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SIGNS OF CLIMATE CHANGE IN AFGHANISTAN: DROUGHT AND ITS EFFECT ON AGRICULTURE

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Afghanistan is one of the countries that have suffered the most damages from the change of climate. Over the recent decades, its temperature has increased and on the contrary, precipitation has decreased, with serious change in its special and temporal distribution. Decrease in the thickness and area of the avalanches, retreat of the snow line, decline of the ground water level, decrease of river flows, and shortage of potable water for humans, animals and irrigation are considered as other signs and effects of the climate change (CC). Occurrence of successive droughts, poverty, mass immigration, decrease of the price of cattle or their death, loss of rain-fed agriculture or its serious damage, decrease of the level of agricultural products, lack of food security, elimination of pastures, spread of human, animal and plant diseases, pollution of water, soil and air and tens of other cases have been continually caused due to the CC in Afghanistan. Although the part of Afghanistan has very little signs of the climate change, it suffers more than any other country. There are two solutions to decrease the effects of the CC in the country. First, to take preventive measures, or to be prepared before the occurrence of an incident and second, to coordinate life conditions with climate changes; all effects of the CC in Afghanistan should be considered.

Keywords: *climate, drought, rainfall, temperature, water.*

Introduction

Over the past centuries, the Earth's climate has changed, and this process has been intensified during last few decades, with unusual changes in climatic parameters (air temperature, moisture and precipitation, air pressure, etc.). These changes are the result of both of human activities (use of too much fossil burning and carbon dioxide emission to the atmosphere) and natural factors (solar winds, the movement of the Earth's plates, volcanic eruptions, atmospheric storms, etc.). No part of the planet has remained save from the effects of climate change. The warm regions have become warmer, the cool regions cooler, the damp regions damper and the dry regions drier.

Afghanistan is considered among the countries which have suffered the most damages from the change of climate. There are many signs of climate change in Afghanistan such as droughts, resulting in decrease of surface and ground water and increase in temperature and evaporation. In recent decades, precipitation has decreased and on the contrary, temperature has increased. Spatial-temporal distribution of precipitation has change seriously as well. For instance, in last days of fall, in winter and in the beginning of spring, either it never snows or it snows little or the precipitation takes place in the form of rain – the precipitation out of season which makes complete the average norm of long-term precipitation. But since it has occurred in the form of rain, it has taken place out of the season or it has melted earlier as a result of momentary increase of the temperature, people cannot store or control it. As a result, there can be a shortage of water even in the middle the year. Decrease in the thickness and area of the avalanches, retreat of the snow line, reduction of ground water level, decrease of river flows, and shortage of potable water for humans, animals and irrigation are considered as other signs and effects of the climate change.

Afghanistan is an agricultural country, with total area 652225 km^2 or 65222500 mln ha. Out of the total area of the country, almost 12% is agricultural land, 3% – forest, 46% are permanent pastures, and 39% are covered by mountains and urban areas. 76000 km^2 (7.9 mln ha), or 12.11% of total area is cultivatable land, 5.3 mln ha of which are irrigable and the rest 2.6 mln ha cannot be irrigated. Out of 5.3 mln ha of irrigable land, only 2.6 mln ha are irrigated due to shortage of water and 2.7 mln ha cannot be cultivated due to the lack of barriers, canals, or have no controlled running waters and lacks its sound management.

It is obvious that almost two third of the population of Afghanistan is busy in agriculture, livestock husbandry and related affairs, which are most vulnerable to drought, because they depend on water. The present work focuses on droughts and their effect on agriculture, agricultural crops and livestock husbandry in Afghanistan.

Drought and Wet Periods in Afghanistan

Over the past half-century, Afghanistan has experienced numerous droughts of different severity. Figure 1 and Table 1 show the drought and wet years, their frequency and severity; drought and wet classification and occurrence percentage are given in Tables 2 and 3.

Figure 1 and Table 1 indicate that the years when precipitation is less and the drought has occurred the level of agricultural crops has also decreased, and on the contrary, in the years when precipitation is higher, the level of agricultural crops has also increased. The relation of drought with the level of agricultural crops has been studied briefly as follows.

