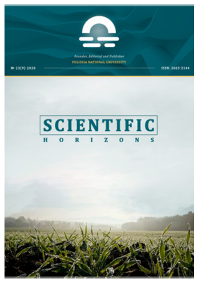
SCIENTIFIC HORIZONS

Journal homepage: https://sciencehorizon.com.ua

Scientific Horizons, 24(8), 26-36



UDC 630*43:504.054
DOI: 10.48077/scihor.24(8).2021.26-36

Assessment of the Consequences of Forest Fires in 2020 on the Territory of the Chornobyl Radiation and Ecological Biosphere Reserve

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Article's History:
Received: 10.09.2021
Revised: 12.10.2021
Accepted: 15.11.2021

Suggested Citation:
Fedoniuk, T., Borsuk, O., Melnychuk, T., Zymaroieva, A., & Pazych, V. (2021). Assessment of the consequences of forest fires in 2020 on the territory of the Chornobyl radiation and ecological biosphere reserve. *Scientific Horizons*, 24(8), 26-36.

Abstract. The article presents the consequences of fires that occurred on the territory Chornobyl Radiation and Ecological Biosphere Reserve in April 2020. Research shows that the results of these events characterized as catastrophic. The condition of forests after fires was assessed using satellite data and field trips to review the condition of forests affected by wildfires. The total area affected by the fire in 4 foci was 51,806.5 hectares. The total area of fires in the exclusion zone is 66,222.5 hectares. About 25% of the territories affected by the fires have changed. To preserve the landscape diversity and mosaic of areas covered and not covered with forest vegetation, it is impractical to conduct afforestation (afforestation of fallows) on the territory of the reserve. Among the forests affected by fires, the majority has a high ecological and forestry potential and, accordingly, a high potential for natural recovery (81.6%). In dead forests, the share with a high potential for natural reforestation is slightly lower and amounts to 66.8%. The share of forests with low natural recovery potential is low and amounts to 1.9% and 4.8% in forests affected by fires and dead, respectively. Significantly damaged, and sometimes destroyed, were a number of rare settlements, which are not only important for nature conservation, but also classified by the Standing Committee of the Bern Convention (Resolution 4) as particularly valuable settlements, as well as the "Green Book of Ukraine" (2009). 2 groups were marked as excessively damaged on the territory of the reserve. It should be noted that there is a slight general violation of the protected core of this object of the nature reserve fund, which will allow it to preserve its environmental potential and the functions of protecting and reproducing biodiversity. Most of the areas of the reserve affected by fires have a high forestry potential and are able to recover independently, so they do not require intervention in natural processes for reforestation. The degree of transformation of the ground cover in pine and oak-pine forests of the reserve under the influence of pyrogenic factor is determined by the intensity of the fire. Reforestation in areas with low forest potential should be carried out with clear planning

Keywords: fires, exclusion zone, nature reserve, reproduction, biodiversity

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INTRODUCTION

The exclusion zone has repeatedly suffered from large-scale catastrophic fires, the most dangerous of which were in 1992, 2015 and 2020 [1-4]. In addition to material damage and negative environmental consequences, forest fires in the exclusion zone changed the radioecological situation, causing repeated transfer of radionuclides [4]. Forest fires are one of the determining factors that can increase migration processes. As a result of crown fires, up to 80% of radiocesium can pass to the mineral part of the soil, while normally this indicator does not exceed 40% [5]. In addition, forest fires lead to organic part of the litter being exposed to ashing, which leads to the destruction of the soil organo-mineral complex and the release of mobile forms of radionuclides [6]. The fact that forest fires cause significant changes in the course of migration processes and the accumulation of radionuclides by the phytomass of stands with stable indicators of moisture content and plant composition was also indicated by O. Sungmin, X. Hou, R. Orth [7], S. Stoulos, A. Besis, A. Ioannidou [8] et al. In addition, as noted by P.R. Robichaud and others, fires can enhance the processes of their vertical migration to groundwater and then to rivers, as well as their rise to surface layers of air with wind erosion [9].

Forest fires cause a deep and long-term restructuring of all components of ecosystems and an increase in the variability of the structure of phytocenoses. The spatial distribution of radioactivity and its modelling in space has been addressed by many scientists [10-12]. Burnout of organic soil particles accumulated in the litter and phytomass increases the content of ash elements and mineralised nitrogen, and increases the heating of the soil surface, etc. [13]. As a result, the course of chemical processes in the soil changes and is accompanied by an increase in the sod process of soil formation. This leads to outbreaks of herbaceous vegetation. Gradually, after the restoration of the moss cover, the podzolic cycle begins to resume in the formation of the soil cover [14-17]. With the closure of the grassy tier, the microclimate gradually stabilises, and with the closure of stands, it acquires properties characteristic of forest ecosystems [18].

Statistics show that natural forests of the temperate climate zone are characterised by the repetition of large forest fires every 10-20 years [19]. This leads to the cyclical nature of the processes of renewal of pine stands, and, as a result, to the formation of a mosaic-step character of stands. Mosaic burnout of the soil cover is caused by the features of localization of combustible materials in pre-fire ecosystems, which affects the seed and vegetative renewal of groups of grass cover and trees [20]. Uneven burnout is partially caused by the formation of dead wood foci in the forest, which cause the transition of crawling fires into crown ones. The transition to ground fires is also caused by the accumulation of coniferous daff. Given this, the probability of crown fires in young pine plantations is higher than in natural forests [21]. It is especially large in dense stands that grow without human supervision.

