

THE NEGATIVE EFFECTS OF THE CLIMATE CHANGE TO THE CITIES OF UZBEKISTAN

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Annotation: *This study examines the impact of global climate change on the environment in the world as a whole, as well as on the Central Asian region and Uzbekistan. It was revealed that climate variability in arid areas negatively affects the state of water and land resources. Climate change carries risks in terms of growing agricultural products, which can lead to changes in agricultural practices. It was revealed that the main challenges for Uzbekistan today and in the future are the reduction of water resources due to climate change and the increase in the need for water in agriculture. Based on the results of the study, it can be concluded that investing in the use of innovative technologies in agriculture, as well as the reconstruction of the existing irrigation infrastructure in the face of climate change, will lead to long-term sustainability of the water sector of Uzbekistan and the use of land resources.*

Keywords: *Central Asia, Uzbekistan, climate change, greenhouse gas, sustainable development of water and land resources.*

Introduction.

Climate change is the defining crisis of our time, and it is happening even faster than humanity feared. No corner of the globe is immune from the devastating effects of climate change. Rising temperatures contribute to environmental degradation, natural disasters, extreme weather events, food and water shortages, economic shocks, conflict and terrorism. Sea levels are rising, the Arctic is melting, coral reefs are dying, oceans are acidifying, and forests are burning. The Central Asian region is already facing the consequences of climate change, which poses a real threat to food, water and energy security, public health and hampers the achievement of the countries' sustainable development goals. Central Asian countries are among the most vulnerable

countries to climate change. Climate change affects the well-being of more than 70 million people, mostly living in rural areas of the Central Asian region. Given that agriculture is a key sector of the economy, the effects of climate change pose a serious threat to food security and sustainability in the region. Building resilience to the increasing impacts of climate change, such as glacial melt and drought, is a major priority in reducing poverty and improving livelihoods in the region [1].

In Central Asia, the fastest increase in average annual temperature occurs near the Caspian Sea. In the Aral Sea area and the southern desert regions of Central Asia - southern Kazakhstan, Uzbekistan, and Turkmenistan - precipitation has fallen by more than 5 percent over the decade.

Given the region's characteristics, vulnerability to climate change is manifested in the increased intensity of glacier and snow melt in the highlands of Tajikistan and Kyrgyzstan, changes in water supply, increasing frequency of natural disasters, and increased aridity. All these risks can cause huge damage to economic stability and food security in Central Asia [2]. All Central Asian countries are parties to the Paris Agreement and are integrating climate issues into government programs and strategies. Climate change mitigation issues are reflected in nationally determined contributions.

Main body

Climate change is causing a number of negative consequences in Uzbekistan. These consequences include:

1. The increase in temperature and the increase in the evaporation coefficient of water affect the reduction and scarcity of water resources in these regions.
2. As a result of the above-mentioned environmental stress, the number of days with no precipitation at all is increasing compared to the periods when there was a lot of precipitation in the 1950s and 1960s.
3. Changes in the above temperatures affect the annual average speed of the wind, which is not typical for Uzbekistan, and it is observed that it will decrease from 3.8-4.0 to 3.1-3.5 m/s.
4. Due to the decrease in soil moisture, the risk of repeated droughts is increasing, it has been observed that droughts are repeated every three years periodically in every ten years.
5. At the same time, the negative ecological changes and the chronic reduction of the flow of the waters of the Syrdarya and Amudarya into the Aral Sea lead to a reduction of the surface covered by water in the Aral Sea.
6. These processes lead to the transformation of the river delta into a desert and the emergence of new desert areas on the bottom of the dry sea.

7. The salt and dust from the new areas of the seabed, which have become deserts, are blown by the wind to the irrigated lands that are cultivated in agriculture, causing these lands to become salinized again.

8. Pollination of atmospheric air in large areas is increasing.

Today, climate change is recognized by the world community as the most serious problem facing humanity. Climate change affects all areas of human life and requires immediate measures to prevent the negative consequences of climate change and adapt to new living conditions.

Modern science provides substantial evidence that human economic activity, primarily due to the burning of fossil fuels, has a significant impact on the climate.

The average annual temperature in Uzbekistan increased by 1.6 degrees (from 13.2 to 14.8 °C) from 1880 to the present, which is higher than the global average. According to experts' forecasts, the air temperature in the region may increase by 1.5-3°C in 2030-2050. It is expected that the air temperature will rise, especially in Arolbay, which will be aggravated by local climate changes.

Conclusion.

Uzbekistan is one of the countries most prone to the effects of climate change. According to experts, the concentration of greenhouse gases in the atmosphere will continue to increase, the risk of water and food shortages will increase as a result of drought, the number of people will increase due to the increase in the duration and intensity of the hot season, as well as floods, floods and other dangerous events. causes repetition. In addition, such work has a negative impact on the state of ecosystems, and leads to the aggravation of the ecological situation in regions such as Arolboi, Karakalpakstan, Surkhandarya, Bukhara and Khorezm regions. Global climate change and the sensitivity of the country's natural resource complex to these changes determine the need to formulate a consistent climate policy.

