

# U W E C

Ukraine War Environmental Consequences Work Group

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## Dear Friends!

Analysis of the environmental consequences of Russia's invasion of Ukraine facilitates understanding of military anthropogenic impacts on the environment and how (and whether) nature adapts in response. Some consequences, such as the desalination of the Black Sea as a result of the **explosion of the Kakhovka hydroelectric power station**, turned out to be less dangerous in the short term than experts had expected. Not much is said about other consequences, for example, the possible "seizure" by **introduced and invasive species** of areas most affected by military operations.

Our Work Group analyzes cases of the war's impact on the environment, and this allows us not only to understand the consequences, but also to identify adaptation strategies.

The explosion of the Kakhovka hydropower station dam on 6 June 2023 has been described as an example of ecocide during Russia's invasion of Ukraine. Even earlier this summer, UWEC experts <u>noted</u> that we will only be able to begin a full analysis of these consequences in the coming months.

For the time being, it seems that the disaster has not had serious negative impacts on the **Black Sea ecosystem**. Freshwater dilution of the sea's salinity was not as radical as expected, and local species, such as dolphins, suffered no more greatly than usual since the beginning of the war. However, clearly this is only a preliminary analysis, and more detailed research is ongoing. Of particular concern is the wartime release of heavy metals, nitrates, and phosphates into the Black Sea. Large rivers such as the Dnieper, Danube, and Don are continuously polluting the sea, and the additional anthropogenic load is problematic for the Black Sea:

• Black Sea heals its wounds: 4 months after the Kakhovka catastrophe

As for the now-dry Kakhovka reservoir, we see active regrowth of forest at an impressive rate of growth. In just a few months, two- to three-meter-tall willows and poplars have appeared. There was even talk of the possible restoration of the forests of the "Great Meadow" (Velykyi Luh), the area flooded as the complex's dams were erected. And although power engineers are determined to restore the Kakhovka hydropower station, environmental experts are categorically against it, unable to find any economic or energy argument in favor of rebuilding:

• Is it time to restore Velykyi Luh?

Another topic in need of particular analysis is ecosystem restoration plans in Eastern Ukraine, especially those areas affected by hostilities. As the head of Ukrainian Nature Conservation

Group and UWEC Work Group expert Oleksiy Vasyliuk notes, there is a high probability that war-affected lands will become hubs for the spread of invasive species, as well as centers experiencing ecosystem change. Full analysis must wait until peacetime; for now, the war is ongoing. Meanwhile, satellite monitoring allows us to make preliminary assumptions:

• <u>Restoring Ukraine's nature post-war: Hopes and risks</u>

*Our fifth webinar, held jointly with <u>Reporters</u> <u>Without Borders – Sweden</u> and <u>Svea Green</u> <u>Foundation</u>, was dedicated to the use of satellite data, open source data, and information-gathering on the environmental consequences of war. During the event, Olexander Opanasenko of Ukrainian NGO Ecodia, OSINT Analysis Specialist Wim Zwijnenburg, and expert Linas Svolkinas of CEOBS gathered to discuss techniques for understanding and assessing the environmental consequences of the invasion of Ukraine. The webinar recording and presentations can be viewed on our website:* 

• <u>Webinar 5: Gathering and analyzing data on the environmental consequences</u> of Russia's invasion of Ukraine

Another important issue is the state of occupied territories – a situation in which very little information is available. One of the largest nature reserves in Europe, **Askania-Nova Nature Reserve**, not only remains within the occupation zone, but also suffers negative impacts. In September, almost 2,000 hectares of its protected steppe burned from fires caused by combat operations. Instances involving construction of military structures on the reserve's territory have been recorded, in part using satellite data. Despite this, it remains difficult to understand the impacts on the reserve's animals and remaining protected areas workers and to what extent work is continues inside the occupied reserve:

• Fires in Askania-Nova: Consequences of military occupation of a reserve

As we have written more than once, the war in the region is not limited to Ukraine and it has been going on for quite a few years. Hybrid warfare negatively impacts Europe's protected areas as a whole, often dividing them, for example the unique **Białowieża Forest**. These impacts are also recognized at the international level. For example, construction of border fences was condemned during the **UNESCO World Heritage Session** that occurred in late September. Read more about how the session on World Heritage went in the context of a growing global political crisis in expert Eugene Simonov's article:

• **UNESCO condemns construction of border fences** 

We continue to follow the environmental consequences of the invasion on our <u>website</u>, on <u>Twitter</u> (X) and on <u>Facebook</u>.

Wishing you strength and peace! Aleksei Ovchinnikov Editor, UWEC Work Group



## Black Sea heals its wounds: 4 months after the Kakhovka catastrophe

Research by Ukrainian scientists into the impact of the Kakhovka hydropower plant dam's destruction on life in the Black Sea reveals unexpected results.

On 6 June 2022, Russian occupation forces launched a terrorist attack, blowing up the Kakhovka hydropower plant's dam. Almost 140 km2 of land was <u>flooded with water</u>. Households, cesspools, landfills, sewage drains, warehouses with agricultural chemicals, car engines, and the generating units Viktoria Hubareva Translated by Jennifer Castner

of the hydropower station itself, gas stations, and bottom sediments in the Kakhovka Reservoir – all was washed away by the floodwaters, ultimately ending up in the Black Sea.

Director of the Ukrainian Scientific Center for Marine Ecology (UkrNCEM) Viktor <u>Komorin reported</u> that the center's staff analyzed water samples and discovered colossal pollution of the Black Sea following the disaster. Their analysis showed much higher



*Cyanobacteria, or blue-green algae. Consuming organic matter, they multiply and result in algal blooms. It is these bacteria that give water its greenish color. Source: <u>Cyano CBF</u>* 

than typical levels of heavy metals such as copper and zinc. The samples also contained arsenic and toxic and carcinogenic chlorine compounds. A little over a month ago, Komorin noted that **water quality had since improved**, **but the toxins had not dissolved**, instead accumulating on the Black Sea's seafloor. The lower reaches of the Dnieper remain a pollution hot spot.

#### Blooms began and ended

Immediately after the disaster, the <u>forecasts</u> were dire. In addition to the temporary reduction in salinity of the Black Sea that actually occurred for a short period (by early July the seawater

salinity had normalized, albeit at a minimum level of 12-13 ppm), scientists predicted that all the pollutants that had entered the Black Sea along with that mass of water would affect all categories of living organisms - from to cetaceans. Combined plankton with hot summer conditions, a large volume of polluted freshwater could the widespread provoke growth of microorganisms and algae and stimulate algal blooms and all its associated negative consequences.

These predictions came to be. In July, over 1,500 km<sup>2</sup> of seawaters near Odesa were overgrown with dangerous and toxic blue-green algae. And, although



*Bioluminescent phytoplankton (left) seen from space in summer 2022. Source: <u>Sentinel-3</u> <u>OLCI enhanced True Color RGB</u> and (right) close view. Source: <u>DW</u>. In total, roughly <u>150</u> <i>different species of phytoplankton were counted in the Black Sea.* 

water bloom is an annual phenomenon, in this instance, it was many times greater than in the previous year.

<u>According</u> to **Galina Minicheva**, director of Ukraine's Marine Biology Institute (National Academy of Sciences) and corresponding member of the National Academy of Sciences of Ukraine, it is this algal bloom that will be the factor to finally clear the sea of some pollutants:

"The processes of absorption, transformation, and deposition of substances can now only occur in the seabed. This will be facilitated, oddly enough, by the algal bloom that has already begun, she explained less than two weeks after the disaster. And the more intensively it progresses, the more and faster algae will take up the organic substrate on which bacteria, including pathogenic ones, feed. In this situation, one must be patient and be grateful to the sea for the fact that it will bear most of the terrible consequences of this immoral catastrophe".

According to marine biologist and Marine Biology Institute (Ukrainian Academy of Sciences) director and corresponding UAS member **Maria Pavlovska**, the bloom has already ended, and this process was to be expected.

"There has been massive growth of phytoplankton due to organic pollution. When phytoplankton dies and decomposes, oxygen levels in water drop, a very bad thing for all marine life that depends on it. That said, we can now state that all organic matter has been processed, the bloom is over and no longer present", she said.

## Dolphins are again dying

According to the Ukrainian Scientific Center of Ecology of the Sea (UkrSCES), dolphins began to die again after the explosion at the Kakhovka hydropower plant in the Black Sea. The center explained that during spring and summer 2022, cetacean mortality (porpoise and common dolphin) increased in the Black Sea, particularly



*Grains collected from the stomach of a common porpoise stranded on the Odesa coastline. Source: <u>UkrSCES Facebook</u>.* 

in the western Black Sea. There were no such phenomena in 2023 until in June and July 2023, when several cetaceans were found dead on the shores of the Odesa region – in Odesa itself and south of the city.

Two dead porpoises were examined and samples collected in an attempt to detect a potential connection between the Kakhovka disaster and cetacean deaths.

The autopsy was carried out by Karina Vishnyakova and Pavel Goldin, Doctor of Biological Sciences the Schmalhausen Institute of of Zoology (Ukraine National Academy of Sciences). According to Goldin, a large number of atypical pollutants, bacteria, and pathogens entered the sea after the water was released from Kakhovka reservoir, all of which could potentially harm dolphins.

## Scientists seek the true cause of porpoise deaths

After examining the dolphins' bodies, the scientists eliminated most scenarios for these cetacean deaths and are studying samples to rule out poison or infectious disease. The last two options could be linked to military operations in the Black Sea and/or sea pollution related to the Kakhovka disaster.

"Although both bodies were severely decomposed, the autopsy made it possible to rule out death caused by fishing gear, fungal infections, injuries and wounds, broken bones, or signs of internal injuries", noted the autopsy report. Consequently, scientists wondered if these deaths could be the result of an infectious disease or acute/chronic poisoning; could they have occurred as a result of Russian military operations, or the explosion of the Kakhovka hydropower plant dam? Just two weeks after the Kakhovka disaster, four dead dolphins were found on the shores of Odesa and Kherson oblasts. After an autopsy, fish and seeds were found in the stomach of one of the porpoises, neither of which dolphins ever eat. Now a group of scientists are working like criminologists step by step to figure out what the porpoise did in the last days of its life.

"The working hypothesis is that some fish ate the seeds, and a dolphin ate that fish. Dr. Galina Pashkevich, a well-known Ukrainian archaeobotany scholar, analyzed the data and reached specific conclusions: these seeds are typical of upland plants with no connection to the Black Sea. Genetic and morphological analyses to determine the type of fish found in the animal's stomach are ongoing. However, we can tentatively say that some of these were freshwater fish, meaning they came from the lower Dnieper", said Pavel Goldin.

Thus, the true cause of the dolphin's death remains to be discovered. After each autopsy, Ukraine sends samples to experts at the University of Padua in Italy and the University of Hannover in Germany for additional analyses. Some tests are also being carried out in Ukraine, the results of which have not yet been officially announced.

