CASE STUDY 4.3
REMOTE SENSING AND AI TO ASSESS WARTIME ENVIRONMENTAL DAMAGE IN UKRAINE

JENNAH COLBORN • Environmental Peacebuilding Association

Assessments of environmental damage have historically been performed post-conflict, but Ukraine quickly recognized the need for technological support in performing real-time assessments of the environmental impacts of the war with Russia. A variety of well-established and innovative technologies have been deployed since the early days of the conflict.

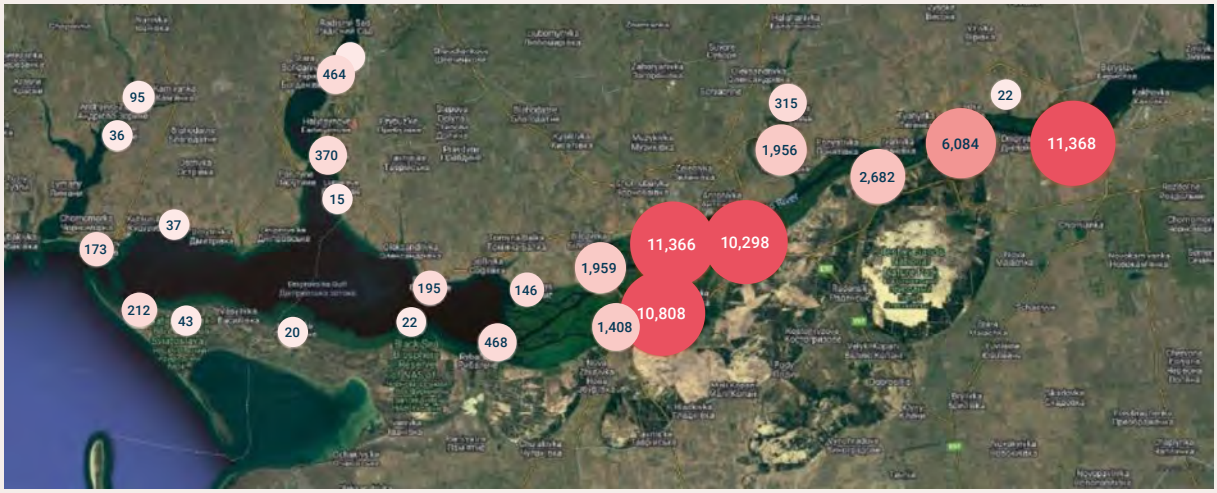
Assessing environmental damage can be dangerous, particularly with the conflict still ongoing, so remote sensing technologies have been key. Responding to a request from Ukraine, UNEP, together with partners, launched the Ecodozor platform, which builds on media reports supplemented by information from the authorities, academia, civil society, and other sources, including social media, for almost real-time information on environmental impacts of the conflict. UNEP has also trained national authorities on the use of remote sensing technologies to assess environmental impacts of the war.

The Kyiv School of Economics uses remote sensing and artificial intelligence to track destruction of buildings across the country in almost real-time. Using a combination of high-resolution satellites and low-flying drones, researchers have collected detailed, quality images of buildings in conflict regions. To ensure completeness of the dataset, both photos and videos are taken, and metadata such as building height, type, and address are also gathered from verified outside sources. GIS specialists, aided by artificial intelligence, then digitize all buildings and assess their damages according to several metrics: size and type of building, number of floors, level of damage (possible, light, severe, and total), and the number and size of destroyed objects. Finally, the digitized data and imagery is stored in an IT system to allow easy access and comparison with other maps.[105]

The Kyiv School of Economics also used remote sensing technology to support real-time environmental assessment of damage from the destruction of the Kakhovka dam. On 6 June 2023, footage captured by a Ukrainian military drone showed water from one of Europe's largest reservoirs gushing through a gaping breach in the dam. Researchers compared satellite imagery from before and after the flood, establishing the dimensions of the flood line, then referenced geospatial and elevation data from NASA's DEM (Digital Elevation Model) to determine the height difference between the flood line and each building in the flooded region to infer the extent of flooding across buildings (FIGURE 4.4).

Further, a remote sensing network has proven useful in monitoring agricultural systems. A team at NASA Harvest has been helping the Ukrainian government to digitally map cropland since early 2022, observing such variables as crop type, season, and artillery damage.[107] Additionally, research groups have been studying the vegetation indices extracted from remote sensing data, employing novel statistical methods and machine learning to better understand climate trends, soil water content, nitrogen uptake, and crop health.[108] Priority has been given to monitoring important food security crops, such as rapeseed, given Ukraine's status as a major exporter of oilseeds and grains to the global market.[109]

FIGURE 4.4: MAP SHOWING THE NUMBER OF FLOODED BUILDINGS IN THE KHERSON AND MYKOLAIV OBLASTS AFTER THE DESTRUCTION OF THE KAKHOVKA DAM.



Source: Kyiv School of Economics 2023.

Finally, Ukraine's open-source intelligence (OSINT) team also employs open-source networking tools to help evaluate the impacts of conflict, environmental or otherwise. OSINT aggregates information across social media posts, video recordings, photographs, audio, eyewitness accounts, news stories, and written records. To verify the credibility of these sources, Ukraine's OSINT team uses a variety of digital forensics technologies: reverse image searches can identify the original source of the content and any manipulations performed thereafter, metadata analysis can reveal information relevant to the creation and modification of the content, and deepfake detection algorithms can separate AI-generated content from authentic media.[110] Using these methods, OSINT was able to produce an environmental damage report in December 2023, covering air pollution, soil damage, and forest fires linked to the war to date.[111]