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Title Forest Fires in Europe, Middle East and North Africa 2018

Abstract

This report contains the annual summary of the fire season of 2018 with official figures provided by 33 contributing countries for the number of fires, burnt areas and fire prevention efforts, and the analysis of fire danger and areas mapped in the European Forest Fire Information System (EFFIS).

Forest Fires in Europe, Middle East and North Africa 2018

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Contents

Foreword

It is with increasing concern that we have seen wildfires affecting important ecosystems in the Pyrenees and the Alpine regions, with a large impact on protected areas like the Danube delta and the Canary Islands, among others. For the first time ever, grasslands and marshes are the ecosystems in Europe most affected by fires. Fires seldom affected such areas in the past. The European Forest Fire Information System (EFFIS) in the Copernicus EU program estimated that the area burnt in the central and northern Europe [1] was nearly 60 times larger than the average burnt area during the last decade.

It is well known that extreme weather conditions are not the only cause of wildfires. Human acts, willingly or unwillingly, often initiate fires that spread uncontrollably under extreme weather conditions, causing significant losses of human lives and enormous destruction of assets.

Indeed, the effects of climate change coupled with unsustainable management practices by increasing fire risk and making our environment more vulnerable to wildfires, were very noticeable in 2018 and continue to be so in 2019.

Better preparedness of countries and the European Institutions helped mitigate the effect of the fires through a continuous joint effort. Yet Greece suffered over 100 casualties in one of the most deadly fires ever in Europe. Vulnerable ecosystems of the Natura 2000 network, our reservoirs of biodiversity, suffered acutely, with over 50000 ha burnt representing 36% of the total burnt area in 2018. These catastrophic events wipe out the achievements of decades preserving valuable habitats and species.

National and regional authorities, EU institutions and international organizations must all work together to minimize the effects of wildfires in Europe and globally.

The RescEU legislation[2] adopted in March 2019 will strengthen the European civil protection, by enhancing prevention and preparedness actions to alleviate the effect of wildfires in the extended European region.

The Communication on stepping up EU action on deforestation and forest degradation, adopted in July by the European Commission, commits to establish actions and further develop information system such as EFFIS for wildfire monitoring at the global scale.

Moreover, the European Commission and experts in the participating countries at pan European level are working on establishing a wildfire risk assessment as well as guidance on forest fire prevention. These activities are conducted with the support of European Forest Fires Information System (EFFIS), which provides policy relevant information to national and EU institutions on the different phases of fire management: from prevention and firefighting, to restoration.

To be effective, we need to engage in a large scale ecosystem restoration plan increasing the ecosystem resilience, which would definitely be cheaper than bearing the costs of disaster control.

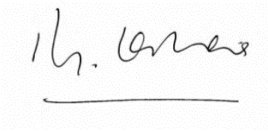
While we are reporting about the impact of wildfires in Europe and the neighboring Mediterranean countries in 2018, we are witnessing that wildfires in 2019 are again a great concern for governments and citizens around the world. The area affected by fires in the past few months expands from the Arctic Circle and Siberia to the Amazon and Indonesia, posing a serious threat to both humans and our environment. It is foreseeable that wildfire will continue to be a threat in the next years and we thus need to take efficient and effective measures to increase the resilience of our environment and

[1] Considering burnt areas in Finland, Sweden, Estonia, Lithuania, Latvia, Germany, United Kingdom and Ireland during the period 2008-2017.

[2] Decision (EU) 2019/420, 20.03.2019

optimize our actions to strengthen the EU capacity to protect our citizens and our natural capital for future generations

This report is the result of a close and lasting collaboration among the countries of the pan-European region. The 2018 report is based on contributions from 33 countries out of the 42 countries that constitute the Expert Group on Forest Fires (EGFF), and it includes, for the first time, aspects related to climate change activities and programs.



Daniel CALLEJA CRESPO
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Executive summary

This is the 19th issue of the EFFIS annual report on forest fires for the year 2018. This report is consolidated as highly appreciated documentation of the previous year's forest fires in Europe, Middle East and North Africa. In its different sections, the report includes information on the evolution of fire danger in the European and Mediterranean regions, the damage caused by fires and detailed description of the fire conditions during the 2018 fire campaign in the majority of countries in the EFFIS network. The chapter on national reporting gives an overview of the efforts undertaken at national and regional levels, and provides inspiration for countries exposed to forest fire risk.

The preparation and publication of the report aims at improving cooperation with the members of the Expert Group on Forest Fires (EGFF) especially with regard to fire prevention and climate change adaptation measures in relation of fires. Our common aim is to maintain and protect our landscapes and natural heritage, to avoid loss of human lives and to minimise the damage caused to property by uncontrolled forest fires.

The aim of the European Forest Fire Information System (EFFIS) is to provide harmonised information on forest fires and assessment of their effects in the pan-European region. For this purpose, collaboration with EU Member States and neighbouring countries has been on-going since 1998. EFFIS started as a pilot project of collaboration between the European Countries and the European Commission in the area of fire information and fire prevention.

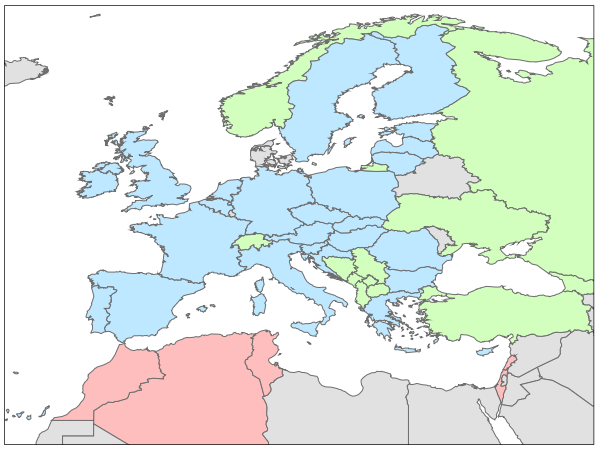


Figure 1. EFFIS network (blue: EU; green: non-EU; pink: MENA)

On the Commission side, EFFIS was initiated by the Joint Research Centre in collaboration with the DG Environment. Due to the high support from the Expert Group on Forest Fires, which constitutes the network of experts from the countries contributing to EFFIS, the system was developed to an operational level supporting national and European policies and providing the information basis for the discussion of issues related to forest fires in the European Parliament[3]. Currently, EFFIS provides operational support to DG ECHO in the area of civil protection, DG GROW in the implementation of the Copernicus Regulation [3] as well as to DG REGIO regarding the implementation of the EU Solidarity Fund Regulation [4] for critical fires. In 2015, EFFIS was included as a component of the EU Copernicus Program Emergency Management Services, which provides a legal and financial basis for its operation under this framework since then.

EFFIS provides an ideal platform for countries to exchange good practices on fire prevention, firefighting, restoration practices and other activities related to fire management, and for the European Commission to update the forest fire services in the countries on relevant initiatives at the European level.

Since its first operation in the year 2000, the number of countries contributing to the information on forest fires in EFFIS and receiving data from it has increased steadily. The use of the system by government organizations and citizens has increased up to nearly 300000 users from 188 countries in 2018.

Currently, the EFFIS network constitutes 42 countries, including 25 EU Member States (Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, the Netherlands and the United Kingdom), 12 European non-EU countries (Albania, Bosnia & Herzegovina, Republic of North Macedonia, Georgia, Kosovo, Montenegro, Norway, Russia, Serbia, Switzerland, Turkey and Ukraine), and 5 MENA countries (Algeria, Israel, Lebanon, Morocco and Tunisia).

[3] http://www.europarl.europa.eu/plenary/en/parliamentary-questions.ht

1 Forest Fires in 2018

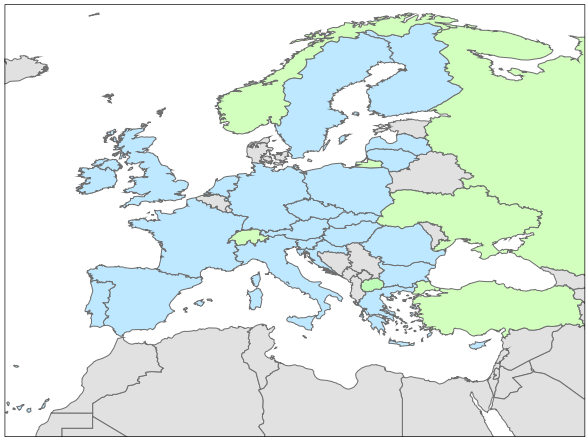
1.1 Introduction to the 2018 fire season

Table 1. Overview of the number of fires and burnt areas reported by the contributing countries in 2018.

Country	Number of fires			Burnt area (ha)			Notes
	2018	2008-17 average	2018 as % of average	**2018**	2008-17 average	2018 as % of average	
Austria	**159**	207	77	**19**	72	26	Change in method of recording fires
Bulgaria	**222**	471	47	**1453**	5315	27	
Cyprus	**131**	100	131	**1136**	1720	66	
Czech Rep.	**2033**	974	209	**492**	272	181	
Germany	**1708**	700	244	**2349**	333	706	
Algeria	**797**	3313	24	**2312**	36361	6	Average 2011-17
Spain	**7143**	12573	57	**25162**	101411	25	
Finland	**2427**	1141	213	**1228**	485	253	
France	**3005**	3791	79	**5124**	11923	43	
Greece	**793**	1055	75	**15464**	28208	55	
Croatia	**54**	229	144	**48543**	9064	536	
Hungary	**530**	1068	50	**906**	4882	19	
Italy	**3220**	5853	55	**161987**	78898	205	
Lebanon	**41**	125	33	**643**	883	73	Only 3 previous years to compare
Lithuania	**211**	180	117	**110**	107	103	
Latvia	**972**	525	185	**2864**	346	827	
Morocco	**343**	464	74	**841**	2964	28	
Netherlands	**949**	-	-	**572**	-	-	New contributor
North Macedonia	**19**	247	8	**95**	4703	2	
Norway	**887**	123	722	**3279**	882	372	Change in method of recording fires 2016
Poland	**8867**	7163	124	**2696**	3143	86	
Portugal	**12436**	18485	67	**43702**	136107	32	
Romania	**158**	267	59	**1341**	1581	85	
Slovenia	**32**	91	35	**20**	278	7	
Slovakia	**262**	240	109	**248**	419	59	
Sweden	**8181**	4115	199	**24310**	2911	835	
Switzerland	**153**	92	166	**69**	110	62	
Turkey	**2167**	2385	91	**5644**	9075	62	
Ukraine	**1297**	2186	59	**1367**	4036	34	

1.2 European countries

The following chapters contain the reports from the contributing European countries. The reports are arranged in alphabetical order and comprise reports from 23 Member States and 6 other non-EU members of the EFFIS network.



1.2.1 Austria

Fire danger in the 2018 fire season

The past year was characterized by above-average temperatures, combined with considerable drought in some places. Although 2018 was the warmest year since more than 250 years, there were comparatively few vegetation fires recorded, hardly any larger fires and an exceptionally small total burning area. Reasons for this discrepancy may be: i) In the particularly arid regions of 2018 there are few forest areas. ii) The summer was generally windless. Strong wind is crucial for a rapid fire spread. iii) Within the Alps mostly wet conditions were present due to recurring rain showers and thunderstorms. iv) The appeals of authorities and fire brigades to handle fires carefully have been well received this year.

Fire occurrence and affected surfaces

In recent years, an average of 200 forest fires per year were recorded. In this respect, 2018 was below-average with 159 forest fires. Only 19 hectares of forest were affected by fires. One has to go back to 2005 to find a year with less affected area (14 ha). From March to early April 2018, several cold air intrusions occurred. This resulted in a relatively weak spring fire season.

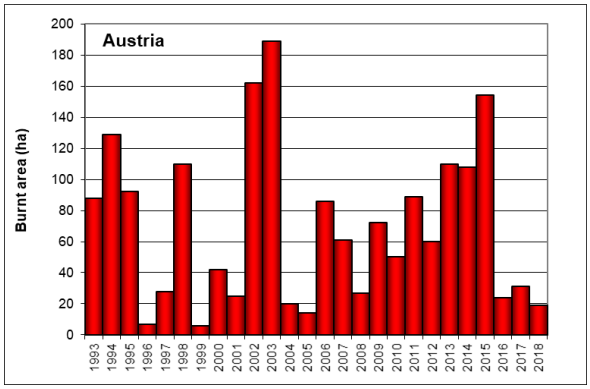
In April, usually the month with the highest number of fires, only 33 forest fires were recorded. May, June and July remained inconspicuous, but August brought an above-average number of fires (47; Figure 3).

At the end of August, the largest forest fire of the year occurred: on August 21st a carelessly discarded cigarette set fire to around five hectares of forest above Hallstatt in Upper Austria.

October brought again a longer dry period and several forest fires, the largest one occurring in Sankt Jakob in Defereggen, Carinthia - about four hectares of Swiss stone pine and larch forest caught fire.

Most forest fires occurred in Lower Austria (28), followed by Tyrol (27), Vorarlberg (23), Upper Austria (21), Salzburg (21), Styria (17), Carinthia (16) and Burgenland (8). About 85 % of forest fires in 2018 were surface fires. Also some smouldering fires occurred, especially after lightning strikes. Only six forest fires were accompanied by (passive) crown fire.

The total number of fires, burnt area and average fire size from 1991 to 2018 is presented in Figure 1.



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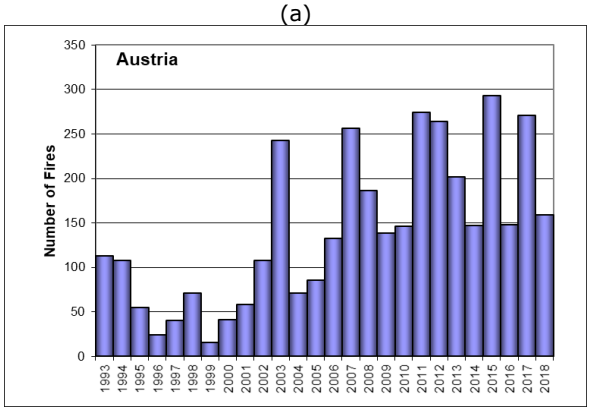

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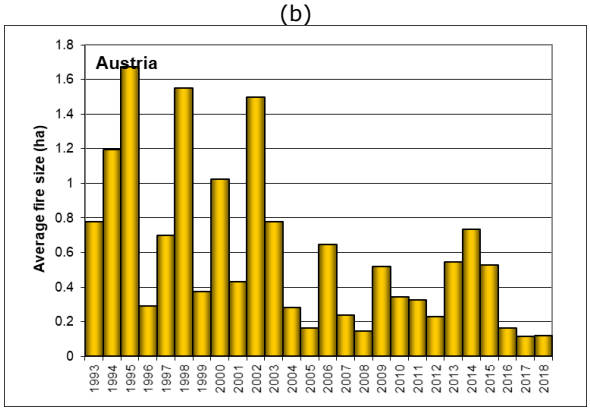


(c)

Figure 2. Burnt areas (a), number of fires (b) and average fire size (c) in Austria from 1993 to 2018.

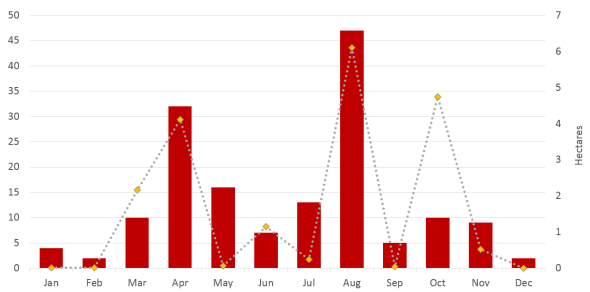


Figure 3. Monthly number of fires and burnt area in Austria in 2018.

Fire causes

128 forest fires in the year 2018 (81%) were directly or indirectly caused by humans (Figure 4). 30 forest fires (19 %) were ignited by lightning strikes. For one forest fire the spontaneous combustion of a compost pile is assumed to have triggered the fire. Regarding the anthropogenic fire causes, they can be ranked as follows: i) Cigarettes (43 cases, 34%) ii) Other causes like hot ashes or flying sparks during work (25) iii) Fires out of control (21) iv) Arson (13) v) Flying sparks from trains (5) vi) Cracked power line (1). For all other human caused fires the exact anthropogenic cause is unknown.

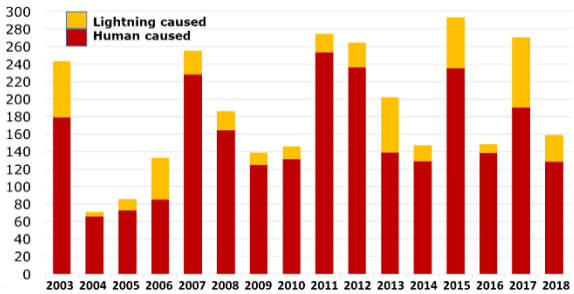


Figure 4. Number of fires by cause (natural/human caused) in Austria from 2003-2018.

Fire fighting means

Austria has more than 300 000 volunteer fire fighters in about 4 500 fire brigades and the densest fire fighter network worldwide. Fire brigades in Austria are highly effective regarding the fighting of forest fires. The mean first-attack time is about 20 minutes after the first report of a forest fire. Many fires can be attacked directly at the front line, as most forest fires are low intensity ground fires. They are usually extinguished within one hour. If necessary, extinguishing lines are established or helicopters are requested as assistance, especially in difficult or inaccessible terrain.

Fire prevention activities and information campaigns

In early 2018 two forest fire workshops with stakeholders and representatives from fire brigades and authorities of all Austrian provinces were accomplished.

Recommendations on the prevention, prediction, control and documentation of forest fires were prepared. High concern was found regarding a central fire documentation and a profound assessment of fire danger throughout Austria. A cooperation between the forest fire research group at BOKU Silviculture and the Central Institute of Meteorology and Geodynamics (ZAMG) was intensified and first steps to improve the current forest fire danger assessment at ZAMG were done. Scientific work and surveys were effectively promoted to the public by regular posts in the Austrian forest fire blog and by posts on Facebook, reaching up to 20 000 people per day. Also several interviews for radio, print media and television were conducted by members of Austrian fire brigades and scientists at BOKU Silviculture.

Injuries and loss of human lives

Through the impact of forest fires and in the course of fire fighting 10 people were injured in Austria in 2018. No deaths have been reported.

Operations of mutual assistance

There are no special projects.

Climate Change

There are different working groups from the Austrian federal fire brigade association and the university. They also discuss about prevention and operational tasks.

Research activities aimed at improving fire management

In 2015 the project AFFRI 2 (Austrian Forest Fire Research Initiative) started in the course of a cooperation between the Institute of Silviculture at the University of Natural Resources and Life Sciences Vienna, provinces in Austria and the federal ministry for tourism and sustainability. In 2018 the work on the related tasks in the work packages continued. The purchase of a weather station by BOKU Silviculture with fuel stick sensors to determine fine fuel moisture allowed the collection of data to better estimate the ignition potential of forest fires.

A first calibration of a mobile fine fuel moisture meter (ME2000) was accomplished in summer 2018. Besides a pilot project with East Tyrol was initiated. Here, the potential fire danger of the mountain forests shall be revealed with the help of high resolution LiDAR datasets. In autumn 2017 a cooperation started with the polytechnic school of Donaustadt. Two students cooperated with the Institute of Silviculture and prepared a first prototype of an integrated fire danger assessment system for Austrian conditions in 2018.

(Source: Institute of Silviculture, University of Natural Resources and Life Sciences,

Vienna; *The Austrian Federal Fire Brigade Association, Austria).*

1.2.2 Bulgaria

Activities for forest fire prevention are the priority of the Ministry of Agriculture, Foods and Forests and the Executive Forest Agency (EFA). Annually before the active fire season, all regional authorities develop an annual plan for forest fire protection of the forest areas and an action plan for forest fire fighting. Those documents are to be submitted annually to the committee of representatives from EFA and to the Directorate General for Fire Safety and Protection of the Population.

Fire occurrence and affected areas

According to the Executive Forest Agency database in 2018 the number of forest fires in Bulgaria was 222 and the burnt area is estimated to be 1 453 ha, with only 19.7 ha of them burned by crown fires. The average size per forest fire in 2018 again decreased to 6.5 ha. The biggest forest fire affected 617.7 ha of forest territories only by ground fire.

The largest number and area burnt by forest fires were reported in Regional Forest Directorate (RFD) Lovech with 20 fires and 667.3 ha, RFD Berkovitsa with 12 and 419.1 ha and RFD Blagoevgrad with 36 and 101.2 ha. Over 80% of all burned forest areas in the country are concentrated in these three RFDs.

By comparison with the average annual burned forest territories in the country of nearly 9000 ha with an average number of 560 forest fires in the period 2007-2017, 2018 ranks second best after 2014, and is among the years with excellent statistics on burned forest areas and the number of forest fires occurring.

Distribution of the burnt areas in 2018 according to ownership is:

- State forest - 40%,
- Municipal forest – 6%
- Private forest – 53%
- Other forests – 1%.

The main causes for the forest fires during 2018 are as follows:

- Carelessness – 159 in number (72%);
- Arson - 13 in number (6%);
- Natural - 8 in number (4%);
- Unknown - 42 in number (19%).

The total number of fires, burnt area and average fire size from 1991 to 2018 is presented in Figure 1 and forest fire statistics including causes are in Table 1.

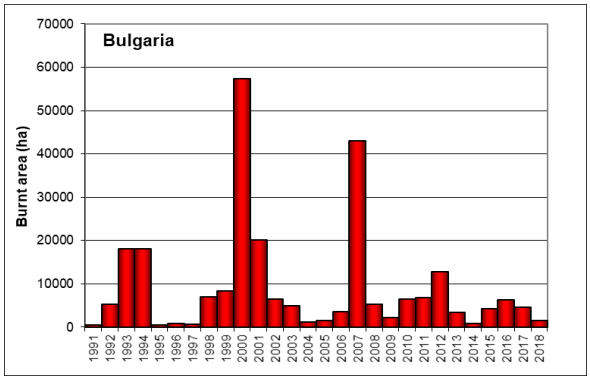
The direct losses by forest fires in 2018 are estimated at only 20 000 Euro, although the average losses for the last 10 years is about 2 300 000 Euro.

Injuries and loss of human lives

During 2018 there were no reported losses of human lives or injuries from forest fires.

Table 2. Forest fire statistics for Bulgaria 2009-2018.

Year	Burnt area (ha)		Fire causes (number)			Total number of fires
	Total	Forest lands	Human activities	Natural	Unknown	
2009	2276	2276	231	5	76	314
2010	6526	6526	191	1	30	222
2011	6883	6883	418	7	210	635
2012	12730	12730	669	42	165	876
2013	3314	3314	334	12	62	408
2014	916	916	128	3	20	151
2015	4315	4313	335	12	82	429
2016	6340	6340	472	22	90	584
2017	4569	4569	433	14	66	513
2018	1453	1453	172	8	42	222
Mean	**4932**	**4932**	**338**	**13**	**84**	**435**



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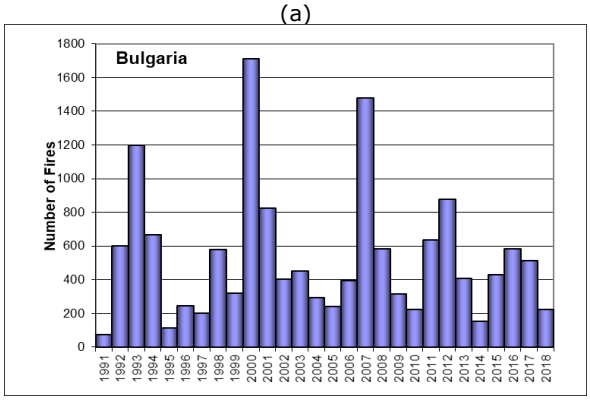

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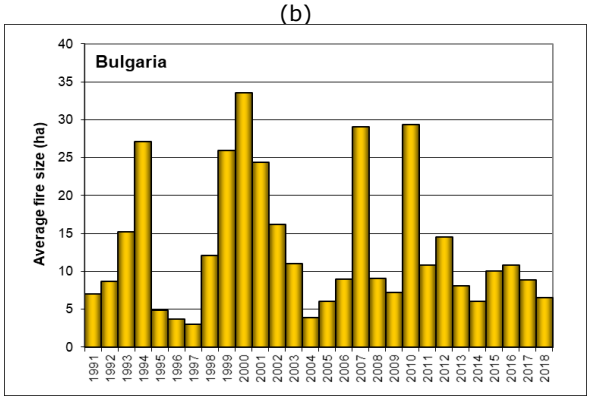

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Figure 5. Burnt areas (a), number of fires (b) and average fire size (c) in Bulgaria from 1991 to 2018.

(Source: Executive Forest Agency, Bulgaria).

1.2.3 Croatia

Fire danger in the 2018 fire season

May: At the end of May 2018, the danger ratings in the northern Adriatic and inland were mostly very low and low, moderate in Dalmatia, and on some islands the ratings were high. In May, the average monthly air temperature in the Adriatic and inland areas was higher than the thirty-year average (1961-1990). The amount of rain, which is not unusual for May, was very unevenly distributed because there were frequent, and in some localities even heavy thunderstorms. Medium monthly danger rating analysis for May (Figure 6) shows that it was low in most parts of the Adriatic. It was moderate only in the southern Adriatic and on the central Dalmatian islands. It was very low in Lika.

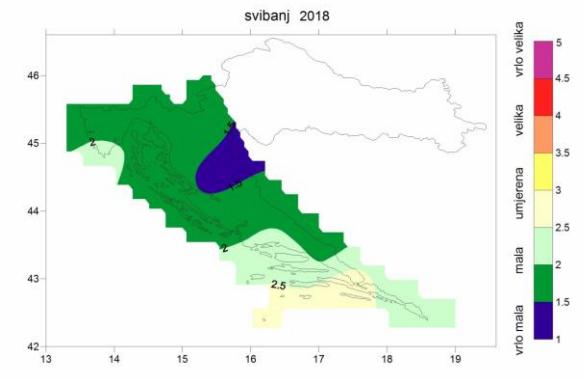


Figure 6. Median monthly danger rating for the occurrence and spread of vegetation fires according to the Canadian method (MIOP) for May 2018.

June: Similarly, relatively unstable weather conditions continued in June. The first and second decades of June were overwhelmingly warm with occasional penetrations of humid air. In the third decade of the month, the altitude airflow turned north and there was an inflow of cool air, causing occasional heavy thunderstorms. There was little or no rain on the southern Dalmatian islands. Medium monthly danger rating analysis for June (Figure 7) shows that it was low in most of the area, especially in the northern Adriatic. The moderate danger rating was observed only in the middle and south Dalmatia. The danger rating was high only on a couple of islands (Lastovo and Mljet).

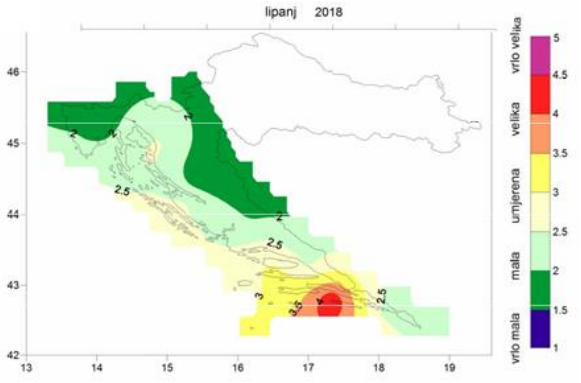


Figure 7. Median monthly danger rating for the occurrence and spread of vegetation fires according to the Canadian method (MIOP) for June 2018.

July: Unstable weather continued in July, and there was local rain and thunderstorms, sometimes even abundant. Precipitation was more frequent in the northern Adriatic and in the mountainous regions. The highest danger ratings were in the south of Dalmatia, mostly high and very high. At the end of the month, with the inflow of very warm air and the emergence of a heat wave, danger ratings increased everywhere. July is generally characterized by occasional strong winds, especially bora. Median monthly danger rating calculation (Figure 8) shows that it was very unevenly distributed. It was even low in the northern Adriatic and Gorski Kotar. In northern Dalmatia and Dalmatian hinterland it was moderate, and in most of central and southern Dalmatia it was high. The largest median danger rating was in the middle Dalmatian islands.

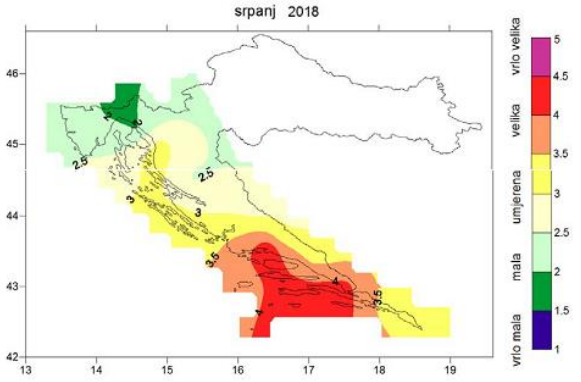


Figure 8. Median monthly danger rating for the occurrence and spread of vegetation fires according to the Canadian method (MIOP) for July 2018.

August: The weather in August was most commonly affected by a field of slightly higher or medium even air pressure. It should be noted that two heat waves were recorded when hot air from the south was coming to our area under the influence of a high-altitude thermobaric ridge. The first heat wave was in the first decade of the month, and the second lasted, in most of the

country, from 20 to 24 August. The heat waves were most prominent in the Adriatic and coastal areas and facilitated the drying of the vegetation. In August, there were several pronounced penetrations of humid and unstable air, which, however, resulted in occasional rain, which therefore reduced the fire risk only in some areas. The lowest amount of precipitation was in the south of Dalmatia. Median monthly danger rating calculation (Figure 9) shows that it was moderate in the part of the northern Adriatic (Istria and Kvarner) and part of the mountainous region of Croatia. In most of Dalmatia, the medium danger rating was high, and somewhere in the middle Dalmatian islands it was very high.

