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**Ukraine War
Environmental
Consequences
Work Group**

Issue #1
2022 UWEC work group



We are writing to share the very first issue of Ukraine War Environmental Consequences Work Group (UWEC). This publication focuses on the environmental consequences of the war.

We are a community of experts, environmentalists, journalists, and activists who have come together to share information about the environmental impacts of the war in Ukraine. We want people in the farthest corners of the world to know about these consequences.

The war has revealed many existing and inter-related challenges facing

today's society. Although the hostilities sparked by Russia's invasion of Ukraine are happening in Eastern Europe, their echoes are being heard around the world.

Our planet's climate and environmental security is under threat. We must work together to not only stop the war, but also find ways to minimize its impacts

In this first issue you can read about:

- [UWEC Work Group - who we are and about UWEC's goals.](#)
- [An interview with Ukrainian Nature Conservation Group director and co-founder Oleksii Vasyliuk about real and potential environmental consequences facing Ukraine as a result of this war.](#)
- [We examine the example of Oskil Reservoir - where a dam failure that is one of the most significant environmental impacts today illustrates how the war is destroying Ukraine's infrastructure and transforming landscapes and ecosystems.](#)
- [Our expert Eugene Simonov discusses the food security crisis stemming from the war, the agriculture industry's reaction, and potential impacts on protected areas around the world.](#)
- [The war is influencing environmental laws in Russia and could result in uncontrolled logging in that nation's forests.](#)
- [Each of our issues will also include our commentary on a digest of recent environmental news linked to the war's consequences.](#)

We would love to hear from you. Write us at editor@uwecworkgroup.info. Don't hesitate to tell others about UWEC and share this issue with your network. We are open to collaboration with experts, environmental organizations, and activists from around the world. Please, let us know if You want to subscribe to our regular issues.

Yours, UWEC Work Group Editors



About **UWEC**: Ukraine War Environmental Consequences Work Group

*Seeking solutions through information sharing about the
environmental impacts of the war*

Today, the repercussions of Russia's invasion of Ukraine are beginning to be felt around the world. Global challenges include an energy crisis exacerbated by many nations' rejection of Russian fossil fuel deliveries, the prospect of famine that will primarily affect the planet's poorest nations, regressing environmental and social policies in many countries, and slowing progress toward achieving climate neutrality goals. Russia's attack on Ukraine is a critical moment, a crossroads of sorts. It is not only about the humanitarian and environmental crises to be comprehended and endured across all of Eastern Europe, but also about choosing a path for the development of global society.

The world cannot wait for the war to end; we must search for solutions to the questions of our time, be they climate

change, destruction of natural ecosystems, or the resumption of the Cold War.

Ukraine at the frontlines

The military invasion of Ukraine, an industrially developed state possessing nuclear facilities, has led to catastrophic pollution with existing and potential transboundary consequences. A significant number of unique natural sites, ecosystems, and species, as well as World Heritage Sites are being destroyed or threatened.

Direct negative environmental impacts are the most obvious, such as emissions stemming from bombardment of oil refineries and natural gas pipelines or destroyed water and sewage treatment facilities.

In addition to obvious consequences, problems can also be indirect or even hidden, receiving less attention. The war is not over and the situation could





worsen significantly. Concern is building that these events could deal a crushing blow to global climate policy. Sanctions and worldwide censure impact critical global collaborations for climate research in Russia.

The war has also triggered relaxation of environmental requirements in Ukraine, Russia, and many other countries. Politicians and corporate lobbyists in many countries propose to sacrifice environmental conservation in favor of strengthening defense and saving the economy.

Another less obvious consequence of the war is increasing pressure on civil society activists, experts, and community initiatives, including those focused on protecting the environment in Russia and Belarus. Many activists and experts from these countries are forced into political exile and yet seek opportunities to continue their work.

Today, the Ukrainian Ministry of Environmental Protection and Natural Resources, environmental NGOs, and a number of international organizations collect information regarding the negative environmental consequences of the invasion. That said, both government agencies and civil society are unable to document negative impacts and even begin to address problems and hazards in occupied areas and active combat zones.

In Ukraine and the larger region, civil society is also fighting to stop the war

from being used as an excuse to relax environmental laws and regulations. Environmental NGOs oppose any relaxation of environmental impact assessment standards and seek to ensure that Ukraine's restoration meets standards for sustainable development and the European Green Deal.

UWEC's beginnings

The founders of the Ukraine War Consequences (UWEC) Work Group are environmental activists, experts, and journalists. The goal of our partnership is to collect, verify, analyze, and share information about the war, produce expert analyses, and offer development solutions meeting the best environmental standards to address the global humanitarian and environmental crises.

As we see it, with incomplete information the problems cannot be understood. So we will gather data on the war's negative impacts on the environment and verify and analyze it. Environmental monitoring organizations and investigative journalists must collaborate to collect, verify, and organize huge amounts of data. This work will leverage existing and develop new assessment and verification mechanisms.

Analysis comes next – processing, analysis, and forecasting. We already have a core group of experts with extensive experience in environmental



and ecological analysis, and we will expand and attract specialists in fields from climate research to energy.

The third phase is information-sharing, including a regular newsletter, website, and social media engagement. Looking ahead, we plan to use a variety of modern media, including podcasts, video, and virtual events.

Key topics

- Transboundary impacts
- Direct environmental impacts from warfare
- War and climate change
- Ecosystems threatened by the war and its aftermath
- Wartime challenges for civil society
- Safeguarding protected areas
- Food security and environmental policies
- Sanctioning impacts on the environment
- Green recovery
- Nuclear safety
- International political crisis and the fate of global cooperation.

Our founding team:

- [Oleksii Vasyliuk](#) – UWEC WG expert group director, [Ukrainian Nature Conservation Group](#) leader and co-founder
- [Eugene Simonov](#) – UWEC WG expert group coordinator, RA(***)EA speaker, [Green Silk Road Network](#) co-founder, and University of New South Wales PhD researcher, listed as “foreign agent” by Russian Ministry of Justice.
- [Aleksei Ovchinnikov](#) – UWEC WG editor-in-chief, [Green Portal](#) co-editor- (Belarusian and regional independent media).
- [Irina Sukhy](#) – Representative of [Ecohome](#) (Belarusian environmental NGO in exile) to UWEC
- [Jennifer Castner](#) – UWEC WG co-editor, translator, [The Altai Project](#) director (US-based Eurasian conservation organization)
- [Angelina Davydova](#) – UWEC co-editor, environmental journalist, fellow with the Media in Cooperation and Transition (MiCT, Berlin). Climate Projects Coordinator with n-ost (Berlin-based network for cross-border journalism) •

Questions? Want to get involved? Have ideas?

Contact us: editor@uwecworkgroup.info



“Nature’s biggest challenges could begin after the war’s end”

An interview with [Oleksii Vasyliuk](#), Director and Co-founder, Ukrainian Nature Conservation Group



Oleksii Vasyliuk has been tracking the environmental impacts of the war in Ukraine since 2014. Over that period, he has co-authored several books dedicated to the negative impacts of the hostilities on the environment as well as violations of environmental policy and law in Ukraine’s occupied territories. We spoke with Oleksii and discussed

both the war’s likely consequences and ways for civil society to minimize them.

– Hello, Oleksii. Tell us a little bit about yourself and the Ukrainian Nature Conservation Group.

– I’m a biologist; I graduated from Shevchenko Kyiv State University. I have worked since 2004 at the



Zoology Institute at the Ukraine National Academy of Sciences, in the Wildlife Monitoring and Conservation Department. I'm also active in a variety of community initiatives.

Unfortunately, and unlike Western nations, science in Ukraine does not have a structural understanding of conservation biology. Biological diversity conservation is a separate branch of science, while here, it's more along the lines of a hobby, an applied activity that you do in your spare time.