Whenever the precipitation decreases, agriculture and livestock husbandry sustain serious damage. For example, in 1970 and 1971 when Afghanistan received precipitation under normal which caused drought, agricultural crops considerably decreased. Meanwhile, livestock husbandry has also been affected. Agricultural land was 0.55 ha per capita in 1980, which decreased to 0.25 in 2007. Successive droughts, especially from 1998 to 2004 caused destruction to many agricultural lands and damaged pastures.

As two third of active population of the country depends on agriculture, more than half of Afghanistan's population suffers during droughts. Almost 85% of all crops in the country are obtained through traditionally irrigated farming. Since 1978, the irrigable area has almost decreased by 60% and changed Afghanistan, which has evolved from near 'self-sufficient' in agricultural crops to a main importer of grains, fruit and vegetables. Therefore, it can be concluded that the droughts have caused a lot of damages in this sphere.

Similarly, gardens, forests, pastures and forest lands of the country have suffered irreparable damage. For example, exporting dry fruit and nuts, especially apricots and almond which is still considered one of the important sources of foreign currency; is not as much as in 1980 when dried fruit of the country has occupied 60% of the world markets.

Effect of drought on wheat production

The effect of drought on wheat production which is the most essential agricultural crop in Afghanistan is estimated. Wheat is among the main and principal agricultural crops which constitutes almost 83% of total expenses of grains of the country. Since its cultivation and amount of production depends on precipitation, and because there is less precipitation than normal in most regions of the country from late 2007 (October) to the middle of 2008 (May), which had caused the drought, the NGOs reported the condition of rain-fed wheat, especially in the north and the west of the country. According to the report of the Afghanistan government, the crop of irrigated wheat

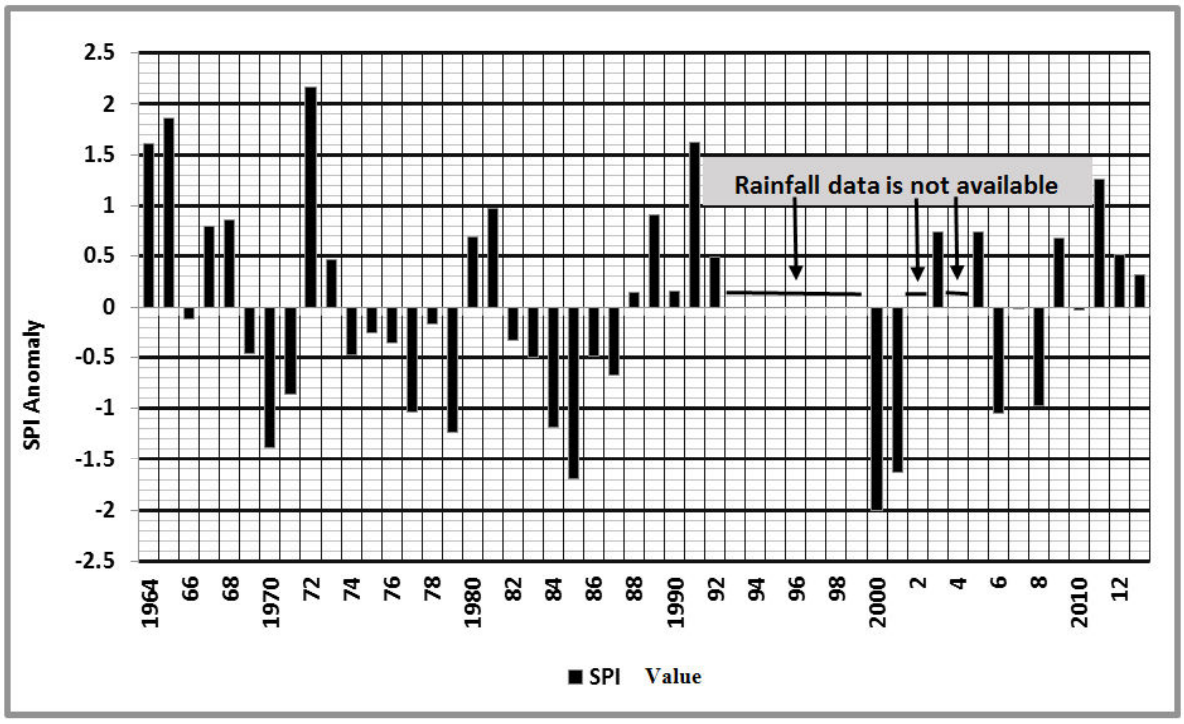

Figure1. Drought and wet years, their frequency and severity in Afghanistan [3, 4]

