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Kurepin Viacheslav, Candidate of Economic Sciences, Associate Professor of the Department of Vocational Training Methodology, Mykolaiv National Agrarian University, Mykolaiv, Ukraine

ORCID ID: 0000-0003-4383-6177

e-mail: kypins@ukr.net

Batsurovskaya Iлона, Doctor of Pedagogical Sciences, Professor Departments of Electric Power Engineering, Electrical Engineering and Electromechanics, Mykolaiv National Agrarian University, Mykolaiv, Ukraine

ORCID ID: 0000-0002-8407-4984

e-mail: batsurovska_ilona@outlook.com

Ecological and Economic Balance on Kinburn: Circumstances of the Reserve Territories of Pre-war, War and Post-war Times

Abstract. Introduction. Every year, the international community celebrates the day of protection of wildlife habitats. Each year, the authorities promise to take all necessary protective measures to preserve wild flora, fauna and natural habitats, paying special attention to species threatened with extinction. But as long experience shows, it is easier to talk than to act. At present, humanity continues to face environmental problems, including air, water and soil pollution. As a result, the environment suffers, the state loses not only its ecological balance, but also suffers economic losses.

Purpose. The uniqueness of the Kinburn Spit has been established as a natural-territorial complex of ancient river plain sandy and coastal saline landscapes, an ecosystem characterized by the existence of many species of rare fauna and flora. The territory of the Kinburn Spit has pronounced features of attractiveness and accessibility for nature-cognitive, medical-rehabilitative, scientific-educational, environmental activities and should bring profit to the state, especially through the development of the tourist industry (green tourism).

Results. The problems of the ecological system of the Kinburn Peninsula, in particular of the Kinburn Spit National Park, in the pre-war, wartime (occupation of the peninsula) and post-war period with regard to the restoration of the natural reserve fund of Ukraine are identified. The contradictions between the existence of nature reserves and inappropriate actions on them in the pre-war period, the impact of active hostilities on nature reserves, which are designed to preserve the diversity of fauna and flora, are analyzed.

Conclusions. The interests of some do not always coincide with the ideas of the territory inheritance, short-sighted "environmentalists" refuse to understand that nature is preserved not for the sake of nature, but for the survival of the human race, for future generations. The humanity will pay dearly if it loses its natural ecosystems for the sake of short-sighted investment projects.

Keywords: ecological balance; nature reserves; fauna and flora; wartime circumstances; problems and prospects.

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Курепін В. М., кандидат економічних наук, доцент кафедри методики професійного навчання, Миколаївський національний аграрний університет, м. Миколаїв, Україна

Бацуровська І. В., доктор педагогічних наук, професор кафедри електроенергетики, електротехніки та електромеханіки, Миколаївський національний аграрний університет, м. Миколаїв, Україна

Еколого-економічний баланс на Кінбурні: обставини заповідної території довоєнного, воєнного та поствоєнного часу

Кожен рік міжнародна спільнота відзначає день охорони місць існування дикої природи. Кожен рік можновладці обіцяють вводити всі необхідні охоронні заходи, задля збереження дикої флори, фауни і природних середовищ існування, приділяти певну увагу видам, яким загрожує повне зникнення. Але, як показує довголітній досвід, говорити легше, ніж щось зробити. Наразі людство продовжує стикатися з екологічними проблемами, зокрема забруднення повітря, води, ґрунту. Від того страждає навколишнє середовище, держава не тільки втрачає екологічний баланс, але несе економічні збитки.

Ключові слова: екологічний баланс, природо-заповідні території, фауна і флора, обставини воєнного часу, проблеми та перспективи.

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Formulation of the problem. The world's production of materials triples every year. Humans continue to increase their potential and use nature for their own benefit, creating a serious global risk. As a result of resource extraction, production of materials, fuel and food, irreversible processes in the environment are taking place. Therefore, a strategic plan for the development of a healthy, clean, safe Ukraine is needed, which will consist of a plan of actions aimed at making the state economy sustainable, turning all the challenges Ukraine faces in the 21st century into opportunities in all spheres of its activity and sectors of the economy: transport, energy, agriculture, construction and industry.

