



Adaptation Strategies for Drought Risk Reduction in Farmers' Livelihoods Kabul, Afghanistan

Roya Quraishi¹

¹ Hydrometeorology Department, Faculty of Geosciences, Kabul University, Kabul, Afghanistan

royaqrsh@gmail.com

ABSTRACT

Among all of the natural hazards, drought is one of the most complex and significant climatic hazard and risk more effects for the people's (farmers) livelihoods and socio-economic progress toward another events. In the world, all of agriculture and non-agriculture sectors will be affected by drought impacts. In this regard, there is two districts from Kabul province in Afghanistan country (Deh Sabz and Paghman) are chosen for surveying as the drought-affected areas. The farmers in these areas are affected from the negative consequences of drought impacts on farming and agro-based livelihoods during the recent years. Accordingly, they have applied several adaptation strategies to decrease drought effects on farming and own livelihood from their previous experiences. This article purpose to fixit farmers' adaptation strategies, and their perception of drought for reducing impacts of drought on their agricultural productions and livelihoods.

The findings of this research are consistent with existing seek on drought in Afghanistan and other regions, and will be useful for application, and understanding of drought impacts on farmer's livelihoods. Because of not done any research about drought in these areas. Thus, this article will assist regional planner, rural sectors, officials, and other people that they have development plans, policies, and extending services.

Key Words

Natural Hazards, Adaptation Strategies, Drought Risk Reduction, Households Farming, Farmers 'livelihoods

1. Introduction

Capital city of Afghanistan is Kabul that is located in the central east part of the country. Total population in Afghanistan estimated near 32.9 million in 2019-2020 based on the most recent National Statistics and Information Authority (NSIA) data. Kabul province as a central province located in an eastern valley in Afghanistan between 34° 32' 38.0256" N (34.543896 North) east latitude and 69° 9' 38.3472" E (69.160652 East) north longitude. This province is situated at an elevation of 1,800 m above sea level and it is surrounded in north into south and of east into west with sky-scraping mounts. Paghman Mountains in the southeast, Crough in the southwest, Shir Darwaza in the northeast, Charikar in the north, and Tangi Gharow are located in the west of Kabul province. It bordered by the provinces Parwan and Kapisa to the Northeast, Laghman to the East, Nangarhar to the Southeast, Logar into the South, and Maidan Wardak to the Southwest ^[9].

The climate of Kabul province is mainly dry and dusty and semi-arid (hot and cold) or steppe with four seasons. The annual rainfall is 400 mm that is little amounts of precipitation from May to November and also contains from the mostly rain fed and fertile rangeland which provides vital grazing grounds for the herds of nomads Kuchi over the three months of the summer. Extreme changes of temperature are occurred between nights and days, season into season, and place in place at Kabul, and diurnal temperature on winter soars by -15 to -20 degrees Celsius (°C), and summer daily temperature soars by +15 to +38°C. coldest month of the year is January that average temperature is reaching up to -12°C, and hottest month is July that average temperature soars up to 25°C. Maximum temperature is recorded about +36.9°C on July and minimum temperature is about -21.7°C on February ^[7].

Drought is a natural slow onset climate hazard, and categorizes by a permanent feature as a hydro-meteorological hazard that has a temporary aberration and with abnormal deficiency of precipitation and environmental moisture over an extended period. It is differed by aridity, which restricts the low rainfall regions ^[2]. Usually occur a season and at a specific location that results a shortage and water demand for several activity of groups, environmental sections, and dryness atmospheric situation.

Drought is starting without inform and expanding cumulative, and its impacts are not observable directly. Hence, stops human lives and assets severely, and has severe multiple, social, economic, environmental or ecosystems, agricultural, developmental,

dryness, and wildfire impacts. This hazard has a negative significant influence on vegetation and agricultural production, forest growth, and animals on a sizeable area and can die millions' people and billions of dollars damages each year in the world. Therefore, obtain accurate drought plays an essential role in planning, water management, and agricultural resources.

Drought is influenced to agricultural sectors such as, earnings of farmers , occasion for occupation, funds of farming finance, and it has caused repetition losses of products, reduction of harvesting, food shortage, undernourishment, local inhabitants poverty, increases of food insecurity, illness, migration, water sources deficiency, and lack of livestock's. Thus, assessment of impacts of drought on crop productions, existing adaptation strategies by farmers on drought is necessary. ^[4]

