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BUXORO VILOYATI IQLIM XUSUSIYATLARI VA IQLIMIY RESURSLARI

Annotatsiya: Ushbu maqolada Buxoro viloyati iqlim xususiyatlari, tabiiy resurslari va ularning iqtisodiyotga ta'siri tahlil qilingan. Shu jumladan viloyatning kontinental iqlim sharoitlari, yuqori harorat rejimi, quyosh radiatsiyasi, shamol tezligi kabi omillarning oʻziga xosligi tavsiflab oʻtilgan. Ayniqsa, quyosh va shamol energiyasidan foydalanish imkoniyatlari geografik asosda koʻrib chiqilgan. Maqolada iqlimiy resurslarni oqilona boshqarish va ulardan samarali foydalanish orqali qishloq xoʻjaligi, sanoat hamda turizm sohasida va qayta tiklanadigan energiya tarmoqlarini rivojlantirish imkoniyatlari tahlil qilinadi. Shuningdek, mintaqada ekologik barqarorlikni ta'minlash uchun iqlimiy resurslardan foydalanishning dolzarbligi haqida tavsiyalar berilgan.

Kalit soʻzlar: Iqlim, quyosh yorugʻligi, harorat rejimi, quyosh radiatsiyasi, oʻrtacha harorat, amplituda, shamol energiyasi, quyosh energiyasi.

CLIMATIC CHARACTERISTICS AND CLIMATE RESOURCES OF THE BUKHARA REGION

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Annotation: This article analyzes the climatic characteristics, natural resources, and their impact on the economy of the Bukhara region. It describes the unique features of the region's continental climate, including high-temperature regimes, solar radiation, and wind speed. Special attention is given to the geographic potential for utilizing solar and wind energy. The article examines the opportunities to develop agriculture, industry, tourism, and renewable energy sectors through the efficient management and rational use of climatic resources. Furthermore, recommendations are provided on the importance of using climatic resources to ensure ecological sustainability in the region.

[&]quot;Экономика и социум" №5(132) 2025

Keywords: Climate, sunlight, solar heat, temperature regime, solar radiation, average temperature, amplitude, wind energy, solar energy.

БУХАРСКАЯ ОБЛАСТЬ: КЛИМАТИЧЕСКИЕ ОСОБЕННОСТИ И КЛИМАТИЧЕСКИЕ РЕСУРСЫ

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Аннотация: В данной статье проанализированы климатические особенности, природные ресурсы и их влияние на экономику Бухарской области. Описаны уникальные черты континентального климата региона, включая высокие температурные режимы, солнечную радиацию и скорость ветра. Особое внимание уделено географическому потенциалу использования солнечной и ветровой энергии. В статье рассматриваются возможности развития сельского хозяйства, промышленности, туризма и отраслей возобновляемой энергии за счет эффективного управления и рационального использования климатических ресурсов. Кроме того, даны рекомендации по климатических обеспечения использования ресурсов лля важности экологической устойчивости в регионе.

Ключевые слова: Климат, солнечный свет, солнечное тепло, температурный режим, солнечная радиация, средняя температура, амплитуда, энергия ветра, солнечная энергия.

Introduction. In our republic, extensive reforms are being implemented to develop modern methods for utilizing natural resources, yielding significant results. The Development Strategy of New Uzbekistan for 2022–2026 outlines essential tasks for implementing the national project "Green Space." In this regard, environmental protection and the rational use of natural resources hold particular importance, with geography playing a crucial role in this process. The implementation of tasks outlined in regulatory and legal documents, such as the Decree of the President of the Republic of Uzbekistan No. PF-60 dated January 8, 2022, "On the Development Strategy for 2022–2026," the Decree No. PF-5863 dated October 30, 2019, "On the Approval of the Concept for Environmental Protection of the Republic of Uzbekistan until 2030," and the Resolution of the Cabinet of Ministers No. 841 dated October 20, 2018, "On Measures to Implement National Goals and Objectives for Sustainable Development until 2030," is a pressing issue of the present day [1].

In today's globalized era, climate change has become a critical concern worldwide. The proper and systematic utilization of climate resources is one of the key priorities set by nations. Uzbekistan is also addressing the challenges of efficient climate resource utilization, as this issue plays a unique role in national development. Climate-related topics are increasingly gaining significance across various sectors, and they are expected to remain highly relevant in the future. One such important area of study is the potential for utilizing the climatic resources of the Bukhara region in line with modern requirements. Therefore, an in-depth scientific and practical investigation of the opportunities for utilizing the climatic resources of Bukhara is necessary.

Several scholars have conducted research on the climatic conditions of the Bukhara region, including A. Karimov, X. X. Rasulov, O. Shodmonov, Sh. I. Ibragimov, M. B. Tursunov, and others. Bukhara's climate falls within the dry subtropical zone, characterized by a high number of sunny days throughout the year. These climatic features are significant not only for agriculture but also for other sectors of the economy.

Research Methods. Bukhara region is one of the countries that belong to the inland basin, located on the boundary between the temperate climate zone and the subtropical climate zone. The region's geographic location has an impact on the formation of its climate [2].

