III. FOREST ECOLOGY AND BIOLOGY

FOREST FIRES IN 2020 - ECONOMIC AND SOCIAL CONSEQUENCES

Hristo Tsakov, Alexandar Alexandrov, Dafina Zoteva, Olympia Roeva

Abstract: The continuing climatic anomalies and the changed social realities caused by the global COVID-19 pandemic impose new responsibilities and new solutions for the management and use of forests.

Experts have proved that overexploitation of the forests and the annual burning of huge forest areas seriously jeopardize food security on a regional and global scale, the economic stability of communities reduces, and the environmental degradation increases.

The fiery hell in Australia in 2020 is one of the worst wildlife disasters in modern history. There are more than 115,000 square kilometers of bushes and forests devastated, thousands of homes destroyed, people and over three million wild animals killed.

In 2020, 499 fires were registered in the forest territories of Bulgaria with total area of 52455 dka. Deciduous and coniferous vegetation, grasses, border farmland and infrastructure are affected.

The paper summarizes the financial damage and resources used to extinguish the fires in the forests of Bulgaria in 2020, regardless of their ownership.

Keywords: forest fires, economic consequences, social consequences.

INTRODUCTION

The new European Forestry Strategy requires ecological restructuring of the economy, providing sustainable quantities of wood, protection of the biodiversity, as well as expanding the opportunities for ecosystem benefits [8].

The prevention and protection of forest territories from fires is regulated in the “National Development Programme: Bulgaria 2020” – sub-priority 3.5 (2) [6].

The immediate organization of the fight against forest fires is carried out by the authorities of the General Directorate for Fire Safety and Protection of the Population with the assistance of the forest state structures, municipalities, owners and users of forest territories [4].

At the same time, forest management is an integral part of rural development policy. In this regard, the so-called “forest measures” in the “Rural Development Program (RDP – 2014-2020)” are related to sub-measure 8.3 “Prevention of damage to forests by forest fires, natural disasters and catastrophic events” [9].

The analysis of fire safety, material and financial losses is based on the Report of the Executive Forest Agency (EFA) for 2020 in the chapter “Protection of forests from fires” by administrative divisions – Regional Forest Directorates (RFD), literature sources and monthly data on the distribution of forest fires [2].

A review of the data on burned areas in the recent decades [7, 10] found that the term “fire season” is much more complex today. In addition to meteorological and climatic factors (precipitation, air temperature, length of the dry period, wind

speed), the ownership of forests and agricultural land plays a significant role [5].

For a clearer picture of the damage and the resources used in the fight against forest fires in 2020, three periods in time are considered: winter-spring, summer and autumn (Tables 1 and 2).

RESULTS AND DISCUSSION

The dynamics of fires in forest and agricultural areas in 2020 is shown in Table 1. During the winter and spring months, 189 fires occurred on an area of 11196 dka. 2038 dka (18.2%) coniferous, 8081 dka deciduous vegetation (72.2%), 944 dka shrub and agricultural land (8.4%) were burned, which were 7452 dka (66.6%) of state, 2125 dka of private (19.0%) and 1568 dka of municipal forests (14.1%).

The main reason is the human action and inactivity, defined as negligence (68.7%). While the causes for 28.6% of the fires were unknown, 2.6% of the fires were intentional. [2].

As early as the first ten days of 2020 (January 2nd – January 10th), local residents, employees of the General Directorate for Combating Organized Crime and the State Forest Service in Vidin, Sliven, Hissar and Karlovo extinguished fires that had broken out in agricultural lands and later spread to forests. By the end of January, the fires were 19. After January 22nd, 1078 dka of pastures (95.7%) were burned, 3 dka of which caused by short circuit and 10 dka by arson.

In February 2020, 42 fires burned, and 38 fires in March 2020 with a total area of 3512 dka.

Appropriate climatic conditions were the reason for activating the pre-spring cleaning of pastures and stubble (1360.4 dka). By their nature, the ignitions

were targeted, deliberate and in violation of the Law for protection of agricultural lands and can be defined as intentional (120 dka).

