

ANALYSIS OF MONITORING THE STATE OF FOREST ECOSYSTEMS IN BULGARIA

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Abstract

This analysis evaluates the current state and future challenges of forest ecosystems in Bulgaria, based on monitoring data from 2019 to 2024. It highlights trends in forest health, including tree vitality, pest and disease impacts, and the influence of climate change. The report underscores Bulgaria's achievements in forest protection and certification, while emphasizing ongoing risks such as increased pest outbreaks, forest fires, and adverse weather conditions. The findings stress the need for adaptive management strategies to ensure sustainable forest management, resilience against climatic and biotic stressors, and the preservation of Bulgaria's rich biodiversity and ecological stability.

Keywords: forest ecosystems, forest ecosystems, ecological stability

INTRODUCTION

The forests of Bulgaria are perceived by Bulgarian society as part of our national wealth and national identity. Forests have numerous and interrelated social, economic and ecological functions. They contribute to the preservation of biodiversity and reduce the adverse impacts of climate change, protect soils from erosion, regulate water supplies, provide jobs and income for the population - they are a source of raw materials for industry and energy. In terms of climate change, forests are the main "Carbon sink". It is extremely important that forest management is aimed at ensuring their good health, as a guarantee for the effective functioning of the wide variety of benefits they provide.

Their economic, social and ecological functions are of great importance for the sustainable development of society and for the improvement of living conditions, especially in rural and mountainous areas. Forests perform numerous economic, ecological and social functions of particular

importance for the sustainable development of the country. They are a key factor in the formation and maintenance of a living environment.

The network for monitoring and assessing the country's forest fund consists of lines that have different distances between them, forming a network. They have an allowable density of 16/16 km (in some cases 8/8 and 4/4 km), at the intersections of which permanent sample areas and two background stations are organized - "Boatin" in the Stara Planina and "Rozhen" in the Rhodope Mountains.

In addition, chemical analyses of samples (tree samples) are performed to detect heavy metals and other toxic substances, as well as their accumulation in soil samples, every five years in order to track pollution processes over time.

EXPOSITION

Monitoring the state of forest ecosystems

The establishment and development of the National Forest Ecosystem Monitoring

System is in accordance with European legislation - Regulation 2152/2003 "Forest Focus", and then according to EU Regulation No. 1737/2006. The National Forest Ecosystem Monitoring System is implemented at two levels - large-scale (level I) and intensive (level II) monitoring. The implementation of the activities at both levels of forest monitoring is carried out according to the recommendations of the Methodological Guide of the Program, including the methods and criteria for harmonized sampling, assessment, monitoring and analysis of the indicators and the corresponding periodicity of implementation.

Large-scale monitoring of forest ecosystems

Bulgaria has been part of the program since 1986 and so far a network of 256 permanent sample areas for monitoring has been established, located on the territory of the forest fund. About 140 sample areas are surveyed annually, with 30 of them being comprehensively surveyed. An assessment of the crown condition is carried out every year, with 12 sample areas being assessed according to the adopted extended methodology. The full survey includes, in addition to the crown assessment, an assessment of soil conditions, nutritional status, taxonomic characteristics, phytocenotic characteristics and floristic composition, an assessment of climatic and meteorological information.

Intensive monitoring of forest ecosystems

Three stations for intensive forest monitoring have been built - Staro Oryahovo, Vitinya and Yundola. The location and equipment of the stations was selected by a team of the Bulgarian Forestry University and the Institute of Forestry of the Bulgarian Academy of Sciences, together with Swiss experts in 2000 and in 2002 was coordinated with the MCP - Forests II level.

At this stage of its development, the forest ecosystem monitoring system - level II covers observation, survey and analysis of all mandatory and some of the optimal

indicators that are important at the local level - crown assessment, soil studies, leaf analysis, growth, vegetation, atmospheric air quality. Since the end of February 2009, the transmission of data on CAV and meteorological parameters from the three stations has been carried out in real time.

Part of the observations and assessments, which represent activities requiring a certain scientific potential and which the EEA cannot perform independently, including visual assessment of the crowns, phytocenological studies, growth, status, etc., are assigned through a contract to a scientific team from the LTU.

