

Climate Change And Vegetation Dynamics In The Yangan-Tau Unesco Global Geopark

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In 2017, the geopark Yangan-Tau was established in the Republic of Bashkortostan (Russia), which was included in the UNESCO network of global geoparks in 2020.

One of the key goals in the geopark's activities is the implementation of Sustainable Development Goal No. 13 "Taking urgent measures to combat climate change and its consequences".

We have analyzed the data of long-term observations of the Duvan meteorological station in the period 1966-2019, as well as for the periods 1961-1990 and 1981-2010. The basic characteristics of climatic variables are calculated and the significance of their variability is estimated. The value of the coefficient of determination R^2 was used to assess the contribution of the linear trend to the overall variability of the indicator and its statistical significance (Perevedentsev et al., 2011).

The trend analysis revealed that in almost all months there is an increase in air temperature. Statistically significant trends were found in January, October and for the year, as well as in March of the period 1981-2010.

The increase in air temperature also confirms the long-term course of its anomalies (Fig. 1). Their distribution shows that since the beginning of the 2000s, the frequency of warm years and, especially, warm winters has been increasing.

Trend analysis shows that the annual precipitation tends to increase in the period 1966-2019 (12 mm/10 years). At the same time, considering the period of the basic norm of 1981-2010, the opposite trend is found – a decrease in the amount of precipitation at a rate of -11.6 mm / 10 years. The amount of precipitation during the cold period has positive statistically significant trends (21.6 mm/10 years). The long-term course of anomalies of seasonal precipitation amounts is illustrated in Fig. 1.

The trends of the main climatic indicators collectively affect changes in the hydrothermal conditions of the geopark territory. One of the widely used indicators is the aridity index of D.A. Pedyu (Galimova, Silantyev, 2019). The long-term dynamics of the index shows a tendency to increase (0.26 units / 10 years). Thus, summer conditions are shifting towards greater aridity.

Vegetation changes were assessed using archived Landsat satellite images (5, 7, 8) with a resolution of 30 m per pixel and BingMaps satellite images (1 m per pixel).

The summer images of 1984 and 2020 were selected, which were subjected to radiometric calibration and atmospheric correction. The processing was performed using the ScanEx Image Processor v.5.0.4 program.

In the images of 1984 and 2020, using automatic decryption, it was found that in 1984 the area of arable land used was 56.5 thousand hectares, and in 2020 this figure decreased by 66%. The overgrowth of abandoned fields was also noted, which goes in two directions: overgrowing with forest and overgrowing with meadow vegetation. The reason is the terrain features and climatic conditions. The area of arable land overgrown with forest for 34 years is 12%, meadow vegetation - 55% of the area of fields in 1985. Thus, the analysis of long-term data showed that the climate of the geopark is becoming warmer and drier, and vegetation cover shows an increase in the area of forests. The changes in climatic conditions and vegetation cover are generally consistent with global trends in global climate change.

The study was carried out with the support of the grant of the Republic of the Bashkortostan "Creating methodological foundations for assessing the balance of greenhouse gases and determining the potential for carbon deposition in ecosystems" (Agreement No. 1 of 12/28/2021, scientific topic code -

ENOC-GVU-01-21).

Fig. 1. The long-term course of anomalies of the average annual air temperature (ΔT), the amount of precipitation of the cold period (ΔR_{hp}) and the amount of precipitation of the warm period (ΔR_{tp})

Keywords: air temperature, atmospheric precipitation, Yangan-Tau geopark, climate change, vegetation

