MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

V. N. Karazin Kharkiv National University

ECOLOGY IS A PRIORITY

Proceedings of the English-Language Scientific Conference

Kharkiv – 2020

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V. N. KARAZIN KHARKIV NATIONAL UNIVERSITY

Ecology is a priority

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The publications contain the proceedings which address the modern ecological state of environment and ecological problems in different regions of Ukraine and other countries and also ways of their solution.

Видання містить матеріали, які стосуються сучасного екологічного стану довкілля та екологічних проблем у різних регіонах України та інших країн, а також шляхи їх вирішення.

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THE RESULTS OF THE INCREASED RECREATIONAL LOAD ON THE TERRITORY OF THE NATIONAL DENDROLOGICAL PARK OF SOFIYVKA

Abstract. The publication presents the results researches of three popular recreational areas during two months of recreational season from May1st to June 31st. in the National Dendrological park of Sofiyivka. These are the Assembly Square, the banks of the Upper Pond and the territory near the Chinese House. Based on the research we identified stages of degression.

***Key words**:* recreational load, grass landing, stages of degression, phytocoenosis, levels of their sustainability.

We are living in a time of great change when recreation and tourism are gradually transforming into one of the most profitable branches of the world economy.

Therefore today recreational nature management should be a priority in functioning of national parks [2]. So, modern social economic and especially environmental situation on the territory of the park of Sofiyivka requires reorientation of the economic activity which would provide sustainable development with minimal negative effect.

To begin with, we should emphasize that the National Dendrological park of Sofiyivka is an outstanding landmark and masterpiece of landscape gardening of the late 18th and early 19th centuries. In addition, it's registered as a cultural heritage of Ukraine. Consequently, it requires special attention and careful attitude.

At the same time it should be noted that under the conditions of rapid urban development the population needs in high quality rest in the open air are increasing. According to Mykola Reimers, rest or recreation is the restoration of an individual's health and opportunities for their performance efficiency by their having a rest outside their homes that is forests, parks and other green zones [1].

In this connection we should realize that the park of Sofiyivka is expected to provide such a rest for the citizens of Uman and the tourists visiting our town. This means that the park has a much higher recreational load on its territory and we set a goal to study this load and define its permissible level. For the research we chose a method connected with degression stages because this method makes it possible to conduct regular researches which are rather realistic, informative and easy to apply. We researched three popular recreational areas during two months of recreational season from May1st to June 31st. These are the Assembly Square, the banks of the

Upper Pond and the territory near the Chinese House. Based on the research we identified stages of degression.

Having analyzed our results we have come to the conclusion that those structural components of the park which are the most attractive to visitors suffer from excessive recreational load. They are the Assembly Square and the banks of the Upper Pond

We will start our analysis with the most damaged spot which is situated in the centre of the Assembly Square near the Valley of Giants (section 29). If compared with the area located opposite the first object, we can see 100% grass landing there while the area under our research is badly damaged with only 5% of grassing. The plants are on the zero and first levels of their sustainability and are unevenly spread on the area. The downtrodden grass comprised 95% and considerable damage of the spot gave it the fifth stage of degression

On the second spot under research we can see successful results of efforts of the staff of the park to control recreational degression of the territory. It was possible to renew the territory by sowing different grasses and 100% grassing-down. The degression is not visible in the area

On the bank of the Upper Pond where visitors get on and off different kinds of water transport such as boats, gondolas, catamarans, water balls, etc., phytocoenosis degrade rapidly and the 4^{th} and 5^{th} stages of degression are observed. (section 26)

The territory nearby the Chinese House are less subjected to recreational load than the previous areas and by visual assessment it can be referred to the third stage of degression.

To make a conclusion, our research has proved that the structural components of the park which are the most attractive to the public, in particular, the Assembly Square and banks of the Upper Pond, suffer from recreational load most of all.

References:

1. Antara Sen, Amii R. Harwood, Ian J. Bateman. Economic Assessment of the Recreational Value of Ecosystems: Methodological Development and National and Local Application., Springer Science+Business Media Dordrecht 2013. 258 p.

2. Kuskov A.S., Golubeva V.L., Odintsova T.N. Recreational Geography, Educational and Methodical Complex. M.: MPSI, Flint, 2005. 496 p.

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CUTTING DOWN RAINFORESTS - AN ENVIRONMENTAL DISASTER WORLDWIDE

Abstract. The article speaks about anthropogenic impact on tropical forest. The damage caused to the planet due to deforestation of tropical forests and its importance. As well as ways to preserve the tropical forest.

Keywords: tropical forest, deforestation, anthropogenic influences, resources, forests.

People take a lot from the forest: materials for construction, food, medicine, raw materials for the paper industry. Wood, needles and tree bark are the raw material for many branches of the chemical industry. About half of the wood is used for fuel and a third is used for construction. A quarter of all medicines used are derived from tropical forest plants. Rainforests account for more than 50% of the planet's green spaces. These forests are home to more than 80% of all animal and bird species. Today, the rainforest is being cut down at a rapid pace. The figures are terrifying: more than 40% of trees have already been felled in South America and 90% in Madagascar and West Africa. All this is an environmental disaster of a global nature.

The damage caused to the planet by deforestation. Despite the fact that forests are a renewable resource, their cutting rate is too high and not covered by the reproduction rate. Tropical forests, home to more than 50 percent of the world's species, used to cover 14 percent of the planet, but now only 6 percent. India's forest area has shrunk from 22% to 10% in the last half-century. Coniferous forests in central Russia, forests in the Far East and Siberia are being destroyed, and swamps are emerging in place of felling. Valuable pine and cedar forests are being cut down. Disappearance of forests is a global ecological problem. Deforestation of the planet leads to sharp temperature changes, changes in precipitation and wind speed.

Burning forests causes carbon monoxide pollution in the air and more is emitted than absorbed. Also when forests are reduced, carbon is released into the air and stored in the soil under the trees. This contributes about one-fourth of the greenhouse effect on Earth. Many areas left unforested by felling or fires become deserts because the loss of trees causes a thin, fertile layer of soil to be easily washed away by precipitation. Soil erosion that develops after felling leads to flooding as nothing can hold back water flows. Floods are caused by disturbed groundwater levels as the roots of trees that feed on them die. For example, extensive deforestation in the foothills of the Himalayas has resulted in major floods every four years in Bangladesh. Previously, floods had occurred no more than twice a century.

The importance of rainforest. Why is the forest so important? The importance of rainforest to the planet can be endlessly enumerated, but let us focus on key points:

- the forest is very much involved in the water cycle;
- trees protect the soil from wind washout and demolition;
- the forest cleans the air and generates oxygen;
- it protects areas from sudden changes in temperature.

Tropical forests are a resource that resumes very slowly, but the rate of deforestation is destroying many ecosystems on the planet. Deforestation leads to sudden temperature changes, changes in air speed and changes in precipitation. The fewer trees there are on the planet, the more carbon dioxide is released into the atmosphere and the greater the greenhouse effect. In place of felled tropical forests, swamps or semi-deserts form and many species of flora and fauna disappear.

How to preserve a tropical forest. Today, experts offer several ways to save the rainforest. Everyone should be involved in this: it is time to switch from paper to electronic media and hand over the waste paper. At the state level, it is proposed to create some kind of forest farms, where the trees in demand will be grown. It is necessary to prohibit logging in protected areas and toughen the punishment for violating this law. It is also possible to increase the state duty on timber when exporting it abroad, to make the sale of timber not reasonable. These actions will help to preserve tropical forests on the planet.

In order to reduce damage from felling, it is necessary:

- to increase the area of new forests planted.
- expand existing protected areas and create new ones
- implement effective measures to prevent forest fires.
- conduct selection of tree species that are resistant to environmental stress.
- fight against poachers.
- minimize wood waste.
- Implement wood recycling methods.

What can people do to save forests:

- use paper products rationally and economically;
- buy recycled products, they are labelled;
- green the area near your home;
- replace trees cut down for firewood with new seedlings;
- draw public attention to the problem of forest destruction.

Human beings cannot exist outside nature; they are part of it. And at the same time, it is difficult to imagine our civilization without the products that the forest provides. In addition to the material component, there is also the spiritual relationship between the forest and man.

References:

1. Tropical forest. Encyclopedia of forests / Chief editor G.I. Vorobyov. Moscow: Soviet Encyclopedia, 1986. T. 2. 631 p.

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PECULIARITIES OF ANTHROPOGENIC TRANSFORMATION OF PHYTOCENOSES IN THE CONDITIONS OF THE RIGHT-BANK FOREST STEPPE OF UKRAINE

Abstract. The results of anthropogenic transformation of hydrophilic flora in the phytocenoses of the Right-Bank Forest Steppe of Ukraine have been presented in the article. It has been found that eutrophication, urbanization and other anthropogenic impacts speed up the degradation of flora and ecosystems as a whole.

***Keywords**:* anthropogenic transformation, synanthropization, adventitious flora, hydrophilic flora.

Processes of the anthropogenic transformation of flora have attracted attention of many researchers. The analysis of works shows that the degree of synthantropization of the hydrophilic flora and its dynamics under the influence of anthropogenic factors remain insufficiently clarified [1].

While analyzed the synanthropic flora, it has been found that due to the changes in the hydrological regime, the number of autochthonous species decrease by 20 - 25% and the number of synanthropic species increases.

Synanthropic flora includes 61 species, ie 17.53% of the total species composition of the flora of this locality. The largest families are: *Asteraceae* (13 species, 21.31%), *Poaceae* (6 species, 9.84%), *Polygonaceae* (5 species, 8.2%), *Brassicaceae* and *Lamiaceae* (4 species, 6.56%)).

Most of the synanthropic species (45 species, 73.77%) are apophyses. Adventitious flora is represented by 16 species (26.23% of synanthropic and 4.6 of total number of species).

In some cases the moderate anthropogenic impact contributes to the conservation and expansion of rare and relict species [3].

Creation of artificial reservoirs on the rivers of the examined region has led to the formation of new ecosystems and the expansion of rare species of hydrophytes: *Salvinia natans* (L.) All., *Potamogeton friesii Rupr., P. compressus L., P. pusillus L., Nymphaea candida C. Presl* and others that have been seen rarely or fragmented before creating reservoirs [2].

Mezohemerobs (149 species, 42.82%) are found to be prevailing, the most of which are attached to the previously transformed ecosystems that are in the recovery stage (the stage of secondary swamping of wetland ecosystems).

It has also been established that the ecosystems are unified because of their intensive use [3].

The analysis of the effect of eutrophication on urban flora has revealed that the area of 13 species site (3.47% of the whole flora) has been significantly decreased by the influence of eutrophication. The development of 175 species (50.29%) is inhibited, while at the same time the development of 150 species (43.1%) under moderate eutrophication carries out without noticeable changes.

The impact of weak eutrophication was favorable for population development for 10 species (2.84%). In control areas that were not influenced by eutrophication, the height of the stems of *Phragmites australis* averaged 180 cm, their number per 1 m2 - 217, phytomass - 4.6 kg / m2. Under the weak eutrophication, the height of the stems reached 240 cm, the number per 1 m2 - 289, phytomass - 5.4 kg / m2. In moderate eutrophic environment, the height of the stems was 170 cm, their number per 1 m2 - 208, the phytomass - 4.1 kg / m2. Excessive eutrophication leads to the increase in the number of stems up to 255 per 1 m2, but their height and phytomass decrease to 155 cm and 3.7 kg / m2, respectively.

The analysis of the coastal urban flora has showed that the changes in the floristic composition accelerate the drying of wetland ecosystems. The number of mesophytic representatives increases by 15-20% and the proportion of monocotyledons decreases in the flora composition (in particular families of *Orchidaceae, Scheuchzeriaceae*, etc.) compared to the coastal areas, which are almost unaffected by anthropogenic factors. Representatives of the families *Asteraceae, Poaceae, Polygonaceae Brassicaceae* and *Lamiaceae* are more resistant to drying.

Significant recreational load (3-5 species per 100 m of the coastal zone and up to 10-12 at weekends) and complex of anthropogenic factors (atmospheric pollution, road construction, noise and other types of pollution) accelerate the process of degradation of flora and ecosystems as a whole.

References:

1. Hapon S.V. (2012) Bryophytes of the Forest-Steppe of Ukraine. Accessed at http://www.botany.kiev.ua/doc/gapon.pdf (in Ukrainian).

2. Convention on Biological Diversity. (2015) The Fifth National Report of Ukraine. Kyiv. Accessed at https: //www.cbd.int/doc/world/ua/ua-nr-05-uk.pdf (in Ukrainian).

3. Synantropization of the vegetation cover of Ukraine (2019). The Third All-Ukrainian Scientific Conference. Collection of scholarly articles. Kyiv, 2019. Accessed at https://www.botany.kiev.ua/doc/zbirnik_conf_syn_2019.pdf (in Ukrainian).

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EFFICIENCY OF USING HYBRID SOLAR COLLECTORS FOR THE ENERGY SUPPLY OF APARTMENT BUILDINGS

Abstract. The predictive efficiency of the use of solar collectors capable of generating both electrical and thermal energy for the energy supply of multi-storey buildings is investigated.

***Keywords**:* alternative energy, effectiveness, cost of production, silicon solar cells.

The economic development of any country depends on the energy sector. Developed countries are paying close attention to renewables, as fuel resources are scarce. Constantly increasing prices for energy carriers are also having a negative impact on the energy sector as a whole. Decreasing reserves of coal, oil and other non-renewable energy sources are a good reason to look for an alternative [2].

Electricity production by solar energy has advantages and is a good alternative to the energy produced by traditional power plants. Among these advantages, one must pay attention to the lack of environmental degradation.

Solar thermal systems are one of the most promising and most developed ones topics in solar energy. Such systems have active and passive use of solar energy. Among the known devices that actively use solar energy, the most reliable are flat solar collectors. The efficiency of solar collectors is accompanied by an increase in cost, which significantly increases the cost of producing energy produced by solar thermal systems [2].

The maximum energy absorption of the solar collector acceptance surface that corresponds to the highest value of the efficiency and the fullest use of solar energy, is achieved by giving the surface a position perpendicular to the incident rays.

Passive systems combine the basic design functions (elements of the structure) as well as the functions of sensing and transporting heat and cold. This is a practical construction.

No additional operating costs, automatically senses and accumulates solar energy. The simplest and most economical advantage is the use of solar energy received by the building cover, that is, the use of solar panels. However, such systems are stationary and many requirements must be met to install them in order not to impair the bearing capacity of the structural elements.

The study is about managing a solar installation connected to a single-phase network. Power is fed into the network by proper control of a single-phase inverter connected to the filter and loads. Active and reactive power are controlled by a voltage-oriented control strategy, taking into account the characteristics of the electrical grid and the load tested by simulation [1].

Solar collectors allow you to rationally use the building area by combining parts, which generates an electrical part and thermal with different heat carriers in one design. It is possible to receive much more energy per unit of building space, but despite the practical significance of such results, the impact of projected market prices on their efficiency has not been sufficiently considered.

The main technologies are solar concentrators and solar energy resources, which are based on the characteristics of its radiation. The use of solar concentrators to enhance the conversion of solar energy into heat, which is converted into energy by means of a heat engine based on the Rankine, Brighton, Stirling cycles and is intended to produce, as a rule, mechanical energy [1].

The use of PVT hybrid solar collectors would greatly improve the efficiency of a renewable source not considered in this study. The great advantage of using concentrated solar energy (CSP) technology is that it can be conveniently installed in parallel with existing fossil fuel power plants to provide a synergistic installation that will improve the efficiency of existing systems.

The proposed system can meet the energy requirements of winter and summer days.

References:

1. Bondarchuk A. S. Study into predicted efficiency of the application of hybrid solar collectors to supply energy to multi-apartment buildings. DOI: 10.15587/1729-4061.2019.174502

2. Olinyk Y. S. Vykorystannya sonyachnykh batarey v suchasnykh umovakh. *Scientific notes of Taurida National V.I. Vernadsky University". Series: Technical Sciences*. 2018. Vol.29. No 2. P. 220-224.

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WATERLOGGED AREAS AS A ACCUMULATING MEDIUM OF SURFACE RUNOFF (ON THE EXAMPLE of KHARKIV)

Abstract. The publication presents the results of studies of water samples and bottom sediments from waterlogged areas of urbanized territories. These waters are connected to ground water and feed sources of drinking water, the quality of which can affect the health of the population. It was determined that the indicators of water and bottom sediments of waterlogged areas do not exceed the MPC standards. Only in bottom sediments the concentration of Zn is 2 times higher than normal. These values are associated with the production activities of PJSC "Kharkiv coke plant".

***Keywords**:* surface runoff, bottom sediments, MPC, waterlogged areas, heavy metals.

Scientists pay considerable attention to studying the features of surface runoff within urban agglomerations. Surface runoff is formed by precipitation that seeps through the soil, entering the ground water, or flowing out, accumulates in the lower reaches of the terrain, where waterlogged areas appear. In most cases, they have direct contact with ground water, which in turn can affect the quality of drinking water in private homeowners' wells and urban sources.

In this regard, experimental studies were conducted to determine the degree of water and sediment contamination in waterlogged areas within the city of Kharkiv.

Sampling was conducted in Nobavarskiy district of the city close to the alleyway Novozhanivsky 11, near PJSC "Kharkiv coke plant", in the autumn, when the concentrations of pollutants were the highest due to the lack of significant precipitation in the summer of 2019. It should also be noted that surface runoff from the industrial site of the plant may contain a significant concentration of pollutants. Another source of pollutants on the territory of the plant is a significant amount of coal, which includes heavy metals and other compounds and which is the main raw material for the production activities of the enterprise of the coke plant [1].

Samples of bottom sediments and water from a waterlogged area located within the floodplain of the UDA river were selected for research. Determination of Zn, Cu, Cd, Cr concentration in samples was carried out in the laboratory of analytical environmental studies of the educational and scientific Institute of ecology of V. N. Kharkiv Karazin National University by atomic absorption spectrometry on the MGA-915 MD spectrometer.

The results of studies of the heavy metals content in bottom sediments were comparable with the standard values of MPC for soils[4], and it was found that the concentrations of zinc exceeded the permissible norms by almost 2 times. All other indicators are within the MPC. It has been determined that the concentrations Cu, Cr and Cd correspond to the current standards [4]. However, the analysis results of the water sample have showed that the concentrations of heavy metals (Zn, Cu, Cd, Cr) correspond to the normative indicators [3].

The results give an opportunity to build accumulative series and determine priority associations of indicators of heavy metals concentration in water and bottom sediments:

bottom sediments (mg / kg)
Zn(45.99) > Cr(0.27) > Cu(0.02) > Cd(0.00016)

water (mg / dm3)
Zn (0.09) > Cu(0.0005) > Cr(0.00002) > Cd(0.00001)

Analysis of research results indicates almost similar priority associations of heavy metals Zn, Cr, Cu, but the indicators of pollutants concentrations differ significantly.

When comparing sample analyses, it was determined that bottom sediments, in contrast to water, contain high concentrations of heavy metals, namely Zn by 511 times, Cr by 13500 times, Cu by 40 times, and Cd by 16 times, respectively. Of course, water is a more dynamic environment and the processes of dilution and self-purification occur much sooner than in bottom sediments, which are constantly accumulated under the influence of various factors. This can be seen by the significant decrease in heavy metals content in the two components.[2]

In the course of research, when comparing the analyses of water samples and bottom sediments with the normative indicators, it has been found that the water meets the regulatory requirements for the quality of waters formed within urban geosystems. However, a significant excess of the concentration indicators in bottom sediments in comparison with the indicators in water Zn and Cr was found. This excess is predictable, since these heavy metals are part of the coke coal that is used in the technological processes of the enterprise [1].

References:

1. Manskaya S. M., Drozdova T. V. Geochemistry of organic matter: textbook. no. Moscow: Nauka, 1964. 315 p.

2. Nekos A. N., Dyachenko R. L., Features of pollution of wetlands within the urban geosystem of Kharkiv. *Materials of all-Ukrainian scientific Taliivskikh readings (Kharkiv, October 30, 2019) Kharkiv*, 2019. P. 79-81.

3. Sanitary rules and standards for the protection of surface water from pollution. SanPiN 4630-88

4. Maximum permissible concentrations of chemicals in the soil: SanPiN 3210-85. - M.: Izdat. GOS. Standard, 1985.

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DETERMINATION OF THE TOURIST AND RECREATION POTENTIAL OF THE VORSKLA RIVER BASIN

Abstract. The publication presents the results of studies on the tourist and recreation potential of the Vorskla river in Poltava region. According to the results of the research, it has been found that this water object can be used for a development of local economy.

Keywords: water tourism, Vorskla river, Poltava region, recreation, potential.

The water resources of the Vorskla River and the aesthetic appeal of local landscapes make it possible to actively develop several destinations of tourism, in particular, sports, green, health and recreation. Many rivers of the basin, and especially the surrounding area, are rich in all kinds of unique natural monuments, protected areas. Given the increasing popularity of water tourism in the world as a whole and in Ukraine in particular, it is an important task to provide all the necessary conditions for its development. But at the moment, the tourism and recreational potential of the water resources of the Vorskla Basin is only partially used.

