



ECOLOGY IS A PRIORITY

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KARAZIN INSTITUTE OF ENVIRONMENTAL SCIENCES
SCHOOL OF FOREIGN LANGUAGES



Ecology is a priority

Annual student`s scientific conference
(April 19, 2023, Kharkiv, Ukraine)

*Under the General Editorship of
N. V. Maksymenko, DSc (Geography), Prof.,
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The publications contain the proceedings which address the modern ecological problems and ways of their solution, applied ecological research and ecological consequences of war.

Видання містить матеріали, які стосуються сучасних екологічних проблем та шляхів їх вирішення, прикладних екологічних досліджень та екологічних наслідків війни.

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DISTRIBUTION OF GREEN INFRASTRUCTURE BY DISTRICTS OF THE CITY OF KATOWICE (POLAND)

The study contains a comparison of the districts in the city of Katowice by the total area of green areas. Areas with the highest share of green infrastructure - Paderevskyi-Mukhovets and Murky have been identified during the study. It was also determined that the smallest share of GI in the districts was in Zazheche, Zavodze and Domb - less than 0.01%.

Keywords: green infrastructure, districts of the city, green areas.

Katowice is an administrative, cultural, scientific, trade, industrial center and the largest city of the Silesian Voivodeship of the Republic of Poland. During the heyday of the coal industry in Silesia, Katowice became one of the most important coal centers in Europe. This had a negative impact on the environment. At the end of the 20th century, significant efforts were made to improve the ecological situation in Katowice. Then, a number of laws and programs aimed at reducing air, soil and water pollution were adopted. More modern technologies and equipment were introduced at industrial enterprises, which made it possible to reduce emissions of pollutants. According to data for 2021, the population of the city of Katowice is about 294 thousand people. The total area of the city of Katowice is about 164 square kilometers. The city has a characteristic industrial area, but also has many green areas and parks (Fig. 1).

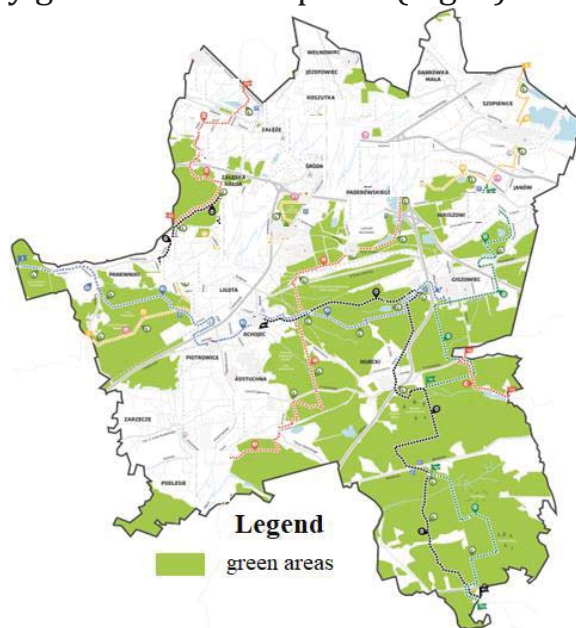


Figure 1 - Layout of green zones in the city of Katowice

In terms of leafiness, Katowice ranks fourth in Poland among cities with county rights and first in the Voivodeship. Katowice forests mostly form a

compact complex, which is important for birds and mammals. Forests in Katowice occupy 1.7% of all forests in the voivodeship. In Katowice, green areas account for 42%. For comparison, in Krakow, green areas, i.e. parks, lawns and forests, make up only 10%.

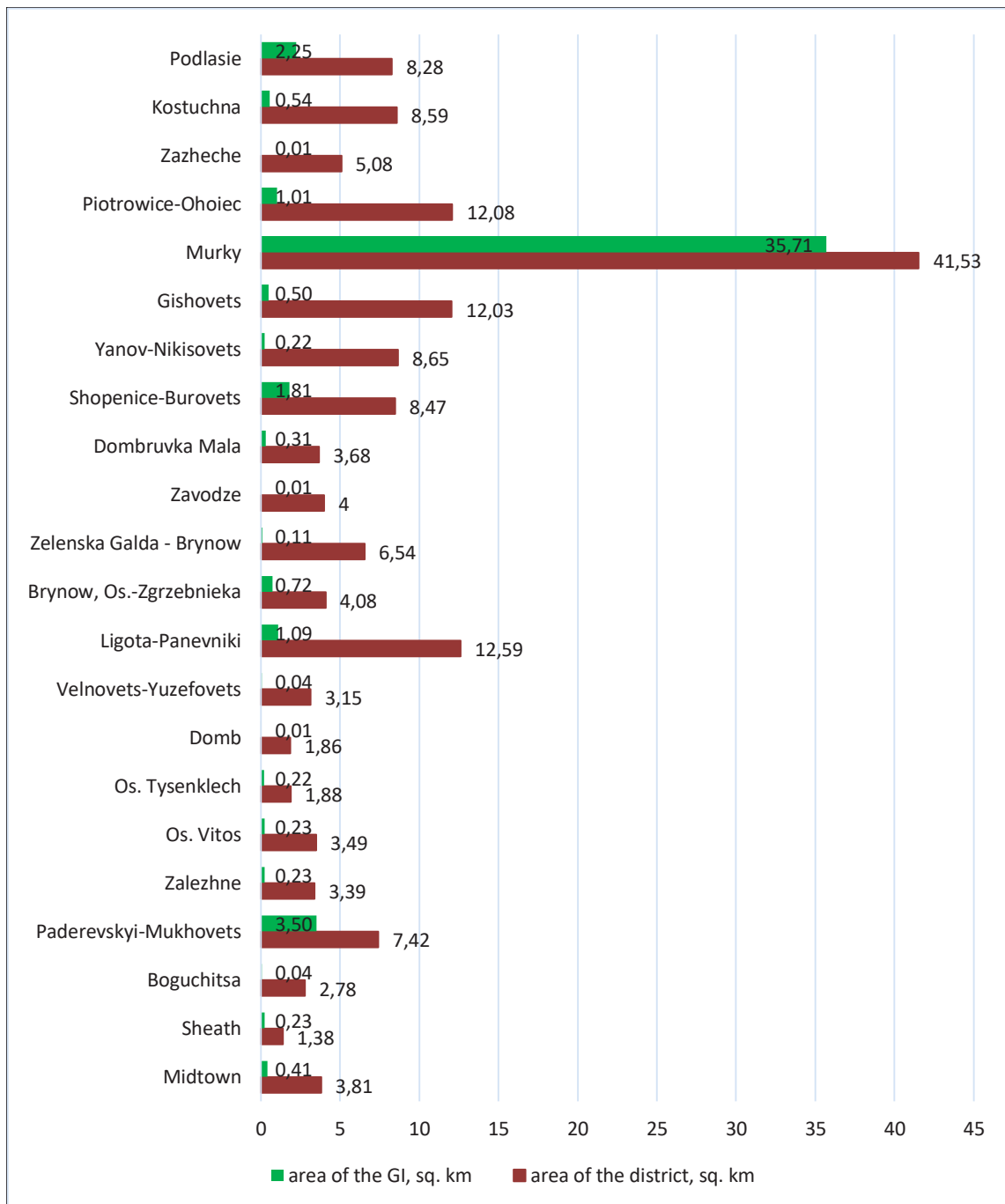


Figure 2 - Comparison of districts of the city of Katowice by the total area of green areas.

A diagram (Fig. 2) comparing green areas clearly shows that the highest share of green infrastructure is in Paderevskiyi-Mukhovets and Murky. It was also determined that the smallest share of GI is in the district of Zazheche, Zavodze and Domb - less than 0.01%.

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PROPOSAL FOR THE ECOLOGICAL RECONSTRUCTION OF THE NORTH BUILDING OF V. N. KARAZIN RHARKIV NATIONAL UNIVERSITY

The publication presents a proposal for the ecological reconstruction of the parterres of the Northern Building of V. N. Karazin Kharkiv National University using cultivars of fine-pointed sakura.

Key words: ecological reconstruction, urban landscaping, fine-saw sakura.

The North Building of V. N. Karazin Kharkiv National University is a part of the outstanding architectural ensemble of the round part of Freedom Square in Kharkiv, one of the most famous buildings in the city and one of the symbols of its education [1].

The best works of architects are always based on the principle of a holistic solution for a building and its environment. It is necessary to choose a solution that will ensure this connection and detailed organization of the immediate human environment, and will contribute to the synthesis of natural and artificial elements of the environment [2].

However, the landscaping of the grounds of the Northern Building of V. N. Karazin Kharkiv National University does not correspond to the status of this famous institution, there is a degradation of the past landscape solutions of the territory, primarily due to the presence of outdated plant varieties, as well as the lack of a reasonable selection of modern plant material for landscaping the grounds of the university building. Therefore, we can observe a lost compositional connection between the architectural style of the building and its landscape environment.

The Northern Building, along with other important administrative institutions, is located on Freedom Square, which is the largest square in Ukraine and the fifteenth largest in the world. The square is adjacent to the Taras Shevchenko Garden, known for its landscaping.

During the «Greening of the Planet» campaign in April 2021, new environmental trends in urban greening were used, in particular, a magnificent composition of cultivars of the grafted form of fine-sawed cherry on a high stem was created on the territory of the Taras Shevchenko Garden adjacent to the Maidan of Freedom [3].

Cultivars of small-fruited sakura, in particular «Royal Burgundy» and «Kanzan», are grafted forms of sakura on a stem of a certain height. Cultivars have a funnel-shaped crown with strictly vertical, strong main branches, widely spreading with age, fast-growing branches, slightly hanging. Leaves: bronze when blooming, shiny green in summer, yellow-orange in autumn, 8-12 cm long.

Flowering: densely double (up to 30 petals), fragrant, purple-pink flowers, up to 6 cm in diameter, on long pedicels, collected in bunches of 2-5 pieces, located along the entire length of the branches [4].

During this time, the sakuras have taken root well, proving to be frost-resistant and highly decorative plants, which we hope will be used to complement and create new compositions in the urban space.

Therefore, we propose to use this landscape idea to create a unified style solution for the territory of the Freedom Square and the buildings located on the Square. In particular, we propose to carry out an ecological reconstruction of the parterres of the Northern Building of V. N. Karazin Kharkiv National University using cultivars of small-fruited sakura. Such an organization of space will give a sense of integrity, harmonious, artistically expressive recognizable landscape.

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UNDERSTANDING A PROBLEM IS THE BEGINNING OF SOLVING IT

The publication looks at the problems of environment pollution in general and in Ukraine, specifying the branches of industry that have suffered the most damage.

Key words: environment, pollution, poisonous substances, destruction of ecosystems.

Environmental problems have been and will be. It's impossible to solve them all, but we must reduce the harmful effects of these environmental challenges.

One of the main environmental problems is pollution. This catastrophe spreads to all segments of the population, starting with homeless people who leave garbage on the sidelines and ending with the top of the government that doesn't take measures to combat pollution problems and also doesn't encourage the population to monitor the environment, sort garbage and change our nature for the better.

For a successful fight against environmental problems, people should have understood of what their bottle left in the forest or a wrapper from the candy, which they threw on the road leads to. Such wrappers and bottles lead to the extinction of animal species, the destruction of ecosystems, climate change, raising taxes to combat the pollution that this person caused.

For us, these things seem corny and I think that most follow the rules of ecology and preserve the world around them. However, a huge percentage of the world's population disregard it, and the authorities should work on it. The top of the country should promote and advertise solutions to environmental problems, encourage the population to collect and sort out garbage; build waste processing plants and create jobs for those who want to change our world, thereby increasing employment.

Today, of the more than 300 million tons of plastic produced each year, an estimated 9 million tons end up as waste in oceans and beaches. Such massive pollution leads to the extinction of animals, changes in ecosystems, deterioration of the food chain that has been formed for thousands of years. Our wallet suffers from these types of pollution. Every year, the authorities lose millions of dollars for cleaning, collection, disposal and many other processes to combat garbage.

Most pollution arises from industrial facilities that emit various gases and toxins into the atmosphere, but in my report I deliberately do not cover this topic. For what reason? Because most of us won't be able to reduce the amount of emissions, the number of enterprises and radically change the environmental situation, but everyone can monitor environmental hygiene and improve the state of nature around them.

Table 1. Assessment of the impact of marine debris in the EU

Sector	Annual costs	Million euros or employees	Lost of earnings (%)
Fishing	Loss of earnings	162.0	2.1
Aquaculture	Loss of earnings	2.0	0.04
Shipping	The cost of repairs	3.9	0.1
Tourism	Loss of earnings	350.0	0.5
Tourism	Lost jobs	5590	0,3
Government activity	Collection of waste	4000.0	6.3
Government activity	Waste management	6000.0	3.7
Government activity	Cleaning of coastal territories	194.6	3.2 - 10.5
Government activity	Collection of waste from water	3,7	-

So, in order to change the environment, you need to start with yourself, change the understanding of the whole problem, monitor your actions and behavior with the outside world. Explore this problem, share with family and remember that all of us are fed by our planet Earth.

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ECOCIDE ON THE TERRITORY OF THE KHERSON REGION IN 2022-2023

The publication presents the results of a study of the state of nature as a result of the Russian-Ukrainian war.

Key words: ecocide, Kherson region, nature, hostilities.

According to expert estimates, after the start of the Russian military aggression in Ukraine in 2014, the ecological state of Ukraine's nature in the eastern regions deteriorated significantly [1], and after the full-scale invasion in 2022, the ecological state reached a catastrophic level not only in the territory where the fighting was and is being conducted actions, but also in territories remote from the front. Mined fields and forests, hundreds of thousands of kilometers of burned and mutilated land, a large number of plants, animals and other living organisms that remained on the verge of survival. The victims of Russia's military aggression were not only people, but also the Ukrainian environment, which suffered significant losses [2]. Forest fires caused by the shelling of the occupiers, ammunition, oil products that poison the soil and water resources, emissions of chemical substances due to the shelling of industrial enterprises, risks of radiation accidents - this is just a small list of threats that Russian military aggression poses to Ukraine's ecology. These events and facts indicate that Ukraine is threatened with real ecocide.

Ecocide is a global mass destruction of the surrounding flora and fauna, contamination of water resources, the atmosphere and other actions that can cause an ecological disaster [3]. In the broadest sense, ecocide is such an impact on the spheres of the Earth - biosphere, lithosphere, hydrosphere, etc. - that caused significant changes in their structure and other serious consequences. The extreme and most destructive form of this crime is military ecocide, when damage to nature is done for military or political purposes.

The term "ecocide" began [4] to be used in the 70s of the XXI century, after the actions of the US Army during the Vietnam War [5]. The US Armed Forces in 1963 scattered more than 100,000 tons of defoliants over the territory of Vietnam and Cambodia. Defoliants are chemical compounds that cause leaves to fall from plants. Unlike herbicides, defoliants do not kill the plant, but suppress it, due to the loss of photosynthetic elements of the plant - leaves [6]. As a result, about 2 million hectares of tropical forests and agricultural lands were completely destroyed. On some areas of the soil in Vietnam, which were polluted as a result of military operations, the vegetation cover has not been restored to this day.

Ecocide has now become as recognizable a crime as crimes against humanity and others. In the legislation of a number of countries, ecocide is recognized as a

serious crime. In Ukraine, ecocide is recognized as a crime punishable by imprisonment for a term of 8 to 15 years [7]. In the Criminal Code of the Russian Federation, punishment is established in the form of imprisonment from 12 to 20 years, in Azerbaijan - from 7 to 15 or life imprisonment, in Tajikistan - from 15 to 20, in the Kyrgyz Republic - from 12 to 20, in Georgia - from 8 to 20, in Kazakhstan - from 10 to 15, Belarus - from 10 to 15, Moldova - from 12 to 20. A lesser degree of responsibility is provided in Estonia - only a fine or imprisonment for up to 5 years. In Finland, deprivation of liberty is provided for from 4 months to 6 years, and in the presence of aggravating circumstances - from 2 to 20 years [5].

For more than a year of active hostilities, more than 2 trillion hryvnias of damage was caused to the Ukrainian environment. The Minister of Environmental Protection and Natural Resources, Ruslan Strilets, claims that more than 500,000 hectares of Ukrainian land are under occupation or in the zone of active hostilities, 2.4 million hectares of forests have already been liberated and require partial or full restoration [8]. In addition, 10 national natural parks, 8 nature reserves and 2 biosphere reserves are currently under occupation [8].

Of course, environmental issues are not the primary and urgent problem for Ukrainians now. No one dismissed pressing problems in society: a full-scale war with Russia, an energy crisis due to the bombings, displacement and unemployment against the background of the war. But this does not mean that we should neglect important environmental problems, because it can carry a greater threat to our lives than we can imagine.

According to the Ministry of Ecology of Ukraine, during the first seven months of the war, Russia caused additional direct emissions of carbon into the atmosphere in the amount of about 33 million tons. More than 23 million tons of greenhouse gases were released into the atmosphere only from fires in forests, agricultural and other facilities during hostilities [8]. On the territory of the Kherson region, both fields and forests burned repeatedly, both as a result of deliberate burning, and as a result of the impact of Russian rockets, shells, mines, etc.

One of the acts of ecocide is considered to be the felling of the Oleshkiv forest by the occupiers, the wood from which is used for the construction of fortifications and for heating the dugouts. The Oleshkiv forest is the largest artificially created forest in the world, the main purpose of growing this forest was to prevent the desertification of the territory of the Kherson region. It is also worth understanding that not only the forest is dying, but its flora and fauna, both due to its cutting down and shelling. As a result of explosions, it is not uncommon for animals to have heart attacks in mammals due to the sharp sound of the explosion [8]. Or they can get scared, start fussing, as a result of which the animals are injured. Animals also stop breeding. Each species of animal has its own mating season. For ungulates it is winter, for birds it is spring. And if a colony of birds comes under fire during the nesting period, the birds will simply leave their nests and nests [8].

Russian troops have also been shelling the Kakhovskaya HPP since the

beginning of the full-scale war, and since November they have started draining water in the Kakhovskaya Reservoir. Currently, the water level there is at its lowest level in 30 years. If it continues to fall, the Kryvorizka and Nikopol districts, Apostolivska, Zelenodolska, Hrushivska, Vakulivska, Pershotravnevska, Marganetska, Myrivska and Tokmakivska communities may remain without water. Residents of these territories will be left without drinking water, and will not have it for the needs of agriculture, since the Kakhov irrigation system, which provides irrigation to the left bank of the Kherson and Zaporizhia regions, is under threat [8].

Discussions regarding the payment of reparations for environmental damage caused by Russia are actively ongoing both in Ukraine and in the world. There is a fairly high probability that the necessary changes will be made to the Rome Statute, and Ukraine will be able to receive full reparations through the International Criminal Court. At the moment, it remains to carefully and meticulously record Russian war crimes.

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DESTRUCTION OF ECOSYSTEMS AS A RESULT OF SHELLING

The publication looks at the consequences of the current Russian- Ukrainian war for protected areas, birds and vegetation, as well as human health.

Key words: environment, destruction of ecosystems, terrestrial and marine ecosystems.

War has a negative impact on the environment. Attacks on forests, terrestrial and marine ecosystems, industrial facilities, transport infrastructure and buildings, destruction of water supply, sewage and waste management systems provoke large-scale and serious damage with long-term consequences for the environment and human health.

The global environmental community is concerned about the events in Ukraine, because the issue of ecology and climate change is not the problem of one country. Therefore, the world mass media repeatedly wrote about the war and its consequences for ecology.

As the war continues to rage across the country, soil and waterway contamination is a major concern for environmental activists. Ukraine is one of the most industrialized countries in Europe, with an estimated 6 billion tons of liquid waste generated by coal mines, chemical plants, and other heavy industries. Over the past six months, such extremely sensitive objects have been constantly subjected to Russian shelling.

The war has already led to the burning of 100 thousand hectares of forests and steppes of Ukraine. Moreover, this is the number that the Ukrainian nature protection group calls based on the results of four months. Today, taking into account the active fires on the Kinburn spit and in the Kherson region, the area of burned forests has most likely increased significantly.

Unique protected areas have been damaged and may not be able to be restored. Such, for example, as the "Holy Mountains" national park, which is also called "Donetsk Switzerland". The destruction of this ecosystem as a result of shelling can have very serious consequences, which will affect not only Ukraine, but also all of Europe. For example, birds can change their migration routes and refuse to nest on the spit next year. And this can lead to an increase in the insect population and have other unforeseen consequences.

The war destroys the unique Ukrainian chernozem. Experts from the Ukrainian nature protection group have conducted an analysis and explained how such artillery bombardment of fields leads to the destruction of unique fertile lands, the restoration of which will take years. Comparing with the experience of restoring agricultural land, for example, after the First World War, we can talk about decades. The destruction by the occupiers of the fertile lands of the south

and east of Ukraine creates not only food security problems, but also poses a threat to the steppe and forest conservation areas. After all, it is necessary to sow somewhere so that people can live. Land that was not used before can be transferred to agricultural use. And these can be territories of nature reserves, sanctuaries and national parks.

Russia has fired more than 2,500 missiles over Ukraine since February 24. Enemy shells that hit our critical infrastructure and residential buildings every day cause significant fires, including forests. This leads to significant pollution of atmospheric air with dangerous substances.

During the detonation of rockets and projectiles, a number of chemical compounds are formed - carbon monoxide, brown gas, nitrogen dioxide, formaldehyde, etc. During the explosion, all substances are completely oxidized, and the products of the chemical reaction are released into the atmosphere. It should be taken into account that the occupier is shelling our oil depots, industrial enterprises that use various chemical substances in their activities. And these are also tens of thousands of tons of harmful substances released into the atmosphere. At the same time, polluted air has no borders. Emissions into the atmospheric air, which were caused by the military aggression of the Russian Federation on the territory of Ukraine, are transferred, settle and have an impact on the territories of other states, sometimes at a distance of thousands of kilometers.

A separate topic is mined territories. Mine ruptures lead to soil contamination with heavy metals - lead, strontium, titanium, cadmium, nickel. This makes the soil dangerous, and in some cases, unsuitable for further agricultural use. Explosions also cause forest fires. So, we return again to the problems of emissions into the atmosphere and food security. The cyclical nature of the consequences and interconnectedness of the processes is obvious.

European biodiversity is dying from enemy technology. These are thousands of plant species that are listed in the Red Book of Ukraine and protected by law. Fighting disturbs the peace of wild animals. They either die or try to escape from hot spots. The Russian Federation conducts hostilities in protected territories of international and European importance, thereby destroying the habitats of rare and endemic species and habitats. This can change the behavior of birds, including their migration. So that everyone understands what the consequences of the invasion of the Russian Federation into Ukraine can be, I will give just one example. When in 2015, Russian troops began to use Kryva Kosa in Donetsk region for landing, all bird diversity disappeared there. Although before that, three thousand pairs of Caspian martins nested en masse on the coast. It was their largest colony in Europe.

We know that the war will end with the victory of Ukraine, we will return our lands, rebuild our cities. Unfortunately, it will take more time and effort to restore nature. Decades may pass. But still, nature will recover, and our lives will be organized in such a way as to move in harmony with the environment. The war will remain in the past as a terrible reminder of what Soviet imperial logic can

lead to. So that this time comes sooner, we will continue to talk about ecology. After all, our future with you is being forged now in difficult wartime. And this future can only be in friendship with nature. The occupiers have already shown themselves to be its enemies.

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STUDYING THE LEVEL OF PUBLIC AWARENESS OF THE PROBLEMS OF PROTECTION AND MAINTENANCE OF STRAY ANIMALS IN UKRAINE

The publication presents the results of a survey aimed at studying the level of awareness of respondents about the problems of protection and maintenance of stray animals in Ukraine.

Key words: stray animals, responsible animal ownership.

According to Ukrainian legislation, stray animals are domestic animals that have been left without human care or have formed semi-free groups capable of reproducing outside of human control [1].

Ukrainian legislation establishes rules for the treatment of stray animals. In particular, Ukraine has the Law of Ukraine "On the Protection of Animals from Cruelty" [1] and the Regulation on the Procedure for Keeping Stray Animals, approved by the Cabinet of Ministers of Ukraine [2].