Tasked by the Prosecutor General's Office, the Marine Biology Institute (National Academy of Sciences of Ukraine) is conducting research near Odesa Bay. The results have yet to be finalized, but intermediate observations can be made.

According to Schmalhausen Institute of Zoology's Pavel Goldin, 31 dead dolphins have been found stranded in Ukraine (as of 4 September), including Crimea, in 2023. As of the same time last year, 110 dead dolphins had been discovered.

Numbers in 2022 and 2023 were compared to the average over 2018-2021. In 2023, significantly fewer dolphins were stranded than the average. In contrast, in 2022 many more dolphins were stranded relative to the same 2018-2021 period.

"We don't yet understand the reason for this. We will observe and draw conclusions later," said Goldin.

## Struggle for a "place in the sun" in the sea, or in our case, for a "place at the bottom."

Due to the facts that, following the Kakhovka disaster the wind seemed to push freshwater against the Black Sea coastline and the breakwaters did not allow it to move away, the flooding freshwater remained near the coastline for about ten days.

Mussels, of which there have always been many on the Odesa coastline, are tied to places with periodic desalination, and they exist at river mouths. The minimum salinity required for mussels is five ppm. If conditions become



*Mussels can attach themselves to any surface underwater to live, feed, and grow. They are grown commercially in many countries around the world. Source: <u>ASC International</u>.* 

completely uncomfortable, they can close their valves and wait up to a week and a half in this isolated state. If water freshens briefly, the mussels survive, but if it stretches past their ability to cope, they die.

Something in between occurred after the Kakhovka disaster, explained **Aleksandr Kurakin**, a dive specialist at the Marine Biology Institute.

Not all the mussels died, but older specimens did not survive the tragic events. The young ones were practically unharmed. At sea there is always a struggle 'for a place in the sun,' or in our case, for a place at the bottom. Now, young mussels have already settled and are growing in places where the old mussels died, explained the scientist.

Eating mussels is nevertheless prohibited for the time being, given the

organisms' fantastic ability to absorb everything that gets into the water. To avoid increasing the concentration of heavy metals in the body, it is better to avoid mussels, rapa whelk, and fish in general from the Black Sea.

## Fish stuck around while crab numbers grow

When the Black Sea's salinity fell, there was a risk of death for marine fish not adapted to survive in freshwater. This was mentioned immediately following the Kakhovka disaster, and there is encouraging news.

Kurakin explained that from time to time the river and sea currents transport freshwater from the Dnieper-Bug Estuary into Odesa Bay, covering the upper layer of the water column by



The marbled rock crab (Pachygrapsus marmoratus), only rarely seen in the Gulf of Odesa for the last 30 years, can now be counted in tens and hundreds of individuals. Source: <u>Wikipedia</u>

about 3-4 meters. In response, fish dive into the depths, and the *crabs crawl away*.

There was no goby fish dieoff. Some fish died, but not tens or hundreds of thousands of dead fish, said the scientist.

There was a time in the 1970s and 1990s when crabs almost disappeared from Odesa Bay. Enormous crab dieoffs occurred due to large volumes of river pollution draining into an area stretching from Crimea to the Danube Delta. The ingress of sewage, agricultural fertilizers, and other waste led to strong algal blooms in the water, which, in turn, reduced water oxygenation and caused dieoffs.

Such dieoffs occurred several times a year. It is difficult to imagine how the sea survived this, but it demonstrates the ecosystem's resilience as well as the ability of its organisms to survive. If it weren't for the sea's crazy driving force, it would have been gone a long time ago. Over the millions of years of its existence, the sea has survived a lot, and, of course, it will survive the Kakhovka catastrophe, says Kurakin.

This thesis is playing out right now, as humans witness the Black Sea's selfrestoration. Kurakin noted that the marble crab (*Pachygrapsus marmoratus*) population, which had almost entirely disappeared 30 years ago, is on the rebound: "Diving into the water after the Kakhovka hydropower plant dam explosion, we first encountered tiny marbled crabs in very large numbers. With each new dive, we encountered more and more of them."

## The sea's recovery

Black the Currently Sea is experiencing heavy anthropogenic pressure from military operations. Fuel, oil products, and noise pollution enter the sea, and marine mammals are vulnerable to echolocation injuries. However, Maria Pavlovska commented that scientists were seeing signs of the Black Sea's recovery following the Kakhovka disaster.

At the time of the flood, a very large quantity of organic and chemical substances, including toxic substances, entered the Black Sea and settled on the seabed. However, as noted earlier regarding organic substances, those have largely dissolved.

The situation is different for mercury and heavy metals, given their ability to accumulate in marine organisms. According to Pavlovska, exact figures for their concentration in the sea are not known, because scientists are unable to conduct large-scale studies including the catch of different biota.

"We are sampling now, but this is not the level of monitoring that is needed," Pavlovska said. "We will conduct a comprehensive study after the hostilities end."

In conclusion, Maria Pavlovska said that the Black Sea remains capable of "digesting" everything that enters as a result of the Kakhovka disaster, although it will take much longer to process harmful substances.

It is also worth remembering that pollution of the Black Sea is associated not only with military actions, but also with the pollution of rivers flowing into the sea – i.e., the Dnieper and Danube. Over the past 20 years, a number of UNDP Global Environment Facilityfunded projects to protect international waters in the Danube and Black Sea basins have resulted in legal, legislative, and institutional reforms, and have also identified 500 priority investments to prevent water pollution. This, in turn, created a welcoming environment that has attracted over USD \$3 billion of investments in reducing nutrient pollution from 17 countries located in those rivers' basins.

These investments helped reduce the load of nitrogen and phosphorus entering the Black Sea by 25 by 25,000 and 4,000 metric tons per year, respectively. These reductions have reversed expansion of the hypoxic zone on the northwestern Black Sea shelf, achieving significant progress in restoration of the shelf ecosystem. However, work remains to be done, and prospects for the development of legal environmental standards are significant.

Main image source: 1plus1.ua



## Is it time to restore Velykyi Luh?

Ukraine Nature Conservation Group position Oleksiy Vasyliuk, Viktor Parkhomenko, Ivan Moisiienko, Viktor Shapoval, Serhiy Panchenko, and Oleksandr Spriahailo all contributed to this article. First published by the Ukrainian Nature Conservation Group's website in Ukrainian on 14 August 2023. The authors recognize Dr. Eugene Simonov for his important advice. Alastair Gill and Jennifer Castner provided editing in English.

elykyi Luh (meaning "Great Meadow") is one of Ukraine's most important natural and historical landscapes. Despite the presence of many monuments from the age of the Zaporizhzhian Sich and a large number of rare animal and plant species, the area was flooded in 1955-1958 during the construction of the Kakhovka Reservoir. For 70 Velykyi years, Luh was lost to nature, science, and Ukrainian culture. But on June 6, 2023, as a result of the destruction of the Kakhovka hydroelectric power plant (HPP) dam by the Russian military, the

reservoir ceased to exist within weeks, putting Ukraine at a crossroads. Now it is necessary to make a historic decision: to restore the natural ecosystems destroyed in the past on the site of the former reservoir, or to build a new HPP and refill the reservoir. In our opinion, the very idea of reviving Velykyi Luh as a natural area is not only timely and environmentally justified, but such a decision would also go a long way to offsetting the wildlife losses caused by the war.

**Restoring natural ecosystems** where they have degraded (and not just saving

those that remain) is the modern basis of sustainable development in Europe. In recent years, European states have increasingly taken bold and visionary decisions aimed at stopping global climate change and guaranteeing a reliable future for the entire continent. In May 2020, the European Commission presented the EU Biodiversity Strategy to 2030, perhaps the most ambitious environmental protection document in the history of Europe. The strategy specific obligations contains and actions to be implemented in the EU by 2030. The document has a number of extremely ambitious goals: at least 30% of land and 30% of marine water areas should become protected areas; at least 10% of agricultural land should be removed from cultivation and restored to natural ecosystems, pesticide use should be reduced by 50%; and at least 25,000 km of rivers should be restored to a free-flowing state.

In July 2023, the European Parliament adopted the <u>Nature Restoration Law</u>, which aims "to put restoration measures in place by 2030 covering at least 20% of all land and sea areas in the EU."

Accordingly, half of land in European countries should become either protected (30%) or restored to their natural state (20%) in the next seven years. Humankind has never set more ambitious nature protection goals. However, the statistics predicting catastrophic scenarios for humanity in the coming decades are more than convincing, meaning we will need to pay far more attention to ecosystem restoration and the relationship between people and nature. Undoubtedly, the accession of Ukraine to the EU will require the fulfillment of these goals as well. And, in this regard, the restoration of Velykyi Luh has clear potential to be a truly unprecedented model project, larger than any Western European local initiative.

The Dnieper River is one of Europe's most important waterways both for biodiversity. people and Peoples migrated along it and various states took shape: the former Kyivan Rus, the Ukrainian Cossack State, and modern Ukraine were all formed around the Dnieper River basin. A useful water transport artery, a powerful intrazonal corridor with a mild climate, protected by forests and terrain from harsh steppe conditions, incredibly rich in fish and fowl - in the past these qualities made the river an exceptionally attractive location for state-building. However, in the 20th century a number of reservoirs were created here, bringing significant changes and a pronounced negative impact on the river's hydrological conditions. Now, after the explosion of Kakhovka Dam, the process of returning the Dnieper floodplain to its natural state has begun. Dam removal to restore natural processes in river ecosystems is in line with today's leading practices.

## Velykyi Luh is an important natural and historical landscape of extremely important cultural value for Ukrainians.

The very fact that the Zaporizhzhian Sich (Ukrainian Cossack State) once occupied this territory makes it a site of great natural and historical importance for Ukraine. And although this part of the Dnieper valley is the cradle of Ukrainian statehood and contains a colossal concentration of historical and archaeological heritage, this particular site is practically unstudied by historians and archaeologists.

The inhabitants of this area – 90 villages and farms home to 37,000 native residents – were forcibly resettled in the 1950s. Before the creation of the reservoir, this area consisted mainly of the Dnieper River's natural floodplain. Looking at the local relief, clearly visible now that the reservoir has disappeared, it can be argued that this territory was home to the most diverse and dynamic landscape in Ukraine. The area played a significant role for local biodiversity and even more so for global seasonal bird migrations. Since the 1920s, scientific and state institutions have sought to create a reserve here.

## The creation of the reservoir created environmental and social problems.

When developing plans for Ukrainian hydroelectric power plants and

reservoirs, the Soviet authorities did not include the value of the land lost in the estimated cost of construction. Kakhovka Reservoir covered large areas with fertile soils, destroying both agricultural land and forests, meadows, marshes, and old forests where many rare plant and animal species were found. More than 100,000 hectares of fertile lands were flooded and taken out of agricultural use, and even larger areas were inundated (both the reservoir itself and the irrigation systems created there).

More than 15,000 collective farmers, workers, and employees were subject to forced eviction from the reservoir zone, and more than 3,000 buildings on the state balance sheet had to be relocated, destroying economic and social ties that had developed over centuries in a densely populated region. Resettlement conditions were discriminatory and economically disadvantageous for the population. People had to transport their own houses and auxiliary buildings and build new ones from the ruins. At the same time, collective farm buildings had to be transported and rebuilt. Extraordinary measures were taken against those who did not manage to resettle in time, including forced resettlement and the destruction of homes.

