Waldumbau von Kiefernwäldern zu einer naturnahen Waldwirtschaft in der Ukraine – unter besonderer Berücksichtigung der Resilienz gegenüber Feuer und Witterungsextremen wie Trockenheit nach den Prinzipien des Integrierten Feuer-Managements



BMEL/BLE Förderkennzeichen 28I-034-01

Anlage Feuer-Management zum Abschlussbericht 2022 (Englisch)

Annex to the Final Report 2022

Activities implemented by the Regional Eastern Europe Fire Monitoring Center (REEFMC) within the project

"Transformation of Pine Stands into Natural Forests in Ukraine – with Special Regard to Fire Resistance and Extreme Weather Conditions, such as Drought on the Basis of Integrated Fire Management" (RESILPINE)

BLE Grant Agreement No. 28I-034-01

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<u>Introductory remarks</u>: Due to the start of the war in February 2022 the originally planned field activities, political consultations and a regional expert meeting on fire management could not be performed as planned. Therefore, the results of the last interim report 2021 constitute the core of this Annex. In addition, the unplanned war-related activities of the REEFMC Team, supported by GFMC, are listed. They are focusing on monitoring of collateral damages arising from the armed conflict, notably forest fires.

I. Analytical and field work

Within Task 1 «Options for the stands structure or admixture of hardwood species in pure pine stands with a view to reducing the risk of fire» the following activities were implemented:

I.I. Literature review

In Ukraine, narrow and outdated approach to fires and fire management still prevails both among ground forest managers and policy makers. Namely, forest fires are considered as a certain social phenomenon in forests that could be controlled within traditional forest management activities by wider applying old prevention measures and strengthening technical capacity of suppression (Zibtsev, 2020). Literature review proved that in Ukraine had developed a number of studies and practical long-term experiments that are

considered a basis for implementation for advanced approaches to forest fire management (Goldammer et al., 2019) as a part of landscape fires phenomena that occurred on all type of landscapes (cultural, natural, urbean-industrial) and driven by climate, land use and social changes and require long term measures toward more fire resilient landscapes and communities.

Since the end of 19th century, Ukrainian researches had been testing with long-term experiments a number hypothesis has been studied in the area of: underplanting or admixture of hardwood species under canopy of pine stands and its influence on microclimate, growth, health of trees, grass vegetation and forest litter; forest health, grow and microclimate in mixed coniferous-deciduous forest with different density and undergrowth; biodiversity and vegetation structure of forests edges and their classification; impact of fires with different severity of forest health and stand dynamic. Based on literature review most appropriate silviculture technologies for increasing fire resilience of pine stands were selected and tested with the field experiments within RESILPINE project.

I.II. Field experiments

1) During the project implementation in the forests of State Enterprise "Teteriv" four research sites were established:

- <u>Plot FRES Tet 41</u>. In the compartment 41-42 Teteriv ranger district plantation was established accordingly to the scheme: 9 rows of Scots pine 1 row of birch. Because of location of site along a road, with the aim to form a more resistant to fires and climate change forest it was planted forest belt with seven rows of pure birch. In the future, within thinning activities will be formed a mixed more resilient to fires stand with species composition 60% of Scots pine, 30% of birch, 10% oak. The forest site type is "fresh subir" (B₂). The plot was established in the spring of 2021.
- <u>Plot FRES Tet 75</u>. In the forest compartment 75-28 of the Potashnyansky district the fire-resistant forest edge 15 m wide planted with next structure: one row of hazelnut and two rows of birch.
- <u>Plot FRES Tet 38</u>. In the compartment. 38-12 Myhalskogo ranger district, established forest edge from birch with an admixture of common oak with wide 50 m. Pre mature pine stands located near this edge in 20 years will be cut down and replaced with mixed pine stands. By that time, 20-year-old birch stand will create fire resistant belt to protect pine plantations from fires during their growth until the age of 20-30 years. The choice of the main species birch is due to the fact that the type of habitat conditions of this area is a poor variety of fresh bor. In the future, when the surrounding pine plantations will reach medieval age and fire safety issues will not be so acute, and birch will reach maturity and be cut down.
- <u>Plot FRES_Tet_107</u>. In the compartment 107-15 of Piskivskoho ranger district, pure birch forest was established for protection of neighbor young pine plantation from potential fire moving from the nearest road.

There are 8 plots in stands with dominating of hardwood species of natural origin established and studied in Teteriv forestry enterprise to understand the role of such forests to resist fires.

2) Two plots were established in the forests of NUBiP of Ukraine (Boyarka Forestry Research Station):

- <u>Plot FRES BLDS 43</u>. On June 4, 2021, an experiment on the planting of a fire-resistant forest edge was established in the pure pine forest edge. To protect the forest from the penetration of fire from open areas (field, floodplain, settlement, etc.) a belt of deciduous species was planted. The area where the experiment is established is characterized by frequent penetration of fire into the forest from the floodplain of the Irpin River in the spring due to large load of light combustible materials grass (<u>https://nubip.edu.ua/node/90446</u>, <u>https://nubip.edu.ua/node/90386</u>).
- <u>Plot FRES BLDS 143</u>. On the deforested grass covered site near pine plantations in the "Boyarka FRS", Boyarka ranger district compartment 143-13 the forest edges experimental site were established with birch and lime tree. The experiment was established to protect pine forest from fires that often ignited from side of the settlement Boyarka and road nearby (<u>https://nubip.edu.ua/node/106128</u>).

- 3) Two experimental plots were established in the forests of Oster Military Forest Enterprise:
- <u>Plot FRES_Ost_2021_372</u>. On April 13, 2021, REEFMC team together with foresters of the Oster Military Forestry State Enterprise jointly established plot on planting fire-resistant forest edge to protect pine plantations, which suffer from arson on the border with the Desna floodplain every spring (<u>https://nubip.edu.ua/node/90854</u>, <u>https://nubip.edu.ua/node/90580</u>).
- <u>Plot FRES_Ost 2021 248</u>. The experiment includes establishing common oak underneath of the canopy of pure pine stand. The experiment was established on 9 November 2021 in a pine plantation (age: 31 years) by seeding *Quercus robur* L. underneath of pine forest. Root diseases of pine (*Fomitopsis annosa*) impacted stand and resulted in dieback of patches of trees (gaps) of Scots pine. In the future, it is expected development of a mixed, uneven aged, complex structure stand (<u>https://nubip.edu.ua/node/100665</u>).

4) Field survey of damage level (dnbr) of burned pine forests in Luhansk oblast

• The region was affected by fires in 2020. REEFMC team conducted field survey of burned forests based on regular plots on grid 4 per 4 km on the area of 28 000 ha with the aim to find patches of forests that survived after the fire and so, could serve, as a model of fire resilient stands. The survey was carried out within the forests of four forest and hunting state enterprises: Severodonetske, Novoaydarske, Kreminske and Stanychno-Luganske (https://nubip.edu.ua/node/90418).

I.III. Analyses of forest and forest edges

The analysis of the database of forest inventory data of forests of the Boyarska Forest Research Station, Teteriv Forest Enterprise and Oster Military Forest Enterprise was performed for classification of stands by parameters of fire hazard and forest edge structure.

I.IV. Analyses of fire history

Fire history was studied for three forestry enterprises – partners of the project. It was shown that half and more fires occur within 200 m forest edge in the border with agriculture or other cultural lands. So, to avoid severe fires in the future that enter forests from fields silviculture approach for design hardwoods edges is a best and long-term solution for reducing of amount and areas of landscape fire.

II. Policy activities

Within Part III of SoW (Ausführliche Vorhabenbeschreibung, Themenfeld III) the following activities were implemented.

II.I. <u>Contribution of the REEFMC team to various working groups related with needs of development of a</u> <u>new national fire management policy, including promotion of project, in particularly</u>:

- Meeting of the working group established by State Agency of Ukraine on exclusion zone management on the development of the "Fire Management Plan aimed at strengthening the protection from firs of natural complexes in the Eclusion Zone" (<u>https://nubip.edu.ua/node/87664</u>).
- Press release of the Ministry of Environmental Protection and Natural Resources of Ukraine "Germany supports Ukraine on the path to sustainable development", including support of the development of the State Strategy of the National Landscape Fire Management System supported by the Germany-based Global Fire Monitoring Center (GFMC) (<u>https://gfmc.online/wp-content/uploads/Germany-Ukraine-Sustainable-Development-Ministry-Ecology-Nat-Resource-PR-30-April-2021.pdf</u>).

II.II. Working with media for increasing visibility of the project:

 Professor of the Department of Forestry S. Zibtsev took part in the International Conference "Aerial Forest Fire Fighting" in Tallinn, Estonia. On October 12-13, 2021. International conference "Air Extinguishing of Forest Fires" was held in Tallinn, Estonia (<u>https://nubip.edu.ua/node/99431</u>).

- 2. Interview of Sergiy Zibtsev to National Ukrainian Radio on fires in Turkey (<u>https://nubip.edu.ua/node/95709</u>).
- 3. September 28, 2021, International round-table "Current Problems of Prevention and Suppression of Forest Fires in View of Climatic Change".

II.III. <u>Implementation of project recommendations into practice and sustaining of further research, related</u> with project:

- 1. All-Ukrainian Forum "Ukraine 30. Ecology" initiated by the President of Ukraine, Volodymyr Zelensky. The forum is a discussion platform where representatives of the authorities of all levels, the expert community, civil society and the international community raise a number of issues that need to be addressed in environmental protection and preparedness to climate change. The "National Strategy for Landscape Fire Management" was presented jointly by Bohdan Borukhovsky (First Deputy Minister of Environmental Protection and Natural Resources of Ukraine), Oleh Bondarenko (Chairperson of the Committee on Environmental Policy and Nature Management), Taras Kacha (Deputy Minister for Economic Development, Trade and Agriculture of Ukraine), Yuriy Bolokhovets (Head of the State Agency of Forest Resources of Ukraine), Andriy Malovany (Head of the State Ecological Inspectorate) Sergiv Zibtsev (Head of REEFMC); supported by GFMC: and Kiev, Ukraine. https://nubip.edu.ua/node/93901 (English). https://nubip.edu.ua/node/93866 (Ukrainian).
- Prof. Sergiy Zibtsev took part in a meeting led by the Governor of Luhansk Oblast on suppression of consequences of large forest fires that occurred in 2020, afforestation of lands affected by fires in Luhansk region(<u>https://nubip.edu.ua/node/88955</u>).
- Representatives of the Regional Eastern Europe Fire Monitoring Center took part in a round table discussion on "Development of interagency coordination for monitoring, prevention and control of forest fires"(<u>https://nubip.edu.ua/node/89429</u>).
- 4. On December 2, 2021, REEFMC team organized a scientific-practical online seminar: "Experience in forestry and forest protection from fires in Germany" (<u>https://nubip.edu.ua/node/102225</u>).
- First Training for fire managers. Event date: 24-26 May 2021. The training was attended by 34 senior management personnel, 28 of them represented all forestry enterprises of the Chernihiv Oblast Forestry Administration. Rest of the participants represented by Desnyansko-Starogutsky National Nature Park, Drevlyanskiy Nature Reserve, and the Main Directorate of the State Emergency Service of Ukraine in Kyiv region (<u>https://nubip.edu.ua/node/93281</u>).
- Second Training for fire managers. Event date: 4-6 October 2021. The training was attended by 18 senior management, 12 of them represented forestry enterprises of State Forest Enterprises of the Kirovograd Oblast Forestry Administration. Others represented the State Enterprise "Slavuta Forestry", Communal Enterprise of Krupetsk Village Council "Specialized Forest Communal Enterprise" and State Enterprise "Festive Forestry" (<u>https://nubip.edu.ua/node/98940</u>).
- 7. First Training for Fire Volunteers of Luhansk Region. Event date: 26-27 June 2021. The training was attended by 25 volunteers from Luhansk region: representative of the TV channel "Donbass Online", representatives of the Rubizhne territorial community, foresters of Severodonetske, Novoaydarske, Stanychno-Luganske, Kreminske forest and hunting enterprises, representatives of NGO "Vostok-SOS". The purpose of the training is to deepen the theoretical knowledge and practical skills of volunteers in the following areas: protection of settlements and local population from forest fires; improving the exchange of information on fire risks between fire brigades of forest hunting, SES and local authorities, OTG, civil defense forces; fire prevention, support of professional forest fire brigades in extinguishing fires, rules of personal safety on fires; the role of volunteers in conducting regular preventive work with OTG in cooperation with the SES, forestry and civil defense in fire prevention (https://nubip.edu.ua/node/94665).
- 8. Second Training for Fire Volunteers of Luhansk Region. Event date: 25 September 2021. The training was attended by 24 volunteers from Luhansk region, a representative of the TV channel "Donbass Online", representatives of the Rubizhne territorial community, local foresters and NGO. As a result, the participants of the training compiled a list of promising areas in which volunteers can work to improve the protection of natural areas from fires. The purpose of the training is to continue working towards improving the theoretical knowledge and practical skills of volunteers mentioned above and also planning patrol routes in areas with high risks of landscape fires.

9. Third Training for Fire Volunteers of Luhansk Region. Event date: 27 November 2021. The training was attended by 25 volunteers from Luhansk region, representatives of the Rubizhne territorial community, local foresters, representatives of NGO "Vostok-SOS", representative of the TV channel "Donbass Online". As a result, the participants of the training compiled a list of promising areas in which volunteers can work to improve the protection of natural areas from fires. The purpose of the training is to continue working towards improving the theoretical knowledge and practical skills of volunteers mentioned above and planning patrol routes in areas with high risks of landscape fires (https://sd.ua/afisha/14202).