According to these documents, stray animals are owned by local communities, which are obliged to ensure their maintenance and care. It also provides for the establishment of local animal protection authorities responsible for monitoring the maintenance and treatment of stray animals [2].

The legislation also provides for the placement of identification marks on animals, which allows for the identification of animal owners and the avoidance of homelessness. Stray animals are subject to mandatory sterilization and mandatory vaccination against diseases.

Violation of the rules of animal treatment entails liability under the law. Thus, administrative fines and criminal liability are provided for cruelty to animals [3].

Ukrainian legislation also provides for the possibility of supporting initiatives to organize voluntary foundations and organizations that deal with stray animals. Such funds can receive state and public support for sterilization, treatment, and rehabilitation [1].

Each country in the world has its own legal regulations on the keeping of stray animals. However, there are some common practices that are used in many countries to ensure animal safety and reduce the number of stray animals. In particular, the creation of animal shelters is the most common practice. Such shelters provide temporary housing for stray animals, provide veterinary assistance, care, and search for new homes. Another important practice is sterilization programs, which control the number of stray animals. A very important practice is educational work, which includes informing about responsible pet ownership, the need for sterilization, and the issues of animal adaptation. Owners should be responsible for their animals, provide them with the necessary care and veterinary assistance, and avoid street straying.

Cooperation with local authorities is also an important practice to ensure animal safety [4].

The state of care for stray animals in Lviv can be characterized as difficult and requires a lot of effort from volunteers and organizations that help animals. Despite the work of organizations, stray animals still pose a problem in the city. Often, stray animals face poverty, hunger, disease, and human indifference. In many cases, stray animals become victims of cruelty and violence. However, thanks to the care and efforts of volunteers and organizations, the number of stray animals in Lviv is decreasing. Organizations provide treatment, sterilization, and shelters for stray animals, as well as hold various events on the occasion of the Day of Animals [5].

Monitoring people's attitudes towards stray animals is a very important component of the study of this issue. By conducting surveys, we can see how people think, hear, and perceive the problem of keeping and protecting stray animals. Monitoring people's attitudes on this issue helps to collect statistics and analyze them. This will help to see the main problems of attitude and awareness of the society and to propose solutions.

We conducted a survey of respondents regarding legal and public awareness of the issue of protection and maintenance of stray animals. The survey also monitored the level of public empathy towards stray animals. The survey includes 18 questions.

The survey on legal and public awareness included the following questions: "Do you think that the system of legal regulation of keeping and protection of animals in Ukraine protects animals from cruelty?", "Are you familiar with the activities of shelters in your city that take care of stray animals?", "What do you think should be changed/implemented in Ukraine to improve the conditions of keeping and protection of stray animals?".

The question related to monitoring empathy included the question: "If you wanted to buy an animal, would you take it from a shelter or buy it somewhere else?".

The survey is scheduled for the period from 03/28/2023 to 04/28/2023. At the time of writing theses, 72 respondents took part in the survey. Previously, 88.9% of respondents believe that there is a problem of keeping and protecting homeless animals in Ukraine; only 9.7% believe that the system of legal regulation of keeping and protecting animals in Ukraine protects animals from cruel treatment.

The Empathy Survey found that the vast majority (namely 83.3% of respondents) would be more likely to adopt an animal from a shelter rather than purchase it elsewhere.

Thus, the preliminary results of the survey showed a very large role of educational work, the result of which should be an increase in legal and public awareness of citizens, an increase in empathy as the most important factor in the formation of humanity, the development of the social intelligence of an individual.

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ANALYSIS OF ECOACTIVIST EVENTS HELD ON THE TERRITORY OF UKRAINE USING THE SWOT - ANALYSIS METHOD

The article presents the results of a SWOT analysis of eco-stocks. Based on the data obtained, conclusions are drawn regarding the strengths and weaknesses of eco-activist activities in two fairly common and developed areas. Ideas for improving activities and, accordingly, solving certain problematic aspects in this way are proposed.

Key words: SWOT analysis, eco-actions, eco-activist activities.

There are a large number of environmental problems in Ukraine. And to solve these problems, significant efforts and resources are required. However, everyone can take action to improve the overall situation. Thus, the development of a culture of eco-activism is very important. After all, eco-activism is considered to be one of the forms of involving people in various events, projects, initiatives in order to improve the quality of the environment, solve certain environmental problems or prevent harm to the environment. But a very important aspect is how effective are the measures that already exist and are periodically carried out in the state. Which specific positive aspects are provided by these measures. Which are the disadvantages and negative aspects of the implementation of a particular eco-action. Consideration is feasible on the example of eco-actions in such especially developed areas as cleaning up territories and preserving primroses.

Measures for cleaning up territories are of different scales, but all of them are conceived to achieve an important goal, to eliminate the consequences of human activity, namely pollution. Let us first analyze this category (Table 1).

According to the analysis, it should be noted that the activities of this category have a fairly large number of advantages. In particular, this is an increase in the level of ecological consciousness of those joining the participation. And also an important aspect of cleansing during such eco-actions those areas that are not cleaned by any of the state structures. Of course, such measures help to increase the proportion of the socially active population, which will responsibly treat nature and will not commit thoughtless acts that lead to absolutely negative consequences. [1].

However, at present, measures for cleaning up territories periodically organized in different regions of the country have certain shortcomings, the solution of which would maximize efficiency. Namely, very often the collected waste is simply taken to the landfill and there is no proper disposal. Therefore, in the future, it is important that the organizers negotiate with certain companies regarding the direction of the collected waste for recycling or for the safe disposal of waste that cannot be recycled.

Table 1. Ecoactivist clean-up activities

Clean-up activities	
Strengths	Weaknesses
- active pastime; - improvement of the state of the environment; - increasing the level of environmental awareness; - formation of public opinion about what a limited number of people can do.	- the activity is not pleasant from the point of view of aesthetics; - the difficulty of attracting participants; - insufficient advertising of measures of this type on the territory of Ukraine.
Opportunities	Threats
- creation of a socially active layer of the population; - cleaning of sufficiently large areas; - cleansing of quiet areas, which are not cleaned by any of the government structures; - this activity can be considered as physical training; - receipt by especially active participants of prizes.	- improper disposal of collected waste; - possible cases of minor injuries (cuts and scratches) by participants.

And another aspect, which, of course, is very important is the promotion of such events, their advertising. So far, it is insufficient, or implemented without a real attempt to attract the attention of citizens. Personalization of advertising in most cases is absent, that is, people are not given information based on their interests. Not all positives are explained. It is necessary to run more advertising on social networks, because most young people perceive information in general through them. For greater trust, it is important to create contests with prizes for the most active.

As for the eco-actions for the conservation of primroses, their main, primary goal is to draw attention to the problem of protecting early-flowering forest plants. In general, in order to prevent the extermination of the first spring flowers, members of public organizations, together with employees of the Ministry of Internal Affairs, are conducting operational work. Namely, they carry out raids and patrols in the markets, as well as educational work, in particular, they distribute postcards. In addition, members of public organizations hold thematic meetings with the population regarding the absolute importance of preserving early-blooming spring flowers, which are thoughtlessly destroyed for financial gain. Next, we will analyze the activities of this direction (Table 2).

Table 2. Ecoactivist activities for the conservation of primroses

Activities for the conservation of primroses	
Strengths	Weaknesses
- protection of unique colors; - educational activities with the population to prevent a decrease in the population of cryptophytes primroses; - punishment of violators.	- the impossibility of solving the issue of conservation in terms of satisfying all aspects.
Opportunities	Threats
- to preserve populations of primroses; - raise people's information awareness about these colors; - carry out work to identify and further prevent acts of financial enrichment through the sale of endangered flowers.	- the emergence of direct conflicts between activists and violators of the law.

First of all, it should be noted that activities conservation measures for primroses have far more advantages than disadvantages. Such eco-promotions are multidirectional. Namely, from finding violators during raids in retail outlets to conducting educational speeches on this issue in institutions in schools. Most importantly, public education activities are already underway to prevent the decline in populations of these flowers. After all, the more informed people are, the predominantly less illegal actions they will commit. But still there are people who are not stopped even by the maximum awareness.

To solve the problem of preserving primroses and at the same time satisfy the aesthetic needs of people, it is necessary to sell artificially bred varieties of flowers, of which there are already a large amount. In a number of European countries, in particular in the Netherlands, this is an absolutely common phenomenon that has gained considerable popularity. Therefore, Ukraine should establish communications on this issue and learn from experience. [2].

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THE IMPACT OF HOSTILITIES ON THE NATURAL RESERVE FUND OF THE SUMY REGION

The share of the territories of the nature reserve fund that was in the zone of direct influence of military operations was determined in the article. The author has found which categories of protected objects were most affected. Examples of specific facts of damage and damage assessment are considered in the paper.

Keywords: protected objects, impact, dangerous zones, explosive objects, damages.

The nature reserve fund of the Sumy region is represented by 9 categories out of eleven that exist in Ukraine. Among the objects of the nature reserve fund of national importance in the region there are: two national nature parks, a nature reserve, 10 reserves and 6 objects of national importance of other categories. Among the objects of local importance there are: 1 regional landscape park, 115 reserves, 104 natural monuments, 20 parks-monuments of horticultural art, 3 botanical gardens, 69 arboretums, 26 protected tracts. In total, there are 291 protected objects in the region on a total area of 178,596 thousand hectares.

Among the listed 10 objects of the reserve fund are the territories of the Emerald network. In particular, these are the following objects:

- UA0000050 «Mykhailiv tsilyna» Nature Reserve;
- UA0000031 «Desna-Starohuty» National Nature Park;
- UA0000042 «Hetman» National Nature Park.
- UA0000048 «Serednoseim» Reserve;
- UA0000049 «Shalyhyn» Reserve;
- UA0000051 Reserve «Verkhnosula».
- UA0000052 "Upper Esman" Reserve;
- UA0000053 "Bohdaniv" Reserve;
- UA0000062 "Smiat-Znobiv" Reserve;
- UA0000147 Reserve Verkhne Podesinya;
- UA0000187 "Shostkiv" Reserve [6].

The full-scale invasion of Russia into Ukraine interrupted the stable and full functioning of the objects of the country's conservation fund as a whole. In general, it has already caused an extremely negative impact on the natural environment. Already on March 1, 2022, according to preliminary estimates of the Ministry of Environmental Protection and Natural Resources, the aggressor was conducting combat operations on the territory of 900 objects of the NRF with an area of 12,406.6 square kilometers, which is about a third of the area of the NRF of Ukraine. And as of September 2022, 1,426 NRF objects that were affected by hostilities have already been identified. This value is 16.5% of the total number of

protected objects within Ukraine. Potentially contaminated with explosive objects are 1.1 million hectares of protected land, namely 24.5% of the area of nature conservation areas [1].

On the territory of the Sumy region (according to data for September 2022), 89 objects of the conservation fund were damaged. All these objects are defined as territories potentially contaminated with explosive objects. The areas of protected lands that are within the danger zones are as follows (Fig. 1).

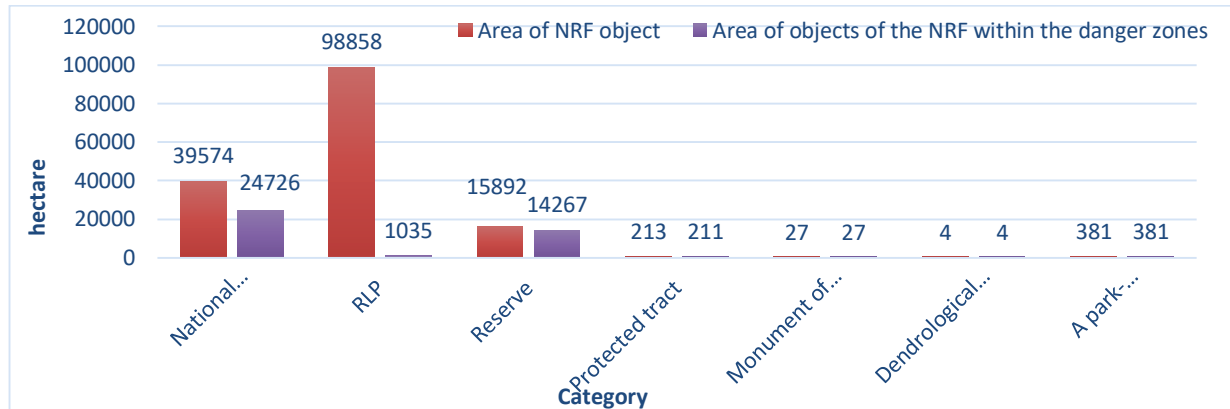


Figure 1 – The ratio of the total areas of NRF objects to the affected areas

According to the data on the graph, the territories of parks-monuments of horticultural art, dendrological parks and natural monuments were completely within the danger zones. The territories of protected tracts have almost completely fallen into the danger zone. To a lesser extent, but still quite significantly, hostilities affected the territory of the reserves, 89.77% of their area is within the danger zones. And national natural parks, although large, but most of their areas, namely 62.48%, are located in hazardous areas. The territories of regional landscape parks were the least affected, namely, only 1.05% of their area fell into dangerous zones [2, 6]. Due to the high probability finding explosive objects, scientists cannot carry out full-fledged research. Currently, it is not even possible to assess in detail the damage caused by the occupiers to this or that object. Only partial overall impact assessments have been carried out.

Next, we consider several examples of the impact, which, nevertheless, has already been assessed. The Desna-Staroguta National Park, which borders on the occupied country to the north and east, suffered significant damage. On the very first day of the full-scale invasion, the object was damaged. The territory of the park itself or the settlements where the buildings of the facility are located are shelled almost every day. On July 31, 2022, the occupiers fired a mortar at and damaged the new building of the Staroguta Environmental Protection Research Department. Only as a result of this shelling, more than 200 live trees were destroyed, namely pines and birches. Damages caused to forest plantations, according to the calculations of ecological inspection workers, amounted to about 6.12 million hryvnias. It was also established that due to shelling, more than 67 sq. square meters of the park are littered with debris from shelled buildings. This damage was estimated at over UAH

27,000. As for the consequences for the animal world, it is currently impossible to assess them [3].

As a result of the undermining of the road bridge by the occupier's troops, the regional landscape park "Seymsk" was also significantly affected. This is another fact of impact, the damage from which has already been estimated. In April 2022, enemy troops blew up a bridge between the villages of Chumakove and Peresyvky in the Konotop district. As a result, 1,700 tons of construction structures fell into the Seim River, which led to a powerful clogging of the ecosystem. In December, the State Environmental Inspection received from the materials of the criminal proceedings the data necessary to calculate the damages and determined that the total amount of damage is almost 372 million hryvnias. A large number of animals live on the territory of the "Seim" RLP, in particular, unique animals whose lives are significantly connected with the Seim River. Taking this into account, it should be noted that further research may find new facts of impact, accordingly, the damage to the environment may be even greater [4].

Due to the artillery and rocket attacks, most of the Hetman National Nature Park was also affected. Large areas of mixed and coniferous plantations were damaged. But the exact data of how many trees were damaged and the amount of damage has not yet been estimated, because it is still impossible to investigate the damaged areas due to the potentially high level of contamination of the park territory with explosive objects. So far, special services only carry out firefighting and environmental protection measures [5].

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APPROACHES TO SOLVING THE PROBLEM OF PRIMROSE DESTRUCTION

The publication substantiates the amateur and commercial use of garden varieties of snowdrop as an alternative to the collection of natural species prohibited by law.

Key words: primroses, *Galanthus nivalis* L., ex situ conservation, sustainable use.

Every year in Ukraine, pursuant to the order of the State Ecological Inspectorate of Ukraine "On Strengthening Measures to Preserve Early Flowering Flora", raids are conducted in winter and spring as part of Operation Primrose to detect illegal sales of primroses [1], including the snow-white snowdrop (*Galanthus nivalis* L.), one of 20 species that are almost all listed in the Red Data Books and lists of different countries. This plant also has a protected status in our country: it is listed in the Red Data Book of Ukraine and is protected by law. According to Article 11 of the Law of Ukraine "On the Red Data Book of Ukraine", the reproduction of the Red Data Book of Ukraine is ensured by establishing increased administrative, civil and criminal liability for the destruction or damage to the Red Data Book of Ukraine, causing damage to their habitat (growth); according to Article 19 of the above law, special use (extraction, collection) of the Red Data Book of Ukraine for profit is prohibited [2].

Pursuant to Article 88-1 of the Code of Administrative Offenses of Ukraine, violation of the procedure for the acquisition or sale of flora or fauna is punishable by a fine of UAH 510 to UAH 1,700. According to part 2 of the above article, the same actions, but within the territories and objects of the nature reserve fund, or to plants protected in accordance with international treaties of Ukraine, entail a fine of UAH 1,700 to 3,655 with confiscation of plants [3].

According to Art. 68 of the Law of Ukraine "On Environmental Protection", the application of administrative liability measures does not exempt the perpetrators from compensation for damage caused by the deterioration of the quality of natural resources [4]. In other words, the law also provides for civil liability. According to the Resolution of the Cabinet of Ministers of Ukraine of November 7, 2012, No. 1030 "On the Amount of Compensation for Illegal Harvesting, Destruction or Damage to Species of Flora and Fauna Listed in the Red Data Book of Ukraine, as well as for Destruction or Deterioration of their Habitat (Growth)", the amount of compensation for damage caused to plants listed in the Red Data Book of Ukraine ranges from UAH 49 to 62 per copy, depending on the species [5].

However, the volume of illegal sales of primroses remains very high and is increasing every year. According to rough estimates, from 8 to 22 million primroses (snowdrops) are illegally sold in Ukraine every year, causing millions

of dollars in losses to the state [6]. The question arises as to why even the protected status does not ensure the sustainable use of these plant species. "Sustainable use" in the context of the definition of terms by the Convention on Biological Diversity of 1992 means the use of components of biological diversity in a manner and at a rate that does not lead to the depletion of biological diversity in the long term, thereby preserving its ability to meet the needs of present and future generations and to meet their expectations [7].

Snowdrops are the first and very fragile and beautiful flowers that appear after the winter cold and, accordingly, symbolize for humans the unsurpassed beauty of nature, the beginning of spring, and hopes for the best. A holiday in honor of this plant was established in the UK in 1984. Nowadays, on April 19, this holiday "The Day of Snowdrop" is held annually in many countries around the world. Therefore, we cannot ignore the thesis of how important this plant is for humans.

Therefore, one of the approaches to preventing the loss of biodiversity is "ex situ conservation" i.e., the preservation of biodiversity components outside their natural habitats [7], including the creation of collections by botanical gardens and dendrological parks.

In order to prevent the destruction of wild, protected species, it is necessary to turn to European experience. There are many snowdrop clubs in Germany, the UK and the Netherlands. European flower growers have bred a large number of varieties of different types of snowdrops, with approximately 500 varieties of snowdrops officially registered. Garden varieties are based on the species *Galanthus nivalis*, *Galanthus plicatus*, *Galanthus elwesii* and *Galanthus caucasicus*. Gardens in Great Britain, Ireland and Scotland offer addresses where you can admire snowdrops and buy bulbs of garden varieties as part of garden tourism [8]. It is varieties, not wild species, that should be used in both amateur and industrial floriculture. In our opinion, this will be an effective solution to preserve protected wild species and at the same time help meet the demand for this extremely attractive plant.

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ASSESSMENT OF ELECTROMAGNETIC RADIATION POLLUTION IN THE CENTRAL PART OF THE CITY OF KHARKIV

The authors conducted a literature review on the influence of electromagnetic radiation on the human body. The level of electromagnetic pollution in the central part of the city of Kharkiv is investigated and estimated in accordance with the current standards.

Key words: electromagnetic pollution, impact on human health, measurement of the level.

The importance of our study lies in the fact that exposure to electromagnetic radiation (EMR) and its impact negatively affects humans. Electromagnetic radiation, like radiation, has no taste or smell, but people encounter it every day when they switch on the TV, electrical appliances, mobile communications, etc. At the same time, if earlier a limited number of people were exposed to hygienically significant levels of electromagnetic radiation, and this was mainly due to their professional activities, today we can talk about the impact of EMR on the entire population of the city.

Electromagnetic pollution is a combination of electromagnetic fields of various frequencies that adversely affect humans. Some researchers call electromagnetic smog, which has emerged and formed over the past 60-70 years, one of the most powerful factors that negatively affect humans today. This is due to its virtually round-the-clock exposure and rapid growth. Some even talk about humanity's transition to a new era of the information society, the core of which is technologies and devices that emit electromagnetic waves [1, 2]. Electromagnetic pollution depends mainly on the power and frequency of the emitted signal.

Electromagnetic fields have a negative impact on the human body, which directly works with the radiation source, as well as on the population living near such sources. Today, according to environmentalists and hygienists, it is known that all ranges of electromagnetic radiation affect people's health and performance, and have long-term effects. A person is not able to physically sense the electromagnetic field that surrounds him or her, but it causes a decrease in his or her adaptive reserves, a decrease in immunity, the development of chronic fatigue syndrome, and an increased risk of disease.

The main parameter of EMR that is standardised is its energy flux density, so this is the indicator we chose to measure. The standard level of energy flux density in Ukraine, established by the Order of the Ministry of Health of Ukraine No. 266 of 13.03.2017 "On Approval of Amendments to the State Sanitary Norms and Rules for the Protection of the Population from the Effects of Electromagnetic Radiation", is $10 \mu\text{W}/\text{cm}^2$ [3]. For our study, we chose a site in the central part of the city, which includes the following streets: Svobody Square, Nezalezhnosti Avenue,

Sumska Street, Rymarska Street. To measure electromagnetic pollution, we used Kailishen BR-9A electromagnetic field testers.

The measurements were carried out near Svobody Square and administrative and educational buildings. Exceedance of the MPL was detected at 39 points for the maximum value and at 22 points for the average value. The maximum values at a height of 2 m are: 18,680 $\mu\text{W}/\text{cm}^2$ – intersection of Nauky Avenue and Nezalezhnosti Avenue; 17,620 $\mu\text{W}/\text{cm}^2$ – intersection of R. Rolan Street and Nezalezhnosti Avenue. The average excess of the surface energy flux density near the Derzhprom building is 6.091 $\mu\text{W}/\text{cm}^2$ (Fig. 1).

Analysing the map, we have obtained, we can see that, in general, the average value of the energy flux density in the study area is 16 $\mu\text{W}/\text{cm}^2$.

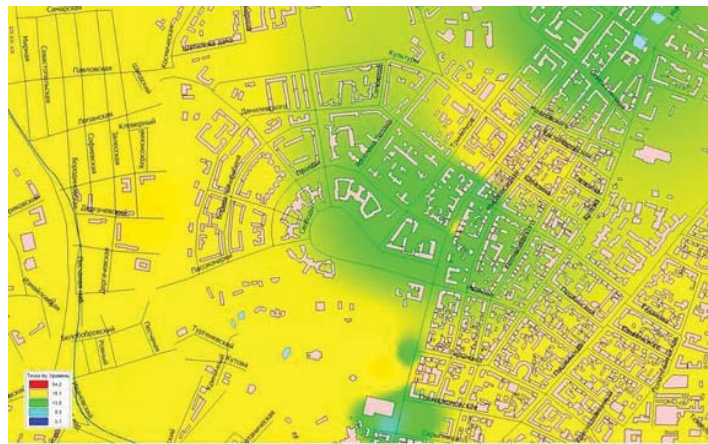


Figure 1 – Measurement of EMR level in the central part of Kharkiv

Thus, in the course of our work, we have analysed the literature sources and investigated the impact of EMR on human health. Moreover, it turned out that with the development of technology, the number of EMR sources is increasing. When measuring the level of EMR in the centre of Kharkiv, we have found out that the level of EMR, on average, is half the normative value, and the maximum value exceeds the norm by almost 2 times.

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ENVIRONMENTAL SAFETY OF URBAN DWELLINGS

The publication presents the results of research from various scientific sources and the author's own research on the impact of various compounds and substances on the human body during stay in urban dwellings.