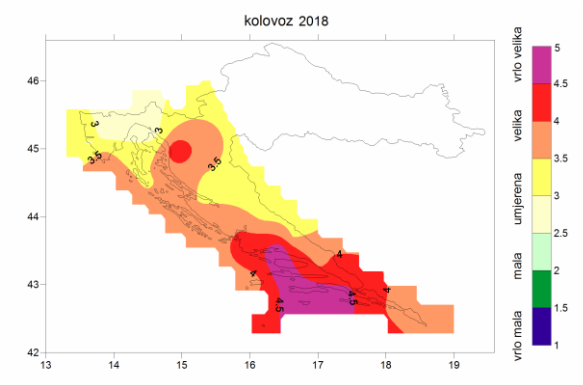


Figure 9. Median monthly danger rating for the occurrence and spread of vegetation fires according to the Canadian method (MIOP) for August 2018.

September: In the most part of September, air temperatures were above average with little or no precipitation. The weather was mostly influenced by a field of medium or high air pressure, and at high altitudes there was an inflow of warm air from the south. The atmospheric fronts reached the continental part of the country, sometimes the northern Adriatic, so there was some rain in those areas. However, in Dalmatia, especially in the south, there was almost no precipitation so these areas experienced the highest fire risks. Moreover, for most days the danger ratings were high or very high. Towards the end of the month, on 24 September, a prominent cold front moved across our country, but again the smallest rainfall was in Dalmatia. Strengthening of the anticyclone ridge from the northwest of the continent after its passing and the lowered air pressure south of the Adriatic caused strong and stormy bora. Therefore, the forest fires that started in the Pelješac area on 25 September created severe problems for the firefighters as they came very close to the settlements on several occasions. Median monthly danger rating for September 2018 (Figure 10) was very diverse. It was low in most parts of the northern Adriatic and in mountainous region of Croatia, and only moderate in the south of Istria and in northern Dalmatia. In Dalmatia, the median danger rating was high, and in some of the middle Dalmatian islands it was very high.

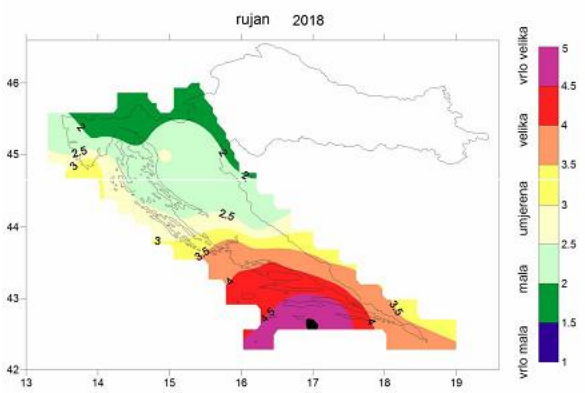


Figure 10. Median monthly danger rating for the occurrence and spread of vegetation fires according to the Canadian method (MIOP) for September 2018.

The firefighting season in 2018 is interesting because of the increased fire risk in September and especially in October, when air temperatures were above average, and there was less rain than usual. Therefore, the danger ratings were higher than usual for that time of the year, especially in Dalmatia. Moreover, by the end of October, the danger ratings for the south of Dalmatia were high and very high. Only at the end of October, when the prominent cyclones shifted across the Mediterranean, and partly the Adriatic, did the danger ratings decline.

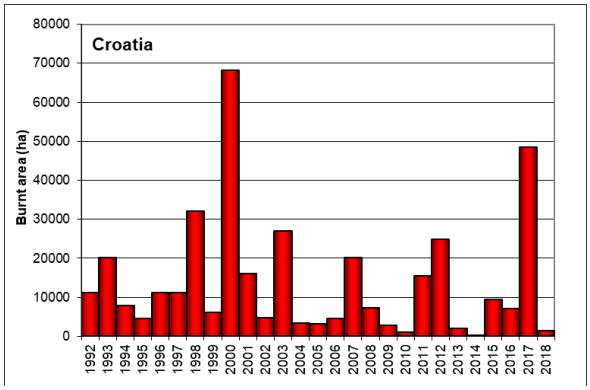
Fire occurrence and affected surfaces

It is important to note that 2018 was the year with the number of fires and area burned below the average. Since 1990, fewer forest fires (44 fires for 188 ha) have been recorded only in 2014 in the Republic of Croatia.

During 2018, 54 wildfires affected 1 506 hectares of land. Most fires (44) occurred in Split area (77% of the number of fires and 71% of the affected surfaces). Of the total affected surfaces, 161 hectares or 10.7% of high forests were affected, 589 ha or 39.1% of other forests (medium forest, coppice, bushes and shrubbery, maquis, garigue, plantations and crops) and 756 ha or 50.2% of unwooded forest and agricultural land.

As far as the ownership structure of the affected surfaces is concerned, it can be noted that 1 032 ha or 68.5% of the affected surfaces were state owned and 474 ha or 31.5% were private surfaces (forest and agricultural land).

A total of 1 875 vegetation fires or 27.24% less than the previous five-year average were recorded in the coastal and karst area in 2018. We emphasize that in these fires, the total area burnt amounted to 3 891 ha, which is as much as 85.87% less than the observed previous five-year average, with the burnt area index (BAIM) lower for a significant percentage of 80.58%. Observing only the period during the fire season (June to October), the number of fires increased by 14.30% compared to the five-year average, but the burnt area is reduced by an exceptionally high 80.71%, thus significantly decreasing the BAIM for that period by 83.13%.



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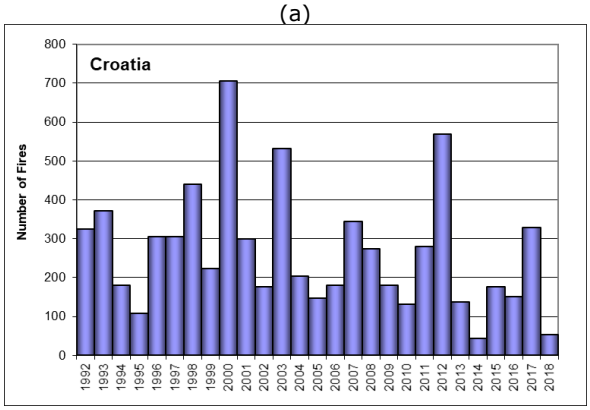

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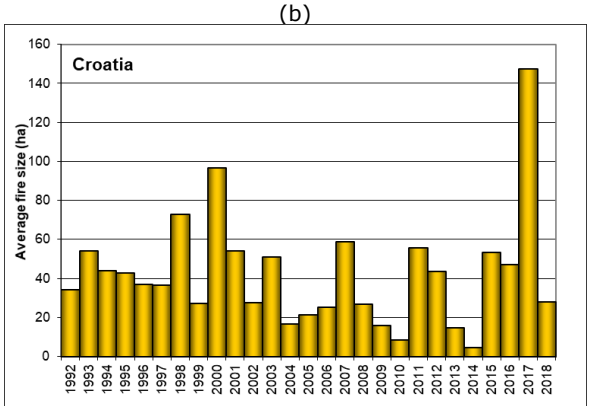


(c)

Figure 11. Burnt areas (a), number of fires (b) and average fire size (c) in Croatia from 1992 to 2018.

Taking into account the entire year, only 6 fires (98 fires in 2017) spread to an area larger than 100 ha or 0.32% (in 2017, 2.36%), 35 fires (370 in 2017) had an area between 10 and 100 hectares or 1.87% (in 2017, 8.91%), 25 had an area (268 in 2017) between 5 and 10 ha or 1.33% (in 2017, 6.45%), 1 809 fires (3 418 in 2017) or 96.48% (in 2017, 82.28%) had spread to an area of up to 5 ha. The trend of number of fires, burnt area and average fire size can be seen in Figure 11.

Year	Area burned in forest fires (ha)			
	Forest	Non-forest	Other/ Agricultural	Total
2008	4119	2868	356	7343
2009	2316	446	138	2900
2010	753	267	101	1121
2011	6937	3106	5512	15555
2012	15515	6201	3106	24804
2013	942	628	429	1999
2014	120	45	23	188
2015	6569	1462	1385	9416
2016	4288	2698	114	7100
2017	31931	12560	4052	48543
2018	**750**	**478**	**278**	**1506**

Fire causes

This year, some of the more demanding and long-lasting fires (with fires of lower intensity) came as a result of dry storms and lightning strikes, which were more pronounced on some of the middle Dalmatian islands.

Firefighting means

During the fire season in 2018, the National Protection and Rescue Directorate - Fire Operations Centre carried out the coordination of ground and air firefighting forces across the coastal area and communication with the Air Force Command operating within the Ministry of Defence. The National Protection and Rescue Directorate - Firefighting Sector together with the representatives of the National Hydrometeorological Institute reported once a week on the situation to the Emergency Response Coordination Centre (ERCC) in Bruxelles, while presenting weekly events in the Republic of Croatia through a video conference.

The National Hydrometeorological Institute prepared a fire weather index on a daily basis. Prior to the start of the fire season, additional firefighter training in extinguishing forest fires (desanting and joint action with aircrafts) was conducted.

The air forces consist of 6 "Canadair" CL-415 type aircrafts, 6 Air Tractor AT-802 A/F type aircrafts and two Mi-8 MTV1 type helicopters. During the fire season, the air forces realized

a total of **2 378** flights, **504:25** hours of flight time, with **10 948** tons of water discharged, **296 5881** litres of fuel consumed, **2 358** litres of foam concentrate consumed, and **115** people and **14.6** tons of equipment transported, which is several times less than in 2017. From the total number of flights in the year 2018, there were **70** firefighting reconnaissance flights recorded, whereby in some situations the planes detected the initial fires and joined the firefighting efforts. This year, a new manner of monitoring has been introduced through an unmanned aircraft system which was used **11** times, on **5** locations, with **7:54** hours of flight time.

Fire prevention activities and information campaigns

Prevention measures regarding fire protection and operational functioning of the firefighting system are defined by the Fire Protection Act, the Firefighting Act and accompanying by-laws. In addition to the aforementioned Acts, the Government of the Republic of Croatia stipulates additional fire protection activities each year (Program of activities in the implementation of special fire protection measures of interest to the Republic of Croatia). The program is implemented by state administration bodies, public institutions and fire brigades, and the Program grants additional funding for the operational functioning of the firefighting system. The National Protection and Rescue Directorate is responsible for coordinating and monitoring the implementation of fire protection measures. An integral part of the Program is the State Plan for the Engagement of Firefighters. The State Plan defines fire commands, standard operational procedures and instructions according to which the firefighting system takes action. The standard operating procedures also determine the operation of aircraft during the extinguishing of forest fires. Prior to the start of the fire season, estimates were prepared and Fire Protection Plans for the following especially endangered areas were developed: islands of Lastovo, Ugljan, Hvar, Vis and Dugi otok. Firefighters and firefighting equipment from the continental part of the country were dislocated during the summer months to a total of 11 endangered coastal locations. In one shift, 51 firefighters from the Professional Fire Brigade and 23 voluntary firefighters, as well as 17 members of the State Firefighting Intervention Units of the National Protection and Rescue Directorate were dispatched to the coastal part of the Republic of Croatia (in total, 568 firefighters with a total of 40 firefighting vehicles participated in 6 full and one partially full shift). In addition to the local firefighters, during the summer in the coastal area there were an additional 1 113 seasonal firefighters deployed in professional and voluntary firefighting units and 34 local professional firefighters deployed in the State Fire Department and the Seasonal Emergency Fire Department on the islands of Mljet, Korčula and Brač.

The Ministry of the Interior performed additional inspections of areas, forests, tourist destinations, hotels, camps and national parks endangered by fires. Information campaigns were also held with the aim of informing the population and tourists of fire hazards through printed flyers and placing billboards. Other competent inspection departments conducted supervision of all other fire endangered areas. The supervision covered the firefighting forest roads and belts, railway lines, public roads of state importance and facilities on those roads, as well as those areas where fires that hindered the flow of road traffic occurred in previous years. Supervision was performed of roads of local significance that were under increased traffic load during the tourist season (access roads to resort hotels, auto camps, public garages, cultural and historic sites and other facilities where a large number of tourists or guests are staying). Furthermore, supervision was performed and measures were taken in national parks, nature parks and other protected forest areas, municipal waste landfills, where municipal waste is disposed of under controlled conditions, especially in the coastal area

Injuries and loss of human lives

During fire extinguishing in the coastal and karst areas, 8 people were injured, 6 of them firefighters (of which 3 were seriously injured - eye injury and fractures) and 2 civilians, while there were no reports of fatalities. In the Republic of Croatia, in total, 9 people were injured in vegetation fires, of which 6 were firefighters and 3 civilians, while one person was killed.

Operations of mutual assistance

In accordance with the concluded inter-state Agreements on mutual assistance in major accidents, further contacts with Bosnia and Herzegovina, Montenegro and Slovenia are ongoing. There is a standard operating procedure signed with Bosnia and Herzegovina, Montenegro and Slovenia with

regard to unhindered crossing of state borders by land and air forces in large-scale fires in the border area. Unlike 2017, there was no request for assistance in 2018 and the air force did not participate abroad.

Climate Change

The climate change we witness, as all predictions and forecasts of future increase in average (especially summer) temperatures and consequently the extension of the main fire season's effort should be perceived as very serious future challenges. Certainly, one of the most important prerequisites for improvement of preventive measures from the occurrence of fire as well as the degree of protection and security of citizens, tourists, their property, animals and nature is to provide more funding for the implementation of preventive fire protection measures and operational activities of the firefighting system, to strengthen the relevant inspection services in terms of human resources and provide more financial means for monitoring, strengthen the local, regional and local self-government units in terms of human resources and all public law enforcement authorities responsible for fire protection for targeted fire protection and intersectoral cooperation, and provide more financial resources and organize professional teams for planning, preparation, implementation and monitoring of EU projects.

Research activities aimed at improving fire management

Of course, generally speaking, as with any fire season, the weather conditions had the greatest impact on the number of fires, area burned and intensity (lower summer temperatures and more periodically distributed precipitation). What certainly, to some extent, contributed to a reduced number of fires, together with last year's negative experience, is the increased awareness of the people about the need to undertake fire protection measures, as well as caution during clearing agricultural areas as well as the fear of repressive measures (for misdemeanour and criminal measures). Before summer and the so-called peak fire season, there were increased advertising activities involving camera and air surveillance, facilitating and enhancing cooperation with police administrations, port authorities and county fire brigade operational centres in the coastal area. In the Program of activities in the implementation of special fire protection measures of interest to the Republic of Croatia in 2018. New short-term measures were implemented that were largely realized or their realization is in its final stage and related to: newly-equipped Situational Operations Centre operating as part of the newly-formed Firefighting Operations Command of the Republic of Croatia in Divulje; surveillance by stationary (terrestrial) cameras; grouping and increasing the number of firefighters as necessary; new Firefighter Training Programs have been developed; construction of new concrete sections of firefighting forest roads/belts (in 2018, 18.35 km of new roads were built); defining sections along the highway and/or other important demining facilities; development of the Standard Operational Procedure (SOP) for cross-border firefighting cooperation and SOP in case of forced landing of a firefighting aircraft at sea; providing operational use of the Otočac and Sinj airports; identifying information on connections system and developing an information and communication manual for emergency services, a unique system using Firefighting Interventions Management (UVI); purchase of 23 000 l of foam concentrate for extinguishing fires from air (Ministry of Defense of the Republic of Croatia); development of Guidelines for Media Relations and Crisis Communication Procedures; development of guidelines for the inclusion of the Civil Protection Headquarters; an accelerated process of adopting the Activity Program; an increased amount of funds for the implementation of the Activity Program. When it comes to significant preventive activities in 2018 compared to previous years, it is stated that there are more frequent ground fire patrols, as well as recording with unmanned aircraft system - drones. In 2018, there were significantly more firefighting reconnaissance flights (than in 2017) by the Republic of Croatia Armed Forces and data access was obtained (images) from a large number of surveillance cameras (which can now be coordinated and monitored from a newly-equipped Situational Operations Centre and the newly established and staffed Firefighting Operations Command of the Republic of Croatia in Divulje).

The actions of the prosecution authority during and after the extremely demanding fire season in 2017, during which persons were arrested and suspected of deliberately causing a greater number of fires, also had an impact on the reduction of intentionally caused fires, as well as the establishment of better surveillance of the territory with the help of high resolution stationary cameras,

constant firefighting reconnaissance flights (firefighting aircrafts) and observations by observers, drones or unmanned aircraft systems.

(Source: Directorate for Forestry, Hunting & Wood Industry, Ministry of Agriculture, Croatia; National Protection and Rescue Directorate, Croatia).

1.2.4 Cyprus

Fire danger in the 2018 fire season

In January 2018, the weather in Cyprus was wet and relatively warm. Unstable weather conditions prevailed during certain periods of the month, giving rain, local thunderstorms, hail and snowfall over the mountains. The mean air temperature was 1.5°C above normal and the average precipitation was 140% of normal.

In February the weather was extremely hot and relatively dry for this season. The mean air temperature was 3.0°C above normal, whilst the average precipitation was 68% of normal.

In March the weather was dry and extremely warm. The mean air temperature was 3.5°C above normal and the area average precipitation was 35% of normal.

In April the weather was extremely dry and warm. The mean air temperature was 3.0°C above normal and the area average precipitation was 18% of normal.

In May the weather was hot and wet. Unstable weather conditions occurred during certain periods of the month, giving local rain, isolated thundery showers and hail over many areas. The mean air temperature was 3.0°C above normal and the area average precipitation was 232% of normal.

In June the weather was relatively wet. Unstable weather conditions prevailed during certain periods of the month, giving showers, local thunderstorms and hail in many areas of the island. The mean air temperature was 0.5°C above normal and the area average precipitation was 410% of normal.

In July the weather was hot and extremely dry. The mean air temperature was 1.0°C above normal and the area average precipitation was 4% of normal. During certain periods of the month, temperatures were up to 6°C higher than normal.

In August the weather was hot and dry. The mean air temperature was 1.0°C above normal and the area average precipitation was 21% of normal. Heat wave conditions, with extremely high temperatures were recorded during certain periods of the month, with maximum daily temperatures reaching and exceeding 40°C.

In September the weather was hot and wet. Unstable weather conditions prevailed during certain periods of the month, giving local showers and isolated thunderstorms, mainly inland and over the mountains. The mean air temperature was 1.5°C above normal and the area average precipitation was 251% of normal.

In October, the weather was wet and relatively warm. The mean air temperature was 1.0°C above normal and the area average precipitation was 175% of normal.

In November the weather was relatively warm and the area average precipitation, was around normal. The mean air temperature was 1.5°C above normal and the area average precipitation was 91% of normal.

In December the weather was extremely wet and relatively warm. The mean air temperature was 1.0°C above normal and the area average precipitation was 169% of normal.

Fire occurrence and affected surfaces

During 2018, Cyprus experienced 131 forest fires that burned 1136 hectares, mostly forest and other wooded land. Six of these fires, were over 50 ha in size.

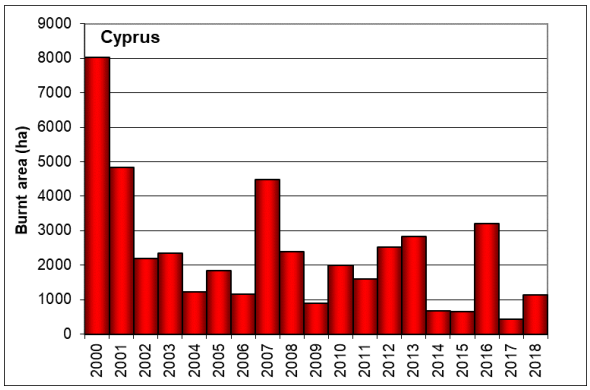
Table 3. Number of forest fires and burnt areas in Cyprus from 2013 to 2018.

Year	*Number of fires*	*Burned area (ha)*		
		Total	*Forest and other wooded land*	*Agriculture and other artificial land*
2014	68	669	496	173
2015	87	652	350	302
2016	119	3205	2946	259
2017	92	428	270	158
2018	131	1136	997	139

Fire causes

Out of the 131 forest fires that occurred in Cyprus during 2018, 27 forest fires (21%) were of unknown origin. Regarding forest fires with known cause, 59 forest fires were deliberately set (57%), followed by negligence (28%) and natural (15%).

The trends regarding both the number of fires and burnt areas over the last 19 years (2000-2018) are shown in Figure 12.



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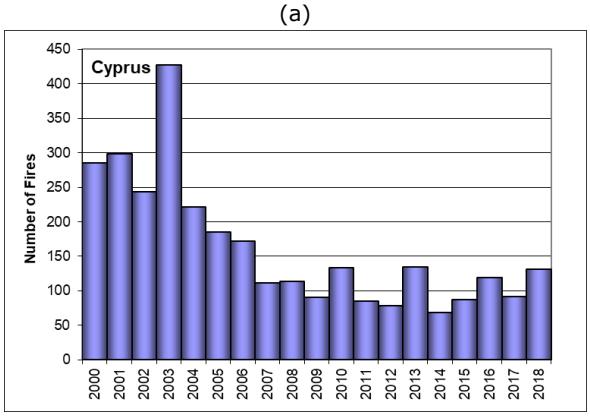

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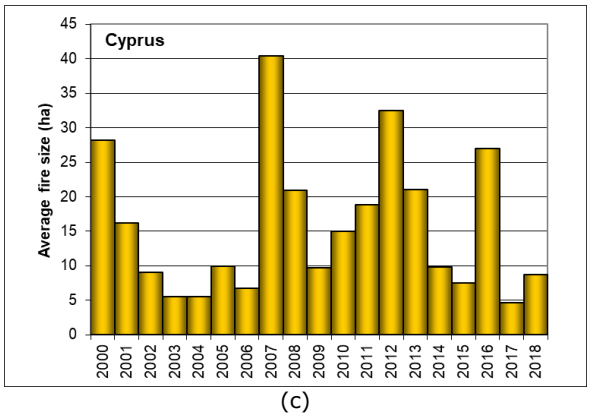


(c)

Figure 12. Burnt areas (a), number of fires (b) and average fire size (c) in Cyprus from 2000 to 2018.

Major fires in 2018

During the afternoon of the 31st of May 2018, a fire broke out near Erimi village, Limassol District. The firefighting efforts were hampered by strong winds and the rough terrain. The blaze burned 180 ha of wild brush and agricultural crops.

On the 1st of October 2018, a fire which raged for several hours near Arsos village, Limassol District, burned 176 ha of other wooded land and agricultural crops.

On the morning of September 20, a fire broke out near Macheras state forest, between the villages of Kampia and Kapedes, Nicosia District. The fire burned 65 ha, mostly of pine forest.

Fire fighting means

All firefighting airplanes and fire engines, were subjected to inspection and maintenance before the beginning of the fire season. During 2018, the two firefighting airplanes, one Air Tractor 802 and one Thrush 550, participated in 72 firefighting operations, with a total number of 229 hours flight time. Apart from the airplanes, the aerial firefighting assets consisted of five medium type helicopters and one coordination helicopter.

Fire prevention activities and information campaigns

The fire prevention program consisted of various activities, including fire break construction and maintenance, fuel management and law enforcement. Moreover, numerous actions and activities aiming to inform and raise awareness among the public, were implemented. For fire detection purposes, 44 lookout stations operated throughout the fire season and air and ground patrol missions were executed.

Injuries and loss of human lives

There were no casualties during the fire suppression operations. However, six firefighters were injured in the line of duty. One person suffered with a burn injury, two with strains/sprains and three with other health problems.

Operations of mutual assistance

The Republic of Cyprus assisted Greece in the battle to extinguish the deadly fires in Attica region, with a ground team of 64 people and 2 fire engines. The Cyprus mission, that consisted of 20 forest officers and firefighters of the Department of Forests, 20 fire fighters of the Fire Service, 20 members of the Civil Defense and 4 rescuers and medics, was transferred with a C-130 aircraft of the Hellenic Air Force.

(Source: Ministry of Agriculture, Rural Development and Environment, Department of Forests, Cyprus).

1.2.5 Czech Republic

Fire occurrence and affected surfaces

Forest fires fires fighting and prevention is covered by the Fire and Rescue Service of the Czech Republic.

In 2018 a total number of 2 033 forest fires were recorded and about 492 ha of forest areas were burned. The total number of fires was significantly over (more than twice) the 10 years average when compared to the 2008-2017 average of 974. The burned area was also highly over the 10-year average of 272 ha. The 2018 fire season is considered to be the worst one since 2015. Considering total numbers, it was one of the worst fire seasons in the last 15 years. As usual, the fires were very often concentrated according to the usual fire risk level over the country (Figure 14).

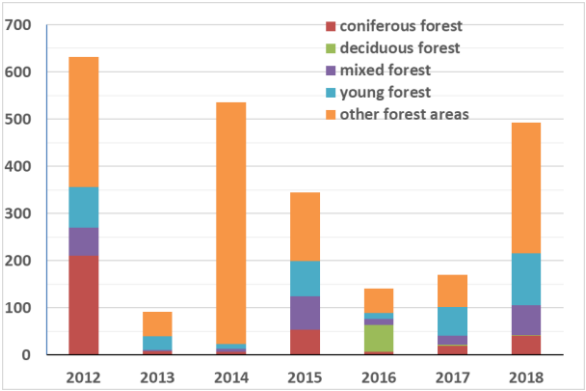
Table 5. Number of fires, burnt area, economic losses and casualties in Czech Republic since 2005.

Year	No. of fires	Burnt area (ha)	Damage caused m.EUR	Saved values m.EUR*	People killed	People injured
2005	626	227	0.8	4.9	0	12
2006	693	405	0.3	4.0	0	16
2007	805	316	0.7	13.3	0	20
2008	470	86	0.1	4.5	3	10
2009	514	178	0.3	6.2	0	20
2010	732	205	0.2	5.0	1	12
2011	1337	337	0.3	6.5	1	27
2012	1549	634	1.8	26.2	2	30
2013	666	92	0.2	3.0	0	7
2014	865	536	0.3	3.3	2	10
2015	1748	344	0.7	24.7	1	33
2016	892	141	0.2	7.8	0	6
2017	966	170	0.3	3.4	2	9
2018	2033	492	0.6	10.5	0	35

**refers to the amount that would have been lost without intervention.*

	2012	2013	2014	2015	2016	2017	2018
coniferous forest	210	8	7	54	7	19	41
deciduous forest	1	0	0	0	56	3	1
mixed forest	59	2	6	71	13	19	64
young forest	86	30	10	74	12	60	110
other forest areas	276	52	512	145	53	68	277

Table 4 (above), Figure 13 (right). Burnt area (ha) from 2012 to 2018 by forest type.



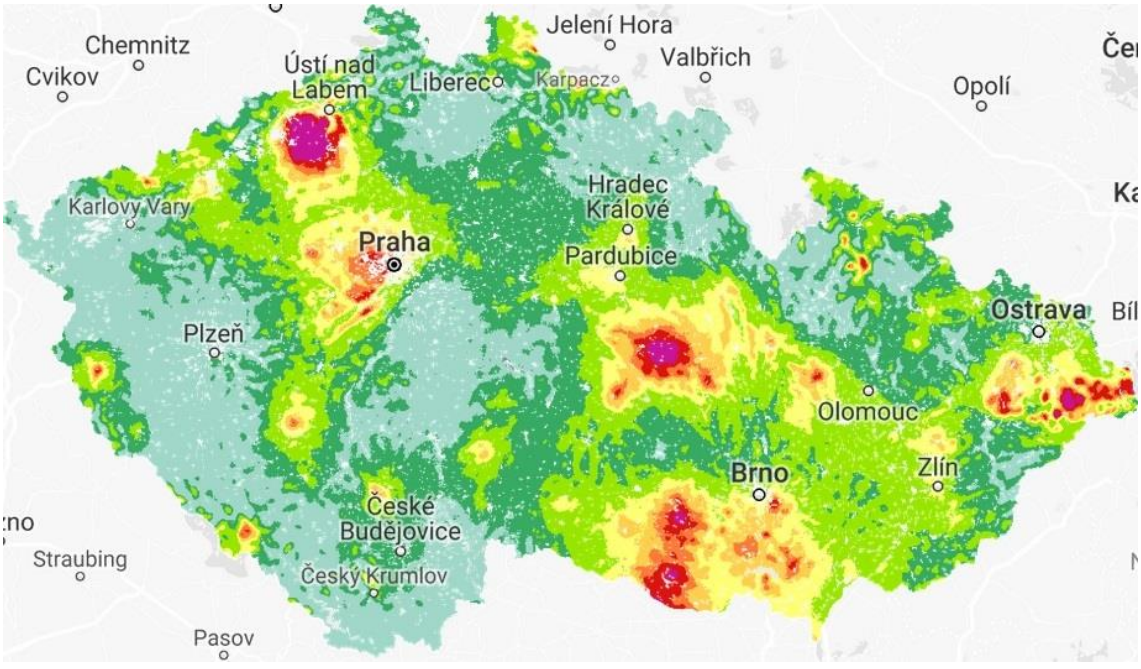
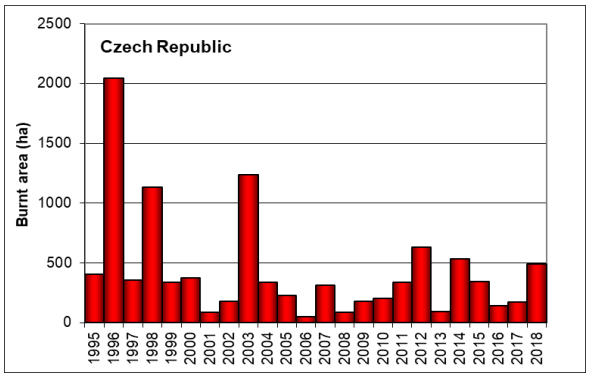


Figure 14. Forests with high risk level, usual situation (Source: Czech Academy of Sciences, project CzechAdapt).

The trends regarding the number of fires and burnt areas from 1995 to 2018 are shown in Figure 15.



