

ENVIRONMENTAL AND ECONOMIC REQUIREMENTS OF AMBER MINING IN UKRAINE

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The negative consequences of illegal amber mining led to damage to the country's economy and the destruction of the ecosystem in those regions where intensive mining is carried out. The article is devoted to a comprehensive consideration of the issue of illegal amber mining. The ecological and economic prerequisites for the emergence of the problem of illegal mining are given, and its main ecological, economic and social consequences are also determined. It is argued that the illegal actions of prospectors and their consequences continue to be a painful issue in the socio-economic life of Ukraine, from which not only the natural environment, but also the economy of Ukraine suffers. As a result of the uncontrolled extraction of precious stones, the actions of criminal groups smuggling them abroad, the state will not receive millions of hryvnias from the state budget. The calculation of Ukraine's annual losses from illegal amber mining and sales is presented. The distribution of reserves and extraction of amber by administrative regions of Ukraine was analyzed. It is noted that there are two direct payments related to amber mining: a fee for a special permit for the development of the site and mining, as well as rent - a share of the income from the sale of precious stones. Generalized data on the formation of amber deposits and mining taxation processes in Lithuania and Poland are given. The dynamics of selling prices of Ukrainian and Polish amber is presented, a significant drop in the price of Ukrainian raw amber compared to 2016

was established. The problem of illegal mining in forest areas in the north-west of Poland has been investigated. It is noted that amber prices are constantly changing depending on the fractions, but the introduction of a single fixed rate will contribute to the development of this industry.

Keywords: *amber mining, disturbed lands, rent, land rehabilitation.*

Formulation of the problem. Unauthorized extraction of amber on the territory of the country has reached catastrophic proportions. The rapid spread of areas of disturbed lands has a negative impact on the ecosystem as a whole. Therefore, there is a need to study the dynamics of changes in the area of disturbed areas and a qualitative analysis of the ecological and economic prerequisites of amber mining in Ukraine.

Analysis of the latest scientific research and publications. It should be noted that the problem of illegal amber mining in Ukraine is currently the subject of scientific discussions and practical research. O. Surilova emphasizes that the proper regulation of the sale and processing of sunstone is a necessary condition for the sustainable development of amber-bearing regions. After all, this will contribute to the cessation of illegal mining, increase in revenue to budgets of all levels, attraction of investments and wide application of public-private partnership. V. Galunko proposes to introduce into the legislation the category of local prospector - this is a citizen of Ukraine who carries out the extraction and primary sale of amber. S. Kovalevskyi, Yu. Marchuk, K. Majevskyi, S. Kovalevskyi, A. Churilov studied the environmental consequences of the negative impact of unauthorized amber mining. In particular, the types of damage to forest lands that occur during amber extraction by non-industrial methods were analyzed and determined, and a comprehensive method of tree reclamation of disturbed forest areas was developed, taking into account acidity. The issues of ecological and economic assessment of the impact of activities related to illegal amber mining and the amount of compensation for damages are considered in the works of P. Nadtochii. The results of the analysis of the study of geotechnological methods of amber extraction, assessment of the impact of

anthropogenic activity on the environment associated with illegal amber extraction, are presented in the works of V. Kornienko, T. Tymochko, and T. Mysliwa.

The purpose of the study is to analyze the development of theoretical approaches to the assessment of ecological and economic prerequisites for amber mining in Ukraine and to provide substantiated recommendations on ways to solve illegal mining, taking into account environmental, economic and social aspects.

Materials and methods of scientific research. The methods of statistical analysis, scientific knowledge, analogy and synthesis were used during the scientific research. With the help of these methods, the issue of ecological and economic assessment of the impact of activities related to illegal amber mining and the amount of compensation for damages was investigated, the distribution of reserves and amber mining by administrative regions was structured in tables, a comparison of market prices for amber in Ukraine and the world was made, experience was studied European countries regarding amber mining.

Research results and discussion. Ukraine ranks third in the world in terms of discovered reserves of amber [1], which has the highest percentage of jewelry quality. According to the analytical agency Global Market Research, the volume of the world amber market is about 2 billion dollars. USA (2018) [2], of which only 560 million US dollars are accounted for by the share of amber raw materials (technical amber).

