



GRID-Arendal, Transboundary Governance and Environmental Crime





The EO4SD-FCS project

An ambitious initiative funded by ESA, successfully demonstrating how data from Earth Observation (EO) technology can be transformed into useful analytical products that can be used to reduce environmental and human insecurity in fragile states.



Reinforcing Fisheries' Governance in Guinea

- Objective 1: Strengthen the national fisheries legal and regulatory framework through transformative policy reforms
- Objective 2: Reduce IUU practices in Guinean marine fisheries by increasing local capacity and effective monitoring, control, surveillance and enforcement (MCSE)
- Objective 3: Improve the transparency and governance of the fisheries sector



The Environmental Impact of the War in Ukraine: A Preliminary Review

A report presenting a snapshot – but by no means a comprehensive picture – of the damage inflicted on Ukraine's environment and the potential environmental and public health impacts, informing priorities for field-level verification work.



Critical infrastructure and urban areas

Water and wastewater treatment

Energy infrastructure

Industrial sites and oil spills

Combined and interlinked effects



Debris and remnants of war

- Munition debris
 - Explosives such as DNT, TNT and RDX are toxic.
 - Heavy metals are common in weapons
 - Depleted uranium – used in past wars – toxicity a larger problem than radioactivity.
- Unexploded ordnance and land mines
- Military vehicles
- Demolition debris

... Hirske by the State Emergency Services of Ukraine, Luhansk



Other damages

Breakdown of institutions and governance

Impacts on agriculture and ecosystems

Interconnected and cumulative effects

Destruction in urban centres and of critical infrastructure

Infrastructure	Estimated Damage National Recovery Council	Estimated Damage World Bank
Roads, km	23,900	16,318 (national and local roads)
Residential buildings, mln m2	44.8	Residential units 816,157(total) 312,246 (destroyed)
Industrial enterprises, factories, units	256	
Civil airports, amount	11	
Rail infrastructure and rolling stock	6,300 km rail tracks 41 bridges	1,119 km rail lines 850 units
Railway stations		93
Healthcare institutions	656	
Bridges and bridge transitions	304	3 million m ² National 428,470 m ² local 63,072 m ² railway bridges
Cars (number)	104,000	392,843 (private) 9,473 communal
Institutions of secondary and higher education (number)	1,177	1,885 178 (Destroyed)
Ports and Port Infrastructure	4	
Military airfields and airports (number)	12	
Administration buildings (number)	111	
Religious buildings (number) Cultural facilities (number)	141 203	Combined 268
Kindergartens (number)	668	
Shopping and entertainment centres (number)	20	
Storage infrastructure (number)	198	
Industrial fuel storages (number)	28	
Retail (number units)	2,910	

Damage to fuel and associated infrastructure



- Several missile strikes in April 2022 demolished the Kremenchug refinery in Poltava oblast
- 15 different oil depots in Ukraine were destroyed or damaged as a result of missile strikes, which means that significant fuel reserves were destroyed
- The State Environmental Inspectorate of Ukraine has registered more than 20 cases of attacks on reservoirs with petrol, diesel, liquefied petroleum gas and mazut (fuel oil) (State Environmental Inspectorate of Ukraine 2022b).
- Wherever possible, investigations estimating damage to the environment are ongoing.

Incidents
with release
of toxic
industrial
chemicals

Industrial Site	Location	Date	Description of the Incident
Coke Plant	Avdiivka	March 13, 2022	Large fire caused by shelling.
Sumy Khimprom	Sumy	March 21, 2022	Release of ammonia; the gas cloud covered an area of 2.5 km ² .
SOE Khimprom	Chernihiv	March 23, 2022	Depressurizing of a tank with liquid ammonia (12 tons), followed by a fire in the working premises.
Scientific-Industrial Enterprise Zorya	Rubezhne, Luhansk oblast	April 5, 2022	Release of the 80 tons of nitric acid caused by the hit of storing tank. The radius of the affected area reached 3.5 km.
Severodonetsk Azot	Severodonetsk	May 5, 2022	Heavy shelling in the one of the largest ammonia producers in Ukraine.
Azovstal	Mariupol	May 29, 2022	Release of liquid ammonia due to the damage of pumping station. The radius of the affected area reached 2.5 km.
Ammonium pipeline Tolyatti – Odessa	Nearby town of Bakhmut in Donetsk oblast	May 30, 2022	Release of technical (low pressure) ammonium from a non operational by-pass pipe. At least six communities were under threat of chemical pollution.

