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ASSESSMENT OF THE IMPACT OF MILITARY OPERATIONS ON AGRICULTURAL LAND USE

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The analysis made in terms of this research shows, that the military-technogenic load leads to high levels of pollution of the territory with oil products, lead, cadmium and aromatic hydrocarbons. The impact of military operations on agricultural land use in the territory of the Bucha city territorial community of Bucha district of Kyiv oblast is assessed. The level of damage to agricultural land affected by military actions is investigated. To calculate the assessment of the impact of military actions on agricultural land use, the "Visual Determination of Land Damage Levels" was used. The amount of damage caused by hostilities to agricultural land use was calculated. The method of expert assessment was used to calculate the economic level of damage caused by hostilities. The ecological condition of the soil within the Bucha urban community was determined. To assess the ecological condition of the soil, an indicator of the ecological stability of the territory in the post-war period was calculated and compared to the pre-war period.

Taking into account the proposed research methods and their results, it is analysed that agricultural land within the territory of the Bucha city territorial community can be used for any crops, but the harvested products' quality have to be controlled. There is a need for agrotechnical measures to reduce the impact of metals on agricultural products.

Key words: *military actions, restoration of territories, agricultural land use, methodology of damage assessment, normative monetary valuation, territorial community.*

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Problem statement

The agricultural sector and land market in Ukraine have been severely impacted by Russia's full-scale invasion on 24 February 2022. The blockade of maritime trade initiated by Russia in mid-February became an obstacle to agricultural exports, while land market operations were halted on the day of the invasion, and as a result of the hostilities, agricultural exports resumed, making Ukraine one of the world's leading grain exporters.

Since the beginning of Russia's full-scale invasion of Ukraine in February 2022, various types of weapons, military equipment and ammunition have been used, leading to serious damage and contamination of the soil cover [1]. The military-technogenic load leads to significant soil pollution and degradation. Military operations involve the use of various munitions, such as high-explosive, fragmentation, armour-piercing and cumulative shells and mines. They cause shock waves and explosive products to be generated and spread in the environment. This leads to deformation of the ground in all directions of shock wave propagation. Combustion, explosions and detonations of ammunition generate a variety of toxic and hazardous products that can pollute the environment. The main source of pollution from live fire is the explosion products, consisting of fine particles and heavy metal ions. These elements enter the soil along with water and ammunition fragments. The distribution and impact of chemical components of ammunition on the natural environment depend on the conversion rate and mass of the explosive in the projectile.

Analysis of recent research and publications

The analysis of scientific and methodological works on assessing the impact of hostilities on land productivity was studied by the following scientists: Butenko Y., Kharytonenko R., Petrychenko S. [2]. The purpose of their study was to investigate the productivity of land affected by military operations in Ukraine.

The productive potential of land in Ukraine was highlighted in the scientific works of the following scientists: Dorosh Y., Dorosh O., Kupriianchyk I., Butenko Y.,

Kharytonenko R. and others [3,4]. The article highlights the essence of the term "productive potential of land", takes into account the prerequisites for its emergence and the importance of assessment. The key indicators for determining the productive potential of agricultural land, taking into account the qualitative characteristics of soils and modern agricultural technologies, are proposed.

Objective

To assess the impact of military operations on agricultural land use in the territory of the Bucha urban territorial community.

Materials and methods of the study

The choice of research methods was based on a comprehensive analysis of information on assessing the state of agricultural land use.

In the course of the research, various methods were used, including an abstract and logical approach to determine the provisions on agricultural land that has been damaged. The monographic method was also used to analyse scientific research on the effects of Russian aggression on agricultural land use. The desk-based method was used to collect and analyse literary, cartographic and other sources in order to determine objective methodological approaches. Additionally, the method of generalisation and the method of expert evaluation were used, which allowed for a comprehensive assessment to achieve the research objective.

Research results and discussion

The object of the study was agricultural land use on the territory of the Bucha city territorial community. The territory of the entire community has been under occupation since the first days of Russia's full-scale invasion of Ukraine and was liberated on 31 March 2022. A large proportion of agricultural land was damaged as a result of hostilities (Fig. 1).

