

U W

E C

**Ukraine War
Environmental
Consequences
Work Group**

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Dear Friends!

We send you our warmest wishes for the New Year. We hope that in 2025 you will be surrounded by the support of friends, family and community, and that your ideas will develop and come to fruition. May you be accompanied by inspiration, success and joy!

*We naturally hope that this year Russia's war in Ukraine will come to an end. Even if it does, this will not mean that our work will be done. The manner in which the country is rebuilt will determine not only Ukraine's future, but that of the entire region. **Today, when environmental movements all over the world are coming under pressure, it is important that islands of 'green development' appear everywhere.** And Ukraine has the potential to become one of these centers. However, a lot of work needs to be done in order to achieve this.*

*One of the main problems that will face Ukraine after the end of the war is, of course, landmines. There is no historical precedent for mining on such a vast scale in a European country. Almost 30% of the country is [mined](#) – a statistic which puts Ukraine ahead of even countries such as Afghanistan and Syria, where wars lasted for decades. **Oleksiy Vasyliuk**, head of the Ukrainian Nature Conservation Group and UWEC Work Group expert, explains what methods can be used to solve the problem, where demining operations can begin and which areas to leave for the preservation and development of nature:*

- [**Caution, mines! The future of mined landscapes**](#)

*Agricultural areas suffer most from mining. As of January 2024, Ukraine has lost almost 20% of its cultivated land since the war began. Many of these areas are either under occupation, contaminated by military action, or both. Restoring agricultural land after the war is an important process that will allow the country not only to recover economically, but also to improve the ecological situation by cleaning the soil. Ukrainian scientist **Oksana Datsko's** article, written especially for UWEC Work Group, looks at what methods have already been tested and can be used:*

- [**Seeds of metal: How war is polluting Ukraine's farmland and threatening food security**](#)

Renewable energy, which is also one of the drivers of Ukraine's "green recovery," has suffered from military activity as a result of Russian aggression. The issue of energy independence is acute today for a country which has been the victim of a particular kind of hybrid warfare: hydrocarbon blackmail. As of January 1, 2025, Ukraine no longer allows Russian gas to transit its territory. But how does Kyiv plan to solve the energy issue in the future? What role can renewable energy sources play, especially given that the war years have significantly



restricted the generation of green power? Read more in the article by our regular contributor **Viktoria Hubareva**:

• [Prospect for renewable energy in wartime: How Ukraine plans to ensure energy independence using ‘green generation’](#)

Nuclear energy is considered by many to be an alternative to renewable energy sources. However, the war has shown that this is an inherently risky direction, since it is vulnerable to use as an element of blackmail in the event of a conflict. For almost three years, Ukraine and Russia have been balancing on the brink of a nuclear catastrophe, and shelling continues to take place in the immediate vicinity of nuclear power plants. For this reason, Ukrainian environmental initiatives such as Razom We Stand are calling to prioritize the development of energy-efficient projects, rather than the creation of energy hubs around nuclear power plants or hydroelectric power plants. Read about this and other environmental consequences of the war in Ukraine in our regular review:

• [Environmental consequences of the war in Ukraine: October – November 2024 Review](#)

Unfortunately, the consequences of the war for zoos and animal shelters, whose inmates have suffered greatly during the war, are rarely discussed. One of UWEC Work Group’s Ukrainian editors, Yuliia Spinova, has written a special feature on this issue, beginning with a look at how various zoos were forced to rescue animals that suffered from military actions during World War II. Unfortunately, Ukraine is now experiencing this challenge in the 21st century, with many of the country’s zoos having become shelters for injured animals, while other zoo animals have had to be evacuated to zoos abroad.

• [Safe haven: How Ukraine’s zoos are saving animals in spite of war](#)



You can find more coverage of the environmental consequences of Russia’s full-scale invasion of Ukraine on our [website](#), as well as on [Twitter \(X\)](#), [Bluesky](#), [Facebook](#), [Telegram](#) and [BlueSky](#).

We wish you strength and peace!

Alexej Ovchinnikov

Editor, UWEC Work Group



Caution, mines!

The future of mined landscapes

Oleksiy Vasyliuk

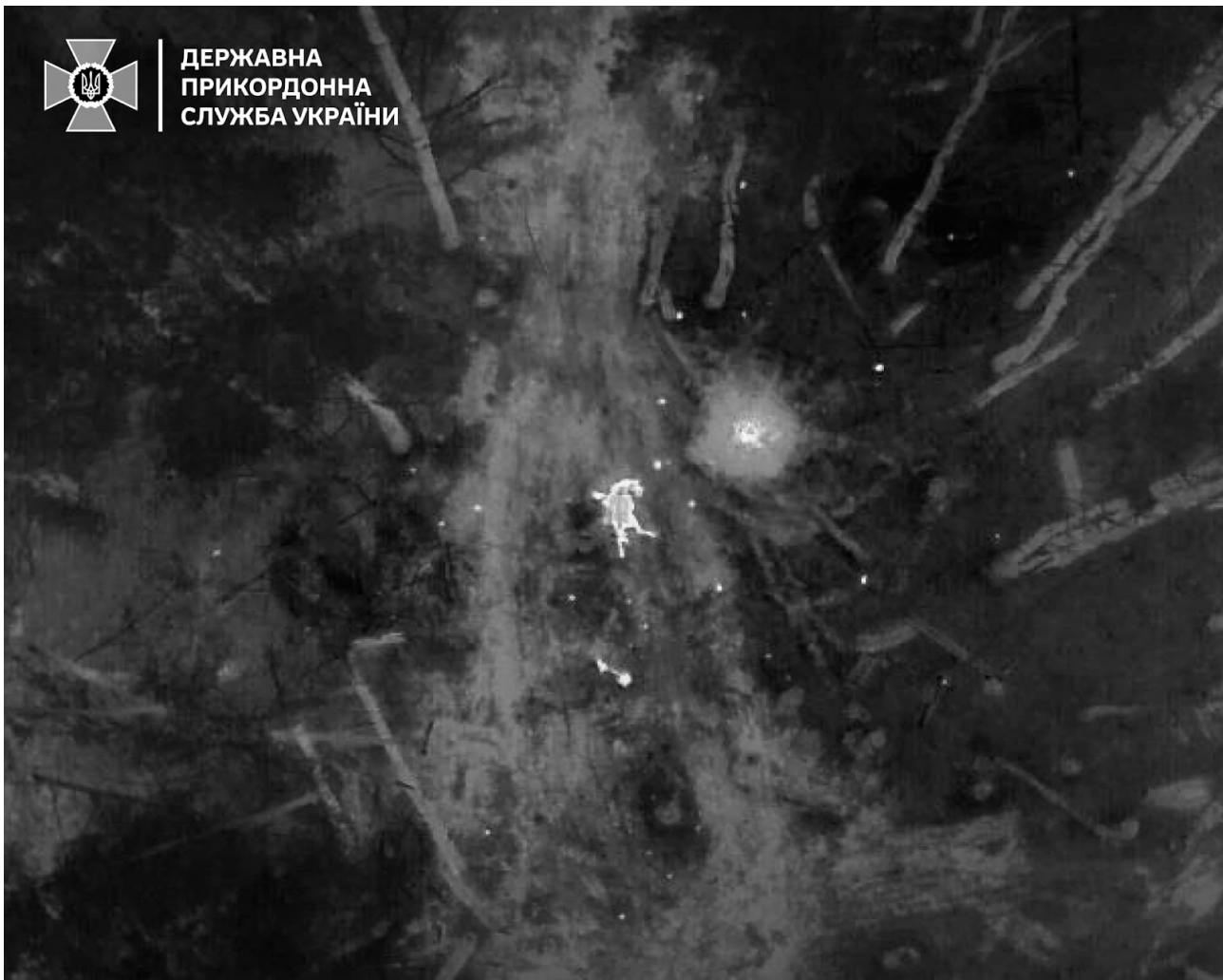
UWEC Work Group [previously examined](#) the environmental impacts of minefields and munitions contamination for Ukraine. Military action spreads explosive objects over very large areas on land and at sea. The issue covers the entire temporarily-occupied zone, the line of combat, all formerly occupied territories, and the international border zone. According to various estimates, 26-33% of Ukraine's territory will require demining, work which [could require](#) anywhere from 77 to 750 years.

Some sites can be cleared relatively easily, returning the land to economic use. At the same time, the areas most damaged by military activity, the international border

zone, and the largest minefields will probably require a very long time to be cleared. The amount of time for which some areas in Ukraine will remain mined is, in fact, so great that it may require multiple human generations to clear them. What will happen to the areas slated to wait the longest for demining? UWEC Work Group examines that question in this article.