2. Investigations Methodology

2.1. Research Plan

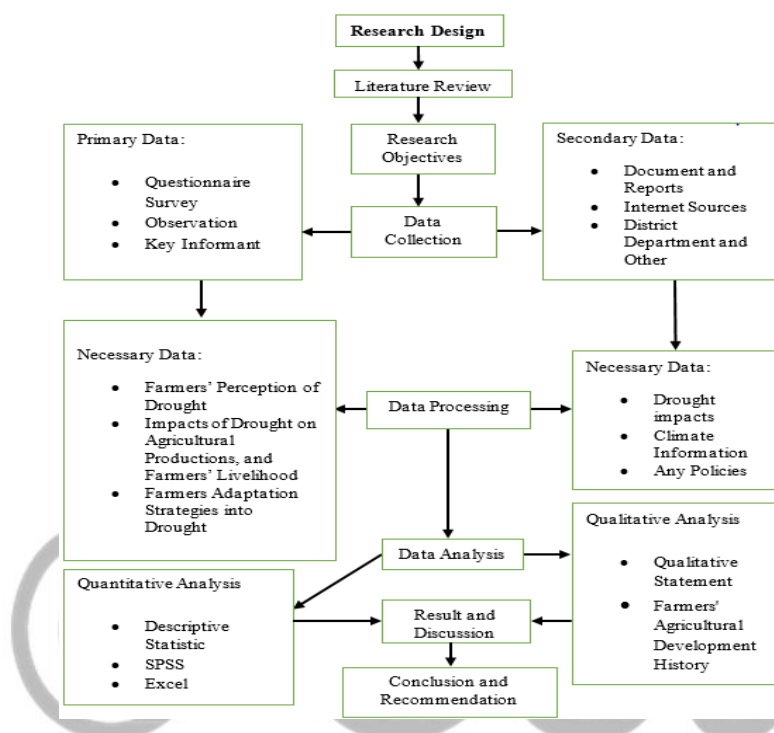


Figure 1. Research Design

Source: Author

As mentioned, this paper is constructed by a plan of survey and analyses, covered by efforts to search drought impacts on agricultural production, farmers' livelihoods, and farmers' adaptation strategies on drought. Therefore, it has recommended several strategies for facilitating farmers as well as government to manage plans to minimize the risk of drought. The combination of exploratory and explanatory research design has shown in Figure 1.

3. Study Area

Drought is physical event that is threatening livelihoods, farming, and farmers in all provinces of Afghanistan including Kabul province. In order to accede the research plan from Paghman Mullah Khel Kala village and from Deh Sabz Tara Khel village have selected as an investigation area. Studies show that these areas have maximum incidence period of drought in last 10 years, and livelihoods of farmers and farming practices have highly affected by this phenomenon.

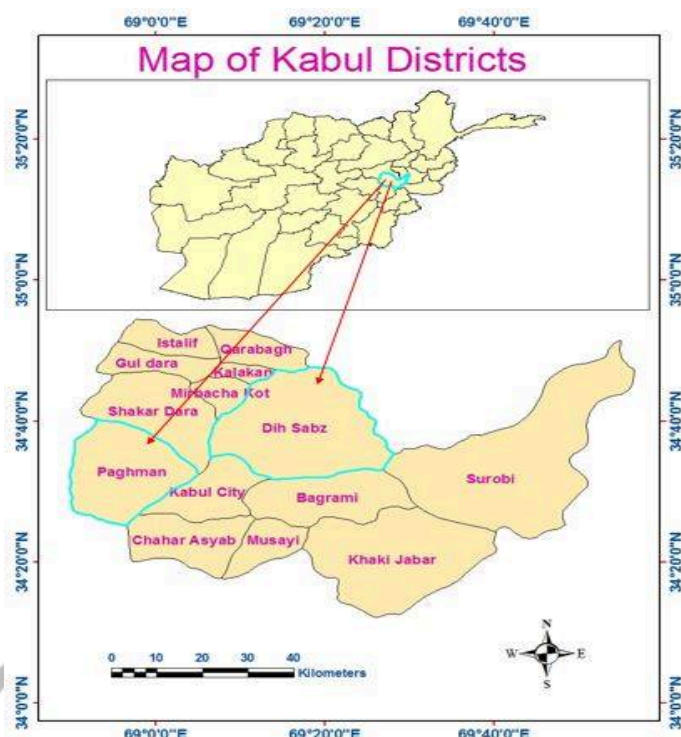


Figure 2. Geographical Distribution of Kabul Province and Study Area

Source: Author

Paghman is located in western part of Kabul province and covers by 600km² area. It is far from about 59 km from center of Kabul province. This district has 117 villages (Adam Khel Kala, Hatam Kala, Seeno Kala, Mullah Khel Kala, Muhabbat Khan Kala, Lachi Khel Kala, and Pajak Tappa) by 3207 population^[9]. Paghman has major agricultural activities, crops production, and vegetables such as, wheat, maize, beans, vetch, peas, fruits, such as almonds, walnuts, mulberry, and pomegranates and animal products. This area has high-quality drinkable water resources for Kabul province that is distributed via pipe system^[5].

Deh Sabz is located in northern part of Kabul province and in northeast part of Kabul city with latitude of 34° 39' 18" N, and with longitude of 9° 14' 29" E. In this area, over 100000 people in 49 villages (Tara Khel, Entiat, Daneshmand, Paymoanar, Deh-Yahiya, Bachtyaran, and Khwaja Chest) live, and people income is mostly agriculture. wheat, maize, mung beans; vegetables such as, potato, onion, tomato, pepper; fruit such as, grape, almond, apricot, apple; fodder and industrial crops such as, alfalfa, clover, etc. are productions of this region. These productions fed by irrigation canal system from Panjshir River and besides, people use both surface water and groundwater for their demands.