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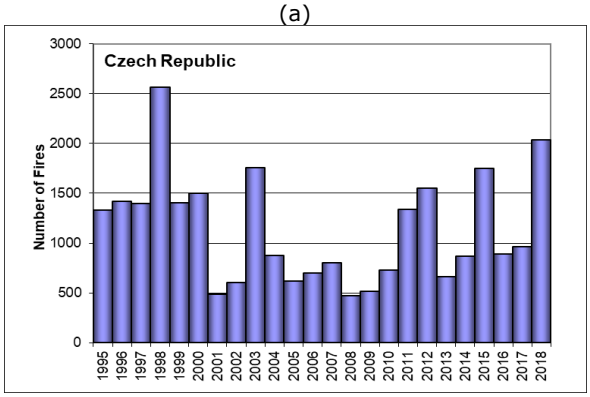

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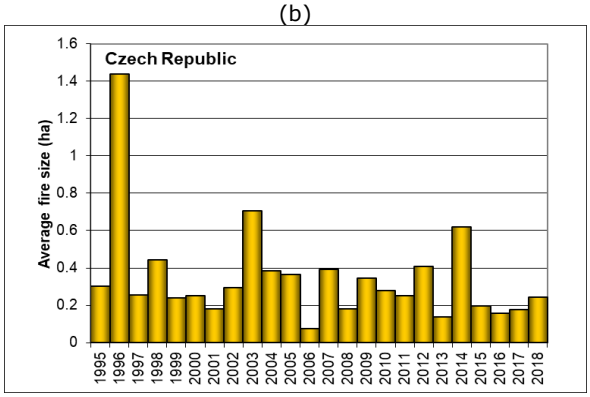


(c)

Figure 15. Burnt areas (a), number of fires (b) and average fire size (c) in Czech Republic 1995-2018.

Firefighting means

It is very common, for bigger fires, to use police helicopter support, for tactical exploration and also for aerial firefighting, using water buckets with up to 1000 litres of water. If needed, it is also possible to ask for army helicopters or some private planes in case of emergency. Because of a rapid growth of the number of forest fires and visible climate changes, there were made some decisions such as buying special fire tracks or a consideration of new aerial firefighting means. The newest fire truck suitable for forest fire fighting is Tatra Force CZS 40 8x8 Titan with increased resistence against fire to protect the truck and firefighters inside (Figure 16).

Figure 16. Tatra Force CZS 40 8x8 Titan truck.

Fire causes

The main causes for the forest fires during 2018 are :

- Negligence 39 %
- Human caused, unknown motivation 42%

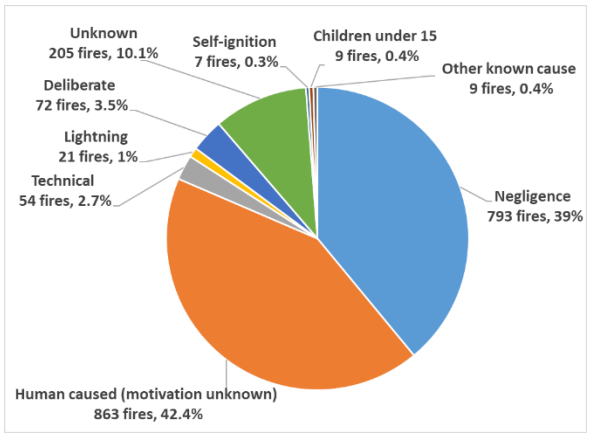


Figure 17. Causes of forest fires in 2018.

The causes of forest fires in the last 5 years are given in Table 6.

Table 6. Causes of forest fires in Czech Republic 2014-2018.

Year	2014	2015	2016	2017	2018
Negligence	123	630	337	426	793
Human caused, Motivation unknown	1	665	371	343	863
Technical	5	32	16	32	54
Lightning	7	38	4	18	21
Intention	26	67	25	19	72
Unknown	24	253	119	111	205
self-ignition	1	2	5	1	7
Children < 15	4	17	4	10	9
Other	2	7	6	6	9

Injuries and loss of human lives

There were no people killed but 35 people injured due to forest fires in 2018. In total, there were 189 people injured and 9 people killed in last 10 years due to forest fires.

(*Source: Fire and Rescue Service, General Directorate, Czech Republic*).

1.2.6 Finland

Fire danger in the 2018 fire season

Based on information from the Finnish Meteorological institute, the overview from summer 2018 was very warm, even hot and dry in Finland. From the beginning of May to the middle of August it was warm and dry in the whole of Finland. Fire danger days for 2018 are presented below in Figure 18.

Fire occurrence and affected surfaces

The number of forest fires in 2018 in Finland was higher (about double) than the normal average level. There were 4 252 wildfires in Finland last year of which 2 427 were reported as forest fires. The total burned area was around 1 621 ha of which 1 228 ha was forest area. The average burned forest area per fire was 0.51 ha.

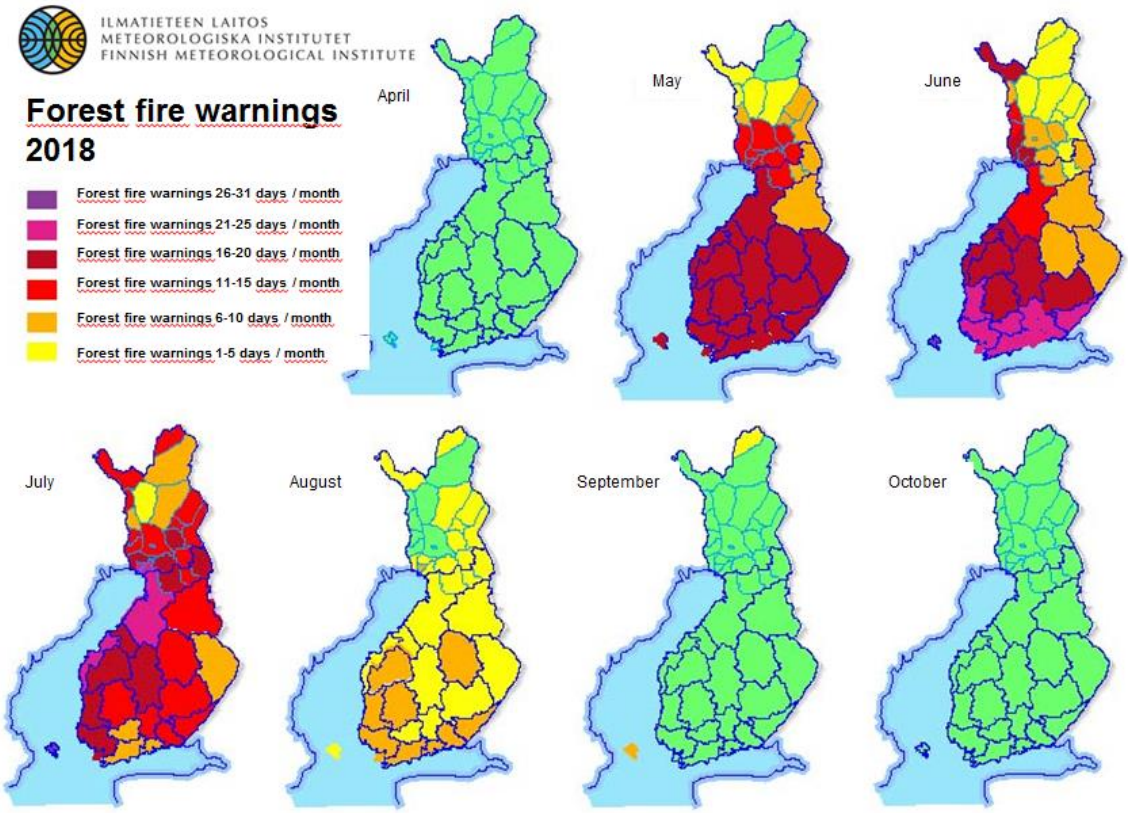


Figure 18. Fire danger days in Finland 2018.

Fire causes

The most common cause of wildfires in Finland was human actions. These caused more than 70%, mainly from accidents. The second biggest reason was natural (less than 10% of fires). The reason for the fire could not be found in over 10% of the cases.

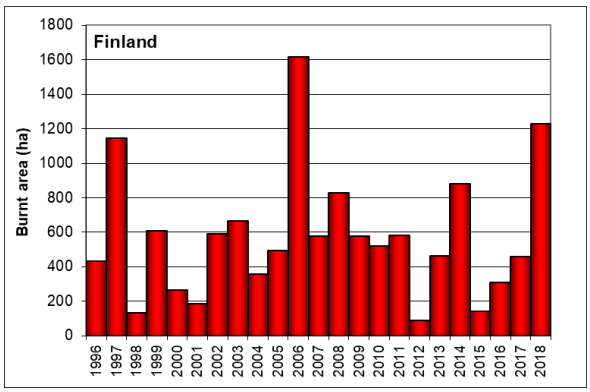
Loss of human lives

Nobody died in Finland forest fires in 2018. Two people were injured in different wildfires, suffering from burns. Some of the wildfires caused damage to buildings; and conversely some of the wildfires were caused by fires in buildings or vehicles.

Operations of mutual assistance

Finland sent one Rescue Platoon (GFFM-V, Ground Forest Fire Module with vehicles) to the large forest fires in Sweden. Finland sent one CP expert to support the ERCC, 2018 Forest and Wild Fire Season, June-September 2018. There has also been information sharing between neighbourhood countries and the EU.

The yearly trends in terms of number of fires and burnt area from 1996-2018 in Finland are shown in Figure 19 and Figure 20.



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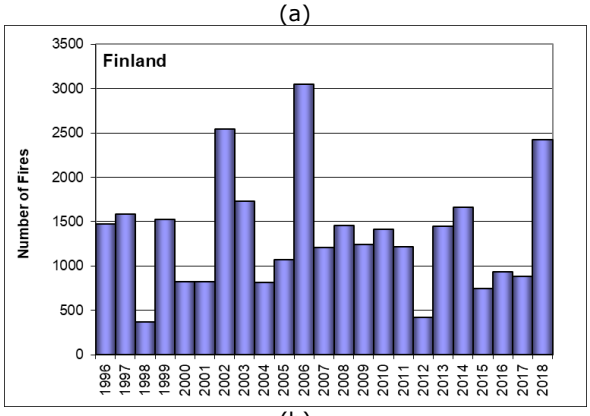

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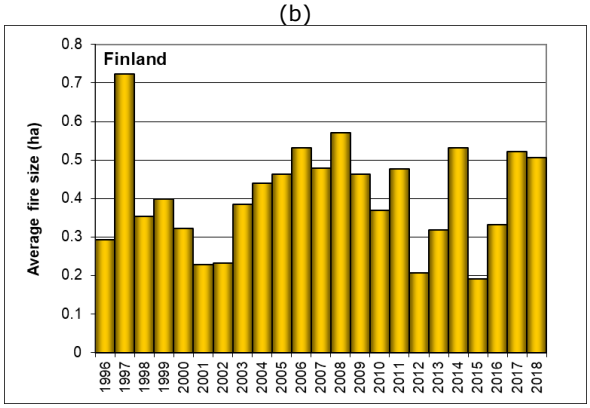

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Figure 19. Burnt areas (a), number of fires (b) and average fire size (c) in Finland from 1996 to 2018.

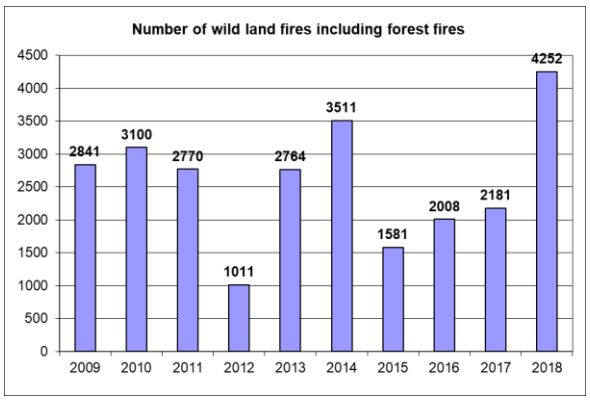


Figure 20. Total number of wildfires including forest fires from 2008-2018.

Fire fighting means

- Finnish military forces NH 90 helicopters are available to extinguish forest fires.
- More co-operation between other authorities such as the border guard.
- Continuation of forest fire aerial officer education for fire officers.
- Starting to improve HNS (Host Nation Support) systems for forest fires.
- Starting also to improve Finnish Forest fire capacities for international assistance.

Fire prevention activities and information campaigns

- Legislation, fire index versus authorities actions, and a ban on open fires
- Information campaigns
- More co-operation with other authorities and institutes such as the Finnish meteorological institute.

Climate Change

<u>Climatic conditions and how they impacted the fire season</u>

The climate is changing more in northern Europe than in other parts of the world.

<u>National adaptation strategies / plans and in particular regarding plans to adapt the forest sector to climate change in order to limit forest fire risks</u>

Finland's National Forest Strategy, adopted by the Government in February 2015, specifies the main objectives for forest-based business and activities until 2025. The strategy was updated in 2019.

Research activities aimed at improving fire management

New research named "*Forest fires in area of Fennoscandia when the climate and the structure of the forests change*" will start in the year 2019.

Other development goals in future:

- Northern European co-operation (Nordred etc.);
- ensure early warning;
- co-operation with rescue services;
- new innovative solutions.

(Source: Ministry of the Interior, Finland).

1.2.7 France

Fire danger in the 2018 fire season

The spring of 2018 was remarkably rainy in the south of France.

The summer of 2018 was characterized by high temperatures, abundant rainfall events in the south of the Midi-Pyrénées, Provence and Corse-du-Sud and well below the normal number of days of strong winds. The month of September was very dry and hot with some very localized rain-storm episodes during the first fortnight.

Following the drought of 2017, many diebacks have appeared in the vegetation of the Mediterranean area. The water deficit was often accentuated by pathogen attacks, the effects of which continued in 2018 despite the heavy rains of spring.

In June 2018, the situation was considered disturbing in a number of areas with the fear of facilitated outbreaks, higher propagation velocities and longer jump fires. In parallel, on the areas burned in previous years, significant difficulties of recovery of vegetation were noted.

The favourable conditions of the summer diminished these effects and the vegetation was reinvigorated.

The susceptible vegetation was concentrated in Corsica and west of the southern defence zone from late July to early September. Overall, the spring rains led to a marked shift, resulting in the vegetation condition at the end of July being similar to that usually seen at the end of June.

These weather conditions explain in part the very good final annual report: a thousand fires burned about 3 000 ha in the Southern zone.

Fire occurrence and affected surfaces

In 2018, 5 124 ha were affected by 3005 fires in mainland France (which is well below the 10-year average of 11 879 ha):

• 3 064 ha were burnt in the Mediterranean departments (the 10-year average is 7 015 ha[4]), of which 585 ha occurred during the summer (640 fires),

• 1 516 ha were in the south-west quarter (average 3 450 ha), including 507 ha in the Landes massif (compared to an average of 1 400 ha), and 200 ha in the Pyrénées,

• 1 553 ha were in the other metropolitan departments.

About 60% of fires in France were located in the Mediterranean departments in 2018, a lower proportion than usual.

2018 ranks first among low-fire statistics, ahead of 2013 (1 205 fires) and 2014 (1 291 fires). The year ranked second lowest for area burnt, behind 2013 (1 922 ha) but ahead of 2015 (3 112 ha) and 1996 (3 119 ha).

The 2018 summer statistics (from 16 June to 30 September) were very low with 640 fires burning 585 ha.

Big fires were rare: there were 6 fires of more than 50 ha including 2 over 100 ha (early January in Haute Corse San Andrea di Cotone, 1 290 ha and Chiatra, 498 ha).

In the month of January, over the entire southern fire defence zone ("Prometheus"), 50 fires burned a total of 1 927 ha.

Outside the "Prometheus" zone

On the former Midi-Pyrenees part of the Occitanie Region, there were 296 fires burning 594 ha including some notable fires:

• 27/08 Marcilhac on Cele (Lot) 24 ha;
• 01/09 Cajarc (Lot) 125 ha;
• 02/10 Valdurenque (Tarn) 40 ha.

In Aquitaine, the data managed by the GIP ATGERI show 832 fires for 507 ha burnt.

There was a notable fire of 159 ha on 20/04 at St-Michel de Castelnau (Gironde).

Some notable fires occurred in areas where large fires are rather unusual, because of the drier than normal conditions in the northern half of France:

• 26/07 Maisod (Jura) about 39 ha;
• 28/07 Musainvilliers (Loiret) about 30 ha;
• 06/10 Cheniers (Creuse) about 30 ha;
•10/10 Montgeron (Essonne) about 60 ha.

The burned surfaces in the Pyrenean chain are related to the practice of agricultural burning.

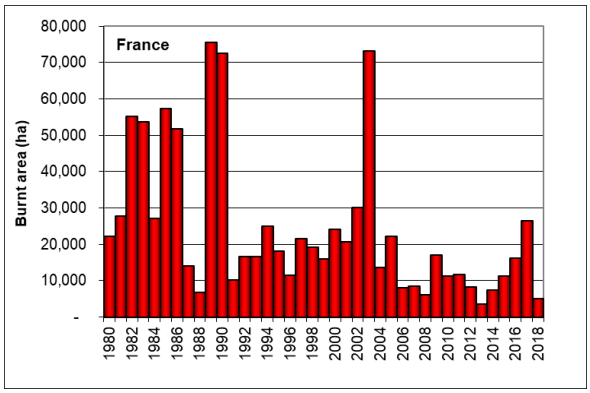
Forest fires in Réunion Island

A Dash aeroplane has now been sent since 2010 over the period of risk, between late September and mid-December. The fires in natural areas were very limited in 2018. In total, 119 ha were burnt by 329 fires,

[4] Prior to the implementation of the strategy to deal with incipient fires in the late 80s, the average was 34 000 ha.

against 580 ha on average over the period 2007-2016.

The yearly trends in terms of numbers of fires and burnt areas in France since 1980 are shown in Figure 21.



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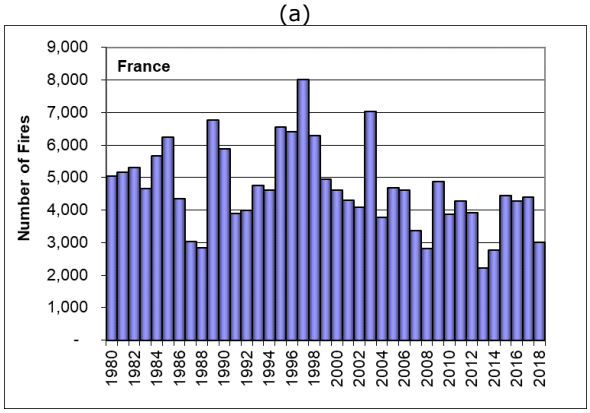

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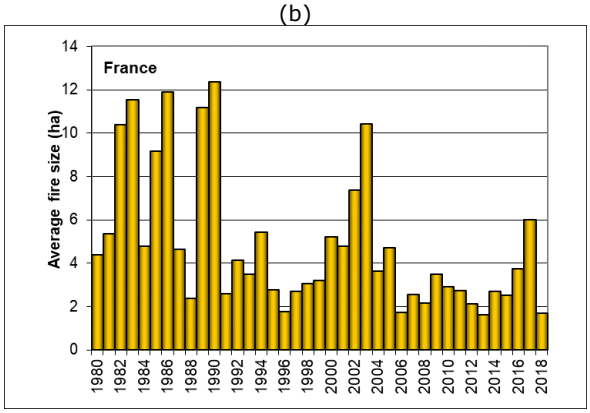

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Figure 21. Burnt areas (a), number of fires (b) and average fire size (c) in France from 1980 to 2018.

Fire prevention activities

The modernization of the technical instructions relating to legal requirements for clearing, forest fire protection plans and the forest fire database in France were pursued in accordance with the guidelines of the April 2016 inspection report on the defence of forests against fire.

Most of the preventive actions were in the Mediterranean region:

- the 116 meteorological zones are equipped with a network of stations, of which 73 are dedicated to forecasting forest fire danger;
- these forecasts were supplemented by monitoring the dryness of the vegetation at 30 sites (Figure 22);
- during the summer, a thousand foresters participated in surveillance and alert operations (lookouts, surveillance, deterrence and first response patrols) for a total of approximately 36 000 man-days funded by the state and communities;
- investment in field equipment continued, representing an investment of around €10 million of work, which benefited from the financial support of the European Union (around €1.4 million from EAFRD: the European Agricultural Fund for Rural Development) for the maintenance of existing amenities (tracks, water points etc.);
- information campaigns were conducted at departmental level (NUTS3) and across the entire region (NUTS1), to publicize preventive regulations (limitation or prohibition of use of fire, traffic in the massifs, clearing obligations, etc.) and dissemination of safety recommendations, in addition to a national inter-ministerial campaign on fire prevention;
- interdisciplinary units (foresters, firefighters, policemen) worked together in most departments to investigate the causes of fires, in order to guide preventive actions and improve the criminal justice response.
- regarding communication, the *Délégation à la Protection de la Forêt Méditerranéenne* (DPFM) has a website (www.dpfm.fr) which provides information on regulations and relays the main events and articles in French related to the DFCI.

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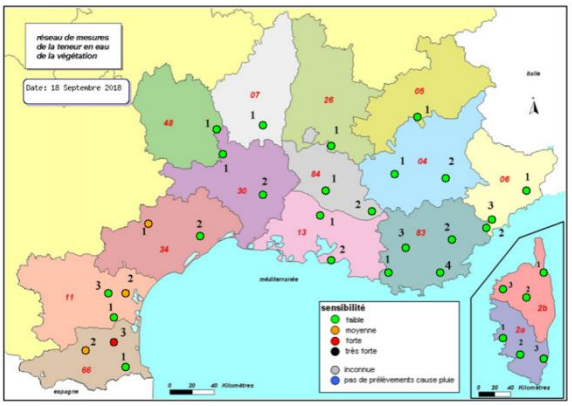


Figure 22. Example of state of vegetation monitoring September 2018.

Impacts on human lives

The measures taken to prevent and fight against forest fires were effective in protecting the population and there were no casualties.

Fire fighting means

To support firefighters funded by local authorities (numbering 37 000 in the Mediterranean departments and 7 700 in the Landes massif), the Ministry of the Interior deployed reinforcements that included:

- 650 military Civil Protection Training and Response Units (UIISC);
- 23 water bombers (12 Canadair, 8 Tracker, 3 Dash);
- reconnaissance and coordination aircraft and 35 rescue and command helicopters.

Under a protocol signed with the Ministry of Defence, with funding from the Ministry of Interior, 45 men, 15 vehicles and three helicopters were assigned to the work of protecting forests.

Finally, around ten reserve firefighters from departmental fire and rescue services outside the Mediterranean area (strictly respecting the required qualifications) coming from different areas of defence were positioned. At the request of the *Centre Opérationnel de Gestion Interministérielle des Crises* (COGIC) of the Directorate General of Civil Security and crisis management, they were thus able to supplement local arrangements on demand.

The effectiveness of the intervention mechanism depends on its ability to act without delay by applying a strategy of fast attack for incipient fires based on the forecast mobilization of resources to combat during periods of high risk. Ongoing cooperation with *Météo France* and the *Office National des Forêts* (ONF) makes it possible to have specifics on the level of foreseeable danger to anticipate the danger and to be more reactive in operational response in the event of a fire.

Thus, in periods of high risk, both national and local resources are mobilized proactively according to the danger level to act promptly while the fire is still manageable: the UIISC elements are deployed in the most sensitive forests alongside local fire brigades, water bombers provide armed air surveillance missions, and the military provide patrols alongside local actors (foresters, firefighters, members of community committees for forest fires).

The summer reinforcement mechanism mobilized by the Ministry of the Interior until mid-September was little used in 2018.

During the year, the civil water bombing aircrafts were engaged on around a hundred fires. Half of these commitments were made between mid-September and mid-October. Major efforts have been made by the Air Resources Group (*le Groupement des moyens aériens*: GMA) to maintain a significant mechanism beyond the summer period.

The military formations of the civil security (ForMiSC) for their part were engaged on a dozen fires (but carried out 300 ground surveillance missions).

Finally, the reinforcing columns of firefighters were mobilized only within certain zones. With the exception of the reinforcements mobilized at the beginning of January during the Haute-Corse fires (about sixty firefighters came from the mainland for four days to reinforce the local means), no major operation was carried out.

On average in 2018, the number of men mobilized represented a total of 1 100 man-days against nearly 30 000 man-days committed at the peak in 2017.

Figure 23. Fire-fighting means deployed in 2018.

Operations of mutual assistance

The summer situation in France made it possible to respond to a request for assistance from the Swedish authorities faced with major forest fires and to make available to them 2 CL 415s, 1 reconnaissance aircraft (Beech 200) and a detachment of 60 men who were engaged on the main fire then under way. The air

detachment completed 741 drops and the ground detachment treated more than 18 km of fire front.

(*Source: Ministère de l'Intérieur – DGSCGC / SDPGC / BAGER; Ministère de l'Agriculture et de l'Alimentation : DGPE / SDFCB / BGED, France*).

1.2.8 Germany

Fire occurrence and affected surfaces

According to the data supplied by the authorities, in 2018 a total of 1 708 forest fires were reported in Germany, corresponding to a burnt area of 2 349 ha (1 104 ha in deciduous forests and 1 245 ha in coniferous forests). This is around four times the number of fires, and six times the burnt area recorded in 2017.

As usual the most affected province (Land) in 2018 was Brandenburg which accounted for 71 % of the total burnt area recorded in the country (Table 7, Figure 24). Three Länder (Bremen, Hamburg and Saarland) did not record any fires.

Table 7. Burnt area in total and by forest type, and total number of fires, Federal Republic of Germany, 2018.

	Burnt area (ha)			*Number of fires*
	Coniferous forest	*Broadleaved forest*	*Total*	
Baden-Württemberg	6.05	1.14	7.19	28
Bayern	76.03	37.24	113.27	132
Berlin	0.79	0.00	0.79	9
Brandenburg	753.77	920.32	1674.09	512
Bremen	0.00	0.00	0.00	0
Hamburg	0.00	0.00	0.00	0
Hessen	8.95	7.39	16.34	140
Mecklenburg-Vorpommern	29.79	0.09	29.88	87
Niedersachsen	27.22	3.96	31.18	168
Nordrhein-Westfalen	30.00	9.41	39.41	160
Rheinland-Pfalz	2.37	2.56	4.93	39
Saarland	0.00	0.00	0.00	0
Sachsen	193.39	112.13	305.52	211
Sachsen-Anhalt	107.10	6.76	113.86	172
Schleswig-Holstein	0.60	0.51	1.11	7
Thüringen	9.09	2.15	11.24	43
Germany	**1245.15**	**1103.66**	**2348.81**	**1708**

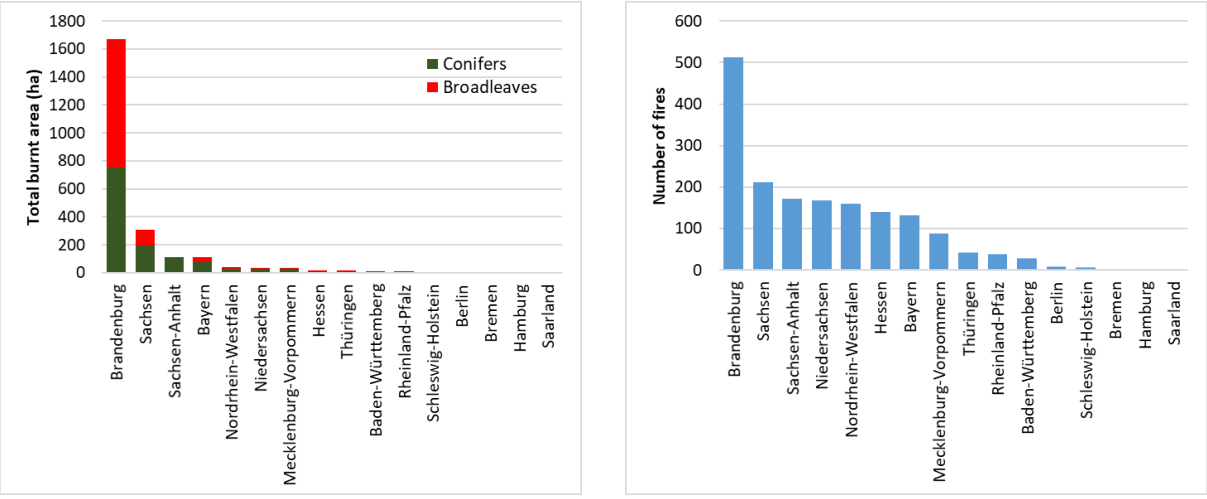


Figure 24. Burnt area (left) and number of fires (right) in Germany in 2018 by Land, ordered by size.

In 2018 the peak of the season lasted for 3 months from July-September (Figure 25).

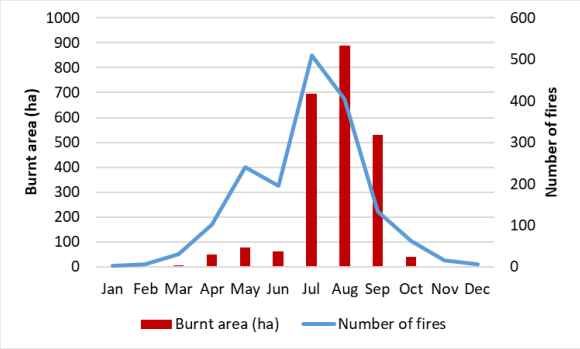


Figure 25. Number of fires and burnt area by month in Germany in 2018

The trend of the burnt areas, number of fires and average fire size in Germany for the years 1991-2018 are shown in Figure 27.

Fire causes and impacts

The main causes of forest fires during 2018 are shown in Figure 26. Within the category of negligence fires, the majority (256) were caused by the general public (campers, visitors, children etc.).