Tranquil life for wildlife amidst deadly mines

It is worth noting that the initial process of laying mines in itself does not have a significant impact on biodiversity. Generally, only large animals can be



ДЕРЖАВНА
ПРИКОРДОННА
СЛУЖБА УКРАЇНИ

A Przewalski's horse, listed in the Red Book of Ukraine, killed by a Russian mine in the Chernobyl zone. Source: [Novynarnya](#)

physically harmed by triggering a mine's detonation. Instances of large animals killed due to contact with mines and tripwires have been made public more than once. Deaths of Red Book-listed species in Ukraine have also been documented, in particular [moose](#) and Przewalski's horses.

Future population losses among large mammal species as a result of explosions seem inevitable. That said, the relative absence of other threats in mined areas may have a positive effect on the restoration of wildlife populations. Small

fauna, birds, flora and mushrooms do not experience any changes at all as a result of mine-laying. Moreover, economic activity ends in mined areas, further reducing negative pressure on wildlife. The exception is spontaneous fires that humans cannot extinguish in mined areas, causing new large-scale losses of biodiversity.

Looking at the experience of the [Chernobyl Nuclear Power Plant Exclusion Zone](#), today the location of the Chernobyl Radiation and Ecological Biosphere Reserve and a place where



Summer 2023 satellite image showing a greenbelt along the front line. Source: [Teksty](#)

people have limited access due to the threat of radiation, one can be sure that mined landscapes could benefit many wild species. The simple fact that humans will not interfere with the presence of wild animals in large areas, frighten birds during nesting season, hunt, or use deadly chemicals to combat “forest pests” is a guarantee that the number of species and their populations in such areas will grow.

Invasive species and the emergence of new ecosystems

A completely different picture emerges on the site of pre-war settlements and fields. Here, there is rapid regrowth of

vegetation followed by the reappearance of wildlife. One should not, however, rush to label such areas “wilderness”. Beginning in 2023, studies of satellite images of Ukraine revealed an enormous greenbelt stretching along the entire front line. It is so large as to be visible by satellite on the European scale.

This greenbelt consists of plants growing in the active combat zone, as well as in mined areas. Such mass overgrowth can be seen especially well along the entire southern front: from the city of Enerhodar and further to the east. Estimates are that this area of spontaneous overgrowth already exceeds one million hectares in size.



FAB500 bomb detonated during demining operations in the Desna River in Chernihiv, April 22, 2022. Source: [General Staff of the Armed Forces of Ukraine](#)

The absence of economic activity and the generalized destruction of most mined areas as a result of military actions lead to the wide-scale spread of invasive species—both herbaceous plants and trees. For many of these species, their large seed base causes mass overgrowth even in the first months after humans depart the landscape, be it in settlements destroyed by war or abandoned, damaged or occupied fields.

- **Read more: [Invasive species threat resulting from Russia’s full-scale invasion of Ukraine](#)**

Nature reserves, lost amidst the ruins

Some of the mined and temporarily-inaccessible sites possess a designated conservation status. They include nature reserves, national nature parks, wildlife sanctuaries, and internationally

protected sites, including UNESCO biosphere reserves. Under conditions of total inaccessibility caused by mining and occupation, conservation areas lose their special conservation status and are left to spontaneously recover after military action and earlier long-term economic use. The scale of this disaster recovery zone is so large that conservation areas will appear as small “islands” in the post-war landscape.

Will these areas become more valuable in a biodiversity development context after the war, as was the case of the Chernobyl exclusion zone, where radiation-contaminated areas became important natural areas that were later given the status of a biosphere reserve? Or, conversely, will they degrade in the near future due to the impossibility of preventing the spread of invasive species? These territories



have the potential to become invaluable depositories of biodiversity, serving as a sort of cornucopia from which wildlife could rapidly spread to areas under restoration. The opposite scenario is also possible: the last remnants of wild nature will simply be overwhelmed by invasive plant species. For now, we cannot know what the changes will be.

Can demining be accomplished without further environmental harm?

A new challenge for Ukraine's natural areas will be demining, a process usually carried out using explosive mechanical methods that involve the detonation of all unexploded ordnance. Although such work usually does not harm people, it nevertheless has a wide range of environmental consequences associated with the explosions. At its foundation, demining work damages ecosystems and maximizes environmental pollution. Ordnance detonation is even often carried out in rivers and lakes, undoubtedly destroying many living organisms.

Are there alternatives to demining? Although private landowners, communities (hromadi), businesses and the state as a whole will strive to quickly return land to economic use, another option is to declare mined territories as

nature conservation areas where spontaneous restoration processes will continue. This applies to lands that cannot be demined in the near future or where demining is not demonstrably expedient. For example, it is unlikely that mines will be removed along Ukraine's international border. However, the question can be posed more broadly. Should lands so damaged by military action that their further economic use is ruled out be demined?

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UWEC Work Group has previously explored the consequences of building border zone infrastructure and the potential for including border zones in



nature conservation areas. These types of land management can serve as a source of ecosystem services, including, for example, carbon sequestration.

Read more:

- [Beasts and Barriers: Obstacles along international borders and their impact on land-based vertebrates](#)
- [Protected areas and border zones in Ukraine: How to harmonize them?](#)

Approaches in other countries: Is it better to skip demining?

Other nations, including [Bosnia, France, Germany, and Cambodia](#), have opted to remove lands from economic circulation or to establish exclusion zones in areas contaminated or mined during military operations. In some cases, for example in natural forests, demining is only possible when accompanied by the forest's total destruction by fire. It is clear that destroying a forest for the sole purpose of demining is not always advisable, as [examples](#) from the Berlin area show.

Since 1989, approximately 1.5 million hectares of military lands have been [excluded from human](#) use in Europe after the end of the Cold War. Use of very large areas was often not realistic as a result of chemical pollution and mining, one reason for converting military training grounds into nature conservation areas.

For example, Denmark proposed that 45% of its training grounds be included in the Natura 2000 network, the Netherlands 50%, and Belgium 70%. In European Union countries, training ground lands are predominantly government-owned (for example, Germany owns 492,000 hectares, of which 316,000 hectares are part of Natura 2000).

In the United States, lands polluted by man-made military development belong to the Department of Defense (4 million hectares), of which 15% have been [declared](#) national parks and protected areas.

Ukraine has its own experience, not only the Chernobyl Exclusion Zone, but also some military lands that previously served as military proving grounds and now have nature conservation status. The best example is Oleshky Sands National Nature Park, previously [used](#) as a bombing range. Before Russia's full-scale invasion, Ukrainian environmentalists repeatedly [proposed](#) the establishment of large nature conservation areas on other military lands, including proposals for national parks: Tarutynskyy Steppe (Odessa region), Samara Forest (Dnipropetrovsk region), Velikiy Les (Sumy region), Divichki (Kiev region), and Kytsivska Desert (Kharkiv region).

In addition to those environmental considerations, economic factors are also in play. Spending money on demining areas that cannot be used for economic purposes is impractical. Restoration through phytoremediation or other



cleaning methods may be too costly to be implemented.

- **Read more about phytoremediation:** [Seeds of metal: How war is polluting Ukraine's farmland and threatening food security](#)

Planning for reclamation and restoration of biodiversity in post-conflict areas remains a topic for further study. No European country has had experience in rehabilitating such a large area of war-affected land.

In addition, no nation has ever undertaken demining such a huge area as will be required in Ukraine. Calculating that demining will require at least a century, then the feasibility of anti-mine activities must be considered not only for heavily contaminated areas, but also in connection with those that have simply been awaiting demining for a long time. It can be assumed that in just a few decades, the areas last in line for demining will become overgrown with dense forests. So, a hundred years down the road, demining will likely require that vast century-old forests will need to be burned. Naturally, such a plan would face questions, including consideration of their environmental feasibility.

How to begin the demining process

After reaching initial broad conclusions on this issue, the demining process should prioritize clearing the lands most likely to be returned to economic circulation. For example, mechanized demining of nature conservation areas would be a disaster, the consequences of which are no less terrible for natural ecosystems than deep plowing for agricultural use.

It is quite likely that after conducting objective assessments of the future potential of the most war-damaged areas and opportunities for demining, areas in Ukraine that have suffered most from military action would be divided into those worth demining and those best left as exclusion zones. This could result in greater diversity in the country's landscapes, filling Ukraine with important ecosystems, and even potentially improving living conditions in demined areas.