The market reached high figures in 2016 (1.74 billion US dollars), when the demand for raw amber from Chinese processors caused the price to rise, namely the price for the fraction of 20-50 g amounted to 5,500-7,000 dollars. US per kilogram. After that, the price of one kilogram of amber of this fraction (20-50 g) has decreased several times in five years on the world market, and in 2022 it corresponds to 1,700 dollars. US per kilogram [3]. According to the Le'amber Consortium, up to 70% of the world's trade in amber raw materials and up to 80% of the world's industrial production in the field of amber is carried out through the PRC. This allows Chinese manufacturers to dictate prices. The price index for Ukrainian amber (raw) is presented in Fig. 1.

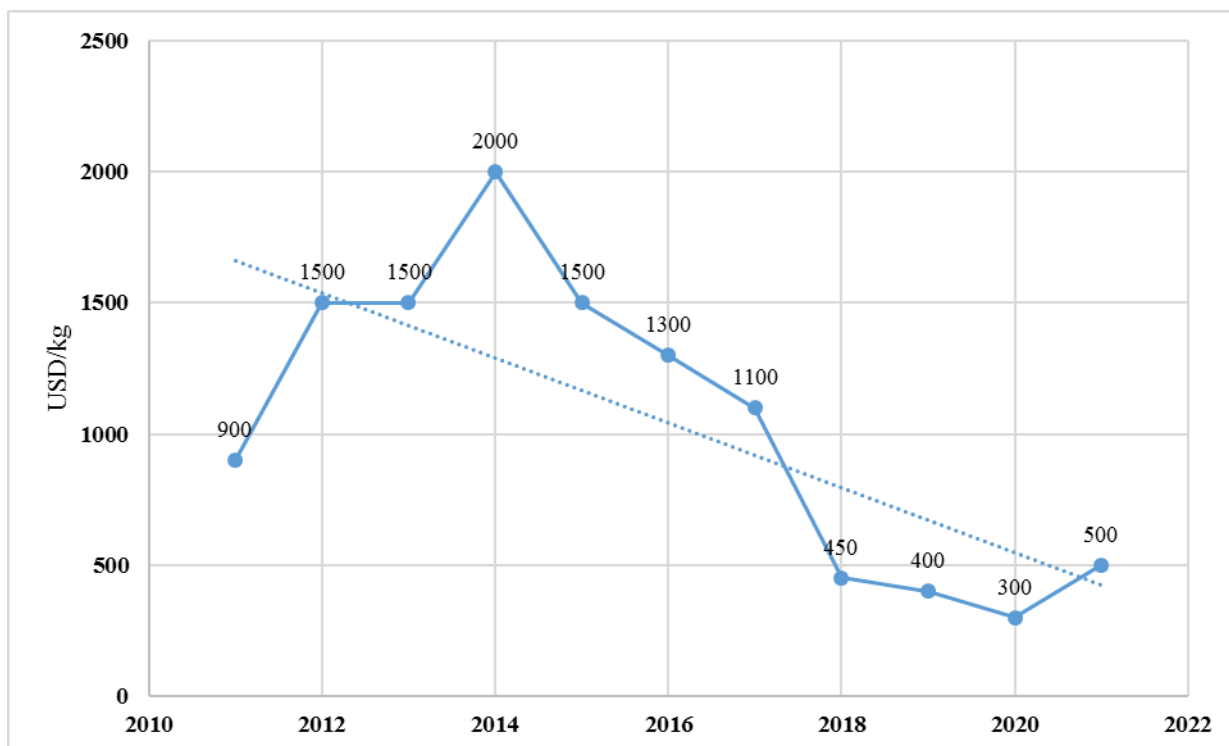


Fig. 1. Price index for Ukrainian amber (raw) 2010-2021, USD/kg

Amber is a fossilized resin of ancient coniferous plants that were widespread on earth in the Oligocene epoch (26 million years ago). Ukrainian amber (succinite) is well processed, has an excellent color, is light and resistant to shocks, moisture, the effects of many chemicals.

