

War impacts ecosystems: damages assessment

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Ecosystem services

- Ecosystem services are the direct and indirect contributions make the base for products, services and social well-being.
- The destruction of ecosystems has a very real monetary value. And the awareness of this should influence the adoption of any decisions, including the desire to start a war.
- The destruction of nature or the excessive use of its resources will result in much greater economic losses in the future than will be gained today.

War destroys ecosystem energy chain

- War destroys the fundamental thing, that performs in “life” rocks, air, water and Sun energy – PLANTS.



Less green – less life

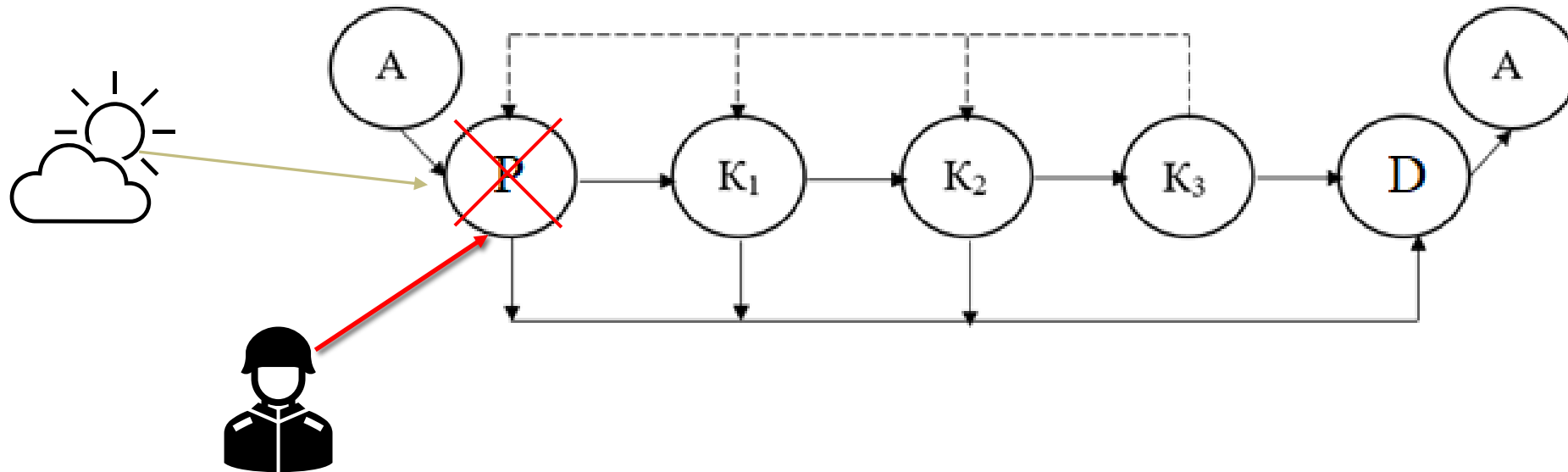


Destroyed forest belt near Vugledar
(photo: Instagram/libkos)



A soldier of the "Bureviy" brigade of the National Guard of Ukraine goes through a snowy forest near Kreminna.
Photo: Konstantin and Vlada Liberovy

General scheme of energy chain



Energy, in contrast to economic or material indicators, is a single quantity, the size (or weight) of which is unchanged over time and is formed under the influence of all environmental factors without exception

The area of Ukrainian lands covered by hostilities

Region	Percentage at April 2022	Areas covered by hostilities, km ²	Natural zone
Zhytomyr	5	1491,6	Mixed forests
Kyiv	20	5626,2	Mixed forests
Chernihiv	80	25492	Mixed forests
Sumy	80	19067,2	Forest steppe
Kharkiv	45	14136,75	Forest steppe
Luhansk	60	16010,4	Steppe
Donetsk	80	21213,6	Steppe
Zaporizhzhia	80	21744	Steppe
Kherson	90	25776,9	Steppe
Mykolaiv	15	3689,7	Steppe
Total		154248,35	