The urgency of the work is that tourist studies of the Vorskla Basin have almost never been conducted recently, and existing publications on this topic need to be updated and date mainly to the Soviet era. The situation has changed dramatically over 30 years, and, therefore, requires a new analytical study.

Analysis of the literary base of the study shows that many scientists dealt with the problem of determining the tourist potential of the rivers in Ukraine 25-30 years ago, but in recent years there has been a tendency to revive interest in the problem of water tourism due to the closer integration of Ukraine into the European space and penetration.

New tourism concepts in domestic science. In particular, in December 2018, the Strategy for the Development of Tourism and Resorts in Poltava Region for 2019 - 2029 was approved. Also, in recent years, research has been carried out at the universities of Kyiv, Kharkiv, Chernivtsi, Lviv and Odessa [1], and relevant publications are published periodically. The works of L.V. Ilyina, V.O. Kukushkina, V.F. Danilchuk, Yu.S. Vasilyeva, G.M. Aleinikova, N.V. Fomenko are devoted to the problem. But almost all of them relate to either tourism within the Soviet Union or Ukraine as a whole, i.e. they are not regional in nature. It is also worth noting that

water tourism in Ukraine as a whole is provided with rather qualified personnel, but has an outdated material and technical base.

The Vorskla River basin is part of the Dnieper basin, sometimes referred to as the "Middle Dnieper sub-basin" [1]. The length of the river within Ukraine is 336 km, total - 464 km. The area of the river basin is 14 700km. It is one of the largest left tributaries of the Dnieper and the main river of the Poltava region. The Vorskla originates near the village of Pokrovka, Belgorod region of the Russian Federation. In the middle and lower reaches, the river flows through the territory of Ukraine (Sumy and Poltava regions). The depth of the river, especially in the upper reaches, is not very significant, and is only 1.5 - 2 m [2]. In the lower reaches, the channel deepens 2-5 m. Also, the Vorskla is characterized by numerous shallows and naturally covered beaches. The flow velocity is negligible - 1.2 km / h [1], in places - up to 2 km / h [1]. That is, in general, the structure of the river bottom is favorable for bathing, and, given the calm nature of the stream, it is also safe.

In addition to geomorphological factors, the tourist potential is also influenced by climatic and hydrological factors - air and water temperature, wind speed, duration and the date of the onset of the ice regime. During 2002 -2017, the water temperature in the river is characteristic. On the one hand, this is a favorable factor as bathing in the river becomes more comfortable, but with the increase in temperature, algae and bacteria, which causes its "flowering", start to multiply more actively in the river. Thus, in the average for the years 2002-2017, the average daily water temperature through 2018 is observed at the end of the second decade of May in spring and the end of the first decade of September. That is, swimming in the river can last for almost 4 months a year. The air temperature changes more dynamically than the water. Air temperatures above 21 are considered to be comfortable for recreation. The number of days per year with such average daily temperatures ranges from 115 to 139 days in different parts of the river. That is, a recreationally attractive river is for more than 4 months a year. The nature of the ice regime is an important feature in terms of winter fisheries, which is quite popular in Ukraine. During 2002-2017, the length of days with ice regime decreased by 14-17 days, the maximum thickness of ice - by 16-25 cm. And the average thickness of ice during 2010-2017 was only 15 cm in the Vorskla and was almost universally close to 0 cm on tributaries of the river. That is, in terms of the ice regime, the Vorskla River basin is not suitable for winter fishing.

Equally important for determining the tourism potential of the Vorskla River and its tributaries is the analysis of water characteristics. According to the WFD classification, water in the Vorskla River is slightly polluted [3]. According to the degree of mineralization, water in the river belongs to the 2nd category I class quality, i.e., to "freshly-halogenated waters", which in their status are characterized as "very good", and the degree of purity - "conditionally pure" [3]. But in the lower reaches the water in the river is more polluted due to industrial emissions and waste

from agricultural fields. Thus, in the upper and middle reaches, the water in the Vorskla River is clean and fully bathing, but in the lower situation it is exacerbated by the heavy use of the river basin for economic needs.

It is also advisable to consider the cultural component of the tourism and recreational potential of the Vorskla Basin. These include resorts, cultural heritage sites, and tourist organizations providing services in the river basin. On the territory of the pool there is an organization "Green farmstead", which offers agritourism services. Poltava region is one of the most important agricultural regions of Ukraine, but since the direction of agritourism is relatively new for our country, the number of visitors is relatively small (during 2012-2017 2500 operations were performed through the organization of tourist services, including recreational activities at camp sites). But because of the large number of rural settlements in the region, the potential for agritourism is considerable. There are 169 objects of the nature reserve fund in the territory of Poltava region. Also in the region there is a network of 44 hotels and 1 hotel-office center. In the Vorskla valley there are tourist bases "Novosandarska", "Sunny", "Krotenkivska ", "Lilac Grove". Also, from the point of view of historical tourism, there is Belske settlement, situated at the height of the rivers Vorskla and Sukha Balka. Another important tourist attraction is the village of Dykanka with a regional landscape park, located near the right bank of the Vorskla River. On the bank of the Vorskla River – the Merle River, there is Natalivka estate next to the Slobozhansky National Nature Park, but it needs reconstruction and road repair work. In addition, there are numerous Scythian mounds in the river valley, which can also be interesting for tourists.

Thus, the Vorskla River basin has a considerable tourist and recreational potential, consisting of both nature and anthropogenic objects. An important obstacle to the development of tourism in the region is the unsatisfactory transport routes and almost complete lack of marketing activities, which are predominantly regional in nature. One of the main tasks is to advertise tourist attractions of the pool, aimed at foreigners. The region is extremely rich in unique terrain, and local landscapes have preserved their natural state with thoughtful groves, floodplain forests and protected tracts. The cultural heritage is also rich and varied, but its current status is not suitable for serious tourism activities.

References:

1.Klimenko V. G., Brezhnev A. Yu., Kotenko Yu. I., Ugryumova Yu. O., et al. Recreational tourism potential of the Siverskyi Donets River basin (within Kharkiv region). *Problems of continuous geographical education and cartography*. 2016. P. 41-47.

2. Poltava.Historical sketch. Poltava: Poltava Literature. 280 p.

3. Danylchenko O.S. Environmental assessment of water of the Vorskla and Vorsklytsa rivers within the Sumy region for the period 1999-2015. Poltava, 2016. 37 p.

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GEOLOGICAL STRUCTURE AND HYDROGEOLOGICAL CONDITIONS OF THE AZOV REGION

Abstract. The purpose of the research is to study the geological structure and hydrogeological conditions of the Azov region of Zaporizhzhya region for the aquifer selection and site of water intake in the eastern outskirts of the village Georgivka for operational reserves calculation of mineral groundwater intake in the recreation center "Metallurg".

Keywords: aquifer, mineral water, deposits, groundwater.

Administratively, the study area is located in the southern part of the Zaporozhye region, within the Azov region. Here, relatively small rivers flow from the slopes of the Azov uplift. The largest of them in the valley and in the catchment area are the Domuzla River with the left tributary of the Akchokrak River and the Korsak River.

The southeastern part of the Azov region is located in the Black Sea mid-steppe physical-geographical province, and the south-western part - in the Black Sea-Priazovsky dry-steppe physical and geographical province.

With regard to climate, it is moderately continental, with drought-dry phenomena. The weather is conditioned by the degree of influence of the Siberian (Asian) and Azores (Atlantic) anticyclones.

Geostructurally, the area is located in the northeastern part of the Black Sea basin and adjacent to the southwestern slope of the Azov Crystalline Massif.

Two structural floors are involved in the geological structure of this territory: the Precambrian crystalline rocks and the sedimentary deposits of Mesozoic and Cenozoic eratem.

The complexly disposed crystalline foundation consists of Metamorphosed volcanogenic, ultrametamorphic, and intrusive deposits of archaeo-paleoproterozoic.

The Mesozoic erathema is represented only by the lower and upper sections of the Cretaceous system.

As concern Cenozoic erathema, it is widespread throughout the study area and is represented by Paleogene, Neogene, and Quaternary sediments.

The area is located in the zone of articulation of the northeast side of the Black Sea depression and the southwestern slope of the Azov Crystalline Massif. The

largest deep faults are the Azov-Pavlograd and Berdyansk-Mariupol, which divide the Ukrainian Shield and the Black Sea Basin.

These tectonic structures at different times of geological development were characterized by different orientation of tectonic movements, which caused a complex history of geological development of the area.

Furthermore, this area is located in the Black Sea lowlands, and in the northeast within the western slopes of the Azov highlands. The surface is a flat and sloping forest plain, divided by the valleys of the Domuzla, Akchokrak, Mala Domuzla and gullies. On the coast of the Azov Sea and the Milk Estuary, abrasive relief forms are observed, and landslides occur.

On the territory of the researches, construction materials have been explored and extracted: construction and molding sand, loam for the production of bricks, expanded clay and tiles, as well as fresh and mineral groundwater.

This location also refers to the northeastern wing of the Black Sea artesian basin in the articulation zone with the fractured waters of the Ukrainian Shield and the Azov Massif (Azov Tectonic Block).

According to the geological structure, there are aquifers and complexes in Quaternary, Akchagil, Middle Miocene, Buchach, Kiev sediments and in the fractured zone of crystalline rocks

The aquifer of Miocene Miocene sediments is ubiquitous. The water-bearing rocks are limestone, fine-grained sands, with a thickness of 15.3 to 18.3 m. The depth of the horizon is 124.7 m. Specific flows are in the range of 2.6–4.3 m^3 / h. The waters of the horizon are pressure head, the head is 113 m.

The Water is hydrogen carbonate-sodium chloride containing free hydrogen sulfide (0.23 g / dm^3) and methane. The mineralization of water in the wells varies from 1.18 to 1.26 g / dm^3, the total hardness from 1.0 to 1.9 mmol / dm^3.

The groundwater of this deposit has been investigated by the Ukrainian Research Institute of IRIC and they are qualified as a natural sulfide mineral healing water called Divnynska.

The aquifer is protected from surface contamination by thick sandy-clay rocks.

I recommend the mid-Miocene aquifer for detailed exploration in order to calculate mineral groundwater reserves. I also recommend this aquifer for resolve the issue with mineral water supply to the recreation center Metallurg.

Acknowledgement. The author expresses special gratitude to the head of the recreation center "Metallurg" for his support and the opportunity to conduct these studies. I also thank *N. I. Cherkashyna* and *F. V. Chomko* for their help in writing and translating the article.

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MONITORING OF FINE DUST AIR POLLUTION IN BIG CITIES (ON THE EXAMPLE OF THE CITY OF KHARKIV)

Abstract. The purpose of the research of monitoring of fine dust air pollution in the city of Kharkiv.

Keywords: air pollution**,** $PM_{2.5}$, monitoring.

Modern progressive rates of technological development lead to an increase of anthropogenic pressure on air and disequilibrium in the environment. Today, the airborne dust is one of the most hazardous air pollutants. The risk, which dust poses to public health, closely correlates with the size and composition of its components.

Particulate matter with an aerodynamic diameter smaller than 2.5 μm, specifically known as fine particles or $PM_{2.5}$, is extremely harmful. Fine particles can remain suspended in the atmosphere for a long time and be transported over long distances with the possible alteration of its composition and characteristics due to physicochemical processes. The emission sources of $PM_{2.5}$ particles are mainly motor vehicles, construction sites, industrial enterprises etc.

Foreign and domestic scientific researches confirm that increased concentrations of $PM_{2.5}$ in ambient air lead to the decrease of average life expectancy and rising morbidity. Due to the microscopic size, $PM_{2.5}$ particles easily penetrate a human body through the respiratory tract and cause asthma, respiratory diseases, cardiovascular disease, lung cancer, etc. Nowadays, there is no evidence of threshold level of $PM_{2.5}$ below which no adverse effects occur.

This scientific research is devoted to the monitoring of dynamics of $PM_{2.5}$ concentrations in the air of Kharkiv for the period from 01Aug/2019 to 01/Apr/2020 (8 months). The monitoring was held at six control points in different districts of the city with diverse anthropogenic pressure. The investigated $PM_{2.5}$ concentration data was obtained from an open electronic resource called Air Pollution.

Fine dust measurement was carried out using the 7bit Pollution Monitor dust meters. During the research period, 28,119 values of $PM_{2.5}$ mass concentration in the air of Kharkiv were processed.

The measured concentrations of $PM_{2.5}$ were compared with international MPCs defined by WHO. The air quality assessment was carried out according to the international air pollution scale for the Air Quality Index (AQI) offered by the European Environment Agency (EEA). Also during the analysis, hourly, weekday, monthly and seasonal variation of $PM_{2.5}$ concentrations was investigated by building a series of charts and graphs.

According to the obtained results, in 17.4% of samples (4,905 out of 28,119) $PM_{2.5}$ level exceeded the MPC defined by WHO. The maximum excess of 80.36 MPC (2009 μg/m$^{3)}$ was recorded on 21/Aug/2019 at 20:00. According to the AQI scale, the air with such $PM_{2.5}$ concentration is considered to be of extremely poor quality. In general, due to the average $PM_{2.5}$ concentrations during the research period, the air quality in Kharkiv city can be classified as fair but quite close to moderate.

Our further research studies will be focused on finding correlation of $PM_{2.5}$ concentrations with the sickness rate of population, as well as the impact of various natural and socio-economic factors of the territory of Kharkiv.

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SOLAR ENERGY

Abstract. The solar power industry in Ukraine moved to a new level of capacity and became one of the fastest growing in the world.The purpose of the research positive and negative factors of introduction of alternative energy in Ukraine are analyzed.

Keywords: Solar energy, Power generation, green tariff.

Solar energy is a very ambitious and ecological method of generating energy using solar radiation. It is a good alternative to traditional methods because the Sun is an inexhaustible source of kinetic energy which is generated by thermonuclear reactions in its interior. Also, the extraction of energy in this way does not lead to pollution of the atmosphere with harmful substances. [1].

The geographical position of Ukraine is quite favorable for extracting energy using SES. After all, the climate in our country is characterized by the presence of a significant number of Sunny days. This is the main fundamental factor for the implementation of commercial prospects in this direction. [2].

In our country, solar energy in a relatively short period of about ten years has turned from an unusual and almost inaccessible method of obtaining energy to an industry that is developing quite powerfully. [3]. On average, 1070 to 1400 kWh/m per year enters the territory of Ukraine per year of solar radiation energy.

At a significant pace, development began to observe after the introduction in the country in 2015 of a law on the purchase of surplus energy produced by solar power plants. Mass creation of industrial and household SES has begun.

Then, as a result of all this, the solar power industry in Ukraine moved to a new level of capacity and became one of the fastest growing in the world. After all, the "green tariff" that was introduced was much more profitable than in other Western and European countries.

Power generation by industrial SES has also increased significantly. In 2019, only for 5 months, the amount of energy produced reached 630 mW. Only one Dnepropetrovsk solar power plant has a capacity of 290 mW and is the third largest in Europe [4].

Currently, photovoltaic cells are used to convert solar energy into electrical energy. In the industrial stations they are located on the ground and occupy a significant area of territory. So to get 1 mW of power, it is necessary to allocate

about 1.5 hectares of land for photovoltaic cells. This is one of the biggest disadvantages of industrial SES. And to ensure household needs, photovoltaic cells are usually placed on the roofs of houses. In addition to the need for large territories, the disadvantage of any SES is that the energy supply is not constant. But despite this, in a counterbalance to disadvantages, it should be said that the stations operate silently and do not pollute the environment.

Also, solar energy is used to generate heat in hot water systems in private homes. For this purpose, special solar collectors are used, which convert solar energy into thermal energy, which then heats the water stored in specialized storage tanks that are heat-insulated. Thus, the water in the tanks can be heated up to 70°C. [5].

It should also be said that SES is much more mobile than traditional sources of energy generation. That is, in contrast to traditional sources that are always tied to a certain territory, solar power plants, especially small-sized stations, can be quickly dismantled and re-installed in another place, provided the appropriate infrastructure.

Conclusion.

So summing up, we should say that for the further successful implementation of projects in the solar energy sector, there are:

- attractive green tariff rate for state and foreign investors;
- the positive dynamics of crediting of projects renewed energy;
- the existence of a number of laws aimed at the development of alternative energy in particular and with the help of SES. Among them is a bill to encourage the production of heat from alternative sources and a bill to improve investment opportunities in the field of electricity production from alternative sources;
- the appearance of domestic household and industrial equipment that is more affordable than analogues. [6].

References:

1. Олійник Я. Б., Шищенко П. Г., Гавриленко О. П. Основи екології: підручник. Київ: Знання, 2012. С. 373–389.

2. Обзор рынка солнечной энергетики. Крестон. 2018. С. 8–10. URL: https://kreston-gcg.com/wp-content/uploads/2018/01/How_to_make_money_in_the_sun_overview_of_the_solar_energy_market.pdf.

3. Марченко З. В., Пирський О. А. Перспективи використання сонячного енергетичного потенціалу на території України. *Вісник Київського національний технічного університету*. Київ. URL: http://www.rusnauka.com/11_EISN_2008/Ecologia/30728.doc.htm.

4. Куди рухається сонячна енергетика в Україні та світі. Торгівля зеленими технологіями. URL: https://greentechtrade.com.ua/ru/kuda-dvyzhetsya-solnechnaya-energetyka-y-tendentsyy/.

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ASSESSMENT OF PHYSICAL AND CHEMICAL CHARACTERISTICS OF THE WATERWAY IN SLOBOZHANSKY NNP

Abstract. The purpose of the research assess the physical and chemical characteristics of the reservoirs of the National Nature Park "Slobozhansky". According to the results of the research, the types of surface water in the study area of Krasnokutsk region were identified and their status at the time of the research was determined.

Keywords: physical-chemical characteristics, surface water, water temperature, electric conductivity, mineralization, oxidation-reducing potential, water indicator.

The main objective of this qualifying scientific research is to assess the physical and chemical characteristics of the reservoirs of the National Nature Park. The actuality of the research is the need to eliminate information gaps in monitoring the physical - chemical characteristics of the reservoirsof NNP "Slobozhansky" for several seasons of the year as well as to assess the physical and chemical characteristics of reservoirs in the park.

The objectives of the qualification work are to identify the types of surface waterstudiedin Krasnokutsk region, their status at the time of the study. Also to evaluate the physicochemical parameters of the reservoirs of NNP "Slobozhansky" and its surroundings.

According to the results of the research, the types of surface water in the study area of Krasnokutsk region were identified and their status at the time of the research was determined. Physicochemical indicators of the reservoirs of NNP "Slobozhansky" and its surroundings were determined. The results of the obtained researches will be included in the Chronicleof Nature of NNP "Slobozhansky".

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ATMOSPHERIC AIR CONDITION IN KHARKIV

Abstract. The publication presents the results of the student's preparatory analysis regarding problems with air pollution in Kharkiv region as well as research on three indicators (dust, nitrogen dioxide, carbon monoxide) in the areas of the city of Kharkiv.

Keywords: dust, nitrogen dioxide, carbon monoxide, atmospheric air pollution, pollutant emissions.

Atmospheric air in Kharkiv region is formed by volumes of pollutant emissions from mobile and stationary sources of pollution. Stationary sources of atmospheric air pollution include the emissions of large industrial enterprises, especially the fuel and energy complex, machine building, coke and chemical industries. According to the Main Directorate of Statistics in Kharkiv Oblast, emissions of pollutants into the atmosphere from stationary sources in 2018 amounted to 44.7 thousand tons (in 2017 - 45 thousand tons, in 2016 - 100.2 thousand tons). The vast majority of pollutant emissions into the atmosphere are from combustion processes in the energy and processing industries (44.61% of total emissions). Of the total pollutant emissions, the largest part is dioxide and other sulfur compounds (20.9% of total emissions). In addition, 7300 thousand tonnes of carbon dioxide have been received from stationary sources of pollution [1].

The large number of commercial and private structures located in Kharkiv and the region, as well as the increase in the number of long-running vehicles, lead to significant air pollution. As a result, in some parts of the city there are increased concentrations of pollutants of atmospheric air, as evidenced by the data of annual observations of air pollution, conducted by Kharkiv Regional Center for Hydrometeorology. The Center monitors atmospheric air pollution in Kharkiv at 10 stationary observation points (PSZs), equipped with complete laboratories POST-1 and POST-2 [1].

DUST. A total of 7008 air samples were selected and analyzed, of which 1.9% have concentrations exceeding the limit (in 2017 - 2.6%, in 2016 - 1.6%) [1].

Pollution of the city by dust has improved a little. The average annual concentration of dust in the city as a whole is 0.08 mg / m3 (in 2017–0.10 mg / m3, in 2016 - 0.08 mg / m3),maximum permissible concentration (MPC) is 0.15 mg / m3 daily average, that is, the average annual dust concentration in the whole city does

not exceed the daily average limit value. Air pollution index for dust was (2016 - 0.54, 2017 - 0.65, 2018 - 0.57) [1].