III. Purchase of equipment

REFMC team received equipment for firefighting from the project including personal protection equipment of firefighter, hand tools for firefighting and slip-on-unit for use during trainings and practical application for fire suppression. The slip-on-unit RotFire is used by REEFMC in the Boyarka Forest Experimental Station of NUBIP for training and fighting fires (<u>https://nubip.edu.ua/node/88034</u>).

IV. Research stay for REEFMC staff in Germany

During 25-30 October 2021, the REEFMC team, the delegation of the National Forestry University of Ukraine led by the Vice-Rector for Research, Professor V. Lavny, as well as representatives of Oster Military Forestry and Semenivske Forestry studied the German experience in adaptation of forests to climate change at the University of Eberswalde, Brandenburg. The delegation from Ukraine acquainted with forestry activities in mixed and pure plantations with the presence of European beech, European spruce, white fir, giant fir, rock oak, Scots pine and other local and introduced forest tree species, and studied the experience of forest protection from fires on territories contaminates with unexploded ordnance demonstrated by GFMC Director Johann Georg Goldammer

https://nubip.edu.ua/node/100679, https://gfmc.online/globalnetworks/balticregion/BalticRegion 7.html

https://gfmc.online/programmes/natcon/gfmc-ukraine-resilpine-2021.html

The complete version of the report (Ukrainian) can be downloaded at the following link:

https://drive.google.com/file/d/1g3WU8kurUc49sgzeWjSYO5S8QGmvrlC5/view?usp=sharing .

Brief summary of Key scientific and technical results of activities in 2021 and 2022

Fieldwork

1) During the implementation of the project in the forests of "Teteriv Forestry" four research plots were established: 1) Teteriv Forestry sq. 41 area. 42 with an area of 2.4 ha; 2) Potashnyanske forestry sq. 75 area. 28 with an area of 0.7 ha; 3) Migalske forestry sq. 38 area. 12 with an area of 2.5 ha; 4) Piskivske Forestry sq. 107 area. 15 with an area of 0.4 ha. All selected areas are freshly logged in 2021.

Plot FRES_Tet_41. In the compartment 41-42 of Teterivske ranger district had created pine plantation with admixture of birch. The plot is adjacent to a 50-meter protective line along highways. From the roadside had planted 7 rows of pure birch and in other area birch was admixture into a pine plantation. The goal – mixed forest with Scots pine with deciduous species (birch). Trees were planted in the spring of 2021.



Figure 1. Location of the experimental plot FRES_Tet_41 on the map (<u>https://forests.org.ua</u>)



Figure 2. Plot view FRES_Tet_41 (a), planted birch seedling (b)

Plot ID	FRES_Tet_41
Coordinates	Teteriv Forestry, compartment 1-42, <u>50°43'47.2"N 29°37'16.8"E</u>
Area	2,2 ha
More photos of	https://drive.google.com/drive/folders/1semdFLRuEUewoCmRjeyV7bskl5f8-
the plot	KBt?usp=sharing

Plot FRES_Tet_75. A fire-fighting fire barrier was created from deciduous species – *Betula pendula* Roth., *Frangula alnus* Mill., *Amelanchier ovalis* Medik., *Malus sylvestris* (L.) Mill.



Figure 3. Location of the Plot FRES_Tet_75 experimental site (https://forests.org.ua/)



a)

Figure 4. Plot view FRES_Tet_75 (a), rows of planted birch (b)

Plot ID	FRES_Tet_75
Coordinates	Teteriv Forestry, Potashnianske forest ranger district, compartment 75-28 50°42'16.9"N 29°44'20.3"E
Area	0,8 ha
More photos	https://drive.google.com/drive/folders/1vjolZ0Q8P5pYrUzbvS9hr0E7E6hjXDtg? usp=sharing

Plot FRES_Tet_38. In the compartment 38-12 of Mygalivske ranger district. In the compartment 38-12 of Mygalivske ranger district had created of birch with an admixture of common oak by sowing. This choice of species is due to the fact that the site has an elongated shape and is located among the premature and mature stands of Scots pine, which in the next 20 years will be cut down in the order to current Forest Management Plan. The choice of tree species is related to the soil and climatic conditions of the region.



Figure 5. Location of the experimental plot FRES_Tet_38 (<u>https://forests.org.ua/</u>)



a)

Figure 6. Plot view FRES_Tet_38 (a), rows of birch (b)

Plot ID	FRES_Tet_38
Coordinates	Teteriv Forestry, Myhalivske ranger district, compartment 38-17 (38/2) <u>50°38'21.7"N 29°37'35.9"E</u>
Area	2,7 ha
More photos	https://drive.google.com/drive/folders/1qIYm6Pa_npvRH6NCSfE0Kg0v02F28vhS ?usp=sharing

Plot FRES_Tet_107. Compartment 107-15 Piskivske ranger district. Fire resilient stands of artificial and natural origin (Figure 7).

b)



Figure 7. Fire resilient mixed plantations. Scots pine with birch (*a*), European larch, European spruce and birch (*b*)

2) Boyarka Forest Research Station

Plot FRES_BLDS_43. Planting by REEFMC team with students of experimental edge as a mixed hardwoods forest. In pure pine forest had created experiment plot - fire resilient forest edge. To protect the forest from the fire from open areas (fields, floodplains, settlements, etc.) created the edge of deciduous species. This forest every spring has a high fire risk by fire from open land (floodplain of the Irpin river). This forest is characterized by large reserves of light combustible materials – grass.



Figure 8. Location of the Plot FRES_BLDS_43 experimental site (based on Google Map)

The edges were created by planting one yearly seedlings of *Tilia cordata* Mill., *Malus sylvestris* Mill. and *Pyrus pynaster* L.



Figure 9. Plot FRES_BLDS_43 in spring (a) and summer (b), REEFMC team during experiment (c), edge in summer (d)

The experiment is designed for 50 years. This long-term experiment will allow tracking the impact of forest fire edges on the movement of fire into the depths of the forest and determine their optimal parameters.

Plot ID	FRES_BLDS_43
Description	https://nubip.edu.ua/node/90446
Coordinates	Boyarka Forest Experimental Station, Plesetske ranger district, 43-13, 50°20'02.3"N 30°09'20.9"E
Area	2 ha
Photos of the plot	https://drive.google.com/drive/folders/1Q5FvRvxI- uW0HywwgwWJFYxRuzYvgQPi?usp=sharing

Plot FRES_BLDS_143. Experimental plot in Boyarka ranger district. On the non-stocked area among the pine forest in the Boyarka Research Station (compartment 143-13) edges of deciduous species (*Tilia cordata* Mill., *Betula pendula* Roth.) were created. The plantations were created on the border of the forest massif with the settlement of Boyarka.



Figure 10. Location of the experimental plot *Plot FRES_BLDS_143* (based on Google Map)



Figure 11. Preparation of soil for planting hardwood edge near fire-prone pine stand in settlement (a), planted birch, apple, pear, lime tree on plot (b).

Plot ID	FRES_BLDS_143
Description	https://nubip.edu.ua/node/106128
Coordinates	BLDS, Boyarka ranger district 143-13, <u>50°18'04.1"N 30°20'20.8"E</u>
Area	0,5 ha
Photos of the plot	https://drive.google.com/drive/folders/1LK8ZxX_ZLISHWLks2ZjMMmNxqhoNrZU h?usp=sharing

3) State Enterprise "Oster Military Forestry"

Plot FRES_Ost_2021_372. Teams of REEFMC with specialists of the Oster Military Forestry State Enterprise jointly created a scientific experiment to create fire-resilient forest in a place, which suffers from fire on the border with the Desna floodplain every spring.



Figure 12. Location of the plot Ost_2021_372 (based on Google Map)

The purpose of the experiment is to test various way to increase fire safety of forest edges to prevent the spread of fire from open landscapes. To create fire resilience edges was used deciduous tree species (*Betula pendula* Roth., *Populus tremula* L.).



Figure 13. Planting of hardwoods mixed edge on the border of flood plain of river Desna (a), overall view of plot *FRES_Ost_2021_372* (b)

In the future, in similar areas with high fire risk planning to increase the number of experimental sites and expand the range of tree species.

Plot ID	FRES_Ost_2021_372
Description	https://nubip.edu.ua/node/90854
Coordinates	State Enterprise "Oster Military Forestry", Gorodyshenske ranger district 372-11/ 12/ 14. <u>50°53'47.4"N 30°46'51.1"E</u>
Area	1,0 /1,4 /0,3 ha
Photos of the plot	https://drive.google.com/drive/folders/1Q5FvRvxI- uW0HywwgwWJFYxRuzYvgQPi?usp=sharing

Plot FRES_Ost_2021_248. November 9, 2021 REEFMC staff together with staff of Oster Military Forestry were established an experimental plot in a pure pine plantation aged 31 years. We had sowed seeds of *Quercus robur* L. under a tent of Scots pine. In the future, it is planned to gradually form a mixed, different age structure of the forest.



Figure 14. Planting of hardwoods edge (aspen, birch) near the road where fires often occurred (a), plot FRES_Ost_2021_248 (b)

In the future, we plan to establish underneath vegetation with common oak. In addition, thinnings from below will be applied to support best trees of Scots pine trees. Such structure of the stand could increase the resilience to climate change and fires in the future.



Figure 15. Installed board with information on experiment. Volodymyr Braiko – director of the State Enterprise "Oster Military Forestry"

Plot ID	FRES_Ost_2021_248
Description	https://nubip.edu.ua/node/100665
Coordinates	State Enterprise "Osterske Military Forestry", Karpylivske ranger district 248-8, <u>50°58'29.4"N 30°44'50.2"E</u>
Area	3,6 ha
Photos of the plot	https://drive.google.com/drive/folders/15WA4SM0CtQBWyhoGU_cbXDemINaX ByKb?usp=sharing

SE Teteriv Forestry

State Enterprise Teteriv Forestry with a total area of 35.692 ha is located in the western part of Kyiv oblast, of which 32.168 ha are covered with forest. The administrative and organizational structure of the forestry includes eight forestry units: Kukharske (5313.7 ha), Blidchanske (4103.9 ha), Teterivske (4740.2 ha), Potashnyanske (4768.5 ha), Myrchanske (3898.9 ha), Piskivske (3823.9 ha), Myhalske (4116.6 ha), Kodryanske (4927.0 ha). The area of the forestry is one of the agricultural districts of the oblast. The forest cover of the oblast is 39.4%. The forests of the forestry are located in one massif, except for 163.2 ha, which are located separately.

According to forest zoning, the territory of the forestry belongs to the forest vegetation zone of Polissya, Kyiv-Chernihiv Polissya (eastern Polissya) forestry district and is part of the Dnipro-Polissya forestry district (Complex forestry zoning of Ukraine and Moldova, 1981, Moldova, K.).

The climate of the forestry area is temperate continental with mild winters and warm summers with sufficient rainfall, which is necessary for the vegetation of forests and favorable for agriculture. Average climatic indicators according to Teteriv meteorological station: average annual temperature +7.1 °C, minimum -36.7 °C, maximum +38.7 °C, average annual precipitation - 645 mm, duration of the vegetation period – 229 days.

The territory of the forestry has plain relief. The main types and kinds of soils are (%): sod-podzolic (76 %), swamp (4 %), sod (20 %). According to the degree of humidity, most of the soils are fresh (index - 2) - 82.0%. Forest areas with excessive moisture account for 4.2 % of the area covered by forest vegetation. The swamps cover an area of 758.4 hectares. According to the type¹ of forest vegetation conditions, 52% is B₂, 24 % - C₂, 7 % - A₂, 7 % - C₃, the rest are others.

Among the forested areas, the largest share is occupied by Scots pine stands (*Pinus sylvestris* L.) – 87.5 % (28135.1 ha), oak stands (*Quercus robur* L.) – 3.2 % (1016.4 ha), hanging birch (*Betula pendula* Roth.) – 4.7 % (1514.0 ha). The rest is occupied with black alder (*Populus tremula* L.), aspen (*Populus tremula* L.), European spruce (*Picea ábies* L.), hornbeam (*Carpinus betulus* L.), white acacia (*Robinia pseudoacacia* L.) and others.

