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CURRENT SITUATION ABOUT DROUGHT IN TURKEY

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ABSTRACT

In terms of the up-to-date climate conditions, the effects of global climatic change in show up as the decrease in water resources, drought, heat waves, increase in floods, and decrease in agriculture in Turkey. Especially the decreasing precipitation and increasing temperatures in the weather in some regions cause serious drought and water scarcity problems. Drought may be observed in every climatic region all over the world even in rainy regions. It is the most complicated one among the natural disasters, and affect more people when compared with the other disasters.
Since Turkey is located in a sub-arid climatic region, it may face the risk of drought frequently. It is expected that there will occur changes in the severity and duration of droughts with the effect of climatic changes in excessive temperature distribution in Turkey. As a result, it is predicted that vaporization will increase, heat waves will cause more deaths and forest fires, and together with these, the drought will be more severe and may be experienced in wider areas in a more frequent manner. Decreases in water levels, agricultural products, pasture and forest products, and increases in fires, in death rates of the animals bred in farms and wild animals, will be observed among the direct effects of drought together with the damages in wildlife and fish species on the environment.

Keywords: Drought, Drought in Turkey, Water Resources, Water Scarcity.

INTRODUCTION

The need to improve ecological knowledge is as relevant as ever since the Earth has arguably entered a new epoch—the Anthropocene—in which the effect of humanity permeates the bio geosphere, especially through the pervasive impacts of anthropogenically exacerbated climate change (1,2). Under rapidly changing climate, accelerated understanding of the diverse patterns and processes driving dynamic ecosystem responses is needed to effectively address the challenges of sustainably managing and restoring affected systems (3, 4).

Among the effects of climatic change, drought may be considered as the most difficult disaster to cope with. Intergovernmental Panel on Climate Change (IPCC) released a report on the physical basis of drought and their effects in September 2013, and caused dreadful expectations about Turkey and the Mediterranean Basin. One of the most important results was the problem of drought, which is expected by us in our region in future. According to IPCC, the annual water amount per capita in Turkey according to 1990 climate conditions was 3.070 m^3. However, the majority of this amount does not exist in areas where it is needed. As a result of the population increase, and with the influence of the global climate change, Turkey will have a more drought climate in future, and the amount of water per capita will vary 700 and 1.910 m^3 (5). This is nearly the same amount of the water per capita in Cyprus. In other words, Turkey may become a poor country in terms of water with the changing climate and increasing population in 2050 (6).

Annual temperature and precipitation partial explain biodiversity and productivity gradients at sub continental scales. But their combined effects depend on stand structure and on seasonal timing, more like the hydrothermal surplus and deficit, the degree hours during months with positive and negative water balance, respectively (7).

Water resources face negative effects of fast population increase, incorrect field use, pollution, and global climatic changes. Water resources are important for our country both in terms of energy and in terms of agriculture. A great deal of water bodies was constructed in our country for the purpose of irrigation and energy production, and such structures are still being built. The ability of such bodies to act in accordance with their establishment purpose is only possible with the lack of drought, in other words, with sufficient precipitation that is expected (8).

Drought is one of the ways in which climate affects water resources, agriculture, and all living creatures. Meanwhile, the drought is among many widely destructive natural disasters and is one of the most dangerous ones with its slow development. In other words, drought is a climatic event that may be observed in any climatic areas in the world even in rainy areas. It is the most complicated one among natural disasters, and it influences more people than any other natural disasters.

Table 1. Characteristics and rank of natural disasters in the world according to points of their various influence mechanisms[1]

Importance Rank	Disasters	Severity of Disaster	Efficient Duration	Total Areas Affected	Total Casualties	Total Economic Losses	Permanency of Social Effects
1.	Drought	1	1	1	1	1	1
2.	Tropical Cyclone	1	2	2	2	2	1
3.	Regional Floods and Overflows	2	2	2	1	1	2
4.	Earthquake	1	5	1	2	1	2
5.	Volcanoes	1	4	4	2	2	1
6.	Middle Latitude Storms	1	3	2	2	2	2
7.	Tsunamis	2	4	1	2	2	3
8.	Forest and Bush Fires	3	3	3	3	3	3
9.	Soil Swelling	5	1	1	5	4	3
10.	Changes in Sea Levels	5	1	1	5	4	1
11.	Isles	4	1	1	4	4	5
12.	Dust Storms	3	3	2	5	4	4
13.	Landslides	4	2	2	4	4	4
14.	Landslides in Shores	5	2	2	5	4	4
15.	Avalanche	2	5	5	3	4	5
16.	Flooding &Liquidation	5	1	2	5	4	4
17.	Tornado	2	5	3	4	4	5
18.	Snowstorms	4	3	3	5	4	5
19.	Coastal Islets	5	4	1	5	4	4
20.	Sudden Floods	3	5	4	4	4	5
21.	Downpours	4	5	2	4	4	5
22.	Lightning Strike	4	5	2	4	4	5
23.	Blowing Snow	4	3	4	4	4	5
24.	Ocean Waves	4	4	2	4	4	5
25.	Hailstorm	4	5	4	5	3	5
26.	Freezing Rain	4	4	5	5	4	5
27.	Strong Winds	5	4	3	5	5	5
28.	Soil Collapse	4	3	5	5	4	5
29.	Mud and Mountain Collapse	4	4	5	4	5	5
30.	Ai-supported Flows	4	5	5	4	5	5
31.	Rock Falls	5	5	5	5	5	5

