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"Water Bankruptcy": Is it a threat to the Volga and Moscow Rivers?

Many regions of the world, especially arid ones, have recently come close to such a large-scale phenomenon as 'water bankruptcy'. This term means a state in which the excessive use of water resources leads to their irreversible loss. Will this crisis affect Russia? This and many other questions were answered by Philipp Sapozhnikov, Leading Researcher at the Shirshov Institute of Oceanology, Russian Academy of Sciences (RAS), in his interview to BM.Moscow Foresight.

- It is obvious that rivers like the Volga and many of its tributaries, including the Oka and the Moskva, are drying up. However, given Russia's immense size, it holds substantial water resources by global standards, underpinned by multi-stage water management systems and vast drainage basins. Therefore, despite increasing domestic consumption and climate change, we are still far from reaching a state of 'water bankruptcy'.

- Could you remind our readers how the Moskva River is connected to the Volga?

- The Moskva River is a tributary of the Oka, which feeds the Great Russian River. Incidentally, it was Peter the Great who first conceived the idea of connecting the Moskva River with the Volga, but it was left to the Soviet government to bring this vision to fruition. In the early 1930s, the capital was growing rapidly and experiencing a severe water shortage, as the Rublyovo water supply system could not cope with the rising demands of the three-million-strong city. In some places, for example,

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opposite the Kremlin, where the Bolshoy Kamenny Bridge is now, the Moscow River became so shallow that it could be waded. Furthermore, at that time, there was no central water supply or heating in the city.

The Volga saved Moscow; for this, a 128-kilometer-long canal had to be dug. The main problem during its construction was the Dmitrov Ridge, located 60 meters above the level of the Moskva River. Laying a canal through it seemed an impossible task.

A very original solution was found: to create a "water bridge." To do this, a dam was built on the Volga River near the village of Ivankovo, which resulted in the creation of the Ivankovo Reservoir. Part of the water from it went along the old Volga riverbed, and another part went through an artificial canal to Moscow. For this reason, the water balance of the Moscow River is heavily connected to the water balance of the Volga.

The scale of the Moscow Canal project remains staggering even today: a total of 240 hydraulic structures were built, including locks, dams, reservoirs, hydroelectric power stations, three ports, and numerous piers. It was during this time that the artificial lakes so beloved by Muscovites were created: the Ikshinskoye, Uchinskoye, Pyalovskoye, Pestovskoye, Klyazminskoye, and Khimkinskoye reservoirs.

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- Do you mean that understanding the causes of the Volga's shallowing will explain why the water level in the Moscow River is falling?

- Absolutely correct. Scientists identify several reasons for the shallowing of the Volga River. On the one hand, this is a result of climate change and shifts in the ecosystems of the Volga catchment basin, and on the other hand, it is the influence of

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human activity.

Rising average annual temperatures are leading to changes in precipitation patterns and the drying up of small rivers that feed the Volga. Winters are increasingly becoming warm and low-snow (with the exception of recent months), and the depth of soil freezing is decreasing. As a result, meltwater seeps into the soil in spring and does not fill the rivers flowing into the Volga. In summer, there is often not enough precipitation to replenish the necessary water levels. Furthermore, summer heat increases evaporation from reservoirs and river surfaces, which further reduces the volume of water flowing into the Volga.

Previously, water used to be retained in swamps and forests during spring, which protected rivers from drying up in the summer. However, due to the destruction of these ecosystems, water overflows riverbeds in the spring causing severe floods, while a water shortage occurs in the summer.

Regarding the human factor that continues to negatively affect the Volga's water levels, one does not have to look far for examples. Sand mining and widespread infrastructure construction near rivers are altering watercourses and the supply system of the reservoirs.

Another serious reason for the Volga River's shallowing is the violation of water protection zones. In many places, including the banks of the Volga, Oka, and Moscow Rivers, mass construction of cottage communities is taking place, right up to the water's edge. The new households growing along the water restrict runoff from floodplains. This also leads to a disruption of the ecological balance.

Water withdrawal from rivers for agricultural irrigation and urban water supply also leads to a decrease in total river runoff.