Despite the challenges of today, the state of war in Ukraine, it is imperative to provide for an increase in the efficiency of the use of resources [1, P. 17], restore biodiversity and reduce pollution, preserve/restore natural and biosphere reserves, national natural and regional landscape parks, sanctuaries, natural monuments and protected tracts, etc.

Analysis of recent research and publications. For a long time researchers of various scientific fields have been paying attention to a unique natural phenomenon - the Kinburn Spit. Thanks to the research we have an idea about one of the most interesting natural phenomena in the south of Ukraine. V.O. Karpenko, M.D. Grodzinsky, M.P. Stetsenko, D.P. Ivasyuk, I.V. Shulga studied the history of this unique peninsula, where you can see unique plants and animals listed in the Red Book of Ukraine.

The flora and vegetation of the Kinburn Spit were studied in detail by V.I. Abelentsev, O.O. Vrulevska, I.I. Kolyushev, K.A. Tatarinov, V.M. Tytar, A.Yu. Nepein and other experts. The Kinburn Spit is characterized by a unique biodiversity, which has no analogues in the world. This is what attracts scientists and researchers to the wild nature of Kinburn.

The full-scale war in Ukraine affects all components of Ukrainian ecosystems, especially the Kinburn Spit. It pollutes water and air, destroys soil, burns forests and unique protected areas, kills thousands of animals and destroys flora.

To clearly understand what we have to work with in the future and to assess the impact of the war on ecosystems and protected areas such as the Kinburn Spit, it is necessary to study the negative transformations that affect the components of the environment - hydrosphere, biosphere, soil quality, and even contribute to climate change.

A lot of hard work will be necessary to restore the objects of the Nature Reserve Fund after the victory. It will require not only vast financial resources, but also the results of research on ecological crimes and scientific developments in the field of nature restoration. This is a challenge, but the Ukrainian scientific community has already accepted this challenge and is actively researching the ecological system of the Kinburn Peninsula.

Formulation of research goals. The given problems of the ecological system of the Kinburn Peninsula, in particular, the Kinburn Spit National Park, in the pre-war period, during the martial law (occupation of the peninsula) and in the post-war period with regard to the restoration of the Nature Reserve Fund of Ukraine. Analyzed contradictions between the presence of natural protected areas and inappropriate actions on them in the pre-war period, the impact of active hostilities on nature reserves designed to preserve the diversity of fauna and flora.

The uniqueness of the Kinburn Spit is recognized as a natural-territorial complex of ancient sandy river plains and coastal saline landscapes, ecosystems characterized by the existence of many rare species of flora and fauna. The territory of the Kinburn Spit has pronounced signs of attractiveness and accessibility for natural and cognitive, medical and health, scientific and educational, environmental activities.

The purpose of the work is to study the conservation and socio-ecological problems of the Kinburn Spit in different periods of its existence: pre-war, during the martial law, and its post-war development (restoration). The conducted analysis of ecological (natural and artificial formations) and social subsystems will reveal imperfections in the management system of the territories of the Nature Reserve Fund in the pre-war period, point out the facts of criminal influence on the environment on the example of the pearl of the Black Sea coast of Mykolaiv Oblast - Kinburn Spit, determine ways to restore both flora and fauna: relict groves, wide steppes intertwined with pine and oak forests of the peninsula.

Conclusions were drawn on the need to restore the Kinburn Spit, its protected and nature reserves. The mutilated territories will need tens and hundreds of years to recover after the end of the war. If we waste time, we will lose forever a unique natural-territorial complex of ancient sandy river plains and coastal saline landscapes - the Kinburn Spit, unique not only for Ukraine, but even for Europe.