According to I. Q. Nazarov, the territory of the Bukhara region is located in the southwestern part of Uzbekistan, in the lower reaches of the Zarafshan River, within the southwestern Kyzylkum Desert. It borders the Khorezm region and the Republic of Karakalpakstan in the northwest, is enclosed by the Navoi region in the east and west, and adjoins the Karmana and Karshi deserts of the Kashkadarya region in the southeast. Bukhara has a dry continental climate with sharp temperature fluctuations throughout the year. Summers are hot and dry, with average temperatures ranging between $+35^{\circ}$ C and $+40^{\circ}$ C, while winters are cold, with temperatures ranging from -5° C to $+5^{\circ}$ C. The annual precipitation is between 100 and 150 mm, increasing the need for irrigation in agriculture [3; 8-12-b].

Climate is shaped by the interaction of multiple factors, with geographical location playing a crucial role. Considering that Central Asia is situated in the interior of the Eurasian continent, the Bukhara region lies at the center of the deserts of Central Asia, exhibiting climate characteristics typical of southern (subtropical) deserts. The research methods employed in this study include observational, stationary, and cartographic approaches. Analysis of meteorological data confirms that the region has an extreme continental desert climate. The main characteristics include sharp temperature contrasts between day and night, spring and autumn seasons (March–November) with relatively humid and unstable conditions, a dry and scorching summer (June–August), and a moderately cold winter. The region experiences 2800–3000 hours of sunshine annually [3;17-18-b].

Given that Bukhara has more than 2800 hours of sunshine per year, it offers favorable conditions for solar energy utilization. The installation of solar panels could meet the electricity needs of households and small businesses while also powering water pumps and irrigation systems in agriculture. Wind energy potential is also present in certain open areas of the region, where wind speeds are sufficiently stable for electricity generation. The installation of small- and medium-sized wind turbines could provide a sustainable power supply for remote areas. The adoption of solar and wind energy would contribute to economic diversification, the expansion of environmentally friendly energy production, and a reduction in harmful emissions. Therefore, it is essential to develop and implement specialized projects to integrate renewable energy sources.

Furthermore, the total solar radiation received in the region amounts to 150–160 kcal per cm². The sum of useful temperatures- defined as daily average temperatures exceeding 10°C ranges between 4800°C and 5100°C annually, creating favorable conditions for cultivating heat-loving crops. The coldest month is January, while the hottest month is July. The average annual temperature in Bukhara is 14.2°C, while in Karakul, it reaches 15°C. However, the annual temperature variation is significant, ranging between 68°C and 72°C, presenting ecological challenges for the organic environment. The region experiences insufficient natural moisture, with annual atmospheric precipitation ranging from 90 to 150 mm, mostly occurring as rain. Snow cover is thin and does not persist for long. Seasonal precipitation distribution is uneven: spring is the wettest season, accounting for 50–55% of annual rainfall, whereas summer is extremely dry, with rainfall dropping to 10–20% in July and August. This causes the "Garmsel" effect, negatively impacting agricultural yields. The region's significant temperature fluctuations between day and night, as well as between seasons, lead to occasional frost, cold spells, and other climatic phenomena.

Winds play a crucial role in Bukhara's climate. Wind activity is observed worldwide, but its impact is particularly strong in desert areas. In Bukhara, winds predominantly blow from the north. This factor must be considered in urban planning, industrial site selection, and infrastructure development. Additionally, natural disasters such as sudden cold waves, flash floods, hailstorms, and summer heatwaves should be taken into account. The potential for utilizing wind energy in certain open areas of the region is promising, as wind speeds are sufficiently stable for electricity generation. By installing small- and medium-scale wind turbines, it is possible to address energy supply issues in remote locations that are far from the main power grid. The use of solar and wind energy contributes to the diversification of the local economy, the development of environmentally friendly energy production, and the reduction of harmful emissions into the environment. Therefore, it is crucial to develop and implement specialized projects aimed at integrating renewable energy sources in the region. In recent years, a slight increase in winter temperatures $(0.3-0.5^{\circ}C)$ and an annual precipitation rise of 10–20 mm have been recorded in Bukhara. Overall, the region's climate is an invaluable natural resource. The high number of sunny days and favorable temperatures present significant advantages. Despite the extreme arid conditions, effective utilization of these climatic features could contribute to improving living conditions and strengthening the national economy.

Indeed, desert resources can be harnessed not only for industrial and agricultural purposes but also for non-material sectors such as recreation and healthcare. The climatic conditions of deserts hold therapeutic potential for human health. The long dry and hot season, with humidity levels as low as 15–20%, has proven beneficial in treating kidney diseases. Additionally, resources such as saline mud, desert sand, medicinal clay, and mineral-rich groundwater provide opportunities for the development of health and wellness tourism. Several sanatoriums in the Bukhara region are currently operating in this field. For example, in Bukhara city, the Sitorai Mokhi-Khossa sanatorium and hot spring treatment facilities are available, while in the Alat district, therapeutic treatments using saltwater and hot sand have been established [4].

Conclusions and Recommendations

In the future, the process of climate aridification in the region is expected to intensify, along with an increasing anthropogenic impact on landscapes. As a result, desertification, a decline in biomass productivity, and a reduction in genetic diversity will be observed. The climatic characteristics and resources of Bukhara region play a crucial role in its economic and ecological development. The high potential of renewable energy sources, such as solar and wind energy, creates opportunities for their efficient and rational utilization. Additionally, proper management of the region's climatic resources is essential for the sustainable development of agriculture and tourism.

Further research on climate resources and the improvement of technologies for their utilization can significantly contribute to the region's economy. Therefore, it is essential to develop a strategic approach for the comprehensive study and sustainable use of Bukhara's natural and climatic potential.

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