Many modern researchers in Ukraine and abroad point out that high soil humidity, relative humidity and extreme temperature anomalies lead to severe forest fires. These figures were the cause of the largest forest fires in 2020. At the same time, fire hazard conditions at the time of the fire in April 2020 were higher than for other registered major fires [1; 12; 14, 22].

The purpose of this work was an assessment of the consequences of forest fires in 2020 using modern geoinformation systems and space technologies for remote sensing of the Earth's surface on the territory of the Chornobyl Radiation and Ecological Biosphere Reserve and exclusion zone in the context of functional zoning of the territory and the nature of forest vegetation, as well as an assessment of the distribution of plant species listed in the Red Book of Ukraine and damage to their habitats.

MATERIALS AND METHODS

The fire area was estimated using satellite imagery data. In addition, each of the stages of research included: field studies of fires, aerial photography using unmanned aerial vehicles, as well as analysis of the obtained high-resolution satellite images. The study covers the area affected by fires in the exclusion zone and amounts to 66,222.5 hectares, including 51,806.5 hectares in the Reserve. At the same time, ESRI's ArcGis GIS tools were used.

Materials from the Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS) instrument sets installed on the Landsat-8 satellite (Geological Survey (U.S.) were used to solve the problems of applying GIS technologies for landscape safety using remote sensing data from the Earth's surface. The satellite information processing products used in this study are posted on the geological portal of the United States Geological Survey [23; 24], in the fire information for resource management system (FIRMS) [25]. This method has already been used by the authors of the article in several previous publications, where this method of data processing was used to determine the electrical conductivity of soil in the Dniprovsko-Orilskyi Nature Reserve and in monitoring of biodiversity in the Chornobyl Radiation-Ecological Biosphere Reserve [26-28].

Indexes derived from the spectral channels of sensors installed on Landsat-8 or Sentinel-2 (ratio of spectral bands) satellites were used to monitor landscape safety [28]. Overall, the resolution of Sentinel-2 spectral channels is higher than that of Landsat-8. But it should be noted that the Sentinel-2 satellite has been operating in orbit since June 23, 2015. Therefore, if there is a need to obtain retrospective information about ecosystems, it is possible to use information from the Landsat-8 satellite (or earlier Landsat series satellites). For current monitoring, information from the Sentinel-2 satellite has an advantage. In addition, by combining information from both sources, it is possible to receive data with a higher time resolution or get scenes without a high level of cloud cover.

The forests after fires was assessed using satellite data and field trips to survey the condition forests affected by wildfires. By comparing the NDVI vegetation indices of 2019, 2020 and 2021, changes in the state of vegetation cover were revealed. As a result of fire damage, changes occur in natural complexes that affect the passage of vegetation and can be detected using satellite data. After analysing the received satellite images, visits were made to the damaged areas in order to validate the decryption data. These methods made it possible to estimate the approximate area and location of dead forests, significantly damaged swamps and fallows.

Analysis of the temporal dynamics of the normalised fire index was the basis for determining the areas of ecosystems affected by the pyrogenic factor and monitoring the dynamics of ecosystem recovery after fires. Of particular importance is the multidimensional statistical analysis of a set of indices for a single date. For example, an analysis of the main components of the set of indices presented at the date corresponding to the highest vegetation activity of vegetation cover will provide information about the diversity of settlements and the state of biotic potential. Ultimately, tensor analysis of the dynamics of a set of indices over time is a tool for understanding the complex dynamics of ecological and landscape systems.

RESULTS AND DISCUSSION

The largest forest fires in the history of the exclusion zone occurred during April and May 2020. They destroyed and damaged thousands of hectares of natural landscapes. The most dangerous in terms of scale and consequences were 4 foci of forest fires [29]. One of the largest occurred on April 03, 2020, on the territory of the Drevlyansky nature reserve, as a result of arson of dry grass by local residents. From there, the fire spread through the territory of the Kotovske Forestry. As a result of arson of deadwood, the second largest fire broke out near the territory of Dytyatkivske forestry, from where the fire spread to the territory of the Reserve and the exclusion zone. The causes of the third largest fire, which started on the territory of the Paryshivske Forestry, have not yet been determined. The fourth fire in the exclusion zone, which was localised in the immediate vicinity of the radioactive waste disposal zone, spread to the territory of the Reserve as well.

The weather conditions of 2019 – early 2020 were favourable for the occurrence of fires were, namely an unusually warm winter and the lack of snow cover. According to observations by the Ukrainian Hydrometeorological Centre (weather station Chornobyl), about 61% of the annual average rainfall and a 2.6ºC increase in the annual average air temperature were recorded in 2019. Weather conditions in the autumn-winter period also contributed to further dehydration of ground fuel and increased the risk of forest fires.