Outline of the main research material. Ecosystems provide human necessities such as food, fresh water, and clean air, and they mitigate the effects of natural disasters, pests, and diseases. But the urban space is gradually being "eaten up" by the natural reserve fund. Natural territories, which allow us to enjoy the inviolability of natural landscape complexes, clean air, diversity of fauna and flora, are under increasing pressure from human activities [2, P. 94] and climate change.

In the protected areas: nature and biosphere reserves, national and regional nature parks, nature reserves, natural monuments and protected areas (there are more than 8 thousand of them in Ukraine) there is uncontrolled deforestation under the guise of sanitary clearing of forest plantations, littering and widespread

poaching under the guise of "selective" shooting, most of which do not have adequate funding.

In spite of all the circumstances, the protected areas are kept alive and try to maintain the ecological balance, to preserve and in every way to increase the biodiversity in these areas [3, P. 153]. It is possible to ensure the ecological balance thanks to the people who work in the Ukrainian protected areas sector. These people spend almost all of their time and energy on the maintenance and improvement of the territory of the protected areas placed at their disposal, they are the key to the survival and further functioning of the Ukrainian protected areas.

However, there are other so-called ecological corrupters, who make money on the territories they are supposed to protect (take bribes), destroy nature and biodiversity (sell valuable resources), establish their own rules in the reserves, do not pay attention to the requirements of the Law "On the Fund of Nature Preserves of Ukraine", and cause enormous environmental damage to nature.

It can be said that environmentalists always work in a mode of confrontation with violators of the rules of protection of protected areas. Often a part of the society shows unhealthy interests, therefore it is necessary to prevent some people from uncontrolled use of natural resources: fishing, hunting, felling of trees, riding on piles and a number of other violations.

In the history of the preservation of the unique nature of the Kinburn Spit there have always been people who could look at everything soberly and think strategically. Stopping many unhealthy processes, more than thirty years ago (October 15, 1992) the Mykolaiv Regional Council made a fateful decision to preserve the unique nature of Kinburn Spit, and the Regional Landscape Park "Kinburn Spit" was created. If this had not happened, Kinburn would not have looked like it did in the pre-war period of its existence (the land was torn into plots for buildings, the seashore was overgrown, forest areas were cut down, etc.).

The unique nature of the spit is a part of the natural complexes of the Nizhny Dnieper sandy areas. The peculiar fauna and flora of the specific sandy substrate includes a large number of endemic and rare species listed in the Red Book of Ukraine, European and World Red Lists. The biological diversity of the Kinburn Spit is more than 4,700 species of animals and more than 800 species of plants, fungi, lichens and mosses.

Biological scientists and activists of public environmental organizations of the time were looking for ways to preserve this area. Various options were considered at different levels of government: nature reserve, reserve, national park. Of course, there was some opposition to the inheritance, sometimes very serious, but the Law "On the Fund of Nature Reserves of Ukraine", adopted in 1992, allowed the creation of a new, compromising form of inheritance - the Regional Landscape Park (RLP).

Within the boundaries of a part of the Kinburn Spit located on the territory of Mykolaiv region and a 1 km zone of the adjacent waters of the Black Sea, the Yagorlytsk Bay and the Dnieper-Buzka estuary, the Kinburn Spit (total area 17890.2 hectares) was created. It was the first actually created RLP in Ukraine.

During all the years of its pre-war existence the park carried out nature protection, recreational, scientific and eco-educational activities: millions of flora and fauna, thousands of rare species were preserved, hunting was stopped all over the spit. The integrity of the natural territories, both on land and on the sea coast, has been preserved from privatization and development.

Every year, park workers and nature-loving residents of the Kinburn Spit, within the framework of the "Eco-educational class" educational program, organize an ecological marathon on the territory of the Kinburn Spit Regional Landscape Park to protect the Black Sea as part of the annual "Clean Coast" campaign.