3.1. Sampling Methods

In order to do purpose of this research a field survey has been conducted. This paper designed by using a simple random sampling technique for determination of farm families. This is a critical research and the target households were chosen from the samples of the villages of Kabul province.

3.1.1. Sample Size

Small farmers from farmer households as a sample for doing interview have selected in research area surveying. A total member 99 households (80 farmer households in Paghman and 19 farmer households in Deh Sabz) in study area for survey from two districts of Kabul province as a sample size have been chosen. Thus, sample size with using following Yamane's formula with 90% of confidence level have calculated:

3.2. Data Sources

The data into this research has collected from the two main sources: (1) Secondary data sources that have obtained from different places, and (2) Primary data, which have collected by the researcher through the study area.

$$n = \frac{N}{1 + N(e)^2}$$

Where,

N = Total number of households in the districts

e = Error limit 10 % (0.1) is taken

n = Sample size (Total number of sample household)

Table 1. Sample Size

District	Household	By Formula
Paghman	6635	80
Deh Sabz	1600	19
Total	8235	99

Source: Author

3.2.1. Secondary Data Collection

During the different stages of research process, secondary data has collected because for understanding overall situation and assessing impacts of drought on farmers and their livelihoods is essential. This information has collected from different kind (printed and online articles) of sources such as, academic journals, published books and reports, research and thesis papers, agricultural and climatic regional documents. Department of meteorology in Kabul, National Statistical Office of Afghanistan, National Directorate of Water, Ministry of Agriculture Irrigation and Livestock are the major recourses of secondary data in this paper.

3.2.2. Primary Data Collection

This paper has mainly fixed on primary data collection. Primary information for the farmers' perception, adaptation strategies about drought hazards, agricultural activities, and livelihood through the face-to-face several days' interviews with farmer households and local people who had more experiences and mostly has been affected by drought was evaluated.

3.3. Analysis of Data

Statistical Package of Social Science (SPSS) and Microsoft Excel software have used for analysis. As well as both qualitative and quantitative techniques for analysis of data have applied in this research to fulfill desired objectives.

3.3.1. Quantitative Analysis of Data

This research with quantitative information from different variables data presentation about the descriptive statistics analysis to calculate the frequency, average, and percentages for finding household information about the drought, the economic conditions, crop productions, yield trend, decline of agriculture productions, income from the sources, rainfall, temperature per statistical analysis of diagrams such as, tabulating, charts by bar and pie are linked.

3.3.2. Qualitative Analysis of Data

Qualitative analysis of data has taken via information collection from households' questionnaire survey, perception, secondary data as well as the history of agricultural development of farmers' experience.

4. Finding and Discussion

This section explained profile of research area and bounded on three part since socio-economic profile, farmers' experiences of drought risk, and inspection of drought impacts on farmers livelihood.

4.1. Respondents' Socioeconomic Profile

4.1.1. Farmers Age Years Distribution

According to table 2, the respondent's age ranges from 20 to 70 years and majority of respondents fall in age category between 41- 60 with a large ratio (58%) in target area. That is mean after age 70 (2%) people cannot work on farms. data from household survey illustrates that most of respondents are living in their respective villages from their ancestors time. Thus, can say that given statements by respondents are verifiable.

Table 2. Classification of Respondents by Age

Age Group	Target Area				Total	
	Paghman		Deh Sabz		Frequency	Percentage (%)
	Frequency	Percentage (%)	Frequency	Percentage (%)		
20-30	19	23.8	0	0	19	19.0
31-40	17	21.3	3	15.8	20	20.0
41- 50	26	32.5	7	36.8	33	33.0
51-60	16	20.0	9	47.4	25	25.0
61-70	2	2.5	0	0	2	2.0
Total Sample Size	80	100	19	100	99	99

Source: Author

4.1.2. Head Household and Worker by Gender

Data from households survey (Table 3) reveals that male households head are 87% and female households head are 12%, which is show number of head males is high in the target area. The reason is that the most female's household because of the non-ability and traditional situation cannot have an active company in the whole provinces of Afghanistan.

Table 3. Classification of Respondents (Household Heads) by Gender

Gender	Target Area				Total	
	Paghman		Deh Sabz			
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Male	68	85.0	19	100.0	87	87.0
Female	12	15.0	0	0	12	12.0
Total Sample Size	80	100	19	100	99	99

Source: Author

Table 4 shows that the labor in the study area is mostly one person, which cannot be effective for households income and livelihood. Therefore, farmers cannot cope against drought event and continue their life.

Table 4. Statistical Information of Number of Household Worker

Number of Family Worker (in Person)	Target Area				Total	
	Paghman		Deh Sabz			
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
One	53	66.3	7	36.8	60	60.0
Two	11	13.7	8	42.1	19	19.0
Three	8	10.0	4	21.1	12	12.0
Four	8	10.0	0	0	8	8.0
Total Sample Size	80	100	19	100	99	99

Source: Author

4.1.3. Occupation

The household survey have shown that the main occupation of household members is mostly agriculture. Data from socio-economic and household information of respondents (Table 5) reveals that they have also some other occupation besides farming.