Thankfully, at our Institute the importance of nature conservation is understood and supported. Overall though, the community of specialists that are interested and engaged in conservation issues is broader than the employees at just one institute. There are professional conservation specialists at the Institute of Botany, universities, and national parks and reserves.

At first we worked in different places and in various public associations. Then we realized the community needed an official status; to transition from an abstract "we" to activity on behalf of some institution, public association. This is where the idea of the Ukrainian Nature Conservation Group came about; we registered it in 2018.

Our team consists almost entirely of professional biologists who make nature conservation their priority. UNCG's mission is to unite experts, biologists, and ecologists in support of the

environment and the implementation of European environmental legislation in Ukraine. All of our members have worked together for a long time and we trust each other.

In my free time, I collect intellectual music of the 1970s. It creates an atmosphere that helps me both relax and focus.

Right now, during the war, our work is totally unlike what we do in peaceful times – we help protected areas employees in occupied territories or that have fled, losing their homes in destroyed cities. We have been [collecting funds](#) for them. It's all a lot of work, but we are trying to support everyone who needs help.

– Ukraine is experiencing its second war in the last ten years. Prior to today, there was fighting in 2014-2015. Was there monitoring and analysis of negative environmental impacts at the time?

– First off, I want to say that this is a single war that started in 2014.

From 2015-2018 I worked for the NGO [Environment-People-Law](#) (EPL) and studied the impacts of military action on the environment. EPL is truly the first organization in Ukraine to have begun serious analysis of those impacts.

I think that at that time, the war was different. The Donbas region has large industrial zones and dense population centers, surrounded by significant,



Results of military trainings in Oleshky Sands National Nature Park. Credit: Wikipedia

sparsely-populated natural areas. Fighting often took place in forests and open spaces. Separatists tried to protect urban infrastructure.

Today, the war is taking place in lands where there are many small settlements surrounded by agricultural zones. Wilderness is less impacted. But cities are being almost completely destroyed, which can have far-reaching negative impacts for the environment.

All these destroyed cities will eventually need to be rebuilt and the resources for that will come from the landscape. They will be built using sand, concrete, stone, and wood taken

from nature. This means that natural ecosystems will be under threat of development.

Going back to the fighting in 2014-15, we tried to collect and analyze as much data as possible. It wasn't easy, of course, especially since most of the land where combat took place ended up occupied.

Our work resulted in the publication of several books – [the Influence of Military Activity on Ukrainian Nature](#) and [Crimea's Environment: Changes and Losses During Occupation](#). Colleagues and I also published [several articles](#) in refereed journals.



Our studies on the war's negative impacts were not the only ones; there is now a specific methodology and knowledge base that exists for analyzing today's consequences. The challenge is that fighting is ongoing and we can't readily monitor the situation or collect data.

Of course, studying these environmental impacts is a big part of the work. Since the hostilities have continued more or less since 2014, you can imagine the scale of the problem. There are also the environmental impacts of military exercises to consider. The biggest of these took place in Oleshky Sands National Nature Park (occupied today). Military training grounds in the occupied Luhansk are also situated in nature refuges.

Of course, we were in total opposition to "military" use of nature, even if it's not generally done to speak out against training exercises during wartime. Still, you can't defend your country with one hand while the other one destroys its natural heritage.

- Oleksii, given the depth of your experience in studying the environmental impacts of the war, can you predict the impacts of the events occurring today in Ukraine?

- You know, we can't even get a clear picture of the impacts of the fighting in 2014-2015. Significant areas have been occupied since 2014, and we haven't

been able to study those areas at all. So, predicting impacts is challenging today. All the more so, given that fighting has now spread across almost all of Ukraine, and all large cities are being bombed, including in the western part of the country, which, of course have a negative impact on the environment. Many speak of fires at oil depots, and we must also remember that sewage treatment plants, water transport facilities, and the general negative impacts of infrastructure destruction on the environment.

We can classify the types of impact and collect open-source data, and we have the tools to do that, for example, using satellites. We also gather a lot of information by monitoring news coverage. I spend several hours every day scrutinizing social media channels and tracking regional news. Occasionally, there are tidbits that we try to verify and analyze from an environmental impact perspective. And alas, if we miss even a day of that sort of work, we will lose some data forever. There is a huge amount of news and it will be impossible to track hundreds of thousands of messages months and years down the road.

That said, reliable information on the war's impacts is very limited. That was clear in 2014-2015 and the same is true today. For example, when we collected information about natural resource use in Crimea, we found



very little available data, and what we found was difficult to collect and analyze.

It's also impossible to collect just a few samples in the sites that we can access and then those samples to calculate quantitative indicators that would allow us to understand the consequences of annexation or occupation. Ideally, samples should be collected at the moment the pollution occurred, and that, I'm sure you understand, is not possible in combat conditions.

Long-term research in places hardest hit by the war are needed in order to comprehend the full scale of the impacts. And for that to happen, the combat must end and we need to get access nationwide. We must also keep in mind that it could take years to remove mines and ordinance. So, we will not be able to access many areas in the near future.

- You mentioned that combat is mostly happening in cities and not in conservation areas and that rebuilding infrastructure may inflict the biggest blow to nature.

Yes. I think that compared to 2014-2015, nature is taking less direct damage from today's hostilities. For the most part, the war is happening in agricultural areas with more fields and small cities than in nature reserves and national parks.

But tomorrow all these cities and villages will need to be rebuilt. Sand,

granite, and other natural materials will be needed.

Ukraine's land code is unique in that it does not permit resource extraction on agricultural lands, most of which are privately owned in the country. These are very large spaces, the areas of which will likely only increase, leaving only a few percent in natural ecosystems.

In recent years, we have already had to oppose mining activities for building materials in protected areas several times, including, for example, beryllium mining in Polesie Nature Reserve. At UNCG, we strive to monitor cases such as these as actively as possible and bring them to the public's attention. We often manage to halt destructive projects. But if their number increases tremendously, will we be able to mitigate the extraction of sand, chalk, crushed stone, and logging?

It would be helpful if reconstruction could follow principles for a "green" and "sustainable" economy. But for that to happen, these principles must be implemented. And even before the start of the war, environmental concerns were not always taken into account when planning resource extraction.

- Tell me what international organizations, activists, and caring people can do today to minimize the



negative environmental consequences of the war?

– It's hard to imagine how to minimize those consequences. They will happen no matter what we do.

The first thing we need is for the war to end as quickly as possible. The longer it goes, the more destruction. Moreover, it should also be said that during the war, we can't engage in conservation work. For example, we can't monitor the agricultural sector that is continuing to convert natural spaces to farmland while the war is ongoing; we can't track logging in

forests where entrance is prohibited due to martial law.

So, in my view, community organizations should come together to bring the war to an end. As quickly as possible. Such collaboration will also enable us to plan and implement successful restoration projects that are also environmentally friendly.

I think that we will be successful if we can unite our efforts. We must collect, process, and analyze data and develop and use analytical tools. We must ensure that Ukraine's reconstruction does not result in the destruction of nature •



Should the Oskil Reservoir be rebuilt after the war?

By Valeriia Kolodezhna, [Oleksii Vasyliuk](#), UNCG

About authors:

Oleksii Vasyliuk. Oleksii chairs the NGO Ukrainian Nature Conservation Group and is a biologist.

Valeriia Kolodezhna. Valeria is an expert in wetland biology at the NGO Ukrainian Nature Conservation Group and a geographer.

One of the biggest environmental changes caused by the Russian-Ukrainian war is the destruction of one of the gates of the Oskil Reservoir in the Kharkiv area on April 2. Roughly 355,500,000 cubic meters of water rapidly escaped from the reservoir, causing the level of the Siverskyi Dinets River to rise and exposing about 9,000 hectares of the silted bed.

