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Assessment Of The Influence Of Changes In The Hydrological Regime On The Forest Plant Community

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Annotatsion. The article assesses the impact of changes in the hydrological regime on the tugai plant community. According to the research results, it was established that the dynamics of groundwater influences tugai vegetation. As a result of changes in the hydrological regime in the lower reaches of the Amu Darya, the process of halophytosis of soil and vegetation significantly intensified, which began with the regulation of river flow, which led to the emergence of various halophytic variants of tugai forests and the degradation of typical tugai ecosystems.
Key words: *Ecosystem, reserve, groundwater, ecological factors, salinity, humidity, plants, biocenosis*

In the tugai massif of the Badai-Tugai Reserve, preserved in the lower reaches of the Amu Darya, dynamic changes that began in the soils under the tugai forests in connection with the regulation of river flow can be verified using the example of the reserve.

Soils under the Turanga tugai (Populus ariana) have an average degree of salinity (0.6-0.98%) per meter from the surface, 0.1-0.4% (non-saline - slightly) values per two meters, and only at three meters are completely non-saline (0.04 - 0.08%) soils. At the same time, in mixed communities of Turango-Petta and Petta (Populus ariana + P. pruinosa, P. pruinosa), soil salinity in the meter layer was slightly higher - 1.2 - 1.6%, reaching a strong (salinized) level.

Tugai (Ass. Halostachys belangeriana + Tamarix hispida) under halophytic variants of the final stages of evolution, the average salinity of the first meter reaches the degree of strong and very strong salinity - (1.6-4.5%), the surface horizon is from 9.3 cm to 23.4%, in the second meter - the degree of strong salinity (1.5%) and in the third meter - the degree of medium salinity - 0.5%. In the early 90s, the soils distributed under the Salih young willow communities were the least saline: 0.09% in the first meter layer and 0.05% in the second meter layer.

In 2001-2002, a further comprehensive study of soil, vegetation, and groundwater was conducted in the Badai-Tugai Reserve. In connection with the construction of the South Karakalpak Main Collector (Kuzmina, Treshkin, 2003), it became known that almost the entire territory of the reserve consists of various automorphic and semi-automorphic soils, groundwater is constantly located at depths from 3.5 to 5.5 m and deeper, under the influence of the minimum amplitude of seasonal fluctuations (up to 1.5 m), precipitation, and does not depend on changes in the water level of the Amu Darya or its Kokdarya channels. At this time, soil salinity under the tugai forests is constantly increasing, and by 2002, it exceeded 2% by weight for the first three meters (based on the dry residue of the aqueous extract) and will continue to grow in subsequent years. In 2002, the average salinity level for each of the first three meters varied from 4.2% to 2.5%.

Previously, in two- and three-meter layers, weakly and moderately saline tugai soils have transformed into highly and deeply saline solonchaks. Under such unusual conditions of existence (severe soil salinization due to the absence of mudflows and gradual deepening of groundwater), the reserve's forest fund continued to rapidly decline.

By 2004, only dried tugai forests remained in the forested area of the reserve (from 80 to 100%), all of which were deprived of the grassy layer and turned into sparse dead cover of turanga trees of different ages. The areas of completely dead wood have significantly increased, and through the efforts of the reserve's workers, measures have been taken to prevent fires and a mass epizootic of bark beetles and wood bugs capable of completely destroying the remaining forest areas of the reserve.

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By 2004, mesophilic tugai plant species appeared in the reserve: *Trachomitum scabrum*, *Erianthus ravennae, Digitaria sanguinalis, Lactuca tatarica, Lepidium obtusum, Karelinia caspica, Cynanchum sibiricum, Polygonum lapathifolyrrospin hadede, Polygonum terg, Taraxacum spp., Clematis orientalis, Qushqönmas turcestanica, Halimodendron halodendron, Salix songarica* were found in significant quantities, even forming thickets.

From 2004 to 2011, the following plant species were not registered in the reserve: *Saccharum spontaneum*, *Imperata cylindrica*, *Calamagrostis dubia*, *Atriplex thunbergiifolia*, *Juncus soranthus*, *Bolboschoenus maritimus, Rumex halacsyi, Solanum,* the first four of which belonged to the typical flora. In addition, the main tugai species in the reserve completely replaced the mesophyte T. ramosissima by halophyte *Tamarix hispida*.

Thus, at the beginning of the 21st century, the process of halophytosis of soil and vegetation cover in the lower reaches of the Amu Darya intensified significantly, which began with the regulation of river flow, which led to the emergence of various halophytic variants of tugai forests and the degradation of typical tugai ecosystems.

