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WATER SHORTAGE AND DROUGHT IN THE CENTRAL ASIAN REGION

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Abstract: This article examines the problems of water shortages and the resulting drought in the Central Asian (CA) region. The world is currently facing a growing threat: devastating megadroughts with prolonged periods of complete precipitation absence lasting for years. It is also noted that the drying up of lakes, which turn into lifeless expanses-deserts-is considered particularly dangerous. This article is based on scientific materials, international documents, and statistical data. It offers recommendations for water resource management, conservation, and rational use, as well as for respecting nature and using water resources rationally.

Keywords: Water scarcity, drought, food security, abnormally hot days, water resource depletion, UN Conventions, Sub regional Programme, planetary pollution, population migration.

INTRODUCTION

The uncontrolled and reckless use of scientific advances and the expansion of large-scale industrial enterprises, while beneficial, have caused significant harm to the environment, leading to widespread pollution of water, air, and soil. The negative impact of human activity on nature is distorting the structure of the natural landscape and depleting natural resources.

Globally, climate change is significantly impacting water resources, leading to droughts. Melting glaciers are altering river flow patterns. According to United Nations reports, the number of people affected by droughts exceeded 1.5 billion between 1990 and 2020. Climate change is becoming a major global threat, directly intensifying geopolitical tensions. This is particularly acute in the areas of poverty alleviation, food and energy security, and the rational use of water and natural resources. The consequences of these processes are particularly noticeable in Central Asia.

LITERARY RESEARCH

The Central Asian region is considered one of the world's most vulnerable to climate change and is already experiencing its negative impacts, including land degradation, water scarcity, droughts, and increased sensitivity of ecosystems to climate change. Average annual temperatures in Central Asia are rising faster than the global average. Over the past 70 years, temperatures in the region have increased by 1.5-2°C, significantly exceeding the global average. According to forecasts, by 2050, temperatures could increase by another 2-3°C, leading to more intense droughts and more frequent extreme weather events.

Over the past 50-60 years, as a result of global climate change, the area of glaciers in Central Asia has decreased by approximately 30 percent. Climate change in the region is leading to soil erosion, reduced crop yields, and threatening food security. More than 60 percent of the region's land is subject to desertification, and droughts, floods, and sandstorms are becoming increasingly frequent. Unique ecosystems such as the Aral Sea, mountain forests and steppe zones are under threat of destruction.

According to E.A. Arustamov [1], arid regions occupy 41 percent of the earth's land surface. More than 2 billion people live in this territory (as of 2000). Ninety percent of the population lives in developing countries, which have low development indicators. Infant mortality in countries occupying arid regions is higher, and the gross national product (GNP) per capita is

lower than in the rest of the world. Due to limited access to water, agricultural markets, and a small number of natural resources, poverty is widespread in arid regions.

According to the website [2], the world is currently facing a growing threat: extreme mega droughts. Research shows that their frequency and intensity are increasing across the globe. These events are already causing significant changes in climate and ecosystems, creating serious consequences for human life and the environment.

Figure 1. Illustration of reservoirs drying up in Turkmenistan.

According to the website [3], two reservoirs in western Turkmenistan have completely dried up (Fig. 1). The reason for this is reportedly a prolonged drought and the cessation of water inflow from the river. The Mammetkul and Delili reservoirs in the Balkan region of Turkmenistan have completely dried up. This was reported by the Meteorological Journal. The reason for this is allegedly a prolonged drought caused by a decrease in precipitation during the cold period of 2024/2025 and the cessation of water inflow from the Etrek River. In November 2024, the total water level in the Mammetkul reservoir was 3.26 km², and in Delili - 0.2 km². By March 2025, the area of Mammetkul had decreased to 2.5 km², and Delili had practically dried up, dropping to 0.08 km². In May, the area of Mammetkol had shrunk to 0.65 km², and Delili had completely dried up. By early June 2025, the Mammetkol Reservoir had also completely dried up. The last time Mammetkol completely dried up was in October 2021, and it remained dry until August 2023, when it was filled by a severe flood. The Mammetkol Reservoir was commissioned in 1964; its full capacity is 20.5 million cubic meters, and its usable capacity is 17.9 million cubic meters. Delili was commissioned in 1970; its full and usable capacity is 5.32 million cubic meters. According to the Etrek meteorological station, precipitation from January to November 2025 was close to normal only in February and March, while in the remaining months, it was significantly below normal. In January, only 1.6 mm of precipitation fell, and in May, 1.4 mm. There was no rain from June to August, and the autumn was also dry. Due to the decrease in precipitation in the first half of 2025, the hydrological