We all know the Tver swamps, as well as the Valdai swamps. It must be admitted that local land improvers worked tirelessly,

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trying very hard to turn wetlands into agricultural land, and they succeeded, it must be admitted—hundreds of thousands of hectares of land were drained and turned into arable fields. As a result, the natural reservoirs for the gradual recharge of the Volga disappeared. Certainly, this phenomenon has significantly affected the decrease in the level of the Volga.

Furthermore, farmers are plowing up floodplain meadows because of the fertile soil there. Of course, one could say this is quite natural and that peasants have always done this. However, let us not forget that cropland is an evaporator with a manifold increased surface area. Because a meadow, where things are growing, holds water with plant roots and protects the soil from evaporation with its shoots, whereas open-air cropland is a powerful evaporator. Nevertheless, there is no way around it; farmers and the population need large harvests.

Unfortunately, the deforestation of floodplain forests continues. In spring, when snow melts in the forest, the water absorbs into the soil, gradually forming small creeks and entire rivers that eventually flow into the Volga. When the forest is cleared, however, the snow mostly just evaporates—or it drains rapidly into small waterways, causing them to rise sharply for a short period. Meltwater, in turn, saturates the soil, seeps into the ground, and joins the groundwater flows. However, these flows may not empty into the waterways that feed the Volga. They do not always head toward the nearest bodies of water; they have their own underground routes.

Unreinforced reservoir banks and the discharge of polluted wastewater into the Volga River lead to silting of the riverbed, which reduces the Volga's depth and forms shoals and water barriers.

- How directly can all these factors be applied to the Moscow River?

- The shallowing of the Moskva River is a complex process, which also depends on a combination of natural and anthropogenic factors.

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Let's say, rising air temperatures can lead to increased water evaporation, especially during dry periods. Temperature swings and rapid snowmelt can reduce snowpack water reserves, which affects river filling.

Conversely, low rainfall or snow reduces the amount of water flowing into the riverbed.

Scientists classify the increase in urbanized land area as an anthropogenic factor. Waterproof surfaces (asphalt, concrete) do not absorb moisture, causing it to flow immediately into the river, which affects the hydrological regime. Massive development along the banks of the Moskva River also deprives the land of its ability to retain moisture and regulate water flow.

Forests and wetlands in the Moscow region act as natural water regulators, absorbing moisture and releasing it gradually into the river system. Deforestation causes water to run off too quickly during spring floods, leading to shallow water levels in summer. Similarly, draining wetlands deprives the Moskva River of its natural water source.

Intensive water consumption (for example, for city water supply or power plant operations) can also lower river water levels. Dams, locks, and other hydraulic structures regulate water levels, but their wear and tear or violation of operating rules can lead to shallowing.