In the first years after the reservoir filled, houses in adjacent settlements began to collapse and hundreds of hectares of land along the shore "slipped" into the water as a result of erosion. In a number of villages located 300-500m from the shore, cracks 1.5-2.5 km long formed in the earth. Consequently, in 1958 the Council of Ministers of the Ukrainian SSR declared a 100 m-wide strip of steep bank as dangerous and prohibited access. Each year, 1-7.5 meters along the shore <u>erode</u> <u>into the reservoir</u>, expanding its surface area and reducing its depth.

Since then, approximately 10,000 hectares of land have been lost in the vicinity of "Kakhovka Sea". Eroding shorelines quickly silted up the nearshore zone for 200-500 m and made it impossible to pump water from near the reservoir itself. Finally, cemeteries and cattle burial grounds were flooded. The relocation of the displaced population to more elevated areas, often without water, coupled with incredibly slow construction of new water lines, meant that water had to be delivered to most of the new villages. This was a significant reduction in quality of life and wealth for those resettled and led to accelerated migration of the region's population, primarily young people, to cities.

Mistakes and miscalculations by the reservoir's designers pushed the water level 2-3 meters higher in some in Kamian-Dnieper places District in Zaporizhzhya Oblast, resulting destroyed wells, flooded cellars, in waterlogged land, and sagging houses. Even 20 km from the reservoir, groundwater rose to just 60-80 cm below the soil, threatening gardens and vineyards and waterlogging meadows. 6,730 hectares of gardens and 6,700 farms were flooded in 1957 alone. Flooding of the region continued until 2023. As a result soil salinity increased and several large garden areas became unusable, among them a magnificent 660-hectare garden in the village of Vodiane.

The promises made by the reservoir's proponents boiled down to the obvious boost for all sectors of the economy. Despite that optimism, not all of these promises to improve life came true. Plans to increase yields of winter crops, cotton, etc., as well as plans for growing shallow-water crops (rice, vegetables, etc.) <u>failed</u>. The same applies to plans for breeding unprecedentedly large volumes of sturgeon and other valuable commercial fish species which instead disappeared from the reservoir altogether and were quickly replaced by low-value introduced fish species. In 1956, just before the reservoir began to fill, the fish harvests totaled 90,000 tons. In 1966, the annual fish catch in the Kherson region amounted to just 1,300 tons. Native fish species populations declined due to pollution, siltation, loss of rheophilic conditions and spawning grounds, and also the inability to swim upstream for spawning. In addition, algal blooms and poor oxygenation led to the disappearance or reduction of fish sensitive to oxygen content in the water, and populations of low-value species that can tolerate brackish water and withstand high water turbidity <u>increased</u>.

The pollution of Kakhovka reservoir's water and bottom sediments was also problematic. Accumulated river water and the entire cascade of reservoirs determine the chemical upstream composition of Kakhovka Reservoir's Existing waters. water treatment facilities in the Dnieper basin are unable to sufficiently purify wastewater. The main sources of surface water pollution overloaded are sewage treatment facilities and drainage networks that are in poor technical condition. More than 90% of the polluted wastewater in the Dnieper River basin originates in urban sewage canals in Dnipro Oblast and from industrial enterprises in the vast mining and metallurgical complex of Dnieper, Kamiansk, Kryvyi Rih, Nikopol, and western Donbas. The average annual content of harmful substances in Kakhovka Reservoir <u>reached</u> dangerous levels: 1-2 maximum permissible concentrations (MPC) of phenols, 6-11 MPC of copper compounds, 7-12 MPC of zinc and 3-10 MPC of manganese.

From the very beginning, when Ukrainians were forcibly resettled in 1954, people <u>had a negative attitude</u> towards the project. Construction went ahead nevertheless, and by the 1950s, censors strictly <u>forbade</u> any mention of the problematic reservoirs in newspapers. Many editors and journalists ended up in Soviet prison camps for reporting on the negative consequences of the construction of hydroelectric power stations. More recently, environmental scientists from Nikopol and Zaporizhzhia and specialists from Dnieper National University and others sought to <u>reduce</u> <u>reservoir water levels</u>.

Resistance would have been much greater, but after the repressions of the 1930s, the national liberation movement activists, professional historians, biologists, and local historians capable of battling the construction of the hydroelectric cascade were either shot, evicted, or found themselves in extremely difficult conditions and under constant checks, when one wrong step was immediately punished.

Construction of the Dnieper reservoirs, and in particular the rather shallow Kakhovka – the second largest in terms of area and the largest in volume – created a significant number of environmental problems, both for people and nature.

Construction and then filling of the reservoir made it almost impossible for the inhabitants of the left and right banks to communicate. Villages that were previously separated by a floodplain and a relatively narrow river were cut off from each other by a much wider and deeper water barrier. Residents of neighboring villages, who had previously actively socialized with each other, built families, and participated in a shared economy, now had to travel hundreds of kilometers in an overland detour through Kakhovka or Zaporizhzhia. Their connections were completely lost, and many families were splintered.

The creation of reservoirs also had a severe impact on river transport. Ships were forced to wait for days, or even weeks, for the passage of vessels through the locks of the HPP. A huge freshwater reservoir like Kakhovka is also extremely dangerous for all types of craft in stormy weather. Given those conditions, there was an unsurprising decline in river transport.

According to <u>published data</u>, after the construction of a six-reservoir cascade on the Dnieper the transportation of goods by water transport fell from 30,800 tons in 1980 to 3,000 tons in 2009 – over tenfold. Over the same period, the number of river passengers decreased from 25,000 to 1,500. The reasons for these rapid declines may be different, but the fact itself refutes arguments for any pivotal role by the dam and reservoir on navigation on the Dnieper River.

#### Would a project on the scale of the Kakhovka reservoir seem justified in 2023?

Despite the significant societal impacts resulting from the destruction of the

Kakhovka HPP, it should be recognized that the economic value of the Kakhovka reservoir in 2023 was insignificant for the state. Ultimately, artificially introduced fish were harvested, and the HPP produced an insignificant amount of electricity.

Other arguments made by today's advocates for restoring the reservoir are related to uses that can be fulfilled by a free-flowing Dnieper. Water for drinking water and irrigation was supplied by pumps; water transportation is more convenient without locks and high waves arising from the wind's reservoir's long fetch across the surface. Some authors suggest that the reservoir had beneficial climatic effects for surrounding settlements, but these theories are very doubtful: although residents of settlements on the shore of the reservoir actually felt an improvement in the microclimate due to the additional moisture content in the air, the state lost 1.3 km3 of water per year due to evaporation.

general, the impact In of the construction of the Kakhovka reservoir for climate change and the region's natural characteristics is not wellstudied. and there is insufficient data. The opportunity to conduct comprehensive monitoring and multifaceted assessments has only recently become available. In any case, changes in microclimate over much larger areas are due to the influence of irrigation systems and may not require restoration of the reservoir.

On the other hand, long-term trends of water quality deterioration and stagnation processes in the reservoir are dissonant with ecosystem services and cannot be ignored. The death and decomposition of blue-green algae produces significant quantities of poisonous chemical compounds: butyric acid, acetone, ethyl and butyl alcohol, ammonia, organic nitrogen, phosphorus compounds, etc. They not only smell bad, but asphyxiate and kill fish, lead to disease in domestic animals that consume the water, <u>complicate</u> the operation of canals (when filters get clogged), etc. Additionally, cyanobacteria toxic products (hepatotoxins, neurotoxins and dermatotoxins) can be dangerous for humans as well. Their active reproduction in reservoirs is often associated with the development of intestinal diseases, allergic dermatitis, liver disease, and even an increased risk of cancer. The problem is further aggravated by the introduction of cyanotoxins into drinking water distribution networks - there are no standardized methods for their detection in Ukraine. Consequently, cyanotoxins cannot be verified or neutralized during the water treatment process.

While oxygen production by phytoplankton during algae blooms is beneficial, invasive plant species are involved in the cycle as well. The overarching problem is that instead of natural areas with native biota and welldeveloped self-regulation mechanisms, artificial reservoirs created unstable, anthropogenically-transformed ecosystems.

> Today, no EU country would finance implement the and construction of a new hydropower plant and reservoir on the scale of Kakhovka dam and reservoir. The cost of such a project appears completely senseless compared to the demands that can be met solely through a reservoir. Most EU countries are engaged in emptying much smaller reservoirs due to their ecological impracticability and are not building new large reservoirs.

In the end, time is against the restoration of the reservoir and the entire hydropower system. There are currently no definite projects or funds for their implementation, or even the means of carrying out such work. On the other hand, the economic infrastructure that is critically dependent on the functioning of the water reservoir is not secure enough to simply wait for restoration. The challenge of supplying water to settlements and agricultural land dependent on irrigation is already being actively solved using alternative methods. Agricultural producers are being forced to swap thirstier crops for drought-resistant ones, and the adaptation process to new realities is taking place independently and in contradiction to as-yet ambiguous prospects for restoring reservoirs.

Most of the land affected by the reservoir's emptying is currently unsuitable for agricultural use due to pollution, minefields, and temporary occupation. Russian Consequently, restoration of natural vegetation in these areas can be considered an ecosystem remediation measure. According to Article 172 of Ukraine's Land Code and Article 51 of Ukraine's Law "On Land Protection", subject to temporary closure areas include "degraded lands, unproductive lands lacking steppe, meadow, or forest vegetation cover, the economic use of which is ecologically dangerous and economically ineffective, as well as industrially-polluted land plots on which it is impossible to produce ecologically safe products, and the presence of people on these land areas is a public health risk; land areas contaminated with chemical substances as a result of emergency situations and/or armed aggression and hostilities during martial law."

## The Russian terrorist attack on Kakhovka HPP caused unprecedented environmental losses and created new environmental challenges.

Many problems stemming the reservoir's creation and existence

disappeared when the reservoir emptied. However, the terrorist attack on Kakhovka HPP caused devastating short-term consequences and created many new problems that did not exist before. Most of the reservoir's fish population and aquatic organisms were destroyed (most were washed into the Black Sea and died); benthic fauna and aquatic vegetation dried out and died (and their decay created public health risks); whole colonies of birds died and whole riparian aquatic vegetation disappeared. ecosystems Drained also affected landscapes protected areas Velykyi Luh and Kamianske Sich National Nature Parks.

The rapid outflow of water wiped out fauna in the flooded area, from large mammals to small insects and even fish, swept into the Black Sea by the current. As a result, Lower Dnieper National Nature Park and several nature refuges lost their natural value. Even more protected areas were flooded, and several endemic species of plants and animals are now threatened with extinction due to increased groundwater levels.

> At least two species of insect (European ant *Liometopum microcephalum* and Kinburn ant *Tapinoma kinburni*) and one species of fish (Estuarine perch *Sander marinus*) have likely been wiped out in Ukraine as a result of the flooding.

