MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
V. N. KARAZIN KHARKIV NATIONAL UNIVERSITY
KARAZIN INSTITUTE OF ENVIRONMENTAL SCIENCES
SCHOOL OF FOREIGN LANGUAGES

Ecology is a priority

All-Ukrainian student English-speaking conference

March 15, 2024, Kharkiv, Ukraine

Under the General Editorship of
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Kharkiv – 2024

УДК 502/504(063)
Е20

Approved for distribution on the Internet by the decision of the Academic Council of Scientific and Methodological Council of the University:
(Protocol 6 dated 19.03.2024)

The publications contain the proceedings, which address the modern ecological problems and ways of their solution, applied ecological research and ecological consequences of the Russian-Ukrainian war.

Ecology is a priority: coll. theses of the All-Ukrainian English-speaking student conference (Kharkiv, March 15, 2024). Kharkiv: V. N. Karazin KhNU, 2024. 85 p.

Editor: N. V. Maksymenko, DSc (Geography), Prof.
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CONTENTS

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KAHOVKA RESERVOIR AND VELYKYI LUG: ARGUMENTS FOR AND AGAINST

On July 18, 2023, the Cabinet of Ministers of Ukraine adopted a resolution that provides for the restoration of the hydroelectric power plant, as well as the dam itself, which held water within the Kakhovsky Sea. That is, it is about refilling the reservoir.

Environmentalists are convinced that the reconstruction of the reservoir will bring more harm than good. The fact is that before the reservoir was flooded, the territory was called Velykiy Lug. It was one of the most important natural and historical landscapes of Ukraine. Since the 1920s, scientific and state institutions sought to create a reserve there, but the land was flooded after 30 years. In this way, fertile chernozems, agricultural lands, forests, meadows, swamps and old forests, where many rare plants and animals were found, were destroyed. For understanding, more than 500,000 hectares of fertile land were withdrawn from agricultural use, and another 100,000 hectares fell into the flood zone.

In addition, due to mistakes and miscalculations by the designers of the reservoir, in the Kamian-Dnipro district of the Zaporizhzhya region, the groundwater level rose by 2-3 meters in some places, and the land became saline. The slow flooding of the region continued until 2023. Among other negative factors, the pollution of the Dnipro River is also mentioned – the water treatment systems could not cope with the volumes of substances entering the water as a result of the operation of the hydroelectric power station.

Despite the significant resonance, the economic value of the reservoir in 2023 was insignificant. Catching of artificially populated fish species, production of a small amount of electricity. Other arguments from supporters of restoration can be compensated by the normal course of the Dnieper: water pumping and irrigation were carried out with the help of pumps, and it is more convenient for water transport without locks. As for the climatic effect, these are very doubtful. It is clear that water has a determining effect, but it is similarly provided by irrigated agricultural land. The latter are directly dependent on the Dnipro, not the reservoir.

The sustainable functioning of the Zaporizhzhya NPP depends not on the presence of a reservoir, but on the cooling pond, which remains intact for now. It is also possible to inject water into it from the branch of the Dnipro, which fits directly under the reservoir.

So, let's name two key arguments in favour of keeping the lands on the territory of the reservoir drained.

First, it is the restoration of the natural ecosystem. The reservoir was a source of evaporation and therefore water loss in the region. In addition, it was not a natural ecosystem and for 70 years remained an artificial technological structure, created by flooding the extremely rich dynamic ecosystems of the Dnipro valley. In the near future, the drained bottom will be overgrown with natural vegetation and will turn into

the largest territory of wild nature in the entire steppe zone of Ukraine. Thus, already a month after the terrorist attack, vegetation began to recover on some areas of the bare seabed. There are even seedlings of native species, including the rare white willow Salix alba.

This will have many positive consequences:

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

• the absorption of the main greenhouse gas will increase significantly;

• the populations of many rare species included in nature protection lists due to the threat of extinction will increase. In particular, it will be possible to prevent the almost inevitable disappearance of cornflower Centaurea appendicata and cornflower Centaurea konkae;

• the area of pastures and hayfields will increase;

• available stocks of valuable wild plants and animals will increase;

• spawning will resume, which will significantly enrich the fish population of the Dnipro Basin and make unnecessary the costs of maintaining several fish farms, which ensured the artificial renewal of fish resources;

• loss of fresh water will decrease, due to the reduction of the open water table;

• water quality will improve, accordingly, the condition of water ecosystems will improve;

• the diversity of water bodies will increase significantly.

• the functionality of the pan-European Dnipro meridional ecological corridor will improve.

At the same time, experts note: if the reservoir is restored, it will lead to another ecocide, because while the dam is being built, the territory will be filled with various plants and animals.

The second argument is that Velykyi Lug has extremely important historical significance. Zaporizhia Sich was located on its territory. That is, a colossal historical and archaeological heritage was partially destroyed there, but most of the artifacts could be preserved. So, the area can be explored.

The latest satellite images of the area show that a large part of the previously drained territory of the former reservoir is now covered with water. The explanation here can be very simple – the spring melting of snow brought additional moisture to the lower reaches of the Dnipro.

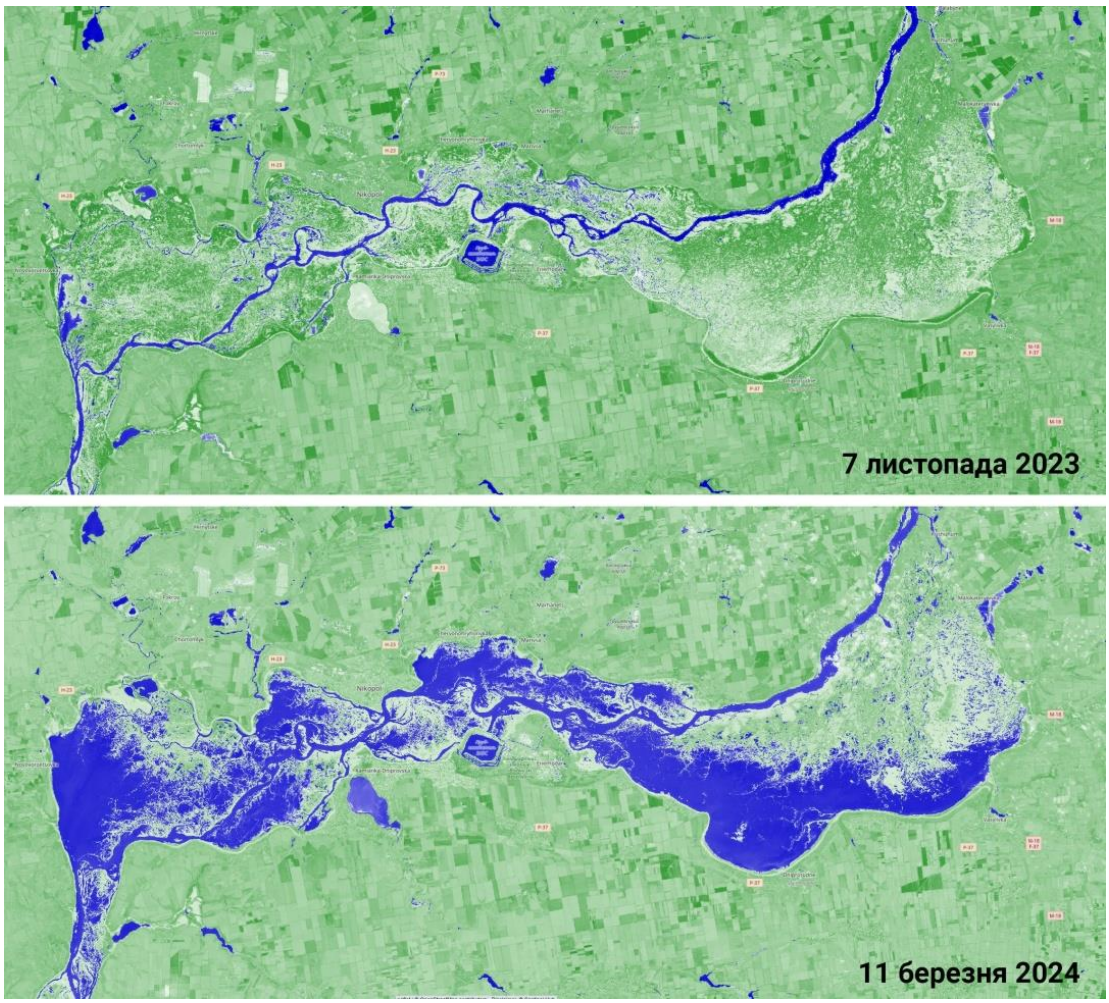

Fig. 1 Kakhovsky Reservoir

Therefore, in the absence of artificial regulation of the water level, today it is possible to observe on the territory of the former Kakhovsky Reservoir the same processes that occur on natural, unregulated river floodplains. Spring watering took place on these lands even before the construction of the hydroelectric power station for thousands of years.

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THE IMPACT OF WAR ON FOREST ECOSYSTEMS IN UKRAINE

Introduction. Currently, the environment of Ukraine, including forest ecosystems, is suffering from the military operations. This is especially noticeable in the east and south of the country. By mid-autumn 2022 alone, forest fires caused by shelling had covered about 330 thousand hectares of forests. In times of war, local monitoring in combat areas is impossible, so it is necessary to improve remote observation methods that will help analyze which areas will require priority restoration after the end of war.

The aim of the study i**s** to analyze the consequences of the impact of military operations on forests and methods of their remote study

Research methods. This paper uses the methods of analyzing information from open sources, scientific literature, mass media, generalization and systematization

Research results. The study found that during the full-scale invasion of Ukraine by Russia, about 2.9 million hectares of forests were damaged in various ways. Trees, shrubs and grass plants suffer mechanical and fire damage, the topsoil is disturbed, and forest areas are contaminated by the remains of equipment, weapons, fuels and lubricants, explosives and combustion and explosion products. Weakening of plants leads to the emergence of diseases and pests. Forest fires lead to a violation of the water-regulating, soil-protecting, sanitary and ecological functions of the forest [6]. About 1 million hectares of forests have been under occupation, including the temporarily occupied territories since 2014 [1].

The following negative factors of the impact of hostilities on forest resources have been identified:

- Forest fires as a result of enemy shelling with shells of various types and caliber.
- Damage to the soil cover of forests as a result of the movement of military equipment, construction of fortifications, and shell hits.
- Toxic emissions from explosions.
- Fall of downed airplanes and rockets.
- The use of wood as a fuel and building material.
- Mass graves of civilians and military killed by the enemy.
- A large amount of garbage, remnants of weapons, spent ammunition and shells, and military equipment.
- Unexploded ammunition.
- Fire and detonation of equipment, fuel and lubricants, and ammunition as a result of enemy shells.
- Damage by explosions and trenching to the root system of entire tree stands.
- Lack of local monitoring and timely recording of the consequences [2].

The following regions suffered the most: Donetsk, Luhansk, Kharkiv (Izyum forests), Zaporizhzhia, Kherson (Kinburn Spit, Fig. 1), Sumy, Chernihiv, Kyiv (Chornobyl zone), Mykolaiv and Crimea, as well as Rivne, Volyn and Zhytomyr regions with built defensive structures.

Fig. 1 Satellite image of the fires on the Kinburn Spit

However, despite the military actions, forests were restored on an area of 32 thousand hectares; 1.9 thousand hectares of new forests were created; 545.2 tons of forest seeds were harvested [3].

For scientifically based further forest restoration and control of plantations' condition when on-site monitoring is not possible, it is necessary to take into account remote sensing methods. Among the currently known remote methods, the following can be distinguished: satellite imagery, aerial photography from airplanes, and drone imagery.

Depending on the capabilities and objectives, these methods can be used to investigate forest areas damaged by hostilities. The safest way to use satellite imagery is to monitor the presence of forest fires, measure the area of deforested areas, the presence of damaged equipment and mass graves, as satellites are capable of capturing large areas, cannot be hit by any type of weapon, and also make it possible to track the dynamics of changes.

Drones can also be used, but only in the de-occupied territories and where the military situation allows. The great advantage of drones is that they can take the most informative and close-up images of tree stands and allow you to notice damage (for example, damage to the bark or root system, which is not visible on satellite images) [4].

Aerial photography from airplanes is currently virtually impossible, as flights of any type of aircraft other than military aircraft are prohibited by law.

Using remote sensing methods, we found out that:

- In the period 2014-2022, 17944 hectares of forested land were completely lost, including 1422 hectares in the temporarily occupied territories
- After February 24, 2022, 5141 hectares were lost in the occupied territories
- In the territories liberated from the occupation, the loss of forest cover on the area was of 11361 hectares.

Restoration of forest cover after the war will be a long process, as it will be necessary not only to plant damaged areas with tree species that meet the conditions of the habitat, but also to carry out demining and cleanup of the territory, prepare the soil

and restore the ability of phytocoenoses to reproduce. [5]

Conclusions

1. The study identified the main negative factors of the impact of military operations on the forests of Ukraine, such as forest fires, detonations, movement of military equipment, etc. A total of 2.9 million hectares of forests were damaged, 1 million hectares of which are located in the occupied territories.

2. In order to restore the forests, it is necessary to monitor their condition and track the dynamics of changes to understand the scale of work required in the future. Already during the war, 32 thousand hectares of forests were restored and 1.9 hectares of new forests were created.

3. The main methods of remote monitoring of forests during the war, namely satellite imagery and drone imagery, are highlighted. It was found that satellite imagery is the only safe and possible option.

4. Using remote sensing methods, it was found that between 2014 and 2022, 17944 hectares of forest plantations were completely lost, of which 1422 hectares were in the temporarily occupied territories, and 5141 hectares were lost after February 24. After the liberation of the occupied territories, the loss of forest cover on an area of 11361 hectares was found.

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ENVIRONMENTAL CONSEQUENCES OF MILITARY ACTIONS ON THE TERRITORY OF UKRAINE

The environment is often called the silent victim of war. Burnt industrial facilities, forests, soil contaminated by mines and shells, flooded coal mines, blown-up structures, dead animals and destroyed plants are the work of the hands and weapons of the Russian invaders who are conducting combat operations on the territory of our country.

The Russian Federation destroys Ukrainian nature mercilessly, deliberately, without hesitation. And it violates the right to an environment safe for life and health not only of citizens of Ukraine, but also of all humanity. This is a challenge that must be answered not only by our state, but also by the entire civilized world.

What is the impact of war on the environment? Russian ecocide policy is aimed at violating human rights!

Almost 10 years of continuous destruction of our natural resources, the scale of which increased after February 24, 2022. The consequences of Russian armed aggression for Ukraine's environmental security can already be called catastrophic.

The Ministry of Environment and Natural Resources of Ukraine currently estimates the environmental damage caused by the occupiers at 2,108 billion hryvnias. These data are as of October 11, 2023. Of these, losses from air pollution – 1,078.7 billion hryvnias, soil and land – 984.4 billion hryvnias, water – 60.7 billion hryvnias. During the year and a half of the war, the State Inspectorate registered more than 2,500 complaints about Russian crimes against the environment. And these are far from the final numbers.

Dry statistics hide much more. According to the numbers, it is a real disaster both for our nature and for ourselves. When we talk about Russian environmental crimes during the war, we are also talking about the violation of fundamental human rights - to life and health.

It is quite difficult to talk about the destructive impact of war on the environment, separating air, water and land separately, because everything in nature is interconnected. Yes, air pollution is simultaneously water and soil pollution.

Massive artillery and rocket attacks by the Russian occupiers of oil depots, oil refineries, and other industrial facilities lead to emissions of toxic substances into the air.

According to the calculations of ecologists, during the burning of oil (fire at an oil depot with several tanks), approximately the same amount of pollutants are released into the atmosphere as the entire transport of Kyiv produces in a month.

Significant air pollution can have a significant negative impact on health in the long term.

On the very first day of the full-scale invasion, the occupiers captured the Chernobyl nuclear power plant, the exclusion zone was under occupation for more than a month. Experts called the situation very dangerous.

At the beginning of March 2022, the Russian military deliberately fired at the largest nuclear power plant operating in Europe – Zaporizhia. The territory of the ZNPP is still under the control of the invaders. They not only violate the mode of operation of the station, but also use its warehouses to store equipment and manpower, detonate ammunition.

Such actions of the Russian Federation create a radiation hazard. This is not a local problem. As in the case of the Chernobyl nuclear power plant, and in the case of damage to the nuclear power plant, not only Ukraine will have negative consequences. The zone of radiation contamination may spread to the countries of Eastern Europe and the northern part of the Middle East. The consequences of a probable accident in the center of Europe will be felt by more than one generation of humanity.

Russia's nuclear terrorism threatens the whole world. The international community should take more effective steps to stop this. After all, it is unlikely that the aggressor will listen to the demand of almost 70 countries of the world, which supported the IAEA resolution regarding the return of the ZNPP to the full control of Ukraine.

Water is a valuable resource for humans and the environment. It gives life and combines everything into one big system. This is precisely why war has such a devastating effect on water resources. The intentional undermining of the Kakhovskaya HPP dam by the Russian military on the night of June 6, 2023, became the biggest man-made disaster of the last decade.

This led to the death of people, the flooding of dozens of settlements, tens of thousands of hectares of territories, in particular, protected areas, the destruction of unique biodiversity, the pollution of the Dnipro and the Black Sea, the loss of the irrigation system, and the reservoir itself turned into a desert. This terrorist attack led to terrible consequences for tens of thousands of people, infrastructure and the environment.

The Prosecutor General's Office opened criminal proceedings on the grounds of the crime provided for in Art. 441 of the Criminal Code of Ukraine on the fact of ecocide, which was caused by the undermining of the Kakhovskaya HPP dam.

The fact that such actions of the occupiers should be qualified as ecocide at the international level was emphasized personally during a meeting with representatives of the UN Independent Commission for the Investigation of Violations in Ukraine.

Overall, the impact on aquatic ecosystems has been devastating since the early days of the war. Military operations on the territory of the Black and Azov seas, targeted shelling of aqueducts, water pumping stations, water treatment facilities and canals. It is the damage and destruction of these facilities that deprives people of access to drinking water. This is another factor of violation of human rights. The UN General Assembly recognizes access to water as one of the basic human rights, and the violation of such rights, the undermining of water supply facilities, dams, mining the banks of reservoirs, and shelling of water pipes can be interpreted as water terrorism.