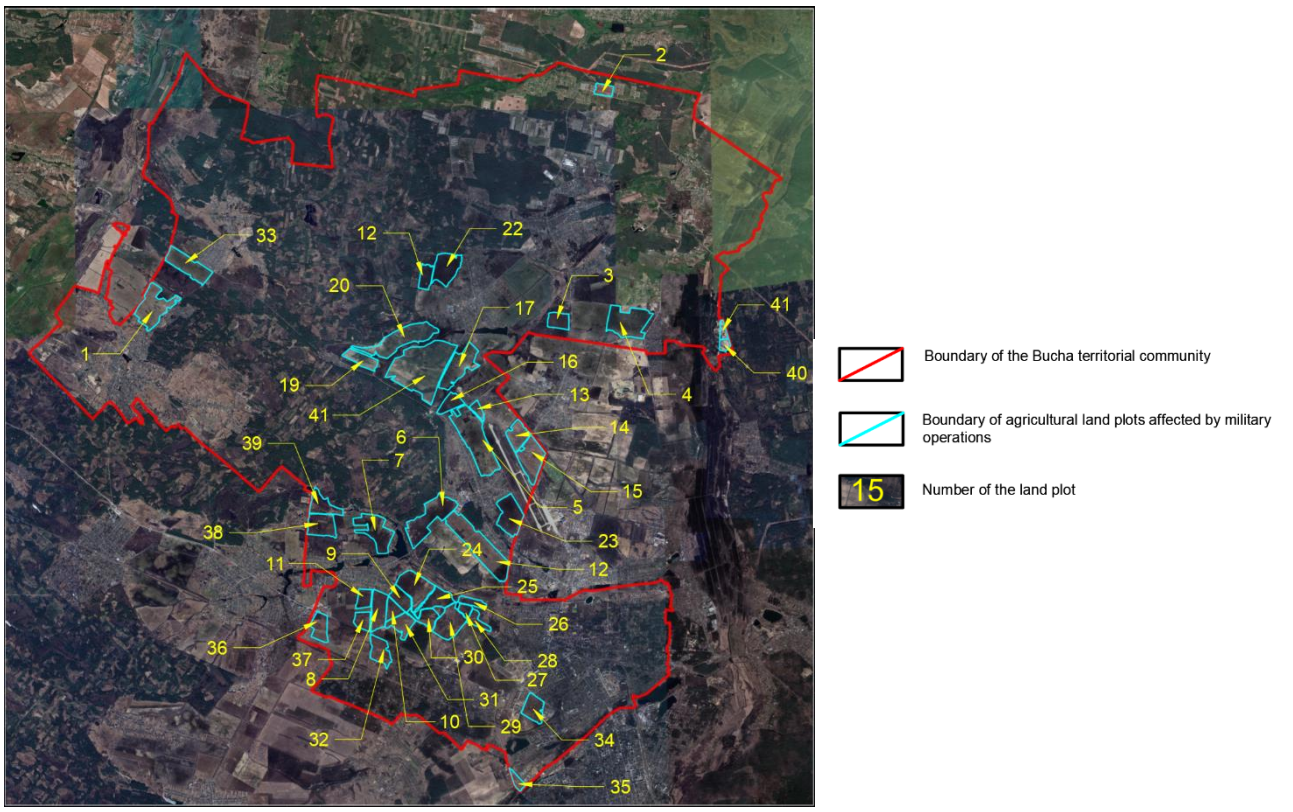

Figure 1. Borders of damaged agricultural land plots on the territory of the Bucha territorial community.
(satellite images were taken from Google Earth, resolution 3000 dpi) [5].

According to the community's passport, agricultural land covers 9073.34 hectares (100%) [6]. There are 11 agricultural enterprises within the Bucha urban community that grow grain and industrial crops.

According to our calculations, the agricultural land affected by Russian aggression as of 15.08.2023 amounted to 2245.12 hectares (24.74%).