Almost all the flooded lands below the dam and drained areas of the reservoir are classified as nature conservation territories of international importance.

Freshwater contaminated with silt from the reservoir's bottom, debris from buildings and infrastructure, vegetation, and animal corpses were flushed far into the Black Sea, reaching the shores of Turkey, Bulgaria, and Romania a few days later. This flood resulted in the colossal desalination of the sea's most biologically diverse coastal strip, as well as its pollution. That, in turn, led to the destruction of marine organisms.

The destruction of the dam created whole series of unprecedented а consequences and new problems for people. Water supply to cities and irrigation from water intakes that pumped water from the reservoir were halted for the time being. The Kakhovka HPP and the bridge crossing it have ceased to exist, and river navigation has become temporarily (until the dam's complete dismantlement) impossible. In addition, stable operation of the Zaporizhzhia Nuclear Power Plant was thrown into jeopardy.

## Velykyi Luh can be restored as a natural area.

While highly visible, the exposure of the reservoir's bottom – hastily <u>described by</u> mass media and elder environmentalists and ecologists in Ukraine as "desertification" – is a short-term negative impact. Firstly, the reservoir was a source of evaporation, and therefore water loss, in the region. Secondly, the almost lifeless shallows stretching endlessly are not a natural ecosystem and remained an artificial structure for 70 years. Undoubtedly, the "desert" landscape here will, in the near future, be overgrown with natural vegetation and become the largest area of natural wilderness in Ukraine's steppe zone.

Kharkiv Our expedition to the Oblast's Oskil Reservoir (also drained subsequent to dam damage during the Russian invasion in early 2022) revealed that natural ecosystems attractive to birds had already recovered in the first year. Studies conducted on specific areas of the former Kakhovka Reservoir have shown that just a month after the water release, vegetation had already begun to recover in some areas. Moreover, research carried out near Kamianske Sich National Nature park, showed that native species seedlings (among them the white willow Salix alba being the most frequent) significantly outnumber alien plant species on the dry reservoir bottom.

Predictions of dust storms have also turned out to be unfounded: the hottest part of the summer has already passed, but no dust storm caused by the blowing of silt from the reservoir bottom has occurred. As the precipitation increases in fall and the basin bottom is covered with vegetation, the probability of dust storms will decrease significantly.

In this context, the intensity of the spontaneous recovery process and the ability of vegetation systems to self-renew cannot be underestimated. Calls to plant wild grasses (and others) are absolutely hasty, unfounded, and unrealistic. Anticipated wind erosion is being solved by nature itself, with bare areas of soil actively sprouting vegetation and anchoring the soil in place, bringing into question any plan for "seeding". The questions of what to sow and where to obtain the necessary quantities of seed material for suitable wild plant species? They are not available in the required amount, and in practice we have to use hay containing a seed fraction, given the difficulty of its separation. Lastly, all classic agro-steppe methods involve pre-sowing soil preparation, the use of special agricultural machinery, and step-by-step seed care, all impossible due to ongoing hostilities in the region. Thus, the proposed and fully explained measures to counteract wind erosion will be irrelevant by the time their implementation becomes possible.

It is very difficult to model the restoration of vegetation cover. By analogy, we can say that a complex of aquatic and coastal, wetland, meadow, and forest vegetation will form at the bottom of the reservoir. The key challenge to natural vegetation restoration will be insufficient seed

availability. This will have the smallest effect on aquatic and swamp vegetation: seeds belonging to aquatic plants float, and rivers and large lakes can serve as dispersal corridors. Seeds for plants that form the basis of meadow and forest communities will be critical; seeds can be transferred by wind, but are more often dispersed by animals, a function that depends on intact, interconnected ecosystems. Wind-sowed plants, such as the aforementioned white willow, will be most successful in colonizing the bottom of Kakhovka reservoir. In the case of willow, seasonality is also important. Shortly before the dam was blown up, the fruits of willows ripened, and scattered seeds using fluff that floated on the water surface, and now we see numerous sprouts. The elm also behaves in a similar way. In many other plants, seeds ripen later and will fall onto the newly formed land. Meadow and forest vegetation cover will gradually advance from the periphery to the center of the former reservoir.

Synanthropic species will play a key role in the first stages of vegetation regrowth in dry areas, including a significant share of invasive species. They have a wide arsenal of seed dispersal methods and can produce huge numbers of seeds. As a result, the bottom of the Kakhovka reservoir will somewhat resemble the abundant vegetation found on dumps and landfill sites.



*Fig 1. July 2023 vegetation regrowth one year after the draining of Oskil reservoir (Kharkiv Oblast). Photo by S. Veter.* 



Fig. 2. July 2023, vegetation regrowth in Kamianske Sich NNP (Kherson Oblast) one month after the draining of Kakhovka reservoir. Photo by S. Skoryk.

Another factor that does not lend itself to analogy is the condition of the substrate. Fairly thick bottom sediments formed over many years, and to a large extent they have leveled out soil fertility, whereas natural floodplains vary significantly, with higher and lower areas. This effect will also contribute to the intensive development of plant species characteristic of such rich substrates. At the same time, for birds, an area with a complex mosaic of lakes, shallow waters, meadows, forests, and even sand dunes will be incomparably more valuable than lifeless shallow waters. Restored floodplain ecosystems provide habitats for many species important for nesting, feeding, and resting during migration. Considering that a restored Velykyi Luh - 'great meadow' - will have an area much larger than any area of nature preserved to this day in Ukraine's steppe zone, it can be assumed that it will become the most important natural area for the entire south of the country.

In the first years, an important influencing factor will be the nature of flooding: how high the spring waters rise, how long they stagnate in lowland areas, etc. During spring flooding, formation of the Dnieper River and floodplain will be particularly intensive, old lakes will be flooded and new depressions will take shape.

We are optimistic about the restoration of natural vegetation and predict a

relatively quick renewal of aquatic, coastal, and wetland vegetation. Dry land areas will be dominated by plants characteristic of invasive weed-covered areas for some time, but in 5-10 years, areas with predominant tree cover will be visible and the first forests of willow, alder, elm, ash maple will form. Considerable areas will be occupied by thickets of shrubs (Amorpha fruticosa) and willows (Salix alba). Two to three generations of pioneer trees can be anticipated prior to the formation of more or less natural and sustainable forest ecosystems. Restoration of meadow vegetation is difficult to predict, because it will depend on land management. Left untouched by humans, these will be insignificant areas of meadow surrounded by thickets of reeds, forests, and shrubs.

## Restoring Velykyi Luh is in the interests of the environment.

In the distant past, the largest natural forest in Ukraine's steppe zone grew on the site of what was Kakhovka Reservoir. (It was named Velykyi Luh because in Ukrainian, unlike the word luky, meaning meadow and grass ecosystems in river valleys – the word luh literally meant floodplain forest). It could be incredibly advantageous for implementing Ukrainian government plans to increase forest cover and the ability to carry out these tasks in a natural way, without harming other ecosystems. Part of the area will be naturally overgrown with meadows. It must be recognized, however, that the focus here is ecosystem restoration: a recovery similar to and even very close to lost natural systems. These native ecosystems were finely tuned and formed as a result of the centuries-old interaction and interference of a number of natural and anthropogenic factors that were in unique balance.

The restoration of semi-natural ecosystems across such a huge area has many positive consequences:

• Diversity of natural ecosystems will increase significantly: instead of almost identical biotopes of the artificial water bodies which occupied more than 90% of this area, dozens of other biotopes will appear, in particular, swamp, meadow, steppe, shrub, forest, halophyte;

• Absorption of greenhouse gases will significantly increase due to the rapid growth of woody plants (Ukraine has committed itself to decarbonization);

• Carbon dioxide absorption will increase significantly (relevant given Ukraine's obligations regarding decarbonization);

• Populations of many rare species included on Red Lists due to the threat of extinction will increase in size; significantly reducing threats to survival. In particular, it will be possible to prevent the almost inevitable disappearance of some local endemics, such as cornflowers Centaurea appendicata and Centaurea konkae;

• Areas of pasture and hayfields will increase;

• Available stocks of valuable wild plants and animals – medicinal, domesticated, hunting, etc. will increase grow

• Fish spawning will resume, significantly enriching the fish population of the Lower Dnieper and eliminating the costs of maintaining several fish farms (which previously ensured the artificial renewal of fish resources);

• Freshwater evaporation will decrease due to reduced water surface area;

• Water quality and the condition of aquatic ecosystems will improve; and

• Diversity of water body types will increase significantly.

## Human advantages of draining the Kakhovka reservoir.

Analyzing the situation in its current state, draining the reservoir may have tangible advantages for the population. For example, water-based transport will now be able to move at all times of the year and will not have to queue at river locks; bridges and ferries will be built and crossing times will be reduced tenfold, this will facilitate converting an economically depressed region into a logistics center that will no longer be isolated from central highways and will be the most convenient in the region for transport logistics. New opportunities to develop solar energy in recently drained areas will also be possible. From an exclusively economic context, there is significant agricultural potential – as many as 200,000 hectares (or at least some fraction thereof) of land. And, of course, the war's end will open up unprecedented opportunities for recreation and tourism development.

## Benefits of draining the reservoir for Ukraine as a state and for Europe as a whole.

The area will become a platform for research on the restoration of natural ecosystems as well as the reintroduction of rare animals and plants. It will also be valuable to create a protected area here to prevent new crop agriculture or rebuilding the reservoir, both of which have already destroyed many unique ecosystems.

## What awaits Velykyi Luh?

There are a number of options. At a minimum they are: 1) do not restore the reservoir, 2) restore it, or 3) build something completely different. It is obvious that from an economic point of view, these options will be prioritized in

this order, and despite the objections of certain individuals, the cheapest option will be to not rebuild the dam. Even the National Bank of Ukraine (NBU) has already announced that in 2023 alone, the consequences of the HPP's destruction will reduce real GDP growth by 0.2%, increase consumer inflation by 0.3%, and increase the trade deficit by \$0.4 billion. At the same time, according NBU's calculations show that the cost of restoring the hydropower infrastructure and its water reclamation systems each cost about \$1.5 billion. Roughly speaking, losses to the economy from destruction of Kakhovka HPP are much smaller than the funds needed to restore this outdated complex.

It is not surprising that Ukrhydroenergo's management team <u>insists</u> that the only option for the future is to construct a new dam and re-fill the reservoir. Although energy industry officials <u>frequently voice</u> doubts that someone will take on the restoration of the dam, nevertheless, this option is the most commonly proposed of all the possible scenarios.

#### Restoring the reservoir will resurrect old problems and create new ones.

Ukrhydroenergo's scenario does not consider environmental impact. Construction of a new HPP will entail all the negative environmental consequences that the creation of the reservoir brought in the 1950s and will reestablish all the chronic problems caused by the reservoir's existence. Disruption of bottom sediments will no longer allow it to be used for fish breeding. Nature will not wait for government decisions and is already restoring ecosystems actively on the drained land. Until the possible construction of a new dam, the entire territory of the former Velykyi Luh will be green again and millions of living organisms will exist there. Refilling the reservoir will be comparable to the same ecocide of which we now rightly accuse Russia. To allow ourselves to frivolously destroy ecosystems at a time when such destruction is one proof of Russia's war crimes is inconsistent at the very least.