Rising water levels in the Siverskyi Donets River, into which the Oskil flows, have helped to stop advancing Russian troops, who are to this day unable to cross the largest river in eastern Ukraine. Although these short-term tactical advantages are important for the protection of our state, the long-term environmental consequences are less clearcut. The Oskil Reservoir was created to regulate water levels in the Siverskyi Donets-Donbas Canal (maintaining water volume in summer, when the Siverskyi Donets River flows). That is, this reservoir is directly related to the water supply for the vast majority of

the population of Donetsk and Luhansk regions. Tangentially, the canal's final destination is Mariupol.

Thus, local and regional governments are first-and-foremost concerned with any threats to the canal's ongoing operations or water supply for the Donbas as a whole. Water supply in the Donetsk region is currently a worry not only for the Donbas Water Company, but also for the United Nations' World Health Organization. Millions of Ukrainians are currently deprived of drinking water, including Ukrainian citizens in the temporarily occupied territories of the Donetsk and Luhansk regions.

Few seem to be worrying about the environmental consequences of the de facto elimination of the Oskil Reservoir.

The reservoir has attained a respectable age; in 2022 it will be 65 years old. It is the largest reservoir on Ukraine's Left Bank and is eighth in surface area and total volume for the country as a whole (122.6 sq km and



Figure 1. Bare landscape of the Oskil Reservoir bed, late May 2022. Credit: Sentinel Hub

0.474 sq km, respectively). However, despite its impressive “dimensions,” 33.5% of the reservoir’s surface area is shallow water, which fish prefer for spawning and where significant sedimentation occurs. Average sediment depth ranges from 0.5 m in the lowlands up to 1 m in the river’s upper reaches. As a result, the reservoir’s water supply is swampy, with high phosphorus content, low water clarity, and mediocre water quality. In such conditions, although cases of fish suffocation are not uncommon, people have no other choice but to rely on this water supply system, for the last 65 years.

Considering that Siverskyi Donets-Donbas Canal pump units have also

reached the end of their service life [1], perhaps the reservoir’s damage is a good opportunity to modernize the Donbas water supply system while giving nature what it deserves – restoration of the Oskil River’s natural floodplain. The floodplain’s natural features remain perfectly preserved beneath the former reservoir and are clearly visible, even from space.

To understand what this means in wildlife terms, we must first understand these recent changes.

On the one hand, the vast majority of water drained away, exposing a significant area of the reservoir’s bed that is now subject to wind erosion. Vegetation on the former shores lost its



Figure 2. Oskil Reservoir bed, 2021 Credit: Sentinel Hub

usual hydrological regime and is unlikely to continue to exist prior to the rupture. This also applies to rare species, such as *Gladius tenuis*. The reservoir's shallows were feeding and nesting grounds for many waterfowl, including rare birds. All of the organisms inhabiting the thick layer of now-exposed silt will die off, resulting in new problems. Most of the young fish and the fish population as a whole have been swept downstream, and there is insufficient appropriate habitat to restore former populations.

On the other hand, the dam has not been completely destroyed. The river's flow has not been restored, and conditions necessary for fish to resume spawning and move freely past the dam do not yet exist.

Thus, the dam's partial demolition destroyed temporary ecosystems

formed on the artificial reservoir's site, but did not create the conditions needed for natural restoration of a rheophilic ecosystem – a natural, unregulated channel with running water.

After the war, we will be at a crossroads. One option is to repair the dam, refill the reservoir, and transport its waters hundreds of kilometers south for another half a century. All the while consuming the electricity and, most importantly, human resources, need for maintaining this type of water supply. Another option is to allow nature to regrow the Oskil's floodplains grasslands, restoring meadow landscapes on the left, flat bank of the river and limiting erosion on the right, high bank. From a wildlife perspective, the second option is most desirable, restoring the natural course of the river by dismantling the reservoir's dam.



Let's look at both options more closely.

Option №1. Return the reservoir to its former state and restore Oskil hydropower plant's capacity.

It takes time to fill reservoirs, a process that depends on conditions. For example, the first filling of the Oskil Reservoir to a normal operational level occurred between 1958 and 1977. No matter the duration, the temporary but greater water demands will not go unnoticed for the Oskil River, its floodplain, and downstream flora and fauna. Below the dam, pioneer plants will increase shallows and overgrow the riverbed. Afterward, the dam will hold back river sediments, and water clarity below it will increase in the area of Sinichynskyi Landscape Reserve. That reserve's goal is to preserve the Oskil River's natural features, riparian and aquatic ecosystems, and rare plant and animal species. River blockage or even a significant decrease in runoff will lead directly to destruction of the reserve's natural value.

In the years after refilling, the reservoir's restoration will make it possible to replenish the Siverskyi Donets-Donbas canal as well producing roughly 11 GWh/year of electricity at the Oskil hydropower plant. But this capacity is actually equal to the average annual generation of a single Vestas windmill, of which at least

500 are installed in various parts of southern and eastern Ukraine. The plant's electricity production dims still further when you factor in the energy needed to pump water at the canal's four pumping stations. According to 2021 Water of Donbas Municipal Enterprise data, electricity consumption costs reached 41% of the total cost of water supply [2]. We can assume that replacing the equipment of even a few of the 64 water pumping stations with energy-saving technologies, the Oskil plant's potential produced energy levels out as much more electricity is needed to maintain the canal than the plant can produce. The Donetsk region is one of the least water-supplied regions in Ukraine. Thus, if the reservoir is refilled and necessary water discharges take place, it will include 50 million m³ of water to supply the Siverskyi Donets-Donbas canal, where its primary use is industrial. This removes not only millions of cubic meters of water from the river, but there are additional water losses during transportation in the canal, an amount that reaches 65-69% [2]. Again, these losses again point to the need for modernization.

Given the large area of shallow water and stagnant water regime, the water in Oskil Reservoir will constantly "bloom", and, given long-term climate forecasts, this problem will worsen. According to hydrobiological measurements in 2016, phytoplankton



in water samples exceeded 100 cells/cm³. Prior to the accident, the blue-green algal “blooming” at the dam reservoir was quite long thanks to abnormally high air and water temperatures. This story will be repeated if the reservoir is refilled, likely resulting in recommendations to avoid recreation and fishing in the area. Fishing is already badly impacted by eutrophication, resulting in fish die-offs caused by suffocation and low fry survival rates in early summer (especially when water levels are lowered rapidly). The figures speak for themselves: while in 2017 the actual catch of fish in the reservoir reached 13.61 metric tons/year (with a total allowable catch of 19.58 tons/year), in 2020 it was half that amount – just 6,076 tons/year. The changing climate warms shallow water bodies such as the Oskil Reservoir, resulting in negative consequences that could be eliminated by restoring the river’s full flow. If the restoration path is chosen, it will be the restoration of inefficient, environmentally problematic, and economically unprofitable infrastructure.

Option №2. Dismantle the dam of the Oskil Reservoir and restore the natural course and floodplain of the Oskil River.