[1]The scoring and importance rank here changes from 1 (the most important or the biggest) to 5 (the least important or the smallest) (9).

Our water resources cannot cover the needs of the industry and increasing population. The majority of the water is wasted with wrong irrigation techniques. The quality of our water used for drinking and irrigation is decreasing with the developing industry and other environmental pollutants. In addition to these, when we consider the effects of global climate change, we can understand clearly that the severity of the drought will be felt more in our country.

Drought in Turkey

Since the properties and effects of drought differ among regions, the definition of it may vary according to regions and sectors. The definition of drought is also different for each discipline. With the broadest definition, drought is defined as "the not being able to cover the water demand by the water supply" in supply-demand relation.

There are also some sources that have defined drought as "negative effects on fields and water resources as a result of decrease in precipitation to extremely lower levels" (8). According to the basic principles accepted in climate classifications depending on precipitation, the areas that receive average annual precipitation at a rate of less than 250 mm are called as dry areas; and the areas with 250-500 mm are defined as the regions with semiarid climate (10). In the United Nations, Fight against Desertation Agreement, Drought is defined as a natural event that appears as a result of precipitation decreasing below the recorded normal levels, influences fields and resource production systems in a negative way, and leads to serious hydrological imbalances (11). While insufficient precipitation causes drought, the increase in the demand for water is one of the important reasons of water scarcity.

Turkey faces drought constantly because it is located in a semiarid climate region. A medium-level meteorological drought occurs in every 6 years in our country and a severe meteorological drought appears in every 18 years in average (12).

According to the questionnaire results applied in 87 member countries released by World Meteorology Organization (WMO), it was determined that 74 countries -including Turkey- were influenced by drought. Again, in 59 countries out of 97 (69%) experienced water scarcity. Africa, the western part of Asia Continent, which includes Turkey and Middle-Eastern countries are among the major regions that are sensitive to water scarcity (13).

The dry and semi-dry areas cover 51 million hectares in Turkey. In other words, in 37.3% of Turkey, semiarid climate conditions are dominant. The changes that may occur in the amount and distribution of precipitation may be felt severely due to dry agriculture that is depending on water resources and precipitation in general. Throughout human history, various drought periods were observed. Turkey, which is located in semiarid climate zone, also faced droughts in the past. The effects of drought will increase in the future (in terms of frequency, severity and influential area due to global climate change), and pose a greater danger (8).

When we consider the changes in winter seasons when precipitation is observed more and in the annual precipitation in the past 40 years, it is observed that drought was experienced severely and widely in the years 1971-1974, 1983-1984, 1989-1990, 1996, 2001 and 2007-2008.The long-lasting ones among these started as meteorological drought and were converted into agricultural and hydrological drought (14).

Our country is located in the subtropical area among the Mediterranean macro-climate zone and experiences major precipitation changes among years, and this causes that widespread or regional-scale droughts at various severity are observed. For this reason, drought is experienced frequently in our country. Th years 1927-1928, 1956-1957, 1959, 1970, 1972-1973, 1977, 1982, 1984, 1989-1990, 1994, 2000-2001 and 2006-2007 were recorded as the periods in which precipitation gap was at dangerous levels in the majority of our country. As a result of climatic reconstructions and characteristic annual analyses performed in our country, it was determined that the years 1676, 1679, 1696, 1715, 1725, 1746, 1757, 1797, 1804, 1815, 1874, 1878-1880, 1886-1887 were the periods in which drought was observed, and some of these periods are also recorded in Ottoman Records (8).