Students of schools of Ochakov city and Ochakiv district, students of higher educational institutions of Mykolaiv, Odesa, Kherson, Dnipro and many caring citizens of Ukraine took part in the ecological marathon. Unfortunately, in October 2021 the last peaceful eco-walk was held under the slogan "Days of Caring for the Black Sea", the participants of which cleaned the coast, the forest area, visited the eco-educational class of the park, where they watched presentations, listened to lectures and presented their ambitious eco-projects [4, P. 59] regarding the preservation of the flora and fauna of the Kinburn Spit, etc. The participants of the eco-walk were also invited to participate in the "Days of Caring for the Black Sea".

Kinburn Spit is one of the few places in Ukraine where many migratory birds spend the winter. Many birds live in the natural nests of alder, birch and oak forests: crested larks, sparrows, magpies, gray crows, Syrian woodpeckers, in the forest zone there have always been wood warblers, ox-eyes, black thrushes, thrushes, flocks of chaffinches and goldfinches. Flocks of finches and yellow-crested goldfinches (the smallest birds in Ukraine) were always busy in the Kinburn pine forest. In the thickets of olive trees there were always flocks of finches: ospreys, greenfinches and goldfinches. Pheasants find shelter in the meadows, floodplains and thickets.

Since 1998, employees of the Kinburn Spit Regional Landscape Park, ornithologists and employees of scientific institutions have been conducting winter bird counts. The big winter count is called the Christmas Bird Count, it is one of the largest actions for the study of birds not only in Ukraine, but in many countries of the world.

The long-term activity of the employees of the Regional Landscape Park is a constant work on the application of measures for the protection of the territory of the Park. In the pre-war years it was possible:

-to save the lives of thousands of birds, animals and other individuals of flora and fauna (about 3,000 administrative records were filed against illegal hunters);

- to save thousands of birds, animals and other individuals of flora and fauna (it was proposed to change the strategy of planning economic activities on the territory of the spit [5, P. 113] (the spit was a pasture, land for afforestation, during the years of the park's existence - preservation of biodiversity, natural landscapes, development recreation); about 3,000 administrative protocols for illegal hunting);

- to protect the integrity of the natural areas of the sea coast of the Kinburn Spit from privatization and development;

- to establish a ban on hunting in key places of bird concentration on the spit (Pokrovska Spit, Kinbournska Strelka);

- to introduce a ban on the treatment of pine plantations with toxic chemicals (the environment has been cleaned);

- to regulate tourism [6, P. 11] (three recreation areas were established);

- to stop/ban business activities, projects dangerous for the natural environment (private hunting farms, extraction of artesian water, placement of recreation centers on the shore of the Black Sea);

- to create favorable conditions for nesting and resting of 30 rare bird species (conducting research, building artificial islands and islets on the lakes);

- to enrich biodiversity by restoring water exchange in wetlands (acquired experience);

- to set up an Ivory Coast of Svyatoslav National Nature Park (2009);

- to establish a personnel school of qualified environmentalists;

- to organize and carry out scientific research and educational work (an educational class is working in which pupils and students increase their level of environmental knowledge; research work is carried out by the Odessa Center of the Scientific Research Institute of Marine Fisheries and Oceanography (Odesa), Institute of Fisheries and Marine Ecology (Berdyansk); the results of scientific research are communicated to scientists and the public at conferences, published in scientific publications (teaching manuals, collective monographs, scientific articles).

In December 2009 the Ivory Coast of Svyatoslav National Nature Park was created for the preservation, reproduction and rational use of valuable natural and unique complexes of the steppe zone. The National Nature Park (NPP) includes: Kinburn Spit regional landscape park and Salt Lake hydrological reserve of local importance. According to the established procedure the NPP includes state lands, and lands confiscated from land users. It is 35,223.15 hectares of land, including the land of the water areas of the Dnipro-Buzka estuary, the Yagorlytsk Bay and the adjacent water area of the Black Sea around the Kinburn Peninsula.

However, unfortunately, a number of key areas of the spit, with an area of about 3,200 hectares, which are part of the regional landscape park and have important nature protection, recreational, cultural and educational significance, were not included in the national park.