In 2016-2018 the most polluted area was the district of Ivanivka (PSZ # 13, Pashchenkivska St., 4). The average annual dust concentration in this area is 0.27 mg / m3, which is higher than normal. Dust index 1.66 (in 2017 - 2.11, in 2016 - 0.75).

Ambient air pollution has increased: in Novobavarskiy (53 Vrubel Str., PSZ № 21); Slobidsky (Heroes of Stalingrad Ave., PSZ No. 18); Kholodnogirsky (PSZ № 16, Kholodnogirska str., 4).

Atmospheric dust pollution has decreased in: Shevchenkivskyi (PSZ № 9, str. 23, Augusta, 34).

NITROGEN DIOXIDE. The average annual concentration (for three years) of nitrogen dioxide in the whole city has been 0.02 mg / m3 at the maximum permissible daily average of 0.04 mg / m3. The atmospheric pollution index for nitrogen dioxide as a whole for three years in the city has been 0.65. The maximum concentration did not exceed the established standard [1].

Nitrogen dioxide content decreased in: Moskovs'kyy (PSZ № 24, Academician Pavlov str., 46); Kholodnogirsky (PSZ № 16, Kholodnogirska str., 4); Shevchenkivskyi (PSZ № 9, 23, August str., 34).

Increased content of nitrogen dioxide has been noticed in: Slobidsky (Heroes of Stalingrad Ave., PSZ No. 18); Nemyshlyansky (Saltiv highway, 120, PSZ № 19).

CARBON MONOXIDE. The average annual concentration of carbon monoxide over the three years in the whole city has been 2.9 mg / m3. The daily average limit concentration is 3.0 mg / m3. The carbon dioxide pollution index of the city is 0.93 (in 2017 - 1.03, in 2016 - 0.99) [1].

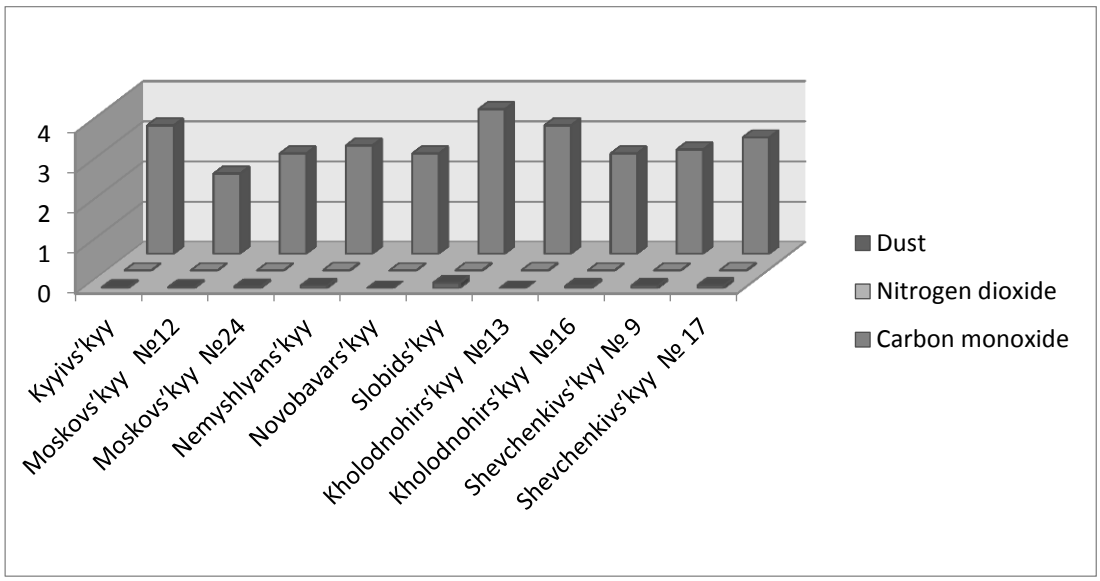

Fig. 1. Data on changes in average atmospheric air pollution in Kharkiv for 2018.

Analyzing the level of atmospheric pollution of the city by average annual concentrations, we note a decrease in the content of carbon monoxide: Moskovs'kyy (PSZ № 24, Academician Pavlov str., 46); Shevchenko (PSZ № 17, the corner of Derevyanka and Belgorod highways); Slobidsky (Heroes of Stalingrad Ave., PSZ No. 18).

The content of carbon monoxide has increased in Kholodnogirsk district (PSZ # 13, Pashchenkivska St., 4).

Analyzing the materials of observations on the state of atmospheric air in the city of Kharkiv over the last 3 years, we note a tendency to deterioration in carbon monoxide, nitrogen dioxide. The level of dust pollution has not changed.

According to the results of the analysis, it should be noted that in 2016-2018 emissions of pollutants into the atmosphere were reduced by stationary sources compared to other years. The main reasons for this decrease were: decrease in heat and electricity production. In addition, there is a positive trend in the reduction of greenhouse gas emissions, in particular due to the modernization, reconstruction, technical re-equipment and replacement of boilers aimed at reducing natural gas consumption.

References:

1. Report about the state of the environmental underground in Kharkiv region. *Kharkiv regional state administration of departourtama target - 2016-2018*. URL: https://menr.gov.ua/files/docs.pdf.

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LARGE-SCALE MAPPING OF MEADOW PLANT COMMUNITIES OF SLOBOZHANSKY NATIONAL NATURE PARK USING MOBILE GIS

Abstract. The publication highlights the experience and results of large-scale mapping of meadows of vegetation on the experimental site of the Slobozhansky National Nature Park, which were carried out during the training landscape-ecological practice in 2019.

***Keywords**:* mapping, mobile GIS, meadow plant communities, Slobozhansky National Nature Park

One of the time-consuming tasks facing conservationists is to inventory and monitor changes in the vegetation cover of the protected area. To solve this problem, the use of geographic information systems (GIS) is widely implemented, which allows to ensure the high speed and accuracy of the processes of gathering and processing information obtained during field research [1]. Currently, Slobozhansky National Nature Park specialists have accumulated some experience in large-scale mapping of forest bogs [2,3].

As part of our landscaping and environmental training at Slobozhansky National Nature Park in June 2019, we conducted a field and camera research on mapping grasslands using mobile GIS.

The experimental area subject to mapping of meadow plant communities is located near the village of Sorokove on the lands of the Volodymyr forestry of the state enterprise "Hutyans'kyy lishosp", within section №33 of forest quarter №44.

The research algorithm consisted of the following steps:

1) identification and plant communities of meadows and their borders in nature;

2) fixing the spatial configuration of each plant group using mobile GIS;

3) Insertion of attributive data in the mobile GIS describing the type of grouping, its dominant species, full-scale measurements, and total measurement per centage of coverage, etc .;

4) camera processing of the attribute tables collected in the field conditions and design of the cartographic work.

In total, 17 plant cover groups are described and mapped. The main data collected during the study are shown in Table 1.

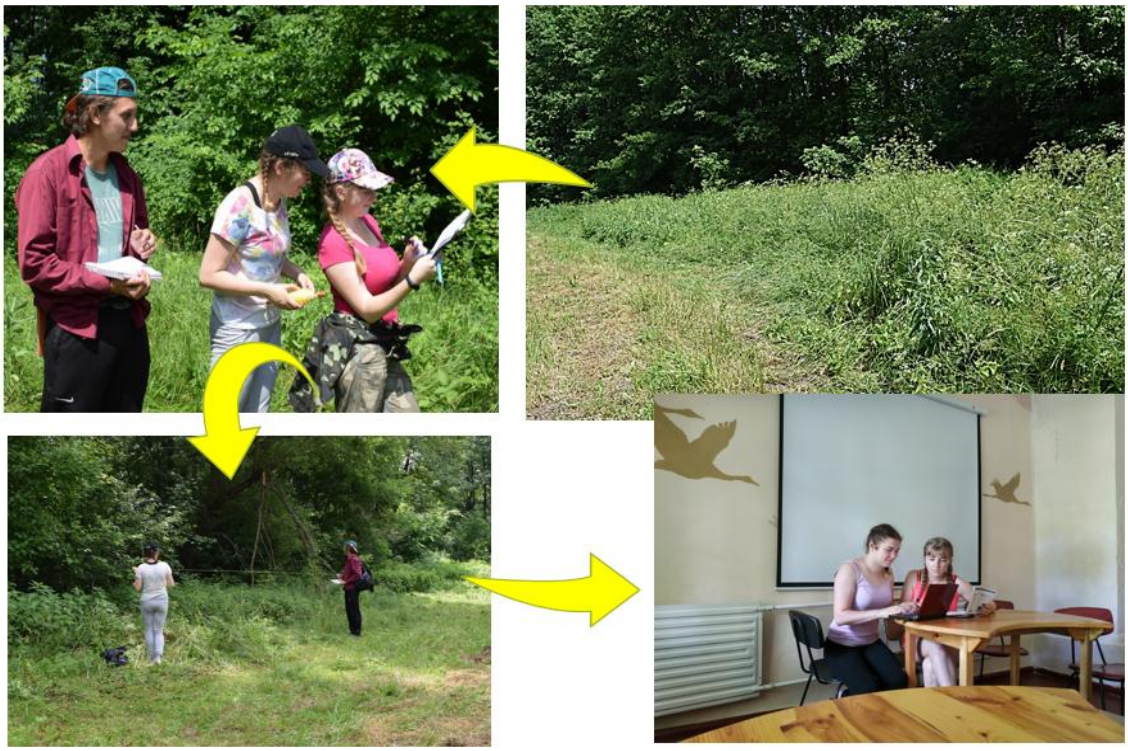

Fig. 1. The process of collecting field informatio nandits processing.

Table 1. Attribute data "Meadow plant groups within the experimental area".

ID	Type of plant community	Dominant species	Direct anthropogenic impact	Percentage of coverage, %	Square, m^2	Perimeter, m
1.	Meadow-forest	Urticadioica	-	60%	219,3	97,5
2.	Meadow-forest	Chaerophyllumtemulum	-	60%	568,3	170,5
3.	Meadow	Carexcyperacea, Aristolochiaclematitis	-	70%	137,8	59,6
4.	Meadow	Carexcyperacea	haymaking	<50%	180,9	99,9
5.	Meadow	Carexcyperacea, Alopecurus pratensis	-	60%	27,8	22,9
6.	Meadow	Carexcyperacea	-	60%	38,5	32,1
7.	Meadow	Urticadioica, Equisetum arvense	-	60%	140,4	68,0
8.	Meadow	Carexcyperacea, Chaerophyllumtemulum	-	90%	281,2	93,2
9.	Meadow	Carexcyperacea, Urticadioica ,Galiumaparine	haymaking	<50%	195,1	103,6
10.	Meadow	Urticadioica, Galiummollugo	haymaking	60%	105,7	38,8
11.	Meadow	Chaerophullumtemulum	-	50%	144,2	48,9
12.	Meadow	Carexcyperacea, Galiumaparine	haymaking	<50%	3312,1	575,4
13.	Meadow	Potentilla sphenophylla	-	50%	653,3	153,3
14.	Meadow	Medicago romanica	-	60%	231,3	87,0
15.	Meadow	Chaerophyllumtemulum, Urticadioica	-	60%	378,2	98,7
16.	Meadow forb	Matricaria chamomilla	-	80%	259,5	125,0

According to the results of the work, a cartographic work (Fig. 2) was concluded, illustrating the territorial structure of the plant communities of the study area and the relationship between the projective cover of the haymaking and the presence of haymaking consequences.

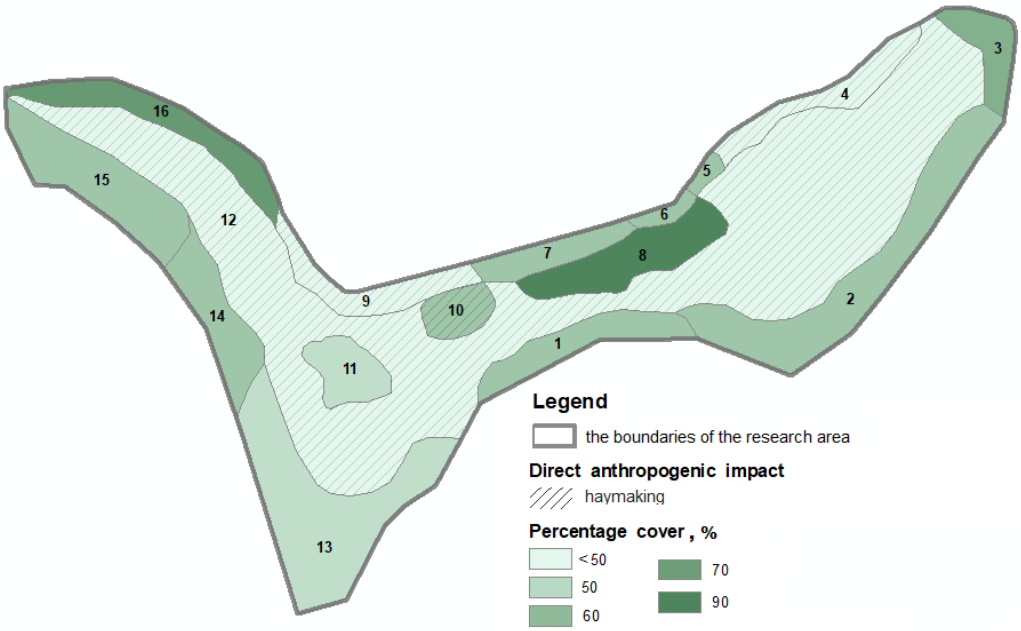

Fig. 2. Hairy plant groups of the experimental site.

In addition, information on the species composition of the plant species of this meadow is inventoried: 70 plant species were identified, 3 of which were listed in the Red Book of the Kharkiv region (Campanulapersicifolia, Matricariachamomilla, Equisétumpratense).

Acknowledgments. The authors are grateful to the research staff of the Slobozhansky National Nature Park Research Department. O. V. Bezrodnovaand K. Yu. Ivanova for her valuable experience in conducting plant

References:

1. Прилуцький О. В. Ви все ще занотовуєте в розмоклий від дощів щоденник? Тоді ми йдемо до вас! Або деякі сучасні ГІС-орієнтовані методи збору польових данних. *ГІС і заповідні території* : зб. мат.доп. учасн. III наук.-метод. сем. Харків. 2016. с. 88-98.

2. Безроднова О. В., Клєщ А. А.Рослинний покрив прибережної та берегової зон лісових боліт НПП «Слобожанський» (особливості структури та напрямкитрансформації). *Вісник Харківського національного університету імені В. Н. Каразіна.*2019.Вип. 32. С.5-17.

3. Безроднова О.В., Іванова К.Ю., Клєщ А.А. Використання ГІС-технологій у моніторингових екологоценотичних дослідженнях лісових боліт НПП «Слобожанський». *Природнича наука і освіта сучасний стан та перспективи*

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IMPACT OF DERGACHI LANDFILL ON UNDERGROUND WATER QUALITY

Abstract. The publication presents results of research performed in 2019 on identification of negative impact of Dergachi landfill on underground waters quality. According to the results of the research, it was founded that 6 water samples have violation of the standard on total hadness.

Keywords: landfill, underground water quality, total hardness.

Degrachi landfill started operation in 1977 and is located on the distance of 1 km from Dergachi town, Kharkiv Oblast. The total area is 13.2 hectares and municipal wastes from Kharkiv are disposed there. In 2006 some recultivation works were performed.

The aim of the research was to identify negative impact of the Dergchi landfill on underground waters. Our research was performed in 2019. We took 11 underground water samples from wells located around the landfill (see figure 1), chemical analyses were performed in Environmental-Analytical Laboratory of Karazin Institute of Environmental Studies.

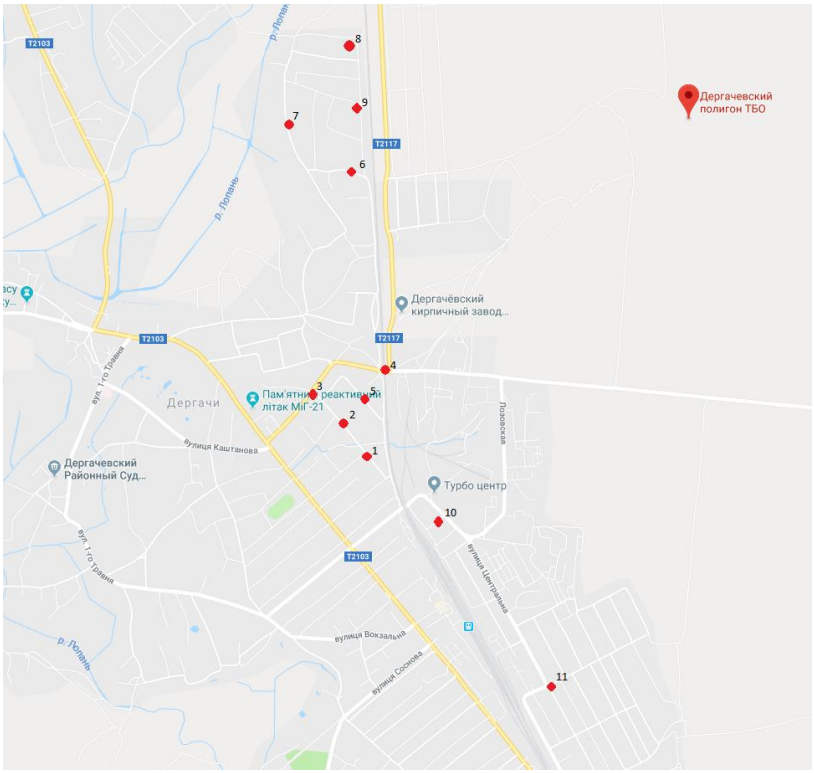

Fig. 1. Dergachi landfill and point of underground water samples.

For assessment of the level of environmental safety of waters we have decided to analyse water samples on the following 15 parameters: pH, transparency, turbidity, hardness, electrical conductivity, ammonia, nitrites, nitrates, general iron, chlorides, zinc, chromium, copper, manganese, cadmium. For comparison we took national standard for drinking water quality (State sanitary norms and rules 2.2.4-171-10 "Hygienic requirements for drinking water intended for human consumption" [1]). The results have shown that most identified concentrations are within normative value. Taking into account the character of the pollution source here we present the results with violation of standard (parameter: hardness) as well as heavy metals concentrations (Figures 2 – 3). Heavy metals do not exceed regulatory standards, the predominant metals in the samples are cadmium and zinc.

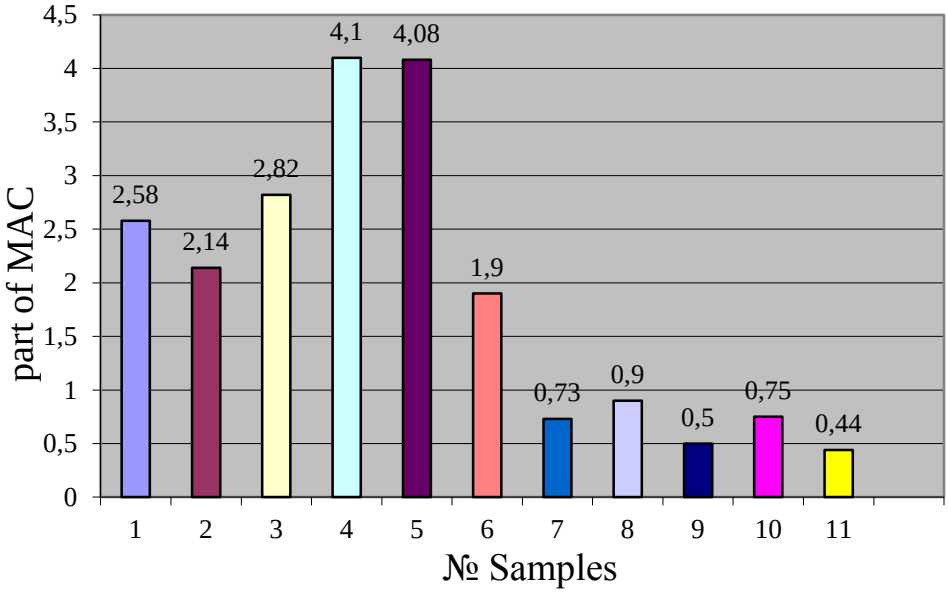

Fig. 2. Hardness value and comparison with standard value.