The soil ecosystem is also negatively affected by hostilities. Eruptions from enemy missiles, aerial bombs, artillery shells, scorched earth cause long-term degradation of

the environment. It is necessary to mention here the soil littering with waste from destroyed enterprises, buildings, military equipment and oil products. All this can lead to significant environmental and social problems: loss of biodiversity, lack of water, food, spread of poverty, mass migrations of the population,

The full-scale war turned our country into one of the most mined countries in the world. 174 thousand sq. m. km – almost a third of the territory of Ukraine – are dangerous for life. If we draw an analogy with other countries, this is half the area of Germany or four Estonia.

Mined lands become an invisible death trap for civilians, including children. Thus, according to the data of the State Emergency Service of Ukraine as of October 23, 2023, since the beginning of the full-scale armed aggression, 559 Ukrainians have been injured by mines and explosive objects, 261 people have died. Among the injured were 68 children, another 14 died.

In addition to life and health, mines also pose a threat to the psychological state of people who are in constant fear of possible explosions. And cleaning up the territories can take decades.

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ECOLOGICAL SIDE OF CHOOSING TERRITORY FOR COLLECTING TOURISM IN UKRAINE

Abstract. The article presents the aspects of choosing a territory for collecting tourism, taking into account its natural and anthropogenic features.
Key words: environment, collecting tourism, tourism planning.

In the process of collecting tourism, human directly interacts with all components of nature that are the objects of their attention. While choosing an area of interest and planning a route for the needs of collecting tourism, it is necessary to analyze and take into account the following aspects caused by the state of the environment and the potential interaction of a human with it:

1. Choosing of the season. Different weather conditions are inherent in different seasons of the year, on which the comfort of the trip depends in one way or another. For example, the availability of roads depends on the rainfall regime (in spring and autumn, under conditions of heavy and frequent rains, dirt roads and meadow/forest paths may be washed away by water). Therefore, it is important to study thoroughly the weather conditions of the area and the availability of a potential route at different times of the year. The expected result, the number of objects of interest to the tourist, as well as the comfort of the trip and the overall impression depend on the climatic conditions of the trip.

In addition, the most important aspect, precisely from the point of view of collecting tourism, is the growing season of plants and mushrooms, which also depends on seasonality.

2. The status of the territory. During choosing the terrain through which the route will run, it is worth getting to know it in detail and taking into account all its features. For instance, if this is a territory that is included in the Nature Reserve Fund of Ukraine, certain restrictions are automatically imposed on its visitors, the scale of which depends on the level of nature protection status. The Law of Ukraine “On the Nature Reserve Fund of Ukraine” states that the collection of medicinal and other valuable plants can be carried out only on the condition that such activity does not contradict the purpose of the territories and objects of the Nature Reserve Fund, established requirements on protection, reproduction and use of their natural complexes and individual objects. It is important to note that on the territory of the NRF objects, which have the highest level of environmental protection, namely natural and biosphere reserves (with the exception of their inner zone of anthropogenic landscapes), tourist collecting activities are prohibited.

On the territory of national natural and regional landscape parks collecting activities are prohibited or limited (depending on the specific object). For example, the “Synevyr” National Nature Park in Zakarpattia region allows collecting mushrooms for personal use but the collection of rare and protected species of mushrooms is

prohibited, and the collection of mushrooms is prohibited at all in the "Holosiyivka" National Nature Park in Kyiv region [3, 4].

For example, on the territory of the "Homil`sha Woods" National Nature Park in Kharkiv region collecting activities are possible only with the permission of the park and in compliance with the established rules. According to the Rules for visiting the above-mentioned NNP approved by the order of the Ministry of Ecology and Natural Resources of Ukraine dated 13.05.2016 No. 135, collection of mushrooms and berries on the territory of the park is possible only with the permission of the park administration and in compliance with the rules of nature protection and is prohibited in the areas with increased protection, in particular, in areas with rare and endangered species of plants and animals [5].

Zakaznyk is also an object of the Nature Reserve Fund of Ukraine and has a special protection regime which provides for the prohibition of any types of economic and other activities that may negatively affect natural complexes and their components. Therefore, collecting activities on the territory of nature reserves in Ukraine is prohibited, as it can harm the ecosystem and increase the level of anthropogenic impact on nature [2].

3. Tourist safety. During choosing a territory, special attention should be paid to its safety condition. Potentially dangerous areas should be avoided, such as coastal or active mountain slopes, or anthropogenically polluted areas: landfills, industrial zones or the vicinity of industrial facilities, etc.

Nature is unpredictable and can be dangerous, so it is important to know how to behave in the event of an encounter with wild animals, what actions should be taken in case of emergency situations and what rules of behavior should be observed in open areas.

4. Contamination of the territory. This item echoes the previous one but it should be considered not only from the point of view of direct impact on the tourist's health, but also from an indirect one. If the objects of collecting activities are plants and mushrooms, then during the development of the route it is necessary to avoid anthropogenically polluted territories (for example, places of accumulation of garbage, dumping of industrial waste, industrial zones, fires, cultivated fields, as well as highways with active traffic) because plants and mushrooms have the property of absorbing substances from the environment, including those that can be poisonous to humans. Thus, together with the collected find, the tourist will also receive substances harmful to his health, which tend to accumulate in human's organism.

The realities of today's Ukraine oblige to take into account additional aspects of the state of the environment, namely, to what extent it has been affected by military actions. Currently, visiting all territories where active hostilities were conducted is strictly not recommended, as it carries a direct threat to human's life. Firstly, due to the high degree of mining of the territory, the risk of encountering the remains of ammunition, secondly, due to the contamination of the components of the environment with heavy metals and harmful gases. As a result of the explosion of the ammunition, under the influence of high temperatures, products are released in the form of a mixture of gases (CO, C, CO_2, SO_2, etc.) which in the process of chemical transformations interact with moist air and fall to the surface of the soil through atmospheric

precipitation, and heavy metals (Pb, Cd, Cu, Zn, Mn, etc.) which are directly deposited in the soil [1]. In future, these substances which are poisonous to humans are actively absorbed by plants and mushrooms which are potential objects of interest for the tourist.

Currently, the military actions have a significant negative impact on the development of collecting tourism in the frontline and de-occupied regions of Ukraine. The situation worsens significantly, due to the temporary unfitness of a large part of the territory for tourists to visit, physical damage and partial destruction of regional biocenoses, and the spread of toxic substances (even if the territory was not directly polluted, this is facilitated by the migration of chemical elements with atmospheric precipitation, surface and groundwater).

Therefore, the direct dependence of collecting tourism on the environment determinates a special approach to its organization. Thus, for the effective functioning of the "human – nature" system during the implementation of this tourist activity and the prevention of harm to both the environment and the tourist, it is necessary to take into account the issues disclosed above.

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AMBER EXTRACTION TECHNOLOGIES AND THEIR IMPACT ON LANDSCAPES AND SEASCAPES

Abstract. The publication provides a brief overview of amber mining technologies and analyses their impact on landscapes and seascapes. The paper outlines the technologies of illegal amber mining that cause negative changes in the landscapes of Western Ukrainian Polissya.

Key words: amber, extraction technologies, environmental impact, landscape, illegal amber mining.

Traditionally, amber is considered a gemstone and is used to make jewellery and decorate haberdashery, furniture, etc. From a geological point of view, amber is an organic mineraloid formed as a result of the fossilisation of coniferous resin during the Late Cretaceous and Paleogene periods [1].The world's largest amber deposits are considered to be the Baltic, Costa de Ambar in the Dominican Republic, Rivne (sometimes called Ukrainian), Burmese, Sumatran and Japanese deposits. There are also smaller deposits of amber and similar gems (copal, kauri resin and damar resin) being actively developed in many other countries, such as the USA, Canada, Mexico, Colombia, Germany, Austria, the Netherlands, Italy, Poland, Romania, Lebanon, Tanzania, Madagascar, New Zealand etc.

All existing amber extraction technologies can be divided into two large groups depending on the location of the deposit: marine and land-based.

The simplest marine methods of amber extraction are extensive in their environmental impact and involve the extraction and appropriation of amber, usually without significant changes to landscape structures and dynamics. For example, amber is collected manually or with the help of thin nets on the beaches of the North and Baltic Seas, where its gems are washed ashore by sea waves. Amber grains are often distinguishable because of their colour and have a warmer temperature than mineral pebbles. It is known that sometimes during strong storms with the surf of sea waves, large quantities of amber of various sizes can be washed ashore. This phenomenon is called "amber storms". Divers can find pieces of amber on the seabed.

Dredging technology is used to extract amber from the seabed on an industrial scale. This technology involves the use of large barges equipped with a grab dredge to excavate amber from the seabed. Dredging has a fairly strong environmental impact on the seascape, the direct consequences of which are a short-term increase in water turbidity, disturbance of bottom sediments and dissolution of toxic substances contained in them, and changes in the topography of the seabed.

Land-based extraction of amber is carried out using closed (mine) or open (quarry) technology. Due to economic unprofitability and negative environmental consequences (acceleration of erosion, formation of sinkholes, contamination of soil, ground and surface water with chemicals emitted during mining processes), today the mine method

is almost not used for amber mining. The only exception is deposits in the Dominican Republic, which are located in the high mountain landscapes of the Cordillera.

Therefore, the open-pit (quarry) method of developing amber deposits dominates. Quarry method is mechanical technology and consist of the following stages:

- excavation of parent soil in places of occurrence of amber-containing geological strata;
- release of waste rock using a quarry excavator;
- treatment of amber-containing rock with water to extract amber;
- cleaning and sorting of precious gems.

Another technology used for the extraction of amber deposits that are not deep (up to 15 m) is auger-hydraulic.The main principle of this method is that the massif of rock is saturated with water and activated by mechanical excitation (vibration) until the formation of a continuous suspension layer of such a density that a repulsive force arises that lifts the amber to the surface of the deposit.

Mechanical and mechanical-hydraulic methods of amber extraction can have high intensity impacts on the landscapes in which they are used. The following negative changes in the vertical structure and landscape pattern can be briefly mentioned, which they cause:

- destruction and transformation of vegetation and soil cover of the landscape;
- introduction of various substances and compounds (chemical pollution) into various components of the landscape (especially groundwater and atmospheric air);
- formation of new micro and meso relief forms that change the horizontal flow of substances in the landscape (formation of sinkholes during mechanical and hydraulic methods or formation of rock dumps during mining and quarrying);
- change of elementary processes and, in general, modes of landscape functioning.

It is worth noting that the use of intensive amber extraction technologies involves a set of reclamation works to restore or improve the landscape after the deposits have been mined, which is enshrined in legislation in almost all countries.

Almost all countries where amber is mined face the problem of illegal amber extraction. In Ukraine, the Volyn, Rivne and Zhytomyr oblasts have become the scene of an acute set of environmental, social and economic problems caused by illegal amber mining [2]. These oblasts are home to the Manevychi, Dubrovytsia -Volodymyrivtsi, Mohyla, Barashiv and Klesiv-Perzhany amber deposits. Most often, illegal extraction takes place with the help of hydraulic pumps and shallow pitting, which leads to a number of negative environmental consequences, in particular, a severe anthropogenic transformation of forest landscapes in Western Ukrainian Polissya [3,4].

Undoubtedly, the solution to this complex problem requires the use of legal regulation mechanisms, improvement of control and supervision systems over the development of deposits, improvement of amber mining technology to increase their efficiency and reduce the impact on the environment, etc. It is equally important to conduct systematic landscape and environmental studies to monitor and assess the changes caused by illegal amber mining. The results of these studies can form the basis for developing effective measures to restore damaged landscapes.

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ANALYSIS OF EUROPEAN EXPERIENCE IN SOIL BIOREMEDIATION IN URBAN ECOSYSTEMS

Since the beginning of the 21st century, the study of urban justifications is beginning to gain more and more importance. The number of publications related to urban justifications is growing exponentially. Until the 2000s, these publications concerned only the evaluation of pollution and the improvement of the fertility of grounds. But, later, the emphasis began to shift towards research into restoration and reclamation of damaged grounds. The share of publications on the reclamation of urban grounds is intensively developing after the year 2000. Bibliometric data on the state of scientific and technological knowledge about urban soils were evaluated using the Web of Science search engine, using the keywords “urban soil”, “remediation”, “restoration”, “rehabilitation” in various combinations. The literature review showed that the majority of scientific articles (>80%) were devoted to soil pollution by heavy metals, and only a small number of publications were devoted to the impact of organic pollutants on soil cover.

Finding ways and methods to eliminate the consequences of poly component soil pollution is an urgent problem all over the world. And it is the methods of phytoremediation that can help accelerate the restoration of degraded soils. Biotechnology of phytoremediation has many advantages, if we take into account the inseparability and naturalness of the relationship between soil and plants, it is not harmful to the environment, it is much cheaper than physical and chemical methods of remediation, and it has wide public support.

Phytoremediation is considered an environmentally friendly, aesthetic, non-invasive and cost-effective technology. In recent years, the amount of work on phytoremediation has increased dramatically, and there have been many encouraging results regarding the ability of certain plants to degrade certain organic pollutants.

We considered the concepts that determine the policy of protection and rational use of soils in the European Union. It was established that the tasks of protection and rational use of soils have evolved significantly since the beginning of the 90s of the last century. In Europe, at first, the protection and rational use of soils were not considered separately, but were connected with the protection of other components of the environment, for example, with soil pollution due to air pollution or with the disposal of industrial and municipal waste. In 2006, an independent “EU Soil Protection Strategy” was adopted. Its necessity was caused by the understanding of the importance of soil as a component of nature and the desire to prevent further soil degradation. This document mainly considered the protection of soils from physical influences (erosion, compaction, etc.) and preservation of their functions.

In November 2021, a new “Soil Strategy until 2030” was adopted. Harnessing the benefits of healthy soils for people, food, nature and climate. Fundamentally important

in the new “Soil Strategy” is that soil is assigned the role of a leading link in the resource-efficient and circular economy of the future. The paper emphasizes that soil is perhaps the greatest recycling mechanism on the planet: soil recycles water, organic matter and nutrients and can break down and filter pollutants [1].

The new “Soil Strategy 2030” is based on the provisions of the previous strategic document and is primarily aimed at improving soil health. In it, special attention is paid to the preservation of soils as a spatial resource and their effective use in the system of a closed cycle economy.

Against this background, natural solutions for soil restoration are increasingly promoted as sustainable options for increasing soil biodiversity while simultaneously addressing the problem of soil pollution in accordance with the UN Sustainable Development Goals, and in the EU, the European Green Deal and the EU Biodiversity Strategy. This is especially relevant for maintaining the sustainability of the urban environment.

The urban environment is very specific in terms of location, spatial heterogeneity, pollution and use. Even if urban soils are not intended for reclamation, the risk to the health of the local population still exists. It is for this reason that it is necessary to rehabilitate these soils. Many studies present evidence that the use of various types of ornamental plants for phytoremediation shows its effectiveness.

We can also assume that decorative plants that are grown as elements of landscape design in cities can be used to restore polluted soils.

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HISTORY OF GLOBAL HUMAN EPIDEMICS. WARS AND EPIDEMICS. MODERN GLOBAL AND REGIONAL EPIDEMIOLOGICAL FEATURES

Introduction. Over the centuries, humanity has faced diseases and epidemics that have affected the development of society, its culture and medicine. There are many examples in history of diseases that have become a kind of test for society, but at the same time provided immunity and civilization development.

Actuality. In the history of mankind,epidemics have always played a key role in defining and reforming social, economic and political systems. The growth of global mobility, the expansion of trade, and new challenges in global security make this topic more relevant than ever. Studying the relationships between wars, epidemics and epidemiological features of the modern world is becoming an important step in understanding and controlling future challenges to global health, economy and society.

Keywords: epidemics, infections, diseases, virus, environmental problems, humanity, epidemic spread, society.

Ancient epidemics and their impact on humanity. The first and one of the most popular epidemics is the plague, also known as the Black Death. It got this name because of its very high mortality rate. The mortality rate for the bubonic form of the plague reached 95%, and for the pulmonary form - 98-99%. The next one, starting in 1816, was cholera. It caused the most powerful pandemic and has been known to mankind since the time of Hippocrates. The spread was facilitated by high temperatures, water pollution, and massive crowds around water bodies. This led to the deaths of tens of thousands of British soldiers and millions of Indians. Also during the First World War (1914-1918), outbreaks of an infectious disease known as typhus were recorded. It is accompanied by mental disorders against the background of high fever and intoxication.

Black smallpox, which probably led to the largest number of deaths in the world. In the twentieth century alone, this virus claimed the lives of 300 to 500 million people. Initially, it spread mainly in Arab and Asian countries, but eventually it spread throughout the world. The last pandemic I would like to mention is the most recent one, the Coronavirus (COVID-19). The virus appeared in late 2019 in Wuhan, Hubei Province, China. Its exact origin is not yet fully understood. So far, about 7 million people have died from the disease. Every day, tens of thousands of healthcare workers around the world are fighting the coronavirus, supported by thousands of volunteers, international humanitarian organizations, governments, etc.

Analysis of current global epidemics and their impact on humanity. Any outbreak of an epidemic in the modern world can be a global challenge for humanity. On the one hand, it is about the ability to quickly and efficiently determine the nature of the causative agent of another disaster and develop appropriate methods and pharmaceuticals for treatment. On the other hand, any epidemic, let alone a pandemic, has very specific economic consequences in the short, medium, and long term. The

coronavirus is spreading around the world, and so is fear. In addition to the aforementioned COVID-19 pandemic and HIV infection, there are many other diseases that are constantly progressing in the modern world.

Type 2 diabetes mellitus (DM) is one of the most common endocrine pathologies in the world and in Ukraine. The epidemic is spreading rapidly, mainly due to unhealthy lifestyles, including lack of physical activity and poor nutrition. This leads to serious problems for health care systems and increases the risk of other diseases, such as cardiovascular disease [1].

At the same time, 30% of the Ukrainian population is overweight. It is known that 80% of patients with type 2 diabetes are overweight or obese. Obesity is one of the most common metabolic diseases in the world, growing at an epidemic rate. The World Health Organization (WHO) has recognized obesity as a new non-communicable epidemic of our time [2].

Tuberculosis also remains a global problem and causes great concern in all countries of the world and in Ukraine in particular.