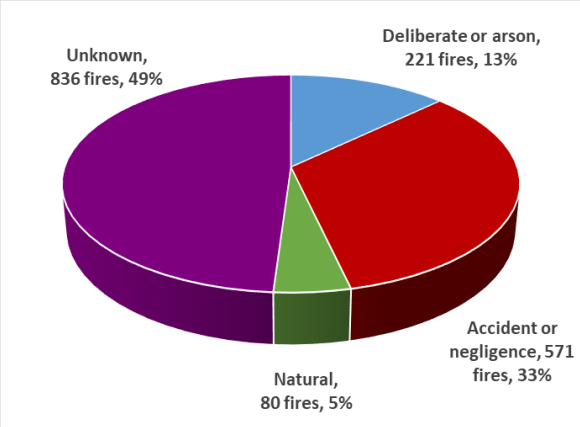
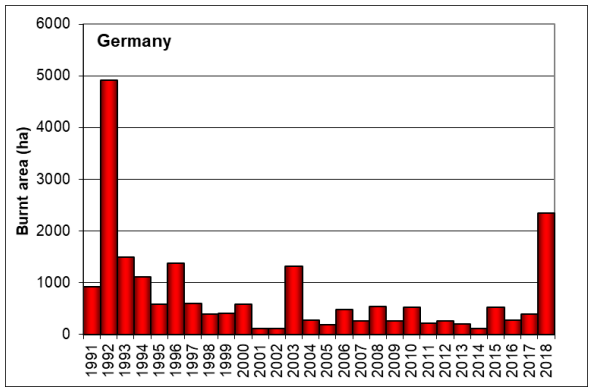


Figure 26. Causes of forest fires in 2018.

The economic damage caused by forest fires in 2018 is estimated to be around 2.67 million Euro. It is higher than the long term average from 1991 to 2018, which is 1.71 million Euro. The cost per hectare burnt was estimated at just over 1 137 Euro/hectare in 2018.

In 2018, approximately 3.4 million Euro were spent on prevention and control measures.



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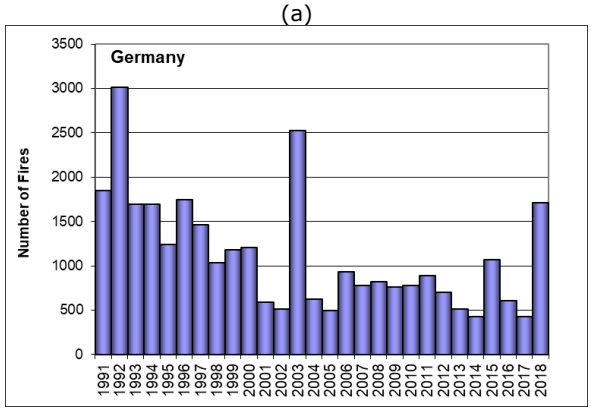

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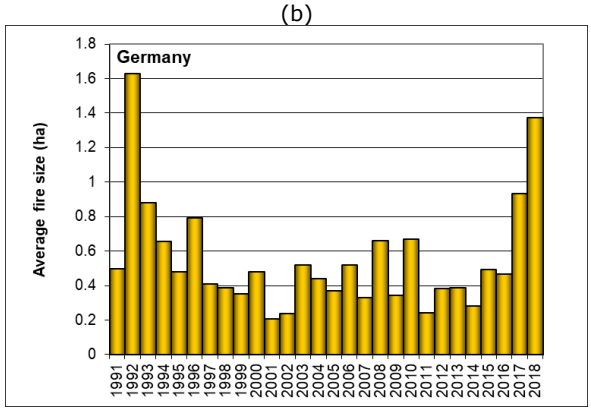


(c)

Figure 27. Burnt areas (a), number of fires (b) and average fire size (c) in Germany from 1991 to 2018.

(*Source: Federal Agency for Agriculture and Food, Germany*).

1.2.9 Greece

Fire danger in the 2018 fire season

The 2018 fire season in Greece started out quietly. The weather was quite favourable, with above average precipitation and lack of strong winds and/or heat waves. Fire danger during the fire season 2018 was characterized by high temperatures, high precipitation levels and high wind levels (June, July, August). Moreover, extremely warm weather conditions at the 23th of July with maximum air temperatures above 40 degrees Celsius in most parts of the country, and extremely high wind level influenced the eastern parts of mainland. That day was the first day of the 2018 season for which a "very high" fire danger rating (class 4 in the 1-5 range) had been assigned in the region of Attica, and to a large part of south-eastern continental Greece. This rating was due to a forecast of strong to extreme westerly winds.

Fire occurrence and affected surfaces

Greece experienced increased levels of fire activity during the present fire season.

The most notable forest fires for season 2018 are listed below:

Date	*Location*
04 Jul	Chania, Crete
23 Jul	Kineta, Gerania mountain
23 Jul	Penteli, Mati, Neos Voutzas
12 Aug	Evia
20 Aug	Amaliada, Peloponnese
25 Oct	Chalkidiki

During the 2018 fire season, a total number of 783 fires were recorded with an affected burnt area of 15 463.6 hectares, 8 668.44 of which occurred on wooded forest land and 6 797.13 were on non-wooded forest land. The majority of fires (614) broke out at parts with less than 1.00 hectare of burnt area.

It is worth mentioning that during the fire season 2018, in comparison with the last fire seasons and specifically 2017, there was a significant reduction in the number of fires (793 compared to 1083 forest fires), but the total burnt area of forest land was increased (15 463.6 hectares compared to 13 393.06 hectares).

The compiled data below have been provided by the local Forest Services. These numbers are still provisional and are likely to rise when compilation of fires is complete. However, the number of the recorded forest fires refers to the majority of the fire incidents for 2018 and there is no large deviation expected.

The number of fires and the burnt areas are shown in the following Table 8.

Table 8. Number of fires and burned area in 2018 by regional forest administration

FOREST ADMINISTRATION AUTHORITIES	*Number of fires*						*Burned area (ha)*		
	Total	*<1 ha*	*1-5 ha*	*5-100 ha*	*100-500 ha*	*>500 ha*	*Total*	*Wooded*	*Non wooded*
Macedonia-Thrace	136	96	26	14	0	0	368.3	181.2	187.1
Epirus & Western Macedonia	101	70	20	11	0	0	178.63	125.9	52.73
Thessaly and Central Greece	146	123	13	9	1	0	927.66	608.66	319.0
Peloponnese, Western Greece & Ionian	200	152	30	13	5	0	1404.48	1222.48	182.0
Attica	33	25	4	2	0	2	6824.4	5648.6	1177.8
Crete	154	137	1	4	2	0	5318.6	743.1	4575.5
Aegean	23	11	7	4	1	0	441.5	138.5	303.0
TOTAL	793	614	111	57	9	2	15463.61	8668.44	6797.13

Fire fighting means and information campaigns

In 2018 the Fire Brigade personnel consisted of 15 966 people, 11 089 of whom were permanent personnel of the Fire Brigade dealing also with structural fires, 1 723 were personnel employed with a five years contract and 1 243 were seasonal personnel, hired for forest fire suppression activities. A further 106 civil service staff and 1 805 volunteer fire fighters were also involved.

The Fire Brigade of Greece has a total of 3 319 vehicles of various types. These vehicles are distinguished as follows:

Firefighting vehicles	1945
Helping vehicles	972
Special vehicles	236
Motor cycles	166
Total	**3319**

The aerial means used during the 2018 campaign are shown in Table 9.

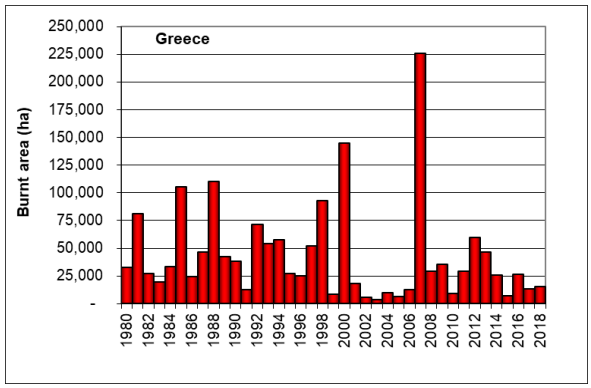
Table 9. Aerial means participating in the 2018 campaign

National fleet		
Type	Number	Availability 2018 (max)
Aircraft CL-415	7	5
Aircraft CL-215	13	9
Aircraft PEZETEL	19	19
Helicopter SUPER PUMA AS 332 L1	2	2
Helicopter BK 117 CL	3	3
Helicopter CHINOOK	3	3
Aircraft C-130	1	1
Total	**48**	**42**
Leased air means		
Type	Availability 2018	
Medium Press Helicopters		9
Heavy Duty Helicopters		5
Total		**14**

The yearly trends in terms of numbers of fires and burnt areas in Greece since 1980 are shown in Figure 28.

Fire causes

In many cases, the ignition source for fires is associated with traditional agricultural burning practices, although the fire causes for the majority of fire incidents remained unknown.



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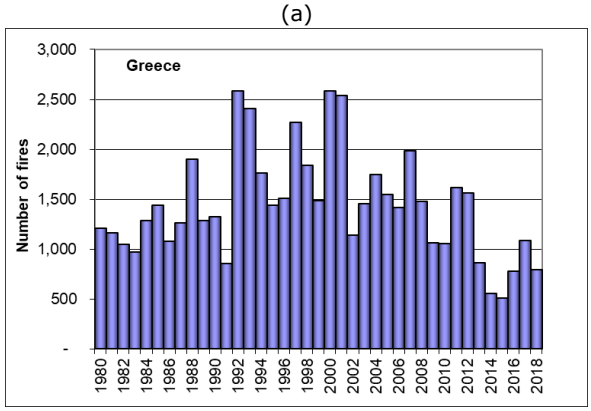

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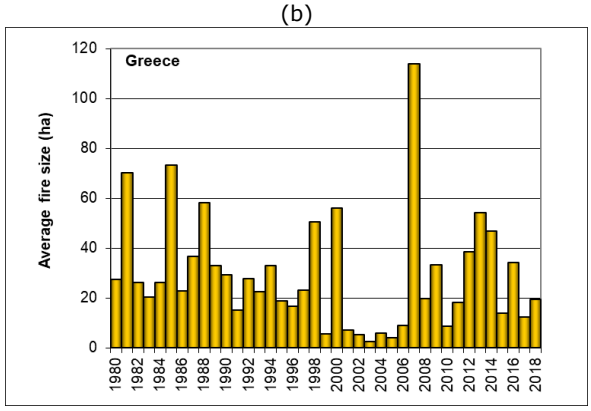


(c)

Figure 28. Burnt areas (a), number of fires (b) and average fire size (c) in Greece from 1980 to 2018.

Injuries and loss of human lives

During the fire-fighting period of 2018, one (1) Firefighter and one hundred and one (101) civilians were killed and seven (7) Firemen and a hundred and thirteen (113) Citizens were injured.

(Source: Ministry of Environment and Energy; Directorate General For The Forests And The Forest Environment, Greece).

1.2.10 Hungary

Fire danger in the 2018 fire season

FWI derived data and values were reported throughout the whole fire season by the Forestry Directorate (FD). FD has been using the JRC's data service to monitor the daily fire danger situation.

Compared to previous years, February and March were wetter than average. In March, there was rainfall almost every day, and several times there was snowfall. The rainy period lasted until the middle of April, which reduced the fire danger. From that time a dry period started, so that fire danger increased causing a lot of fire events. The high danger period shifted to mid-April this year. There were several rainy days in May, and June, so there was no significant fire danger then. Because of the uneven distribution of precipitation in the second part of summer there was a longer period when the FWI values reached a high level in August. Regional fire bans were ordered 14 times during summer and they lasted for 45 days in total.

Fire occurrence and affected surfaces

Forest fire data are collected in close cooperation with the disaster management authority. Data collected on the spot by fire fighters are uploaded to the database weekly, and if necessary can be done day-to-day. Forest fire data are produced and analysed with a GIS method and checked on the spot by the forest authority. The gathered fire data are processed and evaluated by size, date, cause and duration of fires. They are then compared with traditions in forest management processes and the behaviour of visitors and hikers in the forest land area.

Data from 2011-2018 are shown in Table 10.

Table 10. Number of fires and burnt areas.

Year	*Total number of wildfires*	*Forest fires*		*Other land types*
		Number	*Burned area (ha)*	*Number*
2011	8436	2021	8055	6415
2012	21581	2657	13978	18924
2013	4602	761	1955	3841
2014	5783	1042	4454	4741
2015	5318	1069	4730	4249
2016	2677	452	974	2225
2017	7122	1454	4933	5668
2018	**2981**	**530**	**906**	**2451**

906 hectares were affected by 530 forest fires in Hungary in 2018. Compared with previous years, the number and burnt area of fires has been halved. The reasons can be found in rainy periods of Spring and active communication on forest fires prevention in our FIRELIFE project.

98% of forest fires were surface fires in the 2018 fire season, when surface litter and other dead vegetal parts and smaller shrubs burnt down. The average rate of fires smaller than 1 hectare is almost 72 %. There was no large fire in 2018. The average total burnt area was 1.7 hectares in 2018. There was only one fire event where more than 50 hectares were burnt but it did not damage forest land area.

Table 11. Classification of fires by size class in Hungary in 2018.

Classification of burnt area	Number of forest fires	Burnt area (ha)
less than 1 ha	384	122
1 – 50 ha	146	784
50 – 100 ha	0	0
100 – 500 ha	0	0
more than 500 ha	0	0
Total:	**530**	**906**

Compared with previous years, fire events in 2018 show the same trend over several years. Figure 29 represents the tendencies experienced in the last 10 years that there are two most dangerous forest fire periods during each year. Due to the rainy weather period in March the high danger period shifted to April this year.

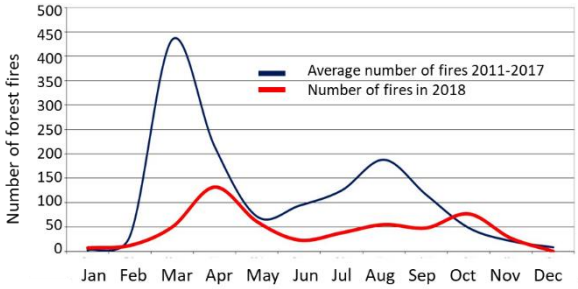


Figure 29. Average number of fires per month.

Traditional grassland use includes burning methods in early spring, which can accidentally spread to nearby forest. These fires usually burn between March and April. Spring vegetation fires usually burn with low or medium intensity in broadleaf forests, juvenile growths, shrubs and grasslands. Fire totally or partially consumes forests and causes serious harm.

37% of spring fires burn in northern areas (Borsod-Abaúj-Zemplén County, Heves County, Nógrád County) which indicates these areas as high forest fire danger zones.

In these areas not only traditional grassland management methods, but other social-economic factors add to forest fire danger. Unlike spring fires, summer fires usually burn in the Great Hungarian Plain. Figure 30 shows the locations of forest fires in Hungary in the high-danger periods of the year.

Analysing the statistics we can see that a total of 276 hectares of forest were burned or affected by fire during 2018. In addition, more than 459 hectares of grass vegetation and 171 hectares of other wooded land were destroyed in forest fires (Table 12).

Table 12. Fires by forest type

Forest type	Total burnt area (ha)
Forested land	276
Other wooded land	171
Other land	459
Total	906

The yearly trends in terms of number of fires and burnt area during the last 18 years in Hungary are shown in Figure 31 below.

Fire Causes

99 % of forest fires are human induced (negligence or arson). Most fires are induced by negligence (adults and infants) and only a small proportion of fires are caused by arsonists. Typical forest fire causes are the incorrectly extinguished fires of hikers, illicit agricultural fires, discarded cigarette butts and sometimes slash burning.

Fire fighting means

Fires were usually extinguished in less than an hour after the alarm. The fire service arrived at the fire in 30 minutes on average. Small fires are extinguished within half an hour.

Injuries and loss of human lives

There were no casualties among fire fighters and civilian people during firefighting in 2018. Fire service equipment was not heavily damaged. No death or personal injury occurred during firefighting last year.

Operations of mutual assistance

Neither Fire Service nor Forest Authority served mutual assistance last year.

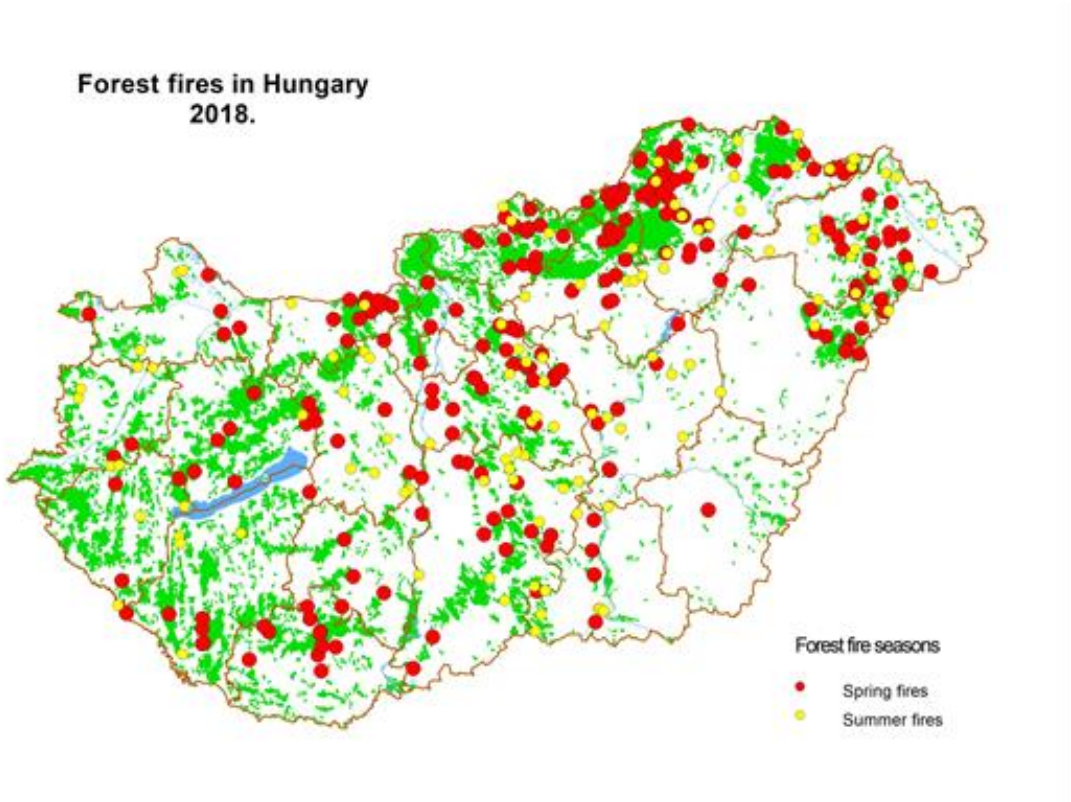


Figure 30. Locations of forest fires in Hungary in 2018.

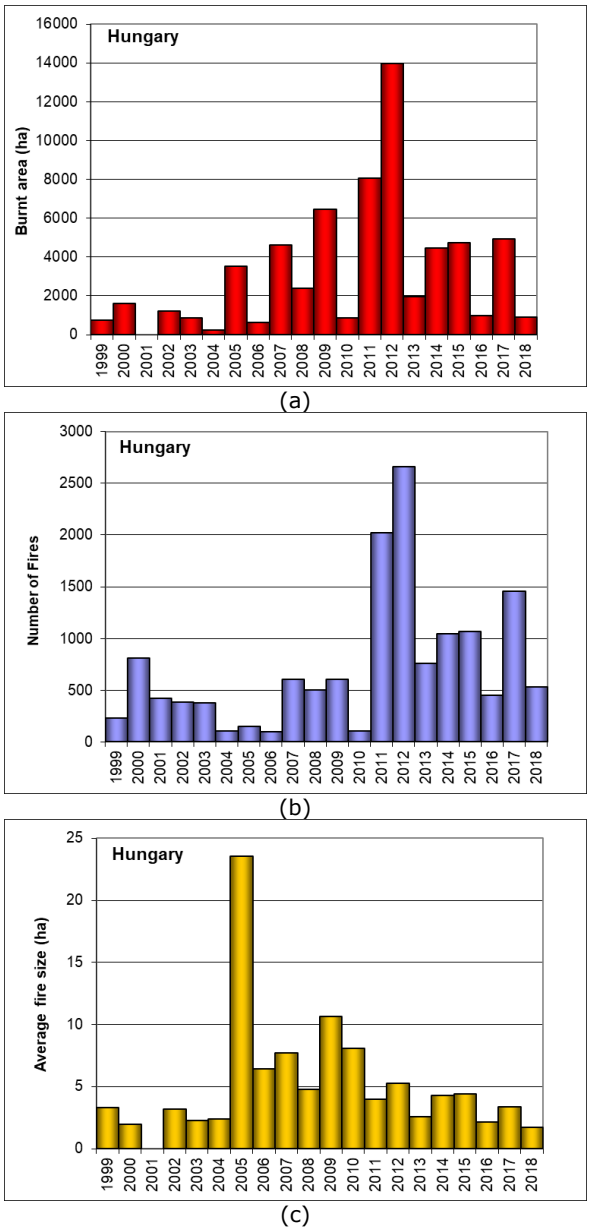


Figure 31. Burnt areas (a), number of fires (b) and average fire size (c) in Hungary from 1999 to 2018.

Fire prevention activities and fire information campaigns

There is a cooperation agreement between the Fire Service and the Forest Authority. The National Fire Prevention Committee established by the government has been monitoring all fire prevention activities. Forest fire prevention activities are implemented by the forest authority in the frame of a FIRELIFE project.

The aim of the project is to enhance effective, proactive and continuous forest fire prevention activity in Hungary. The key goal of the project is to disseminate useful and adequate information to the public on forest fire prevention.

Every one of the communication campaigns helped to reach our goals through 2018:

- Our participation in countrywide and regional information events with a FIRELIFE adventure course, reaching the target groups of children, wider public, farmers, hobby gardeners and smokers – 22 days;
- Contact with the media through workshops, press releases, with the help of publishing articles in the relevant offline media in order to reach the people in the country and also at a regional level – 41 online appearances;
- Direct communication with those target groups which can be involved more deeply through personal contact, for example farmstead owners and hikers – 77 days;
- Online information transfer and campaigns with the help of our website, and our NÉBIH Facebook profile;
- 1 500 storybooks and sticker booklets were sent for students and kindergarten children;
- 100 forest fire prevention experts with higher education degrees and 150 forestry engineering, nature conservation engineering and forest fire officer university students have attended our training courses in 2018.

Compared to 2012, the number and area of fires fell to 1/3 by the end of the project period, despite the fact that in 2018, both the number of fire-risk days and the extent of fire hazard area were about 20 percent higher than in 2012 in Hungary and Europe. the communication project drew attention to the forest fire problem and restarted many fire prevention processes that had been abandoned. For example, the use of controlled burning as a biomass management tool has become possible again. On the basis of the information received during the implementation of the project, we have improved the fire prohibition system, which now operates more flexibly and faster, using forest fire indices calculated by the EU JRC. Daily updated fire-prevention maps have been placed on the project website, where related leaflets can be accessed immediately. Many people have learned that forest fire in Hungary is also a growing risk that originates from human causes, and that it is not just something you see on TV, but which could also happen nearby.

FIRELIFE project website: www.erdotuz.hu.

(*Source: National Food Chain Safety Office; Forestry Directorate*).

1.2.11 Ireland

The Department of Agriculture, Food and Marine (DAFM) is the agency responsible for forest Protection in Ireland.

A significant drought event in June and July 2018 led to high fire risk conditions across much of Ireland. Irish Fire and rescue services responded to 2 800 wildfire related calls during this period, including several large incidents. These fires required significant suppression efforts and many incidents required the use of aerial firefighting tactics due to scale, terrain and observed fire behaviour.

The pattern and scale of incidents also allowed for an evaluation of recent improvements to fire management approaches in Ireland. A key objective has been to better coordinate and optimise the use of existing fire management resources, maximise preparedness and re-orient these resources towards wildfire challenges as they arise.

There was a marked reduction in agricultural burning observed during 2018, and a major shift in burning activity into the legal period in February. This is thought to be as a consequence of eligibility measures taken by the Department of Agriculture, Food and the Marine during 2017.

These measures will be continued during 2019. Most ignitions during summer 2018 can be attributed to accidents, negligence and malicious intent by members of the general public, and greater awareness of wildfire risks by the wider public is required into the future.

Fire occurrence and affected surfaces

During 2018 it is estimated that approximately 5 500 ha of land was affected by fire, including approx. 500 ha of forest lands.

Table 13. Estimated total losses in 2018.

Forest	Non-Forest
500 ha	5500 ha (estimated)

Fire danger during the 2018 season

Like many parts of Northern Europe, Ireland endured a significant heatwave during June and July 2018. Large blocking Atlantic high pressure systems dominated from the outset of summer, and kept the North Atlantic Jet Stream to the north of Ireland, permitting high temperatures and low precipitation rates to build. These conditions had a major impact on fire risk, particularly in the drier East and South-East regions of the Country.

The usual expected spring fire season was preceded by a short and intense period of observed fire activity between 26th and 28th February, in advance of Atlantic Storm 'Emma'. Easterly low-humidity airflows and high wind speeds and the end of the permitted open season for controlled burning by landowners precipitated the issuance of a Condition Red Fire Danger Notice by DAFM.

The DAFM Forest Fire Danger Rating System was activated in early March 2018 and a series of five Condition Orange High Fire Risk warnings were issued between April and May 2018, in line with expected meteorological risk patterns at this time of year.

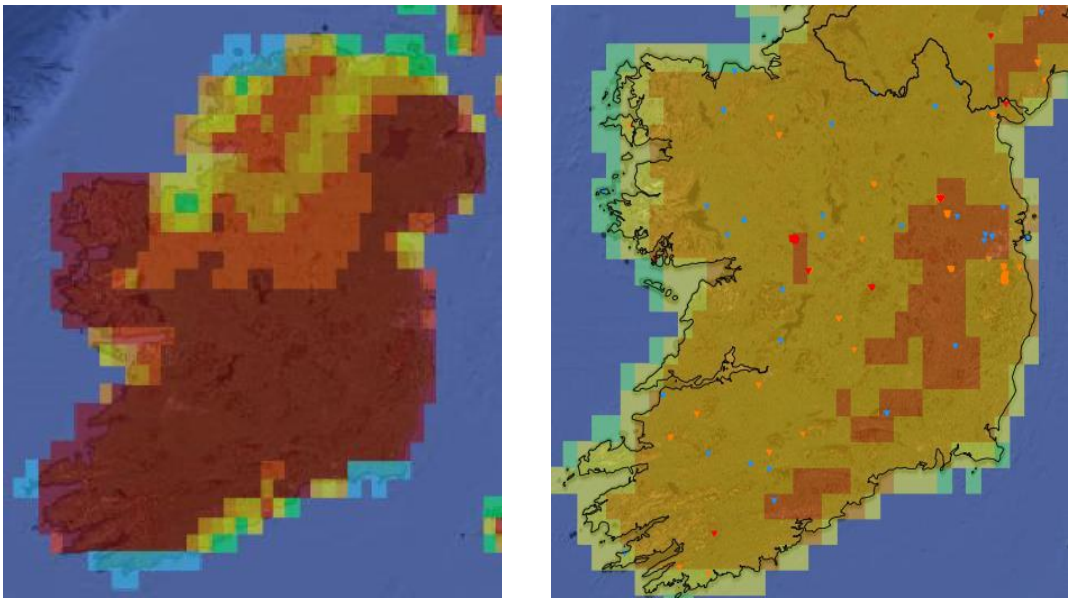


Figure 32. European Forest Fire Information System Fire Risk and Detected fire activity on July 04, 2018. (*Source: Copernicus/European Commission*).

Prolonged Atlantic high pressure patterns consistent with high fire risk dominated two main periods between June and July 2018, the first of these ending with the arrival of Storm 'Hector' on June 14th. A second prolonged dry period initiated from June 21st and the Condition Orange Fire Danger Notice was upgraded to Condition Red – Extreme Fire Risk on June 26th, in line with observed ignitions, indicative fuel moisture levels and observed fire behaviour. Fire behaviour was generally moderated by relatively low wind speeds. During this phase significant fire activity was observed in the Eastern region, mainly focussed on areas adjacent to population centres and on conservation lands.

Five Condition Red Fire Danger Notices were issued to cover the period between 26th June and July 16th, as severe drought conditions took hold and soil moisture deficits and drought codes increased. Increasing drought codes indicate increased moisture stress in vegetation and subsurface peat soils and increased availability of large diameter surface fuels such as logs that contribute to high intensity fires.

Fire prevention activities

A Lessons Learned report - 'Response to Wildfires in 2017 – Report and Recommendations' arising from wildfires during 2017 was a very helpful document to guide preparedness for agencies concerned.

Coillte (Irish State Forestry Board) Fire Improvement Plan was put in place for 2018 and implemented during the season, including improved equipment, training, procedures and availability of contract air support.

A significant reduction in illegal agricultural burning was observed during 2018 arising from land eligibility enforcement actions during 2017. Local fire groups such as the Cork Wildfire Cooperative, Kerry Wildfire Partnership, Hen Harrier Project and SUAS project in Wicklow permit local level fire prevention, coordination and cooperation on fire prevention by landowners. Education of farmers in relation to land eligibility requirements and improved practice regarding controlled burning helped cut down on illegal fires during 2018.

A number of Locally-Led RDP funded projects supported through DAFM have been approved and were operational during 2018. Several of these projects are focussed on high fire risk upland regions and contain specific fire management measures. These provide an effective means of local communication with landowners in terms of modifying behaviour and attitudes towards fire use.

A total Burn Ban was implemented nationally from June 26th, with the three Regional Emergency Control Centres refusing to accept legal Control burn notifications from farmers, and advising them to make alternative arrangements. Ignition risks associated with normal agricultural activity were identified and highlighted in the general and farming media.

A number of Media statements and Fire Danger Notices received significant national media attention, both prior to and during the main active phases.

A Ministerial release was issued by DAFM in early March, 2018 advising of the dangers of fire. Existing Fire Danger notice formats were modified in June to cater for a wider audience and ignition risk profile than was previously the case, particularly the general public and recreational users. A number of Government Departments, Local Authorities, Forestry Companies and the State Farm Advisory service also issued guidance on fire prevention.

Fire Activity

Fire activity during 2018 can be divided into 4 distinct phases - February, April, June and July. Western areas saw a spike in fire activity between the 27th and 28th of February, 2018, arising from easterly airflows and human ignitions activity in advance of Storm 'Emma'. The ignitions activity observed is consistent with agricultural burning ahead of the close season deadline of March 1st. 24% of detected fires during January-June 2018 occurred during this period, compared to 1% in preceding years. This suggests a significant change in Farmer behaviour in relation to agricultural burning. This change may be related to enforcement measures taken during 2017.

