

| Research Article



Best Practices of Using Land and Water Resources in Khiva Khanate and its Ecological Significance

Sanjarbek Davletov, Sadokat Matkarimova, Kudrat Masharipov, Umida Tajieva
Mamun University, Department of History, 220901 Khiva, Republic of Uzbekistan

Abstract: The article analyzes the advanced historical experiences of land and water resources use in the Khiva Khanate and their ecological significance for today. In it, the authors highlight the rational use of natural resources, artificial irrigation systems, and traditional farming methods in the Khorezm oasis. In the Khiva Khanate, the population mainly used natural humus as fertilizer, along with the mineral-rich silt of the Amu Darya River. These methods had a positive effect on the ecology and helped develop agriculture in harmony with the natural environment. Plants such as saxaul were used in the region to stop sand drifts, and they knew how to use natural drainage methods to lower groundwater, which served to reduce soil salinity. Based on the information presented in the article, it is noted that the experience of the population of the Khiva Khanate in the rational use of land and water resources, even the targeted use of flood waters of the Amu Darya, water conservation and preservation of soil fertility are still relevant for the present. At the same time, the article emphasizes the importance of these experiences in the development of modern approaches in the field of ecology and agriculture. This study demonstrates that the rich knowledge and traditional methods accumulated in the past are still relevant for the present.

Keywords: Ecological condition, land-water resources, natural resources, ecological problem, land-water relations, agriculture, globalization process, irrigated agriculture in Khiva Khanate, soil fertility, land and water resources.



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Introduction.

Natural resources are one of the foundations of the cultural development and economic well-being of countries and peoples. Therefore, the historical development of society has been closely linked to the effective use of natural resources. In recent years, globalization processes have also had an impact on the natural balance, and urgent problems are emerging before the world community, such as solving the issue of improving the socio-economic situation on planet Earth, as well as the ecological situation. The adoption of the United Nations Sustainable Development Goals, an international document aimed at uniting efforts in this regard, is of great importance. Especially at the current stage of human development, environmental problems are increasingly becoming a topic of discussion among scientists, politicians, and civil society institutions.

During the years of independence, the restoration, preservation, study, and transformation of the historical heritage created by the ancestors of the Uzbek people into the spiritual property of present and future generations has risen to the level of state policy. In the field of historical knowledge, research is being conducted on various aspects of world and Uzbek history. One of the new directions in this field is environmental history. This direction serves to enrich the aspects of the history of Uzbekistan and its integral part, the history of Khorezm, related to the relationship between "nature and society", to expand the knowledge of the population about environmental culture, to improve modern approaches to preserving the ecology and environment, rational use of natural resources, and to study and solve environmental problems.

In this regard, research has revealed the knowledge of the population of the Khorezm oasis, based on traditional farming and water management, rational use of natural resources based on climate and natural conditions, and the continuous fertilization, irrigation, and crop rotation of arable land.

Literature analysis and method.

A number of studies on the topic were carried out in Uzbekistan during the years of independence. These include the work of I. Jabborov, H. Ziyoev, R. Balliyeva, M. Jumaniyazova, Yu. Rakhmonova, U. Abdurasulov, S. Saimanov, S. Matkarimova, N. Kamolova, M. Karlibaev, S. Sulaimanov and others. They analyzed issues of land ownership in the Khorezm oasis, land-water relations and other aspects.

The role of modern foreign studies in this regard is also important. Among the works belonging to this group, one can cite the works of foreign specialists-scientists S. Becker, J. Seitz, E. Brit, P. Sartori, K. Bichsel, V. Naumkin, E. Burnakova, U. Zhuzbayeva and others. The issues reflected in their studies corresponded to the goals set by the authors, and within their framework, information on some aspects of the use of nature was also reflected. For example, the work of the American scholar S. Becker on the Khiva and Bukhara khanates is of great importance, in which the aspects of economic growth in the khanate are reflected in materials on the agrarian life of Khiva [1].