In all decades from November 2019 to April 2020, higher values of the average air temperature were recorded compared to similar decades of previous years and, especially, compared to the long-term norm. The lack of precipitation also exceeded the norm by 30%. The snowless winter of 2019-2020 additionally contributed to a further decrease in the humidity of the forest litter, grass cover and topsoil. The relative humidity of the air was also low during April 2020, while the value of this parameter varied between 20-40% during daytime hours, with the minimum recorded value of this parameter of 16%. Such weather conditions, further complicated by increased wind speeds, caused the rapid spread of fires and the complexity of their elimination.

The winter-spring period of 2020 was also marked by the excessively low water content of rivers and other aquatic ecosystems of the exclusion zone. Low soil moisture reserves in the catchments of the Pripyat River and its tributaries, as well as a lack of snow and low cementation of the soil (freezing did not exceed 10 cm), led to the absence of spring flooding. Given this, the conditions for ensuring fire prevention measures were extremely unfavourable (low humidity of floodplains and peatlands, drying up of most fire-fighting reservoirs and other water bodies). The low water content of the canals of the Pripyat land reclamation system was also caused by the fire of peatlands of the Kryva Hora-Chapaivka district.

As the authors of the article have already noted in reports and chronicles of nature [29; 30], the largest share of territories affected by fires are forests – 64.3%, fallows – 21.6%, swamps – 5.7%, fires of previous years and dead woods – 5.3% (Table 1, Fig. 1).

***Table 1**. Damage to the ecosystems of the exclusion zone as a result of forest fires (April 2020), ha*

Land category	Total area affected by fires, ha		
	Total for the Reserve	Total for the radioactive waste management zone, ha	Total for exclusion zone, ha
Forests	32413.1	10179.2	42592.3
Fallow lands, meadows	10721.8	3558.8	14280.6
Swamps	3530.5	235.6	3766.1
Burnt, dead forests	3513.6	4.6	3518.2
Free-growing forest plantations	64.9	0	64.9

Table 1, Continued

Land category	Total area affected by fires, ha		
	Total for the Reserve	Total for the radioactive waste management zone, ha	Total for exclusion zone, ha
Clearings, sighting lines	291.2	69.2	360.4
Roads	157.8	27.4	185.2
Firebreak	60	31.6	91.6
Water bodies	738.1	119.8	857.9
Other lands	315.5	189.8	505.3
Total	51806.5	14416	66222.5

Source: *[30]*

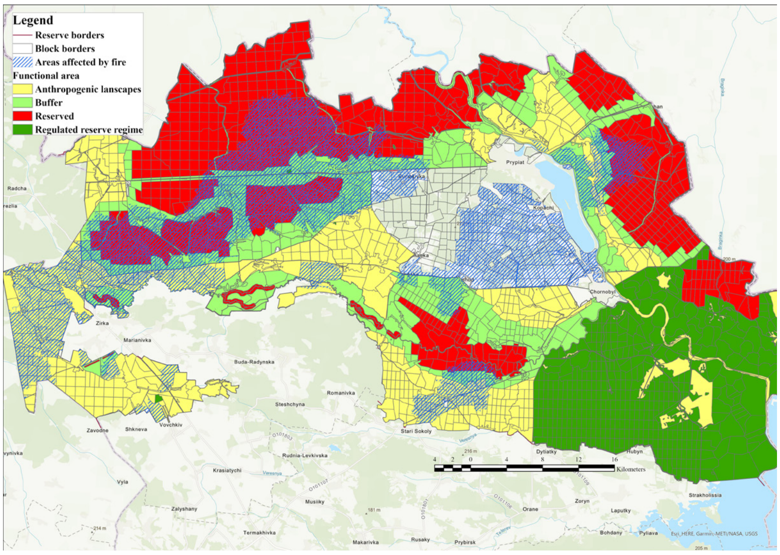


Figure 1. *Spread of fires in the context of functional zoning of the Reserve*

Fires on the territory of the exclusion zone in the spring of 2020 lasted about a month, as a result of which large areas of forest, meadow and swamp ecosystems were damaged. Most of the damage was caused to the forests. However, it should be noted that the degree of damage and the ability to regenerate in tree species vary. Among the breed composition of forests, the greatest damage was caused to monoculture pine forests, some of which died in the first weeks after the fire, and some will die off in the next 2-3 years. Deciduous tree species have a high ability to regenerate vegetatively and began to actively recover 1-3 months after the fire. The distribution of forests by tree species in the areas affected by the fire is shown in Figure 2. Thus, the share of scotch pine in damaged forests was 52%, silver birch (*Betula pendula*) – 35%, black alder (*Alnus glutinosa*) – 6.4%, common oak (*Quercus robur*) – 6.4% [29; 30]. According to surveys of fires, wetlands are also characterised by the greatest risk of death of pine forests, and in some places birch and alder.