Defoliation

The level of defoliation (loss of leaf mass) is an indicator of the degree of damage to forests and the disruption of their health status. Defoliation is an indicator of the deterioration of the health and vitality of the tree. This indicator responds to various factors, including changes in climate conditions, extreme weather events, atmospheric deposition, insect and fungal attacks. The assessment of defoliation is a valuable early warning system for the response of forest ecosystems to various changes and stress factors. According to the adopted international assessment scale, the observed trees are classified into five grades: 0 - healthy or undamaged (defoliation from 0 to 10%), 1 - slightly damaged (defoliation from 11 to 25%), 2 - moderately damaged (defoliation from 26 to 60%), 3 - severely damaged (defoliation from 61 to 99%) and 4 - dead (100% defoliation).

Defoliation results for the period 2019-2021.

In 2021, surveys on changes in the degree of defoliation and crown coloration, damage from biotic, abiotic and other stress factors were conducted on 5,570 trees in 159 permanent sample plots from the network of the National Forest Ecosystem Monitoring System – Level I (large-scale forest monitoring). The assessments were carried out at the sample tree level and included four conifers: Scots pine (*Pinus sylvestris* L.), black pine (*Pinus black* Arn .), common

spruce (*Picea fir trees* L.) and common fir (*Abies white* Mill .), and eight broad-leaved tree species: common beech (*Fagus sylvatica* L.), oak (*Quercus cerris* L.), oak (*Quercus frainetto* Ten .), winter oak (*Quercus petraea* Liebl .), red (American) oak (*Quercus rubra* L.), common hornbeam (*Carpinus betulus* L.) , large-leaved linden (*Tilia platyphyllos* Scop .) and common chestnut (*Castanea sativa* Mill .). The total number of observed coniferous sample trees was 2430 (43.2%), and of deciduous trees – 3140 (56.4%).

The results of the large-scale monitoring conducted on the indicator " *defoliation* " show that in 2021, coniferous and deciduous tree species maintained their condition compared to the previous years 2019 and 2020. The trend for better condition of deciduous trees compared to coniferous trees persists, with the percentage of observed deciduous trees that were assessed as healthy in grades 0+1 (without and slightly defoliated) being 76.8%, for coniferous trees this percentage was 53.2%. Compared to the previous year, a slight increase in the share of healthy trees was observed for all species by 0.8%, respectively by 0.5% for deciduous trees and by 2.7% for coniferous trees. The share of those in the 4th degree (dead/dried) decreased by 0.8% in deciduous tree species, by 1.8% in coniferous tree species, and by 0.3% in total for all. The share of drying and dead/dried trees of degrees 3 and 4 in coniferous species increased slightly - 13.5% in 2021, compared to 13.0% in 2020, while in deciduous species it decreased - 2.4%, compared to 4.1% in 2020.

Studies conducted in 2021 in the sample areas with deciduous species up to 60 years old show that the best condition is the plantations of cer (*Q. cerris*), of which 97.5% were assessed as healthy - without or slightly defoliated (in 0+1 grades), followed by the plantation of red (American) oak (*Q. rubra*) - 92.5% and that of eastern beech (*F. orientalis*) in the Strandzha region, where since 2019 the share of healthy ones has decreased from 96.7% to 86.6% in 2021. With the highest percentage of defoliation

over 25% (2+3+4 grades) are the plantations of common beech (*F. sylvatica*) - 55.0% (compared to 2020, it has decreased by 27.5%) and the beech plantations - 27.8%. Of those over 60 years old, the best condition is the plantation of large-leaved lime (*T. platyphyllos*), where 97.5% of the sample trees are healthy (in degree 0+1). The plantations of common beech (*F. sylvatica*), where 83.8% of the sample trees are in 0+1 degrees of defoliation, are in very good condition, followed by the cerus (*Q. cerris*) with 82.1%. The condition of the sycamore (*Q. frainetto*) and the holm oak (*Q. petraea*) is approximately the same , 66.7% and 70.0% are assessed as healthy and slightly defoliated, respectively. The trees with the highest percentage of defoliation over 25% (2+3+4 degrees) were observed in the sample area with a plantation of common chestnut - 100%, followed by those of common hornbeam - 43.8%, the blackthorn plantations with 33.3% and the winter oak plantations with 30.1%.