Recent studies on precipitation distribution in Turkey show that there is a visible decrease in the annual precipitation rates in the Black Sea region and Mediterranean Regions. In addition, in early 1930s, in late 1950s, in early 1970s, and in early 1980s and 1990s, dry periods were experienced. It was also observed that several humid periods disrupted the drought conditions especially in 1935-1945, in the 1960s and in late 1970s. It was recorded that there was a widespread drought in the majority of Turkey in 1970 and 1980s. while excessive droughts are experienced in one region of Turkey due to global climate change, excessive precipitation may be observed in another region. The areas with precipitation has begun to receive more precipitation, which is recorded in average values of precipitation in Turkey. For this reason, the annual average precipitation amounts for Turkey do not agree with each other. In this respect, the issues like when, where and how much precipitation occurs in a certain area must be considered instead of annual total precipitation amounts, and drought indices must be assessed in practice (8).

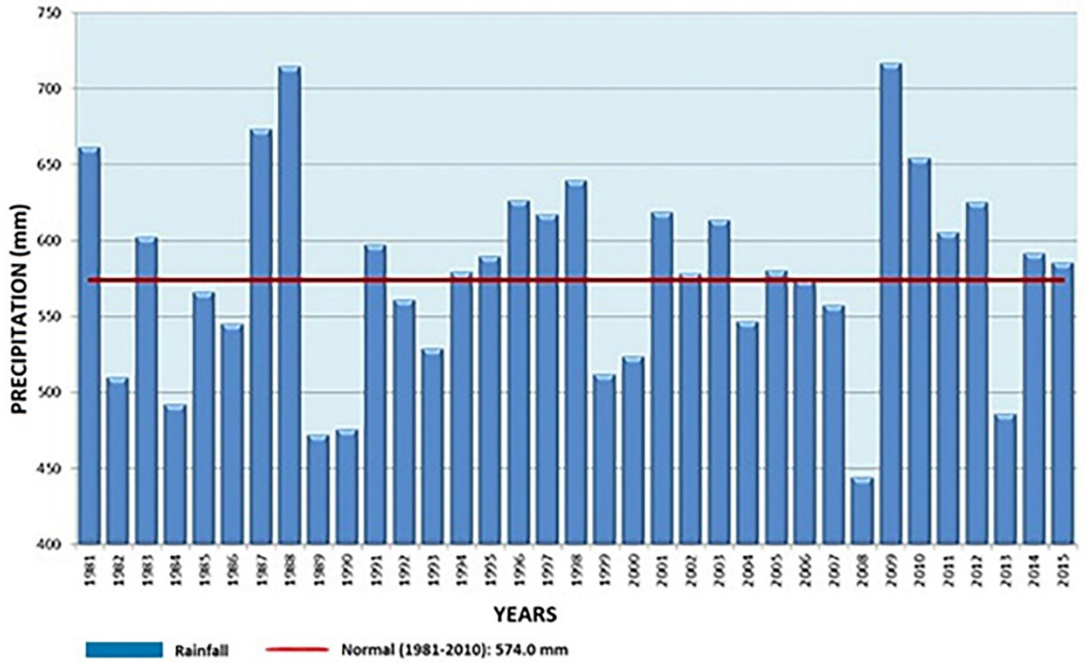

Figure 1. Annual regional precipitation in Turkey. Annual total precipitation change between 1981-2015 (15).

According to the first projections made with global climate models, the majority of Turkey will have an extremely dry and hot climate in 2030. The temperatures in Turkey will increase 2°C in winter, and 2-3°C in summer. The precipitation will increase slightly in winter, and decrease in summer at a rate of 5-15%. It is predicted that there will be increase in temperatures latitudes in which Turkey is also located, and precipitation and the water content in the soil will decrease. In an analysis made on night-day temperatures of Turkey and its precipitation rates, it was determined that statistically significant increases were observed in Turkey especially in night temperatures, which is also the case in the world (16- 19). All the above-mentioned facts and predictions show that drought has increased and its effects will be felt more in the future, and therefore, the importance of water will increase for Turkey in future.

As a conclusion, it is expected that changes in the severity and duration will be observed in the regional distribution of excessive temperatures in Turkey. As a result, it is foreseen that vaporization will increase, heat waves will cause more deaths and forest fires, and droughts will become more severe and spread to wider areas (20). It is also expected with drought that, famine, forest fires, heat waves, locust invasion, acarida, mosquitos, and similar insects and depending on these, long-distance migrations will also increase.