Incidents affecting tailings storage facilities

- Hostilities near Severodonetsk could have affected the tailing storage facilities of the Azot plant, containing 649,000 tons of solvents and sludge obtained from the regeneration of ion exchangers as well as magnesite sludge from the process of potassium.
- There have been reports of damage to one of the two tailings of the Avdiivka Coke Plant, containing 443,000 tons of phenol, sulfuric compounds, naphthalene and other toxic substances.

TOTAL
VISIBLE
DAMAGED
BUILDINGS

~75%*

DESTROYED

50

SEVERELY
DAMAGED

54

MODERATELY
DAMAGED

101

POSSIBLY
DAMAGED

15

* Approximate percentage, some structures are not digitized in the base layer used for comparison



UNOSAT Damage Assessment Overview Map

This map illustrates a satellite imagery based damage analysis within the Azovstal industrial site of Mariupol City, Ukraine.

Using imagery collected on 25 April 2022 and 21 June 2021, analysts found that 220 out of 294 structures sustained visible damage in the area of interest (AOI). This represents approximately 75% of them. Out of these, 50 are destroyed, 54 severely damaged, 101 moderately damaged and 15 possibly damaged. In addition, 214 impact craters have also been identified.

This analysis is based on damage visible as of 25 April 2022 as seen in marginally degraded satellite imagery. This is a preliminary analysis and has not yet been validated in the field. Please send ground feedback to the United Nations Satellite Centre (UNOSAT).

Legend

- Destroyed
- Severe damage
- Moderate damage
- Possible damage
- Impact crater (Damage to road)
- Impact crater (Damage to ground)
- AOI

Debris

- Shelling in the northern, eastern and south-eastern parts of the country resulted in large amounts of debris in cities and towns.
- In some settlements, all buildings have been either damaged or demolished.
- Asbestos is likely to be present in debris given the widespread use of asbestos in building materials and infrastructure.

 **% TOTAL VISIBLY
DAMAGED CELL**
21%

**AREA OF
INTEREST**
198km²

INSET 1:
22 March 2022



INSET 2:
22 March 2022



UNOSAT Damage Assessment Overview Map

This map illustrates a satellite imagery-based Rapid Damage Building Assessment (RDBA) in the Chernihiv City, Ukraine. The RDBA divides the city into 500m x 500m cells, each of which is analyzed to determine whether or not there are damaged buildings inside the cell.

Based on imagery collected on 22 March 2022, analysts found that 191 cells out of 901 cells in the City of Chernihiv sustained visible damage. This represents approximately 21% of the cells over the city.

This analysis is based on structures visibly damaged as of 22 March 2022. This is a preliminary analysis and has not yet been validated in the field. Please send ground feedback to United Nations Satellite Centre (UNOSAT).

Legend

-  Chernihiv City
- Damage**
-  No visible damage
-  Damage

Damage to urban water sector

- Damage to the major water supply pipeline in the city of Mykolaiv led to a reported critical situation with drinking water.
- Artillery shelling resulted in damage to the third lift of the water pipeline of the Seversky Donets – Donbass canal, leading to termination of water supply in Donetsk and Luhansk regions.
- The water supply of the city of Chernihiv was damaged
- A major incident affecting wastewater treatment plants occurred due to the damage of the Zaporizhzhia city wastewater treatment station, located in the village of Vasilivka, and untreated wastewater leaked into the Dnieper River.

Other incidents reported by the State Environmental Inspectorate of Ukraine:

- Damage to the Severodonetsk city wastewater treatment station which could cause untreated wastewater discharging to Seversky Donets.
- Damage to wastewater treatment plants in Popasna (Donetsk oblast), Lisichansk and Rubizhne (both in Luhansk oblast) was recorded in early April 2022.
- On 19 April 2022, a wastewater treatment plant in Druzhkovka and the Velyko-Anadolska filtering station (both located in Donetsk region) were damaged.
- In situ testing and collection of evidence bases is currently impossible due to ongoing hostilities.

Impact of the conflict on agriculture



- The heaviest shelling affected the black soils (chernozem).
- Construction of fortifications, explosion craters and compaction of soil by tanks' tracks and wheels of military vehicles caused damage to and physical degradation of soils.
- The ammunition and missiles residues in these craters may become a source of chemical pollution caused by heavy metals, missile and vehicles fuel and other toxic chemicals together with metal parts.
- These substances can potentially reach the groundwater, especially in certain areas of Kherson and Mykolaiv oblasts
- Up to 30 million hectares of land in Ukraine is mined.

Next Steps



- Rapid identification and mapping of physical impacts on landscape and urban infrastructure, of fires, and visible pollution incidents
- Bomb crater identification and unexploded ordnance
- Identifying and mapping medium- to long-term changes in landscape areas damaged through fires, deforestation, or other secondary environmental impacts
- Mapping and monitoring agricultural production and impacts thereon
- Monitoring water pollution