Defoliation dynamics in broadleaf tree species

Of the coniferous species observed up to 60 years old - black pine (*P. nigra*), Scots pine (*P. sylvestris*) and fir (*A. alba*) plantations, those of fir retain their good condition - and in 2021 there are no dead/dried trees and all sample trees are healthy (in grade 0+1). A slight deterioration is observed in black pine plantations - 50.7% of the sample trees were assessed as healthy (53.5% in 2020), and dead/dried trees reached 8.5% (2.6% in 2020). The worst condition is in the Scots pine plantations, where the share of assessed healthy trees increased slightly to 45.1% (38.8% in 2020), and that with defoliation over 25% (2+3+4 degrees) increased to 54.9% (61.2% in 2020). In the plantations over 60 years old, the worst condition is Scots pine – in 2021, healthy and slightly affected by defoliation were 36.8% of the observed trees, the condition of black pine was better with 48.7%. The condition of spruce plantations is the best, in which healthy or slightly defoliated sample trees were 86.4%,

followed by those of common fir – 68.2%.

The worst condition continues to be the Scots pine plantations, where only 39.2% are healthy. The deterioration of the health condition of Scots and Black Pine in some of the observed plantations is due to the increased development of fungal pathogens on the roots, stems, branches and needles (*Heterobasidion annosum*, *Diplodia sapinea*, *Cyclaneusma minus*, *C. niveum*, etc.). Their spread is strongly contributed to by the climate changes observed in recent years (mild and snowless winters, wet periods at the beginning of the growing season, strong winds that carry spores over long distances, etc.), as well as prolonged periods of drought, leading to physiological weakening of the trees. For all observed coniferous tree species in 2021, an increase in the share of healthy and slightly defoliated (0+1 degrees) was recorded compared to the previous year and a decrease in the share of those with defoliation over 25% (2+3+4 degrees), in which it decreased from 48.1% in 2020 to 46.7%.

The dynamics of the condition with respect to the indicator "defoliation" in the observed deciduous tree species, for the entire analyzed period, shows a variation in the proportion of healthy (without and slightly defoliated) in the range from 70.2% (in 2012) to 84.3% (in 2015), while in conifers there is a trend towards a decrease in the proportion of healthy, reaching 51.9% in 2020, disrupted in 2021 when their proportion slightly increased to 53.2%.

Forest damage

Forests and other areas of forest territories in which damage has been identified, classified by the main damaging factors (abiotic, biotic and human activity) and by forest type.

The ecological monitoring conducted in 2021 in the Large-Scale Forest Ecosystem Monitoring Network (Level I) showed that 38% of the sample trees observed were free of damage. The proportion of healthy trees decreased by 6% compared to the previous year. The overall health status was assessed as good.

Analysis of damage data for the main tree species shows that again the highest percentage is caused by insect pests and fungal pathogens – 1% of all damage.

The species composition of the identified pathogens and insect pests in the observed coniferous plantations remained relatively unchanged in the majority of the permanent sample plots (PSP). In the artificial plantations of **Scots pine**, outside the boundaries of the natural range of the species, drying processes occur, resulting from physiological weakening, in combination with attack by bark beetles and fungal pathogens. The trees are initially colonized by the apex bark beetle (*Ips acuminatus*), and subsequently by *Ips sexdentatus*, *Tomicus piniperda*, *T. minor*, etc.

Heterobasidion contributes to the deteriorating condition of **the white and black pines. annosum**, causing root rot, *Diplodia sapinea*, damaging twigs, *Dothistroma septosporum* and *Cyclaneusma minus*, causing damage to the needles.

Diplodia sapinea is one of the most significant invasive causes of drying in species of the genus *Pinus* in Bulgaria. The presence of trees infected with root fungus (*H. annosum*) has a negative impact on the affected stands. For **spruce, attacks by the bark beetle** *Ips* are a potential danger. *typographus*. In 2021, it was observed massively multiplication of the pest in the Parangalitsa PPA. Damage from the **bark beetle** (*Pityokteines curvidens*), which has colonized individual trees.

The analysis of the data shows that the phytosanitary condition of the forests is slightly deteriorating compared to previous years. And in 2021, the largest share is in the territories affected by insect pests causing tree drying. A 15.3% decrease in the affected areas in coniferous plantations was reported - 180,365 da (213,014 da in 2020). Despite the fact that there is a decline (by 27,930 da less than in 2020), the pine processionary moth (*Thaumetopoea pityocampa*) continues to be the most significant pest, maintaining a relatively high level of

affected areas – 105,187 da. Its range is expanding eastwards and at higher altitudes in the mountains.

