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FOREST MANAGEMENT

ON TERRITORIES CONTAMINATED WITH UNEXPLODED ORDNANCE

CONTENT

This is English summary of the report "Forest Management on Territories Contaminated with Unexploded Ordnance", which has been written and produced by WWF-Ukraine together with the Regional Eastern Europe Fire Monitoring Center and Global Fire Monitoring Center within the framework of the project "Supporting responsible forestry for sustainable development in Central and Eastern Europe" .

Full version of the Report (in Ukrainian) is available at the WWF-Ukraine website.

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KEY MESSAGES

War-munition explosions in Donetsk and Luhansk regions in 2014-2020 caused forest fires and damage, forcing forestry enterprises to cease management activity in affected areas. However, dangerous zones haven't been identified and marked and any management measures were developed in the forest inventory materials. Nowadays, this issue has significantly escalated in other regions affected by military actions.

Hostilities have affected 3 million hectares of Ukrainian forests, 900 objects of the nature reserve fund with an area of 1.24 million hectares, leading scientific and educational forestry institutions, thousands of skilled staff, buildings, equipment, and infrastructure.

Forests are one of the most difficult objects for demining, which led to insignificant areas of demined territories during 2016-2022 in the Luhansk and Donetsk regions. After February 24, 2022, forests in Ukraine were contaminated with parts of the most modern types of weapons, the experience of which is quite limited in the world.

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Continuous monitoring of forest damage in forests where hostilities are taking place, is possible with the creation of an online system with continuous identification and reporting of forest losses with a frequency corresponding to the accumulation time for the relevant area of six to ten cloud-free observations.

The experience of Bosnia and Herzegovina, Croatia, and Northern Macedonia proves that no quick and effective solutions to the problem of mined forests have been found in the world. Instead, the main efforts in these countries have been aimed at disseminating information about the risks among the local population, limiting access to forests, conducting training among the local population, and demining and clearing the area.

The key to solving the problems is the development of a systematic approach to forest management in the territories contaminated with unexploded ordnance, which will increase the safety of forestry staff, representatives of other services, and the local population and preserve valuable ecosystems.

EXPERIENCES OF FOREST MANAGEMENT IN COUNTRIES AFFECTED BY MILITARY CONFLICTS

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The direct effects of the military operations from dozens of wars in the countries of Asia, Africa, the Middle East and Europe on forests and other ecosystems are bombing, land mining, deliberate arson, pollution by unexploded ordnance. This leads to environmental pollution, destruction of natural resources, deforestation, etc. Other examples of the negative impact of direct military operations on forests include their burning for the purpose of destroying enemy positions (Bulgaria, Republic of Congo). During military conflicts, forests as a natural resource, are deliberately damaged through e.g. burning or felling by the parties to the conflict or suffer as a result of hostilities (Afghanistan, Pakistan, Israel, Lebanon).

The indirect impact of military operations on forests is manifested through forced resettlement, which can lead to an increase in the use of forest resources (Bosnia and Herzegovina, Democratic Republic of the Congo, Nicaragua, Colombia, Sudan). The impacts of military conflicts on forests are complex: in some regions of the country, the restoration of forest cover can be recorded, and in others, deforestation can be observed. Another factor influencing forests and biodiversity, which causes both immediate and long-term consequences for forests and forestry, is the contamination of the territory by unexploded ordnance and mines. Their detonation can lead to the death of animals, fires and direct damage to trees.

The countries of the European region most affected by landmines are Bosnia and Herzegovina, Croatia, Serbia, North Macedonia, Georgia, Ukraine and Armenia. Traditional forest use becomes dangerous and difficult, and the wood often contains projectile fragments and is not suitable for use.

In addition, extinguishing forest fires, where it is impossible to use conventional equipment, becomes much more difficult in contaminated territories, and it becomes practically impossible to carry out forest management activities due to the danger to the staff. Forest wildfires caused by mine explosions have in many cases resulted in casualties, staff's reluctance to deal with them or orders for firefighters to stay away from danger zones.

The opinion that after a fire the territory can be considered demined is wrong. In polluted areas, forests with their timber and non-timber resources are excluded from forest management, which has a negative effect on the economic condition of local communities and the state as a whole.

LEGISLATION FOR TERRITORIES CONTAMINATED WITH UNEXPLODED ORDNANCE

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The presence of unexploded ordnance on the entire territory of Ukraine from the time of the Second World War and contaminated territories of Joint Forces Operation in Donbas since 2014 led to issuing regulation and creation of demining service before 2022.

