The problem of water shortage in the Khorezm region in the context of climate change

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Abstract: This thesis analyzes the problem of water scarcity in the Khorezm region under climate change and its impact on the socio-economic and ecological situation of the region. The location of the Khorezm region in the lower reaches of the Amu Darya, insufficient natural moisture, and high dependence of agriculture on irrigation make the issue of water resource use even more urgent. As a result of climate change, increasing air temperature, increased evaporation, and increased demand for water can further exacerbate existing problems. The thesis highlights the main causes of water scarcity, its impact on agriculture, and effective ways to reduce the problem.
Keywords:climate change, water scarcity, Khorezm region, Amu Darya, irrigation, agriculture, water resources, water-saving technologies, land reclamation, adaptation.

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Water resources are one of the most important natural factors of human life and economic activity. Especially in regions with arid and sharply continental climatic conditions, the availability of water resources determines the standard of living of the population, agricultural production, environmental sustainability and regional development opportunities. In recent years, as a result of global climate change, problems related to the use of water resources have been increasingly exacerbated in many regions of the world.

Central Asian countries are also among the regions experiencing the impacts of climate change on water resources. The distribution of water resources in the Amu Darya and Syr Darya basins, the region's main rivers, along with the expansion of irrigated land, population growth, and climate change, are increasing pressure on water.

Khorezm region is one of the regions particularly sensitive to this problem. Since the region is located in the lower reaches of the Amu Darya, the region's agriculture, drinking water supply, and ecological systems are directly linked to the river's waters. Due to the lack of natural precipitation, agriculture is mainly carried out through irrigation.

Studying the problem of water scarcity in the context of climate change is of great importance in determining the future development prospects of the Khorezm region. Therefore, rational use of water resources, reduction of water losses and adaptation of agriculture to water scarcity are among the urgent tasks of today.

Main part

The geographical location of the Khorezm region creates a high demand for water resources.

Most of the territory consists of plains, and natural moisture conditions are relatively unfavorable. Since the annual amount of precipitation is much less than evaporation, the importance of irrigation water for the cultivation of agricultural crops is extremely high.

The region's agricultural crops include cotton, grain, rice, vegetables, and melons. Some of these crops, especially rice and some vegetables, require large amounts of water during the growing season. Therefore, the reduction of water resources can directly affect the volume of agricultural production.

The impact of climate change on water resources can be seen through several main factors. First, increasing air temperature leads to increased evaporation. Second, in conditions of high temperature, plant transpiration increases, increasing their need for water. Third, variability in precipitation over time and space can reduce natural water supply opportunities.

Another important aspect of water scarcity in Khorezm is the efficiency of water resource use. In some parts of the irrigation networks, water is lost due to filtration and evaporation. As a result of the use of open channels, some of the water may be lost before reaching the cultivated areas.

Therefore, in addition to increasing available water resources, it is an important task to increase the amount of agricultural output per unit of water. This requires the introduction of water-saving technologies, modernization of irrigation systems, and strengthening water use discipline.

Water scarcity also affects the soil-ameliorative state. In the Khorezm region, a large part of irrigated land has a problem of salinity. When the balance between irrigation and collector-drainage systems is disturbed, the level of groundwater can rise and the accumulation of salts in the soil can increase.

In such conditions, the problems of water scarcity and salinity are closely linked. Due to the lack of water, in some cases it becomes difficult to fully implement soil washing measures. As a result, the reclamation condition of agricultural lands may deteriorate.

Impact of water scarcity on agriculture

The greatest impact of water scarcity is seen in agriculture. The lack of irrigation water negatively affects the vegetation process of crops. Especially during the flowering, fruiting or grain-forming period of plants, water shortages can lead to a sharp decrease in productivity. In cotton cultivation, insufficient water supply slows down the vegetative development of the plant. In grain cultivation, a lack of moisture can negatively affect the processes of earing and grain formation. In vegetable and melon crops, a lack of water leads to a decrease in product quality and yield.

However, water scarcity not only affects productivity but also the cost of producing agricultural products. Additional funds are required to transport water over long distances, operate pumps, and maintain irrigation systems.

Ways to reduce water shortage in Khorezm

Solving the problem of water shortage in the Khorezm region requires an integrated approach. First of all, it is necessary to widely introduce water-saving irrigation technologies. Drip irrigation technology allows you to deliver water directly to the root zone of the plant. This increases the efficiency of water use.

In addition, laser leveling of the land also helps to evenly distribute water during irrigation. With traditional irrigation, there may be an excess of water in some areas and a lack of moisture in other areas. In leveled areas, water is distributed relatively evenly.

Reconstruction of irrigation canals and reduction of water losses is also an important direction. Water losses due to filtration can be reduced by concreting some canals or converting them to closed pipes.

Optimizing crop composition in agriculture is also an effective way to adapt to water scarcity. It is important to determine the proportion of water-intensive crops in accordance with the water supply of the area, and to use varieties that are resistant to drought and salinity.

The use of modern GIS and remote sensing technologies in water resource management also offers great opportunities. Satellite images can be used to determine the vegetation status of cropland, soil moisture, and salinity levels. Based on this information, it becomes possible to optimize irrigation across regions.

In the context of climate change, water resources management should be carried out not only within the agricultural sector, but also from the perspective of the entire regional development. The population's need for drinking water, the water demand of ecological systems, and other sectors of the economy should also be taken into account.

Conclusion

The problem of water scarcity in the Khorezm region is likely to become even more pressing in the future under climate change. Rising temperatures, increased evaporation, and a high dependence of agriculture on irrigation will increase pressure on existing water resources.

The location of Khorezm region in the lower reaches of the Amu Darya River requires a special approach to the use of water resources. Water scarcity can affect agricultural productivity, the condition of land reclamation, production costs, and the ecological stability of the region.

To reduce the problem, it is necessary to widely introduce water-saving technologies, modernize irrigation networks, improve collector-drainage systems, optimize the composition of water-intensive crops, and use climate-resistant varieties.

It is also advisable to regularly monitor the condition of water and agricultural land using GIS and remote sensing technologies. Such an approach will help to effectively use water resources, ensure the sustainability of agricultural production, and reduce the negative effects of climate change.

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