Calculation example

Calculate the primary productivity that starts the food chain of life in these territories. The basis is the annual productivity of ecosystems: mixed forests – 75 t/ha, forest-steppe – 125 t/ha, steppe – 85 t/ha. As a result, we will get:

Mixed forests:

$$(1491.6 + 5626.2 + 25492) \text{ km}^2 \cdot 100 \text{ ha/ km}^2 \cdot 75 \text{ t/ha} \approx 24.5 \cdot 10^6 \text{ tons}$$

Forest steppe:

$$33203.95 \text{ km}^2 \cdot 100 \text{ ha/ km}^2 \cdot 125 \text{ t/ha} \approx 41.5 \cdot 10^6 \text{ tons}$$

Steppe:

$$96439.8 \text{ km}^2 \cdot 100 \text{ ha/ km}^2 \cdot 85 \text{ t/ha} \approx 81.97 \cdot 10^6 \text{ tons}$$

The total biomass in the three zones will be 147.97 million tons. Of this amount, we will assume 60% as lost as a result of tanks and other vehicles influence:

$$147.97 \cdot 10^6 \text{ tons} \cdot 0.6 = \mathbf{88.78 \cdot 10^6 \text{ tons}}$$

That is, the ecological systems of **Ukraine did not receive at least 88.78 million tons of plant biomass in 2022.**

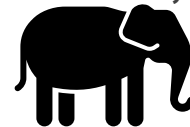
Calculation example

According to R. Lindemann's «10% rule», the flow of phytomass in the food chain will have the following numbers:

- 88.78 million tons – **destroyed** producers (plants, bushes, trees);
- 8.878 million tons – consumers of the first order (herbivorous animals; humans);
- 0.8878 million tons – consumers of the second order (predators; humans);
- 0.08878 million tons – third-order consumers (humans).

The biomass of first-order consumers is equivalent, for example, to the mass of:

one and a half million savannah elephants



250 million adult roe deer



or 2 billion adult broiler chickens.



Lost biological harvest in ecological systems of Ukraine

The volume of unfixed energy in plants is equivalent to, for example, 3.6 million tons of oil (only from tanks influence).

Damages from tanks in a 10-year perspective for natural ecosystems already due to the fact of military aggression of the Russian Federation amounted to **at least 146 billion USD.**

A component of photosynthesis	Biological harvest	Lost phytomass	Lost biological harvest	
			grams	million tons
Carbon dioxide (CO ₂)	170 g	88.78 · 10 ⁹ kg	14.4 · 10 ¹²	14.4
Water (H ₂ O)	50 g		4.2 · 10 ¹²	4.2
Energy of the Sun	1.8 MJ		159.8 · 10 ⁹ MJ	
Organic matter	100 g		8.9 · 10 ¹²	8.9
Oxygen (O ₂)	120 g		10.2 · 10 ¹²	10.2