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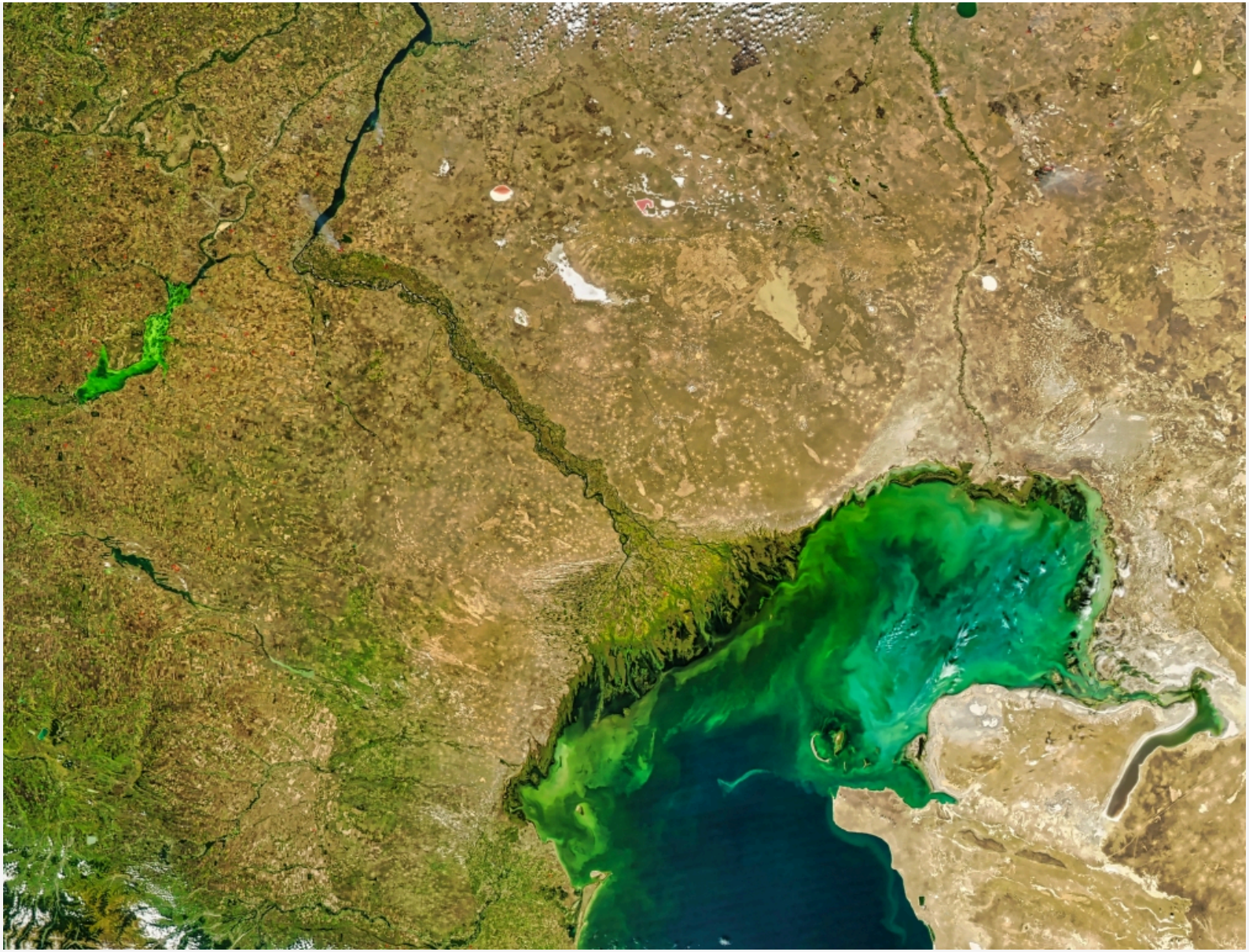

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- What is happening in the Caspian Depression, where a vast network of river branches of various sizes is scattered across the Volga avant-delta?

- Over the last six or seven years, water levels in the avant-delta have been dropping rapidly: areas that used to be 1,5 meters deep are now only 20 to 30 centimeters. Recently, as our scientific expedition navigates the channels of the avant-delta out into the Caspian Sea, we have had to slow down our motorboats to avoid the risk of damaging the hull or the propeller.

Sometimes, due to strong wind-induced surge in the northern Caspian Sea, water levels in the channels can drop drastically and unexpectedly. In May 2025, a group of scientists from the Institute of Oceanology expedition took a boat to the southern edge of the avant-delta along one of the longest channels to collect water samples. When they decided to return to base, they noticed that while they were traveling south, the water had dropped by another 10 centimeters by the end of the day. As a result, they had to drag their heavy boat by foot through the shallows for 18 kilometers.

- There is a widespread opinion that hydraulic structures on the Volga have a negative impact on the river. However, it used to be widely accepted that hydroelectric power plants were the safest and most environmentally friendly sources of energy...

- The Volga-Kama Hydroelectric Cascade consists of 13 hydro-engineering complexes, which house 12 hydroelectric power plants. Their total capacity exceeds 12,000 MW. This accounts for about 4% of all electricity generated in Russia.