Table 1

Statistics of drought and wet years, periods and severity in Afghanistan, 1964–2013 [3, 4]

No	Years	Drought and wet value	Drought and wet periods		Drought and wet severity							
					Drought				Wet			
			drought	wet	MD	MeD	SD	ExtD	MW	MeW	SW	ExtW
1	**1964**	**45.76**		first								
2	**1965**	**52.96**										
3	**1966**	**–3.27**	first									
4	**1967**	**22.68**		second								
5	**1968**	**–24.5**	second									
6	**1969**	**–13.22**										
7	**1970**	**–39.29**										
8	**1971**	**–24.54**										
9	**1972**	**61.54**		third								
10	**1973**	**13.18**										
11	**1974**	**–13.56**	third									
12	**1975**	**–7.39**										
13	**1976**	**–10.13**										
14	**1977**	**–29.34**										
15	**1978**	**–4.65**										
16	**1979**	**–35.17**										
17	**1980**	**19.69**		fourth								
18	**1981**	**27.58**										
19	**1982**	**–9.45**	fourth									
20	**1983**	**–14.25**										
21	**1984**	**–33.8**										
22	**1985**	**–48.21**										
23	**1986**	**–13.91**										
24	**1987**	**–19.05**										
25	**1988**	**3.92**		fifth								
26	**1989**	**25.87**										
27	**1990**	**4.26**										
28	**1991**	**46.10**										
29	**1992**	**13.86**										
30	**1993**	Rainfall data is not available										
31	**1994**											
32	**1995**											
33	**1996**											
34	**1997**											
35	**1998**											
36	**1999**											

37	**2000**	**–57.12**	fifth									
38	**2001**	**–46.49**										
39	**2002**	Rainfall data is not available										
40	**2003**	**21.071**		sixth								
41	**2004**	Rainfall data is not available										
42	**2005**	**21.07**										
43	**2006**	**–29.68**										
44	**2007**	**–1.56**	sixth									
45	**2008**	**–27.99**										
46	**2009**	**19.18**		seventh								
47	**2010**	**–0.81**	seventh									
48	**2011**	**35.75**										
49	**2012**	**14.69**		eighth								
50	**2013**	**8.96**										

M D	**Me D**	**S D**	**Ext D**	**M W**	**Me W**	**S W**	**Ext W**
Mild Drought	Medium Drought	Serious Drought	Extreme Drought	Mild Wet	Medium Wet	Serious Wet	Extreme Wet

also decreased considerably. According to the United State Department of Agriculture (USDA) report [5], wheat production in 2008 and 2009 decreased almost 60% or 1.5 mln t than in previous year. The decrease of winter grain crop caused the Afghanistan government and the UN to demand for 400 million US dollars from the United Nations for importing additional wheat and other food stuff for 4.5 mln people who were suffering from the drought.

The less precipitation, the less will be cultivated and rain-fed wheat area and crop per hectare. According to USDA assessment [5], the amount of wheat production had decreased by almost 55% and the barley by 67 % compared to 2007. Similarly, decrease of wheat in domestic markets caused an increase in its price by 200 %.

Estimations based on Central Statistics Organization report [1] show that about 1.25 mln ha of land are cultivated as rain-fed in Afghanistan and the most of rain-fed lands are located in the north provinces of the country (Figure 2).

Since droughts have caused irreparable damage to agriculture of the country throughout its history, it is considered to be one of the main reasons of weakness of the agriculture sector. When the amount of precipitation was less than normal in 2008 and there was drought in the country, the spread and growth of plants was less than the normal and the plants were in bad condition (Figure 3). On the contrary, the amount of precipitation was normal even more than normal in

Table 2
Drought classification and occurrence percentage [3, 4]

No	Drought classification	Percentage of occurrence
1	Mild	**68.181**
2	Medium	**22.727**
3	Serious	**4.545**
4	Extreme	**4.545**
5	Total	**100**

Table 3
Wet years classification and occurrence percentage [3, 4]

No	Wet classification	Percentage of occurrence
1	Mild	**73.682**
2	Medium	**5.263**
3	Serious	**15.789**
4	Extreme	**5.263**
5	Total	**100**