Nº	Species	Density (min – 0, max – 1)					Total	%	
		0.1	0.2	0.3	0.4	0.5	0.6	area, ha	
1	Frangula alnus	26.6	1448.7	69.5	995.3	2.4	400.8	2943.3	44.84
2	Sorbus aucuparia		849.6	3.3	254.6		54.6	1162.1	17.71
3	Corylus avellana	3.5	510.1	16.4	430.9	6.0	177.5	1144.4	17.44
4	Juniperus communis L.		460.3		82.0		28.7	571.0	8.70
5	Sambucus racemosa	10.0	242.0		31.0		15.9	298.9	4.55
6	Salix viminalis L.		34.2		192.0		39.8	266.0	4.05
7	Caragana frutex		7.3		23.4			30.7	0.47
8	Sambucus nigra L.		24.1		6.1			30.2	0.46
9	Prunus padus		1.4		14.5		4.4	20.3	0.31
10	Euonymus verrucosus		12.7		7.0			19.7	0.30
11	Swida sanguinea L.		9.9		2.3		2.6	14.8	0.23
12	Acer tataricum		7.7		3.7		0.2	11.6	0.18
13	Viburnum opulus				11.0			11.0	0.17
14	Salix caprea L.				8.8			8.8	0.13
15	Rubus caesius L.		0.2		4.7	0.4	1.7	7.0	0.11
16	Euonymus europaeus		3.0		1.8		2.2	7.0	0.11
17	Crataegus oxyacantha		5.8					5.8	0.09
18	Ulmus minor Mill.		2.9					2.9	0.04

Table 1. Distribution of the forest area with understory of Teteriv Forestry by relative density (sq. m per ha)

¹ A, B, C, D – forest soil fertility index (from poor to fertile) and 0, 1, 2, 3, 4, 5 – soil moisture index (from very dry to very wet)

Nº	Species	Density (min – 0, max – 1)						Total	%
		0.1	0.2	0.3	0.4	0.5	0.6	area, ha	
19	Pyrus communis L.		2.4					2.4	0.04
20	Rosa canina L.		2.4					2.4	0.04
21	Amelanchier ovalis				1.4			1.4	0.02
22	Fraxinus excelsior L.				1.1			1.1	0.02
23	<i>Betula pendula</i> Roth.					0.5		0.5	0.01
	Total	40	3625	89	2072	9	728	6563	100

¹ A, B, C, D – soil fertility (from poor to fertile) and 0, 1, 2, 3, 4, 5 – soil moisture (from very dry to very wet)

Table 2. Distribution of the forest area with th	ne undergrowth of Teteriv Forestry by density
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		Number, thousand units per hectare								Total		
Nº	Species	0,1- 1,0	1,1- 2,0	2,1- 3,0	3,1- 4,0	4,1- 5,0	5,1- 10,0	10,1- 15,0	15,1- 30,0	≥30,1	area, <i>ha</i>	%
1	<i>Betula pendula</i> Roth.	47.3	116.0	40.4	18.2	1.7					223.6	15.3
2	Alnus glutinosa (L.) Gaerth.	1.8	12.0	10.9	6.3	16.1					47.1	3.2
3	Carpinus betulus L.	14.3	4.5	20.9	13.4	11.3	3.1		1.5		69.0	4.7
4	Quercus robur L.	372.9	82.5	26.0	25.7	2.0				3.8	512.9	35.1
5	Acer platanoides L.	3.5									3.5	0.2
6	Acer negundo L.	6.9									6.9	0.5
7	Populus tremula L.	17.8	3.3	2.2	4.4	0.6					28.3	1.9
8	Pinus sylvestris L.	162.2	145.8	125.8	21.4	81.7	23.4	5.0			565.3	38.7
9	Picea abies L.	2.7									2.7	0.2
	Total	629	364	226	89	113	27	5	2	4	1459	100

The territory of the enterprise's forests is characterized by an average class 2.02 of fire danger, which is due to the large proportion of pine plantations covered with forest vegetation (88.5 %), including young pine (25.9 %).

Ecroptry district		Forest F	Total	Mean			
Forestry district	1	2	3	4	5	area, <i>ha</i>	class
Blidchanske	1163.4	2588.5	133.7	109.3	109.0	4103.9	1.88
Kodryanske	2390.5	2074.2	115.0	131.8	215.5	4927.0	1.72
Mygalske	915.8	2243.2	333.9	357.9	265.8	4116.6	2.22
Myrchans'ke	918.2	877.0	728.6	897.1	478.0	3898.9	2.77
Potashnyanske	1579.6	1834.1	482.2	655.8	216.8	4768.5	2.18
Teterivske	1378.2	2959.4	177.0	117.8	107.8	4740.2	1.86
Kukhars'ke	2552.0	2297.1	281.7	86.7	96.2	5313.7	1.65
Piskivske	1334.4	1577.9	312.6	295.3	303.7	3823.9	2.12
Total	12232.1	16451.4	2564.7	2651.7	1792.8	35692.7	2.02

Table 3. Distribution of area of Teteriv Forestry forest by fire danger classes*

* 1st class - the least danger, 5th class - the greatest danger

SE Oster Military Forestry

State Enterprise "Oster Military Forestry" with a total area of 16,616.7 hectares, of which 13915.8 ha is covered with forest - is located in the southwestern part of Chernihiv oblast. The administrative and organizational structure of the forestry includes five forestry: Bondarivske (3063 ha), Koropske (4813 ha), Karpylivske (3140 ha), Horodyshche (3060 ha), Desnyanske (2540 ha). The area of the forestry is one of the agricultural districts of the oblast. The leading branch of the national economy is stockbreeding. The forest cover of the administrative district, on the territory of which the forestry is located, is 19 %. Forests in the area are uneven. The area of the forestry is characterized by a well-developed network of public transport routes. The economic activity of the forestry aims at the integrated management of forestry and hunting in combination with the harvesting and processing of wood and other measures aimed at the

rational use and restoration of forest resources. In addition to meeting the needs of the national economy in wood and forest by-products, forest plantations are important for conservation and recreation.

According to forest zoning, the territory of the forestry belongs to the zone of Ukrainian Polissya, the subzone of Chernihiv Polissya. The territory of the forestry has a hilly plain relief. The climate of the forestry area is temperate-continental. Average climatic indicators: average annual temperature +6,4 °C, minimum -37,8 °C, maximum +37,0 °C, average annual precipitation – 570 mm, duration of the vegetation period – 195 days.

The predominant soils are sod-podzolic and sod-podzolic gleied. Depending on the thickness of the podzolic horizon, they are divided into weak, medium and strongly podzolic soils. By type of forest vegetation conditions 40 % is B₂, 27 % - A₂, 10 % - C₄, 6 % - C₃, the rest are others. According to the degree of humidity, most soils are fresh (index -2). The share of forest areas with excessive moisture is 11.9 % of the forest area covered with forest vegetation. The swamps cover an area of 1168 ha.

Among the forested areas, the largest share is occupied by Scots pine stands (*Pinus sylvestris* L.) - 72.5% (9820.3 ha), black alder (*Alnus glutinosa* L.) – 13.6 % (1890.5 ha), hanging birch (*Betula pendula* Roth.) – 10.8% (1505.8 ha). The rest are plantations of common oak (*Quercus robur* L.), white acacia (*Robinia pseudoacacia* L.), aspen (*Populus tremula* L.) and others.

Nia	Species			[Density	(min –	0, max	- 1)				Total	tal	
Nº		0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	1,0	ha	%	
1	Frangula alnus	16,0	227,8	665,4	917,7	321,6	413,0	251,4	47,7	25,3	0,9	2886,8	74,25	
2	Corylus avellana		25,7	61,4	167,8	61,5	80,6	11,2	8,1	24,4		440,7	11,34	
3	Sorbus aucuparia		23,9	62,1	70,2	153,2	50,5	42,3	18,0	0,9		421,1	10,83	
	Sambucus		10.9	20.2	24.4		16 5					00.0	2.24	
4	racemosa		19,0	20,2	34,4		10,5					30,3	2,34	
5	Caragana frutex		3,1	2,9	3,4	21,6	1,0					32,0	0,82	
6	Salix caprea L,		6,1	0,9					6,0			13,0	0,33	
	Sambucus nigra			2.0								2.0	0.05	
7	L,			2,0								2,0	0,05	
8	Acer negundo L,						1,2					1,2	0,03	
	Total	16	306	815	1194	558	563	305	80	51	1	3888	100	

Table 4. Distribution of the forest area with understory of Oster Military Forestry by relative density

Table 5. Distribution of the forest area with undergrowth of Oster Military Forestry by density

			Numbe	r, thousa	nd units	per ha	-	Total	
Nº	Species	0.1-	1,1-	2,1-	3,1-	4,1-	5,1-	area,	%
		1,0	2,0	3,0	4,0	5,0	10,0	ha	
1	<i>Robinia</i> pseudacacia L,	53,6	89,8	16,7	2,8	6,0		168,9	37,19
2	Betula pendula Roth,	20,9	18,3	7,8	4,9	2,6	1,9	56,4	12,42
3	Alnus glutinosa (L,) Gaerth,			0,9				0,9	0,20
4	Carpinus betulus L,	13,2	1,3					14,5	3,19
5	Quercus robur L.	40.5	64.9	5.1				110.5	24.33
6	Quercus rubra	1.4						1.4	0.31
7	Tilia cordata Mill.	7.7						7.7	1.70
8	Populus tremula L.	4.3		2.2				6.5	1.43
9	Pinus sylvestris L.	35.5	39.7	8.5	2.2		1.5	87.4	19.24
Total		177	214	41	10	9	3	454	100

The territory of the enterprise's forests is characterized by an average class 2.51 of fire danger, which is due to the large (72.5 %) share of covered pine plantations, 16.5 % of which are young.

Ecroptry district		Forest Fi		Total	Mean		
Foresity district	1	2	3	4	5	area, <i>ha</i>	class
Bondarivske	1221,9	1284,7	76,4	261,1	218,9	3063,0	2,01
Korops'ke	698,0	1341,4	370,4	1268,9	1135,0	4813,7	3,16
Karpylivske	1071,2	1393,4	155,1	415,3	105,0	3140,0	2,07
Horodyshchens'ke	652,7	1364,8	161,9	716,7	163,9	3000,0	2,46
Desnyans'ke	437,0	1164,5	308,3	500,5	121,7	2540,0	2,49
Total	4080,0	6548,8	1072,1	3170,5	1744,5	16616,7	2,51

Table 6.	Distribution	of area of	Oster Military	/ Forestry	y forest b	y fire danger	classes*

* 1st class - the least danger, 5th class - the greatest danger

Boyarka Forest Research Station

A separate unit of the National University of Life and Environmental Sciences of Ukraine "Boyarka FRS" (hereinafter FRS) is located in the central part of Kyiv oblast. The total area of the FRS is 17,835 ha, of which 92.4 % (16,161 ha) are forest areas covered with forest vegetation. The administrative and organizational structure of the forestry includes two forestries: Plesetske (9846 ha), Boyarske (8087 ha).

According to the forest vegetation zoning, the territory of the FRS belongs to the southern zone of Ukrainian Polissya and is on the border with the forest-steppe zone. The climate is mild, with heavy rainfall. Average climatic indicators: average annual temperature +6,7°C, minimum -33°C, maximum +36°C, average annual precipitation – 610 mm, duration of the vegetation period – 182 days. Significant reduction of groundwater levels in some years has led to reduced growth, weakens stands from damage by entomological pests and forest diseases, reduces the survival of forest crops, impaired the quality and yield of planting material in nurseries and more. In general, the climate of the FRS location area is favorable for successful growth of tree and shrub species (pine, oak, birch, black alder, hazel, rowan, buckthorn, elder, etc.), as well as the introduction of a number of valuable species.

The most common type of soils are podzolic (sod-podzolic subtypes), much less - gray forest soil, sod and chernozem podzolic, as well as sod developed, meadow and swamp, of different mechanical composition and physicochemical properties. All this to some extent have led to the formation of different habitat conditions. According to the degree of humidity, most of the soil will be restored to fresh (index -2). Excessive soil moisture is 1,6 % of the area covered by forest vegetation. The swamps cover an area of 79.5 hectares.

The forest fund of the forest research station is dominated by Scots pine stands (*Pinus sylvestris* L.) – 81.6 %, oak (*Quercus robur* L.) – 13,5 %, alder (*Alnus glutinosa* (L.) Gaerth.) – 2,0 %. Given that fresh subforest and sub-forest conditions are most favorable for the growth of Scots pine stands as the main forest species, the forest fund of the enterprise is mainly represented by stands with background participation of Scots pine in the first tier and oak admixture in the second. In general, within the enterprise plantations have a composition of 9Sz1Dz (90 % of stock are Scot Pine, 10 % – Common Oak), average age – 74 years, middle class of quality Ia, and average completeness – 0,63

											Total	
No	Species			De	nsity (n	nin – 0,	max –	1)			area,	%
	opeoleo										ha	ļ
	F armente stress	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9	7000 5	07.04
1	Frangula alnus	1170,0	1103,0	1948,3	1608,2	645,6	272,9	243,7	46,8	0.5	7038,5	27,94
2	Sorbus aucuparia	1136,6	931,3	1415,4	941,3	536,3	255	265	47,5	2,5	5530,9	21,95
3	Corylus aveilaria	109,5	296,8	793,5	1280,0	589,0	402,7	530,4	174,8	6,7	4183,4	16,60
4	Sambucus nigra L.	160,0	386,5	738,8	833,1	225,9	191,8	130,5	32,1	07	2704,7	10,74
5	Prunus padus	46,7	123,8	206,8	280,6	169,7	169,7	176,3	50,8	9,7	1234,1	4,90
6	Euonymus verrucosus	62,2	71,7	258,9	361,1	111,2	58,7	66,7	15,1	4.0	1005,6	3,99
/	Crataegus oxyacantna	55,0	78,0	158,0	201	101,6	112,0	106,3	27,9	4,2	904,0	3,59
8	Sambucus racemosa	199,6	120,8	87,9	126,4	43,6	43,6	25,7	3,4		651,0	2,58
9		58,4	87,0	92,6	130,6	14,2	58,3	34,1	3,3		538,5	2,14
10	Acer tataricum	51,2	46,7	11,6,6	222,6	47,9	31,1	93,1	8,2		500,8	1,99
11	Rosa canina L.	26,9	55,9	53,8	50,8	45,3	9,8	0,9	0,9		244,3	0,97
12	Berberis Vulgaris L.	41,2	16,7	23,3	22,6	10,7	24,1	15,0	6,1		159,7	0,63
13	ruthenicus	101,1	20,5	16,2	4,8	5,7	5,6	4,9			158,8	0,63
14	Amorpha fruticosa L.	11,0	6,3	4,0	59,2	7,1	7,0				94,6	0,38
15	Robinia		0,5	7,6	16,1		10,6	37,7	1,3		73,8	0,29
10	pseudoacacia		-	40.0	00.0	10					04.0	0.44
10	Rubus Idaeus L.	4.0	4 5	13,2	20,0	1,0	0.7	2.4			34,2	0,14
17	Swida sanguinea L.	1,2	4,5	4	13,3	1,7	0,7	3,4			28,8	0,11
18	Prunus spinosa L.	4,6	5,2	4,5	2.2	0,3	10,0				24,6	0,10
20	Lonicera capritolium L.	2,5	1,6	1,2	3,3	4,1			-		12,7	0,05
22	Rubus caesius L.		-	6,9	1,4				-		8,3	0,03
23	Ligustrum vulgare	07	0.7	7,3	0.7	0.7			-		7,3	0,03
24	Swida alba L.	0,7	0,7		2,7	2,7			-		6,8	0,03
25	Juniperus communis	6,3	0,4								6,7	0,03
26	Salix viminalis L.	3,2	2,4					0,5			6,1	0,02
27	Cydonia oblonga		5,9								5,9	0,02
28	Hedera helix L.				5,1						5,1	0,02
29	Ribes nigrum L.	1,2	2,0		0,4	1,2					4,8	0,02
30	Ficus carica L.	,	,	2,7	,	,		1,9			4,6	0,02
31	Salix triandra L.			,		4,4		,			4,4	0,02
32	Salix caprea L.					,	3.2				3,2	0,01
33	Euonymus nanus				2.0			1,1			3,1	0,01
35	Juniperus communis			1,8	,			,			1,8	0,01
36	Salix cinerea I				14						14	0.01
37	Lonicera tatarica				1,7			10			1.0	0.00
01	Physocarpus							1,0			1,0	0,00
38	opulifolius							0,8			0,8	0,00
39	Sorbus aria				0,3						0,3	0,00
	Total	3249	3368	5847	6248	2629	1667	1745	418	23	25195	100

