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Genetic Features of Drought are in Azerbaijan

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ABSTRACT

The initial stage of the drought usually begins with low-activity high anticyclones and is followed by continuous (several weeks to 2-3 months) high temperatures and low rainfalls. As a result, the soil moisture reserve decreases, the high temperature gradually decreases in humidity, increase potential evaporation, and the threat to agricultural crops increases. The long-timedroughts (several years) even lead to the migration of the population. In this regard, it is undeniable that the role of the Azores and Siberian maximums in the activation of hydrometeorological anomalies in Azerbaijan has recently increased.

KEYWORDS: *trend; angle coefficient; drought; productivity.*

INTRODUCTION

The effects of the global warming are now increasingly relevant to the researchof the drought. Not only researchers, but the whole world is concerned about how long the temperature will rise and what complications it will cause. On the other hand, in contemporary times, it becomes necessary to holdresearch in a new field, such as the quantitative study of drought-productivity relations. In order to characterize the drought in the territory of the republic in terms of the space and the time, firstly, the regions with the long-term observation data have beenstudied. In the figure 1 there have been presented the calculated SPI-indices for the Guba region on using the 116-year precipitation data [1,4].

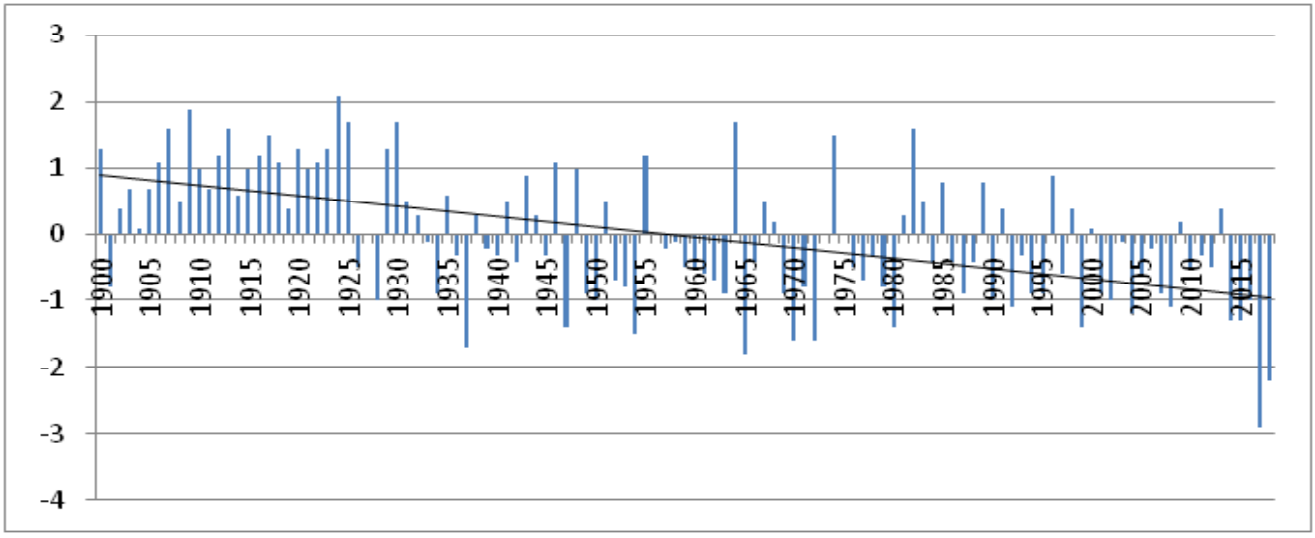

Figure 1. SPI-drought indices in Guba in 1900-2018 y.y.

As it can be seen from the graph, the value of the trend for SPI-indices over 1900-2018y.y. tends to decrease. So, the beginning of the warming period, accepted in western countries, coincides with the growing trend of the drought. 62 years out of mentioned 116 years have been passed dry. After 1940 y., the frequency of droughts increased even more. Thus, in the period up to 1940 y., over only 7 years and then over 55 years there have been drought. Until 1949 y., the frequency of droughts reached 14 years. So, in 1940-1949y.y. the frequency of drought in Guba increased by 50% (Figure 1).