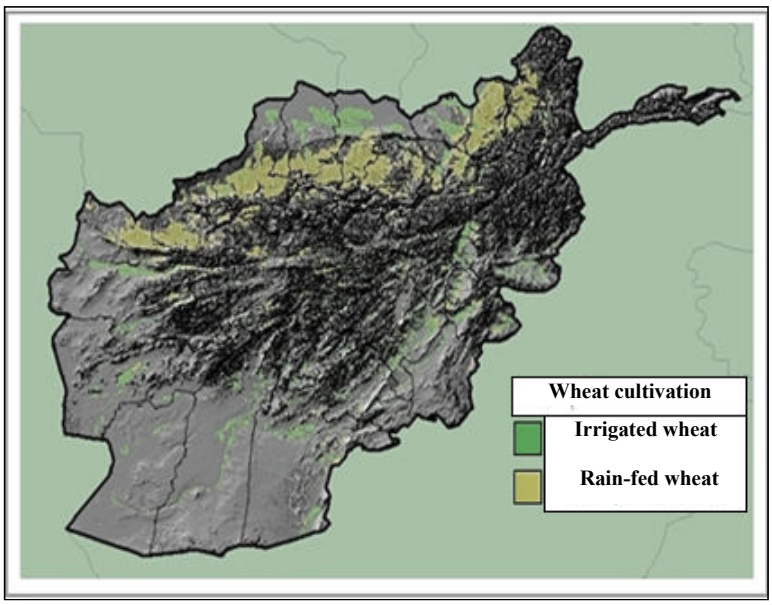

Figure 2. The irrigated and fain-fed wheat cultivation area in Afghanistan [1]

2009 and it was considered as a wet year, the spread and growth of the plants enjoyed good conditions.

As mentioned above, the production of grains, especially wheat depend more on the weather condition and precipitation. 25% of the rain-fed lands are allocated for the cultivation of wheat and this amount varies annually (Figure 4).

It should be noted that rainfall data of the Ministry of Agriculture, Irrigation and livestock husbandry [4] did not show the 2011 as metrological drought and, in total, it was a normal even wet year, but it rained in this year untimely and caused agricultural drought as a result of which the production of irrigated and rain-fed wheat considerably decreased. Due to less water and lack of precipitation in April and May, the crop of rain-fed wheat decreased. Also, the irrigated wheat was damaged in each part of the country, especially the north and northwest was damaged seriously. As a result, in 2011 the irrigated wheat crop decreased by 28% and the rain-fed – by 77%. Irrigated and rain-fed wheat crop showed a decrease by 14% and 17%, respectively, in 2010, compared to 2009.

Annual change in grains production over the recent 14 years (from 1998 to 2011) shows that 1998, 2003, 005, 2007 and 2009 are considered as good (Table 4).

On the contrary, the level of grains production decreased due to the droughts in 1990, 2000, 2001,