Table 7. Distribution of the forest area with understory of Boyarka Forest Research Station by density

			Number	, thousan	d units pe	er hectare	•	Total	%
Nº	Species	0,1-1,0	1,1-2,0	2,1-3,0	3,1-4,0	4,1-5,0	5,1-10,0	area, <i>ha</i>	
1	Robinia pseudacacia L.	53,9	4,0	3,9				61,8	6,36
2	Betula pendula Roth.	1,6						1,6	0,16
3	Alnus glutinosa (L.) Gaerth.				1,2			1,2	0,12
4	Carpinus betulus L.	44,4	52,7	52,3	18,5	1,6		169,5	17,43
5	Quercus robur L.	202,8	189,4	18,9				411,1	42,29
6	Quercus rubra	14,5	66,5	1,8	0,6	2,8	2,4	88,6	9,11
7	Acer platanoides L.	71,7	19,7	1,7		3,0		96,1	9,88
8	Acer saccharinum		1,0					1,0	0,10
9	Acer negundo L.	0,3						0,3	0,03
10	Tilia cordata Mill.	13,5	7,3					20,8	2,14
11	Pinus sylvestris L.	54,7	59,2	6,3				120,2	12,36
12	Prunus avium L.	2,3						2,3	0,24
13	Acer pseudoplatanus	2,7						2,7	0,28
14	Fraxinus excelsior L.	1,3		0,4				1,7	0,17
15	Fraxinus viridi			0,1				0,1	0,01
	Total		400	85	20	7	2	972	100

Table 8. Distribution of the forest area with undergrowth of Boyarka Forest Research Station by density

The territory of the enterprise's forests is characterized by an average class 2,14 of fire danger, which is due to the large share of pine plantations covered with forest vegetation (81,6%), of which young (20,6%).

Table 9. Distribution of area of Bo	/arka Forest Research Station b	y fire danger classes'
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Ecrestry district		Forest f		Total	Mean		
	1	2	3	4	5	area, <i>ha</i>	class
Boyarske	1444,1	3778,4	1938,3	499,6	328,6	7.989	2,31
Plesetske	2162,8	6240,2	857,5	287,9	297,6	9.846	2,01
Total	3606,9	10018,6	2795,8	787,5	626,2	17.835	2,14

* 1st class – the least danger, 5th class – the greatest danger

Analyses of fire history

A study of Armanteras et al. (2013) regarding of the distribution of the number of fires relative to the distance (inside or outside the edge) to the edge showed that the vast majority of fires occur within 1000 m of the edge of forests, and only a few fires over far distance. These studies also showed that the most intense fires (over 500 MW) occur close to the edge, but their percentage of all fires is very low, from 70% to 84% of fires are of low intensity fires 50 MW). The main factors that determine the scale of natural fires and are used in modeling the risk of burning the area are the fuel load and weather conditions (Fernandes, 2012). That is why the shaping of fire -resistant stands is an important element of fire management in the era of climate change.

There are few studies on classification and description of edges. Foresters, ecologists, and landscape scientists evaluate the value of the edge differently. For fire management purposes in Ukraine, we consider the most appropriate classification feature is the width of forest strip from the edge in which there are differences in microclimate, taxonomic indicators of trees, biodiversity from between deeper forest and edge itself (Kuzyk, 2011). According to this classification, false, elementary and multicomponent edges are distinguished.

- The false edge is characterized by the absence of undergrowth and shrubs. This edge is very similar to the areas inside the forest by location of trees, distribution of trees in diameter and height, species diversity. Pine as a light-demanding species transmits a lot of light underneath of canopy and creates favorable conditions for the development of non-forest species of grasses. Grass during the vegetation season has a higher moisture content and reduces the rate of drying of forest litter, which has a positive effect on reducing fire risk. However, in spring and autumn, dry grass is easy to ignite fuel and promotes rapid spread of fire. Trees that grow on the edge of the forest have low canopies due to lateral lighting that determine high risk of crown fires development in case of high wind speed (40-60 km per hour).
- The elementary edge is characterized by a small variety of trees, shrubs and herbaceous plants, which is observed in a strip less than the average height of the stand. This edge reduces the amount of solar radiation that penetrates the canopy and better traps the wind, which causes more moisture in the litter. During the growing season, species diversity, namely the presence of deciduous and herbaceous species with high humidity reduces the risk of fire. However, with prolonged dry weather in autumn and spring, dry grass, leaves and litter pose a higher risk of fires. In the absence of human activity, such edges eventually become multicomponent.
- The multicomponent edges are characterized by the higher diversity of species of flora and fauna. The number of species of shrubs can be several times higher than in the elementary edges. The main difference by which such edges differ from the elementary ones is their width, which is wider than the height of the stand. The width of such an edge can reach up to 200 m toward depth of the forest. In such edges, as well as in elementary ones, the access of solar radiation to the earth's surface decreases and the wind speed slows down, which contributes to a slower drying of forest litter. The fire hazard in such edges is similar to the danger in elementary edges, but the large width of the edge helps to slow down or stop the spread of fire from open space and contributes to the successful fight against fires in them due to lower burning intensity. In addition, such edges are usually consisting from very dense shrubs, which helps reduce number of visitors and ignition sources to these areas. Multicomponent edges are formed naturally over a long period of time, in the absence of human activity. Also, it is possible to speed up the process of forest fires in forests, or vice versa from the forest to settlements, it is advisable to ensure the formation of such edges with a width of 100-200 m.

Based on classification above, for fire history analysis it was used 200 m width of the edge. The aim of analysis is to identify the areas of the forest where fires occur most often, as well as to prove the needs for the formation of fire-resistant edges in pine forests. Spatial and temporal information on fires over the last 10 years was used for the analysis within the framework of three partner enterprises – Teteriv Forestry, Oster Military Forestry and Boyarka Forest Research Station. Satellite information on fires obtained through the Landscape Fire geoportal (www.wildfires.org.ua) that was developed by REEFMC team earlier.

Teteriv Forestry State Enterprise

Teterivske Forestry State Enterprise with a total area of 35.692 ha is located in the western northern part of Kyiv region, of which 32.168 ha are forested. The forest cover of the region is 39,4%. The forests located in one massif, except for 163,2 ha, which are located separately. In terms of species composition, forests are mostly represented by pure pines stands in some places with a slight admixture of deciduous species - birch, oak, hornbeam, aspen, maple. In total, there are 9 species of trees (*Betula pendulum* Roth., *Alnus glutinosa* (L.) Gaerth., *Carpinus betulus* L., *Quercus robur* L., *Acer platanoides* L., *Acer negundo* L., *Populus tremula* L., *Pinus sylvestris* L., *Picea abies* L.). Among the species that growth underneath of crown layer most common species is *Frangula alnus*, *Sorbus aucuparia* L., *Corylus avellana* L., *Juniperus communis* L., *Sambucus racemosa* L., *Salix viminalis* L., *Caragana frutex*, Sambucus nigra L., *Prunus padus* and others. The complete list of undergrowth species is 23 species.

According to satellite data, over the past 10 years, 306 fires with area more than 14,06 ha occurred on the territory of the enterprise, of which 152 fires (49,7%) occurred within 200-meter-wide forest edges. During 2012-2021, 13.621 ha of forests were burned by these fires, of which 406 ha (29,9%) were inside a 200-meter forest edges.

Currently, the fire occurrence controlled through an effective system of early detection and fast response, but with changing climate the situation can change dramatically. Therefore, it is advisable to take long-term measures to increase forest resilience to fires by silvicultural practice - by increasing the share of deciduous species in pine forests, or the formation of open forests in places where there is danger to human settlements.

Within the framework of the RESILPINE project, experimental plots (*FRES_Tet_107*, *FRES_Tet_38*, *FRES_Tet_75*, *FRES_Tet_41*) were established, where the share of deciduous species in pine plantations is expected to increase in the long run. In the future, such areas will be an example of the formation of pests resistant to pests, diseases, fires and climate change with a complex structure.



Figure 16. Distribution of fires in the forests of Teteriv Forestry

Oster Military Forestry

Oster Military Forestry State Enterprise with a total area of 16 616 ha of which the area is covered with forest – 13.915 ha is located in the southwestern part of the Chernihiv oblast. The Oster forestry located inside area with many agricultural fields including animal production. The forest cover of the administrative district, on the territory of which the forestry is located, is 19%. Forests in the area are uneven. The area of

the forestry is characterized by a well-developed network of public transport routes. The area also famous recreational destination and good for fishing due to location between two big rivers – Dnipro and Desna.

According to satellite data, it was found that over the last 10 years, 283 fires with area more than 14,06 ha (pixel) have occurred on the territory, of the enterprise, of which 142 fires (50.2%) occurred in a 200-meter edges between forested and non-forested territories. During 2012-2021, these fires covered 1276 ha of forests, of which 415 ha (32,5%) in the 200-meter strip from the edge of the forest.

The forests are mostly represented by pure Scotch pine stands with a slight admixture of birch, oak and aspen. Poor sandy soil conditions limit the list of tree species to nine: *Robinia pseudacacia* L., *Betula pendulum* Roth., *Alnus glutinosa* (L.) Gaerth., *Carpinus betulus* L., *Quercus robur* L., *Quercus rubra*, *Tilia cordata* Mill., *Populus tremula* L., *Pinus sylvestris* L.). List of understory species include 8 species (*Frangula alnus*, *Corylus avellana*, *Sorbus aucuparia*, *Sambucus racemose*, *Caragana frutex*, *Salix caprea* L., *Sambucus nigra* L., *Acer negundo* L.).

Given the fact that 50.2% of all fires occur in edges 200 m wide from the edge of the forest, the dangers of fire and climate change, it is necessary to increase forest resilience to fires by forestry methods, including increasing the share of deciduous species in pine plantations. It is also possible to form open landscapes (open parklike) on the border with settlements, which will reduce the risk of forest fires for settlements.



Figure 17. Distribution of fires on the forest of Oster Military Forestry Enterprise

As part of the RESILPINE project, experimental plots (*FRES_Ost_2021_248* and *FRES_Ost_2021_372*) were established in the pine plantations of the Oster Forestry, where an increase in the share of deciduous species in pure pine plantations is envisaged.

Boyarka Forest Research Station

Boyarka Forest Research Station (BFRS) is the separate subdivision of the National University of Life and Environmental Sciences of Ukraine and located in the central part of Kyiv oblast. The total area of BRFS is 17.835 ha, of which 92,4% (16.161 ha) are covered with forest vegetation. Soil conditions are richer than in the Forest Zone, as forests are located in the transitional zone between the Forest and Forest-Steppe natural zones. Due to this, the species diversity of trees and shrubs is greater than in the Forest Zone. The list of tree species found in the forests of the enterprise consists of 15: (*Robinia pseudacacia* L., *Betula pendulum* Roth., *Alnus glutinosa* (L.) Gaerth., *Carpinus betulus* L., *Quercus robur* L., *Quercus rubra, Acer platanoides* L., *Acer saccharinum, Acer negundo* L., *Tilia cordata* Mill., *Pinus sylvestris* L., *Prunus avium* L., *Acer pseudoplatanus, Fraxinus excelsior* L., *Fraxinus viridi*). The species composition of undergrowth species is represented by 39 species, among which the most common are *Frangula alnus, Sorbus aucuparia, Corylus avellana, Sambucus nigra* L., *Prunus padus, Euonymus verrucosus, Crataegus oxyacantha, Sambucus racemosa, Caragana frutex, Acer tataricum, Rosa canina* L. and others.

As illustrated in Fig. 18 for the period 2012-2021 in the forests of the enterprise there were not many fires with areas more 14.06 ha, which can be explained by an effective system of detection and response, as well as greater species diversity of undergrowth species and tree species. According to satellite data, 88 fires have occurred in the BLDS forests in 10 years, of which 81 fires (92%) in the 200-meter strip from the edge of the forest. In 2012-2021 fires burned 561 ha of forests of which 325 ha were in a 200-meter strip from the edge of the forest.