Figure 2. Land plots affected by military impact
(satellite images were taken from Google Earth, resolution 3000 dpi) [5].

To visually assess the level of land damage, the methodology "Visual Determination of Land Damage Levels" proposed by such scientists as A. Sploednik, O. Holubtsov, S. Chumachenko, and L. Sorokina was used, as cited in [1].

The study (Fig. 1, Fig. 2) shows that among the damaged agricultural land use (2245.12 ha), visual inspection revealed a low level of land damage (from 10% to 25% of the area on each plot). This indicates that they are suitable for use for any crops, subject to quality control of agricultural products.

The impact of hostilities was assessed using the following approach:

1) visual assessment of the affected land plots using Google Earth;

2) economic assessment of the damage to land plots affected by Russian aggression.

3) assessment of the ecological condition of the soil by calculating the ecological stability of the land;

Ukraine has developed a number of methods for assessing the amount of damage caused by military operations, including the "Methodology for Determining the Amount of Damage Caused to Land and Soils as a Result of Emergency Situations and/or Armed Aggression and Hostilities during Martial Law" [9] of the Ministry of Environmental Protection and Natural Resources of Ukraine (MEPNR), which provides for the determination of "the amount of damage caused to land and soils by states, executive authorities, local governments, business entities and individuals due to soil pollution, with There is also the "Methodology for Determining Damage and Losses Caused to the Land Fund of Ukraine as a Result of the Armed Aggression of the Russian Federation" [10] of the Ministry of Agrarian Policy and Food of Ukraine (MAPF), which provides for "determining damage and losses caused to the land fund of Ukraine as a result of the armed aggression of the Russian Federation, including losses of the land fund, as well as related lost profits" [10].

However, these methods are not yet fully tested, requiring a large range of specific data on land plots, in particular, agrochemical soil surveys. For example,

agrochemical soil testing requires additional costly research and time, which makes it difficult to apply the methodology in operational calculations.

Therefore, in the absence of other reliable data necessary to apply the methods of the Ministry of Environment and the Ministry of Agrarian Policy, we consider it acceptable to use the normative monetary value (NMV) indicator for the expert method of assessing damage to land plots affected by Russian aggression. Such an assessment of damages based on NMV is easy to carry out operational calculations in a particular territory, and makes it possible to take into account at least the order of magnitude of the damage in planning decisions.

In accordance with the current Procedure [11], the NMV of a land plot takes into account such factors as: the capitalised rental income rate and the area of the land plot, the location of the territory of the territorial community in the zone of influence of large cities, the resort and recreational value of settlements, the location of the territory of the territorial community within the areas of radiation contamination, zonal factors of the location of the land plot, the designated purpose of the land plot, the use of the land plot in accordance with the main purpose within the relevant

The calculation was based on the NMV of agricultural land as of 01.01.2024 [12]. The results of the calculations are presented in Table 1.

Table 1: Assessment of damage to land affected by Russian aggression

№ plots	Area, ha	NMV, UAH/ha	Estimated losses, UAH
1	89,8761	27884,08	2506112,68
2	17,8110	27884,08	496643,62
3	30,5466	27884,08	851763,06
4	99,8554	27884,08	2784375,81
5	142,6914	27884,08	3978818,30
6	102,3670	27884,08	2854409,64
7	76,5951	27884,08	2135783,97
8	51,3866	27884,08	1432869,18
9	31,0655	27884,08	866232,72

