

Forest fires in Bulgaria - communication, coordination and coherence

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Abstract. In recent years, forest fires have become a pan-European problem. Although mainly the Mediterranean countries are affected, large fires have also been observed in the Czech Republic, Bulgaria, Germany, Slovenia and many other countries. Most EU Member States have more burnt areas than average in the period 2013-2022. The risk of forest fires has spread to areas that were not previously at risk and extends far beyond the Mediterranean region. This is causing huge social, environmental, climatic and economic losses across Europe. The risk of forest fires expected to increase further due to climate change. Forest fires are catastrophic events that require rapid, accurate, and collaborative prevention and response. Effective communication, coordination, and coherence among stakeholders are crucial to save lives, protect ecosystems, and minimize economic loss. Therefore, horizontal and vertical coordination, communication and coherence of fire prevention and control measures should be improved. The aim of the present study is to analyze the legally established order for horizontal and vertical coordination, communication and coherence of forest fire prevention and control measures in Bulgaria, to identify shortcomings and to propose improvements.

Key words: forest fires, risk, communication, coordination, coherence.

Introduction

Forest fires are uncontrolled fires that occur in nature and are often aggravated by climatic conditions. They spread through vegetation, such as trees, shrubs, and grasses, in forested or wildland areas. Forest fires are a natural disaster that expected to occur more frequently due to climate change, land use and socio-economic changes. Wildfires are any unplanned or uncontrolled fire affecting natural, cultural, industrial and residential landscapes (Murray et al., 2021). A wildfire is a large, uncontrolled fire that burns vegetation in the wild, often causing damage to ecosystems, wildlife habitats, air quality, and human communities. Large-scale wildfires affect not only forested landscapes, but also grasslands and other types of land cover, including urban areas. (UNEP, 2022). "Wildfire" is a broader term than "forest fire", which includes fires in forests, grasslands, shrub lands, and other wild areas.

As noted in the EASAC (2025), "wildfires" are divided into several types: brush fire, desert fire, forest fire, grass fire, hill fire, peat fire, vegetation fire, and veld fire (ICDO, 2025). In this article, the term "forest fire" is used for fires occurring in forest areas defined under the Forest Act (2011). Wildfires are used for landscape fires, or fires occurring in the entire wild territory - both agricultural and forest. For the intermediate areas (the zones where natural landscapes meet urban and suburban areas, such as residential areas adjacent to forests or shrub land (EASAC, 2025)), the term "Wildland urban interfaces" (WUI) (Climatecheck, 2020) is used.

Fires are never isolated hazards that require a separate and unique management approach that ignores the context of the larger disaster risk. It must be recognized that local communities at risk from forest fires are at risk from other hazards of a different nature, and that multiple risk reduction

measures have shared and co-benefits when applied simultaneously. For example, the United Nations Office for Disaster Risk Reduction (UNDRR) (2021) has urged a multi-hazard approach to effective risk reduction, i.e. a risk management framework that includes components such as risk analysis, risk planning, risk reduction, emergency preparedness, emergency response and post-disaster recovery.

In addition to the negative consequences for the environment, economy and culture, forest fires also claim human victims. Forest fires occur for various reasons, but most often they are the result of human negligence. People often light fires in nature and leave them unextinguished, throw cigarette butts or burn waste near forests. Other factors include deliberate arson and sparks from machinery or cars. Natural causes include lightning and the spontaneous combustion of dry vegetation at high temperatures. Prolonged drought and strong winds contribute to the rapid spread of fire. In most cases, forest fires are the result of one or more factors, but very often, they are the result of administrative irregularities and bureaucracy.

There is a need to review the administrative requirements, the coordination between the services involved and the implementation of effective and efficient measures to prevent forest fires. UNEP (2022) notes that in many countries more than 50% of available funds are used for direct forest firefighting, while usually only a small percentage is available for planning and prevention. This article is based on the assumption that prevention is cheaper than extinguishing!

The main objectives of the study are: (1) to assess the legal provisions for coordination, communication and coherence between institutions involved in forest fire prevention and response; (2) to assess existing methodologies for forest fire risk assessment; and (3) to identify systemic gaps and propose practical improvements.

Materials and methods

This study employed a qualitative legal-policy analysis combined with data synthesis to examine the institutional and legislative framework governing forest fire prevention and management in Bulgaria.

The analysis was based on primary and secondary sources, including:

- Legal documents (the Forest Act (2011), the Disaster Protection Act (2006), the Ministry of Interior Act, (2014), Ordinance No. 18/2015, and Ordinance No. 8121z-968/2014) were reviewed to identify formal obligations and procedures for coordination, communication and coherence for forest fire prevention and response, when they were begun.

- Institutional structures (Organograms and operational mandates of the Ministry of Interior, the Ministry of Agriculture and Foods, the Executive Forestry Agency (EFA) and regional fire safety directorates) were analysed to map horizontal and vertical coordination.

- Forest fire statistics (Data on forest fires in Bulgaria from 2000 to 2024, including number of fires and burnt areas) were extracted from the national forest information system (www.system.iag.bg) and cross-referenced with reports from the European Commission's Joint Research Centre (EC, JRC).

- Analysis of methodologies for fire risk assessment: The study examined two methodologies for forest fire risk assessment – Lyubenov (2016) and Borissova et al. (2023, 2024) – where compare used data, indicators and their implementation.

- Comparative analysis: Forest fire incident trends in Bulgaria were compared with those in other EU member states using normalized metrics (burnt area as % of average).

- Critical gap analysis: Identified discrepancies between formal legal frameworks and their practical implementation through structured expert judgement and review of institutional reports.

Results

Forests in Bulgaria

The total area of forests in Bulgaria as of 31.12.2024 is 4 283 668 ha, and the forested area (including Mountain pine (*Pinus mugo*)) – 3 939 110 ha. Forest territories are 3 952 622 ha. The country's forest cover is 38.59%, which has increased by 8% over the last 25 years, i.e. the combustible load has increased. In 2024, 5 626 921 m³ of wood was harvested, which is 70.3% of what was planned in the forest management plans (MAF, EFA, 2025).