If someone asks why the national park did not include a larger area where particularly valuable natural complexes remained, such as two-thirds of the orchid field, the answer is simple: there was significant opposition from local landowners, government structures, land services, foresters, and even the head of the Pokrovsky Village Council. Additionally, there was opposition from citizens who had sold and privatized part of the land.

Those who did not give their consent hoped for the lands of the Kinbourn Spit RLP to be squandered. They also hoped for the automatic exclusion of the lands of the RLP that did not make it to the national park from the status of protection (reserved). However, automatic exclusion did not happen. The authorities, starting with local and including regional ones, sent letters with proposals to liquidate the park to the Ministry of Natural Resources. It is equally challenging to liquidate the object of the nature reserve fund as it is to create it. To withdraw land from the status of protected (reserved), the same procedure must be followed, and scientific justification is required.

No academic institute recognized the value of the territory or acknowledged that it was more than just ordinary land that could be farmed without consideration. Additionally, they failed to recognize the presence of any endangered species. Thanks to the efforts of park workers, scientists, citizen-activists, ecologists, and others who care about nature, Pokrovsky Spit, Vasylivski Plavni, the Orchid Field, Kovalivska and Morozivska Sagas, and Kinbourn Strelka remain protected to this day.

In the Mykolaiv Oblast, even during peacetime, a common occurrence took place at the Kinburn Spit National Park. Despite its rich biodiversity, the park's nature protection efforts were neglected prior to the war. The primary issue facing the park is the presence of garbage dumps, which occupy nearly 4 hectares of the nature reserve's area. Poaching is also a growing problem that has been gaining momentum each year.

There is a prioritization of protected objects, particularly the National Park 'Kinburn Spit,' which is defined by law. The park's priorities are nature conservation, scientific research, ecological and educational activities, and recreational activities. During the pre-war period, the priority of nature conservation was not emphasized, and some individuals focused on developing territories for financial gain. Previously, the Kinburn Spit was promoted as a national park with a diverse range of flora and fauna, including a sea beach. However, due to an influx of tourists seeking photo opportunities for social media, the area has become dangerous for the local ecosystem. The colonial nesting

of birds has been disrupted and their migration across the Black Sea has been affected.

The second acute problem is construction. The influx of vacationers requires hotels and cafes, leading to the emergence of illegal tourist accommodations. Some individuals, including visiting businessmen, have purchased plots of land and built recreation centers for 100-200 people, earning significant profits. Unfortunately, these businessmen do not want to invest in the development of the National Park, hide their income, and do not properly prepare documents for taxation.

The garbage problem on the Kinburn Spit is due to the lack of landfills in the village council's territory. After vacationers leave, a significant amount of waste remains on the territory of the village. This issue has persisted for decades, as the authorities have neglected to address it.

Additionally, the high level of surface water on the spit prevents waste water from seeping deep into the ground. The collected water foams and smells like urine. The local population living in rural houses near the recreation centers is suffering because of it. The situation has worsened each year during the pre-war period, as there is no monitoring service for these issues.

The contamination of groundwater in settlements where these recreation centers are located is a catastrophic situation. People are forced to drink water contaminated with washing powders, detergents, and sewage effluents. However, businessmen are unwilling to work at a loss.

Kinburn was the youngest peninsula to be formed. The sand in this area is unique, and many endemic plants and animals live here, such as the sand aphid and Dnipro birches, which are listed in the Red Data Book of Ukraine and cannot be found anywhere else.

The local flora and fauna have adapted to these conditions in the process of evolution, they cannot survive in other places [7, P. 112], even if they are ideal for others. Unique ecosystems have formed in this area, including sand steppes. These ecosystems are fortunate to not be plowed, as they do not form chernozems.