Consideration of factors that influence the spread of infections in the world. The spread of infections in the world is a complex and urgent problem that requires careful study and a systematic approach to ensuring global health security. Today, vaccination, the ability to see a doctor on time, and information about the symptoms of various diseases have become the main methods of fighting infection. Unfortunately, increasing global mobility, economic globalization, and climate change are opening up new opportunities for the spread of infectious diseases, while challenging humanity to develop effective control and prevention strategies. Human factors are key to the spread of infections in the world. People interact with pathogens, and their actions can influence the spread of disease. The level of immunity in a population determines the degree of susceptibility to disease. International travel and trade can also contribute to the rapid spread of infections. Natural factors play an important role in the spread of infections in the world, affecting the viability and transmission of pathogens. For example, microbes and viruses. Infectious diseases are caused by microorganisms such as bacteria, viruses, fungi, and parasites. Climate change can also affect the distribution of vectors, such as mosquitoes, that transmit infections [3].

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COMPARATIVE ASSESSMENT OF THE INSULARITY INDEXES OF THE NATURE-RESERVE FUND OF IVANO-FRANKIVSK AND CHERKASY REGIONS OF UKRAINE

Abstract. The article gives the calculation of isolation indices of the nature reserve fund in Ivano-Frankivsk and Cherkasy regions. The study found low effectiveness of protected areas in ensuring the conservation of biological and landscape diversity.. In general, the calculations showed better sustainability of the nature reserve fund in Ivano-Frankivsk region, where the share of objects with an area of more than 50 hectares is higher. The overall insularity index in Cherkasy region is 0.83, which shows that small-sized protected areas are more important in the region. They are not able to withstand external negative impacts.

Keywords: nature reserve fund, insularity index. Landscape, sustainability, restoration, biodiversity.

The relevance of this work lies in the fact that the creation of an ecological network, including the largest objects of the nature reserve fund of Ukraine, can actually be a solid foundation for solving the problem related to the preservation and rational use of land. This is necessary for our country to protect the animal and plant life that is constantly being affected by humans.

The purpose of the work is to compare the insularity indices of the nature reserve fund of Ivano-Frankivsk and Cherkasy regions of Ukraine.

The calculation of the insularity index [1] is based on the fact that a protected natural area will be stable only when it is whole and has a sufficient area to support the diversity of self-reproduction of biotic resources and landscapes. So, for local frame cores, their area should be at least 50 hectares. This suggests that when designing a local network, it is necessary to investigate which objects meet the criterion of optimality size for the purposes of optimization and further development of an effective management strategy.

The insularity index (I) includes two components, the first (It) is calculated based on the total area of the study area (S) and the area of all protected objects relatively stable (with an area of more than 5 km^2) and non-sustainable (with an area of less than 5 km^2). The area of the latter is denoted as (S_1).

In Ivano-Frankivsk region, the insularity index of NRF is normal, and in Ivano-Frankivsk district, 0.8 is close to 1 (Table 1).

The values of the I index are in the range from 0 to 1. And the greater it is than zero, the greater the share of unstable objects in the territorial structure of the natural reserve fund of the district. Accordingly, obtaining a value of 1 as a result of the calculations will indicate the complete poor quality of the existing structure and the fact that it cannot provide the required level of preservation.

Table 1.

Index of insularity of Ivano-Frankivsk region

Name of the administrative district	Total area of protected objects in the district (thousand hectares)	The area of relatively unstable NRO	Im	Total number of protected objects in the district (pcs)	The number of relatively unstable NRO	In	Index of insularity
	S	***S_1***	***Im***	***N***	***N_1***	***In***	***I***
Verkhovyna	114,84	26,23	0,2	31	23	0,7	0,45
Ivano-Frankivsk	164,119	112,67	0,7	99	83	0,8	0,8
Kalush	231	93,3	0,4	8	5	0,6	0,5
Kolomyia	79,7	14,38	0,2	21	19	0,9	0,55
Ivano-Frankivsk region, total	589,66	246,58	0,4	159	130	0,8	0,62

In Cherkasy region, the insularity index of the NRF in all districts is close to 1 (Table 2).

Table 2.

Index of insularity of Cherkasy region

Name of the administrative district	Total area of protected objects in the district (thousand hectares)	The area of relatively unstable NRO	Im	Total number of protected objects in the district (pcs)	The number of relatively unstable NRO	In	Index of insularity
	S	***S_1***	***Im***	***N***	***N_1***	***In***	***I***
Zvenigorod	427,1	298,43	0,7	111	99	0,9	0,8
Zolotonosha	146,7	123,87	0,8	64	58	0,9	0,85
Uman	53,5	48,1	0,8	222	214	0,9	0,85
Cherkasy	439,3	324,6	0,7	108	87	0,8	0,75
Cherkasy region, total	1066,6	795	0,7	505	458	0,91	0,83

The values of *I* index are in the range from 0 to 1. The greater it is than zero, the greater is the share of unstable objects in the territorial structure of the natural reserve fund of the district. Accordingly, obtaining a value of 1 as a result of the calculations will indicate the complete poor quality of the existing structure and the fact that it cannot provide the required level of preservation.

During the study, we determined that the insularity index was better in Ivano-Frankivsk region, where the share of objects with an area of more than 50 hectares is

higher. The overall insularity index in Cherkasy region is 0.83, which shows that small-sized protected areas are more important in the region. They are not able to withstand external negative impacts.

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MAPPING OF UNAUTHORISED DEFORESTATION USING GEOGRAPHIC INFORMATION WEB TECHNOLOGIES

Abstract.The article gives a literature review of the problem of deforestation in Ukraine.describing the method of their remote monitoring.

Keywords: illegal deforestation, remote monitoring, satellite images.

Remote sensing methods, including forest monitoring using aerospace data, play an important role in determining the status and management of forests, which are complex and changing natural systems and a valuable source of industrial raw materials. Obtaining information on forest composition using ground-based methods, especially over large areas, is a labour-intensive task, so the use of satellite imagery and other aerospace data is an effective means to ensure accurate mapping, environmental monitoring and optimisation of forest resources.

In the context of forest inventory, the use of cartographic materials and geographic information web technologies is necessary to perform various tasks, such as determining the area of forest plots, establishing taxation indicators and monitoring changes in quantitative and qualitative parameters of forests. Information obtained from geographic information databases is often the only available source of data, which necessitates combining attribute databases with satellite imagery to update and detail mapping information, especially for small local objects. Web-based GIS technologies, which include interactive web-based mapping, analysis and measurement, monitoring and modification, and public access to information, play an important role in ensuring the accuracy and accessibility of forest resource data, contributing to the sustainable use of forest ecosystems.

When analysing satellite images to determine terrain characteristics, an important task is to decipher various objects, such as settlements, road networks, water bodies and terrain. To do this, the characteristic features of objects such as size, shape, background, colour and shadows are used. For example, forest interpretation involves analysing the tone, structure and spatial distribution of vegetation. Web-based geoinformation technologies are widely used for efficient processing and visualisation of geospatial data, ensuring accuracy and accessibility of information about landscape features. The process of processing satellite images is divided into pre-processing aimed at removing distortions and thematic processing, which includes object recognition based on decoding features such as channel combination, index images, principal component analysis, spectral separation and classification.

For mapping illegal logging, it is better to use Sentinel-2 L2A made by the Sentinel-2 spacecraft, which consists of two identical satellites Sentinel-2A and Sentinel-2B.

The spacecraft of this series belong to the space segment of the Copernicus programme, which is engaged in environmental monitoring.

To detect clear-cutting over a several-year period, it is better to use images from one season, recommended August, when forest vegetation acquires the most saturated, not bright colour, clearly distinguishable from other vegetation. Also, August usually has the lowest cloud cover, which hinders the visibility of objects in the visible range.

ArcGIS Online was used for the work. ArcGIS Online is a web-based geographic information system (GIS) platform. ArcGIS Online provides an opportunity to collaborate on projects using geospatial data and tools.

The study compares the images from 06.08.2016 with the images from 15.08.2021. For the study, we chose a 12,062.2 square kilometre area, which lies between the coordinates 52.341348 N 31.531813 W; 51.354488 N 31.563377 W; 51.363278 N 33.14013 W; 52.350432 N 33.143348 W.

In Fig. 1, you can see that the deforested area has increased since 2021. Adding up the areas of the landfills, we found out that the total area of the detected logging was 0.106798 square kilometres.

a) snapshot by 06.08.2016 b) snapshot by 15.08.2021

Fig. 1. The deforested area

Further studies will assess the area of forests in the study area and monitor forest regeneration to fully determine the state of forest resources. It is also planned to obtain information on the legality of the logging operations, in particular, on permitted industrial and sanitary logging.

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PRIVATE HOUSEHOLD PLOTS AS OBJECTS FOR CONSERVATION OF RARE PLANT SPECIES

Abstract.The article examines the potential of private household plots as objects for the conservation of rare plant species in Ukraine. The author gives examples of such species as Galanthus elwesii, Bulbocodium versicolor, Tulipa quercetorum, and others growing on plots in the village of Dobrynka, Dnipropetrovsk region. The article emphasizes the importance of household plots for biodiversity conservation.

Keywords: rare plants, private plots, conservation, biodiversity

The issue of biodiversity conservation is becoming increasingly pressing for humanity every year. In Ukraine, this issue is also quite complex, because not only are plants being destroyed annually due to anthropogenic factors and human activities, but the situation is further complicated by military actions. To prevent the complete disappearance of rare plants, various types of reserves, national parks, sanctuaries, nature conservation funds, etc. have been created. But in addition, it would be desirable to also draw attention to private household plots. These can be yards, gardens, flower beds, vegetable gardens, and other parts of private territories of some residents.

For example, at one time, residents of the village of Dobrynka collected collections (from the natural environment or brought from other territories) of some species of rare plants, such as: *Galanthus elwesii* Hook.f., *Scilla siberica* L., *Tulipa quercetorum* Klokov et Zoz, *Bulbocodium versicolor* (Ker Gawl.), *Adonis wolgensis* Steven ex DC, *Iris pumila* L., *Paeonia tenuifolia* L., etc.

The village of Dobrynka is located on the right bank of the Samara River, in the Synelnykivsky district of the Dnipropetrovsk region, in the southeast of Ukraine, on the border with the Kharkiv region. This territory is within the Middle Orel-Samara floristic subregion [2], which has the most favorable natural conditions within the region. The following natural complexes have formed here: zonal steppes (multi-herb fescue-feather grass on typical chernozems), extrazonal ravine and floodplain oak groves [3, 4], pine forests, intrazonal - solonetz-solonchak complexes, azonal - floodplain meadows, vegetation of water bodies, technogenic, etc. [1, 5]

Below is information about the rare plants that are in the collection of the village of Dobrynka.

Galanthus elwesii Hook.f. – a vulnerable species, listed in the Red Book of Ukraine and the IUCN Red List. It is widespread in forest and steppe groups of southern Ukraine. The populations are linear, elongated along the banks of estuaries, valleys of ravines, often fragmented. The highest density is in upland oak forests (160 individuals per 1 m^2), somewhat lower in ravine forests (65 individuals per 1 m^2) and shrub thickets (60–140 individuals per 1 m^2), and the lowest is in steppe groups (40–50 individuals per 1 m^2). In forest groups, homeostatic populations with complete spectra have formed, while in steppe areas there are regressive populations with right-sided spectra.

It grows in oak, ravine elm-maple forests as part of the spring synusia of the grass layer (Alno-Ulmion alliance), along ravines and gullies, on limestone and steppe slopes as part of tree and shrub thickets (Prunion stepposae alliance) and fescue-feather grass steppes (class Festuco-Brometea). It is protected in the Staromanzyrskyy Sanctuary and the Tylihulskyi Lyman Regional Landscape Park (Odesa and Mykolaiv regions).

Bulbocodium versicolor (Ker Gawl.) – a vulnerable species, Red Book of Ukraine. This spring ephemeroid was found on the western outskirts of the village, on the slopes of a ravine and the slopes of an old quarry, which has been in a self-overgrowing state for a long time, in its upper, middle and lower parts. Single flowers as well as small groups of 2-3 individuals are found. The species is protected in the Dnipropetrovsk region with the status of a rarity category, as vulnerable. In addition, it is protected in the Yelanetskyi Steppe Nature Reserve, the Ukrainian Steppe Nature Reserve, the Luhansk Nature Reserve, the Tylihulskyi Regional Landscape Park (Odesa region), in many sanctuaries, nature reserves, and botanical landmarks of the Poltava and Zaporizhzhia regions.

Tulipa quercetorum Klokov et Zoz – a vulnerable species, Red Book of Ukraine. The species was found on floodplain meadows near estuaries on the outskirts of the village. The location had an area of several square meters. The species is protected in the Dnipropetrovsk region with the status of a rarity category, as rare. In addition, it is protected in the Ukrainian Steppe Nature Reserve, the Luhansk Nature Reserve, the Holy Mountains National Nature Park, and in many other territories of the nature reserve fund.

Adonis wolgensis Steven ex DC – an undervalued species, Red Book of Ukraine. The species was found on the western outskirts of the village, in the valley near the slope and slopes of an old quarry, which has been in a self-overgrowing state for a long time. They occur in quantities of about a dozen individuals per square meter. The species is protected in the Dnipropetrovsk region with the status of a rarity category, as vulnerable. In addition, it is protected in the Ukrainian Steppe Nature Reserve, the Luhansk Nature Reserve, the Holy Mountains National Nature Park, in the regional nature parks - Donetskyi Kryazh, Kleban-Byk, Zuievskyi, and others, and in a number of sanctuaries and natural landmarks.

Paeonia tenuifolia L. – a vulnerable species, Red Book of Ukraine, and also of the Dnipropetrovsk region. Numerous, dense and complete populations occur locally. In protected areas, the density reaches 1 individual per 1 m^2 in some years. The population size in Kara-Dagh is up to 10,000 individuals, and about 1 million individuals in the Crimean Mountains. They grow mostly individually, with insignificant numbers, especially near settlements. It is protected in the Ukrainian Steppe (Khomutovskyi Steppe and Kamyani Mohyly branches), Luhansk (Striltsivskyi Steppe and Provalkyi Steppe branches), Karadah, Yalta Mountain Forest, Crimean, Kazantypskyi, Opukskyi Nature Reserves, Holy Mountains National Nature Park, Kleban-Byk Regional Landscape Park, and a number of other objects.

Scilla siberica L. – a protected species, listed in the regional Red Books of Vinnytsia, Zaporizhzhia, Dnipropetrovsk, Kyiv, Poltava, and Chernihiv regions. It is widespread in the Forest-Steppe and Steppe of Ukraine. The range of the species covers Eastern Europe, the Caucasus, and Western Asia (Turkey, northern Iraq, north-western

Iran). As a naturalized plant, it occurs in various regions of the world, including North America. In Ukraine, it is widespread in the Forest-Steppe and Steppe.

Iris pumila L. - a rare species protected in many regions of Ukraine. The main distribution zone of this plant covers the south of Eastern Europe. The western border of the range runs through Moldova, Romania, Hungary, and further extends eastward through the steppe and, partially, the forest-steppe zones of Ukraine, the Chernozem region, the Don region, and the Volga region. In the extreme east, this plant is distributed to the Southern Urals, the Cis-Urals, the south of Western Siberia, and the steppes of Kazakhstan. The southern distribution border runs through Crimea, the Azov Sea region, the Caucasus, and Asia Minor. Outside the main range, small populations of dwarf irises exist in Central and Southern Europe, particularly in Germany, Czechia, the Balkans, and the Mediterranean region.

Thus, private household plots have great phytocenotic potential for cultivating, preserving, and propagating rare plant species and can be considered as objects for their conservation.

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POLLUTION OF WATER OBJECTS IN UKRAINE AND WAYS TO SOLVE THIS PROBLEM

Abstract.The publication presents the results of research into the quality and state of water resources of Ukraine.

***Key words*:** water objects, research, wastewater, pollution of water bodies, influencing factors.

Every year, the condition of rivers, lakes and groundwater in Ukraine deteriorates. The reason for this is such problems as pollution of water bodies by wastewater discharges from enterprises, excessive use of natural resources, overgrowth and siltation of natural water bodies [1].

Water resources of Ukraine are one of the sources of drinking water for the population.

On the territory of the country, water bodies are unevenly distributed: the whitest water reserves are in the west, the smallest - in the southern regions of Zaporizhzhia, Donetsk, Odesa and Kherson regions. Of course, the water resources of Ukraine are currently in a dangerous state and require rational use and protection from pollution.

According to statistics, Sumy, Chernihiv, and Volyn regions, as well as the northern territories of Kyiv and Poltava regions, are best supplied with drinking water.

Currently, the state of Ukraine's water resources cannot be called satisfactory, because according to official statistical data, about 300 million cubic meters of untreated wastewater are dumped into reservoirs every year, and unofficial data show much worse results [1].

Exceeding the maximum allowable pollution standards can be recorded in almost every water body. The average annual data of laboratory measurements carried out by the bodies of the State Agency of Water Resources of Ukraine indicate an increased content of controlled substances of easily oxidized pollutants in water. For example, in the basin of the Dniester River, a significant deterioration of water quality was observed due to dry conditions [1].

High temperature in the summer period every year causes a massive "blooming" of water and, as a result, a decrease in its dissolved oxygen to critical values and an increase in indicators characterizing organic pollution.

The water quality of the Danube River, where manganese and phenol were found, also does not meet the standards. 90% of water samples from the Dnipro recorded an excess of pollutants. The main factors affecting the hydrochemical state of the waters of the Dnipro basin were unfavorable weather conditions, the decrease in water content of the Dnipro River and its tributaries, as well as anthropogenic load [1].

According to the results of the research, the intake in the village is considered the most polluted drinking water intake. Bilyaivka in Odesa region. Every year, the quality of the water there deteriorates, and the pollution indicators exceed the norms by several times.

Sources of dirty water

Practically all water bodies are intensively polluted due to the increase in the influence of anthropogenic factors: economic activity in violation of the permissible limits of land development, excessive use of natural resources, siltation and pollution of rivers, non-compliance with the regime of limited management on coastal protection strips. Water resources suffer from pollution from industrial and municipal wastewater, which contains organic and bacteriological pollutants [1].

Solving the problem of pollution

Experts believe that in order to improve the condition of reservoirs, it is necessary to ensure an optimal combination of forest plantations and meadows around water bodies, to implement a set of measures to stop the discharge of untreated sewage into them, to monitor the condition of hydrotechnical structures on rivers, processing of banks, which leads to shallowing and siltation of rivers.

It is also necessary to equip enterprises that carry out production activities with a rainwater drainage system with treatment facilities to prevent pollution of water bodies with untreated rainwater. However, there is a problem of providing enterprises with the necessary systems. Thus, there is an option - to force the owners of large enterprises to establish a system at the legislative level, or to introduce a system of fines [1].