In recent years, attacks by the rusty pine leaf wasp (*Neodiprion sertifer*) have had a negative impact on the health of pine plantations. Damage from the species ranks second in importance, with the trend in the scope of areas affected by the pest continuing in 2021 – 65,879 da (64,683 da in 2020).

In 2021, a decrease (by 38%) in the areas attacked by bark beetles and woodlice was observed - from 14,971 da (2020) to 9,278 da (2021), which is due both to the timely implementation of sanitary and forced fellings to absorb the damaged wood, and to the better physiological condition of coniferous plantations. In deciduous forests, the areas affected by insect pests decreased by 29% compared to the previous year. The successful introduction of the entomopathogenic fungus *Entomophaga maimaiga* in areas where *Lymantria* (*Lymantria*) calamities have been reported (*dispar*) led to a decrease in the pest population. In 2021, attacks were reported on an area of 23,929 da, which is 65% less than the previous year (69,514 da in 2020). A decrease in the affected areas was found in attacks by leafrollers and pedometers (Tortricidae and Geometridae) – 14,920 da (31 636 da in 2020). There has been a significant increase in the areas of oak forests affected by the invasive alien species oak borer (*Corythucha arcuata*). In 2020, the damage covered an area of 7,253 da, and in 2021 it already reached 37,942 da, with 83% of them being moderately and heavily affected. The pest is covering more and more territories in the country, causing significant economic damage.

A deterioration in the health of deciduous plantations affected by diseases has been

reported. In 2021, oak forests were most affected, where tracheomycosis disease (*Ceratocystis roboris*) on an area of 7,797 da (2,136 da in 2020). Drying of ash plantations on an area of 2,128 da in Northeastern Bulgaria has been reported, and it is predicted that it will expand its range in the coming years.

In 2021, the total area affected by diseases and drying of conifers increased from 42,222 da in 2020 to 98,523 da, which is 57% more than in the previous year. The areas infected by diseases are mainly in the plantations of white and black pine, affected by the fungal pathogen *Diplodia sapinea*, causing tree dieback. In 2021, the areas affected by the dieback amounted to 84,524 da, which is 65% more than in 2020 (29,406 da). The recently introduced invasive fungal pathogen *Lecanosticta acicola*, causing a necrotic disease on pine needles, expands the affected areas from 72 da in 2020 to 9,075 da in 2021, of which 78% are moderately and heavily affected.

The trend of reducing the size of areas attacked by insect pests continues - in coniferous plantations to 180,365 da in 2021 (213,041 da in 2020), and in broadleaf plantations to 77,857 da in 2021 (110,537 da in 2020).

The areas affected by abiotic factors have increased significantly in the last two years - from 41,134 da (2020) to 135,853 da (2021). The largest number of abiotic factors is caused by ice dams (39,119 da), while snow dams and snow drifts account for 48,513 da in coniferous forests and 22,469 da in broadleaf forests, followed by those caused by wind dams and wind drifts, respectively 15,523 da in coniferous forests and 2,534 da in broadleaf forests.