The practice of removing old and small/offline dams has long been

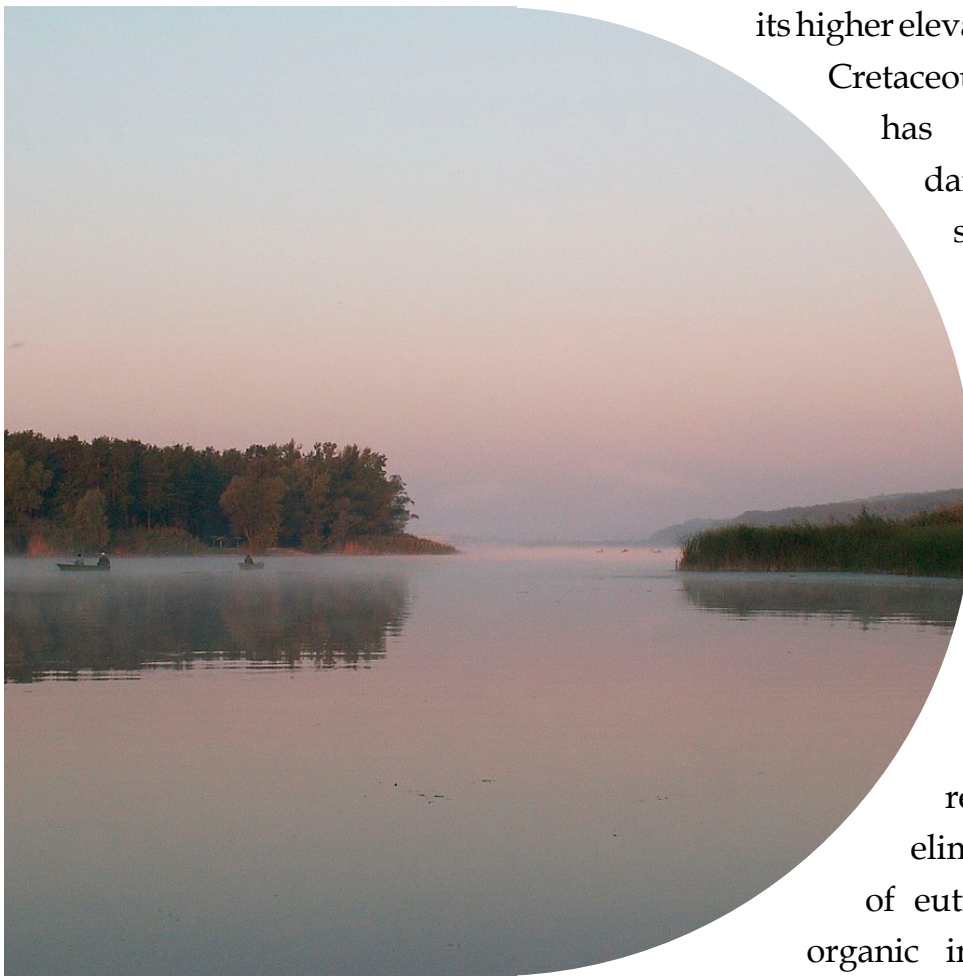
acceptable in the EU and the US and is actively spreading further today. 2021 was a record year – 239 abandoned or dilapidated dams were dismantled in the EU; a thorough study of the pre- and post-conditions of their decommissioning was conducted for each of them.

Restoring the Oskil River’s flow solves several problematic issues in the region, problems that were highlighted in a report on the state of the environment in Donetsk region in 2019 [3]. The “According to the ‘Improvement to the hydrological regime and ecological condition of the Siverskyi Donets River in Kharkiv, Donetsk, and Luhansk regions feasibility report,’ indicates excession obstruction to the river’s flow. The obstruction coefficient is 1.54, based on the high number of freshwater reservoirs and ponds in the river basin. One option presented sought to “determine the feasibility of operation of hydraulic structures in reservoirs.” This option is absolutely appropriate in the case of the Oskil Reservoir.

Let’s imagine what will happen if, after expert analysis, further operation of the reservoir and hydroelectric power plant is deemed inexpedient (as laid out in the brief overview above), and the dam is dismantled. It is very important that solutions aimed at solving environmental problems are truly environmentally friendly. For



example, in order to prevent water levels in the reservoir from being lowered, communities may begin to develop previously inaccessible “land resources” by plowing or building up reclaimed areas. The reservoir bed will remain bare only temporarily; floodplain meadows will regrow and become a natural oasis for people and animals.



First of all, restoration of the Oskil’s natural runoff will give many fish species the opportunity to return to their habitats, a process predicated on running water and an unblocked channel. These fish populations are a ready prey base for bird species

nested in reed thickets around the former reservoir or for those birds that will return to restored floodplain landscapes. Of course, this also includes species protected by Ukraine’s Red Book that require free-flowing water.

Unfortunately, the reservoir’s detrimental effects have not only affected wildlife. The right bank of the river, with its higher elevation and picturesque

Cretaceous outcroppings, has suffered significant damage from storm surges up to 1 m in height during the reservoir’s existence. When the river again begins to flow naturally, water quality will increase and phosphate levels will be naturally regulated. This will eliminate the problem of eutrophication, because organic impurities, including

phosphates (which are significantly elevated above normal in the reservoir samples), served as a kind of catalyst for the growth of photosynthetic algae.

While the economic profitability of the reservoir’s water resources and generated energy at Oskil Hydropower Plant can be questioned (above, Option



№1: Restore the reservoir), the water-regulating function of the dam remains relevant. The water in the Oskil rises an average of 5 m during spring flooding, an amount that should not threaten villages along the river with flooding. However, no one is safe from above average flooding, especially in the context of global warming. Examining the experience of the state of California in the United States, the observation can be made that it is natural floodplains, rather than channel blocking, that represent sustainable solutions for climate change. After liberating the river of its dam, new wastewater treatment and drainage systems are designed. There are several options: build rainwater runoff basins, or, in the case of herbaceous plants on the site of a former reservoir, build filtration buffer strips. This approach has not yet been implemented in Ukraine, but the United States and Europe have

a sufficient number of successfully completed projects and people willing to share their experiences.

The potential restoration of the Oskil River's natural course is the first conscious step to free Ukrainian rivers from dams. As the largest country in Europe, Ukrainians are in a position to assert an environmentally conscious position while deepening ties and sharing experiences with friendly countries. A decision to dismantle this dam will accelerate decisions on the modernization of water supply systems in Donbas. But in addition to undoubtedly important infrastructure and economic functions, first and foremost, dam removal presents an opportunity to restore dozens of species of flora and fauna to their natural habitats. This is truly a step for humanity toward reconciliation with nature •



If not by sword then by plowshare: the ecological impacts of a war-induced food crisis

By [Eugene Simonov](#)

While the world watches in horror as Russia's war in Ukraine creates and exacerbates a food crisis, we also see how the threat of famine triggers decimation of natural ecosystems. Direct human consumption and agricultural production are two key

factors driving [declining biodiversity](#) around the planet.

How the Russian invasion creates a global food crisis

The Russian invasion of Ukraine has reduced agricultural production and



Figure 1. “Ukraine’s wheat, which feeds the world, can’t leave the country,” by Max Bearak. *Washington Post* (April 10, 2022). Credit: *Washington Post*

largely blocked Ukraine’s food exports. The international response to Putin’s offensive has also complicated exports from Russia and Belarus, with a bevy of international sanctions imposed on those nations’ banks, companies, and individuals.

Meanwhile, according to the [“Global Report on Food Crises 2022”](#) in 2021 Ukraine and Russia accounted for major shares of global exports of wheat (33%), barley (27%), maize (17%), sunflower seeds (24%), and sunflower oil (73%) (IFPRI, February



2022). The Russian Federation is the world's top exporter of nitrogen fertilizers and the third largest exporter of phosphorus fertilizers ([GRFC2022](#)). Russia and Belarus alone control 40% of the world's potash supply.

Reduced exports added to the problems caused by already soaring international food prices, prices which had reached an all-time high in late 2021. At that point, Russia imposed temporary limitations on exports of grain, plant oils, sugar, and some fertilizers, all of which contributed to the hike in prices.

The global crisis deepened further as [other exporter countries](#), including [India](#) and [Indonesia](#), limited exports of wheat, plant oils, and other food commodities to protect their own population from price spikes and malnutrition.

In 2021, 36 out of the 53 countries and territories experiencing food insecurity around the world relied on Ukrainian and Russian exports for more than 10% of their total wheat imports, including 21 countries struggling with major food crises (e.g. Yemen, Sudan, Nigeria and Ethiopia).

For example, the East Africa region obtains 90% of its wheat imports from the Russian Federation (72%) and Ukraine (18%) ([GRFC2022](#)).

In May 2022, the UN's World Food Program worried that declining food exports worsened by the Ukraine war would result in more undernourished people, as many as 8 to 13 million people in 2022 and 2023. That [institution](#) sources 50% of its wheat from Ukraine and Russia, helping to feed 125 million people worldwide.