Table 5. Occupational Structure of Sample Respondents' Household Members

Occupation	Target Area				Total	
	Paghman		Deh Sabz			
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Farmer	47	58.8	5	26.3	52	52.0
Business/Trade	3	3.7	0	0	3	3.0
Official	15	18.7	3	15.8	18	18.0
Non-agricultural worker	13	16.3	9	47.4	22	22.0
Non-employment	2	2.5	2	10.5	4	4.0
Total Sample Size	80	100	19	100	99	99

Source: Author

4.1.4. Level of Education

Data from household survey reveals that literacy of households member has classified into five-education level and result indicates that majority (45%) of the people of study area are illiterate (Figure 3).

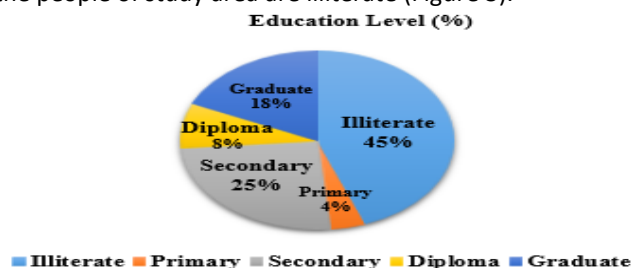


Figure 3. Education Background of Households' Members

Source: Author

4.2. Understanding, Experiences, and Interpretation of Farmers from Drought

Drought concept in term of farmers' perception is important for sustainability environment and economic activities of farmers' livelihood. There is differences between physical environment, level and type of engagement to activities of agriculture, and extending effects in financial well-being. Knowing that, drought phenomenon impacts can be reduce and avert.

4.2.1. Farmers Understanding of Drought

Data from households survey (Table 6) reveals that most of farmers (77.8%) defined "lack or late rainfall" as the main cause of drought in target area.

Table 6. Understanding of Drought by Farmers in Study Area

Understanding from Drought	Target Area				Total	
	Paghman		Deh Sabz		Frequency	Percentage (%)
	Frequency	Percentage (%)	Frequency	Percentage (%)		
Lack or Late of Rainfall	53	66.3	17	89.4	70	77.8
Lack of Irrigation and Water Supply	23	28.8	1	5.3	24	17.0
No Pasture for Grazing	3	3.8	0	0	3	1.9
Dry Soil	0	0	1	5.3	1	2.6
Dusty	1	1.3	0	0	1	0.7
Total Sample Size	80	100	19	100	99	100

Source: Author

4.2.2. Farmers' Experience of Drought

People who live for a long time in an area will get more experience. Data from households survey in table 7 illustrates that most of people (59.7% from total) who are living from 20 to 50 years in this study area gotten more experience about how to arrange crops type plantation and cultivation date. In addition, they know about the months, duration, and severity of drought in a year. Therefore, they can organize their possibilities in the area.

Table 7. Farmers Living Years in Study Area

Years of Living	Target Area				Total	
	Paghman		Deh Sabz		Frequency	Percentage (%)
	Frequency	Percentage (%)	Frequency	Percentage (%)		
10-20	23	28.8	0	0	23	23.2
21-30	21	26.3	1	5.3	22	22.3
31-40	13	16.3	2	10.5	15	15.1
41-50	17	21.3	5	26.4	22	22.3
51-60	5	6.3	7	36.8	12	12.1
61-70	1	1.3	2	10.5	3	3.0
71-80	0	0	2	10.5	2	2.0
Total Sample Size	80	100	19	100	99	100

Source: Author

Farmers funded out the usual months of the drought in their area based on their experiences from the previous droughts. The respondents have identified drought time range within June-October (Table 8).

Table 8. Drought Months Experiences by Farmers in Study Area

Drought Duration	Target Area				Total	
	Paghman		Deh Sabz		Frequency	Percentage (%)
	Frequency	Percentage (%)	Frequency	Percentage (%)		
September, October	30	36.5	19	100	49	68.2
June, July	12	16.0	0	0	12	8.1
June, July, August	25	31.5	0	0	25	15.7
July	3	4.0	0	0	3	2.0
No drought	10	12.0	0	0	10	6.0
Total Sample Size	80	100	19	100	99	100

Source: Author

There is a significant difference about drought months' experience between two districts. The main reason belongs to geographical location of these districts. Deh Sabz is smooth and its require water comes from rivers, but Paghman is a mountainous area and its require water comes from mountains. Therefore, Paghman people has water in the reservoirs during

the drought months. According to the information from the key informant and interview, in the study area duration and severity of drought have increased by compare to the previous.