Forest damage from wildfires

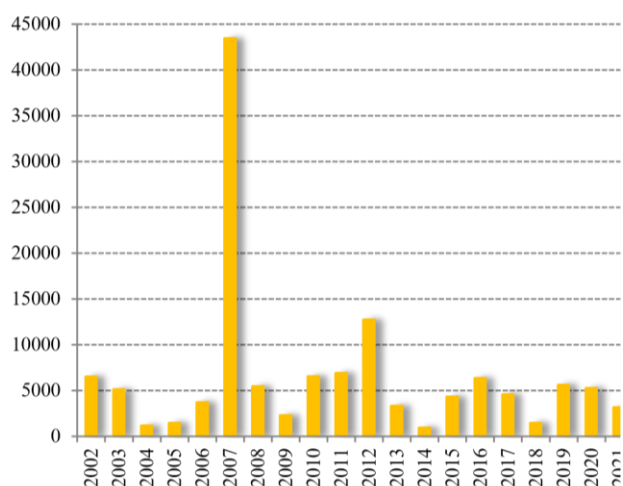


Fig. 1. Dynamics of the area of burned forest areas (2002-2021), hectares

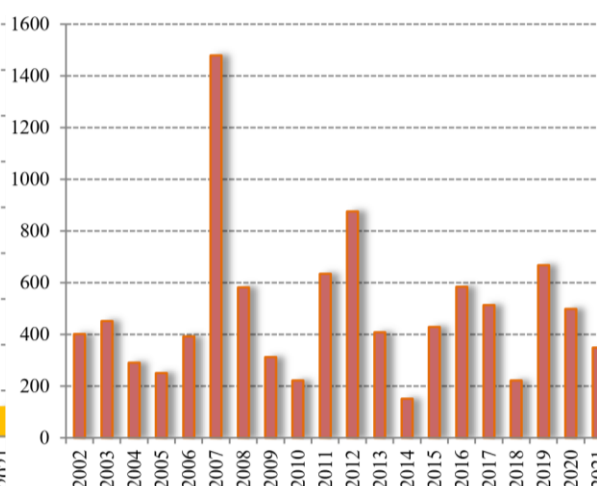


Fig. 2. Dynamics of the number of fires that occurred annually (2002-2021), number of fires

**The information in the graphs is based on data from the Executive Forestry Agency*

In 2021, the number of forest fires in the country was 499, which affected 3,143.4 ha of forest areas, with 413.7 ha of them being burned by peak fires. Compared to 2020, the number of forest fires in 2021 was 150 fewer, the burned areas were 2,115 ha fewer, and the areas affected by peak fires were 77.2 ha more. The highest number of fires and affected areas were registered in the area of activity of the Kardzhali Forest Fire Department (40 fires and 818 ha of affected areas), the Kyustendil Forest Fire Department (44 fires and 785.5 ha of affected areas) and the Plovdiv Forest Fire Department (37 fires and 629.6 ha of affected areas). More than 71% of all burned areas in the country are concentrated in these three RDGs.

Due to the high average daily temperatures and the strong winds that broke out, in the period from 15.07 to 31.08.2021, the situation in the country turned out to be extremely difficult in terms of the preservation and protection of forest areas from fires. During this period, 188 fires occurred, 53% of all registered during the year, and over 83% of all forest areas affected by fires in 2021 were burned (2,616.3 ha). The largest forest fire was registered in August in the land of the village of Yugovo, in the area of the State Hunting Farm "Kormisosh", which, due to the

difficult terrain and poor weather conditions, also grew and developed on the territory of the State Hunting Farm Asenovgrad, affecting over 466 ha of forest areas.

And in 2021, the highest percentage of burned areas was registered in forest areas that are state-owned - 65%, followed by those owned by municipalities - 24%, and 11% were in forest areas owned by individuals and legal entities.

Forests in 2023

The total area of forests and forest territories as of 31.12.2023 is 4,280,137 ha, of which forested area (including coppice) – 3,936,140 hectares. The area of forest territories is 3,953,595 ha (92.4% of the total area). The area of agricultural territories, having the characteristics of a forest within the meaning of Art. 2 of the Forest Act ("forests on agricultural territories"), is 326,542 ha (7.6% of the total area).

The forest territories – state property, managed by the state enterprises under Art. 163 of the Forestry Act, are 2,889,898 ha (73.09%). The state forests managed by the Ministry of Environment and Water are 172,362 ha (4.36%), including reserves and maintained reserves – 33,386 ha,

Rila National Park – 53,480 ha, Pirin National Park – 40,332 ha, and Central Balkan National Park – 45,164 ha. The state

forest territories provided for management by Experimental Forestry Enterprises (EFFEs) are 11,269 ha (0.29%).

The distribution of non-state forest territories is: forest territories owned by municipalities – 441,271 ha (11.16%), forest territories owned by individuals – 379,125 ha (9.59%), forest territories owned by legal entities – 59,670 ha (1.51%), including forest territories owned by religious communities – 16,493 hectares.

As of 31.12. 2022, the total area of forests and forest territories is 4,273,126 ha, of which forested area (including squatter) 3,926,058 ha, the area of forest territories – 3,955,790 ha (92.6% of the total area). Forest territories – state property, managed by state enterprises under Art. 163 of the Forest Law – 2,889,748 ha (73.05% of the GT). State forests managed by the Ministry of Environment and Water – 172,362 ha (4.36% of the GT), including reserves and maintained reserves – 33,386 ha, Rila National Park – 53,480 ha, Pirin National Park – 40,332 ha, and Central Balkan National Park – 45,164 hectares. Forest territories provided for management by Educational and Experimental Forestry Farms – 11,269 ha (0.29%). Non-state forest territories – owned by municipalities – are 441,858 ha (11.17%), owned by individuals – 381,068 ha (9.63%), owned by legal entities – 59,485 ha (1.50%), including forest territories – owned by religious communities – 17,062 hectares.