The peculiarities of climatic conditions, which have been quite unstable in recent decades, make the issues of dynamic changes in ecosystems very relevant today. Changes in humidity conditions in river valleys and deltas lead to rapid changes in ecosystems (Novikova et al., 1998, 2001; Treshkin, Kuzmina, 1989, 1993; Pankova et al., 1994, 1996; Kuzmina, Treshkin 1999, 2001, 2003; Kuzmina, 2005; Kouzmina, 2004; Kouzmina et al., 2005; Kuzmina et al., 2011, 2011).

A complete change in the vegetation cover of deltas and plains is facilitated by the regulation of the movement of new hydraulic structures and rivers over long distances, which, in turn, contributes to a change in the structure of agricultural use of territories. Changes in the number and distribution (often disappearance) of many valuable endemic, commercial, and rare species of plants and animals can lead to changes in the soil conditions of adjacent territories (Henrichfreise, 1996, 2000; Kouzmina, 2004; Kouzmina et al., 2004, 2005).

Depending on the proximity of some communities, meadows with high meadows or communities of trees and shrubs are formed, in the first year the height of the shrubs can reach up to 1 m, by four years they already turn into dense thickets 3-5 m high, by 20 years they form a full-fledged poplar (from turanga) up to 20 m high, which begins to die at the age of 40-60 years (Zakrteger, 1927; Drobov, 1951; Treshkin, 1990).

According to the profiles of the ecological model compiled by scientists Treshkin and Kuzminov (1996) of the Badai-Tugai Reserve, extensive studies were conducted with a detailed description of soil pits along 10 sample plots with a depth of more than 3.5 m. This allowed drilling groundwater along the profile and in various biogeocenoses to determine that in the forest part of the reserve in the early 90s, the groundwater level (GW) in the low-water period varied from 2.0 m on sandy islands. Along the river (in the old-plain part of the Amu Darya) the groundwater level was 3.1-4.5 m, and at the time of the creation of the reserve (1973-1976), the groundwater level in the plain forests was low, i.e., 1.5-2 m (Baklanov et al., 1980).

Based on the results of a study conducted in 2022 in the territory of the Lower Amudarya Biosphere Reserve, it was established that a certain dynamic is observed in the state of groundwater (Fig. 1).

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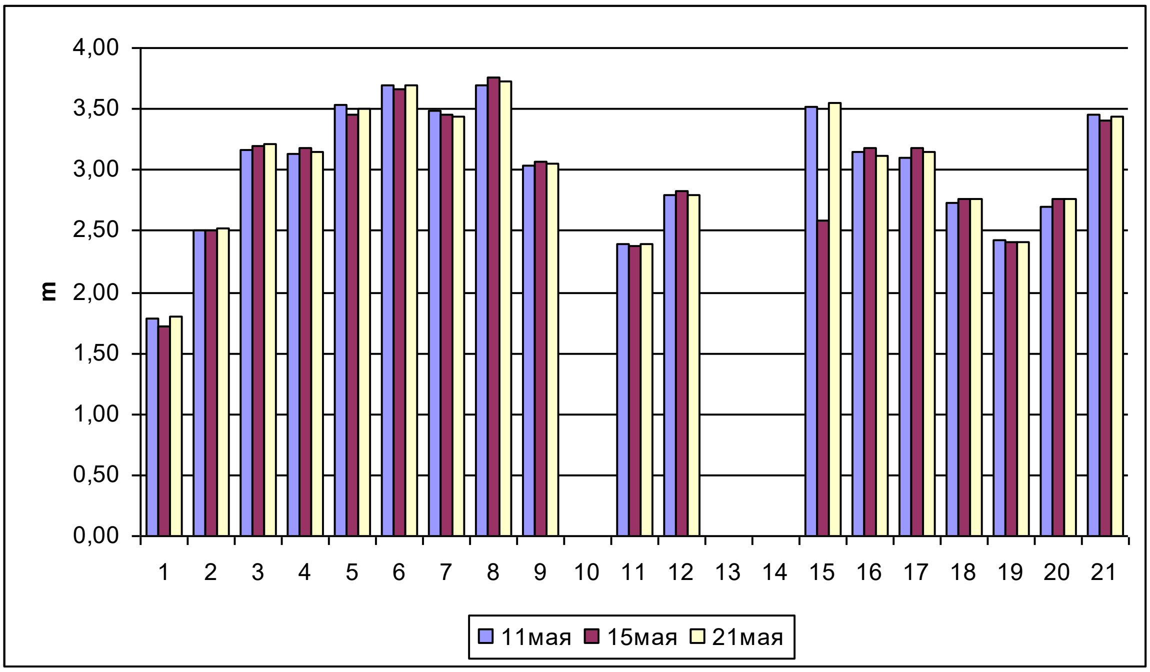

Figure 1. May 2023 by cross-sections in the Lower Amu Darya Biosphere Reserve territory water level dynamics

Thus, according to observations in May 2023, the maximum level was recorded at levels 6, 8, 15, and 21. It should also be noted that the water rise at the beginning and end of the month is not very large compared to the middle of the month.