№ plots	Area, ha	NMV, UAH/ha	Estimated losses, UAH
10	23,3833	27884,08	652021,58
11	24,0570	27884,08	670806,50
12	141,8480	27884,08	3955300,15
13	12,9401	27884,08	360823,02
14	40,5598	27884,08	1130973,61
15	71,8360	27884,08	2003080,03
16	28,2551	27884,08	787868,28
17	78,3596	27884,08	2184985,27
18	229,4201	27884,08	6397168,60
19	35,6212	27884,08	993265,21
20	107,7678	27884,08	3005007,04
21	26,3207	27884,08	733929,26
22	62,8909	27884,08	1753654,14
23	69,6255	27884,08	1941442,02
24	75,8739	27884,08	2115674,75
25	44,3395	27884,08	1236366,96
26	17,8333	27884,08	497263,87
27	12,1757	27884,08	339506,98
28	19,7109	27884,08	549621,67
29	67,0396	27884,08	1869337,25
30	31,1083	27884,08	867426,91
31	36,9860	27884,08	1031321,43
32	41,6583	27884,08	1161602,69
33	69,9886	27884,08	1951568,35
34	41,2619	27884,08	1150549,63
35	13,5959	27884,08	379108,65
36	37,1610	27884,08	1036200,39
37	23,8434	27884,08	664851,21
38	53,7867	27884,08	1499791,67
39	42,9236	27884,08	1196885,11
40	10,5444	27884,08	294020,82
41	10,2144	27884,08	284819,30
Σ	2245,1251	-	62603251,31

Thus, the amount of damage caused, based on the normative monetary assessment of losses, is UAH 62 million 603 thousand 251.31.

In addition, due to the lack of data on agrochemical soil surveys, we consider it permissible to conduct an environmental assessment of the soil condition by calculating the coefficient of environmental stability of the land use area, according to the methodology [7,8] (Table 2).

Table 2. Calculation of the environmental sustainability factor

Lands	**К1**	**Area, ha (thousand ha) P**	**К1*P**
Built-up land	0	3897,3498	0
Arable land	0,14	3591,5842	343,7046
Hayfields	0,62	5481,7573	5625,4717
Water	0,38	261,3147	99,2996
Forest	1	7776,0000	7776,0000
Total	2,14	21008,0060	11776,8109

$К_{en.su.} = 11776,8109 \div 21008,0060 \times 0,7 = 0,39$

The environmental assessment of the soil condition determined that the coefficient of environmental stability in the territory of the Bucha territorial community is 0.39, which decreased by 0.17 compared to the pre-war period, indicating its environmental instability and significant environmental deterioration as a result of military actions. However, due to the fact that the land does not have an active anthropogenic load and is not used, the ecological condition of agricultural land will improve.

Conclusions

To achieve this goal, the impact of hostilities on agricultural land use was assessed. This assessment within the Bucha territorial community revealed that there are 9073.34 hectares (100%) of agricultural land, of which 2245.12 hectares (24.74%)

were damaged as a result of hostilities. However, the level of damage ranges from 10% to 25%, which indicates a low degree. Thus, the land plots remain suitable for growing various crops, subject to quality control of agricultural products. This points to the need for agrotechnical measures to reduce the impact of metals on products. In addition, due to the impossibility of using the damaged land and not obtaining gross output from it, it is proposed to exempt landowners and land users of these plots from paying land tax.

Referance

1. Land pollution as a result of Russia's aggression against Ukraine. Ecodia. Available at : https://ecoaction.org.ua/zabrudnennia-zemel-vnaslidok-rosii.html.
2. Butenko, Y., Kharytonenko, R., & Petrychenko, S. (2023). Analysis of scientific-methodical approaches to assessing the impact of hostilities on land productivity from scientific-methodical approaches to assessing the impact of hostilities on land productivity. Land management, cadastre and land monitoring, 1, 104-116. https://doi.org/10.31548/zemleustriy2023.01.10
3. Dorosh, O., Dorosh, I., Kupriyanchyk, I., Butenko, Y., Kharytonenko, R. (2018). Assessment of land resources productive potential influence on agricultural products gross output in Ukraine. Scientific papers Series "Management, Economic Engineering in Agriculture and rural development", 18/3, 107-114.
4. Butenko, Y., Kharytonenko, R. (2017). Produktivnyi potensial zemel ta pryntsypy yoho otsinky v Ukraini. [Productive potential of lands and principles of its assessment in Ukraine]. Land management, cadastre and land monitoring, 1, 58-65. DOI: http://dx.doi.org/10.31548/zemleustriy2017.01.058
5. Google Earth. Available at : https://earth.google.com/web/search/Bucha,+Kyivska+oblast/@50.57879193,30.13036422,149.48181669a,58186.77800467d,35y,0.00000466h,0.12278216t,0r/data=CigiJgokCb4DxfpgXklAEZCZiPFyPklAGRngHK6Zej5AIeTaeQXftT1A.
6. Passport of Buchansk city territorial community The official website of the Buchansk City Council. The official website of the Buchansk City Council.

