

Analysis of Agricultural Drought in Zarafshan (With Emphasis on Mastcha)

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Abstract: Drought is an unexpected decrease of rainfall in a particular time in an area which is not necessary dry so that the moisture lowers so much that the normal trend of growth in that area will be impaired (1). Drought is not the permanent feature of an area and it might happen in every climate and is unpredictable and it affects agricultural products and power and surface and underground water and causes famine.

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1. Introduction

In 2010, drought occurred in the town of Mastcha located in the valley of Zarafshan which lies at latitudes 39°44' and 39°10' and at longitudes 69°-70°45' east and its area is 3720 km² with a population of 19500 people. Drought occurs in areas with semi-arid, sub-humid and humid climate. It endangers agricultural activities and makes it impossible to attain agricultural products and self-sufficiency frequently and thus affects the yield, quality, and quantity of agricultural products. There has not been a comprehensive definition of drought so far. Scientist have in different categories have made various definitions.

Weather scientists: Drought is the serious decrease of rainfall or precipitations in a long period of time. Of course, this geographical event is different from one area to another one.

According to Kits and Glants, drought refers to a long period of time when the rainfall is below the average and it is even different from season to season. Hydrologists: Drought occurs when the volume of surface water decreases and thus the water of the wells, groundwater and the water behind the dams will reduce (Iglesias, A. and Moneo, M. (eds) (2005).

Farmers: They believe that drought reduces the moisture of the soil and air, and thus lowers the quality and quantity of crops and agricultural products. Baron (1985) says that there are over 150 definitions of drought. Generally, drought is a constant stable period which lasts several months to several years when the amount of water in water resources of an area is minimized and reduced. Drought is a normal phenomenon in a climate even though many people consider it as a random event. This event happens in all climates although it is different in various climates. Drought is a temporary disorder and it is different from dryness. Dryness is related to areas with low rainfall and it is a permanent kind of climate while drought is a temporary event.

Drought is a natural disaster which causes lack of water for the activities of some species and the

environment. It is a natural disaster which is assessed based on average climate and hydrological conditions over a long period of time. The time and the effect of rainfall are always important. Other climate phenomena such as high temperature in sunny days, the amount of energy received in an area, and low moisture are often together with drought in many ways and can increase drought dramatically. It is taken from the word drought.

It refers to a condition in which the rainfall is lower than normal rate. It is caused by climate changes and it is difficult to plan a program and to manage it because the severity and the frequency of events are unknown. The feature that restricts planning to prevent water shortage during the drought is its random occurrence. This flexibility which causes crisis and lack of water and requires more efforts to be dealt with than to be planned must be quite predicted and controlled. People are willing to consider drought as a natural part of climate course and they believe that drought will be finally removed. In drought two problems have remained unsolved: one is its repetition and the other is its severity therefore a complete planning is required to decrease the costs of drought and its severity.

Lack of information about the costs of drought is another factor which makes minor problems to be considered in planning to deal with drought while the real cost of drought and its damage could be more than other natural disasters. The effects of drought and its costs on people and society must be analyzed. Humans suffering caused by drought is rarely measured in assessing the costs. Indirect costs are more difficult to determine than direct ones and are usually unclear and thus the decision makers with not have comprehensive information about the drought costs and damage. Drought has a remarkable effect on total expenses during the time. Drought is one of the most important natural disasters which have lots of adverse environmental effects in spite of its low death toll. It naturally destroys the economy of areas (Sušnik, A. 2005).

1.1. Review of Literature

Yang, Guohua & Zhou, Yongzhang. (2005) believe that in humid and semi-arid climate drought occurs when the annual rainfall and precipitation is less than 85% of its annual average. Of course, the effect of this phenomenon depends on the climate conditions of the area and its activities. Morgan R. 1985 explains that drought is a period of time when the rainfall decreases during the months and years so that the crops and agricultural products are seriously damaged and water supplies reduce severely and a large number of cattle die because of hunger and thirst.

Sivakumar MKV, Wilhite DA. 2002 believes that drought is a constant period of time without any rainfall. He emphasizes that various needs to water makes it impossible to have a comprehensive definition of drought and even a one-to-several-week period without any rainfall might be agriculturally serious especially when the weather is hot and the soil and air temperature is very high and even the power plants which require to save water will face problems after the lack of rainfall within several month particularly during the summer.

Bari and Charley believe that drought is a periodic lack of rainfall which leads to lack of soil moisture and flowing water and thus ruins human activities and wildlife. Dryness is a constant feature of climate in an area which means the lack of sufficient rainfall for the growth of living things in that area while drought is an unexpected decrease of rainfall in an area in a particular time which is not necessarily arid. The rate of this reduction is so much that it impairs the usual growth trend in the area.

Therefore, drought is not a constant climate feature and it might happen in every climate. For example if the rainfall in an area is less than 100 mm the plant species of that area might die even though the rainfall in another part of the area is above the average and that area is humid. For instance, if the rainfall is less than 800 mm in the West Mountains of Hesar, it is arid but if the rainfall is 300 mm in Mastcha, it is humid.

Professor Mohebatof has discussed the climate of Tajikistan and has divided it into several parts based on the scientist's ideas. The region of Foon Yaghnab in Zarafshan and has pointed that the winter is humid and the summer is a dry season there.

2.1. Research Objectives

The aim of this research is to study humid and dry months and also to analyze drought and its fluctuations in the region of Mastch because the main economic income of Zarafshan which is one of its districts is through farming especially potatoes (Kartooshkeh), vegetables, wheat, beans, etc. By knowing the dry months and drought, farmers are

trained to choose products which resist dryness. Of course, if drought happens frequently for several years and they cannot resist it, the farmers have to leave the area and move to urban areas and this leads to decrease of agricultural products which is a serious problem for the people of the area.