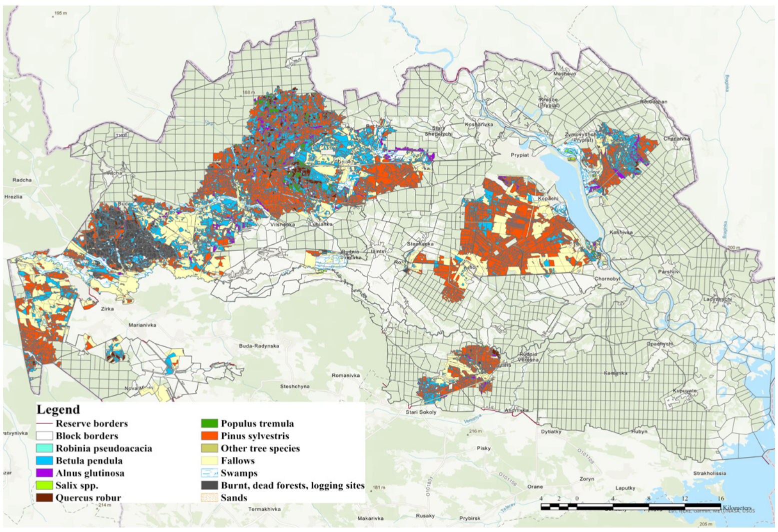


Figure 2. *Distribution of territories affected by fires by tree species*

For a more detailed analysis of the nature of the spread of fires in this area, a simplex graph was constructed (Fig. 3). The majority of forests affected by fires are young – 37.14% and medium-aged plantings – 52.57%. It graphically shows the ratio of three variables: the age of the stand in years, the height (M), and the quality class of the stand in the area of fire spread. This graph allows assessment of the fire propagation risks in a given area and is a tool for analysing compositional data of planting quality indicators in a three-dimensional format. As these graphs show, under the conditions of high intensity ground fire, young stands with trees whose bark is thin and unable to protect against the effects of high temperatures are most damaged. Coniferous young trees are particularly affected.

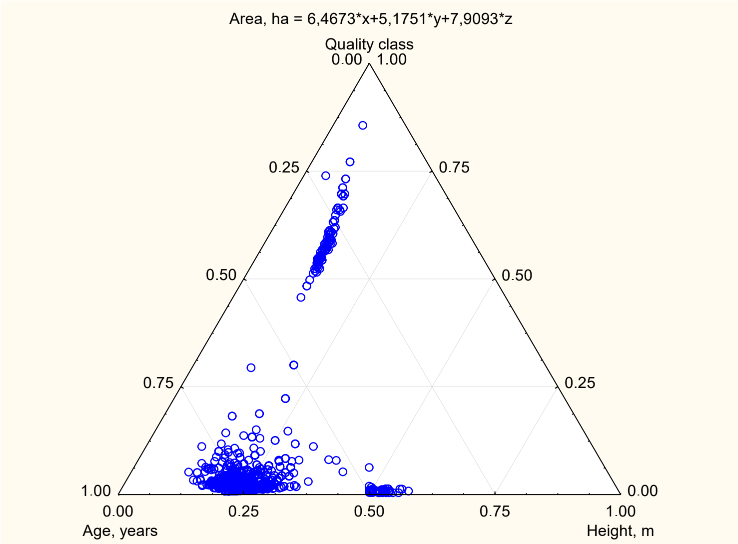


***Figure 3**. Ternary Graph of Area, ha against Age, years and Height, m and Quality class*

According to the results of the previous survey, the area of fires consist of forests – 63%, fallows – 21%, meadows and wetlands – 7%, burnt areas of previous years – 7%, as well as other lands – 2%. These territory is characterised by the presence of particularly valuable oak-hornbeam forests, West Palearctic Scots pine forests, continental deciduous and mixed forests of pine-oak, oak swampy forests, birch and coniferous swampy forests, coastal willow formations, Central European tributary ash-black alder groves, mixed oak-elm-ash forests near large rivers, high-grass meadows, eutrophic and oligotrophic upland bogs.