The stewardship paradigm for land resources in Ukraine must change and attitudes of Ukrainians toward ecosystem services be evaluated in order to undertake fundamental government decisions on the importance of preserving biodiversity. •

Translated by Jennifer Castner



Seeds of metal: How war is polluting Ukraine's farmland and threatening food security

Oksana Datsko

One of the world's biggest suppliers of grain and industrial crops, Ukraine's agricultural economy has been badly hit by Russia's war of aggression. Although the country's agrarian sector is well developed, the ongoing invasion has brought food shortages, logistical difficulties and a change in climatic conditions. New research shows that in the northern regions of Chernihiv, Sumy and Kharkiv, soils contain dangerously high levels of heavy metals, creating a potential threat to agriculture and food security.

The full-scale Russian invasion has had a serious impact on Ukrainian agriculture, particularly the condition of the soil in which crops are grown. Military activity, use of heavy equipment and damage inflicted by various types of shells on agricultural soils can have a significant impact on their fertility and, accordingly, on crop yield and quality. The preservation and restoration of soils has become a priority for farmers, scientists and the government, since food security depends on it – not only



Working on the creation of a protocol with the participation of Associate Professor Olena Melnik from SNAU and Professor Mark Horton (Royal Agricultural University, UK).

Source: Elena Melnik

for Ukraine, but also for many countries around the world. With this in mind, scientists from the Sumy National Agricultural University (SNAU) have begun actively exploring the possibility of assessing the degree to which soils have been polluted with heavy metals.

The first step toward this was to develop a protocol for soil sampling in craters formed as a result of military action. To achieve this, **Olena Melnik**, an associate professor in the Department of Ecology and Botany at SNAU, who also heads the institute's international projects division, teamed up with scientists from the UK's Royal Agricultural University (RAU), located in Cirencester in southwest England. Working with RAU specialists, Melnik

carried out fieldwork at the nearby military training ground on Salisbury Plain and developed a plan of action for carrying out scientific research.

Soil is the foundation of agriculture and food security: First steps in pollution research

"One of the key challenges facing our team, which has set itself the goal of developing a protocol for collecting soil samples, was how to adapt it for the conditions in Ukraine," said Melnik. "If in Great Britain we had the opportunity to provide stability and controlled conditions for experiments in military training areas, in Ukraine active fighting and changing circumstances make it far harder to do this," she explained, adding that safety



Collecting soil samples in a crater formed by the impact of an aerial bomb. Source: Olena Melnik

was a particular concern for the experts collecting samples.

“In Ukraine’s fields we needed to ensure that the sector was de-mined and safe for work, since it was important to obtain samples not only in a crater, but at a certain distance from it in a control site. This is essential in order to compare the results obtained.”

Collecting data on soil pollution in Ukraine

The next step in the research was field expeditions to collect soil samples in three regions of Ukraine that have been badly affected by the war: Kharkiv, Chernihiv and Sumy. The study was carried out in and around craters formed as a result of impacts from aerial bombs or multiple-launch rocket systems (MLRS), and showed the heavy metal content in these sites.

SNAU rector **Ihor Kovalenko**, a professor in the university’s Department of Ecology and Botany, shared his thoughts on the experience: “We began collecting samples in the spring of 2023. I had to work in the north of the Sumy region, in the Shostkinskyi district. The first experience was collecting samples in a crater that had been formed by an aerial bomb. The dimensions were enormous, and there was a great deal of work.

“Nonetheless, we had to work quickly, because this sector is still being shelled. This experience forced me to think more deeply about the point of our work. Collecting samples and documenting damage isn’t just documenting destruction, it’s a contribution to the country’s food security.”

Collected soil samples underwent careful preparation and were then subjected to analysis, which at first glance



appeared to be the simplest stage of the research. However, the scientists soon ran into an unexpected challenge – interpreting the results. X-ray fluorescence analysis revealed the gross forms of heavy metals in the soil, i.e. the total quantity of each of them. But then a question arose: how safe are these concentrations for people and the environment?

Test results give hope for a swift recovery

Analyzing data on heavy metal content is not an easy task. Ukrainian legislation only outlines maximum permissible concentrations for individual metals, such as arsenic, barium, antimony and some others. The lack of specific standards for other metals significantly complicates the assessment of the danger they pose and their potential impact on the ecosystem. In order to gain an understanding of pollution levels, the decision was taken to compare data with control sites located at least 50 meters away from the craters (the distance depended on their size).

As for the consequences of bombs hitting agricultural land, the research reveals certain environmental problems. In some regions increased heavy metal content was discovered: barium, zirconium, rubidium, manganese and zinc. However, the situation is not as critical as it might have appeared at first glance.

This assumption was made in accordance, using one-way ANOVA

(“analysis of variance”) when comparing data obtained from the crater and control samples. Statistically significant excesses were recorded in three of the seven craters studied, all of which were in the Sumy region, which contains chernozem soils with a neutral soil reaction (pH 6.7). On average, gross barium content at the control sites was within 300 mg/kg of soil, but the values in the crater exceeded that value by an additional 100-150 mg/kg of soil.

A similar situation was also noted for some other elements: zirconium content on the slopes of one bomb crater was 30 mg/kg of soil, for example. Some of the most excessive heavy metal content was recorded not only in craters created by explosions, but also in control areas where no impacts had occurred.

This suggests that military activity is not the only factor influencing soil quality - it is possible that some of the changes have been caused by violations of agricultural practices, such as the excessive use of fertilizers or pesticides.

Analysis of the data obtained from craters created by MLRS shells showed similar results: elevated levels of heavy metals such as barium, zirconium, manganese and zinc in the soil. In many cases, however, the concentrations of these elements remain within acceptable



limits. Excessive quantities of the elements studied was noted in both control sectors and bomb craters.

Phytoremediation: an agrochemical method for restoring damaged soils

Barium, zirconium and rubidium, although absorbed by plants, do not play a role in their physiological processes: they accumulate primarily in the green mass and do not penetrate the grain. Zinc and manganese are necessary for plant growth, promoting photosynthesis and the formation of proteins. However, excessive accumulations of these elements in the soil can affect crop production and the environment in general. It is advisable to use remediation methods to restore soils contaminated with these substances.

One of these methods is phytoremediation, the use of plants to clean soils. Research by SNAU scientists has proven, for example, that mustard is capable of absorbing barium and zinc in large quantities, even in its flowering phase. Mustard can be grown several times on a single plot per season, making remediation more effective.

Soil samples were therefore collected layer by layer at intervals of 10 cm to a depth of 1 meter. Scientists noted that barium levels in the soil fell by 90-200 mg/kg during the period from seedling emergence to flowering, depending on the sampling depth – a significant

decrease. However, since barium does not play an active role in the vital functions of plants, there is no clear data on the transfer of barium to the harvested crop in scientific literature.

Thus, mustard may be useful to help restore agricultural lands contaminated with heavy metals. However, several vegetation periods of the crop may be needed to clean the soil and reduce contamination, an amount depending on heavy metal concentration and the soil's physical and chemical characteristics. In addition to cleaning, the mustard plant enriches the soil with organic matter, improving its fertility and structure, which helps restore the land's productive potential.

The study also examined the suitability of other plants for soil restoration and showed that peas have potential heavy-metal phytoremediation properties, particularly with iron and chromium. This shows that phytoremediation can be, in general, a relatively effective means of extracting heavy metals from soil.

What should be done with plant matter containing heavy metals?

It is usually recommended that vegetation with accumulated heavy metals should be burned. Although heavy metals remain in the ash after burning, filters can be used to prevent



Elina Zakharchenko, an associate professor in the Department of Agricultural Technology and Soil Science at SNAU, stands in a crater formed by a MLRS shell. Source: Elina Zakharchenko

their release into the air. This method is especially attractive because energy crops, such as miscanthus, willow or castor oil plant (*Ricinus communis*), have a tendency to accumulate large quantities of heavy metals from the soil.

The burning vegetation is frequently the subject of discussion for scientists, but questions remain on the best way of disposing of the resulting ash safely. Some researchers suggest using the ash in cement production. Here too,

questions arise regarding the kind of structures that can be built from such cement in order to prevent repeated environmental pollution.

War-damaged soils in Ukraine can be restored with the right approach

In general, the study results give cause for cautious optimism. Concentrations of heavy metals detected in the soil do not generally exceed maximum



permissible levels, meaning there are significant opportunities for Ukrainian lands to be restored after the war. Careful agricultural approaches and increased control over the use of agrochemicals will help restore the natural balance. Modern technologies permit detailed studies of soil composition, allowing prompt responses to be taken to counter potential threats while maintaining the fertility of the soil.

Soil is one of the world's main ecosystems. And in terms of environmental protection, when we talk about the pollution of individual areas with heavy metals, this is not simply a local problem, but also a possible threat to other ecosystems: groundwater, forest belts, and ultimately food (trophic) chains. All these components of nature are interconnected and none of them are immune to pollution's consequences.