34 of all droughts, that have occurred in Gubaover 1900-2018y.y, have been observed over 1950-2000y.y., and it consists of about 45% of noted drought years in the region

(figure 1). The intensity of droughts in these years also differs from previous years. . Thus, over mentioned 50 years 6 times "very strong", 14 times "strong", 9 times "moderate", 5 times "weak drought" have been observed (Figure 1).

Droughts in Guba in 2000 - 2018 y.y. consist of approximately 24% of all droughts observed over 116 years. In other words, 15 years has been recorded as a dry year in 18 years, during which both the frequency and intensity of the droughts increased(Figure 2). So, 10 of the 18 years of drought have been registered as "strong" and 1 year as "very strong" drought year. Thus, in each of these 18 years (with exception of 2 years) a drought has been recorded. Thus, in the example of Guba region, located in the north-eastern region of the republic, it has been determined that the incidence of drought increased by about 30-35% in every 50 years over 1900-2018y.y.

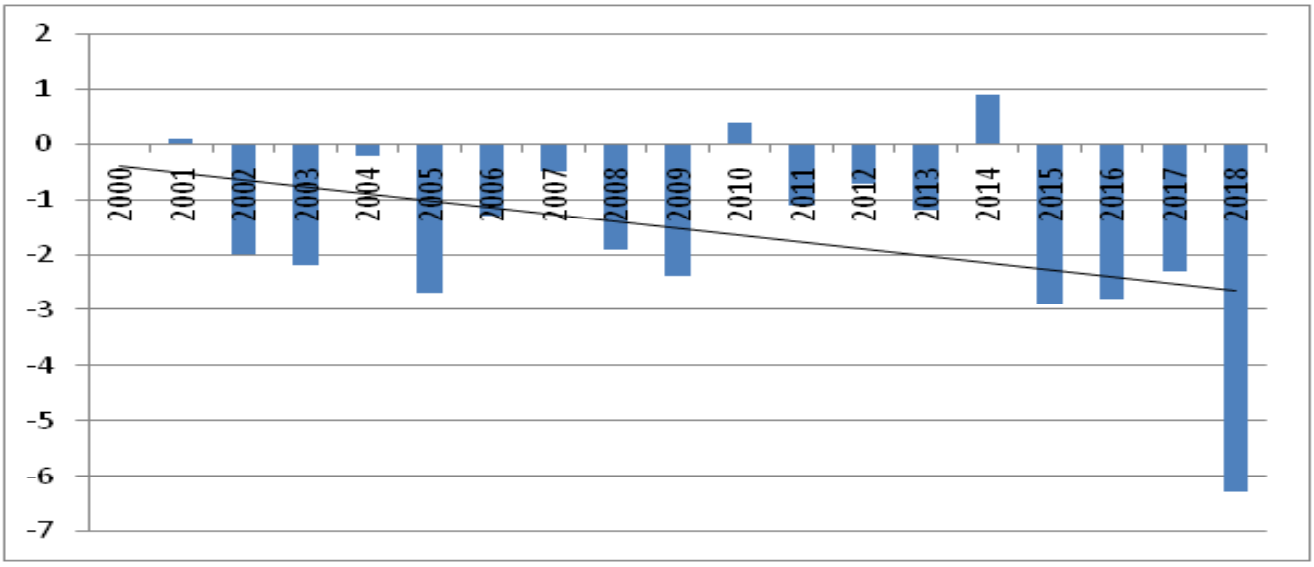

Figure 2. SPI-drought indices in Guba in 2000-2018y.y.

Of course, sharp changes in the intensity of the drought depend on the orographic and climatic characteristics of the region. The region is located on the north-eastern slope of the Greater Caucasus at the altitude of about 600-700 m above sea level and covers a number of mountain slopes, valleys and high mountain ranges.

If we pay attention to the features of the drought in the Ganja region, located on the north-eastern slope of the Lesser Caucasus in terms of similarity of the synoptic situation, we can say that the SPI-indices are similar to those in Guba. Here, the trend is on the decline.The transition from positive to negative occurred in 1965 y. 59 years of researched 116 years have been dry. And it consists of51% of total years. 29 years of these occurred drought years coincides with beforeand 30 years after 1965 y. (Figure 3).