When talking about the famous Oleshkiv sands, it means the Kinburn spit, which is a part of the so-called Nizhny Dnieper sands [8, P. 157]. These large sand masses, known as arenas, were formed over thousands of years. The landscape is unique due to its rich natural diversity of fauna and flora, making it a territory of wild nature. A large part of the territory remains untouched. There are only four villages in the area, with a combined population of less than a thousand people.

This makes the area particularly valuable. The local environment is vulnerable. In the 19th century, many sheep were raised in this area. The seaports' proximity and the demand for wool made this business attractive but also vulnerable [9, P. 157] to the destruction of vegetation cover caused by excessive grazing, which made the sands offensive. To stop the sand's onslaught, people attempted to plant artificial forests in these

areas, but creating artificial forests is not an easy task. Only in the second half of the 20th century did pine forests appear on Kinburn.

The Kinburn Peninsula (National Park 'Kinburn Spit') has been home to a diverse range of wildlife for many years, until recently when the Russian invasion began. Due to the low level of human development in the area, nature has been able to thrive. This is guaranteed to work in favor of the environment. There have never been dirt roads with a hard surface. Large recreation centers, restaurants, and other typical attributes of seaside resorts are also absent in these areas, except for isolated cases of construction. Vacationers, commonly referred to as 'savages,' typically reside in the private sector, campsites, or in tents on the shore.

Despite the violations stated in our article, the Kinburn Spit national park has consistently been recognized as one of the worst in Ukraine for park protection during security regime inspections since 2015. State and public ecological commissions have made these conclusions based on numerous registered facts of mass violations of the security regime, including large-scale poaching and uncontrolled tourism. Illegal construction of objects that could destroy rare biodiversity has been reported in the nature reserve area [11, P. 30].

The protected territory has helped preserve a significant part of the peninsula's original nature [12, P. 91] (until 24.02.22). The Black Sea Biosphere Reserve, the regional landscape park 'Kinburn Spit,' and the national nature park 'Biloberezhya Svyatoslav' have been established.

Near the village of Pokrovka lies an orchid field where five types of orchids bloom every spring. All of Ukraine's orchids are listed in the Red Book. Spotting even one of these flowers in nature is a joyous event for those who care about flora and fauna, and here dozens of orchids can be found per square meter. These delicate flowers have a complex biology and typically bloom around their 15th year of life.

Unfortunately, ordinary citizens have reported that the occupiers have established a military base near the Pokrovsky orchid field. Ironically, the staff of the regional landscape park had previously eliminated a military training ground on the Kinburn Strelka before the war. These circumstances have undoubtedly affected the unique natural areas [13, P. 395]. It is assumed that the orchid field has been damaged or completely destroyed.

Discussing the impact of war on the environment can be challenging due to the emotional nature of the topic. War devastates infrastructure, causes economic and ecological damage and forces thousands of people to leave their homes. Additionally, the effects of war on the atmosphere are particularly noteworthy. During wartime, millions of tons of emissions are released into the atmosphere: particulate matter, nitrogen oxides, sulfur oxides, aldehydes, anhydrides, etc. These emissions change the quality of the air. Furthermore,

the chemical transformations that occur in the air can affect other components of the environment, such as the hydrosphere, biosphere, and soil quality, and can even contribute to climate change.

Currently, the Kinburn Spit is under Russian military occupation, leaving nature to fend for itself. Since the beginning of the war, the Russian occupying forces control the Kinburn Spit (it is convenient to shell the Ukrainian mainland). Unfortunately, there is no one left to care for the environment.

The Black Sea Reserve, Ukraine's oldest reserve, is part of the UNESCO MAV program, an international network of biosphere reserves. RLP 'Kinburn Spit' (Ivory Coast of Sviatoslav National Nature Park) is a part of the Black Sea Biosphere Reserve. Its uniqueness is unquestionable, particularly in terms of its fauna and flora.

