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REGIONAL DIFFERENCES IN THE AGROCLIMATIC CONDITIONS OF NAMANGAN REGION'S DISTRICTS AND THEIR VULNERABILITY TO CLIMATE CHANGE

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Abstract

This thesis analyzes the agroclimatic conditions of the districts of Namangan Region, their regional differences, and their vulnerability to climate change from a geographical perspective. It provides a comparative overview of the heat resources, seasonal distribution of precipitation, vegetation periods, and water availability characteristics of plains, adyr (foothill), and mountainous areas. Climate normals for Namangan City for 1991–2020 and temperature trends for 1970–2024 are examined using publicly available data. Furthermore, issues related to rising temperatures, drought risks, water scarcity, soil degradation, and land reclamation conditions are assessed. Practical recommendations are developed for adapting agriculture to climate change.

Keywords: Agroclimatic conditions, regional differences, vegetation period, climate change, water resources, soil degradation.



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Introduction

Global climate change is one of the major factors affecting the sustainability of agricultural production. In the Fergana Valley, hot and dry summers, the seasonal distribution of precipitation, and increasing irrigation requirements necessitate improvements in the use of agroclimatic resources. According to data published by the United Nations Environment Programme (UNEP) in 2025, the average annual temperature in Uzbekistan has increased by 1.6°C over approximately the past 60 years. This situation is considered one of the factors contributing to increased water scarcity and drought risks in the country [1].

In Namangan Region, changes in relief from plains to adyr (foothill) and mountainous areas result in regional variations in agroclimatic conditions. Therefore, assessing climate-related risks and developing adaptation measures while taking into account the natural and geographical characteristics of individual districts are of significant scientific and practical importance.

Agroclimatic indicators for Namangan Region, based on the 1991–2020 climate normals for Namangan City available in open climate databases, show that the annual average temperature is 14.9°C and the annual precipitation is 203 mm. These indicators characterize the meteorological conditions of the city and cannot be directly applied to all districts of the region [2].

Table 1. Selected Statistical Indicators of Agroclimatic Conditions in Namangan City

Indicator	Value	Period
Annual average air temperature	14.9°C	1991–2020
Annual precipitation	203 mm	1991–2020
Average temperature of the hottest month (July)	28.0°C	1991–2020
Average temperature of the coldest month (January)	−0.1°C	1991–2020
Month with the lowest precipitation (August)	2.7 mm	1991–2020
Month with the highest precipitation (March)	27.3 mm	1991–2020
Long-term temperature increase trend	+0.40°C per decade	1970–2024

Source: Climate statistics for Namangan City from the StatsClimat database, based on WorldClim/CRU TS v4.09 data [2].

As shown in the table, precipitation in Namangan City is not evenly distributed throughout the year. While the amount of precipitation reaches 27.3 mm in March, it decreases to 2.7 mm in August. The sharp decline in summer precipitation, combined with high temperatures, increases the need to provide agricultural crops with sufficient moisture through irrigation. The long-term upward temperature trend also highlights the need for regular monitoring of agroclimatic risks.

Regional Differences in the Agroclimatic Conditions of Districts

The districts of Pop, Chust, Mingbuloq, and Uychi in Namangan Region differ in terms of the characteristics of their plains and adyr (foothill) areas. In the plains and irrigated agricultural lands of Mingbuloq and Uychi, water availability, soil moisture, and land reclamation conditions are of particular importance. In Pop and Chust districts, alongside plains, adyr and foothill landforms are also present. Therefore, rather than classifying these districts into a single agroclimatic group, it is more appropriate to consider their elevation and relief characteristics.

In the foothill and higher-altitude areas of Kosonsoy, Chortoq, and Yangiqo‘rg‘on districts, altitudinal zonation influences temperature, moisture conditions, and the duration of the vegetation period. As altitude increases, air temperatures tend to decrease, precipitation may increase in certain locations, and the vegetation period may become shorter. Although these areas offer favorable conditions for horticulture, viticulture, and certain vegetable crops, risks associated with late spring frosts, heavy rainfall, and slope erosion must also be taken into account.

Table 2. Comparative Characteristics of Agroclimatic Features and Climate Risks in the Districts of Namangan Region

Regional group	Districts	Main agroclimatic characteristics	Predominant risks
Plains and irrigated areas	Mingbuloq, Uychi	Utilization of heat resources and irrigated agriculture	Water scarcity, salinization, increased evaporation
Plains, adyr (foothill), and foothill areas	Pop, Chust	Regional differences in relief and moisture conditions	Drought, water erosion, local variations in water availability
Foothill and higher-altitude areas	Kosonsoy, Chortoq, Yangiqo‘rg‘on	Altitudinal zonation and variations in temperature and vegetation periods	Late frosts, heavy rainfall, mudflows, and slope erosion

Source: The author's qualitative analysis based on natural and geographical characteristics. The risks presented in the table do not indicate quantitative risk levels but rather identify the key factors that should be considered for each area.

The Impact of Climate Change on Agriculture

Rising air temperatures resulting from climate change may increase crop water requirements, accelerate moisture loss from the soil, and affect the timing of certain phenological stages. In this regard, the vulnerability of different areas depends not only on temperature and precipitation but also on irrigation infrastructure, water-use efficiency, the mechanical composition of the soil, and land reclamation conditions.



Table 3. Climatic Factors, Their Potential Consequences, and Adaptation Measures

Climatic factor	Potential impact on agriculture	Recommended measures
Rising temperatures	Increased crop water requirements and heat stress	Use heat-resistant crop varieties and adjust planting dates
Low summer precipitation	Increased irrigation demand and risk of water scarcity	Introduce drip irrigation and reduce water losses
Prolonged dry periods	Reduced crop yields and decreased soil moisture	Apply moisture-conservation agricultural practices and water-saving technologies
Heavy rainfall and mudflows	Soil washout, erosion, and damage to cultivated areas	Contour farming, protective vegetation cover, and drainage measures
Improper water management in irrigated areas	Secondary salinization and deterioration of land reclamation conditions	Improve drainage systems and monitor soil salinity

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According to international environmental assessments of Uzbekistan, rising temperatures and recurring droughts are identified as significant risks affecting water resources and land conditions [1]. However, determining the precise level of risk for individual districts of the region requires separate calculations based on meteorological station data, hydrological observations, and soil and land reclamation indicators.

Conclusion

The analysis shows that the agroclimatic conditions of the districts of Namangan Region differ in terms of relief, altitude, heat resources, seasonal distribution of precipitation, and water availability. According to publicly available data for Namangan City, the annual average temperature is 14.9°C, annual precipitation is 203 mm, and the temperature trend for 1970–2024 indicates an increase of +0.40°C per decade. These findings highlight the need to strengthen climate monitoring in the region [2].

The following measures are proposed to adapt agriculture to climate change:

1. Develop agroclimatic maps for individual districts of the region based on temperature, precipitation, accumulated active temperatures, and vegetation period indicators.
2. Expand the use of water-saving irrigation technologies in areas with a high risk of water scarcity.
3. Improve land reclamation monitoring and drainage systems in areas prone to soil salinization.
4. Promote contour farming and expand protective vegetation cover in foothill areas to prevent water erosion.
5. Integrate observations from Uzhydromet with district-level agricultural data to statistically assess the impact of climate risks on crop yields.

In general, improving the resilience of agriculture in Namangan Region to climate change depends on taking regional agroclimatic differences into account, ensuring the rational use of water and soil resources, and establishing continuous scientific monitoring.

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