Data on the main indicators of forests as of 31.12.2020 are shown in Table 1. The data shows that only about 50% of the increment and 84% of the predictions are used. This is a signal that a

significant amount of wood is accumulating in the forests, which increases fuel reserves and is a factor of emergence more fires.

According to the distribution by ownership (Fig. 1), most of the forests are state owned

(73.15%) followed by municipal (11.16%) and forests owned by physical bodies (9.55%) (MAF, EFA, 2025). According to this indicator, the largest number and area of forest fires are expected in state-owned forests.

Table 1. Main indicators of forests in Bulgaria as of 31.12.2020.

Indicators	Measure	Value
Total stock	Thousand m ³	718 411
Average stock	m ³ /ha	184
Total increment	Thousand m ³	13 560
Average increment	m ³ /ha	3.48
Average age	Years	60
Actual harvesting	m ³ /ha	1.79
Actual harvesting/forecast	%	83.9
Actual harvesting / increment	%	51.4
Actual harvesting / stock	%	0,97

Source: Forestry 1960 – 2020 (2021)

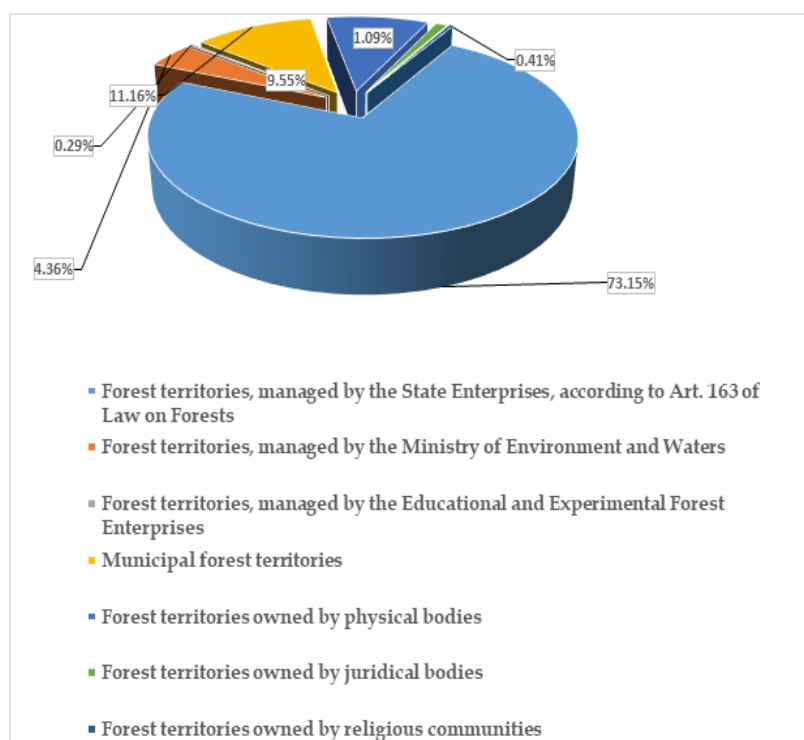


Fig. 1. Distribution of forest property.

Source: (MAF, EFA, 2025).

Organizational structure in the forestry sector

The structure of the Ministry of Agriculture and Food is shown on Fig. 2. It has an important role in the coordination, communication and coherence of actions in case of forest fires.

The structure of this Ministry determines who communicates with whom and how, provides a clear coordination chain in case of forest fires and maintains uniform standards and procedures for effective and rapid response through established laws, regulations and rules. The Regional Directo-

rates of Forests and the State Enterprises under Art. 163 of the Forest Act and their divisions – the State Forest Enterprises (SFEs) and the State Hunting Enterprises (SHEs) are the main units at regional and local level, which actively participate

in decision-making for the prevention and fight against forest fires.

Fig. 3 shows the structure of the State Forest/Hunting Enterprise, which is also strictly hierarchical.

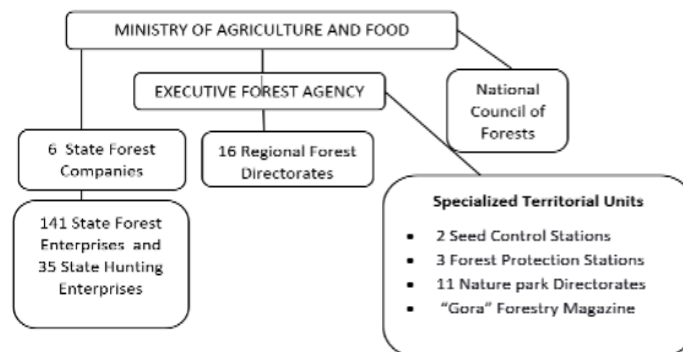


Fig. 2. Structure of the Ministry of Agriculture and Food.

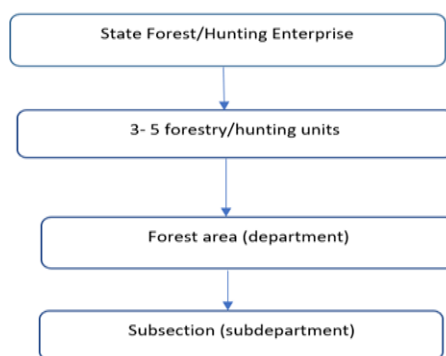


Fig. 3. Structure of State Forestry/Hunting Enterprise.

In accordance with Article 17 of Ordinance No. 18 of 7 October 2015 on the inventory and planning of forest areas, the departments are divided into subdivisions, which represent the smallest territorial unit of the forest areas and serve as the basis for their inventory and management. The subdivisions are relatively permanent and uniform and are differentiated according to the following criteria: ownership, fiscal characteristics, management, typological affiliation, function and category.