drought intensified in reservoirs and rivers that do not flow into the Amu Darya basin. This led to a sharp decrease in the water volume in the Murghab and Tekhen reservoirs. The artificial reservoirs fed by the low-flowing Etrek River completely dried up. In the autumn, the water use situation in the Amu Darya basin reservoirs also worsened.

In the research of the authors A. Imanmurzaev and J. Kalmirzaev [4], it is noted that currently in Central Asia as a result of climate change, dry periods have become more frequent. One of the main reasons for this is the drying up of the Aral Sea and its negative impact on the human factor. Natural population growth and climate change, an increase in demand for water, an increase in abnormally hot days and a decrease in the number of rainy and snowy days lead to droughts. According to the experts of the World Bank, by 2050, water resources in the Syr Darya basin are expected to decrease by 5 percent, and in the Amu Darya basin - by 15 percent. In 2050, a shortage of fresh water in Central Asia may lead to a decrease in the gross domestic product by 11 percent. This article uses the SPI method based on data from meteorological stations located in the Republic of Karakalpakstan. Annual precipitation in this region was collected and distributed by region in the SPI program using GIS technologies and mathematical statistical methods. An analysis of hydrometeorological data from the Takhtkapir, Chimboy, Kongrot, and Nukus meteorological stations in the Republic of Karakalpakstan allowed us to compile, digitize, and analyze climate change maps. Rising air temperatures are one of the main factors exacerbating water shortages. Snow and glaciers are the main sources of water in the region, but most of the water is generated from snow. Mountains also store water for the summer season in exchange for winter snowfall. A decrease in snowfall further exacerbates the problem and creates serious difficulties in storing water for the summer season. As a result, centuries-old glaciers continue to shrink.

The website [5] notes that authorities have announced a drought forecast for several regions of Kazakhstan for August 2025. According to forecasters, there is a high probability of drought in the south of the country at the end of summer. Drought is expected in August in the following districts:

- West Kazakhstan Region – in the Zhanibek, Zhangakal, Akzhai, Karatobin, and Bokey-Orda districts;
- Aktobe Region – in the Shalkar and Irgiz districts;
- Kostanay Region – in the Amangelsk and Zhangelsk districts;
- Karaganda Region – in the Aktogay district;
- Abay Region – in the Ayaguz and Urzhar districts;
- Almaty Region – in the Balkhash and Zhambyl districts;
- Kyzylorda Region – in the Aralsk, Karmakshy, Shiel districts and the city of Kyzylorda;
- In the Atyrau region – in the Makhambet, Isatay, Dambi and Kyzylkoginsky districts;
- also in most of the Mangistau, Dzhambyl, Turkestan and Ulitau regions.

According to biologist B. Rasulov [6], "If the rate of drought worldwide continues at this rate, agriculture in Uzbekistan will become difficult in the near future." In an interview with Kun.uz, he noted that the country is facing drought, and that an acute shortage of water resources is causing serious problems. It is necessary to abandon traditional agricultural methods and embrace new scientific approaches. The gradual depletion of water resources is particularly noticeable in agriculture. For example, it is a crucial tool for ensuring food security. Soil salinization, declining crop yields year after year, increased agricultural costs, and the spread of viral, bacterial, and fungal diseases can be seen as a logical continuation of the main negative consequences.