A prerequisite for signing the Paris Agreement is the preparation of the Intended Nationally Determined Contribution (Intended Nationally Determined Contribution) for reducing greenhouse gas emissions, which the country wants to achieve by 2030, and submitting it to the UN Intergovernmental Panel on Climate Change. The Nationally Determined Contribution (NDC) is the main mechanism for implementing national actions to contribute to the global goals of the Paris Agreement.

According to the Paris Agreement, the main obligation of Uzbekistan is to reduce greenhouse gas emission per unit of GDP by 10% from the level of 2010 by 2030.

The MMBH of Uzbekistan includes measures and actions to mitigate and adapt to climate change in the period up to 2030. Implementation of Nationally Determined Contribution (NDC) is actively being carried out and is making a significant contribution to the development of the economy of Uzbekistan.

Geographic examination of current green space issues

Analysis of the urban geography of Uzbekistan reveals several important aspects. As a landlocked country with a land area of 425,400 km² and 444,103 km², Uzbekistan is characterized by diverse geographical features. The population, which is about 35 million in 2021, is concentrated in both urban and rural areas, with about 49 percent living in rural areas (Statistical Agency under the President of Uzbekistan). This distribution reflects the country's dependence on agriculture, which accounts for a large portion of the economy. The country's topography consists largely of lowlands and plains, including the Aral Sea basin in the north and west (Republic of Karakalpakstan) and the vast Kyzylkum Desert in the south (Navoi Province). In eastern Uzbekistan, however, there are mountainous regions such as the Gissar Mountains (Kashkadarya Province and Amudarya River Basin), which are up to 4600 m above sea level. The fertile and irrigated Fergana Valley, surrounded by mountain ranges, is an exception to the low population density found in most rural areas. Uzbekistan has a continental climate, ranging from warm continental in the Fergana Valley to cold semi-arid in the western regions, where a cold desert climate prevails (Ministry of Ecology, Environmental Protection and Climate Change of Uzbekistan).

Average temperatures in January range from +4 °C in the south to -10 °C in the north, while in July they range from +27 °C in the north to +37 °C in the south. Summers are long, extremely dry, and hot, with little precipitation. However, precipitation increases with altitude in the east and southeast, reaching up to 800–900 mm on the slopes of the western Tian Shan and Pamir Alai (Fergana, Namangan and Andijon provinces). The irregular terrain can lead to soil erosion and river silting during heavy summer rains (UZHYDROMET; World Bank Data).

Climate change poses a significant threat to the sustainable development of Uzbekistan. Rising temperatures, droughts, and extreme weather events are already being observed. These changes may negatively impact the country's ecosystems, including its barren forests and woodlands (Annex 1, Table 1). Given the vulnerability of ecosystems to anthropogenic factors and climatic events, early planning of environmental activities focused on sustainable management and restoration of the landscape is critical to maintaining the country's biosphere and its beneficial functions (UNEP). Uzbekistan has an average population density of 74 persons per square kilometer, and its population has grown at an annual rate of 1.4 to 2.9 percent from

1990 to 2018. The country has about 25.5 million hectares of agricultural land, much of which is used to grow cotton, followed by wheat and other cereals (Statistical Agency under the President of Uzbekistan).

In terms of forest cover, Uzbekistan is considered a forest-poor country, with only about 7.2 to 7.5 percent of the land area covered by forests (FAO). The State Forestry Fund covers most of the forested area, about 11.9 million hectares (State Committee of Forestry of Uzbekistan). Forests in Uzbekistan play a critical role in combating desertification, protecting against soil erosion and flooding, and mitigating the effects of dust storms and dry winds (UZHYDROMET). However, the remaining natural forests are under pressure from a variety of factors, including overgrazing, increasing demand for fuelwood, unsustainable land use practices, wildfires, and climate hazards. Only a small portion of state forest fund land is dedicated to timber and fuelwood production, while one-third is used for protected areas and biodiversity conservation, mainly for non-timber forest products (see also Appendix: Figs. A2 and A3).

Given the dry climate of the country, the category of other forested land in Uzbekistan is also important. Forested land has changed over time, including the inclusion of agricultural land in the State Forest Fund and the transfer of land with forested parcels. These changes have contributed to variations in forested acreage and overall forest cover. Looking at the geographic and climatic conditions of Uzbekistan, the urban geography of the country is influenced by a combination of lowlands, mountains, deserts, and fertile valleys. Despite their limited extent, the country's forests play an important role in preserving the environment and promoting sustainable development. Efforts to manage and restore landscapes, considering the impacts of climate change, will be critical to the future well-being of Uzbekistan and its people (FAO).