4.2.3. Situation and Interpretation Drought

Current drought has occurred in middle of the year in months Jun, July, August, September, and October and continues. Therefore, water shortage crisis see in the reservoirs such as, wells, and springs in the dry season. The worst drought will be for Afghanistan in 2017 (Table 9). Farmers in Kabul province suffer more than a decade from severe drought.

Table 9. Drought Years Frequency in Paghman

Drought Years	Target Area (Paghman)		Total		
	Intensity Level of the Drought	Frequency	Percentage (%)	Frequency	Percentage (%)
2009	No drought	0	0	0	0
2010	No drought	0	0	0	0
2011	High	2	2.5	2	2.0
2012	No drought	0	0	0	0
2013	No drought	0	0	0	0
2014	No drought	0	0	0	0
2015	No drought	0	0	19	19.1
2016	Moderate and High	11	13.0	30	30.3
2017	Low and High	51	63.8	70	70.2
2018	High and Very High	6	7.2	6	5.0
All of Years	High and Very high	3	3.2	3	3.8
No Drought	No drought	9	10.3	9	11.6
Total Sample Size		80	100	99	100

Source: Author

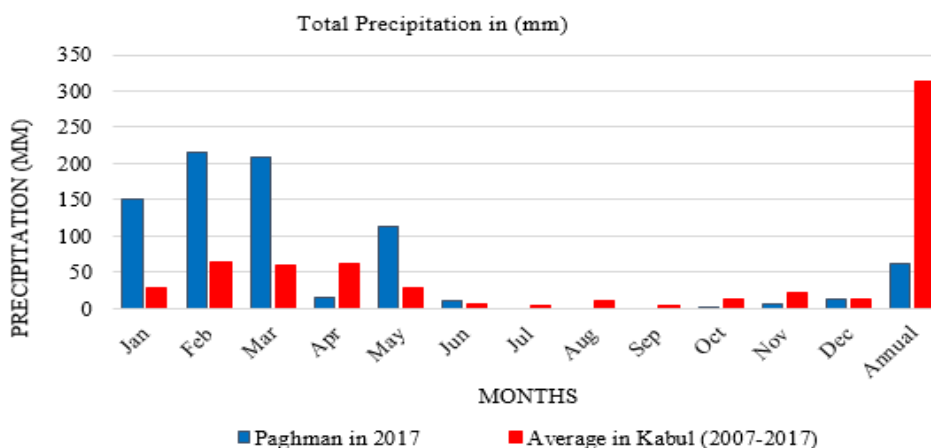


Figure 4. Total Precipitation Monthly in Paghman in 2017 and Average in Kabul Region (2007-2017)

Source: Author

To prove this point, comparison of monthly precipitation in 2017 with average precipitation in Kabul region from 2007 to 2017 has done and illustrates that total precipitation amount in 2017 in Paghman during Jun to September is zero.

it is less than annual average amount precipitation between 2007-2017 in Kabul. In addition, graph shows that the annual average precipitation in Paghman is less than annual average precipitation in Kabul (Figure 4).

4.3. Drought Impacts

In the light of farmers' experience from the household survey (Table 10), the big problem in the study area is that water resources have become drier by compare previous years, and drought impacts on crop yields, livestock, pasture have more seen. Households survey is realized that drought has been affected the study area and reduced agricultural lands. Agricultural lands in Paghman area have lost by drought and lack of water and were without cultivation. The same, every family in Deh Sabz uses a very little present of their lands for cultivation.

Table 10. Drought Experience in Study Area

Drought Problems	Target Area				Total	
	Paghman		Deh Sabz		Frequency	Percentage (%)
	Frequency	Percentage (%)	Frequency	Percentage (%)		
Drying Water Resources	62	77.5	14	73.7	76	76.8
Makes Surrounding Drier	10	12.5	3	15.7	13	13.1
Famine	2	2.5	0	0	2	2.0

Crop Failure	6	7.5	1	5.3	7	7.1
Increase Food Price	0	0	1	5.3	1	1.0
Total Sample Size	80	100	19	100	99	100

Source: Author

4.3.1. Drought Impacts on Livestock

According households survey (Table 11) reveals that drought had also affected livestock in the study area and after drought, a number of livestock have decreased. The farmers cannot cultivate and store enough forage and grains for feeding their animals during drought time. the most problem of drought on livestock is water shortage and low rainfall that can decrease pasture and fodder supply, and will cause of losing weight, and losses most of livestock.

Table 11. Livestock Efficiency on Drought Time in Study Area

Livestock Efficiency on Drought Time	Target Area				Total	
	Paghman		Deh Sabz		Frequency	Percentage (%)
	Frequency	Percentage (%)	Frequency	Percentage (%)		
Less	14	17.4	8	42.1	22	22.2
Very less	35	43.8	11	57.9	46	46.5
Medium	27	33.7	0	0	27	27.3
High	3	3.8	0	0	3	3.0
Very high	1	1.3	0	0	1	1.0
Total Sample Size	80	100.0	19	100.0	99	100.0

Source: Author

4.3.2. Drought Impacts on Irrigation

Interview with farmers and data from households survey (Table 12) reveals that the management of surface irrigation is changed compare to previous situation.