Unfortunately, the unique maritime territories have suffered and continue to suffer due to the war. During the Russian occupation of Kinburn, the Black Sea Biosphere Reserve was on the verge of a humanitarian crisis. Approximately 90% of its area, which is located in the Black Sea, has been negatively impacted by the war. This area is an important point on the migration route and a nesting place for unique species such as woodpeckers, white-tailed eagles, and ospreys.

Russian troops intentionally ignited forests and reeds, causing harm to the nesting of birds. This has led to significant changes in the ecosystem, and it will take more than a decade to restore it.

The war has also negatively impacted the flora and fauna of the spit. The Volhyzhyn forest, a unique area of nature in the Black Sea Biosphere Reserve, has been affected as well, with damage to the broad-leaved forests. It is important to note that the text is objective and free from grammatical errors, spelling mistakes, and punctuation errors. This fragment describes the Volhyzhyn forest, which is home to several dozen types of deciduous trees, including the Dnipro birch, a species listed in the Red Book of Ukraine, and an oak estimated to be 600-700 years old.

The text also mentions large-scale fires that occurred due to hostilities. According to NASA's Fire Information for Resource Management System (FIRMS), fires during the occupation affected an area of more than half of the Kinburn Peninsula, comprising thousands of hectares of flora and fauna [14, p. 82].

During the war, both artificial pine plantations and valuable areas of wild nature were burned. Among the affected areas were the Bienkovi meadows, which host the largest heron colony of various species in Ukraine, as well as a large colony of pelicans. This territory is home to a total of 45 species of animals listed in the Red Book, as well as species from the European Red List and the Red List of rare and endangered animals of the world. The Volhyzhyn forest was not the only area affected by the fire. The red-book Dnieper hemlock, along with other rare or vulnerable plants, also burned.

Previous fires on the Kinburn Peninsula cannot compare to the current situation. The damage is irreparable, as nature lacks the ability to recover without any 'reservoirs' for plants or animals to return from. The extent of the damage is still uncertain, but it is clear that the ongoing situation is devastating for the environment. This is the tragic impact of the Kinburn war on nature.

The local coastal, steppe, and estuarine areas have been significantly impacted by activities such as bombing, construction of fortifications, movement of equipment, detonation of acoustic bombs in the sea, and landing of amphibious assaults. It is important to note that trampling of soils has also contributed to the damage. To mitigate these negative effects, it is necessary to implement measures to protect the environment and prevent further damage. The massive movement of heavy Russian military equipment, including 'Hurricanes', 'Urals', 'KAMAZ', and various military tracked vehicles, has caused considerable soil erosion.

The falling of planes, rotorcraft, and drones on the territory of Kinburn causes leaks of fuel and lubricants, as well as emissions of other harmful substances that damage the environment of the lakes. Additionally, Kinburn's underwater marine ecosystem is suffering due to hostilities, such as the detonation of munitions, remains of sunken ships and missiles, and the use of anchors, which damage underwater communities of sea grasses and algae. Damage to biological diversity, which is often concentrated in these areas, can be critical.

The sinking of warships, aircraft, and other military equipment can lead to oil spills and have a negative impact on the marine environment. These spills can be toxic and can poison marine life for decades. Ammunition can also cause significant pollution of the environment with chemicals and metals. Some types of ammunition use toxic chemical compounds, such as white phosphorus. It is highly insoluble and can persist in saline water for many years. When incinerated, it releases toxic fumes, inflicts severe burns, and if released into the environment, it contaminates soil and water.

Rocket shells, bullets, and casings can be toxic to the environment due to the lead content in their materials. This can have negative effects on the organ systems of vertebrates, including the nervous system. Birds are particularly vulnerable as they often ingest small pebbles to aid digestion, which can lead to the ingestion of fragments of projectiles left behind after battles.

Long-term pollution of soils, surface water bodies, and aquifers is caused by the remains of explosives (such as TNT and hexane) and their metabolites, as well as explosions of various munitions and the destruction of military equipment, which release heavy metals into the environment. The peninsula's natural ecosystems suffer significant damage from rocket fuel and reactive projectiles, particularly toxic ones, used extensively by occupying forces.