Indeed, unlike coal-fired thermal power plants, hydroelectric power plants do not pollute the air. Furthermore, the creation of reservoirs on the Volga improved shipping conditions and made it easier to supply settlements with fresh water. The problem of floods, which used to affect Nizhny Novgorod, Kazan, Rybinsk, and other cities, was also resolved.

But there is a price to pay: decades on, the impact of human activity on the river is clear. Water quality has dropped, the salt balance has altered, parts of the Volga have dried up, and fish are dying, while algae blooms occur more frequently.

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- The media has repeatedly reported that there is an excess of fallen leaf mass in the forests of central Russia, which allegedly contributes to the shallowing of the Volga River and its tributaries. Is this an exaggeration?

- The uncontrolled spread of certain broadleaf trees and large shrubs poses an ecosystem modification threat, leading to the displacement of native species and the disruption of the overall ecological balance, including the hydrological balance.

This is not about aspens or birches, but rather boxelders and hazel, whose leaves tightly block natural moisture from reaching the ground across many areas of the Moscow River watershed. According to scientists, hazel displaces other plant species, forming monoculture stands where the herbaceous layer forms much weaker under its canopy than in birch or aspen forests.

Furthermore, hazel releases substances that inhibit the growth of other plants. This leads to the formation of bare soil, which accumulates dirt and dust. Because of this, hazel is sometimes considered a weed.

If you take a close look at how the forests in Central Russia have changed in recent years, you will see a massive increase in hazel. Places that used to be open birch or pine woods now have a new understory: sprawling 6–9-meter-tall hazel bushes.

The second species of broadleaf trees that has become massive is the boxelder maple, which over the last decades has quietly produced abundant growth along the Volga forests. It is its leaves that cover the ground with a thick carpet during leaf fall, preventing moisture from seeping into the ground.

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On one hand, the mass growth of fast-growing hazel and maple is beneficial: they retain water in the upper soil layer, releasing it to taller trees during dry summers. However, their falling leaves end up in streams and silt up the bottom as they decay, causing the water level of forest rivers to rise. Broadleaf cattail, reeds, and sweet flag then expand across the shallows. As a result, the streams become nearly impassable for water flow.

The former operating system of the Volga River was based on specific flow velocities and volumes in small waterways. Now, as total siltation and shallowing of these watercourses occur, combined with overgrowth, water rushes through in spring, yet moves very slowly in summer. While there is no vegetation on these silt beds, spring water flows quickly through the stream channels. However, in summer, it barely moves, struggling to push through the thick, massive aquatic grasses.

Such a picture is observed today in the forests of the Moscow, Yaroslavl, Vladimir, Ryazan, Kaluga, and Tula regions.

- Who should regulate the water level in the Volga reservoirs?

- This constitutes a crucial aspect of hydropower station management, enabling the efficient regulation of water resources to meet the demands of the power grid, agriculture, water supply, shipping, and other water users.

In spring, the river fills with meltwater, and reservoir levels rise simultaneously. However, evaporation losses there are colossal, reducing the volume of water reaching the Volga avant-delta. It is estimated that due to the heat during the summer of 2023 alone, 80% of the Volga water failed to reach the Caspian Sea.

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- What measures could you, as a scientist, suggest to help the Volga ecosystem?

- For this, first and foremost, water protection measures must be introduced: restricting economic activity within water protection zones, restoring floodplain meadows, and... creating artificial wetlands. Yes, indeed, such projects already exist.

Among the priority measures, it is crucial to establish local environmental education for the population. For instance, some irresponsible rural residents follow an old, obscure tradition of burning grass in floodplain meadows every spring. This exposes the ground surface, turning it black with soot, which causes it to heat up rapidly during the day and accelerates water evaporation. At the same time, wildlife suffers immensely—mice, hedgehogs, and even hares inhabit the dry, last-year grass, and bird nests are hidden there...

Currently, plans are underway at the state level to restore the network of hydrological stations at the mouths of tributaries flowing into the Volga River, establishing precise control over water inflows, outflows, and the reasons behind these fluctuations.

For the time being, I believe these measures will be quite sufficient to prevent **'water bankruptcy' in Russia.**

Sergei Kron.

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