Table 1. Burned forest resources and type of ownership

2020 Months	Number of fires	Burned areas, dka	Burned vegetation, dka								Burned property, dka					
			coniferous	%	deciduous	%	mixed	%	another	%	state	%	municipal	%	private	%
January	19	1126	599	53.2	238	21.1	4	0.4	285	25.3	714	63.4	76	6.8	334	29.8
February	42	211	549	26.0	1528	72.4	0	0	34	1.6	1540	73.0	209	9.9	361	17.1
March	38	1401	221	15.8	1028	73.4	9	0.6	143	10.2	1111	79.3	194	13.8	96	6.9
April	90	6558	669	10.2	5287	80.6	120	1.8	482	7.4	4087	62.2	1089	16.6	1334	20.2
January-April	189	11196	2038	18.2	8081	72.2	133	1.2	944	8.4	7452	66.9	1568	14.1	2125	19.0
May	25	571	201	35.2	330	57.8	1	0.2	39	6.8	190	33.3	57	10.0	263	46.7
June	8	23	1	4.4	12	52.2	5	21.7	5	21.7	12	52.2	0	0	11	47.8
May-June	33	594	202	34.0	342	57.6	6	21.9	44	7.4	202	37.9	57	10.7	274	51.4
July	63	3923	369	9.4	2414	61.5	0	0	1140	29.1	1348	34.4	2397	61.1	172	4.5
August	100	19430	2274	11.7	9508	48.9	408	2.1	7240	37.3	10954	56.4	6752	34.8	1702	8.8
September	90	15495	1951	12.6	11538	74.5	216	1.4	1790	11.5	9908	63.9	3145	20.3	2316	14.8
July- September	253	38848	4594	11.8	23460	60.4	624	1.6	10170	26.2	22210	57.4	12294	31.8	4190	10.8
October	15	1779	57	3.2	1324	74.4	0	0	398	22.4	307	17.3	1465	82.4	7	0.7
November	9	154	135	87.7	19	12.3	0	0	0	0	121	78.6	15	9.7	18	11.7
December	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
October-December	24	1933	192	9.9	1343	69.5	0	0	398	20.6	428	22.1	1480	76.6	25	1.3
Total	499	52571	7026	13.4	33226	63.2	763	1.5	11556	21.9	30292	57.6	15399	29.4	6614	12.7

Forest fires reached their winter maximum (90) in April 2020, with total burned area of 6558 dka.

In recent years, with the beginning of permanent warming, fire activity has decreased. The May 2020 fires were 25, and in June 2020 – 8, with a total area of 594 dka.

Summer fires (July – September) are usually the most dangerous. They cover large areas and are accompanied by a strong, often changing direction, wind. On August 8, a fire broke out from an unextinguished cigarette at the Lesovo border checkpoint, which travelled 20 km in a few hours. The fire covered hard-to-reach terrains, crossed the

Tundzha River and engulfed a total of 8,000 dka of deciduous forest and vineyards. The summer fire maximum occurred at the end of August and the beginning of September (190 fires on 38848 dka of forests). 57.4% state, 31.8% municipal and 10.8% of private forests were burned.

The autumn fires were 24 in a total area of 1933 dks. There were no forest fires in December 2020. The epidemic measures taken in regards to COVID-19 have limited the activities in the forest territories and reduced the fire hazard.

What are the financial losses caused by forest fires in 2020?

Table 2. Summarized financial and material costs after fires in 2020

2020 Months	Financial costs											
	Personnel	Transport	Technic (Machines)	Others	Burned stored wood (m ³)	Price value	Damaged wood (m ³)	Price Value	Burned Seedlings	Price Value	Other damage	Total
January	136	405	0	0	0	0	0	0	0	0	0	541
February	0	943	0	0	0	0	180	5400	0	0	0	6523
March	133	794	0	0	30	0	0	0	0	17375	0	18302
April	685	1639	175	4	0	0	0	0	30	0	0	2533
January-April	954	3781	175	4	30	0	180	5400	30	17375	0	27689
May	0	451	0	0	5	210	0	0	0	0	0	661
June	0	110	0	0	0	0	0	0	0	0	0	110
May-June	0	561	0	0	5	210	0	0	0	0	0	771
July	2379	3586	310	1000	25	385	475	3000	63500	14930	0	25590
August	1983	4702	5560	588	0	0	0	0	0	0	0	12833
September	2590	6768	1253	65024	0	0	8887	251838	18550	4823	192035	524331
July- September	6952	15056	7123	66612	25	385	9362	254838	82050	19753	192035	562754
October	100	671	0	217	0	0	36	2206	8000	0	200	3394
November	297	229	0	0	0	0	0	0	0	0	0	526
December	0	0	0	0	0	0	0	0	0	0	0	0
October- December	397	900	0	217	0	0	36	2206	8000	0	200	3920
Total	8303	20298	7298	66833	60	595	9578	262444	90080	37128	192235	595134

Table 2 summarizes the seasonal resources and financial costs related to the people involved in extinguishing the fires (forest and fire brigade personnel, local people, volunteers), transport expenses and used equipment, the value of wood and forest saplings burned, and other costs incurred.

During the winter-spring season, 954 people took part in extinguishing the 189 fires, the fuel costs of the transport equipment (175 machines) were BGN 578. 180 m³ of wood, 30 m³ of logs in storage and burned saplings, worth a total of BGN 27689, were damaged. On an annual basis the damages are 4.7%.