According to the State Balance of Mineral Reserves of Ukraine as of 2020, 17 deposits are taken into account, of which 9 are developed, 5 are not developed, and 3 are explored (on which exploratory and industrial development was carried out). The development of nine deposits is carried out by Ukrainian enterprises, namely: Klesivske deposit - the Pugach site is operated by the state-owned enterprise Burshtyn Ukrainy, the Fedorivska site is operated by Tehnobud LLC, the Volodymyrets Shchydnyi deposit is operated by the commercial structure of the Solar Craft Center LLC, Manevitske 1 deposits, Manevitske 2, Kamin-Kashirske 1, Kamin-Kashirske 2 - KP "Volynpriodresurs", Western part of the Kanonychi section - LLC "INCLUS-8", South-Eastern section of the Zolote deposit - LLC "RED.MET", Bilkivske deposit - LLC " Ecological technologies and construction". It should be noted that in 2020, amber was not mined at all deposits [4].

The total balance reserves of deposits are for category C_1 – 42342.79 kg, for category C_2 – 1421359.03 kg. In 2020, the total production of amber during the exploitation of deposits and research and industrial development during the geological study of the sites amounted to 6353.53 kg, in 2019 – 2818.8 kg, in 2018 – 2488.24 kg [4].

Table 1. Distribution of deposits and mining of amber by administrative regions [4]

Name of the region	Number of deposits			Deposits for 01.01.2021				Repayment in 2020		
	Total	Incl.		Total, kg		including those under development, kg		Total, kg	Incl.	
		development	exploratory mining	A+B+C ₁	S ₂	A+B+C ₁	S ₂		Production, kg	Losses, kg
Volynska	4	4			997559,48		997559,48	2061,52	2061,52	
Zhytomyrska	4	1	2		36752,8		36139	843,62	843,62	
Rivnenska	9	4	1	42342,79	387046,75	42342,79	163952,23	3448,39	3448,39	
Total	17	9	3	42342,79	1421359,03	42342,79	1197650,71	6353,53	6353,53	

To date, 12 enterprises have received a special permit for the use of subsoil in the Volyn, Zhytomyr, and Rivne regions. According to the State Tax Service, as of November 1, 2020, the rent for the use of subsoil for amber extraction is paid by only five business entities, namely: Technobud LLC, Burshtyn Ukrainy SE, Right Solution LLC, SE "Ukrburshtyn", Ltd. "Company "Nadra Halychyna". These enterprises annually extract about 5% of the real volume of amber extraction in Ukraine, and illegal extraction according to various estimates is from 70 tons to 350 tons per year [5], which causes losses to the state budget of hundreds of millions of hryvnias annually. In Ukraine, the share of jewelry amber is 27% of technical amber, while in Poland, the share of jewelry quality amber does not exceed 10-15% of production. It

should also be noted that the small depth of occurrence means that Ukrainian succinite is 20-40% cheaper than in other countries.

In 2021, the State Geology and Subsoil Service of Ukraine prepared more than 50 subsoil areas with amber deposits. The total amount of special permits sold is 44.9 million UAH, in 2020 – 51.6 million UAH, in 2019 – 670 thousand UAH [1].

About 90% of the world's amber reserves are located in the Kaliningrad region, the rest is distributed between Poland, Lithuania, Ukraine and other countries. The Ukrainian share of the world amber market is 30-40%. Comparative sales prices of Ukrainian and Polish amber in the European Union as of October 11, 2022, according to data [6], are structured in table 2. The advantages of Ukrainian amber compared to foreign amber are its depth of occurrence, which is from 2 to 10 meters underground and its suitability for jewelry processing, namely the fourth part of raw material. Accordingly, lower mining costs and higher stone quality.

Table 2. Comparative sales prices of Ukrainian and Polish amber in the European Union as of October 11, 2022.

Fractions	Polish amber			Ukrainian amber		
	average price, USD/kg	minimum price, USD/kg	maximum price, dollars US/kg	average price, USD/kg	minimum price, USD/kg	maximum price, USD/kg
2-5 gr.	204,6	175,4	233,8	225,7	200,6	250,8
5-10 gr.	341	316,6	365,4	464	376,2	551,8
10-20 gr.	703,9	643	764,8	852,9	752,6	953,2
20-50 gr.	1096	925,6	1266,4	1353,3	950,6	1756
50-100 gr.	1802,3	1704,8	1899,8	2257,7	2006,8	2508,6
100-200 gr.	2143,3	2045,8	2240,8	2834,7	2759,4	2910
200-300 gr.	2435,5	2386,8	2484,2	3135,7	3010,2	3261,2

Shallow occurrence of "sunstone" plays into the hands of prospectors, but not the environment or society. The proximity of the deposit increases the temptation to extract the stone by hydromechanical means, which allows extracting no more than 40% of all reserves - the rest is broken into smaller fractions and loses its value. In addition, this method leads to great environmental consequences and losses.