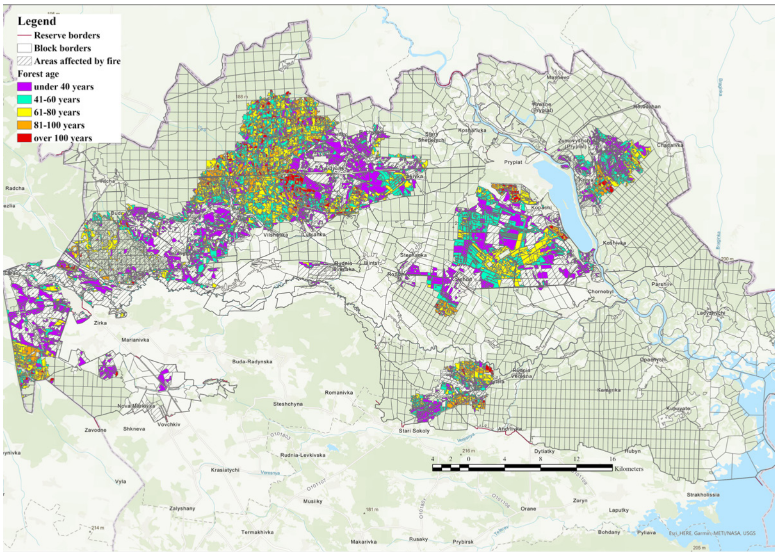
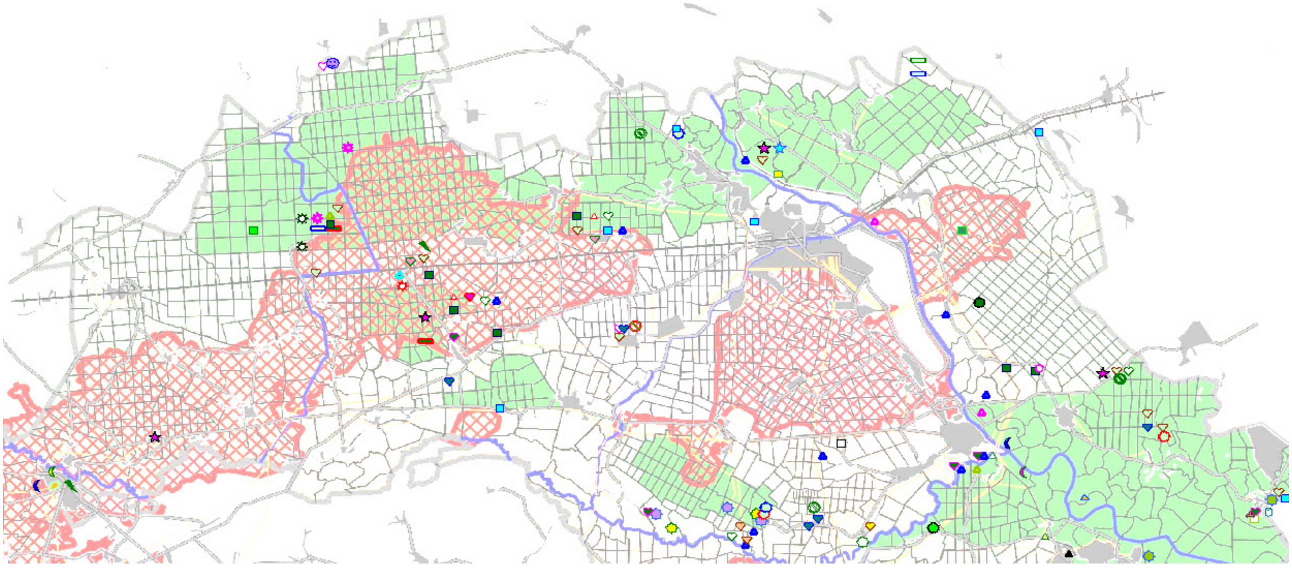


***Figure 4**. Distribution of territories affected by fires by forest age*

As the authors of the article previously noted in the Chronicle of nature [30], largely damaged, as well as partially lost, a number of rare biotopes have been identified within the Reserve, which are of great environmental importance and are listed in the settlements from Resolution 4 of the Standing Committee of the Bern Convention (14 biotopes) [31], in the "Green Book of Ukraine" (2009) [32]. 2 groups are significantly and moderately damaged within the Reserve. At the same time, the protected core of the Reserve has not been strongly affected and has been preserved, which will ensure further conservation of biodiversity and other conservation functions.



Symbols:

- *Aldrovanda vesiculosa*
- *Pedicularis palustris*
- *Salix lapponum* (approximate point)
- *Salix myrtiloides*
- *Salix starkeana* (approximate point)
- *Viola uliginosa*
- *Drosera rotundifolia*
- *Huperzia selago*
- *Lycopodium annotinum* (approximate point)
- *Salvinia natans*
- *Polypodium vulgare*
- *Matteuccia struthiopteris* (approximate point)
- *Botrychium multifidum* (approximate point)
- *Ophyoglossum vulgatum*
- *Picea abies* (approximate point)
- *Juniperus communis*
- *Alisma gramineum* (approximate point)
- *Allium ursinum*
- *Sparganium minimum* (approximate point)
- *Zannichellia palustris* (approximate point)
- *Leucanthemella serotina* (approximate point)
- *Dianthus stenocalyx*
- *Silene lithuanica*
- *Gentiana pneumonanthe*
- *Chenopodium acerifolium* (approximate point)
- *Lythrum hyssopifolia* (approximate point)
- *Polemonium caeruleum*
- *Trapa natans*
- *Chimaphila umbellata*
- *Moneses uniflora*
- *Pyrola chlorantha* (approximate point)
- *Batrachium aquatile* (approximate point)
- *Calla palustris*
- *Stipa borysthenica*
- *Carex paniculata* (approximate point)
- *Carex umbrosa*
- *Juncus bulbosus* (approximate point)
- *Iris sibirica*
- *Lilium martagon*
- *Veratrum lobelianum* (approximate point)
- *Caulinia minor* (approximate point)
- *Najas major* (approximate point)
- *Cephalanthera rubra* (near Dytiatky point is approximate)
- *Dactylorhiza incarnata* (approximate point)
- *Dactylorhiza fuchsii*
- *Epipactis helleborine* (approximate point)
- *Epipactis palustris*
- *Goodyera repens*
- *Gymnadenia conopsea* (approximate point)
- *Hammarbya paludosa* (approximate point)
- *Neottia nidus-avis*
- *Platanthera bifolia*
- *Platanthera chlorantha*
- *Bromopsis benekenii* (approximate point)
- *Potamogeton rutilus* (approximate point)
- *Jovibarba globifera* (approximate point)
- *Sempervivum ruthenicum*
- *Andromeda polifolia* (approximate point)
- *Oxycoccus palustris*
- *Ledum palustre*
- *Clematis recta*
- *Trollius europaeus* (approximate point)

Figure 5*. Distribution of plant species listed in the Red Book of Ukraine and damage to their habitats as a result of forest fires in 2020*

Among the rare and endangered species of flora and fauna, the following were recorded here: *Lilium martagon, Platanthera chlorantha, Leucanthemella serotina, Succisella inflexa, Carex umbrosa, Lycopodium annotinum L., Silene lithuanica, Pulsatilla patens, Pulsatilla pratensis,* etc. [29; 30].