Disadvantage here is that no standardized system of territorial subdivision is used. Although according to the Forest Act (2011) a subdivision is the smallest territorial unit in the forest areas, the Property Act (1951) uses parcels that do not correspond to the territorial subdivision according to the Forest Act. The smallest territorial unit under

the Forest Act can be subdivided into parcels under the Property Act. This makes it difficult in certain cases to collect information and apply uniform criteria in the smallest territorial units (mainly in forests of private and municipal ownership), established under the Forest Act and the Property Act in the prevention and fight against forest fires.

Bulgarian legislation, related to forest fires and the institutions responsible for fire prevention, notification and response and for fighting forest fires

The main document that regulates civil defense, including fire protection, is the Disaster Protection Act (2006).

Activities to protect the population in the event of hazards and disaster are carried out by

the Unified Rescue System (URS). The main components of the URS are clearly defined in the law:

- The General Directorate “Fire Safety and Protection of the Population” in the Ministry of the Interior;
- The regional directorate of the Ministry of Interior;
- BRC (Bulgarian Red Cross);
- The Centers for Emergency Medical Assistance.

The other components of the Unified Rescue System (ministries and departments, municipalities, business enterprises and individual entrepreneurs, non-profit legal entities, including voluntary associations, the Armed Forces) provide assistance on request in accordance with the civil defense plans.

According to the Ministry of the Interior Act, the “General Directorate for Safety and Protection of the Population” (Fig. 4) is a specialized national structure of the Ministry of the Interior that ensures fire prevention, rescue and protection in the event of a disaster under the conditions and in accordance with the provisions of this law and the Disaster Protection Act.

General Directorate, Regional Directorates, Regional Services and Sections “Fire Safety and Protection of Population” execute tasks aimed at fighting fires: “Preventive activity; state fire control; preventive control; firefighting activity; rescue operation; early warning and announcement of disasters to the executive authorities and the population.”



Fig. 4. Structure of the General Directorate “Fire Safety and Protection of the Population”.

According to the Forestry Act in force since 2011, in Art. 136: Measures and activities to protect forest areas from fires are planned for each forest territorial unit regardless of the ownership of the territory and are mandatory for implementation. The planning of measures and activities to protect forest areas from fire is at the expense of the state budget and the implementation and maintenance of measures and activities to protect forest areas from fire shall be organized and carried out by the owners or the persons to whom the area has been handed over for management, at their expense.”

Pursuant to Ordinance No. 8121z-968 of 10 December 2014 on the rules and standards for fire safety when carrying out activities on agricultural land, for the rules and standards for fire safety

when carrying out activities on agricultural land (Art. 12), it is not allowed in agricultural lands and outside them (sloughs and roadside strips): burning of stubble and other plant residues on agricultural land and outside such land (meadows and roadsides) is prohibited and the use of open fire sources.

According to legal provisions, forest fire extinguishing activities include: employees and workers of the Executive Forest Agency, its bodies and departments; employees and workers of the Ministry of Interior, its bodies and departments; participation of local self-government bodies, the local population and other people involved in solving the problem of forest fires; General Directorate “Fire Safety and Protection of the Popula-

tion”; regional and local government officials; employees of the departments of the Ministry of Defense, the National Police “Gendarmerie” – Ministry of the Interior and the National Police and “Border Police” – Ministry of the Interior and volunteers.

Institutions responsible for extinguishing forest fires:

- Executive Forest Agency and its structures.
- State Forest/Hunting Enterprises.
- General Directorate “Fire Safety and Protection of the Population” (GD “FSPP”) and its regional structures.
 - Municipalities and town halls.
 - The Ministry of Defense.
 - Regional administrations.
 - Private owners and co-operatives.
 - Volunteers and NGOs.

Firefighting activities are organized and carried out by the authorities responsible for fire prevention and the protection of the population, independently or together with the specialized forces and resources of the executive authorities, organizations, legal entities and citizens. The organizations of GD “FSPP” provide methodological and technical support to the territorial bodies of the executive within the framework of disaster protection.

The most important organizations and institutions for fire detection and firefighting are listed below:

- Ministry of the Interior – General Directorate “Fire Safety and Protection of the Population” (GD “FSPP”) – General, Metropolitan and Regional Directorates.
- Ministry of Agriculture and Food – Executive Forest Agency with the Department of “Control of the Protection of Forest Areas and Fire Prevention”.
 - Regional administrations.
 - Municipalities with their Regional Safety Council (RSC).
 - Up-to-date information on the state of the meteorological situation can now be obtained via the websites of the Air Traffic Control, the Executive Agency “Hail Control”, the Air Force and the National Institute of Meteorology and Hydrology (NIMH).
 - In accordance with the national emergency call system with the single European emergency number (SEE) 112, emergency calls are received

and processed by the Operations Duty Centre (ODC).

All the above-mentioned organizations coordinate with each other to avoid duplication of activities. After receiving a signal via the national emergency call system with the single European number 112, information about a fire, is forwarded to the relevant institution – Fire Safety and Protection of the Population, Police, Emergency Medical Assistance, National Medical Coordination Centre, Mountain Rescue Service – Bulgarian Red Cross and Executive Agency “Maritime Administration”, which sends a team to the scene of the accident.

Communication and coordination between the Ministry of Agriculture and Food, the Executive Forest Agency and the Ministry of Interior/GD “FSPP”) during forest fires is carried out through pre-defined procedures, operational centers, notification systems and interdepartmental headquarters. The main leadership is the fire department, while the EFA provides resources, expertise and field monitoring.

Forest fires in Europe

Particularly long dry periods increase the risk of forest fires, but other factors such as rain and wind, vegetation, terrain and forest management practices have a major influence.

The 2022 was a record year with one of the worst forest fire seasons ever recorded in the EU. Forest fires have also seriously affected Northwest America, Siberia, South Asia and many other regions of the world (EC, Copernicus, 2022; Nasa, Earth Observatory, 2022). Lives were lost, livelihoods destroyed, and many hectares of forests burned (San-Miguel-Ayanz et al., 2023).

