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UWEC Ukraine War Environmental Consequences Work Group

Consequences of munitions use and CHEMICAL POLLUTION stemming from military combat in Ukraine

WEBINAR #2

Photo: Ukrainska Pravda, Yekateryna Polyanska, day.kyiv.ua, Unsplash

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Photo: Rivne vechirne

Today's topics:

1. Consequences of explosive blast waves
2. Use of incendiary ammunition and impacts of fire for nature
3. Shelling industrial sites and other dangerous sites
4. Pollution of rivers and seas
5. Chemical and radioactive pollution
6. Military waste
7. Evaluating the scale of pollution
8. Land rehabilitation after the war ends

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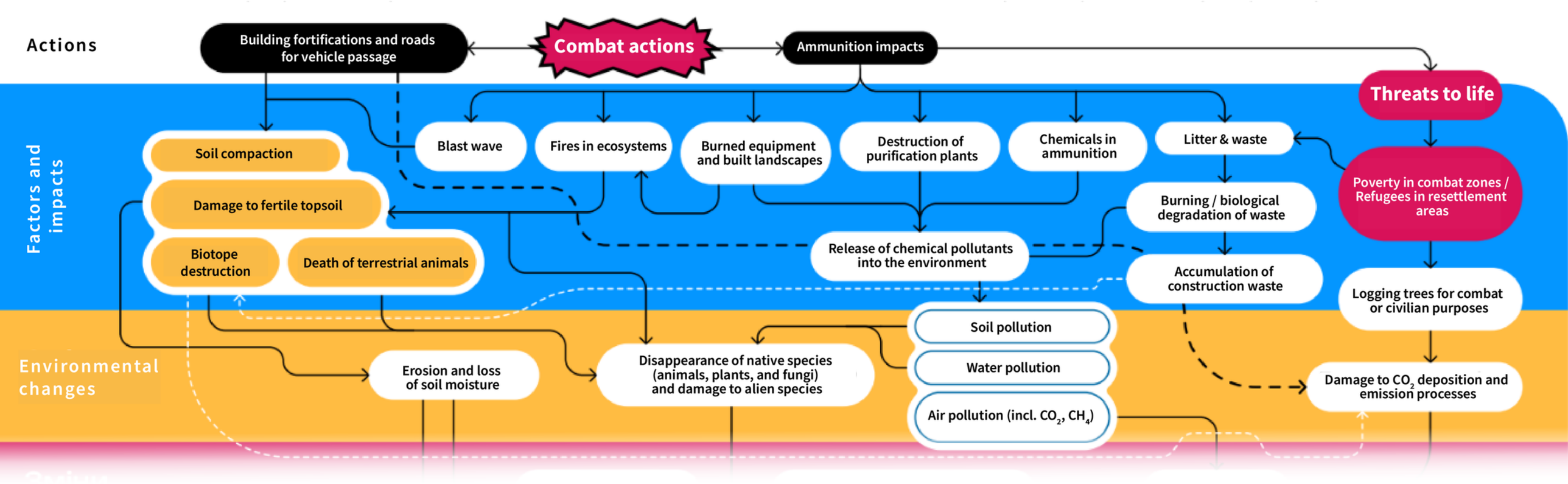

See the entire flowchart >>>

Figure: Ukrainian Nature Conservation Group

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1

Consequences of explosive blast waves

Blast waves lead to a series of issues with their own long-term consequences.

- Simultaneous soil compaction and destruction of its structure → Create a locus of erosion and facilitate the spread of invasive plant species
- Hydrological changes → Accelerate desertification
- Release of carbon from disturbed soils → Accelerates global climate change

Additionally, the explosion itself is a factor in biodiversity destruction.

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Crater depth

≈6 m

Photo: Tweet @operativno_ZSU

In addition to chemical pollution, munitions explosions cause extensive damage to topsoil and soil erosion in the broadest sense.