2. Material and Methods

To achieve the goals of the research it is necessary to study the climatic physiological conditions and the soil during the drought in the area. By studying this phenomenon for a long time some experts believed that drought is one of the most terrible natural disasters for human beings and living things including animals and plants. However, since drought is an irregular phenomenon, there has never been a regular method to predict and or to deal with it. Research methods are divided to several kinds:

Statistical methods which are dealing with the numbers of rainfall and precipitation.

In this method, regression, variance analysis, changes domain, standard deviation and etc. have been applied.

Non-statistical technique which has been used by many people and various models has been presented. For example in Coupon method (1918 the vegetation on earth has been divided to several climates based on the temperature and monthly and annual rainfall and with regard to distinct units.

Brown JF et.al (2008) has identified categories of climate based on the hottest and the coldest months of the year and in relation to vegetation in each climate. Each one has been divided to smaller units based on the percentage of humid days. Miller (1931) classified the climate based on temperature and by using the vegetation of five major climates. Each one is divided to smaller units based on the seasonal rainfall.

Wu H, Hubbard KG, Wilhite DA. 2004 have studied the climate based on the need of area to water. He determined the need of each area to water by means of potential and real evapotranspiration and determined the climate based on the water balance.

In this article, Dommartin method was used to identify drought and dry months. In this method, average monthly and annual temperature and rainfalls have been applied as the required tools and drought in an area has been studied and analyzed. In Dommartin method, humid index or dryness coefficient equal to 10.4 represents semi-dry or sub-humid climate. By calculating the monthly dryness coefficient of Mastcha's climogram it was concluded that five months of the year (June, July, August, September, and October) were dry months, three months (May, November, and February) were semi-arid while

December, January, and April were sub-humid months.

The Figure1 indicated that the average rainfall in 11 years from 2000 to 2010 equals to 258 mm so that in 8 years it has been below the average that is drought and in 3 years it has been above average that

is humid years. Therefore, in this area, drought is more than humid years and a solution must be found to this problem so that the farmers in this area will not gain loss since the best agricultural products such as potatoes, apples, vegetables, and wheat are produced in this area.

Table 1: Mastch's average rainfall in 11 years from 2000 to 2010

Months of the year	January	February	March	April	May	June	July	August	September	October	November	December
temperature	1 -	1	12	1315	19	21	24	23	19	15	8.5	2
rainfall	14	18	40	41	40	16	12	.612	12.5	19.4	25	21.6
Dryness coefficient	1516	1916	2118	2019	1615	6119	412	5	1	912	1612	2119

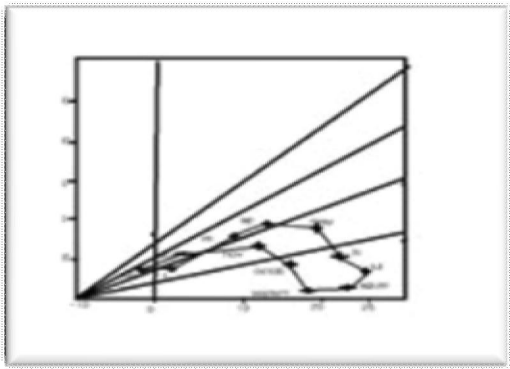


Figure 1: Mastch's climogram

4. Discussions

As it was calculated, dryness coefficient in the area of Mastch equals 10.4 which mean the area is arid or semi-arid annually. Statistics during 11 years indicated that the average rainfall was 258 mm so that in 8 years it was below the average that is drought and in 3 years it was above average that is humid years. Moreover, based on Dommarton Climogram it was identified that five months of the year (June, July, August, September, and October) were frequently dry months, three months (May, November, and February) were semi-arid while December, January, and April were sub-humid months. In the months when planted products such as different kinds of vegetables, wheat, and barely are either dry or half-dry, they need irrigation and the soil moisture is used by the plant and is also vaporized. The land also has high dryness coefficient. In dry months, the need to water is multiplied which might cause damage to gardens, trees, and bushes.

To prevent such damage some tips are suggested:

- Solutions before drought.

- Predicting drought and the period of its removal.

- Forecasting rainfall conditions in an area through weather stations any analyzing the information and providing it to planners and managers of crisis in the region.

- Planting fruit trees or plants which resist arid climate which is a basic way to fight drought .

- Providing water supply in this area, and pumping the water of Zarafshan river whose origin is the Godiov station and using efficient systems of irrigation such as pressurized irrigation, sprinklers, and dripping in low water seasons.

- Building dams in this mountainous region which has good conditions for saving water and directing it to agricultural lands and can provide electricity for the region.

- Ionizing clouds to increase rainfall in the region, ensuring agricultural products and crops in order to support the farmers in case of any loss.

- A major difference between drought management and other crises caused by natural disasters is that since drought appears gradually the managers have enough time for planning and can fight it carefully and appropriately. Therefore, it is necessary to have a comprehensive managerial plan for this purpose to be executed whenever necessary.

- Identifying potentials and capabilities to fight drought and its negative consequences, making cold storage for keeping fruits and silos for storing wheat and other kinds of grain and providing proper conditions to maintain meat, providing financial liabilities, forming consultation meetings with experts and farmers.

- Advertising and informing people and providing appropriate situation for people's

participation in fighting with drought and saving water.

Post-crisis period: In this period restoring the resources is the main strategy of the area. Restoring the system of agricultural products and gardens is the main affairs of a general strategy. Experiencing drought in a region can offer good strategies for choosing cultivation systems to forget unpleasant and tough memories.

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