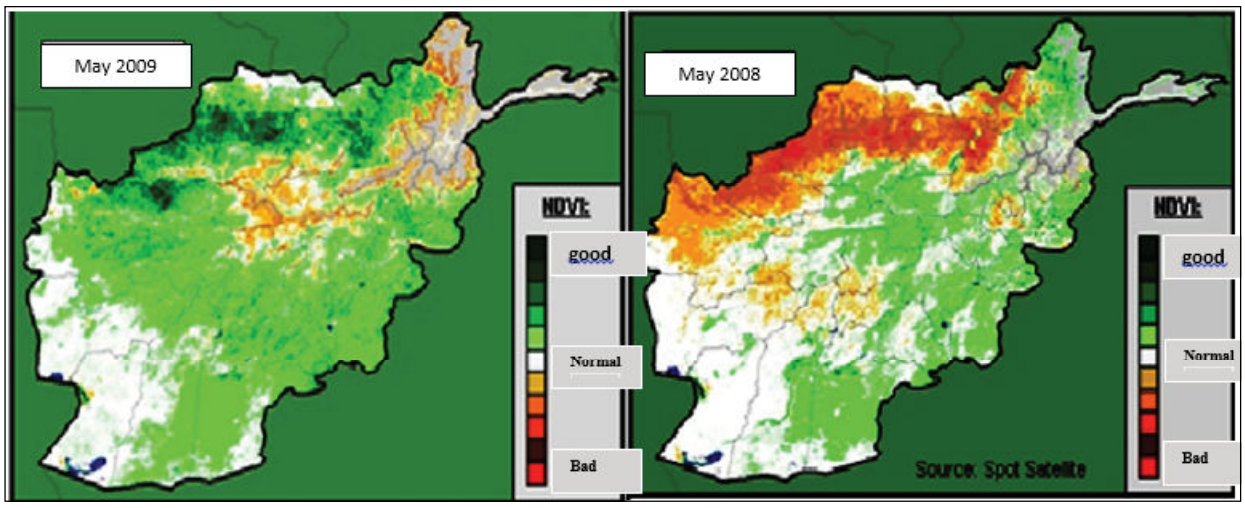

Figure 3. The comparison of plant condition of Afghanistan in 2008 and 2009 [5]

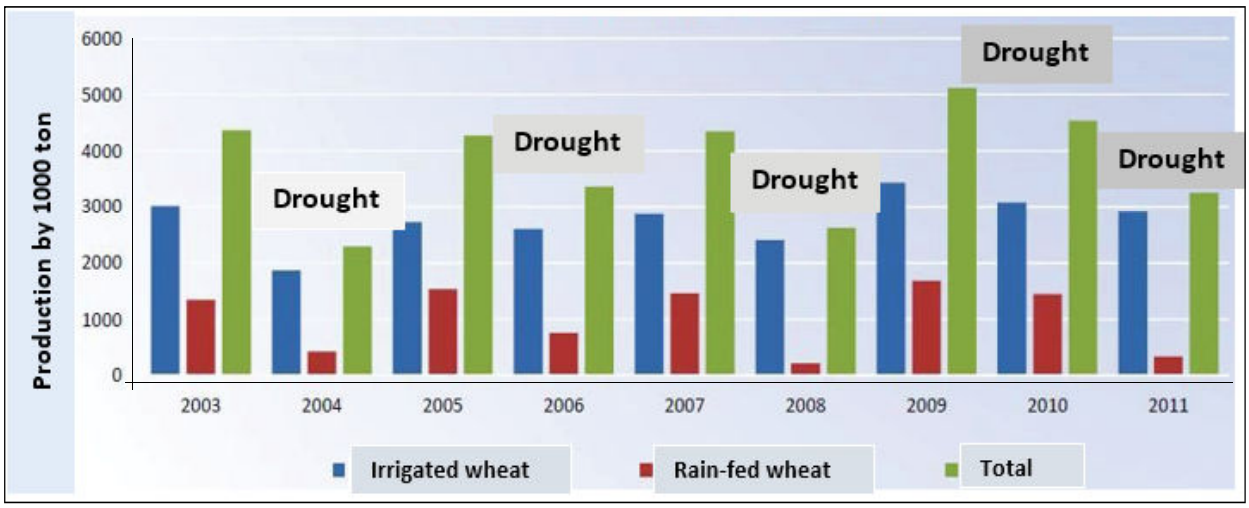

Figure 4. Irrigated and rain-fed wheat production chart from 2003 to 2011 by metric ton, Afghanistan [2]

2002, 2004, 2006, 2008, 2010 and 2011, negatively affecting on agricultural production as a whole.

Conclusion

The effect of drought on the level of agricultural crops, especially irrigated and rain-fed wheat in period from 2012 to 2018 has been studied. In the current 2018, year 21 provinces of Afghanistan face an unprecedented drought. This year, due to shortage of water, foodstuff and herbs for animals thousands of people, especially from Ghor and Badghees provinces had to leave their homes. Nearly two million livestock (cows, bulls, sheep, and goats) died. In the same manner, this year (2018) Afghanistan faces lack of an amount of 1.5 mln tons of wheat. There are two solutions to slightly reduce the effect of climate change in Afghanistan. First, to take preventive measures to be prepared before the occurrence of the incident and second, to coordinate life conditions with climate change.