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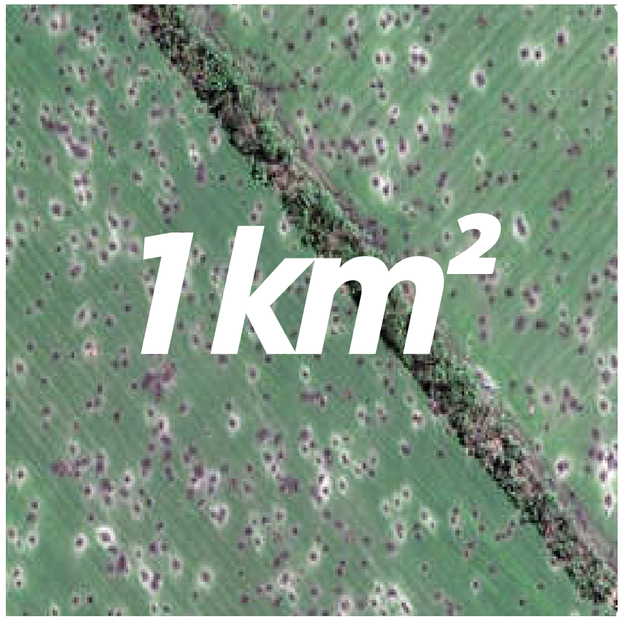

- **480 craters**
- **7 to 12 m** in diameter
- soil displacement radius **up to 22 m**

Field southeast of Izium, Kharkiv Oblast

Dense array of ammunition explosions in combat zones leads to continuous land contamination.

Read the article >>>

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2

Use of incendiary ammunition and impacts of fire for nature

Putting out fires in combat zones is almost impossible.

Video: ICTV

Shelling with phosphorus munitions in Bakhmut

Use of incendiary munitions causes fires in ecosystems.

Burning vegetation (e.g., forests) leads to large-scale releases of carbon into the atmosphere, accelerating global climate change.

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3

Shelling industrial sites and other dangerous sites

As a result of hostilities in eastern Ukraine, a network of large metallurgical and chemical industry facilities **was completely destroyed**.

Burning fuel depot in Crimea

Fire at industrial facilities, as at any warehouse or commercial facility, releases vast amounts of chemical pollutants into the atmosphere.

Video: ICTV

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Photo social media

Rocket attack releasing ammonia-based fertilizers in Mykolaiv Oblast

Environmental degradation negatively affects human health.

This intentional contamination could be a **potential violation** of the the Geneva Convention's prohibition on the **use of weapons of mass destruction**.

Is it possible that the Russians are specifically targeting explosive fertilizers to create just such effects?

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4 Pollution of rivers and seas

Waste from destroyed treatment facilities, as well as munitions, burnt equipment, etc. enter rivers, causing water pollution and the death of aquatic living organisms.

Kryvyi Rih, Dnipopetrovsk Oblast

Irpin, Kyiv Oblastt

Sewage treatment facilities were destroyed by **rocket strikes** in **all** occupied areas and anywhere Russian armed forces conducted offensives.

Read the article >>>

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There is virtually no way to remove chemical pollutants from seas. In addition, there is no way to protect marine life from pollution. For this reason, **marine pollution remains one of the most complex issues among the environmental consequences of war**.

Photo: Ukrinform

Mariupol, Donetsk Oblast

Photo: @CinCAFU, Telegram

Berdyansk, Zaporizhzhia Oblast

War and the Sea: How hostilities threaten the coastal and marine ecosystems of the Black and Azov Seas >>>

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Bombing of the Azovstal enterprise in Mariupol

Photo Maksem Borodin (Courtesy Photo)

The photo shows a spoils dump separated from the sea by a small dam and a channel of accumulated toxic leachate.

The plant stored large quantities of raw materials and fuel, making the steel factory the largest source of pollution in Ukraine.