How to reduce water pollution

1. Use less chemicals when cleaning the house. This simple step can make a big difference. Natural cleaning products are also effective for household care, but they do not harm the planet's water resources [2].

2. Dispose of waste correctly. Never pour non-biodegradable waste down the drain. If you do not know how to properly dispose of them, consult a hazardous waste collection point or search for information on the Internet. Here is a list of some substances that should never be flushed down the drain.

3. Save more water. Saving water is very important for the preservation of the planet's water resources. Purifying drinking and domestic water requires a lot of effort and energy, so save as much water as possible, especially during droughts [2].

4. Try not to use plastic. Since plastic is not biodegradable, it accumulates in rivers, lakes, and seas. Such garbage causes considerable harm to marine life and people. Whenever possible, glass containers or cloth bags should be used instead of plastic [2].

Therefore, it is necessary to understand very clearly that all the problems that are related to the environment affect each of us. All of us cannot simply stay away from these problems, as indifference can lead to very bad consequences. I believe that it is necessary to start, first of all, with oneself. Environmental ethics is a special system of values and principles that regulate the relationship between man and nature and are a component of human activity [2].

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PROBLEMS AND CONSEQUENCES OF IMPROPER WASTE DISPOSAL

Abstract. This short text briefly describes the problems related to illegal landfills and provides simple solutions to this problem.

Keywords*:* landfills, ecology, environment.

The issue of uncontrolled landfills is particularly acute for Ukraine. Such The article gives a comparative analysis of green infrastructure level in the cities of Sumy and Chernivtsi. For this purpose, we calculated the percentage of the green zones area and the green index per person in the administrative districts. The results showed a significant difference in the presence and placement of green zones in these cities of Ukraine. Given the importance of green spaces for the health and well-being of the population, further development and preservation of green areas are becoming critical for improving the quality of life in urban environments. A careless attitude to such an important issue has extremely serious consequences for ecology.

In order not to be wordless, I will give an example of my village of Zolochiv, where all waste was taken to a landfill located near the highway leading to Kharkiv, so I am well acquainted with such a problem. Thus, in Ukraine, there are about 6,000 landfills that are difficult to call legal, and 33,000 that are not legal. You can also mention the topic of how people in the countries of the former Soviet Union can easily throw away garbage in a forest strip or throw out some conventional can during a walk under a tree, instead of in a trash can. Yes, there are laws regarding improper waste disposal, but people don't care about these laws.

An example is Europe, which found a way to encourage people to donate cans by simply paying them for each can donated with checks that people can use to pay for their purchases in supermarkets, and set up a special tax on cans. So at least people are forced to follow this simple but effective rule for the environment.

In modern conditions, the problem of accumulation of production and consumption waste is one of the leading threats to the ecological security of the state. Currently, Ukraine is experiencing an increase in the amount of waste generated, including chemically hazardous waste, and the area of unauthorized landfills is expanding significantly. Currently, about 10 tons of waste per capita is generated in Ukraine annually, compared to 5.5-6 tons of waste per capita in EU countries. In comparison with the indicators of waste accumulation in the European Union, Ukrainian volumes cause serious concern, taking into account the extremely insufficient level of their disposal and disposal. The volumes of waste accumulation, the number of landfills and landfills for their disposal are increasing, the sanitary condition of settlements is deteriorating. To date, the country has accumulated about 36 billion tons of waste, which is more than 50 thousand tons per 1 km2 of territory, of which only 30% of industrial and 4% of household waste is disposed of. At the same time, the main sources

of waste generation are mining and chemical, metallurgical, machine-building, fuel and energy, construction and agro-industrial complexes. The situation is worsening in the field of hazardous waste management, the total amount of which is about 1.6 billion tons, as well as unusable and prohibited chemical plant protection products, which are currently stored in 4,075 warehouses in violation of the requirements for ensuring environmental safety. The situation with specific waste generated in the process of medical care, veterinary practice and related research work, which after getting into household waste containers and landfills and landfills, can lead to the spread of various infectious diseases, requires an urgent solution. The problem also lies in the lack of a scientifically based concept of processing and disposal of hazardous waste, unsatisfactory implementation of proven modern technologies, imperfection of technological processes and incompleteness of technological cycles of processing of primary raw materials, unregulated system of their collection, lack of safe disposal or localization methods, etc. Despite the mandate of the former President of Ukraine from 30.05.2011, until now there is no effective system for handling worn tires, rubber products and waste from rubber production, used lubricants, and elements of electrical and electronic equipment. Unfortunately, after such a period of time, no one has started the fight against illegal garbage dumps.

Sweden has become the most successful in sorting and processing garbage. 99% is recycled there, and recently Swedes have been forced to import garbage from their neighbors due to its shortage. With the help of modern technologies, they process garbage into energy that powers public transport, heats and lights municipal institutions and residential buildings. Poland has strict legislation and two tariffs for waste removal, where the price for sorted waste is much lower than for unsorted waste. There is also a system of fines for regularly refusing to sort waste. In Austria, they learned to use biotechnology to break down plastic for processing into new textiles and other products. The waste processing plant in Vienna has become a real art object. In the capital of Denmark, Copenhagen, they went even further and built a 500 meters long ski slope, a climbing wall and other sports and training facilities on the roof of a waste processing plant.

Thus, if the Ukrainian authorities really want to become Europe, and not just in words, then such a problem as illegal landfills will cease to exist for Ukraine. For this, it is necessary to become Europe not only in words, but also in deed.

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INFLUENCE OF PHYSICAL FACTORS (NOISE, VIBRATION) ON THE HUMAN BODY

Abstract.The publication presents the results of research from various scientific sources and the author's own observations.

***Key words**:* ecology, noise, vibration, human health, vibration sickness.

The research considers this topic because modern living conditions of the population are surrounded by loud sounds, various noises and vibrations, from home to transport, so it is important to know how dangerous these physical factors are and how they can be eliminated.

Nowadays, such physical factors as noise and vibration have become a real problem for humanity. The development of the transport sector, significant industrialization and transition to predominantly urban life are key factors that have led to noise and vibration pollution. Every day, from morning to night, a person feels this negative influence on himself.

Let us consider noise as one of the physical factors of pollution. We regard noise as random mechanical vibrations of varying intensity in an elastic medium with frequencies in the audible range from 16 to 20,000 Hz, which is an unfavorable factor in the production environment. It is omnipresent: in industry, transport or agriculture. An important characteristic of noise is its frequency composition. If sounds with a frequency of up to 400 Hz prevail in the noise, then this noise is called low-frequency, if sounds with a frequency from 400 to 1000 Hz prevail – medium-frequency, if more than 1000 Hz – high-frequency [1].

Scientists now explain that loud sounds, such as gunshots, the roar of tanks and planes, and even music at rock concerts, are perceived not only by the auditory organs, but also by the skin, heart, and respiratory organs. They excite a person and cause the release of a large amount of hormones (for example, adrenaline) into his blood, thus contributing to the emergence of a feeling of fear and danger [2].

As a person who had direct experience of being under occupation at the beginning of the full-scale invasion of Ukraine by the Russian Federation, I fully confirm these theses. The feeling of fear and danger during shelling has an extremely negative effect on human health. After the rush of adrenaline, the heartbeat increases sharply, then a feeling of fatigue and anxiety appears. Over time, such symptoms as deterioration of memory and concentration due to prolonged stress may also appear. It should also be noted that due to the negative impact of stress, which occurs due to constant exposure to loud noises from gunshots and explosions, one may experience frequent headaches and exacerbation of chronic diseases. In addition to the above symptoms, sleep disturbances and high irritability are also added.

If we are talking about the impact of noise in cities, then increased noise in cities is the reason for shortening the life span of a person. According to modern researchers, this reduction varies between 10-12 years, and adults are the most sensitive. There is research confirming that young people can withstand more intense noise than people older than 30-40 years. Thus, 46% of people under the age of 27 react to increased noise, 57% at the age of 28-37, 62% at the age of 38-57, and 72% at the age of 58 and older. Complaints about noise in individuals can also be related to the specifics of their professional activity (mental work - more response to noise; physical work - less). It is a fact that people cannot adapt to noise or vibration. The positive thing is that noise can have not only a negative effect, but also a rather calming one, like calm music, or natural phenomena (rumble of rain, etc.) [3].

Now let us talk about vibration as a physical factor of environmental pollution. Vibration is the movement of a material point or mechanical system, during which the value of the quantity characterizing this movement alternately increases and decreases over time [4]. We distinguish local and general vibration. Local vibration occurs due to the vibrations of hand tools. Due to the general vibration, the whole body suffers, as the vibrations are transmitted from the mechanisms through the floor and the seat. The most dangerous frequency of general vibration is considered to be 6–9 Hz, (the frequency of internal organs' own oscillations). The dangerous frequency for the heart, chest, abdomen is 5 Hz, for the head – 20 Hz [5].

Vibration is perceived by the human body as a shock due to transport, vibrations of solid bodies, buildings or parts of devices. The human body has its own vibration frequencies and therefore it is a complex oscillatory system, and the changes that occur in the human body are related to the frequency characteristics of vibration. Low-frequency (up to 30 Hz) and high-frequency (above 30 Hz) vibrations are distinguished according to the biodynamic response of the human body to the action of vibrations. Vibration directly affects all human organs and systems body, but the nervous, digestive and locomotor systems suffer the most. Also, as a result of long-term exposure to vibration, an occupational disease, the so-called vibration disease, can develop [5].

Factors such as physical exertion and static contribute to the development of vibration disease stress, noise, hypothermia, overheating, etc. Women, as well as people of young age and older than 40 years, are more sensitive to vibration. People with neurological disorders and diseases of peripheral vessels are prone to the development of the disease. The highest percentage of vibration sickness is registered with experience of working with vibration tools from 10 to 15 years [6].

Let us consider methods of prevention and control of these physical factors of environmental pollution. In order to prevent harmful effects from vibration, the following measures should be taken: reduce vibration frequencies at the sources of their occurrence, i.e., this will include operations to increase the accuracy of processing parts, improve the technological process and balancing; increasing the rigidity of the system, i.e., the use of spring vibration isolators and vibration-isolating pads, wearing special shoes with high elastic soles and the use of vibration-isolating gloves in work [5]. We can achieve vibration reduction by changing the technological process with the manufacture of parts from such materials as kapron, rubber, textolite, timely

implementation of preventive measures and lubrication operations; centering and balancing of parts, reduction of gaps in joints and other means and measures, and the duration of work with a vibrating tool should not exceed 2/3 of the work shift, the continuous action of vibration should not exceed 15-20 minutes. If the vibration machine exceeds the permissible value, then the contact time of the worker with it is limited [7].

To reduce the harmful effects of noise on workers, depending on the type of work, there are permissible levels at workplaces. The equivalent noise level, taking into account the permissible levels for all frequencies, should not exceed:50dBA in the premises of design bureaus, laboratories; 60 dBA – in control rooms and work rooms; 80 dBA in production facilities at permanent workplaces, in experimental laboratories. Reducing noise pollution can be achieved by: reducing noise at the source of its generation; isolation of noise sources; application of architectural and design solutions; use of personal protective equipment. The use of sound-absorbing materials is good [7].

Conclusion: Therefore, during the analysis of various scientific sources of information regarding the impact of noise and vibration on the human body, it was investigated that these physical factors are especially widespread in professional activities where physical labor is used, and there are mechanisms that create noise and vibrations. It was investigated what effect these physical factors have on a person. Noise affects all body systems, but the cardiovascular and nervous systems are the most vulnerable. Symptoms of exposure may include nervous tension, irritation, depression, and impaired attention and working capacity. Vibration has a similar effect, it also affects all body systems, with the nervous, digestive and locomotor systems suffering the most. As a result of long-term effects of vibration pollution, vibration disease develops. In order to prevent the impact of these physical factors, noise or vibration sources are eliminated, technological processes and equipment operation are improved, special protection is used, for example, vibration-isolating gloves or sound-absorbing materials. Special attention is also paid to the work schedule in places where these factors are concentrated, because constant contact with them will inevitably lead to a deterioration of health.

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SUSTAINABILITY ASSESSMENT OF THE NATURE RESERVE FUND OBJECTS IN ZAPORIZHZHIA REGION

Abstract. The article looks at the problem of nature reserves insularity in the districts of Zaporizhzhia region in quantitative and planar terms and the general index. Based on the results, cartographic models are constructed.

Keywords*:* nature reserve fund, insularity, unstable object, district, Zaporizhzhia region.

The insularity index (I) assesses the resilience of nature reserve sites to negative external impacts. It is calculated in both quantitative (In) and planar (Im) terms. According to the methodology [1], objects with an area of less than 50 hectares cannot withstand negative factors.

Im is determined by the following formula:

$$Im=S_1/S,$$

where S_1 is the area of relatively unstable PAs (up to 50 ha), ha;
S - total area of protected areas of a certain territory, hectares.
The indicator In is determined by the following ratio:

$$In=N_1/N,$$

where N_1 is the number of unstable PAs (up to 50 hectares);
N is the total number of protected areas in a given territory.
The insularity index of protected areas (*I*) is calculated as follows:

$$I = (Im + In) / 2$$

We calculate the area and number of unstable protected areas in each district of Zaporizhzhia region based on [2, 3]. For example, here is the calculation procedure for the Melitopol district.

In this area, we have the following objects of the nature reserve fund:

National natural park Pryazov (only 61,993.65 ha)

Regional landscape parks: absent

Protected tracts: Forest along the floodplain of the former the Velyky Utlyuk river, Yakovenko forest plantation.

Reserves of national significance: Molochny lyman, Altahir, Radivoniv, Kosa Fedotova, Syvashyk, Staroberdyansk.

Reserves of local importance: Domuzgla Stream, Zrazkova Stream, Vidrig Chebretsovoy, Protective Strip, Right Bank of Milk Estuary #1, Right Bank of Milk

Estuary #2, Right Bank of Milk Estuary #3, Steppe Slope of Milk Estuary, Troitska Stream, Starobogdanivske Tract, Virgin Area #1, Virgin site #2, Virgin site #3, Virgin site #4, Virgin site #5, Virgin site along the railway, Sudarma Tract, Chornomorchenko virgin site, Troitskaya virgin stream #1, Troitskaya virgin stream #2, Virgin site in the mouth Arabka r., Pristine area in the floodplain of the Korsak river #1, Pristine area in the floodplain of the Korsak river #2, Pristine area in the floodplain of the Molochna river, Pristine area in the steppe, Elizavetiv forest, Forest area near the Domuzgla river, Biloretsky forest, Mouth of the Korsak River, Floodplain of the Maly Ultyuk River, Floodplain of the Molochnaya River, Izvestyn Pond, Sosnovy Bir Kulisha, Stepanivska Spit, Tykha Zavod, Trach of Biloretsky Pond, Floodplain of the Atmanai River, Tashchenak Pod;

Natural monuments of national importance: Stone grave above the Molochna River, Upper Khiv'ya of the Utlyutsky estuary;

Natural landmarks of local importance: Old petiole oak, Patriarch oak, Petiole oak #1, Petiole oak #2, Petiole oak #3, Petiole oak 502, Virgin area along the railway, Stone grave near the village. Novospaske;

Dendrological parks of local importance: Golden Coast;

Zoological parks: absent

Parks-monuments of garden and park art of national importance: Gorky Park;

Parks-monuments of horticultural art of local importance: Alley of Glory, Forest nursery, Park near the railway station, Park Elite, Park of horticulture, Garden Park, Park of Kyrylivka sanatorium, Student's grove, Healing springs.

The calculation has showed that the area of all protected areas in the area is 92,015.56 hectares (S). The area of protected areas that meet the criterion of instability (less than 50 hectares) is 487.01 hectares (S1)

Calculate the indicator Im:

Im= 487.01/92015.56= 0.0053

By number, 45 out of 67 protected areas are unstable.

N1 = 45, N = 67

Calculate the ln indicator

In=45/67 = 0.666

Calculate the insularity index of Melitopol district:

I=(0,0053+0,666)/2= 0,6713/2= 0,34

This example was used to make calculations for all districts of Zaporizhzhia Oblast. The result for all districts is shown in Fig. 1:

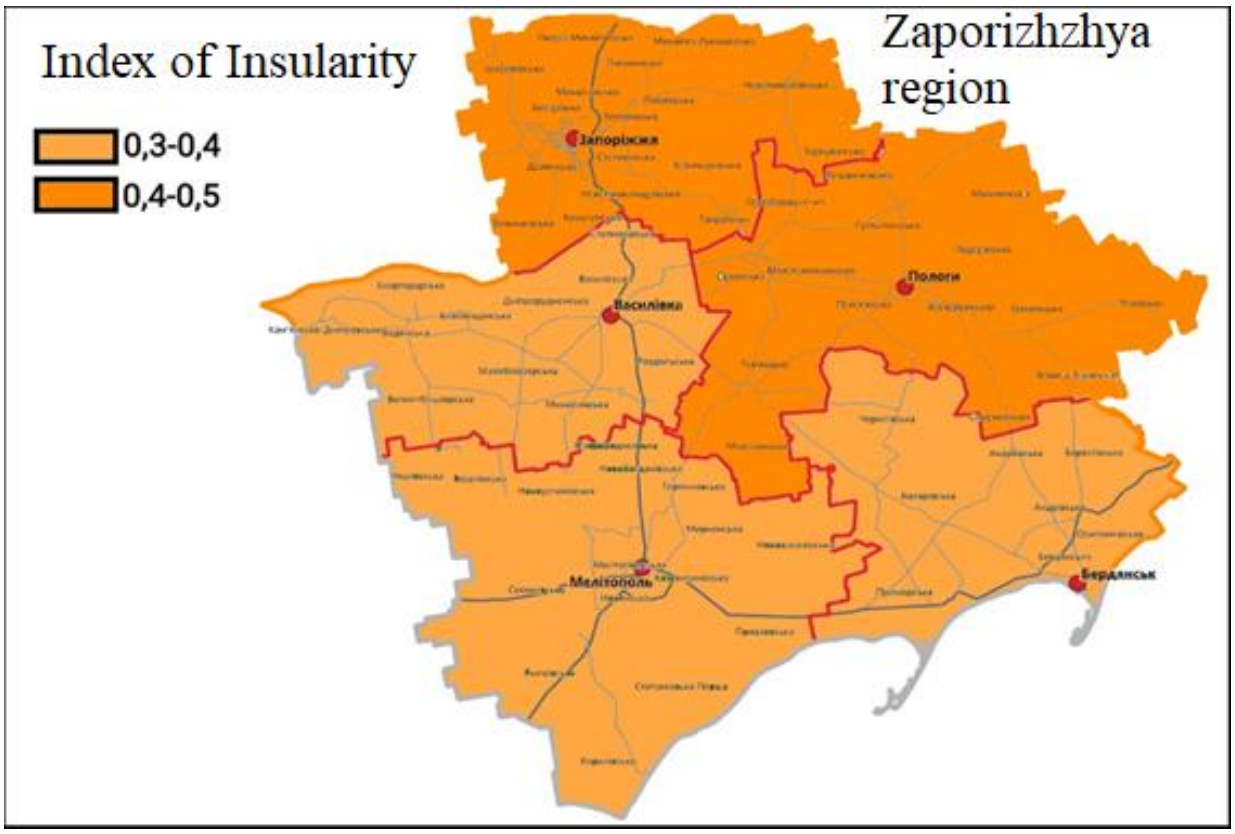

Fig. 1. Index of Insularity of Zaporizhzhya region districts

As a result, we can say that the insularity level of the regions is average, satisfactory. However, in two northeastern districts there is a danger of the values approaching half, which is a risk for the stability of the NZF system of the district.