The authors of this article noted in our previous reports and publications that some valuable and rare habitats of particular conservation importance and included in the list of habitats of Resolution 4 of the Standing Committee of the Bern Convention have been damaged and sometimes lost. In particular, it includes [29-31]:

- D2. 3 – transition swamps and floodplains – more than 5 ha;
- D5.2 – swamps dominated by large sedges – more than 50 ha;

- E 1.9 – open dry acidophilic and neutrophilic grass groups – more than 100 ha;
- E2.2 – plain hay meadows – more than 10 ha;
- E3.4 – wet and moist eutrophic meadows – more than 10 ha;
- E5.4 – moist high-grass meadows and fern edges – more than 1 ha;
- G1.11 – riparian willow forests – more than 10 ha;
- G1.21 – floodplain periodically wet forests dominated by alder (Alnus) or ash (Fraxinus) – more than 50 ha;
- G1.22 – floodplain forests dominated by oak (Quercus), elm (Ulmus) and ash (Fraxinus) – more than 10 ha;
- G1. 51 – sphagnum birch forests – more than 5 ha;
- G1.7 – thermophilic deciduous forests – more than 50 ha;
- G1. 8 – acidophilic oak forests – more than 10 ha;
- X04 – complexes of upper swamps – more than 0.5 ha;
- X35 – continental sand dunes – more than 10 ha.

From plant communities that are listed in the "Green Book of Ukraine" (2009) significantly and moderately damaged within the Reserve are: *Pineta (sylvestris) juniperosa (communis)* (more than 1 ha), Scheuchzeria-Sphagnum swamps (more than 1 ha) [32].

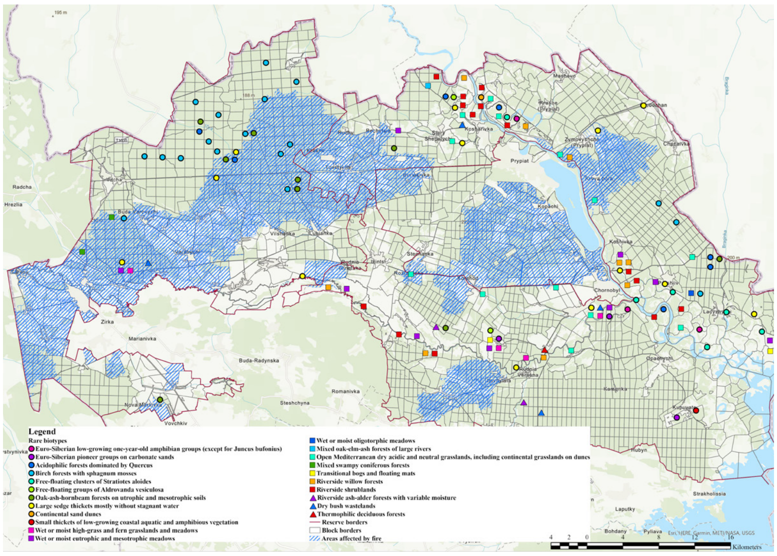


***Figure 6**. Habitats protected by Resolution No. 4 of the Berne Convention, which are in danger of destruction due to forest fires in 2020, and require special protection measures*

The condition of forests after fires was assessed using satellite data and field trips to observe the condition of forests affected by wildfires. These methods made it possible to estimate the ap-proximate area and location of dead forests, significantly damaged swamps and fallows (Fig. 7).

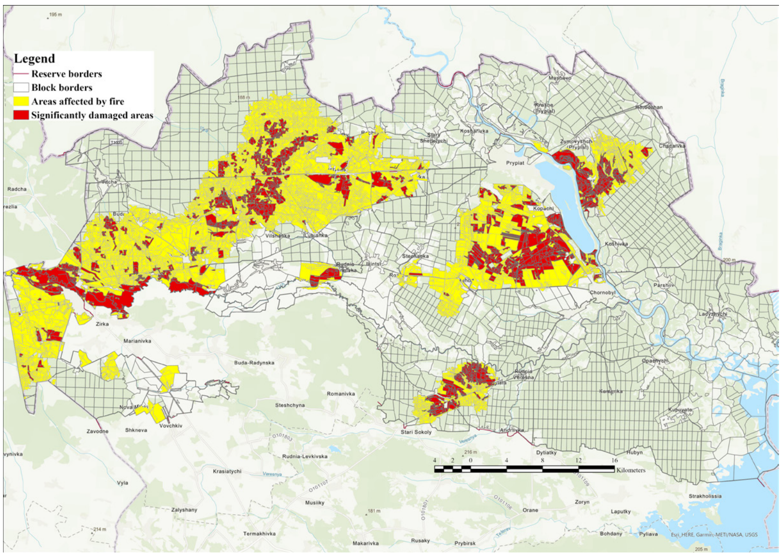


***Figure 7**. Location of natural complexes significantly damaged by fires in 2020*

According to the data obtained as a result of fires in 2020 about 25% of the territories affected by fires have been changed. Among them, 62.2% are forests, 20.3% are fallows, 11.5% are swamps, 2.5% are burnt and dead plantings. In addition, the fires affected grassy and woody-shrub vegetation overgrowing roads, areas under power lines, floodplains, reclamation canals, which was also reflected as a result of analysis of satellite data.