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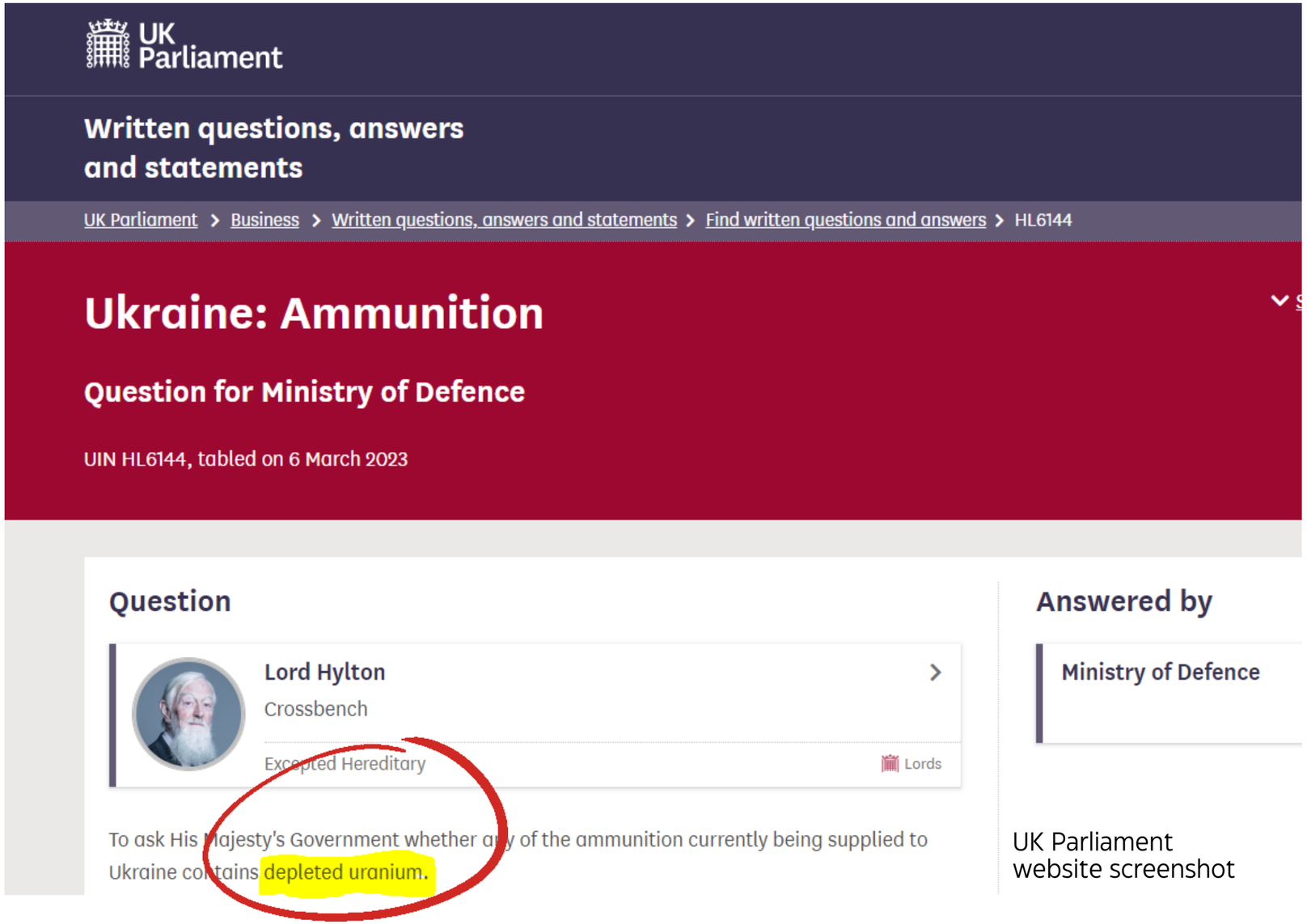
5 Chemical and radioactive pollution

Another concern is the use of depleted uranium in some types of munitions projectiles. But in fact, radiation levels in this case are no more dangerous than radiation from a granite step or monument.