"The results obtained during the project do not allow us to say that agricultural lands exposed to shelling should be withdrawn from agricultural use," says **Elina Zakharchenko**, an associate professor in the Department of Agricultural Technology and Soil Science at SNAU, commenting on the preliminary conclusions of the study.

"Particular attention should be paid to areas with high concentrations of heavy metals, where there may be a risk of

bioaccumulation in the food chain – though nothing has been found so far. We should base the identification of areas that may be unsuitable for further cultivation on a multi-level risk analysis, including environmental, economic and social aspects. Conservation of such lands on a large scale may be considered if critical levels of contamination are confirmed, especially mobile forms of heavy metals."

The bad news and the good news

During the course of their research, the SNAU scientists analyzed about 300 soil samples from 30 craters created by aerial bombs and MLRS shells, recording a certain excess of heavy metal concentrations. Special attention should be paid to results obtained from areas where military hardware was destroyed – sometimes the concentrations of heavy metals there are dozens or hundreds of times over the limit.

However, although the war has already left – and continues to leave – deep scars on Ukraine's soils, prospects for their restoration and further effective use look promising. With the introduction of sound agricultural practices and proper environmental control, Ukraine's agricultural lands will continue to provide food security for both the country and the world, despite all the challenges.

Risks to security mean that such studies of soils in frontline areas remain quite limited. Unfortunately, it will



only be possible to draw more detailed conclusions once the war is over. •

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Translated by Alastair Gill



Prospect for renewable energy in wartime: How Ukraine plans to ensure energy independence using “green generation”

Victoria Hubareva

*R*ussia's war in Ukraine has destroyed **US\$16 billion** of the country's energy infrastructure. Restoring the country's energy industry to its previous form is a longer, more difficult and more expensive prospect than building new generating capacities based on renewable energy.

Energy sector losses since the start of the full-scale invasion and the government's chosen strategy

According to [estimates](#) by an analytical team at the Kyiv School of Economics, as of May 2024 direct losses



in Ukraine's energy sector alone amount to over US\$16.1 billion. The greatest damage resulted from the destruction of electricity generation facilities (\$8.5 billion), primary power lines (\$2.1 billion), and oil and gas infrastructure (\$3.3 billion).

In considering these factors, Ukraine began preparing for the 2024 heating season in the spring and chose a general course towards decentralization of the energy sector, in order to avoid concentrating significant generation capacity in a single location and thus ensuring energy security in the country. In addition, rebuilding large power plants is more time-consuming, difficult and expensive than smaller generating capacities. At least, this is Ukrenergo's [assessment](#).

For this reason, instead of building new large facilities, energy sector managers are concentrating on purchasing gas peaking power plants (small, highly maneuverable gas power plants), biogas thermal power plants, and electrical energy storage systems for renewable energy plants.

A state-owned electricity transmission system operator in Ukraine, Ukrenergo's [restoration](#) plan is ambitious. The company is creating a model future energy system on the basis of renewable energy. The goal is to increase wind generation capacity fivefold, biofuel thermal power plants fourfold, increase solar generation by 60%, and build 0.8

GW of energy storage systems from scratch in two to three years.

On August 13, 2024, Ukraine's government approved the National Action Plan for Renewable Energy through 2030 (hereinafter referred to as the National Plan). The plan sets a national goal for achieving 24 GW of renewable energy generation capacity and a 27% share of renewable energy in gross final energy consumption. Facilities to generate 6.1 GW of onshore wind energy, 12.2 GW of solar energy, 876 MW of bioenergy, 40 MW of geothermal energy, and 4.7 GW of hydropower must be built in order to achieve these goals.

- **Read more:** [Distributed electricity generation in Ukraine: the risks and opportunities](#)

Is the National Plan achievable given the reality of wartime?

Losses for renewable energy producers are [estimated](#) at \$282 million (excluding damage to large hydroelectric and pumped storage power plants). According to an analysis by the Energy Charter Secretariat, 13% of solar power capacity is located in temporarily occupied territories, and 8% of that amount has been damaged or destroyed. Approximately 80% of wind



power capacity remains in occupied territory, and some was damaged by shelling. In addition, at least four biogas plants are known to have been destroyed as a result of Russian aggression. Even in the best case scenario – deoccupation of all Ukrainian territories – it is very likely that most power generation facilities built before the war will have been destroyed, damaged or looted.

And although information is being disseminated that the share of renewable energy in Ukraine’s energy balance has grown to 9.8% in the first six months of 2024 alone, unfortunately, the main reason for this growth is not renewable energy, but rather the Russian army’s destruction of 73% of the country’s thermal power generation. In other words, electricity generation in the country has fallen overall.

Ukraine has [lost](#) at least 1 GW of “green energy” generation since 2022. At the beginning of the full-scale invasion, installed renewable energy capacity in Ukraine totalled 9.9 GW, of which 2 GW was wind energy, 6 GW solar energy, and 0.2 GW bioenergy. At the start of 2024, renewable energy generation totalled 8.7 GW – new renewable energy capacity is [coming online](#) in Ukraine despite two years of war.

However, in order to achieve the goals set out in the National Plan, Ukraine will need to build three times more capacity over a six-year period than it currently has today. The most interesting aspect

is that this is theoretically possible, from the perspective of land being available to site new generation capacity.

According to preliminary [research](#) by Greenpeace Ukraine, Ukraine can achieve production of 91% of its energy from renewable energy sources using just one percent of the land area needed for construction of solar and wind power plants.

For example, a study in the city of Kremenchuk showed that installing solar panels on school roofs can meet the entire city’s energy demand. The most proximate forecasts for commissioning of wind power plants (WPP) also give cause for hope: at present, Ukraine is preparing to build 4 GW of WPP generation capacity that [can be commissioned](#) in one to two years. And Ukraine’s National Plan, as mentioned above, requires 6.1 GW of wind energy over the next six years.

However, the main issues in Ukraine are not the availability of renewable energy plants alone, or even the lack of those willing to install them. According to renewable energy sector [experts](#), the leading obstacle is inadequate legislation and lacking investor confidence in the Ukrainian regulatory system for the renewable energy market.



According to European-Ukrainian Energy Agency CEO **Anastasia Vereshinskaya**, to overcome these obstacles, Ukraine must first pay off its electricity market debts, create security funds to offset cover risks (including military), and implement regulations to meet European regulatory standards.

What examples of energy independence can Ukraine boast of today?

An “ideal” version of Ukraine’s energy independence specifically during power outages is the ability of enterprises, households, co-owned multi-unit apartment buildings and municipal buildings to meet their needs for heat and electricity independently, using renewable energy sources. And such examples already exist.

Municipal projects are being implemented in Ukraine, including schools, outpatient clinics, hospitals and kindergartens that can now fully or partially meet their needs using renewable sources. For example, an outpatient clinic in Horenka, destroyed during the Russian offensive near Kyiv, has been meeting half of its own needs for almost two years thanks to renewable energy sources.

In partnership with other organizations, Greenpeace Ukraine installed both a heat pump in the clinic that, in its first year of operations, generated 43% in savings on heating and a solar power array that met 55% of the outpatient clinic’s demand for

electricity. In other words, the building can run on 100% solar power 150 days per year!

A similar example can be found in Kryvyi Rih – there, 40 kW of solar panels were installed on the roof of a kindergarten, an array that can provide budgetary savings of up to 40% of estimated electricity costs. Five comparable projects have already been implemented in the city, and seven more are in the works. Similar projects are being implemented in Mykolaiv, Bukovina, and Volyn, in Lviv and Poltava regions, and in other regions of Ukraine. Most of them are financed by the EU.

Moreover, it is not just municipal facilities that are becoming energy independent. For example, a logistics center in the Vinnytsia region was equipped with solar panels and energy storage units. The business is not just saving on energy – it completely meets its needs using renewable energy. One of Ukraine’s largest agricultural holdings, MHP, is currently building two biogas methane plants in order to export biomethane to the EU in the future.

All of these examples suggest that, despite existing barriers and risks associated with the war, both foreign partners and Ukrainian enterprises directly interested in cost savings and developing energy-efficient decentralized generation systems are betting on the effectiveness of renewable energy as a means of supporting Ukraine. •

Translated by Jennifer Castner
Main image source: [hromadske](#)



Environmental consequences of the war in Ukraine: October – November 2024 Review

Alexei Ovchinnikov

Each month, the UWEC editorial team shares highlights of recent media coverage and analysis of the Ukraine war's environmental consequences with our readers. As always, we welcome reader feedback, which you can leave by commenting on texts, writing to us (editor@uwecworkgroup.info), or contacting us via social networks.

Greenpeace study shows nuclear crisis in Ukraine deepening as war escalates

A study carried out by Greenpeace has highlighted the very real possibility of a nuclear catastrophe if Russia continues to attack Ukraine's energy infrastructure.