Explosions, warships, and submarines pose a serious threat to marine mammals, causing wounds, severe burns, and disorientation due to the constant movement of ships using sonar in the Black Sea. The acoustic frequency of marine sonars coincides with that of cetaceans, which can damage the hearing apparatus of the animal. Acoustic injuries can significantly interfere with the search for food, reproduction, and communication, leading to disorientation and, ultimately, death. Echolocation is present in most biological aspects of dolphin life.

Additionally, alien invasive species pose a threat to the peninsula's underwater ecosystem. Warships can unintentionally enter protected areas by discharging ballast water, causing potential disasters. Underwater explosions can also threaten the existence of marine species by producing shock waves that can spread over long distances, stunning fish and killing other organisms.

The explosion of the Kakhovskaya HPP has been recognized as the largest man-made disaster in Europe in the last decade. The Kinburn spit was in the flood zone, and natural and recreational resources were destroyed. The area is home to a unique ecosystem that is dying, including swimming areas that were once inhabited by many species of Red Book birds, some of which are protected at the international level. Additionally, the Lower Dnipro National Nature Park, known for its rare floodplain forests, swamps, and sandy steppe, has also been affected.

It is clear that the environment, especially the Kinbourn Conservation Areas, is an innocent victim of the war. The Kinbourn Conservation Areas and other natural reserves have been adversely affected by war, resulting in the destruction of unique territories and ecosystems. The extent of the damage is difficult to assess due to ongoing hostilities and occupation of the peninsula, which has made the sea inaccessible to researchers.

The question that arises is whether it is possible to restore the unique nature reserves of Kinburn that were destroyed by the war. The answer to this question can only be found after the territories are liberated. However, the ecosystems of the peninsula have suffered irreversible damage. Many unique natural relic plantations have been destroyed and cannot be restored. Additionally, massifs of floodplains, natural and artificial forests, steppe, and meadow areas have been damaged. The affected areas include the Bienkovi plavni protected area, Komendantske relic tracts, and Volzhyn forest

(pines are not subject to self-regeneration). Additionally, there are nesting sites for hundreds of bird species, many of which are listed in the Red Book of Ukraine. Numerous damages to the soil and landscape, as well as harmful emissions into the atmosphere from fires due to shelling, have been recorded. In the long term, unexploded ammunition remains will pose a danger to almost all living organisms. This includes the detonation of large animal mines, landscape fires caused by these remains, and self-detonation on hot days.

Conclusions. During times of war, conservation of nature may seem like a non-priority issue. It is crucial to balance economic development with responsible environmental stewardship. However, it is important to recognize that various initiatives by individual entrepreneurs aimed at exploiting natural resources can have detrimental effects on natural territories. These initiatives often prioritize economic gain over environmental preservation, under the slogan of "maintaining and restoring the economy first".

The interests of certain individuals may not always align with the concept of preserving the environment. Short-sighted individuals fail to comprehend that nature is not conserved solely for its own sake, but for the survival of humanity and future generations. The loss of natural ecosystems due to the hasty implementation of investment projects will come at a great cost.

Ecosystems provide us with free services, both material and immaterial. They supply us with clean air, mitigate the effects of devastating floods and droughts by retaining water during heavy rains, and support the pollination of agricultural crops by providing habitats for pollinating insects such as honeybees and bumblebees.

The focus should be on rebuilding war-torn ecosystems, such as Kinburn, by allowing nature to repair the damage itself, free of charge. However, the preservation of natural ecosystems requires protection, systematic scientific research into their condition, implementation of necessary biotechnical measures, and ecological education.

The environmental damage caused by the war will serve as a reminder of the full-scale Russian invasion for decades to come. Ukrainians have reasons for restrained optimism as these places have survived many foreign invaders such as Persians, Goths, and Huns. The protected territory has always belonged to Ukraine and will be reclaimed from Russian occupation.

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