In addition, restoration of the reservoir would be significantly more costly than the original construction, in part because of the impossibility of recreating the 1950s project. If restored, a new reservoir (and we hope that this will not happen) would have to be equipped with a fish ladder to operate across the elevation between the Dnieper and the reservoir surface exceeding 16m, require logistical solutions for crossriver connections (ferry, aviation), await engineering of modern embankments, resolve public safety issues in the potential flood zone with an extensive system of smaller saddle dams, and ensure large-scale reconstruction of worn-out distribution network the

of irrigation channels, etc. Building a modern equivalent of the former complex of HPP, irrigation systems, and a safe reservoir presents a far greater and more expensive challenge than it did 70 years ago.

Nevertheless, it is sensible to question the expediency of this option even at the stage of assessing energy needs. According to data published by the Institute of Nature Management and Ecology of the National Academy of Sciences of Ukraine, the entire cascade of hydroelectric power plants on the Dnieper produces 9 billion kW – just 5–7% of Ukraine's overall electricity production in Ukraine.

## Is it possible to meet Ukraine's needs without restoring Kakhovka HPP?

In analyzing whether it is possible to meet Ukraine's needs without restoring the reservoir, it must be understood that most of these needs will become relevant only after de-occupation of Ukrainian territories and demining; the latter process may take decades.

The situation with water transport and logistics is easiest to assess. Periodic dredging of the navigation channel will be sufficient for river transport, and in general the situation may be even better than during the reservoir's existence. Intricate passage requirements through the reservoir, long queues at shipping locks, and the complete impossibility of winter navigation all served to complicate matters. In addition, large wind waves on the reservoir's wide expanse during storms significantly complicated shipping.

Instead of the former ferry, the alternative to which was a detour around the entire reservoir (more than 200 km one-way), it will now be possible to build several modern, convenient bridges, the logistical practicality of which will also encourage road rebuilding throughout the region.

In the first months following the disaster, it was the supply of drinking water and irrigation that caused the most concern. Restoration of drinking water supply to cities like Kryvyi Rih and Nikopol was an urgent issue in the first days after the dam was destroyed, and repairs to pumping stations will be completed in the near future. If water supply is restored in the coming months, there will be absolutely no need for the reservoir's reconstruction. The situation is similar with irrigation, for which water was also pumped into canals from the reservoir. If necessary, pumping stations to restore canal water supply can be rebuilt on the left bank of the former reservoir after de-occupation. Traditional resource-hungry methods of irrigation using sprinklers can be replaced by modern and economical drip irrigation technologies - in fact, irrigation agriculture in the region is in general need of modernization.

The challenge of irrigation is the most difficult, in our opinion. Existing canals and irrigation systems require large volumes of water. The amount of water required for irrigation should be calculated using the most economical for irrigation agriculture. options However, we must consider all possible alternatives to address this issue, including considering irrigation options that do not require rebuilding the reservoir.

If modern irrigation technologies are used, significantly less water will be required for the same areas, and the Dnieper's natural flow will be sufficient to fill the water supply lines.

As for concerns about the operation of Zaporizhzhia Nuclear Power Plant, its long-term functioning does not depend on the presence of a reservoir, but rather on its own cooling pond, which remains intact for the time being. It is also possible to supply it with water pumped from a channel of the Dnieper that is currently directly adjacent to the cooling pond.

Only one issue remains – the question of how to replace the electricity previously generated by the hydropower plant. The Kakhovka HPP generated 1.4 billion kWh per year, significantly less than 1% of Ukraine's electricity generation, and that HPP's role in the energy sector is extremely small.

Another key function, <u>according to</u> Ukrhydroenergo officials, is the ability to balance the energy system during peak demand. While this is a well-known feature of cascaded reservoirs, it was not the case with the Kakhovka reservoir. It should not have been actively used for peak regulation since there is no reservoir below it, meaning that sharp drops in discharge from the station would have had major detrimental consequences for the ecosystem and the population, including powerful erosion. In today's world, energy industry alternatives are a) "smart networks" that redirect the energy produced by the system to peak times, b) batteries, c) power that is quickly accessible, for example gas (and in the future even solar), d) consumption regulation to smooth "peaks" (for example, by differentiating electricity prices by time of day).

The issue of energy spikes is not relevant for Kakhovka HPP, rather the concern is about the loss of maneuverability of the Dnipro HPP further upstream. There are three solutions here: a) find a safe place for a counter-regulator reservoir; b) transfer this function to other parts of the remaining HPP cascade; or c) a combination of the first two options.

## 15. Today our work is to prevent hasty decisions.

Now is not the time to blindly ask "How can we restore the reservoir?" Instead, we should seek to quickly and rationally meet the existing needs of our state and population using modern technologies and solutions. What are the benefits of alternative scenarios?

Making hasty decisions not based on the study of international experience, impartial development of multiple scenarios, or a strategic environmental assessment can only result in new damage and losses. Decisions of this magnitude entail such important consequences that accepting them under the pressure of lobbyists without extensive study of the issue and the input of all stakeholders will be an unacceptable mistake.

Despite this, our state has already made its first hasty decision. On 18 July, the Cabinet of Ministers of Ukraine approved the <u>resolution</u> "On the implementation of the experimental project "Construction of the Kakhovka Hydroelectric Station on the Dnieper River. Reconstruction after destruction of the Kakhovka HPP and ensuring stable operation of the Dnieper HPP during the reconstruction period." This decision, adopted without proper environmental assessments and evaluations and the necessary detailed economic calculations, already has caused indignation among experts and public organizations. At the same time, lobbyists for the restoration of Kakhovka reservoir are presenting it as the sole option and the only possible solution to a number of problems: irrigation, logistics, energy, etc. This is completely untrue, and certain arguments openly

manipulate public opinion. It is to be hoped that the unexpected renewal of VelykyiLuh, the memory of whichSoviet ideologues sought to erase for decades, can become a symbol of Ukraine's postwar recovery. The unique experience of Kakhovka Dam's destruction has the potential to be engraved in the history of the Russian-Ukrainian war as an example of how Ukraine "built back better".

Velykyi Luh's restoration will be the largest environmental project ever carried out in Europe. Considering the scale of this undertaking, it is quite realistic to turn it into a pan-European one. European environmentalists, scientists, and governments will be interested in joining the largest natural ecosystem restoration project on the continent. Broad international cooperation will contribute to future success thanks to European Union countries that can share their extensive experience in carrying out similar work; Velykyi Luh's restoration has the potential to become Ukraine's decisive contribution to the EU's commitment to restore 25,000 km of rivers to their natural condition by 2030.



## Restoring Ukraine's nature post-war: **Hopes and risks**

The issue of restoring nature after the war is becoming increasingly relevant for Ukraine. On the one hand, it is important to understand the extent to which it is actually possible to restore the country's damaged ecosystems. On the other hand, spontaneous restoration of vegetation is completely unpredictable and can cause concern, as the case of the Dnieper valley shows. While a natural floodplain forest on the site of the former Kakhovka reservoir may regrow, abandoned crop fields and ruined settlements could potentially become places where invasive plant species flourish. Oleksiy Vasyliuk Translated by Alastair Gill

Military activity has a wide range of destructive effects on natural and agricultural landscapes, including:

- munitions explosions;
- construction of fortifications;

• felling of forests for military needs;

• remains of destroyed equipment litter the landscape;

• passage of heavy, tracked vehicles;

• fires at explosion sites that spread uncontrollably; and

• chemical pollution of the soil.



The village of Andriivka in the Donetsk Region (a) during its liberation in August 2023 and (b) September 2023. In the first photo it is clear that there is no vegetation or small branches on the trees despite it being summertime. In the second photo, taken several weeks after the first, there is a visible increase of synanthropic, mostly invasive plant species. Source: <u>Military</u> <u>Chronicle of the 3rd Separate Assault Brigade</u>

All of these factors alter the existing landscape to the point of being unrecognizable, often with little remaining life.

At the same time, the destructive consequences are short-term, and in the long-term the fate of landscapes and biodiversity in polluted areas will be primarily determined by future human use. The long-term unavailability of land for economic activity as a result of occupation, and, especially as a result of mining, is leading to the spontaneous restoration of quasi-natural ecosystems on a large scale.

Even a few weeks without an intensive agricultural load are enough for an area to begin to become uncontrollably overgrown. Consider the amount of year-round weed control required in any garden plot, for example.

In fact, the scale of these processes is startling even now. A comparison of 2023

thermal survey data of the earth's surface using MODIS spectroradiometers (during the active growing season) with similar periods from previous years shows that all areas that were the scene of hostilities, where fighting is ongoing, and mined areas have become zones of large-scale overgrowth.

Vegetation reflects sunlight and generally creates zones of moisture and coolness, while arable land and areas of open soil absorb solar heat, meaning they are not recognized by satellites as a heated surface. Working inversely, thermal imaging data can be used to obtain information about areas where there is no vegetation, areas where there is – and if there is, how much.

Such data can be obtained for any day. The best aerial thermal <u>images</u> of Ukraine are from 2021 and 2023. Imaging from the year 2022 should be discounted, since it was atypical: the



*Daytime surface temperature: summer 2021 (a) and summer 2023 (b). Source: <u>Yevheniya</u> <u>Drozdova and Andriy Harasim</u>* 

lands were plowed but not sown, and there were also many fires.

Intensive spontaneous overgrowth of vegetation is already occurring across a total of at least 1.5 million hectares of land, all of which is former fields and settlements where agricultural activity has ceased. In other words, an area 20 times larger than the Chornobyl exclusion zone is highly likely to have been overgrown by invasive plant species. For part of the territory, this change has taken place in a matter of months.

The colossal destruction to landscapes, land mines, and social factors (occupation and the migration of the population away from the zone of active hostilities) have created new conditions, in which plants and animals found themselves outside the scope of human economic activity for the first time in several centuries. For a second year now, fields have not been cultivated, no pesticides have been used, industry stands idle, and there are simply vast areas without any people.

But it would be wrong to romanticize this state of affairs and see in it the rebirth of wild nature. Apart from the fact that there are no more people in the destroyed villages, and farmers no longer work in the fields, the war has led to the colossal pollution of the soil with chemical products of ammunition, destroyed wastewater treatment plants, chemical plants, and heavy industry facilities, such as metallurgical plants. Most of the most dangerous industrial facilities in Ukraine happen to be located precisely in the zone that has been most heavily damaged over the past year and a half. Nevertheless, changes do occur in nature. And changes caused by military activity only contribute to the spread of synanthropic vegetation and invasive species.

A Sentinel satellite image from early summer 2023 shows the light-colored bed of the former **Kakhovka reservoir**,



A satellite photograph, in which overgrowth along the frontline is visible. Source: <u>texty.org.ua</u>

which was completely drained after Russian forces blew the dam in June 2023. And to the east of it (on the right of the photo) and then to the north is a large dark green zone covering a total area of more than a million hectares.