UK Parliament website screenshot

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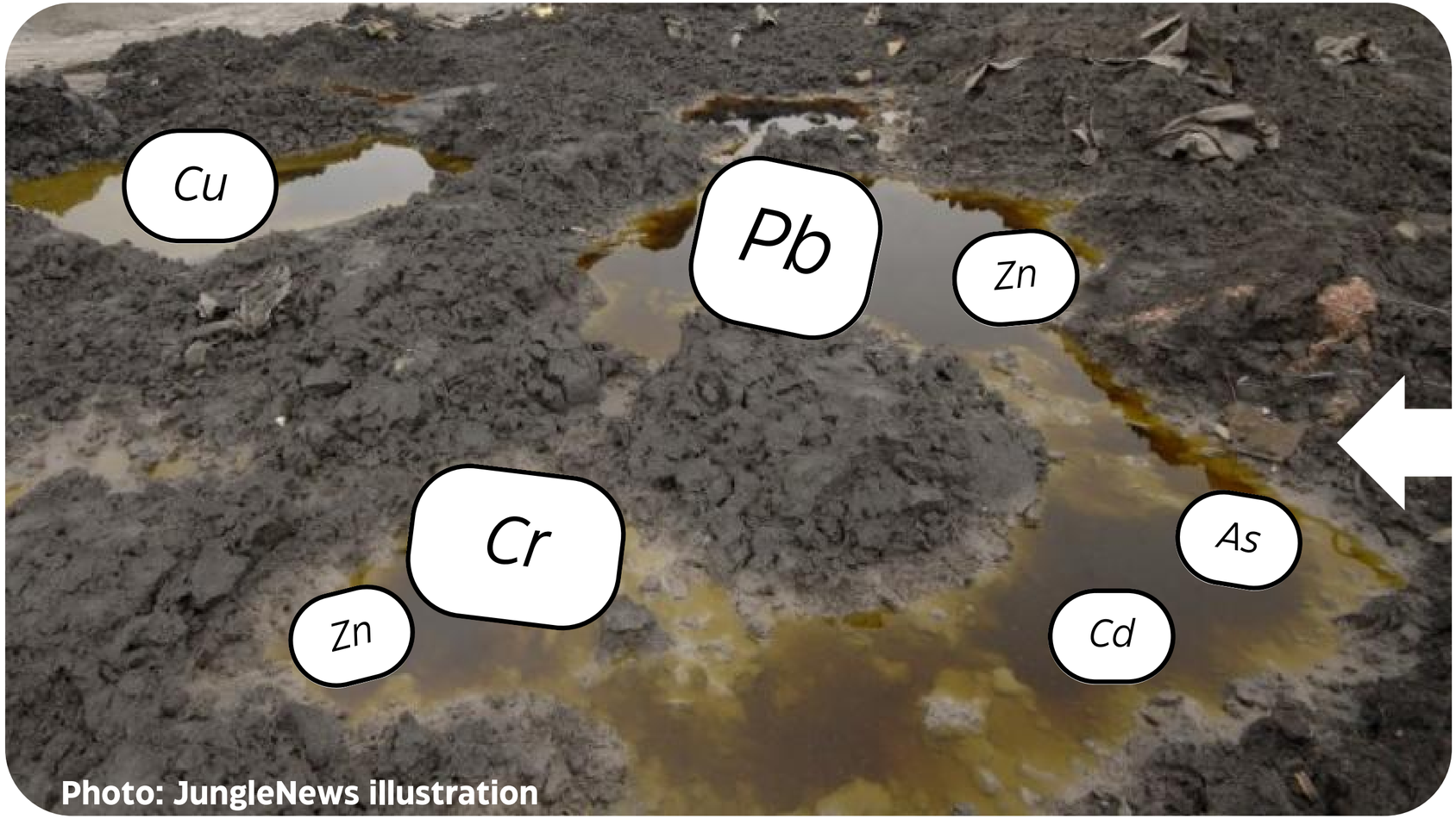

Photo: JungleNews illustration

Heavy metals play an important role in soil pollution. Preliminary studies of the Anti-Terrorism Operation and Joint Forces Operation zones between 2016-2020 found high concentrations of heavy metals in soils.

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6 Military waste

Destroyed military equipment and remnants of downed missiles are large-scale environmental pollutants (toxic fuel in missiles; ammunition in exploded armored vehicles, etc.).

Kharkiv

Bucha, Kyiv Oblast

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Detonation of a tank's weapons load

Video: 93rd Mechanized Brigade "Kholodnyi Yar"

Everything seen during an explosion immediately enters the atmosphere.

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A city converted to waste

Marinka, Donetsk Oblast

Video: Mykolaiv city website

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7

Evaluating the scale of pollution

Environmental pollution resulting from munitions explosions and the actual sites where they fall are the single largest consequence of military operations for the environment.

- Is it possible to measure environmental pollution during hostilities?
- Is it worthwhile measuring pollution after the hostilities end?
- Is it possible to back-calculate contamination on the basis of the ammunition itself?

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9 Land rehabilitation after the war ends

1. How much time is needed for rehabilitation?
2. Is rehabilitation possible?
3. What to do with territories where it is not possible?
4. Will pollution lead to a future wave of environmental refugees?
5. Where to store the construction waste resulting from the destruction of entire cities?

Residents' lack of understanding of the threats from pollution leads to the use of contaminated land.

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Soil decontamination

Phytosanitation and phytoextraction are nature-based methods for soil purification.