Among the areas affected by fires and significantly damaged, forests, swamps and fallow areas can be considered valuable for preserving biodiversity. Burnt and dead plantings were valuable as possible testing sites for ecosystem restoration research and monitoring the course of natural regener-ation processes in ecosystems. The largest losses due to fires were among pine forests (82.17%) and birch (13.6%). The distribution of damaged forests by main species and their location is shown in Figure 8.

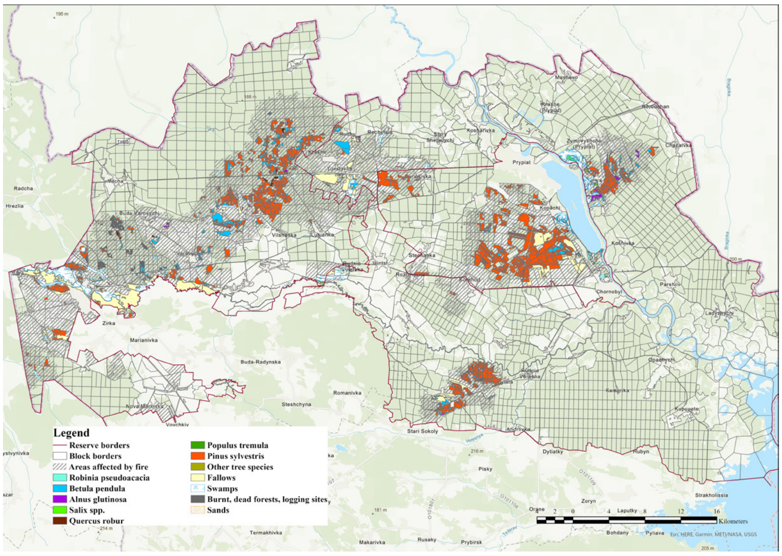


***Figure 8**. Location of forests destroyed by fires and their division by main species*

Young and middle-aged stands are predominant among the dead forests (Fig. 9). The death of stands in these forests is caused both by the influence of high temperatures on the crown and trunk and by the burning of root systems in the upper layers of the soil (Figs. 10-11). In particular, in humid, damp and wet conditions on the territory of the Reserve, the above-ground cover is often formed with a predominance of sphagnum mosses and sedges (especially in deciduous forests). Due to the high levels of moisture in such areas of the forest, they form a surface root system, which is significantly damaged in the event of fires. This leads to the death of stands and windthrow in them in the coming months after the fire.

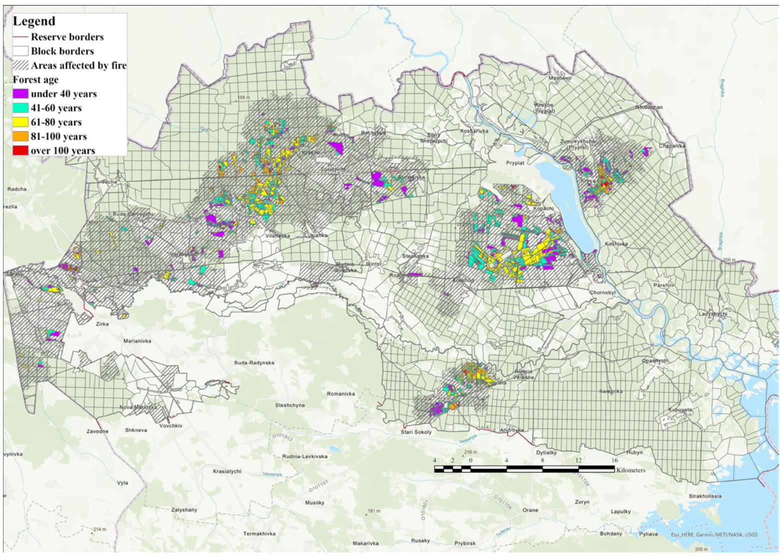


***Figure 9**. Location and distribution of forests destroyed by fires by age*

The degree of transformation of the ground cover in the pine and oak-pine forests of the Reserve under the influence of pyrogenic factor is determined by the intensity of the fire. After a ground medium-intense fire in pine and other forests of the reserve, there is a decrease (up to 90%) in the species diversity of moss-lichen cover. High-intensity and low-intensity fires lead to the complete death of the moss-lichen cover. Biotic diversity in areas affected by high-and low-intensity fires is differ than in the control area, in particular, there is a larger number of species and genera belonging to certain communities. As example, in the areas affected by the large fire in 2015, forest species – indicators of living above-ground cover – are being replaced by ruderal ones.