Available at : https://www.bucha-rada.gov.ua/content/pasport-buchanskoyi-miskoyi-terytorialnoyi-gromady.

7. Tretyak, A. M. (2008). Zemlevporyadne proektuvannya: teoretychni osnovy i teritorial′nyy zemleustriy [Land management planning: theoretical foundations and territorial land management]: Education guide, 576.

8. Dobryk, D. S., Kanash, O. P., Babmindra, D. I., Rozumny, I. A. (2009). Klasyfikatsiya sil′s′kohospodars′kykh zemel′ yak naukova peredmova yikh ekolohobezpechnoho vykorystannya [Classification of agricultural lands as a scientific preface to their ecologically safe use]. 2nd ed., Kyiv, Ukraine: Urozhaj, 464.

9. On the approval of the Methodology for determining the amount of damage caused to land and soil as a result of emergency situations and/or armed aggression and hostilities during martial law. Official website of the Parliament of Ukraine. Available at : https://zakon.rada.gov.ua/laws/show/z0406-22#Text.

10. On the approval of the Methodology for determining damage and losses caused to the land fund of Ukraine as a result of the armed aggression of the Russian Federation. Official website of the Parliament of Ukraine. Available at : https://zakon.rada.gov.ua/laws/show/z0586-22#Text.

11. On the approval of the Methodology of normative monetary valuation of land plots. Official website of the Parliament of Ukraine. Available at : https://zakon.rada.gov.ua/laws/show/1147-2021-п#Text.

12. Directory of indicators of normative monetary valuation of agricultural land in Ukraine - Data sets - Open data portal. Main page - Data.gov.ua. Available at : https://data.gov.ua/dataset/7c0ce9a3-d90d-40d8-815b879c0caf5cb9/resource/5dc56c6b-f843-4cdc-8142-ffb726aadd5b.

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ОЦІНКА ВПЛИВУ ВОЄННИХ ДІЙ НА СІЛЬСЬКОГОСПОДАРСЬКЕ ЗЕМЛЕКОРИСТУВАННЯ

Проаналізовано, що воєнно-техногенне навантаження призводить до високих ступенів забруднення території нафтопродуктами, свинцем, кадмієм

та ароматичними вуглеводнями. Визначено оцінку впливу воєнних дій на сільськогосподарське землекористування на території Бучанської міської територіальної громади Бучанського району Київської області. Досліджено рівень пошкоджень земель сільськогосподарського землекористування, що зазнали наслідків воєнних дій. Для розрахунку оцінки впливу воєнних дій на сільськогосподарське землекористування було застосовано «Візуальне визначення рівнів пошкодження земель». Розраховано розмір шкоди завданої внаслідок воєнних дій сільськогосподарському землекористуванню. Для розрахунку, економічного рівня завданих збитків внаслідок воєнних дій, було застосовано метод експертного оцінювання. Визначено екологічний стан ґрунту в межах Бучанської міської території громади. Для оцінки екологічного стану ґрунту, було розраховано показник екологічної стабільності території у повоєнний період та порівняно з довоєнним періодом.

Враховуючи запропоновані методи досліджень та їх результати, проаналізовано, що землі сільськогосподарського призначення в межах території Бучанської міської територіальної громади можна використовувати під будь-які культури за умови контролю сільськогосподарської продукції. Проаналізовано, що є необхідність у проведенні агротехнічних заходів, з метою зменшення надходження впливу металів на сільськогосподарську продукцію.

Ключові слова: воєнні дії, відновлення територій, сільськогосподарське землекористування, методика оцінювання збитків, нормативна грошова оцінка, територіальна громада.