The determination of the drought indices of mountainous areas is of more interest than the foothills. One of the main reasons for this is that some studies [1,3] show increased rainfall in mountainous areas. In this case, the situation could be perceived as a change in the circulatory regime. Thus, in a sense, it can be said that in contemporary warming periods, onthe increasing temperature, the precipitation decreases, and the drought increases.

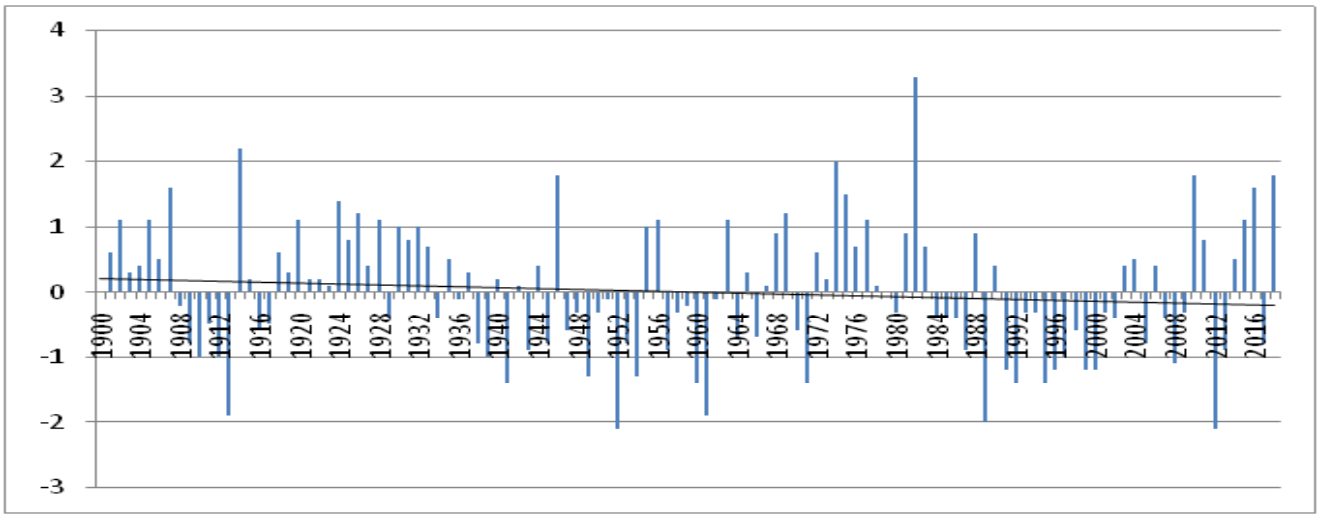

Figure 3. SPI-drought indices in Ganja in 1900-2016y.y.

The number of dry years in Ganja began to decrease after 2001 y., and this decrease became more active in 2013 y. Only, according to the data for 2000-2018 y.y., the frequency of droughts reached 72% (Figure 4).