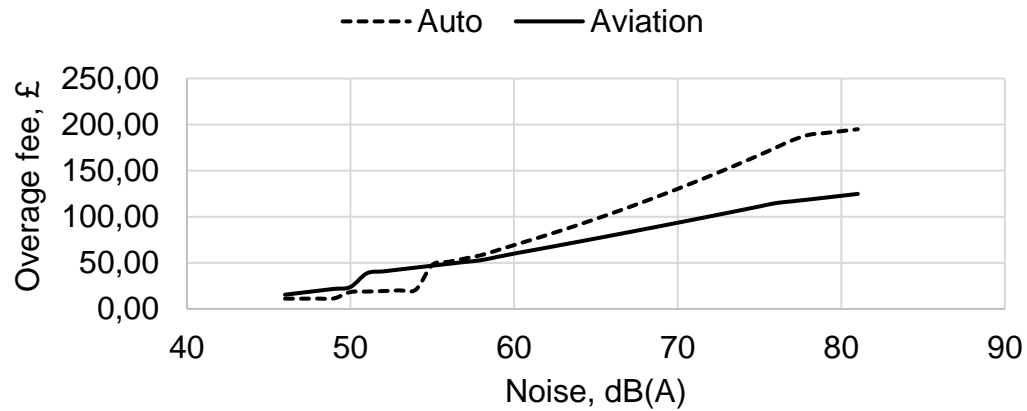


Negative impact of military jets on the environment

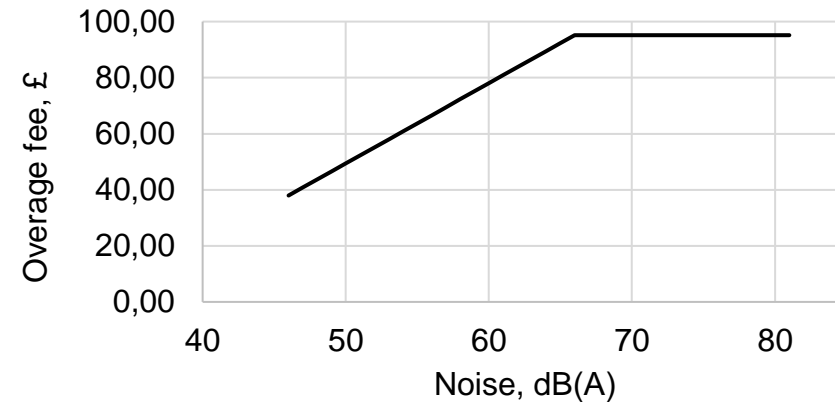
Every day of the war started by Russia against Ukraine adds 765.8 thousand dollars for air pollution and **1.4951 billion dollars** noise pollution to the amount of reparation payments (for every 7 days).

Every week Russian fighters destroy at least 26.4 sq. km of Ukrainian territory with all its landscape and biotic diversity.

Noise of war



Amount of daytime noise pollution charge, pounds sterling (£)



The size of the charge for avianoise pollution at night, pounds sterling (£)

Based on: Environmental Noise: Valuing impacts on: sleep disturbance, annoyance, hypertension, productivity and quiet. (2014). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/380852/environmental-noise-valuing-impacts-PB14227.pdf

Losses from noise pollution of fighter jets by region

Region	Population as of February 1, 2022, thousand	Territory covered by hostilities*, km ²	Area of the region, km ²	Population density, thous. inh./km ²	Number of households affected by noise	Harm to health from noise, million USD
Zhytomyr	1177.6	1491.6	29832	39	19626.67	8.2
Kyiv	1794.5	5626.2	28131	64	119633.3	50.2
Chernihiv	957.7	25492	31865	30	255386.7	107.1
Sumy	1034.4	19067.2	23834	43	275840	115.7
Kharkiv	2596.3	14136.75	31415	83	389445	163.3
Luhansk	2101.7	24015.6	26684	79	630510	264.4
Donetsk	4056.4	21213.6	26517	153	1081707	453.6
Zaporizhzhya	1636.3	21744	27180	60	436346.7	183.0
Kherson	1000.4	25776.9	28461	35	302018.1	126.7
Mykolaiv	1090.5	3689.7	24598	44	54525	22.9
Total						1495.1

And the total daily damages for violation of Ukrainian legislation, in terms of negative noise impact on biodiversity, amount to 6.13 million dollars.