Figure 18. Distribution of fires on the forest of Boyarka Forest Research Station

The map also shows a very dense network of settlements, which increases the risk of fires. Given current trends in climate change, and the current species composition of forests, which is represented by an average of 90 % of Scots pine and 10 % of other species (oak, birch) should begin work on the formation of resistant to climate change, pests, diseases and fires forests by forming mixed uneven aged stands with a complex structure. Within the RESILPINE project, experimental plots (*FRES_BLDS_43* and *FRES_BLDS_143*) have been set up in the BLDS forests.

IV. Research stay for REEFMC staff in Germany

During the research visit, the Ukrainian delegates held a number of important meetings with representatives of the sectors of education, science, forestry and fire management. Participants got acquainted with the educational programs and research areas of the Eberswalde University for Sustainable Development, visited regional forest management bodies, state-owned, municipal and private forestry enterprises, and lands contaminated with unexploded ordnance, such as the former "Jüterbog" and NGS "Heidehof-Golmberg" military training grounds. Also, forest owners presented the results of many years of experience in conducting close-to-nature forestry and were acquainted with the peculiarities of national and local policies on cuttings, logging and game management.



Figure 19. Participants of the research visit to the municipal forest of Eberswalde

Delegates took part in a demonstration of the regional Forest Fire Management Headquarters in Eberswalde, where the coordinator and staff explained principles of landscape fire detection and monitoring systems, information exchange process, rapid response and interagency cooperation in firefighting coordination.



Figure 20. Participants in the Brandenburg Forest Fire Management Headquarters (Waldbrandzentrale)

Participants met with Director of the Global Fire Monitoring Center (GFMC) Johann Georg Goldammer, who presented the results of many years of experience in the use of prescribed burning to reduce natural fire hazard, and restoration of heathlands in areas contaminated by unexploded ordnance at former military training grounds Jüterbog and NGS Heidehof-Golmberg.



Figure 21. The REEFMC Team with the Directors of Forestry Enterprise Semenivsk and Oster Military Forestry Enterprise (Ukraine) in Heidehof-Golmberg Nature Reserve, with the local hosts of Foundation "Naturlandschaften Brandenburg" and Forest District Stuelpe.

V. Publications of scientific and technical results of activities in 2021

Monograph

Zibtsev S.V., Myronyuk V.V., Yavorovsky P.P., Soshenskyi O.M., Gumenyuk V.V., Sendonin S.E., Levchenko V.V., Puzrina N.V. Scientific and methodological support for the creation of a geoportal for risk assessment, forecasting and prevention of natural fires in Ukraine: a monograph. Kyiv: "Scientific Capital" Private individual Shmydko TS 2021. 340 p. (in Ukrainian)

Journal publications

Hall, J.V., S.V. Zibtsev, L. Giglio, S. Skakun, V. Myroniuk, O. Zhuravel, J.G. Goldammer, and N. Kussul. 2021. Environmental and political implications of underestimated cropland burning in Ukraine. Environ. Res. Lett. 16 (2021) 064019.

Soshenskyi, O., S. Zibtsev, V. Gumeniuk, J.G. Goldammer, R. Vasylyshyn, and V. Blyshchyk, Volodymyr. 2021. The current landscape fire management in Ukraine and strategy for its improvement. Environmental & Socio-economic Studies 9 (2), 39-51. <u>https://doi.org/10.2478/environ-2021-0009</u>.

Gumeniuk V., Holiaka D., Koren V., Soshenskyi O. Effects of ground fires on Scots pine forests of the Poliskyi Nature Reserve. Forestry ideas. 2021. Vol. 27. No 1 (61). P. 3-18. ULR: <u>https://forestry-ideas.info/issues/issues_Download.php?download=389</u>.

Myroniuk V., Zibtsev S., Bogomolov V., Soshenskyi O., Gumeniuk V., Vasylyshyn R. A web-based platform LANDSCAPE FIRES: regional-level fire Management information sys-tem for Northern Ukraine. Proceedings of the XXth International Conference "Geoinformatics: Theoretical and Applied Aspects", 10-14 May 2021, Kyiv. P. 21113. URL: <u>https://eage.in.ua/wp-content/uploads/2021/05/21113.pdf</u>.

Soshenskyi O., Zibtsev S., Terentiev A., Vorotynskyi O. Social and environmental conse-quences of catastrophic forest fires in Ukraine. Ukrainian journal of forest and wood science. Kyiv, 2021. Vol. 12 (3). 21-34. URL: <u>https://doi.org/10.31548/forest2021.03.002</u> (in Ukrainian).

Soshenskyi O., Myroniuk V., Zibtsev S., Gumeniuk V., Lashchenko A. Evaluation of Field-Based Burn Indices for Assessing Forest Fire Severity in Luhansk Region, Ukraine. Ukrainian journal of forest and wood science, 2022. Vol. 13 (1). 21–34. URL: <u>http://surl.li/dmxmr</u>.

Sydorenko S., Gumeniuk V, de Miguel-Díez F., Soshenskiy O., Budzinskyi I. Assessment of the Surface Forest Fuel Load in the Ukrainian Polissia. Fire Ecology. Submission id: FECO-D-22-00082. (in press).

Zibtsev S.V. et al. Forests Recovery of Luhansk Region on Burned Areas in the Context of Climate Change : monograph. Kyiv: Editorial and Publishing Department of NUBiP of Ukraine, 2022. 154 p. (in Ukrainian).

Abstracts

Zibtsev, S., Georg Goldammer, J., Soshenskii, O., and Gumeniuk, V.: Transformation of Forests to Closeto-Nature Forest Management in Ukraine: Nature-based silvicultural and fire management methods for increasing the resilience of pine stands to drought and wildfire, EGU General Assembly 2022, Vienna, Austria, 23–27 May 2022, EGU22-13361, <u>https://doi.org/10.5194/egusphere-egu22-13361</u>, 2022.

Myroniuk V., Zibtsev S., Soshenskyi S., Gumeniuk V., Vasylyshyn R., Bidolakh D. Mapping fire severity over heterogeneous forested landscapes in the Eastern Ukraine to support postfire forest management. Proceedings of the XVI International Scientific Conference "Monitoring of Geological Processes and Ecological Condition of the Environment" 15–18 November 2022, Kyiv, Ukraine (in press).

Myroniuk, V., Zibtsev, S., G. Goldammer, J., Bogomolov, V., Borsuk, O., Soshenskii, O., Gumeniuk, V., and Zibtseva, E.: Fire risk assessment for prevention improvement in the Chornobyl exclusion zone, EGU General Assembly 2022, Vienna, Austria, 23–27 May 2022, EGU22-13368, <u>https://doi.org/10.5194/egusphere-egu22-13368</u>, 2022.

Zibtsev S.V., Sydorenko S.G., Soshenskyi O.M., Bogomolov V.V., Gumeniuk V.V. Increase the scale of landscape fires of Ukraine as a result of large-scale invasion of the Russian Federation. Scientific and Practical Conference" Interdisciplinary research: humanitarian and natural sciences", Odesa, July 22-23, 2022: abstracts. Odesa, 2022. P. 92-93 (in Ukrainian).

Zibtsev S., Sydorenko S., Myroniuk V., Bogomolov V., Soshenskii O., Gumeniuk V. Approach for Selection of Fire Risk Assessment, Reduction and Adaptation Products for Demonstration Within FirEUrisk Project. TerraEnVision 2022 Nature-based Solutions to Facilitate the Transitions for living within the Planetary Boundaries. Utrecht, the Netherlands, June 27 - July 1, 2022. Vol. 3 TNV2022-FI-3132. P. 88. ULR: <u>https://terraenvision.eu/2022/book.php</u>.

Myroniuk V.V., Zibtsev S.V., Gumeniuk V.V., Soshenskyi O.M. Modeling of risks of occurrence and development of landscape fires in the FLAMMAP software environment. International Scientific and Practical Conference «Ecosystem Services of Forests and Urban Landscapes», Kyiv, November 18, 2021: abstracts. K., 2021. P. 84-85. URL: <u>http://surl.li/dmxvk</u> (in Ukrainian).

Soshenskyi O.M., Zibtsev S.V., Gumenyuk V.V. Modern challenges to the forest fire protection system in Ukraine. International Scientific and Practical Conference «Present and Future of Ecotone Forests of the Middle Latitudes», Kyiv, June 11, 2021: abstracts. K., 2021. P. 121-122. URL: <u>http://surl.li/dmxoe</u> (in Ukrainian).

Zibtsev S.V., Myroniuk V.V., Vasylyshyn R.D. Information system to support long-term and operational monitoring, prevention and suppression of landscape fires based on web technologies. International Scientific and Practical Conference «Present and Future of Ecotone Forests of the Middle Latitudes», Kyiv, June 11, 2021: abstracts. K., 2021. P. 53. URL: <u>http://surl.li/dmxoe</u> (in Ukrainian).

Soshenskyi O.M., Zibtsev S.V., Terentyev A.Yu., Gumeniuk V.V., Vorotynsky O.G. Catastrophic Forest fires in Ukraine in 2020. International Scientific and Practical Conference, "Modern problems of forestry and ecology: solutions", Zhytomyr, October 7-8, 2021: abstracts. Zhytomyr, 2021. P.169-170 (in Ukrainian).

Vorotynskyi O.G., Soshenskyi O.M., Tokareva O.V. Classification of forests adges as a basis for their fire resistance formation. International Scientific and Practical Conference "Forests in the context of modern challenges", Kharkiv, October 20, 2022: abstracts. Kharkiv, 2022. P. 6-7 (in Ukrainian).

Status of the project activities in comparison of planned targets for 2021

Project activities and tasks that had been planned for 2021 were implemented according to project plan.

Tasks listed in the SoW and executed during 2021:

- National Strategy of Landscape Fire Management in Ukraine developed, submitted officially to the Ministry of Environmental Protection and Natural Resources of Ukraine, publicly discussed and disseminated among stakeholders;
- Explore existing experience and legislation regulation for formation of open, park-like landscapes (thinned stands), as ways to increase the fire resistance of forests and reduce the risks of fires from agricultural lands and settlements (literature review);
- Assessment of post-fire dynamics and tree health after controlled burning (tree dying, state of trees, restoration of grasses, undergrowth);
- Identification and establishing research plot for demonstration of prescribed burning procedure for fuel reduction as a tool for increasing fire resilience of landscapes near villages;
- Experimental controlled burning done near Kudriashovka village with the aim of reduce fuel load and reduce risk of transfer of forest fires from pine forest on the village;
- Technical preparation and arrangement of official permissions in co-operation with Kreminna Forest and Hunting enterprise for doing silviculture treatment near village Kudriashovka and establishing of open and park-like landscape (semi-open landscape) by applying intensive 2-stage thinning 20% for overcrowded 60-year-old pine stands;
- Field research with the purpose of measures of characteristics of tree stands and characteristics of forest fuel after large fires and without fires (Luhanska and Kyivska oblasts);
- Preparation and publication of monograph, papers and abstracts for dissemination of project results and better sustainability of the project in forestry related scientific journal and popular national newspapers;

- Research stays for REEFMC and forestry enterprises partners staff in Germany;
- Research visit of the Head of the GFMC Prof. Dr. Johann Georg Goldammer to REEFMC to support ongoing research skipped due to COVID restrictions.

Conclusions

After four large fires of 2020 burned up to 160 000 ha many ground foresters and forestry enterprises look for long-term silviculture solutions that allow to reduce areas and severity of fires in future under the impact of climate change. Also, specific Ukrainian feature of wide use of fires on agricultural lands that determine usual pathways of landscape fires from cultural lands toward natural ecosystems (forests) determined to special interest to increase fire resilience of edges by inserting hardwoods that reduce temperature of burning and simplify its suppression before fire enter fire prone pine forests. Both factors attracted additional attention to the project ideas and project results that stimulating project dissemination on other territories such as flammable pine forests and burned areas on sands arenas in Luhansk oblasts and also burned in 2020 areas of Ovruch Forestry and Narodychi Forestry in Zhytomyr oblasts. All those stakeholders started to use project approach to create more fire resilient stands instead burned ones. Special recommendation on reforestation with taking into account resilience requirements were developed for them. Project via demonstration research experiments, publications, seminars successfully promoted among forestry specialists, environmental NGO's, local authorities, local population, volunteers and other stakeholders' technologies of reducing fire hazard of pine forests via adding (planting) hardwoods species underneath of pine, establishing hardwood edges to prevent development of fires via different types of flammable landscapes. New firefighting equipment and protection means that was delivered via project funds were demonstrated during series of trainings for firefighters and volunteers. Latest experience of forestry in Germany related with adaptation of forests to climate change and approaches toward safe fire management at the UXO contaminated sites in Brandenburg State was transferred to Ukrainian professional forestry circles via seminars and web publications.

For sustainability of project results joint Germany – Ukrainian team will apply for funding for continuation of the project or new project.

The need for continuing cooperation with the German partners is underscored by the developments that occurred between the end of the reporting period 2021 and the end of the project in 2022. With the beginning of the Russian invasion and war in February 2022 the collateral damages by Russian military attacks have severely affected the forests of Ukraine and the related infrastructures and personnel of forest (fire) research and management.