In V. Naumkin's photo album dedicated to Khiva, one can observe the presence of evidence substantiating aspects related to the nature of the Khiva khanate and its use [2].

In his research, J. Seitz studied irrigation and agricultural life in the Khiva khanate using the example of 1768–1914. The author shed light on the changes and continuity of irrigated agriculture in the Khiva khanate before and after the Russian Empire's conquest of 1873 [3].

In his research, E. Britt made a comparative analysis of two irrigation periods in the Khorezm oasis, namely the first, ancient, and the second, modern systems. According to the author, the specific characteristics of historical periods were considered an important influencing factor for environmental stability and human well-being [4].

In the preparation of this article, research was carried out based on the method of historical and comparative analysis, using historical sources, in particular, documentary materials, as well as scientific literature, and the results of modern research.

Discussion and results.

The centuries-old culture of land cultivation of the peoples of Central Asia was based primarily on artificial irrigation. Traditional and forgotten methods of land and water use in the region have adapted to climate change.

The soils of the Khorezm oasis were formed mainly on the alluvial deposits of the Amu Darya. The sharply continental climate, dry air, and human economic activity played an important role in the formation of this soil. The fertility of the soils in the oasis area was not very high, but the silt and various mineral salts brought by the river significantly increased the fertility of the soil. In the floodplains and old floodplains of the Amu Darya, meadow and meadow-swamp soils were

common on the alluvial deposits, and in the thickets, swampy soils. In the floodplains of the Amu Darya, thickets are abundant. Bushes and herbs such as poplar, willow, juniper, sycamore, yulgun, kandir, chiy, kuga, and sedge grew in the forests. It is recorded in the memoirs of authors of the 19th century that poplar and mulberry non-rotating nails were made for ships [4, 49].

Dates were one of the rare parts of nature in Amudarya groves. In these groves, there were a lot of different natural plants, especially reed beds. In the meadow soil areas of the oasis, there are sedges, wheatgrass, sedges, and saxovolum in sandy areas, and in salty areas, there is a plant of salt. The saxophones have slowed down the sand migration. Therefore, establishment of tree groves has long been considered important in maintaining the fertility of agricultural land [6, 38-39].

By the 11th century, the main type of agriculture in Khiva was grain growing. The abundant grain harvest is documented in the archival documents of the Khiva Khanate [7]. More than half of the arable land was allocated for wheat and millet, and about a fifth for cotton. The remaining land was planted with barley, rice, flax, sesame, melons, and watermelons. The population also grew sesame, a crop that required little water, in their fields. Craftsmen extracted oil from this plant and widely used it in confectionery. N. Muravyov (1819), who was in the city, noted that in Khiva “they consume an incomparable amount of sesame oil” [8, 87]. The population also cultivated ruyan and produced red dye from its roots. This plant grew for 3 years. The roots were collected, washed, dried, crushed, and boiled in boiling pots. One-year-old roots were better, but they gave less dye [5, 25].

Although horticulture played a much smaller role in the economy, apricots, peaches, vines, apples, pomegranates, pears, and other fruits were also grown in the gardens of Khiva [9, 18]. N. Muravyov, who visited Khiva in 1819, wrote about the country's horticulture and noted that Khiva was naturally devoid of forests, but there were many gardens full of fruits, sweet and healthy, which were replenished by the labor of the population [8, 87].

Melons were also grown in large quantities in the Khorezm oasis from ancient times. Sesame and flax, melons, watermelons, pumpkins, carrots, and onions occupied vast areas of melon crops. Khiva melons have been famous throughout the world for many centuries. Farmers knew that these melons grew well in sandy soil and reached their peak sweetness only when allowed to ripen during periods of low rainfall. Historical sources indicate that these melons, which constituted the main part of Khiva's exports, were wrapped in special gold-plated papers and transported to distant lands [11, 334].