Ukraine's most important and experienced international demining organizations have been present since 2016. The global coordinating role in mine action is carried out by the UN (UNMAS), NATO, and OSCE, as well as a group of non-governmental organizations, such as the HALO Trust, the Geneva International Centre for Humanitarian Demining, the Swiss Foundation for Mine Action, the Danish Demining Group, Croatian Mine Action Centre and others.

Several regulatory acts regulate demining activities in Ukraine:

- Law of Ukraine "On Mine Action in Ukraine" (2018)
- Regulations of marking mine and explosive remnants of war (ERW) hazards (2019).

Starting from February 24, 2022, the designation of mined areas was established in the following cases:

1. simulated mining to receive a warning signal;
2. real mining;
3. designation of post-occupied or shelled territories.

Legally unmarked territories with unexploded ordnance are allowed outside the combat zones to ensure national security and defence and repel and deter armed aggression. Also, until the end of martial law, restrictions on the distribution of cartographic or other information regarding territories with unexploded ordnance lead to numerous uncertainties regarding the demarcation of mined and explosive-contaminated territories. This creates very high risks for forestry staff and society. Access to the forests is prohibited by regional military-civil administrations, apart from representatives of the forestry enterprises, Territorial Defense Forces, and relevant services of the State Emergency Service.

However, there are **no special procedures and regulations for the demining of forests** in the current legislation, and there are no **regulatory acts for the management of forests contaminated with unexploded ordnance** (demining orders, procedures, list of documentation for including / excluding areas from the list of dangerous locations).

CASE STUDY OF ZHYTOMYR REGION

In the liberated territories, the process of unexploded ordnance elimination in forests and returning them to forest management is actively taking place. Forestry enterprises request the territorial division of the State Emergency Service or Territorial Defense Forces to facilitate the demining of roads and certain areas of the forest lands. In most forestry enterprises of the Zhytomyr Region, the territory with a danger of detonation of mines or unexploded ordnance is determined. These territories are excluded from any forest management, logging permits for these areas are not issued by regional forestry divisions, and any on the ground activities are on hold. In some cases, the "mines" signs are left in place by forestry workers after elimination operations since clearance certificates are not issued.

CONSEQUENCES OF MILITARY ACTIONS FOR FORESTRY AND THE NATURE RESERVE FUND OF UKRAINE

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1. Deforestation in certain regions due to hostilities and fires resulting from them, limited ability to control wildfires in the territories where hostilities took place, increasing the area of wildfires and further deforestation of the region in the short term.

2. Impossibility of silviculture treatments, forest restoration, fire and pest management, harvesting, forest products use, etc. As a result, the sanitary condition of forests gets worse, and the risk of wildfires increases.

3. Internal migration will increase anthropogenic pressure and may increase the use of forest resources in the territories out of the military action zone.

4. Deterioration of the population's economic situation will increase the intensity of the use of non-wood forest resources. Firewood demand could potentially increase illegal logging.

5. Biodiversity loss due to the death of large fauna and the destruction of valuable habitats on the territories of the nature reserve fund caused by contamination with unexploded ordnance and mines.

6. Limitations on conducting scientific research, including suspension of continuous (long-term) studies.

7. Management plans for territories contaminated with unexploded ordnance and mines must be developed. Change of patrol routes, closure of part of forest roads.

8. Abandoned and contaminated agricultural lands can be shifted to a nature reserve fund or forestry enterprises, which will require developing a procedure for their transfer and management plans.

9. Reduction of jobs, an outflow of qualified staff.

Solving these problems will require revising the current legislation and adapting to post-war conditions. Balancing priorities of natural resource management in post-war recovery is complicated by the economic needs and territory reintegration process. In turn, this can worsen the transparency of management and the sustainable use of natural resources. Economic recovery depends on land and forest resources and on income from the extraction and sale of natural resources or goods made of them.

FOREST, COMMUNITIES AND CLIMATE CHANGE

The traditional way of life for local communities often depends on forests and wetlands ecosystems. The management and restoration activities in the post-war period should involve local communities as direct beneficiaries.

Considering the complexity and duration of post-war recovery projects, flexible, innovative, and adaptive management approaches are required. In addition, potential threats from forecasted climate change must be taken into account in the stage of planning activities, e.g., monocultural pine stands already bring high wildfire danger to populated areas.