Keywords: environmental safety, atmospheric air, drinking water, human health, volatile organic compounds, formaldehyde.

The relevance of the research topic lies in the fact that people spend most of their lives indoors - at home, at work, or in institutions. According to experts from the World Health Organization, a city dweller spends almost 80% of their time indoors. Scientists who have compared the air in city apartments have found that the air in rooms is 4-6 times dirtier than outdoors. So how safe is the environmental situation that surrounds us most of our lives for our health?

While indoors, the human body is exposed to various factors, such as light, noise, vibration, ultra- and infrasound, electrostatic fields, microclimate parameters, radiation levels, the composition of the air in residential premises (by main substances: carbon monoxide, nitrogen dioxide, hydrogen sulfide, ammonia, phenol, benzene, formaldehyde, etc.), the intensity of electric and magnetic fields, etc. Food and drinking water can also pose a threat to human health. Indoor environmental problems are not limited to synthetic compounds that enter the building with products and materials; they are not limited to air pollutants or food and drinking water.

Volatile organic compounds are a large group of chemical compounds based on carbon. These compounds are widespread in residential environments, and they come from products, materials, and processes inside the home. They can easily evaporate at room temperature. Specific household sources of many of these organic pollutants include: smoking and secondhand smoke, which release benzene, styrene, and many other chemicals into the atmosphere, room air fresheners that release p-dichlorobenzene, carpets and pillows that release styrene into indoor air, and aerosol cans that contain trichloroethane.

Formaldehyde is a colorless gas with a pungent, characteristic odor. It is a natural part of the environment and the human body. It decomposes easily under aerobic and anaerobic conditions in air, water, and soil. In air, formaldehyde decomposes under the influence of sunlight to form carbon monoxide and formic acid. When formaldehyde is present in water, it is rapidly converted to glycol. Formaldehyde is not normally found in soil, although it has been found in soils around manufacturing plants that use phenol-formaldehyde resins. This substance is not capable of bioaccumulation.

Radon is a colorless, odorless, naturally occurring radioactive gas. In most cases, most of the radon contained in buildings comes from the building's soil foundation. According to the WHO report, up to 14% of all lung cancer cases in the world are associated with human exposure to this particular radioactive gas. At a radon concentration of 100 Bq per cubic meter indoors, the number of patients with this disease increases to 16%.

In Ukraine, more than 20% of the housing stock does not meet the requirements for radon content in indoor air, which is 50 Bq for newly built buildings and 100 Bq for old ones. Radon accounts for more than 75% of all radiation sources in Ukraine. Similar situations have been observed in a number of other countries.

The impact of water quality on human health is an important factor in the environmental safety of residential premises. Clean water is the most essential component for humans after air. The human body is 70% water. People need water for thermoregulation and metabolic processes in the body. If contaminated water is ingested, it can lead to illnesses. Nitrates contained in water can cause stomach cancer, calcium and magnesium salts lead to urolithiasis and hypertension, and lead reduces the body's ability to absorb some vital vitamins.

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SOME FINDS OF RARE PLANTS ON THE OUTSKIRTS OF THE VILLAGE DOBRYNKA, DNIPROPETROVSK REGION

The publication presents the results of the survey of the areas around the village of Dobrynka, Dnipropetrovsk region, where a number of plant species were found, which should be officially protected as rare and endangered (listed in the Red Book of Ukraine and the Red Book of Dnipropetrovsk region).

Key words: flora, rare species of plants, Red Book.

One of the global environmental problems is the preservation of biodiversity. In order to solve this problem, such important environmental protection documents were adopted at various levels as the Red List of the International Union for Conservation of Nature, the European Red Lists, the Bern, Bonn and Washington Conventions, the Red Book of Ukraine and regional red books/lists. On the territory of the steppe zone of Ukraine, the natural complexes of the Samara River valley deserve special attention.

The village of Dobrynka is located in the south-east of Ukraine, in the Synelnyk district on the border with the Kharkiv region, on the right bank of the Samara River.

It should be noted that this territory is located within the Central Oril-Samara floristic subdistrict (according to Tarasov, 2012), which has the most favorable natural conditions within the region. The following natural complexes were formed here: zonal steppes (various sedge-grasses on ordinary chernozems), extrazonal - baryrac and floodplain forests, pine forests, intrazonal - salt marsh-salt marsh complexes, azonal - floodplain meadows, vegetation of water bodies, etc. (Belgard, 2013; Masiuk, 2021).

The flora around the village is quite diverse and interesting. In particular, there are plants listed in the Red Books of Ukraine and the Dnipropetrovsk region.

In recent years from 2019 to 2023, such species as *Bulbocodium versicolor*, *Tulipa quercetorum*, *Adonis wolgensis*, *Amygdalus nana* were found on the outskirts in various types of habitats.

***Bulbocodium versicolor* (Ker Gawl.)** is listed in the Red Book of Ukraine and has a nature protection status - vulnerable. This spring ephemeroid was found on the western edge of the village, on the slopes of the stream and the slopes of the old quarry, which was in the stage of self-growth for a long time, in its upper, middle and lower parts. There are both single flowers and small groups of 2-3 individuals. The species is under protection in the Dnipropetrovsk region in the status of the category of rarity, as vulnerable. In addition, it is under protection in the reserve "Yelanetsky Steppe", the Ukrainian Steppe Nature Reserve, the

Luhansk Nature Reserve, the regional landscape park "Tyligulsky" (Odesa region), in many nature reserves, protected tracts, botanical monuments of nature in the village of Poltava and Zaporizhia regions.

Tulipa quercetorum (Klokov et Zoz) is listed in the Red Book of Ukraine and has a nature protection status - vulnerable. The species is found on floodplains near estuaries on the outskirts of the village. The location had an area of several m². The species is under protection in the Dnipropetrovsk region in the status of rarity category, as rare. In addition, it is under protection in the Ukrainian Steppe Nature Reserve, the Luhansk Nature Reserve, the National Nature Park "Holy Mountains" and in many other territories of the nature reserve fund.

Adonis wolgensis (Steven ex DC.) is listed in the Red Book of Ukraine and has a nature conservation status - unassessed. The species was found on the western outskirts of the village, in the valley near the slope and slopes of the old quarry, which has been in the stage of spontaneous growth for a long time. They are found in quantities of about a dozen individuals per m². The species is under protection in the Dnipropetrovsk region in the status of the category of rarity, as vulnerable. In addition, it is protected in the Ukrainian Steppe Nature Reserve, the Luhansk Nature Reserve, the National Nature Park "Holy Mountains", in the regional nature parks - "Donetsk Kryaz", "Kleban-Bik", Zuyevsky and others and in a number of reserves and monuments "a piece of nature."

Amygdalus nana is listed in the Red Book of the Dnipropetrovsk region and has a conservation status - rare. The bushes were found on the hill of the plakor native right bank of the Samara River, in typical steppe conditions, on sunny meadows. It rarely grows in single bushes, more often in groups that form a light pink color scheme with an area of several square meters, sometimes it is found next to the field. In Ukraine, the species is included in the lists of regionally rare plants of Vinnytsia, Donetsk, Zaporizhzhia, Kyiv, Kirovohrad, Mykolaiv, Odesa, Poltava, Ternopil, Kharkiv and Khmelnytskyi regions.

Thus, a number of plant species that must be officially protected as rare and endangered (listed in the Red Book of Ukraine and the Red Book of the Dnipropetrovsk Region) were noted in the surveyed areas of the outskirts of the village of Dobrynka, Dnipropetrovsk Region.

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FACTORS AFFECTING THE ENVIRONMENT

The publication presents an analysis of factors affecting the environment, their possibilities and consequences.

Key words: environment, influencing factors, pollution, impact on the environment

Today, humanity is facing many environmental problems that need to be solved immediately in order to live in an ecologically clean environment.

Let's consider several types of factors affecting the environment: atmospheric air pollution by combustion products, negative impact on water areas, radioactive and thermal pollution. We will determine the consequences of these problems and possible ways to overcome them.

Environmental impact of water areas (in the case of HPP)

Hydropower is one of the important sub-branches of electricity and water management. More than 20% of industrial and production funds are concentrated on hydroelectric power plants. HPPs perform various functions in the general energy supply system, but many years of experience in using water energy have also revealed the shortcomings of hydropower. One of the main ones is the unevenness of the natural flow of rivers. It can be overcome by creating reservoirs that regulate the flow, but the creation of reservoirs entails a number of negative consequences for the environment. Reservoirs affect the natural regime of rivers, as they change their hydrological and temperature regime, flood large areas, cause landslides, restructuring of agriculture and natural ecological systems. The impact of the reservoir is found not only in the vicinity of the reservoir itself, but also upstream and downstream, in the delta region of the river, and sometimes in the coastal marine zone [1].

The construction of dams and reservoirs creates the following serious problems:

- dams prevent fish migration, traffic, delay solid runoff and runoff of biogens (nitrogen and phosphorus), change banks, reduce floods;
- the creation of reservoirs causes a significant displacement of the population, deforestation, compensatory works, irreversible withdrawal of runoff to fill the reservoir;
- there is a change in the climate in the coastal strip (in an arid climate, there is an increase in humidity, the peak of the rainy season moves from autumn to summer, etc.).

As a rule, when reservoirs are created and the water level rises, the flow rate decreases, flooding of large areas is observed. These circumstances cause the formation of stagnant zones in some areas under the surface of the water, which

contributes to the excessive development of algae, especially blue-green algae - the so-called "water bloom". The taste and color of the water changes, because a large amount of secretions from algae get into the water and the oxygen regime deteriorates; filters of water intake structures are clogged and normally balanced processes of metabolism in the reservoir are disturbed and some species are replaced by others that are more adapted to such, less favorable, conditions [1].

Atmospheric air pollution by combustion products

One of the main causes of pollution of the natural environment and, in particular, atmospheric air, is emissions of exhaust gases by motor vehicles. The specified problem is relevant in modern conditions, because its failure to solve it is dangerous for human health.

It is known that the fuel for internal combustion engines of automobile transport is mainly gasoline and diesel fuel. The chemical composition of combustion products and the degree of their pollution of the atmosphere depend on the quality of the fuel (the presence of toxic impurities in it), the technical perfection of the engines, the presence of cleaning devices, as well as on the level of technical operation of the vehicle. The main ingredients of exhaust gases are carbon monoxide, nitrogen oxide, hydrocarbons, lead and other impurities. In total, about 200 different substances were found in the exhaust gases of cars, most of which have toxic properties. That is why, in modern conditions, an urgent environmental task is the development of alternative modes of transport, their consumption of environmentally clean types of energy, the development of which scientists from all over the world are working on [2].

Radioactive pollution (in the case of nuclear power plants)

The most dangerous consequences are accidents at nuclear power plants with the release of radioactive substances into the atmosphere, resulting in long-term radioactive contamination of the area on huge areas.

The accident that occurred in 1986 at the Chernobyl NPP is the largest in terms of the scale of environmental pollution. The history of mankind has not yet known such an accident, which would be so disastrous in terms of its consequences for the environment, health and life of people. Radiation pollution of huge territories and reservoirs, cities and villages, the impact of radionuclides on millions of people who have been living in contaminated territories for a long time, allows us to call the scale of the Chernobyl disaster global, and the situation extraordinary [3].

One of the consequences of the accident at the Chernobyl station is long-term exposure to small doses of ionizing radiation due to the entry into the body of radioactive substances contained in food and water. Under the influence of small doses of ionizing radiation, there is a gradual development of pathological processes.

The question of survival in conditions of increased radiation is relevant for residents of many regions of Ukraine. Since now the main threat is radionuclides entering the human body with food products, one should know preventive and preventive measures to facilitate the elimination of these harmful substances

from the body [4].

Thermal pollution

The development and functioning of modern cities is accompanied by the formation of specific microclimatic conditions that negatively affect the level of urban air pollution and the health of the population. The urban environment of many large cities continues to lose quality for the life of the population. This is due to the high level of physical and chemical pollution of the atmosphere, noise, vibration, heat and other types of man-made effects.

Thermal pollution of atmospheric air in cities is caused by:

- emissions of high-temperature gases from industrial enterprises and transport;
- heating and subsequent cooling of residential building elements, as well as additional heat losses from heated premises during the heating season;
- the operation of engineering facilities that have production related to thermal processes, primarily boiler rooms, chimneys, facilities of thermal power plants, etc.

The main areas contributing to the reduction of thermal pollution of the urban atmosphere and the improvement of the microclimatic conditions of the city are architectural and planning measures, the localization of polluting objects outside the city limits or in the leeward part with the creation of tall smoke pipes [5].

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ECOLOGICAL INNOVATIONS IN THE FIELD OF HUMAN REST

The paper highlights the environmental issues associated with different types of human burial. The authors identify modern new types of ecological burials and the impact of these processes on the environment. The advantages of ecological human burial over traditional types of burial are revealed in the paper with analysis of the world experience in providing such services.

Key words: peace of mind, eco-innovations in funeral services, composting, environmental protection.

The negative effects of anthropogenic impact on the environment remain one of the main problems of humanity. According to Art. 50 of the Law of Ukraine "On Environmental Protection" (version of 10.07.2022) [1], environmental safety is recognized as a state of the environment that guarantees the prevention of deterioration of the ecological situation and human health. Unfortunately, the present-day Ukraine is characterized by a significant negative human pressure on ecosystems. This impact is caused by military operations on the territory of the country. These actions cause a lot of harm to both society and the environment. It is the environmental components that mostly suffer not only from the direct impact of the war but also from its consequences. One of these consequences is the increase in burial sites, i.e., cemeteries. Given the world's population and the increase in the number of burials, it is an urgent task to reduce the area allocated for cemeteries and to popularize non-burial, most modern methods of burial.

Cemeteries and columbaria are located directly near people's places of residence, so they can be considered as one of the hazardous objects of urbanized areas, since when a body is buried, the remains of cadaveric material create environmental contamination with pathogenic microflora [2]. One of the environmental problems of traditional burial is the poisoning of soil and groundwater by formaldehyde, which is used to treat bodies before performing ritual actions. Another significant problem of cemeteries is the huge amount of plastic waste in the form of artificial wreaths, flowers and other items made of synthetic materials, which are usually piled up in landfills near cemeteries and are not specially removed or disposed of.

An alternative to traditional types of burial is the most modern eco-friendly "green" and "eco-burial". A green cemetery is a place where a body is buried in a way that promotes its natural decomposition and aims to cause minimal damage to the environment. Eco-burial is a set of burial methods that involves the use of biomaterials that help with decomposition and are intended to cause the least amount of harm to the environment.

In the modern world, there are already many types of eco-friendly burials: from cremation and aquamation to composting and burial in the form of a coral reef base. While cremation is a well-known type of burial, aquamation is a new type of burial that can be called liquid cremation. The essence of the process is that by means of alkaline hydrolysis, the body is dissolved in a matter of hours inside a specially made stainless steel cylinder. Aquamation is actively used and legal in Canada - in Saskatchewan, Ontario, Quebec, and the Northwest Territories, and other provinces are currently only considering this burial option. Companies such as Ontario Eirene.ca offer aquamation as an alternative to flame cremation [3].

Composting is a common form of organic waste disposal for people. But the American company Recompose went further and provides services for composting the bodies of the dead. The company sees its main task as reducing the impact on the environment by abandoning toxic practices of body handling. "Recompose uses a process called terramation, a natural organic transformation, to dispose of human remains into the soil (compost). This transformation involves stimulating the microbes that exist in each of us with moisture and oxygen to naturally decompose the body. During this process, the body is placed in a special container, covered with wood shavings, alfalfa and straw. The entire process of producing this fertilizer takes 8-12 weeks. The company offers the opportunity to take the fertilizer for their own use or to donate it to the forests on the territory of Bells Mountain, a 700-acre non-profit land trust in southern Washington, USA.

Composting and alkaline hydrolysis do not directly emit many greenhouse gases, but the construction of facilities where they take place consumes a significant amount of energy.

Another eco-friendly burial method can be burial in an urn with seeds or tree seedlings. There are several such types of urns, including the BiosUrn, The Living Urn and EterniTrees. The idea is that the cremated remains, or ashes, are placed in a biodegradable container that decomposes when buried in the ground. Then a seed or sapling of a tree is planted on top, which is nourished by the cremated remains. The problem with this type of urn is that while the container is easily biodegradable, the cremated remains are too "salty" and with a high pH of approximately 11.8 to support the development (growth) of plant material. Therefore, the ashes will remain in a salty clump under the soil for some time. After the oxidation and desalination processes, the products (substances) created will be organic material or fertilizer that can help minimize the impact of cremated remains on plant development [6]. For example, Italian designers Raoul Bretzel and Anna Citelli invented Capsula Mundi (Latin for "capsule of the world"), an egg-shaped organic box suitable for burying the whole body in the fetal position, as well as for ashes. This capsule is made of a special organic plastic shell that decomposes quickly and allows cadaveric material to nourish the roots of a tree that is planted over the capsule during burial. The goal of this project is to create a cemetery full of trees, not tombstones; to reduce waste; and to create a new life after death [4].

Another newest eco-friendly burial project in Florida is the Eternal Reefs coral reef caskets (this method is suitable for previously cremated bodies), where the first step in the process is cremation. In the next step of the process, the cremated remains are mixed with a special concrete material that is used to create an artificial reef. The reef ball is then placed in the ocean with a plaque with the name and information about the deceased attached.

Thus, the problem of burial is relevant due to the constant growth of cemetery areas and their negative impact on the environment. Soil and groundwater are the most affected, and given that cemeteries are located near people's homes, there is harm to the population when drinking untreated water from underground sources.

Today, many "green eco-burial" technologies have already been created to reduce the negative impact on the environment. Moreover, with the development and dissemination of information about modern types of eco-friendly burials and methods used by different companies in different parts of the world, it is likely that humanity will achieve a reduction in the negative effects of burials.

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MODERN ECOLOGICAL PROBLEMS AND WAYS OF THEIR SOLUTION

The publication describes the main environmental issues that significantly affect the state of our nature. Ways to solve them are also presented.

Key words: environment, global warming, pollution, energy.

Throughout the world, all Nations have ecological problems. However, the immediate effects on the medium and long term are harmful. But to guarantee a better life for the future generation, it is essential to find solutions to remedy this, because the whole planet is threatened.

The main cause of the environmental problems is Man, who continues to grow every year and who leaves more and more of his mark on the environment to satisfy his needs and improve his living conditions. Saving the environment would therefore require changing the behavior of individuals and the government. So, what are the specific options for solving these problems?

Air pollution:

- Carbon monoxide, nitrogen and sulfur oxides, fine particles, VOCs, heavy metals, radioactivity;
- soil acidification (resulting in particular from acid rain) results in a reduction in the fertility of natural environments and crops;
- the ability of some species to reproduce or feed is impaired by the disruption of pheromones, hormones and odors;
- in humans, pollution increases the frequency of certain cancers, respiratory diseases and associated mortality, and interferes with reproduction;
- it is estimated that air pollution is responsible for more than 500,000 premature deaths in Europe in 2014.

Solutions:

- develop renewable energies, promote energy efficiency and sobriety (limit the heating and air conditioning of buildings, illuminated advertising, night lighting, etc.);
- energy renovation of buildings;
- factory filters;
- develop public transport, carpooling, car-sharing, piggyback transport, river transport, cycling, walking, etc.;
- public information, prohibition of hazardous substances and development of alternatives.

Global warming:

- CO₂ concentrations in the atmosphere have increased by more than 40% between 1750 and 2013 and the pace is accelerating;

- the consequences are already visible and will worsen for decades even if emissions were reduced to 0 today;

- increase in the Earth's average temperature and precipitation;
- melting of sea ice, permafrost and mountain glaciers;
- ocean warming and sea level rise, etc.

Solutions:

- conversion of the most emitting energies (coal, oil, gas) to renewable energies;

- Carbon tax;
- rational management of forests, protection of natural areas;
- orientation of agriculture towards agroecology, agroforestry;
- slow down meat production;
- develop public transport, carpooling, car-sharing, piggyback transport, river transport, cycling, walking, etc.;
- energy renovation of buildings;
- produce better (more durable, better designed repairable products) and less.

Pollution of rivers, lakes, oceans and groundwater:

many human activities directly or indirectly pollute water pollution with nitrates, heavy metals, pcbs, hydrocarbons, plastics, etc. Some pollutants are found in our food (bioaccumulation) or in the water we consume.

Solutions:

- in agriculture, limit the use of phytosanitary products (improve targeting, favor natural amendments);
- improving industrial processes and pollutant recovery;
- generalize wastewater treatment (mainly in developing countries, particularly in Asia) and improve their efficiency.

On your scale:

I will never stop saying that we should reduce waste to solve the various ecological problems. In fact, to achieve this, I proceed as follows:

- limit the use of drinking water for cooking and recover rainwater for other needs: garden watering, household cleaning, etc;
- reduce energy consumption by unplugging unused appliances, turning off the heating and air conditioning when the house is empty;
- buy only the essentials when supplying to reduce consumption;
- repair faulty equipment and machinery instead of acquiring new items to reduce e-waste which is harmful to the environment;

- purify wastewater;
- perform water softening;
- use a cloth bag that can be used several times instead of a sachet.

In short, these are just a few examples, but to save the earth from global warming, everyone must get involved.

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THE INFLUENCE OF HOSTILITIES DURING THE RUSSIAN-UKRAINIAN WAR ON THE CONDITION OF THE SOILS OF THE KHERSON REGION

The publication presents the results of a pilot study of soils damaged by hostilities in time of Russian-Ukrainian war.

Key words: soils, Kherson region, hostilities.

The total area of the Kherson region is 28,461 km². Among the zonal types of soils, southern low-humus and low-humus chernozems predominate, which are replaced by chernozems, southern saline soils, and further south by chestnut saline soils. Meadow-chernozem and sod sweetened clay soils are characteristic of the region. Most of the soils of the Kherson region can be classified as fertile. The soils of the Kherson region feed not only the population of Ukraine, but also the population of a number of countries in the world, where grain from Kherson region are exported. However, the full-scale invasion of the territory of Ukraine caused a number of threats to the soils of the region. War causes great damage not only to cities, houses, bridges, roads, people, human lives, but also to ecology, and in my report we will consider, as an example, soils.

Nature needs 10,000 years to form black soil. One shelling or missile attack is enough to destroy it. The soils of the region are constantly damaged by military equipment that drives across the fields, forming ruts and trampling the entire crop with its wheels, and the soil is constantly interrupted for trenches and the construction of fortifications. Every day there is intensive shelling with permitted and prohibited weapon, eruptions are formed from air bombs and artillery fire, new mined territories are created, heavy military equipment is destroyed, which leads to the leakage of oil products and the burning of the earth. All these consequences of military operations pollute the soil, and with it, negatively affect the country's economy and people's health.

Even after de-occupation, one cannot simply return to the land and start farming as if nothing had happened. It is possible to return the land to cultivation only if it is thoroughly inspected and demined.

After analyzing materials from the Internet, I formed an opinion and can give an answer to the question: how does the Russian-Ukrainian war affect the condition of the soil.

Damage to the soil as a result of military operations can be mechanical and chemical in nature. Each of these influences is critical in its own way and causes destruction of the earth's structure and functions.

Mechanical influence. It deforms the ground cover, which leads to a violation of the soil structure during the construction of protective structures, bombing sites, demining of territories, as well as due to the use of weapons and military

equipment that creates ruts, creating vibration, radioactive and thermal effects. The consequence of this impact is compaction, soiling of the territory with products of combat activity, soils lose their ability to restore humus and fertility.

Chemical influence. Changes the natural physical and chemical parameters of the soil cover. First of all, the pH and humus content, the concentration of toxic chemicals increases. The consequence of this is that these lands cannot be used in the long term.

As ecologist Oleg Listopad notes, "as a result of the projectiles hitting the fields between the forest strips, sinkholes have struck. How to process all this after the end of the war? One centimeter of black earth takes a hundred years to form. Black soil is a layer of fertile soil, under which there is clay or sand. Accordingly, the funnels formed by shelling will need to be filled with lower layers and compacted" (November 2022).