Illegal mining of amber causes losses to the state, harms the ecology of the northwestern regions of Polissia, and prevents the legal development of related industries. Thus, only in the Rivne region as of 2017: "Forestry lands disturbed due to illegal amber mining - about 4.16 thousand hectares, which is 92% of the total number of state-owned lands, or 73% of the total number of state and private ownership of the lands of the region". According to preliminary estimates, more than 495 million hryvnias are needed to rehabilitate state-owned lands disturbed by illegal amber mining in the region.

The authorities see a solution to this problem by reducing the rental rate for sold amber (from 25% to 5% in 2020, 8% in 2021, 10% in 2022) [7], distributing payments between local and state budgets, as well as establishing transparent rules for obtaining licenses. After all, the license and rent are direct payments that are related to the extraction of the stone, which ensure its special permission and financial income in the form of a share of the income from its sale. So, in 2016, the combined budget received - 2.08 million UAH, 2017 - 1.75 million UAH, 2018 - 793 thousand UAH, 2019 - 2.6 million UAH, 2020 - 2.9 million hryvnias

Changes to the Tax Code of Ukraine [7] also provided for criminal liability for illegal mineral extraction, regulation of access to amber deposits, by establishing the right of land easements and reducing the rent rate. Also, the new legislation strengthens responsibility for non-compliance with land reclamation requirements and the obligation to compensate for losses incurred. This is confirmed by Article 254 of the Criminal Code of Ukraine, which stipulates the punishment for evading reclamation: "a fine of seven thousand to ten thousand non-taxable minimum incomes of citizens or restriction of freedom for a period of up to three years" [8].

According to the Amber Europe company, there is a significant drop in prices for Ukrainian raw amber compared to 2016 (Fig. 2), it should also be noted that prices for Ukrainian amber in the European Union are higher than in Ukraine (Fig. 3).