April – May saw a reduced level of fire activity in comparison with previous years. There was a significant reduction in Agricultural related burning detected between March and May 2018, in comparison with the preceding period 2002-2017.

The bulk of fire incidents occurred during the June/July phase, and these fires were most severe. Soil moisture deficits allowed for penetration of fire into subsurface peats, and made larger diameter fuels available to burn. These conditions do not normally apply during spring fire incidents. Most ignitions

were associated with activities on lands accessible to the public for recreation.

At a national level, Fire and Rescue Services responded to over 2 800 calls related to wildfires in the four-week period beginning with the issuance of the first DAFM Red Fire Danger Notices on the 26th June. Most of these wildfires occurred on public lands adjacent to urban areas, or on lands commonly used by the general public for recreation.

Much of the lands affected were subject to Natura Designations and protection, including lands within Wicklow Mountains National Park, Slieve Blooms Special Protection Area, and several Raised Bog Sites designated as Natural Heritage Areas.

Fire Suppression

Most fire suppression activities were conducted by Local Authority Fire and Rescue Services. On state owned forest lands and Nature Reserves, these services were frequently augmented by firefighting personnel and equipment from Coillte Teoranta (State Forestry Board) and the Irish Defence Forces.

Ground operations were augmented by 2 Helicopters (EC120) hired from private sector contractors and additional medium lift helicopter support (AW 139, EC135) from the Irish Defence Forces.

2018 saw a major increase in the use of air support at fires, and the early deployment of aerial assets in response to wildfire incidents. This reflects the severity of the fire incidents involved, and improved mechanisms for the deployment of aerial assets arising from 2017.

Significant adaptation to firefighting tactics in drought conditions was observed throughout the main risk period, including the early use of air support and prepositioning and availability of resources in line with projected risks.

In general, fire crews, equipment and systems of work adapted well to operations in high temperatures and fuel conditions very different to typical spring fires. Low ambient wind speeds reduced fire behaviour below potential levels, but as drought progressed fire behaviour and severity became more difficult to deal with, particularly on peatland sites where fire penetrated into the subsurface peat substrates. Updated tactics and specialised equipment are required to deal with fires of this type effectively.

International Assistance

The Irish Government provided 2 Helicopter resources from the Irish Defence Forces to Northern Ireland Authorities on July 6th, and again on July 10th, at the request of Northern Ireland Fire and Rescue, and with the assistance of the Irish Department of Foreign Affairs, and Department of Defence.

Figure 33. Slieve Bloom Fire, July 6th, 2018. *Photo: Irish Defence Forces.*

(*Source: Forest Service, Department of Agriculture, Food and the Marine, Ireland*).

1.2.12 Italy

Fire *Danger*

In 2018, the mean fire danger in Italy during the fire season (mid June to mid September) was the lowest in the last 30 years (Figure 34, left), more than three times lower when compared to 2017, 2012 or 2007.

A significant proportion of the inter-annual variability in total area burned in Italy is explained by fire weather (Figure 34, right). Indeed, a change in FWI from one year to the next is correlated with the corresponding change in burnt area, with 2018 showing the lowest delta and 2017 among the highest.

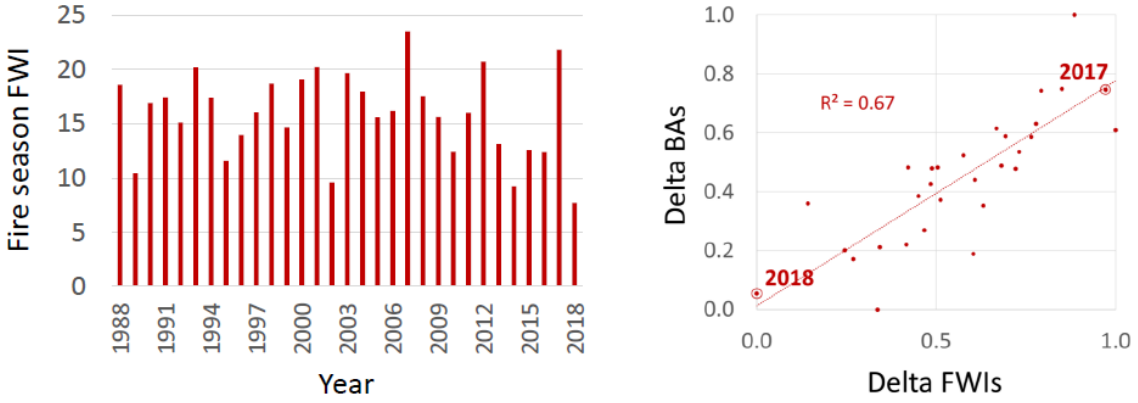


Figure 34. (left) Mean daily fire weather during the fire season (Jun-Sep) from year 1988 to 2018. (right) Mean daily fire weather during the fire season versus the total area burned for years 1988-2018. Calculations used the delta approach to correct for autocorrelation: a change in FWI from one year to the next is correlated with the corresponding change in BA. Changes are standardized from 0 to 1. Years 2018 and 2017 are evidenced by a double circle. Fire weather was indexed using the FWI according to the Global fire danger re-analysis (Vitolo et al. 2019).

The 2018 season was characterized by high afternoon rainfall in the July-August period, with a particular increase in natural causes (about 3% of events caused by lightning) and periods of greater aridity in the month of September.

Therefore, unlike previous fire seasons, the peak of events occurred in September and the most extreme events (e.g. the fire of Monti Pisani) occurred in the late summer / autumn period and in some cases, such as in Piemonte, in winter, which occurs frequently at those latitudes.

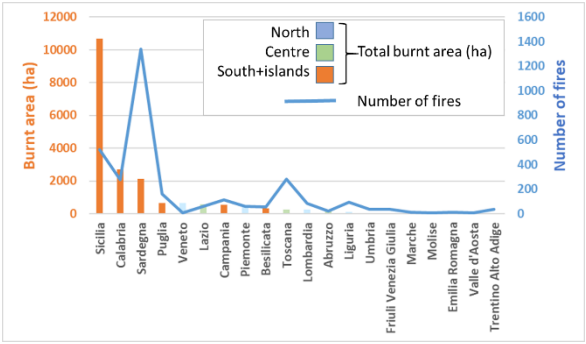


Figure 35. Number of fires and burnt area by region in 2018.

Fire occurrence and affected surfaces

According to information received from the Italian authorities, there were a total of 3 220 fires in Italy, which burned a total of 19 481 ha. The greatest number of fires occurred in Sardegna, but the largest burnt area was in Sicily (Figure 35, Table 14).

Fire causes

An analysis of the recorded forest fire events shows that they developed mainly in the last week of September, characterized by trigger points located within the wooded area, in the time slot 11.00-17.00, with a greater recurrence in the days of Saturday and Sunday. It was also found that these events were mainly caused by direct ignition and therefore probably due to deliberate causes

of different types (eg pasture renewal, uncultivated cleaning, hunting, etc.).

Table 14. Number of fires and burnt area in Italy by region in 2018.

Year 2018	Num. fires	Burnt area (ha)			
		Forest	Non-forest	Total	Av. fire size
PIEMONTE	60	302.1	96.9	399.0	6.7
VALLE D'AOSTA	8	1.2	1.0	2.2	0.3
LOMBARDIA	85	167.6	84.2	251.8	3.0
TRENTINO - A.ADIGE	34	0.5	0.4	0.9	0.0
VENETO	8	629.5	0.5	630.0	78.8
FRIULI V.GIULIA	35	13.5	6.5	20.0	0.6
LIGURIA	93	95.1	3.4	98.5	1.1
EMILIA ROMAGNA	12	3.3	0.1	3.5	0.3
TOSCANA	279	173.7	83.6	257.4	0.9
UMBRIA	34	12.3	9.4	21.7	0.6
MARCHE	14	10.9	6.3	17.2	1.2
LAZIO	62	328.5	247.8	576.3	9.3
ABRUZZO	21	90.7	111.3	201.9	9.6
MOLISE	8	10.9	3.9	14.9	1.9
CAMPANIA	115	499.0	48.8	547.8	4.8
PUGLIA	160	321.5	317.1	638.6	4.0
BASILICATA	57	114.2	192.7	306.9	5.4
CALABRIA	274	2058.8	635.7	2694.5	9.8
SICILIA	522	3915.4	6758.9	10674.3	20.5
SARDEGNA	1339	56.1	2067.3	2123.4	1.6
TOTAL	**3220**	**8805**	**10676**	**19481**	**6**

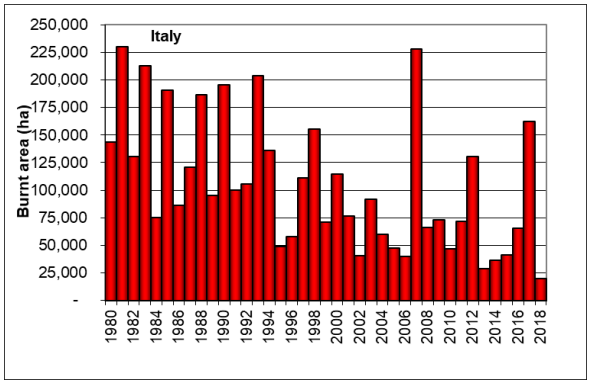
NORTH	**335**	**1212.8**	**193.1**	**1405.8**	**4.2**
CENTRE	**418**	**627.0**	**462.4**	**1089.4**	**2.6**
SUD+ISOLE	**2467**	**6965.1**	**10020.3**	**16985.3**	**6.9**
TOTAL	**3220**	**8805**	**10676**	**19481**	**6**

From the analysis of the data, the type of forest most affected was Mediterranean maquis (wooded areas definable as a degradation stage of holm oak due to previous fires, indiscriminate cuts or pasture, so-called disclimax). These formations would eventually evolve again into holm oak communities, if not affected by fire, grazing or cutting within 15-20 years, followed by formations of pure or mixed conifers (stands characterized by high flammability often associated with past reforestation).

The orography of the affected territories is typically hilly in ruderal areas characterized by nitrophilous vegetation that tolerates or prefers environments disturbed by human activity.

In synthesis we can say that in 2018 the areas most affected by forest fires were areas with Mediterranean scrub placed in hilly areas of central southern Italy. These ecosystems fall into areas not suited to production forestry or intensive agriculture.

The yearly trends in terms of numbers of fires and burnt areas in Italy since 1980 are shown in Figure 36.



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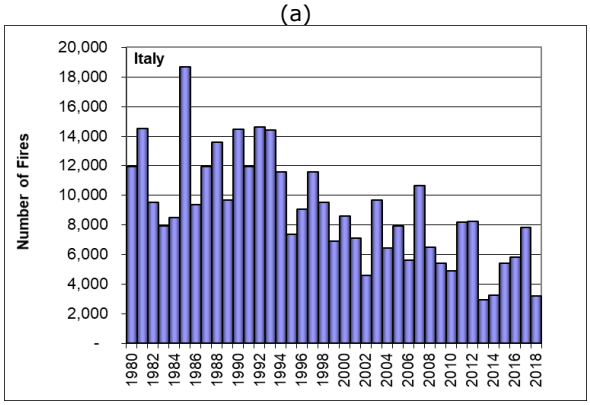

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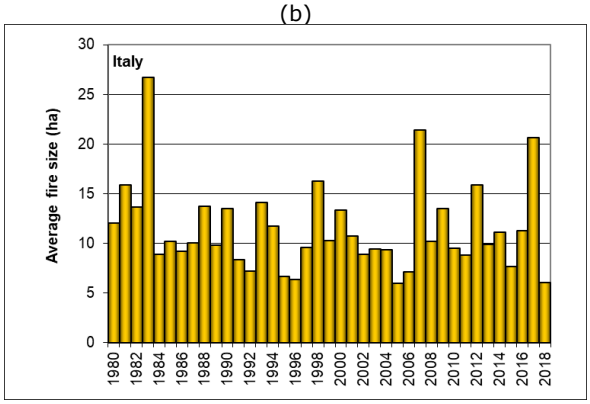

(c)

Figure 36. Burnt areas (a), number of fires (b) and average fire size (c) in Italy from 1980 to 2018.

Fire-fighting means

According to the National law, Regions have the task to extinguish forest fires with ground crews supported by light and medium helicopters. They can sign special agreements with National Fire Corps (CNVVF) to carry out this activity. 17 Regions out of 20 selected this option and subscribed agreements on forest fire fighting with CNVVF. The State coordinates, through the Unified Air Operational Centre (COAU), the National forest fire-fighting air fleet: 19 Canadair CL415 and 4 heavy

helicopters Ericson S64, all managed by the National Fire Corps.

During the summer campaign, some military helicopters and other medium helicopters from CNVVF are also available. Regional air fleets have about 70 helicopters of private companies. Puglia Region only adopted planes (2 Fire Boss).

In the course of 2018, regional aircrafts were engaged on 595 fires, national assets received 320 requests. The Sicilia region placed more than 50% of such requests (Figure 37).

Ground crews make use of pick-up trucks, with small water tanks (400-600 litres), which are very useful to move on the network of narrow roads over Italian hills and mountains. The National Fire Corps usually provides heavy fire engines.

After the severe summer 2017, the Italian Government decided to improve the resources of the National Fire Corps increasing ground and air means through a 10 years plan of investments aimed to improve the response of the State to wildfires. Moreover, several cross-organisational workgroups were created with the aim to improve cooperation between the different actors involved in forest fire-fighting activities.

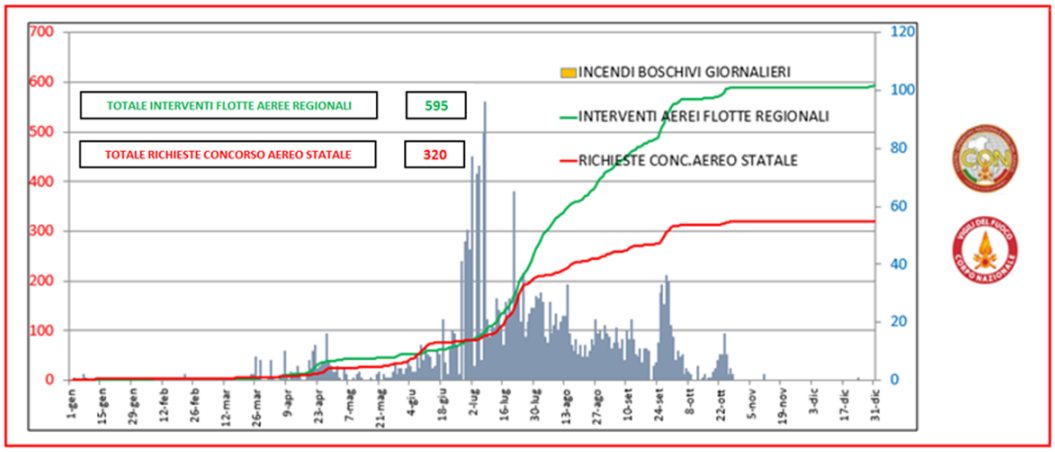

Figure 37. daily number of forest fires in 2018; number of missions of forest fire fighting aircraft.

Figure 38. In the Italian forest fire fighting system different Organizations and Corps work together.

Fire prevention activities and information campaigns

In 2018 the new Italian Forestry Law 34/2018 was approved, which introduced relevant aspects for forest fire prevention. Both Art. 3.2c and Art. 7.1 include fuel management techniques in forested areas within the family of silvicultural practices, with cascading effects on authorization protocols. Of particular interest is the Art. 12, which includes high fire risk areas within territories where Regions can implement fuel management programs in accordance with land owners, or when absent, with forms of direct replacement or assignment of the management of the land involved to companies or consortia.

In the wake of the national Forestry Law, the Tuscany Region has modified its forest legislation (L.R. 11/2018) to encourage active forest management by introducing an innovative planning tool for the Italian fire management sector, the "*Piani Specifici di Prevenzione AIB*" (Specific Forest Fire Prevention Plans). These are strategic fuel management plans aiming at optimizing resources for active fuel management (fuel breaks, preventive silviculture, prescribed burning) in 20 forest districts of the Tuscany Region at high fire risk.

The approval of these plans included information campaigns targeted at local populations in both schools and communities, which can be consulted at the following link: http://www.toscana-notizie.it/speciali/servizio-antincendi-boschivi

In 2018 the Med-Star Strategic Project under the Italy-France Maritime cross-border program was approved, which involves Liguria, Sardinia and Tuscany Regions. Notably, the project has been funded jointly to 4 simple projects connected to it: MEDFOREST, INTERMED, MEDCOPFIRE and MEDPSS. The first one focuses on fire prevention by improving and implementing fuel management programs (fuel breaks implementation, prescribed burning, preventive silviculture) in involved Regions.

After large fires in 2017 and 2018, several forest restoration programs integrating principles of fire prevention started in Piemonte (9 large fires in 2017), Campania (Mount Vesuvio fire in 2017) and Tuscany (Monte Pisani fire in 2018) Regions. Of particular interest is the "*Piano Straordinario Incendi Boschivi*" of the Piemonte Region: (https://www.regione.piemonte.it/web/temi/ambiente-territorio/foreste/tutela-bosco-territorio/piano-straordinario-interventi-per-gli-incendi-boschivi-2017).

This Plan identified priority areas for restoration based on forest ecosystem services, fire severity and a participatory program involving local populations in territories affected by 9 large fires for a total of 9 700 ha of forests in 2017. Funds of the Rural Development Program for both fire prevention and restoration (measures 8.3 and 8.4) will be oriented towards priority areas as identified by the Plan.

Injures and losses of human lives

According to National Fire Corps data (*Stat-ri-web*), in 2018 the number of injured due to forest fires were 3, while two of them were probably the authors of unintentional fires. Two casualties were due to vegetation fires (not classified as forest fires according to the National law), and 16 were injured; again, 7 of them were probably the authors of unintentional fires due to agricultural practices.

International assistance operations

During 2018, the Canadair CL 415 of National Fire Corps were engaged in three missions to help EU Member States in forest fire-fighting: two in Sweden and one in Greece.

The first mission, requested by Sweden to the Union Civil Protection Mechanism, was based on the risk indices which indicated a potentially dangerous situation. Two Italian Canadair were engaged from 10 to 17 June, based in Orebro. During this period, despite the high danger levels, only a few operational flights were made, while a series of trainings were carried out with the aim to improve the coordination of air operations, as well as share strategies and fire attack techniques. Such activity proved very useful in the course of the second mission of the IT AFFF with planes in Sweden.

The second mission to Sweden, from 17 to 27 July, involved two CL 415 Canadairs along with 5 other planes from France and Portugal as well as helicopters and ground teams from different EU countries. Thanks to the double crews and the light conditions in Sweden, each Italian Canadair flew an average of 12 hours a day reaching 160 hours of flight, 1 360 drops, and 8 100 tons of water dropped during the mission.

On 24 July 2018, two Canadair were sent to Greece, under the coordination of the Civil Protection Department, to comply with the request placed by the Greek Government to the Union Civil Protection Mechanism to face the dramatic emergency that hit the Attica area, East of Athens.

The activity of the Italian Canadair, having their base at Elefsina airport, began on July 25th and ended on July 27th and carried out 4 missions, with 38 launches, for a duration of 6 hours and 45 minutes of flight.

Table 15. Operations of mutual assistance in 2018.

Module	Mission	Time	Notes
IT AFFF with planes (2 Canadair CL 415)	Sweden	10-17 July	Voluntary pool
IT AFFF with planes (2 Canadair CL 415)	Sweden	17-27 July	Buffer capacity
IT AFFF with planes (2 Canadair CL 415)	Greece	25-27 July	Voluntary pool

Figure 39. Italian Canadair CL 415 during the 2nd forest fire-fighting mission in Sweden.

Climate change

In Italy, 2018 marked a new average annual temperature record, with an average anomaly of +1.71° C, when compared to the reference climate value of 1961-1990. All the months of the year except February and March were warmer than normal. During 2018, the average rainfall was moderately above the normal climatological values. However, the trend during the year was rather fluctuating and very rainy months alternated with drier ones. March, May and October were characterized by heavy rainfall, extended to the whole National territory, while in April, September and especially December the rains were scarce in all regions. For this reason, some of the worse forest fires in 2018 raged at the end of September, when the summer campaign was off.

It is increasingly clear that Italy must increase its preparedness to deal with wildfires campaigns that are no more well defined in terms of time and space. Also, the land use is changing quickly; the borderlines between forests and fields are no longer well defined. In the marginal agricultural areas, fields are no longer cultivated, and stands of transition shrubs are growing creating very suitable areas for the spread of fires. For this reason, the protective effect of cultivated areas is decreasing and, in the worse years, like 2017, agricultural areas are no more safety lines to stop the fire; on the contrary, they become areas which allow a faster spread of fires to the forests. Note-worthily, fires involving agricultural areas, including those with stands of transition shrubs, are growing and their number exceeds forest fires. This evolution also increasingly challenges the forest fire-fighting response system.

Research activities aimed at improving fire management

Several research project and studies to improve fire management in Italy were carried out in 2018. The PREVAIL project (https://www.prevailforestfires.eu/) under the EU Civil Protection Mechanism aims at demonstrating that fire prevention can make large fire suppression more effective and less costly. Of particular interest are actions targeted to analyse the use of Rural Development Program funds for fire prevention, and to set the state of art of "smart solution" for fire prevention, where the setting of economically sustainable circular economies have positive externalities on fire prevention (e.g. vineyards cultivated in strategic fuel management areas).

Of interest for fire risk mitigation, the FORMA project uses Laser scanner technologies to produce a fuel types map of the Puglia Region and the assessment of the road network to improve fire prevention in the area.

A number of studies published in 2018 addressed the main drivers of current fire regimes in both the Alpine (Conedera et al. 2018, Vacchiano et al. 2018) and Mediterranean Regions (Mancini et al. 2018a, Mancini et al. 2018b, Ricotta et al. 2018). Some studies deepened the effects on soil ecology of both prescribed burning (Catalanotti et al. 2018) and wildfires (Capra et al. 2018).

Ascoli et al. (2018) produced a review on how to design firebreaks and fuelbreaks while Salis et al. (2018) carried out a simulation study to improve the strategic planning of fuel treatments at the landscape scale. A new fire danger model was tested in the Sardinia Region (Sirca et al. 2018).

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(Source: Source: Comando Carabinieri per la Tutela Forestale, ambientale e agroalimentare; Italian National Fire Corps – Forest Fire Fighting Service; Minister For Agriculture, Food, Forestry And Tourism Policies – Directorate General Of Forest, Italy).

1.2.13 Latvia

Fire danger in the 2018 fire season

In 2018 the forest flammable period was set from April 27 and continued until September 30.

Fire occurrence and affected surfaces

In the reporting year, 972 forest land fires were detected and extinguished, of which 2 863.90 ha of forest land was affected, including 506.6 ha of new stands. 331 forest fires were extinguished in state forests with a total area of 2 618.37 ha.

The largest forest fire occurred on July 17, 2018 in the North Kurzeme Forestry, Talsi County, Valdgale Parish, Lielsalu Peat Mire Development Area, which resulted in 1 353.15 hectares of burned forest land (Figure 41). A large fire broke out in the territory of the Riga Regional Forestry Administration at the NAF Adazi Landfill, where 776.7 ha of forest land burned. On July 31, a lightning strike resulted in a forest fire in Ramata in the area of North Vidzeme Forestry, where forest land and swamp burned 239.7 ha.

The average forest fire area in 2018 was 2.95 ha.

Table 16. Number of fires and burnt areas by month

Month	Number of forest fires	Burnt area (ha)
January	0	0
February	0	0
March	7	4.97
April	131	113.9641
May	185	68.0359
June	261	914.9223
July	123	1660.0833
August	113	72.3666
September	98	28.9037
October	30	0.4946
November	17	0.1918
December	7	0.0215
Total	**972**	**2863.95**

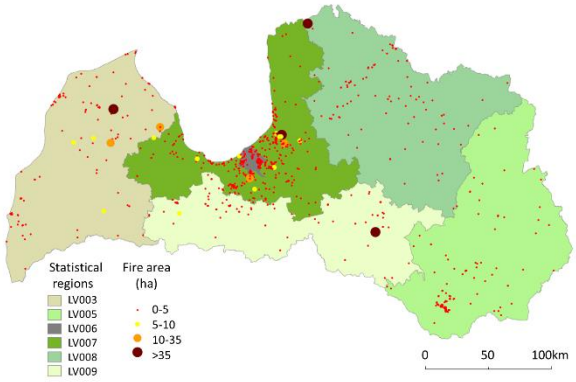
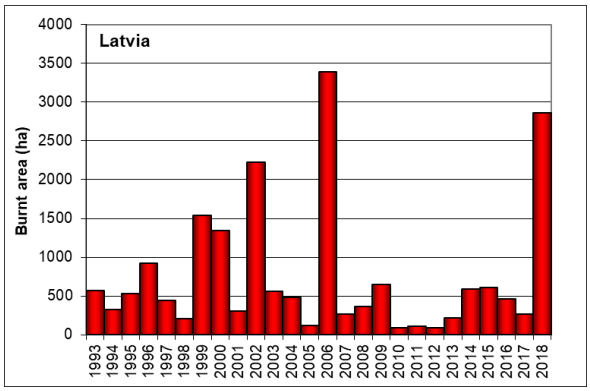


Figure 40. Map of forest fire locations in Latvia in 2018.

Figure 41. The largest forest fire of the year, 17 July 2018 in the Northern Land forest, Talsi municipality, Valdgale parish, the Great Island peat Mire development area, resulting in 1 353.15 hectares of burned forest land.

The yearly trends in terms of number of fires and burnt area during the last 26 years in Latvia are shown in Figure 42.



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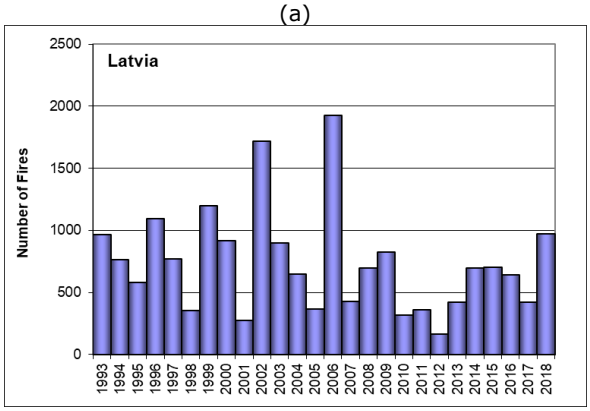

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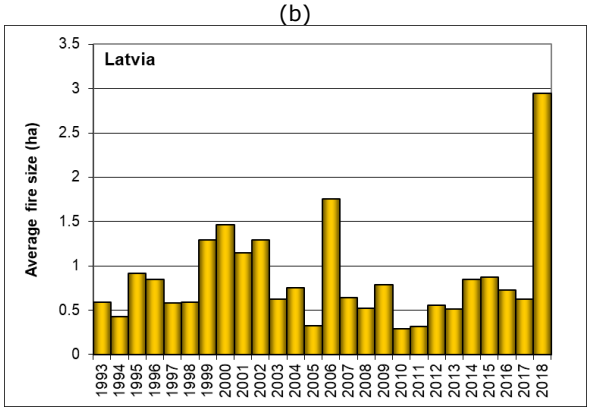


(c)

Figure 42. Burnt areas (a), number of fires (b) and average fire size (c) in Latvia from 1993 to 2018.

Preventive measures

The fire service network is used for fire protection (in total 181 fire towers).

In the summer of 2018, the State Forest Service provided seasonal workers with 335 posts (tower attendants, specialized fire tanker drivers, forest firefighters, forest fire station managers, operative on-call staff), without which rapid response to forest fires would not be possible and would increase burnt forest land areas. Fire prevention measures in 2018 cost 101965 Euro (Table 17).

Table 17: Expenditure on fire prevention measures in Latvia in 2018

Title	*Costs, EUR*
Latvian State forest	
Creating new fire breaks, 6 km	302
Existing fire break cultivation, 3336km	70593
Water point, warning sign renovation	31070
Total	**101965**
Riga City Forest	
Creating new fire breaks, 0 km	
Existing fire break cultivation, 548km	

New equipment

In 2018, the State Forest Service purchased 11 new Mercedes Benz UNIMOG 4023 forest fire trucks and 14 Toyota Hilux off-road trucks to ensure the rapid detection, containment and elimination of forest fires.

(Source: State Forest Service, Environmental and Forest Protection Division, Latvia).

1.2.14 Lithuania

Fire danger in the 2018 fire season

Forest fires during the year 2018 in Lithuania settled at a low level. The amount of wildfires and the total burnt area was low. The first fire in 2018 was recorded in April, the last one in November. A heat wave in Lithuania occurred in August. The number of fires was influenced substantially by the weather conditions in spring and summer.

Fire occurrence and affected surfaces

In 2018, according to the data of the Directorate General of State Forests, 211 forest fires occurred and damaged 110.45 ha of forest. 16 forest fires were bigger than 1 ha. The highest number of forest fires occurred in May (34.12% of fires and 49.69% of burnt area). The total damage was estimated to be 45 575 euro. The yearly trends in terms of number of fires and burnt area during the last 28 years in Lithuania are shown in Figure 43.

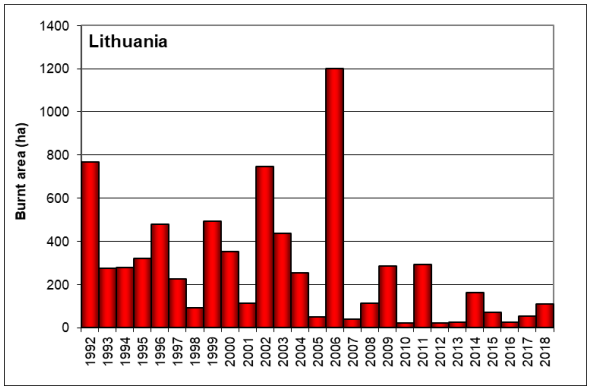
Fire prevention activities

The Directorate General of State Forests under the Ministry of Environment organizes the establishment of the uniform system of state fire prevention protection measures. Annual contracts between the Lithuanian Hydro meteorological Service and Directorate General of State Forests are signed concerning calculations of complex forest fire figures and pronouncements of classes of fire rates in each territory of the state forest enterprise. A Forest Fire Danger Map is updated daily (at 12 a.m.) from April to September and can be found at the site http://www.meteo.lt/lt/web/guest/misku-gaisringumo-klases-prognozes.