The **Action plan** for overcoming the consequences of military aggression for authorities, landowners, forest users, and the nature reserve fund should include:

1. Risks assessment from contamination of territories with unexploded ordnance and mines.

2. Cartographic materials and GIS systems with the mapping of dangerous areas and their field marking.

3. Raising public awareness.

4. Drawing up plans for demining territories with the priority of ensuring population safety, considering wildfire danger, and then - the region's economic recovery.

5. Management measures need to be planned by forestry enterprises to ensure sustainable forest management. Intensify thinning in order to obtain technical wood and firewood.

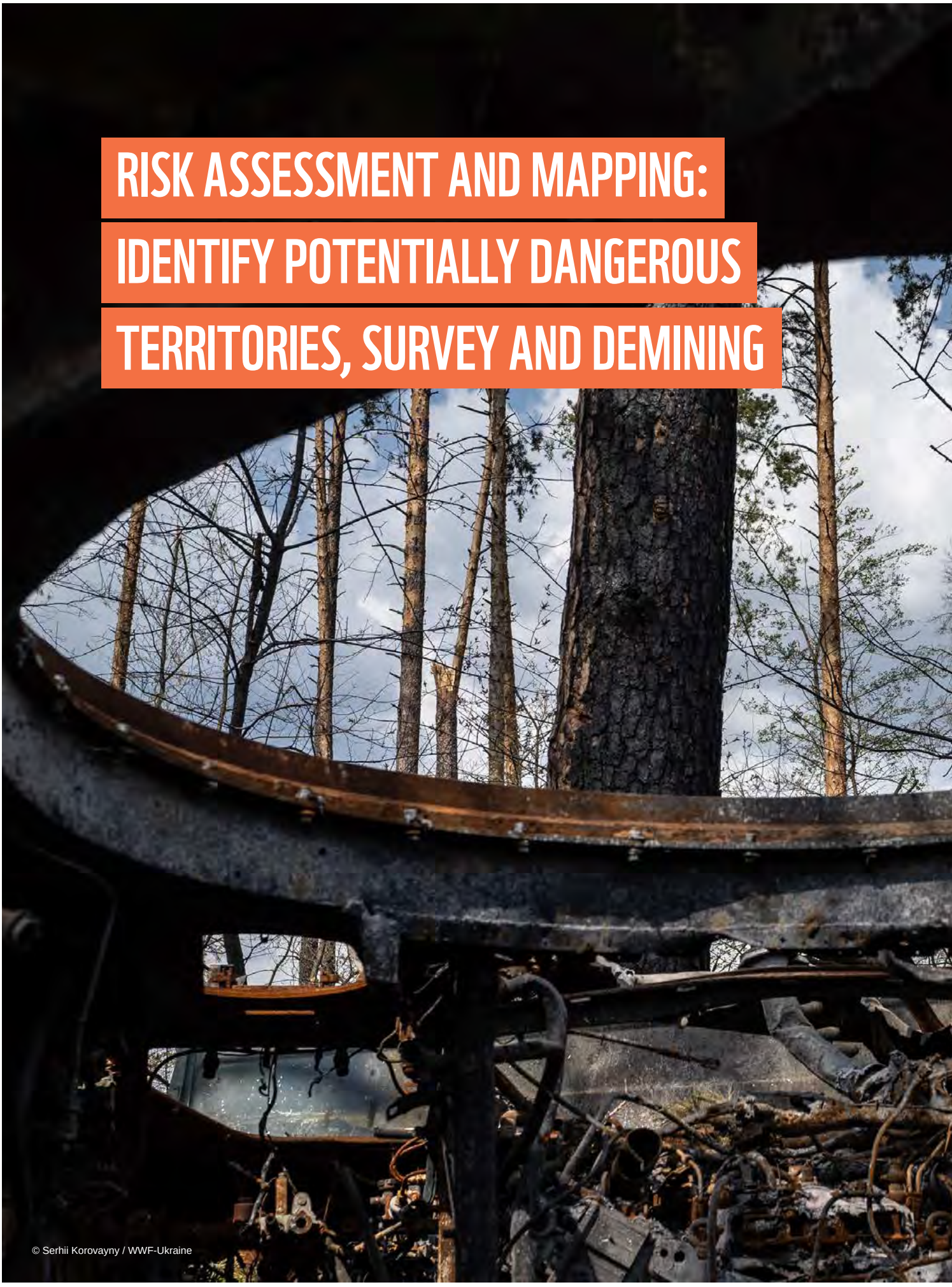
6. Calculate the necessary volume of sawn materials for the restoration of infrastructure and houses, and firewood for heating for the local population by local authorities, in cooperation with forestry enterprises. If enterprises can't provide the necessary volumes of wood without harming the environment, provide for its purchase in other regions.