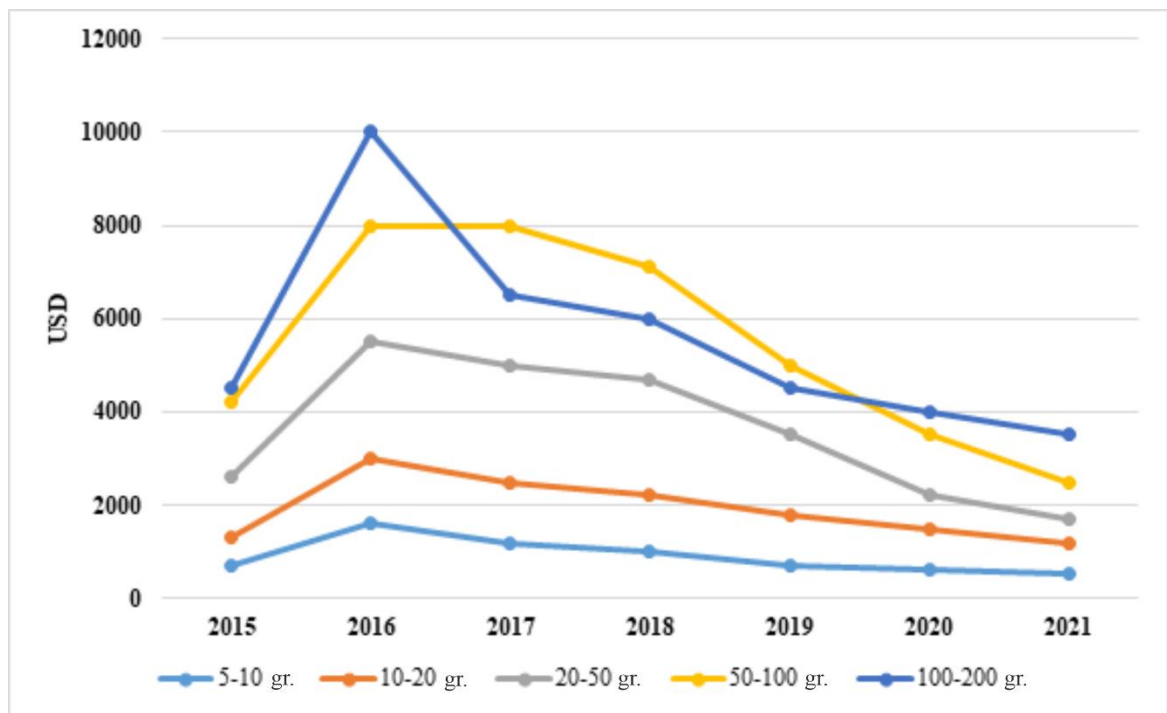


Fig. 2. Dynamics of amber prices 2016-2021, USD/kg

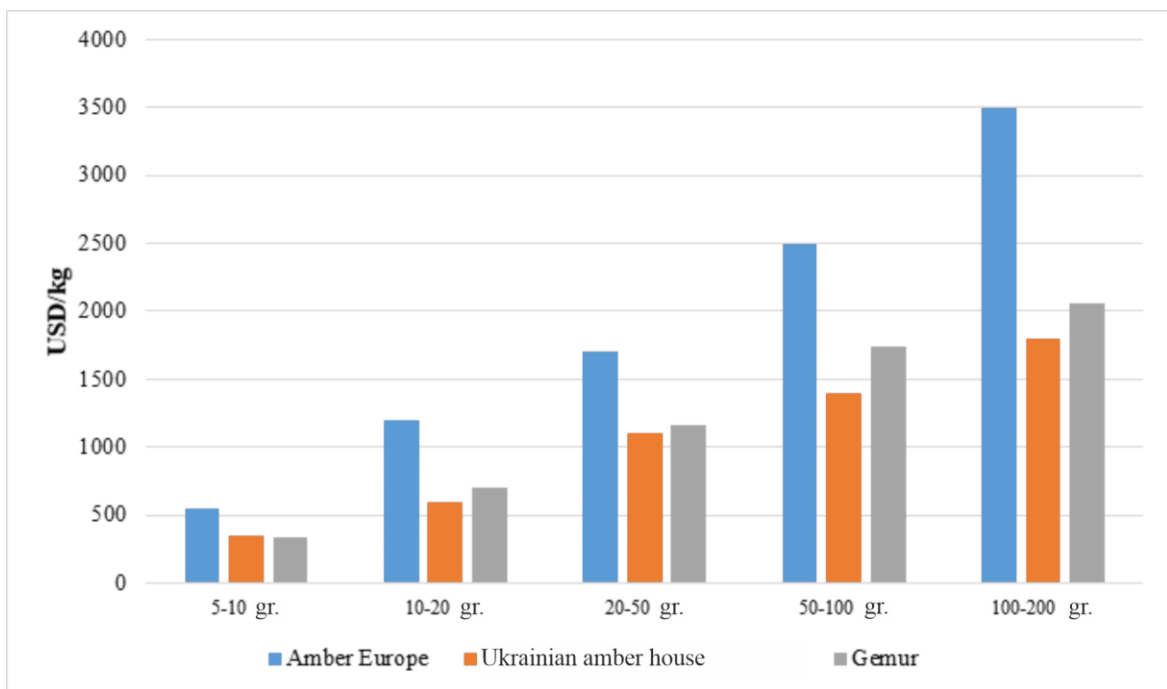


Fig. 3. Prices of Ukrainian amber in Europe, China and Ukraine, USD/kg

Obviously, we should not expect significant budget revenues in the field of amber mining, according to calculations, they will make up less than 1% of all revenues from rent for the use of subsoil. In 2016, rent in the amount of UAH 39,699.10 million was received to the consolidated budget for the use of subsoil, in 2017 – UAH 44,978.70 million, in 2018 – UAH 43,045.30, in 2019 – UAH 44,938.90 million UAH, 2020 – UAH 50,115.10 million.

It should be noted that illegal extraction of amber, according to various industry experts, ranges from 70 to 350 tons per year, which exceeds legal extraction by 30-70 times. Thus, according to the report of the national assessment of risks in the field of prevention and countermeasures against the legalization (laundering) of proceeds obtained through crime, the financing of terrorism, the average value of the minimum amount of losses from illegal extraction and sale of amber is 4 billion dollars. USA [5]. The calculation of Ukraine's annual losses from illegal mining and sales is presented in Table 3.