Photo: Andriy Dubchak/RadioSvoboda.org

Soil metamorphosis: Ukrainian study of war impacts on soils >>>

The methods involve cultivating specially selected plants capable of dissolving or absorbing pollutants from contaminated sites. Subsequently, the absorbed heavy metals are removed from the site along with the sorbent plant.

[The process is similar to using activated charcoal, used for poisoning]

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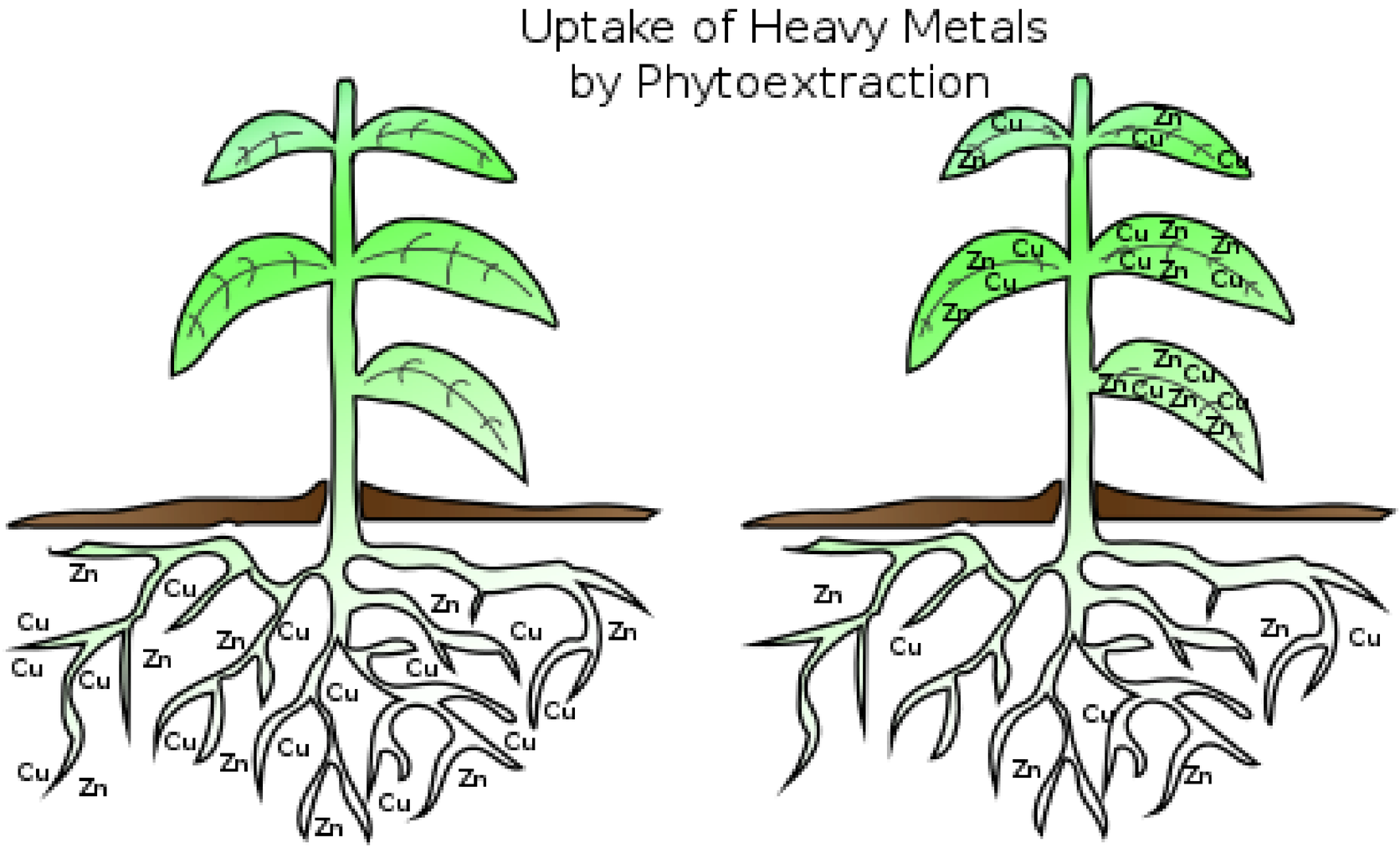

Various types of plants are used to remove heavy metals (Pb, Ni, Cr, Zn, etc.) from the soil. Among them are common crops such as sunflower and spring rapeseed.

Image: Wikimedia Commons

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