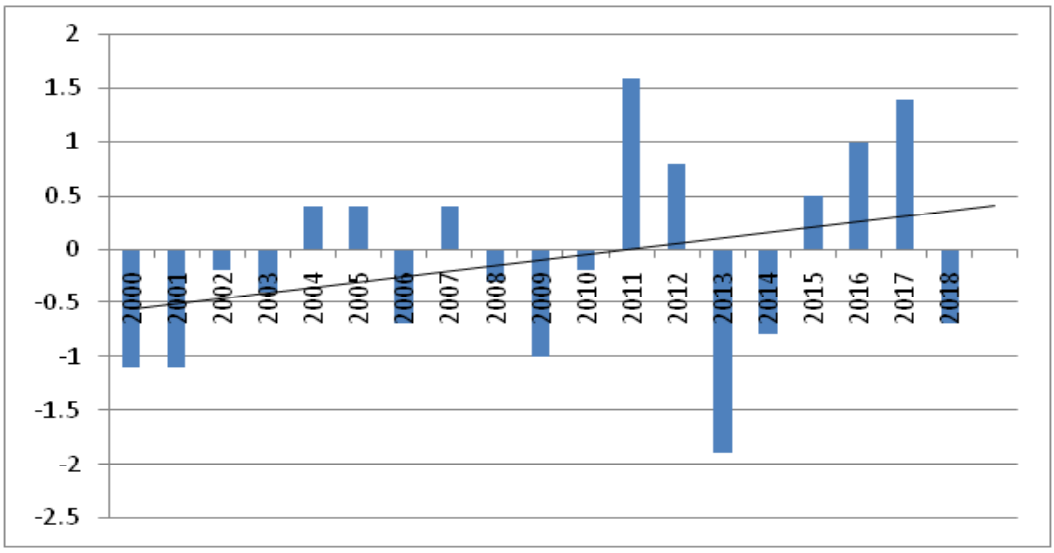

Figure 4. SPI-drought indices in Ganja in 2000-2018y.y.

Sufficient information has been collected on the increase of drought in the mountainous areas of the republic during the period of contemporary warming. Thus, from 1900 y. to 2014 y., 52 droughts have been recorded in the mountainous areas (Zagatala),it consists of 46% of all years. The trend is declining. The growth is more noticeable in the period after 1964 y.Naturally,the peaks in temperature rise are mainly observed in the first decade of the XXI century (Figure 5).

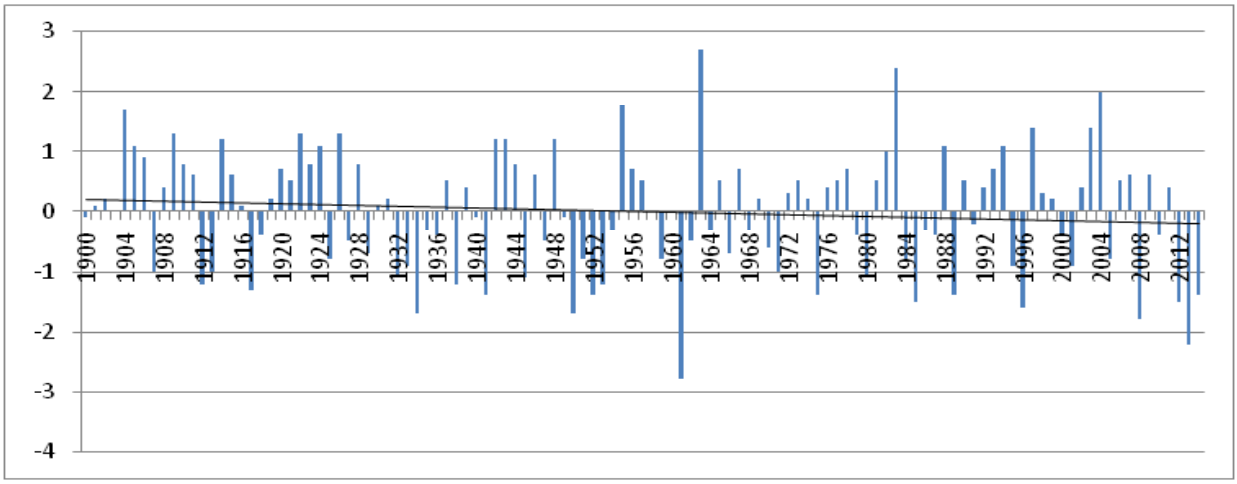

Figure 5. SPI-drought indices in Zagatala in 1900-2014 y.y.