Director of programs for the Marjan Study Group in the department of war studies at King's College London **Jasper Humphreys** has coined a new term for such changes: **"war-wilding"**. The story of war-wilding is one more of transformation than it is of recovery, as many think.

It is difficult to assess how the issue of nature restoration is perceived in the world as a whole, but in Ukraine the generally accepted opinion is that natural ecosystems easily return to areas abandoned by people – a view that stems largely from the aftermath of the nuclear disaster at the Chornobyl nuclear power plant in 1986. After the accident, the local population was forcibly evicted from a vast area of northern Ukraine and southern Belarus, turning it into a deserted radiationcontaminated exclusion zone. However, natural ecosystems have now fully recovered in this area, and it has become the largest wild forest in eastern Europe.

The restoration of the **Chornobyl ecosystems** was facilitated by the presence of a large number of natural swamps and forests in the area, as well as generally humid conditions in the Polesye region. Beavers quickly blocked the drainage canals and wildlife



*The town of Pripyat and the former fields surrounding it in the Chornobyl exclusion zone after 30 years without human activity. Source: <u>vnebo.ua.</u>* 

returned to the radiation-contaminated territory, covering former fields and even villages with forest. Despite the radiation pollution, most wild species are thriving here today, and the Exclusion Zone has not become, as many feared after the 1986 disaster, either a "dead zone" or a "kingdom of mutants." This may be because most wild animals have a significantly shorter natural lifespan than is necessary to experience the effects of long-term exposure to radiation.

There is another relevant factor: at the time of the disaster there were almost no invasive species in the marshes of northern Ukraine. Man once reclaimed these lands from the swamps, but as soon as he left them, nature quickly returned.

"Chornobyl experience" But the cannot be repeated in the south and east of Ukraine, where the vast majority of land has been regularly plowed for a long time, and where no more than 3% of natural steppe ecosystems - refugia of native fauna and flora - have remained in their natural state. And where, as a result of climate change, all roadsides have long been home to dangerous invasive species that are resilient to arid climates. Any handful of native soil contains more seeds from invasive species than native flora. So a rebirth of natural ecosystems can not be expected here. But there is a risk that all the abandoned settlements and fields already represent the largest ever precedent for the spread of invasive species. And the total size of



*Recovering vegetation one year after the draining of the Oskil reservoir (Kharkiv region, July 2023). Source: <u>UNCG</u>* 

areas overgrown with invasive species already significantly exceeds the area occupied by natural steppe ecosystems.

In the short term, then, invasive and synanthropic plant species will make up a significant part of spontaneous recovery processes. Before the war, these species typically spread only along roads and in forest belts (although they disperse seeds across all land types).

However, in some areas the opposite trend should be expected, particularly in intrazonal ecosystems. This term refers to steppe zone forests, which typically fill narrow ravines and river valleys in gullies. Forest ecosystems self-regulate moisture evaporation, creating a windproof zone under the dense canopy, a humid microclimate that supports the forest itself during dry periods.

The majority of invasive species are spreading across southern Ukraine as a result of general aridification – that is, gradual desertification. Such species are drought-resistant invaders from drier regions – herbaceous plants (Anisantha tectorum, A. sterilis, Rhaponticum repens, Portulaca oleracea, Opuntia humifusa, Aegilops cylindrica) and trees (Gleditsia triacanthos, Robinia pseudoacacia, Elaeagnus angustifolia). But, for example, other processes are at work in river valleys, where conditions



Young willows on the bed of the former Kakhovka reservoir. Source: Vadim Maniuk <u>personal</u> <u>archive</u>

are not arid and completely different kinds of biotopes are found there.

Studies of annual overgrowth on the bed of the former **Oskil reservoir** in Kharkiv Oblast showed that 63% of the plant species that overgrow new territories are native. Over time, native perennial species will further supplant single-year introduced species.

Regrowth of vegetation at the bottom of the former Kakhovka reservoir is underway. Of course, in river valleys, where conditions are unfavorable for drought-resistant invasive species, restoration mainly involves native species, as in the areas of wetlands and forests in northern Ukraine.

Ukraine is geographically large enough to have a variety of natural conditions, so at present it is hard to say what form war-wilding will take in different parts of the country. It was enough to dissuade UWEC Work Group experts from indulging in casual predictions to see that in the three months after the destruction of the Kakhovka dam, not only had thousands of young trees sprouted on its bottom, but also that these young trees had already reached human height. The question is – how will this territory look in 10 or 20 years?

In any case, the changes underway today are a unique experiment, allowing the study of spontaneous vegetation successions over unprecedentedly large areas that were recently inhabited and are now abandoned. In addition, there is also precedent for the massive spread of invasive species, on a hitherto unseen historical scale. It should also be recognized that there are remnants of natural ecosystems among the abandoned areas as well as protected areas. These will serve as refugia for natural flora and support the spread of natural ecosystems to adjacent areas.

At the moment, it is unclear how long the partial occupation of Ukraine will last, much less the process of demining affected areas. According to preliminary estimates by the Ukrainian Cabinet of Ministers, demining will take more than 70 years. So it can be presumed that the very last post-war clean-up operations may take place in areas where a 70-yearold forest will already be growing, and mines will be buried deep in the soil under the roots of trees. Since this calls into question the feasibility of complete demining, UWEC Work Group experts propose that the most damaged areas, as well as environmentally protected sites, should be designated as special zones where demining will not be carried out at all. The spontaneous restoration of ecosystems in these territories could be seen as a powerful contribution to the fulfillment of Ukraine's state conservation objectives for degraded

lands, as well as the fulfillment of international obligations on combating desertification and climate change. After all, in practice all these tasks consist of restoring natural vegetation in places where it was degraded or absent.

In the coming decades, planning for scenarios combining development of new ecosystems and coexistence with humankind for land areas experiencing spontaneous vegetation recovery will be the central challenge and perhaps a stumbling block for expert biologists and land managers. Biologists and ecologists therefore find themselves in a very uncomfortable position: nature is not waiting for humans to act and is rapidly taking over land abandoned by people and environmentally damaged areas. Knowledge of the biology of these landscapes is now useful only for comparing the new reality with memories of the past. And, finally, for the present most of the areas damaged by the war are inaccessible, and it is possible that many will remain off limits until the process of demining them is complete. •

#### Main image credit: *Irish Times*



## Webinar 5: Gathering and analyzing data on the environmental consequences of Russia's invasion of Ukraine

Together with <u>Reporters without</u> <u>Borders-Sweden</u> and <u>Svea Green</u> <u>Foundation, UWEC Work Group</u> hosted the fifth in a series of webinars on the environmental and climate consequences of Russia's invasion of Ukraine on 25 October. Its theme was the collection and analysis of data on the environmental consequences of the war in Ukraine. Presenting experts spoke about the collection and verification of data on environmental damage resulting from military operations and described the techniques using satellite technologies, field research, and other methods.

Alexander Opanasenko from the Ukrainian NGO <u>Ecoaction</u> spoke about the organization's experience in

documenting environmental damage and environmental crimes, including the creation of interactive maps.

Wim Zwijnenburg from Paxforpeace talked about the use of OSINT techniques, remote sensing, and Earth Observation Systems to analyze the environmental consequences of the war in Ukraine. He also highlighted opportunities for collaboration and participation in data collection and analysis for organizations and interested activists from various countries. Representing the Conflict and Environment Observatory (CEOBS), Linas Svolkinas, spoke about remote data collection, verification of publicly available data, gaps in available information about environmental damage and opportunities to eliminate them, as well as the peculiarities of the war in Ukraine in terms of damage to the environment.

The experts' presentations are available in <u>English</u>.

Video recordings of the webinars are also available on our <u>YouTube channel</u>•



## **Fires in Askania-Nova:** Consequences of military occupation of a reserve

by Victoria Hubareva Translated by Alastair Gill

In September 2023, fires raged across Askania-Nova, a unique biosphere reserve in the south of Ukraine. What is happening now in this Russian-occupied reserve?

The Askania-Nova Biosphere Reserve in the Kherson region has been under occupation since the first day of Russia's full-scale invasion of Ukraine. Founded by the assimilated German Friedrich von Falz Fein in 1898, the reserve is the oldest protected area in Ukraine. It was he, having noticed that sheep grazing was destroying steppe vegetation, who first decided to allocate an area that would fenced off from animals in order to preserve the natural condition of the land.

Over time, the reserve grew in size. It survived two wars and was later inscribed as a UNESCO Biosphere Reserve. When Ukraine gained independence in 1991, Askania-Nova



*PlanetScope satellite image shows areas damaged by fire since the full-scale invasion began in Ukraine. Source: UNCG* 

retained its borders. Scientific research was conducted in the reserve and nature lovers could go on guided tours. The reserve lies on a migratory route for birds, and hundreds of thousands of different species of birds fly through the area every year. Askania-Nova also has an active rewilding program, repopulating the area with animals that for various reasons had disappeared from their habitats.

The reserve was taken over by the Russians in the first days of the fullscale invasion of 2022. Despite that occupation, the reserve managed to continue to function as a Ukrainian institution during the first 13 months of the war. Over that period, reserve management refused to cooperate with Russian occupiers, facilitating continued protections for the protected steppelands. The collections of zoo animals and plantings in the arboretum were also secured.

Since the beginning of the occupation, military equipment, troops, and occupation personnel have been stationed on the reserve. They build combat fortifications, and aircraft now constantly fly over its territory, a practice that is illegal for protected areas. All this has created and continues to create significant stress factors for animals and, of course, makes it impossible for the biosphere to carry out its normal work.

#### Read more in this article: <u>Askania-Nova Biosphere Reserve</u> <u>Captured by Invaders</u>

## Russian administration and new risks

On March 20, 2023 the occupation authorities <u>appointed</u> their own administration and established effective control over the institution. This led to an increase in risks and removed all real levers of influence over the course of events and means of supporting the reserve's collections through legal Ukrainian channels.

According to the Ukrainian Nature Conservation Group, fires in August and September 2023 created new threats. During the last of these, caused by a lightning strike on 1 September, 1,790 hectares of protected steppe burned, visible on satellite imagery. This conflagration was the largest to date since the occupation began.

Responsibility for the fire's consequences and damage inflicted upon the protected steppe ecosystem lies entirely with the occupation administration. One of the biosphere's specialists, who wished to remain anonymous, noted:

"Although the latest fire was caused by a lightning strike, its spread could have been

prevented by a sufficient firebreak (200m in width), as prescribed by fire protection measures (in fact, a strip just 100m wide was mowed). According to eyewitnesses, the previous fire in the protected natural depression of Velykyi Chapel's'kyy Pid resulted from a missile launch over the protected area from a Russian military the aircraft, although occupation administration promptly reported on discovery of 'debris from an unknown artillery system of Ukrainian origin...'"