Volodymyr Boreyko adds: "Kherson, Mykolaiv, and Donetsk regions have already lost a lot of arable land. When there are trenches or gaps, the tractor will not pass. Plus, there are many mines on the ground that have not yet exploded, and demining will be a very long process - at best, it will take several years" (Boreyko 2022).

The process of transforming contaminated land into suitable land is called reclamation - this is one of the ways to solve the problem with soils in the future. The choice of remediation technology depends on the nature and degree of pollution, the intended purpose or use of the area being restored, as well as on the availability of efficient and cost-effective technologies.

Unfortunately, not all land can be made suitable for farming again. Therefore, the best option for the most polluted areas is land conservation. That is, it involves the complete or partial cessation of economic activity and the withdrawal of land from agricultural circulation. The best option for supporting such areas would be to grant them nature protection status.

In summary, we can say that soils suffer greatly during military operations and are affected by many different factors that damage the land, namely: the passage of heavy military equipment that creates ruts, the explosion of rockets and other types of weapons, the construction of fortifications, pollution thousands of tons of soil are lifted and damaged by the leakage of fuel, heavy metals and their compounds, radioactive substances, burning of the earth due to the destruction of equipment, as well as explosions. In addition, explosive ordnance-contaminated and mined areas, as well as debris from missiles and military equipment, will pose a threat for decades. As a result of these actions, the structure of the soil is disturbed, which in the future leads to erosion. The loss of fertility is obvious, because the fertile soil layer is on the very surface. Explosions also pose a threat to the soil, namely, as a result of explosions, harmful substances are released into the air, which, due to the fact that they do not stay in the air for a long time, come in the form of precipitation and accumulate in the soil.

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ENVIRONMENTAL CONSEQUENCES OF WAR

The publication presents the results of research from various scientific sources and own observations, using the example of Ukraine to describe the main environmental consequences of the war.

Key words: Ukraine, war, ecology, pollution, ATO, protected areas, erosion, ammunition

The research was conducted using the example of Ukraine, because for more than 10 years now, there has been an ongoing war on its territory, taking into account the beginning of the conflict with Russia since 2014. Therefore, the important question arises of finding out what damage armed aggression causes to the environment, and in what way exactly the territory is being polluted.

Let's consider the environmental consequences for Eastern Ukraine. With the beginning of the Anti-Terrorist Operation (ATO), the environmental state of the Donbass region underwent significant negative changes. The operation disrupted the work of mines, resulting in their shutdown, which led to the accumulation of explosive gases in their voids. Chemical plants were shelled, posing a threat of spreading dangerous, toxic chemicals. There was also a problem with the export and disposal of waste, which led to the accumulation of household waste. Even protected areas were not spared, as they suffered from destruction, thus the ecological state of the region was significantly negatively impacted by the war [1].

In addition to the above-mentioned consequences, the population suffered from deteriorating drinking water quality, as special disinfection plants stopped working and water began to reach people untreated. In cities, the increased levels of harmful chemicals in the atmosphere led to a rise in the number of cases of chronic bronchitis, emphysema, lung cancer, and allergic diseases [2].

The military operations caused numerous fires in the ATO zone. Within 4 months, 2901 cases of fires were recorded, which were complicated by their rapid spread and long duration due to the lack of firefighting measures. The burning of forests, which were widely spread in the ATO zone, led to the exposure of sands on which they were planted, and therefore, initiated erosion processes [3].

Therefore, it can be concluded that as a result of a large number of fires in the ATO zone, significant damage was done to man-made forest plantations, their burning, damage and pollution by various flammable materials. The territory after the burning of these same forests remained unprotected from erosion processes, because it was an area of sand, without vegetation cover, and only artificial plantings could restrain these negative processes.

Let's consider the environmental consequences of the full-scale invasion of Ukraine. The armed aggression has caused significant damage to the country's

territory. The harm to our environment and the deliberate destruction of natural resources is a true ecocide against the people of Ukraine.

According to the Ministry of Environmental Protection and Natural Resources of Ukraine, as of March 20, 2022, hostilities were taking place in the territory of nature reserves covering an area of 12.4 thousand square kilometers, which is one-third of the entire nature reserve fund of Ukraine. This includes most of the territories of wetlands designated for conservation under the Ramsar Convention on Wetlands of International Importance, which is a cause for concern [4].

The movement of heavy machinery and the construction of certain defensive structures cause damage to the soil cover, leading to the degradation of the vegetation and increased erosion processes. The boundaries of the protected areas, such as the Emerald Network, are also under threat. Due to the hostilities in these areas, the migration routes of many bird species may be altered, and in the worst case scenario, there is a risk of offspring of birds and mammals being driven away [4].

A threat to the environment is also posed by ammunition, which detonate or burn, thereby polluting the air with toxic substances that also damage the top layer of soil upon entering it and detonating. The detonation of ammunition can also lead to the ignition of vegetation and the further spread of fires over large areas if not extinguished in time.

In addition to the aforementioned consequences, biological ones are no less harmful. As an example, the occupation of the villages of Kutuzivka and Shestakovo in Kharkiv region can be cited, where there were large dairy farms. Russian military personnel slaughtered cows for food, but left the remains on the ground without proper disposal and burial. As is known, the decomposition of remains leads to the release of gases such as ammonia, methane, and hydrogen sulfide, which worsen the air quality around the contaminated area with remains. Water resources also suffer because, as a result of precipitation, toxins from carcasses can be washed into rivers as well as into the soil. The remains of dead animals can provoke various diseases, both bacterial and viral, which will have a negative impact on the overall biota.

Conclusion: War has a significant negative impact on every aspect of the environment. The movement of heavy machinery and the use of various types of ammunition damages the soil cover of the area, leading to erosion. The number of fires in the war zone increases, which results in harmful emissions into the atmosphere, a reduction in forest cover, and increased erosion. Water resources can become contaminated due to the interruption of purification facilities or the infiltration of toxicants into the water. Due to the large amount of organic remains, there is a high probability of disease outbreaks, the spread of toxicants with precipitation into water resources, and the pollution of the air with toxic gases.

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HISTORY OF FORMATION AND CURRENT STATE OF THE NATURE RESERVE FUND IN KIROVOHRAD REGION

A network of nature-reserved territories within the boundaries of modern Kirovohrad region was formed in several stages. The process lasted more than 80 years. As of January 1, 2021, 223 objects of the nature reserve fund of national and local importance with a total area of 100,318.84 hectares, which is 4.08% of its territory, were created in Kirovohrad region. However, the largest concentration of objects is in the east of the region.

Key words: Park, territory area, nature reserve.

We can trace the formation of a network of nature-reserved territories within the boundaries of modern Kirovohrad region in several stages.

The first stage was launched in 1940. According to the government's decree, the Veselobokovenki arboricultural research station was transformed into the state reserve "Veseli Bokovenki". Later, it was transferred to the management of the reserves at the Ukrainian SSR National Park. As of January 1, 1941, there were nine state nature reserves in Ukraine, while in 1951, there were already 12 state nature reserves. As of January 1, 1980, the network of the nature reserve fund of Kirovohrad region consisted of 26 territories and objects. In the early 1980s, the number of PZF objects of national significance increased.

During 1984-1991, the network of naturally protected objects of local significance grew quantitatively. Protected tracts were created in Dolyna ("Nataliivka", "Olexandrivska Dacha") (1984), Svitlovodsk ("Barvinkova and Tulip Mountain") (1987), nature reserves and monuments were established in Novomyrhorod ("Balka Troyanivska") (1988), Novgorod ("Bilopil"), Znamyanka ("Barrels"), Kompaniivka ("Ingulska zhila") (1989) and others. In 1991, five forest reserves of local importance were established within Novomyrhorod district ("Okip", "Luki", "Korobchyno"), the ornithological reserve "Adzhamsky" (Kirovohrad district).

In 1999, the PZF network of the region grew to 130 nature-protected territories and objects. Among them: sanctuaries of national significance: "Monastyryshche", "Kogutivka", "Chornotashlytsk", "Vlasivska balka", "Vytoky Ingulets", "Velyka Vys", "Redchyne" [6].

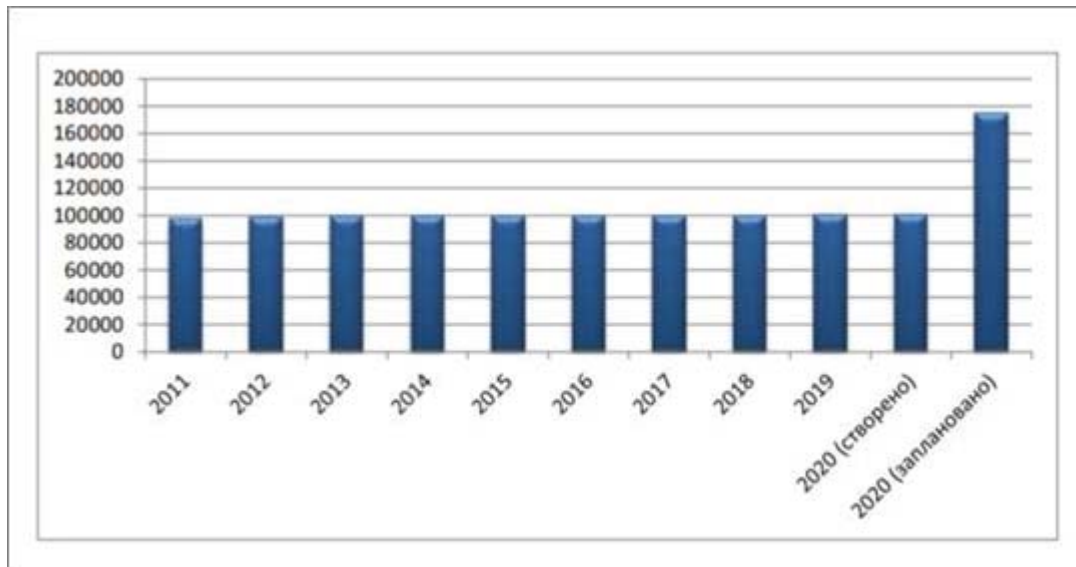


Figure 1 - Change in the area of "NRF" in Kirovohrad region from 2011 to 2020 [1].



Figure 2 - Change in the number of "NRF" objects in Kirovohrad region from 2011 to 2020 [2,3].

As of January 1, 2021, 223 objects of the nature reserve fund of national and local significance with a total area of 100,318.84 hectares, which is 4.08% of its territory, were created in Kirovohrad region. Regional landscape parks are represented by: regional landscape parks – 2 (area – 78758.05 hectares); nature reserves of national importance – 21 (area – 5728 ha) and local importance – 84 (area – 12818.92 ha); natural monuments of national importance – 2 (area – 9.1 ha) and local importance – 50 (area – 525.48 ha); dendrological park of national importance - 1 (area - 109 hectares); Parks-monuments of horticultural art of national importance – 2 (area – 63.7 ha) and local importance – 6 (area – 107.75 ha); protected tracts - 55 (area - 3192.76 hectares) [6].

According to the results of the calculations, Oleksandrivka district has the highest percentage of "reserve", while all the others have a result below 3%.

Table 1. "Reserve index" for new administrative districts of Kirovohrad region [4,5]

Name of the administrative district	Area of the administrative district (ha)	Total area of protected objects in the district (ha)	"Reserve Index" by district (%)
Golovanivka	424400	8503,53	2
Kropyvnytskyi	970900	25721.27	2.65
Novoukrainka	519600	2636.22	0.51
Oleksandrivka	540500	64361.91	11.9

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STUDYING OF DIFFERENT LEVELS OF BIOLOGICAL SYSTEMS: METHODOLOGICAL ASPECT

The publication presents the conquered of basic knowledge about the functioning of biosystems, justification of modern methods for studying biological objects, phenomena and processes.

Key words: biological systems, research methods, research optimization.

Biological systems are an essential part of every natural resource in its various manifestations. Therefore, it is worth paying attention on research methods. Focusing on the main or key issues of a topic, we cannot ignore the side facts that may seem insignificant at first sight. However, such facts may conceal the beginning of important discoveries. Before starting scientific research, it is necessary to familiarize yourself with the methodology and techniques of scientific work.

Methodology is commonly interpreted as the theory of research methods, creation of concepts, a system of knowledge about the theory of science or a system of research methods. Additionally, a method is understood as a set of research techniques which involves various approaches and operations with real materials [1].

Biological cognition is an organized activity aimed at discovering and gaining new knowledge about living nature. A wide range of methods is applied to explore the diversity of biosystems [2].

General methods of scientific cognition are divided into two groups: empirical and theoretical.

Empirical methods help to study natural objects that are accessible to perception, which include: 1) observation is a method in which an object or phenomenon is studied without interfering with it, only its properties are recorded and measured (e.g., flower dissolution, animals' life and behavior); 2) comparative-descriptive method is a method that reflects the ability to describe phenomena, processes and organisms, compare them with similar ones to determine common and distinctive features (e.g., plant-animal-animal);

3) experimental method is based on the fact that researchers modify the structure, function, behavior of objects of investigation and observe the consequences (e.g., studying the effect of different factors on seed germination); 4) monitoring is a method of continuous observation of the state of individual biological objects, the course of certain processes in ecosystems or the biosphere (e.g., studying changes in animal populations in a certain area).

Theoretical methods of cognition are methods by which a researcher, without

working directly with natural objects, acquires knowledge through mental operations. Theoretical methods include: 1) modeling is the study of a particular process, phenomenon or object by creating a model or simulation (e.g., a molecule model, an aquarium model, water bodies). The research involves the study of an image in the form of a model, features. The results of the study are transferred from the model to the object. Models are typically in the form of drawings, sketches, diagrams, charts, matrices, symbols and have a wide range of applications and uses in science; 2) statistical method is mathematical processing of data collected through other research, which allows for comprehensive analysis and identification of complete regularities. In addition, the main general biological approaches to studying biological systems include historical, systemic, morphological, physiological and ecological methods.

Consequently, it is important to carefully select the methods for studying biological systems at different levels of research. This will ensure the versatility, completeness, reliability and accuracy of the studies, which can be used for the rational use of natural resources in various biological systems depending on their intended purpose.

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THE POTENTIAL OF THE VYAZIVOTSKYI LANDSCAPE RESERVE AS A HABITAT FOR RARE SPECIES

The publication shows the results of research on rare flora and fauna in the Samarskyi Lis (Dnipropetrovska Oblast). In addition, the article discusses the Vyazivotskyi Landscape Reserve as a potential habitat for rare species and an integrated part of the Emerald Network.

Key words: Emerald Network, landscape reserve, natural habitats

The objects of the nature reserve fund of Dnipropetrovska Oblast include land areas, water bodies, natural biogeocenoses and were created to preserve biodiversity, maintain the overall ecological balance and preserve typical and unique ecological complexes with all their components. They have a significant potential in the context of natural habitats that are under threat and require special measures for their conservation.

The Vyazivotskyi Landscape Reserve is located on the territory of Verbkyvska United Territorial Hromady, near the villages of Kocherezhky and Vyazivok. The status of a landscape reserve of local importance was granted in accordance with the decision of the Dnipropetrovs'k Regional Council of October 21, 2011, No. 179-9/VI. The purpose of the reserve is to preserve and protect valuable natural complexes and landscapes, as well as the genetic fund of plants and animals, especially rare and endangered ones.

According to the data provided by Verbky village council, the total area of the reserve is 374.6 hectares, including 318.2 hectares of agricultural land, 23.7 hectares of forest land, and 32.7 hectares of water land.

The Vyazivotsky Landscape Reserve is in the Samara River basin and consists of four separate areas covering aquatic and near-water phytocenoses of the Vyazivok and Bobrivka rivers, as well as certain fragments of floodplain forests and steppe virgin lands. The ratio of areas of the main types of habitats within the Vyazivotskyi Landscape Reserve is as follows: forests - 6.3%, shrubs - 1.0%, steppes and meadows – 81.7%, marshes – 5.3%, and water bodies – 3.7%.

The flora of Prysamaria is extremely rich. About 1,079 species of vascular plants belonging to 5 divisions, 107 families, and 453 genera have been recorded here. Such a high species diversity is primarily due to the diversity of environmental conditions in the area: the presence of floodplain watersheds with fragments of zonal steppe vegetation, deep ravines and gullies with gully forests, and the wide valley of the Samara River.

The Vyazivotskyi Landscape Reserve is located close to one of the Emerald Network sites, the Samarskyi Forest (Samarskyi lis – UA0000212). Thus, the southern areas of the reserve are located at about 1 km from the Samarskyi lis,

and the northern ones – 6 km. Accordingly, the territory of the reserve is potentially the location of natural habitats similar to the Samarskyi lis. Today, the reserve contains wetlands of river floodplains, including remnants of floodplain oak and elm forests, fragments of a typical mixed-grass and fescue steppe, floodplain meadow herbaceous communities, which are natural habitats of many species of animals and are included in the list of habitats under threat and in need of special protection measures [1].

In the context of the Emerald Network, it is important that species listed in Resolution 6 of the Bern Convention may be found within the proposed territory, as it is for their conservation that Emerald Network sites are created. According to modern research, 215 species of higher vascular plants from 167 genera and 62 families were found in the eastern part of the Samara Forest on an area of 340 ha, of which 42 species are subject to special protection, including *Senecio borysthenticus* (D&c.) Andr. (EC), *Agropyron dasyanthum* Ledeb (IUCN), *Viola lavrenkoana* Klovov (EC), *Allium savranicum* Besser (CCU, 2009, 2021), *Stipa borysthentica* (Klovov ex Prokudin) [2, 3].

Within the eastern part of the Emerald Network site "Samarskyi Lis - UA0000212", 7 species of insects listed in the Red Book of Ukraine (2009), as well as 2 species of insects protected by the Bern Convention - *Lucanus cervus* (Linnaeus, 1758) and *Lycaena dispar* (Haworth, 1802) - were found [2]. In addition, 4 species of fish listed under the Berne Convention have been identified (fish - *Leucaspis delineatus*, *Rhodeus amarus*, *Cobitis taenia*, *Syngnathus abaster*). The International Red List includes 3 species of amphibians (*Lissotriton vulgaris*, *Hyla arborea*, *Bufo bufo*) and 1 species of reptiles (*Emys orbicularis*) [3].

A total of 74 species of birds have been found in the Samarskyi Forest. Of these, 3 species (*Coracias garrulus*, *Ciconia nigra*, *Buteo rufinus*) are listed in the Red Book of Ukraine [2].

In the eastern part of the Emerald Network site "Samarskyi Lis - UA00002122", 10 species of mammals were found, of which 9 species are protected by the Bern Convention, and 2 species (*Eptesicus serotinus*, *Nyctalus noctula*) are listed in the Red Book of Ukraine [2].

Based on the proximity of the Vyazivotskyi Landscape Reserve to the sites of rare species, it is possible to assume that they may be found on the territory of the reserve. This indicates the high potential of this reserve as an integral part of the Emerald Network. There is an obvious need for a detailed study of the flora and fauna of the Vyazivotskyi Landscape Reserve, which will be aimed at identifying rare species and habitats included in Resolutions 4 and 6 of the Bern Convention. The combination of natural habitats will ensure effective monitoring studies, comprehensive implementation of measures to restore destroyed ecosystems, increase the natural resource potential of countries, preserve their biodiversity and landscapes, and the genetic fund of flora and fauna, which, in turn, will help maintain a stable natural balance in the Earth's biosphere.

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ECOLOGICAL CONSEQUENCE OF THE WAR

Recently, humanity has faced an environmental problem. It is obvious that man exerts the greatest influence on nature. Human influence on nature now significantly exceeds the ability of the biosphere to self-regulate and generally endangers the possibility of its existence as a system. In my opinion, society should change its attitude towards nature and its resources. Nowadays, humanity is able to produce a sufficient amount of agricultural and industrial products without harming the environment. The achievements of science and technology open up not only opportunities for satisfying human needs, but also create prerequisites for preserving and increasing the Earth's resources. In order to improve the conditions that have developed in the biosphere of the planet, humanity must fundamentally change its attitude towards nature and its resources.

In this story, I want to talk about the consequences of war on ecology. High-intensity conflicts require and consume enormous amounts of fuel, leading to huge CO₂ emissions and contributing to climate change. Large-scale vehicle movements can cause extensive physical damage to sensitive landscapes and biodiversity, as can the heavy use of explosive ordnance. The use of explosive weapons in urban areas creates huge amounts of debris and debris that can cause air and soil pollution. Pollution can also be caused by damage to light industry and environmentally sensitive infrastructure such as water treatment plants. The loss of energy supply can have reverberating effects that harm the environment by shutting down treatment plants or pumping systems, or can lead to the use of more polluting fuels or household generators.

The war between the two countries affects not only their economy, but also the ecology of the planet. Ecosystems cannot be divided by conventional borders, if the natural resources of one country suffer, it affects other countries as well. If the natural balance in one geographical location is destroyed, it will definitely be felt by another. Consider the example of the Ukrainian-Russian war. From the first days of the invasion of the Russians, all the damage they inflict on the Ukrainian environment is recorded. We can already talk about 257 cases of ecocide. These are the explosions of fuel and lubricant warehouses, oil product storages with corresponding consequences for the environment. These include airstrikes on enterprises that use dangerous chemicals in production. This includes the damage and destruction of treatment facilities, and the spilling of sewage into our reservoirs, as well as damage to the soil cover, burning of forests - especially in the territories of the nature reserve fund.

Ukraine occupies 35% of Europe's biodiversity, there are more than 70 thousand rare and endemic species of flora and fauna. This, unfortunately, may

have been destroyed during this war. 16% of the territory of Ukraine is covered by forests, artillery explosions will most likely cause forest fires, from which 20 thousand hectares of Luhansk region have already burned in 2020.

The question arises, why is the whole world here, when the environment in Ukraine is being destroyed? Today, 2.5 million hectares of Europe's nature conservation network are under threat of destruction due to the actions of the Russian Federation. These are 160 objects of the Emerald Network - territories of existence of species and habitats protected at the pan-European level. The war also provokes the emission of greenhouse gases, in particular methane from a damaged gas pipeline. Enemy shells that hit our critical infrastructure and residential buildings every day cause significant fires, including forests. This leads to significant pollution of atmospheric air with dangerous substances.

On the first day of the invasion, gamma radiation in the Chernobyl zone was about 28 times higher than the annual norm. This happened due to heavy traffic. Ukraine currently has 15 nuclear reactors operating in 4 different locations. It is possible that even if one reactor is damaged, we will see a second Chernobyl disaster. The debris and radiation released during the attack could spread thousands of kilometers and lead to many health problems, such as thyroid cancer, not only in Ukraine, but also in nearby countries.

During the detonation of rockets and projectiles, a number of chemical compounds are formed – carbon monoxide, brown gas, nitrogen dioxide, formaldehyde, etc. During the explosion, all substances are completely oxidized, and the products of the chemical reaction are released into the atmosphere. The actions of the invaders lead to the destruction of entire ecosystems.

Polluted air has no borders. Emissions in the atmospheric air, which were caused by the military aggression of the Russian Federation on the territory of Ukraine, are transferred, settle and have an impact on the territories of other states, sometimes at a distance of thousands of kilometers.

Due to the aggression of the Russian Federation, power plants were damaged in Ukraine, which led to the massive use of generators. Gasoline and diesel generators with internal combustion engines pollute the environment with substances that affect human health and the environment. These include carbon monoxide, carbon monoxide, soot, nitrogen oxide, fine dust.

There is an interesting statement: if, for example, generators are installed around every house in the city, their emissions will exceed the emissions of a thermal power plant. But this is normal if they are installed near every house. Also, noise from generators affects animals, because they are more sensitive to sounds.

Large-scale fires at infrastructure and industrial facilities lead to air poisoning with particularly dangerous substances. Pollutants can be carried by winds over long distances.

Even before the start of the Russian invasion in February 2022, Ukraine had low ratings on environmental indicators such as air quality, biodiversity production, and ecosystem health, so post-war Ukraine's environmental situation

is likely to be worse than ever.

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RATIONAL USE OF PLANT RESOURCES ON THE EXAMPLE OF THE GENUS CANNABIS.