Figure 10. *Burning of living above-ground cover and litter in the black alder forest in the TFC C_4. Photo from 29.04.2020*

Figure 11. *Windthrow in a pine forest after burning root systems in the TFC B_3. Photo from 21.07.2020*

In dry and fresh conditions in coniferous plantations on the territory of the exclusion zone high reserves of forest litter are formed, which causes high combustion temperatures and thermal damage to tree trunks and crowns. Deciduous forests in these conditions are most often young stands up to 0.6 relative density with an admixture of Scots pine, formed naturally on former agricultural lands. Such forests are characterised by high reserves of herbaceous plants, which leads to the rapid passage of fires in them. However, in such stands, young trees have thin bark that is not able to protect them from fires.

CONCLUSIONS

Forest fires that occurred in April 2020 on the territory of the Chornobyl Radiation and Ecological Biosphere Reserve and the exclusion zone had catastrophic consequences. More than 51,806.5 hectares of protected land within the Chornobyl Radiation and Ecological Biosphere Reserve and 66,222.5 hectares within the exclusion zone were damaged by forest fires. More than 25% of the damaged territories were significantly changed. The causes of fires in most cases were the ignition of dry grass as a result of arson by residents of the nearest settlements.

Many forest ecosystems affected by fires in April 2020 have a high ecological and forestry potential and, accordingly, a high potential for natural recovery (81.6%). In dead forests, the share with a high potential for natural reforestation is slightly lower and amounts to 66.8%. The share of forests with low natural recovery potential is low and amounts to 1.9% and 4.8% in forests affected by fires and dead, respectively. To preserve the landscape diversity and mosaic of areas covered and not covered with forest vegetation, it is impractical to conduct afforestation (afforestation of fal-lows) on the territory of the reserve. In addition, fallows are an important food base for ungulates, in particular, Przewalski's horse, deer, and bison.

In the pine and oak-pine forests of the reserve, the transformation of the ground cover is determined by the intensity of fires. Crawling medium-intensity fires of pine and other forests cause a decrease in the species diversity of mosses and lichens by up to 90%, while crown and high intensity ground fires lead to its complete loss. Most of the territory damaged by fires in 2020 on the territory of the Reserve has a high forestry potential, and its ecosystems are capable of self-healing, so they do not require any forestry activities.

The losses within the reserve of rare biotopes, which have an important environmental function and are included in the list of settlements of Resolution 4 of the Standing Committee of the Bern Convention (14 biotopes), were significant. In general, the protected core of the Reserve has not undergone a strong transformation and has been preserved, which will allow it to continue to perform the functions of preserving and reproducing biodiversity and other environmental functions.

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Оцінка наслідків лісових пожеж 2020 року на території Чорнобильського радіаційно-екологічного біосферного заповідника

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Анотація. У статті представлені наслідки пожеж, які сталися на території Чорнобильського радіаційно-екологічного біосферного заповідника у квітні 2020 року. Дослідження показують, що наслідки цих подій мали катастрофічний характер. Стан лісів після пожеж оцінювався з використанням супутникових даних та виїздів з метою огляду стану лісів пройдених пожежами в натурі. Загальна площа, пройдена вогнем у 4 осередках, становила 51 806,5 га. Загальна площа пожеж на території зони відчуження складає 66 222,5 га. Серед пройдених пожежами територій зазнали змін близько 25 %. Для збереження ландшафтного різноманіття, мозаїчності вкритих і не вкритих лісовою рослинністю ділянок – проведення лісорозведення (заліснення перелогів) на території Заповідника є недоцільним. Серед лісів пройдених пожежами більшість має високий еколого лісівничий потенціал та, відповідно, високий потенціал природного відновлення (81,6 %). У загиблих лісах частка з високим потенціалом природного лісовідновлення дещо менша і складає 66,8 %. Частка лісів з низьким потенціалом природного відновлення є невисокою і становить 1,9 % та 4,8 % у лісах пройдених пожежами та загиблих відповідно. Значною мірою пошкодженими, а подекуди зруйнованими, виявилися низка рідкісних оселищ, що володіють не лише важливим природоохоронним значенням, але й віднесені Постійним комітетом Бернської конвенції (Резолюція 4) до особливо цінних оселищ, а також «Зеленої книги України» (2009). Надмірно пошкодженими на території Заповідника відмічені 2 угрупування. Варто відзначити незначне загальне порушення заповідного ядра даного об'єкту природозаповідного фонду, що дозволить йому зберегли свій природоохоронний потенціал і функції охорони та відтворення біорізноманіття. Більшість територій Заповідника, пройдених пожежами, мають високий лісівничий потенціал та здатні самостійно відновитися, тому не потребують втручання у природні процеси з метою лісовідновлення. Ступінь трансформації надґрунтового покриву у соснових і дубово-соснових лісах заповідника під дією пірогенного фактора визначається за інтенсивністю пожежі. Лісовідновлення на ділянках з низьким лісівничим потенціалом необхідно здійснювати з чітким плануванням

Ключові слова: пожежі, зона відчуження, заповідник, відтворення, біорізноманіття