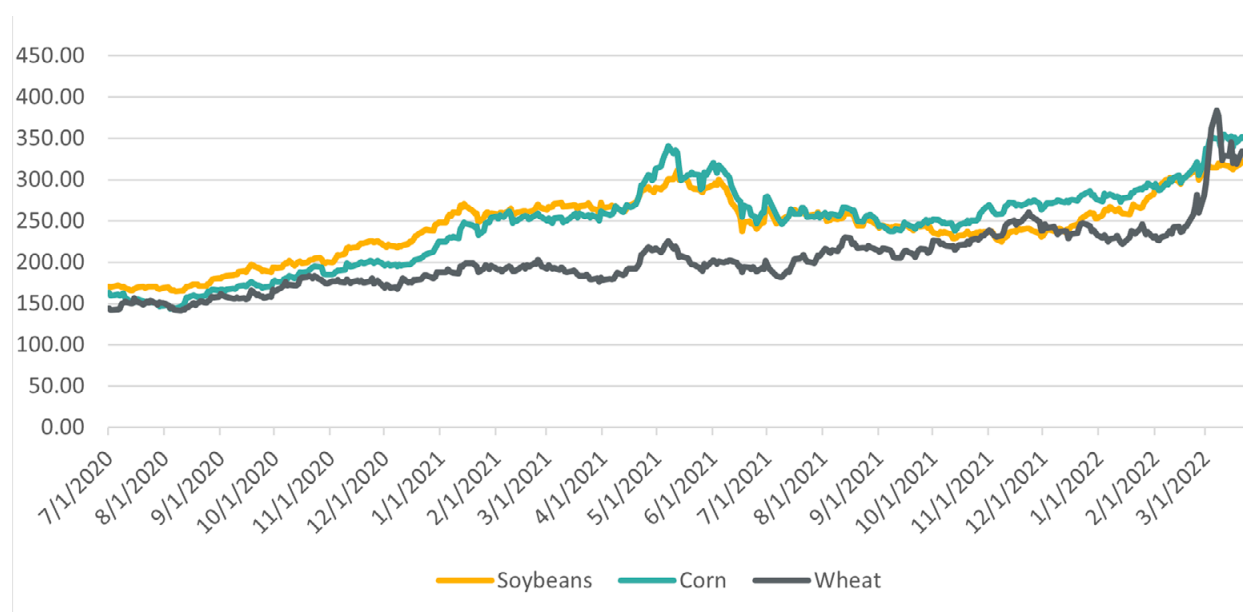
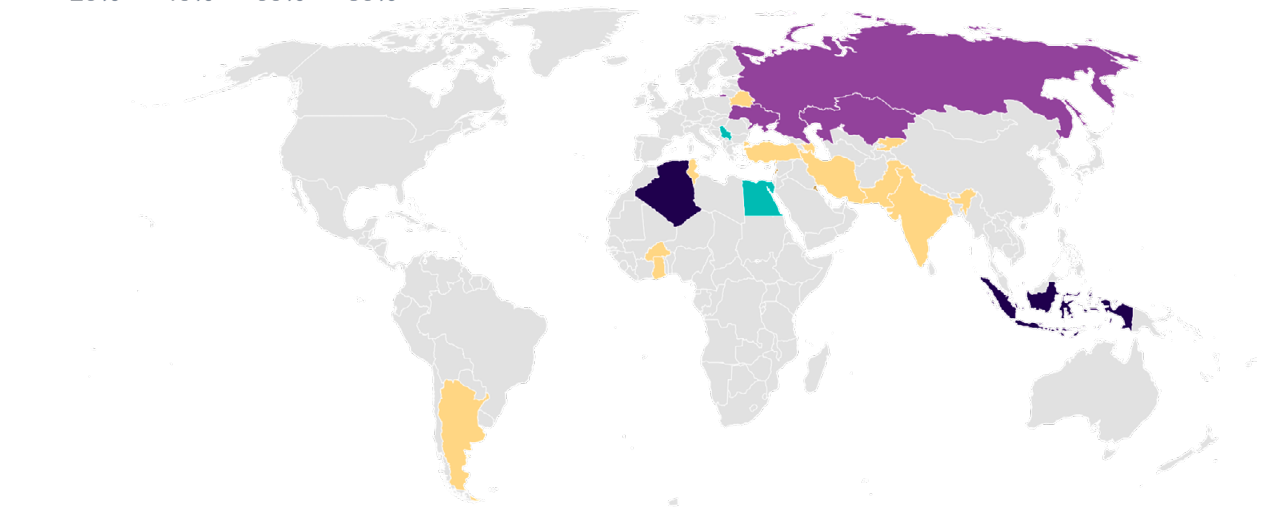
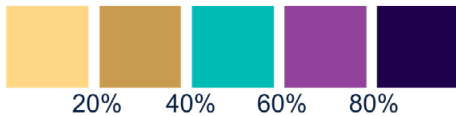


Figure 2. Price dynamics for corn, soybeans and wheat in USD/ton. Dow Jones Commodity Prices Index, 2022. Credit: Sustainalytics



Proportion of a country's exports (in calorie terms) subject to restrictions.



Source: IFPRI

Powered by Bing

© Australian Bureau of Statistics, GeoNames, Microsoft, Navinfo, OpenStreetMap, TomTom & Wikipedia

Figure 3. Countries restricting trade in certain staple food products as of May 2022. Source: Australian Trade & Investment Commission, “High food prices drive rise in export restrictions”, May 2022. Credit: austrade.gov.au

How a global food crisis triggers environmental destruction

As countries strive to respond to war and food crises, their leaders often seek to relieve those pressures by encroaching on key biodiversity areas and the habitats upon which endangered species depend.

For example, in March 2022 the [government of Ukraine simplified](#) rules for the short-term lease of fallow agricultural land to allow food production by agricultural workers displaced from active war zones moving to other parts of the country.

[According to Ukrainian Nature Conservation Group \(UNCG\)](#), this move increases pressure on natural steppes and meadows – some of the most biodiverse and vulnerable ecosystems – severely damaged by indiscriminate expansion of arable land under the Soviet Union’s planned socialist economy. In May 2022, Ukraine’s Verkhovna Rada legislature passed the law “On the peculiarities of land relations under martial law” (№ 2211-IX), which encourages resumed exploitation of natural meadows and steppes, even those located within protected areas. The new law [contradicts several older pieces of legislation](#), but



definitely aims to open non-agricultural land to plowing. Given that Ukraine has the capacity to produce 85 million metric tons of grain annually, most of it for exports, an extra 1-2 million tons of grain stemming from additional land development add little to the gross harvest and therefore do not contribute to Ukraine's food security or economic prosperity. On the other side of this coin, development of the last remaining unplowed natural grasslands may lead to heavy losses in biodiversity terms.

Russia's agriculture sector has been in the ascendant since long before its attack on Ukraine this year, boasting an all-time record grain harvest in 2021 and steady but modest annual expansions of plowed lands. Food commodities are excluded from western sanctions and arguably remain the most profitable export commodity upon which Russia can still rely. To fill the void in the grain market left by its own blockade of Ukraine, Russia is shooting for a record 85 million-ton grain yield in 2022.

As a result, reclamation of Russia's arable land may proceed even more quickly this year. In April, President Putin [sought](#) to accelerate renewed use of cropland abandoned by Soviet-era collective farms, while the [United Russia](#) voting bloc in the Duma secured trillions of rubles in governmental funding for the [reclamation of 13 million hectares over a 3-year period](#). As a result, arable land will grow by at least by 1 million

hectares by the end of this year. In this process, remaining untouched natural grasslands may be targeted first thanks to the relative ease of their exploitation, while clearing newly reforested old fields requires greater investment.