Forest fires have recently become a pan-European problem. Although France, Spain and Portugal were particularly affected in the summer of 2022, there were also large fires in Bulgaria, the Czech Republic, Germany, Greece, Slovenia and several other European countries (Table 2). A total of 20 EU member states recorded more burnt areas than the average in 2022. In 2023 in 9 European countries number of forest fires is more than average (Bulgaria, Cyprus, Finland, France, Germany, Greece and Lithuania and in 7 about burnt areas – Bulgaria, Cyprus, Germany, Greece, Italy, Norway and Switzerland (San-Miguel-Ayanz et al., 2024).

Table 2. The number of forest fires and burnt areas in some European countries in 2022.

Countries	Number of forest fires			Burnt areas (ha)		
	2022	2012-2022 average	2022 as % of average	2022	2012-2022 average	2022 as % of average
France	22796	4368	522	70301	13710	513
Hungary	2731	1245	219	20947	4392	477
Czechia	2473	1428	173	1715	382	448
Germany	2397	889	270	3058	737	415
Norway	1275	325	393	2455	1080	227
Romania	1021	347	294	13153	2316	568
Bulgaria	516	470	110	8126	4766	171
Slovakia	297	223	133	1210	431	280
Croatia	245	184	133	24226	12639	192
Slovenia	217	88	247	4059	254	1599
Switzerland	115	95	122	322	89	364

Source: San-Miguel-Ayanz et al. (2023).

Forest fire risk has expanded to areas that were not previously at risk and extends far beyond the Mediterranean region. This is causing huge social, ecological, climatic and economic losses across Europe. Losses from forest fires far exceed all other losses in forests - from illegal logging and grazing as well as damage from fungi and insects (San-Miguel-Ayanz et al., 2023). In addition, the damage caused is much more expensive and takes much longer time to repair.

As the risk of forest fires increases and covers ever-wider forest areas beyond the traditionally affected Mediterranean regions, effective coordination, communication and coherence between countries becomes crucial to prevent catastrophic

consequences. To effectively deal with the increasing risk of forest fires at the modern stage, countries need to build strong international coordination, common communication systems, and coherent response and prevention strategies and use modern technologies. This will allow for faster response, reduced damage and saving human lives and natural resources.

Forest fires in Bulgaria for the period 2000-2024

For the period 2000-2024, 13 595 forest fires occurred, resulting in the burning of 269 305 ha of forest areas (Figs. 5, 6, and 7).

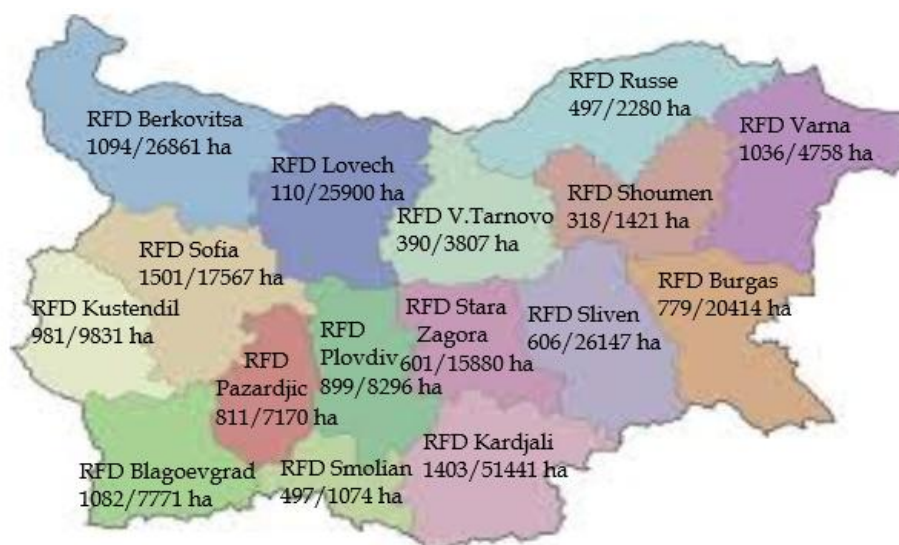


Fig. 5. Number and area in ha of forest fires for the period 2000-2024 by Regional Forest Directorates.

The average annual number of fires for the period is 544, the average annual burned area is 9 225 ha, and the average area of one fire is 16.96 ha. The damages indicated in the EFA reports amount to 81 226 thousand BGN or an average annual amount of 3 249 thousand BGN (EFA, 2024).

The analysis of the prerequisites, causes and factors for the occurrence of forest fires leads to the conclusion that Bulgaria, in terms of fire risk parameters, is approaching the traditionally dangerous region of the Mediterranean.