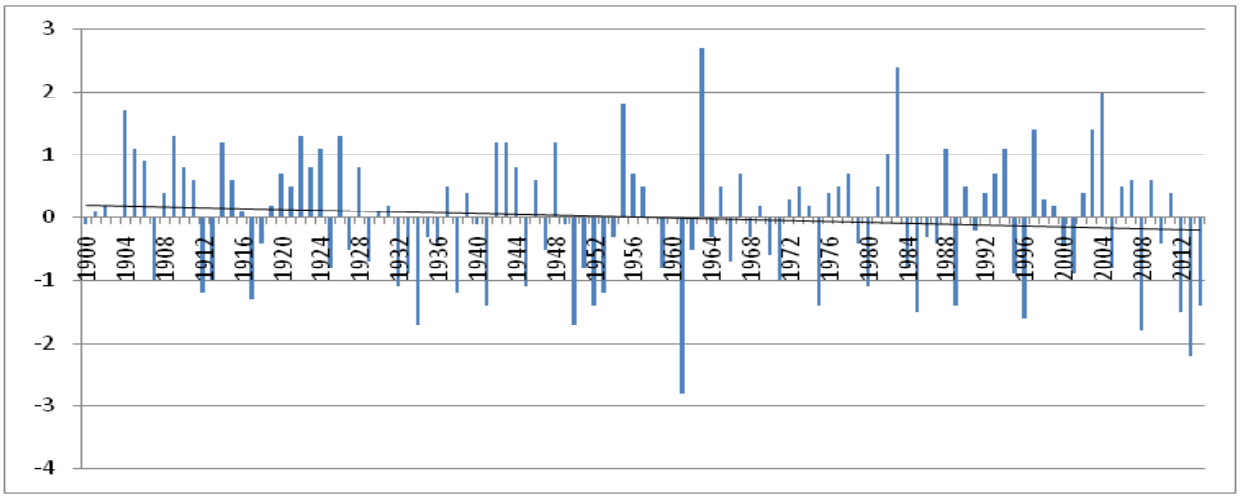

Figure 6. SPI-drought indices in Zakatala in 2000-2015y.y.

In 2000-2015y.y., the intensity of the drought years increased sharply in Zagatala. Each of the "strong" and "weak" droughts has been repeated 4 times (Figure 6).

Lenkaran natural region is located in the south-western part of Azerbaijan, in the subtropical climate zone on the shores of the Caspian Sea. The role of the Caspian Sea in the formation of natural synoptic processes is exceptionally great. From 1900 y. to 2014 y., 60 years of drought have been recorded in the region. It consists of 53% of all 1900-2014 y.y. (Figure 7). Most droughts have been occurred in 11 years over 2000-2015y.y.

