

Section 3. Geography

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GEOGRAPHICAL ANALYSIS OF IRRIGATION EROSION PROCESSES IN THE IRRIGATED AREAS OF THE KASHKADARYA REGION

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Abstract

This article provides a detailed analysis of the extent of irrigation-induced erosion in the irrigated lands of the country, with particular emphasis on the irrigated areas of the Kashkadarya region. The negative impacts of this erosion on irrigated lands are discussed, and a number of recommendations are proposed as potential solutions to mitigate its adverse effects.

Keywords: *irrigation erosion, irrigation-induced erosion, soil erosion, Kashkadarya Basin*

Erosion occurring in irrigated lands under the influence of natural and anthropogenic factors is referred to as irrigation erosion. Irrigation erosion is widespread in foothill areas, sloping plains, and hilly terrains, particularly within the irrigated zones of the gray soil regions.

Irrigation erosion leads to a sharp decline in soil fertility and, eventually, to the complete degradation of the soil. Soils affected by this type of erosion are characterized by a reduced thickness of the soil profile, a lighter texture in the upper layer, lower contents of organic matter and mobile compounds, and higher pH values. In such soils, biological activity decreases, and surface crust formation is commonly observed.

In Uzbekistan, the area of croplands affected by irrigation erosion amounted to 798 thousand hectares (National Action

Program to Combat Desertification in the Republic of Uzbekistan, p. 63–66). The largest affected areas were observed in the foothill and hilly zones of the Tashkent, Samarkand, Kashkadarya, Surkhandarya, Andijan, and Namangan regions, primarily on light-colored, typical, and in some cases dark gray soils (Maksudov, H.M., & Gafurova, L.A., 2012, p. 216–217).

As can be seen from the data in Table 1, the regions of Uzbekistan most affected by irrigation erosion are predominantly mountainous areas. This is explained by the fact that the leading factors in the development of water erosion are, undoubtedly, the degree of slope in the relief combined with the intensity of precipitation. In particular, when comparing the regions most affected by erosion of irrigated lands, Syrdarya accounts for

57.1%, Samarkand for 50%, and Tashkent for 24.5%, making them the leading regions in terms of irrigation erosion (Table 1).

Table 1. *Area of agricultural lands affected by irrigation erosion, in thousand hectares (1999) (National Action Program to Combat Desertification in the Republic of Uzbekistan, p. 63–66)*

Administrative divisions	Total agricultural land, thousand ha	Irrigation erosion		Share in percentage
		Not observed	Observed	
Republic of Karakalpakstan	504	396	108	21,4
Andijan	276	255	21	7,6
Bukhara	275	269	6	2,1
Jizzakh	289	240	49	16,95
Kashkadarya	500	402	98	19,6
Navoi	115	114	1	0,86
Namangan	276	215	61	22,1
Samarkand	374	187	187	50
Syrdarya	327	140	187	57,1
Tashkent	389	292	97	24,9
Fergana	349	329	20	5,7
Khorezm	274	274	–	–
Across the Republic	4243	3445	798	18,8

In the Kashkadarya region, nearly one-fifth of irrigated lands – specifically 19.6% or about 98 thousand hectares – were affected by irrigation erosion. At the national level, this indicator stood at 18.8%, meaning that the Kashkadarya region corresponded to the national average. However, in several regions of the country, the figures were significantly lower than the average. For example, in Bukhara it was 2.1%, in Navoi 0.86%, and in Fergana 5.7%, while in Khorezm irrigation erosion was entirely absent, which is noteworthy.

It is evident that the processes of irrigation erosion in the irrigated lands of Uzbekistan have undergone a number of changes. In particular, the total area affected by this erosion across the country amounted to 682 thousand hectares in 2009, which is almost 100 thousand hectares less compared to ten years earlier. However, among the internal regions of the republic, the most significant changes were observed in Kashkadarya (159.7 thousand ha), Tashkent (138.6 thousand ha), and Samarkand (121.7 thousand

ha). Together, these three regions account for 61.5% of the total area affected by irrigation erosion in the country (Figure 1).