Every year state forest enterprises, together with the Fire and Rescue Services and Armed Forces, organize educational training in the forest in order to check how organizations are able to organize forest fire extinction, manage difficult situations, control the actions, collaborate with each other and keep the connection. In order to sustain the system of general state fire protection measures, state forest enterprises budgeted 1 907 thousand EUR from their own funds in 2018, and 13 310 km of firebreaks were mineralized.

Automatic early warning systems for forest fire prevention "FireWatch" are used in 25 state forest enterprises having forests with high fire risk (total 24 central stands and 84 detectors).

Forest fire detection systems help to detect forest fire focus coordinates with better precision, so that fire brigades can arrive at the fire faster, and extinguish the fire more efficiently.



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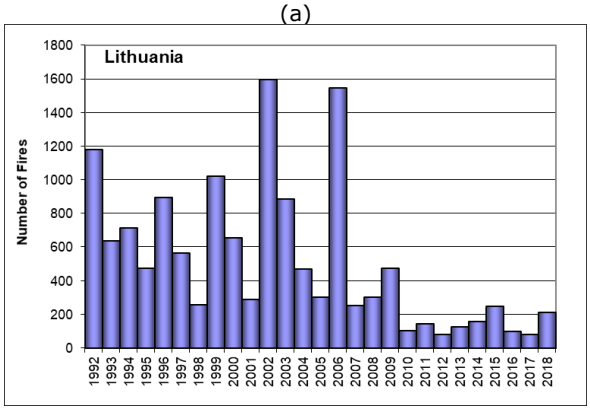

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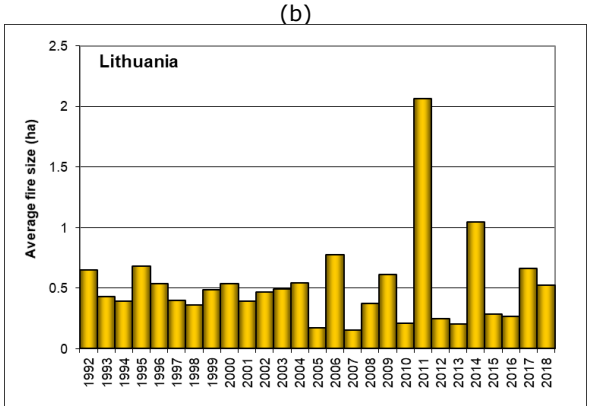


(c)

Figure 43. Burnt areas (a), number of fires (b) and average fire size (c) in Lithuania from 1992 to 2018.

Operations of mutual assistance and loss of human lives

No operations of mutual assistance were taken and no casualties were reported in Lithuania during the fire season of 2018.

(Source: State Forest Enterprise, Nature Protection and Forest Policy Group, Ministry of Environment, Republic of Lithuania).

1.2.15 The Netherlands

Fire danger in the 2018 fire season

Like other European countries, The Netherlands experienced an intense drought in 2018. While a typical year has a peak in fire activity in Spring and early Summer, 2018 had a very pronounced peak in fires in mid-Summer and fires occurring even until Autumn. This coincided with the prolonged dry and warm period caused by the drought.

Fire danger is classified using weather data collected at weather stations on various locations in The Netherlands. The weather stations are collecting data about rainfall, humidity, temperature, wind speed and wind direction and the weight of a wooden stick. With the M8-index this information is converted into the risk of an uncontrollable wildfire. In 2018, fire danger was at 'high risk' for more than 50 days in a row.

Despite the high wildfire risk, there were no exceptionally large wildfires. The largest fire (~200 ha, on 15 July 2018 near the village of 't Harde) occurred at a military training ground in grass- and heathland. The most complex fire (~35 ha, on 7 August 2018 near the village of Wateren) occurred in the northern part of the Netherlands. This fire started in heathland and spread quickly into a wheat field and into deciduous forest, resulting in evacuation of five campsites in the middle of the tourist season.

Fire occurrence

The Netherlands Fire Service registered a total of 949 wildfires in 2018, concentrated in the summer months (July, August) and on dry sandy soils in the Veluwe region (centre), Noord-Brabant and Limburg (southeast) and in the sand dunes along the coast (Figure 44). The total number of fires in 2018 was roughly triple that of 2017, when 321 wildfires were registered.

These numbers are the first Dutch wildfire statistics since The Netherlands stopped their dedicated data collection in 1996. These new numbers were collected using a new wildfire registration method developed by the Netherlands Fire Service, Institute of Safety, and Wageningen University that counts fires as wildfires when they meet specific criteria:

1. The incident classification in the national dispatch system is "wildfire" (natuurbrand) or a related term ("heath fire", heidebrand; "moorland fire", veenbrand, "forest fire", bosbrand, "dune fire", duinbrand or "reed fire", rietbrand etc.); or:
2. The incident classification is not "wildfire" or a related term but additional resources were sent to the fire and afterwards information (from safety regions or news agencies) indicated the fire occurred in vegetation. All fires that meet these criteria are counted, regardless of their size. This means that fires that burn only 10-100 m2 are also included in these numbers, to allow dataset users to use their own size cut-off, if desired, during any post-processing of data.

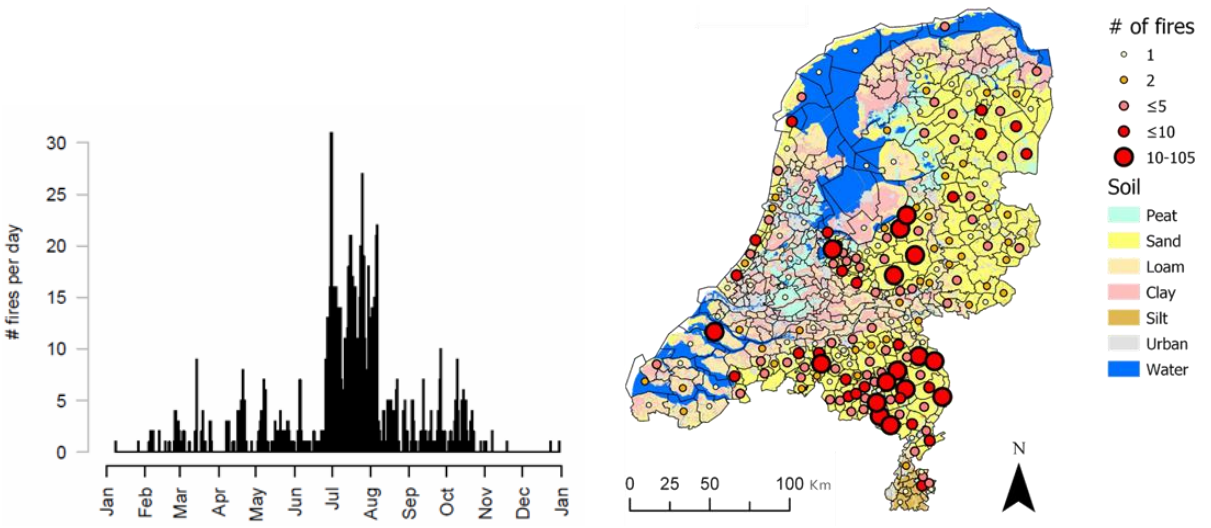


Figure 44. Temporal distribution (number of fires per day, left) and spatial distribution (number of fires per municipality, right) in The Netherlands in 2018. Note that fires are plotted in the centre point of each municipality – not at their exact location within the municipality. (Map created by Jetse Stoorvogel).

The vegetation type in which the fire occurred is registered for most larger fires (fires that exceed ~100 m^2) based on field observation, ground-based imagery and news reports. Fire size is estimated from photo and video material, or in the field. While the exact size of all fires is currently not measured, field estimates suggest that the majority of fires is small (< 1 ha).

The estimated total affected surface in 2018 was almost 650 hectares, mostly grass- and heathlands (72%). The remainder was forest (18%) and agricultural land (mostly wheat ready for harvest). In 2017 the affected surface covered 232 hectares (53% grass- and heathlands, 47% forest).

Fire causes

Fire cause was studied for a small number of fires in 2018 and classified using the European classification for wildfire causes. In 56% of the wildfires, no information about the cause was available. For those fires where the cause was studied and identified, most fires ignited due to the use of weapons (on military exercise sites, 20%) or by humans, mostly deliberate (17%).

Anecdotal evidence suggests that the number of fires ignited by natural causes or due to working activities near vegetation in the Netherlands is very small, with the great majority of fires caused by human behaviour (deliberate or accidental).

Fire fighting means

The very long wildfire season resulted in a lot of effort from the fire services. When wildfire danger is high, the fire department will directly send additional resources to a wildfire. Also, the Fire Bucket Operations (aerial firefighting, a collaboration between the Ministry of Defence and the Netherlands Fire Service) is ready for immediate use.

In 2018, a total of more than 2 600 fire engines were sent to extinguish the fires, with an average call of almost three fire engines per wildfire. More than a thousand water trucks (with a capacity of at least 10 m^3) supported the extinguishing activities. The Fire Bucket Operations were used five times for aerial assistance.

Figure 45. Fire bucket operations.

Figure 46. Ground Fire in Loonse en Drunense Duinen.

Fire prevention activities and information campaigns

The Netherlands Fire Service has a National Program for wildfire risk management. The goal of this program is to develop national expertise to be able to prepare for complex incidents that may only occur rarely, but for which the impact may be severe.

The approach to Wildfire Management in the Netherlands is based on recommendations from a Government Inspection Report that evaluated the 200-ha 2010 fire on the Strabrechtse Heide. This report concluded that the Netherlands was not fully prepared for wildfires of this size and with the given wildland-urban interface impact. The goal of Wildfire Management within our National Program is to prevent uncontrollable fires which is essential in a densely populated country like the Netherlands where even small fires can have major impact.

The Netherlands Fire Service focuses on Wildfire Management to gain more insight into the risks, to be able to prevent disasters. Through collaboration, this is done jointly with land managers and other stakeholders such as the Ministry of Defence, Justice and Safety, and relevant provinces.

Risk index wildfires

The basis for wildfire risk management is the Risk Index Wildfires (Figure 47). This provides insight into the risks of a wildfire based on 17 parameters and helps the fire department and land managers to prepare and prevent an uncontrollable wildfire. These parameters include for example the type of vegetation, number of people in the area, response times for the fire department and the water resources available. The summed scores of 17 fixed parameters determine the risk in an area per square kilometre. This interpretation is displayed in a 'risk colour'. For example, red depicts an area of high risk and green an area that poses a lower risk.

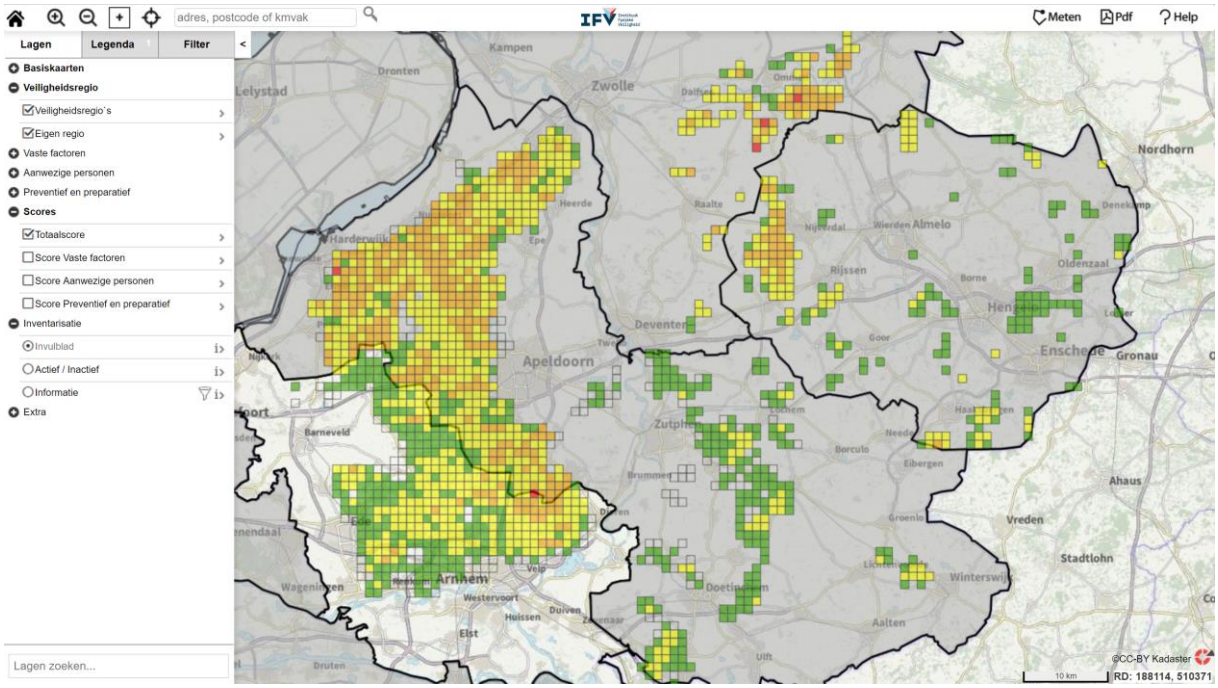


Figure 47. Risk Index Wildfires.

The Netherlands Fire Service and the Institute for Safety have developed a wildfire spread model based on the vegetation types and fuel models in The Netherlands. The online wildfire spread model uses meteo data, a map and fuel models to generate scenarios and simulations of the expected fire spread. The model is used for both risk management and operations during an incident (tactical / strategic decision-making).

Usage of satellite data

Satellite data is used to create detailed vegetation maps of the Netherland to tailor fuel models for the wildfire spread model. The Institute of Safety furthermore uses satellite data to estimate the level of drought in both living and dead vegetation in order to generate an up-to-date picture and prognosis of the risks of a wildfire as a

replacement for the weather stations that are used right now.

Figure 48. Areal view of wildfire in Hoge Veluwe.

Figure 49. Wildfire at military training site in 't Harde.

Area-oriented approach

Because the effects of a wildfire can be substantial, the Netherlands Fire Service wants to better manage the risks involved. They work together with land managers and other stakeholders who play an important role in reducing the risk of an uncontrollable wildfire. Together, they identify and assess the land that poses a risk with the aid of the Risk Index Wildfires and the wildfire spread model. This includes an assessment of how risks of uncontrollable fires can be limited, for example, by constructing or strengthening natural barriers with less flammable vegetation.

Geodata and information provision

Up-to-date geodata can help the fire department with the preparation and the effective combating of a wildfire. For example, land managers know best about their land, interests, and priorities. Annual standardized requests for data intended for wildfire management (such as maps with roads that can be used by the fire department) are sent to land managers through a national format adapted to fire service needs. This information is stored at a central location and is available to all stakeholders in wildfire management.

Wildfire Investigation Team

After several years of ad-hoc activities, wildfire cause and origin investigation was granted official status in June 2019 through the installation of a National Wildfire Cause and Origin Investigation Unit (Team Natuurbrandonderzoek). Through post-fire analysis of wildfire spread, this unit investigates its origin and potential cause. Wildfire cause and origin investigation not only allows fire service and police to investigate potential causes of wildfires, but also learn from fire and its spread. It is additionally used to determine the effectiveness of fire prevention measures and the techniques/tactics of fire-fighting measures.

The Dutch Wildfire Investigation Team is a shared initiative of police and fire services – all members of the team have followed the FI210 wildfire investigation course and an annual 'Burn to learn' is organised for training updates, reflection and exchange.

Injuries and losses of human life

No losses of human life or severe injuries were reported. There have been some mild issues of smoke inhalation but as records are not kept, no details can be reported here.

Operations of mutual assistance

In 2018, Fire Bucket Operations were deployed once for assistance in Germany (Figure 50).

Figure 50. Fire bucket operations in Germany.

Climate Change

According to the Dutch Royal Meteorological Institute KNMI, 2018 was the fifth very warm year in a row, which fits the trend of a warming climate (*KNMI, 2019*). KNMI publishes annual weather summaries, here the 2018 report (*KNMI, 2019*) is shortly summarized: Summer 2018 was the warmest year in De Bilt (where records are kept) since 1901, and very sunny and very dry. The southeast of the country saw its longest regional heat wave ever registered in the country, lasting from 12 July to 8 or 9 August 2019. June was much warmer than normal and very dry, July was the second warmest since 1901 as well as record-dry and record-sunny. The start of August was very warm and dry, followed by less high

temperatures. Autumn was mild, very dry, and based on national averages the sunniest since 1901 (*KNMI, 2019*). This warm, dry and sunny weather coincided with wildfire activity through to October 2018.

While average annual rainfall is 847 mm in the Netherlands, 2018 was very dry with only 607 mm on average (*KNMI, 2019*). The national average maximum rainfall decifit of 309 mm was reached on 8 August 2019, which has a return interval of approximately 30 years (*Sluijter et al, 2018*). An assessment of the 2018 Summer drought by KNMI indicated that the drought cannot be (partly) attributed to global warming. Yet the probability of much drier summers is expected to increase in the future, due to the combined effects of a sharp decrease in summer rainfall and a possibly strong increase in potential evaporation (*Sluijter et al, 2018*).

Research activities aimed at improving fire management

PhD and MSc research

PhD research at VU University Amsterdam is testing how biotic attack by the honey fungus (*Armillaria*) and beetles affects the decomposability and flammability of coarse wood of Black pine (*Pinus nigra*) in plantations in the Dutch dunes. These plantations tend to be fire-prone and wildfire is considered to be a hazard to people and property in the area. This PhD research involves incubation of dead wood of different decay stages, before and after fire, in a "tree cemetery" where dead wood decay of infected and uninfected trees are compared. Experimental burns are done to compare the flammability of dead wood from infected and uninfected trees in the fire lab (FLARE) at VU Amsterdam.

Master student research projects include focus on heathland fuel moisture monitoring using imaging spectroscopy and high-resolution fuel type mapping, analysis of fire statistics, characterization of litter, fuel moisture, drivers of fire-induced soil heating, and learning from fire disasters (Wageningen University).

Figure 51. Wildfire in Wateren.

Innovative Training Network PyroLife: 15 PhD candidates on integrated fire management

Wageningen University has been awarded a 4 million euro Innovative Training Grant to train 15 PhD students to become the new generation of experts in integrated fire management. This project, called PyroLife, is funded under the Marie Curie Actions within the European Horizon2020 program (grant number 860787). PyroLife brings together knowledge from different countries, scientific disciplines and practices. Southern European leadership in fire expertise will be used to understand and predict wildfires in Northern Europe, whilst Northern European lessons learned in the prevention of floods will be applied in Southern Europe.

PyroLife is the first large and integrated doctoral training programme on wildfires globally. WUR will offer four PhD positions on: the effects of wildfires and ashes on soil and water quality, designing landscapes adapted to the increasing risk of wildfires, and applying Dutch knowledge in water management (prevention and the widely-known 'poldermodel') to 'living with fire'.

WUR will lead a consortium of 10 leading European universities and institutes. All PhD candidates will receive training from 21 international partners, including governments, fire services, business and non-profit agencies. Through close collaboration with the range of stakeholders involved, research design is based on stakeholder needs and research output is communicated to the relevant actors involved.

References:

KNMI (2019), Jaaroverzicht van het Weer in Nederland (JOW) 2018. Accessible via www.knmi.nl/nederland-nu/klimatologie/gegevens/mow.

Sluijter, R., M. Plieger, G.J. van Oldenborgh, J. Beersma, H. de Vries (2018). De droogte van 2018. Een analyse op basis van het potentiële neerslagtekort. KNMI.

(Source: Brandweer Nederland, Institute of Safety; Department of Environmental Sciences, Wageningen University, Netherlands).

1.2.16 Norway

Fire danger in the 2018 fire season

In Norway we are using the fire index from Germany (WBKZ). The index is based on three main elements: precipitation, air temperature and humidity. The fire season is normally from March to September. Still, there will be variations since the country is 1 750 km from south to north and there may be flooding in one part of Norway while there is high forest fire index another place.

The fire season starts in the south-west in March-April and during the season it moves south and east (Figure 52). In the western part it is mainly brush-fires. In the southern part it is pines on poor soil that dries up quickly which is most common. The largest areas with forest are in the eastern part of Norway.

The average temperature for the whole country in 2018 was 1.4°C above normal (!), and the year became the 15th warmest in a series dating back to 1900. The precipitation in 2018 was close to normal. From month to month there were large variations. March was cold and dry, May and July had the highest temperature ever (since 1900) and the precipitation was very low. The combination between high air temperature and low precipitation is not experienced before.

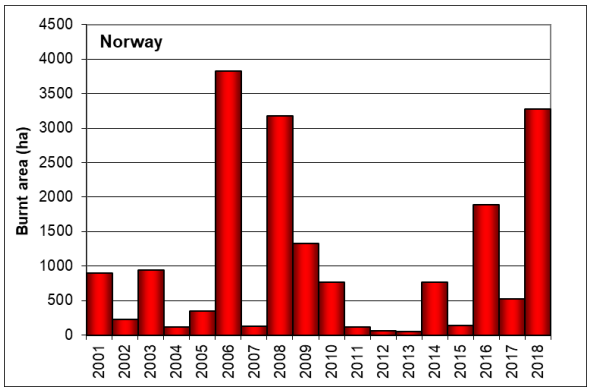
Fire occurrence and affected surfaces

In 2018 there were 887 forest fires recorded in Norway; 1 251 ha of productive forest and 2 028 ha of other wooded land. There were 1 126 fires recorded in brushes and grass (non-forest).

The trends regarding both the number of fires and burnt areas from 2000-2018 are shown in Figure 12.

Figure 52. Progression of fire season.

Photo credit: Dag Botnen, Norway



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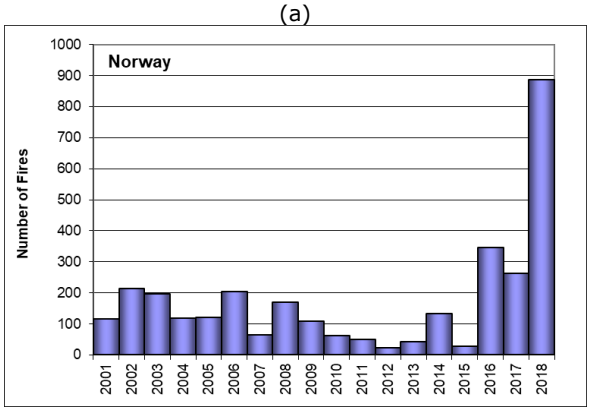

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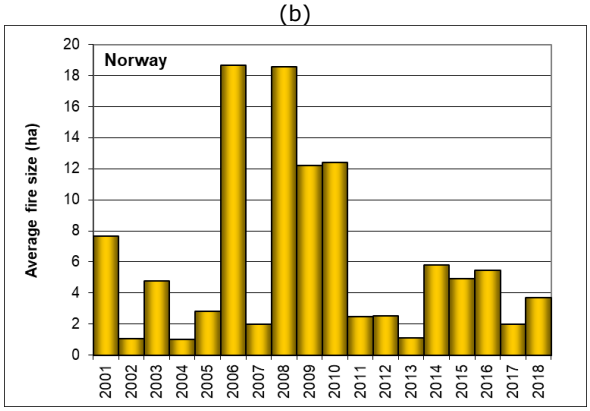
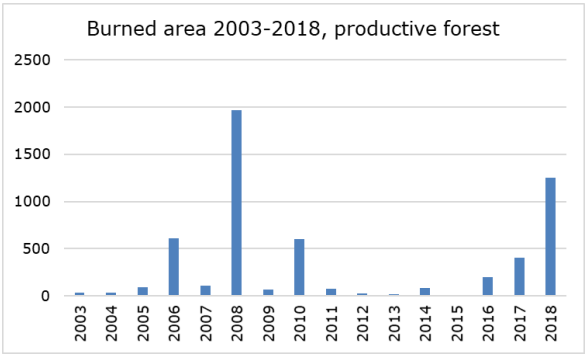


(c)

Figure 53. Burnt areas (a), number of fires (b) and average fire size (c) in Norway from 2001 to 2018.

Photo credit: Dag Botnen, Norway



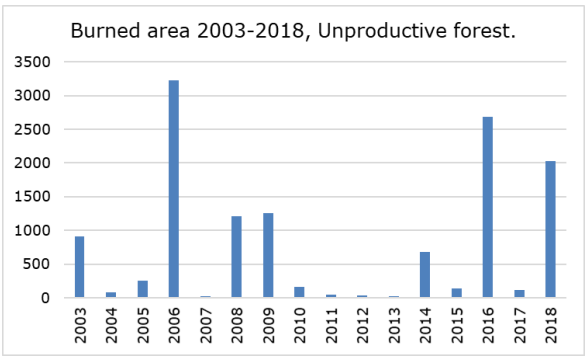


Figure 54. Burnt area of productive/unproductive forest in Norway 2001-2018.

Fire prevention activities

The municipalities are responsible for the Fire Services in Norway and the Fire Service is responsible for prevention and action regarded to the forest fires. Some activities are assigned to Governmental Authorities through the Directorate for Civil Protection.

Responsibilities: Directorate for Civil Protection:

- Establishment of frameworks for population and Fire Services through laws and regulations. In Norway is it by law prohibited using fires in the forest or wildland in the period from 15. April to 15. September.
- Following up and maintain agreement with air resources and coordinate placement and numbers of helicopters.
- Following up and maintain agreement with forest fire management support.
- Developing and maintaining system for statistics reporting fires (BRIS).

Responsibilities: Norwegian Meteorological Institute:

- Providing information on forest fire index through the internet and provide information through television (Forecast) when the forest fire index is high.

Responsibilities: Fire Service, municipalities:

- Prevention: risk analysis, monitoring (air / plane), exercises / skills, information / campaigns and prescribed burning.
- Preparedness: handling the fires with focus on the fire potential (initial attack).

Fire fighting means and information campaigns

The Directorate for Civil Protection has an agreement with a private helicopter company.

Normally, a helicopter is centrally located in the eastern part of Norway. Through the agreement it is possible to increase the number of helicopters and location of these if the fire risk is high. The company has 8 locations in Norway and has agreements with other partners.

Helicopters are available for Fire Services in the period from 15 April to 15 September (24/7). For 2018, the helicopter(s) were used in 140 fires with approximately 520 hours in the air. Use of helicopter(s) for exercises were only 3 hours.

The Directorate for Civil Protection has established an expert team that supports the local fire chief officer when they have large forest fires and when the helicopter is received.

Norwegian fire services consists of 4 000 full-time and 8 000 part-time firefighters where the fire department is an all-risk service. For those municipalities that have significant forest fire risk, there are groups established only for fighting forest fires. These groups are managed by the fire services.

In 2018, there was focus on information regarding the high forest fire risk. The Directorate for Civil Protection, municipalities and the fire services provided information through local and national press and media, via social media and it became a general understanding of the situation among the public. This is probably one explanation for a low number of fires despite the high fire risk.

Photo credit: Dag Botnen, Norway

Photo credit: Dag Botnen, Norway

Research activities aimed at improving fire management

There are no ongoing research activities regarding forest fires.

Climate change

Climatic conditions and how they impacted the fire season

Climate changes in Norway leads to higher air temperature and it is expected that there will be more precipitation, but also droughts due to increased temperature.

The consequences of this are increased growth in grass, shrubs and trees. This leads to overgrowing of cultural landscapes, a longer fire season and larger fires as a result of more fuel.

National adaptation strategies / plans and in particular regarding plans to adapt the forest sector to climate change in order to limit forest fire risks.

The Directorate for Civil Protection has started an analysis to adapt the national preparedness to large forest fires. It will at a later stage be made a preventive analysis.

Operations of mutual assistance

None.

Loss of human lives

A firefighter in Akershus lost his live on 15 July 2018 while fighting a forest fire.

Photo credit: Dag Botnen, Norway

(Source: Directorate for Civil Protection (DSB), Norway).

1.2.17 Poland

Fire danger in the 2018 season

The weather conditions had influence on the forest fire danger risk trend in the year 2018. They were the most favourable to the occurrence of fires not only in comparison to the last years 2012-2017, but also to all years after the year 2001.

The diagrams (Figure 55 - Figure 59) show the variations of air temperatures, precipitation, relative air humidity, pine (*Pinus sylvestris* L.) litter moisture, and the national degree of forest fire danger risk (NDFFDR) in the 2018 fire season (April-September). They also present the number of fire outbreaks.

The mean monthly air temperature was 18.0°C at 9 a.m. and 23.5°C at 1 p.m. These were the highest average seasonal air temperatures noted since the year 2001. For comparison, the average from years 2001-2010 were 16.0°C at 9 a.m. and 21.0°C at 1 p.m., and in the year 2017 only 15.3°C and 19.5°C respectively. The average monthly air temperatures in the year 2018 were also higher in comparison to all previous years.

In April, the coolest month of the season 2018, the mean monthly air temperature reached 12.7°C at 9 a.m. and 19.0°C at 1 p.m. These temperatures were higher, in comparison to 2017, by about 1.4°C in the first observation term and up to 7.8°C in the second. In May the average air temperature reached 18.5°C at 9 a.m. and 23.9ºC at 1 p.m.

In June followed the further growth of the average monthly air temperature to 20.0°C at 9 a.m. and to 24.4°C at 1 p.m. The highest average monthly air temperatures were observed in July and August. In the morning they reached 21.2°C and 20.8°C respectively, and in the afternoon: 25.7°C and 26.6°C.

In September the air temperature decreased, and reached 14.5ºC at 9 a.m. and 21.4ºC at 1 p.m. The maximum air temperatures oscillated from 27.8 °C (April) to 33.1°C (August). It is also necessary to mark, that in October (not reckoned as part of the fire season) high air temperatures remained, favouring the occurrence of a great number of forest fires in this month.