In today's world, the problem of rational use of natural resources is a pressing one. First and foremost, it is about protecting the environment and ensuring environmental safety. The importance of these factors is due to the fact that the further existence of humanity depends on addressing issues related to ensuring environmentally and technologically safe living conditions for citizens and society, and preservation of the environment. At present, unfortunately, a large number of business entities do not consider these factors to be of primary importance for optimizing their operations and establishing production processes with due regard to such conditions. In view of this, I would like to consider industrial hemp (technical or non-narcotic) plant of the Cannabis family from different angles from the point of view of the maximum fullness of its use. Hemp is a very versatile product. It can be used in the following industries.

Oil – oil is produced from hemp seeds by cold pressing. It contains valuable omega-3, 6, and 9 fatty acids in an ideal ratio, and in terms of their quantity, it surpasses even expensive fatty fish. Hemp oil contains vitamins A, B1, B2, B3, B6, B9, C, E, as well as calcium, phosphorus, potassium, magnesium, copper, and iron. Rich in antioxidants, it prevents blood thrombosis, lowers cholesterol and promotes weight loss. Stearic and gamma-linolenic acids contained in hemp oil are not synthesized in the human body, but are vital for it, helping with burns and abscesses, and it is also used for radiculitis, bruises, fractures, and various joint diseases. Also, the oil is also used to make confectionery and canned food.

Forage – is a valuable carcinogenic product for livestock. A kilogram of such cake is equivalent to 2.9 kg of oats or 3 kg of barley, 3.1 kg of corn, and 15.3 kg of potatoes, which indicates its high feed nutritional value.

Textile – industrial hemp fescue, which used to be considered a waste product of fabrics and ropes, can serve as a valuable building material and an alternative to conventional insulation, such as mineral wool or polystyrene. Hemp fiber is used in the production of fabrics: blankets, pillows with hemp filling. It can also be used as a material for faux fur, socks, shoes, clothing, reusable face masks, and as bedding for pets.

Cosmetic – the product of industrial hemp processing can be used to make soap and skin care products. It regulates the sebaceous glands, accelerates the regeneration of oily skin regeneration. Hemp seed oil is recommended for the treatment of skin diseases such as eczema and psoriasis. In addition, it protects the skin from the harmful effects of ultraviolet rays.

Medicine – On May 20, the Supreme Council registered a bill to legalize the use

of cannabis for medical and scientific purposes. Cannabis used for medical purposes helps to alleviate patients' suffering and normalize their health in a number of serious diseases and conditions. Therefore, its use in medicine is a normal global practice. The use of such drugs would help nearly two million Ukrainians suffering from chronic pain and other disorders. These are thousands of children with drug-resistant forms of epilepsy, hundreds of thousands of cancer patients, more than a hundred thousand palliative care patients and war veterans with post-traumatic stress disorder. The plant of the genus Cannabis can be used in various forms: inhalations, capsules, sprays, oils, extracts, or "tea", – depending on the medical need. In particular, Cannabis-based products can be effective as pain reliever in palliative care. Its use can help reduce the use of opiates. of opiates. In addition, it can help cancer patients overcome symptoms such as lack of appetite, nausea, and insomnia. Some forms of epilepsy cannot be treated with existing medications. These are is the so-called drug-resistant epilepsy. The use of the Cannabis plant significantly alleviates the course of seizures and reduces their frequency. It is important that you can use this inhaler anywhere - at the airport or at school. This will improve the quality of life of patients. In addition, Cannabis can help those who have been through war, captivity, or have been victims of domestic violence and suffer from post-traumatic disorder. In this state, people are looking for ways to calm down, reduce anxiety, overcome panic attacks or simply forget, and may turn to alcohol or cannabis. Although these drugs actually only increase anxiety, increase the risk of depression and loss of social connections. Instead, the plant of the Cannabis genus has an anxiolytic effect, which means it calms you down but does not affect your behavior or, for example liver and brain health in the way that alcohol does. There are only two types of cannabinoids used in medicine cannabinoids, two compounds – cannabidiol and delta-9-tetrahydrocannabidiol (THC). Cannabidiol is not a psychotropic substance, and THC has minor "intoxicating properties".

Alternative energy – in terms of calorific value, hemp briquettes and hemp flakes occupy an intermediate place between coal and wood. The hemp stalk has a high calorific value, which is calorific value, which is somewhat inferior to coal, but exceeds that of soft wood and peat. Unlike traditional fuels, it is a rapidly renewable raw material: from 1 hectare it yields significantly more productivity than forest species in one year. Thus, the annual growth of pine is 2,3 m³ per 1 ha, while hemp with an average yield of 50 c/ha of straw is 5-6 m³ and with large yields – twice as much. Also, after burning hemp, ash remains, which is a valuable fertilizer:

CaO – 24 %, P₂O₅ – 4.85 %, K₂O – 6.3 % [1].

The use of hemp stalks for energy purposes is a promising area of use, as it is possible to use not only the whole plant, but also its parts. We can also use hemp straw, for which there are already special generators that allow you to burn two rolls of raw materials at once, which is a step towards waste-free production and rational use of plant and land resources. This type of fuel will be the safest of all because the plant contains almost no sulfur or other pollutants contained in oil

that pollute our atmosphere when burned.

Hemp absorbs a large amount of carbon dioxide, and this gas is formed when fuel is burned, so growing this plant for industry can save us from global warming by cleaning up the the atmosphere. Based on this, we can say that hemp raw materials have their advantages, as the basis - organic substances that minimize pollution.

Thus, the potential of the Cannabis genus, when used rationally, is very diverse and multifunctional. On the one hand, it is a useful crop, the profitability of from the cultivation of which is 2.5 times higher than the profit from wheat and a fodder product for livestock. But, when grown as an agricultural crop, its biological characteristics must be taken into account, ecological capabilities, and its intended use. On the other hand, the plant contains a lot of the same type of substances – cannabinoids – that have pronounced medicinal properties. The largest costs in hemp cultivation technology are for seeds and fertilizers. Seeds are quite expensive, but if you follow the right conditions, the cultivation pays off in full and will bring a lot of profit. So, growing Cannabis plants is not only profitable, but also quite easy – you just need to know how to do it.

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WHAT ARE THE POSSIBLE DANGERS OF INDUSTRIAL POULTRY FARMING DURING MARTIAL LAW?

The publication presents the results of a study of the mass death of birds at a poultry farm in Chornobaivka at the beginning of full-scale hostilities in Ukraine, as well as the possible consequences for the environment from this disaster.

Keywords: Chornobaivka Poultry Farm, pestilence, environmental harm.

The research was conducted with the help of the information from the open Internet sources, opinions of experts, as well as from the words of one of the eyewitnesses of the events.

The work of industrial livestock enterprises is associated with significant environmental challenges. These include the timely burial of animals, the emission of biological waste, the need for a large amount of water for livestock (which significantly affects the water balance of the territory), and the constant unpleasant smell in the air that causes many complaints from the residents of nearby settlements, etc. That is why, in a country with developed animal husbandry, the activities of industrial enterprises are strictly controlled by the relevant bodies of environmental supervision.

During a natural disaster, economic instability, or hostilities, an identified environmental hazard can turn into a real disaster. Currently, during large-scale hostilities, Ukrainian livestock enterprises (including poultry) are in an extremely difficult situation due to constant power outages or logistical problems with the delivery of fodder and other items for livestock and poultry. Thus, according to KSE Agrocentre estimates, almost 400,000 bee colonies, 95,000 goats and sheep, 212,000 cattle, 507,000 pigs, and about 11.7 million birds died because of Russian aggression. And these obvious economic losses can also turn into an ecological disaster for the population.

The purpose of the article is to determine the nature of the existing ecological danger that can be caused by an industrial livestock enterprise during hostilities and occupation.

One of the most famous examples of losses caused to military livestock was the mass death of several million chickens at Europe's largest Chornobaivka Poultry Farm, located in the Skhidne village, Kherson region. When it happened, I was nearby in occupied Kherson, but then I did not realize how dangerous such an event could be. And that's why now, after analysing in detail the sources and experts' opinions and personal interviewing of one of the eyewitnesses of those events, this is exactly what I want to reveal in the article.

So, the catastrophe began in early March 2022 due to the occupation of part of the territory of Ukraine by the Russian invaders, Europe's largest Chornobaivka Poultry Farm, a key enterprise for the Kherson region, remained completely without power. As a result, the automated animal feeding systems stopped working, and because of the threat of shelling, workers were not brought to the farm anymore for security purposes, as well as animal feed. Then it even got to the point that the chickens started eating each other, because, according to an eyewitness, many feathers were found in their stomachs. In addition, it became impossible to maintain an appropriate sanitary regime at the enterprise. In an attempt to save the situation, poultry farm workers managed to distribute part of the products and chickens to the local population but, in the end, about 4.4 million chickens died of thirst and hunger [1]. It was possible to bury some of them in an enormous pit with an area of 1,880 square meters [6]. The death of such a large number of birds without the possibility of safe disposal could become an ecological disaster, which, according to the head of the State Environmental Inspection of the Southern District, Konstantin Sivak, was avoided [5].

Currently, the prosecutors of the Kherson Regional Prosecutor's Office are guiding criminal proceedings for the fact of mass destruction of objects of the animal world which can cause an ecological disaster (Article 441 of the Criminal Code of Ukraine - ecocide), as a result of the armed aggression of the Russian Federation against Ukraine and the mass shelling of Chornobaivka by enemy troops.

Summarizing, it is worth emphasizing that the definition of the destruction of the Chornobaivka Poultry Farm by the regional prosecutor's office as ecocide indicates the full scale of the danger of this situation compared to what had been happening before the hostilities. According to the president of the All-Ukrainian Environmental League, Tetyana Tymochko, organic waste from birds can serve as a favourable environment for the development and survival of pathogenic microflora, contain an increased amount of heavy metals, pesticides, pharmaceuticals, radioactive substances, weed seeds, and other pollutants. In addition, due to the development of dangerous microorganisms in this waste, there is always a risk of an outbreak of epidemics, such as pathogenic strains of *Escherichia coli*, which infected thousands of people in Europe, and dozens of people died [2]. So, taking into consideration the number of dead birds, it is difficult to imagine how terrible the consequences of such a pestilence could be for the region's ecology.

Even though environmental experts have already visited the farm, their findings were not public, so we can only guess to what extent its de facto destruction will harm us. But taking into account all of the above, we can conclude that non-compliance with safety standards in the operation of poultry enterprises may lead to such consequences as:

- an outbreak of epidemics due to the reproduction of dangerous microorganisms in bird waste;

- pollution and contamination of surrounding soils with excessive volumes of manure and droppings;
- contamination of water reservoirs (including wells) with liquid manure, suspension, and wastewater;
- air pollution with methane and hydrogen sulphide produced during digestion in animals and due to the large amount of manure that accumulates on farms;
- the spread of unpleasant odour in the air caused by the release of ammonia from microflora from the urine of birds, etc.

And all these threats become especially relevant during full-scale hostilities when it is sometimes simply impossible to control the situation at enterprises due to occupation or shelling. That is why the state in such time should take care of the safety of poultry enterprises as much as possible because, in the worst case, it can potentially turn into an ecological disaster, the elimination of which will then require a lot of effort, time, and funds.

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MODERN ECOLOGICAL PROBLEMS OF THE MENSCHYNA AND WAYS TO SOLVE THEM

The publication will present an overview of the existing environmental problems of the city of Mena, Chernihiv region, and proposed ways to solve them.

Key words: pesticides, solid waste, waste water, environmental awareness, forest cover

About 30 medium-sized agricultural enterprises work in the community, which are engaged in growing grain and oil crops, storing cereals, and breeding meat and dairy cattle [7]. However, at the same time, there are adverse environmental consequences, due to agricultural activities, and so, due to the use of a significant amount of fertilizers and pesticides. The main danger of pesticides is that they enter the biological cycle, and subsequently enter the body of humans and animals. For organochlorine and triazine pesticides, decay is an important prerequisite for their migration along the soil profile, as well as into the surrounding environment, which can threaten natural biogeocenous communities, as well as human existence [2]. Therefore, the assessment of soil pollution is of great ecological importance. The main negative environmental consequences of the use of pesticides can be identified as follows: their ability to accumulate in the soil and be transported by living organisms of the trophic chain; reduced biological productivity and degradation of the normal function of soil microorganisms; reducing the intensity of the soil self-cleaning process; the ability to accumulate in rivers and groundwater; inhibit biochemical processes and prevent the natural restoration of fertility; lead to loss of taste qualities and nutritional value of agricultural products [2].

In order to prevent the content of pesticides, which is higher than the DRL, it is necessary to take into account the time from the beginning of processing to the planned harvest period and to use drugs whose detoxification period is shorter than the hygienic standard for the time of pesticide decay to safe concentrations. Accumulation of pesticides in environmental objects will not be allowed if pesticides are used in such a way that their new inputs to the soil and plants do not exceed the rates of their chemical and biological decomposition. Particularly strict requirements should be met during the selection of pesticides on irrigated lands and in rice crop rotations, where it is prohibited to discharge drainage water into reservoirs if the content of pesticides exceeds the MAC [2]. Thanks to the improvement of the economic regulation of the irrational use of pesticides, it will be possible to ensure the appropriate level of ecological safety of the region and strengthen the level of its competitiveness in the national dimension.

The use of large doses of fertilizers leads to a decrease in the quality of

products. Groundwater – leads to pollution of nearby rivers and reservoirs. The increase in the use of mineral fertilizers made it possible to increase the yield among agricultural crops, on the same area for their cultivation, but subsequent attempts to increase their doses did not contribute to the growth of the crop [2]. For the safety of the environment, it is necessary to observe the application norms, terms, and methods of application, and it is also necessary to observe the MPC of the drug in products, soil, water, and the working area of the drug application.

Due to the lack of a comprehensive system of garbage management and its separate collection, solid waste is one of the biggest pollutants of the environment. In 2019, 3,552 tons of waste (15,109 m³) were generated on the territory of the community [6]. The officially registered landfill of the Minority is quite dangerous, because there are no waste sorting equipment and a waste processing plant on the territory. Often, people create landfills in various places, usually these are the closest to settlements, forest strips, ravines along paths, roadsides, these areas are exposed to toxic substances, in places where waste accumulates, microbiota die and the soil is poisoned, and settlements can receive polluted water and a pungent smell from vapors into the atmosphere [4]. So, at the moment, the following were recorded: an unauthorized landfill near the quarry near the Mena-Lisky road; a garbage dump on the side of the road to Makoshino, where people often throw away garbage. The main part of garbage is solid waste, construction materials and organic matter. Solving the problem of waste management is possible under the condition of an integrated approach: environmental education, provision of correct environmental information for the public, creation of conditions for carrying out technical and biological reclamation of existing landfills and ensuring the functioning of the system of measures aimed at preventing environmental pollution, construction of landfills that would meet the indicators of Ukrainian regulatory documents and directives of the European Union, creation of effective waste processing complexes using existing advanced technologies [4].

The community has an insignificant level of sewage provision (14%), [6] which leads to pollution of the natural environment. Plants and wildlife living in or around polluted water often accumulate toxins and pathogens found in wastewater. For example, the presence of heavy metals in predatory fish is positively correlated with increased sewage pollution in these waters. Freshwater ecosystems, including lakes, rivers, streams, and underground reservoirs, are critical to human health and survival because they provide essential drinking water [1]. Because people live near these ecosystems and often use them for waste disposal, freshwater systems are particularly sensitive to sewage pollution. To combat this problem, it is possible to implement: effective sewage systems in rural and urban areas, if local residents do not have enough funds for connection, then provide them with interest-free credit funds to cover their needs; modernization and development of the wastewater treatment and processing system, this will help avoid water pollution and improve people's living

conditions; carrying out educational campaigns among the population on issues of hygiene and ensuring safety when using sewage systems.

A big problem of the Menshchyna is low environmental awareness. The problem can lead to improper waste management. If residents do not know how to properly handle waste, then waste can be thrown into the natural environment, which has happened more than once in the territory of the Minority. Low environmental awareness can lead to improper use of resources. If residents do not know how to conserve energy and water, they may overuse them, which not only leads to higher utility bills, but also to environmental pollution and depletion of these resources. Low environmental awareness can lead to danger to people's health. Residents often do not know which substances are harmful to health and how to avoid them and may accidentally come into contact with them in everyday life. For example, harmful substances can be contained in cleaning chemicals, cosmetics, or even in food. A problem with ecological consciousness, which manifests itself very negatively, is the burning of dry vegetation, and often uncontrolled burning. Burning vegetation and the remains of fallen leaves has a negative impact on the health of the population, especially on the respiratory and cardiovascular systems [3]. In order to qualitatively overcome the problem of environmental ignorance, it is necessary to lay the foundations of environmental education from an early age so that children learn to understand the importance of environmental protection from a young age. Involvement of the mass media and mass campaigning for environmental protection, raising important issues and explaining them to the public will allow to increase the number of people who will rationally use our environment.

The territory of Menshchyna is forested by only 9%, [6] while the forested area of Chernihiv region is 20.9%, and the optimal indicators for the region are 21.3% [8]. Achieving optimal indicators of forest cover in the territory helps to reduce the possibility of undesirable phenomena: soil erosion processes; shallowing and pollution of river water bodies; desertification of territories. Forests are a powerful carbon accumulator [5]. The negative consequences of the greenhouse effect are significantly reduced. The problem is the destruction of entire forests. Tree disease is one of the main causes of forest destruction. Another negative factor is arbitrary felling of trees, which is actually not recorded by anyone. In the process of felling, a huge amount of nitrogen, phosphorus, calcium, etc. is removed from forest soils, same-age, one-species tree stands are formed, and forest monocultures develop [5]. We must not forget about forest fires. The constant growth of the recreational load on forests increases the level of danger of fires. Also, gross violations of fire safety techniques are increasingly occurring on the part of the population, including due to spontaneous burning of dry vegetation. To increase the afforestation of the territory, it is necessary not only to plant new trees, but also to protect the forests by: carrying out preventive care and cutting down diseased trees, adopting legislative acts to reduce illegal deforestation, carrying out forest surveillance to prevent fires and development of forest areas. Ensuring more effective control and imposing fines on violators,

which will reduce the number of illegal logging.

Therefore, in order to improve the situation with pollution from pesticides and fertilizers, it is necessary to modernize the system of their introduction, comply with all deadlines, recommendations and requirements. Citizens' understanding of ecological processes, creation of conditions for technical and biological reclamation of existing landfills and ensuring the functioning of systems of measures aimed at preventing environmental pollution, construction of solid waste landfills that would meet the indicators of Ukrainian regulatory documents will solve the problem with garbage. Improving the sewer system and connecting it to local residents will be the basis for improving the wastewater situation. Environmental education from primary school and environmental advocacy will be able to raise the level of environmental awareness of citizens. In order to improve the situation with the forest, it will be necessary to carry out preventive maintenance of the forest, prevent fires, and protect the forest from illegal logging.

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MODERN ECOLOGICAL PROBLEMS AND WAYS TO SOLVE THEM

The publication looks at most urgent present-day environmental problems and the ways to their solution.

Key words: environment, destruction of ecosystems, terrestrial and marine

Modern ecological problems are among the most pressing issues facing our society. Air, water and soil pollution, destruction of forests and other natural resources, global warming and other problems have serious consequences for people and nature.

One of the biggest environmental challenges is global warming, caused by greenhouse gas emissions such as carbon dioxide, methane, and others. This can lead to rising sea levels, shrinking glaciers, changing climate conditions, and reduced crop yields.

Air pollution is one of the most serious environmental problems. Emissions from industry, transportation, and other sources pollute the air with toxic substances that can have harmful effects on human and animal health. In addition, polluted air can lead to global warming and climate change.

To combat this problem, it is necessary to reduce the emission of toxic substances into the air. This can be done by using less polluting modes of transportation and energy, as well as more efficient waste treatment technologies. Other measures to combat air pollution include regulating emissions of pollutants at the legislative level, supporting the development of environmentally friendly technologies and energy, promoting the use of renewable energy sources, and increasing the energy efficiency of production and construction. In addition, it is important to raise environmental awareness among the population and spread knowledge about the problem of air pollution and its consequences.

Water pollution is another serious problem. Emissions from industry and agriculture, as well as uncontrolled waste discharges into rivers and lakes, can contaminate water with toxic substances, leading to the death of fish and other aquatic organisms, as well as contamination of groundwater.

To prevent water pollution, it is necessary to set strict standards for emissions and waste discharges into water bodies, as well as to conduct systematic water quality inspections. In addition, more environmentally friendly agricultural and industrial methods can be used.

It is also important to restore and preserve aquatic ecosystems that help clean water and provide biodiversity. For example, restoring wetlands and marshes can help reduce water pollution and increase the number of aquatic organisms, which

will contribute to ecosystem balance and human health. More efficient water treatment technologies that reduce the amount of toxic substances entering water bodies can also be used to reduce water pollution.

Deforestation is one of the most serious environmental problems. Forests are an important element of the ecosystem that provides oxygen and living space for animals. In addition, forests are an important source of timber and other natural resources. To combat this problem, it is necessary to reduce deforestation and implement more effective forest conservation policies. Forestry and reforestation programs can be implemented, and deforestation in important ecosystems can be banned.

In addition, it is important to reduce illegal deforestation, which is a serious problem in some countries. This can be done by establishing more effective control mechanisms and imposing severe penalties on those who violate forest protection laws. In addition, it is important to support sustainable forestry initiatives to ensure that future generations have healthy and diverse forests.

Global warming is one of the most serious environmental problems. Climate change can have serious consequences for people and nature, including changes in sea levels, changes in vegetation, and decreased levels of available water. To combat this problem, it is necessary to reduce the emission of greenhouse gases, such as carbon dioxide, into the atmosphere. This can be done through the use of less polluting energy sources, such as solar and wind power, and the use of more efficient waste treatment technologies.

In addition, trees and other plants, absorbing carbon dioxide can be planted, and carbon credit restoration methods can be used to help preserve the carbon stock in the soil and plants. It is also important to implement effective waste management policies and reduce the use of plastic materials that can be renewed or recycled. It is important to consider environmental impacts when making decisions in all areas of life and industry.

Conclusion

Environmental issues have thus become a global concern, and we must act decisively to reduce their impact on our planet and future generations. Raising public awareness, utilizing the latest technologies and international cooperation are just a few of the ways we can help solve these problems. It's important to realize that each of us can do our part to preserve the environment, and we must work together to create a more environmentally conscious and healthy planet.

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FOREST ECOSYSTEMS IN MEGALOPOLIS – IMPACTS OF URBANIZATION AND OPPORTUNITIES FOR BIODIVERSITY CONSERVATION FOR BETTER MANAGEMENT

The publication presents the results of the approbation of the research topic. It also provides directions for further scientific work and development of recommendations for management of forest and park ecosystems in megalopolis conditions.

Key words: effective management, green infrastructure, the park ecosystems, Sustainability

According to the decisions of the 69th UN General Assembly, the EU Biodiversity Strategy 2030 and the EU New Forestry Strategy 2030, sustainable forest management and sustainable urban development are among the main global sustainable development goals. To achieve sustainable urban development, these policy documents recommend paying special attention to improving air quality and preserving green infrastructure (GI), including forests and park ecosystems within cities. Therefore, reliable assessment methods and periodic monitoring of the state of forest ecosystems in cities are essential for further sustainable and effective management. Green spaces and forest ecosystems are in a continuous process of adaptation to the dynamic and aggressive urban environment. It is important to take a comprehensive approach to their conservation - to identify weak links and processes, and to develop solutions to maintain the healthy state of ecosystems.

Urbanization, as a global irreversible process, reduces biodiversity, disrupts ecosystem connectivity, worsens access to water resources and the hydrological regime of ecosystems, reduces the quality and quantity of natural soils, and transforms them into urban soils, which leads to a deterioration of green spaces. The conservation of green spaces within cities to provide ecosystem services in the context of increasing urbanization is a very important research topic. The depression of green spaces within megacities is exacerbated by global climate change processes and excessive vehicle emissions. Therefore, to develop effective land use policies, sustainable urban development and infrastructure management, it is crucial to assess the impact of urbanization on the condition and viability of forest ecosystems and their provision of ecosystem services.