7. Carrying out wildfire management around areas contaminated with unexploded ordnance to prevent the spread of wildfires and the possibility of wildfires localization while ensuring staff safety.

8. Using the potential of natural regeneration in areas inaccessible for forest management.

9. Ensuring safe working conditions (for example, laying safe traffic routes for staff) and preventing the outflow of qualified staff.

RISK ASSESSMENT AND MAPPING: IDENTIFY POTENTIALLY DANGEROUS TERRITORIES, SURVEY AND DEMINING



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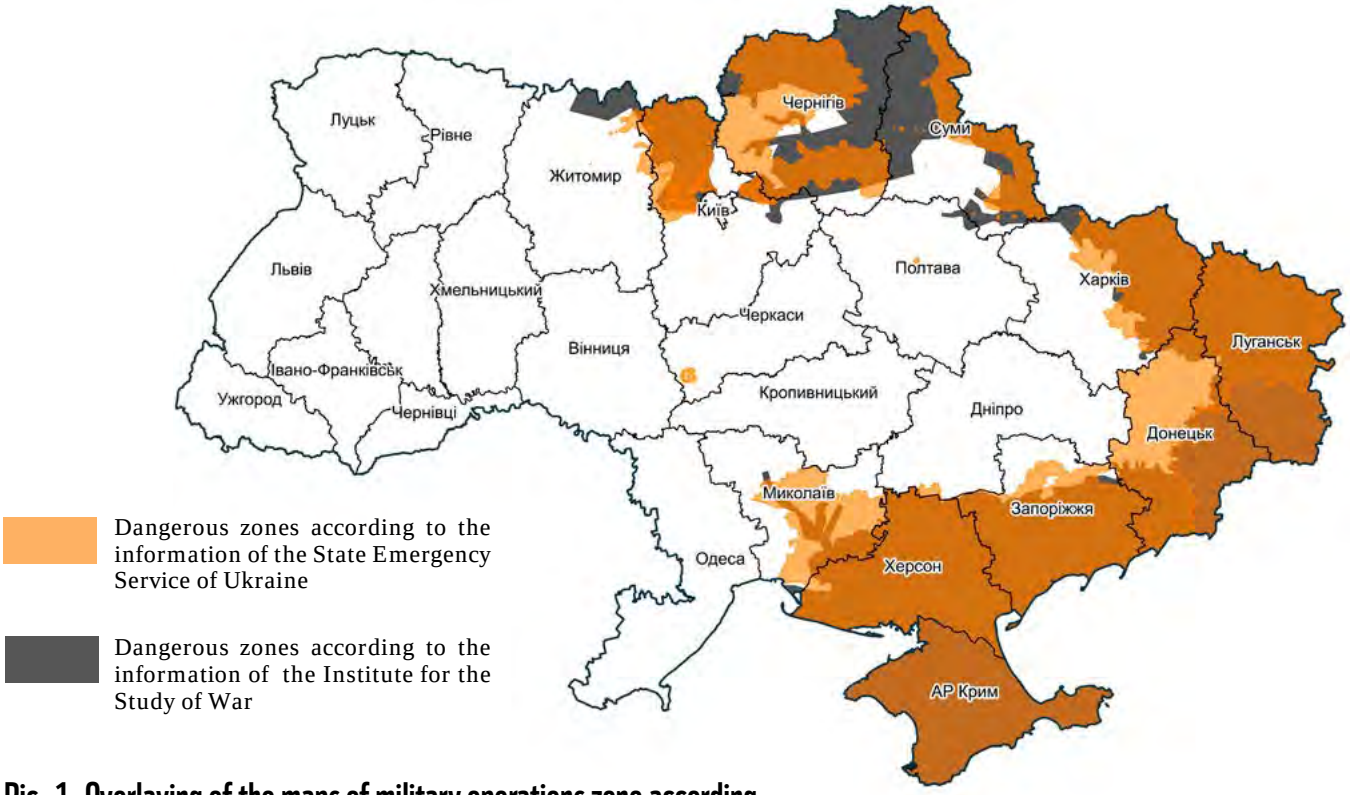
The following resources contain cartographic information about the war in Ukraine:

- Ministry of Defence of The United Kingdom
- The Institute for The Study of War (ISW)
- Geneva International Centre for Humanitarian Demining (GICHD)
- Live Universal Awareness Map (LIVEUAMAP)
- Ukraine War Map

The Mine Action Service of the State Emergency Service of Ukraine has developed an interactive map of territories that could potentially be contaminated with unexploded ordnance.

