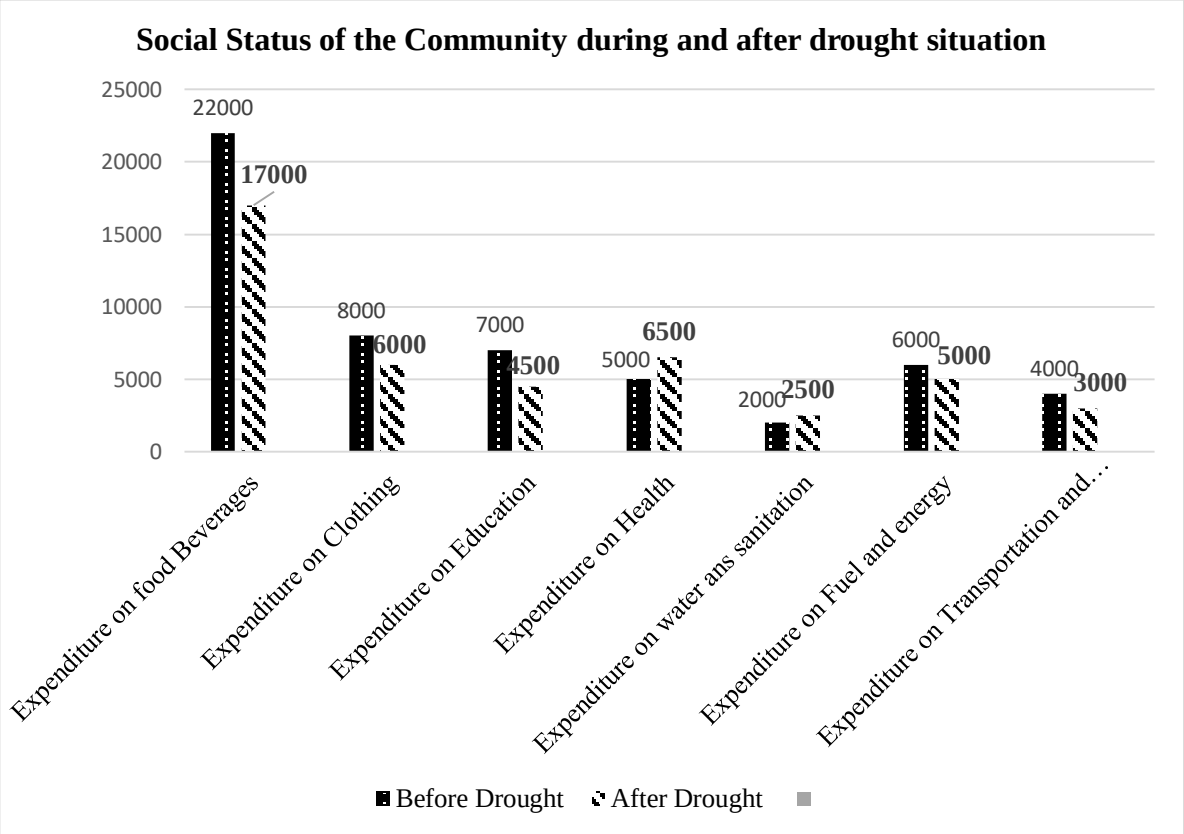

Figure 5.1 Social Status of the study area before-after drought situation

In figure 5.1, we made the comparative analysis on the basis of social indicators. These includes the expenditure on (food beverages, clothing, education, health, water and sanitation, fuel and transportation. An average amount of (22000 and 17000 Rupees) expenditure on food beverages among respondents have been observed before and after drought situation respectively. Almost 30% amount detected on food beverages by respondent's due to drought stress condition. Similarly, 25%, 36% 16% and 25% reduction have been observed on clothing, education, fuel/energy and transportation and recreational activities by people of the study area after

drought condition. Whereas, 30% and 25% increment have observed on health and water/sanitation expenses respectively due to drought stress condition. we can conclude that drought and (health and water/sanitation) problems are positively correlated with each other.

4 Conclusion

In Balochistan, the major economic activity of the people is agriculture, and their livelihood is attached with it throughout the province. This current study is exploratory in nature and its aim was to assess the socio-economic impacts of drought on the farming communities in district pishin. The paper utilized both primary and secondary data and sources. A household survey was employed, using the data of 377 households using stratified random sampling. The study results reveal that drought has adverse impacts on the socio-economic fabric of the farming communities in the district by affecting their education, occupation, livestock, health and sanitation. At the same time, it has affected the agriculture produced, fruits. The results further indicated that most of the fruits trees were drier due to low precipitation and their production was reduced. In addition, the differences among the major fruits production have been observed statistically significant at five percent alpha. Based on the results it can be concluded that the current drought spell has severally affected the study area to a considerable level. the paper recommends safety nets, farmer's awareness building regarding the climate adoption and use of varieties of crops resistant to low precipitation. The paper also recommends the institutional preparedness of the agriculture extension office to provide the climate data and train the farmers on different adaptation strategies to the climate change for sustainable agriculture and farming communities preparedness to withstand to, recover from and cope of with droughts disasters in the district and province.

References

Abrar, M. (2016). Determinants of Rural Household Poverty : The Role of Household Socioeconomic Empowerment Determinants of Rural Household Poverty : The Role of Household Socioeconomic Empowerment. January 2015.

Ainuddin, S., & Routray, J. K. (2012). Institutional framework, key stakeholders and community preparedness for earthquake induced disaster management in Balochistan. Disaster Prevention and Management: An International Journal, 21(1), 22–36.

Arkin H, Colton RR 1963: Tables for statisticians, New York: Barnes and Noble Books, 2nd Edition, contributed by National Library of Australia.

Ashraf, M., & Routray, J. K. (2015). Spatio-temporal characteristics of precipitation and drought in Balochistan Province, Pakistan. Natural Hazards, 77(1), 229–254.

Adger, W. N. (2000). Social and ecological resilience: Are they related? Progress in Human Geography, 24(3), 347–364.

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.

Brown, L. R. (2013). Peak Water : What Happens When The Wells Go Dry ? August.

BUITEMS, & UNDP. (2015). Drought Risk Assessment in the Province of Balochistan, Pakistan. 87.

Briceño, S. (2015). Looking Back and Beyond Sendai: 25 Years of International Policy Experience on Disaster Risk Reduction. International Journal of Disaster Risk Science, 6(1), 1–7.

Basharat, M. (2019). Water management in the indus basin in Pakistan: Challenges and opportunities. Indus River Basin: Water Security and Sustainability, 31(3), 375–388.

BUITEMS, & UNDP. (2015). Drought Risk Assessment in the Province of Balochistan, Pakistan. 87.

FAO. (2019). Proactive approached to drought - Where are we now and where do we go from here? 50. http://www.fao.org/3/ca

NDMC, & PMD. (2016). Drought watch bulletin, 2016. National Drought Monitoring Centre, Pakistan Metrological Department, Islamabad.

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.

Skoglund, A., & Jensen, T. (2013). The Professionalization of Ethics in the Intergovernmental Panel on Climate Change (IPCC) - from Servant of Science to Ethical Master? Sustainable Development, 21(2), 122–130. https://doi.org/10.1002/sd.1559

Vogt, J. V., Naumann, G., Masante, D., Spinoni, J., Cammalleri, C., Erian, W., Pischke, F., Pulwarty, R., & Barbosa, P. (2018). Drought Risk Assessment and Management. A conceptual framework. In EUR 29464 EN, Publications Office of the European Union (Vol. 2018, Issue August). https://doi.org