Table 12. Irrigation Source in Study Area

Irrigation Source	Target Area				Total	
	Paghman		Deh Sabz		Frequency	Percentage (%)
	Frequency	Percentage (%)	Frequency	Percentage (%)		
Rain	3	3.7	0	0	3	3.0
Karez	51	63.8	1	5.3	52	52.5
Well	13	16.3	3	15.8	16	16.2
River	3	3.7	0	0	3	3.0
Streams	6	7.5	9	47.3	15	15.2
Springs	3	3.7	0	0	3	3.0
Canal	1	1.3	0	0	1	1.0
Well and Streams	0	0	6	31.6	6	6.1
Total Sample Size	80	100	19	100	99	100

Source: Author

That means, farmers in the past could be receive their require water through the regional organization and people who is called "Mirab". Now, from dig wells they irrigate their farmlands. Data also proves that most irrigation source of water for household is Karez. Groundwater than surface water are is the main irrigation source for study area. Decline household survey shows that during the drought period and water shortages in the study area, the amount of water in the reservoirs become less, all irrigation system faced with some difficulties, Karezes will be dried, surface water has decreased, and levels of groundwater. Groundwater level in Paghman wells between 2007 to 2017 has decreased as an average of 8 m. (Figure 5).

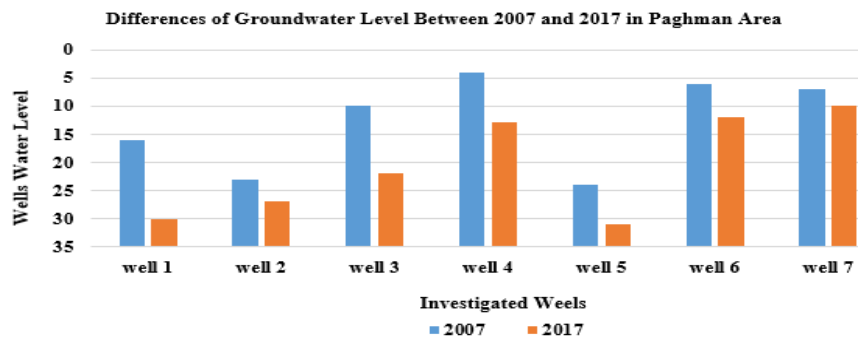


Figure 5. Groundwater Level Difference between 2007 and 2017 in Paghman Area

Source: Author

Most of respondents said, more water withdrawing from the well is reduced water levels in other wells around the same well. Inadequate water supply, damage of irrigation structures, and maintenance has been neglected. Natural forests destruction has reduced infiltration of rainfall and lead to flash flood, also disrupting irrigation system and other water reservoirs.

4.3.3. Socio-economic Impacts of Drought

Economic impacts of drought is decrease of farmers' income that can influence to the market prices and other economic activities of farmers' household. Drought influences farmers economic livelihood is income decreasing, costs rising, households' consumption limitation, farmers relying on non-farm income, and poverty creation. According to the result of data from households' survey by table 4.18, drought impacts on farmers' productions have caused decreasing income and raising of costs in the study area (Table 13).

Table 13. Livelihood Threatened in Study Area

Livelihood Threatened	Target Area				Total	
	Paghman		Deh Sabz		Frequency	Percentage (%)
	Frequency	Percentage (%)	Frequency	Percentage (%)		
Decreasing Household Income	27	33.8	9	47.4	36	36.4
Rising the Food Prices	15	18.8	1	5.3	16	16.2
Rely on Non-farm Income	4	5.0	5	26.3	9	9.0
Low Income and Rising Costs	34	42.4	4	21.0	38	38.4
Limitation of the Household Consumption	0	0	0	0	0	0
Food Scarcity and Malnutrition	0	0	0	0	0	0
Total Sample Size	80	100	19	100	99	100

Source: Author

4.3.3.1. Drought Impacts on Agriculture Income

Drought effects on agriculture crops and livestock, and reduce income and even destroy all production in an area. According to households survey (Table 14), respondents have replied that drought has reduced agriculture annual income. Therefore, agriculture investment in study area have been reduced by drought constraints, and lack of water. Drought impacts on farmers' income in Paghman are more than Deh Sabz because in Deh Sabz agriculture income is depended on fruits especially grapes and agriculture income in Paghman is depended on different agriculture productions such as, crops, fruits, livestock, vegetables, etc. Thus, fruits are more vulnerable than other crops against drought impacts.

Table 14. Decreasing Farmers Income by Drought Impacts in Study Area

Decreasing Income	Target Area				Total	
	Paghman		Deh Sabz		Frequency	Percentage (%)
	Frequency	Percentage (%)	Frequency	Percentage (%)		
10-20%	14	17.4	0	0	14	14.1
21-30%	19	23.7	14	73.6	33	33.3
31-40%	16	20.0	3	15.8	19	19.2
41-50%	7	8.8	1	5.3	8	8.1
51-60%	17	21.3	0	0	17	17.2
No impact of drought	7	8.8	1	5.3	8	8.1
Total Sample Size	80	100	19	100	99	100

Source: Author

4.3.3.2. Drought Impacts on Households Assets

According households survey (Table 15), 22.2% of respondents have said, they have sold their assets and 77.8% of respondents have replied that during period of drought they did not sell their assets. Thus, drought influence on farmer's assets in study area is not much.