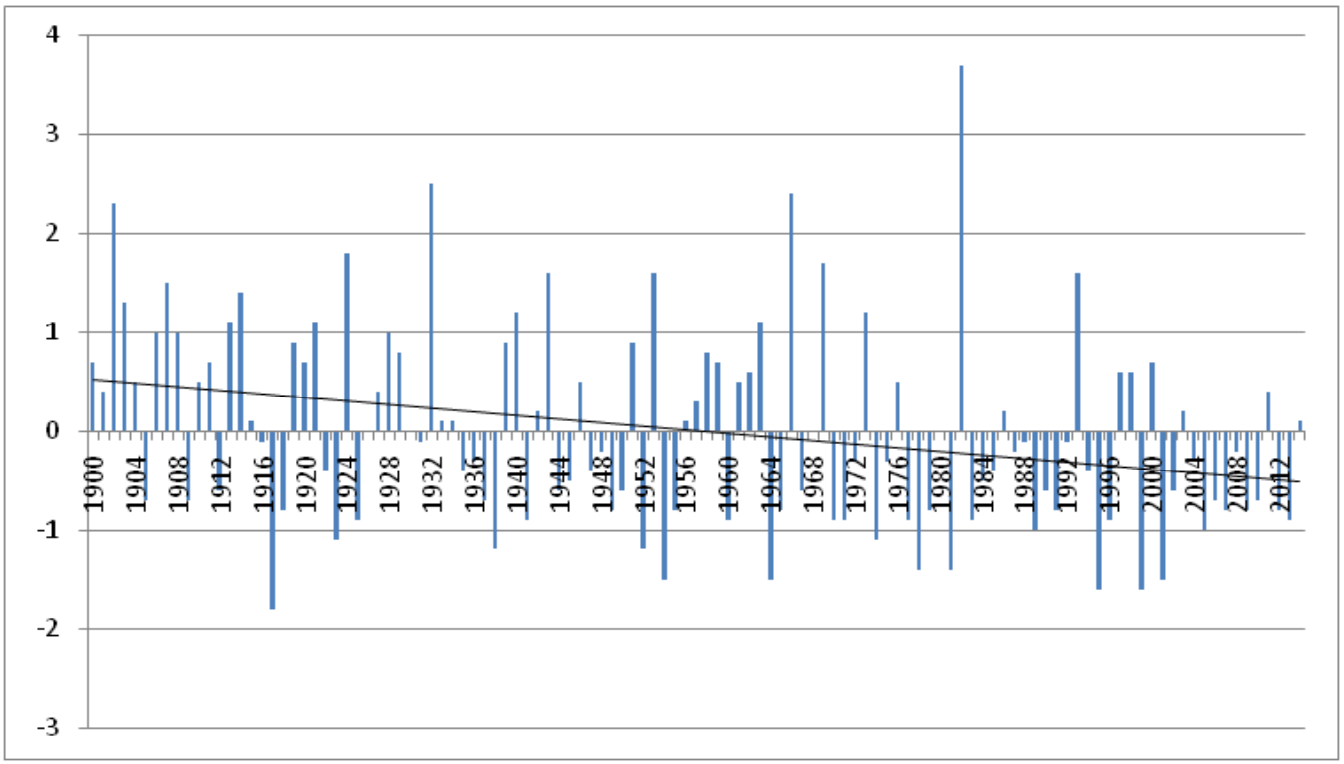

Figure 7. SPI-drought indices in Lenkaran in 1900-2014 y.y.

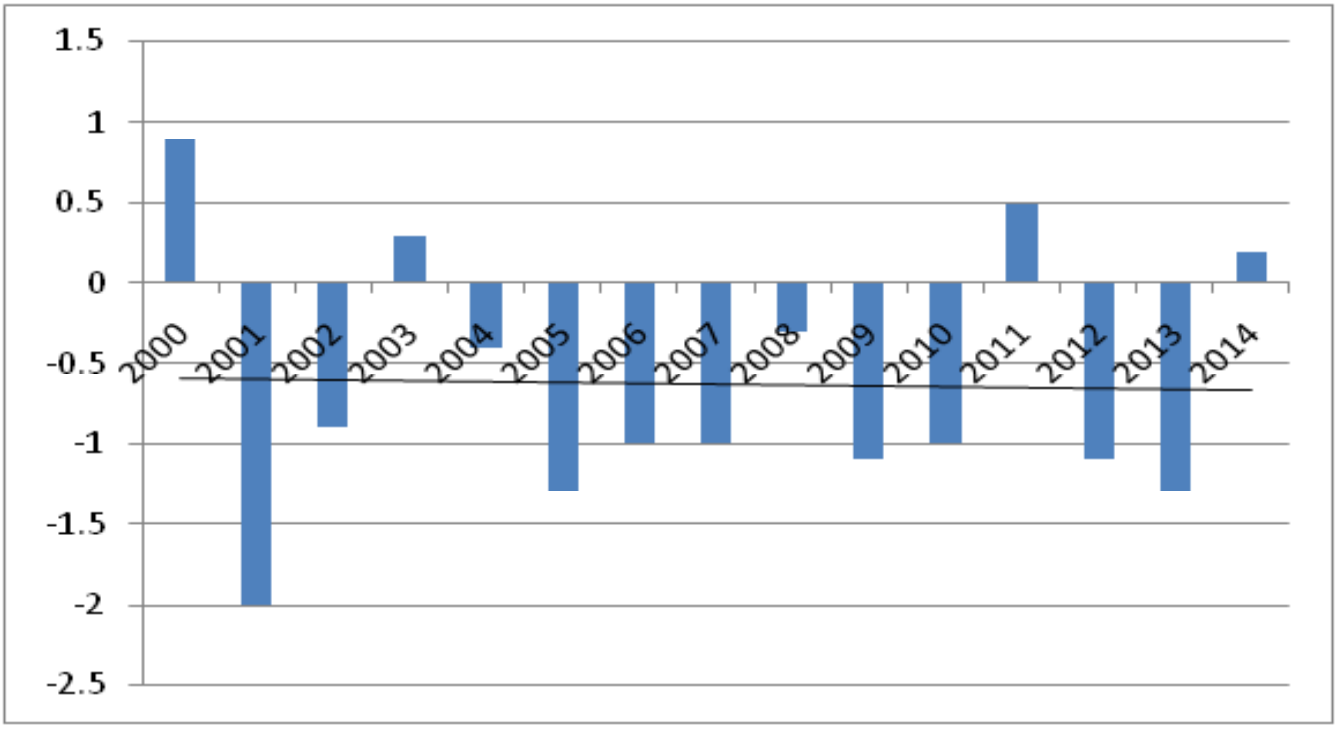

Figure 8. SPI -drought indices in Lenkaran in 2000-2014y.y.