Land classification in Uzbekistan plays an important role in shaping the urban landscape and managing natural resources. The 1998 Land Code divides land into eight categories, including state forest land, agricultural land, reserve land, private land, industrial land, recreational land, cultural and architectural heritage land, and water areas. This classification reflects Uzbekistan's diverse geographic features, ranging from forests and agricultural lands to deserts and water bodies. Forestry activities in Uzbekistan focus on afforestation in the desert zone, particularly in the Aral Sea area, to combat salt and dust erosion and stabilize shifting sands. Forests also serve as protective barriers around oases, industrial sites, railroads, roads, and pipelines, mitigating the effects of dust storms, dry winds, and other natural phenomena. The main function of forests in Uzbekistan is to combat desertification, reduce flood risk,

and prevent soil erosion. They also contribute to the conservation of biodiversity and wildlife.

Protected areas play a crucial role in preserving Uzbekistan's natural ecosystems and promoting sustainable development. The country has established nature reserves, national nature parks, wildlife reserves, and protected landscapes, among others (Appendix, Table A1). These areas occupy about 4.7 percent of Uzbekistan's total land area. Most nature reserves and some wildlife sanctuaries are overseen by the State Committee for Ecology and Environmental Protection of Uzbekistan, while the State Committee for Forestry manages national nature parks and other protected areas (State Committee for Forestry of Uzbekistan; World Bank Data). Most of the protected areas and forests are located in mountainous regions, which emphasizes the importance of these areas for biodiversity conservation. Management of forests and natural resources is the responsibility of state enterprises, including state forest enterprises. State forest enterprises have territorial responsibilities at the district level and manage the State Forest Fund, which covers about 11.2 million hectares of land. The forestry program implemented in Uzbekistan aims to plant forests, especially in arid areas and the Aral Sea region, to protect soil and water, preserve biodiversity, and promote natural regeneration. Uzbekistan's urban geography is thus shaped by its diverse land classification, with forests and protected areas playing a critical role in preserving the environment, combating desertification, and reducing the impact of natural hazards. Managing and conserving these resources requires coordination among various agencies and the implementation of sustainable practices to ensure the long-term well-being of urban areas and the country as a whole.

Uzbekistan faces challenges related to illegal tree cutting, particularly in the desert and riparian forest regions. The scarcity of forest and tree resources exacerbates the problem, as people rely heavily on these resources for firewood and local timber. Continuous extraction of fuelwood has led to the gradual degradation of natural saxaul forests in desert areas, while illegal logging has significantly affected poplar forests in riparian areas over the past two decades (State Committee of Forestry of Uzbekistan). In the eastern mountainous regions of the country, there are reports of unregulated charcoal production and illegal logging, particularly affecting the natural juniper forests (World Bank Data). However, compared to forest-rich countries, the problem of illegal logging in Uzbekistan is relatively inconspicuous. To curb illegal logging, a combination of effective law enforcement, promotion of alternative activities for sustainable fuelwood and charcoal production, and use of alternative energy sources is needed.

Unfortunately, limited data make it difficult to make a realistic assessment of the extent of unrecorded logging and its potential impact on forest degradation. In addition to illegal logging by external actors, there is also the possibility that valuable walnut, poplar, or juniper trees are falsely declared as sanitary wood to legally justify their logging. However, in the absence of reports of such incidents, it is difficult to assess their extent. In addition, illegal logging of walnut tubers may still occur in certain cases. Although there is no evidence of significant illegal logging in Uzbekistan, the country needs to address the problems associated with illegal logging in order to protect its limited forest and tree resources. Implementing sound law enforcement measures, promoting sustainable alternatives to firewood and charcoal production, and exploring alternative energy sources are critical steps to mitigating the problem. In this way, Uzbekistan can protect its urban and rural landscapes, promote environmental sustainability, and ensure the availability of vital resources for its people.

In Uzbekistan, the forestry sector primarily focuses on protection and restoration rather than incongruent practices between industrial forestry and conservation. Cross-sectoral cooperation with agriculture, water, soil, and nature conservation is generally positive and does not pose significant problems for forest integrity. Historical deforestation and large-scale degradation of natural forests and shrublands have occurred, but conflicts mainly arise from excessive grazing by livestock (UNEP). The main challenge today lies in the severe degradation of many areas, necessitating an integrated landscape approach that incorporates diverse land uses. The agriculture, forestry, and fisheries sectors contribute between 25 and 29 percent of Uzbekistan's GDP, depending on the data. No specific annual harvest level is set for production forests, as all harvests are conducted for health reasons. Official annual harvests in recent years have amounted to 36,000 m³, and local production of sawn timber is approximately 26,000 m³ per year. Estimates suggest that the total stock of all forests and species combined ranges from 30 to 60 million m³. While figures on forest area, biomass, and increment are based on estimates and require verification, it can be noted that increment is either increasing or relatively stable across all forest types. Forests with mountain juniper (*Juniperus*) and riparian forests stocked with *Populus densifolia* (poplar) exhibit relative stability in terms of stocking.

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