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HYDROLOGICAL REGIME OF SMALL WATER BODIES AS A FACTOR IN THE FORMATION OF ECOTONE PLANT COMMUNITIES

Abstract. The study analyzes the seasonal dynamics of the water surface area of three small water bodies in the buffer zone of the Vyazivotskyi landscape reserve for the period 2013-2022 using multispectral Landsat images and water indices. It was found that the maximum area of water bodies occurs in March, and the minimum in August. Such a hydrological regime contributes to the formation of ecotone plant communities in the transition zones between aquatic and terrestrial environments.

***Key words**:* small water bodies, hydrological regime, ecotone plant communities, buffer zone, landscape reserve

Small water bodies in the steppe zone of Ukraine are dynamic water objects that create specific ecological conditions in adjacent areas [2]. Due to natural and anthropogenic factors, they undergo changes, which leads to the transformation of vegetation cover [1]. The aim of the study is to analyze the features of the water regime of the buffer zone of the Vyazivotskyi landscape reserve as the main factor in the formation of ecotone plant communities.

The object of the study is three water bodies in the buffer zone of the Vyazivotskyi reserve. To detect the water surface area and its changes, multispectral Landsat Collection-2 Level-1 images for 2013-2022 were used [4]. Water indices NDVI, NDWI, WRI, AWEI, and the MNDWI-SRTM-OBIA algorithm [3] were applied. The accuracy assessment of the methods was carried out by calculating the overall accuracy (OA) and the Kappa coefficient.

The AWEI index for the warm period of the year (OA = 97%, Kappa = 0.94) and the MNDWI-SRTM-OBIA algorithm (OA = 80%, Kappa = 0.75) for the cold period showed the highest accuracy in detecting water bodies. For each image, the AWEI index was calculated or the MNDWI-SRTM-OBIA algorithm was applied, and corresponding masks separating land and water were created. Based on them, the raster data were converted to vector format.

The study of the seasonal dynamics of water bodies allows us to determine the features of the water regime of the water-land ecotones. For this purpose, long-term average monthly indicators of water surface area were calculated. As a result, it was determined that the period of highest water content of the studied water bodies falls on March, while the lowest is in August.

The area of the water surface varies according to climatic indicators, which are key factors in the formation of the water balance of these water bodies. Thus, an increase in temperature during the summer causes evaporation of water from the water bodies, which exceeds the amount of precipitation during this period, and, accordingly, a gradual decrease in the area of the water body is observed. In contrast, during the winter period, positive values of the water balance of the studied water bodies are revealed.

According to the obtained data, a map was created that shows the maximum (March) and minimum (August) values of the water surface area of the studied water bodies for 2022 (Fig. 1). The map shows white areas characterized by periods of spring flooding and gradual drying in summer. Such a water regime creates conditions for the formation of specific ecotone plant communities, which are scattered along the entire perimeter of the water body, with the largest ones located in the upper half of each water body. Ecotone areas are characterized by increased biodiversity and play an important role in maintaining the ecological balance in the region.

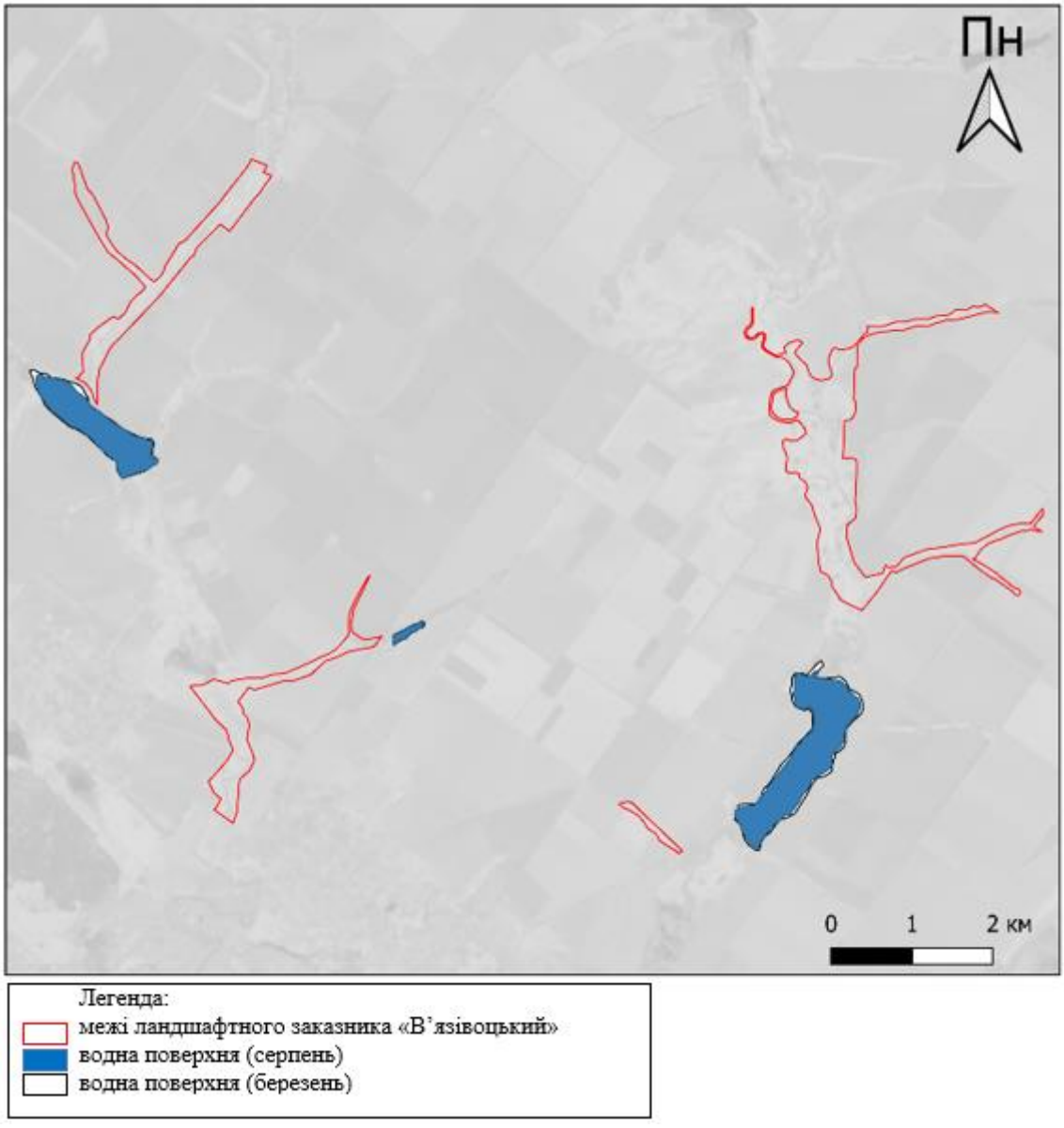

Fig. 1 Map of water bodies in the buffer zone of the Vyazivotskyi landscape reserve

The results of the study can be used to develop effective strategies for the conservation and monitoring of ecotone plant communities, as well as for planning water resource management measures in the reserve's buffer zone. In addition, the obtained data can serve as a basis for further research on the impact of the hydrological regime on the ecosystems of small water bodies and adjacent areas.

In the future, it is advisable to continue monitoring the hydrological regime of water bodies using additional remote sensing methods and field observations. This will deepen the understanding of the relationships between hydrological processes and the formation of plant communities, as well as develop recommendations for the conservation and restoration of ecotone areas in the region.

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RETROSPECTIVE REVIEW OF RED DATA BOOK PLANTS FOUND IN THE VOLNOVAKHA DISTRICT OF DONETSK REGION

Abstract.The article presents rare plants on the verge of extinction, which belong to the Donetsk region of Volnovakha district. The importance of protecting these species is emphasized.
Keywords: plants, rare species, biodiversity, steppe.

Donetsk region is not second to any other region of Ukraine, such as the Carpathians and Crimea, in terms of species diversity and uniqueness. However, this part of Ukraine has been most affected by anthropogenic impact due to the intensive development of industry, agriculture, and a high level of urbanization [1, 4]. Currently, Donetsk region is in a state of war, which negatively affects not only the local population, but also the landscape and plants, which in turn affects animals. That is why preserving flora biodiversity is an urgent issue in the region [3].

According to the Red Data Book of Donetsk region, there are 1930 species of vascular plants, including 93 endemic and subendemic species [2]. The rare fraction includes about 18% of the total number of species, including 23 species that are likely to have disappeared [2].

The Volnovakha district is in the southwestern part of Donetsk region and borders on Dnipro and Zaporizhzhia regions. It is characterized by the steppe zone and black soil. The district is rich in minerals, which contributed to the development of industry, resulting in the deterioration of flora and soil.

Despite the difficult ecological situation, Volnovakha district remains an area where you can find plants that are under protection.

Below is a list of Red Data Book species of Donetsk region that were found on the territory of Volnovakha district.

Liliopsida. Order ***Liliales*****:** family ***Colchicaceae:*** *Bulbocodium versicolor (Ker. Gawl.) Spreng. (Colchicum versicolor Ker. Gawl.);* family ***Liliaceae:*** *Tulipa gesneriana L. (T. schrenkii Regel), Tulipa graniticola (Klokov et Zoz) Klokov (T. ophiophylla Klokov et Zoz subsp. graniticola Klokov et Zoz, T. biebersteiniana auct. non Schult. Et Schult. f., p.p.), Tulipa ophiophylla Klokov et Zoz (T. biebersteiniana auct. non Schult. & Schult. f., p.p.), Tulipa quercetorum Klokov et Zoz (T. biebersteiniana auct. non Schult. & Schult. f., p.p., T. sylvestris auct. non L., p.p.).* Order ***Asparagales*****:** family ***Orchidaceae:*** *Cephalanthera longifolia (L.) Fritsch.;* family ***Convallariaceae:*** *Convallaria majalis L.;* family ***Iridaceae:*** *Crocus reticulatus Steven ex Adams.*; family ***Hyacinthaceae:*** *Hyacinthella pallasiana (Steven) Losinsk. (Hyacinthus pallasianus Steven), Ornithogalum boucheanum (Kunth) Asch., Ornithogalum fischerianum Krasch.;*family ***Amaryllidaceae*****,** subfamily ***Allioideae:*** *Allium pervestitum Klokov.* Order ***Poales*****,** family ***Poaceae:*** *Elytrigia stipifolia (Czern. ex Nevski) Nevski, Stipa capillata L., Stipa dasyphylla (Czern. ex Lindem.) Trautv. (S. pulcherrima K. Koch.*

dasyphylla (Czern.) Pacz., S. pennata L. dasyphylla (Czern.) Lindem.), Stipa grafiana Steven (S. pulcherrima K. Koch subsp. grafiana (Steven) Pacz., S. pennata L. β grafiana Lindem.), Stipa graniticola Klokov, Stipa joannis Čelak (S. pennata L.), Stipa lessingiana Trin. et Rupr., Stipa tirsa Steven (S. stenophylla auct.), Stipa ucrainica P.A. Smirn. (S. zalesskyi Wilensky subsp. ucrainica (P.A. Smirn.) Tzvelev.), Stipa zalesskii Winlensky (S. rubentiformis P.A. Smirn.). Order ***Alismatales*****,** family ***Araceae:*** *Arum elongatum Steven (A. orientale M. Bieb. subsp. elongatum (Steven) Engl.).*

Magnoliopsida**.** Order ***Lamiales*****:** family ***Lamiaceae:*** *Acinos fominii Des.-Shost., Salvia stepposa Des.-Shost. (S. dumetorum Andrz. ex Besser, p.p.), Teucrium chamaedrys L., Teucrium scordium L., Thymus pseudograniticus Klokov et Des.-Shost.;* family ***Veronicaceae:*** *Chaenorhinum klokovii Kotov (Microrrhinum klokovii (Kotov) F. Speta);* family ***Scrophulariaceae:*** *Scrophularia donetzica Kotov.* Order ***Asterales*****:** family ***Campanulaceae:*** *Adenophora lilifolia (L.) Ledeb. ex A. DC., Campanula trachelium L.;* family ***Asteraceae:*** *Artemisia nutans Wild. (A. cretacea Kotov), Centaurea ruthenica Lam., Centaurea taliewii Kleopow, Centaurea tanaitica Klokov, Inula helenium L., Leucanthemum vulgare Lam.* Order ***Malvales,*** family ***Malvaceae:*** *Alcea heldreichii (Boiss.) Boiss.* Order ***Rosales,*** family ***Rosaceae:*** *Amygdalus nana L., Crataegus ucrainica Pojark, Fragaria moschata (Duchesne) Weston, Rosa adenodonta Dubovik (R. balsamica Besser).* Order ***Ranunculales*****:** family ***Ranunculaceae:*** *Anemone sylvestris L., Chrysocyathus vernalis (L.) Holub (Adonis vernalis L., Adonanthe vernalis (L.) Spach), Chrysocyathus wolgensis (Steven) Holub (Adonis wolgensis Steven, A. volgensis Steven, orth.; Adonanthe wolgensis (Steven) Chrtek et Sláviková), Delphinium sergii Wissjul. (D. schmalhausenii auct. non Albov), Pulsatilla bohemica (Scalycký) Tzvelev (P. pratensis (L.) Mill. subsp. Bohemica Scalický, P. nigricans Störck), Ranunculus cassubicus L.;* family **Papaveraceae,** subfamily ***Fumariaceae:*** *Corydalis marschalliana (Pall. ex Willd.) Pers. (C. bulbosa (L.) DC. subsp. marschalliana (Pers.) Chater, nom. inval., C. cava (L.) Schweigg. & Körte subsp. marschalliana (Pall. ex Willd) Hayek, Fumaria marschalliana Pall. ex Willd., Pistolochia marschalliana (Pall.) Holub), Corydalis solida (L.) Clairv. (C. bulbosa (L.) DC., nom. rej., C. halleri (Willd.) Willd., C. bulbosa (L.) DC. subsp solida (Clairv) Chater, nom. inval., Fumaria bulbosa L. var. solida L., Pistolochia solida (L.) Bernh.).* Order ***Piperales*****,** family ***Aristolochiaceae:*** *Asarum europaeum L.* Order ***Fabales*****,** family ***Fabaceae:*** *Astragalus ponticus Pall., Astragalus pubiflorus DC. (A. exacapus L. subsp. Pubiflorus (DC.) Soó), Calophaca wolgarica (L. f.) DC., Caragana scythica (Kom.) Pojark. (C. grandiflora (M. Bieb.) DC. subsp. scythica Kom., Genista scythica Pacz. (G. albida Willd.), Hedysarum grandiflorum Pall.* Order ***Caryophyllales*****,** family ***Caryophyllaceae:*** *Cerastium pseudobulgaricum Klokov (C. gracile auct. Non Dufour), Dianthus elongatus C.A. Mey. (D. lanceolatus auct. non Steven ex Rchb.), Dianthus pallidiflorus Ser. (D. maeoticus Klokov), Otites donetzica (Kleopow) Klokov (Silene donetzica Kleopow), Otites hellmannii (Claus) Klokov (O. graniticola Klokov, Silene hellmannii Claus), Paronychia cephalotes (M. Bieb.) Besser.* Order ***Brassicales*****,** family ***Brassicaceae:*** *Crambe aspera M. Bieb., Crambe tatarica Sebeók, Erysimum krynkense Lavrenko (Acachmena krynkensis (Lavrenko) H.P. Fuchs).* Order ***Boraginales*****,** family ***Boraginaceae:*** *Echium russicum J.F. Gmel (E. rubrum Jacq., E. maculatum L.), Omphalodes scorpioides (Haenke) Schrank, Onosma*

tanaiticum Klokov. Order ***Geraniales*****,** family ***Geraniaceae:*** *Erodium beketowii Schmalh.* Order ***Malpighiales*****,** family ***Euphorbiaceae:*** *Euphorbia cretophila Klokov (E. petrophila auct. non C.A. Mey., p.p.).* Order ***Sapindales*****,** family ***Rutaceae:*** *Haplophyllum ciliatum Griseb.* Order ***Saxifragales*****,** family ***Paeoniaceae:*** *Paeonia tenuifolia L. (P. biebersteiniana Rupr., P. lithophila Kotov, P. tenuifolia L. subsp. Biebersteiniana (Rupr.) Takht.).* Order ***Solanales*****,** family ***Solanaceae:*** *Physalis alkekengi L.* Order ***Gentianales*****:** family ***Asclepiadaceae:*** *Vincetoxicum intermedium Taliev (Antitoxicum intermedium (Taliev) Pobed.), Vincetoxicum maeoticum (Kleopow) Barbar. (Cynanchum maeoticum Kleopow, Antitoxicum maeoticum (Kleopow) Pobed.), Vincetoxicum rossicum (Kleopow) Barbar. (Cynanchum rossicum (Kleopow) Pobed.);* family ***Gentianaceae:*** *Gentiana cruciate L.*

Pinophyta. Order ***Ephedrales*****,** family ***Ephedraceae:*** *Ephedra distachya L.*

Polypodiophyta. Order ***Polypodiales*****:** family ***Aspleniaceae:*** *Asplenium septentrionale (L.) Hoffm.;* suborder ***Aspleniineae*****,** family ***Cystopteridaceae:*** *Cystopteris fragilis (L.) Bernh. (C. filix-fragilis auct., Polypodium fragile L.);* suborder ***Polypodiineae*****,** family ***Dryopteridaceae:*** *Dryopteris carthusiana (Vill.) H.P. Fuchs (D. spinulosa (Sw.) D. Watt., D. euspinulosa (Diels) Fomin, nom. illeg., Polypodium carthusianum Vill.).*

Equisetophyta.Order ***Equisetales*****,** family ***Equisetaceae:*** *Equisetum telmateia Ehrh. (E. majus Garsault).*

Out of 382 species of plants under special protection in Donetsk Oblast, 84 species have been recorded in Volnovakha district. These rare plants belong to 5 classes, 23 orders, and 35 families.