Note: In the analysis of all charts, the decrease or increase of the trend should be accepted only for SPI indices, not for drought.

THE DROUGHT –THE ANALYSIS OF THE PRODUCTIVITY OF RELATIONSHIPS

It is known that the drought is the most dangerous atmospheric phenomenon for the agriculture. But what does promise for the agricultural productivity the linear increase in air temperature as a result of the contemporary warming?

To clarify the issue, let's look at the grain productivity table in the regions, which we studied (Table 1).

Table 1. Grain productivity in several regions of Azerbaijan (cents / ha)over 2000-20014y.y.

Years	Guba-Khachmaz	Ganja- Gazakh	Sheki-Zagatala	Lenkoran
2000	23.5	24.2	18.1	22.7
2001	26.6	28.4	25.2	24.0
2002	27.1	29.1	21.2	23.8
2003	24.9	28.8	18.3	24.2
2004	22.3	28.9	23.4	24.0
2005	21.6	29.8	21.4	24.2
2006	23.5	29.5	20.5	24.6
2007	23.8	31.3	24.0	24.9
2008	21.3	32.8	29.6	23.3
2009	21.3	30.9	25.3	20.5
2010	20.2	26.3	20.2	14.0
2011	23.0	30.3	30.2	18.9
2012	21.2	31.3	32.3	19.7
2013	24.1	31.6	28.6	20.6
2014	20.4	28.1	19.4	19.8

As can be seen from the table, the maximum productivity in the Guba-Khachmaz economic region - 27.1 has been observed in 2002 y.during the drought. In 2003 y., due to a slight increase in the intensity of the drought, the productivity has been fallen slightly to 24.9 cents / ha, followed by a weak drought in 2004 y. and a "strong" drought in 2005 y. The minimum productivity is 20.2 cents / ha in 2010 y., when the precipitation has been above the norm. The second minimum productivity in 2014 y.has been 20.4 cents / ha, when the precipitation has beensignificantly higher than the norm (Figure 4).

RESULT

Of course, there are many atmospheric and other phenomena that affect the productivity, and we propose to assess the trend angle to assess the risk of impact of each of these many processes. The value of this angle is determined by the angle formed by the axis of the trend. Thus, on describing the productivity the graph is constructed for the Ganja point and the tangent of the angle at the point of the intersection with the axis of the trend is calculated. According to our calculations, the value of this angle is 0.074 rad.

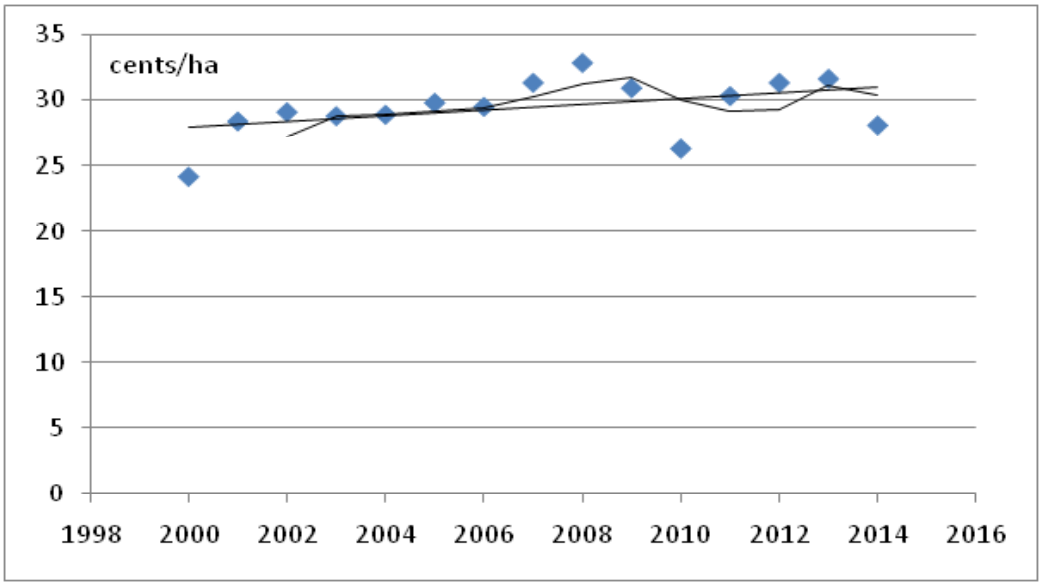

Figure 9. The determination of the inclination angle of the trend inGanja-Kazakh economic region.0,074 rad.