Table 3. Calculation of annual losses of Ukraine from illegal extraction and sale (from 70 to 350 tons) of amber [5]

Fractions of black market	Price for faction USD	Estimated price for 1 kg, USD	Estimated price for 1t, USD	Minimum annual illegal production, USD	Maximum annual illegal production, USD
2-5 grams	200	80 000	80 000 000	5 600 000 000	28 000 000 000
5-10 grams	700	93 333	93 333 333	6 533 333 333	32 666 666 667
10-20 grams	1 300	86 667	86 666 667	6 066 666 667	30 333 333 333
20-50 grams	2 600	74 286	74 285 714	5 200 000 000	26 000 000 000
50-100 grams	4 200	56 000	56 000 000	3 920 000 000	19 600 000 000
100-200 grams	4 500	30 000	30 000 000	2 100 000 000	10 500 000 000
200-300 grams	4 500	18 000	18 000 000	1 260 000 000	6 300 000 000
Sums of values	18 000	438 286	438 285 714	30 680 000 000	153 400 000 000
Average values	2 571	62 612	62 612 245	4 382 857 143	21 914 285 714

In Lithuania, amber mining is taxed per kilogram. The use of subsoil is possible only after the development and approval of the project for the use of subsoil by the Ministry of Environmental Protection. The project should contain directions for land reclamation and measures to protect the subsoil remaining in the deposit from depletion and deterioration in quality during temporary or complete cessation of exploitation of the deposit.

The mined amber, after screening and weighing each fraction, is registered in the Amber Accounting Register. The person who conducts mining pays tax on state natural resources and submits a declaration for mined amber resources in accordance with the established procedure.

Tax rates for minerals are established in the law on tax on state natural resources. According to this law, mineral tax rates were increased by approximately 37%, to €280/kg for amber fractions up to 40 mm, and €900/kg for amber fractions over 40 mm.

According to a preliminary estimate, there are almost 112 tons of amber in the deposit located in Juodkrante, there are almost 112 tons of amber. When applying rates for 20 years of field development, it is possible to receive 41 million euros of income, 70% of which is proposed to be transferred to the Lithuanian budget, 20% to be left to the municipalities where the deposits are located, 10% to be transferred to the environmental protection support program [9] .

In Poland, numerous finds of amber have been confirmed in Paleogene and Quaternary deposits. In addition to amber deposits in the beach area of the Baltic Sea (especially in the eastern part), which are the subject of collecting and "professional" gathering (so-called amber fishermen), amber deposits are also found in the Pomeranian and Lublin Voivodeships.

The geological balance of amber in Poland is 2,131.23 tons in the C₁ category, 1,357.34 tons in the C₂ category. The total amber balance decreased by 92.27 tons, i.e. by 2.6% compared to the previous year, and is 3488.57 tons [10] (Fig. 4).