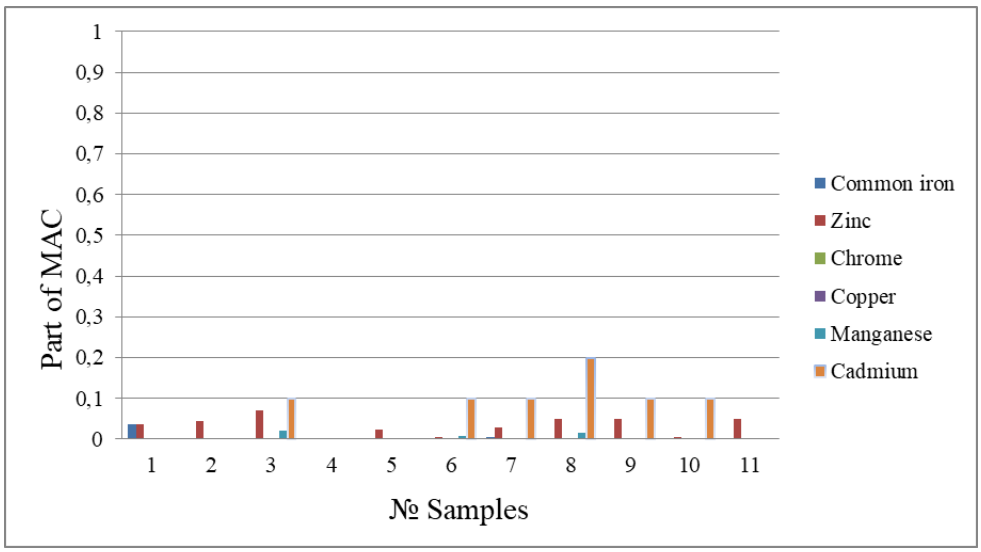

Fig. 3. Heavy metals concentrations and comparison with Maximum Allowable Concentrations.

As we can see, six samples show significant excess on water hardness. It is known that water with high hardness contains excess calcium and magnesium salts, hydrogen carbonates, sulfates and iron. [2] Frequent consumption of hard water can adversely affect human health, causing kidney disease. [3] That is why the recommendations: water needs special filtration or boiling before use.

References:

1. State sanitary rules and rules "Hygienic requirements for drinking water intended for human consumption" DSANPin 2.2.4-171-10.

2. Judicial independent examination of Ukraine URL : https://ekspertiza.com.ua/uk/tse-korisno-znati/918-zahalna-zhorstkist-vody

3. Andrusyshyn I. M. Influence of mineral composition of water on health status of the population (literature review) "Institute of Occupational Health of Ukraine". Kyiv. 2015.

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ASSESSMENT OF ATMOSPHERIC AIR POLLUTION IN THE CITY OF KHARKIV BY CARBON OXIDE

Abstract. Dynamics of carbon monoxide pollution in 2014-2018 has been analyzed in the article. It is established that the average annual carbon monoxide content in most of the territory exceeds the MPC, which is a threat to the city's ecosystem.

***Keywords**:* atmospheric air, pollution, carbon monoxide, average content, MPC.

The source of carbon monoxide in the atmosphere is transport emissions, the work of various businesses, burning of coal, oil and natural gas.

Carbon monoxide in Kharkiv was studied at 10 pollution control points (PCP). They determined average annual content and maximum MPCs between 2014 and 2018.

Throughout all the years of the study, the highest average annual carbon monoxide content was at PCP № 18. At PCP № 11 and № 13 the average annual content of the substance increased every year, but was less than at PCP № 18. The lowest level of carbon monoxide during the study period was found at PCP № 12.

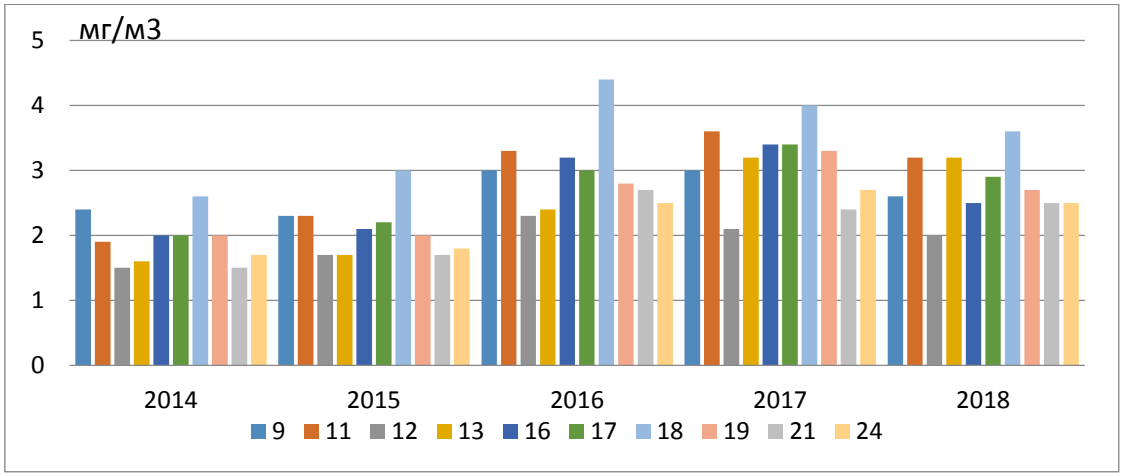

Fig. 1. Dynamics of the average annual carbon monoxide content at all observation posts from 2014 to 2018.

This result may be due to the fact that PCP № 18 is located near the highway, where a large number of cars pass every day; PCP № 11 is in the city center, where there is also a heavy load on the atmosphere from transport; PCP № 13 is located

near the railway where all the load goes from the trains. PCP № 12 is located in residential quarters , therefore, has the lowest carbon monoxide content over the years of study. There has been a tendency towards a decrease in carbon monoxide content in all PCP since 2017.

The highest values of average carbon monoxide content in atmospheric air in almost all PCPs were different in 2017. We have analysed in space-time this example using diagrams of annual dynamics of indicators (Fig. 2 and Fig. 3.)

In Figure 2, most PCPs contain average concentrations of carbon monoxide - 3-4 mg / m3. In April and May concentration did not exceed the MPC at all points. The highest content of the substance, at some points, was found from June to August.

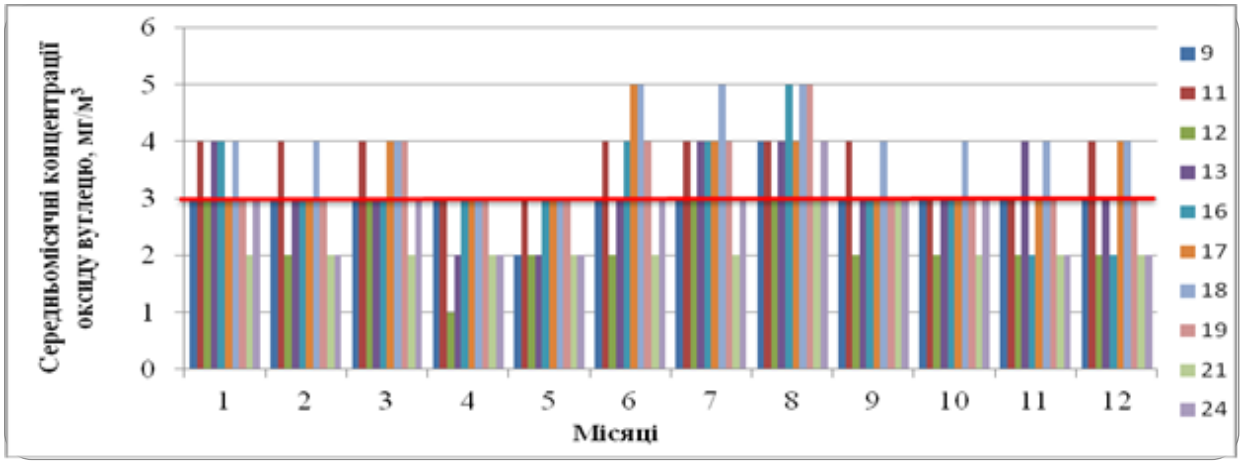

Fig. 2. Average monthly concentrations of carbon monoxide for 2017.

Figure 3 shows that in January maximum content exceeded the MPC at all points.

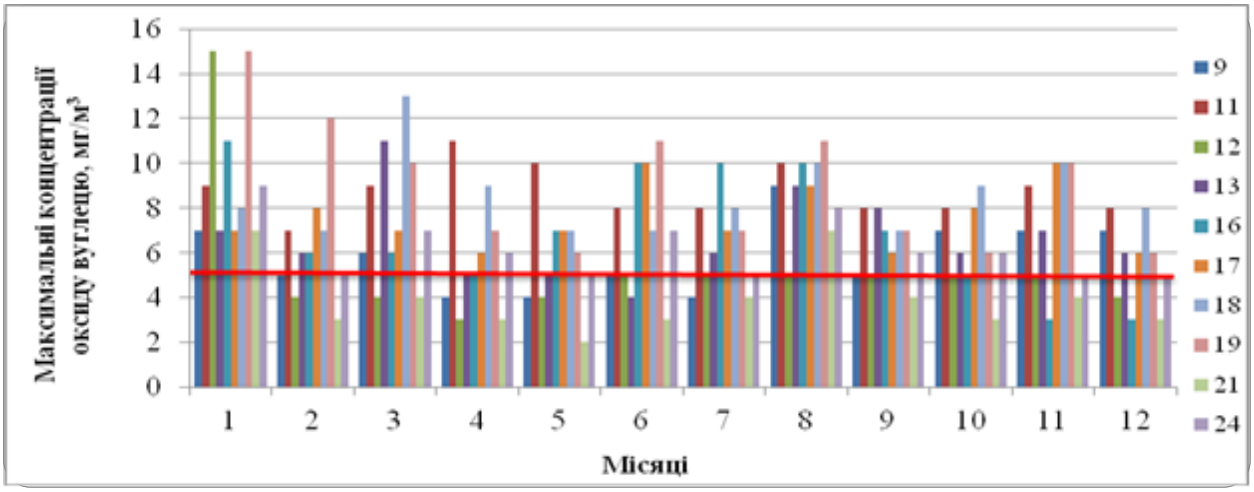

Fig. 3. Maximum concentrations of carbon monoxide for 2017.

Throughout the year, the MPC was exceeded in Teatralny, at the corner of Derevianko and Belgorod highways, Heroes of Stalingrad and Saltovsky highway. The lowest concentrations at all points were found in December.

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ACCOUNTING THE EUROPEAN BEAVER IN NNP " SLOBOZHANSKYI": EXPERIENCE IN PARTICIPATING IN THE EVENT

Abstract. The article highlights the personal experience of participating as a volunteer in the event to register the European beaver (Castor fiber) in the territory of the National Nature Park Slobozhanskyi, which took place in 2019.

Keywords: volunteering, accounting, European beaver, National Nature Park Slobozhanskyi.

Monitoring the number of species of living organisms is one of the important components of the employees' work in national natural parks. This procedure allows you to evaluate the quantity of certain species populations to make decisions about the need for their regulation, preservation or reproduction.

It should be noted that the calculation of individuals of various species is a very time-consuming task, which, as a rule, is not difficult for a few teams to cope with, and sometimes it is impossible without assistance.

Every year, National Nature Park Slobozhanskyi invites volunteers and enthusiasts to take part in events to register European beaver (Castor fiber). Last year, 2019, this event took place from November 26 to December 1.

Nature lovers from several regions of Ukraine - Kharkiv, Zaporizhzhya, Kyiv, Lugansk, Sumy and Poltava - responded to the invitation of the park administration. Among those 15 who were lucky to take part was me - Anastasia Larionova, a 3rd year student of Karazin Institute of Environmental Sciences.

Throughout the entire time of this event, a group of volunteers was accommodated in the guest rooms of the park's visit center. One of the nice "bonuses" was that the park's visit center is located in an old manor located in the territory of the Nataliievka park-monument of landscape gardening art. This gave us a unique opportunity to get to know the local cultural attractions of the Krasnokutsk Territory.

Without understating, we can say that the European beaver (Castor fiber) is an animal mascot of the National Nature Park Slobozhanskyi, its image adorns the park's logo.

The fact is that a beaver is a transformer species that is able to actively influence its environment by regulating the hydrological regime of water bodies. It is thanks to the beaver population and their activity in Kharkiv region that unique forest marshes

and lakes in the valleys of the Merla and Merchik rivers have been preserved, which are called upon to protect the National Nature Park Slobozhanskyi.

Unfortunately, as a result of water bodies' pollution, destruction of habitats and climate change, the beaver population may be reduced, and at the same time, the beaver's "home" - forest swamps and lakes - will also be threatened. That is why it is very important to keep records and monitor the state of the European beaver population.

The season for accounting was not chosen by chance: at the end of autumn and the beginning of winter, beavers begin forage operations. In the summer period, the diet of these animals consists mainly of various species of grassy and higher aquatic vegetation. However, before winter, a beaver actively harvests wood and shrubbery near its hut as a supply of food for the winter.

It is important to note that beavers have teeth growing all their lives, so they need to grind them constantly. Beavers solve this problem, firstly, by harvesting materials for the construction of huts and dams (trunks and tree branches), and secondly, by eating the bark of deciduous trees and harvesting branches for the winter. As a rule, beavers prefer to "bite" the bark and branches of birch, aspen, willow, acer tataricum, hazel, ash, alder, elm, much less often - pine, acer negundo.

Actually, determining the size of the beaver population occurs by counting the trees gnawed by beavers.

The work was organized as follows. Every day from 8.00 a.m. until nightfall, 3 groups of volunteers together with the park staff went on the field trip (Figure 1).

Fig. 1. Participants in the survey during a field trip on a birch trunk felled by beavers.

Each group had a GPS navigator, a caliper and a special notebook for recordings.

The essence of the counting was as follows: the diameters of all trees and bushes were measured on the studied family plot of animals, with the help of a

caliper, on which fresh (light wood) traces of beaver teeth were noticeable. The following information about the detected bites was recorded:

- Partially gnawed trees that are gnawed by beavers but not yet felled.
- Completely gnawed trees lying on the ground without bark and branches or trees from which only a column of the trunk remains.

In addition, the width of the traces of the front teeth on the trunks of trees and bushes was measured using a caliper. The traces were chosen in places where the deep furrow and clear edges are better seen. The obtained data on the size of tooth traces allow us to determine the age of individuals (table 1).

Table 1. Determination of the beavers' age by the width of the front tooth.

Age group	Width of tooth trace, mm
Beavers of the first year	1,9-5,7
Beavers of the second year	6,4-7,2
Adults	7,8-9,3

In my opinion, to identify and record the species of gnawed trees was the most difficult, since it turned out to be quite laborious to distinguish strongly gnawed columns of elm trunks from alder.

During the accounting period, all places with fixed and promising beaver huts in the territory of the national natural park were checked.

The observations obtained during the beaver counting event have led to several conclusions:

- Beavers transform their habitat very intensively. Around some swamps in the park within a radius of about ten meters, all the trees were tumbled down by beavers. For ease of movement, beavers dig channels connecting strategically important areas and the entrance to the hut. On land, these tireless "builders" trample down paths sometimes having a width of about one meter;
- The summer of 2019 was hot, with little rainfall, which caused the marshes to dry out. The entrances to the beaver huts were not protected by water. This is a great danger to beavers, as feral dogs can enter their homes. This forces the beavers to migrate from the marshes to more deep bodies of water.

Acknowledgement. The author expresses special gratitude to *N. A. Brusentsova*, the head of the research department of the Slobozhanskyi National Nature Park for valuable advice and the opportunity to try herself as a naturalist. I also thank *N. I. Cherkashyna* and *A. A. Klieshch* for their help in writing and translating the article.

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ECOLOGICAL PROBLEMS OF KHERSON REGION AND THEIR EFFECTS ON ECO-TOURISM DEVELOPMENT

Abstract. This publication touches upon the actual theme of present time – the connection between ecology and tourism. Tourism now is one of leading directions of further development of national culture and economy. For the last decades the proportion of tourists increased sharply, as a result there were problems of different character, including ecological.

Keywords: natural resources, eco-tourism, ecological balance, tourism.

Tourist potential of a territory depends on natural resources and terms. In priority always there is a variety of landscapes, clean air and unpolluted water. But lately, through irrational use of natural resources, deepening of ecological crisis, the amount of resources began sharply to diminish. The most anthropogenic loading is tested exactly by resort, curatively-health territories and recreational zones that use recreational natural resources valuably. All changes that happen with a natural object can destroy it.

Exceeding recreational capacity of the territory and overloading directly tourist infrastructure results in distorting the ecological balance, there are such processes in an environment, as an increase of volumes of wastes, considerable contamination of environment (in particular by the exhausts of transport vehicles), inefficient use of natural resources of territory (consumption of plenty of water resources, felling of the forests, destruction of integral landscapes,etc.).

Negative influence of tourism on an environment results in the disbalance of the ecological situation, creating threat of disappearance of certain type of the vegetable or animal world, leading to a number of threats to the ecosystem and biosphere of the territory, destruction of integral natural environment. Certain displays will be considered on the example of Kherson district.

Among the displays of distorting the ecological balance on Kherson we distinguish:

- heap of garbage of hard wastes of open character;
- alcalination of soils as a result of wrong irrigation;
- contamination of enterprises of chemical industry (extrass of such gases, as methane, carbon dioxide, substances as the particulate suspended matters, connections of nitrogen, oxide of carbon;

- large areas of ruined steppes;
- an expense of enormous amount of water resources, as a result lack of drinking-water;
- a sharp reduction in forestland.

The consequence of wrong irrigation is contamination of the Dniper delta , considerable aquatorium of the Black and Azov seas with pestilences of unrefined and sewer waters near such settlements, as Zalizny Port, Novofedorivka. The forests of Kherson area occupy only 4% of all territory, but it does not stop poachers to chop a tree near villages of Pidstepne, Solonetzi. And sharp reduction of timberlands territory can negatively influence on the development of green and ecological tourism on the territory of Kherson district.

In the last few years the territory of broken steppes increased in Kakhovka, Hornostaiv districts. This index cannot testify to ecological education of population, because steppes' plowing is violation and destruction of integrity of steppe landscape, threat for many types of fauna and flora.

The ways to reduce the manifestation of these problems include transition to safe alternative fuels; restriction of entry of vehicles to the territory of the recreational zone; organization of nature reserves; rational use of natural resources; control of deforestation; intensive afforestation

Considering the tourism industry, one of its priorities is ecotourism, which involves the reduction of tourist infrastructure, the use of environmentally friendly modes of transport, introduction and creation of new environmental technologies. Eco-tourism is gaining momentum from year to year. It has extremely large recreational, cognitive, environmental educational resources, encourages the wise use of the gifts of nature and can contribute to the socio-economic balance of the countryside. For, in our opinion, the main tasks of ecotourism are to increase the level of impact and importance of those natural objects that perform an important function in the ecosystem and the biosphere of the territory, and the rational use of natural resources both by the local population and by tourists who have a rest and directly influence the environment.

Having a number of unique natural resources, which play an extremely important role in the formation of ecotourism, Kherson region has a significant chance of successful development of ecotourism. The largest man-made forest in the world with an area of 100,000 hectares is among such sites; Europe's only desert - the Oleshkiv forests; mineral and therapeutic muds of Sivash Lake; the Black Sea Reserve; Askania-Nova Biosphere Reserve; deserted islands with wildlife the Jarilgach and Biryuchiy; the Dnieper Delta and the outlet to the two seas: the Azov and Black.

But for further long-term involvement of these objects in the development of tourism, in particular environmental, it is urgent to address environmental issues.

References:

1. Dmitruk O. U. Ecological tourism. K., 2004. 192 p.

2. Kubay D. Ecological aspects of modern development of tourism. *Announcer of the Lviv university. Series of the International relations*. 2008. Edition 24. 142-146 p.

3. Beydik O. O. Recreational-tourist resources of Ukraine. K., 2001. 395 p.

4. Zaika O. I Perspective directions of development of ecological tourism in Kherson district. *Ukrainian III scientific-practical conference «Modern progress of tourism trends» .P. II. it is Mykolaiv : of МФ КНУКІМ*, 2015. 38-40 p.

5. Holod A. P. Ecologization of tourist activity in the context of providing of steady development of region. *Ukraine: the East-west is problems of steady development : materials of Ukrainian III scientific-practical conference 24-25 of November 2011 – Lviv : РВВ НЛТУ Ukraine*, 2011. T. 1. 86-88 p.

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BIODIVERSITY LOSS

Abstract. The article highlights the importance of biodiversity conservation and its role in maintaining normal ecosystem functioning.

Keywords: biodiversity loss, drivers of biodiversity loss, ecological effects.

Biodiversity loss, also called loss of biodiversity, a decrease in biodiversity within a species, an ecosystem, a given geographic area, or Earth as a whole. Biodiversity, or biological diversity, is a term that refers to the number of genes, species, individual organisms within a given species, and biological communities within a defined geographic area, ranging from the smallest ecosystem to the global biosphere. (A biological community is an interacting group of various species in a common location.) Likewise, biodiversity loss describes the decline in the number, genetic variability, and variety of species, and the biological communities in a given area. This loss in the variety of life can lead to a breakdown in the functioning of the ecosystem where decline has happened.

The idea of biodiversity is most often associated with species richness, and thus biodiversity loss is often viewed as species loss from an ecosystem or even the entire biosphere. However, associating biodiversity loss with species loss alone overlooks other subtle phenomena that threaten long-term ecosystem health. Sudden population declines may upset social structures in some species, which may keep surviving males and females from finding mates, which may then produce further population declines.