In the 1890s, large caravans of Khorezm melon pulp were sent to France via Orenburg, where it was used to make the highest quality cognacs exported to Russia. Academician N.I. Vavilov in 1928 determined the average weight of Khorezm melons to be 10-14 kg. Khorezm melons were recognized as being unparalleled in the world in terms of size, sugar content, taste, long shelf life, and long-distance transportation [12, 7].

Khorezm farmers have long developed complex methods of crop rotation, which allowed them to cultivate the soil almost continuously during the growing season without quickly exhausting it. Several travelers have reported on the ability of Khorezm farmers to rotate crops in order to get the maximum benefit from their fields without losing productivity.

The high water of the Amu Darya was one of the main sources of fertility in Khorezm. The Amu Darya is famous for its muddy nature, and its floods have accumulated a huge amount of fertile soil. There is reliable evidence that the main fertilizer of the settled Khorezm people was humus. Local humus is still considered the most ecological and effective way to enrich the soil to improve plant growth.

One of the Russian authors, drawing attention to the practice of applying fertilizers in Khorezm, noted that "... instead of manure, in some places they prepared fertile fertilizers from a mixture of the remains of residential buildings with dry grass, sometimes ash and other things" [13, 210].

Indeed, when talking about the agricultural culture of the khanate population, which reflects the productive use of land resources, it is worth noting that the population prepared fertilizers and ointments for the fields in the autumn and winter seasons in order to increase soil fertility. For this, sand was thrown about two meters in a certain place. Then local fertilizers and soil that had been exposed to the sun were mixed several times. This ointment was prepared in an amount of 500 carts, sometimes more. In general, fertilizer preparation work could be carried out using this method at any time of the year. Trade in fertilizers prepared using this method was also carried out. There were many people engaged in the fertilizer trade in Khiva, and landowners bought fertilizer and spread it on their fields from the beginning to the middle of the spring season. All irrigated areas in the region received water from the Amu Darya, the river carried a large amount of silt, and therefore a layer of silt settled on the irrigated fields every year. In addition, fertilizers applied to arable land also contributed to strengthening the cultural-irrigation layer of the soil. To increase the fertility of the fields, farmers carried out special measures that had been developed over the centuries, namely, soil from the lands of old buildings and sand mixed with manure were thrown into the fields. In this case, manure became a fertilizer, and sand improved the physical properties of clay soils. 22% of the working time of farmers during the entire farming period was spent on applying fertilizers to the land [14, 200]. Thus, irrigation water, on the one hand, and the farmer himself, on the other, participated in the creation of the cultural-irrigation layer of the soil.

Foreign experts noted that the level of productivity of Khorezm agriculture during the period under study differed sharply from the average productivity in other regions of the world. Using fertilization and irrigation, high seeding rates, Khorezm farms in the years when agriculture was good, produced¹ 36 to 42 bushels from the ground² The average yield per acre in Khiva was at least 30 bushels. In 1900, only four states in the United States had an average yield of wheat exceeding 20 bushels per acre, and a third of the states had half that [15, 22]. The Russian zoologist Bogdanov treated the people of the Khanate with great respect, highly appreciating their skill and hard work, which was why the Khiva oasis agriculture was at a high level. "These peace-loving steppe cultivators did not destroy anything in nature," wrote Modest Nikolaevich, "but enriched the local fauna. They were not mistaken in choosing a place. It took a lot of work to turn the lifeless barren lands into a flourishing oasis, and now this area, surrounded by waterless deserts and sand dunes, is the most suitable place for agriculture, gardening, winemaking and silk production due to its productivity and healthy climate" [16, 132]. Such information is widely cited in the materials of 19th-century authors.

In conditions of water shortage, unique methods of land preparation, fertilization and irrigation were formed in the oasis. In particular, the preparation of the area for crops began with leveling the surface of the land, that is, the hills of the land were uprooted and the depressions were filled. For more convenient irrigation, it was divided into separate small areas separated from each other by ridges of soil. Then the field was washed away by repeated irrigation several times in a row. The soil, especially during the first irrigation, quickly absorbed water and dissolved salts came to the surface. Thus, the layer where plant roots mainly develop was cleaned. The method of draining water that was saturated with salt and had not yet had time to penetrate the soil was also used.