A number of ecologists, all Russian and Ukrainian experts in grassland conservation, agree on the most likely negative consequences. Many species of birds, mammals, reptiles, and invertebrates that rely on natural grasslands will be displaced by reclamation of arable land in Ukraine and Russia. Steppe Eagle, Pallid Harrier, Red-footed Falcon, Little Bustard, Steppe Marmot, Speckled Ground Squirrel, Steppe Viper, and several species of Bush Crickets are species of special concern in western Russia, just to name a few examples. Restoration of the population of critically endangered Saiga Antelope in Russia's Trans-Volga region will fail if even a fraction of the 900,000 hectares of presently fallow lands the species relies upon are converted back to crop production. Steppe-like grasslands on fallow lands are the only habitat type suitable for restoration of the steppe biome in Russia and Ukraine – tilling those lands renders biome restoration impossible.

Food as a weapon

Today, we are seeing the negative effects of a global crisis on environmental conservation programs all over the



Long-abandoned fallow land with native steppe vegetation is reclaimed once again on [Kurilovskaya Steppe](#), Saratov Province, Russia Credit: UWEC Work Group

world. Several other grain-producing regions have attempted measures that may open high conservation value natural areas to agricultural development and mining.

On March 23 of this year, the [European Commission](#) held an extraordinary session to approve subsidies to farmers and allow member states to not only reclaim [fallow land](#) set aside to protect biodiversity, but also to treat those lands with pesticides. This attempted step backward for the EU's Green Deal was led by [France, which currently holds the EU presidency](#). An EU farmers' union, Copa and Cogeca lobbied in opposition to the EU's Farm

to Fork policy as well, [arguing](#) that "Since the Russian government is using food security as a weapon, we must counter it with a food shield".

Many [environmental NGOs](#) criticized the move and insisted that the Green Deal could be a cure, not an obstacle to food and energy security. Meanwhile, [scientists argue](#) that instead the EU should abolish the use of biofuels, the production of which consumes 9% of global crop production. The full extent of the damage from plowing "biodiversity lands" will be revealed at the end of 2022, as each country notifies the European Commission on the extent of its "derogation" plans. The cumulative



negative impact may be substantial: [Ireland has already indicated](#) it plans to plant 25,000 ha of new cropland, while, according to its Ministry of Agriculture, [Bulgaria will make](#) full use of derogations and encourage farmers to use all available capacity for food and feed production. Just 5% of land in Bulgaria is set aside for ecological purposes.

The EU's decision to sacrifice biodiversity for agriculture appears quite controversial in light of Eurostat's recent 2022 *Sustainable Development in the EU* report, which shows good to moderate progress on all UN SDGs (including those on energy and climate), but backslide for SDG 15, devoted to terrestrial biodiversity. Over the last 15 years, populations of common bird species declined by 5% and grassland butterflies plummeted 20%. The report clearly points to the key driver: *"Agricultural intensification reduces natural nesting habitats such as hedges, wetlands, meadows, and fallow fields, while pesticides and changes in plowing times for cereals disrupt breeding and decrease available food sources."* Eurostat, likely anticipating negative effects from recently endorsed "derogations", [adds a disclaimer](#) that *"the impact of the Russian invasion of Ukraine is not yet reflected in the 2022 SDG report."*

On the same day in March that the EU approved reclamation subsidies to farmers, seven lobbying organizations

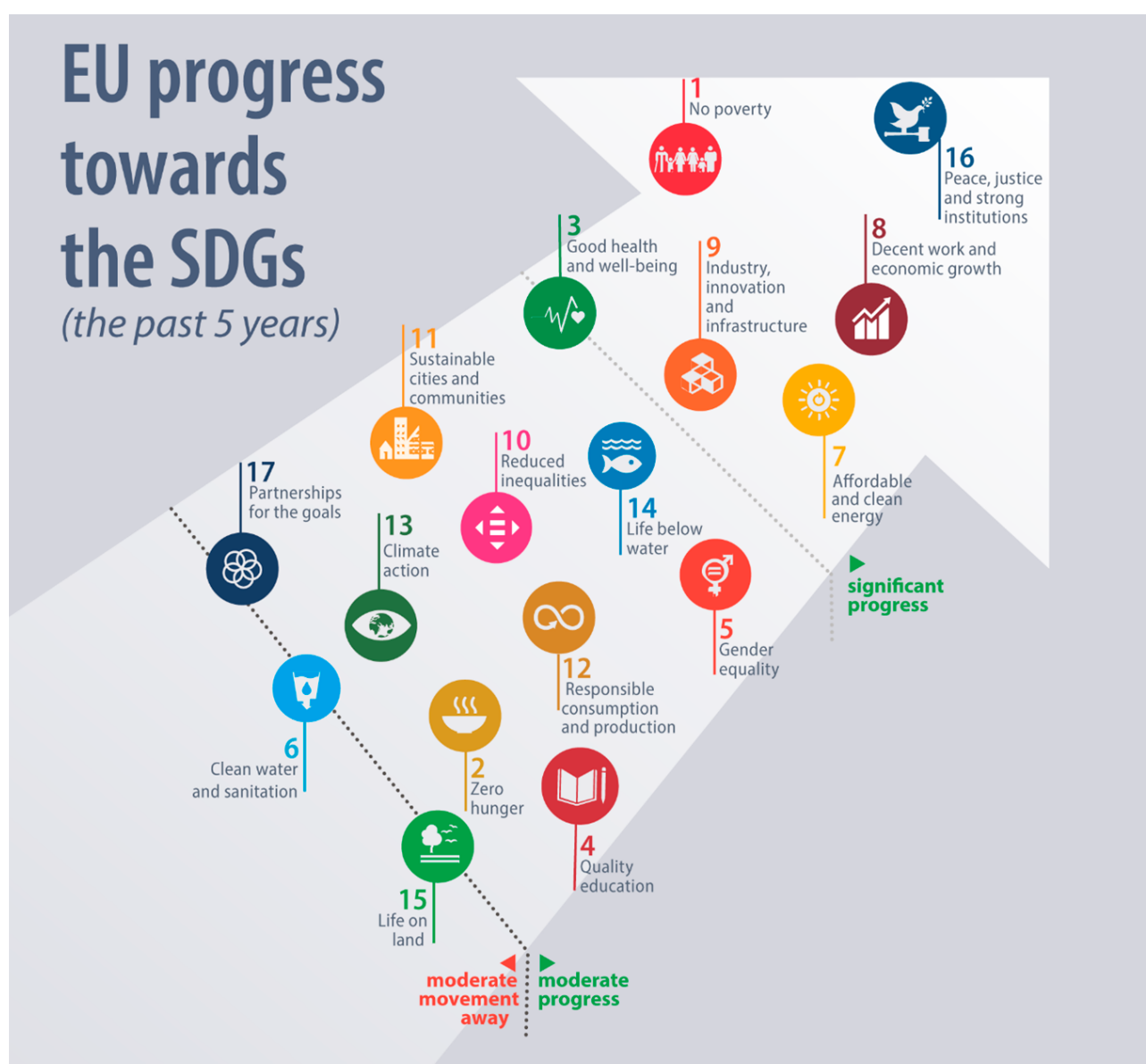
representing U.S. farmers and its food industry [asked the US Department of Agriculture](#) to [allow planting crops](#) on more than 4 million acres of "prime farmland" currently protected under the Conservation Reserve Program (CRP). Ironically, the 20 million-acre CRP is an environmental protection scheme set up 50 years ago when the Soviet invasion of Afghanistan resulted in a ban on US grain exports to the USSR at a time when many US farmers were overproducing. The CRP subsidizes long-term abandonment or restricted use of land susceptible to erosion, wetlands, and grasslands located on private farmland. The new planting proposal is [still under consideration](#).