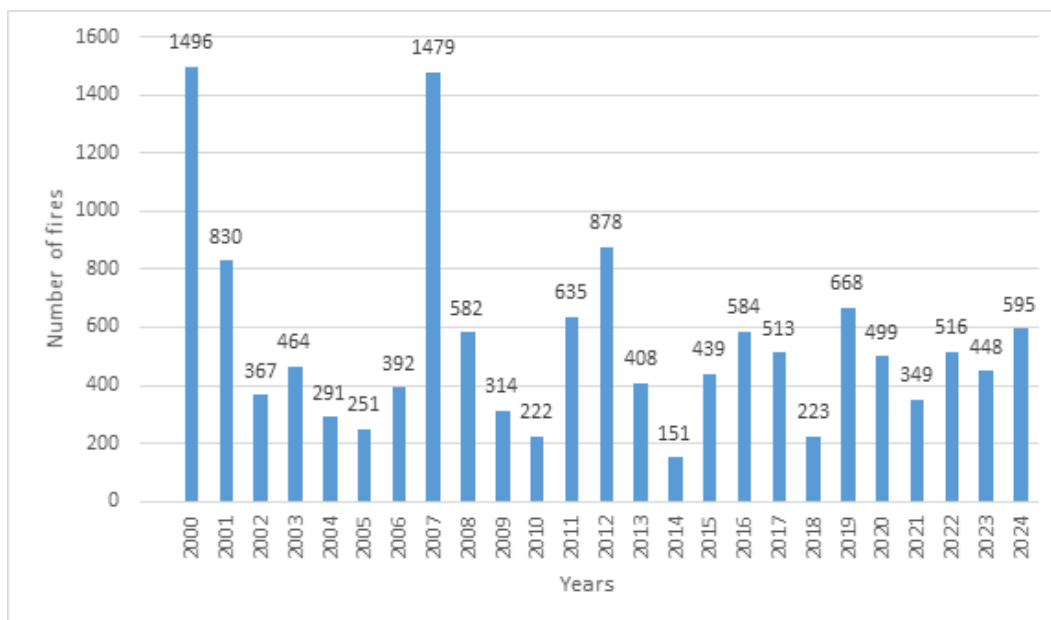


Fig. 6. Number of forest fires in Bulgaria for the period 2000-2024 (www.system.iag.bg)
Source: EFA (2024).

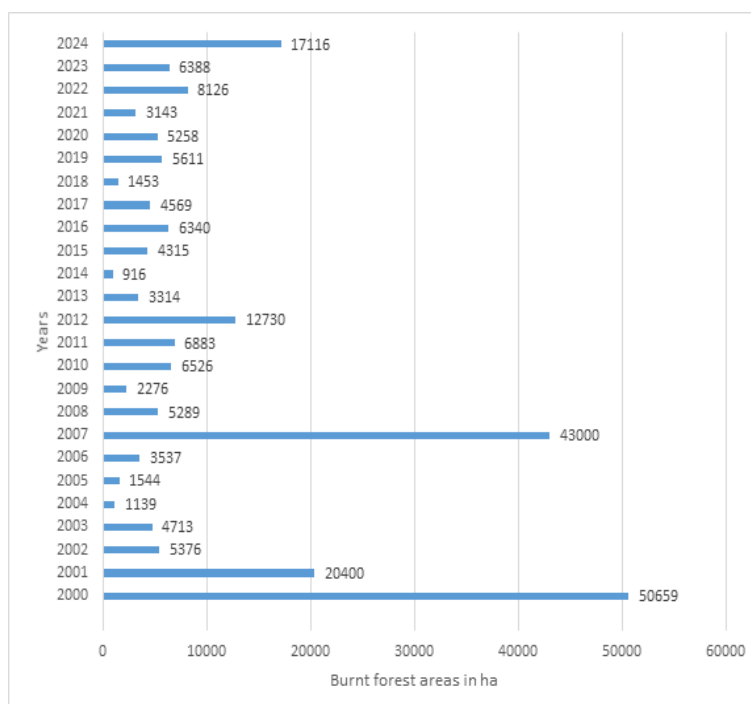


Fig. 7. Burnt areas in ha in Bulgaria for the period 2000 – 2024.
Source: EFA (2024).

Global warming has led to changes in fire regimes, which has increased the risk of more frequent hot and dry weather (Semenova & Sumak, 2022). This has significant ecological impacts on the ability of ecosystems to recover and provide services to society (Aponte et al., 2016).

Consequently, there are increasing demands on fire management policies to develop effective prevention programs, organize a timely and spatial response and ensure sustainable fire containment (Pandey et al., 2023). The study of forest fire risk assessment systems and their relationship to weather patterns is particularly important for coun-

tries where forest resources, management and sustainability are critical to meeting societal needs (Borisova et al., 2024; de Rigo et al., 2017).

In Bulgaria, a national methodology for determining forest fire risk was developed and approved in accordance with European Union requirements (Lyubenov, 2016). The methodology was approved in 2016 and based on it, a forest fire risk assessment by region was carried out for the country (Fig. 8).

The national methodology for determining forest fire risk (proposed in 2016) is only applicable at the administrative level of districts (NUTS 3).