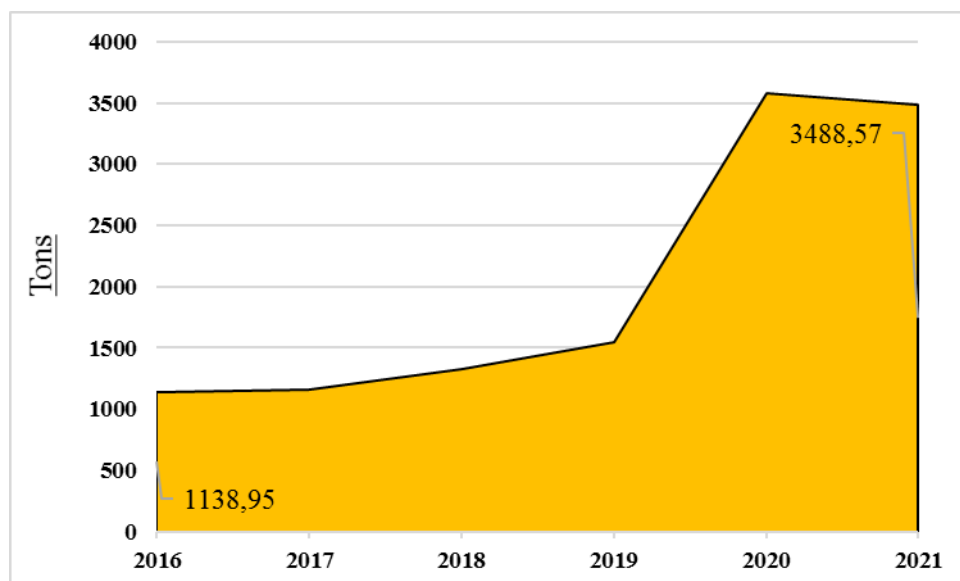


Fig. 4. Dynamics of the explored total balance of amber in Poland for 2016-2021.

The Pomeranian region of Poland and its center Gdansk are the amber capital of the world. Since 1998, the world championships for catching amber nuggets, international amber auctions, competitions of jewelry and artistic works have been held there every year, where world jewelry companies that process amber are actively involved. About a thousand tons of sunstone are mined annually in the country. A fixed rent is set for its extraction, the rate of which is equal to 2.8 dollars. USA or 10 zlotys per kilogram. We emphasize that the rate does not take into account the size of the stone fraction, and the price of the license itself is fixed and varies within 165 dollars. USA, i.e. 616 zlotys per hectare. Licenses are issued by regional authorities (voivodeships) [11].

It is also worth paying attention to the distribution of rent payments, which provides for the receipt of 60% to the budget of the commune (an analogue of the Ukrainian district) and 40% to the environmental protection fund, which provides financing for environmental protection measures. An interesting fact is that the collection and sale of amber from the coast of the Baltic Sea does not require a license, but only the payment of a fixed rent to anyone who wants to. In addition, Poland sees amber as a raw material for the production of goods - jewelry, home decoration goods, etc., which contributes to the economic development of the country and ensures the operation of related industries [12]. About 60% of amber mining and processing enterprises are small and medium-sized, employing about 5,000 people. China is the biggest buyer of Baltic gold. Almost 90% of production goes there.

Illegal stone mining in the northwestern forests of the country remains an urgent problem for the Republic of Poland, and local authorities are unsuccessfully trying to fight it. Every year in mass information sources there are reports about illegal actions of prospectors, most often amber is washed out in Stogy, Gurky Zachodyny and Sobyshev. As a result of these actions, the forest often looks like the cratered surface of the Moon (Fig. 5, 6).



Fig. 5. Disturbed lands after illegal actions of prospectors in Stogy (Poland)

Source: online map of the portal trojmiasto.pl.

Link: <https://mapa.trojmiasto.pl>.



Fig. 6. Destroyed forest.

Source: Information portal trojmiasto.pl.

Link: <http://surl.li/ditba>

Local authorities take measures to restore damaged areas every year, recultivating the forest every few years. Depending on the available resources as part

of the maintenance of forest areas, trenches are filled in and fertile soil is fertilized to accelerate the process of vegetation restoration. In some cases, where possible, a forest is planted. It should also be noted that the local authorities spent PLN 115,000 for the reclamation of two disturbed areas in Stogy with a total area of 3.62 hectares.

Persons who extract amber without the required permit are subject to arrest and a fine (up to PLN 5,000). In the event of serious damage, the perpetrator is liable for a crime punishable by imprisonment for up to 3 years [12].

In 2018, during a smuggling attempt at the external borders of Poland, the customs and tax service seized a total of 1,236 kg of amber, in 2019 – 1,048 kg, in 2020 – 249 kg, in 2021 – 140 kg. After registration, the extracted amber is processed and sold with added value to customers in China, the United States and the rest of the world.

Work is currently underway on a draft amendment to the Mining and Geological Law, which provides for an increase in the fine for illegal amber mining to eighty times the amount of the mined mineral, multiplied by the amount of mined raw materials. The fine for illegal exploration of amber deposits will also increase to PLN 400,000 for each square kilometer of the area covered by such activity.

Despite the preservation of a part of illegal mining, in the Lublin Voivodeship the company White Amber received a license for the development and extraction of minerals for a period of 20 years, which plans to extract 100 tons of amber on the territory of 14 hectares.