Then, for the drought that will affect the productivity in the same way (in the example of Ganja), the angle of inclination of the trend is determined (0.17rad). At the end 43% can be found by calculating the ratio 0.074 / 0.17 = 0.43 (Figure 9 and Figure 4). So, for Ganja region the impact of the drought on the productivity in the region can be estimated at 43%.

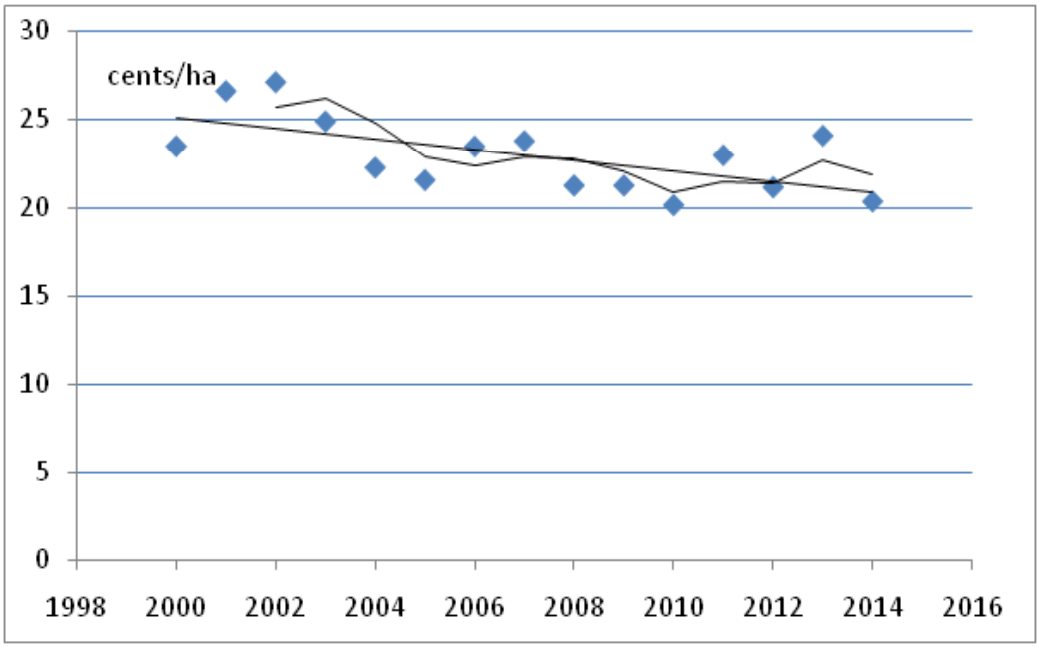

Figure 10. The determination of the inclination angle of the trend in Guba-Khachmaz economic region.0,13 rad.

The inclination angle of the trend for the drought consists of 0.26 rad (Figure 2). In this case, it is estimated at 0.13 / 0.26 = 0.5 = 50%.

In the Sheki-Zakatala economic region, the tangent of the inclination angle of droughtis -0.22rad, and the productivity is 0.13 / -0.22 = -0.59 = 59%, while the productivity is 0.13 rad (Figure 10). At the same time, the critical increase of the impacts to the drought is understood.

In the Lenkaran economic region, the inclination angle for the productivity is 0.17 rad, and for the drought -0.083 rad. 0.17 / 0.083 = 2.04 (the trend line passes approximately parallel to the ox axis (Figure 8). In this case, the productivity has been determined only by the drought. Thus, the impact on the productivity in other processes can be assessed in the same way.

Thus, the greatest drought in the territory of the Republic of Azerbaijan has been observed after 2000 y. During this period, 15 years passed in Guba, 11 years in Ganja and Lenkaran, and 8 years in Zakatala. According to the degree of the intensity, the strongest droughts have been observed in Guba. As for the risk of the impact on the productivity, we can mention the Lenkaran economic region.

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