Table 15. Drought Affects Farmers Assets in Study Area

Drought Impacts on Farmers Assets	Target Area				Total	
	Paghman		Deh Sabz		Frequency	Percentage (%)
	Frequency	Percentage (%)	Frequency	Percentage (%)		
No Sale	60	75.0	17	89.5	77	77.8
Land Sale	2	2.5	2	10.5	4	4.0
Livestock Sale	14	17.5	0	0	14	14.2

Home Instruments and Jewelry Sale	4	5.0	0	0	4	4.0
Total Sample Size	80	100	19	100	99	100

Source: Author

Because people in study area are engaged to agriculture activities, drought has affected on farms and labor of them. According to households survey (Table 16), recent drought has made significant constraints for labor. Therefore, many laborers especially young generations want to work in non-farm sectors because of agriculture labor wage is insignificant than other sectors.

Table 16. Household Labor in Study Area

Household Labor	Target Area				Total	
	Paghman		Deh Sabz			
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Peasant	47	58.7	2	10.5	49	49.5
Shopkeeper	6	7.5	6	31.6	12	12.1
Official	16	20.0	3	15.8	19	19.2
Worker	2	2.5	8	42.1	10	10.1
Non- employment	2	2.5	0	0	2	2.0
Non-agriculture	7	8.8	0	0	7	7.1
Total Sample Size	80	100.0	19	100.0	99	100.0

Source: Author

4.4. Current Adaptation Strategies to Reduce Drought Impacts

Based on farmers' household survey and live observation, farmers' adaptation strategies against drought for reducing its impacts in study area have identified.

Table 17. Farmer's Adaptive Capability to Reduce Drought Negative Impacts in Study Area

Adaptive Capability to Drought	Target Area				Total	
	Paghman		Deh Sabz		Frequency	Percentage (%)
	Frequency	Percentage (%)	Frequency	Percentage (%)		
Unable to Adapt with Drought	53	66.3	14	73.7	67	67.7
Able to Adapt with Drought	27	33.7	5	26.3	32	32.3
Total Sample Size	80	100	19	100	99	100

Source: Author

In this regard, two strategies on-farm and off-farm are currently practicing by farmers that they have been done by farmers experience and perception about drought. According to survey from respondents (Table 17), some of farmer households are able and have possibilities to use at least one drought strategy to cope with negative effects of it, and some of them are not able to cope with adverse drought impacts. One of the reason is lack of farmer's ability and less education of them about adaptation practices and another reason is some of households do not have enough money to invest against drought. On the other hand, they cannot get loan from any organizations or banks because they cannot pay it again.

4.4.1. Adaptation On-farm Strategies

Strategies of on-farm are named "delaying plantation date", and "change cropping system" and shown in table 18, and adopted by farmers based on experience for reducing drought impacts on farm. They are using by different methods and different available resources in different ways, and called as "Agro Tool,"and distributed with "plastic mulch". "Irrigation Techniques Strategies" deal on irrigation actions such as, "dripping or spraying system", "deep wells", "using ponds", etc. Another strategy of on-farm that is named "Resistance Variety" by "drought-resistant crop varieties," that can adopt with less water (Table 18).

Table 18. Drought Adaptive On-farm Strategies

Drought adaptive strategies	Target Area				Total	
	Paghman		Deh Sabz			
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Delaying of Plantation Date	42	52.5	4	21.1	46	46.5
Change the Cropping System	30	37.5	7	36.8	37	37.3
Dripping System of Irrigation Techniques	6	7.5	3	15.7	9	9.1
Plastic Mulch	0	0	1	5.3	1	1.0
Drought Resistant Crop Varieties	0	0	0	0	0	0

Nothing	2	2.5	4	21.1	6	6.1
Total Sample Size	80	100.0	19	100.0	99	100.0

Source: Author

Interview with farmers and data survey in study area show, some agriculture products (cereals, potato, barley, maize, fruitful and unfruitful trees, saffron/crocus and poppy, etc.) are rather resistance to drought. Farmers replied that cereals, maize, and fruitful trees have more resistance with drought. By usage of plantation date can cultivate crops, and get more yield. Matching plantation date for major crops mostly can be adopt by wheat, onion, potato, and some fruits in the study area (Table 19).