[In early March](#), Brazil's President Bolsonaro used the looming threat of fertilizer shortages stemming from the potential disruption of Russian and Belarusian exports as a pretext for reviving a draft law aiming to open Indigenous lands in Amazonia to mining. The law was first proposed in February 2020, but it was challenged in the courts and ruled unconstitutional. Bolsonaro claimed that mining in Amazonia will render Brazil self-sufficient in potassium and phosphorus fertilizers. A large scandal resulted when Brazil's Socio-Environmental Institute revealed that only 1.6% of Brazil's reserves of potassium and 0.4% of phosphorus are located on Indigenous lands. It was instantly clear, that this proposed legislation was actually



aimed at gold mining and hydropower development on those same Indigenous lands. The proposal was again shelved after a major protest. In April and May, Brazil legally [purchased a sufficient supply of fertilizers from Russia](#), as the transaction was not subject to Ukraine-related sanctions.

If high food prices and food shortages continue to exacerbate the situation in crisis-affected countries, it will necessarily have profound impacts on natural ecosystems and species. First, people will try to extract nutrients they no longer can buy at retail from the environment around them, resulting



Data mainly refer to 2015–2020 or 2016–2021

ec.europa.eu/eurostat

Figure 4. “Sustainable development in the European Union – Monitoring report on progress towards the SDGs in an EU context – 2022 edition,” Eurostat, May 2022. Credit: ec.europa.eu



in widespread increases in subsistence hunting and adding pressure on flora and fauna. Secondly, families will expand inefficient but reliable subsistence agriculture to make up for food shortages. This sort of subsistence-focused encroachment took place in the outskirts of Russian cities during the breakup of the Soviet Union, when development of “collective gardens” led to the degradation of many high conservation value areas important for biodiversity, e.g. floodplain wetlands and peatbogs. As the crisis unfolds there [are signs](#) that similar expansion may be happening again today.

The cases examined here show that remaining natural areas, wild flora and fauna are being used to make up for food insecurity caused by the war in Ukraine and sanctions on

Russia. Facilitated by governments, industry lobbyists use the crisis as an excuse to exploit natural areas with high biodiversity value, while malnourished populations resort to deriving food from surrounding landscapes by any means possible. These adaptations may severely compromise implementation of the UN’s Sustainable Development Goals relating to biodiversity and biological resources. It is quite regrettable that in the 21st century, the largest food-producing nations in the world cannot identify better ways in which to confront war-related distortions in food trade beyond direct encroachment on natural areas. The war in Ukraine and its cascading impacts certainly provide ample opportunity for exploring creative new solutions •



Defense ministry declares war on forests?

By [Eugene Simonov](#) and translated by [Jennifer Castner](#)

In addition to the direct negative impacts of the war on Ukraine's natural environment, the "military operation" also has consequences for environmental protections in Russia. A new legal initiative could lead to unlimited logging in forests.

The organization Moscow Region Ecological Defense has called upon citizens to participate in public discussion of a proposed statutory instrument ["On Amendments to Appendix 10 to the Government of the Russian Federation's Decree "On the Peculiarities of Licensing Activities in the Russian Federation in](#)

[2022"'](#). Community leaders [worry that if the document is approved](#), the Russian Ministry of Defense will be empowered to take control of any forested lands, not only those designated as "military". Meanwhile, Ecological Defense has regularly observed dumps, landfills, industrial sites, and housing replacing "military forests" in Moscow Oblast, with the timber sold off to destinations unknown.

[According to the Ministry's proposal](#), submitted in May for public input, "it is permissible to carry out selective and clearcut harvests of forest stands of any





age ... for the needs of defense, without provision (delimitation) of forest plots, without the establishment of an easement or the issuance of permits ... on forest fund lands and defense and security lands with the right to use ... wood, obtained as a result of logging activity.... Transportation of the selected wood for defense needs takes place without issuance of electronic support documentation.” Moreover, the agency does not plan to provide advance notice of the type and location of logging activity. The draft proposes to allow the agency to inform local government after logging has already occurred, and not immediately, but within a 30-day period. [According to The Moscow Times](#), currently, Russian Federation government entities and relevant local governments coordinate applications for forest exploitation. The review period is 10-15 days.

Ukrainian intelligence was the [first to report](#) on this initiative on March 15th, mistakenly attributing the intention to clear cut forest on Ukrainian territory to Minister Shoigu. Russian and Ukrainian environmentalists apparently believed an “intercepted” [letter from Shoigu to Putin](#) to be falsified. The letter’s justification began with the words *“In order to create fortifications for military units participating in a special military operation....”*

Taking this proposal at face value, the establishment of wooden defenses could

take place in the Russian Federation as early as 2022. The army already builds unlimited wooden trench covers and log roads during military exercises, but why then do they need additional permission for unlimited logging? It is unlikely that the Ministry of Defense will return to its “patriotic roots” and resume building age-old abatis works. At the time, such defensive forests were protected areas, with no intention of transporting the timber elsewhere, let alone without documentation. Greenpeace [noted](#) that the proposal published for public input, unlike other legislation drafts submitted for consultations, is not accompanied by any explanatory note and therefore one can only guess about real intentions of its initiators.

Recall that in 2021, the cost of timber products in Russia doubled or even quadrupled, while this initiative dates to the second week of the special military operation, when sales of Russian forest resources had not yet become the subject of international sanctions. That appears to be the key to this puzzle.

The Russian experts we interviewed concluded that we are likely dealing with an attempt by military officials to obtain indulgences for logging in any location and timber’s unlimited sale for profit. All of this is planned to be done under the pretext of providing troops in wartime.

The draft resolution could also be the result of an “international exchange



of experience”: the [military junta in Myanmar](#) was previously actively engaged in illegal logging, and this same junta is known for its close cooperation with the Russian military.

The greatest danger is that logging could be permitted in protected areas across Russia, lands where there is no current provision for logging for defense needs. Logging without any significant restrictions could occur in the high conservation value areas (such as forests in protected areas or water conservation zones, etc.) or in the most socially important forests (for example, urban forests).

In southern Russia’s sparsely forested areas adjacent to the theater of war, this could quickly result in significant destruction of ecosystems and violations

of citizens’ environmental rights. And this is just half the problem.

Experts believe that the primary harm from this declaration is not so much related to the “military” logging itself, but with the dangerous precedent being set – the elimination of any rules or limitations to the interests of any and all powerful lobbyists. As the social and economic crisis grows in Russia, this same logic can be applied, for example, to “logging to support businesses in distress”, “logging for the benefit of local government”, etc. Any number of justifications come to mind. Such turns of events are quite likely in light of the numerous ways in which environmental legislation has been [systematically weakened](#) since the start of the war in Ukraine •





Environmental news about the war in Ukraine – 30 May – 12 June

A publication of the UWEC WG

News from the front on the environmental consequences of military activity in the Luhansk and Donetsk regions

At the end of May and early June, the most active combat took place in the Luhansk and Donetsk regions, with particular intensity in Severodonetsk. The highest density of shelling occurred in that city, resulting in the almost complete destruction of its infrastructure. Street-fighting took place there as well.

Several chemical industry sites are located within city limits. This includes Severodonetsk Azot Association, a producer of nitrogen fertilizers, ammonia, organic alcohols and acids, household chemicals, and polymer products.

[A tank containing nitric acid](#) at the Azot plant exploded during shelling on May 31, resulting in a release of toxic substances into the atmosphere. Local administration chief Sergei Gaidai urged city residents to shelter in place in order to avoid exposure.

An [ammonia pipeline was also damaged](#) during combat in the

Bakhmutovsky district in Donetsk region in early June, also resulting in environmental pollution.

Located not far from Severodonetsk and Sloviansk, Sviati Hori National Park is located directly in the conflict zone. The unique chalk mountains on the banks of the Siversky-Donets River are habitat for many Red Book-listed species. The park is also a refugium for a unique Scotch pine subspecies (*Pinus sylvestris* var. *cretacea* Kalenich), present here since before the last Ice Age.

Unfortunately, the majority of the national park has been damaged by fires resulting from the fighting. The remaining territory has been mined and/or contaminated by fuel, both rocket and vehicular.

