



Study of the military actions impact on the Buchansky district soils (Kyiv Region, Ukraine)

Yuliia Spinova^{1,2}, Iryna Vyshenska¹, Anastasia Sakva¹, and Oleksii Vasyliuk^{1,2}

¹Centre for Studies of Ecosystems, Climate Change and Sustainable Development, National University of Kyiv-Mohyla Academy

²NGO Ukrainian Nature Conservation Group

Soil damage as a result of military actions is primarily associated with shell bursts, as well as with the movement of heavy equipment, fortifications construction and related processes, such as fires caused by them and following changes in the phytodiversity.

The impact on the physical condition of soils occurs through a pneumatic effect - that is, upturning the soil by explosions, and changes due to the equipment movement, digging trenches and other fortifications.

Changes in the chemical and biological characteristics of the soil occur as a result of animal and human corpses decomposition products, of fuels and lubricants leakage from heavy equipment, and also a large amount of abandoned equipment, or its remnants, chemicals from projectiles and debris contamination.

Shelling accompanied by explosions, as well as the use of lighting and incendiary projectiles led to large-scale fires, which deplete soil nutrients (particularly humus and minerals such as magnesium and phosphorus). In addition to changing the chemical composition, high temperatures destroy pedobionts, which have a direct impact on both the chemical and physical condition of the soil, and are responsible for its fertility and stability. In the future, such changes may lead to accelerated erosion. Oil products from heavy machinery are quickly absorbed, especially into dry and sandy soils. As a result, physical and chemical characteristics change, water and air permeability and microbiological processes are disturbed, so soil degradation occurs. Besides the direct impact, the process of soil contamination with fuel substances can lead to easy ignition and large-scale fires.

The most widely used weapons in this war are 82 mm and 120 mm high-explosive shells, 125 mm high-explosive and cumulative shells, 122 mm, 152 mm, 203.3 mm, 240 mm high-explosive, incendiary and illuminating shells.

We made calculations of the burnings spread, identified correlations between them and shellings using QGIS and NASA data on the Buchansky district for February 24, 2022 – June 26, 2022. In total, 2.712 burnings were detected for that 4 months of Russia's full-scale invasion on the territory of Buchansky district (area is 2.558 km²). Most of them took place within the settlements where

battles were fought.

With satellite images from the open database of Maxar Technologies we analyzed the most affected soil surfaces in this district.

One of the chosen plots is represented by the Irpin River meadows and is the Emerald network site. 18 impact marks were counted here in total: 4 bursts from 82-mm shells, 8 bursts from 122-mm and 6 – from 152-mm shells. An additional external analysis of a young pine forest area showed the vegetation overgrowth is no more than 10% after 2.5 months of succession process and represented by ruderal and segetal plant species.

Moreover, 8 objects of the Nature Reserve Fund of Ukraine with particularly valuable ecosystems in the Buchansky district were affected by military operations and their stability is currently significantly reduced.