The above list of information resources makes it possible to analyze and assess the situation related to the military occupation of the territory of Ukraine, first, to assess the potential danger of contamination of the territory with unexploded ordnance. A comparison of the State Emergency Service of Ukraine map and the ISW map makes it possible to asses difference in data provided by different organizations (pic.1)



Pic. 1. Overlaying of the maps of military operations zone according to the data of the State Emergency Service of Ukraine and the American Institute for the Study of War ISW (® REEFMC)

All the given maps are created on the scale of the country; therefore, they are rather rough, and the regulatory framework for the filling and placement of the map is not supported. Therefore, **none of these maps can be used as a basis for decision-making on the suspension or resumption of forest management.**

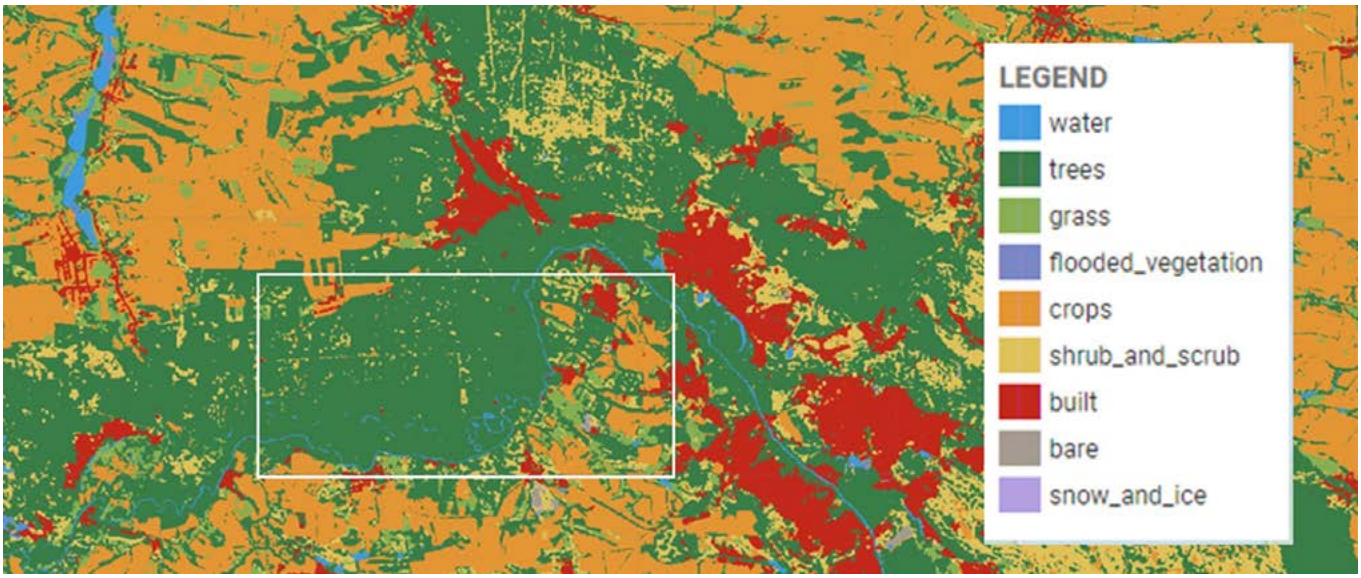
To create an accurate map it is necessary to clarify the situation on the ground. It is the method used by foresters in the liberated territories - they are involved in identifying potentially dangerous territories, then detailed survey and demining is being carried out. Considering the lack of access to a large part of the territories of Ukraine because of military actions, solving the problem of forest monitoring with the use of remote sensing data provides wide coverage of the territory with a sufficiently high spatial resolution. The mapping methodology for assessing the impact of military actions on forests, landscape fires and forest wildfires is based on available sources of information and the types of impacts.

