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## **FOREST ECOSYSTEMS AND RESOURCES DAMAGED BY MILITARY OPERATIONS IN UKRAINE (ZHYTOMYR DISTRICT)**

Currently, a significant part of the forest resources of Ukraine is in an extremely unsatisfactory state as a result of military operations. According to the State Forestry Agency (Public report 2022), 2,9 million hectares of forests have varying degrees of damage as a result of hostilities making up almost 20% of the total forest area in Ukraine. Currently, about 1 million hectares of forests are under occupation or under the influence of active hostilities. 690,000 hectares need demining, but this number increases every day not only due to the occupation of territories but also due to further mining of territories on the border of Ukraine and Belarus. Territories affected by hostilities (Ukrainian Nature Protection Group March 2022).

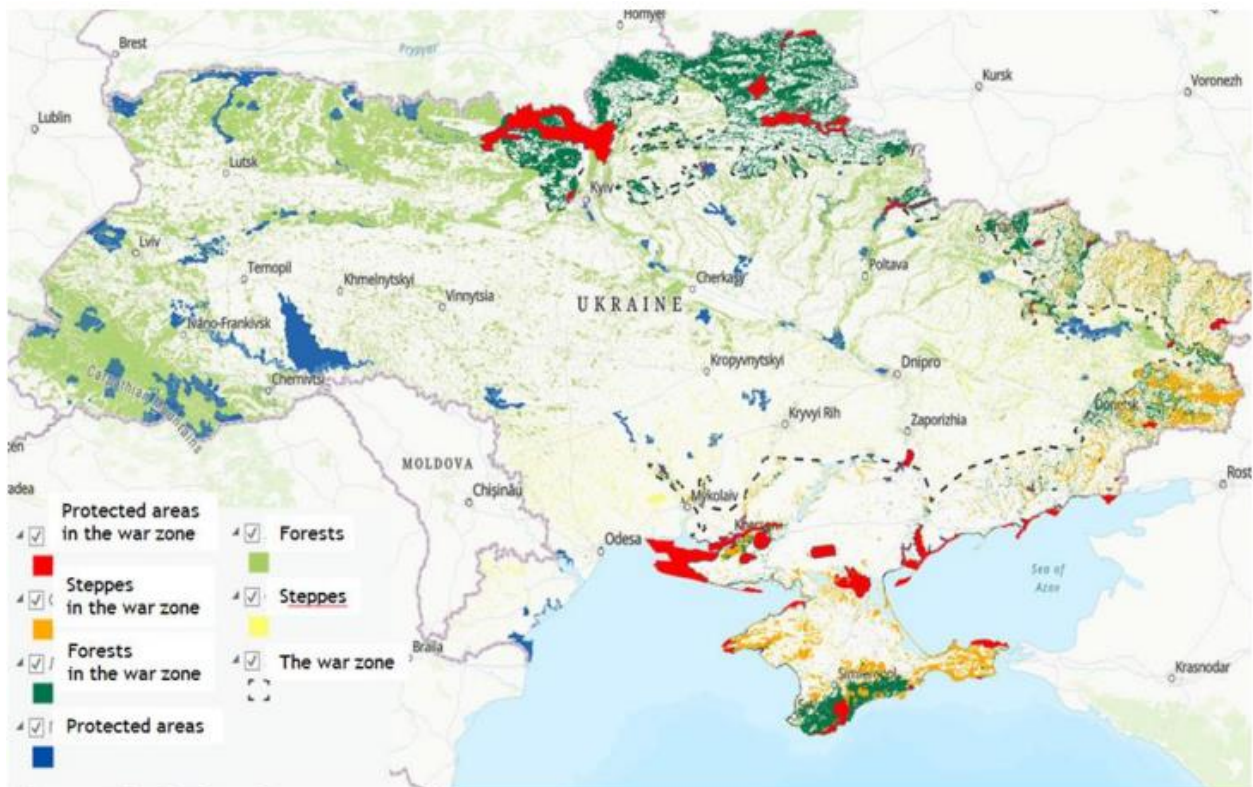


Fig. 1. Territories affected by hostilities (Ukrainian Nature Protection Group March 2022).