## Russians are preventing contact with territories under their control – but reserve staff are still gathering information

Askania-Nova employees who have left for Ukrainian-controlled areas over the past year now collect information about the biosphere reserve remotely using satellite imagery. No specialists capable of carrying out direct visual examinations remain in the reserve.

Although some of the reserve's personnel remain in occupied territory, **Viktor Shapoval**, director of the Askania-Nova Biosphere Reserve, says most of these people are simply hostages of the situation:

The occupation administration threatens these people with pretty strict sanctions for the transmission of any information. However, we understand the general picture and the interruption to the institution's activities. We obtain some data through remote monitoring (as in the case of fires, mowing, etc.). Meanwhile, the occupation administration, trying to claim credit for certain positive developments, publishes news itself.

## Assessing the damage: Did 2,000, 3,000, or 7,000 hectares burn in Askania-Nova?

A post on the reserve's Facebook page <u>reported</u> that the fire of 1 September was already the seventh to have broken out in Askania-Nova since Russia's full-scale invasion of Ukraine.

Yet prior to this, some media <u>published</u> reports that 7,000 hectares of land had been burned — this disinformation was spread by the press service of the Ministry of Environmental Protection and Natural Resources of Ukraine.

In fact, during the occupation period, over 3,500 hectares of the reserve have been destroyed by fires – more than a tenth of the entire reserve. This figure was first announced by the Ukrainian Nature Conservation Group, subsequently confirmed by the reserve itself, and then repeated by Viktor Shapoval in a personal conversation.

Most of the burned areas – 2,208.62 hectares – are protected land that is home to plant formations listed in the Green Book of Ukraine (similar to the Red Book, but containing data on vegetation formations rather than specific plant species). As reserve staff note, fires in the buffer zone and in anthropogenic landscape areas broke out in agrocenoses – weedy fallow areas and crop stubble. All of the fires within the protected zone occurred in the steppe biotopes that are Askania-Nova's main natural asset and a model example of fescue and feathergrass steppes in the Black Sea region.

Areas under protection for over a century have been damaged as a result of the fires, including the "Stara" area, protected since 1898, and "Uspenovka," protected since 1927. In addition, this entire territory is part of the Emerald Network in Ukraine and has a UNESCO certificate under the Man and the Biosphere Program.

## Velykyy Chapel's'kyi Pid may lose its unique biodiversity

The destruction of the Velykyi <u>Chapel's'kyy Pid</u> by fire was a disaster of equal proportion. This area, which is periodically filled with meltwater in the spring, has the highest diversity of flowering plants in the reserve. The area is so valuable that it has been listed as a wetland of international importance and is protected by the Ramsar Convention, and its biotopes are included in a resolution of the Bern Convention as being of particular value and subject to protection.

"Given the dates of the last largescale fires (at the end of the growing season), most annual plants had already completed their growing season, a significant portion of the perennials, including rare ephemerals (Gesner, Scythian tulips), were already in a semidormant state. In addition, dominant species of feathergrass, listed in the Red Book of Ukraine, were not destroyed, losing only their above-ground parts," said a representative for Askania-Nova.

## Askania-Nova has bigger problems than disappearing plants

According to Viktor Shapoval, fires in Velykyi Chapel's'kyi Pid pose a greater risk to ungulates than the problem of burning vegetation. This is because the area holds a collection of animals that have been assigned the status of National Treasure in Ukraine:

"The territory is fenced, and if it burns completely, the animals will not be able to get out and seek shelter in a safe area," says Shapoval.

Large fires also affect the entomofauna (insect species), which, unlike birds or mammals, are unable to avoid dangerous areas. It is this faunal group that suffers the most.

Fortifications, trenches, explosion craters, and other military actions inflict great harm, disturbing the soil cover and creating war (i.e. created as a result of military activity) landscapes.

"This is something that truly destroys the steppe. If not forever, then for decades," says Shapoval.

#### Can the reserve recover?

"In fact, for a steppe ecosystem, a fire is not a disaster unless the entire area burns out," says Shapoval. According to him, fires are a natural phenomenon that occurs relatively often in steppes. They can be caused by lightning strikes, and the steppe ecosystem is generally adapted to fire. During a fire, only the above-ground part of plants is damaged, and perennial species can grow back from their below-ground organs. Secondly, a seed bank remains in the soil, allowing plants to continue existing in the burned area.

Special efforts to restore vegetation are therefore unnecessary when favorable conditions arise.

"On the whole, recovery will be spontaneous. In fact, even in the preoccupation period, Askania experienced many fires, and vegetation had the opportunity to recover," said Shapoval.

It is impossible to name a precise timeline for recovery at this stage — it all depends on many factors and their interactions, but in any case, the plant life will recover. Detailed information about the course and dynamics of change will only become available next year, when the growing season comes around again.

However, large-scale fires do threaten protected ecosystems where areas that recover after a fire event may differ in terms of their species composition. A restored Askania-Nova may be strikingly different from the one that has been protected for more than a century. • **Main image credit:** <u>*Rubryka*</u>



## UNESCO condemns construction of border fences

Eugene Simonov Translated by Alastair Gill The author's opinions and views do not necessarily reflect those of UWEC Work Group.

latest UNESCO World **h**e Heritage Committee session, held from September 10-25 in Riyadh, Saudi Arabia, condemned two anti-immigrant fences dividing natural ecosystems. One of these is a militarized barrier on the Poland-Belarus border.

UWEC Work Group has previously written about the environmental problems of constructing fences along borders in these articles: • <u>Can the Iron Curtain Be Green?</u> <u>Europe's nature is being divided by</u> <u>fences and fortifications</u>

• <u>Protected areas and border zones</u> in Ukraine: How to harmonize them?

 <u>Beasts and Barriers: Obstacles</u> <u>along international borders and their</u> <u>impact on land-based vertebrates</u>

Rising geopolitical tensions and the growing number of military conflicts, as well as nationalist tendencies in

politics, are weakening and degrading mechanisms international for environmental cooperation. Russia's aggression in Ukraine has affected the implementation of many agreements, World Heritage among them the Convention. In 2022 the annual World Heritage Committee (WHC) session, scheduled to happen in Kazan, Russia, did not take place, since many countries considered it impossible to convene under the chairmanship of a country that had just begun a war. As a result, important decisions on many World Heritage sites have been postponed concerning Lake Baikal, for example.

The 45th session of the World Heritage Committee (WHC), eventually held after a significant delay, resulted in the adoption of resolutions calling for a reduction in environmental damage caused by "anti-immigrant" barriers built along borders, specifically the Belarusian-Polish **Białowieża Forest** and the Mexican biosphere reserve **El Pinacate and Gran Desierto de Altar** in the Sonora desert on its border with the U.S. Both of these protected areas were victims of the migration crisis and unilateral defensive measures at around the same time.

The similarities and differences between these two episodes show how geopolitical confrontation affects the environmental management of <u>border</u> <u>barriers</u>, which UWEC Work Group authors regularly discuss.

## Politicization of the WHC session puts nature at risk

The 45th session of the World Heritage Committee (WHC), held in September 2023 in Saudi Arabia, was one of the most troubled in the organization's history. Due to the <u>unwillingness of the</u> <u>hosts</u> to invite one of the Convention signatories (Israel), the session almost fell through and was postponed for two months. As a result, it was so poorly prepared that dozens of registered participants, including the author of this article, did not receive official visas and had to instead obtain tourist visas.

During discussions of reports on the state of World Heritage sites, several WHC members from Africa, the Middle East, and Russia generously handed out indulgences to other countries, helping them to avoid fulfilling basic obligations to protect natural and cultural values. Only the Belgian delegation challenged this – the remaining committee members were hesitant to get involved in politicized polemics.

Scientifically based recommendations for the protection of World Heritage sites included in the draft resolutions proposed by the World Heritage Center and the International Union for Conservation of Nature (IUCN) were mercilessly distorted and annulled in an exchange of "diplomatic pleasantries" or in the name of a collective struggle against "the remnants of colonialism."

The Russian Federation, which last year exchanged its chairmanship of the session for a war of aggression and international pariah status, has now fully recovered and taken revenge, actively playing along with the most destructive attempts to reduce the mechanisms of the Convention to formalistic nonsense. As a result, Zambia and Zimbabwe essentially given permission were to build a giant hydroelectric power station at the very foot of the Victoria Falls, and Bangladesh was praised for a perfunctory report on a "strategic assessment" of the impact of industrial Sundarbans, development on the world's largest mangrove forest, and was also allowed to continue building ports, factories, and thermal power plants immediately along its perimeter.

When, on the day of the discussion, the author of the article asked the Indian delegation, which controls the other half of Sundarbans (and some of the new industrial sites in the area), for consultations with the Indian conservation expert helping to formulate a position on the draft decision, he was told that the specialist would "arrive in three days." Two other delegations from Committee member countries also had no conservation experts present when making crucial decisions on natural sites.

That is, a number of WHC member countries apparently simply have no need for specialists to help them make decisions, because those decisions are determined by political preferences rather than by requirements for the protection of World Heritage sites.

During the meetings, the Saudi chairman unceremoniously interrupted and silenced not only NGO activists of the opportunity to speak, but also representatives of the Convention's State Parties, including the Ukrainian representative when she tried to respond to verbal attacks from the Russian delegation.

The German non-governmental organization World Heritage Watch, which deals with issues relating to the Convention, laments the results of the session in its press release:

"The UNESCO body suffers from some of the same systemic flaws that cripple the UN Security Council: Member states of the World Heritage Committee can abuse their power and take politically motivated decisions contrary to the obvious facts, while civil society remains consistently excluded decision-making processes." from its "The common heritage of humanity is being brought to ruin before everyone's eyes," states Stephan Doempke, Chair of World Heritage Watch. "The crisis of multilateralism does not stop at UN Special Agencies such as UNESCO. We therefore call on the 195 States Parties to the World Heritage Convention to initiate a reform of the Rules of Procedure of the World Heritage Committee at their General Assembly in Paris in November to remedy glaring



An opening for large mammals in a fence along the Polish border. There are also culverts for small animals at the base of each section. Source: <u>Council of Europe</u>.

abuses, and to elect states to the Committee that offer greater guarantees of adhering to the spirit and letter of the World Heritage Convention."

However, procedural flaws often turn out to be a blessing in disguise. There are so many World Heritage sites in the world that require immediate protection, and WHC sessions are held so infrequently that at each session the UNESCO WHC monitoring mechanism can only afford to discuss the most controversial draft resolutions on the state of conservation of the sites. This means that only decisions on whether to include or remove sites on the World Heritage in Danger list are discussed, as are draft decisions to which at least one WHC member categorically objects. Most draft resolutions by necessity have to be adopted without discussion, in the form prepared by UNESCO bodies (in strict accordance with the rules of the Convention after consultations with the countries that own the relevant sites).

Fortunately, only 22 of more than 200 assessment resolutions were discussed (and in most cases were significantly watered down), while the rest were "rubber-stamped" without discussion. Paradoxical as it may sound, in recent years such undiscussed resolutions tend to turn out to be more constructive and useful for the protection of sites than those that have gone through the crucible of debate between Committee members. Below we examine two such resolutions and their significance for the sites in question.