"It is now time for the [International Atomic Energy Agency] to act more decisively both



in clear and unambiguous communications to the Russian government and in its action for the immediate deployment of the expanded mission to critical substation infrastructure,” [said](#) Shaun Burnie, a nuclear energy expert from **Greenpeace Ukraine**.

According to the study, since the beginning of the full-scale invasion Russia has destroyed around 90-95% of Ukraine’s thermal power plants and 40% of its hydropower plants, leaving its energy sector dependent on three nuclear power plants with nine reactors. Meanwhile, the Zaporizhzhia nuclear power plant remains occupied by Russian troops and is not supplying electricity to the country.

On top of this, Russia continues to strike substations and power lines. This could result in blackouts at nuclear reactors, which require a constant power supply for the stable operation of reactors and their emergency shutdown.

“When a nuclear power plant loses its offsite power from the grid, a so-called Loss of Offsite Power (LOOP) event occurs and the power plant falls back to three main power sources for its critical safety systems: on site batteries, back-up diesel generators, and the possibility to trip one reactor at the plant to house load” the [report](#) notes.

This may require one or several reactors to be switched off. Not only are reactors difficult to restart after shutdown, but power outages like this obviously increase the risk of an accident at a nuclear power plant.

Greenpeace Central & Eastern Europe calls upon the **IAEA** and other international institutions to apply as much pressure to Russia as possible to halt missile attacks on Ukraine’s energy system. It is also necessary to increase the number of IAEA missions, and to strengthen international support for the restoration of Ukraine’s energy sector, which has suffered as a result of the war. An important part of Greenpeace’s proposal is the decentralization of Ukrainian energy, a process which is already underway. This will make it more flexible and resilient to attacks from Russia, and will also ensure the country’s energy independence after the war.

You can read the full analysis by Greenpeace Central & Eastern Europe [here](#).

RazomWeStand unveils catalog for investment in development of energy-efficient projects in Ukrainian cities

According to the [“Investment Catalogue of Ukrainian Cities”](#) published by the Ukrainian environmental initiative RazomWeStand, Ukraine’s energy system was already in need of modernization even before the full-scale invasion, especially in the central heating and hot water supply sector. The war only exacerbated the problems.

Every city in Ukraine with a population of more than 400,000 needs



between \$20-100 million in investment to ensure it has a resilient heating system and water supply. In many cities, outdated Soviet technologies are still in use, resulting in up to 60% of energy being lost.

The aim of the catalog, developed in collaboration with USAID Governance and Local Accountability (HOVERLA), ISE Group, Ukraine-Moldova American Enterprise Fund, Association of Coal Communities of Ukraine, and the Association of Ukrainian Cities, is to present and estimate the cost of potential solutions to modernize and increase the energy efficiency of projects in Ukrainian cities. The authors suggest that this will be a way of attracting more investment, as well as showing the problems currently faced by Ukrainian communities.

Developing energy-efficient projects in Ukraine will not only modernize the country's infrastructure, but will also help it adapt quicker to the Green Deal, as well as significantly reducing the load on the power grid.

The RazomWeStand catalog is available to read [here](#) (in English).

UWEC Work Group publishes report on environmental impact of war in Crimea

As part of the [KrymSOS](#) project, UWEC has published a study entitled "Crimea's Environment: Changes and

Losses During the Full-Scale War." Authored by **Oleksiy Vasyliuk**, **Viktor Hubareva**, and **Viktor Parkhomenko**, the study describes the main environmental problems that Crimea has faced since annexation and during the war. These include the commercial use of protected areas, the delisting of protected species, deforestation, poaching, the exploitation of Crimea's natural resources, fires in steppe forests, water supply problems, and much more.

It is important to remember that Crimea's ecosystems are unique biotas that enjoy protected status under international agreements. Despite these protections, the peninsula's natural environment has suffered significantly from recent human activity.

The ecosystem was dealt a serious blow during the Soviet era, when the construction of the North Crimean Canal effectively [altered](#) natural conditions in northern Crimea. After Russia's annexation of the peninsula in 2014, Ukrainian environmental and ecological organizations were forced to suspend their work in Crimea. Ukrainian organizations and experts exchanged information and analysis of what was happening in Crimea using open sources such as satellite data, or via insider information. However, as UWEC Work Group has reported regularly, the nature conservation



situation on the peninsula has not improved.

Read about the environmental problems the war has caused in Crimea:

- [The thirsty peninsula: How much water will Crimea need in the future?](#)
- [Sleight of land: How Russian authorities in occupied Crimea are using legal trickery to develop protected areas](#)
- [The Crimean Bridge: Environmental impact of Russia's 'project of the century'](#)
- [Nine years after Crimea's annexation: militarization's environmental consequences](#)
- [Militarization of Crimea. An infographic](#)

You can read more about "Crimea's Environment: Changes and Losses During the Full-Scale War" [in the report](#) (in English and Ukrainian).

Czech NGO holds seminars as part of 'Clean Air for Ukraine' program

In October, the Prague-based environmental organization Arnika ran three seminars as part of the Transition program, with financial support from the Czech Ministry of Foreign Affairs.

On October 9, energy conservation experts, activists, and scientists discussed whether nuclear power is a reliable future option for Ukraine, taking into account past and present threats, in an online seminar titled "[Ukraine's Energy Future: Challenges and Opportunities.](#)" In the course of the discussion, participants put forward various possible solutions and discussed projects to develop safer and more sustainable energy sources (primarily renewable ones) as part of the path to energy independence for Ukraine.

On October 10, it was followed by the online seminar "[Environmental Monitoring in Wartime,](#)" where participants shared their experience and the importance of carrying out monitoring of air and water quality while martial law is in place. Reports were presented by the Dnipro regional council's Center for Environmental Monitoring, as well as the municipality of Kryvyi Rih. The discussion also highlighted the [Water Conflict Chronology](#) resource, which documents the ecological state of water bodies in countries where military activity is taking place, including Ukraine (since 2014), as well as Ukraine's [EcoCity](#) nationwide network for monitoring air quality, which is today the most accessible and widely used data source in public monitoring efforts.



The third seminar, on October 23, was called “First Study of Sediment Pollution in the Kakhovka Reservoir,” and presented the results of an analysis of 14 soil samples: 11 from the sediments of the former reservoir, two from a crater left by a Russian S-300 missile strike, and one from an industrial area of the city of Zaporizhzhia. The samples were gathered in two stages and tested for various pollutants, including pesticides, heavy metals, petroleum hydrocarbons, and so-called evergreen chemicals, per- and polyfluoroalkyl substances (PFAS). The most alarming findings were high levels of the dangerous, long-banned pesticide DDT, and relatively lower concentrations of another harmful insecticide, hexachlorane (HCH). These substances were detected in sediment samples from Zaporizhzhia’s main beach, which locals regularly use for recreation.

Read more about Arnika’s research into the consequences of the disaster at the Kakhovka hydroelectric power station in our article:

- [Pollution from the bed of the Kakhovka Reservoir could affect water quality in local settlements](#)

Ukraine blocks Russian chairmanship of Black Sea pollution body

Representatives of Bulgaria, Georgia, Romania, Turkey, Ukraine and Russia convened on October 16 for the 44th

meeting of the Black Sea Commission. The commission is responsible for the protection of the marine environment from pollution from land-based sources, oil, and other harmful substances as a result of accidents, as well as the preservation of biotic and landscape diversity.

Russia was due to take over the chairmanship of the commission from Romania at this year’s meeting, but Ukraine vetoed the transfer, stating that Russia is an aggressor whose actions have led to significant pollution of the Black Sea in recent years as a result of the war. A report has been [published](#) (in Ukrainian) on the official website of the Ministry of Environment and Natural Resources of Ukraine.

Read more about the environmental consequences of the war for the Black Sea:

- [Impact of Russia’s invasion of Ukraine on the Black Sea and the Sea of Azov](#)
- [Black Sea heals its wounds: 4 months after the Kakhovka catastrophe](#)
- [War and the Sea: How hostilities threaten the coastal and marine ecosystems of the Black and Azov Seas](#)

UAnimals protests against suffering of animals during war and ecocide

Ukrainian animal rights movement UAnimals held its annual march to raise



awareness of the war's impact on animals in Warsaw on October 8. The initiative has also set up an [online platform](#) where you can make donations to help animals that have suffered during Russia's full-scale invasion of Ukraine.