Even though a species is not eliminated from the ecosystem or from the biosphere, its niche diminishes as its numbers fall. If the niches filled by a single species or a group of species are critical to the proper functioning of the ecosystem, a sudden decline in numbers may produce significant changes in the ecosystem's structure. For example, clearing trees from a forest eliminates the shading, temperature and moisture regulation, animal habitat, and nutrient transport services they provide to the ecosystem.

Natural Biodiversity Loss

An area's biodiversity increases and decreases with natural cycles. Seasonal changes, such as the onset of spring, create opportunities for feeding and breeding, increasing biodiversity as the populations of many species rise. In contrast, the onset of winter temporarily decreases an area's biodiversity, as warm-adapted insects die

and migrating animals leave. In addition, the seasonal rise and fall of plant and invertebrate populations (such as insects and plankton), which serve as food for other forms of life, also determine an area's biodiversity.

Biodiversity loss is typically associated with more permanent ecological changes in ecosystems, landscapes, and the global biosphere. Natural ecological disturbances, such as wildfire, floods, and volcanic eruptions, change ecosystems drastically by eliminating local populations of some species and transforming whole biological communities. Such disturbances are temporary, however, because natural disturbances are common and ecosystems have adapted to their challenges (see also ecological succession).

Human-Driven Biodiversity Loss

In contrast, biodiversity losses from disturbances caused by humans tend to be more severe and longer-lasting. Humans, their crops, and their food animals take up an increasing share of Earth's land area. Half of the world's habitable land (some 51 million square km [19.7 million square miles]) has been converted to agriculture, and some 77 percent of agricultural land (some 40 million square km [15.4 million square miles]) is used for grazing by cattle, sheep, goats, and other livestock. This massive conversion of forests, wetlands, grasslands, and other terrestrial ecosystems has produced a 60 percent decline (on average) in the number of vertebrates worldwide since 1970, with the greatest losses in vertebrate populations occurring in freshwater habitats (83 percent) and in South and Central America (89 percent).

Researchers have identified five important drivers of biodiversity loss:

1. Habitat loss and degradation—which is any thinning, fragmentation, or destruction of an existing natural habitat—reduces or eliminates the food resources and living space for most species. Species that cannot migrate are often wiped out.

2. Invasive species—which are non-native species that significantly modify or disrupt the ecosystems they colonize—may outcompete native species for food and habitat, which triggers population declines in native species. Invasive species may arrive in new areas through natural migration or through human introduction.

3. Overexploitation—which is the harvesting of game animals, fish, or other organisms beyond the capacity for surviving populations to replace their losses—results in some species being depleted to very low numbers and others being driven to extinction.

4. Pollution—which is the addition of any substance or any form of energy to the environment at a rate faster than it can be dispersed, diluted, decomposed, recycled, or stored in some harmless form—contributes to biodiversity loss by creating health problems in exposed organisms. In some cases, exposure may occur in doses high enough to kill outright or create reproductive problems that threaten the species's survival.

5. Climate change associated with global warming—which is the modification of Earth's climate caused by the burning of fossil fuels—is caused by industry and other human activities. Fossil fuel combustion produces greenhouse gases that enhance the atmospheric absorption of infrared radiation (heat energy) and trap the heat, influencing temperature and precipitation patterns.

Ecological Effects

The weight of biodiversity loss is most pronounced on species whose populations are decreasing. Biodiversity is critical for maintaining ecosystem health. Declining biodiversity lowers an ecosystem's productivity (the amount of food energy that is converted into the biomass) and lowers the quality of the ecosystem's services (which often include maintaining the soil, purifying water that runs through it, and supplying food and shade, etc.).

Biodiversity loss also threatens the structure and proper functioning of the ecosystem. As parts are lost, the ecosystem loses its ability to recover from a disturbance (ecological resilience). Beyond a critical point of species removal or diminishment, the ecosystem can become destabilized and collapse. That is, it ceases to be what it was (e.g., a tropical forest, a temperate swamp, an Arctic meadow, etc.) and undergoes a rapid restructuring, becoming something else (e.g., cropland, a residential subdivision or other urban ecosystem, barren wasteland, etc.).

References:

1. Rafferty J. P. Biodiversity loss. *Encyclopædia britannica.* 2019. URL: https://www.britannica.com/science/carbon-footprint.

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PECULIARITIES OF THE HUMAN BUCCAL EPITHELIUM CELLS REACTION ON THE CHEMICAL COMPOUNDS EFFECT

Abstract. The reaction of living organisms to changes in the concentration of irritant is investigated. The experiment was carried out on the example of CuSO4 solution influence on the dynamics of the number of heterochromatin granules in cells of human buccal epithelium (biotest). To create different conditions of irritation of the test objects CuSO4 solution at concentrations of 0.25, 0.5, 1 g / mol was selected.

Keywords: buccal epithelium, biotest, heterochromatin, CuSO4 solution.

The buccal epithelium is a layer located, in particular, in the oral cavity of a human or animal and covers the inner surface of the cheek. Cells of the buccal epithelium can be used as a test object (i.e. biomaterial) when studying the effect of environmental factors on living organisms, and, in particular, on humans.

A solution of CuSO4 in different concentrations was selected as the irritant. This substance was selected because of its availability in laboratory experiments and a relatively widespread use of such compounds in the environment.

The purpose of the study was to establish a dose-response relationship. This concept is to determine the relationship between the dose of a toxic chemical (in our case CuSO4), which affects the test object and the manifestation of damage caused by a certain dose of irritant. The term "answer", in this case, means the damage suffered by a test object at any level of organic matter organization (cell, organism, population, etc.).

The experiment was planned in 6 stages:

1. Sampling cells of buccal epithelium and placing them in a solution of NaCl (saline).

2. Preparation of CuSO4 solution in concentrations of 1, 0.5, 0.25 g / mol (irritant)

3. Mixing buccal epithelium cells samples and solution of the stimulus in the ratio of 1: 1 in 1 ml. in special containers. Then they stand in a cool place for 1 hour.

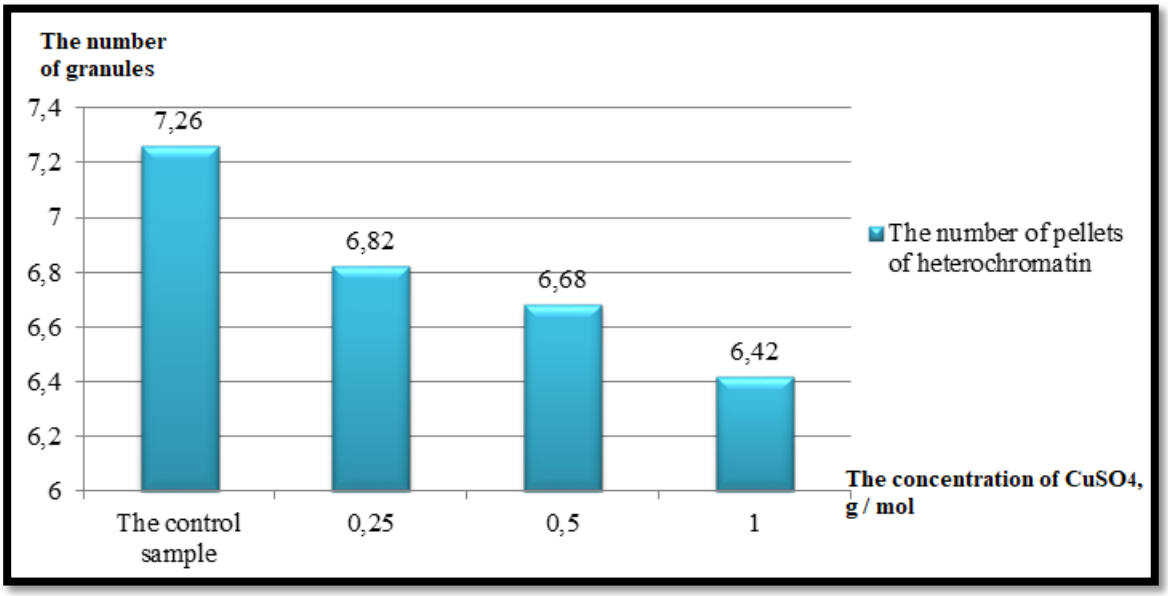
4. Addition of dye Orseyin (2%) to the obtained solutions for cells fixation in them and cessation of biochemical processes in them.

5. Using a microscope, to determine the amount of heterochromatin granules that remain intact after exposure to a stimulus of different concentrations.

6. Comparative analysis of the obtained results – to determine dependence of the inhibition degree of heterochromatin granules on the influence of CuSO4 solution in different concentrations.

For the accuracy of the obtained results, the experiment was repeated three times (according to the indicators of different concentration) and the average value was found. The average sample for one experiment was 50 cells of the human buccal epithelium.

The average values of the number of granules, as well as the error of the experiment, were calculated using the STATISTICA computer program and shown in the figure.



* - in the control sample, the concentration of CuSO4 is 0 g / mol (zero).

Fig. 1. Dynamics of heterochromatin granule count in cells under the influence of CuSO4 solution of different concentration.

The graph analysis shows the dependence of the inhibition degree of heterochromatin granules on the concentration of CuSO4 solution. In the control sample, the average number of granules is 7.26. In this experiment, an indicator characterizes the average number of cells of the buccal epithelium, which is a normal indicator for humans. After the irritant is added to the solution, the number of granules is reduced. In CuSO4 concentration of 0.25 g / mol, the average number of granules in a buccal epithelial cell decreases to 6.82, and in a concentration of CuSO4 of 0.5 g / mol - to 6.68, respectively, when diluted with CuSO4 concentrate with a value of 1 g / mol - up to 6.42 pellets per cell.

It is known from scientific publications that the number of heterochromatin granules in cells of the buccal epithelium can be influenced by important characteristics of the body (the owner of the cells of the buccal epithelium) - age, presence of diseases of the cardiovascular system, presence of genetic hereditary diseases. Reducing the number of heterochromatin granules in buccal epithelial cells may be preceded by physical exertion of varying nature and duration, depending on the physical characteristics of a particular organism.

A person without hereditary and pathological diseases was selected for experimental studies. Immediately before and during the selection of biomaterials for research, a person did not perform any physical exertion that could affect the results of the experiment. Therefore, these results can be considered average for the ordinary person.

The experiments performed confirmed the direct relationship between the dose of the affected stimulus and the response strength of the irritating biological system (cells). It has been found that the higher the concentration of $CuSO_4$ in solution is, the more the cell is suppressed, and therefore the response to the effect increases.

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DEVELOPMENT AND EFFICIENCY OF PHYTOREMEDIATION METHODS FOR AGRICULTURAL PURPOSES OF POLLUTED PESTICIDES

Abstract. The publication expresses the effectiveness of phytoremediation in comparison with other methods of soil recovery contaminated with pesticides (DDT and trifluralin) through the analysis of scientific literature. The plants that showed the best results can be used as inexpensive remedies.

Keywords: phytoremediation, soil, pesticides, accumulation.

Today, mankind has ceased to think of flora as a source of food and wood or a photosynthetic organism. Recently, the discussion of a new concept, "phytoremediation", as a natural soil cover cleaner, has become popular [1].

In the 1980s, American scientists began to develop the basics of phytoremediation technologies. Phytoremediation is a technology of purification of the environment from natural and artificially synthesized chemical elements, the basis of which is the use of vegetation. Today, in many countries, the United States, Canada, the United Kingdom and others they are widely used to reduce heavy metals, pesticides, nitrogenous compounds and radionuclides. The most important step in the phytoremediation process is the right selection of the plants to be used. During its growth, the plant absorbs some nutrients through the roots, stems and leaves, which can be used as a method of reducing the concentration of substances in the air, soil and water.

Phytoremediation is based on four basic technologies: phytostabilization is the absorption and retention of the roots of the pollutant plants, thereby preventing them from migrating into soil, groundwater; phytoextraction – the absorption of contaminants by roots, followed by displacement into the above-ground organs; phytostimulation – activation of the processes of absorption and / or decomposition of pollutants; phytodegradation and phytotransformation – decomposition of organic xenobiotics by plants into non-toxic chemical compounds, this method is characterized by the greatest potential [2].

With the example of pesticides, it is obvious that not only do they affect the pest-producing microorganisms and weeds, they can also cause destruction of micro- and meso-fauna, changes in soil organic matter, reduced yield, leaching of pesticides to the near groundwater [3].

During the last two decades, several experiments were conducted during which the ability of flora representatives to accumulate or decompose xenobiotics was detected, while clearing the soil cover. Analyzing the results, it can be argued that the efficiency and stability of plants in this task was higher than that of microorganisms-destructors due to their low adaptability to certain environmental conditions. The choice of plants should be based on the study of issues including the degree of soil contamination, the study of the processes of detoxification and movement of toxicants in soil and plants, climate, evaporation rate, vegetation period of species, root depth, resistance to pests. Phytoremediation can be used as tree plantations and shrubs with annual grasses [2, 4].

In [2], to determine the characteristics of migration of organochlorine pesticides, the objects of study were the fields and sanitary protection zones of the currently inactive formulations, which stored poison chemicals, including DDT. In 52 study sites, soil research and sampling of vegetation and soil were performed, which predicted a high likelihood of the spread of pesticides during their improper storage or intensive use in pest control. As a result, the tolerance of DDT values by more than 20 MPC.

The study found that some wild plants near the sources of the sources are toxicotolerant, that is, can withstand the content of excessive toxicants in the soil. However, it is impossible to study their response to individual components, so the evaluation is performed for a complex of pollutants. Phytocenosis is represented by ruderal weeds and meadow species. Prevailing in the conditions of multicomponent contamination of the territory are perennial species of plants with the ability for vegetative reproduction. Therefore, some types of sprouting plants on soils contaminated with organochlorine pesticides have the ability to phytodegradation. This speaks to the prospect of a deeper study of phytotechnology to produce eco-friendly products.

Examples are the following plant species: *Elytrigia repens*, which has accumulated 46.3 ± 1.3 μg / kg of DDT dry matter and its metabolites, *Gallium aparine*, has accumulated 422.7 ± 9.3 μg / kg of dry matter, *Artemisia absinthium* - 30.5 ± 1.0, *Taraxacum officinalis* - 1605.6 ± 1.7 (in root), 729.7 ± 51.5 (in terrestrial) and *Spergula arvensis* - 53,7 ± 3,2 (root), 101,3 ± 3,2 (in terrestrial organs). As we can see, the highest absorption capacity of wild plants was manifested by *Taraxacum officinalis* and *Gallium aparine* [5].

Moklyachuk in his dissertation [5] examined annual plants, which largely showed the effectiveness of phytoextraction and phytodegradation in contaminated territories with organochlorine pesticide DDT. These were Pumpkins (*Cucurbita pepo*) and Zucchini (*Cucurbita pepo*) in the class of two-seater. When collecting soil remedies containing 15 MPC DDT, a difference in parameters was observed compared to control plants: Pumpkins reduced root length by 11.7%, stem length increased by 20%, and Zucchini reduced root length by 8%, an increase in stem

length by 2,1%. As we can see, the characteristics of the plants remained almost unchanged, however, in plants, especially Cucurbita pepo Pumpkin, active accumulation of DDT metabolites was observed. Conversion of DDT from soil with contamination of 1500 μg / kg (15 MPC) to dry matter is 4.1 μg/kg for pumpkin plants and 5.1 μg/kg for zucchini plants.

To determine the effectiveness of remediation of soil contaminated with herbicide trifluralin, vegetative experiments were conducted using medicinal herbs *Agastache foeniculum*, *Tagetes patula*, *Plantago major*, and *Valeriana officinalis*. After collecting phytomass and measuring the herbicide content, it was found that in *Agastache foeniculum* contained 1,9 μg/kg of dry matter, in *Tagetes patula* – 5,3 μg/kg, in *Plantago major* – 2,7 μg/kg, in *Valeriana officinalis* – 254,3 μg /kg [6]. So, we can say that *Tagetes patula* and *Valeriana officinalis* are powerful remedies for soil contaminated with trifluralin.

There are several ways to utilize the flora used for soil remediation from pesticides. One of the most popular and time consuming is the transformation of phytomass into bioenergy through the combustion process. Especially valuable energy crops, which have high productivity (up to 30 t / ha), because they can make phytoremediation not only costly technology, but also make it profitable. Energy crops intensively absorb carbon dioxide and reduce the effects of global warming. It should be noted that biomass burning from contaminated lands, which may contain metal oxides, occurs only at power plants.

The following can be distinguished by the conversion of plant residues to biofuel. If the concentration of pollutants in the feedstock exceeds the permissible levels, then it is suggested to mix it and the material from the unpolluted territories or wood biomass to reduce the level of pollutants in biofuels. Another way is rot, which requires careful monitoring of the seal and formation of the filtrate and removing it in time to prevent its spread [7].

CONCLUSIONS

1. Phytoremediation technology is efficient and least costly, since the plants used can be very diverse. The uptake of organochlorine pesticides significantly distinguished *Taraxacum officinalis* and Gallium *aparine*, which in comparison with other wild species accumulated in themselves 1605,6 ± 1,7 and 422,7 ± 9,3 μg/kg dry matter, respectively, compared with others (30,5 ± 1,0 – 101,3 ± 3,2 μg/kg). Regarding annuals, the ability to accumulate and to some extent decompose DDT was shown by the Pumpkins (*Cucurbita pepo*) and Cucurbita (*Pepo Pumpkins*) the Two-Seed.

2. Trifluralin, a herbicide characterized by aggressive rhizomes, high toxicity to fish in contact with water bodies, has been banned in the EU since 20 March 2008. Contamination is topical now, so perennial herbs, *Agastache foeniculum*, *Tagetes patula, Plantago major*, and *Valeriana officinalis*, were investigated to determine

their effectiveness. *Tagetes patula* and *Valeriana officinalis* were the most promising contaminants.

3. When utilizing biomass, it is necessary to choose technology that can cope with the task at lower labor and economic costs. Currently, biomass is being converted to energy through power generation and biofuel generation. The use of biomass for biofuel processing is an order of magnitude more efficient than incineration at power plants, as this technology is less labor intensive and more sophisticated due to the wider range of uses used.

References:

1. Scott D. Cunningham, David W. Ow. Promises and Prospects of Phytoremediation. *Plant Physiology.* 1996. №110. P. 715–719.

2. Іванків М. Я. Особливості міграції та акумуляції хлорорганічних пестицидів у системі “ґрунт-рослина” в умовах західного лісостепу України: автореф. дис. На здобуття наук. ступеня канд.. с.-г. наук: спец. 03.00.16 «Екологія». К., 2016. 37-38 С.

3. Ступин Д. Ю. Загрязнение почв и новейшие технологии их восстановления: Учебное пособие. Санкт-Петербург: Издательство «Лань». 2009. 25-26 С.

4. Green C., Hoffnagle A. Phytoremediation field studies database for chlorinated solvents, pesticides, explosives, and metals.*U.S. Environmental Protection Agency*. 2004. P. 168.

5. Моклячук Л. І. Науково-методичні основи екотоксикологічного моніторингу і ремедіації забруднених органічними ксенобіотиками грунтів : автореф. дис. д-ра с.-г. наук. Ін-т агроекології УААН. К., 2008. 23-25 С.

6. Моклячук Л. І., Зацарінна Ю. О., Драга М. Екологічне обгрунтування фіторемедіації забруднених трифлураліном грунтів. *Вісн. Львів. ун-ту. Сер. біол.* 2012. Вип. 58. С. 131-138. - Бібліогр.: 14 назв. - укр.

7. Кулік М. І., Галицька М. А., Самойлік М. С.. та ін. Фіторемедіаційні аспекти використання енергетичних культур в умовах України. *Agrology*. 2019. №1. С. 65–73.

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MODELING OF OPERATIONAL CONTROL OF THE OXYGEN REGIME OF THE AQUATIC ECOSYSTEM IN THE CONDITIONS OF THE DNIEPER BASIN

Abstract. The article investigates the adequacy of the mathematical model of oxygen regime prediction in the Dnieper basin, based on the classic Streiter-Phelps model. Retrospective analysis of the Dnieper oxygen parameters with further verification of the Streeter-Phelps model adequacy for the Dnieper basin conditions was used. The mathematical model of the dynamics of the integral indices of the ecological state of the reservoir (the Streeter-Phelps model) has been improved by supplementing the corrective coefficients, which allows predicting with sufficient accuracy the change of the Dnieper ecological state.

Keywords: Dnieper basin, ecological state, anthropogenic load, quality assessment, quality forecast.

Continuous human activity constantly leads to a deterioration of water quality and environmental flow of river runoff. The issue of protecting river basins, and in particular their rational use, is the most pressing issue of today, directly related to the health of the nation as a whole.

The issue of real-time water quality is of paramount importance. Systematic analysis of the current environmental state of the Dnieper basin and the organization of management and protection of its water resources allows to identify a number of the most urgent problems that need to be addressed.