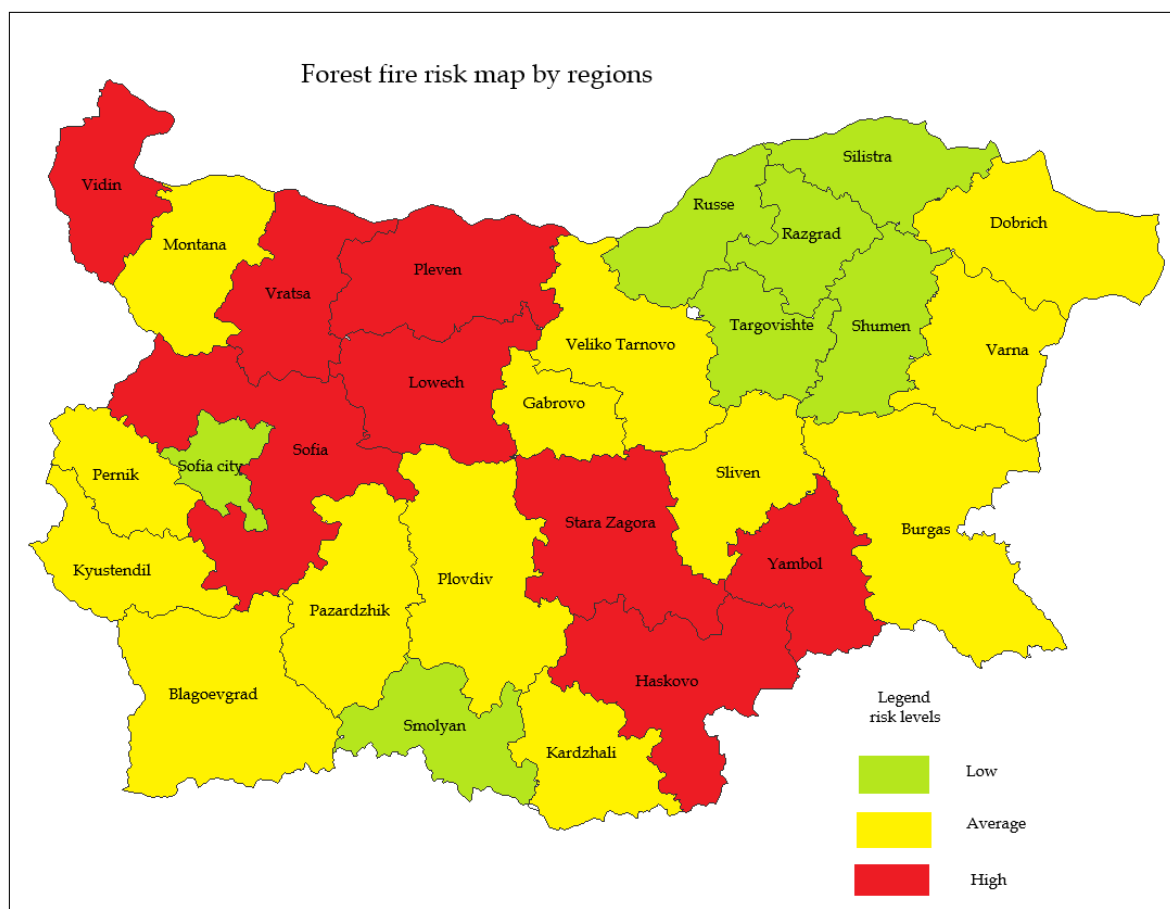


Fig. 8. Degree of danger from forest fires in Bulgaria by administrative regions.
Source: Lyubenov (2016).

This is too large area, distorts the risk assessment, and reduces its level (Stoyanov, 2021). Object-oriented vulnerability analysis needs to ensure that all parties involved in forest fire risk management can respond effectively.

That is why a team of scientists from the Forest Research Institute of the Bulgarian Academy of Sciences together with a team from SU "St.

Kliment Ohridski" has developed a methodology for assessing the risk of natural fires (Borisova et al., 2023; Borisova et al., 2024) at the level of the smallest territorial forest unit - the subdivision.

With the help of advanced digital forest monitoring tools combining powerful remote sensing technology with large databases and using the developed risk assessment methodology, a uni-

fied register of potential fire risk factors is proposed, integrating 29 indicators into five thematic groups, reflecting current data on hazards, vulnerability and emergency response capacities. The factors are assessed and overlaid to obtain an integrated forest fire risk assessment on the smallest unit of forest management and inventory – subdivision. The methodology has been presented to all institutions involved in forest fire prevention and control, but it has not yet been accepted and implemented by them.

Unfortunately, modern tools for digital forest monitoring, which combine powerful remote monitoring technology with large databases and artificial intelligence, are hardly used in Bulgaria. Moreover, the poor or lack of communication between the institutions involved in fighting forest fires contributes to the fact that a lot of money is spent on extinguishing forest fires instead of many times more on preventing them.

Combating climate change and the effects of forest fires requires the combined efforts of governments, the public and the scientific community. Raising awareness of the risks, action to reduce greenhouse gas emissions and better management of forest areas are key factors in reducing the environmental and social impacts of forest fires and climate change.

There are also several reasons that have a negative impact on the implementation of forest fire mitigation measures:

- State forestry departments do not have enough of their own human and technical resources for adequate measures.
- The fire brigades do not have the necessary material and technical basis for action in all fire stations.
- The local population sometimes does not participate optimally in firefighting.
- There is no central office to coordinate forces and resources when different organizations are involved in firefighting.
- Firefighting operations begin without the obligatory reconnaissance of the fire situation at the fire scene.
- There is no information about the tactical parts and the fire parameters.
- Possible dangerous directions for the spread of the fire are not considered.
- Forces and resources are diverted to protect unimportant facilities and objects.

- At critical moments, when the fire needs to be brought under control, the fire brigade and the army are usually called in to help.

- Finally, it is important to inform and educate the population about the prevention of forest fire.

Another important point is overcoming the contradictions between the interests of farmers, foresters, fire services and environmentalists. Ultimately, the interests of society are at stake. At this stage, the solution is a compromise – a calculated, organized and controlled compromise. To this end, experts from GD “FSPP” and the Executive Forest Agency, in consultation with MoEW bodies, nature conservation organizations and associations, local authorities and farmers, should develop and adopt a single normative document regulating forest fire prevention measures.

Discussion

In recent years, Bulgaria has faced longer and more severe fire seasons, particularly in 2022, 2024, and 2025. These seasons were driven by hotter, drier summers, droughts, and high winds, increasing both ignition rates and fire spread. Forest fires occurred most often in southern and western regions, with several incidents near protected areas and populated zones.

The analysis of vertical and horizontal coordination, communications and coherence in the major forest fires in 2022, 2024 and 2025 showed that vertical coordination between local, regional, national and international (EU) institutions is improving and has a positive role in preventing and fighting forest fires. Horizontal coordination is good at local and regional level, especially with regard to the EFA, regional forest directorates and fire safety authorities at local, regional and national level, as well as district, municipal and local administrations. Communication systems and information flows are mainly managed by the GD “FSPP” Operations Centre, but increased use of international information (EFFIS, Copernicus, etc.) is noted.

In the area of coordination, greater interaction between institutions in practice is noted and coherence with the EU has improved, especially in the case of major fires. Increased use of satellite data with EU support improves national strategic coordination.

Along with the improvement of coordination, communication and coherence in the prevention and fight against forest fires in Bulgaria in recent years, some weaknesses have also been reported. Good vertical coordination does not always compensate for the limited national resources and especially the lack of specialized aircraft. When large fires occur simultaneously, gaps in connections are observed at regional and national level.

Horizontal coordination does not use standard operating procedures, the pooling of different resources is not standardized, and the integration of volunteers is weak due to insufficient training and an unclear place of their participation.

Communication systems show gaps in the interoperability of fire, forest, regional, municipal and volunteer teams, there are delays in the provision of information, and despite the improvement of public warning systems, they are not applied equally in all regional and local administrations.

In terms of coherence, the gaps are reduced to uneven horizontal coordination in different regions, dependence on international resources due to limited national resources, and delays in joint operations due to communication barriers at the tactical level.