Table 19. Seasonal Pattern in Study Area

Season	MAR	APR	MAY	JUN
Spring				
Season	JUN	JUL	AUG	SEP
Summer				
Season	SEP	OCT	NOV	DEC
Autumn				
Season	DEC	JAN	FEB	MAR
Winter				

Spring (rainy season)	
Summer (hot and dry season)	
Autumn or Fall (cold and dry season)	
Winter (very cold, and snow precipitation season)	

Source: Author

The second on-farm strategy is "Change Cropping System" are more used by farmers as an adaptation strategy in study area. By having crop pattern and a good management practices can yield potential, inputs, and soil fertility. Therefore, different crops are planted to absorb maximum temperature, extremes weather, and economic return. Field observations and interview with farmers (Table 20) show that farmers can change system of crop by wheat cultivation, potato, and vegetables (i.e., Strawberry, Tomatoes, and Cucumbers).

Table 20. Drought Resistant Crops in Study Area

Drought Resistant Crops	Target Area				Total	
	Paghman		Deh Sabz		Frequency	Percentage (%)
	Frequency	Percentage (%)	Frequency	Percentage (%)		
Cereals	32	40.0	0	0	32	32.4
Potato	2	2.5	0	0	2	2.0
Barley	0	0	1	5.3	1	1.0
Maize	12	15.0	10	52.6	22	22.2
Fruitful trees	17	21.2	8	42.1	25	25.2
Unfruitful trees	10	12.5	0	0	10	10.1
Saffron/Crocus and Poppy	7	8.8	0	0	7	7.1
Total Sample Size	80	100.0	19	100.0	99	100.0

Source: Author

They practiced rotation of crop for wheat and potato that is caused an increase to productivity, maintaining, and moisture for reducing unwanted conditions. , they adapted two crops (Cucumbers and Strawberry) or three crops (Tomato, Strawberry, and Cucumbers) under greenhouse in the same land and same time for vegetable (Table 21).

Table 21. Plantation Date of Major Crops in Study Area

Crops	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Wheat												
Barley												
Maize												
Potato												
Onion												
Vegetables												
Fruit												

	Plantation Date
	Production Period
	Harvesting Period

Source: Author

"Dripping system of irrigation techniques" as an adaptation practice method is beneficial as farmers by this method can more use water, and store it for a long time. The constraint of this method is vast of cost and by adopt of it sometimes cannot flow water well into the pipe. "Plastic mulch" is efficient than the organic mulch but its cost too high.

4.4.2. Farmers' Adaptation Off-farm Strategies

Farmers' Adaptation Off-farm Strategies are related to all non-agriculture activities and farmers apply them to obtain additional income during drought time. The off-farm methods such as, "income diversification," "business/trade", "industrial labor", "migration", and "selling assets" are adapted as strategies to fulfill households' demand and reduce impacts of drought on farmers livelihoods. Some off-farm methods (selling assets and migration) are not good options but sometimes farmers choose them as a last choice for obtaining income and fulfilling livelihoods and household consumptions (Table 22).

Table 22. Farmers' Off-farm Adaptation Strategies to Reduce Drought Impacts on Livelihood

Off- form Strategies	Target Area				Total	
	Paghman		Deh Sabz		Frequency	Percentage (%)
	Frequency	Percentage (%)	Frequency	Percentage (%)		
Income Diversification	42	52.4	13	68.4	55	55.6
Handicrafts	0	0	0	0	0	0
Business/ Trade	13	16.7	0	0	13	13.1
Non-agriculture Labor	3	3.6	4	21.1	7	7.1
Migration	18	22.3	2	10.5	20	20.2
Selling Assets	4	5.0	0	0	4	4.0
Total Sample Size	80	100	19	100	99	100

Source: Author

Data from households' survey reveals that farmers inside and outside of study area engage in business activities. This method is one of the off-farm adaptation strategy. Some of farmers work in factory such as, brick kiln, carpentry, welding, etc. Some of farmers have sold their assets such as, part of land, and some livestock during drought situation for fulfilling their needs.

5. Conclusion

Farmers' experience and their perception about drought and its consequences is excellent. Drought happen in different seasons in Kabul province and its impacts on agriculture products are significant and can disturb date of plantation and crops harvesting. Precipitation deficiency over the last years (2009-2018) has declined the major crops, and vegetables harvest. Some farmers have applied several different adaptation strategies to reduce drought impacts on livelihood and agriculture activities, but some farmers due to inadequate ability cannot do any practices against drought.

Deep wells digging, method of dripping irrigation, mulch etc. that are among adaptation on-farm strategies need high cost to establish and practice. That means, farmers' adaptive capacity of abilities depend on socioeconomic qualities. Farmers have adapted some of off-farm strategies for reducing drought impacts on livelihood, but some of these strategies (assets selling and migration) always cannot help farmers' income because negative consequences of these strategies on households' future are very strong. For example, if younger family members want to migrate for finding complete income in order to support their household. In this case, women and elderly are faced to many problems such as, care children or doing other duties.

Because of in study area no any investigation has been done into drought field. therefore, retrievals of this research about adaptation strategies against drought, perception of drought impacts on agriculture products and farmers' livelihood for study area and even whole country can be applied and effective. As well as from findings of this research, regional and rural planners, agriculture officials, policy makers can use effective adaptation strategies against drought in order to create sustained livelihood.

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