According to UAnimals, which continues to rescue homeless animals from frontline areas, three zoos and about 20 animal shelters have been shelled since the beginning of the full-scale invasion. Rough estimates suggest that more than a million animals have died. Since the Russian invasion, 5,327 animals have been evacuated from the war zone, more than 20 shelters have been reopened and more than 950 metric tons of food have been distributed to animals in Ukraine. Meanwhile, work to sterilize homeless animals continues.

The march was held as part of an annual campaign to draw attention to

problems facing animals in Ukraine. The first UAnimals march was organized on October 15, 2017 by the founder of the initiative, Oleksandr Todorchuk. The following year, an all-Ukrainian march was held to protest the exploitation of animals in zoos, laboratories, and nurseries, and in 2019, almost all 24 of Ukraine's major cities joined the campaign.

In 2020, the COVID-19 pandemic saw the march held online for the first time. The event has been held in Warsaw since the start of the full-scale invasion in 2022.

You can learn more and make donations to support the organization's work on its [website](#).

Read more about the consequences of the war for animals:

- [Animal victims of war](#)

Translated by Alastair Gill



Safe haven: How Ukraine's zoos are saving animals in spite of war

Yuliia Spinova

Russia's full-scale invasion of Ukraine has sharply altered the contours of life for the whole country. While all living beings in Ukraine are in danger, animals' chances of survival in wartime conditions differ drastically, whether for wild animals in their natural environment or for those in human care in zoos, animal shelters and rehabilitation centers. UWEC Work Group has already published articles about the impact of military action on [rare](#)

[small mammals](#), [abandoned pets and farm animals](#), on [seals](#) and other sea creatures ([1](#), [2](#), [3](#)), as well as the consequences of the war for animals living in protected areas ([1](#), [2](#), [3](#)). This article deals with the survival of those animals whose everyday life depends entirely on humankind.

Over the last year, the IUCN Species Survival Commission has regularly noted the important role of zoos and botanical gardens in the conservation



London, 1915. Some of the zoo's animals were used for propaganda purposes. This play on words on the carapace of a tortoise shows the need for large quantities of ammunition. Source: [Illustrated London News Ltd/Mary Evans](#)

of biodiversity and even published a corresponding [declaration](#). Today's zoos, with their modern technologies and zoological databases, are a powerful tool for supporting the population of many animal species, as well as for the preservation of several species that have died out and disappeared in the wild.

However, war has always led to huge losses for zoos, and sometimes even to the complete annihilation of their animals.

Zoos and the wars of the past

During the First and Second World War, zoos experienced severe difficulties, affecting their operation, their financing



and social attitudes towards animals. Many zoos lost animals during these wars due to a lack of resources, bombing and evacuation. Animals in captivity were under threat not only because of the conditions in which they were kept and their complete dependence upon human beings, but also as a result of changes in social priorities, when military needs took priority over everything else.

London Zoo and the move to Whipsnade

The archives of [London Zoo](#) show that at the beginning of World War II the zoo was already preparing for possible bombing, since in September 1939 some of the zoo's animals were transferred for protection to Whipsnade Park Zoo, located in a village 55 km northwest of London. These included two large pandas (one of them, Ming, was the first large panda to appear in a European zoo), two orangutans, four chimpanzees (which subsequently escaped from the island where they were resettled), three Asian elephants and an ostrich. All the zoo's poisonous animals were killed, in order to prevent them from escaping if the zoo was bombed. Some reptiles were saved, however, including a Komodo dragon and Chinese alligators. Additionally, two large wooden shelters – 7.6 and 8.5 metres long – were constructed to house two enormous pythons.

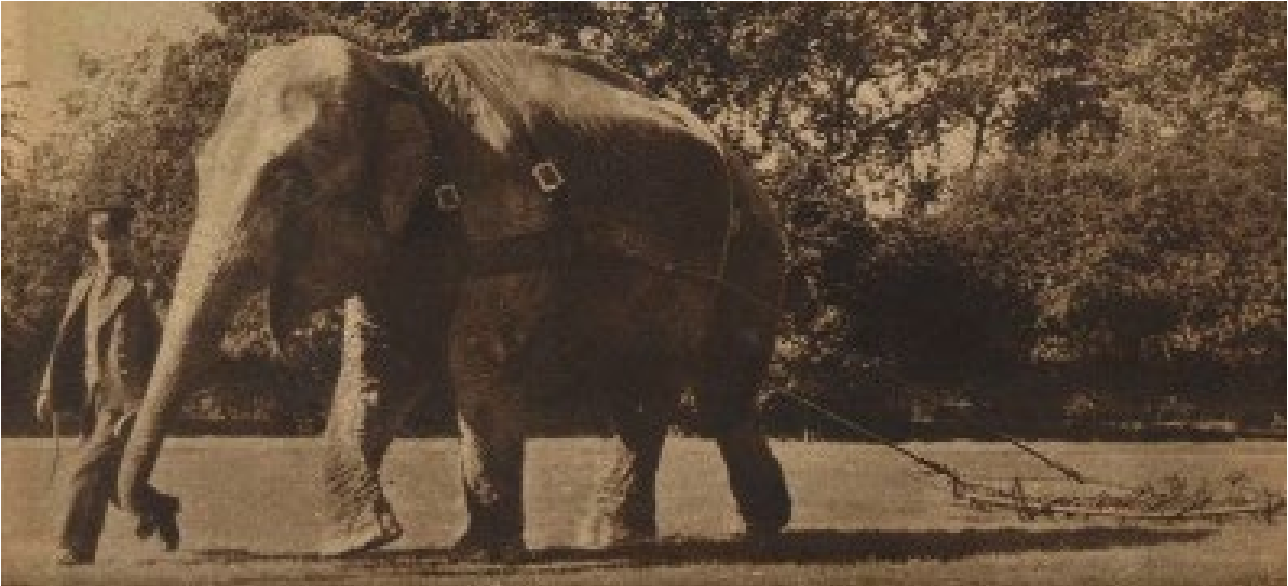
During the war the zoo was hit by bombs on numerous occasions.

Sometimes these raids left little but broken glass, while in other cases entire buildings were destroyed. One of those days was 27 September 1940. Several high-explosive bombs hit the zoo, damaging the buildings where the zebras, rodents and civets were housed, along with the gardener's office and all breeding areas. Miraculously, not a single animal suffered, although a zebra and a wild donkey with a foal escaped (the zebra was later found). Thirty-five incendiary bombs fell on the zoo that night, and following the discovery of an unexploded bomb the complex was closed for more than a week.

The first Christmas of the war was a sad one for the zoo, especially after the death of a black rhino that had been evacuated from London. Later an African elephant also died. Their bodies were cremated. But this was the last time that dead animals were burned – from then onward, they were used as feed for carnivorous animals.

When in 1940 the German-Italian-Japanese alliance was named Axis, the zoo began to refer to axis deer (*Axis axis*) simply as “spotted deer.”

The war was a difficult ordeal for the animals. When heavy snow fell on the zoo, one panda and tiger cubs went into convulsions. With the beginning of fuel rationing, the number of visitors dwindled, meaning the zoo had less money to spend on feed. Visitors were initially encouraged to bring lettuce



A keeper from Whipsnade Zoo ploughing with Dixie the elephant, 1940. Source: [Whipsnade Zoo in World War Two](#) by Janie Hampton

leaves, cabbage and carrots with them, but soon nobody even had this to spare. The zoo began to grow its own mealworms to feed the birds, and fed meat covered in fish fat to those animals that usually consumed fish.