¹ Akr (ing. acre) – ingliz o'lhov tizimida yuza birligi. 1 A. = 4840 kv. yard = 4046,86 m².

² Bushel (ing. bushel) – suyuqliklar va sochiluvchan moddalarning hajm o'lchovi. Asosan, Angliya va AQShda qo'llaniladi. 1 B. = 36,4 l. (Angliyada); 1 B. = 35,2 l. (AQShda).

In the conditions of the Khorezm oasis, due to the proximity of groundwater (sizot), there was a long-standing tradition of growing guzhum and willow trees. The roots of these trees drew sizot into the lower layers of the earth, improving the meliorative state, and also provided a large amount of wood, which was an important resource for construction. In particular, the tolerance of guzhum wood to various conditions was taken into account [17, 124].

The air temperature decreased under the shade of the large-leaved and exotic guzhum tree. The guzhum tree is adapted to the hot and dry climate in Khiva, and because it also feeds on salt water, the temperature in its shade can drop to 35 degrees in 50 degree heat.

The rich experience accumulated over many years in irrigation work allowed the local population to develop certain skills in creating and implementing complex water management techniques. As a result, in the process of long-term development, the simplest methods of water extraction mechanisms gradually moved to more complex types, and a unique irrigation technique emerged.

In Khorezm, the simplest methods of water extraction from canals to fields were “sepma”, “depma” and “nova”, while the ancient water extraction device called “chgir” became the most “advanced” method.

Another feature of the natural conditions of the khanate was the issue of floods in the river. On the one hand, these phenomena required measures to protect the fields in agriculture, and on the other hand, they encouraged the productive use of it for irrigation of land in conditions of water scarcity.

The Amu Darya River overflowed several times a year. Since these floods coincided with the period when crops needed water, local farmers compiled a flood calendar based on centuries of experience. Therefore, in the Khorezm oasis there were special people who knew when the river flood would begin and how the river flow would change [18, 32]. According to their calendar, irrigated agriculture in the oasis (during the growing season) was based on 4 floods of the Amu Darya: 1) Blue reed; 2) White fish; 3) Star; 4) Forty chilgov.

In particular, the “Blue reed flood” (in late March), that is, begins when the reeds have just grown in the lakes. Depending on the growth rate of the reeds, it was determined whether the flood was timely or delayed. In mid-April, white fish began to migrate from the Aral Sea to the upper reaches of the Amu Darya. It was called “Aq balyk tashuvi”. “Yulduz tashuvi” (mid-May) was determined by the time of the appearance of the constellation of the stars Hulkar. “Kirq chilgov tashuvi” (summer chill) began in the second half of June and lasted for 40 days. If the floods were late or did not occur at all, this worried the whole country and indicated the imminent collapse of the economy [19, 305].

In the Khiva Khanate, ice formed in large canals and lakes during the winter months was cut off, piled up in one place in huge quantities, covered with earth, and then buried. The ice in such piles was used as a source of cooling in the summer. The ecological advantage of this was that the melting of the ice reduced the heat of the environment in the summer.

It is known that when salt water freezes, its salt molecules are squeezed out by ice crystals. As a result, when the ice melts, fresh water is formed. Therefore, the ice formed in the winter served as a source of fresh water and coolness in the summer [20, 26].

Conclusion.

The rich experience accumulated over many years in the use of land and water resources in the Khorezm oasis allowed the creation and implementation of complex water management techniques, as well as the formation of certain skills in the formation of land management technology. In conditions of water scarcity, unique methods of land preparation, fertilization, and irrigation were formed in the oasis.

In the Khiva Khanate, humus served as the main fertilizer. In some cases, in addition to humus, household waste and ash mixtures also served as fertilizers. It should be noted that the rich experience accumulated by Khorezm farmers in irrigation over a long historical period has allowed them to create sophisticated water management techniques.

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