Forests on agricultural territories – state property (“State Forests”) – 31,454 ha (9.63%). Forests on agricultural territories – municipal property (“Municipal Forests”) – 189,597 ha (58.06%). Forests on agricultural territories – property of individuals (“Private Forests”) – 78,915 ha (24.17%). Forests on agricultural territories – property of legal entities (“Private Forests”) – 11,735 ha (3.59%), including forests on agricultural territories – property of religious communities (“Private Forests”) – 2,234 hectares. Forests temporarily managed by the municipality (VSO) – 14,558 ha (4.46%). Other agricultural territories with

unclear ownership – 283 ha (0.09%).

As of 31.12.2022, the area of agricultural territories having the characteristics of a forest within the meaning of Art. 2 of the Forest Act (“forests on agricultural territories”) is 317,336 hectares. Forests on agricultural territories – state property (“State FFS”) – 30,943 ha (9.75%). Forests on agricultural territories – municipal property (“FFS of municipalities”) – 186,720 ha (58.84%). Forests on agricultural territories – property of individuals (“FFS of private individuals”) – 76,519 ha (24.11%). Forests on agricultural territories – property of legal entities (“FFS of private legal entities”) – 11,637 ha (3.67%), including forests on agricultural territories – property of religious communities (“FFS of religious organizations”) – 2,232 hectares. Forests temporarily managed by the municipality (VSO) – 11,113 ha (3.5%). Other agricultural territories with unclear ownership – 404 ha (0.13%).

Certified forest areas in Bulgaria currently hold a certificate from Forest stewardship council – FSC (Forest Stewardship Council). According to the official information of FSC (<https://fsc.org>), the area of certified forest areas as of February 21, 2024 is 2,356,416.86 ha, equivalent to 60% of the total forest area in the country, and the certified units are 30 (*table 3*) . FSC Wood Chain of Custody Certificate – Chain of custody has 406 certified units.

The area of certified state forest territories managed by state enterprises under Article 163 of the Forestry Act is 2,336,868.86 ha, equivalent to 81% of the total territory managed by them in the country, and the certified units are 28 units.

State of forest crops in 2024

The inventory of forest crops was carried out in October 2024 in compliance with the methods and requirements described in Regulation No. 2/07.02.2013 on the conditions and procedure for afforestation of forest territories and agricultural lands. The inventory was carried out, in accordance with the requirements of Art. 36, para. 3 of

the Regulation, by commissions appointed by order of the directors of the State Forestry Agency/State Forestry Agency for state forest territories and by the owners for the remaining forest territories. Control checks were carried out by the Forestry Agency, and for state forest territories by the relevant State Forestry Agency under Art. 163 of the Forest Act.

The total inventoried area of crops is 52,171.32 decares, including 49,370.93 decares in state forest territories (94.7%) and 2,800.39 decares (5.3%) in forests and lands owned by municipalities and legal entities.

In the state forest territories, the following have been inventoried: 1-year crops - 14,154.7 decares; 2-year crops - 12,614.6 decares; 3-year crops - 12,221.45 decares; 4-year crops - 6,551.67 decares and 5-year crops - 3,828.5 decares.

In forests and lands - municipal and private property, the inventoried areas are as follows: 1-year - 186.5 decares; 2-year - 427.6 decares, 3-year - 1066.4 decares and 4-year - 1119.9 decares.

State forest territories.