Green infrastructure provides unique ecosystem services for urban biodiversity conservation, landscape continuity, air purification, stabilization of urban ecosystems, and has the greatest potential for climate change mitigation

and adaptation. Thus, GI is very important for maintaining human health and sustainable urban development. Therefore, systematic studies of environmental quality are necessary to implement EU policies and guide decision-making by officials. Therefore, it is important to conduct a comparative assessment of the state of the forest ecosystems and their performance of ecosystem services (biodiversity conservation, air purification, stabilizing effects on the psycho-emotional, mental / intellectual state of residents, visualisation, adequate perception of reality as part of social ecosystem services) in time and space.

Within the scientific project "Bioindication assessment of park ecosystems under conditions of urbanization" (2022-2026) at the Institute for evolutionary ecology NAS Ukraine we study forest ecosystems in megalopolis of Kyiv (Holosiivsky national park - the largest forest area, located within the megacity) and Berlin. We have developed and tested a system to assess the state of forest and park ecosystems within the megacity [1, 2].

In the conditions of urbanization, it is necessary to trace the dynamics of forest ecosystems for better management and risk assessment, biodiversity conservation and evaluation of the invasion process of alien plant species. For comparative studies of forest and park ecosystems in Ukraine and Germany it is important to learn about European approaches to the study of forest ecosystems and biodiversity conservation. This will allow a better assessment of the situation in megacities and formulate recommendations for the effective management of urban green infrastructure.

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COMBAT ACTIONS IMPACT ON THE ECOSYSTEMS OF UKRAINE

The publication provides data on the impact of Russia's active military operations on the ecological state of ecosystems in Ukraine.

Key words: war in Ukraine, ecological catastrophe, ecosystem pollution, technogenic impact.

Our unmatched Ukrainian nature is currently a silent victim of the Russian Federation's war against Ukraine! The scale of the ecological catastrophe in our country is already very serious: according to Forbes data of April 30, 2022: "Russia has launched missiles worth about \$7.5 billion". Up to 2,800 high-precision missiles were launched into Ukrainian territory, many of which hit the territory under Ukraine's control. Each explosion of a projectile, destroyed building, and fire is accompanied by a powerful release of dust and gases into the atmosphere, which are carried by air over large distances and settle in people's lungs [3].

Even eliminated missiles by air defense forces cause damage due to toxic fuel and the explosion. All of this means that the war in 2022 deliberately or indirectly releases all possible pollutants into the environment: from the content of treatment facilities, production warehouses to raw materials of chemical industry enterprises.

Inhabitants of many cities and villages in Ukraine are already feeling air pollution - the consequences of the military actions. For example, after strikes by Russian air and space forces on an oil depot in the village of Kryachky in the Kiev region on the night of February 27, there was a series of explosions that caused an ecological catastrophe associated with a serious release of formaldehyde, which can cause cancer.

According to O. Vasilyuk's assessment, the air pollution currently occurring in Ukraine is second in scale only to the Chernobyl nuclear disaster. "Warehouses of paint and varnish products are being destroyed, an ammonia storage facility in Sumy was intentionally destroyed by a missile (with an affected area of about 2.5 km²). There are deliberate ignitions in Chernobyl. This had no significance for the defense sector the only explanation for this is a significant deterioration in air quality." We are currently experiencing the worst ecology catastrophe in terms of air pollution in a point of time," sums up the ecologist [1].

Massive fires occur both in places of explosions, missile and artillery launches, in places of hitting military equipment, and in natural and agricultural areas. Fires in ecosystems lead to the destruction of biodiversity on large areas. The territories of the Kiev, Dnipro, Chernihiv, Sumy, Kherson, Luhansk, and Donetsk regions are particularly affected. Projectile explosions destroy trees and provoke fires.

According to O. Ovchinnikov [5], almost 102,000 hectares of Ukrainian landscapes have been damaged by fires during the six months of the war. Military

actions take place in the eastern and southern regions of Ukraine, which are characterized by low forest cover. Here, forests perform protective functions. Their destruction and damage will affect the climate of these regions and may lead to significant erosion processes. In particular, the consequences of the war in southern Ukraine could be wind erosion and desertification.

As a result of the war in Ukraine, almost 36,000 hectares of nature reserves have been damaged. The intact steppes, chalk cliffs in the Donetsk region, coastal ecosystems in southern regions, and swamps in northern Ukraine - territories that are habitats for rare and endemic plant species - have been affected by the active hostilities. The Hetman, Pryazovskyi national nature parks, and the Meotida nature park in the Donbas have suffered the most.

During detonations of shells and ammunition, a number of chemical and toxic organic compounds are formed. As a result of military actions, as well as accidents at industrial facilities, the content of harmful chemicals has sharply increased, exceeding the MPC by several times. The interaction of harmful chemicals with soil leads to its oxidation, which in turn affects the representatives of flora and fauna, and later - humans. Heavy metals, when washed out by rain, get into groundwater, and from there into reservoirs and rivers. According to ecologists, during the period of military actions, the content of sulfates in groundwater increased by 2.5 times [2].

During explosions, many toxic metal debris are formed. According to ecologists' estimates, 392 tons of harmful substances, metal debris, and gunpowder got into the territory of the Saur Mogila landscape park. Another harmful factor of the detonation of ammunition is the formation of craters from the impact of shells. Only on the territory of the aforementioned landscape park, experts counted about 16,000 craters that completely destroyed the fertile soil layer in an area of 225 km².

Explosions lead to the simultaneous destruction of most living organisms that fall within the blast wave, fire, and debris zone. The effect is very short-term, but in the long term, the destruction of the plant and soil cover leads to the emergence and spread of erosion processes and long-term degradation of the territory. The destruction of the plant cover also leads to the spread of alien plant species that form hotspots in damaged areas [4].

A large number of tiny organisms that make up and maintain soils, as well as its biological cover – lichens, mosses, fungi, and grasses - are most vulnerable to the effects of ammunition. That is why all living organisms that exist in the depths of soils or protect its surface from erosion are unable to protect themselves from negative impacts.

In addition to harmless CO₂ and water vapor, the oxidation of one kilogram of explosive in the air releases several tens of cubic meters of toxic gasses: SO₂, NO_x, CO (including aromatic hydrocarbons, which are significantly more toxic than usual). Sulfur and nitrogen oxides return to the soil from the atmosphere through acid rains, which change the pH and cause burns to plants, as well as literally burn soil fauna, algae, bacteria, seeds, and roots of grasses, and mycorrhizal fungi that

are in symbiosis with plant roots. Soil becomes the final link in the chemical impact of ammunition.

A portion of metal fragments and substances that have not reacted remain in the soil, while others scatter and settle around (fragments up to 300 m, unused reagents up to 35 m). Fragments carry a significant threat. Ammunition shells are most often made of cast iron alloy, which, in addition to carbon and iron, contains copper and sulfur. Artillery shells of 120 and 152 mm caliber produce 1600-2350 and 2700-3500 fragments weighing one gram, accordingly. Chemical elements from the surface of fragments will oxidize, enter the cycle of substances in the surrounding environment, and enter the trophic chains.

On a satellite image showing a 1 km² field planted with winter crops, 480 craters from 82 mm caliber shells, 547 craters from 120 mm caliber shells, and 1025 craters from 152 mm caliber shells were counted. Only on this square kilometer of the field, 50 tons of iron, 1 ton of sulfur compounds, and 2.35 tons of copper entered the soil. The explosions have turned out no less than 90,000 tons of soil, and even after filling the craters, we will no longer have a significant amount of fertile soil on these plots. By the way, this means that 37% of the entire area shown on the satellite image has actually lost its fertile soil layer [1].

Summing up, it is essential to note that modern weapons have a destructive impact on the state of ecology both in the zone of their use and on the entire ecosystem of the planet due to the global circulation of substances in nature and the interconnection of all local ecosystems. Currently, world scientists mainly call for the development of methods to localize the consequences of military actions in a limited area. However, it is necessary to mark a vector of human development that will make it possible to completely eliminate the use of weapons, thereby minimizing the anthropogenic impact on the ecology of the planet.

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FORMATION PECULIARITIES OF THE ANNUAL WEATHER COMFORT IN THE CARPATHIAN REGION OF UKRAINE

The publication presents the results of research on climatic comfort and features of weather formation on the example of the Carpathian region of Ukraine.

Keywords: weather, weather comfort, air temperature, humidity, wind speed.

The author carried out the research, revealing the main regularities of the distribution of comfortable weather on the territory of the Carpathian region of Ukraine. The region includes Ivano-Frankivsk, Lviv, Zakarpattia, and Chernivtsi regions.

To determine the characteristics of comfortable weather, a classification was made for the temperate zone of Ukraine using the methodology [1] for calculating temperature, humidity and wind efficiency indices.

The initial data of meteorological indicators of temperature and air humidity, wind speed for the multi-year period from 1991 to 2021 were taken from information sources [2-4]. Using the methodology, the main indices were calculated, which formed the basis for the classification of weather comfort for Ukraine.

Table 1

Classification of weather comfort for the temperate zone of Ukraine

Weather comfort	Values of temperature and humidity indices and wind efficiency	Designation of the degree of weather comfort
Comfortable	95-170	
Subcomfortable	from -2 to 95	
	from 170 to 415	
Uncomfortable	to -2 and more than 415	

Analyzing the received data for the 30-year period from 1991 to 2021, we can state that in the cold half-year from January to April and from October to December, uncomfortable weather is observed in all parts of the region.

The minimum air temperature is -3.3 in the Ivano-Frankivsk region in January, and the maximum is +11 in the Zakarpattia region in April. The highest air humidity is in Lviv region in December and is 85%, and the lowest is 62% in Zakarpattia region. The highest wind speed in Ivano-Frankivsk region is 4.4 m/s from January to April, while the lowest wind speed is 2.1 m/s in Zakarpattia region in October.

In May, Ivano-Frankivsk and Lviv regions are characterized by uncomfortable weather. At the same time Chernivtsi and Transcarpathian regions show sub-comfortable weather.

The minimum air temperature is +13.3 in the territory of the Ivano-Frankivsk region, and the maximum temperature is +16.1 in Zakarpattia. The highest air humidity is observed in the Ivano-Frankivsk region at 73%. At the same time, the lowest humidity is simultaneously observed in the 2 regions of Zakarpattia and Chernivtsi at 65%. The maximum wind speed is 4.4 m/s in Ivano-Frankivsk region, the minimum is 2.8 m/s in Transcarpathia.

In June, sub-comfortable weather is observed in three parts of the region: Zakarpattia, Ivano-Frankivsk, and Lviv. Chernivtsi region is characterized by comfortable weather

This month, the highest air temperature in Zakarpattia Oblast is +18.7, the lowest in Ivano-Frankivsk Oblast is +16.1. The maximum air humidity index is 75% in Ivano-Frankivsk region, the minimum is 65% in Transcarpathia. A similar situation is repeated with wind speed, the maximum indicator is 3.8 m/s in Ivano-Frankivsk region, the minimum is 2.8 m/s in Transcarpathia.

In July, Lviv, Zakarpattia, and Lviv regions have sub-comfortable weather, Ivano-Frankivsk region has comfortable weather this month.

The maximum air temperature is +20.8 in Zakarpattia Oblast, the minimum is +18.2 in Lviv Oblast. In terms of air humidity, the picture has the opposite situation, in Lviv Oblast the maximum indicator is 75%, the minimum is 65% in Zakarpattia. In terms of wind speed, Chernivtsi Oblast has the highest indicator is 3.1 m/s, and the lowest is Zakarpattia 2.3 m/s.

In August, sub-comfortable weather persists in Zakarpattia and Chernivtsi regions and comfortable weather in Ivano-Frankivsk region. Only Lviv region will undergo changes, the sub-comfortable weather of which will change to comfortable.

The maximum air temperature index is +20.2 in Zakarpattia Oblast, the minimum indicators are +17.7 in 2, Ivano-Frankivsk and Lviv Oblasts. The highest indicator of humidity is in Lviv Oblast at 76%, the lowest indicator is in Chernivtsi Oblast at 68%. The maximum wind speed in Ivano-Frankivsk region is 3.8 m/s, the minimum indicator is 2.1 m/s in Transcarpathia.

In September, the region is marked by uncomfortable weather in Lviv and Ivano-Frankivsk regions. Zakarpattia and Chernivtsi regions are characterized by sub-comfortable weather.

Minimum temperature values correspond to +13 in Lviv region, maximum - +15.5 in Transcarpathia. The maximum value of air humidity is 79% in Lviv Oblast, the minimum is 70% in Chernivtsi Oblast. The maximum air speed with an indicator of 3.8 m/s corresponds to Ivano-Frankivsk region, and 2.8 m/s to Transcarpathia.

Meteorological indicators of temperature, air humidity, and wind speed influenced the annual regime of weather comfort in the Carpathian region. In the cold period of the year, the comfort of the weather is affected by low temperature

(less than + 14), humid air (humidity from 71 to 85%), and high wind speed (more than 3 m/s). In the warm period of the year, the comfort is affected by humid and moderate - dry air (humidity from 71 to 85% and from 50 to 70%), air temperature higher than comfortable indicators (more than +18-20).

So, in the Carpathian region, the most favorable time of comfortable weather according to all meteorological indicators falls on the summer period.

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MODERN ECOLOGICAL PROBLEMS AND WAYS OF THEIR SOLUTION

The publication presents various environmental problems of the Planet Earth. It also suggests different ways of solving environmental problems.

Key words: problem, ecology, trees, animals, earth, atmosphere, water, pollution

We live in a world where there are more machines, factories, robots, rubbish, waste than animals and plants. People have simplified their lives, but they have forgotten that we are not alone on this planet. This simplified life has a downside, a scarier, more violent, more real life. What are the consequences of this easy life?

The first global problem is air pollution. Factories, plants and other industrial facilities constantly release huge clouds of poisonous and harmful smoke into the atmosphere. Millions of factories cause irreparable damage to our planet. This emitted carbon dioxide heats up our planet. This problem also causes acid rain. It destroys trees, plants and the earth.

The second environmental problem is water pollution. Every one of us goes to the beach in the warm season, but not everyone notices what happens on the beach. Heaps of plastic, bags, bottles, all in different colors and sizes. All this ends up in the water. The pollution is also caused by factories that dump their waste into the sewage. Some rivers are so polluted that the water is no longer fit for water inhabitants.

The third problem is pollution of the earth. Humans are the cruelest and most irresponsible creatures on earth. We do not notice how kind and generous the earth is to us. How many beautiful trees there are, how rich the harvest is, how diverse the water world is, we take it all for granted. Few people think about the fact that every day tons of rubbish ends up on the ground. A discarded wrapping paper from a pocket, a cigarette thrown out of a car window, a coffee cup left on the ground are all killing our earth. Billions of people daily throw a few kilos of rubbish on the street. Millions of factories pour chemical waste directly into the ground. Vegetables and fruit are then grown on this land that will contain this chemical waste. As a result, it can cause many diseases.

The next, and already the fourth problem, is the destruction of animals and plants. There is a very beautiful coat for sale in a shop. It is made of mink. Has anyone ever wondered how many of these beautiful animals were killed for one coat? Crocodile skin boots, carpets, hats, jewelry that are made of leather, coats of various animals. Billions of animals killed. Millions of plant and animal species that are on the brink of extinction. Luckily, the Red Book and nature reserves have been invented. Maybe they will help to save some species of animals and plants.

There are more and more problems, the sixth is the destruction of forests. Forests are failing to recover from human intervention. Every day several

thousand trees are destroyed. And every single one of them goes for human needs. The extent of the destruction is so great that in a couple of hundred years people won't be able to breathe. More than 10 million hectares of forest disappear every year, and the numbers are getting higher and higher.

Are there any methods for solving these problems? For a start, it's necessary to reduce the use of plastic. Do away with disposable dishes, plastic bottles and bags. Improve and promote the sorting and recycling of rubbish and waste. Use cleaner fuels that do not pollute our atmosphere. We must introduce fines and penalties for polluting the atmosphere, land, and water. Constantly advertise the pollution of the environment. Permanent cleaning up of streets, forests, rivers, and oceans. To protect and restore forests, different kinds of animals and plants. Plant trees where they were cut down. Save water, as billions of cubic meters of water are wasted every year. Modern sewage treatment plants make it possible to purify it to its natural state. Switch to clean energy sources. That means phasing out nuclear power, engines and furnaces that run on coal and oil products. The use of natural gas, wind power, solar power and hydroelectricity ensures a cleaner atmosphere. The use of biofuels can significantly reduce the concentration of harmful substances in exhaust gases.

What conclusion can be drawn? Humans are polluting our entire planet. The air, the earth and the water all suffer at the hands of man. And no one can solve this problem except man himself. It is no exaggeration to say that the planet is our mother. It feeds us, clothes us, makes us comfortable. But a man, while taking advantage of all this, not only neglects its main treasure, but mercilessly destroys it. Today there are many international organizations working for the prevention of pollution of the environment and aimed at solving many problems. There are many solutions, but one has to realize that these methods do not work in a narrow framework.

If we do not succeed in stopping deforestation, soon much of the green space will be wiped out. Pollution of the world's oceans will lead to global cataclysms, mass disease and increased mortality rates. At present we can already observe the preconditions of this tragedy. Unless the principles of waste management are improved and systematized, additional sources of energy are found and nuclear weapons are eliminated, there can be no talk of a further peaceful and healthy life on the planet Earth.

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THREAT TO UKRAINE'S RADIATION SAFETY

The article shows that the Russian armed aggression against Ukraine causes significant damage not only to the economy and cultural heritage, but also to the environment of our country. It underlines numerous cases of purposeful destruction of natural resources and infrastructure facilities to be features of ecocide against the Ukrainian people

Key words: aggression, destruction, nuclear disaster, power plant, radionuclides, radiation safety

As a result of the aggressive actions of the Russian troops, there was a threat to Ukraine's radiation safety. All Ukrainian reactors are at risk, but shelling or a missile attack on the core of one or more of the 15 reactors of four large-scale nuclear power plants in Ukraine could lead to a nuclear disaster. In addition, the seizure of nuclear power plants by the Russian military carries a significant threat of a radiation disaster, both as a result of accidents at the facilities of the industrial use zone and as a result of the burning of forests and fallows, which accumulated a significant number of radionuclides.

Due to damage to the high-voltage power line, in March, the facilities in the exclusion zone of the Chernobyl Nuclear Power Plant remained without external power supply, which threatened to violate the radiation safety of the new safe confinement and spent nuclear fuel storage. Although the Chernobyl nuclear power plant is currently back under the control of the Ukrainian side, the Russian military has stolen all the machinery and equipment that contains data on radiation control and the amount of radioactive waste in the exclusion zone.

According to the Ministry of Environmental Protection and Natural Resources of Ukraine, on March 20, 2022, the fighting took place on the territory of the nature reserve fund with an area of 12.4 thousand square meters. km and this make up a third of the entire nature reserve fund of Ukraine, in particular, in the majority of wetlands that are protected under the Ramsar Convention on Wetlands of International Importance.

About 2.9 million hectares of the Emerald Network, i.e., a network of protected areas created to preserve species and habitats that require protection at the European level, are under threat of destruction. It is a habitat for thousands of plant and animal species. A number of migratory corridors of many bird species pass through the war zone, which will obviously be forced to change them. If the hostilities continue until the end of spring, there are risks for surviving many birds and mammals. The movement of heavy equipment, the construction of fortifications and military operations damage the soil cover. This leads to the degradation of vegetation and increases wind and water erosion

Attacks by Russian troops on critical Ukrainian infrastructure and industrial facilities are aimed at causing maximum damage to the Ukrainian economy. They also have significant negative environmental consequences. For example, on March 8, 2022, as a result of devastating shelling of the city of Irpin, Kyiv region, the polyethylene products factory of LLC "Planet Plastic" was bombed by the occupiers. There was a fire in the main shops with chemical materials and plastic products. On March 14, as a result of the shelling by the Russian troops of the water treatment facilities of the Vasilevskiy Water Supply and Drainage Workshop, which is located in the village of Verkhnya Krynytsia, Zaporizhzhia region, destroyed building and equipment sewage pumping station No. 1, the power line was also damaged. Return water from several districts of the city of Zaporozhe now enters the Dnipro River without any treatment.

On March 18, as a result of rocket fire by Russian troops in the city of Lviv, several rockets hit the property complex of the State Enterprise "Lviv State Aviation Repair Plant". And this could lead to the pollution of atmospheric air and land resources with dangerous substances. Numerous cases of shelling and airstrikes resulted in damage to storage containers for oil, kerosene, propane, diesel fuel, etc.; enterprises or warehouses where chemical, pharmaceutical or paint materials were stored; water mains, gas pumping stations, which led to pollution of air, groundwater or surrounding areas. Damage to public utilities results in contamination of the water layer with organic substances. In particular, the destruction of sewage pumping stations leads to the fact that return water from settlements enters the Dnipro without any treatment. Raw sewage contains a large number of organic substances, pathogenic bacteria, sulfates, chlorides, etc. Such pollution could lead to large-scale blooms in the Dnieper and Black Sea after warmer weather sets in.

During the detonation of rockets and artillery shells, surrounding soils, wood, turf, structures are oxidized, and a number of chemical compounds are formed, as well as a large number of toxic organic substances. During the explosion, all substances undergo complete oxidation, and the products of the chemical reaction are released into the atmosphere. In the atmosphere, oxides of sulfur and nitrogen can cause acid rain, which changes the acidity of the soil and causes plant burns, to which conifers are especially sensitive. Acid rain has a negative effect on the human body, mammals and birds, on the condition of mucous tissues and respiratory organs.

With the onset of heat, the threat of an increase in the number and expansion of the area of forest fires, including in the exclusion zone of the Chernobyl nuclear power plant, is increasing. In the territories occupied by Russian troops, emergency services cannot work and extinguish fires. There are also favorable conditions for the spread of fires in monoculture pine plantations in the north and east of Ukraine. In the absence of a fully functioning landscape protection system as a result of the Russian occupation, fires may reach the characteristics of large-scale fires in 2020 or even more catastrophic. As of mid-March, based on the analysis of satellite survey data (VIIRS, MODIS), 18 centers of fires were

detected, which covered more than 3,073 hectares of fallows and 1,337 hectares of forests, as well as swamps, fires of previous years and abandoned settlements.

As a result of damage to Ukraine's infrastructure, a number of threats and challenges have arisen, including: emergency pollution of rivers;; local pollution of underground and surface waters as a result of large-scale spills of oil products from exploded tanks, from destroyed equipment and other hostilities. The probability of destruction of sludge storage facilities and landfills is also significantly increasing, which threatens water pollution and emergency situations in the regions. It is also worth pointing out the destruction caused by shelling of the port infrastructure along the coast of the Black and Azov seas, which leads to water pollution and the spread of toxins into the sea.

In addition to the environmental legislation of Ukraine, the Russian Federation grossly violates the UNECE International Convention "On the Protection and Use of International Watercourses and International Lakes", the Convention on Wetlands of International Importance (Ramsar Convention). According to the estimates of the Ministry of Environmental Protection and Natural Resources of Ukraine, as of March 20, 2022, the total amount of damage caused by the Russian forces is 438.3 million US dollars or 12.7 billion hryvnias. And with every day of hostilities, the amount of damage increases significantly.

Pollution of soil and water space, reduction of biodiversity, increase in the number of pests in forests is far from a complete list of environmental problems that Ukraine will face after the end of the war. It can be assumed that the future ecological disaster in Ukraine will have not only a local, but also a regional character, since the contamination of water and marine ecosystems, groundwater with possible radiation, chemical or toxic waste will have a cross-border impact on some European countries.

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THE IMPACT OF INDOOR PLANTS ON THE ECOLOGY OF UNIVERSITY PREMISES

The publication considers the role of green plants in air purification in the premises and states that phytoncides released by plants can affect the growth, development and viability of microorganisms.

Key words: plant phytoncides, air environment, microbial flora, landscaping.