It is difficult to overestimate the importance of the Dnieper basin waters in providing Ukraine's water resources, since almost 80 % of the economic water supply in Ukraine, which accounts for two thirds of the country's population of about 30 million people, belongs to the Dnieper waters. On its shores are located more than fifty major cities and industrial centers, in particular the capital of Ukraine – Kiev, which determines its national significance for the country [1].

In [1,2] the main characteristics of the Dnieper basin that determine its ecological state were considered. A retrospective analysis of the water quality of the Dnipro River was carried out according to the monitoring demand of Ukraine's water resources over the last 10 years (difference of total anion content, PO_4^{3-} phosphate ions, NH_4^+ ammonium ions, biochemical oxygen demand (BOD_5) ratio to dissolved oxygen (DO) concentration), and possible causes of surface water quality change were identified.

Based on the analysis [1,2], the aquatic ecosystem of the Dnieper River, as the main aquatic artery of Ukraine, being under constant technogenic influence, tends to permanently and steadily deteriorate its ecological state.

In the future, changing the ecological state of the surface waters of the Dnieper basin in the direction of its improvement cannot occur without the development and implementation of a reliable and effective model for predicting its ecological state.

The solution to the complex problem of the Dnieper basin environmental rehabilitation should be taken to a new level in accordance with the radical changes in the nature of nature management and development strategy of the country's economy, and only by developing a national program of restoration of its ecological state.

Today, substantive reviews on the prediction and analysis of dissolved oxygen content and biochemical oxygen demand are reported in [3].

Two-component predictive models of the ecological state of water have become quite widespread, where the processes of formation of water quality are estimated by the demand of oxygen (processes of biochemical oxidation of organic compounds) and its receipt (the process of atmospheric aeration).

Some differences are noted in the prediction of water quality: a return to classic models in which the concentration of dissolved oxygen is a function of the decay of dissolved organic matter and natural processes (atmospheric aeration). The DO-BOD relationship is described by the classic Streeter-Phelps model, whose equations of processes based on first-order kinetics assumptions were analytically solved by Phelps and Streeter for a river section, and are now quite widely used in calculations.

Meaning that, it is advisable to determine the adequacy of the mathematical model for the prediction of oxygen regime conditions in the Dnieper basin on the basis of the classic Streeter-Phelps model, taking into account the data of a retrospective analysis of its oxygen indices.

The purpose of the article is to determine the adequacy of the predictive mathematical model for predicting oxygen regime (BOD and DO) in the Dnieper basin on the basis of the classic Streeter-Phelps model.

To achieve this goal, it is necessary to solve the following problems:

- carrying out a retrospective analysis of the data of oxygen indicators of the Dnieper;
- verification of the adequacy of the Streeter-Phelps model for the conditions of the Dnieper basin.

A retrospective analysis of the water quality was carried out according to the water sampling samples of the Dnipro River within the Basin Water Resources Management Department for 12 posts [3].

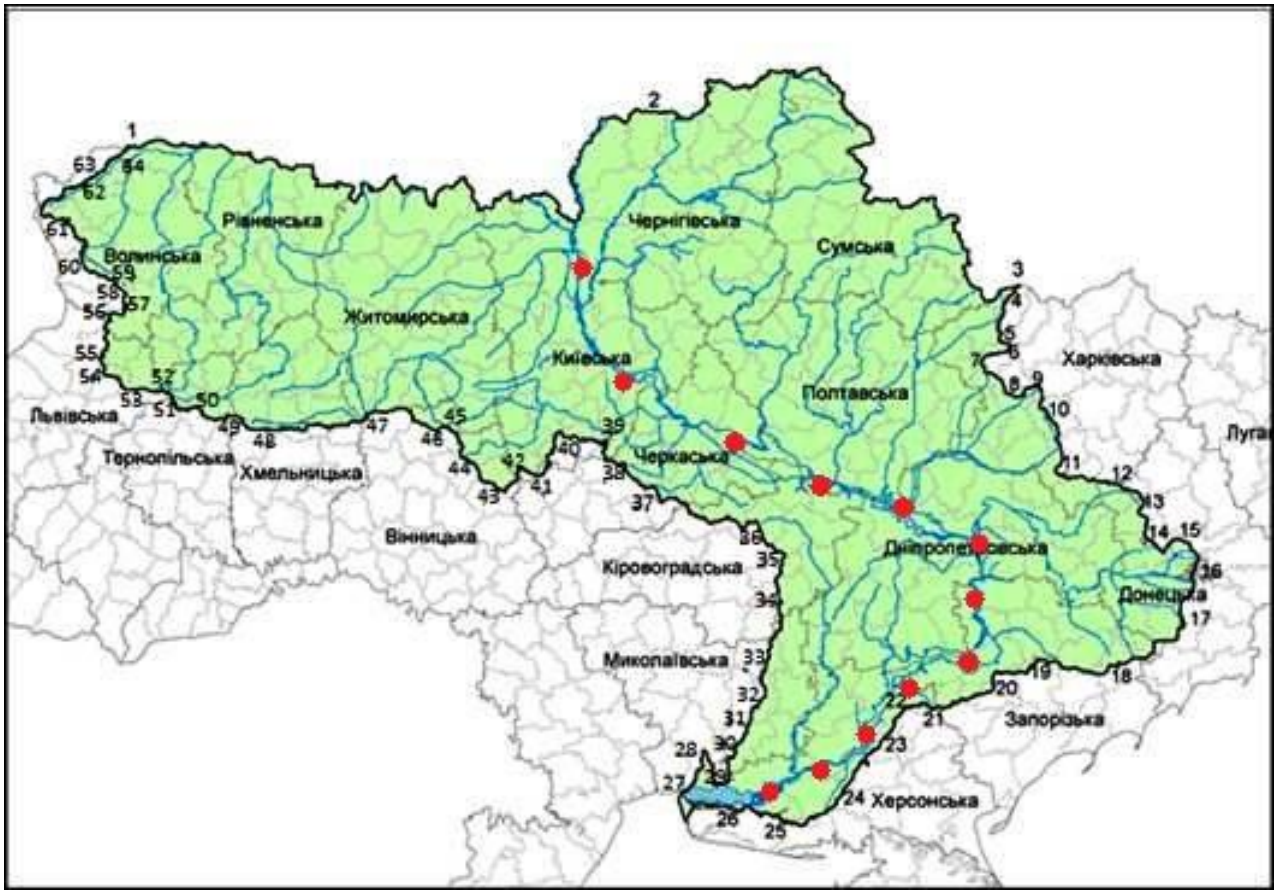

Fig. 1. Schematic location of 12 water intake control posts, according to which a retrospective analysis of the data of the Dnieper oxygen indicators was carried out.

Investigations of the oxygen regime of surface waters of the Dnieper basin were conducted by retrospective analysis of monitoring data and environmental assessment of water resources of Ukraine by the State Water Resources Agency of Ukraine, taking into account the requirements of regulatory documents for the period from January 2013 to January 2018 (for BOD_5) and from January 2015 to January 2018 (for DO).

The result of simulation of dissolved oxygen values (Fig. 2) shows a high correlation coefficient – 0.85; for the classic model it is 0.71.

The advantages of the proposed approach are the ability to easily and promptly process the available monitoring data of the surface water source. Using the proposed model allows you to make calculations without the use of special computer programs and profile skills.

As a disadvantage, however, it will be fair to point out the limitations of the components of the model, which may possibly be the subject of further research in the direction of determining operational methods of controlling the ecological state of the surface source. If the goal of our research is to be achieved, the application of the proposed model is justified.

The main purpose of the obtained model is to forecast BIA and dissolved oxygen deficiency based on the results of operational monitoring.

On the basis of the retrospective analysis for 2013–2018, the analysis of changes

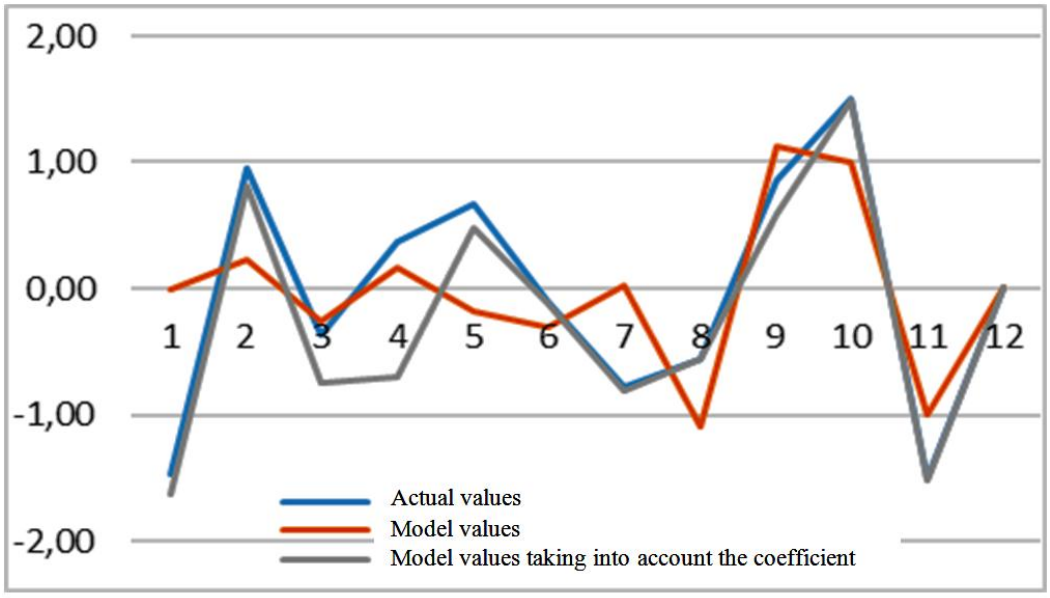

Fig. 2. Dynamics of simulated and actual (2018) dissolved oxygen values (mg/dm^3).

in the BOD_5 and DO indicators in the Dnieper water was performed according to 12 sampling posts. Trends in the deterioration of the oxygen regime of the river have been identified – a decrease in the concentration of dissolved oxygen and an increase in BOD_5 by annual average. This can be explained by the increase in anthropogenic load on the reservoir pool. The mathematical model of the dynamics of the integral indices of the ecological state of the reservoir (the Streeter-Phelps model) has been improved by supplementing the corrective coefficients, which allows to predict with sufficient accuracy the change of the ecological state of the surface source, including in the conditions of the water ecosystem of the Dnieper basin. The parameters k_1 (coefficient of biochemical oxidation of organic substances) and k_2 (coefficient of reaeration) of the Streeter-Phelps model for the water conditions of the Dnieper basin were calculated.

References:

1. Ponomarenko R.V., Plyatsuk L.D., Tretyakov O.V., Kovalov P.A. Determination of ecological state of the main source of water supply in Ukraine. *Technogenic and ecological safety.* 2019. Vol. 6. Issue 2. P. 69–77.

2. Bezsonnyi V., Tretyakov O., Khalmuradov B., Ponomarenko R. Examining the dynamics and modeling of oxygen regime of Chervonooskil water reservoir. *Eastern-European Journal of Enterprise Technologies.* 2017. Vol. 5/10 (89). P. 32–38. URL:http://repositsc.nuczu.edu.ua/handle/123456789/5546

3. Tretyakov O.V., Bezsonnyi V.L., Ponomarenko R.V., Borodych P.Iu. Improving the efficiency of predicting the impact of technogenic pollution on surface water bodies. *Emergency Problems.* 2019. Vol. 29. P. 61–78. URL: http://repositsc.nuczu.edu.ua/bitstream/123456789/8881/1/%D0%9F%D0%9D%D0%A1%201_2019.pdf

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ENVIRONMENTAL QUALITY OF TOBACCO PAPER

Abstract. The results of the research into the quality of cigarette paper in cigarettes of Ukrainian brands of different price categories are presented in the paper. It has been determined that heavy metals such as Mn and Zn are present in cigarette paper.

Keywords: heavy metals, cigarettes, cigarette paper.

At the moment, smoking is one of the most widespread habits affecting a large part of the population. For instant gratification, a person spends a lot of money every day on cigarettes, completely forgetting about their health. Huge corporations that manufacture and sell tobacco products have significant profits because demand for their products always exists.

Humanity must understand that behind all these are the problems of environmental hazards for both humans and the environment. Cigarette production has a complex cycle, which includes the production of special papers. Cigarette paper is the outer shell of the tobacco rope. This is a special paper designed for industrial production and manual rolling of cigarettes. This uses high quality pulp paper.

There is a concept of "special paper", which is characterized by the fact that it has certain qualities for a specific function and purpose, cigarette paper belongs to the group of special papers. Such paper must have properties that meet the specific requirements of its purpose and, so-called, high world standards: high resistance to break and tear; high opacity; low breathability; excellent combustion speed control; there should be a good cut without a break (excess paper) and a good edge is maintained; the paper should also be white in color and well-handled at various stages of production.

Native Americans were the first to think of wrapping tobacco in straw, reeds, corn leaves, these were the first similarities of cigarettes. In 1492, Christopher Columbus, on one of the islands in the Caribbean (this was possibly Tobago Island, whose name some researchers call it "tobacco"), met an old scorching Indian. By the way, this is where the traditional symbol of the American tobacco shop - the Indian smoking a pipe - appeared.

In the "old world," cigarettes spread after the Crimean War of 1853-1856, when Russian and Turkish soldiers began wrapping tobacco in paper liners or scraps of newspapers to burn in the halt. This habit was taken over by British and French soldiers in the Crimea from Turkish companions, and later in England mass production of cigarettes was established. The first cigarette factory in Europe was built in London.

Mass popularization of the cigarette obliged the invention of the machine for their manufacture in the US in the late 1880's. And since the beginning of the twentieth century, cigarettes have begun to look as we know them today.

Over time, the technology of paper production has changed. Contemporary cigarette paper, unlike the so-called "papyrus" paper, which was used in ancient times in the production of cigarettes, has certain additives that reduce the formation of side smoke from the paper and regulators of burning (smoldering). Thus, the first group of additives include chalk (calcium carbonate), oxide and magnesium hydroxide. The second is sodium acetate, tricalium citrate, sodium orthophosphate, potassium tartrate. Today every cigarette maker creates his own brand of cigarette paper. Depending on the type, the density of the cigarette paper is 21-35 g / m², thickness 32-51 microns. It consists mainly of sulfate cellulose fibers, coniferous wood (70-85%) and flax (15-20%) or a mixture of flax and hemp fibers (20-30%).

Chemical-analytical studies have been conducted to determine the quality of cigarettes of various price categories sold in Ukrainian retail networks and in demand for the public and to determine the environmental safety of their consumption for human health.

Laboratory studies of the quality of the cigarette paper were performed in the educational and scientific laboratory of analytical ecological studies of the Ecological Research Institute of Karazin University. During the experiment, the concentrations of heavy metals (BM) - Cr, Zn, Cu, Mn, Cd, Pb in the cigarette cigarette paper cut were determined. the price category of three brands from different manufacturers: the low price category of the Kyiv trademark, the middle price category of the LM brand and the high price category of the Parliament brand.

The results of the studies showed that only minor Zn and Mn concentrations were found in paper of all types of cigarettes. For visual operational analytics of the obtained results and determination of priority associations of VM, accumulative series were constructed to determine the concentration of VM in cigarette paper.

Parliament cigarettes, mg / kg

Mn (0.0004)> Zn (0.0006)> Cr (0) - Cu (0) - Cd (0) - Pb (0)

Cigarettes of the brand «LM, mg / kg

Mn (0.0011)> Zn (0.0006)> Cr (0) - Cu (0) - Cd (0) - Pb (0)

Cigarettes of the KYIV brand, mg / kg
Zn (0.0014)> Mn (0.0005)> Cr (0) - Cu (0) - Cd (0) - Pb (0)

An analysis of the accumulation series has showed that the priority association of VM is Zn and Mn. The highest concentration of Zn was found in the paper of the cheapest cigarettes and this is 2 times higher than in the paper of the medium and high price cigarettes. Most Mn was found in medium price cigarettes, which is 2 times higher than in low and high price cigarettes. At such values, the concentrations of Mn and Zn are so small that they can be neglected. And in general, the concentrations of Cr, Cu, Cd, Pb are not defined in the cigarette paper of different price categories.

Therefore, it can be argued to a certain extent that the cigarette paper of the most popular Ukrainian cigarettes of different brands and different price categories is almost free of heavy metals and can be considered safe.

According to our previous research on cigarette filters and tobacco, it can be said that cigarette paper is the safest component of a cigarette.

References:

1. Табачные изделия. *Большая советская энциклопедия* : [в 30 т.] / гл. ред. А. М. Прохоров. 3-е изд. М. : Советская энциклопедия, 1969 – 1978.

2. Технический регламент на табачную продукцию. *Собрание законодательства РФ*. № 52, 29.12.2008 г., (ч.I), ст.6223.

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ESTIMATION OF DAMAGE OF WOOD SPECIES OF URBAN RECREATIONAL AREAS BY MISTLETOE

(case of Kholodnogirskiy district of Kharkiv)

Abstract. The publication presents the results of calculations of the severity index and the percentage of damage to the trees of the recreational zone by Viscum album in the territory of the recreation zones of the Kholodnogirsk district of Kharkiv. It is determined that the indexes of severity range from 3.4% to 10.5%, and the percentage of damage from 8% to 27.3%. The main reasons for the destruction of tree species in recreational areas of the city are listed. Recommendations are given to improve the condition of woody vegetation.

***Keywords**:* mistletoe *(Viscum album L.)*, urban recreation areas, severity index, per cent incidence.

In modern urban areas, much of the tree species planted for greening cities is adversely affected by many factors. Air pollution, pollution of surface runoff, pests and parasitic plants - all this leads to mass destruction of urban flora. It has been found that for the Kholodnogirsk district of Kharkiv, the main problem of landscaping is damage of tree species Viscum album L.

Viscum album L. is a dioecious bush with yellowish-evergreen leathery leaves growing in tree crowns of many species [1]. Mistletoe is called semi-parasitic because its leaves are capable of photosynthesis and only water and minerals are taken from host plants. As a rule, mistletoe spreads in its natural environment with the help of winter herbivorous birds - thrushes and waxwings, which feed on its fruits. Another way to spread it is to use contaminated tree trimming equipment, as well as a vegetative propagation method.

Currently, in the cities of mistletoe belongs to the category of active invasive plants. This is due to the particularly favorable conditions for the development of populations of this semi-parasite plant in the area where plantations are usually most weakened compared to natural ones due to increased anthropogenic loading. Such areas are recreational zones of cities. Green spaces are not only the "lungs" of the city, but also a means of creating a comfortable visual environment. Therefore, keeping these plants in good condition is an extremely important and urgent task. Five park recreational zones of Kholodnogirsk district of Kharkiv city were selected for the study: Yunost Park, O.I Meshchaninov Square, Volonteer Street Park, the park area around the monument to the firemen and Tivoli Garden.

The results of field studies of the park zones made it possible to calculate the index of severity of tree damage by Viscum album L.. For this purpose, a technique was used, the essence of which was to calculate the ratio of the number of affected trees to the total number of plants studied, as well as to assess the severity of the lesion [2].

$$SI(\%) = [\{(P \times Q)\}/(M \times N)] \times 100, \quad (1)$$

where,

P = severity score, Q = number of infected plants having the same grade; M = total number of observed plants, N = maximum number on the rating scale [2].

Table 1. Scale of the severity of plant damage by Viscum album L. [2].

Score	Description
0	No incidence (no mistletoe)
1	1-5 per plant
2	6-10 per plant
3	11-15 per plant
4	16-20 per plant
5	>20 per plant

For this purpose, a visual evaluation of woody plants was carried out within the park's recreational zones. Visual studies were performed by counting the mistletoe bushes for each affected woody plant. The number of mistletoe bushes parasitized on the plant was determined by severity for each tree. As an example, a fragment of the results obtained during the study of tree species in the square named after OI and Meshchanin (Table 2) is given.

Thus, it was found that the severity index for the territory of the Yunost Park is 3.4%. For O. I. Meshchaninov Square - 4.1%. The park area around the monument to the firemen has a 7.2% seriousness index, the highest being 10.5% in the Tivoli Garden.

In the next stage, the percentage of lesions of the tree species was determined. For this purpose, the total number of trees in the study area and the number of woody plants affected by Viscum album L. were estimated. The highest value of this indicator is characteristic of the Tivoli Garden - 27.3%. The park trees on Volonteer Street - 24%, The park area around the monument to the firemen - 14.4% and the Yunost Park - 12.5% were also significantly affected. The smallest lesion of tree species - 8% was recorded in the territory of O. I. Meshchaninov Square.

Consequently, the study found that the most affected by Viscum album L. was the tree vegetation of the Tivoli Garden and the park along Volunteer Street.

These recreation areas are located directly adjacent to residential buildings where no measures for plant health have been observed. The least damage to this semi-parasitic plant is characteristic of O. I. Meshchaninov Square and Yunost Park.

Table 2. The severity of tree species Mistletoe White (Viscum album L.) in O.Meshchaninov Square (fragment).

