

**THE IMPACT OF CLIMATE CHANGE ON THE AGROECOLOGICAL
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**XORAZM VILOYATIDAGI SUG'ORILADIGAN TUPROQLARNING
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**ВЛИЯНИЕ ИЗМЕНЕНИЯ КЛИМАТА НА АГРОЭКОЛОГИЧЕСКОЕ
СОСТОЯНИЕ ОРОШАЕМЫХ ПОЧВ ХОРЕЗМСКОЙ ОБЛАСТИ****Аминов Бехзод Бахрамович** – докторант**Охунжанова Дилдора Камилжоновна** – докторант

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Tayanch so'zlar: iqlim o'zgarishi, sug'oriladigan tuproqlar, agroekologik holat, sho'rlanish, Xorazm viloyati.

Rezyume. Maqolada global iqlim o'zgarishlari sharoitida Xorazm viloyatining sug'oriladigan tuproqlarida kechayotgan asosiy agroekologik jarayonlar tahlil qilinadi. Havo haroratining oshishi, yog'in-sochin miqdorining o'zgarishi hamda suv resurslari tanqisligi tuproq sho'rlanishi, unumdorlikning pasayishi va degradatsiya jarayonlariga ta'siri ilmiy manbalar asosida yoritib berilgan. Tadqiqot natijalari hududda barqaror yer resurslaridan foydalanish bo'yicha amaliy tavsiyalar ishlab chiqishga xizmat qiladi.

Ключевые слова: изменение климата, орошаемые почвы, агроэкологическое состояние, засоление, Хорезмская область.

Резюме. В статье анализируются основные агроэкологические процессы, происходящие на орошаемых почвах Хорезмской области в условиях глобальных климатических изменений. На основе научных источников освещается влияние повышения температуры воздуха, изменения количества осадков и дефицита водных ресурсов на процессы засоления почв, снижения их плодородия и деградации. Результаты исследования служат основой для разработки практических рекомендаций по устойчивому использованию земельных ресурсов региона.

Key words: climate change, irrigated soils, agroecological condition, salinization, Khorezm region.

Summary. The article analyzes the main agroecological processes occurring in the irrigated soils of the Khorezm region under conditions of global climate change. Based on scientific sources, the impacts of rising air temperatures, changes in precipitation patterns, and water resource scarcity on soil salinization, fertility decline, and degradation processes are examined. The research findings contribute to the development of practical recommendations for the sustainable use of land resources in the region.

Introduction. In recent years, global climate change has exerted a significant influence on natural environments and socio-economic processes in almost all regions of the world. Rising air temperatures, changes in precipitation patterns, increasing frequency of drought events, and growing water scarcity are causing serious environmental problems, particularly in arid and semi-arid regions [1]. Central Asia, including the Republic of Uzbekistan, is considered one of the regions most vulnerable to climate change impacts. The Khorezm region is characterized by its specific natural and geographical conditions, low-lying

relief, and strong dependence on the water resources of the Amu Darya River [2]. Agriculture in the region is predominantly based on irrigated farming, and irrigated soils play a crucial role in ensuring regional food security. However, under conditions of climate change, increasing water shortages, intensified evaporation processes, and fluctuations in groundwater levels are having a negative impact on the agroecological condition of irrigated soils.

The impact of climate change on irrigated soils in the Khorezm region is primarily manifested through increased soil salinization, deterioration of physical and chemical

properties, reduction in humus content, and a decline in biological activity [3]. These processes lead to decreased crop productivity, reduced efficiency of land use, and pose serious threats to the stability of agroecosystems. Agroecological problems are becoming particularly acute in areas cultivated with cotton, wheat, and vegetable crops. At present, under conditions of climate change, the scientific assessment of the condition of irrigated soils, identification of existing problems, and development of effective mitigation and adaptation measures constitute an urgent scientific and practical task. From this perspective, studying the agroecological condition of irrigated soils in the Khorezm region, analyzing the influence of climatic factors, and substantiating appropriate adaptation measures are of great importance [4]. The aim of this article is to analyze the impact of climate change on the agroecological condition of irrigated soils in the Khorezm region, identify the main negative processes, and develop scientifically grounded conclusions for the sustainable use of land resources.