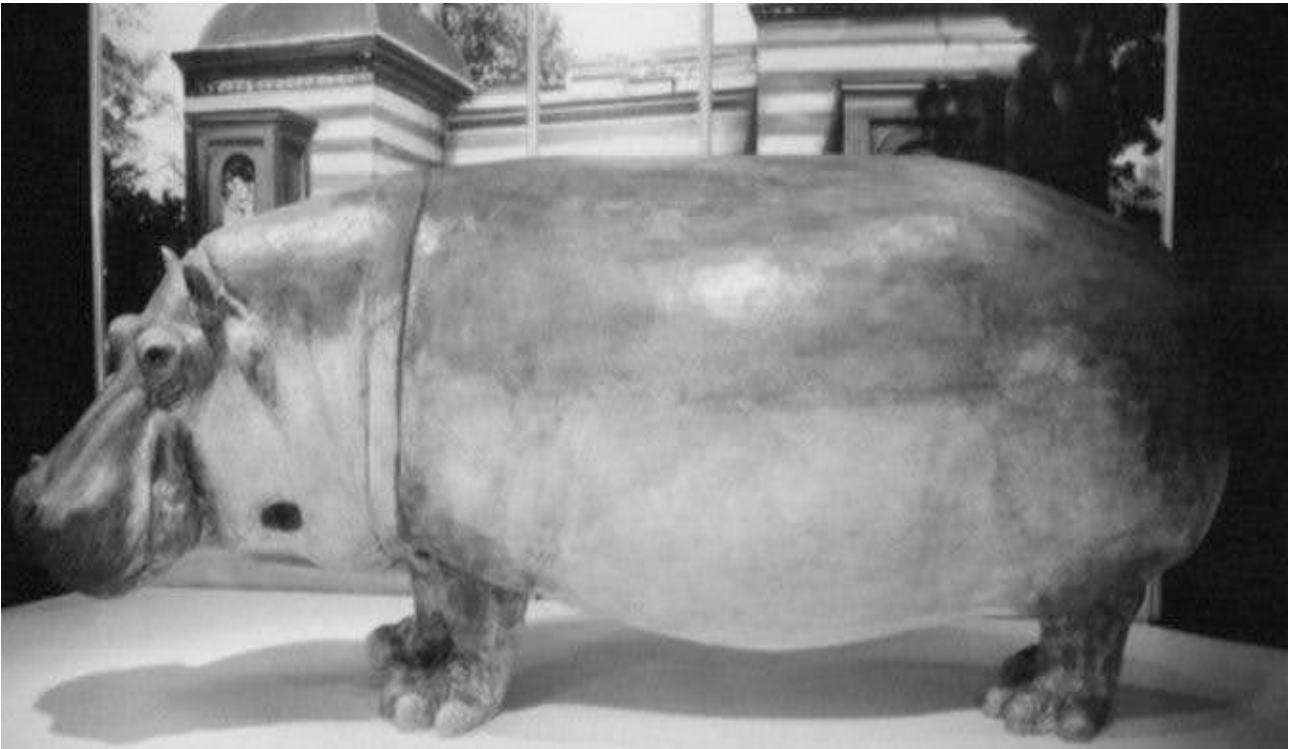
A colony of bright green noisy parrots, originally from South America, lived in an enormous common nest above the zoo's main entrance gate. Once they were even bold enough to descend and wreck a nearby orchard. The following year they were kept in a cage until its apple harvest had been gathered.

The signal that traditionally announced closing time at five o'clock, which sounded from a high water tower, now served as an air-raid siren. According to the testimony of local inhabitants, it was always accompanied by the baying of the zoo's wolves, which created a somewhat creepy atmosphere.

Over 40 bombs were dropped in the vicinity of the zoo in 1940. Most of these fell on the park, forming large hollows, which later turned into ponds. However, these bombardments also claimed victims: a spur-winged goose (*Plectropterus gambensis*) – the zoo's oldest resident – and a baby giraffe.

Berlin Zoo

[Berlin Zoo](#) also suffered badly from military action in World War II, with many bombs falling on the complex. During the fight for Berlin, the zoo became a battlefield, and tanks and shells left their destructive mark. The condition of the park, which had once been so popular with visitors, gradually worsened and by the end of the war it was riddled with craters and littered with dead soldiers and the corpses of animals. Of a population of



A keeper from Whipsnade Zoo ploughing with Dixie the elephant, 1940. Source: [Whipsnade Zoo in World War Two](#) by Janie Hampton

around 3,500 animals, fewer than 100 survived.

Warsaw Zoo

[Warsaw Zoo](#) came under regular shellfire in September 1939, and many animals died as a result of either bombs and bullets (anthropoid primates) or missiles (an elephant and a giraffe). After Warsaw's surrender, the Nazis transferred most of the animal species to the Schorfheide nature reserve in Germany, while others, described at the time as being of "no value", were shot, and the zoo was closed. After its director Jan Żabiński was released from captivity, the animals were gradually shipped back to the zoo, though it only reopened in 1949.

Belfast Zoo

During the Blitz in 1941, the Luftwaffe also bombed the zoo in [Belfast](#), Northern Ireland. Twenty-three of the animals in Belfast Zoo (including six wolves, two polar bears, a hyena, a tiger, a puma and a black bear) were shot by members of the Royal Ulster Police on orders of the Home Office, which was concerned that the animals would escape as a result of a bombing raid. In one particularly famous episode, which was later even adapted into a [film](#), a local woman saved a young elephant. Denise Austin, one of the zoo's first keepers, decided to ensure the safety of an elephant calf named Sheila by taking her out of the zoo every evening and bringing her home.



This rare photograph was taken during a visit to Warsaw Zoo by Polish soldiers from the 1st Rifle Regiment. Source: [The History of the Warsaw Zoo](#)



Sheila the elephant, who was removed from Belfast Zoo every day to avoid the risk of being hit by a bomb during the Belfast Blitz in 1941. Source: www.belfasttelegraph.co.uk

Ukraine's zoos also suffered during World War II. On September 19, 1941 the Red Army retreated from Kyiv and two days later the fascist occupation

began. On September 24, explosives left by Soviet sappers almost completely destroyed a number of the city's central streets (including Kreshchatyk and



today's Maidan Nezalezhnosti, among others). The blasts disabled the city's utility networks.

At the beginning of the war, [Kyiv Zoo](#) could boast 155 mammals and 796 birds, a three-year-old zebra and bears aged from seven to 15 years old. In his report to the city administration dated October 18, 1941, the zoo's director Ivan Chernyakhivsky [noted](#) that the general condition of the animal was satisfactory, with the exception of those subject to culling. However, the lack of bread, sugar, and bulk feed had a negative effect on their health.

In addition, in the very first few days after their entry into Kyiv the Germans began to remove animals, feed, equipment, special clothing and coal from the zoo, reasoning that the animals would die in any case.

Ukraine's zoos in times of tumult

Today there are 13 zoos in Ukraine that are protected areas, of which seven are of national importance and five are of regional importance.

Kyiv Zoo

In 2022, Kyiv State Zoo [found](#) itself in completely new circumstances following Russia's full-fledged invasion of Ukraine.

According to [estimates](#) by Kyiv authorities, air-raid sirens sounded in the capital 638 times in 2022. These states of alert lasted a total of almost 700 hours,

meaning that Kyivans, including the staff of the zoo, spent nearly 29 days – an entire month – in basements and bomb shelters.

When fighting began in the Kyiv region, 16 of the zoo's staff immediately joined the ranks of the territorial defense forces, and later the Ukrainian army. Shelters were set up in the zoo's basements, and to this day, animals are transferred from their outdoor enclosures and locked in indoor premises during air raids.

One sad example of direct losses among the zoo's bird population as a result of military action concerns pink pelicans (*Pelecanus onocrotalus*), which destroyed their own eggs, and, accordingly, their lack of offspring in 2022.

The significant increase in noise (sirens, explosions and gunshots) and vibration pollution also led to the disruption of the natural course of hibernation in the zoo's bats. Their failure to reproduce in the spring is probably also associated with the stress experienced by the females.

A similar "malfunction" also occurred with the zoo's lemurs, with one female abandoning her cub. The young lemur was then artificially fed by veterinarians, who gave it the timely name of Bayraktar (the name of the Turkish-made drones widely used by Ukraine).

In the first two and a half years of the full-scale Russian invasion, staff at Kyiv Zoo took more than 500 animals from other locations into care.



They were all registered in the [ZIMS Species360 database](#), the world's first integrated global real-time database of animals in zoos and aquariums. The list includes animals evacuated from [combat zones](#) (the Kyiv, [Kharkiv](#) and [Kherson regions](#)); animals received from private individuals who were unable to care for their "favorites" due to power outages after missile strikes on energy infrastructure; wild animals confiscated by the Ukrainian police on suspicion of being illegally traded; and bats received from people for rehabilitation.

Some of the first animals to be turned over to the zoo were a [roe deer](#) and an owl. The zoo's veterinary doctors fought for days on end to save the life of the deer, whose body was covered with severe burns, but unfortunately it died. The owl, which had lost its sight as a result of an explosion at close quarters, was given the necessary treatment and it still lives in one of the bird enclosures.

Kyiv Zoo [acknowledged](#) these losses, but continues to endure these difficult times with dignity. As Ukraine began experiencing problems with electrical and heating supply as a result of Russian attacks on its critical infrastructure, the zoo purchased electric generators using charitable donations.

Kyiv Zoo has received over 70 metric tons of feed and veterinary medicaments as humanitarian aid from zoos and partner organizations of the European Association of Zoos and Aquariums

(EAZA), as well as selected international charities and peace foundations.

Kharkiv Zoo

[Kharkiv Zoo](#) in its more than 125-year history has also endured many difficulties: the civil war, when it survived the red Bolshevik terror, the rampage of Anton Denikin's [White Guard](#), the consequences of the intervention; World War II, when the zoo changed hands twice; and the 1990s, when the city's residents saved the animals from starvation.