№	Wood species	Number of bushes (*Viscum album)*	Severity index
1	Norway maple *(Acer platanoides)*	14	3
2	Norway maple *(Acer platanoides)*	9	2
3	Norway maple *(Acer platanoides)*	4	1
4	Norway maple *(Acer platanoides)*	2	1
5	Small-leaved linden *(Tiliacordata)*	1	1
6	Norway maple *(Acer platanoides)*	9	2
7	Norway maple *(Acer platanoides)*	7	2
8	Norway maple *(Acer platanoides)*	3	1
9	Norway maple *(Acer platanoides)*	2	1

This is due to the fact that in these areas there is an alternation of the breed composition of vegetation and the presence of tree species resistant to damage (so 12% of trees in the square named after O. I. Meshchaninov are birch trees). Another factor in reducing the plant damage of mistletoe is the sanitary pruning of trees, in particular in the territory of O. I. Meshchaninov Square and Yunost Park.

Increasing the degree of environmental hazard due to the excessive spread of mistletoe in Kharkiv is mainly due to the fact that for a long time the issue of tree the damage to the trees by this parasite semi-plant was not given due importance. Therefore, some recommendations should be made to improve the condition of the green spaces of the Parks and Recreation Zones of the Kholodnogirsk district, infected with Viscum album L. There are several methods you can use to combat mistletoe. The first method is the mechanical removal of branches affected by the plant - semi-parasites or complete removal of the tree with damage to the crown of more than 60% [3]. The second method is primarily the treatment of tree species infected with Viscum album L.. The third method is the permanent replacement of distant affected trees by non-invasive species such as conifers, walnut trees or birch trees.

References:

1. Rybalka I. O., Vergeles Y. I., Barannik V. O. Modeling of white mistletoe populations to address the environmental management of urban ecosystems. *Utilities of cities*. 2016. Issue 130. P. 36-43.

2. Asare-Bediako, E., Addo-Quaye, A. A., Tetteh, J. P., Buah, J. N., Van Der Puije, G. C., Acheampong, R. A. Prevalence Of Mistletoe On Citrus Trees In The Abura-Asebu-Kwamankese District Of The Central Region Of Ghana. *IJSTR.* 2013 P. 122127.

3. Ivchenko A. V, Bozhok O. P, Patsura I. M, Kolyada L. B, Bozhok V. A. Features of the organization of effective fight against mistletoe. *Naukovyy visnyk NLTU Ukrayiny*. 2014. Issue 24.5. P. 13-18

4. Sapun A. V., Gladyr V. S. Estimation of damage of wood species of urban recreational areas by mistletoe. *Vll Mizhnarodnoyi konferentsiyi molodykh vchenykh "Ekolohiya, neoekolohiya, okhorona navkolyshnoho seredovyshcha ta zbalansovane pryrodokorystuvannya», 28-29 November, 2019*. Kharkiv. 2019. P. 37-39.

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ESTIMATING LANDSCAPE AND ECOLOGICAL CONDITIONS OF A TERRITORY THE NNP «SLOBOZHANSKY» FOR THE RESIDENCE OF ARTIODACTYLA

Abstract. There is the algorithm of landscape ecological estimating the quality of living conditions the territory the NNP «Slobozhansky» (the Kharkiv region of west Ukraine) for hunting species of Artiodactyla. The main result of the study is computer maps, databases and some landscape ecological assessment maps. They are recognized by the scientific part of NNP as valuable scientific data, which will be the basis for refining the project of NNP «Slobozhansky». and making operational optimization decisions. It is established that some features of land management, such as the immediate neighborhood of highly intensive fields, the presence of intrusions into the contours of private areas cause conflicts of use and the risk of loss of numbers of the most valuable representatives of fauna.

It is planning to use this technique for other animals that live in the territory of NNP «Slobozhansky» in the future.

Keywords: NNP «Slobozhansky», landscape ecological estimating, conditions of a territory, a hunting grounds, the Artiodactyls.

Introduction. The natural object of the study is the territory of the Slobozhansky National Natural Park (NNP), which was established in 2006 on the lands of Bohodukhiv and Krasnokutsk districts of Kharkiv region. The subject is to evaluate the favorable conditions of the reindeer habitat as an indicator of the possible productivity of the national park grounds.

The main objective is to determine the optimal number of reindeer for habitat in the NNP on the basis of the use of assessment criteria for the habitat of wild boar, European roe deer, grazing deer and elk developed for other purposes, according to forest management.

The scientific novelty lies in the development of a method of boning nature conservation lands based on ecological evaluation on the example of four species of reindeer, in order to further apply the developed method to other representatives of the fauna and other objects of the nature reserve fund. The practical meaning of this work is to create a database of land bonuses for the purpose of implementing the necessary measures in certain areas of the park.

As one of the main tasks of ecological arrangement of any nature conservation area is the conservation, restoration of typical and unique species of fauna, it is necessary to carry out a preliminary assessment of the suitability of the territory by geo-ecological criteria and determine the optimal number of animals living there.

Unfortunately, there is currently no certified methodology for assessing the suitability of the territory of nature reserve fund facilities for the habitation of large animals. However, we have a departmental development of the State Forestry Committee of Ukraine, approved by the decree on "Procedure for organizing hunting grounds", which, however, concerns the hunting ground hunting. Despite the inconsistency of the tasks of nature protection and hunting economy, both tasks (nature conservation and hunting and regulation) are aimed at optimizing the number of individuals of certain species of fauna, although in different ways.

The ultimate goal is excellent: for nature, it is the conservation and reproduction, control of animal populations, and for hunters - the control of the maximum number of animals for hunting. That is why, in the absence of a methodology for ROM, we consider it appropriate to consider, first and foremost, hunting management materials, as they are a limiting factor in the conservation of the gene pool [1]. maximum number of animals for hunting. That is why, in the absence of the methodology of the objects of the nature reserve fund, we consider it appropriate to consider, first of all, the materials on the organization of hunting grounds, since they are a limiting factor for the conservation of gene pools.

The estimation algorithm. To obtain a database and maps for assessing the park's suitability for deer habitat, we use the algorithm proposed by the authors (fig. 1.).

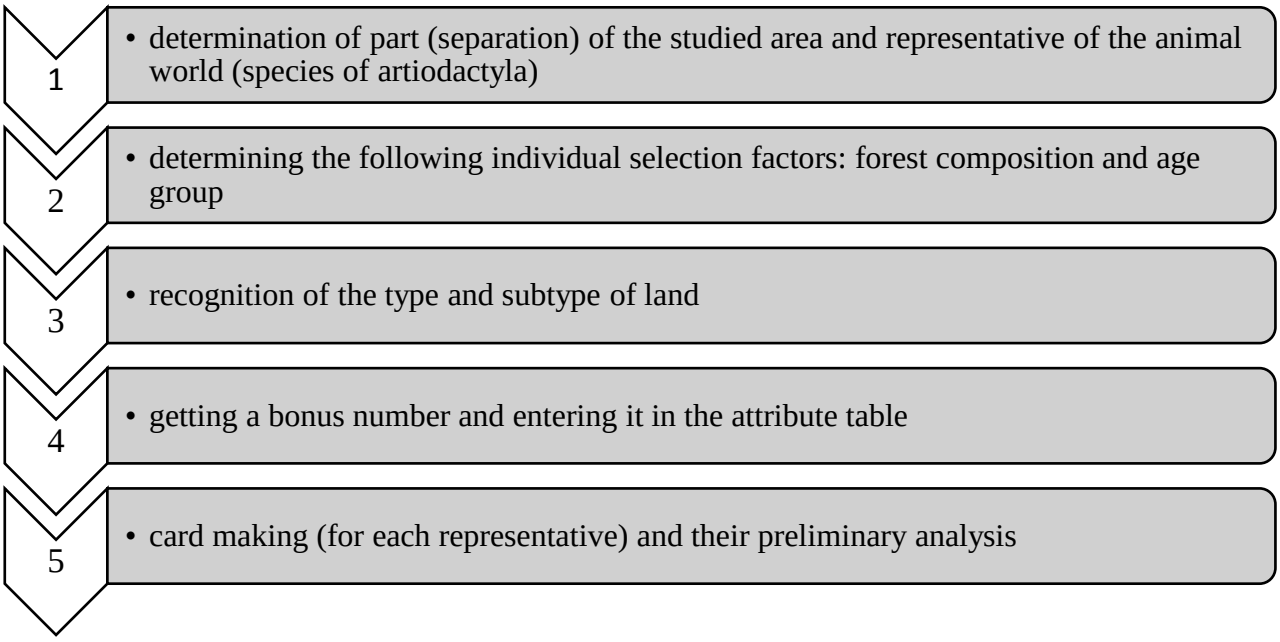

Fig. 1. Algorithm for determining the productivity of the lands of objects of the nature reserve fund for the habitat of different species of animals [by the author].

The conditions of a territory. The first step is to determine the territorial position of the studied area and the representative of the fauna that resides in the given territory and the living conditions which will be investigated in the work [2,3]. The next step is to analyze the materials of the forest taxation ordering, namely to

determine the following factors about the individual selection: composition of the forest elements and age group. Having determined this, it is possible to move on to the next stage, namely the definition from the table «Classification of hunting lands according to the class of bonuses within a certain zone», corresponding to a certain element of the forest, type of lands, and by age group - subtype of lands. Having determined these indicators, it becomes possible to obtain the number of bonuses owned by the given territory for each of the studied animal species. It is also necessary to amend for certain territories. After that, you must enter the received bonus number in the attribute table. After the table is filled, we put the cards and draw them according to the rules of mapping. The last but most important step is the analysis of the mapping material obtained.

The general analysis of the territory of the NNP “Slobozhansky” regarding the habitat of reindeer shows that this territory is suitable for not all deer species. This is first and foremost related to the natural conditions of the territory. Deer use shrubs and shrubs to feed deer, which is lacking in some areas of the park. As not all the territory of the park is homogeneous in vegetation, so not the whole territory of the park is equally suitable for the location of deer.

Protective properties are important for the reproduction and reproduction of Artiodactyla. Not all areas of the park have high protective properties. This is due to the location of the NNP itself and the characteristics of the adjacent territories. Unfortunately, Slobozhansky is not a single territorial entity, but is fragmented and divided into several parts, bordering on agricultural and private property. Also, poaching that thrives, despite the park's activities, is a factor that greatly reduces security.

Conclusion. Therefore, the main result of the study is computer maps, databases and bonuses, which are recognized by the scientific part of NNP as valuable scientific data, which will be the basis for refining the project of NNP «Slobozhansky». and making operational optimization decisions. It is established that some features of land management, such as the immediate neighborhood of highly intensive fields, the presence of intrusions into the contours of private areas cause conflicts of use and the risk of loss of numbers of the most valuable representatives of fauna (above all the best specimens of the most important, entire forest areas).

In the future, it is planned to use this technique for other animals that live in the territory of NNP «Slobozhansky».

References:

1. Law of Ukraine "On the Nature Reserve Fund of Ukraine". *Bulletin of the Verkhovna Rada of Ukraine.* К .: 1992. № 34. Art. 502.

2. Taxation description of the Parkhomovsky Natural Science Research Department as of 01.01.2016.

3. The Kharkiv district. The Nature, Population and Economy. Eds. A. Golikov, A. Sydorenko. Kharkiv University. 1997. 288 p.

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SAFETY OF TOBACCO PRODUCTS

Abstract. The publication presents the results of studies on the concentration of heavy metals in tobacco cigarettes of different price categories. The results of studies have shown that the concentrations of heavy metals in tobacco of high price cigarettes are the lowest.

Keywords: heavy metals, cigarettes, tobacco.

Today, in our country, a large part of the population are supporters of cigarettes. There are many different brands of cigarettes on sale in Ukraine, quality studies are presented by the manufacturers themselves, which may be untrue information.

The average smoker daily smokes from half to a whole pack. Smoke of 10-20 cigarettes enters the body, not taking into account secondhand smoke. The figure is not small, given that cigarettes contain heavy metals, such as Cd, Pb, Zn, which are toxic and accumulate in the body.

New laws prohibit smoking in many public places, reducing the number of passive smokers who receive more harm than the active, and forcing some smokers to abandon their destructive habit. Over the years 2010-2017, Ukrainians have significantly changed their attitude to smoking: if earlier 43% of Ukrainians smoked, now they still smoke 23% of adults, but statistics show that half of them want to quit. Currently, 40% of Ukrainian men and 9% of women smoke in Ukraine - 8.2 million of our adult compatriots. Such positive dynamics can be observed thanks to new state bills, active anti-advertising and anti-propaganda on smoking, the emergence of alternative types of smoking (sticks, electronic cigarettes, hookahs, etc.) [1]

However, the biggest incentive to quit smoking is created by economic indicators, that is, the pricing policy of the state that sets the value of cigarettes. Yes, their value has more than doubled compared to 2016 and is projected to continue to increase. By the way, 21.0% of current tobacco smokers say they will stop smoking if the price of tobacco increases sharply, and 25.8% say that they will smoke less. Accordingly, most Ukrainians prefer low-price cigarettes. [1]

In order to determine the quality of cigarettes of different price categories sold in Ukrainian retail chains and in demand by the population, and to investigate the safety of their consumption for human health, chemical analytical studies of these products have been carried out. The concentration of heavy metals (BM) in tobacco

of three cigarette brands from different manufacturers and different price categories was determined.

Laboratory studies of tobacco quality were performed in the educational and scientific laboratory of analytical ecological studies of the ecological faculty of KhNU named after VN Karazin. During the experiment, the concentration of BM (Cr, Zn, Cu, Mn, Cd, Pb) in cigarettes was determined: low price category of Kyiv brand (sample 1), medium price brand LM (sample 2) and high Parliament's brand price category (sample 3). And for comparison, US-made Nat Sherman Premium Cigarettes (sample 4) were taken

The experimental studies made it possible to construct accumulating series of accumulation of VM in cigarette tobacco for visual operational analytics in order to determine priority associations.

Parliament cigarettes, mg / kg
Cr (0.015)> Cd (0.14)> Pb (0.9)> Zn (8.1)> Cu (10.2)> Mn (146.2)
Cigarettes of the brand «LM, mg / kg
Cr (0.038)> Cd (0.88)> Pb (1.96)> Cu (4.88)> Zn (10.74)> Mn (88.1)
Cigarettes of the KYIV brand, mg / kg
Cr (0.056)> Cd (1.98)> Pb (2.45)> Cu (6.46)> Zn (18.44)> Mn (128.84)
Nat Sherman Cigarettes, mg / kg
Cd (0)> Cr (0.00005)> Cu (0.0010)> Pb (0.0290)> Zn (0.0362)

The analysis of the accumulation series showed that the priority association of the presence of BM in tobacco cigarettes is the combination of Cr, Cd and Pb. And the lowest concentrations of VM are found in US cigarettes, and Cd has not been determined at all. Unfortunately, there are no normative indicators for VM in tobacco.

Also, as a result of the performed research, it was determined that the highest concentration of Cr was in the cigarettes of the Kyiv brand (0.056 mg / kg), which is 2 times higher than in the cigarettes of the LM brand (0.038 mg / kg) and 4 times more than in Parliament cigarettes (0.015 mg / kg). The highest concentration of Zn was found in tobacco of sample 1 (18,446 mg / kg), which is almost 2 times higher than the concentration in tobacco of sample 2 (10,7454 mg / kg) and sample 3 (8,134 mg / kg). The highest concentration of Cu was found in tobacco of sample 3 (10.1688 mg / kg), which is 2.5 times higher than the concentration in tobacco of sample 1 (6.457 mg / kg) and 1.5 times more than in tobacco of sample 2 (4.8835 mg / kg). The highest concentration of Mn was in tobacco of sample 3 (146,201 mg / kg), which is 1.5 times higher than in tobacco of sample 2 (88,137) and 1.15 times more than in tobacco of sample 1 (128,84). The highest concentration of Cd was found in tobacco of sample 1 (1.9867 mg / kg), which is 20 times higher than in tobacco of sample 3 (0.146) and 2.5 times higher than in sample 2 (0.8801 mg / kg).

The lowest Pb concentration was detected in tobacco of sample 3 (0.9645 mg / kg), which is 2 times less than the concentration in tobacco of sample 2 (1.9645 mg / kg) and 2.5 times less than in sample 1 (2 , 4560mg / kg). It is also determined that the concentration of AM in American cigarettes is much lower (Cr - 300 times, Pb - 31, Zn - 233, Cu - 10200 times) than Ukrainian ones, and Cd has not been determined at all. We can say that they are almost safe and do not adversely affect health. But the price of a pack in the territory of Ukraine is about $ 25 (625UAH), whether they are worth their money and whether it is worth spending such money on cigars.

Concerning the quality of Ukrainian cigarettes, the results of the studies are ambiguous. By most indicators, VM concentrations in Parliament's high-price cigarettes have lower VM concentrations than in Kyiv-brand low-price cigarettes, except for Mn and Cu concentrations. The most toxic substances (Pb and Cd) have the highest concentrations in tobacco of the low price category of the Kyiv brand. Pb is known to accumulate in the brain, liver, bone, and kidneys. At high concentrations of Pb, the brain and central nervous system are disrupted, causing coma, cramps and even death. Cd, in turn, also causes serious illness. The main "repository" of Cd in the body are the kidneys (30-60% of the total) and the liver (20-25%). The remaining Cd is concentrated in the pancreas, spleen, and tubular bones. Its accumulation results in unbearable muscle pain, involuntary bone fractures (Cd capable of leaching Ca from the body), skeletal deformity, impaired lung, kidney and other organs. Excess Cd can cause malignancies. [2]

Therefore, the study showed that the tendency to decrease the quality of cigarettes is inversely proportional to the price category, the higher the price, the lower the concentrations of heavy metals.

References:

1. Поширеність куріння в Україні. 2018. URL: https://moz.gov.ua/article/news/poshirenist-kurinnja-v-ukraini-zmenshilas-na-20.

2. Отравление свинцом и здоровье. Всемирная организация здравоохранения. 2018. URL: https://www.who.int/ru/news-room/fact-sheets/detail/lead-poisoning-and-health

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TEMPORAL CHANGES IN THE ATMOSPHERIC AIR POLLUTION INDEX OF THE CITY OF KHARKIV

Abstract. The six-year fluctuations of the atmospheric air pollution index at different monitoring stations of Kharkiv Regional Center for Hydrometeorology are analyzed. It is established that in the whole city, the worst situation was in 2016-2018. Observation posts include the highest pollution indices at PCP № 13 (Ivanivka district, Pashchenkivska St., 4), and PCP № 18 (Heroes of Stalingrad Ave, 3) and PCP № 9 (23 August Str, 34).

***Keywords**:* atmospheric air, pollutants, pollution monitoring points, atmospheric pollution index.

Kharkiv Regional Center of Hydrometeorology monitors air pollution in the city of Kharkiv at ten stationary pollution control points (PCP) equipped with complete laboratories "POST -1" and "POST -2". These PCPs continuously record contaminant content by automatic gas-congestion for further laboratory analysis. Since the air content of such substances as ammonia, nitrogen dioxide, sulfur dioxide, carbon monoxide, dust, soot, hydrogen sulfide, phenol, formaldehyde, and others is measured at all PCPs, statistical measurement makes it possible to assess the state of the city's atmospheric air in different areas.

The atmospheric pollution index (API) is used for the integral assessment of the atmospheric air conditions. This is a complex indicator calculated on the total of five major pollutants when translating their absolute values concerning the maximum permissible concentration (MPC). The translation of absolute values in API allows us to take into account the environmental damage caused by pollutants of varying degrees of harmfulness more realistically:

$$IPA = \sum (q_i / MPCi_{mr})^{\alpha i}$$

Where: q_i –concentration i-of each substance, mg / m^3;

MPCi - Maximum Permissible Concentration, mg / m^3;

mr – maximum single MPC i- of each substance, mg / m^3;

αi - hazard ratio of i-each substance with substance of III hazard class (α, I class is 1.7; α, • II class - 1.3; α, III class - 1.0; α, IV class - 0.9)

Analyzing the level of atmospheric pollution in the city by harmful impurities according to the pollution index (API) in different parts of the city, we noted that (Fig. 1)

- at all PCPs during the whole period of API observations significantly exceeds 1, indicating unfavorable environmental situation;

- during the study period, the highest APIs were observed at PCP № 13, 18 і 9, respectively; Pashchenkivska, 4 Ivanivka district, 3,Heroiv Stalingrada avenue and str. 23 Serpnia, 34 Pavlovo Pole District.

- The lowest API indicators are typical for the Saltivka district in the 607 micro district in the street Gvardiitsiv Shyronintsiv, 44 (PCP № 12) and Bavaria in Vrubel Street, 53 (PCP № 21).