Materials and Methods. The research was conducted on irrigated agricultural lands of the Khorezm region. The study objects included irrigated meadow-alluvial, meadow, and sierozem (gray) soils widely distributed in the lowland areas of the region. These soil types constitute the main basis of agricultural production in the Khorezm region and are considered among the agroecosystems most sensitive to climate change. To assess the impact of climate change on the agroecological condition of soils, long-term meteorological, hydrological, and soil science data were used. In particular, long-term data from meteorological stations located in the Khorezm region, including air temperature, precipitation, evaporation rates, and wind regime indicators, were analyzed. Based on these data, trends in climatic factors were identified, and their effects on irrigated soils were evaluated. Soil investigations were carried out under both field and laboratory conditions [5]. During field surveys, soil profiles were excavated in irrigated areas, and their morphological characteristics – such as the thickness of genetic horizons, color, structure, texture, moisture content, and degree of salinity – were described. Soil samples were collected separately from each genetic horizon and prepared for laboratory analyses. Under laboratory conditions, the main agroecological indicators of soil samples were determined through the following analyses: soil texture, total and mobile salt content, soil reaction (pH), humus content, carbonates, nutrient elements (nitrogen, phosphorus, and potassium), and water-physical properties [6]. The degree and type of soil salinization were assessed based on the total dissolved salts content and ionic composition. In evaluating the agroecological condition of irrigated soils, groundwater level and mineralization were considered important factors. For this purpose, data from reclamation monitoring wells located in the study area were used. Changes in groundwater levels and chemical composition were analyzed in relation to soil salinization and secondary degradation processes. To obtain a deeper understanding of climate change impacts, a comparative-analytical approach was applied. This method involved comparing climatic and soil indicators obtained in different years to identify changes in agroecological conditions. Statistical analysis methods were used to assess relationships and trends among the main indicators. In

addition, scientific literature and regulatory documents were analyzed during the research process. Scientific studies by researchers from the Republic of Uzbekistan and foreign countries on climate change, irrigated soil degradation, and agroecology were reviewed and synthesized [7]. This approach contributed to the scientific justification of the research results and strengthened the conclusions. The integrated application of these research methods made it possible to conduct a comprehensive and systematic assessment of the impact of climate change on the agroecological condition of irrigated soils in the Khorezm region.

Results and Discussion. The research results indicate that the agroecological condition of irrigated soils in the Khorezm region is undergoing significant changes under conditions of climate change. Analysis of long-term meteorological data confirms a clear upward trend in the average annual air temperature in the region. In particular, rising temperatures during the growing season intensify evaporation processes, which negatively affect the moisture regime of irrigated soils. Changes were also observed in the annual and seasonal distribution of precipitation. Precipitation occurring mainly over short periods and in an uneven manner leads to insufficient accumulation of natural soil moisture reserves. This situation increases the demand for irrigation and forces more intensive use of water resources. As a result, secondary salinization and soil degradation processes in irrigated lands are becoming more active [8]. According to soil analysis results, irrigated meadow-alluvial and sierozem soils in the study area exhibit an increasing trend in total dissolved salt content. Areas with relatively shallow groundwater levels showed a more pronounced degree of salinization. This indicates that, under climate change conditions, water scarcity combined with the deterioration of reclamation status exerts a complex and cumulative impact on the agroecological condition of soils [9].

Negative changes were also recorded in the physical properties of soils. Under conditions of high temperatures and water deficit, soil structure degradation, increased bulk density, and reduced water permeability were observed. Such changes restrict root system development and adversely affect crop growth and development, ultimately leading to a decline in agricultural crop yields. Analysis of humus content revealed a gradual decrease in organic matter in irrigated soils. Under climate change conditions, accelerated decomposition of organic matter due to high temperatures, together with insufficient application of organic fertilizers, leads to a reduction in humus reserves. This process negatively affects soil fertility and undermines the stability of agroecosystems. When compared with studies conducted by other researchers, the obtained results demonstrate that the impact of climate change on soils in the Khorezm region is more complex and multifactorial [10]. While some studies emphasize rising temperature as the primary negative factor, the findings of this research highlight that water scarcity and reclamation-related issues also play a critical role. The results suggest that mitigating the impacts of climate change and improving the agroecological condition of irrigated soils require an integrated approach. In particular, enhancing water-use efficiency, introducing modern irrigation technologies such

as drip irrigation, strengthening agrotechnical measures against salinization, and restoring soil organic matter reserves are of great importance.

Furthermore, the development of climate change adaptation measures should take regional characteristics

into account. Under the conditions of the Khorezm region, improving agroecological monitoring systems and ensuring regular control of soil conditions will help prevent negative processes and support the sustainable use of irrigated lands in the future.

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