By direction of afforestation in 1-year forest crops - state-owned, afforestation predominates in "mature plantations" - 8,047.0 decares (57%), followed by those "for forest restoration" - 3,553.8 decares (25%), of which 136 decares on fire sites, "new afforestation" - 2,206.7 decares (15.4%), "filling in rows" - 317.2 decares (2.3%) and in "two-story" - 30 decares (0.3%). Compared to the previous year, afforestation in the direction "for forest restoration" is 561.3 decares less, which shows that the trend of reducing areas damaged by natural impacts, fires and diseases that cannot be naturally restored continues. The afforestation carried out to restore burned areas is small – 136 decares. For the last five years, it has been established that in the South-West Regional Forest Reserve-Sliven and South-West Regional Forest Reserve-Blagoevgrad there is a lag in carrying out afforestation on existing fire areas with soil preparation. The South-West

Regional Forest Reserve-Sliven indicated that in the autumn of 2024, 510 decares of fire areas were afforested and in the spring of 2025, another 205 decares were afforested, which will be inventoried as annual crops in the autumn inventory of 2025.

Traditionally, afforestation with broadleaf species prevails - 89%, with the most used species being Euro-American poplars - 60%. The positive trend for the inclusion of hairy oak in the composition of the crops is maintained, with 618 decares recorded for 1-year crops, which is nearly 50 decares more than the previous year. Of the coniferous species, the most preferred is again the black pine, with 991.6 decares inventoried in 2024, which represents 62.4% of 1-year coniferous crops.

Of the distribution of afforestation of annual crops by state enterprises and by type of crop, the most common are broadleaf crops created on the territory of the North-West Border Forest Reserve-Vratsa - 3,326 decares (mainly poplar crops) and coniferous crops on the territory of the South-West Border Forest Reserve-Blagoevgrad - 587 decares.

The largest share is in pure crops – 91.1%, with the ratio of broadleaf/coniferous being 89:11. 7,540 decares have been created with Euro-American poplars, which is 66% of the created pure broadleaf crops. The most preferred poplar cultivars for afforestation are again P. cv. I -214 – 61% and P. cv. Agate – 22%.

Of the annual crops inventoried in 2024, mixed crops are 1259.2 ha (9%), with 80% of them being mixed broadleaf. Of the species with good honey-bearing qualities, the main place is occupied by the white acacia, with a small participation of field ash, common sycamore, willows, sweet chestnut and gledichia.

The volume of forest crops created in the DGT for anti-erosion purposes is 5,071.9 decares, which is 818 decares more than the previous year. A total of 3,612 decares were rejected, which is 4 times more than in 2023, when 836.6 decares were rejected, of which

1,848 decares were poplar crops.

According to data from state enterprises, the rejected crops are as follows: in the Central and Southern Regions - 1752 decares, of which 1147 decares are rejected annual poplar crops, South-West Regions - 869 decares /of which 85 decares are poplars, South-West Regions - 614 decares /of which 436 decares are poplars, South-West Regions - 287 decares /of which 100 decares are poplars, North-West Regions - 90 decares /of which 80 decares are poplars.

The main reason given is the prolonged summer drought with extremely high daily temperatures, and other reasons are the decrease in groundwater, damage from diseases and pests, grazing by domestic animals, etc. The main reasons for the changes in the typical conditions of poplar habitats are the long periods of drought accompanied by high temperatures, an atypically low level of the Danube River for the spring season, a decrease in the level of groundwater. As a result of the unfavorable climatic conditions, in the autumn of 2024, a widespread attack by poplar spotted leafhopper was detected on all poplar crops on the territory of all farms along the Danube River. In addition to poplar leafhopper, the presence of damage from necrosis on the stems, small poplar glassworm, poplar cigarette beetle and poplar leafworm were also reported. In recent years, there has been a drying out and low percentage of interception of poplar crops planted along the Maritsa and Tundzha rivers, due to a significant decrease in the groundwater level.

The Chart shows that the lowest interception rates are annual crops on the territory of SEDP Sliven – 46% and SCDP Gabrovo – 48%. The main reason for the low interception rate for both enterprises, 22-25% lower than in 2023, is the huge volume of poplar crops discarded in 2024.

The most used type of soil preparation for afforestation is the full mechanized one – 70%. Of the partial soil preparation, representing 29% of the total, the largest percentage is the construction of terraces –

11%. The established crops without soil preparation occupy 0.06% - only 8 decares.

Forest crops - municipal and private property.

In 2024, the inventoried annual crops are 186.5 decares, of which 143.5 decares - municipal property and 43 decares on forest territories - private property. In 2023/2024, forest crops were created on the territory of only 3 regional forest directorates - Kardzhali, Sliven and Sofia. On the territory owned by "Dundee Precious Metals Krumovgrad" EAD, 43 decares of crops were created as part of the implementation of biological reclamation in the "Ada Tepe" area.