GFMC and REEFMC have supported the Department of Fire Management of the State Agency of Forest Resources of Ukraine (SAFRU) to formulate and submit requests to the government of Germany for at-hoc assistance to Ukraine in April 2022 by provision of firefighting equipment. Particular requests for armored fire suppression tanks and drones for surveillance and decision-support on terrain contaminated by unexploded ordnance were made – all based on experiences by GFMC as mentioned in this report.

2022: Activities during the War

With the beginning of the war on 24 February 2022, REEFMC, supported by GFMC, began to monitor wildfires arising from the armed conflict. Landscape Fire Bulletins were issued regularly, which include updates on fires on the territory of Ukraine (in ecosystems, agricultural lands and in cities, including updated maps of active fires, updated fire statistics, maps and details of large fires). Safety advisories have been issued to address the threats of wildfires burning on terrain contaminated with unexploded ordnance (UXO) and radioactivity. The maps show monthly accumulated locations of fires depicted by satellites. GFMC and REEFMC have set up dedicated web portals, extracts are **annexed** to this report:

- REEFMC: Fire Management on Terrains contaminated by Unexploded Ordnance (UXO) (1)
- <u>GFMC: Landscape Fire Bulletins and Safety Advisories During the War in Ukraine (2)</u>
- <u>Narrative / diary of GFMC-RFMC cooperation in Ukraine (Annex 4 includes the time of RESILPINE project (2020-2022)</u> (3)

Annexes to the Final report below

Regional Eastern Europe Fire Monitoring Center

Nubip.edu.ua/en/node/9087/8

Fire Management on Terrains contaminated by Unexploded Ordnance (UXO)

The work of REEFMC on <u>Fire Management on terrain contaminated by radioactivity in the</u> <u>Chernobyl Exclusion Zone</u> is a cooperative effort with the <u>Global Fire Monitoring Center</u> (<u>GFMC</u>). In 2013, the GFMC published a White Paper directed to the United Nations and International Organizations entitled "Vegetation Fires and Global Change: Challenges for Concerted International Action". This White Paper includes an analysis of dangerous wildfires affecting human security in the landscapes of Eurasia, including threats of fires burning on lands contaminated by radioactivity, UXO and land mines:

- White Paper directed to the United Nations and International Organizations "Vegetation Fires and Global Change – Challenges for Concerted International <u>Action</u>" (PDF, 3.7 MB)
- <u>UN White Paper: Chapter 22 Wildfires and Human Security in Cultural</u> <u>Landscapes in Transition – Examples from Temperate-Boreal Eurasia (by J.G.</u> <u>Goldammer)</u> (PDF, 0.2 MB)

Related activities of GFMC on fire management on terrains contaminated by ammunition stemming from WWII and the Cold War in Germany can be monitored on web pages of GFMC, e.g.:

- <u>GFMC / Fire Ecology Working Group: Service Portfolio for Germany</u> (in German language)
- <u>Development of systems allowing safe application of prescribed fire and wildfire</u> <u>suppression on terrains contaminated by UXO</u> (in German language)

Wildfire Defense of Rural Communities adjacent to UXO-Contaminated Areas

In Ukraine, Germany and all over Europe, many wildfires affecting forest and protected areas are started by agricultural fires. Vice-versa, wildfires in vegetation around local communities threaten villages and farmsteads. Therefore, REEFMC and GFMC prioritize wildfire prevention and wildfire defense of rural communities. Relevant gudelines have been publish in Ukrainian language:

Defense of Villages, Farms and Other Rural Assets against Wildfires: Guidelines for Rural Populations, Local Communities and Municipality Leaders in Eastern Europe (in Ukrainian) *A new tool for rural communities is the Welte TankBox*, which was developed as a versatile system for forestry enterprises and rural municipalities. The system can be attached to forest machines as well as all agricultural tractors (Video). It has the options of high and low pressure extinguishing and therefore can be used not only for firefighting, but also watering of plants. The system has been inspired and co-developed by GFMC:

- <u>Welte Tank Bag</u> (in English)
- <u>Welte Tank Bag</u> (in German, more details)
- <u>Video portal</u>

Regional Eurasia and Southeast Europe / Caucasus Wildland Fire Network

gfmc.online/globalnetworks/SEEurope/SEEurope_1_radio.html

GFMCadmin



Fire Management on Terrain Contaminated by Radioactivity, Unexploded Ordnance and Land Mines in Temperate-Boreal Eurasia

LANDSCAPE FIRE BULLETINS AND SAFETY ADVISORIES DURING THE WAR IN UKRAINE

During the war, the aggression and partial occupation of Ukraine by the Armed Forces of the Russian Federation, which started on 24 February 2022, wildfires are occurring as collateral damages and purposely set. The Regional Eastern Europe Fire Monitoring Center (<u>REEFMC</u>) and GFMC are monitoring the situation.

Landscape Fire Bulletins include updates on fires on the



territory of Ukraine (in ecosystems, agricultural lands and in cities, including updated maps of active fires, updated fire statistics, maps and details of large fires). Safety Advisories have been issued to address the threats of wildfires burning on terrain contaminated with unexploded ordnance (UXO) and radioactivity. The maps show monthly accumulated locations of fires depicted by satellites.

The <u>REEFMC</u> provides two dedicated portals in English language:

- Fire Management on Terrains contaminated by Unexploded Ordnance (UXO)
- <u>Fire management in the Chornobyl Exclusion Zone (on radioactively contaminated</u>
 <u>terrain)</u>

Wartime Landscape Fire Bulletins

- Landscape Fire Bulletin No. 1 (24 Feb to 03 March 2022) (ENG) (PDF)
- Landscape Fire Bulletin No. 1 (24 Feb to 03 March 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 2 (04-03 March 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 3 (11-17 March 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 5 (25-31 March 2022) (UKR) (PDF)

- Landscape Fire Bulletin No. 6 (01-07 April 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 7 (08-14 April 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 8 (15-21 April 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 9 (22-28 April 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 10 (29 April to 05 May 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 12 (13-19 May 2022) (UKR) (PDF)
- <u>Decision of the Cabinet of Ministers of Ukraine concerning Forest Protection</u> (20 May 2022) (UKR-ENG) (PDF)
- Landscape Fire Bulletin No. 13 (20-26 May 2022) (UKR) (PDF)
- <u>Extract of GFMC presentation at the Wildfire Summit 2022</u> (San Francisco, California, U.S.A., 25-26 April 2022) (PDF)
- <u>A tractor driver blew up on a mine near Kyiv</u> (NULESU website)
- Landscape Fire Bulletin No. 14 (27 May to 02 June 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 15 (02 to 09 June 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 16 (10 to 16 June 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 17 (17 to 23 June 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 18 (24 to 30 June 2022) (UKR) (PDF)
- <u>€ 454 million for the State Forest Agency, including fire management</u> (<u>Lugano,</u> <u>Switzerland, Ukraine Recovery Conference</u>, 4-5 July 2022) (translated from Open Forests to ENG) (PDF)
- <u>Assessment of Impact of Russian Invasion into Ukraine on Landscape Fires (06</u> <u>July 2022) (ENGLISH)</u> (PDF)
- Landscape Fire Bulletin No. 19 (01 to 07 July 2022) (UKR) (PDF)

New Monthly Format of Landscape Fire Bulletins

- Landscape Fire Bulletin No. 20 (24 Feb to 31 March 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 21 (01 to 30 April 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 22 (01 to 31 May 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 23 (01 to 30 June 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 24 (01 to 31 July 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 25 (01 to 31 August 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 26 (01 to 30 September 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 26 (01 to 30 September 2022) (ENG) (PDF)
- Landscape Fire Bulletin No. 27 (01 to 31 October 2022) (UKR) (PDF)
- Landscape Fire Bulletin No. 27 (01 to 31 October 2022) (ENG) (PDF)

Obituary for Semen Oblomei

Readers of the websites of <u>REEFMC</u> and GFMC are aware of the engagement of REEFMC staff and students of the Institute of Forestry and Landscape-Park Management of the National University of Life and Environmental Sciences of Ukraine (NUBiP). In June 2022, Semen Oblomei, a third year student of NUBIP, was killed in Donbass, Eastern Ukraine, in line of duty of defending Ukraine against the military aggression. Semen Oblomei has worked with Regional Eastern Europe Fire Monitoring Center (REEFMC) and participated as a volunteer in <u>First Firefighting School of NUBiP</u> in May 2021. In April 2021, Semen together with staff of REEFMC, established a fire resilient forest edge in Boyarka Forest Research Station of NUBiP – an activity of German-Ukrainian project RESILPINE (<u>German</u> / <u>Ukrainian</u>) in partnership with GFMC.

- Obituary by NUBiP
- Ukrainian TV report about the life and death of Semen Oblomei: <u>https://www.youtube.com/watch?v=opEDhyEffBs</u>





In Memory of Semen Oblomei

For spring 2022 it was planned that Semen will join the REEFMC team for establishing fire resilient pine stands near village Kudriashovka, Luhansk oblast, located in midst of pine forests at high wildfire risk. After the Russian invasion on 24 February 2022, Semen stopped his study in the University and joined the Ukrainian army to protect Ukraine. The REEFMC Team, left with Semen (kneeing, foreground), and GFMC are paying tribute to Semen.

Monthly Maps of Active Landscape Fires in Ukraine

The monthly maps are derived from various satellite sensors – courtesy <u>Orora Wildfire</u> <u>Detection and Monitoring from Space</u>. For weekly resolution – see Ukraine Landscape Fire Bulletins above.



Map of active fires on the territory of Ukraine for the period 24 February to 31 March 2022. Source: <u>REEFMC</u> / GFMC.



Map of active fires on the territory of Ukraine for the period 01-30 April 2022. Source: <u>REEFMC</u> / GFMC.



Map of active fires on the territory of Ukraine for the period 01-31 May 2022. Source: <u>REEFMC</u> / GFMC.







Map of active fires on the territory of Ukraine for the period 01-31 July 2022. Source: <u>REEFMC</u> / GFMC.



Map of active fires on the territory of Ukraine for the period 01-31 August 2022. Source: <u>REEFMC</u> / GFMC.



Map of active fires on the territory of Ukraine for the period 01-30 September 2022. Source: <u>REEFMC</u> / GFMC.



Map of active fires on the territory of Ukraine for the period 01-31 October 2022. Source: <u>REEFMC</u> / GFMC.

Safety Advisories

- <u>REEFMC-GFMC advisory on wildfire safety on UXO-contaminated terrain in</u> <u>Ukraine (Ukrainian; 22 March 2022)</u> (PDF, 0.4 MB)
- <u>REEFMC-GFMC advisory on wildfire safety on UXO-contaminated terrain in</u> <u>Ukraine (English; 22 March 2022)</u> (PDF, 0.4 MB)
- <u>Advisory on wildfires in Chernobyl Exclusion Zone (ChEZ) burning on radioactively</u> <u>contaminated terrain</u> (in Ukrainian; 21 March 2022) (PDF, 0.6 MB)
- <u>Advisory on wildfires in Chernobyl Exclusion Zone (ChEZ) burning on radioactively</u> <u>contaminated terrain</u> (in Ukrainian; 25 March 2022) (PDF, 0.4 MB)



Total fires depicted by satellite sensors in Kyiv Oblast, 01-15 March 2022. Source: <u>REEFMC</u>.



The bombardments and rocket attacks by Russian Armed Forces are causing fires in residential areas / cities and surrounding landscapes. Satellite-derived locations of fires in the map show the situation on 15 March 2022 NW Kiev and Irpin. Source: <u>Orora</u>.

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	 +380 : pressa zsu.go Busin 	800 500 410 a@mil.gov.ua		In Polissya, the oc achieved frontiers advance into the a to limited forces, withdraw, Air reco being built up and being mined.	coupiers are trying t s, regrouping after t area of the settleme they were unsucces onnaissance is unde I approaches to the	to gain a foothold on the the losses. The invaders to ent of Teterivske, however ssful and were forced to erway, air defense equipm positions of their troops	ried to r, due ent is are					
	Фото		Bce goro	In the Sivershchyr Chernihiv, the ene organize logistica occupiers are con and civilian object the routes of logis Losynivka, Velyka Talalaivka, Makey	na, due to an unsuc emy is trying to reco I support for its unit tinuing engineering ts. The enemy cont stics in the areas of Doroha, Monastyry evka.	ccessful attempt to blocka over from significant losse ts. In the Brovary direction a work, mining the infrastr inues to hold checkpoints settlements Novy Bykiv, yshche, Berestovets, Prok	ide es and n, the ucture : on thori,					1
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	10			In the Donetsk dir federation remain Severodonetsk, P The enemy is uns group by transfer carrying out the fe so-called "republi Donbas.	ection, the aim of U is to establish contr opasna, Verkhnotoj uccessfui, incurs lo ring additional force orced mobilization o ics" in the tempora	he armed forces of the ru of over Rubizhne, retske, Mariinka and Marii sess, trice to increase the as to the Izvarino area and of the civilian population o rily occupied territories of	ssian upol. i of the				4	ß

Facebook SITREP of the General Staff of Armed Forces, Ministry for Defense, Ukraine, 23 March 2022, reporting about land mining by Russian Forces.