Reasons of drought in our country

Perhaps the most important result of the climate change in Turkey and in Mediterranean Region in which our country is also located is the high-pressure area around 30^{o} latitude moving towards northern areas (in the northern hemisphere) (21, 22). In this respect, our middle, southern and south-eastern areas are in sub arid climate zone and under the risk of Desertation even now. The climate change that will increase its effect in near future will convert the climate of southern part of our country into a climate that is similar to Syria and Iraq, our southern neighbors, and our middle and northern parts will face the current climate of southern part. This situation means that the risk of drought and Desertation will increase in all of our regions. The most important point here is the Mediterranean Basin is becoming more inclined to drought with each passing day due to climate change. It is also expected that the temperatures will increase as a result of the climate change. When the temperatures between 1970-2000 are compared, it is expected that this increase will find 2^{o}C in 2020-2050 period according to the IPCC RCP 8.5 scenario (especially in summer and in Southeastern Region of our country).

There are various reasons for the increase in the drought in Turkey, which has a sub arid climate. One of the major reasons is the fact that the areas which receive precipitation are far from the areas that need precipitation. In addition, the quality of drinking, usage and irrigation water is decreasing with ever-increasing industrial activities, and water basins are destroyed because they are not protected.

Drought stress is among the most destructive abiotic stresses that increased in intensity over the past decades affecting world's food security. Drought stress may range from moderate and short to extremely severe and prolonged duration, restricting the crop yields. (23- 25).

In order to examine the reasons of drought and to determine the effects of the scarcity of precipitation and drought, data are being collected on the decreases in the yield of agricultural products with the scarcity of water in rivers and dams. Similarly, the distribution, change, and release of temperature are not assessed in a holistic and parallel manner. Firstly, the scarcity of precipitation is accepted as the first indication of drought in general. Agricultural drought occurs after meteorological drought. Agriculture is the first economic sector that is affected by drought. It takes time for precipitation to flow and affect the water level in rivers and lakes. For this reason, hydrological observations cannot be accepted as the first sign of drought. The results of drinking and usage water scarcity and the results of agricultural and hydrological drought show themselves as socio-economic drought in time. Drought is related to with the delay in precipitation season, and with the relation between crop growth season-precipitation ab the effects of precipitation, in other words, the level of the precipitation is associated with the number of the days with precipitation. High temperature, strong winds, low humidity and similar variables are also influential in drought (8).

Insufficient precipitation cause drought, and the demand on water increases, which is another important reason for water scarcity. The following factors may be considered as the reasons of water scarcity;

1. Water demands caused by human activities,
2. Vegetation affecting water resources in the region,
3. Climatic conditions (sub-arid climate for Turkey),
4. Drought (the frequency and severity of dry periods),
5. Desertation and deforestation,
6. Water stress (excessive water demand due to high population and intense industry, illegal wells and underground water usage),
7. Environmental damage, use of water basins out of purpose, pollution and global climate change.

RESULTS

When we consider the scarcity of water in our country, the irregular amount and distribution of the precipitation except for some regions, the scarcity of water in metropolitan cities and in agricultural production, the decrease in drinking, usage and precipitation water quality with the ever-increasing industrial activities, and environmental pollution that occur as a result of the other activities, and see the increasing effects of the increasing global climate change; it is clearly understood that the severity of drought will be felt more than today in a near future. With the increase in drought, the share and management of many international and national water resources -including the use of rivers that run through many cities and countries- will be more difficult. All these abovementioned facts reveal the importance of the dimensions of the danger Turkey might face in future.

The negative climate changes and increasing water demands in our country shows how high the risk of drought is. With global warming, it is expected that the high-pressure zone in sub-tropical area will move towards the north, to Turkey. As a result of this, the majority of Turkey will be under the influence of an extremely dry and warm climate. With the movement of high-pressure zone towards the north, a climate that is similar to tropical climate will be dominant, and irregular, sudden and severe precipitation, floods, landslides, and erosions will increase. The drier air may cause more frequent drought with longer durations. In this case, it is an expected situation that the water resources in the Mediterranean Basin will be influenced more.

The effects of drought occur mostly slowly and in the long run with a slow-progressing process. These characteristics of drought shows that the precautions that must be taken should be applied before drought appears to eliminate its long-term effects. For this reason, Risk Management is the main principle in keeping the long-term effects of drought in the management and planning of drought. When we consider the experiences of the countries that have fought against drought, it is understood that the last-minute precautions like Crisis Management are not influential. For this reason, drought planning, which depends on risk management in Turkey and in similar countries, must include efficient steps and must be conducted at national and regional level.

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