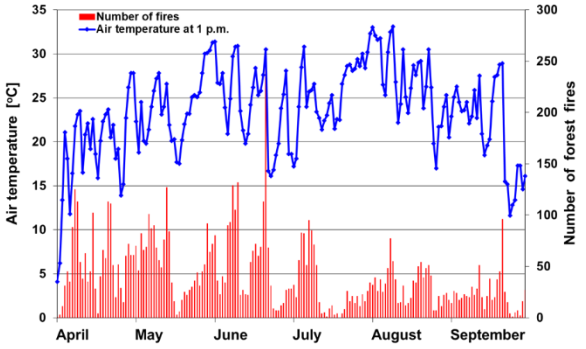


Figure 55. Air temperatures and numbers of forest fires in fire season 2018.

The average precipitation level in the fire season was 1.8 mm, and it was the lowest in comparison to years since 2001, except the year 2015 (1.5 mm). For comparison, the average precipitation level from 2001-2010 was 2.7 mm, and in 2017 it was 2.9 mm. Almost all the fire season was characterised by a small quantity of rainfall. Only in July it was decidedly above the average for the fire season, because it reached 3.4 mm, and in the remaining months reached 1.5 mm. The maximum value of rainfall (20.1 mm) in the 2018 fire season was noted in July.

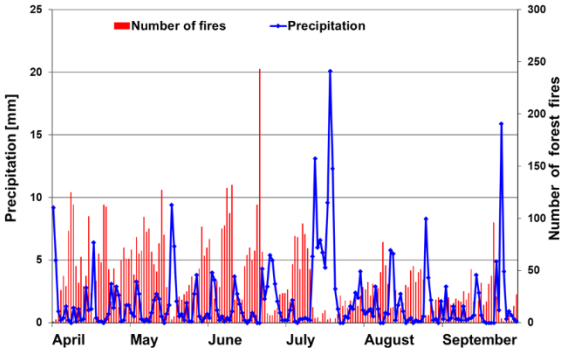


Figure 56. Precipitation and numbers of forest fires in fire season 2018.

Mean pine (*Pinus sylvestris* L.) litter moisture values (the reference fuel type in Poland's condition) were the lowest which appeared in years 2001-2018. They reached 26.8% at 9 a.m. and 21.3% at 1 p.m., below the security level in respect of fire for dead pine litter, amounting to 30%. For comparison the average from years 2001-2010 amounted to 31.0% and 26.0%, and in the year 2017 to 35.2% and 29.8% respectively. Below average mean litter moisture values for the 2018 fire season were noted in both of the observation terms in May (23.5% at 9.00, and 17.4% at 1 p.m.), June (respectively 23.6 and 18.7%) and August (respectively 25.1 and 19.6%). In April, July and September mean litter moisture values were above the average for the 2018 fire season. They oscillated within the range of 28.7-30.1% at 9 a.m. and 22.9-24.8% at 1 p.m.

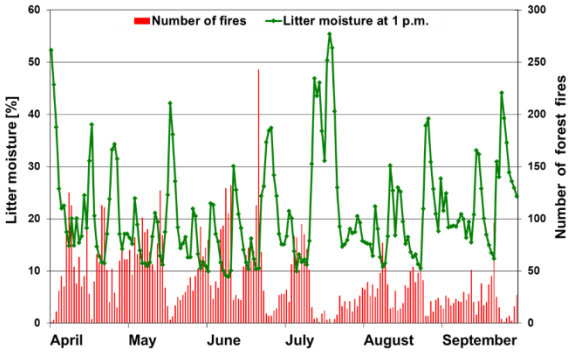


Figure 57. Litter moisture and numbers of forest fires in fire season 2018.

The mean relative air humidity for the 2018 fire season reached 73.6% at 9 a.m. and 50.6% at 1 p.m. They were lower in comparison to years 2001-2010, when they reached 76% and 55%, and in the year 2017 78.8% and 61.5% respectively. The lowest values at 1 p.m. (below the average for the 2018 fire season) were observed in May (44.6%), June (48.8%), April (48.8%) and August (50.1%). The higher values of relative air humidity from the average for the fire season appeared in July (55.7%) and September (54.5%).

In the morning term of observation the relative air humidity was below the average for the fire season only in May (64.5%) and June (66.1%). Whereas the highest mean relative air humidity was observed in September (87.1%), and in the remaining months it was within the range 74.2-75.5%.

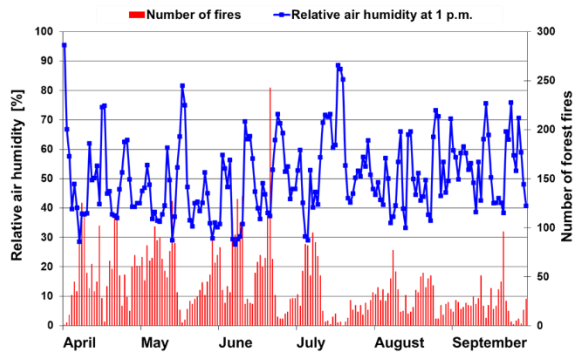


Figure 58. Relative air humidity and numbers of forest fires in fire season 2018.

The average national degree of forest fire danger (NDFFDR) in the four-degree scale (0, 1, 2, and 3) reached 1.2 at at 9 a.m. and 1.5 at 1 p.m. This means that the fire danger in the whole analysed period was moderate. In comparison to the 2017 year followed the growth of danger, because in this year NDFFDR reached 0.8 and 0.9 respectively.

The greatest forest fire danger occurred in May and June, when NDFFDR reached 1.5 at 9 a.m., and at 1 p.m. 2.0 in May and 1.7 in June. In these two months the percentage of occurrence in the third level of forest fire danger reached about 30. The lowest forest fire danger was in September, when NDFFDR reached 0.8 in the morning, and 1.2 in the afternoon, and share of occurrence in the third level of forest fire danger was incidental.

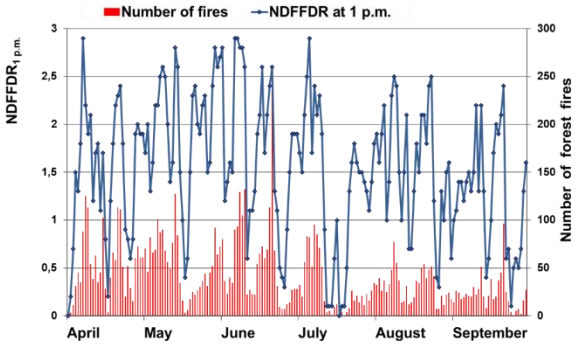


Figure 59. The National Degree of Forest Fire Danger Risk and numbers of forest fires in fire season 2018.

Fire occurrence and affected surfaces

In 2018 in Poland, a total of 8 867 fires broke out (5 947 in forest and 2 920 in other non-wooded natural land), over 5 275 more than in 2017 (3 592 fires), with a surface area of 2 696 ha (2 047 forest and 649 ha other non-wooded natural land), over 1 673 ha more than in the last year (1 023 ha) - Table 18 and Figure 62.

The greatest proportion of fires occurred in June (19.6%; i.e. 1 735) - Figure 60. This was followed by May (19.0%), April (17.7%) and August (11.0%). The lowest number of fires in the fire season (April-September) occurred in September (7.9%) and July (10.1%). 85.3% of fires occurred in the fire season.

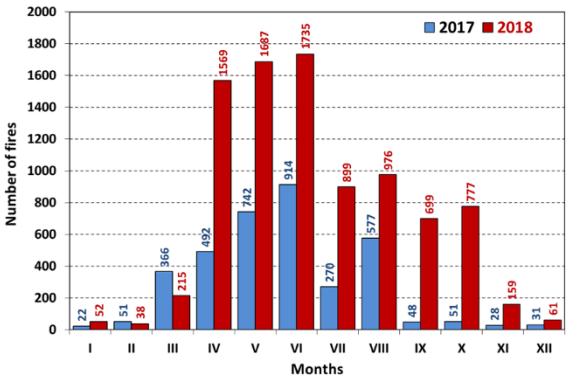


Figure 60. Distribution of number of forest fires by months in 2017 and 2018 in Poland.

The largest number of fires in 2018, similar to last year, occurred in Mazowieckie Province (2 110 - 23.8%).

The lowest number of forest fires occurred in Opolskie Province (165), Warnińsko-Mazurskie Province (169), and Małopolskie Province (236). These data are illustrated in Figure 63 - Figure 65.

The largest burnt forest areas were recorded in:

- Mazowieckie Province (502 ha),
- Dolnośląskie Province (485 ha),
- Zachodniopomorskie Province (226 ha).

The smallest area was in Opolskie Province (41 ha) and Pomorskie Province (58 ha).

Small forest fires; i.e. with a surface area of less than 1 ha, represented 95.14% of all the forest fires in 2018 (Figure 7), with the burnt area amounting to 40.49%.

Fires with a surface area of between 1 ha and 10 ha represented 38. 68% of the burnt area, with their number representing only 4.75%.

In addition there were 9 large fires (10-100 ha) representing 9.37% of the burnt area, and one very large fire (>100 ha) which represented 11.46% of the burnt area.

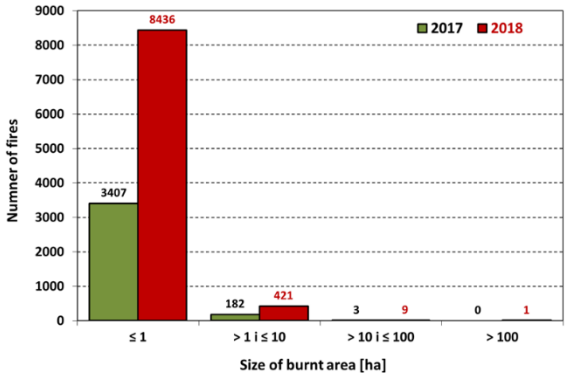


Figure 61. Distribution of the number of forest fires by size of burnt area in the years 2017 and 2018 in Poland.

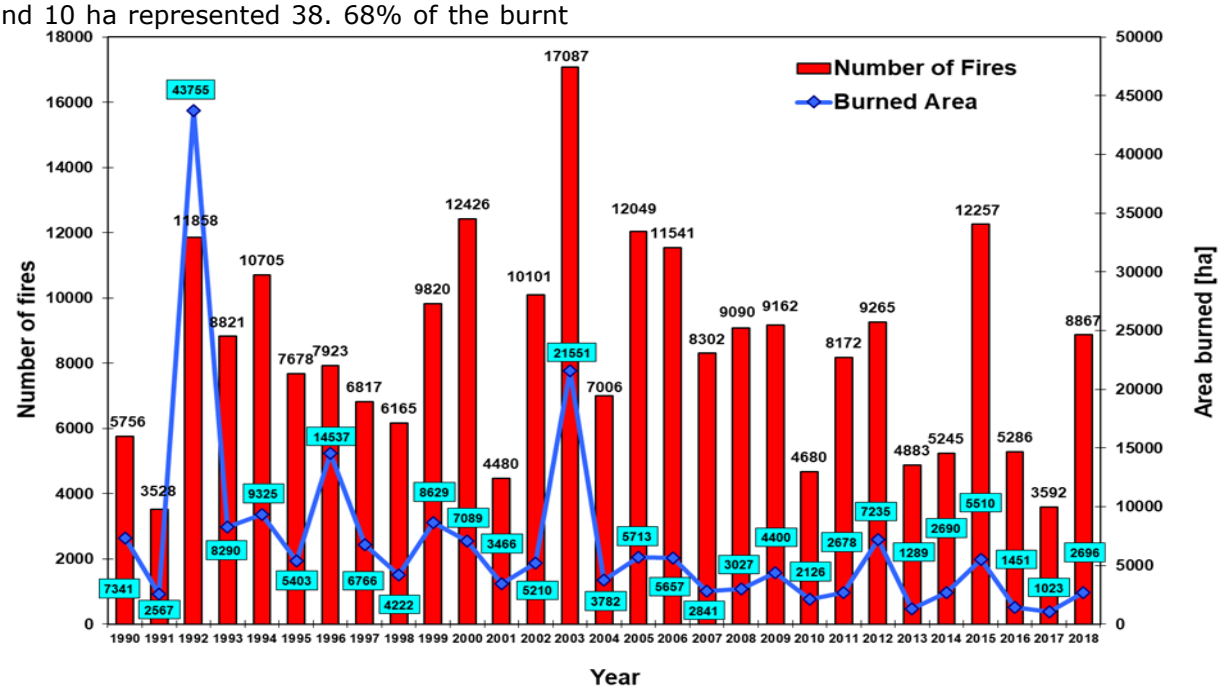


Figure 62. Total number of fires on high forest and area burned in Poland in the period 1990-2018.

Table 18. Forest fires in Poland in the period 2007-2018.

Year	Number of fires			Burnt area (ha)		
	Forest	Non wooded	Total	Forest	Non wooded	Total
2007	5 086	3 216	8 302	1 642.64	1 198.24	2 840.88
2008	5 568	3 522	9 090	1 810.74	1 216.39	3 027.13
2009	5 633	3 529	9 162	2 524.58	1 875.90	4 400.48
2010	2 975	1 705	4 680	1 358.26	767.98	2 126.24
2011	5 126	3 046	8 172	1 526.11	1 151.66	2 677.77
2012	5 752	3 513	9 265	4 781.65	2 453.62	7 235.27
2013	3 168	1 715	4 883	810.42	478.12	1 288.54
2014	3 603	1 642	5 245	1 956.90	733.55	2 690.45
2015	8 292	3 965	12 257	3 765.87	1 744.03	5 509.90
2016	3 545	1 741	5 286	862.37	588.68	1 451.05
2017	2 334	1 258	3 592	692.73	329.80	1 022.53
2018	5 947	2 920	8 867	2 047.26	648.87	2 696.13

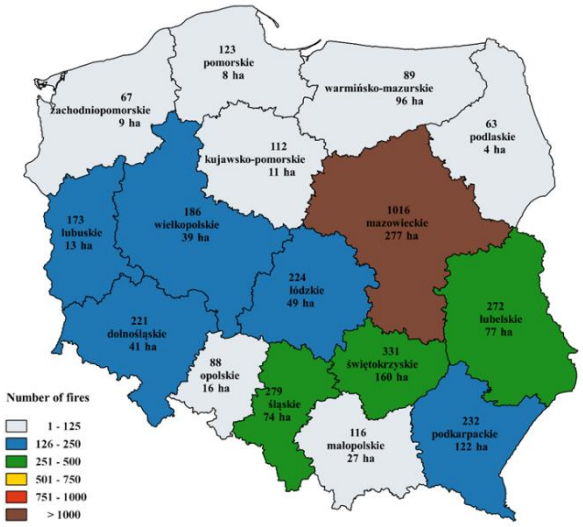


Figure 63. Number of forest fires and burned areas by provinces (NUTS2) in 2017.

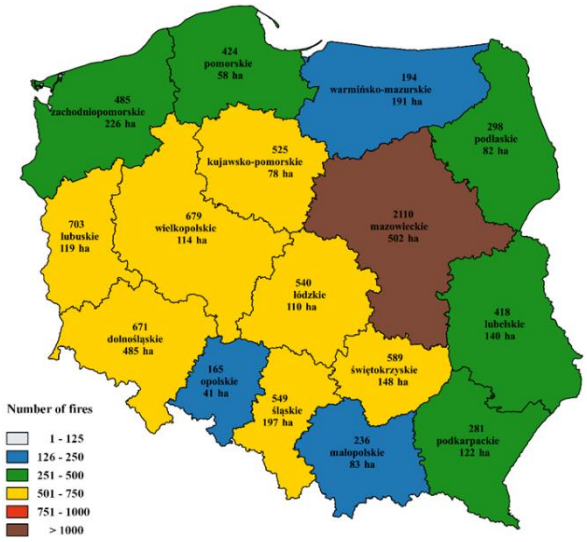


Figure 64. Number of forest fires and burned areas by provinces (NUTS2) in 2018.

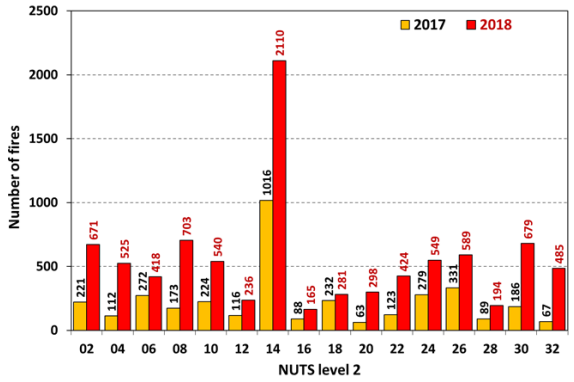
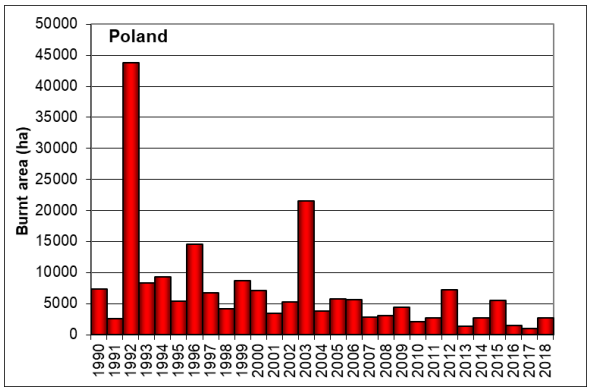


Figure 65. Distribution of the number of forest fires by province (NUTS2) in 2017 and 2018 in Poland.

The burnt area, number of fires and average fire size for the years 1990-2018 are shown in Figure 66.



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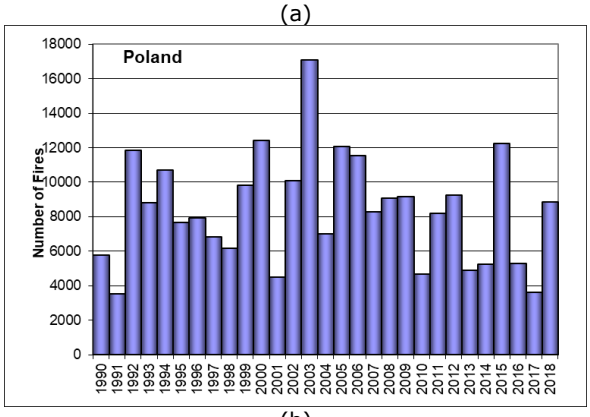

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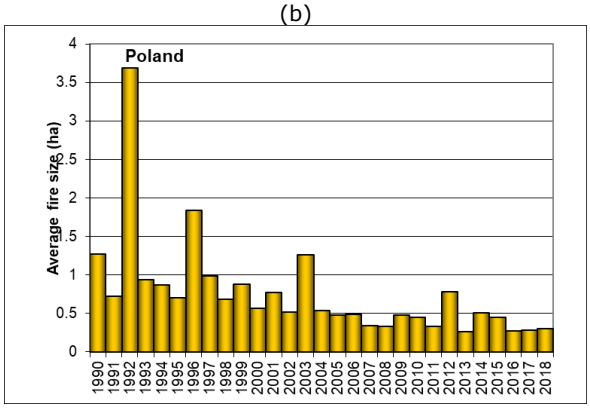


(c)

Figure 66. Burnt areas (a), number of fires (b) and average fire size (c) in Poland from 1990 to 2018.

Fire causes

Human activity was the main cause of forest fires; specifically arson represented almost half of the fires (40.78%), followed by negligence (27.01%) and accident (4.72%), whereas unknown causes accounted for 26.5% (Figure 67).

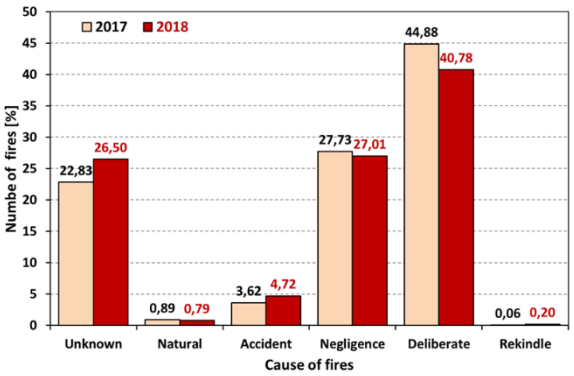


Figure 67. Distribution of the number of forest fires by causes in 2017 and 2018 in Poland.

Fire fighting means and information campaigns

The "State Forests" National Forest Holding (State Forests NFH) had at its disposal equipment, consisting of:

- 35 fire suppression airplanes and 4 helicopters,
- 355 patrol and fire suppression vehicles,
- 5 medium and 3 heavy vehicles,
- 257 portable pumps.

These means were used to extinguish 4% of all the fires in the areas managed by the State Forests NFH, whereas the other fires were suppressed by units of the State Fire Service and voluntary fire brigades.

In 2018, as part of information and promotion activities, the following measures in the State Forests NFH were taken:

- more than 10 thousand lectures in schools, youth camps and at country-meetings,
- more than 1 thousand appeals concerning the forest protection against fires were provided on the radio and the television,
- 224 contests devoted to the forest fire protection were organized,
- more than 104 thousand posters, information leaflets and calendars related to forest fires were disseminated,
- more than 3.5 thousand information boards were erected.

Fire prevention activities

In forest areas managed by the State Forests NFH, works were carried out to prevent the conditions for fire outbreaks and to reduce their spread, by repairing 4 084.57 km of fuel breaks and building 79.12 km of new fuel breaks; in addition, forests were cleaned over a surface area of 20.2 thousand ha, by reducing the quantity of inflammable biomass.

The observation system of the State Forests NFH consisted of:

- 659 fire protection lookout points, including 262 (39.76%) equipped with a system of TV cameras;
- 7 patrol airplanes;
- 355 ground patrols.

The effectiveness rate of fire detection by fire protection lookout points was 35.5%, airplanes detected 1.4% of fires and civilians notified of 57.2%. The other 5.9% of fires were detected by fire protection patrols.

The communication and alarm network in the State Forests NFH consisted of: 6 438 radio-telephones, including 1 131 base sets, 2 324 mobile sets and 2 983 hand held sets, as well as 95 converters to the frequency band used by the State Fire Service.

Water supply for fire suppression purposes was provided by 11 707 water supply points, including about 4.3 thousand natural points and over 2.6 thousand artificial ones. Moreover, water was supplied by more than 4.7 thousand hydrants located in the vicinity of forests.

In 2018, the fire protection costs incurred by the State Forests NFH amounted to 92.3 million PLN.

Information on Poland's National Forest Fire Information System can be found on: http://bazapozarow.ibles.pl/ibl_ppoz/faces/index.jsp.
Poland's Forest Fire Danger Map, which is updated daily from March to October (at 9 a.m. and at 1 p.m.), is shown on http://bazapozarow.ibles.pl/zagrozenie/

(Source: Forest Research Institute, Forest Fire Protection Department, Poland).

1.2.18 Portugal

Fire danger in the 2018 fire season

In Portuguese mainland territory (NUTS 1 PT1) the burnt area in 2018 was 44 578 ha. The burnt area represents 68% of the average of the previous decade which was 140 620 ha. Regarding the number of rural fires, there was a total of 12 273 fires in 2018, which represents a decrease of 44% when compared to the average of fires in the last decade and a decrease of 58% compared with 2017.

At Madeira's archipelago (PT3), 63 rural fires were recorded in 2018. The total burnt area in this region was 178.9 ha (89.2 ha in forest and other wooded lands and 89.7 ha in shrublands).

According to the information provided by the Portuguese Sea and Atmosphere Institute (IPMA), the meteorological daily severity index (DSR), derived from the Fire Weather Index, shows the evolution of the fire risk in an operational perspective for the year 2018 (Figure 68).

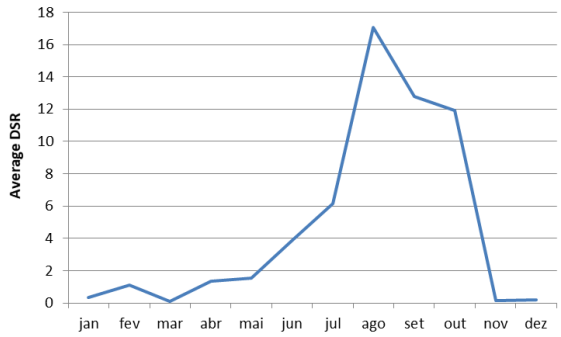


Figure 68. DSR variation in 2018.

Fire occurrence and affected surfaces

In 2018 the Portuguese Mainland registered a total of 12 273 rural fires, responsible for the burning of 44 578 ha (Figure 69). *Eucalyptus globulus* and *Quercus suber* stands were the forest cover most affected by fires.

About 45% of the occurrences (5 518) were reported between January and June, which burned about 5 166 ha (12% total burned area), as seen in Table 19.

In the summer period (July-September) about 4 825 rural fires occurred (39% of the total number of rural fires), which consumed approximately 35 476 ha (80% of the total burnt area).

In 2018, the most critical month was August, with 2 250 rural fires (18% total number of rural fires) and 31 166 ha (70% total burnt area).

Fire occurrence prevailed mostly in the high population density districts, such as Porto (North region), Braga (North region), Viseu (Centre region), Aveiro (Centre region) and Lisboa (Lisbon region) which registered 55% of the total number of fires.

The southern region of Algarve was the most affected by rural fires (26 994 ha – 61% of the total burnt area): Table 20.

Table 19. Rural fires in Portugal in 2018 (monthly distribution).

Month	Number of fires	Burnt area (ha)			
		Forest and other wooded land	Shrublands	Agricultural land	Total
January	149	3	120	15	138
February	1444	513	1321	86	1920
March	201	44	138	4	186
April	1056	724	852	5	1581
May	2085	524	558	22	1104
June	583	46	54	137	237
July	757	219	57	318	594
August	2250	17743	11607	1816	31166
September	1818	1516	1952	248	3716
October	1817	597	2792	500	3889
November	57	10	10	0	20
December	56	2	25	0	27
TOTAL	**12273**	**21941**	**19486**	**3151**	**44578**

Table 20. Number of fires and burnt areas in Portugal in 2018 (NUTS2).

PT1 - NUTS 2 Region	Number of fires	Burnt area (ha)			
		Forest and other wooded land	Shrublands	Agricultural land	Total
North	7106	2796	6993	134	9922
Centre	2865	991	1665	523	3179
Lisbon	920	163	468	158	790
Alentejo	1028	2180	356	1156	3692
Algarve	354	15811	10003	1180	26994
TOTAL	**12273**	**21941**	**19486**	**3151**	**44578**
Madeira	63	89.2	89.7	-	178.9

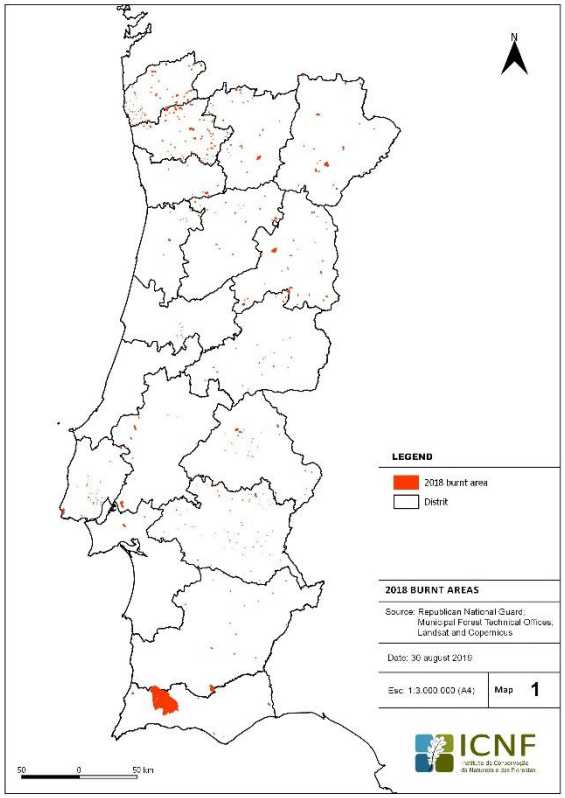
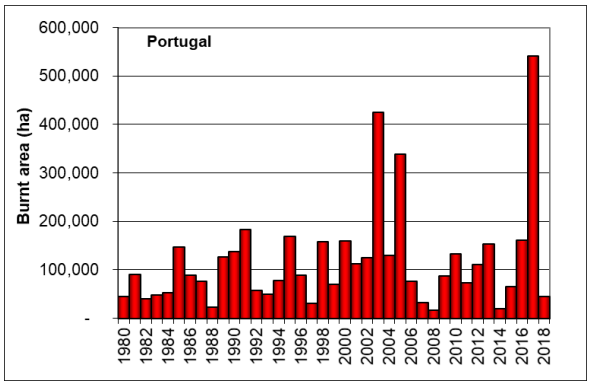


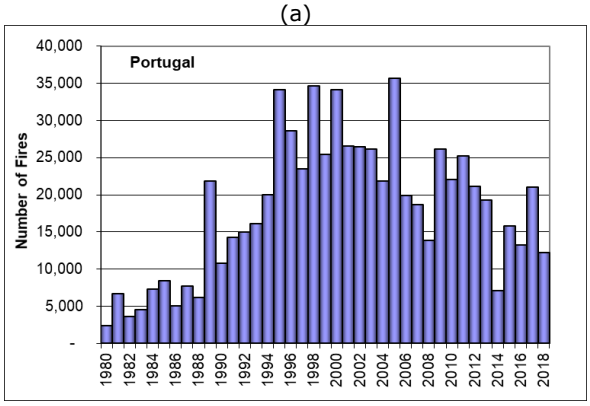
Figure 69. Burnt areas in 2018 (Portugal).

Portugal registered 25 large fires (>= 100 ha), which corresponded to 77% of the total burned area. There were 4 fires larger than 500 ha, which burned 29 157 ha. The largest fire of 2018 occurred in Faro district (NUTS 2 Algarve), which burned 27 764 ha, and lasted from the 3rd to the 10th of August.

The analysis of the yearly trends in the number of fires and burnt areas in Portugal is shown in Figure 70.