During my years at university, I noticed that in some classrooms it was easier to think and make decisions and engage in mental activity. In contrast to others, where these characteristics were reduced to nothing. Having studied biology since childhood, I found a scientific explanation for this phenomenon. These considerations formed the basis of an environmental project designed to help understand the need for greening the premises of higher education institutions.

Relevance of the project. The air environment of university premises is far from ideal, because in addition to ordinary dust, there are often conditionally pathogenic microorganisms in the air, such as staphylococcus aureus, microscopic molds, etc. These microorganisms, when exposed to favorable conditions on the mucous membrane of the upper respiratory tract, can cause acute respiratory or allergic diseases. In the XXI century, scientists have registered a new disease: "sick air syndrome", which manifests itself in the fact that a seemingly healthy student gets tired quite quickly, irritability, drowsiness, and digestive problems. All of the above symptoms are associated with indoor air pollution.

It is possible to regulate the microbial flora of the air with the help of indoor plants, because it has recently become known that almost all plants secrete special biologically active compounds that have a detrimental effect on bacteria, viruses, fungi, protozoa and multicellular organisms. These substances are called phytoncides.

Object of study: plant phytoncides.

Subject of the study: the effect of plant phytoncides (garlic, onions, etc.) on living organisms (molds, E. coli).

Project goal: to prove that the phytoncides released by plants can affect the growth, development and viability of microorganisms, which means purifying the air in university buildings and improving the overall physical condition of students; to identify indoor plants with the highest phytoncidal activity for landscaping and improving the air environment.

Phytoncides play an important role in regulating the microbial flora of the air and maintaining the stability of the biological environment. The spectrum of

antimicrobial action of phytoncides is very wide; they have a detrimental effect on pathogens of dysentery, cholera, tuberculosis, gas gangrene, typhoid fever, influenza viruses, etc. In addition to antimicrobial action, phytoncides of some plants enhance secretory and motor activity of the digestive tract, improve regeneration processes and accelerate wound healing, stimulate the body's defenses, lower blood pressure, and act as anti-arteriosclerotic substances. The use of phytoncides is known in diseases of the gastrointestinal tract, renal and pulmonary diseases. 3 phytoncides of lower and higher plants are extracted into antibiotics, which are widely used by humans both in agriculture and in medical practice.

I decided to investigate the effect of phytoncides on the growth, development and viability of microorganisms, and thus to purify the air of university premises and improve the overall physical condition of students. Experiments were conducted with *E. coli* bacteria and molds. Meat nutrient medium and applesauce were placed in Petri dishes. Juice of various phytoncides was added to them: violet, Kalanchoe, pine needles, onion, garlic, and orange. The changes in the state of the cups' contents were monitored. The results of the experiments can be seen in Figures 1-2.



Figures 1-2 Effect of phytocides of some plants on colonies of organisms.

During the laboratory experiment, it was found that phytoncides have an inhibitory and suppressive effect on the growth and reproduction of microorganisms.

A comparative analysis of the effect of phytoncides on organisms of different levels was carried out and it was found out and experimentally proved that the strength of the effect of phytoncides of different plants on organisms is different. According to the data obtained during the laboratory experiment, it is possible to classify plants according to the strength of their phytoncides. Garlic and pine needles had the strongest effect, followed by orange, and then Kalanchoe. Onions and violets had the weakest effect. In the control samples, without the addition of phytoncides, there was a continuous growth of microbial colonies.

I also decided to find out which indoor plants have the highest content of phytoncides in their composition. Plants with large leaves and a large number of pores on them are most suitable for maximum air purification in closed rooms. The record holder among such plants is crested chlorophytum, and it prefers a highly polluted air environment. Four chlorophytum plants can purify the air in a 10 m² room.

Another fairly common houseplant that releases phytoncides that kill

streptococci and staphylococci is indoor geranium, or pelargonium. It is recommended to place this plant in bedrooms and rest rooms. The scent of geraniums calms a person, which is very important in case of insomnia, neuroses and stress.

Another phytoncidal plant is the variegated dieffenbachia. It cleanses indoor air from toxic substances, so the place to place it is windows facing a noisy highway, factory, or gassed premises of enterprises.

Ficuses effectively purify the air from poisonous formaldehyde, and they not only absorb toxic substances but also convert them into sugars and amino acids. It has been found that ficuses successfully filter out benzene, trichloroethylene, and pentachlorophenol evaporation products from the air.

By having a large number of plants at home or at university, you can partially protect yourself, because it is known that plants reduce the number of pathogens in the air thanks to their phytoncides. It is estimated that 5-7 plants are enough for a room of 19-25 m³, for example: 1-2 myrtle, 2 flowering begonias, 2 aglonemes, several pilea and pelionia bushes.

Citrus fruits – lemon, orange, tangerine – will fill the room with aroma. They are easy to grow from a seed. They will help to cope with fatigue and apathy. Just rub the leaf with your fingers and smell it. It is no coincidence that in Japan, essential oils of lemon or orange are sprayed in workshops, and the Japanese know what efficiency is.

Our modern universities are full of computers, TVs, and electrical appliances. All of them emit radiation that is harmful to health, so you should grow cacti and place them near these devices. Cacti absorb harmful radiation.

Thus, landscaping in higher education institutions can have a positive impact on the indoor air environment. The antimicrobial effect is combined with the emotional impact of some plants.

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INFLUENCE OF RUSSIA'S WAR AGAINST UKRAINE ON THE CONDITION OF UKRAINIAN LANDS

The article considers the problems and consequences that arose and are arising during the war on our land, what kind of environmental changes are the combats making on the environment, and what work we shall have to do when all this is finished.

Keywords: soil, environment, consequences for the environment, consequences of war, nature conservation areas, biodiversity.

During the first month of Russia's full-scale invasion of Ukraine, activists recorded more than 100 crimes against the environment committed by Russian troops. War mercilessly destroys all aspects of nature - air, water, soil, plants. Seizure and shelling of nuclear power plants, widespread explosions of equipment and ammunition, other man-made disasters that threaten to make the surrounding areas uninhabitable. The longer the war lasts, the more damage it will do to the environment, and the more consequences we will have in the future. On the one hand, military actions have a negative impact on the environment, and on the other hand, the resources that go to war could be spent on preserving the environment or on resource-efficient technologies [1].

In the conditions of war, the attention of the authorities is focused on such urgent issues as financing the army, settling refugees and providing aid to the wounded. But at the same time, it is necessary to pay attention to other possible consequences of the war, and to study them comprehensively, since problems of the state of the surrounding environment can easily turn into threats of a social nature [2].

Approximately 200 properties of the Emerald Network, covering 2.9 million hectares, are under threat of destruction. The Emerald Network is a network of protected areas created to protect species and habitats that need protection at the European level but are located outside the EU. They provide a habitat for thousands of species of flora and fauna. These territories play an important role in protecting biodiversity and preserving the climate [3].

Environmentally destructive explosions are the direct consequences. In addition, the Russian-Ukrainian war takes place in the spring, when animals wake up, birds return and all creatures prepare for reproduction. Habitat destruction and noise pollution negatively affect the breeding season. The burning of explosive ammunition and non-metallic parts of weapons pollutes the soil and water with heavy metals and toxic elements. Not to mention the tons of scrap metal scattered around the forest plantations [4].

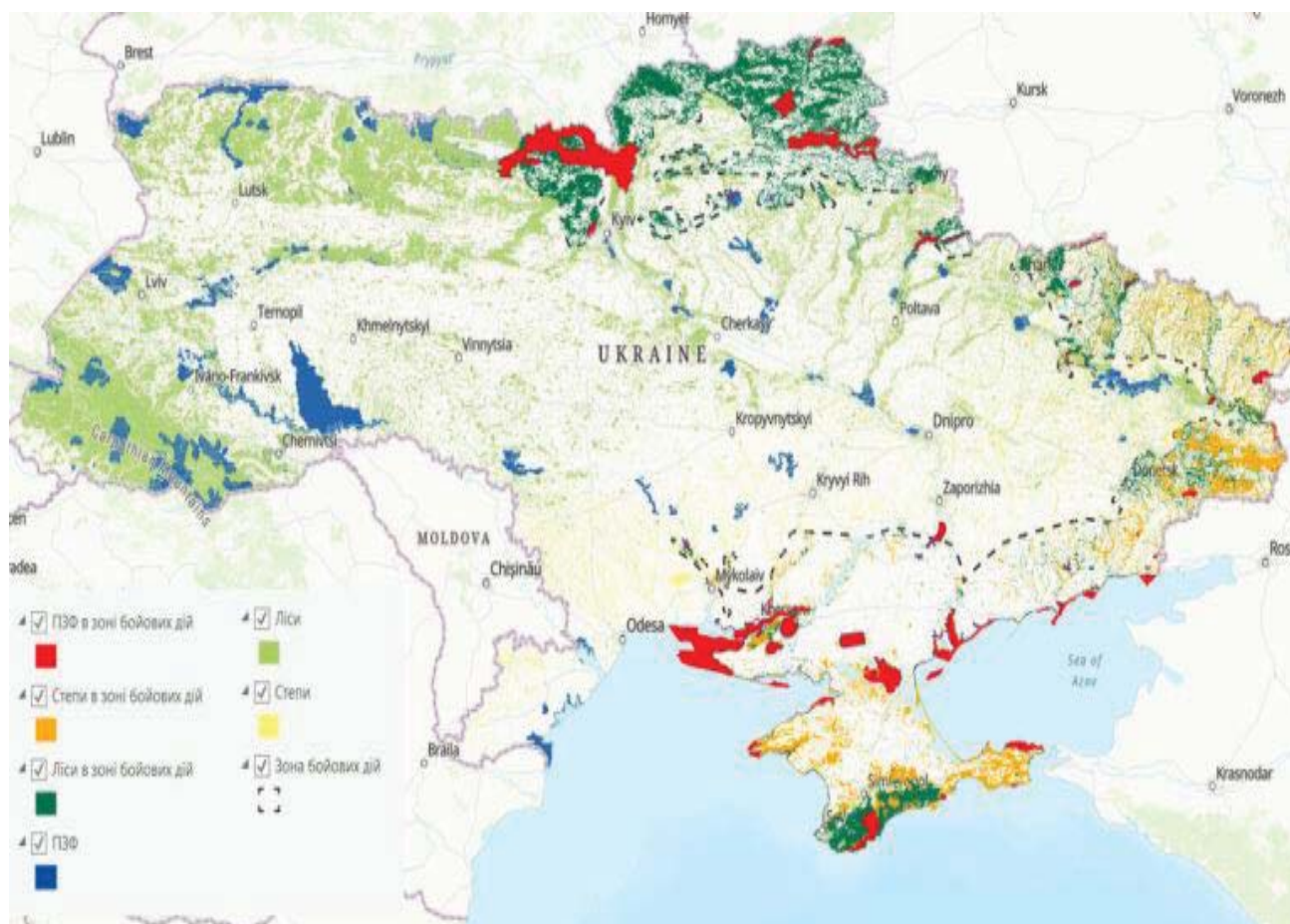


Figure 1 – Visualization of the affected natural territories, resulting from the military invasion, according to the data of the NGO "Ukrainian Nature Conservation Group".

Most of the migratory corridors of birds now pass over the war zone. All of this can cause the birds to become restless, exhausted due to changing routes or not being able to rest, and coming under fire [3].

The indirect impact of hostilities on the environment is not caused by fire or shelling, but, for example, by the loss of electricity in mines that require water to be pumped out. Without electricity, the pumps would not operate and the mine would be flooded with toxic or radioactive waste seeping into the groundwater [4].

What will happen after the war? After the war, we will reap the fruits of hostilities. Destruction of ecosystems, soil pollution and reduction of biodiversity, increase in the number of pests and diseases of the forest. In order to rebuild the country, we will also need a significant amount of natural resources. There is also a risk that Ukraine will not be able to respond to climate change. This is very important, because war contributes to climate change, and the reconstruction of the country will inevitably entail greenhouse gas emissions [1].

It is important that the recovery plan of Ukraine includes measures for the restoration and preservation of ecosystems, and the plans for the reconstruction

of settlements include nature-oriented solutions and measures for adaptation to climate change [3].

Since we expect significant chemical contamination of soils and waters, it is important to take care of an effective environmental monitoring system after the war. This would make it possible to record the real volume of environmental damage and allow us to take the most effective measures to avoid further deterioration of the situation and to restore ecosystems to a safe state - both for humans and wildlife [1].

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EFFECTIVE WAYS TO REDUCE HARMFUL EMISSIONS FROM AUTOMOBILE TRANSPORT

The publication lists the existing and prospective ways of reducing harmful emissions from road transport.

Keywords: zero level of harmful emissions, automobile transport, reducing harmful emissions

Today, the problems of environmental pollution from transport infrastructure are quite acute in Ukraine. This is the direct impact of road, rail, air and water transport, as well as anthropogenic impact on the environment during the design, construction and operation of linear transport facilities.

Tymochko T.V., head of the public organization All-Ukrainian Ecological League, indicates that about 55% of the total amount of harmful inputs, which include more than 200 different compounds, including: oxides of carbon, lead, nitrogen, formaldehyde, and in particular impurities, are accounted for by motor vehicles aromatic carbohydrates, carcinogens, including surfactants, among which there are many mutagens.

Iryna Bondarenko, an expert on sustainable mobility of the public organization Ecodia, points out that, in addition to air pollution, transport is the source of approximately 12% of greenhouse gas emissions in Ukraine, which cause climate change.

One of the most effective ways to reduce harmful emissions from road transport is a gradual increase in the share of electric cars in the total number of cars and the gradual replacement of cars with internal combustion engines by electric cars with a zero level of harmful emissions.

The second of the most effective ways to reduce harmful emissions from road transport is to replace petroleum products with a more cost-effective and environmentally friendly option. The leading alternative for oil consumers is the hydrogen engine.

By 2030, the EU will already have 100,000 hydrogen-powered trucks on the roads and build 1,500 hydrogen filling stations for them, the President of Hydrogen Europe Valerie Bouillon-Delparte announced this plan. And this is not just the plans of a startup, but a real program supported by 62 companies in the production of cars, components and hydrogen fuel cells.

Recently, the aerospace company Astron Aerospace (USA) introduced the environmentally friendly internal combustion engine Astron Omega 1, which can become an alternative to electric motors. The Astron Omega 1 is similar in design and operation to a Wankel rotary engine, but according to the developers, their unit is a completely linear device that has no sealing problems. The design makes it easy to adapt it for different vehicles, including two-wheelers. Developers claim

that regardless of the type of fuel, which can be any, the level of engine emissions is very low.

The emergence of an internal combustion engine with a very low level of emissions, which can work on any type of fuel, can also become one of the most effective ways to reduce harmful emissions from road transport.

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THE ROLE OF ENVIRONMENTAL EDUCATION IN THE DEVELOPMENT OF ECOLOGICAL CULTURE

This publication discusses global environmental problems of today and the role of environmental education in the development of ecological culture.

Keywords: ecological culture, global environmental problems, environmental education.

Ecological culture is a type of human activity transmitted through generations and its relationship with the environment that promotes a healthy lifestyle, sustainable socio-economic development, ecological safety of the country and each individual. It is a means of self-organization of human essential forces in the conditions of a specific natural environment. It includes a range of issues related to human use of nature, transformation of nature according to their interests, as well as the consequences of such activities.

The global environmental problems of the Earth are associated with climate change, depletion of the stratospheric ozone layer, acidification, tropospheric ozone, chemicals, waste, biodiversity, surface Waters, marine and coastal environments, soil degradation, the state of the urban environment, and the risks of technological and natural disasters.

As we can see, humanity is facing a large number of problems. Scientists cannot fully understand the causes of some of them and their connection with anthropogenic activity. But the need for urgent changes in the daily life of the people becomes urgent. If people continue to move forward in such a harmful way for the future, there will be no future. Solving global environmental problems begins with ourselves, our families and communities, with a change in consciousness in order to preserve our environment comfortable, safe, and diverse.

The purpose of environmental education is to form a responsible and caring attitude towards nature based on environmental awareness. This involves compliance with moral and legal principles of nature management and propagation of ideas on its optimization, active study and conservation of biodiversity.

Tasks of environmental education include:

1) acquisition of leading ideas, basic concepts and scientific facts based on which the optimal influence of humans on nature and nature on humans is determined;

2) understanding of the multifaceted value of nature as a source of both material and spiritual development of society;

3) mastering practical knowledge, skills, and rational nature use abilities, developing the ability to evaluate the state of the natural environment and make

the right decisions to improve it;

4) the development of skills in predicting the possible consequences of one's activities in nature;

5) formation of the concept of interrelationships in nature;

6) development of a spiritual need for communication with nature, the desire to explore the surrounding nature in unity with moral experiences;

7) formation of a desire for active action towards improving and preserving the natural environment, promoting environmental knowledge and an intolerant attitude towards harmful human actions towards nature.

The main principles of environmental education are:

1) interdisciplinary approach in shaping the ecological culture of students;

2) purposefulness, systematic and continuous communication of students with the environment in the process of cognitive, gaming, labor and other types of activity;

3) unity of intellectual and emotional-volitional aspects in the activities of students aimed at studying and improving the state of the environment;

4) interconnection of local, regional and global ecological problems;

5) predictability, which implies responsibility for preserving the living environment for future generations.

Environmental education is carried out at all stages of schooling, each stage has specific goals and objectives, and an appropriate methodology is selected taking into account the age characteristics of students.

At the I stage (grades 1-6) - initial ideas about the environment, living and non-living nature, and attitudes towards nature are formed, which are manifested in concrete behavior at the elementary level (observing seasonal phenomena in nature, participating in greening the school, observing rules of behavior in nature).

At stage II (grades 7-8) - the leading ecological problem is the preservation of the diversity of plant and animal species. Students should be able to recognize species of plants and animals in nature, explain their relationships with the environment, identify adaptation to conditions of coexistence in natural communities, conduct phenological observations, and follow rules of behavior in nature.

At stage III (grade 9) - the central ecological problem is the protection of human health from the negative consequences of anthropogenic activity. Students should understand the harm to human health caused by smoking, alcohol, HIV infection, the harmful effects of pollutants on the human body, the dangerous effects of toxic substances on human health at different stages of ontogenesis, and be able to provide assistance to victims.

At stage IV (grades 10-12) - the main ecological problem is directed evolution (the emergence of new directions in natural selection under the influence of anthropogenic factors, which can have unpredictable catastrophic consequences). Students should be able to evaluate the impact of human activity on natural ecosystems and biodiversity, use ecological knowledge in their own

activities.

So, ecological education contributes to the formation and development of ecological consciousness in the individual - the ability to adequately assess the state of the surrounding natural environment and in every way contribute to its improvement with their actions, or at least not worsen it with environmentally unfriendly actions.

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THE ECOLOGY OF WAR

The publication looks at the problems of war atrocities affecting the environment considering the fact that military actions contribute to an incredibly large amount of CO₂ emissions.

Key words: gunpowder, explosives, environment, pollution, poisonous substances.

There are many environmental problems to be solved in the world, such as waste sorting and processing, emissions of toxic gases into the atmosphere from industry and transportation, etc. In Ukraine, there is another urgent and less common problem - the ecology of war.

Since the new stage of the full-scale war of Russia against Ukraine, which started on February 24th, 2022, millions of artillery and mortar shells have been used. How does an artillery or mortar shell fly out of the barrel? The shell is propelled by the recoil that happens due to the combustion of fuel. The fuel typically consists of gunpowder, explosives of C-5, C-6 based on nitroglycerin. Each shot, artillery systems that use 152 mm and 155 mm shells can use up to 10kg of fuel, and the total weight of the powder charge can reach 40 kg. Every time these substances burn, toxic chemicals are released into the atmosphere:

- carbon monoxide (CO) – causes poisoning and suffocation;
- nitrogen oxide (NO) – causes irritation of the mucous membranes and respiratory tract;
- hydrogen sulfide (H₂S) – has an unpleasant odor and is poisonous to humans in high concentrations;
- dust and other large particles – products of combustion;
- other toxic substances.

As a rule, 152 mm and 155 mm shells carry about 10 kg of explosive. Typically, the explosive mixture includes TNT (trinitrotoluene), 1,2,3-trinitroxypropane, 2,4 Dinitroanisole, NTO (Nitrotriazolone), RDX (cyclotrimethylene trinitramine), or their combinations, as well as other chemicals (aluminum, barium, lead) that affect the characteristics of the shell. After the shell explodes, the following toxic gases are released:

- nitrogen dioxide (NO₂);
- phosgene (COCl₂);
- sulfuric acid (H₂SO₄);
- nitrogen oxide (NO);
- hydrogen cyanide (HCN).

Also, it should be noted that military actions contribute to an incredibly large

amount of CO₂ emissions due to the consumption of large volumes of fuel by military equipment. For example, the amount of fuel consumed by military equipment is:

- Ural and similar military trucks - 40 liters per 100 kilometers;
- T-64 - from 300 to 400 liters per 100 kilometers;
- T-72 - from 300 to 400 liters per 100 kilometers;
- T-80 - from 400 to 500 liters per 100 kilometers;
- Different types of AFV, IFV, and APC - 100-250 liters per 100 kilometers;
- Other types of vehicles used in the war.

It's difficult to imagine how much CO₂ is released into the atmosphere by using thousands of this equipment daily.

We must not forget that Russia strikes targets in chemical, metallurgical, energy, and other infrastructure. Hitting such objects causes irreversible processes of emissions of a large number of poisonous substances. Examples of enterprises that have been destroyed or damaged include:

- Azovstal Metallurgical Plant;
- Mariupol Metallurgical Plant named after Ilyich;
- Avdiivka Coke and Chemical Plant;
- Kremenchuk Oil Refinery;
- Odessa Oil Refinery;
- Shebelinsky Oil Refinery;
- Lysychansk Oil Refinery;
- Severodonetsk Azot Association;
- Polysan Paint and Varnish Plant, Sumy;
- Numerous shelling of tanks containing ammonia, nitric acid, and other.

All of these substances end up in the environment and are toxic to animals, plants, and humans. When they enter bodies of water, they destroy ecosystems. When combined with oxygen and water, toxic compounds fall as acid rain, changing the pH level of the soil, causing burns in plants, irritating the mucous membranes of animals and humans.

In conclusion, it can be noted that in ecological rankings, Ukraine consistently ranks among the worst in Europe. After the war, the country faces the worst environmental situation it has experienced in recent times.

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STATE ENVIRONMENTAL CONTROL IN THE SYSTEM OF ENVIRONMENTAL SAFETY

The author investigated the current state of environmental control in Ukraine, proposed ways to solve problems in the field of environmental safety and gave examples of articles dealing with greening of accounts plan of enterprises. The work of the state environmental control authority has been analyzed on the example of a metallurgical enterprise and the ineffectiveness of the work of the State Environmental Control Authority has been proved as well.

Key words: State Environmental Control Authority, environmental safety, environmental damages, lawsuits.

Today, many developed countries of the world prioritize the issues of environmental problems, the elimination of their consequences and the integrity of ecosystems. Ukraine began to reform the field of environmental control in order to eliminate all obstacles to its effective implementation, too. Analysis of the state and trends in the development of environmental control in the environmental safety system will help identify existing problems and develop ways to solve them.

Environmental control is carried out in order to ensure compliance with the requirements of the legislation on environmental protection by every state body, enterprise, institution, organization, and citizen. The following legal acts determine the legal principles of environmental control in Ukraine: the Constitution of Ukraine and the Law of Ukraine "On the Basic Principles of State Supervision (Control) in the Field of Economic Activity" [1]. Today, environmental control in Ukraine is carried out in a low quality, dishonest manner and does not guarantee environmental safety for the state. It is necessary to reform the industry and adapt the legislation in this area to European norms. The existing draft law 3091 was the first step towards these changes. However, there are many things in it that need to be improved. Today, the implementation of state supervision (control) in the field of environmental protection is ambiguous. Although the total number of submitted claims and lawsuits have positive trends, they still attract little attention of the public and do not change in any way (fig. 1).