Radioactive emissions from wildfires burning in Chernobyl Exclusion Zone (ChEZ) on 11 March 2022, transport towards Ukrainian territories. Source: <u>https://nubip.edu.ua/node/106588</u>



Radioactive emissions from wildfires burning in Chernobyl Exclusion Zone (ChEZ) on 16 March 2022, transport towards Belarus. Source: <u>https://nubip.edu.ua/node/106588</u>

Background Information

In 2013 the Global Fire Monitoring Center (GFMC) published a comprehensive White Paper directed to the United Nations and International Organizations entitled "Vegetation Fires and Global Change – Challenges for Concerted International Action". This White Paper includes an analysis of dangerous wildfires affecting human security in the landscapes of Eurasia, including threats of fires burning on lands contaminated by radioactivity, UXO and land mines:

 <u>UN White Paper: Chapter 22 – Wildfires and Human Security in Cultural</u> <u>Landscapes in Transition – Examples from Temperate-Boreal Eurasia</u> (by J.G. Goldammer) (PDF, 0.2 MB) White Paper directed to the United Nations and International Organizations "Vegetation Fires and Global Change – Challenges for Concerted International <u>Action</u>" (PDF, 3.7 MB)



Ground and aerial impressions of UXO-contaminated territories in Germany: Advanced armoured and UAV technologies for safe prescribed burning and wildfire control. Source: GFMC (Goldammer et al. [2012, 2016]; see references further down; project website [in German]).

Safe Fire Management on Contaminated Terrain

In 2014 the Organization for Security and Cooperation in Europe (OSCE) commissioned the Report results and recommendations for wildfire suppression in contaminated areas, with focus on radioactive terrain refer (Goldammer, J.G., Kashparov, V., Zibtsev, S., Robinson, S., Freiburg-Basel-Kyiv, 53. p.)

- English Version (PDF, 3.1 MB)
- Russian Version (PDF, 3.8 MB)
- <u>BCMS Version</u> (PDF, 4.5 MB)
- Version for use in FYR of Macedonia (PDF, 4.6 MB)
- Albanian Version (PDF, 4.4 MB)

In 2018 the Regional Eastern Europe Fire Monitoring Center (REEFMC) published the pocket guidelines for fire management in the Chornobyl Exclusion Zone, a result of cooperative efforts between REEFMC, the Chornobyl Fire Management Agency and the U.S. Forest Service:

Pocket Guidelines for Fire Management in the Chornobyl Exclusion Zone (in Ukrainian) (PDF, 13.0 MB)

International Consultation on Fire in Irradiated Forests

An International Meeting on Reduction of Disaster Risk from Catastrophic Wildfires in the Chernobyl Irradiated Forests in was held under the auspices of the National Agricultural University of Ukraine, Yale University, GFMC / UNISDR in Kiev, Ukraine, 25-28 July 2007.

- Chernobyl programme (PDF, 1 MB)
- Chernobyl conference report
- GFMC Calendar with visual impressions

Ukraine: Second National Round Table and Consultation on Irradiated Forests

The Ministry of Ukraine on Emergencies and Affairs of Populations Affected by the consequences of the Chernobyl catastrophe convened a Round Table on \mathcal{P} Reduction of Risk of Disaster from Wildfires in the Chernobyl Irradiated Forests. The meeting was held on 6 October 2008 at the Ministry and cosponsored by Yale University School of Forestry and Environmental Studies, Global Institute of Sustainable Forestry (U.S.A.) and the Global Fire Monitoring Center (GFMC).

Meeting report (PDF, 17 KB)

Advanced Seminar Wildfires and Human Security: Fire Management on Terrain Contaminated by Radioactivity, Unexploded Ordnance (UXO) and Land Mines This seminar addressed the consequences of wildfires and fire management on contaminated terrain and was conducted in Kiev and Chornobyl, Ukraine, 6-8 October 2009, by the Global Fire Monitoring Center (GFMC) in the frame of the activities of the Council of Europe (CoE) and the joint project Enhancing National Capacity on Fire Management and Risk Reduction in the South Caucasus (Environment and Security Initiative [ENVSEC]), the UNISDR Regional Southeast Europe / Caucasus and Central Asia Wildland Fire Networks and the UNECE / FAO Team of Specialists on Forest Fire.

• Background information (English) (PDF)

- Background information (Russian) (PDF)
- Seminar brochure (PDF, 3.3 MB)
- Letter of Endorsement by the Speaker of the Ukrainian Parliament Mr. Litvin
- <u>Seminar report</u> (PDF, 0.1 MB)
- <u>Chernobyl Resolution on Wildfires and Human Security: Challenges and Priorities</u> for Action to address Problems of Wildfires burning on Terrain Contaminated by <u>Radioactivity, Unexploded Ordnance (UXO) and Land Mines</u> (PDF, 52 KB)

International Conference ■"Twenty-five Years after the Chornobyl Accident ■" The International Conference ■"Twenty-five Years after Chornobyl Accident. Safety for the Futurem" was held in Kyiv / Chornobyl, Ukraine, 20-21 April 2011. A joint presentation ♂"Needs for Development of Wildfire Management in the Chornobyl Exclusion Zone ="" was given by C.D. Oliver, S.V. Zibtsev, A.M. Hohl, J.G. Goldammer, J. McCarter, M.M. Petrenko and O.A. Borsuk.

- Final agenda of 25 years Chornobyl Accident Conference (with wildfire contributions) (PDF, 1.8 MB)
- <u>Abstract of presentation</u> <u>Needs for Development of Wildfire Management in the</u> <u>Chornobyl Exclusion Zone</u> (PDF, 3.1 MB)
- Forest fires around Chernobyl could release radiation, scientists warn (The Guardian, 26 April 2010)

Regional Eurasian Wildland Fire Network

W gfmc.online/globalnetworks/balticregion/BalticRegion_7.html

GFMCadmin

A Region of the Global Wildland Fire Network

Regional Network Meetings, Conferences and Capacity Building

Regional Network Meetings, Conferences and Capacity Building

The Regional Eurasian Wildland Fire Network is active in Eastern Europe, Caucasus and Central Asia – the EECCA region. The activities were initiated by GFMC with members of the UNECE/FAO Team of Specialists on Forest Fire (1981-2014) and since 2017 by the Eurasian Team of Specialists on Landscape Fire Management. Many activities are jointly conducted with the UNISDR Regional Wildland Fire Networks of <u>Southeast Europe /</u> <u>Caucasus</u>, <u>Central Asia</u> and <u>Northeast Asia</u>. The boundaries of these regions are overlapping (see <u>map</u>). Activities in the EECCA region are summarized below, starting at bottom with one of the major events in the 1990s and two UNECE regional conference held in 2004 (Turkey and <u>Finland</u>). The most recent event is on top of this list. More information is provided by links to dedicated websites.

28-30 September 2022

Forest Firefighter Training Course for State Forestry Enterprises of Ukraine in the Ukrainian Center for Advanced Training of Forestry Personnel *Ukrcentrkadrylis*, Boyarka, Kyiv region. Training organizers:

- State Agency of Forest Resources of Ukraine
- Regional East European Fire Monitoring Center
- Ukrainian center for training, retraining and advanced training of forestry personnel *Ukrcentrkadrylis*
- Educational and Scientific Institute of Forestry and Horticulture of the National University of Bioresources and Nature Management of Ukraine
- Global Fire Monitoring Center (GFMC), Freiburg, Germany

Training participants: Staff of forest fire stations, senior foresters, foresters' assistants and foresters of state forestry enterprises. In-person course with field exercise and GFMC contribution online.

- https://nubip.edu.ua/node/115158
- Training Agenda (Ukrainian)
- <u>Training Agenda</u> (English)



Forest Firefighter Training Course for State Forestry Enterprises of Ukraine Conducted by REEFMC in remote cooperation with GFMC – Boyarka, 28-30 September 2022

02 August 2022

Online meeting "Forest. Climate. War", organized by WWF Ukraine with participation of 54 representatives from state forest enterprises of Ukraine, Regional Eastern Europe Fire Monitoring Center (REEFMC), Kyiv, Ukrainian Research Institute of Forestry and Melioration named after G. M. Vysotskiy (URIFMM), Kharkiv, National University of Life and Environmental Sciences of Ukraine (NUBiP), Kyiv, National Forest-Technical University (NLTU), Lviv, State Forestry Resources Agency of Ukraine, Ministry of Environmental Protection and Natural Resources of Ukraine, non-governmental organization and local communities. Presentation of Prof. Sergiy Zibtsev, REEFMC: "Forest and Fire Management during war", in chi he reflected the experience of the Global Fire Monitoring Center on fire management on terrains contaminated by unexploded ordnance (UXO).

WWF-REEFMC Meeting "Forest-Climate-War" Agenda (UKR) (PDF)

22 May 2022

Government of Ukraine approved the procedure for organizing the protection and conservation of forests and amended some resolutions of the Cabinet of Ministers of Ukraine. The document was developed in pursuance of the decision of the National Security and Defense Council of Ukraine "On challenges and threats to national security of Ukraine in the environmental sphere and priority measures to neutralize them", enacted by Presidential Decree of 23.03.2021 № 111. The procedure clearly defines a number of measures for forest conservation. It includes **rules for the protection of forests from fires**, illegal logging, damage, weakening and other harmful effects, protection from pests and diseases.

- <u>Press release by Ministry for Ministry of Environment of Ukraine</u> (20 May 2022, UKR with ENG translation) (PDF)
- <u>Resolution of the Cabinet of Ministers of Ukraine No. 612 "Order of organization of protection and protection of forests"</u> (UKR) (PDF)

<u>Resolution of the Cabinet of Ministers of Ukraine No. 612 "Order of organization of protection and protection of forests"</u> (ENG, robot translation) (PDF)



Since 24 April 2022

During the war in Ukraine, wildfires are occurring as collateral damages and purposely set. <u>REEFMC</u> and <u>GFMC</u> are monitoring the situation. Landscape Fire Bulletins include updates on fires on the territory of Ukraine (in ecosystems, agricultural lands and in cities, including updated maps of active fires, updated fire statistics, maps and details of large fires). Safety Advisories have been issued to address the threats of wildfires burning on terrain contaminated with unexploded ordnance (UXO) and radioactivity. The map shows the up-to date accumulated locations of fires depicted by satellites:

<u>GFMC post on fire management on contaminated terrain, during armed conflicts</u> <u>and post-conflict</u>

25-28 October 2021

Field excursion of Research Cooperation Project "Transformation of Forests to Close-to-Nature Forest Management in Ukraine: Nature-based silvicultural and fire management methods for increasing the resilience of pine stands to drought and wildfire" (RESILPINE) with fire management components. Field visits of the Ukrainian partners from Regional Eastern Europe Fire Monitoring Center (REEFMC), Institute of Forestry and Landscape-Park Management, National University of Life and Environmental Sciences of Ukraine (NULESU) at the former GFMC experimental areas in Nature Reserve Heidehof-Golmberg, wilderness area fire management in Jüterbog (Stiftung Naturlandschaften Brandenburg) and Forest District Baruth / Stülpe; Jüterbog, Treuenbrietzen, Teltow-Fläming County, Germany.

RESILPINE at GFMC: <u>https://gfmc.online/programmes/natcon/gfmc-ukraine-resilpine-2021.html</u>



The REEFMC Team with the Directors of Forestry Enterprise Semenivsk and Oster Military Forestry Enterprise (Ukraine) in Heidehof-Golmberg Nature Reserve, with the local hosts of Foundation "Naturlandschaften Brandenburg" and Forest District Stuelpe. Photo: <u>REEFMC</u>

REEFMC brochure 2021 (PDF)

04-06 October 2021

The Second Firefighter School NUBiP Fall 2021 was held in Boyarka Forest Experiment Station, Dzvinkove, Kyiv region, Ukraine. The landscape fire management training for trainees representing State Forest Enterprises and the State Emergency Service of Ukraine, was provided jointly by REEFMC and GFMC.

- https://nubip.edu.ua/en/reefmc
- Second Firefighter School NUBiP 2021 Agenda (English) (PDF, 0.4 MB
- Second Firefighter School NUBiP 2021 Report (English): <u>https://nubip.edu.ua/en/node/98947</u>
- Second Firefighter School NUBiP 2021 Report (Ukrainian): <u>https://nubip.edu.ua/en/node/98947</u>
- <u>Second Firefighter School NUBiP 2021 Report (Ukrainian and English)</u> (PDF, 1.0 MB)





Регіональний Східнокеропейський центр моніторынгу пожеж (REEFMC) Національний універсного біоресурсія і природокористування України

Регіональний Східноєвропейський центр моніторингу пожеж

Regional Eastern Europe Fire Monitoring Center





Second Firefighter School NUBIP Fall 2021 in Boyarka, Ukraine. Landscape fire management training for trainees representing State Forest Enterprises and the State Emergency Service of Ukraine. Joint REEFMC and GFMC training; Boyarka Forest Experiment Station, Dzvinkove, Kyiv region, Ukraine.

26-27 June 2021

Forest Fire School for Volunteers of Luhansk Region, Ukraine: Pilot training in participatory approaches in landscape fire management with NGOs and volunteers in Ukraine, conducted by the Regional Eastern Europe Fire Monitoring Center (REEFMC) in Luhansk region, together with the charitable organization "Vostok-SOS Charitable Foundation" and SE "Severodonetsk LGM", remotely supported by GFMC. The trainings took the form of reports, practical classes, excursions and field exercises.

- https://nubip.edu.ua/en/reefmc
- Report on the Forest Fire School (PDF, 0.3 MB)



Forest Fire School for Volunteers of Luhansk Region Sievierodonetsk, Luhanska Oblast, Ukraine, 27 June 2021

17 June 2021

Ministry of Environment of Ukraine opening the public consultation on the Draft State Strategy for the National Landscape Fire Management System for 2021-2035 jointly elaborated by the Ministry and GFMC:

- <u>Announcement of the State Strategy for the National Landscape Fire Management</u>
 <u>for public consultation</u>
- Press release of the Ministry for Environment



Natural landscapes – forests, protected areas and wetlands – are subjected to socioeconomic and climate change. In order to preserve valuable natural areas and protect them from landscape fires, the Ministry of the Environment and the Global Fire Monitoring Center (Germany) have prepared a draft State Strategy for the National Landscape Fire Management System for 2021-2035 – open for public consultation until 17 July 2021.