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COMPARATIVE ASSESSMENT OF THE NATURE RESERVE FUND OF POLTAVA AND KHERSON REGIONS OF UKRAINE

Abstract.Insularity indices of the nature reserve fund of Poltava and Kherson regions were calculated. The low effectiveness of the NRF for ensuring the conservation of biological and landscape diversity is established. In general, the calculations showed a better provision of protected areas in Kherson region.

Keywords: nature reserve fund, insularity index, landscape, sustainability, restoration, biodiversity.

The relevance of this work lies in the fact that the creation of an ecological network with the largest objects of the nature reserve fund of Ukraine can help solve the problem of conservation and rational use of land in our country. This is necessary for the protection of animal and plant life, which is constantly exposed to the influence of people.

The purpose of the work is to compare the insularity indices of the nature reserve fund of Poltava and Kherson regions of Ukraine.

The calculation of the insularity index [5] is based on the idea that for the sustainability of a protected natural area it is important that it be intact and have a sufficient area to maintain the diversity of biological resources and landscapes through self-reproduction. For local cells, it is important that their area should be at least 500 hectares. This emphasizes the importance of researching objects that correspond to the optimal dimensions for optimization and further development of an effective management strategy when designing a local network.

The insularity index (I) consists of two parts. The first part (Im) is determined on the basis of the total area of the studied territory (S) and the area of all protected objects, which are stable (with an area of more than 500 ha) and unstable (with an area of less than 500 ha). The area of unstable objects is denoted as (S_1). The second component (In) is determined based on the total number of protected objects that are sustainable (N) and non-sustainable (N_1).

In Poltava region, the insularity index of the NRF in all districts is almost the same, close to 0.5 (Table 1).

According to the methodology, the values of the I index are in the range from 0 to 1. And the greater it is than zero, the greater the share of unstable objects in the territorial structure of the natural reserve fund of the district. And, accordingly, obtaining a value of 1 as a result of the calculations will indicate the complete poor quality of the existing structure and the fact that it cannot provide the necessary level of preservation.

In Poltava region, the index of insularity of the NRF in all districts is almost the same. The highest indicator of the index of 0,56 units belongs to Myrhorod district, correspondingly, the lowest indicator of 0,39 is available for Kremenchutsky district.

Table 1.

Index of insularity of t Poltava region

Name of the administrative district	Total area of protected objects in the district (thousand hectares)	The area of relatively unstable NRO	Im	Total number of protected objects in the district (pcs)	The number of relatively unstable NRO	In	Index of insularity
	S	***S_1***	***Im***	***N***	***N_1***	***In***	***I***
Myrhorod	15,8	5,2	0,32	52	42	0,8	0,56
Kremenchuk	57,36	3,86	0,06	38	28	0,7	0,39
Lubny	34,38	5,51	0,16	70	57	0,8	0,49
Poltava	56,8	9,6	0,16	93	79	0,8	0,5

In Kherson region, the NRF insularity index is normal, and in the Kakhovsky district the lowest is 0,37 close to 0 (Table 2).

Table 2.

Index of insularity of the Kherson region

Name of the administrative district	Total area of protected objects in the district (thousand hectares)	The area of relatively unstable NRO	Im	Total number of protected objects in the district (pcs)	The number of relatively unstable NRO	In	Index of insularity
	S	***S_1***	***Im***	***N***	***N_1***	***In***	***I***
Henichesk	53,2	0,05	0,0009	5	4	0,8	0,4
Skadovsk	178,62	0,674	0,004	23	16	0,7	0,35
Berislavsk	1,5	0,512	0,3	12	10	0,8	0,56
Kherson	15,94	0,732	0,04	33	26	0,8	0,41
Kakhovka	76,1	1,385	0,02	11	8	0,7	0,37

The values of the I index are in the range from 0 to 1. And the greater it is than zero, the greater the share of unstable objects in the territorial structure of the natural reserve fund of the district.

Having calculated the index, we can conclude that in the Kherson region the index of insularity of the NRF is almost the same, and in the Beryslav district the indicator is the highest: 0,56 is the closest to 1.

During the work, we have determined that the insularity index in the two regions is almost the same, but the indicators are not much better in Kherson region.

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A RETROSPECTIVE REVIEW OF RARE PLANTS OF THE LOWER PRYSAMARYA

Abstract. The article provides a retrospective analysis of the plants of the lower Prysamarya over 138 years, highlights the problem of anthropogenic pressure, and emphasizes the importance of creating a nature conservation area in this region.

***Keywords*:** lower Prysamarya, Emerald Network, rare species.

Samara forest is the largest steppe forest in southern Ukraine, covering the territory on the left bank of the Samara River, in its middle and lower reaches, within the Pavlohrad and Novomoskovsk districts. Prominent naturalists and researchers as M.I. Kotov, D.I. Yavornytsky, G.N. Vysotsky, V.V. Stakhovsky and others studied various aspects of the unique nature of this object. The greatest contribution to the study of the flora of Prysamarya was made by such researchers as I.Y. Akinfiev, M.O. Albytska, M.A. Sidelnyk, O.L. Belhard, V.V. Tarasov. Belhard developed a typology of forests in the southeast of Ukraine and his work was based on the study of the forests of Prysamarya, Tarasov studied in detail the representatives of the flora of the Samara forest and included them in the flora synopsis (1988), and his monograph (2005), which was used in the floristic study [8], according to which the floral composition of the Dnipro Prysamarya includes more than 1150 species of higher plants, 61 of which are protected by the Bern Convention, and some are relics and endemics, and the number of finds is only growing every year. Modern researchers who provide important additions to the geobotanical sketches of the Samara Forest are O.M. Masyuk, B.O. Baranovsky, V.V. Manyuk, D.G. Yemshanov, and O.S. Grigorenko. The site is dominated by floodplains and arenas, there are lakes formed by the riverbed activity at different times and lakes of the salt marsh terrace [3]. Landscape diversity is represented by five complexes: gully-steppe, valley-beam, floodplain, arena-boreal, and halophilic-lake-steppe [1, 2, 4]. The lower Prysamarya covers the following settlements and adjacent territories: Cherkaske, Hvardiyske, Khashcheve, Orlivshchyna, Novomoskovsk, and another nature conservation site - Samarski Plavni[5, 6] . This area of the Samara forest is quite vulnerable due to anthropogenic pressure, and the number of endemic and relict species and flora diversity in general was significantly reduced in the 1940s due to the flooding of the Samara rapids by the Dnipro hydroelectric power station [1, 11].

In 1996, Ukraine ratified the Berne Convention, which gave rise to the creation of protected areas in Ukraine the Emerald Network. These are protected areas created throughout Europe to prevent the extinction of species and habitats (listed in Resolutions 4 and 6) represented in them (For the lower Prysamarya, the following habitats are common: G1.22, G1.8, G:3.11, etc.) [6, 7]. In the European Union, it has a different name - Nature 2000, but it performs almost identical functions. In total, Emerald Network protected areas cover 10% of Ukraine's territory, with another 3%

being considered for approval in 2020. The Samara forest is included in the list of protected areas ("Samarskyi Lis - UA0000212") and a national natural park of national importance was supposed to be created on its territory by 2017, but this has not yet been done, and anthropogenic pressure has increased, so the only way to preserve rare plants of the lower Prysamarya and the Samara Forest as a whole is to create a number of protected areas in this area and grant this forest the status of an international biosphere reserve [1].

Despite the anthropogenic transformation, lower Prysamaryia remains an area where rare Red Data Book and relict species can be found [5, 9, 10, 11].

List of Red Data Book species of Dnipropetrovska oblast found in lower Prysamaryia:

Division Rhodophyta, Class Goniotrichales: *Chroodactylon ramosum (Thwait.) Hansg*

Division Chlorophyta, Class Chlorophyceae: *Stigeoclonium fasticulare Kutz*

Division Bryophyta, Class Bryopsida: *Polytrichum commune Hedw., Sphagnum palustre L.*

Division Polypodiophyta, Class Polypodiopsida: *Cystopteris fragilis (L.) Bernh, Pteridium aquilinum (L.) Kuhn, Dryopteris carthusiana (Will.) H.P.Fucks, Dryopteris filix-mas (L.) Schott., Matteuccia struthiopteris (L.) Tod, Salvinia natans (L.) All.*

Division Pinophyta (Gymnospermae), Class Gnetopsida: *Ephedra distachya L.*

Division Magnoliophyta (Angiospermae), Class Liliopsida (Monocotyledonae): *Allium regelianum A. Besk. ex Iljin., Allium rotundum L., Allium savranicum Besser, Galanthus nivalis L., Convallaria majalis L., Polygonatum odoratum (Mill.) Druce, Syperus glomeratus L., Scirpus supinus L., Hyacintella leucopaea (C. Koch) Schur, Ornithogallumbouscheanum (Hunth.) Asch., Ornithogallum fimbriatum Willd., Scilla sibirica Haw., Crocus reticulatus Steven ex Adams, Wolffia arrhiza (L.) Horkel ex Wimmer, Fritillaria meleagroides Patrin ex Schult. et Schult. f., Fritillaria ruthenica Wikstr., Tulipa quercetorum Klokov et Zoz, Orchis militaris L., Platanthera bifolia (Cust.) Rchb., Aeluropus littoralis (Gouan) Parl, Molinia caerulea (L.) Moench, Potamogeton nodosus Poir, Sparganium minimum Wallr., Adoxa moschatellina L.,*

Division Magnoliophyta (Angiospermae), Class Magnoliopsida (Dicotyledonae): *Adoxa moschatellina L., Achillea leptophylla M. Bieb., Centaurea substitut Czerep., Jurinea longifolia DC., Senecio borysthenicus (DC.) Andrz. ex Czern., Senecio paucifolius S.G.Gmel., Tragopogon ucrainicus Artemcz, Chartolepis intermedia Boiss., Anchusa popovii (Gusul.) Dobrocz., Hesperis tristis L., Dianthus stenocalyx Juz., Camphorosma monspeliaca L., Elatine alsinastrum L., Chamaecytisus lindemanii (V. Krecz.) Klásková, Galega officinalis L., Alyssum savranicum Andz., Corydalis marschalliana (Pall. ex Willd.) Pers., Hippuris vulgaris L., Limonium caspium (Willd. Gams), Nuphar lutea (L.) Smith., Anemone nemorosa L., Caltha palustris L., Pulsatilla grandis Wender, Pulsatilla patens (L.) Mill, Ranunculus lingua L., Thalictrum lucidum L., Padus avium Mill., Potentilla erecta (L.) Raeunsch, Salix caprea L., Melampyrum cristatum L., Veronica officinalis L., Veronica serpyllifolia L., Viola tanaitica Grosset.*

Over 138 years of research, 68 species have been found in the flora of the lower Prysamarya. Of these, 68 species are listed in the Red Data Book of the Dnipro region, 9 of which are endangered, 11 are considered lost; 17 species are listed in the Red Data

Book of Ukraine, 6 species are listed in the European Red List (R, I), and 1 in the World Red List (R).

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RESEARCH ON DIFFERENT COVERING MATERIALS FOR FORMING AN OPTIMAL GREENHOUSE MICROCLIMATE

Abstract. The use of greenhouses is actively growing in the modern agricultural sector to achieve high productivity and quality of plant products. With the increasing popularity, especially in the context of changing climatic conditions, the question arises about the optimal choice of materials for greenhouse covering. Therefore, researching various materials and their impact on the microclimate inside the greenhouses is extremely relevant.

***Key words**:* greenhouse, microclimate, temperature regime

We conducted a study analyzing the temperature regime and humidity inside greenhouses depending on the materials used for their covering, namely polyethylene film, polycarbonate, and glass.

The study included a comparative analysis of temperatures on the surface and inside the greenhouses. Experiments were carried out on the premises of the "Feduline" company in Casseneuil (France) in three different greenhouses located next to each other at a distance of 5 meters. All greenhouses were closed without plants or ventilation systems to ensure uniform experimental conditions. Temperature was observed both inside and outside each greenhouse at a height of 1.5 meters above the ground surface, with measurements taken every 15 minutes to obtain average values.

On January 21, 2024, it was found that temperature changes were similar at night but significantly different throughout the day, likely due to the influence of solar radiation penetrating inside the greenhouses during the day. The air temperature inside the greenhouses ranged from 3.3 to 25.1°C for the greenhouse with polyethylene covering, from 6.2 to 22.7°C for the greenhouse with polycarbonate, and from 4.7 to 20.8°C for the greenhouse with glass covering. The temperature difference was 22, 16.5, and 16.1°C respectively for the plastic, polycarbonate, and glass-covered greenhouses. The average air temperature inside the greenhouses was 11.6, 13.2, and 11.4°C respectively. It was found that the maximum air temperature was 15.1, 12.7, and 10.8°C higher than the outside air temperature in the greenhouses with plastic, polycarbonate, and glass covering respectively.

The minimum temperature inside the greenhouses was observed between 06:30-06:45, while the maximum temperature was recorded between 14:00-14:15. The greenhouse with plastic covering exhibited rapid temperature changes due to the thinner plastic film, which is more sensitive to external temperature.

The greenhouse with plastic covering showed the most significant temperature fluctuations inside. The air temperature in the polycarbonate-covered greenhouse was 2.4°C lower than in the plastic-covered greenhouse and 1.9°C higher than in the glass-covered greenhouse. Additionally, the greenhouse with polycarbonate covering had the highest values for both minimum and average air temperatures overall.

We can explain this by the air layer between the polycarbonate panels retaining heat from solar radiation during the day and acting as a barrier to heat transfer at night. These results confirm that polycarbonate is the most suitable material for greenhouse covering to retain heat at night during the cold season, while glass is most effective for energy savings during cooling in the hot season. The greenhouse with plastic covering exhibited the highest temperature fluctuations inside, while the greenhouse with polycarbonate covering tended to maintain a high air temperature overall. Glass covering demonstrated the smallest temperature fluctuations inside. This study underscores the importance of choosing greenhouse covering materials considering their economic efficiency and the characteristics of the surrounding microclimate.

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CHARACTERISTICS OF PLANT DIVERSITY IN THE ICHTHYOLOGICAL RESERVE "BALKA VELYKA OSOKORIVKA"

Abstract. The article presents the results of the flora study in the ichthyological reserve "Balka Velyka Osokorivka" in 2021-2023. During the research, we identified 16 regionally rare and 7 species of vascular plants subject to national protection. The authors determened anthropogenic threats to plant diversity, and substantiated the expediency of changing the conservation status of the territory..

***Key words*:** plant diversity, rare species, plant conservation, ichthyological reserve

Biodiversity loss is a pressing issue due to factors like changes in land use, climate change, the expansion of invasive species, overexploitation and environmental pollution from construction, plowing of land, land reclamation, reservoir construction, creation of transport infrastructure networks, and other types of mining and agricultural activities [1, 2, 3, 4]. This loss is primarily associated with the degradation of plant communities (phytocenoses). To address this, there is an urgent need to create protected areas and conduct research to study plant resources, monitor changes in vegetation, and gain knowledge for conservation efforts.

The ichthyological reserve of local significance "Balka Velyka Osokorivka", where expeditions were conducted, is located within the Synelnykove district of the Dnipropetrovsk region, southwest of the village of Varvarivka and northeast of the village of Voronove, in the lower reaches of the Osokorivka River (a left tributary of the Dnieper River). Its area exceeds 2000 hectares. The status was granted in accordance with the decision of the Dnipropetrovsk Regional Executive Committee dated 14.10.1982 № 654 for the preservation of spawning, wintering and fattening sites of valuable fish species.

The watershed-gully landscape of Velyka Osokorivka is characterized by several microclimatic variants, geomorphological features, different exposures and steepness of slopes, and a variety of forest growing conditions. Here we can distinguish the following types of vegetation cover: areas of various grass-cereal steppes, meadows, artificial deciduous upland forest tracts, marshes, cultural phytocenoses, which determine a significant species diversity of terrestrial and semi-aquatic fauna and flora.

The study of flora was carried out during 2021-2023 on the mainland territories of the ichthyological reserve. During the expeditionary trips, species of flora with a protected status were identified, namely 16 species from the Red Book of the Dnipropetrovsk region and 7 species from the Red Book of Ukraine.

Bulbocodium versicolor (Her. Gawl.) Spreng. Populations were found on the slopes of ravines and in areas of steppe along the Osokorivka River, in sparse artificial plantings. Some populations are quite dense, over 100 individuals per 10 m^2. Conservation status of the species: listed in the Red Book of Ukraine (vulnerable), listed in the Red Book of the Dnipropetrovsk region (vulnerable).

Stipa pennata L. Found in a steppe area and on the northern side of a second-order ravine northeast of the village of Voronove, the finds are few, diffuse individuals in a community with other typical steppe plants. Conservation status of the species: listed in the Red Book of Ukraine (vulnerable), listed in the Red Book of the Dnipropetrovsk region (vulnerable).

Adonis vernalis L. Small populations, 5-25 individuals in steppe areas along the Osokorivka River and terraced slopes. The largest population was found in a second-order ravine (1 kilometer north-east of the village of Voronove), where the density was over 75 individuals per 10 m^2. Conservation status of the species: listed in the Red Book of Ukraine (not evaluated), listed in the Red Book of the Dnipropetrovsk region (vulnerable), included in the CITES Appendix.

Astragalus ponticus Pall. Isolated growth sites in steppe areas and on the tops of a second-order ravine (1 kilometer north-east of the village of Voronove). Conservation status of the species: listed in the Red Book of Ukraine (vulnerable), listed in the Red Book of the Dnipropetrovsk region (rare).