Summary findings from the inventories carried out

In terms of climate, 2024 was extremely unfavorable for established forest crops. According to NIMH data, prolonged periods of no precipitation were recorded, combined with extremely high temperatures, and it is expected to be declared the warmest year since 1930. Despite the rainy month of March with more precipitation compared to March of 2022 and 2023, the month of April had less precipitation than April 2023 and relatively dry and unusually warm weather for the season. The total volume of river runoff in the country for the month of April was 36% less than April 2023. In May, the amount of precipitation in most places in the country was again above the monthly climate norm, but the summer and autumn months are characterized by severe and prolonged drought and extremely low precipitation. Under these climatic conditions, crop development for most of the year occurs in hot weather and a deepening deficit of soil moisture, which leads to weakening of the seedlings and predisposes to the appearance of damage to the leaves - scorching and attacks by various pests.

The average interception rate for all annual crops is 59.4%, close to that of 2023 (59.34%) and lower than 2022 (66.87%).

The volume of forest crops established for anti-erosion purposes is 5,115 decares,

which represents 35.7% of all inventoried annual crops.

A large part of the crops have a capture rate lower than 80%. The low percentages achieved are due to poor soil moisture reserves due to prolonged summer droughts, extremely high summer temperatures, low water levels in the rivers and low groundwater levels, drained poplar stands, damage from diseases and pests, and a large volume of rejected poplar crops.

Analysis of monitoring the state of forest ecosystems

The current state of forest ecosystems in Bulgaria shows considerable stability with trends towards gradual improvement in broadleaf tree species and some challenges in conifers, especially pine. Forest health trends based on defoliation data show a slight increase in the proportion of healthy trees in 2021, with broadleaf tree species overtaking conifers in terms of health. However, large parts of forest stands remain affected by stress factors caused by both climate change and human activity.

Climate change and extreme weather conditions have a significant impact on the health and spread of pests and diseases. Mild winters, wet periods and longer droughts lead to physiological weakening of trees, which facilitates the spread of fungal pathogens and insect pests such as *Ips typographus*, *Thaumetopoea pityocampa*, *Neodiprion sertifer* and others. As a result, the areas of affected forest stands are increasing in diseases and drying, especially in pine and deciduous forests such as oak.

Intensive monitoring of the state of forests shows that in recent years there has been a trend towards a reduction in the areas affected by insects and diseases, thanks to active sanitary activities, timely care and improved physiological resistance. However, negative climatic conditions remain a serious factor for the future, which requires strengthening adaptive strategies and strategic management.

Fire statistics and damage in 2021 show a decrease in the number and area of forest fires compared to the previous year, with the

main impact on state-owned territories. However, the danger of large forest fires remains, especially in extreme weather conditions, such as high temperatures and winds.

In 2024, the total area of forests in Bulgaria reaches over 4.28 million ha, with the majority being state-owned. Certified forest areas under FSC management reach about 60% of the total forest area, which indicates sustainable management and a high level of environmental responsibility.

Areas affected by pests and diseases remain significant, especially in coniferous plantations, where the development of pathogens and pests is also related to climatic conditions and human activities. Inventories for the state of forest crops in 2024 show that adverse climatic conditions such as prolonged droughts and extreme temperatures negatively affect the establishment and development of new crops, which is risky for their sustainable recovery.

CONCLUSION

Bulgaria has successfully implemented its strategic objectives for the protection and conservation of forest resources, being the first country in Europe to meet the requirements for the insurance of 35% of the national territory and the strict protection of over 12% of forests ahead of schedule. As a result, the country has a significant wealth of old and biodiverse forests that contribute to climate resilience, biodiversity conservation and socio-economic development. Despite the progress achieved, future challenges include the need for more effective management in the context of climate change, the increasing threat of pests and diseases, as well as the need to take measures to increase the resilience of forest ecosystems. Integrated protection strategies, silvicultural practices and enhanced monitoring and scientific approaches are needed to preserve the forest potential for future generations. At the same time, it is important to stimulate the development of certified and environmentally responsible

forest practices, as well as the active involvement of society and stakeholders in the protection and sustainable management of forests. Only through a systematic and long-term approach will Bulgaria preserve its wealth and guarantee the ecological, social and economic stability of its forest ecosystems.

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