According to the official resource of the Ministry of Environmental Protection and Natural Resources of Ukraine "EcoThreat" (EcoThreat 2023), the total damages caused to the environment of Ukraine as a result of military actions amount to UAH 2,071 billion, including UAH 1,011 billion due to the occurrence of forest fires. Forest fires caused by hostilities damaged 2 60,279 hectares and led to the release of 43,499,811 tons of pollutants into the atmosphere. Another 281,223 hectares of forests were destroyed due to illegal felling of forests to build fortifications, strengthen trenches, and create obstacles for the movement of military equipment. According to the Ministry, the military actions violated 900 objects of the nature reserve fund with an area of 12,406.6 square kilometers, which is about a third of the area of the nature reserve fund of Ukraine. About 200 territories of the Emerald Network with an area of 2.9 million hectares are under threat of destruction (Ecodia 2022).

Among the most affected regions are the Chernihiv region with approximately 400 thousand hectares, Sumy region with 290 thousand hectares, Luhansk region with 200 thousand hectares and Kyiv region, Zhytomyr region and Kharkiv region with each 120-160 thousand hectares. These figures are indicative and do not reflect the real situation, as a significant area is occupied or mined and cannot be assessed. In the Zhytomyr region, the situation is complex by the fact that two biosphere reserves located on the border with Belarus fall into the zone of influence of military operations. The nature reserve "Drevlyanskyi" is located in the Narodytsky district. Most parts of the reserves are radioactively contaminated forests. Therefore, in addition to the damage to forest ecosystems, military actions can provoke forest fires and, as a result, secondary pollution of the environment with radionuclides. The Polisky Nature Reserve is located in the Ovrutskyi and Olevskyi districts characterized by poor boreal (taiga) northern landscapes with forest and forestswamp

complexes that are unique for Ukraine and Europe and are part of the Emerald Network. Biodiversity of forest ecosystems suffered significant losses as a result of the destruction and pollution of the territories of their habitats and the creation of unfavorable conditions for existence (noise, vibration, air pollution). Currently, about 600 species of animals and 750 species of plants and mushrooms are under threat of destruction due to the large-scale invasion. These include more than 120 wetland bird species. According to the deputy minister of Environmental Protection and Natural Resources, the war is a threat to 35% of Europe's biodiversity, which is located in Ukraine (Ministry of Environment 2023).

The conduct of hostilities and mining of forest territories leads to the impossibility of maintenance measures, which in turn contributes to the deterioration of forest conditions, the accumulation of dry wood, and an increase in fire danger. This is especially dangerous during the dry season, when fighting can cause large-scale fires. In 2022, fires in forest areas caused by hostilities and shelling were added to the annual increase in fire danger in forests caused by global warming. The presence of mined areas with a significant number of explosive objects makes timely detection and prompt response impossible. In 2022, 1,009 fires were eliminated in the forests of 3 the branch on an area of 15,500 hectares, which is 1.5 times more than the number and 53 times the area of fires in the previous year (Public report of the State Forestry Agency 2022). The main causes of fires (62%) are the burning of plantations as a result of active hostilities, shelling with cruise missiles and shells, as well as the presence of explosive objects in them. WWF-Ukraine experts state that natural forest ecosystems will be able to recover from fire damages and degradation but the artificial pine forests, especially in northern Ukraine, will not be able to restore themselves for decades due to the lack of precipitation and climatic changes to the winter season (WWF Ukraine 2020).

This is why, after the end of hostilities (or the liberation of territories), the country will need a quick and effective restoration of forest ecosystems and resources. The situation is complicated by the fact that, in addition to the destruction of vegetation, the soil and many other key attributes have been disturbed as a result of explosions and the construction of shelters.

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