Erosion occurring in irrigated lands under the influence of natural and anthropogenic factors is referred to as irrigation erosion. In the Kashkadarya region, irrigation erosion is mainly distributed across foothill sloping plains and hilly areas (within the irrigated lands of the gray soil zone). In 2009, soils affected by irrigation erosion in the region covered nearly 159.7 thousand hectares, accounting for about 31% of all irrigated lands. Analysis of the available data indicates that the expansion of irrigated areas is accompanied by an increase in the extent of land affected by irrigation erosion (Figure 1).

Taking into account that examining this type of erosion at the district level within the Kashkadarya region may enhance the practical significance of the study, the state of this negative natural–anthropogenic process was analyzed for the year 2021 (Figure 2).

Figure 1. Area of lands affected by irrigation erosion, in thousand hectares (2009)

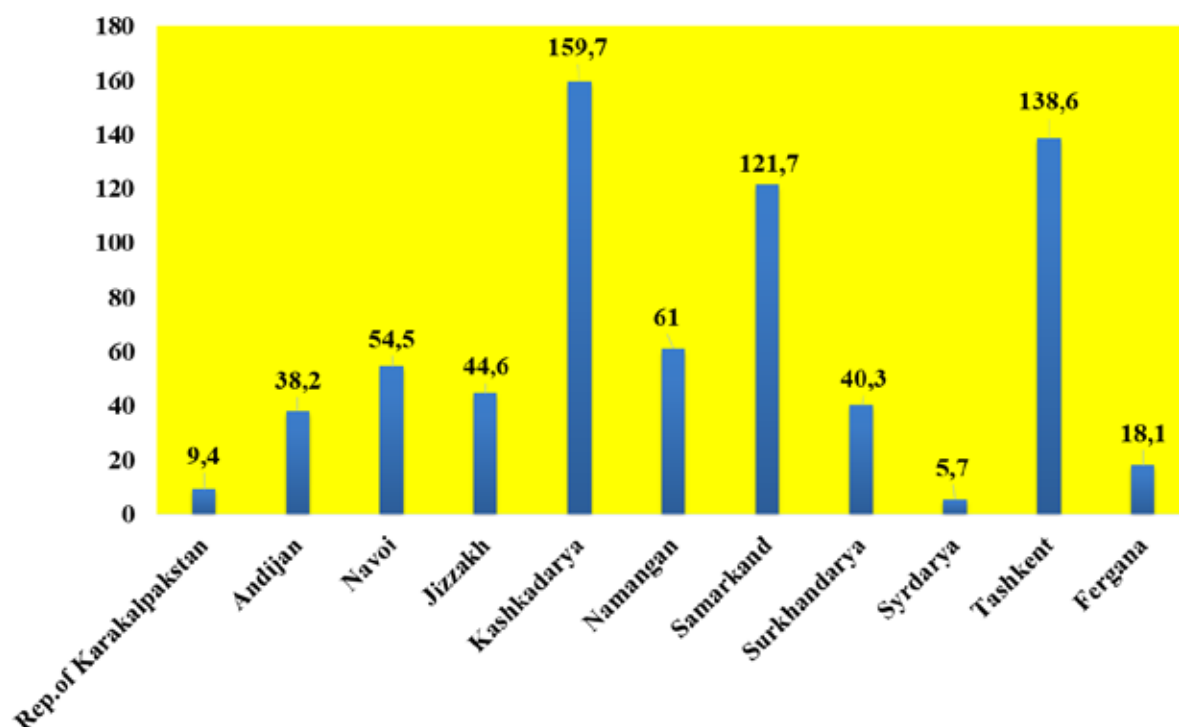
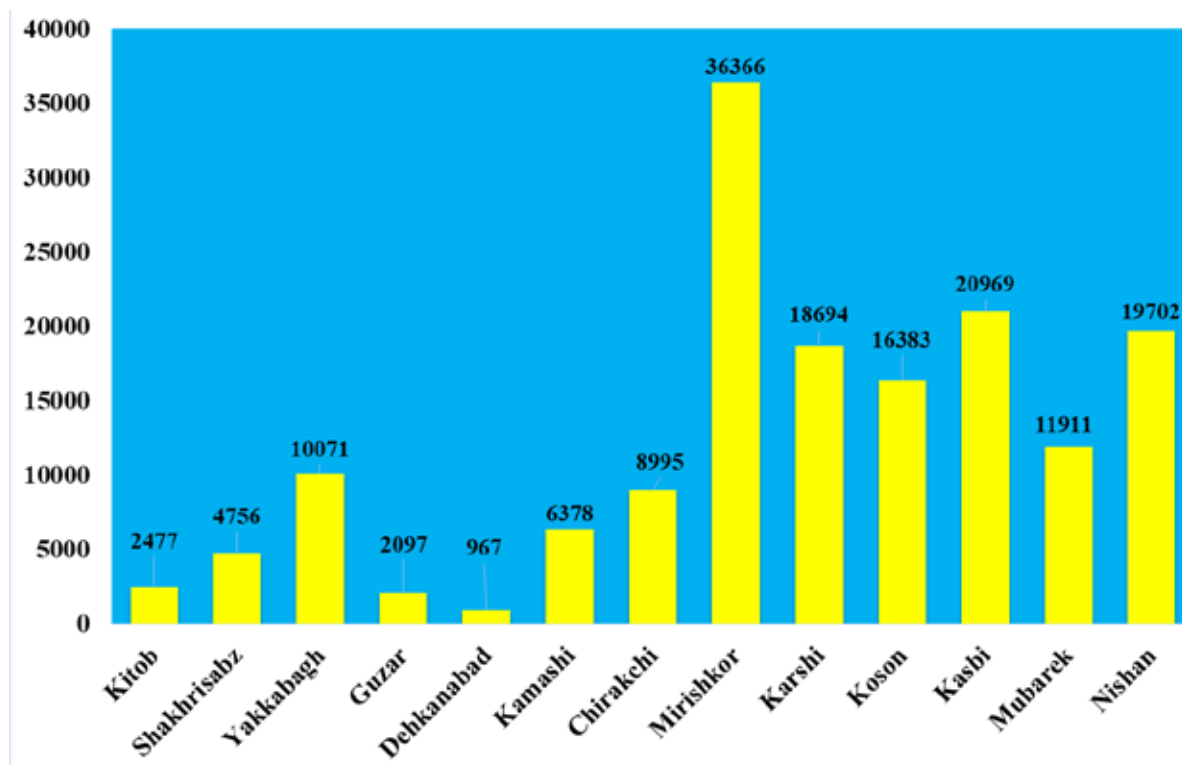