In summary, it can be concluded that during the several medium-sized forest fires in 2022 in Southeastern Bulgaria, efficient local and regional coordination was observed, but there was a shortage of aircraft for fighting fires. In 2024, after the activation of the EU assistance system, helicopters from other EU countries were immediately deployed. National coordination through GD "FSPP" is efficient, but coordination between local administrations and international teams is difficult and requires more time for the assistance deployed to become active. In the summer of 2025, fires on several fronts required both national mobilization and EU assistance through rescEU. This confirmed that coherence depends on both structured vertical command and robust horizontal integration.

In recent years, Bulgaria demonstrated strong progress in vertical coordination and strategic communication, particularly in connecting national and EU response systems. However, horizontal coordination and operational coherence at the tactical level remain inconsistent, limiting the overall efficiency of forest fire response.

Conclusions

The number of forest fires and the size of burnt areas have reached critical levels in recent years. The information collected by the EFA on the fire situation and the damage caused by forest fires in the country is very general, inaccurate and incomplete to make adequate decisions to solve the problem of forest fires in Bulgaria. There is a lack of methodological literature and training programs for the forestry officials, FSPP staff and the local population on forest fire prevention.

In recent years, Bulgaria demonstrated strong progress in vertical coordination and strategic communication, particularly in connecting national and EU response systems. However, horizontal coordination and operational coherence at the tactical level remain inconsistent, limiting the overall efficiency of forest fire response.

It can be concluded that communication ensure that everyone receives and understand the critical information and keep people informed. Coordination enables efficient deployment of the resources and personnel and bring everyone together and coherence guarantees aligned consistent actions across all fronts and ensure long-term resilience. These three elements together form the backbone of effective forest fire management and can significantly reduce the negative impact of such disasters.

To improve the prevention and fighting against forest fires it is need to implement the developed methodology, the indicators and standardized information system for recording, reporting and analyzing forest fires (Borisova et al., 2023, 2024). It has a need to develop and adopt a methodology for determining the degree of fire risk in forests that is consistent with the criteria and requirements adopted by the European Union and develop and adopt a methodology for determining the damage caused by forest fires. In addition, there is a need to integrate processes of the coordination, communication and coherence into national disaster management plan to build resilience at the actions in preventing forest fires and enhance response capacity upon their occurrence.

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References

- Aponte, C., de Groot, W., & Wotton, B. (2016). Forest fires and climate change: causes, consequences and management options. *Int J Wildland Fire*, 25(8), i-ii. doi: [10.1071/WFv25n8_FO](https://doi.org/10.1071/WFv25n8_FO)
- Borisova, B., Todorova, E., Ikhtimanski, I., Zhiyanski, M., Stoyanov, T., Glushkova, M., Bozhilova, M., Georgieva, M., Penev, P., Atanasova, M., & Dimitrov, S. (2023). Methodology for assessing the risk of natural fires. University Publishing House “St. Kliment Ohridski”, 115 p. ISBN: 978-954-07-5672-1. Retrieved from: <https://www.wildfires112.eu/> [in Bulgarian]
- Borisova, B., Todorova, E., Ihtimanski, I., Glushkova, M., Zhiyanski, M., Georgieva, M., Stoyanov, T., Bozhilova, M., Atanasova, M., & Dimitrov, S. (2024). Wildfire risk assessment and mapping – an approach for Natura 2000 forest sites. *Trees, Forests and People*, 16, 1-16. doi: [10.1016/j.tfp.2024.100532](https://doi.org/10.1016/j.tfp.2024.100532).
- Climatecheck. (2020). Managing Wildfire Risk to Real Estate and Property. Available at: <https://climatecheck.com/>
- De Rigo, D., Liberta, G., Durrant, T., Artes Vivancos, T., & San-Miguel-Ayanz, J. (2017). *Forest fire danger extremes in Europe under climate change: variability and uncertainty*. EUR 28926 EN, JRC108974. Publications Office of the European Union, Luxembourg, ISBN 978-92-79-77046-3. doi: [10.2760/13180](https://doi.org/10.2760/13180).
- Disaster Protection Act, State Gazette, 102, 19.12.2006. Retrieved from: <https://www.mi.government.bg/> [In Bulgarian]
- EASAC. (2025). Changing Wildfires: Policy Options for a Fire-literate and Fire-adapted Europe. Elmqvist, T., Valkó, O., Stoof, C., Aakala, T., Arca, B., Arianoutsou, M., Arsava, K., Ascoli, D., Bengtsson, J., Castro, R., Engelbrecht, J., Fra Paleo, U., Granström, A., Ibisch, P., Kalabokidis, K., Kandárová, H., Marinšek, A., Knottnerus, A., Metallinou, M., Müller, M., Oliveira, T., Pereira, J.M.C., Plieninger, T., Palaiologou, P., Pulido Diaz, F., Saražin, J., Stoyanov, T., Newman Thacker, F., van der Werf, G., & Zerefos, C. EASAC policy report 48. ISBN 978-3-7001-9739-3. doi: [10.1553/EASAC_Report](https://doi.org/10.1553/EASAC_Report)
- EC, Copernicus. (2022). CAMS: monitoring extreme wildfire emissions in 2022. Available at: <https://atmosphere.copernicus.eu/cams-monitoring-extreme-wildfire-emissions-2022>
- EFA. (2023). Executive Forestry Agency Annual Report for 2022. Retrieved from: <https://www.iag.bg/data/docs/gd2022.pdf> [in Bulgarian]
- EFA. (2024). Data on the distribution of forest fires in the RFD during the period 01.01.2000 - 31.12.2024. Available at: www.system.iag.bg
- Forest Act, State Gazette, 19, 08.03.2011. Retrieved from: <https://eea.government.bg/> [In Bulgarian]
- Forestry 1960 – 2020. (2021). Main characteristics of the Bulgarian forest and forestry for the period 1960-2020. Retrieved from: https://www.iag.bg/data/docs/1_harakteristiki_na_gorata.pdf [in Bulgarian]
- ICDO. (2025). Forest Fire (Wildfire). Available at: [https://icdo.org/about-icdo/disasters/forest-fire-\(wildfire\)](https://icdo.org/about-icdo/disasters/forest-fire-(wildfire))
- Lyubenov, K. (2016). Development of a methodology for determining the risk of forest fires on the territory of the country for the needs of Measure 8 “Investments in forest areas – development and improvement of the viability of forests from the RDP (2014-2020)”. Final report under Contract No. RD 10-80/14.08.2015, Sofia, April 2016. Retrieved from: https://www.iag.bg/data/docs/Ocenka_i_kartografirane_na_risk_ot_gorski_pozhari.pdf
- MAF, EFA. (2025). Annual report of the Executive Forestry Agency for 2024. ISSN 3033-0572. Retrieved from: https://www.iag.bg/data/docs/Doklad_24.pdf [in Bulgarian]
- Ministry of Interior Act, State Gazette, 53, 27.06.2014. Retrieved from: <https://lex.bg/laws/ldoc/2136243824> [In Bulgarian]
- Nasa, Earth Observatory. (2022). Smoky Fires Rage in the Northwest. Available at: <https://earthobservatory.nasa.gov/images/150328/smoky-fires-rage-in-the-northwest>
- Ordinance No. 18/2015 on inventory and planning of forest territories, State Gazette, 82, 23.10.2015. Retrieved from: <https://lex.bg/bg/laws/ldoc/2136651447> [in Bulgarian]