CASE STUDY OF CHERNIHIV REGION

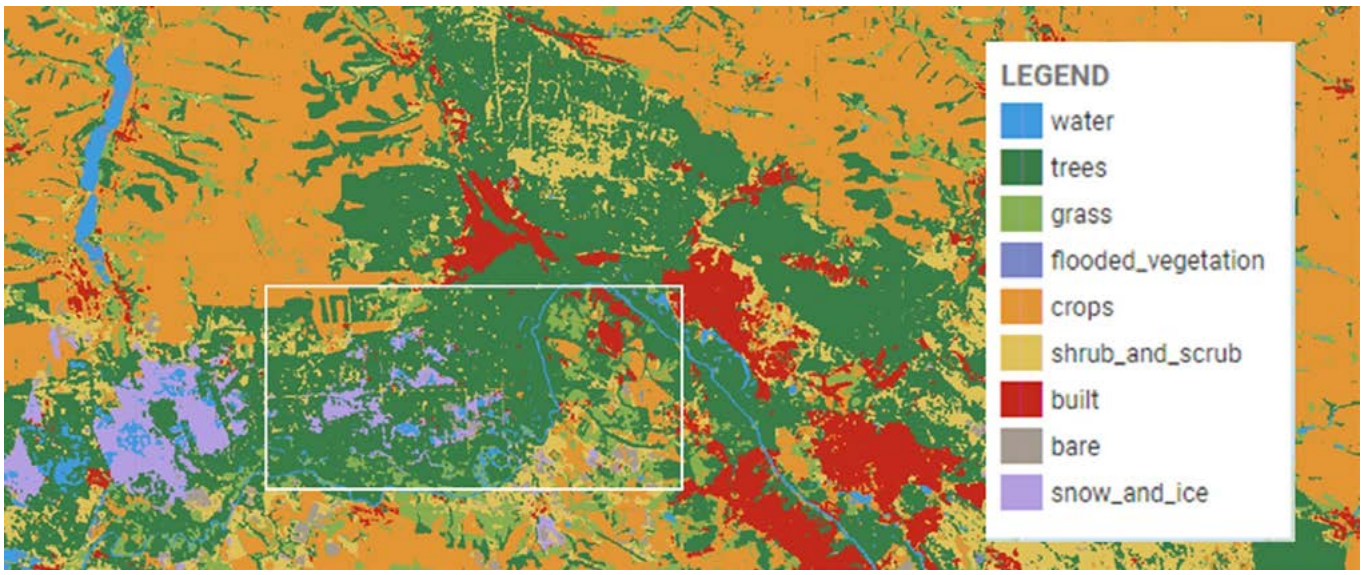
Joint interdepartmental commissions of forestry enterprises of the Chernihiv region and the State Emergency Service, the Ministry of Internal Affairs, and the Armed Forces of Ukraine collected the data from land surveys. A comparison of the data obtained from land surveys and the layer of the **State Emergency Service of Ukraine map** proves that the area is contaminated with unexploded ordnance **14 times lower than the map data.** The State Emergency Service of Ukraine map inaccuracy is caused by the maximum possible contaminated territory indication based on information about combat operations, military routes or their deployment, and shelling locations.

Close to real-time forest monitoring based on remote sensing technologies is challenging to provide. The alternative approaches are PlanenScope (Planet Team, 2017), used in Italy for identifying illegal clear cuttings, or Dynamic World based on Sentinel-2 and "trained" global machine learning models. Even under a false classification, where the wildfire ground is mistakenly classified as a flooded area, the resource quickly informs about the current forests' damages.

Pic. 2. Monitoring of forest disturbances in the war zone (Luhansk region) based on the Dynamic World system:
a) land cover of June-August 2021;



b) land cover of May 10 - June 10, 2022



KEY FINDINGS OF MAPPING

114 state forestry enterprises, 20 agricultural enterprises, 14 communal and 12 other forest users, and forest owners were affected by military actions. The largest areas of affected forests are located in Chernihiv (423.5 thousand ha), Sumy (287.9 thousand ha), and Luhansk (205.1 thousand ha) regions.

From February 24, 2022, to the end of June, the largest number of wildfires occurred in March (67% of the total area of wildfires), of which 52% were wildfires on agricultural land and 11% were forest wildfires (Table). More than half of the area (55%) affected by wildfires was in the regions with military activities. Forest wildfire areas predominated in May and June (38% and 34%, respectively), while agricultural land fires predominated in March and April (52% of the total area).