After Russia's armed aggression against Ukraine, the International Amber Organization is the initiator of the amber certificate of origin program, because customers increasingly have questions about the origin of the sunstone. The goal of the Baltic Amber Certification Program, from the extraction of raw materials, the development and production of jewelry or decorative products to the end consumer, is to ensure the transparency of obtaining amber from legal sources with care for the environment and environmental protection processes in the areas of exploration and extraction of amber from deposits located in Poland.

The association plans to conduct a double check of the amber - first the purchased raw material, and then the product from it, in order to make sure of its origin. The results of these tests will be recorded in a special certificate - Amber Origin Certificate. It should be recognized that complete cessation of illegal mining is impossible in a short period of time. Only in 2021-2022, according to the data of the Unified State Register of Court Decisions, the courts adopted: "about 100 decisions on the transfer of seized amber to the ownership of the state in the form of the State Repository of Precious Metals and Precious Stones of Ukraine. The total weight of the transferred stones only according to the decisions analyzed by us is more than 7,400 kg." [13]

Conclusions and perspectives. The article examines the ecological and economic prerequisites for the emergence of the problem of illegal amber mining, and defines its main ecological, economic, and social consequences.

The price indices for Ukrainian amber (raw) for the period 2010-2021 and the sale prices of Ukrainian and Polish amber on the world market were analyzed. The calculation of Ukraine's annual losses from illegal amber mining and sales is presented.

It is noted that in Poland, a fixed rental rate is established for a kilogram of mined precious stones, regardless of the fraction. The cost of a mining license is also fixed - about 165 dollars. US per hectare. It is noted that there is also a problem of illegal mining in Poland, most often amber is washed in Stogy, Hurky Zachdyny and Sobieszów. In particular, local authorities take measures to restore damaged forest areas every year. Persons who extract amber without the necessary permit are subject to arrest and fine. Amber mined in Lithuania, after screening and weighing each fraction, is registered in the Register of Amber Accounting. A person who conducts mining pays a tax on state natural resources and submits a declaration for mined amber resources in accordance with the established procedure. It is noted that amber prices are constantly changing depending on the fractions, but the introduction of a single fixed rate will contribute to the development of this industry. In order to solve the environmental problems associated with the barbaric attitude towards the

environment, it is necessary to develop land rehabilitation programs, even before the exploration of deposits and mining, as well as to introduce an environmental insurance mechanism to oblige land rehabilitation after mining operations.

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**ЕКОЛОГО-ЕКОНОМІЧНІ ПЕРЕДУМОВИ ВИДОБУВАННЯ
БУРШТИНУ В УКРАЇНІ**

Негативні наслідки незаконного видобування буришину призводять до заподіяння збитків економіці країни та руйнування екосистеми тих регіонів, в яких ведеться інтенсивне видобування. Стаття присвячена комплексному розгляду питання незаконного видобування буришину. Наведено еколого-економічні передумови виникнення проблеми нелегального видобутку, а також визначено його основні екологічні, економічні та соціальні наслідки. Аргументовано, що незаконні дії старателів та їх наслідки продовжують бути болючим питанням в соціально-економічному житті України, від яких страждає не тільки навколишнє природне середовище, але й економіка України. Внаслідок неконтрольованого видобутку дорогоцінного каміння, дії злочинних формувань його контрабандного постачання за кордон держава недоотримає до державного бюджету мільйони гривень. Представлено розрахунок щорічних втрат України від нелегального видобутку і збуту буришину. Проаналізовано розподіл запасів та видобутку буришину по адміністративних областях України. Зазначено, що існує два прямих платежі, пов'язаних з видобутком буришину це плата за спеціальний дозвіл на розробку ділянки та видобуток, а також рента – частка доходу від продажу дорогоцінного каміння. Наведено узагальнені дані про формування покладів буришину та процеси оподаткування видобутку в Литві та Польщі. Представлено динаміку цін продажу українського та польського буришину, встановлено значне падіння ціни на український необроблений буриштин в порівнянні з 2016 роком. Досліджено проблему нелегального видобутку в лісових масивах на північному заході Польщі. Зазначено, що ціни на буриштин в залежності від фракцій постійно змінюються, але запровадження єдиного розміру фіксованої ставки сприятиме розвитку даної галузі.

Ключові слова: видобуток буришину, порушені землі, рентна плата, реабілітація земель.