On February 24, 2022, Kharkiv residents were awoken by a vague rumble and distant muffled explosions. By midday, Russian motorized infantry had occupied the northeastern outskirts of the city. Enemy artillery was destroying residential buildings. From this point onward, it became very dangerous to move around the city. The zoo's staff and their families, many of whose homes were left in ruins, moved to the zoo. The wife of one of the staff even gave birth in the zoo.

The zoo has had to accept a total of 46 animals from private collections, which could not be saved due to the war.

The disruptions of the first days were smoothed over by a two-week supply of feed. Later, volunteers were of great assistance, bringing food not only for the animals but also for the zoo's staff. Power cuts were the biggest concern, since a large number of electric fences had appeared in the zoo following reconstruction work,



most of the gates (partitions between the sections of the enclosures) ran on electric motors. Without electricity it also became impossible to supply and filter water, heat buildings, and much more.

The animals reacted calmly to these changes and were bothered little by distant blasts. Only when explosions resounded close by and the shockwave smashed glass and broke open gates did they become frightened. The monkeys [reacted the most acutely](#), running for shelter with loud screams.

Cherkasy Zoo

In a situation when all regions were being hit by missile strikes, it was unclear how quickly the war would reach specific cities. Cherkasy Zoo continued to operate normally on February 24-25, 2022, only closing to the public on the 26th.

In the first year of the full-scale war 70 new animals were transferred to the zoo for care.

In view of the new realities, the zoo developed an action plan in case of missile strikes. For the protection of animals, zoo staff and visitors, the decision was taken to lock the larger animals inside buildings.

Odesa Zoo

[Odesa Zoo](#) was closed to the public for a whole month from the first day of the full-scale invasion (February 24, 2022). Fortunately, the grounds of the zoo [were not damaged](#) by shelling, so the animals

did not suffer physically. Nonetheless, all personnel had to adjust to a new work schedule, to ensure that some of the specialists were on duty around the clock.

The biggest problem for the zoo was the huge wave of animals – mainly pets – which local residents began bringing in during evacuations. Around 700 individuals (birds, rodents, reptiles, fish, spiders, scorpions and mollusks) [have moved](#) to the zoo either permanently or temporarily.

In April 2022 the zoo appealed to Odesans for help preparing the grounds for the zoo's 100th anniversary. The idea was to give the city's residents a moral boost. The results exceeded all expectations – the initiative gave birth to a genuine volunteer movement, in which around 100 people took part over a three-month period. People came in families, in teams from various organizations, local residents and the internally displaced alike.

In these years of war Odesa Zoo has saved a total of 1,700 animals, of which 1,400 were pets and 300 were wild. In 2023 alone it received 1,000 birds and 100 animals.

Mykolaiv Zoo

Mykolaiv Zoo [lived](#) through eight bombardments during the first six months of the full-scale invasion.

"We were faced with the question of evacuating the animals, which we were



During nocturnal shelling of Mykolaiv on 18-19 April, 2022, two rockets hit the grounds of the zoo. Source: [Volodymyr Topchyv](#)

completely unprepared for,” recalls the zoo’s director Vladimir Topchyv of the early days of the invasion. “Until mid-March the city of Mykolaiv was in semi-encirclement. There was one road left out – toward Odesa –

and it was overloaded with transport. At night the bridges opened. The freezing weather lasted until the end of March”.

“We didn’t have enough transport cages, and we needed more than 400. We also needed



transport. And during transportation the animals needed to be accompanied, fed and cleaned up after. The question of where to take the animals also hadn't been resolved. Where could we accommodate them so they wouldn't die? It seemed impossible to solve this complex logistical challenge. To move out the elephants, giraffes, hippopotamuses, primates, tropical birds, polar bears, tigers, lions, leopards... We decided against evacuation, since this had already been done during World War II. And we stayed with our animals, and they with us."

The zoo opened charitable accounts in euros, dollars, Swiss francs, Czech crowns, Polish zloty, British pounds and Japanese yen. People from all over the world donated money to the zoo by purchasing "virtual" tickets.

Rivne zoo

On 24 February, 2022 the zoo received an order to restrict the presence not only of visitors but also employees. The zoo was closed, and the number of employees was reduced to the minimum necessary to ensure the care of the animals.

A temporary shelter was set up in the administrative building, and a supply of water, medicine and fire-fighting equipment was organized. Zoo staff provided active assistance in setting up a checkpoint near the zoo on the road leading out of the city.

Rivne Zoo, which is located in a relatively peaceful western region,

received a great deal of requests to accept evacuated animals from other parts of the country. A large number of internally displaced citizens from regions which had suffered severely from military action also came to Rivne. Over time, there was a growing need to open the zoo to visitors, which in turn required expanding and increasing the size of the above-mentioned shelter.

A landmark event was a round table discussion on the topic of "Modern realities of Ukraine's zoos in wartime," planned to coincide with the zoo's 40th anniversary and held on August 4-5, 2022, despite the country being at war. The leaders and employees of 14 zoological institutions gathered to discuss the problems that zoos were facing during the invasion.

Mena Zoo (Chernihiv region)

Hundreds of animals live at Mena Zoo: lions, camels, pelicans, bears. In 2022, on the first day of the war, tanks entered neighboring villages, preventing some zoo staff from going to work. As a result, the director and finance team had to care for the animals and clean cages during the early period of the invasion.

After the bridges were blown and there was no longer any Russian equipment on the streets, people began to return to work. The zoo then turned to local residents for help, who began



For obvious reasons, Mena Zoo has even altered the sign over its entrance, replacing the Latin 'z' with the Cyrillic 'з'. Source: 0462.ua

to share what they could. In just one week the zoo [received](#) donations of money and food for at least the next six months.

The town of Mena was not shelled, but tanks drove through, planes hummed in the sky, and explosions and artillery salvos could be heard nearby. Animals are very sensitive to powerful sonic impacts, so these sounds of war frightened them. "Even now, they rush around the enclosure during the sirens, especially the bears. We have to open the dens. Everyone wants peace," said Zinaida Maksimenko, director of Mena Zoo.

Aid for zoos

In the first days of the war in Ukraine, two coordination centers were set up in neighboring Poland. These were engaged in providing feed and veterinary drugs for animals from affected zoos. Zoological institutions and private individuals in Europe and around the world provided enormous

assistance during the first year of the full-scale war.

EAZA subsequently established a separate [fund](#) in support of Ukraine's zoos called the EAZA Ukraine Zoos Emergency Fund, which continues its work to date. Anybody can donate to the fund, and can also support each zoo individually by visiting them or purchasing charity tickets on the website.

Why support is crucial

In comparison with past wars, the modern methods of waging war as practiced by the armies of Russia and Ukraine are rather different. While in the past all aerial attacks were carried out by means of direct shelling and bombardment from aircraft, nowadays missiles of various types and range are used, as well as unmanned aerial vehicles (UAV), usually referred to as drones. On the whole, we are observing a significantly larger number of cases of indirect damage and negative



consequences for zoos and their inhabitants: the destruction of logistics and corresponding problems with deliveries of feed and the movement of zookeepers, which can affect the conditions in which animals are kept. These can all cause stress in animals and, as a result, psychological and behavioral changes.

Another distinguishing feature of a zoo's work amid the ongoing war is the care given to animals from outside the zoo – both pets, whose owners or volunteers bring them in themselves (in the case of abandoned animals) and wild animals (from other, destroyed zoos, or which have suffered from military action in their natural habitats).

There are two sides to this situation. On one hand, this can be seen as evidence of a higher level of environmental awareness and humanity (environmental ethics has developed significantly over the past decades compared to the beginning of the last century). On the other hand, this causes a problem for zoos, since they are forced to accept additional animals onto their balance sheet, animals that often arrive with unknown background and origin and which are kept in less comfortable conditions than those prescribed by today's high modern standards for animal husbandry.

Another question concerns the evacuation of zoo animals during a war

in the country. This is an issue that is not raised by zoos located some distance away from the frontline areas or combat zones. As is clear from the historical record, evacuation was a common occurrence in past wars. But in those times there were far fewer animals in zoos than today. And, as has been said above, the priority is now the wellbeing of the animals, which, in the case of their transportation, means finding vast resources – transport containers/mobile cages, transport (which for some species needs to be specially designed), accompanying personnel (keepers and veterinary doctors) – which no zoo possesses. In addition, in cases when animals are shipped abroad, it is necessary to find places for each of them in advance in European zoos that provide suitable conditions for temporary care.

The war has hindered the active development of most of Ukraine's state zoos, although some of them have now gained new cognizance of their goals and a push in the right direction. For zoos to continue to serve their main functions (conservational, scientific, environmental and educational) in wartime conditions, financial and humanitarian support remains critically important. •

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