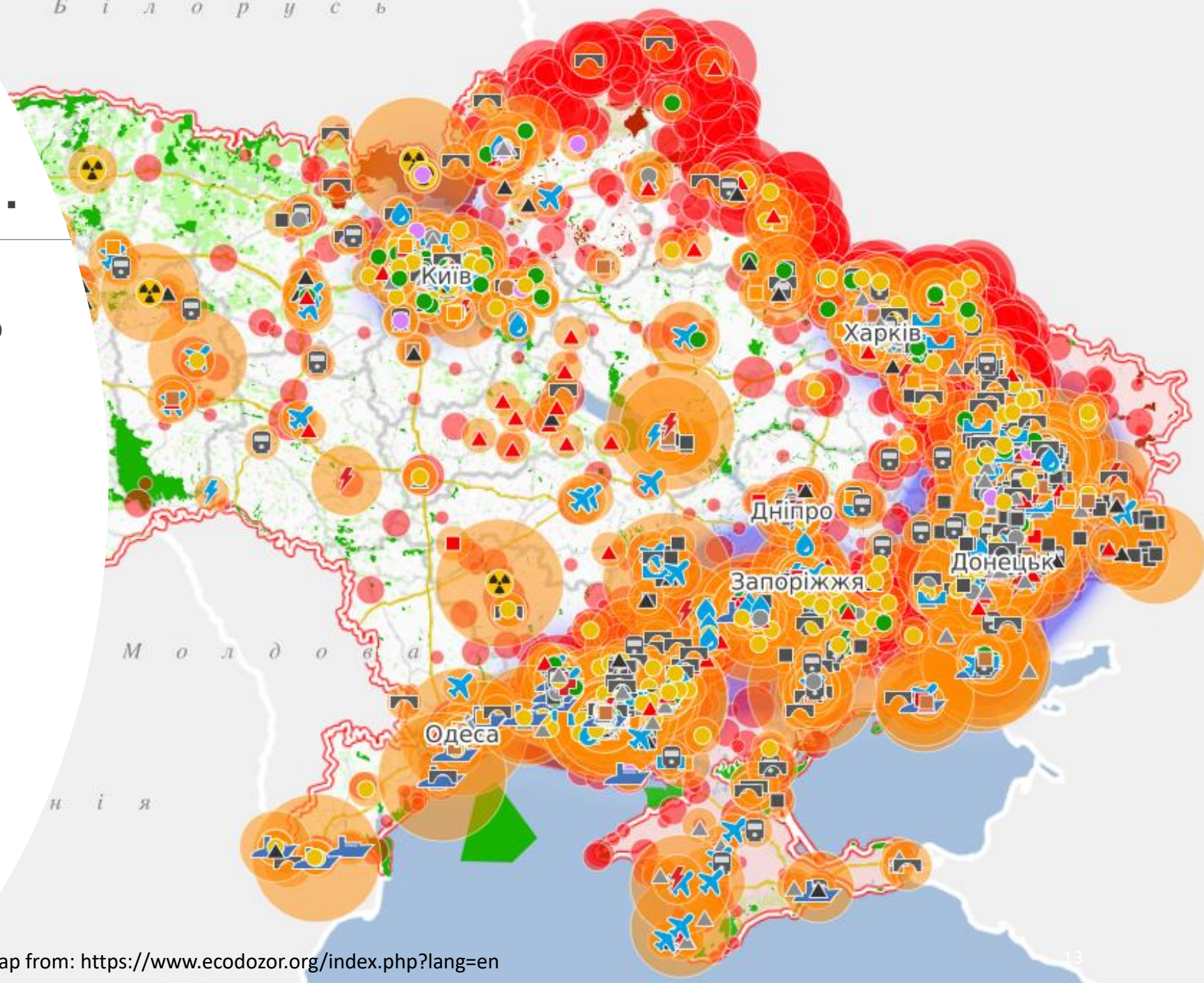
Ecosystems in fire...

During the year of the war, only russian **tanks** caused damages to the environment in the amount of about **138.5 billion dollars**.

Fighter jets caused damages of almost **79 billion dollars** by the factors of emissions of exhaust gases, noise and bombings.

Negative impact of the general **noise of hostilities** amounted to about **2.3 billion dollars**.

The total amount of damages based on only these components is already comparable to the state budget of russia for a year.



Thank you for your attention!

Together we will defeat russians.

Glory to Ukraine!