E. Aripov [7], director of the Uzbek Institute for Strategic and Interregional Studies, stated that by 2050, Central Asia will face a shortage of clean drinking water due to melting glaciers

and arid climate. Within twenty-seven years, the region's largest river, the Amu Darya, could lose 15 percent of its drainage basin.

Methodology

Water shortages and droughts typically lead to crop failure, which in turn exacerbates food shortages. Drought is literally the twin of desertification. It is characterized by reduced precipitation and a decline in water resources. Unfortunately, this problem, which once occurred over decades, has become a constant companion of humanity in recent years.

Desertification, land degradation, and drought (DLDD) are global problems. According to the UN, drylands occupy 30% of the Earth's surface in more than 100 countries, and are currently home to 2 billion people. If the UN's proposed scenario, taking into account current desertification rates, is confirmed, by 2025, one in five people on Earth will live in drought-prone areas. Currently, more than two billion hectares of productive land are degraded worldwide, and we continue to degrade an additional 12 million hectares annually.

As is the case globally, DLDD in Central Asian countries poses not only a serious environmental, but also an economic and social problem. According to an FAO report, Central Asian economies remain largely based on agriculture, which accounts for 10-38% of GDP and 18-65% of employment. This makes these countries vulnerable to droughts by reducing agricultural production, negatively impacting food prices, trade, and market access, leading to reduced farm incomes and unemployment. DLDD directly impacts the livelihoods of rural populations, reducing land productivity and negatively impacting the stability and functioning of natural systems, as well as the services that depend on these systems. According to reports, agricultural yields in the region have declined by 20-30% since independence, resulting in annual losses of $2 billion in agricultural production.

It should be noted that desertification and drought are trans boundary problems requiring joint action, and guided by the mechanisms laid down in the UN Convention to Combat Desertification (UNCCD), the Central Asian countries agreed on and adopted the Sub regional Action Programme of Central Asian Countries to Combat Desertification in the Context of the UNCCD in 2003. The objectives of this programmer were to harmonize sub regional interests, exchange information and experience, attract donors to the implementation of the UNCCD, synergize in the implementation of environmental conventions in the sub region, develop and implement joint programmer, and improve socio-economic conditions.

Experts emphasize that climate change is the main factor contributing to the increased duration and severity of droughts. There is a link between rising temperatures and decreased precipitation. Thus, regions once renowned for abundant rainfall are now suffering from drought, threatening agriculture and water supplies.

Recent decades have also seen an increase in the number of forest fires igniting in arid areas. This creates a dangerous combination: dry vegetation is highly flammable, and high temperatures facilitate the spread of fire. This situation is expected to worsen unless necessary measures are taken.

Regions where droughts have become commonplace face threats to their economies and ecosystems. To cope with the consequences of these phenomena, it is necessary to develop effective water management strategies and adapt agriculture to new climatic conditions.

Uncontrolled human encroachment on nature and its callous exploitation over centuries, particularly since the onset of the Industrial Revolution, have led to the state of the environment threatening the quality of life and the very existence of human society. Over the past two decades, a huge number of local environmental disasters have occurred, negatively impacting the environment. Humans return the benefits they receive from nature to it in a degraded form,

resulting in the pollution of the planet. And this process is increasing every year. For several generations, residents have been sounding the alarm, trying to draw attention to these issues.

Conclusions

In conclusion, I would like to note that malnutrition, hunger, dehydration, and, consequently, loss of human life are the main consequences of droughts. Furthermore, they lead to mass population migrations, reduced energy production, reduced livestock growth and productivity, habitat damage, social instability, forest fires, and wars over water. Such severe climate change is simply changing people's lives for the worse.

It should be noted that the fight against drought and desertification is becoming a matter of life and death for the peoples living in Central Asia. Therefore, it is no exaggeration to say that it is our duty to demand that every citizen respect nature and use water resources rationally.

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