Astragalus dasyanthus Pall. Habitat – steppe slopes, thickets of steppe shrubs, glades of ravine forests. It occurs in the composition of meadow-steppe, steppe phytocenoses. It grows in steppe areas of ravine systems throughout the reserve, but the populations are small and fragmented. Conservation status of the species: listed in the Red Book of Ukraine (vulnerable), listed in the Red Book of the Dnipropetrovsk region (rare), listed in the European Red List (I) and the IUCN Red List (R).

Stipa lessingiana Trin. et Rupr. It is found on the slopes of ravines, as a dominant, and in the composition of cenoses with other typical steppe plants. Conservation status of the species: listed in the Red Book of Ukraine (not evaluated), listed in the Red Book of the Dnipropetrovsk region (rare).

Stipa capillata L. Found in the northern part of the reserve, where crystalline rocks outcrop, steppe slopes of the first above-floodplain terrace. Conservation status of the species: listed in the Red Book of Ukraine (not evaluated), listed in the Red Book of the Dnipropetrovsk region (rare).

Ephedra distachya L. Habitat – In the north of the reserve, 1.6 kilometers southwest of the village of Zelene and 3.5 kilometers northeast of the village of Voronove, a small second-order ravine with two arms, southern slope, a local, dense population. Conservation status: listed in the Red Book of the Dnipropetrovsk region (rare).

Salvinia natans L. The northern part of the reserve, where the watercourse becomes narrow. Conservation status of the species: listed in the Red Book of Ukraine (not evaluated), listed in the Red Book of the Dnipropetrovsk region (vulnerable).

Iris pumila L. Found on the slopes of a ravine, 1 kilometer northeast of the village of Voronove. The population is diffuse. Conservation status: listed in the Red Book of the Dnipropetrovsk region (rare).

Salvia austriaca Jacq. Isolated finds on the slopes of a ravine, 1 km northeast of the village of Voronove. Conservation status: listed in the Red Book of the Dnipropetrovsk region (rare).

Scilla sibirica Haw. A local population of several dozen individuals in the thalweg of a ravine, 2.4 km northeast of the village of Voronove. Conservation status: listed in the Red Book of the Dnipropetrovsk region (rare).

Bellevalia sarmatica Pall. ex Georgi. A few individuals were found in a glade, 1.7 km northeast of the village of Voronove. Conservation status: listed in the Red Book of the Dnipropetrovsk region (rare).

Hyacintella leucopaea C. Koch. The largest population was found on the slopes of a second-order ravine (1 kilometer north-east of the village of Voronove), together with *Adonis vernalis* L. Conservation status: listed in the Red Book of the Dnipropetrovsk region (rare).

Allium rotundum L. Several local small populations on steppe slopes of ravines. Conservation status: listed in the Red Book of the Dnipropetrovsk region (rare)

Fragaria vesca L. A local population in the thalweg of a ravine, 2.4 km northeast of the village of Voronove. Conservation status: listed in the Red Book of the Dnipropetrovsk region (endangered).

The above-listed species are threatened by negative anthropogenic factors, namely burning in the spring of 2022, and fallen plant residues in the fall (so-called grass burning), gathering for bouquets, and haymaking in ravines. To reduce these factors, it is proposed to disseminate environmental knowledge and culture among the population, mark the boundaries of the reserve with protective signs, and strengthen control over logging. The “Balka Velyka Osokorivka” reserve is simultaneously one of the main spawning grounds of the reservoir, a valuable habitat for avifauna, and is included in the list of IBA territories and met criteria B1 and B2 (2001). The plant diversity consists of at least 554 species, some of which are Red Book species. The ravine serves as a shelter for animals of the steppe, forest-edge, and forest fauna. Thus, the ichthyological reserve “Balka Velyka Osokorivka” has great potential as a protected area for Red Book fish, birds, plants and the preservation of their habitats. In addition, part of the adjacent territory of the reserve is included in the Emerald Network and could become one of the cores of the Dnieper eco-corridor, so it would be advisable to change the status of the ichthyological reserve to a regional landscape park or a national nature park.

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DEFORESTATION ON THE TERRITORY OF UKRAINE

Introduction. Forests in Ukraine perform important functions in providing oxygen, regulating the climate, and preserving rich flora and fauna. Nevertheless, massive deforestation leads to negative consequences that threaten ecosystems and people's lives. Forests are of great importance for the ecological stability of the country, as they contribute to air purification, groundwater conservation, erosion prevention and provide a unique environment for many species of plants and animals. The loss of forest massifs due to felling is fraught with these useful functions and can lead to negative changes in climatic conditions and the balance of natural ecosystems. The main forest-forming species in the forests of Ukraine are: coniferous - common pine, spruce, fir; hard-leaved: common oak, forest beech, common hornbeam, sharp-leaved maple; soft-leaved - white acacia, drooping birch, aspen, black alder [1].

Actuality. Deforestation is one of the most urgent environmental problems of our time, which has a serious impact on the environment and biodiversity. Forests play an important role in maintaining ecosystems, providing oxygen, purifying the air and regulating the climate. Nevertheless, mass deforestation leads to catastrophic consequences that threaten not only the natural environment, but also human life.

The problem of deforestation on the territory of Ukraine. Images from space testify to the reduction of the area of Ukrainian forests and the felling of the oldest massifs. Despite the increase in the forest area in some regions, the total forest area is decreasing. Especially in recent years, there has been a reduction in the area of old, mature forests. What leads to this decrease?

As one of the leading wood exporters in Europe, Ukraine faces a serious problem in terms of illegal exports. The lack of knowledge about the scale of illegal activity in this area causes serious concern. Without the introduction of the European wood accounting system, which ensures strict control from planting trees to the production of furniture or parquet, the industry becomes vulnerable to abuses and violations. This makes it possible to massively cut down the forest in violation of international norms, but then export it legally.

Another problem is the irrational use and management of forest resources. Bad trends have also developed in the industrial processing of wood species. More than 50% goes to fuel and energy needs or to waste. The structure of the use of wood resources and production of wood-based products is generally unsatisfactory.

One of the biggest shortcomings of forest control is that the last national inventory of forests was carried out in 1996. While the official data is based on about 16% of Ukraine's forest cover, this indicator is already less than 11%. And the optimal share of forests is about 20% of the Ukrainian territory. And in order to achieve this indicator, in the future it is necessary to plant about 2 - 2.5 million hectares with new trees.

A very high level of deforestation is observed in the territory of Chernihiv, Kharkiv regions, the Carpathians and Polissia. This has its consequences. Today, the largest area in forest plantations is occupied by young trees (45.4%) and medieval plantations (37.7%), while maturing and mature stands make up only 10.1% and 6.8%, respectively, which is 1.5-2 times less than optimal values [1]. A large share of medieval and mature trees indicates considerable amounts of felling and restoration 50-80 years ago. Thus, in the territory of Eastern Polissia, the area of young trees is 45.1 thousand ha or 15.5% of the pine area is planted, which is slightly less than the optimal value [3].

Careful removal of forests is of decisive importance, as it entails not only the loss of green plantings; it has a significant impact on the environment. Deep ravines, destructive landslides, and villages appear on the cleared territories. Along with the deterioration of the gas composition of the atmosphere and the change in the hydrological regime of water bodies, the destruction of photosynthesizing phytomass, which plays an important role in ecological processes, occurs. In addition, numerous species of plants and animals are disappearing, erosion processes are becoming more active. Ukraine is now facing the threat of desertification. Improper use of forests leads not only to their destruction, but also to the replacement of valuable species, such as conifers, with less valuable softwoods, such as birch and aspen, which produce low-quality wood.

Improper implementation of forest management in Ukraine has led to significant depletion of forests, a decrease in the productivity of their ecosystems, and a deterioration in the structure of the forest fund [1].

Ways to solve the problem. To prevent further reduction of forest areas and develop a sustainable forest management strategy, we should take comprehensive measures. Among them are strengthening of control over logging, encouraging the use of sustainable forest management and the transition to alternative sources of wood [7]. The document, which is undergoing the approval procedure, provides for the adaptation of forests to climate change, the conservation of biodiversity and the digital transformation of the forest industry.

Conclusion. Deforestation in Ukraine is a serious problem that requires immediate management and measures to preserve this valuable natural resource for future generations. Resolving this issue requires targeted government programs, enhanced control and public participation in decision-making processes on the landscape and environmental well-being of the country.

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WAR DESTROYS THE ENVIRONMENT AND HARMS THE CLIMATE

Abstract.The article highlights the impact of the war in Ukraine on climate change due to large greenhouse gas emissions created as a result of hostilities and infrastructure reconstruction. In addition, the war leads to an increase in fires and mass migration, which also affects the climate and requires immediate measures to minimize the consequences.
***Key words**:* war, greenhouse gases, climate, emissions, responsibility.

Today's global security encompasses not only military issues, but also climate dimensions. Adaptation to climate change includes the transition of armies to environmentally friendly fuel, changes in infrastructure and protection of the territory from harmful environmental impacts. Russian aggression against Ukraine poses a threat at all levels, including environmental. It harms the Ukrainian climate by occupying and poisoning the land, as well as affecting nuclear and energy security [1].

In the first seven months of the full-scale war in Ukraine, at least 100 million tons of carbon dioxide were emitted, leading to climate change [3]. If today it has been going on for 24 months, then the estimated total volume of carbon dioxide will be 343 million tons [4].

Globally, military operations and industry may be responsible for about 5% of all greenhouse gas emissions, but the issue of accounting for these emissions has remained unresolved since 1998. The Paris Climate Agreement does not set mandatory limits on emissions from military operations, but countries can voluntarily account for and offset them. Ukraine advocates the creation of a global platform for assessing climate damage from hostilities [3].

Uniting countries to fight the climate crisis can also serve as an example for establishing responsibility for devastating military actions. The issue of accounting for emissions from hostilities needs to be addressed immediately due to the lack of a clear methodology. Scientists believe that more research needs to be done in this area, and the Intergovernmental Panel on Climate Change (IPCC) supports the need for reporting on military emissions. To reduce the impact of the military sector, it is important to create a methodology for calculating emissions, identify those responsible for them and compensate for the damage caused. Investments in recovery should contribute to the reduction of greenhouse gas emissions and adaptation to climate change, as well as the use of less carbon-intensive materials and the development of renewable energy [3].

According to scientists' calculations [2], the total contribution of fine soot to the Earth's heat balance is greater than all greenhouse gases, except for carbon dioxide. The mechanism of the impact of ash on climate change is as follows: due to its small size, soot particles can move over long distances and not settle on the ground for a long time. This is especially pronounced during dry periods of the year, when ash with air masses can be transferred even to areas with permafrost. Normally, the white and shiny surface of the ice reflects the sun's rays and this prevents the atmosphere from

overheating. But when the permafrost is covered with ash, the natural process of reflection of solar radiation does not occur — the process of heating and accelerating melting begins [3].

Anthropogenic activities, such as plant emissions and exhaust gases, also contribute to climate change. However, the contribution of the war, especially in the context of the conflict with Russia, to climate change is unpredictable and difficult to assess. The release of methane and other anthropogenic gases has a major impact on climate change. A particularly large amount of harmful substances is released into the air during fires that occur in cities, industrial facilities and chemical plants during hostilities. This results in the release of organic matter, carbon dioxide and nitrogen dioxide, which contribute to global warming. Forest fires also significantly accelerate this process, destroying thousands of hectares of forests and grass ecosystems. It is necessary to pay more attention to the problem of fires and emissions of harmful substances to preserve our planet. Restoration of destroyed infrastructure, closure of airspace and detours for carriers also lead to significant greenhouse gas emissions [2].

According to official figures, the war in Europe and other parts of the world has led to a massive migration of refugees, which has led to a shift in the production and consumption of energy resources, food, clothing, and other goods to other countries. This has led to the replacement of energy-intensive industries with manufacturers from other countries, as well as to the destruction of supply chains. As a result, the reduction in emissions in Ukraine is offset by an increase in emissions in other regions, which does not contribute to climate improvement [4].

The impact of war on the Earth's ecosystem can have devastating consequences, including climate change due to greenhouse gas emissions. These effects may be less visible compared to other damages, such as flooding areas or land pollution, but they also have a serious impact on the environment. Ukraine aspires to become a member of the EU and has already adopted a strategy for environmental security and adaptation to climate change. Russia's actions lead to ecocide in Europe and threaten the survival of humanity. Climate damage and other environmental impacts should be taken into account when assessing the total damage from the war and when bringing the aggressor to justice [1].

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UNAUTHORIZED LANDFILLS AS A PROBLEM IN TRANSCARPATHIAN REGION

Abstract. The article looks at the problem of solid household waste management in the Transcarpathian region. The author has analyzed the main indicators that make it up. It was established that the specific disposal of solid waste at unauthorized landfills is about 0.52 m3/ha, which is quite high among the regions of Ukraine. With good coverage of the population by solid waste removal services (77%), spontaneous landfills are widespread. The article discusses the ways of evolution of landfills over time.

Keywords: landfills, waste, unauthorized, spontaneous.

According to the Ministry of Development of Communities and Territories of Ukraine, more than 25,000 unauthorized landfills on an area of about 1,000 hectares are registered in Ukraine every year, the occurrence of which obviously relates to the lack of centralized removal of solid waste (22% of the country's population is not covered by removal services solid waste).

One of the objectives of the National Waste Management Strategy in Ukraine until 2030 [1] is to increase the level of MSW recycling to 50% by 2030 and abandon a large number of existing landfills and landfills while simultaneously launching new regional landfills.

Transcarpathian Oblast is characterized by relatively low values of specific solid waste disposal (4.3 t/people), at the same time, specific solid waste disposal at unauthorized landfills is about 0.52 m3/ha, which is quite high among the regions of Ukraine [2]. It is characterized by one of the lowest shares of landfill space in Ukraine (0.0075%) and one of the highest shares of overloaded landfills - about 11%, while in the neighboring Chernivtsi region - less than 2% [2].

In general, the coverage of the population with solid waste removal services is the average for Ukraine - 77% [2], but this does not reduce the problem, since the private sector population traditionally takes garbage outside the village and throws it on the sides of roads, on the banks of rivers, on the edge of forests, etc. In this way spontaneous landfills are created, which are occasionally either burned or compacted. Most often, grass grows through garbage and it naturally decomposes or mixes with plant remains.

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THE EFFECT OF WATER EROSION ON THE SOILS OF UKRAINE

Abstract.The article considers the problems that arose and arise from the appearance of soil erosion. This article looks specifically at the effects of water erosion. What consequences will the farms and Ukraine in general suffer from the changed qualities of our fertile soil. And what measures will need to be taken to improve the situation.

Keywords: water erosion; soil; ground cover; black soil; ecological condition of soils; soil degradation; land protection

Soil cover is one of the main components of the environment, which performs important biosphere functions, participates in regulating the quality of surface and underground waters and the composition of atmospheric air. Soils are the habitat of most organisms on the surface of the earth and provide a favorable environment for humans and agricultural production [2]. Competitive advantages of the development of agriculture in Ukraine are favorable agro-ecological conditions. Also, the fact that more than half of the arable land of our country consists of fertile chernozems [1].

However, a number of adverse processes are currently affecting a significant part of the soil. One of the main causes of soil degradation in Ukraine is erosion [6]. It leads to the deterioration of the physical properties of the soil, the reduction or complete destruction of humus, macro- and microelements, the deterioration of soil fertility, the reduction of the yield of agricultural crops by up to 60% and the increase of costs for agrotechnical measures [3].

According to the State Geocadastre the area of agricultural land in Ukraine is 13.3 million hectares, of which 4.5 million hectares are medium and heavily eroded soils, which are affected by water erosion, and 68,000 hectares of soils are completely devoid of humus [1].

Currently, climatic conditions are one of the main factors of erosion. Soil destruction due to erosion can take various forms, including erosion, excavation, washout, formation of ravines and ravines [4].

When studying the factors affecting the intensity of the erosion process, we should pay attention to the amount, nature and mode of precipitation, the energy of falling raindrops and the erosion index, because this factor provokes the manifestation of water erosion [1].

Thanks to our current capabilities of using the Internet, you can visually see the problem in online services that provide the opportunity to view space images.

Here is an example from programs b Google Earth Pros :

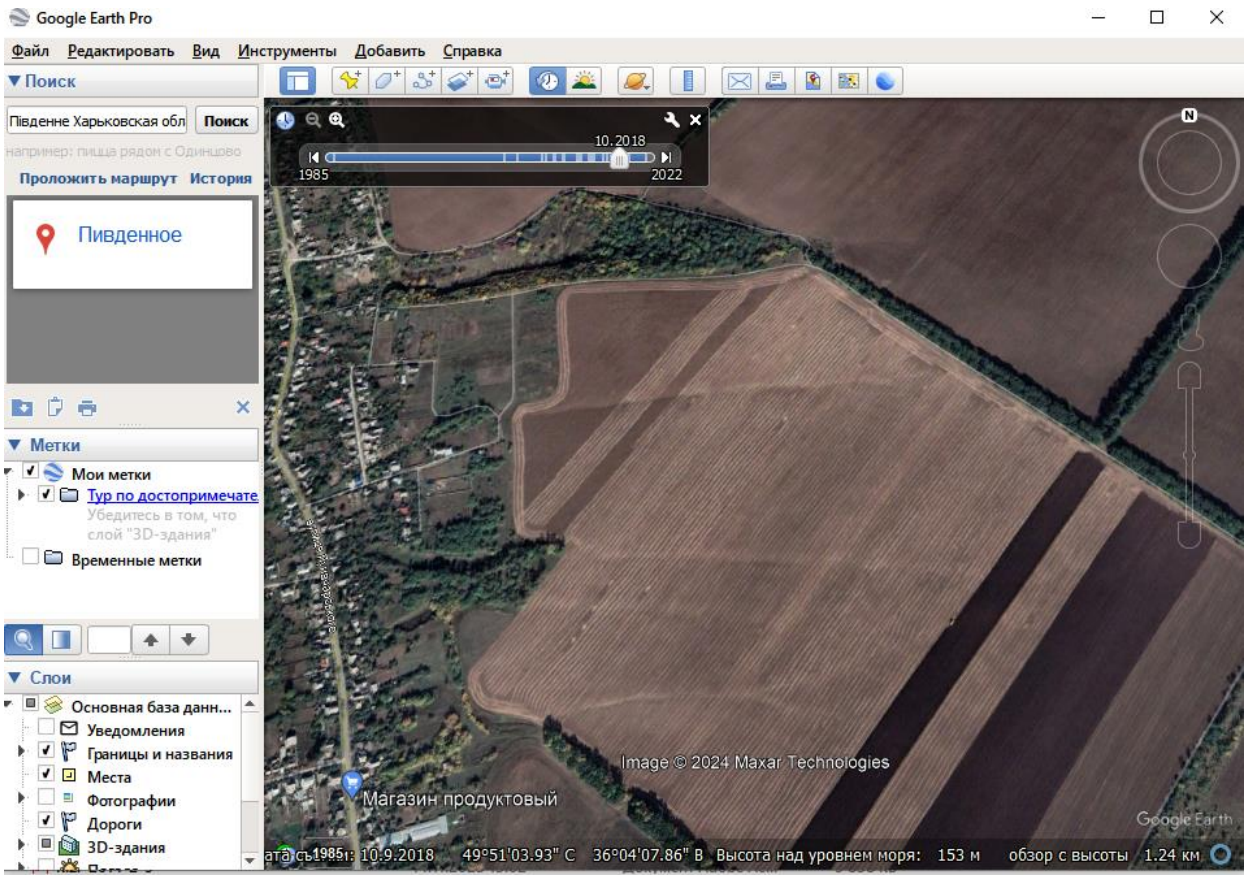

Fig. 1 Manifestations of water erosion on a field in the city of Yuzhnoye in 2018.