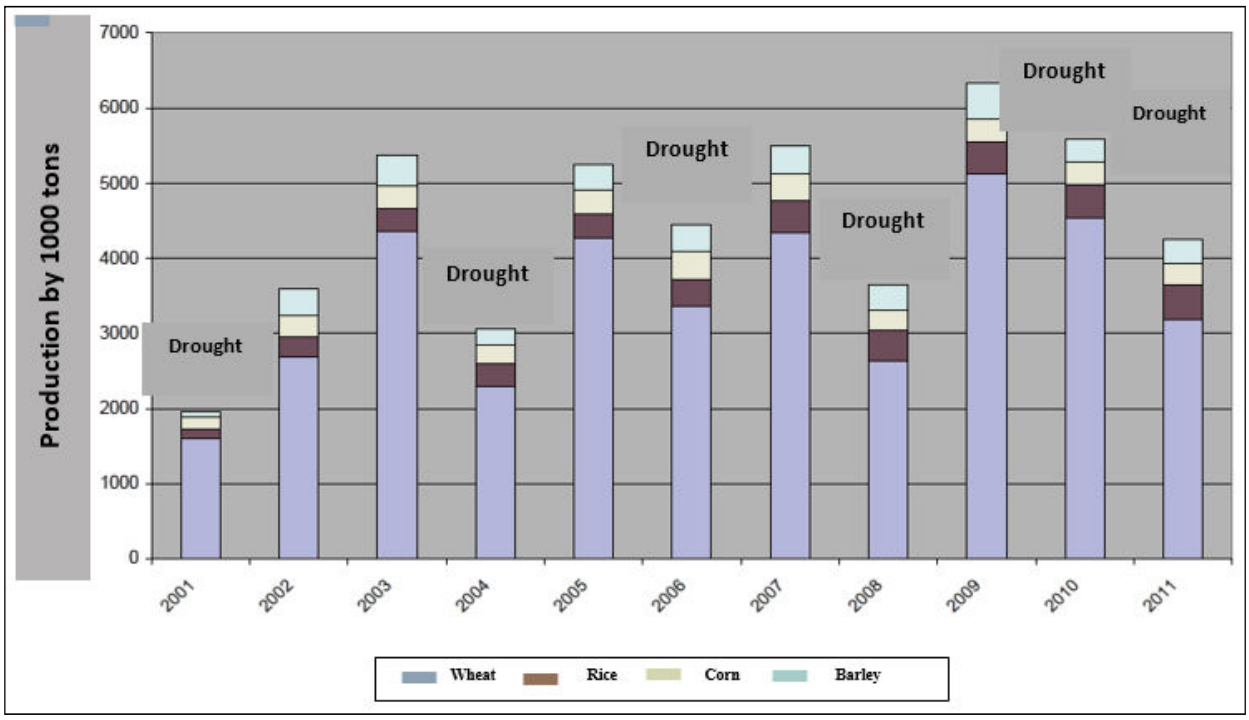

Figure 5. The production of grains chart of the country from 2001 to late 2011, Afghanistan [2]

Table 4

Relation of drought with the production of grains in Afghanistan from 2003 to 2011, by 1000 tons [2]

Irrigated wheat	Rain-fed wheat	Irrigated and rain-fed wheat	Rice	Corn	Barley	Total	Years	No
2020	814	2834	301	330	240	3705	1998	1
1988	512	2500	188	240	216	3144	1999	2
1329	140	1469	105	115	74	1763	2000	3
1514	83	1597	122	160	87	1966	2001	4
2110	576	2686	260	298	345	3589	2002	5
3017	1345	4362	291	310	410	5373	2003	6
1867	426	2293	310	234	220	3057	2004	7
2728	1538	4266	325	315	337	5243	2005	8
2604	759	3363	361	359	364	4447	2006	9
2878	1465	4343	425	360	370	5498	2007	10
2406	217	2623	410	280	333	3646	2008	11
3433	1682	5115	432	300	486	6333	2009	12
3082	1450	4532	450	301	437	5720	2010	13
2917	339	3256	450	301	305	4312	2011	14

Therefore, all effects of the climate change in Afghanistan, such as droughts should be taken into account.

REFERENCES:

1. Afghanistan Statistic yearbook, 1390: (Agriculture Development Report) Statistics Central Press Issue 30rd.
2. Agriculture Prospects Report, Policy and Planning Department Marketing, Economics and Statistics Division (Faahm) (MAIL) Kabul, 2005 to 2011.
3. Report for Rainfall Parameter, Afghanistan Meteorology Department, 1955 to 2013, Kabul, Afghanistan.
4. Report for Rainfall Parameter, Ministry of Agriculture, Irrigation and livestock, 2005 to 2013, Kabul, Afghanistan.
5. USDA (United State Department of Agriculture) (2008) Foreign Agricultural Service Commodity Intelligence Report.