The EU passes a softened embargo for Russian oil

After lengthy discussions, the European Commission approved a sixth round of sanctions. They include an embargo on oil and petroleum product deliveries from Russia that will come into full force



beginning in 2023. The proposed sanctions were debated and adopted with the abstention of three countries – Hungary, Czech Republic, and Slovakia – that acknowledged a “significant” dependence on Russian oil and did not oppose the proposal.

[According to Politico](#), the main focus is a ban on deliveries of oil and oil products by sea, products which account for roughly 70% of all of the EU’s oil imports from Russia.

Deliveries via the Druzhba pipeline will continue at the insistence of Viktor Orban’s “coalition”. The argument cited by Hungary, Czech Republic, and Slovakia is that their lack of ports prevents them from relying on alternative routes.

At the same time, Germany and Poland announced a voluntary refusal to import Russian oil through the northern leg of the Druzhba oil pipeline beginning in 2023.

According to the President of the European Commission Ursula von der Leyen, oil imports from Russia to the EU will be reduced 90% starting in 2023. The Czech Republic also plans to join the embargo by mid-2024. Slovakia and Hungary have not yet set dates for phasing out Russian oil and gas.

Whether the EU’s decision will lead to a reduction in global imports of Russian oil is still unknown. In May, [petroleum energy exports from Russia increased by 6%](#) over April. Other

markets, such as India and China, are also being actively explored.

It is not clear what mechanisms can halt potential Russian oil imports under other labels, for example, as “Kazakh”, “Latvian” or “Turkish” oil. This brings to mind [Shell’s decision](#) not to define oil blends containing less than 50% of the Urals brand as Russian oil.

It is not clear how European (primarily, Greek) companies will be compensated for their loss of the income built on hedging tankers of Russian crude.

One way or another, however, the sanctions are a clear confirmation that EU members remain in solidarity, while not forgetting their goal of achieving carbon neutrality.

It’s worth noting that this embargo will be effective only in the event of a complete rejection of fossil fuels, development of energy efficiency programs, and a transition to renewable energy. Otherwise, supply disruptions or other difficulties could result in the EU being forced to cancel sanctions.

Ukrainian environmental organizations call for strengthening action to achieve a complete blockage on Russian fossil fuels

Marking the 100th day of the war, Ukrainian environmental organizations [released a statement](#) calling for a complete embargo on deliveries of



Credit: ecoaction.org.ua

fossil fuels from Russia. Such a blockage would end the financing for Russia's military invasion of Ukraine.

Every drop of oil purchased from Russia is another drop of Ukrainian blood spilled all over the country, and every piece of Russian coal is another bullet fired at Ukrainian civilians. We must stop Putin and his war machine, restore peace, and end the fossil fuel addiction that feeds war in our country and conflicts in other countries of the world.

In the view of this, we demand:

- *a complete and immediate embargo on Russian oil, gas, and coal as well as sanctions against the Russian nuclear sector to accelerate a global clean energy transition;*
- *secondary sanctions on all buyers of Russian fossils, including buyers outside sanctions coalition countries, i.e. foreign shipping companies and refineries; and*

- *immediate clean energy transition and rapidly accelerated investments in the development of energy efficiency and energy savings measures across Europe as a wartime effort to increase energy security and hasten climate action.*

European states in particular should assume special responsibility for this point and reduce demand for fossil fuels as quickly as possible. They must enforce an immediate embargo against Russia and enact full-scale decarbonization efforts by prioritizing energy efficiency and clean energy and by preventing dirty gas, oil, and coal from Russia from simply being replaced by fossil fuels from other questionable sources.

The open letter has already been signed by many community organizations, not only in Ukraine but from around the world. [Add your signature now.](#)



The war could result in weakened climate and environmental policies in Russia, including the possibility of the country pulling out of the Paris Agreements

The confrontation between Russia and the West has already resulted in the Russian Federation State Duma beginning to discuss the [possibility of withdrawing from the Paris Agreements](#). Specifically, this would permit the nation to break its commitment to cut greenhouse gas emissions by 30% by 2030.

True, this [idea was criticized by Russian Ministry of Natural Resources and the Environment](#). Minister Aleksandr Kozlov announced that Russia should not withdraw from the Paris Agreements and that statements on this topic are speculation for PR purposes.

As noted by the authors of an article in [The Conversation](#), the military invasion and resulting sanctions could lead one of the world's largest producers of emissions to put its climate policy on hold. Russia has not previously distinguished itself with ambitious plans for climate neutrality, but within the framework of international obligations it had agreed to achieve certain indicators by 2060.

Renewed "Cold War logic" could result in the country beginning to independently set its climate and

environmental priorities. Doing so will deal a serious blow to global climate policy.

In addition, at present, research funding, in particular studies related to melting Arctic permafrost, has come into question. This financing was allocated within an international programmatic framework, and it is not yet clear whether that research will now be subsidized from the federal budget.

Today, we are also seeing rollbacks of climate policy issues in Russia. Lukoil, a key fossil fuel magnate, is [pressuring the state to simplifying reporting](#) on greenhouse gas emissions. At the same time, investors in renewable energy are beginning to leave the country's market.

Dolphins continue to die in the Black Sea

Observers in both Turkey and Bulgaria, as well as in the temporarily-occupied Crimea are confirming observations of a significant increase in 2022 of hundreds of common dolphins (*Delphinus delphis*) becoming entangled in fishing gear and suffocating and/or becoming stranded.

[According to Dr. Bayram Öztürk](#), head of the Turkish Marine Research Foundation (Tudav), there is not yet a scientific explanation. The main hypothesis is acoustic trauma resulting from the ongoing military actions taking place in the Black Sea.



Credit: ecopolitic.com.ua

Senior Researcher at Ukraine's National Academy of Sciences [Dr. Pavel Gol'din commented](#) that the cause could be a combination of several factors, for example, intoxication, acoustic trauma, and infectious outbreaks.

According to Gol'din, a collegial community of Ukrainian scholars and experts is currently studying the war's negative consequences for the Black Sea basin. They are evaluating negative chemical impacts, including rocket fuel compounds and ammunition. Harmful acoustic impacts are also under study, as are the effects of fires burning along the coastline.

Unfortunately, because a significant portion of the coast is either occupied

or within the active combat zone, it is almost impossible to conduct reliable analyses using sampling methods. However, it is already known that many protected areas in the Black Sea region have suffered significant damage. Indeed, the Russian Black Sea Fleet flagship "Moskva" sank within in a protected area, an event that will certainly have negative consequences.

In [an interview published by Krym.Realii](#), RFE/RL's Crimean portal, Dr. Gol'din confirmed, starting in March, the deaths of large numbers of common "white-sided" dolphins across the Black Sea coasts of Turkey, Bulgaria, and Crimea. Some of the marine mammals

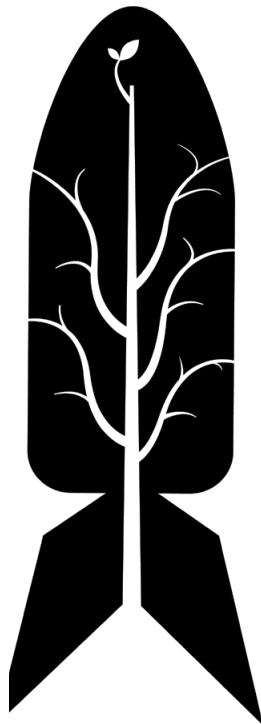


were found stranded alive, meaning that they self-stranded.

Gol'din agrees that acoustic trauma could be a key factor contributing to weakening these animals. It has been previously scientifically proven that the low frequency sonar used by submarines damages the hearing apparatus of dolphins. Animals perceive the sounds at the same frequencies and are harmed as a result.

Russia is [operating four submarines](#) (two-thirds of the nation's existing Black Sea submarine fleet) in the war zone.

The fighting continues, which means that the likelihood of more marine mammal deaths remains present as well. Unfortunately, while the war continues, it remains impossible for now to analyze the war's impacts on the Black Sea ecosystem as a whole •



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