Pic. 3. Spatial wildfires distribution map between February 24 and March 31, 2022

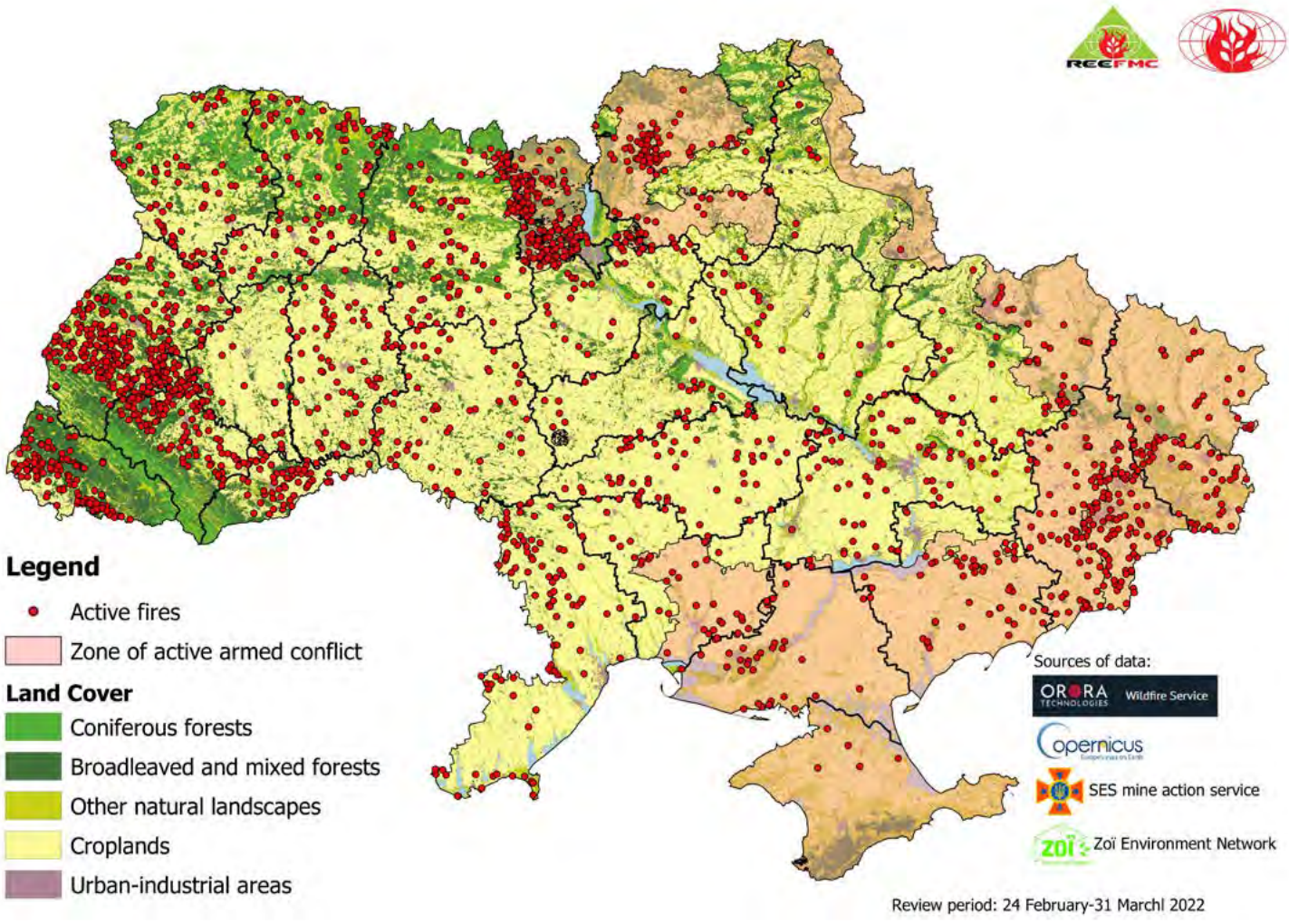


Table. Fires on the territory of Ukraine between February 24 and June 30, 2022

MONTH		ALL WILDFIRES		DISTRIBUTION OF THE AREA OF FIRES BY TYPES OF LANDSCAPES, ha				
		number	area, ha	forests	including conifers	agricultural lands	other natural landscapes	populated areas
FEBRUARY-MARCH	total	2 036	1 027 669	109 217	34 853	537 304	325 252	55 896
	in areas affected by military actions	725	484 210	46 595	21 563	244 979	157 508	35 128
APRIL	total	279	104 913	8 878	2 717	53 376	29 396	13 263
	in areas affected by military actions	125	64 957	6 715	2 386	27 184	20 946	10 112
MAY	total	395	261 960	100 682	69 757	58 971	82 493	19 814
	in areas affected by military actions	193	170 030	74 381	52 659	25 191	55 665	14 793
JUNE	total	241	150 054	51 059	33 541	35 517	44 788	18 690
	in areas affected by military actions	196	134 443	48 522	32 299	29 920	40 594	15 407
TOTAL	total	2 951	1 544 596	269 836	140 868	685 168	481 929	107 663
	in areas affected by military actions	1 239	853 640	176 213	108 907	327 274	274 713	75 440

Within the Emerald network, the area contaminated with unexploded ordnance is 1 100 427 hectares (24.5 % of Ukraine's nature reserve fund total area). Currently, it is difficult to assess the damage caused to the nature reserve fund due to the significant scale of contamination with unexploded ordnance and military actions that are still ongoing, as well as the lack of a single cadastre for the nature reserve fund. Nature conservation institutions are under the management of various departments and state institutions, organizations, and enterprises, and the information that should be stored in regional state administrations is often incomplete or absent.

FOREST MANAGEMENT - KEY RECOMMENDATIONS

Current anti-mine legislation in Ukraine does not define special actions in forests. This requires the development of three main documents:

- National long-term strategy for the management of forests contaminated with unexploded ordnance and mines and relevant regulatory acts
- National plan for the clearance of forests from unexploded ordnance
- National plan for conducting informational activities to raise awareness.

The most important task for the near future is the **safety of the local population**, who live near places with unexploded ordnance, and may also intentionally or unintentionally get into contaminated areas.

Prior to implementation of any forest management activities demining should be performed using specialised equipment.

In the case of damage to the **land within protected areas**, it is possible to consider the expediency of restoring the damaged object or establishing another one to compensate for the loss of conservation territories. Optimal solution shall include conducting biological inventories to identify which species were damaged and which remained on the territory.