Figure 2. Areas affected by irrigation erosion in the region, in hectares (2021)



The data in the table were compiled by the author using information provided by the Regional Cadastral Chamber.

In the region, the total area affected by irrigation erosion amounted to 159.7 thousand hectares; however, this indicator varies significantly across districts. The largest areas

subject to irrigation erosion were observed in Mirishkor (36.3 thousand ha), Kasbi (20.9 thousand ha), and Karshi (18.6 thousand ha) districts. Together, these three districts accounted for 47.5% of all lands affected by irrigation erosion in the region.

One of the main reasons for the intensification of irrigation erosion in the irrigated lands of the oasis is the low resistance of gray soils to washout. According to A. Rasulov (1976), the total area of gray soils in the Kashkadarya Basin amounts to 2,068 thousand hectares, or 65.3% of the total territory. Of this, 917 thousand hectares are typical gray soils and 282 thousand hectares are dark gray soils. In addition, 55 thousand hectares of meadow-gray and meadow saline soils are distributed with-

in the basin (Rasulov, A. M., 1974). The widespread occurrence of these soil types in Kashkadarya undoubtedly plays a significant role in the development of irrigation erosion.

The distribution and intensity of irrigation erosion depend not only on the slope gradient, exposure, and morphology of the terrain but are also largely influenced by irrigation techniques. Indeed, one of the primary causes of the development of irrigation erosion is the inherent susceptibility of soils to washout.

In addition, chemical reclamation, the establishment of shelterbelts, the cultivation of protective crops, and the application of crop rotation are proven measures in combating soil erosion.

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