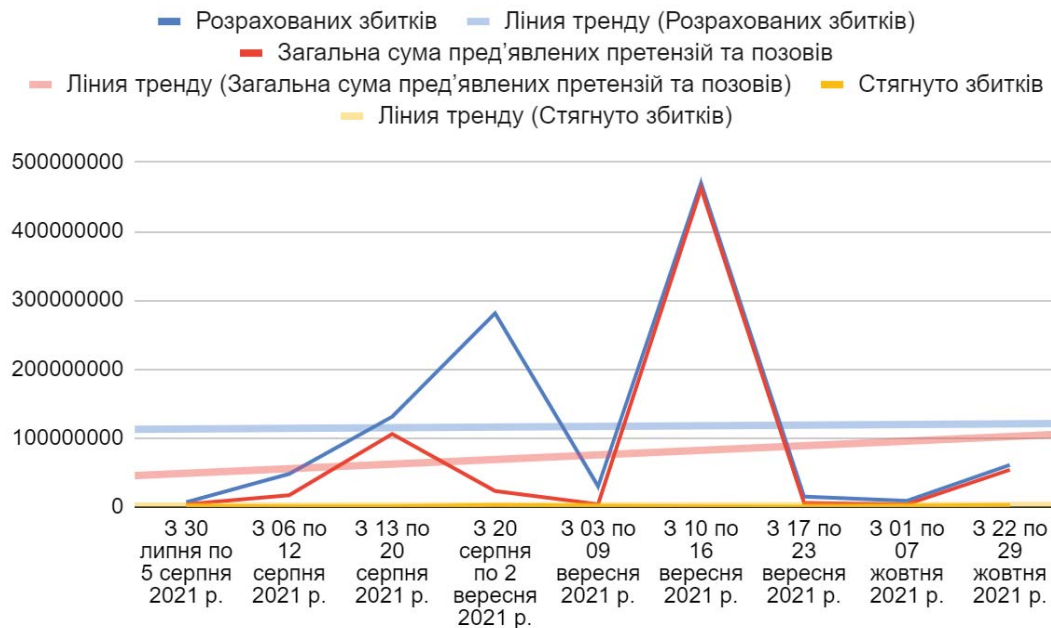


Figure 1 - Status and trends of calculation, presentation and collection of damages

In Kharkiv region, 27328194 UAH of damages were calculated and predicted, and 3067918 UAH were incurred. In all other regions, the difference between these indicators looks similar [2].

We have analyzed the implementation of state environmental control on the example of the State Enterprise "Powder Metallurgy Plant" in the city of Brovary, Kyiv region, which covers the following activities: forging, pressing, stamping, profiling, powder metallurgy. The plant produces metal powders by spraying molten metal with high-pressure water, as well as a wide range of composite materials [3]. Metallurgical complexes can be classified as a branch of economic activity that has the greatest impacts on the environment and human health. Environmental control of metallurgical enterprises should be carried out as often and efficiently as possible, it is impossible to allow excessive ingress of pollutants from this enterprise into the environment.

Low-quality state control in the field of environmental protection was carried out at the State Enterprise "Powder Metallurgy Plant" and not all inspection results were entered into the tables on the website. In addition, the measures of influence (response) and sanctions were not applied, which in this case should be, because the enterprise does not comply with many regulatory and legal acts and thereby harms the environment and humanity. However, the event of state supervision took place, and it is good that they found a violation of the requirements of the law, and an administrative document was handed over to eliminate the violations of the business entity [4].

No No	Description of the actual circumstances and relevant evidence (written, material, electronic or other, confirming the existence of a violation of the requirements of the law)	Normative-legal act (NLA) or normative document, the requirements of which are violated	Part of the NLA
11	It does not determine the composition and properties of the generated waste	1. On waste, Law of Ukraine, 187/98-BP, 1998-0305, Law of Ukraine	1.1
22	A passport has not been developed for each gas treatment plant	1. On Protection of Atmospheric Air, Law of Ukraine, 2707-XII, 1992-10-16, Law of Ukraine	1.1
33	Allows mixing of waste	1. On waste, the Law of Ukraine, 187/98-BP, 1998-03-05, Law of Ukraine	1.1
44	Does not submit a waste declaration in the form and in the order approved by the Resolution of the Cabinet of Ministers of Ukraine	1. On waste, the Law of Ukraine, 187/98-BP, 1998-03-05, Law of Ukraine	1.2
55	Does not comply with the permit conditions and rules of special water use	1. Water Code of Ukraine, Code of Ukraine, 213/95-BP, 1995-06-06, Code of Ukraine	1.3
66	Discharge limits of pollutants are not observed	1. Water Code of Ukraine, Code of Ukraine, 213/95-BP, 1995-06-06, Code of Ukraine	1.1
77	It does not monitor the quality and quantity of water discharged into bodies of water	1. Water Code of Ukraine, Code of Ukraine, 213/95-BP, 1995-06-06, Code of Ukraine	1.1

More efforts should be made to minimize environmental risks from this type of activity in the future. Moreover, it would be advisable to supplement the company's plan of accounts with articles: 110 treatment facilities, 136 demolition of treatment facilities, 851 expenses for treatment facilities, 747 income from the use of secondary raw materials, 810 expenses for the use of energy from renewable sources, 948.1 excess emissions and discharges of pollutants, because in the course of work we found out that this enterprise does not comply with the requirements of environmental legislation [5].

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**MONITORING OF LONG-TERM DYNAMICS OF EARTH'S SURFACE
TEMPERATURE USING REMOTE SENSING METHODS:
THE KIROVOHRAD OBLAST CASE STUDY**

The publication presents the results of monitoring of the long-term dynamics of the temperature of the earth's surface in the Kirovohrad oblast using remote sensing methods.

Key words: monitoring of temperature changes, climate change, land surface temperature, Google Earth Engine, MODIS, remote sensing.

Introduction. Monitoring of the long-term dynamics of the temperature of the earth's surface in the Kirovohrad oblast using remote sensing methods is very important today. Due to the methods of remote sensing, we can check the state of the long-term dynamics of the Earth's surface temperature without any financial costs, process the data very efficiently and predict future changes over a certain period of time. A change in the temperature of the earth's surface leads to a change in climate, which in turn leads to global warming. An increase in surface temperature leads to negative consequences for the biosphere, in turn, for ecosystems, starting with the urban ecosystem and ending with a change in the species diversity of living organisms. According to the report of the Intergovernmental Panel on Climate Change (IPCC) for 2022, it was determined that the change in the state of the climate, which can be determined by changes in the variability of its properties of the state of the climate and by changes in the average value of the state of the climate and that persists for decades or longer. Climate change can be caused by anthropogenic factors or natural internal or external processes, such as volcanic eruptions, as modulation of solar cycles. It should also be added about anthropogenic changes in the composition of land use, use of natural resources and changes in the composition of the atmosphere due to industry and increased emissions of exhaust gases from transport, etc. The United Nations Framework Convention on Climate Change (UNFCCC), in its article 1, defines climate change as: "climate change that is directly or indirectly related to human activity, that changes the composition of the global atmosphere and that, in addition to natural climate variability, which is observed during comparable periods of time". Thus, the UNFCCC distinguishes between climate change caused by anthropogenic activities that change the composition of the atmosphere and climate variability caused by natural causes [1].

Theoretical part. The relevance of monitoring the long-term temperature of the earth's surface in the Kirovohrad oblast with the help of remote sensing methods is precisely the fact that very few works have been carried out on this topic, and even more so in the Kirovohrad oblast of Ukraine. A quantity that plays an important role in tracking the impact of changes in climatic conditions on our

environment from a global, regional or local scale is Land Surface Temperature (LST). Changes in the temperature of the earth's surface represent, on the one hand, climate change processes, such as global warming, which can lead to negative consequences for the environment, and on the other hand, land surface processes, such as deforestation, mining, and urbanization. As one of the core climate variables (ECV), LST is recognized by the World Meteorological Organization and has a close relationship with near-surface air temperature. Satellite LST has become an invariable tool for multiple monitoring of conditions in large areas. However, in order to make climate statements, as well as to quantify the impact of Earth processes, namely the Earth's surface variables over long periods of time, these processes require sensors and special applications, such as the Moderate Resolution Imaging Spectroradiometer (MODIS), which is already available more than 30 years [2]. Kirovohrad oblast is an oblast in the central part of Ukraine. It was formed on January 10, 1939, the oblast center is the city of Kropyvnytskyi. It is located at the confluence of the Dnieper and Southern Bug rivers in the south of the Dnieper Highlands. The area of the region is 24.6 thousand km² (4.1% of the territory of Ukraine). The length of the region from north to south is almost 148 km, from west to east – 335 km [3]. Google Earth Engine is a computing platform that allows users to run geospatial analysis on Google's infrastructure [4]. MODIS (or Moderate Resolution Imaging Spectroradiometer) is a key instrument aboard the Terra (originally known as EOS AM-1) and Aqua (originally known as EOS PM-1) satellites [5]. The Terra Moderate Resolution Imaging Spectroradiometer (MODIS) Land Surface Temperature/Emissivity 8-Day (MOD11A2) Version 6.1 product provides an average 8-day per-pixel Land Surface Temperature and Emissivity (LST&E) with a 1 kilometer (km) spatial resolution in a 1,200 by 1,200 km grid. Each pixel value in the MOD11A2 is a simple average of all the corresponding MOD11A1 LST pixels collected within that 8-day period [6].

Results. The region of interests (ROI) of the Kirovohrad oblast (Ukraine) was selected using the Google Earth Engine space image decoding program using the MODIS module (MOD11A2.006 Terra Land Surface Temperature and Emissivity 8-Day Global 1 km).

Time filtering of the collection starting from 2000 was carried out. The period of time is 20 years. Filters were applied to the collection, and the average temperature of the Earth's surface was determined from the data set. The minimum temperature was 7°C, the maximum temperature was 40°C. For visualization, a color palette of indicators was adopted, namely the following colors: "darkblue", "blue", "limegreen", "yellow", "darkorange", "red". If we take the difference between the maximum value and the minimum value, the difference is equal to 33°C, that is, each indicator has a value of 5.5°C. With these data, a space image was prepared (Fig. 1).

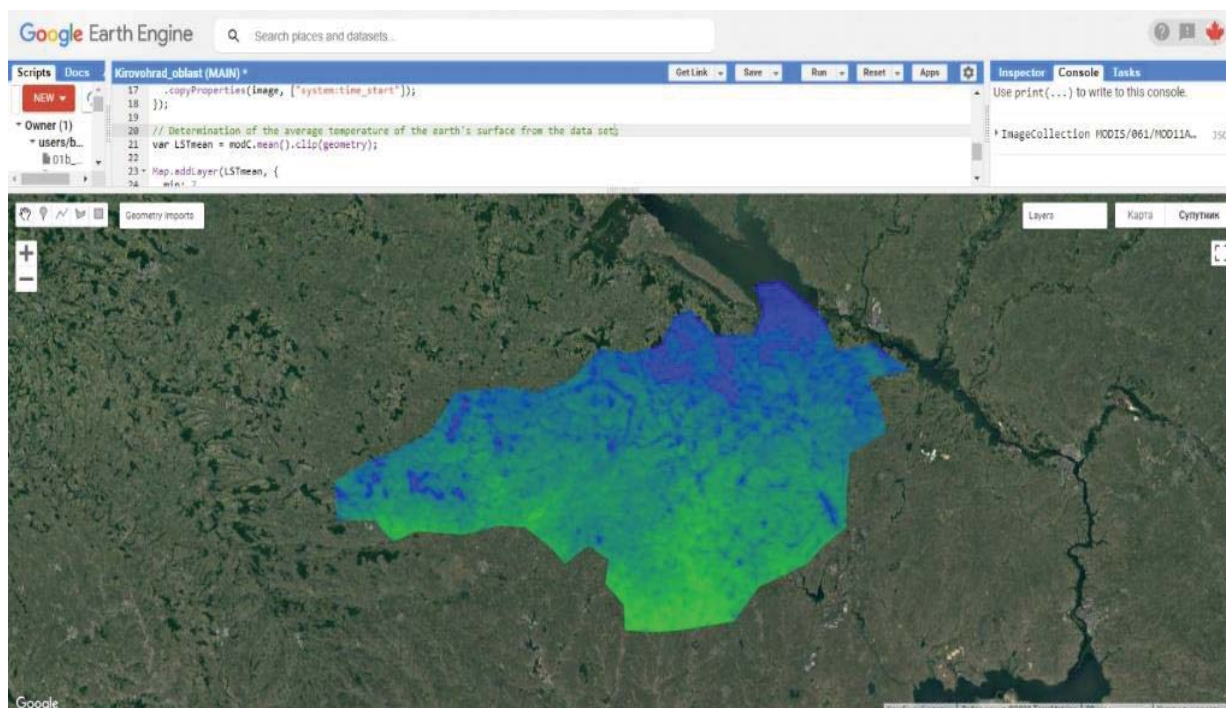


Figure 1 – Visualisation of the long-term dynamics of the earth's surface temperature in the Kirovohrad oblast (Ukraine) using remote sensing methods.

The space image is dominated by more color palettes, such as: "darkblue", "blue", "limegreen". That is, it can be emphasized that, according to MODIS data, the temperature varies from $+7^{\circ}\text{C}$ to approximately $+18-19^{\circ}\text{C}$ in individual locations, that is, zones of increased temperature. According to sources, the average air temperature during the year in the Kirovohrad oblast usually ranges from $+7.7^{\circ}\text{C}$ to $+8.5^{\circ}\text{C}$. This is associated with mild winters with noticeable thaws, as well as warm, sometimes even dry summers [7]. It is possible to compare data from a space image and meteorological data. Therefore, the lower threshold of average temperatures from the selected temperature of $+7^{\circ}\text{C}$ from the space image and from official data almost coincide. An increase in temperature in some locations may be associated with active anthropogenic activity. It is also clear from the space image that the average temperatures are higher in the south of the oblast.

Conclusions. Monitoring of the long-term dynamics of the Earth's surface temperature in the Kirovohrad oblast using remote sensing methods can provide us with temperature change during the time of interest. Based on MODIS data, the long-term dynamics of the earth's surface temperature were calculated, as well as the long-term dynamics of the earth's surface temperature in the Kirovohrad oblast were visualized using the Google Earth Engine application. Average temperatures in the Kirovohrad oblast (Ukraine) over a period of 20 years are visualized on a satellite image. As a conclusion, we can add that the development of this topic will be in the next scientific researches.

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HOW THE WAR AFFECTS THE HYDROECOSYSTEM OF UKRAINE

This publication provides an overview of the impact of military operations on the territory of Ukraine on hydroecosystems.

Key words: military operations, hydroecosystems, water resources, groundwater, pollution, ecological situation, protection, restoration, biodiversity.

The war in Ukraine has endangered national security and has major economic consequences for all countries. Natural ecosystems suffer the most from war, in particular, hydroecosystems such as rivers, reservoirs, groundwater, lakes, and swamps can be seriously damaged as a result of military operations [1]. Water resources play an important role in the life of every living being, therefore the study of the impact of the military on the hydroecosystem of Ukraine is extremely relevant nowadays.

Studies of the impact of military actions on hydroecosystems were conducted in many countries of the world. According to research, war can cause significant changes in hydrological processes, such as a decrease in the level of groundwater, pollution of water resources and changes in water regimes [2-4]. Thus, damage to public utilities leads to water pollution by organic substances. On March 14, 2022, there was a shelling of the water treatment facilities of the Vasylivsk Water Supply and Drainage Operation Department (the village of Verkhnya Krynytsia, Zaporizhzhia Region). As a result, the building of the sewage pumping station №1, which supplies wastewater from the city of Vasylivka to the sewage treatment plant, was destroyed. Return water from the city now enters the Dnipro without any treatment. Untreated discharges contain a large amount of organic substances, helminth eggs, pathogenic bacteria, sulfates, chlorides. Such pollution can lead to large-scale blooming of water in the Dnieper and Black Sea with the onset of warmer weather [17-18]. Also, military actions can lead to the destruction of coastal zones, which in turn can lead to increased erosion and reduced water quality. In addition, war can have an impact on the biodiversity of hydroecosystems, in particular, on the decrease in the number of various species of fish and other aquatic organisms [5,12]. According to the Ministry of Environmental Protection and Natural Resources, according to preliminary estimates, as of March 1, 2022, the aggressor is conducting combat operations on the territory of 900 objects of the nature reserve fund with an area of 12406.6 km², which is about a third of the area of natural of the reserve fund of Ukraine. About 200 territories of the Emerald Network with an area of 2.9 million hectares are under threat of destruction. The Emerald Network is a network of protected areas created for the preservation of species and habitats that require protection at the pan-European level, but are located in non-EU countries. All this habitat for

thousands of species of plants and animals. These areas play an important role in protecting biodiversity and preserving the climate. The habitats of some rare and endemic species and habitats found themselves in the zone of active hostilities, which threatens their existence, for example, virgin unplowed steppes, chalk slopes in Donetsk region, coastal habitats in the southern regions, swamps in the north [14].

Ukraine has repeatedly faced military conflicts that had an impact on the country's hydroecosystem. In particular, the war in the east of Ukraine in the period from 2014 to 2022 led to a significant decrease in the level of groundwater and pollution of water resources, which may affect the ecological situation in the region in the long term [5, 10-11]. In recent months, the water level in the Kakhovsky Reservoir began to drop rapidly after the Russians opened the gates of the Kakhovsky Dam. The situation around Ukraine's largest reservoir attracted the attention of the mass media, and it was actively commented on by scientists and officials. "Ukrainian Pravda" found out how dangerous the decrease in the water level in the Kakhovsky Reservoir is. Also, who and how can solve this problem and why the reservoir itself is called part of a "controlled ecological disaster". The Kakhov reservoir is the lowest, that is, the most downstream reservoir on the Dnieper. In order to create it, in the 1950s of the last century, the river was blocked by a dam of the Kakhovskaya HPP. This is how an artificial reservoir more than 200 kilometers long with a maximum width of more than 20 kilometers was formed. Dozens of villages were once located on the site of the Kakhovsky Reservoir. Also, a man-made reservoir flooded the Velikiy Lug – huge river floodplains, the history of which is closely connected with the Zaporizhzhya Sich. On the left bank of the reservoir is the Zaporizhzhya NPP, which is currently controlled by the Russians. The Kakhovsky canal supplies water from the reservoir to the villages and fields of the Kherson and Zaporizhzhia regions. And the Dnipro-Kryvyi Rih canal supplies water to the industrial districts of Kryvyi Rih. The peculiarity of both channels is that water cannot flow through them by itself, but only with the help of pumps. On the other hand, water flows independently to the Crimea through the North Crimean Canal, thanks to the natural slope. But only on the condition that the reservoir itself maintains a sufficiently high level (According to the materials of online publications, gazeta-fp.com.ua) [14]. In addition, the war led to the destruction of many water supply and water treatment facilities, which in turn reduced water quality and worsened the sanitary-epidemiological situation in the war zone [4, 10]. The military actions and the inhuman unsanitary conditions created by the occupiers in the territory of Mariupol, violations of drainage, and water supply caused the spread of such intestinal infections as typhoid fever. From the latest news and from the information that comes to us, the problem with drainage and water supply is big. Water is not centrally supplied to the population, the majority do not have water at all. The situation is also problematic due to the fact that the occupiers do not allow relatives to be buried. There is information about the demolition of houses under the rubble of which people's bodies are. This is one of the worst factors

affecting the spread of intestinal infections. In some regions – such as Kherson region, Donetsk region, Mariupol itself – the temperature can now reach 40°C. This leads to the fact that the corpses decompose, a large number of bacteria multiply, which gradually, falling into the soil, enter the water. Also, as a result of the war, the coastal zones of Donbas were destroyed, which can cause increased erosion and a decrease in the biodiversity of hydroecosystems [9-8].

Scientific studies confirm that military actions have a serious impact on hydroecosystems and water resources. The war in Ukraine has led to a significant decrease in the level of groundwater and pollution of water resources, which has serious consequences for the ecological situation in the region. For the further protection and restoration of hydroecosystems, it is necessary to conduct studies of the impact of military operations on water resources and develop measures for their protection and restoration. Such measures may include the restoration of destroyed water treatment and water supply systems, the preservation and restoration of biodiversity of hydroecosystems, and the implementation of effective mechanisms for controlling the use of water resources [1,10-15]. "The war of the Russian Federation in Ukraine is the first international conflict in the last 20 years with such significant and irreparable damage to the environment," writes the Minister of Environmental Protection and Natural Resources of Ukraine, Ruslan Strilets. The terrorist country specifically fires at civilian infrastructure facilities, destroying natural resources, creating epidemiological situations and destroying the civilian population. At the moment, due to the war, it is impossible to carry out specific studies, but all war crimes committed by Russia against Ukraine must be recorded, so that after the war, reparations can be demanded from the Russian Federation and work on the restoration of dams, cleaning of waters from oil products and other pollution. It is also necessary to solve the epidemiological problem of typhoid outbreaks and complete clearing of territories from ammunition and other consequences of war.

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SWOT ANALYSIS AS A TOOL FOR DEVELOPING A STRATEGY FOR THE TREATMENT OF HOMELESS ANIMALS

The publication presents a SWOT analysis with a study of methods of regulating the number of homeless animals in Ukraine

Key words: homeless animals, regulation of the number of animals, registration and identification of animals, sterilization of animals.

There is a problem with homeless animals in Ukraine. And the full-scale invasion intensified it even more. As animal rights activists emphasize, Ukraine is among the top ten countries with the largest number of homeless animals. With the help of a SWOT analysis, we will consider the strengths and weaknesses of such measures for dealing with homeless animals, such as registration, identification, sterilization of animals, what are the opportunities and what threats may arise. The results are presented in Tables 1-2.

Table 1. SWOT-ANALYSIS of registration and identification of animals

Registration and identification of animals	
Strengths	Weak sides
minimization of the number of homeless animals; establishment of a system of responsibility of animal owners.	it is possible to have persons who will avoid registration of animals; the impossibility of completely leveling the "shadow" animal market.
Opportunities	Threats
track the location of animals (when installing chips); quick (if necessary) finding of the owner of the animal; obtaining, thanks to the identifier, all the necessary amount of data about a certain animal; formation of an up-to-date database regarding, in particular, the number of both owned and homeless animals.	leaving animal cubs and young individuals to fend for themselves.

The SWOT analysis shows that registration and identification of animals is very important. In this process, there are more strengths and opportunities than weaknesses and threats. In particular, with the help of registration and identification, it is possible to track a lost animal, find the owner, conceptually,

form a system of responsibility of the owner, which will contribute to ensuring the epizootic well-being of the country.

Legal regulation of animal identification and registration is carried out in accordance with the Law of Ukraine "On Veterinary Medicine" [1].

Table 2. SWOT-ANALYSIS of animal sterilization

Sterilization of animals	
Strengths	Weak sides
allows to regulate the increase of homeless animals; reduces the risks of aggression in homeless animals, and accordingly, the risks of attacks on people; mostly, sterilized animals live even a bit longer.	the risk of certain (mainly temporary) problems with the animal's urinary system; sterilization of homeless animals at an inappropriate age (which often happens) can increase the risks of certain health problems of the animal; often, the metabolism of sterilized animals changes and there is an increase in weight (for prevention, feeding with special feed is necessary, which in the case of animals in shelters will not be carried out).
Opportunities	Threats
sterilization makes the animal cleaner and calmer; if the animal is sterilized, a significant proportion of people will prefer to adopt it from the shelter.	sterilization includes anesthesia, which causes a certain (albeit rare) risk of an unpredictable reaction to the anesthetic ; sterilization of dogs increases the risk of joint problems; risk of thyroid problems; increased risk of certain fatal cancers.

That is, sterilization of animals is the responsibility of every pet owner or curator, because if this procedure is neglected, then in a few years, the number of homeless animals will increase many times [2, 3].

Therefore, it can be concluded that, first of all, appropriate explanatory work should be carried out with the population at the places of residence, work and study. On the part of local authorities, there should be a mechanism for controlling the keeping and accounting of domestic animals. Registration and identification, sterilization of animals are ways to solve the problem, because the number of homeless animals will decrease, each registered animal will be in a single register, this will make it possible to identify the owner and bring him to justice in case of violation of the legal norms of keeping animals.

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