### Construction of the border fence between Belarus and Poland, dividing Białowieża Forest

In 2022, biologists Oleksiy Vasyliuk and Vadim Kiriliuk wrote a detailed analysis of the border fence in Białowieża Forest, in which they pointed out that it was an important opportunity for Poland to consider and combine the needs of environmental protection and national security. A <u>new UNESCO</u> report on the state of the site reveals that the fence was built in Poland without carrying out the necessary assessment of the impact on the heritage site. The 186-kilometer-long, 5-meter-high steel fence stands on a concrete foundation and includes 24 standard passages for large mammals, five meters wide and 4.5 meters high.

At the end of 2022, in response complaints by citizens, Poland to submitted to the secretariat of the Bern Convention a document titled "Analysis of the impact of the construction of the barrier on the subjects of protection of the Natura 2000 site Białowieża Forest together with the Białowieża National Park Area." Warsaw subsequently similar document to submitted а **UNESCO** and other authorities, although in terms of its form and content it does not fully comply with impact assessment standards. Nevertheless, the argumentation set out in it was strong enough for the Bern Convention bodies to reject the complaints.

The arguments presented by the Polish side to UNESCO and the Bern Convention, came down to the <u>following</u>:

1. Poland had been subjected to threats from Belarus/Russia, aimed at discrediting Poland in the EU, and had therefore been forced to act quickly in a dynamic crisis;

2. At the beginning of the crisis in 2021, Poland hastily erected a barbedwire fence that was extremely harmful for animals (and people), but the new barrier cannot cause injury to animals (judging by the photographs, the new fence is indeed less dangerous for animals).

3. The analysis conducted shows that 24 passages are located in optimal locations, based on available information about animal migration patterns. The barrier does not block watercourses and has not been constructed along rivers, which serve as natural obstacles.

4. It makes no sense to make a larger number of passages in the fence, since there has been a continuous multilayer barrier on the Belarusian side of the border since the Soviet era. This is a whole system of manmade structures, including several fences made of barbed wire, and is impassable for most animals. This is confirmed by telemetry



*Temporary barbed-wire fence on the Polish side of the border in 2021. Source: <u>Council of</u> <u>Europe</u>.* 

data from tagged bison and other large mammals that generally do not migrate deeper into the Belarusian part of the site beyond this system. Belarus recently upgraded and reinforced this structure, making it even less permeable for large mammals.

Indeed, back 1992, when in nominating the Belarusian part of the World Heritage Site, UNESCO and the International Union for Conservation of Nature and Natural Resources strongly recommended that Belarus study the possibility of dismantling its system of Soviet-era border structures. These recommendations were repeated from <u>1999</u> to <u>2004</u>, until, finally, in 2005, Belarus promised to begin partially dismantling the barriers, primarily in mammal migration areas, and in 2006 <u>asked</u> UNESCO to cover the costs.

The money was not allocated, either because it is a relatively prosperous country by UN standards, or because of a lack of clarity in the application, but in 2007, 2009, and 2014 UNESCO continued to persistently recommend that Belarus adapt its border fence to the needs of migrating animals. Therefore, when the Polish side attempts to justify the small number of passages in its fence by citing the presence of a parallel barrier belonging to its neighbor, it forgets that the task of removing or adapting the Belarusian fence was originally supposed to be a joint endeavor. So there is good cause to reproach the Polish side: the measures it has taken are



Multi-layered system of human-made barriers along the Belarusian border in Białowieża Forest. Source: <u>Council of Europe</u>.

likely to ensure that the border conflict will divide the protected forest in two forever.

The UNESCO World Heritage Center assesses the data currently provided by Poland as insufficient to draw conclusions, pointing out in its analysis that the choice of measures to ensure migration is not supported by scientific evidence, and the impact assessment presented is limited to Polish protected areas and does not assess the impact on the transboundary site as a whole. In its resolution, the UNESCO WHC requests both countries to invite a UNESCO/ IUCN monitoring mission to evaluate the damage to heritage values and the adequacy of measures taken to mitigate the damage. If extensive damage is discovered, the mission will also have to consider the possibility of adding Białowieża Forest to the World Heritage in Danger list.

It is not clear from the text of the decision whether the mission will consider the impact of the two lines of fencing in both countries or only the new one in Poland. However, biologist Vadim Kiriliuk <u>recently stated</u> that it is known that for ungulates, the stress and injuries caused to animals caught between several parallel barriers can be especially dangerous. Therefore, in this regard, the Polish authorities are right: the combined impact of the Belarusian and Polish fence systems on the natural ecosystem should now be considered.

The chief challenge is that at present the two countries are in no way inclined to cooperate and often use this situation, including appeals to UNESCO, for political purposes.

Belarus has been broadening its intimidation tactics, not only by shipping hapless migrants into the border zone, but also by stationing Russian mercenaries nearby "for protection against NATO," as well as continuing with endless military exercises near the border. For Minsk, appeals to UNESCO are purely a political screen.

This fall, however, the Polish ruling party Prawo i Sprawiedliwość (Law and Justice) decided that its best chance of winning the parliamentary elections in October was to base its campaign on a showdown with its eastern neighbors and migrants, which briefly led to a souring of relations with Ukraine. Ten thousand troops were deployed to guard the border with Belarus, which, according to this writer, may indicate that the fence is of limited use as a means of protecting the border.

The issues of removing the recently constructed fence and ending discrimination against migrants (which EU legislation requires of Poland), was put to the public in an extremely dubious "referendum" held concurrently with the elections. Prawo i Sprawiedliwość believed that holding this referendum would help increase election turnout, thus garnering more votes, but these expectations were in vain. More than 70% of voters voted in the elections, while only 40% took part in the "referendum," which made its results not a binding call for action, but rather only a recommendation. But of those who voted, more than 90% opposed demolition of the troubled barrier, though it is extremely unlikely that they had access to reliable information about its real effectiveness and side effects.

Poland's right-wing populists are likely to lose power as a result of the elections, leaving their replacements with a fence and the stifling odor of xenophobia as a means of patriotically mobilizing the electorate. The hope is that there will be greater interest on the Polish side of the fence in addressing national security issues in a meaningful conservation-sensitive manner. and But there is no hope for any productive dialogue with Belarus in the foreseeable future, negating prospects for transborder environmental cooperation. UNESCO also mentions the lack of cooperation in its resolution.

#### Mexico and the United States cooperation on border fencing

The problems facing Białowieża Forest are echoed by another <u>WHC</u> <u>decision/resolution on the fence</u> that separated the Mexican biosphere reserve **El Pinacate and Gran Desierto de Altar** in the Sonora Desert from several protected areas across the border in the U.S. state of Arizona.

The construction of a continuous metal "wall" along the entire land border with Mexico was one of the hysterical election promises made by Donald Trump, who mobilized voters by inciting hatred against migrants. In February 2022, the NGO <u>Center for Biodiversity Conservation</u> contacted UNESCO to ensure that the damage was reviewed and that it accelerate work on measures to reduce the barrier's impact on biodiversity.

The key species here (like European bison in Białowieża Forest) is the Sonoran pronghorn, a relict ungulate that once inhabited deserts in North America and is now in danger of extinction. Cutting a single population into two has only added to the threat.

In response to UNESCO's appeal and according to the Convention, the government of the U.S. (a country without its own nearby World Heritage site, is obliged not to cause harm to other sites) cheerfully reported that it was aware of the extensive damage caused and had already instructed the National Park Service, which is working alongside Mexico's National Commission of Natural Protected Areas, to develop a comprehensive plan to deal with the consequences. The two sides are also jointly developing a comprehensive conservation plan for the Sonoran pronghorn. All that remains is for UNESCO to call for the "acceleration and deepening" of efforts and to recommend a monitoring mission...

To be honest, it is unclear whether American agencies will be able to help overcome at least some of the negative consequences caused by the "Trump wall," but the speed with which they have made a complete U-turn and begun to cooperate with Mexico inspires some hope. The site is still at risk of being listed as "World Heritage in Danger" in the near future, which could help mobilize large resources (primarily from the U.S. budget) to correct the situation.

## The WHC and Russia

The Russian delegation, with the support of Ethiopia and other "colleagues" in the WHC, managed to prevent the Volcanoes of Kamchatka from being included on the site list of World Heritage in Danger, where, according to the rules of the Convention, it was necessary to include it, since Russia had illegally eliminated protected status from part of the site's territory. But at the same time, Russia promised to strengthen protection of the site, including the territory previously excluded from the protected area, and not to build a port there for cruise ships. Resolutions were passed without discussion on five more natural sites in Russia: Golden Mountains of Altai, Virgin Komi Forests, Lake Baikal, Western Caucasus, and Wrangel Island, as well as on the Landscapes of Dauria site, jointly administered with Mongolia. These resolutions presuppose a reasonable strengthening of environmental measures and warn against violations. In its <u>resolution</u> on "Wrangel Island," the WHC warns that the site may be included on the World Heritage in Danger list if Russia updates its regulations to allow military maneuvers throughout the reserve.

#### Read more:

• Polar bear vs military monsters

On 14 September 2023, on the very day the WHC adopted this decision, the Russian Ministry of Natural Resources <u>approved</u> an update to regulations related to Wrangel Island Nature Reserve, eliminating any attempts to permit military maneuvers and other potentially harmful activity across the entire territory of the reserve, strictly limiting defense activities to the specially designated sites. This shows that, despite threats from high-ranking lawmakers to force the country to abandon the "overly politicized" UNESCO, the mechanisms of the Convention can still have a beneficial effect on environmental decision-making in Russia.

In the international arena, however, Russia tends to view the World Heritage Convention not as a mechanism for cooperation, but as a geopolitical weapon. So it is no accident that, at the

time of the WHC session, the Ministry of Natural Resources and Environment of Russia announced "public consultation" on a draft government resolution assigning strict scientific nature reserve (zapovednik) status to the Falz-Fein Askania-Nova State Nature Reserve in Kherson oblast. This reserve, which has existed for more than a century and which was <u>occupied</u> by Russian forces in the first days of the war, is currently the sole protected natural area in Ukraine that is a candidate for inclusion on the World Heritage list. Russia's strategy seeks to reassert and legitimize its control of protected areas in occupied territory, confronting the fact that they are recognized as belonging to Ukraine by UNESCO and all other UN bodies.

Read more about the current situation in Askania-Nova:

• <u>Fires in Askania-Nova:</u> <u>Consequences of military occupation of</u> <u>a reserve</u>

It is also worth noting that on the eve of the WHC session, the historic center of Odesa, which was recently <u>included</u> on the "World Heritage in Danger" list, was subjected to a devastating Russian bombardment, damaging several historical monuments. The 45th session of the WHC was also forced to add cultural and historical sites in <u>Lviv</u> and <u>Kyiv</u> to the same list as under significant threat during the war and therefore requiring urgent support. • *Main image source: <u>Wildpoland</u>* 



## U W E C

Ukraine War Environmental Consequences Work Group