Subsequently, water level monitoring was repeated in August and September (Fig. 1 and 2). Analysis of the dynamics of groundwater levels in the territory of the biosphere reserve showed that in August 2023, a rise in the water level was observed. The highest indicator was on August 26, 2022, at cross-sections 3, 5, 8, 9, and 16, up to 4.43 m. The lowest water level during the entire month was at the 1st section, i.e., 1.7 m, at the 10th, 13th, and 14th sections the water level was zero. Also, in the middle of the month, a sharp drop in water was noted in Stvor No. 15, where it amounted to 0.4 times.

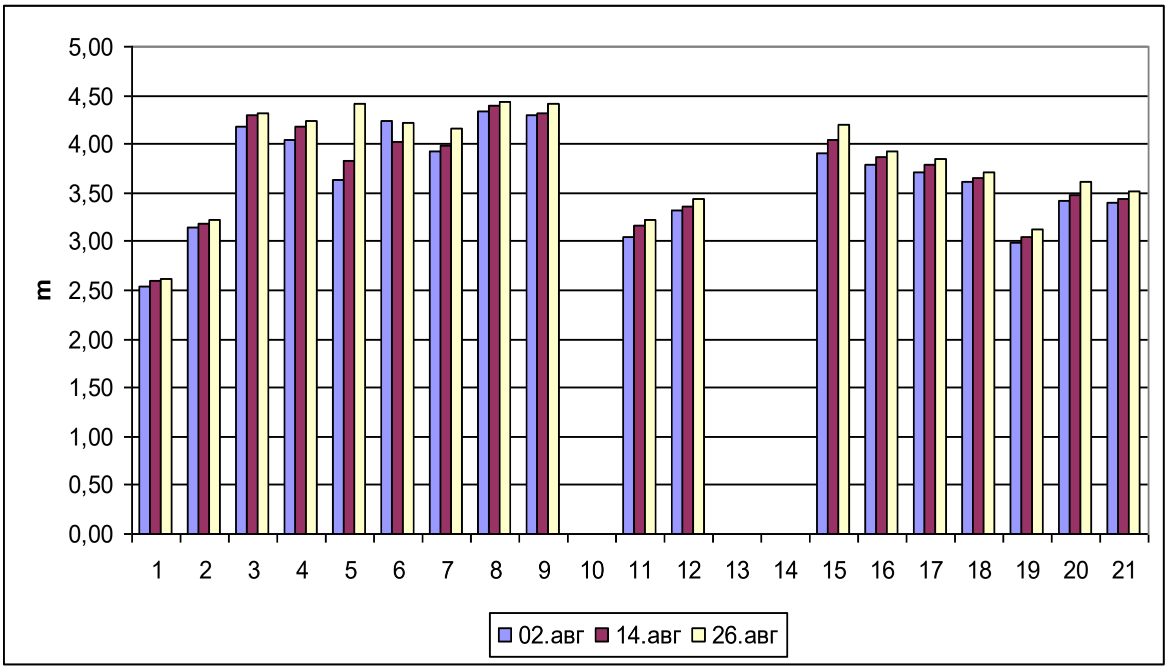

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Figure 2. Dynamics of groundwater levels by seams in the territory of the Lower Amu Darya Biosphere Reserve as of August 2023

Let us consider the dynamics of the water level in the established cross-sections as of September 2023 (Fig. 2). As can be seen from the figure, a high level was observed only at the beginning of the month for all sections. In May, the maximum value of the groundwater level rise was 3.76 m, in August the maximum value was 4.43 m, and in September the maximum value was 3.94 m. The lowest groundwater level was observed in May - 1.72 m, in August - 2.53 m, and in September - 2.21 m. The results show that by the end of the month, patterns of decreasing groundwater dynamics were recorded in all sections.

Thus, having analyzed the literary sources on the dynamics of tree and shrub vegetation in the tugai forests of the lower reaches of the Amu Darya, we can conclude that this is currently significantly complicated by anthropogenic interference and a change in the tree cenotype. Shrub formation occurs mainly not due to endodynamic changes, but due to direct (desertification process) and local (transformation changes) human influence.

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