In May and June 33 fires broke out with equipment costs of BGN 561. The burned storage wood is 5 m³, estimated at BGN 210. In total, the annual losses for these two months are the smallest – BGN 771 (0.1%).

Summer fires (July - September) covered large areas and were accompanied by strong winds with changing directions. In financial terms, the damages were estimated at BGN 562,754 (94.5% of the annual losses). 6952 employees and volunteers were involved in the process. 20848 dka were extinguished. 9362 m³ of wood, worth BGN 254838, were damaged. Additional BGN 192035 were spent.

The fire hazard in forest areas were significantly reduced with the precipitations and the changing weather at the beginning of the winter. 24 fires occurred on an area of 1933 dka, with total losses of BGN 3,920 (0.6% for the year). The total damage for 2020 is estimated to BGN 595,134 (excluding future costs for preparing the soil, seedling production, afforestation and cultivation of future plantations), which according to experts will increase to about BGN 20 million over time.

CONCLUSION

The fire statistics show that the largest and longest fires during the summer of 2020 are in the districts of Haskovo (1731 dka), Stara Zagora (7284 dka), Lovech

(5571 dka), Yambol (5330 dka), as well as in the Danube area (Fig. 1).

Areas near the settlements and lands of Filipovo, Prisadets, Matochina, Sladun, which suffered a fire invasion in 2007, were set on fire again (Fig. 2).

Fig. 1. Active fires in Bulgaria in the period 04-11.08.2020

Fig. 2. Re-burned areas 2007-2020

The causes of forest fires in percentage are: human negligence – 65.4%, unknown origin – 28.9%, arson – 3.1% and natural causes – 2.6% [1].

Fields, farm buildings have been burned to ashes, wild and domestic animals have been charred, and the unique biodiversity in the Sakar Mountains has been disturbed.

Fires increasingly occur in agricultural lands and spread to forest areas.

The restructuring of the economy requires forest owners and farmers to take measures for joint activities in the protection and use of the environment [3].

- Agricultural forestry as a social practice and control has the task of integrating forest ecosystems with agricultural food production to ensure higher productivity.

- The creation of buffer zones is a well-used practice to increase the yields of crops and pastures.

- Timely water supply and sustainable water regime in the settlements is an urgent social measure and necessity.

- The restoration of irrigation systems and wells will help fight summer fires.

ACKNOWLEDGEMENTS: This work was supported by the Bulgarian National Science Fund Project DN16/6 “Integrated approach for modelling of the forest fires spread”.

REFERENCES

1. Alexandrov, A., H. Tsakov, N. Ikonov. The fire season – what the numbers say, Bulgarian forest, 4 (78), 2020, 3 (in Bulgarian).

2. Annual Reports, Bulgarian Executive Forest Agency. In: Saving Forests from Fires, Sofia, 2020, 31-35 (in Bulgarian).

3. EU – Brussels, Forest Fires. Spark for a new EU policy, Reducing the risk of forest fires towards an integrated approach to fire management in the EU, 2018, 46.

4. Forest Law - SN. 19 of 08.03.2011 (Art. 141 para. 1).

5. Naydenov, I., A. Alexandrov. Ecological, social and economic functions of forests, Publishing House of BAS “Prof. M. Drinov”, 2020, 55-59 (in Bulgarian).

6. National Development Program of Bulgaria 2020, Sub-Priority 3.5 Creating conditions for protection and improvement of the environment in the regions, adaptation to the occurring climate changes and achieving efficient use of natural resources, 2012 (in Bulgarian).

7. The fire hell in Australia 2020. BirdLife, Australia, BGNES, 2020.

8. Position of UEF 2020, European forests need multifunctional and sustainable management based on a new financing system, Bulgarian Forest, 4 (78), 2020, 2 (In Bulgarian).

9. Rural Development Program (2014-2020), Sub-measure 8.3 Prevention of forest damage from forest fires, natural disasters and catastrophic events, 2014.

10. Tsakov, H., A. Alexandrov, O. Roeva, D. Zoteva, Forest Fires in Bulgaria in the last decade (2009 – 2018). Ecological engineering and environmental protection, 3, 2019, 5-6 (in Bulgarian).

**Prof. Hristo Tsakov,
Prof. Alexandar Alexandrov**

Forest Research Institute,
Bulgarian Academy of Sciences
132, St. Kliment Ohridski Blvd.,
1756 Sofia, Bulgaria
E-mails: hristotsakovbg@abv.bg,
alexandrov_38@abv.bg

**Dafina Zoteva, Ph.D.,
Prof. Olympia Roeva**

Institute of Biophysics and Biomedical
Engineering,
Bulgarian Academy of Sciences
105 Acad. G. Bonchev Str,
1113 Sofia, Bulgaria
E-mails: olympia@biomed.bas.bg,
dafy.zoteva@gmail.com