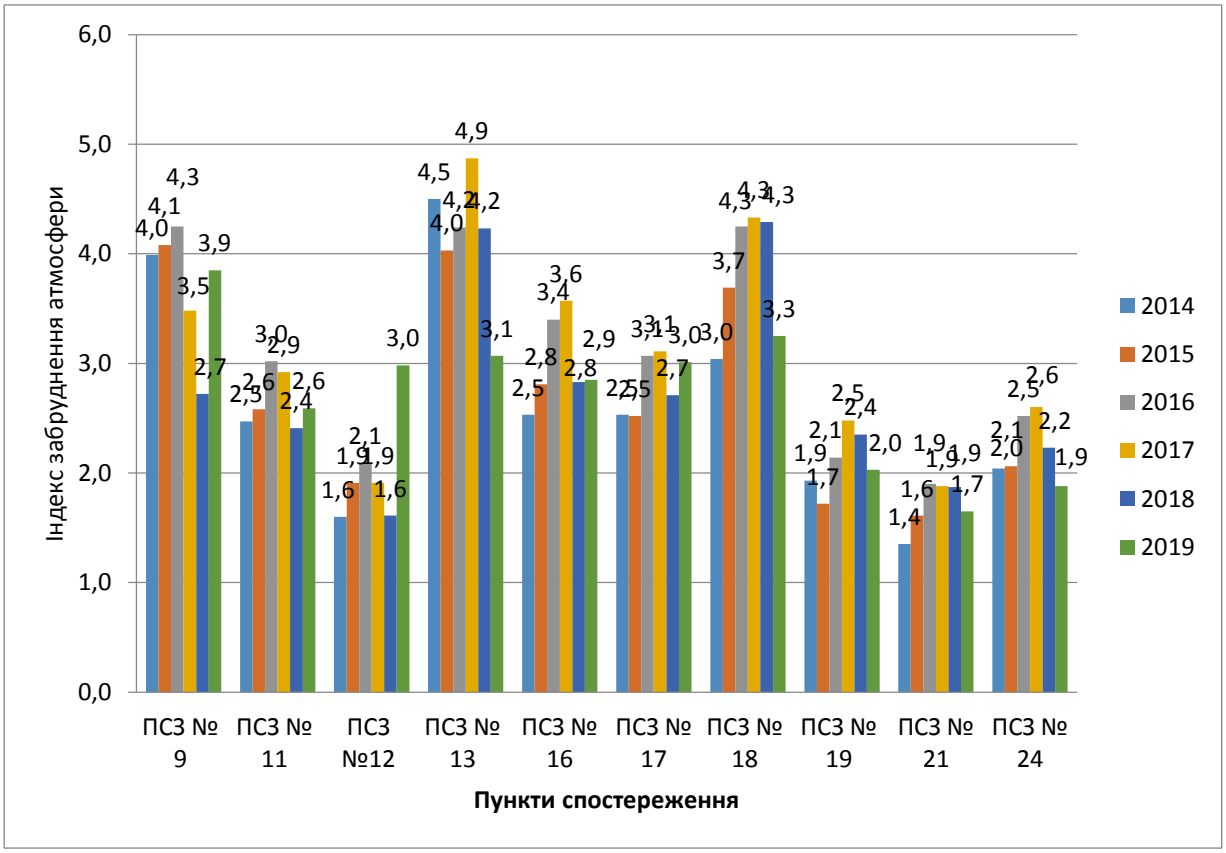

Fig. 1. Index of atmospheric pollution in different parts of the city.

The analysis of temporal changes in the API made in Fig. 2, showed that from 2014 to 2017, there was a gradual increase in API at all PCPs, after which an intensive decline began to date. The exceptions are the area of 23 Serpnia and Saltivsky housing estate, 607 residential districts, where in 2019 there was a significant increase in pollution and, as a consequence, the value of API. The trend of a slight increase in API in 2019 is also characteristic of the city center and Sokolnyky. Intensification of the traffic flow from the center to the northern part of the city may be the reason for this situation.

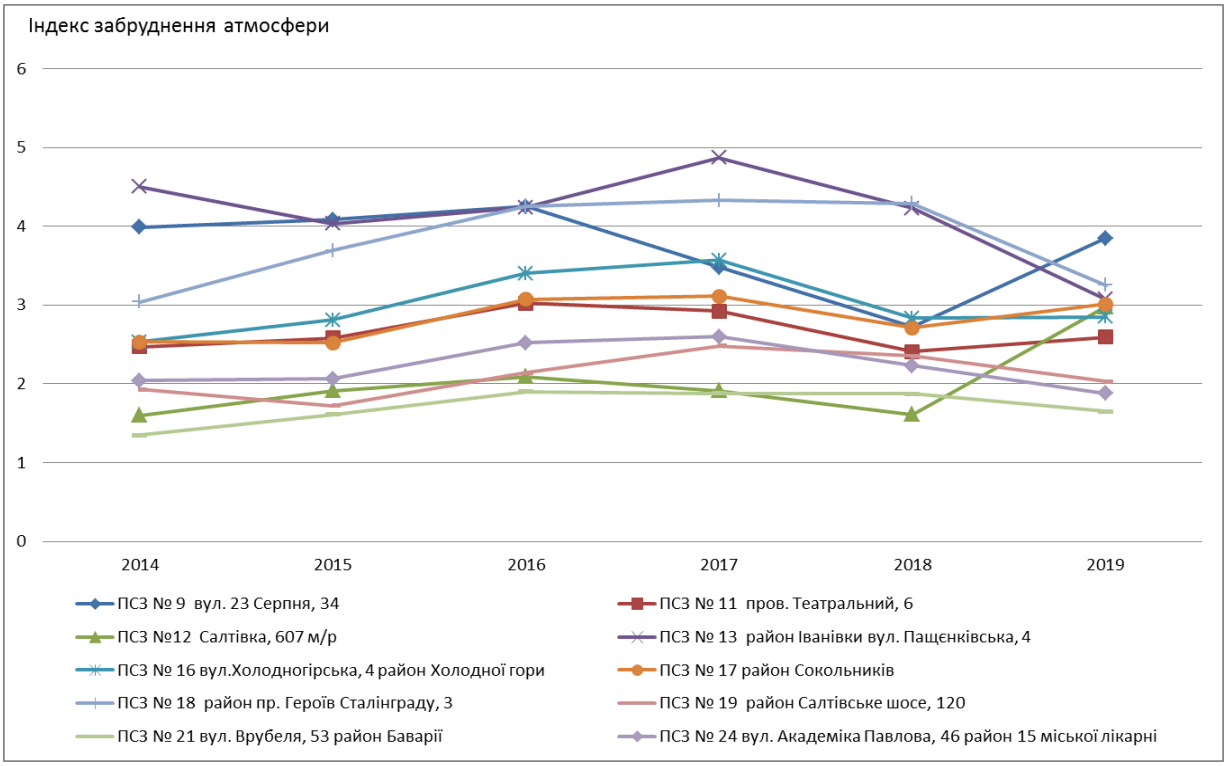

Fig. 2. Interannual API changes in Kharkiv.

Conclusions. The study has found that relatively low pollution is characteristic of the areas of Bavaria and the Saltivsky housing estate. The reason for this is the lack of industrial sources of pollution and wide streets with good purging, which contributes to the reduction of traffic pollution.

The average level of pollution due to API is inherent in the central part of the city, the area of Holodna Gora and Sokolnyky. A common feature of these territories is the absence of industrial pollution against the background of high transport loads.

The highest level of pollution is inherent in industrial Ivanivka, as well as in the areas of 23 Serpnia str. and Heroiv Stalingrada, where there is little industrial pollution along with high transport pollution.

References:

1. Regional reports on the state of the environment in Kharkiv region 2014-2018. URL:https://kharkivoda.gov.ua/oblasna-derzhavna-administratsiya/struktura-administratsiyi/strukturni-pidrozdili/486/2736

2. Information on the ecological status of Kharkiv and Kharkiv region for January - December 2019. URL: https://kharkivoda.gov.ua/oblasna-derzhavna-administratsiya/struktura-administratsiyi/strukturni-pidrozdili/486/2736

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AIR POLLUTION IN THE CITY OF MYKOLAYIV

Abstract. The publication provides data on the main sources of air pollution in the city of Mykolayiv and the emissions of pollutants from 2014 to 2018. It is established that the maximum emission amounts were different in 2015.

***Keywords**:* atmospheric air, pollutants, sources of pollution.

As there are no enterprises of chemical and coal industry, Mykolaiv region is not included in the list of regions with high atmospheric pollution.

The main sources of atmospheric pollution are stationary sources and mobile sources of pollutant emissions. The study of the atmospheric air conditions was conducted by the structural unit of the Mykolayiv Oblast Center for Hydrometeorology at the Complex Laboratory of Observations on Environmental Pollution. Observations were made at 4 stationary posts. The observation posts are mostly located in the central part of the city. At the same time, only 2 of them are in the area of large transport highways and production enterprises' influence. Because of this, only the results of the observation on posts 2 and 3 potentially reflect the impact of industrial emissions and motor transport on the atmosphere of the city of Mykolayiv [1].

As of 2018, eleven enterprises with emissions exceeding 100 tonnes / year are listed as major stationary sources of pollution. The amount of emissions from these enterprises is - 8,952 thousand tons, which occupies 68, 4% of the emissions of all enterprises in the region [2].

Atmospheric air pollution from mobile sources was not monitored in 2016, 2017 and 2018.

Materials of the Regional report on the state of the environment in the Mykolaiv region in 2018 allow us to analyze information on atmospheric air pollution in the territory of Mykolayiv from 2014 to 2018. It was found that the largest amount of atmospheric air emissions in the studied period was in 2015 (5,473 thousand tons) and in 2014 (4,99 thousand tons). Since 2016, the amount of pollution has decreased and in 2018 reached the lowest level - 3.03 thousand tons (Fig. 1).

In 2018, 13.098 thousand tons of pollutants were emitted by stationary sources into the air which is 1080 tons or 7.6% less than in 2017 [2].

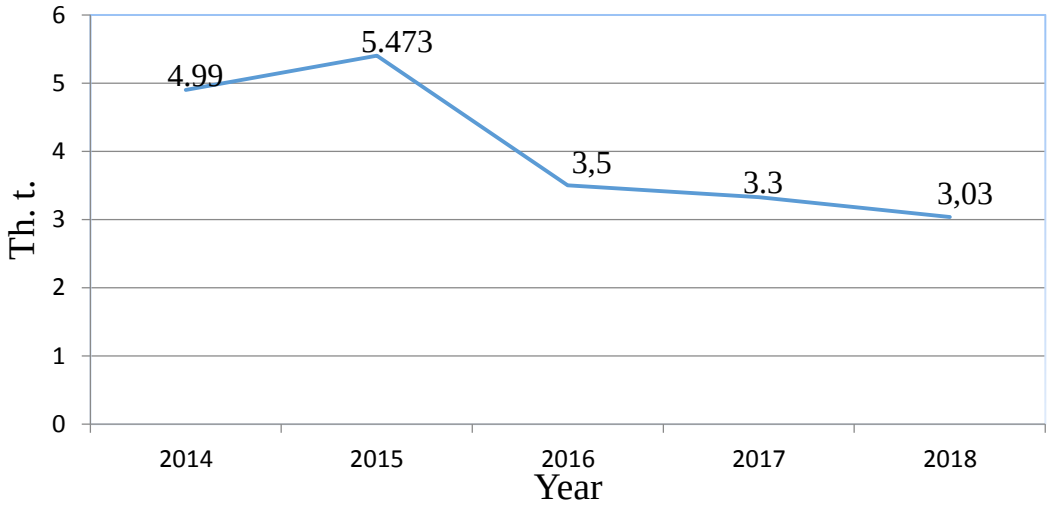

Fig. 1. Emissions of pollutants into atmospheric air from stationary sources in Mykolaiv.

References:

1. Report on strategic environmental assessment of the state planning document– the master plan of Mykolayiv. URL: https://mkrada.gov.ua/files/Ogoloshenya/Report%20pro%20CEO.pdf

2. Regional report on the state of the environment in Mykolaiv region. URL: https://menr.gov.ua/files/docs/Reg.report/Natsdop_Mykolaiv%20region_2018.pdf

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AGROPHYSICAL PROPERTIES OF SOIL WHEN USING SUBSURFACE DRIP IRRIGATION ON LINDEN TREE PLANTATIONS

Investigation of the agrophysical properties of soil in the application of underground drip irrigation was carried out on the experimental plots under two-year linden plantations, located within the scientific-experimental functional zone of the Dendrological Park of the national value of V. Dokuchaev Kharkiv National Agrarian University.

In terms of soil and climate, it is the southern part of the Left Bank Forest Steppe. The type of forest plant conditions is a fresh soil. Soils are typical medium-washed black soil, underlain by woody loam on a thick layer of sands of the Poltava tier. The climate is continental with unstable humidity. The average annual air temperature is + 6,5 ° C with fluctuations from +38 to -35 ° C. The frost-free period is 113-200 days. The average annual rainfall is 520 mm with fluctuations from 330 to 740 mm. The rainfree period can last from 10 to 52 days. The term with relative humidity below 30% can be 24 days or more. Droughts and dry winds are possible these days [1].

The field experiment was performed according to conventional methods and was accompanied by observations and determination of soil parameters [2, 3].

In order to study the effect of soil drip irrigation on the agrophysical properties of the soil, the following studies were conducted:

- soil density was determined by the Kaczynski method in soil layers 0–10 cm, 10–20 cm, 20–30 cm, 30–40 cm in the spring at the beginning of the growing season [4];

- macroaggregate analysis - by the method of dry sieving according to Savinov, water resistance of soil structure - by the method of wet sifting in soil layers 0–10 cm, 10–20 cm, 20–30 cm, 30–40 cm [5];

Statistical processing of the results to assess the significance of differences between the variants was performed by B.A. Dospehov's method of analysis of variance [5].

The results of the balanced density indicators of the soil structure indicate their optimum value after the irrigation season of 2018 at the beginning of the 2019 growing season for all soil layers. A variance analysis of soil density determination

results was used to evaluate the significance of differences between the variants. The results indicate that there is no significant difference between the variant with soil drip irrigation and the control over all the studied soil layers. That is, the application of soil drip irrigation retains the optimum value of soil density. The absence of soil compaction, loose surface of its surface layer, the absence of crust formation contributes to growth and development of both the root system, and the aboveground part of plants.

In our experience, the use of soil drip irrigation ensured a good structural state in the content of air-dry, agronomically valuable, 0.25-10 mm particles. The average content of air-dry aggregates on the control is 75.76%, with drip irrigation - 76.33%. The values of the structural coefficients also almost coincide - 3,4 on the control, - 3,3 on the studied variant.

The results of wet sieving indicate that the drip irrigation provided a good structural condition of the soil in the content of water resistant aggregates in the size of 0.25-5.00 mm. The average value of this indicator for the soil layer 0–40 cm in the control is 53.69%, in the variant with irrigation –58.89. An analysis of variance of wet soil sieving to assess the significance of differences between the variants revealed that the difference in values for the soil layer of 10-20 cm is significant, in particular it is 10.96% in favor of irrigation.

Thus, the results of the study show that soil drip irrigation, compared with traditional methods of irrigation, provides the most efficient way of delivering water directly to the root zone of plants, improving agrophysical properties of the soil.

The use of soil drip irrigation obviously reduces the human impact. Subsoil location minimizes the possibility of damage to drip lines and pipelines.

The mentioned advantages of PKZ are manifested only in compliance with all requirements of technological processes of crops cultivation, implementation of ecological and reclamation monitoring (EMM) and its variant - soil reclamation monitoring (MMM) on irrigated areas [2].

References:

1. The site of Kharkiv V.V. Dokuchaiv National Agrarian University. URL: https://knau.kharkov.ua/dendropark.html

2. Recommendations for the survey of the ecological and ameliorative state of land in the conditions of drip irrigation. Kharkiv: O.N. Sokolovsky Scientific Research Center, 2012. 20 p.

3. Method of soil sampling in plantations of perennial crops under conditions of drip irrigation. Recommendations. Kharkiv: “Miskdruk”, 2013. 24 p.

4. Dolgov S.I., Bakhtin P., Rastvorova O.G. Soil Physics. L., 1983. P.91–96.

5. Dospehov B.A. Methods of Field Experience, M .: Agropromizdat, 1985. 351 p.

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LANDSCAPE - ECOLOGICAL PLANNING OF FOREST LANDSCAPES IN KHARKIV OBLAST

Abstract. Forest resources are an important regulator of the stability of the ecological balance of the environment for many industries. The article describes the basic tasks for the implementation of landscape-ecological planning.

***Keywords**:* landscape ecological planning, forest resource, ecological assessment.

Purpose of research - develop the main directions of nature management optimization on the basis of geoecological assessment of forest landscapes in Kharkiv region.

The Task of research is :

- to analyze literature sources on the problems of rational use of forest landscapes in Ukraine and the world;
- to study the structure of the forest fund of Kharkiv region;
- to assess the ecological conditions of forests by means of landscape-ecological planning;
- to identify problems that exist in the forest landscapes of Kharkiv region;
- to develop directions of optimization of nature use in concrete forest landscapes according to their purpose.

The novelty of expected results is in:

- comprehensive ecological assessment of the state of forest landscapes by means of landscape-ecological planning;
- creation of a network of experimental sites for ecological monitoring of forest landscapes;
- modeling and forecasting the state of forest landscapes with different input parameters of their operation.
- development of recommendations for improving the system of forest use, protection and preservation of forest landscapes of Kharkiv region.

An example of the implementation of the goal was Target concept of land use a Vasyschivsky forestry (Fig. 1).

Thanks to the analysis of the target concept of use of the territory of forest area, it is allocated such territories:

- forest - which are used for maintenance of successions, and receiving profit on wood procurement; with

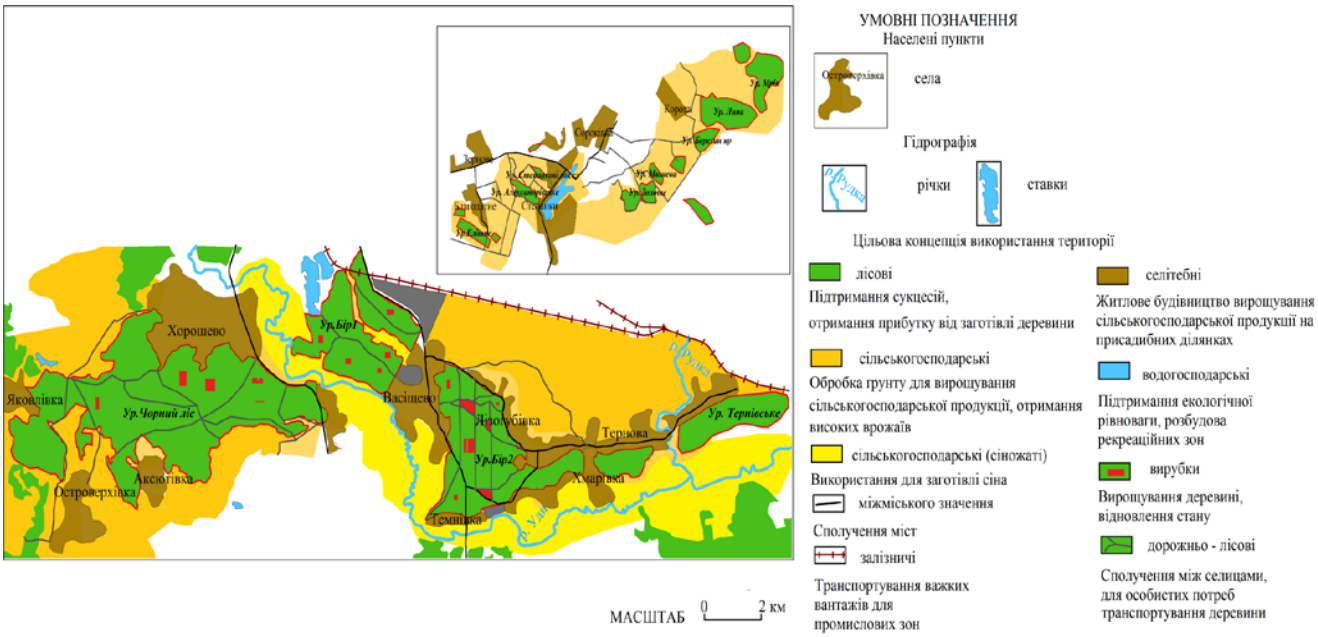

Fig. 1. Target concept of land use a Vasyschivsky forestry

- agricultural - processing of the soil for cultivation of agricultural products, receiving big crops; And also agricultural - which on haymakings are used for hay preparation;

- residential - housing construction of cultivation of agricultural products on personal plots;

- water management - maintenance of ecological equilibrium, development of recreational zones;

- the road forest are used for the message of local population between settlements, wood transportation; Railway - are used for transportation of heavy freights to the industrial zone; long-distance value - are used for the message of the cities.

***References**:*

1. Landscape Ecological Plan for State-owned Forests in Valtimo URL: https://julkaisut.metsa.fi/assets/pdf/mt/mt29.pdf

2. Landscape- ecological planning (LANDEP) in the process of territorial planning. URL: https://cutt.ly/4yC9M4R

3. Landscape-ecological planning in urban and peri-urban area - study area Trnava, Slovakia URL: https://oppla.eu/casestudy/17266

Наукове видання

«Ecology is a priority»

Збірник тез доповідей

Англійською мовою

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