- Ordinance No. 8121z-968 of December 10, 2014, on the rules and norms for fire safety when carrying out activities on agricultural lands, State Gazette, 105, 19.12.2014. Retrieved from: <https://lex.bg/laws/ldoc/2136409344> [in Bulgarian]
- Pandey, P., Huidobro, G., Lopes, L., Ganteaume, A., Ascoli, D., Colaco, C., Xanthopoulos, G., Giannaros, T., Gazzard, R., Boustras, G., Steelman, T., Charlton, V., Ferguson, E., Kirschner, J., Little, K., Stoof, C., Nikolakis, W., Fernández-Blanco, C., Ribotta, C., Lambrechts, H., Fernandez, M., & Dossi, S. (2023). A global outlook on increasing wildfire risk: Current policy situation and future pathways. *Trees, Forests and People*, 14, 100431. doi: [10.1016/j.tfp.2023.100431](https://doi.org/10.1016/j.tfp.2023.100431)
- Property Act, State Gazette, 92, 16.11.1951. Retrieved from: <https://lex.bg/laws/ldoc/2122102787> [in Bulgarian]
- Regulation on the organization and activities of the Ministry of Interior, Effective from 22.07.2014., Adopted by Decree of Council of Ministers No. 207 of 18.07.2014, State Gazette, 60, 22.06.2014. Retrieved from: <https://lex.bg/bg/laws/ldoc/2136265362> [In Bulgarian]
- Report on the distribution of the total forest area in hectares by forest type as of 31.12.2020, (2021). Retrieved from: https://www.iag.bg/data/docs/2_GF2020.pdf [In Bulgarian]
- San-Miguel-Ayanz, J., Durrant, T., Boca, R., Maianiti, P., Liberta, G., Jacome Felix Oom, D., Branco, A., De Rigo, D., Suarez-Moreno, M., Ferrari, D., Roglia, E., Scionti, N., Broglia, M., Onida, M., Tistan, A., & Loffler, P. (2023). *Forest Fires in Europe, Middle East and North Africa 2022*. Publications Office of the European Union, Luxembourg, JRC135226. doi: [10.2760/348120](https://doi.org/10.2760/348120)
- San-Miguel-Ayanz, J., Durrant, T., Boca, R., Maianiti, P., Liberta, G., Jacome Felix Oom, D., Branco, A., De Rigo, D., Suarez-Moreno, M., Ferrari, D., Roglia, E., Scionti, N., Broglia, M., Onida, M., Tistan, A., & Loffler, P. (2024). *Forest Fires in Europe, Middle East and North Africa 2023*, Publications Office of the European Union, Luxembourg, JRC139704. doi: [10.2760/8027062](https://doi.org/10.2760/8027062)
- Semenova, I., & Sumak, K. (2022). Dynamics of fire weather conditions in the mixed forest areas of Belarus and Ukraine under recent climate change. *Geofizika*, 39(1), 71-84 doi: [10.15233/gfz.2022.39.10](https://doi.org/10.15233/gfz.2022.39.10)
- Stoyanov, T. (2021). Determining the degree of risk of forest fires in Botevgrad TP. *Forest Science*, 2, 35-48.
- Murray, V., Abrahams, J., Abdallah, C., Ahmed, K., Angles, L., Benouar, D., Brenes Torres, A., Chang Hun, C., Cox, S., Douris, J., Fagan, L., Fra Paleo, U., Han, Q., Handmer, J., Hodson, S., Khim, W., Mayner, L., Moody, N., Moraes, L., Nagy, M., Norris, J., Peduzzi, P., Perwaiz, A., Peters, K., Radisch, J., Reichstein, M., Schneider, J., Smith, A., Souch, C., Stevance, A.-S., Triyanti, A., Weir, M., & Wright, N. (2021). *Hazard Information Profiles: Supplement to UNDRR-ISC Hazard Definition & Classification Review: Technical Report*. Geneva: United Nations Office for Disaster Risk Reduction; Paris: International Science Council. doi: [10.24948/2021.05](https://doi.org/10.24948/2021.05).
- UNDRR. (2021). Annual Report. Retrieved from: <https://www.undrr.org/publication/undrr-annual-report-2021>
- UNEP. (2022). *Spreading like Wildfire – The Rising Threat of Extraordinary Landscape Fires. A UNEP Rapid Response Assessment*. Nairobi. Available at: <https://www.unep.org/resources/report/spreading-wildfire-rising-threat-extraordinary-landscape-fires>

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