Forest restoration in contaminated areas should be focused on natural regeneration. The species composition of natural regeneration in the case of its survival will differ from the species composition of artificial forests, which are usually created by forestry enterprises according to the typical schemes developed in the 70-80s of the last century.

Pest management should be aimed at remote monitoring of the forests' sanitary state by available means (drones, remote sensing). Pest outbreak preventive measures outside the contaminated territories with unexploded ordnance and mines should be done in a timely manner. Develop scientific recommendations on monitoring and prevention of outbreaks for forests in contaminated areas with the involvement of foresters, scientists, and other stakeholders.

CHALLENGES FOR IMPLEMENTATION

- Lack of Forest policy effective implementation tools
- Lack of synergy between practice and science which leads to not considering the essence of forest ecosystem dynamics under climate change
- Lack of impartial specialists in strategic planning in forestry and forest policy
- Lack of financial and technical support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POSSIBLE SOLUTIONS

- Advanced update of norms and regulations to EU Forest policy considering climate-friendly solutions and biodiversity friendly practices and a participatory process involving all stakeholders
- Update vocational and advanced training programs for forestry students and staff with wide involvement of scientists from leading national and international institutions
- Transfer of international experiences and technical support
- Ensure sustainable recovery and management of damaged forests

All **wildfire prevention and extinguishing** should be aimed at controlling the fire sources, informing the public about the dangers of wildfires in contaminated areas, limiting public access, and preparing long-term complex wildfire barriers (200-300 m wide and more, strips of hardwoods, paved roads), water sources, detection systems, early arrival to prevent fires from moving from explosive-free to contaminated areas and vice versa.

For the **regulatory framework** of forest management on contaminated territories, it is necessary to organize the process of exchanging available information, challenges, and solutions between forest users, departments, local authorities, the local population, and scientists. Some forestry enterprises can serve as a model for finding practical solutions and appropriate regulatory mechanisms.

Retention of jobs and qualified specialists in the forestry sector shall be secured under the process of reform of forestry enterprises and anticipated reduction of staff.

The development of forest policy shall focus on introducing effective tools for quick forest management problems identification, negotiation with the involvement of equal-right stakeholders, and legislative decision-making based on modern scientific research and world experience.

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Working to sustain the natural world for the benefit of people and wildlife.

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