In this case, in Fig. 1, the manifestation of water erosion is provoked by the fact that the field is located on a slope, and thus, when the steepness of the slope increases, water runoff increases [1]. You can recognize the signs of this erosion by the difference in color (much whiter than the field). Tthey are significantly different from the normal structure and color of the field. You can also visually observe that these white stripes seem to be a little deeper, because they have already been washed away in places and thus form a non-uniform surface.

The activity of soil erosion in recent years is associated not only with the increase in arable land and the load on pastures, but also with the use of heavy tillage equipment, which compacts the soil and destroys its structure [4].

To create environmentally sustainable agricultural landscapes and reduce erosion processes in Ukraine, it is necessary to take measures for the rational use of land resources, maintaining and increasing soil fertility, restoring soil productivity, and maximizing the biological potential of terrestrial and aquatic ecosystems [3] .

Let us consider several situations, that is, types of fields, and what we can do on them:

I type: intact and slightly damaged by soil erosion. Cultivation of main crops (including row crops) and pure crops is allowed. The flow is regulated by agrotechnical methods and field protection forest strips.

II type: parts of slopes with large slopes with moderately and strongly eroded soils and the presence of jet washes. Crop rotation on these lands should be dominated by continuously planted crops and perennial grasses. Cultivation of steam and row crops

on this group of lands should be extremely limited or prohibited. Runoff from these slopes is regulated by anti-erosion measures of water use technology.

III type: the lower parts of the slopes with slopes greater than 7°, which are mainly occupied by heavily washed soils. This type of land is used as a pasture, reclaimed or fully forested area [7] .

Often, in order to reduce surface erosion, water retention ramparts are used. They are made in the upper part of ravines or on the sides of ravines [4] .

Effective methods of combating water erosion are also soil-protecting crop rotations, soil cultivation along slopes and liming of soils on slopes [3].

One of the most important and cheapest measures is the optimization of the structure of agricultural land. The essence of this measure is to optimize the ratio of the area of ecologically unstable agricultural land - arable land, gardens, to the area of stable agricultural land such as natural fodder land and forests. This ratio can be considered optimal if it does not exceed units, but the exact optimal value of this ratio varies from region to region [7].

Conservation and rational use of soils should be at the center of national policy, because the condition of soils determines the way of life of mankind and has a decisive impact on the environment [2].

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MILITARY OPERATIONS ON COMPONENTS OF THE ENVIRONMENT

Abstract.The study contains a review of the literature on the impact of armed aggression on the components of the environment. The study found that all components are affected both directly and indirectly. The key problem is that in the territories that are still occupied, it is impossible to monitor and assess the damage caused to the environment.

Keywords: military actions, consequences, environmental components, impact.

Missile explosions, artillery shelling, and landmines produce a variety of chemical compounds, such as carbon monoxide and carbon dioxide, water vapor, nitrogen oxide, and others. In addition, toxic elements such as sulfur and nitrogen oxide are released, which can cause acid rain.

Regular enemy shelling leads to fires in industrial and warehouse buildings, which releases a significant amount of combustion products into the air.

For example, in April 2022, in the city of Rubizhne, Luhansk region, Russian troops twice fired nitric acid into the atmosphere.

In 2022, emergency power outages were introduced in Ukraine due to massive rocket attacks, which led to a decrease in electricity supply. Due to the outages, Ukrainians were forced to use other alternatives to supply electricity, and generators became the most common devices. Their use leads to the emission of harmful substances into the environment, such as carbon monoxide, carbon monoxide, soot, nitrogen oxides and fine dust, and inhalation of these compounds directly harms public health.

Our water resources suffer not only because of the shelling, but also because of the equipment that Russian troops dump into the rivers while fleeing. These actions lead to general contamination of the water body with various substances, such as iron, other heavy metals, and fuel from submerged equipment. As a result, steel structures corrode in large quantities, and water bodies become saturated with metal ions, which leads to pollution of aquatic ecosystems. For example, in 2014, in the city of Lysychansk, Russians destroyed a bridge that crossed the Siverskyi Donets River, and the remains of this bridge were collected for several years, and it is obvious that a significant portion of them remained at the bottom or were transported to other areas by the current. Thus, it harmed the biota living in the area.

Donetsk and Luhansk oblasts, which have been partially occupied since 2014, face the threat of mine flooding. Due to the constant shelling, the power grid is affected, so the pumps that pump out water cannot work. As a result, the mines are flooded with groundwater that may be contaminated with heavy metals.

In the areas close to the front line in Donetsk, Luhansk, Zaporizhzhia, Mykolaiv and Kherson regions, the infrastructure of sewage systems is constantly damaged by shelling, leading to pipe bursts and depressurization.

During the shelling of military positions, shells explode, resulting in the formation

of craters 0.5 to 5 meters deep, depending on the type of shell. This leads to the destruction of vegetation and soil cover, and disrupts the hydrological regime of the soil. The movement of heavy machinery also causes soil compaction, which leads to changes in its structure. This results in a new soil profile that is not typical for the area. Each shell explosion causes the formation of a complex mixture of chemicals that settle in the soil and inhibit plant growth, reducing the population of soil animals and bacteria.

Mass burial or simple discarding of human bodies during military operations also leads to a significant accumulation of toxic substances in the soil. The process of their decomposition increases the risk of disease outbreaks that can be transmitted through the preserved microorganisms.

Since the beginning of the full-scale invasion, the total area of forests damaged by fires is estimated at 250,200 hectares [2, 3]. In the occupied Luhansk region, the fires caused by the military aggression of Russian troops have affected the territories of the nature reserve fund, in particular, the Kreminna Forests National Nature Park, the largest natural forest area in eastern Ukraine, as well as part of the adjacent steppe and a hydrological reserve.

The military conflict on the territory of Ukraine has caused a major obstacle to the development of the agricultural business and crop production. Some of these factors are the reduction of sown areas, mining of the territory, burning of land, destruction of facilities and equipment for growing and production, as well as disruption of logistics in the country. In 2023, it was determined that the total area of mined territories in Ukraine, as a result of Russian aggression is 174 thousand square kilometers [4-6]. After the end of the war and demining, not all areas will be suitable for agriculture.

The occupiers are forcing Ukrainian farmers to throw away or give away their products for literally nothing, as Russian troops do not allow them to export their crops for sale in Ukraine. In the Kherson region, as of February 2023, Russia's military aggression caused total losses to Ukrainian agriculture amounting to $8.72 billion [1].

Military operations have a significant impact on environmental components, causing a wide range of negative consequences. First, military conflicts lead to severe pollution of air, soil and water resources due to explosions, the burning of oil storage facilities, the remnants of warfare agents, and emissions from military vehicles and equipment. Secondly, war causes extensive destruction of infrastructure, including roads, bridges, power plants and other facilities, which can lead to environmental pollution due to emergencies. Thirdly, military actions can lead to the loss of biodiversity through the destruction of ecosystems and the mass killing of animals. In addition, military conflicts can lead to a large amount of internal displacement, which can lead to overpopulation and resource shortages in unoccupied cities.

Mitigating environmental problems during the war in Ukraine is a rather complicated process. Particular attention can be paid to the territories that are not occupied, ensuring the protection of water bodies, forests, nature reserves and other environmentally important places can minimize the impact of military operations on nature. In the affected territories, it is necessary to collect evidence and assess the damage caused by the Russian Federation, which will help to raise funds for environmental restoration.

During the conflict, it is important to regulate the activities of industrial enterprises

and infrastructure that can cause serious pollution. The use of environmentally friendly technologies and appropriate controls can help reduce the environmental impact.

After the cessation of hostilities, it is important to assess the damage in the de-occupied territories and start restoring ecosystems. Also, cooperation with international organizations and partners can help with the issue of environmental crises caused by war. This can include providing humanitarian aid, technical support, and data exchange.

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ADAPTIVE CAPABILITIES OF *STIPA PENNATA* L. TO MINE DUMP CONDITIONS

Abstract.The article investigates the adaptive capabilities of the rare species *Stipa pennata* L. to the adverse conditions of mine dumps in Western Donbas. It highlights the biological features of the plant that allow it to survive in technogenically disturbed areas. The importance of protecting this species is emphasized.

***Keywords*:** feather grass, mine dumps, adaptation, rare species.

Coal is the only type of energy resource in Ukraine whose potential volume of reserves can be sufficient to ensure the country's energy security and contribute to the development of metallurgical and chemical production. As a result of coal mining, new technogenic objects are created – mine rock dumps, which exhibit extremely unfavorable edaphic conditions for the development of vegetation cover. Mine rock dumps consist of inert rock masses devoid of nutrients and organic components necessary for the life of plant organisms. The potential acidity of the rock, the presence of toxic elements in the substrate, including heavy metals and salts, have a negative impact on the growth processes of autotrophic organisms. The high density of the dumped rocks creates unfavorable conditions and mechanical obstacles for seed germination and root system development. The intensive impact of wind and water erosion on the exposed surfaces of the dumps is one of the main factors and consequences of the absence of vegetation cover.

In the Dnipropetrovsk region, there are 10 operating coal mines, which means at least 2 dumps per mine. There are also mines that have ceased operations, but the dumps still exist. The most significant factor of the negative impact of the coal industry on the environment is the disturbance of the land surface during the extraction of mineral resources, which causes changes in the structure and deterioration of the quality, or even complete destruction of the fertile layer, as well as changes in the relief and landscape disturbance [4, 6]. This, in turn, leads to the extinction or degradation of flora and fauna [2].

In the Dnipropetrovsk region, studies of mine dumps are being conducted. For example, in 2021, a study was carried out on the industrial site of the M.I. Stashkov mine of the branch «Dniprovskoye Mine Management». The area of the studied territory was 86.6 hectares. 49 flora and fauna species were identified, of which 22 were rare plants, 6 species of invertebrates, and 21 bird species. The list of rare plants includes Stipa pennata L. [1, 3, 5].

Feather grass is a species of herbaceous plants of the Poaceae family. It grows on dry, stony soil. According to its characteristics, it is a hemicryptophyte and mesotroph. The mesocryptophytic properties allow it to grow in conditions of limited moisture. Coal dumps are heated by absorbing sunlight, and feather grass is a megaterm plant, so high temperature will not be a limiting factor. There is no light competition on the dump, feather grass is a heliophyte, and a sufficient amount of light will provide energy

for growth and development. Pollination occurs by wind, which gives an advantage over entomophilous plants, allowing further development without insects. Additionally, the seeds of feather grass are dispersed by wind, creating the possibility of moving over long distances. The mine dump is located near a steppe area, where you can find this plant species.

Feather grass is in the Red Book of Ukraine and has a vulnerable conservation status. It is protected in the branches of the Ukrainian Steppe Nature Reserve (Mykhailivska Tsilyna and Cretaceous Flora), the Holy Mountains National Nature Park, the Podillia Tovtry National Nature Park, botanical reserves of national importance “Pavlivsky” (Odesa region), “Vyshneva Gora” (Rivne region), “Obizhevsky” (Ternopil region), “Cretaceous Outcrops”, “Berezova Balka” (Luhansk region), landscape reserves of national importance "Sokil", “Ivakhovetsky” (Khmelnytsky region), “Komarivshchyna” (Dnipropetrovsk region). It is necessary to ensure the protection of all places of growth of this species, take measures to control the state of populations, and take regulatory measures to prevent the elimination of the species within the boundaries of protected areas. Plowing and construction on steppe areas, excessive grazing, as well as afforestation and terracing of slopes are prohibited. It is also listed in the Red Book of the Dnipropetrovsk region and has a vulnerable conservation status.

Populations occur infrequently and spread over a limited area due to the ecological characteristics of a particular species. Under favorable conditions, especially in the absence of significant grazing, it can reach a dominant state, while in unfavorable conditions, it can form separate localities.

After analyzing the area surrounding this mine dump, we can see that most of the land is used for agricultural plantations. Nearby, there is the “Maryin Hai” reserve, which has national significance.

Therefore, the problem of mine dumps in Ukraine, especially in Western Donbas, requires attention and resolution. The negative impact of the coal industry on the environment, particularly the disturbance of the land surface, leads to the degradation of flora. Based on the information obtained, we can conclude that the range of adaptive capabilities of feather grass to the phytotoxic conditions of mine dumps is expanding, including increased acidity levels, significant content of toxic salts, heavy metals, and high density of mine rocks.

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COMPARATIVE SECURITY ASSESSMENT OF GREEN INFRASTRUCTURE IN THE CITIES OF SUMY AND CHERNIVTSI

Abstract. The article gives a comparative analysis of green infrastructure level in the cities of Sumy and Chernivtsi. For this purpose, we calculated the percentage of the green zones area and the green index per person in the administrative districts. The results showed a significant difference in the presence and placement of green zones in these cities of Ukraine. Given the importance of green spaces for the health and well-being of the population, further development and preservation of green areas are becoming critical for improving the quality of life in urban environments.

Keywords*:* nature reserve fund, green index, green infrastructure.

We determine the relevance of the topic of assessing green infrastructure in regional centers – large cities of Ukraine by several key factors:

- Environmental problems: The increase in construction and intensive growth of settlements leads to the destruction of green areas and natural resources, polluting the environment and deteriorating the quality of residents' lives.
- Social quality of life: Green infrastructure in cities improves the quality of life of residents. It creates opportunities for active recreation, communication, sports and supports physical and mental health.
- Climate change: Green infrastructure in cities can help reduce the impacts of climate change, including air pollution and rising temperatures. Large cities in Ukraine also suffer from extreme weather events.
- Urban planning and development: Proper planning of urban development requires an assessment of the existing green infrastructure, identification of its shortcomings and strategies for further development.

All these aspects testify to the relevance of the topic of assessing the provision of green infrastructure in large cities of Ukraine, as it concerns both the quality of life of the population and environmental and social problems that have become important in modern urban planning and development, which confirms the analysis of previous studies in this direction.

The purpose of the study is to compare the level of green infrastructure in the regional centers of Ukraine, classified as large cities, at the level of administrative districts, and to develop recommendations regarding possible ways to improve this situation.

The Green Index is a numerical indicator used to measure the degree of green environment, nature conservation and sustainable use of natural resources in a specific region, city or country. It is also sometimes called the environmental sustainability index or the environmental sustainability index.

The Green Index evaluates various aspects of the impact of human activity on nature and the degree of preservation of ecological balance and is an important tool for

determining environmental sustainability and developing strategies for preserving nature and reducing the impact of human activity on the environment.

We have chosen two medium-sized cities in Ukraine - Sumy and Chernivtsi for comparison. Comparing the data, we can say that both cities have areas with different levels of green infrastructure. In the city of Sumy, the Kovpak district has a lower index than the Zarichny district, which is 6.95 m^2/person, indicating a relatively high ratio of green areas per person (Table 1).

Table 1.

Provision of green infrastructure in the administrative districts of Sumy

Administrative district of the city	Number of population, persons	The total area of the district, km^2	The area of the green zone of the district, km^2	Composition percentage GI, %	Green Index m^2/person
Kovpak	140000	65,1	0,33	0,51	2,36
Zarichny	151000	30,3	1,05	3,47	6,95

The city of Sumy has a population of 268,409 people, and the green infrastructure in the districts is formed from the following components:

Kovpak district – Square of the Sumy-Kyiv divisions; Memorial Square to the victims of the Holodomor; Park “Kazka”; Park “Asmolova”; Park “Druzhba” (2.36 m^2/person);

Zarichny district – Kozhedub Park; Banking Academy Square; Shevchenko Square (6.95 m^2/person).

In the city of Chernivtsi, the Shevchenko district also has the highest green index, with 36.93 m^2 of green spaces per person (Table 2).

Table 2.

Provision of green infrastructure in the administrative districts of Chernivtsi

Administrative district of the city	Number of population, persons	The total area of the district, km^2	The area of the green zone of the district, km^2	Composition percentage GI, %	Green Index $м^2$/person
Pershotravnevyi	78100	24	0,16	0,67	2,05
Sadhirskyi	282200	78,7	0,02	0,03	0,07
Shevchenko	28160	50	1,04	2,08	36,93

Sadhirskyi and May Day districts have a significantly lower green index, which indicates the uneven distribution of green zones across the city. These data indicate the difference in provision of green areas for residents of different districts of both cities, and this may affect the quality of life and degree of green environment in these districts.

The city of Chernivtsi has a population of 260,195 people, the green infrastructure in the districts is formed mainly at the expense of the following parks:

Pershotravnevyi district – Yury Fedkovich Park; Reserve Park “Hot Urban”; Chernivtsi dendrological park (2.05 m^2/person);

Sadhirsky District – Sadhirsky Park (0.07 m^2/person);

Shevchenko district – Taras Shevchenko Central Park of Culture and Recreation; Schiller Park; Botanical garden of Yuriy Fedkovich Chernivtsi National University; October Park; Chernivtsi dendrological park (36.93 m^2/person);

Considering the importance of green areas for the lives of citizens, it is important to pay attention to the preservation and expansion of such areas in cities. This may include preservation of existing parks, gardens and forests, creation of new green areas and integration of green elements into urban planning. The expansion and preservation of green areas is a necessity, for the quality of life of citizens, it is important to focus on the preservation and expansion of such areas in cities. This may include preservation of existing parks, gardens and forests, creation of new green spaces and the integration of green components into urban planning.

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