

**ENVIRONMENTAL CONSEQUENCES OF THE CREATION  
AND OPERATION OF RESERVOIRS IN THE STEPPE ZONE**

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Water reservoirs are so common worldwide that the changing they bring have reached a planetary scale. Water regimes are changing in the basins and on the shores of reservoirs, along the rivers and all the way to river deltas and receiving water bodies. Ecological consequences, i.e. a response of ecosystems and their components to changes in the water regime, are expressed in the increase or decrease of water availability, depend on the landscape and have zonal specificity.

Our research explores the largest reservoirs in the steppe zone of the European part of Russia, in the deltas of the Volga and Amu Darya rivers, and the Aral Sea Region. Additionally, we have analyzed an extensive list of scientific literature for the article.

In modern steppe landscapes, reservoirs are an important factor transforming the natural environment. Under the influence of changes in the regime of river runoff, the hydrogenic transformation of landscapes came to its end on the shores of reservoirs, i.e. natural complexes that are adapted to annual flooding have been formed on their shores. Meanwhile, their exposed bottoms become overgrown with pioneer communities, the long-term dynamics of which depends on annual water level fluctuations.

Artificial reservoirs are the reason for formation of hydromorphic biotopes in arid conditions of the steppe zone that are rarely found in natural conditions, and also for a maintained natural biodiversity of soils, vegetation and animals.

Negative ecological consequences in the lower pools of reservoirs in the steppe zone are especially strong in the river deltas and receiving water bodies. They are caused by changes in water regime and increasing irretrievable and partial withdrawal of river runoff due to cascades that have appeared on the rivers after an arid warming in the river basins.

Environmental protection activities to mitigate or completely eliminate these negative consequences are based on the management of the volume, regime and quality of river runoff directed to the lower pools of hydrosystems. For Russia, schemes of integrated use and protection of water bodies, as well as norms of permissible impact of economic and other activities on water bodies, including permissible irretrievable withdrawal of runoff, environmental flow and water releases, have been developed. However, our studies showed that ecological runoff (including release of water) is not carried out in most river basins which worsens the condition of aquatic and floodplain ecosystems. There are water protection zones on the shores of reservoirs, up to 200 m wide on the largest reservoirs. We found out that this protection zone is smaller than the influence zone of reservoirs on the shores, which manifests itself in backwater and groundwater dilution: zone of the Krasnodar reservoir is from 25 to 560 m, about 300 m on the Tsimlyansk reservoir, up to 540 m on the Veselovsk reservoir, and 13 to 107 m on the Proletarsk reservoir. It is practical to set the width of the protection zone

along the boundary of direct impact of the reservoir.

At the same time, the natural complexes forming on the coasts become biomeliorants, i.e. they prevent pollution, siltation and depletion of water bodies. These complexes hinder erosion, maintain stable hydrochemical regime and biodiversity of coastal aquatic ecosystems, which are limited in the steppe zone.

*Keywords:* water reservoir, upper and lower pools of the hydroelectric system, river deltas, receiving water bodies, water regime, runoff volume reduction, water factor, hydromorphic soil indices, vegetation, animals, evaluation criteria, ecological consequences, salinization, environmental protection measures, steppe zone.

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