08 June 2021

All-Ukrainian Forum "Ukraine 30. Ecology" initiated by the President of Ukraine Volodymyr Zelensky. The forum is a discussion platform where representatives of the authorities of all levels, the expert community, civil society and the international community raise a number of issues that need to be addressed in environmental protection and preparedness to climate change. The "National Strategy for Landscape Fire Management" was presented jointly by Bohdan Borukhovsky (First Deputy Minister of Environmental Protection and Natural Resources of Ukraine), Oleh Bondarenko (Chairperson of the Committee on Environmental Policy and Nature Management), Taras Kacha (Deputy Minister for Economic Development, Trade and Agriculture of Ukraine), Yuriy Bolokhovets (Head of the State Agency of Forest Resources of Ukraine), Andriy Malovany (Head of the State Ecological Inspectorate) and Sergiy Zibtsev (Head of REEFMC); supported by GFMC; Kiev, Ukraine.

- REEFMC post (English): https://nubip.edu.ua/node/93901
- REEFMC post (Ukrainian): https://nubip.edu.ua/node/93866



Ukraine 30.Ecology – Presentation of the National Strategy for Landscape Fire Management 08 June-2021, Kyiv, Ukraine

24-26 May 2021

First Spring Firefighter School NUBiP 2021 in Boyarka, Ukraine. Landscape fire management training for 32 trainees representing 14 State Forest Enterprises from Chernihiv Oblasts, Chief Foresters and Fire Management Engineers, representatives of

protected areas Drevlianskii and Desniansko-Starogutskii Natural Reserves, officers of the State Emergency Service of Ukraine (Chernobyl Emergency Brigade 11). Joint REEFMC and GFMC training; Boyarka Forest Experiment Station, Dzvinkove, Kyiv region, Ukraine.

- https://nubip.edu.ua/en/reefmc
- <u>First Spring Firefighter School NUBiP 2021 Agenda</u> (Ukrainian and English) (PDF, 0.6 MB)



Participants of the First Spring Firefighter School 2021 in Boyarka Forest Experiment Station, Ukraine, jointly conducted by National University of Life and Environmental Sciences of Ukraine (NULESU), Regional Eastern Europe Fire Monitoring Center (REEFMC) and GFMC.

March 2020

Follow-up of the National Round Table on the Future of Landscape Fire Management in Ukraine (cf. below):

- Press release of the Ministry of Environment Protection and Natural Resources of Ukraine on the Strategy and Action Plan for 2021 (12 March 2021) (Ukrainian and English, PDF)
- LAW OF UKRAINE No. 1259 IX "On amendments to certain legislative acts of Ukraine on strengthening the protection of forests, preventing fires on the lands of forest and water fund, peatlands and lands of other categories", as adopted by Verkhovna Rada of Ukraine and signed by the President of Ukraine on 19 February 2021 (published on 18 March 2021; in Ukrainian, with unofficial translation to English; PDF)

- Decree of the President of Ukraine № 111/2021 of 23 March 2021 "On challenges and threats to Ukraine's national security in the environmental sphere and priority measures to neutralize them" with relevance o landscape fire management (published on 23 March 2021; in Ukrainian, with unofficial translation to English; PDF).
- Press release of the Ministry of Environmental Protection and Natural Resources of Ukraine "Germany supports Ukraine on the path to sustainable development", including support of the development of the State Strategy of the National Landscape Fire Management System supported by the Germany-based Global Fire Monitoring Center (GFMC) (published on 30 April 2021, PDF)

01 December 2020

National Round Table on the Future of Landscape Fire Management in Ukraine, facilitated by the Working Group for the development of a Draft State Strategy of a National System of Landscape Fire Management" in support of the "Joint Working Group of the Committee on Environmental Policy and Nature Management and the Committee on Law Enforcement on the Causes of Forest Fires and their Prevention in the Future" of the Parliament of Ukraine (Verkhovna Rada) and the Working Group "Development of State Strategy on Forest Management 2035" of the Ministry of Environment Protection and Natural Resources of Ukraine", Ministry of Environment Protection and Natural Resources of Ukraine", Kyiv, Ukraine / Online.

- Decree for the establishment of the Working Group for the development of a Draft State Strategy of a National System of Landscape Fire Management signed by Minister for Environment and Natural Resources, Mr. Roman Abramovskyy. Appointment of GFMC Director Johann Georg Goldammer as Co-Chair of the Working Group, with First Vice Minister Bogdan Borukhovskyy (7 September 2020) (PDF, 0.1 MB)
- Questionnaire for experts working in organizations that respond to or are related to the prevention and extinguishing of landscape fires (01 October 2020)
- <u>Related press release by Prime Minister of Ukraine, Mr. Denys Shmyhal, at the visit</u> of the extreme fires in Luhansk Region, Eastern Ukraine (Government website, 02 October 2020)
- National Round Table Agenda (Ukrainian) (PDF, 0.2 MB)
- National Round Table Agenda (English) (PDF, 0.2 MB)
- Round Table report on website of the National University of Life and Environmental Sciences of Ukraine (Ukrainian) (mirrored on GFMC repository, PDF)
- Round Table report on the website of the National University of Life and Environmental Sciences of Ukraine (English) (mirrored on GFMC repository, PDF)
- Round Table report on the website of Open Forests (Ukrainian) (mirrored on GFMC repository, PDF)
- <u>Fires of a new type: Nine lessons to learn after the fires of 2020</u> (Forest and Hunting 6/2020) (Ukrainian, PDF)

National Round Table

DEVELOPMENT OF A STATE STRATEGY FOR THE NATIONAL SYSTEM OF LANDSCAPE FIRE MANAGEMENT 01 December 2020, Kviv, Ukraine



29 October 2020

On 29 October 2020, representatives of the Department of Silviculture of Education and Research Institute of Forestry and Landscape-Park Management and Regional Eastern Europe Fire Monitoring Center (REEFMC) Prof. Sergiy Zibtsev, Assoc. Prof. Vasyl Gumeniuk and Assoc. Prof. Oleksandr Soshenskyi took part in a discussion on fires in Luganska oblast: "Reforestation after fires: how, when, who?" organized by the Crisis Media Center "Seversky Donets". At the end of September and in early October 2020 the Luhansk region survived terrible forest fires, probably the largest in all history of independent Ukraine. The fire covered more than 20,000 hectares of forests and affected more than 30 settlements. Eleven civilians and three military were killed. More than 500 private houses burned down. Representatives of the Departments of Ecology and Natural Resources of various regions of Ukraine, the Institute of Ecology of the Carpathians of the National Academy of Sciences of Ukraine, international experts, eco-researchers, forest workers of the region, representatives of state and local authorities, entrepreneurs and public activists are invited to participate in the discussion.



For more details: <u>https://nubip.edu.ua/en/node/82765</u>

03 September 2020

Initiation of the work of the "Working Group for the development of a Draft State Strategy of a National System of Landscape Fire Management" in support of the "Joint Working Group of the Committee on Environmental Policy and Nature Management and the Committee on Law Enforcement on the Causes of Forest Fires and their Prevention in the Future" of the Parliament of Ukraine (Verkhovna Rada) and the Working Group "Development of State Strategy on Forest Management 2035" of the Ministry of Environment Protection and Natural Resources of Ukraine".

- <u>Decree for the establishment of the Working Group for the development of a Draft</u> <u>State Strategy of a National System of Landscape Fire Management signed by</u> <u>Minister for Environment and Natural Resources, Mr. Roman Abramovskyy.</u> <u>Appointment of GFMC Director Johann Georg Goldammer as Co-Chair of the</u> <u>Working Group, with First Vice Minister Bogdan Borukhovskyy</u> (7 September 2020) (PDF, 0.1 MB)
- Questionnaire for experts working in organizations that respond to or are related to the prevention and extinguishing of landscape fires (01 October 2020)
- <u>Related press release by Prime Minister of Ukraine, Mr. Denys Shmyhal, at the visit</u> of the extreme fires in Luhansk Region, Eastern Ukraine (Government website, 02 October 2020)

16 July 2020

On 16 July 2020, the First Meeting of the working group on the development of the State Forest Management Strategy in Ukraine until 2035 took place in Kyiv. The working group is chaired by the <u>Ministry of Ecology and Natural Resources of Ukraine</u>. Prof. S. Zibtsev, head of the <u>Regional Eastern Europe Fire Monitoring Center (REEFMC)</u>, is a member of the working group. REEFMC will be responsible for the Forest Fire Management System.

Meeting report



First Meeting of the working group on the development of the State Forest Management Strategy in Ukraine

15 July 2020

On 15 July 2020 the Minister of Ecology and Natural Resources of Ukraine, Roman Abramovskyy, signed Order №3 of 15 July 2020 "On approval of the Working Group member for the development of the State Forest Management Strategy until 2035", in order to ensure the development of the State Forest Management Strategy until 2035 and to determine the main priorities for forestry development, wood exploitation, reforestation, ways to finance forest inventory, forest protection, and management of landscape fires.

- Ministerial Order №3 of 15 July 2020 (Original in Ukrainian)
- Unofficial translation (English)

09 July 2020

At the invitation of the Verkhovna Rada Committee on Environmental Policy and Nature Management and the Law Enforcement Committee, the Minister of Environmental Protection and Natural Resources of Ukraine Roman Abramovskyy took part in a meeting of the Working Group on Forest Causes and Prevention in the Future in Zhytomyr Oblast. The Minister heard reports on the problems arising in the work of forestry and said that the Ministry will hold consultations with experts and experts, as a result of which a draft State Strategy for Forest Management until 2035 will be developed. "It is necessary to develop a strategy for the next 15 years and identify the main priorities for forestry development, forest use, reforestation, ways to finance forest management, forest protection, prevention and elimination of forest fires," said Roman Abramovsky. **Part of this strategy will be the development and implementation of the National System for Protection of Natural Landscapes from Fire.** During the visit, the Minister inspected the areas where forest fires took place in April this year, in particular the most affected Ovruch and Narodytsky districts.

- Press release by the Ministry: https://menr.gov.ua/news/35535.html
- Mirrored on GFMC Archive (PDF)

11 June 2020

First meeting of the *Working Group of the Committee on Environmental Policy and Nature Management and the Committee on Law Enforcement on the Causes of Forest Fires and their Prevention in the Future*, in the Parliament (Verkhovna Rada) of Ukraine, with WG member and participation of the head of the Regional Eastern Europe Fire Monitoring Center (REEFMC), Sergiy V. Zibtsev. At the meeting, held at the parliament in Kiev, the Head of REEFMC highlighted most important aspects and steps on fire management needed in Ukraine based on experience and long-term co-operation with GFMC. The cooperation has been supported by the <u>European and Mediterranean Major Hazards</u> <u>Agreement (European Open Partial Agreement EUR-OPA) of the Council of Europe and</u> <u>the OSCE</u>.

- Meeting report by the National University of Life and Environmental Sciences of Ukraine: <u>https://nubip.edu.ua/en/node/78006</u>
- <u>Meeting report mirrored by GFMC</u> (PDF)



The Working Group meeting observed the safety rules imposed due to the COVID-19 pandemic.

04 June 2020

Online Kick-off Meeting of the Research Cooperation Project "Transformation of forests to close-to-nature forest management in Ukraine: Nature-based silvicultural and fire management methods for increasing the resilience of pine stands to drought and wildfire" (RESILPINE) with fire management components:

- Wildfire risk reduction of pine forest by enrichment with broadleaved species
- Wildfire hazard reduction of pine forest by applying nature-based integration of prescribed burning
- Strategic planning and treatment of fuel breaks between forests, agricultural lands and settlements

Partners:

- Hochschule für nachhaltige Entwicklung Eberswalde (HNEE) (Eberswalde University for Sustainable Development), Fachbereich für Wald und Umwelt
- Ukrainian National Forestry University (Lviv, Ukraine)
- Regional Eastern Europe Fire Monitoring Center (REEFMC)
- GFMC

Sponsor: German Federal Ministry for Food and Agriculture (BMEL) / German Federal Agency for Agriculture and Food (BLE). Initial project duration: May 2020 – April 2022; Eberswalde, Germany; Lviv, and Kiev, Ukraine; GFMC.

- https://nltu.edu.ua/index.php/en/
- <u>https://www.hnee.de/en/Startseite//HNE-Eberswalde-Startseite-E9875.htm?</u>
 <u>cb=1588118853</u>
- https://nubip.edu.ua/en/reefmc



Sponsor: German Federal Ministry for Food and Agriculture (BMEL) / German Federal Agency for Agriculture and Food (BLE). Initial project duration: 1 May 2020 – 30 April 2022; Eberswalde, Germany; Lviv, and Kiev, Ukraine; GFMC.

- <u>https://gfmc.online/globalnetworks/balticregion/BalticRegion_7.html</u>
- https://nltu.edu.ua/index.php/en/
- <u>https://www.hnee.de/en/Startseite//HNE-Eberswalde-Startseite-E9875.htm?</u>
 <u>cb=1588118853</u>
- https://nubip.edu.ua/en/reefmc

23 January 2020

Launch of a web page "Natural Hazards – Landscape Fires" as part of <u>BeSafeNet</u> to provide basic understanding of the fundamentals of landscape fire and how people can protect themselves and their assets from the threats of wildfires. The website is tailored for high school students (age 15-17 years):