(a)



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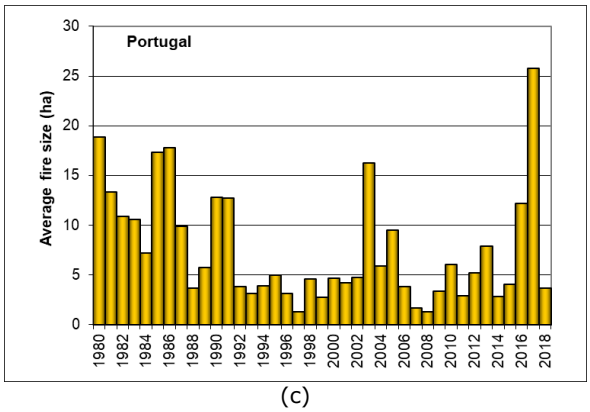


(c)

Figure 70. Burnt areas (a), number of fires (b) and average fire size (c) in Portugal 1980-20187.

Fire causes

Of 12 273 occurrences registered in 2018, the National Guard proceeded with the investigation of causes for 10 278 forest fires (82%), of which 3 813 were of unknown origin (Figure 71).

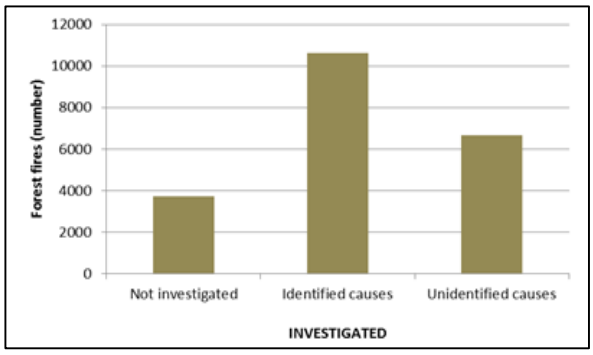


Figure 71. Criminal rural fires 2018 investigation

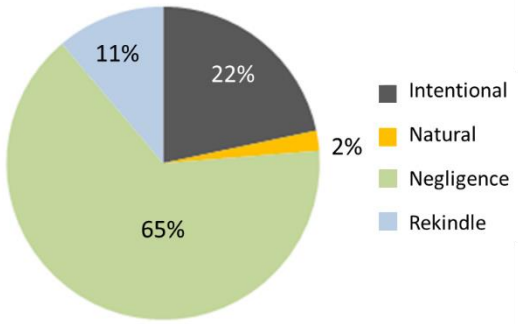


Figure 72. Main causes of rural fires 2018.

Amongst those fires with determined cause, intentional acts corresponded to 32.4% and accidents or negligence were present in the ignition of 49.7% of the total number of fires (Figure 72). The use of fire for renewal of shrub pastures in mountain grazing areas still has a strong impact on the total burnt areas.

Forest fire planning

The Institute for Nature Conservation and Forests (ICNF) kept its efforts in the forest fire planning at the local, municipal and regional (district) levels. The municipal planning objective is pursued by the municipal forest technical offices (GTF), based on the municipal plans for forest fire prevention (PMDFCI, 5 year planning) and the municipal operational plans, which are part of the PMDFCI and are updated on a yearly basis.

The GTF provided technical support to the municipal commission for forest protection. By the end of 2018 there were 267 GTF established and 227 updated PMDFCI.

The regional level planning (for the entire Mainland) is assured by 18 regional forest plans updated before each summer in cooperation with municipalities and district commands for relief operations, at the district level.

<u>Forest fuels management</u>

Forest fuels management is one of the key-actions in the forest fire prevention domain. In 2018, a total area of 60 158.4 ha was managed. A total area of 1 101 hectares was managed with prescribed burning.

<u>Water reservoirs</u>

During 2018, 636 water reservoirs (including water tanks) were renovated and 29 new water reservoirs were created.

<u>Forest roads</u>

In 2018, 23 125 kilometres of forest roads were managed.

(*Sources: Ministry of Agriculture, Rural Development and Fisheries - National Forest*

Authority and National Authority for Civil Protection, Portugal).

1.2.19 Republic of North Macedonia

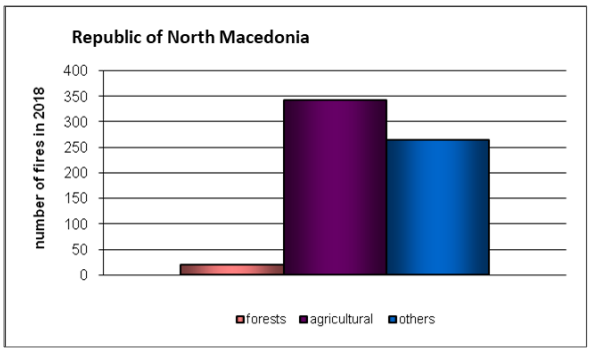
Fire danger in the 2018 fire season

The fire danger in the 2018 season in Macedonia settled at a low level. The number of wildfires and the total burnt area was low. The number of fires was influenced substantially by the weather conditions in summer. The majority of fires occurred during the summer months.

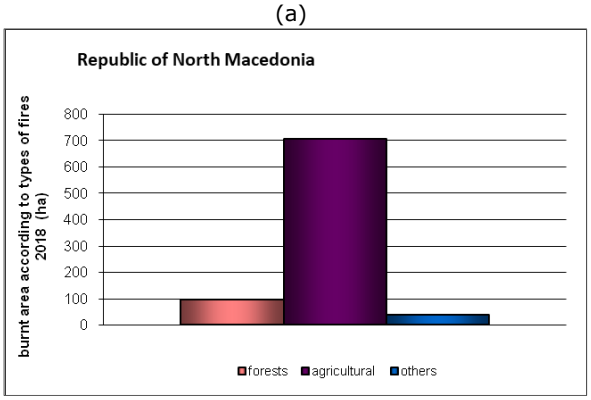
Fire occurrence and affected surfaces

During the year 2018 there were 626 fires of which 19 were forest fires, affecting a total area of 94.8 ha. The affected agricultural area was 707.1 ha and the total affected area was 840.3 ha. 3.03 % of the total number of fires were forest fires.

The comparative charts for burnt area, number of fires and average fire size for the years 2007-2018 as well as the number of fires and burnt area according to types of fires for the year 2018 are shown in Figure 73 and Figure 74.

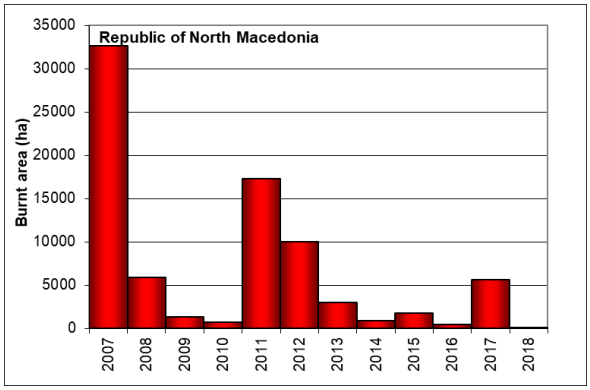


(a)

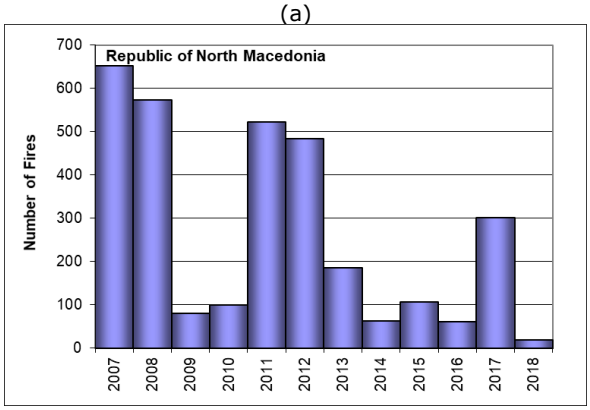


(b)

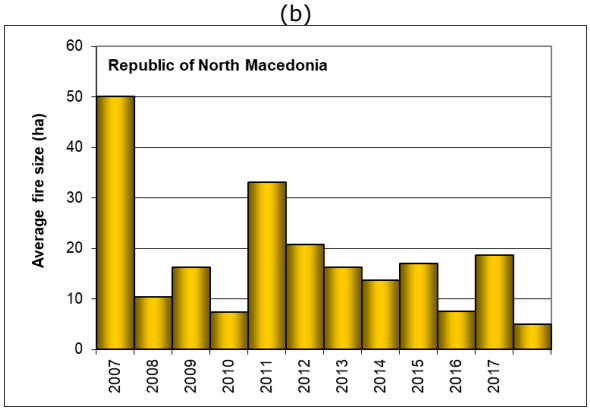
Figure 73. Number of fires (a) and burnt area (b) according to the type of fires in 2018.



(a)



(b)



(c)

Figure 74. Burnt areas (a), number of fires (b) and average fire size (c) in the Republic of North Macedonia from 2007 to 2018.

Fire prevention activities and information campaigns

Fire prevention and fire-fighting activities were undertaken along with public information campaigns. For the purpose of awareness raising, media events such as press conferences, short reports and announcements on the TV and radio were organized.

There was regular cooperation between the Macedonian Hydro Meteorological Service and Protection and Rescue Directorate.

In accordance with article 5 paragraph 1 item 3 of the Law on Protection and Rescue and article 54 of the Law on Forests (which require all entities, including citizens, to fulfil the obligation for fire protection in forests), the regional units for protection and rescue organised working meetings in the period May-June 2018 with all competent entities including fire brigades, forestry companies, local self-government, public enterprises, institutions and services in connection with undertaking preventive and operational measures for protection against forest fires.

Climate Change

In cooperation with the Ministry of Environment, there is under development National adaptation strategies / plans to adapt the forest sector to climate change in order to limit forest fire risks. National plans provide mitigation and adaptation measures to climate change, and any other information that the government considers relevant to achieving the UN climate change goal.

There is developed Communication strategy and action plan on climate change. Modelling the impacts of climate change on forestry. Increasing the number of forest fires is one of the most frequently perceived consequences of climate change.

The Forestry Sector in the Republic of Macedonia is expected to suffer significant impacts of climate change, especially boreal forests, on which impacts can be really serious. In order to mitigate these impacts and to derive maximum economic benefit from forestry, the Report proposes an Action Plan containing short-term and long-term adaptation measures.

There was developed vulnerability assessment forestry from climate change and possible adaptation measures and it is part of the Third National Climate Change Plan.

Research activities aimed at improving fire management

According to research taken and peer review there is a need for reform, in order to improve fire management

Operations of mutual assistance and loss of human lives

No operations of mutual assistance were taken and no casualties were reported in Macedonia during the fire season of 2018.

(Source: Protection and rescue Directorate, Department for analysis and research, the Republic of North Macedonia)

1.2.20 Romania

Meteorological characteristics during 2018

In 2018, the mean annual national temperature (10.4°C) was +1.2°C higher than the standard climate normal (1981–2010). The year 2018 was ranked the third warmest year in the 1901-2018 period. Positive deviations of the mean monthly temperature against the normal standard climate of each month were recorded in 9 months, ranging between 0.3°C (February) to 4.6°C (April).

The annual precipitation amount in Romania (698.8 mm) was 10% higher than the standard climate normal (1981–2010). Deviations were positive in 8 months, ranging from 16% in January to 92% in March. The maximum annual precipitation amount was recorded at the meteorological station Stâna de Vale (1839 mm) and the lowest in Sulina (296 mm).

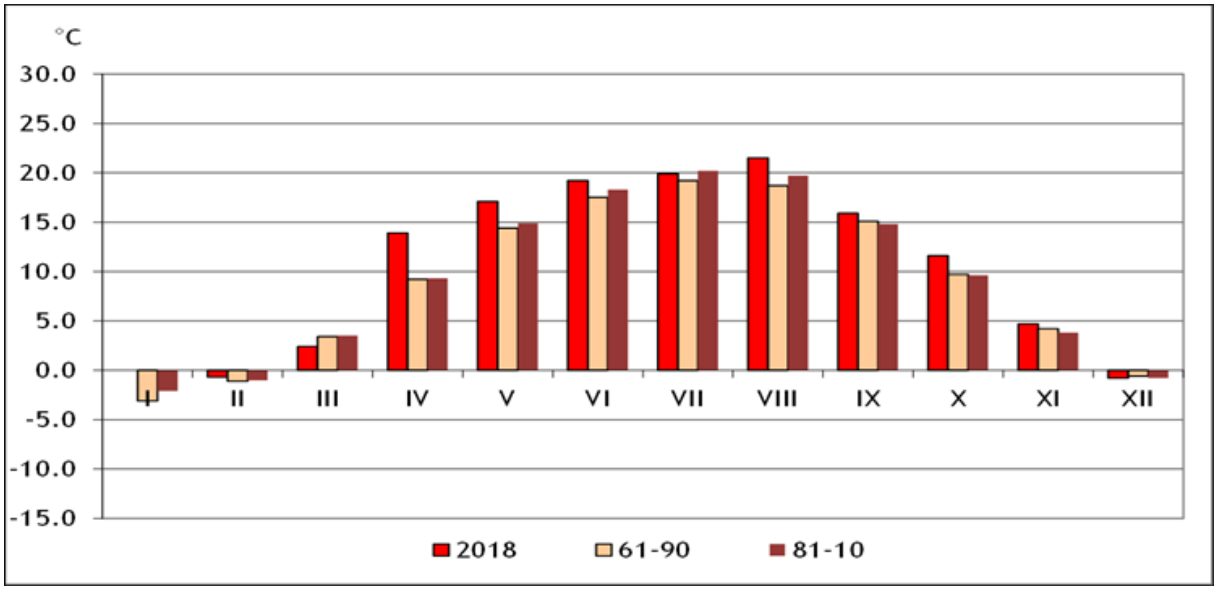


Figure 75. The national mean monthly temperature in Romania in 2018, compared with the standard climatologically normal (1961-1990, 1981-2010)

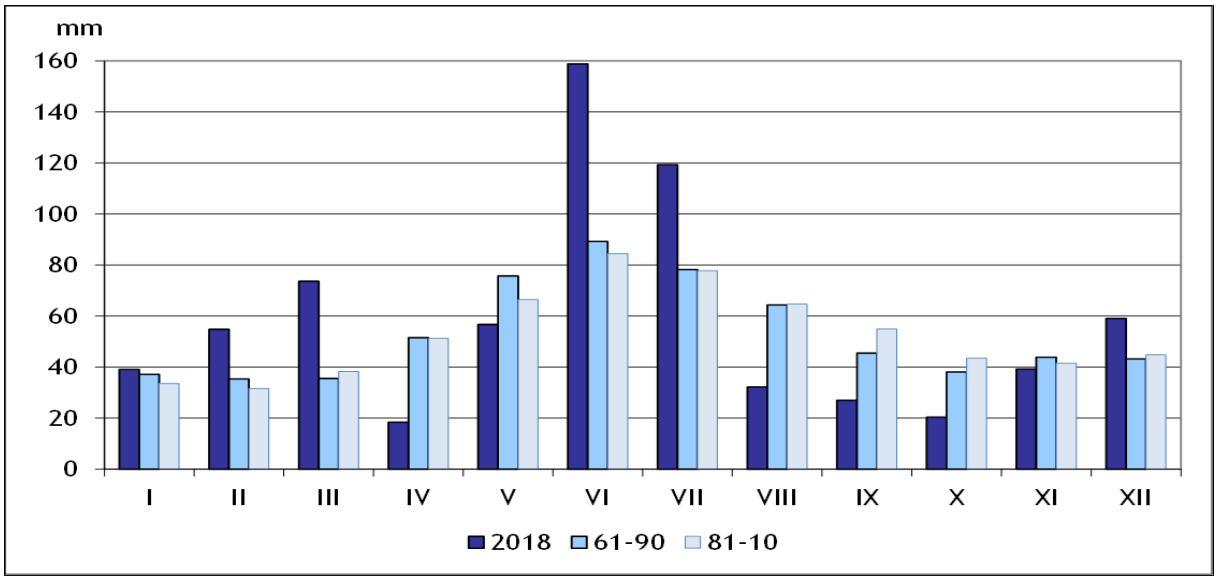


Figure 76. The national mean monthly precipitation amount in Romania in 2018, compared with the standard climatologically normal (1961-1990, 1981-2010)

Fire occurrence and affected surfaces

In 2018, 158 forest vegetation fires were recorded at national level, affecting 1 341.25 ha, of which 156 fires occurred on 1 336.25 ha in the national forest, and 2 fires occurred on 5 ha in forest vegetation, located on land outside the forest.

As a result of the fires, an estimated damage of 30 thousand Euro occurred, burning 48 thousand seedlings of plantations and natural regenerations plus 470 cubic meters of standing or under operation timber.

The periods with a high number of fires occurred in autumn (in the period between October 26 – November 11 there were 57 fires burning a total of 960 ha). The principal cause was the fire propagation from pastures and farming land, on drier, warmer and windy weather.

A summary of the number of fires and total burnt area by cause, land ownership and fire type is presented in Table 21-Table 23.

Table 21. Causes of forest fires.

Cause of fire	EFFIS code	Number of fires	Burnt area (ha)
Unknown	100	43	109.28
Lightning	210	1	0.2
Vegetation management	411	84	1160.67
Agricultural burning	412	30	71.1

Table 22. Nature of the affected property.

Property type	Number of fires	Burnt area (ha)
State public property	104	1003.2
Communities public property	15	77.29
Private property	43	260.76

(4 fires common on State and private property)

Table 23. Type of fire.

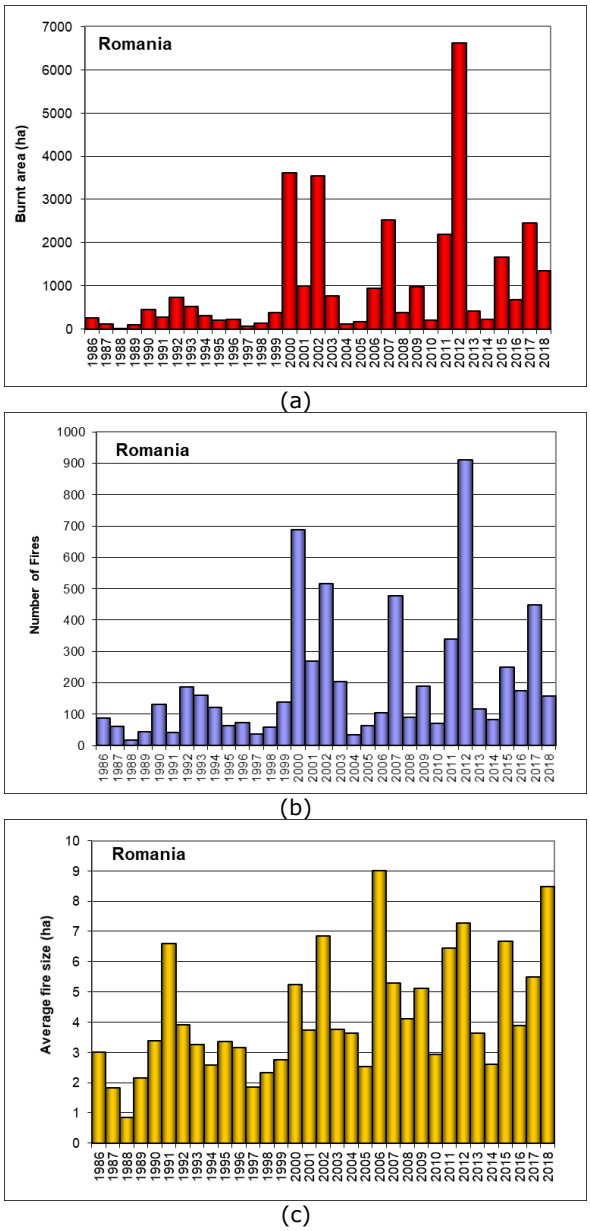
Fire type	Number of fires	Burnt area (ha)
Litter fires	150	1326.01
Mixed fires (litter, canopy)	8	15.24

In 2018, there were 4 important forest fires as follows:

-In spring, a forest fire of 56 ha, extinguished after 11 days and another one in high mountains, of 4 ha, extinguished after 18 days.

-In autumn, a forest fire of 264 ha and another one of 84.9 ha, extinguished after respectively 4 and 5 days.

The burnt area, number of fires and average fire size for the years 2000-2018 are shown in Figure 77.



(a)

(b)

(c)

Figure 77. Burnt area (a), number of fires (b) and average fire size (c) in Romania from 1986 to 2018.

Fire fighting means

Firefighting actions involved a total of 5 519 people, of which:

- Forest rangers – 1 596 people
- Military and civilian fire-fighters – 2 243 people
- Policemen and gendarmes - 365 people
- Citizens – 1 315 persons.

For the next period, we intend to update the technical instructions and specific legislation, in order to prevent more efficiently and to decrease the number of forest fires.

(*Source: National Meteorological Institute, Ministry of Waters and Forests, Romania*).

1.2.21 Russian Federation

Fire danger in 2018

The indicators of fire season 2018 exceeded the average annual data. Meteorological conditions in the Far East were characterized by earlier snow melt, low snow cover in winter, as well as arid weather conditions of early spring compared with the 2017 season.

The frequency of development of anticyclones increased contributing to the establishment of weather conditions without precipitation.

The first forest fire occurred on January 7 in Primorsky Krai (Far East). Traditionally the fire season is divided into three periods: spring, summer and autumn. Extreme fire danger rating was observed in early Spring in Primorski krai (Far East), Baikal Lake area and European part of Russia.

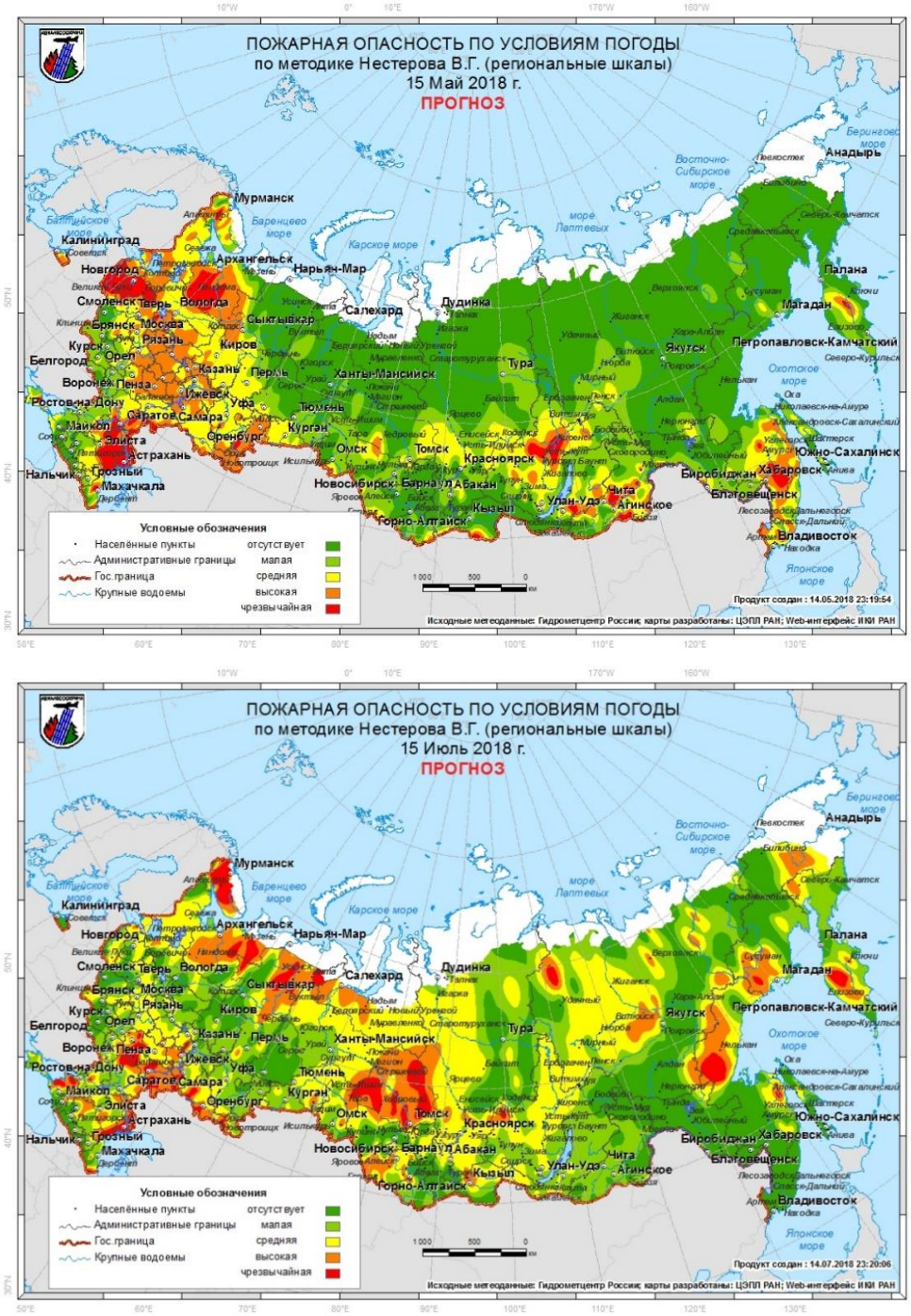


Figure 78. Fire danger rating based on the Nesterov Index in early spring (top) and 15 July (bottom).

Fire occurrence and affected surfaces

The highest number of fires and area burned in the summer period was observed in the Krasnoyarsk and Irkutsk regions (Siberia), Amurskaya oblast, Republic of Sakha - Yakutia, and Khabarovski krai (Far East). The share of these regions accounts for about 90% of the area burned in the Forest Fund of Russia during this period. There were high and extreme fire danger ratings all through the summer period.

There were 4 603 fires on the forest fund territory and the area burned 696 040 hectares, including 572 369 hectares (covered by forest) during the summer period. In comparison with the average five-year data the number of fires decreased by 1.2 times, and the area burned also decreased by 1.8 times (Figure 79).

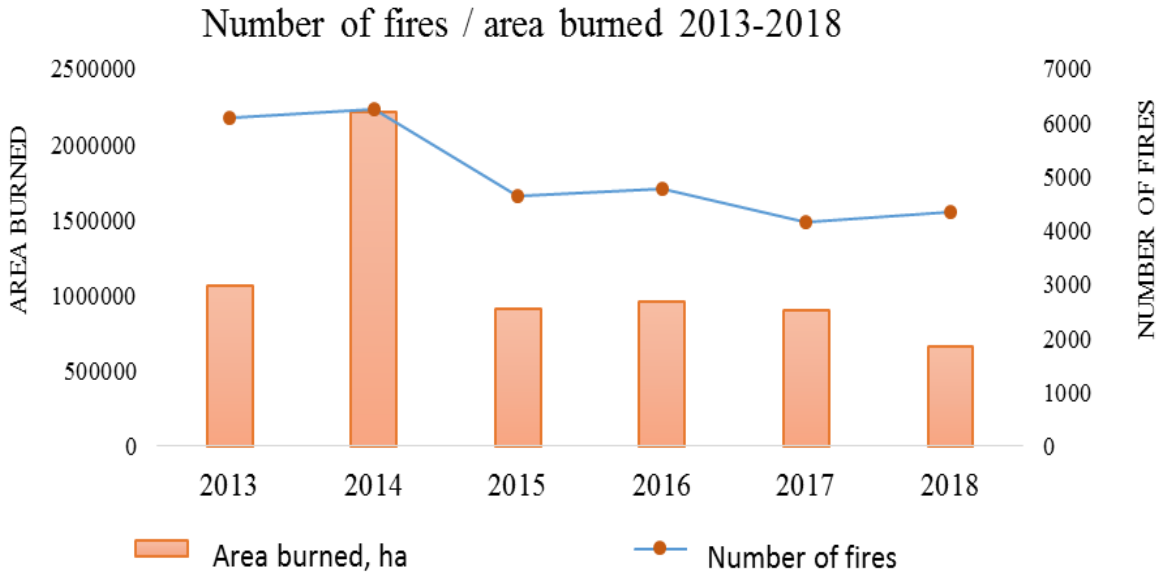


Figure 79. Number of fires and burnt area, ha (summer period) 2013-2018.

Fire causes

Most fires in the Spring were ignited due to carelessness, and as a result of the transfer of fires from other land categories. In the Summer period maximum temperatures were observed and most fires occurred due to carelessness and as a result of thunderstorm activity. In the Autumn period only the anthropogenic factor was a cause of fires.

Fire fighting means and fire prevention activities

Under the plan of interregional assistance, over 60 deployments were provided with a total of 1 755 firefighters to stabilize the forest fire situation and eliminate the emergency regime in the forests of 7 regions with the most difficult forest fire situation.

Rain seeding operations continued in 2018 in the areas with most fires.

(*Source: Aerial Forest Fire Centre, Russian Federation*).

1.2.22 Slovakia

Fire danger in the 2018 fire season

The fire danger was high in the beginning of the season in some part of country. The amount of wildfires increased and the average size was decreased compared with last year. The number of fires was influenced substantiality by the rain and the human factor (negligence, particularly) in spring and summer.

Fire occurrence and affected surfaces

A total number of 262 forest fires was reported in Slovakia in 2018, corresponding to a total burnt area of 248.38 ha. The average burned forest area per fire was 1.83 ha.

The biggest fire occurred on 03/05/2018 around the Vysoké Tatry and damaged 10 hectares of coniferous forest. The cause of the fire was negligence.

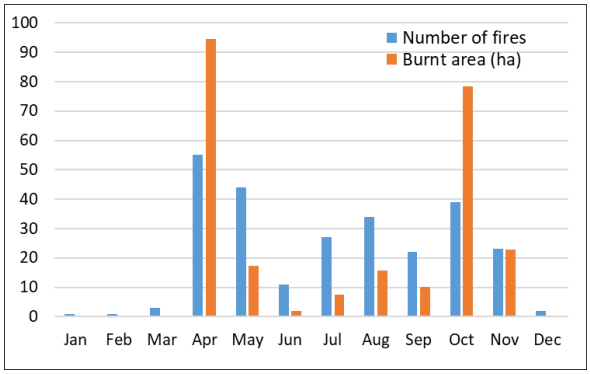
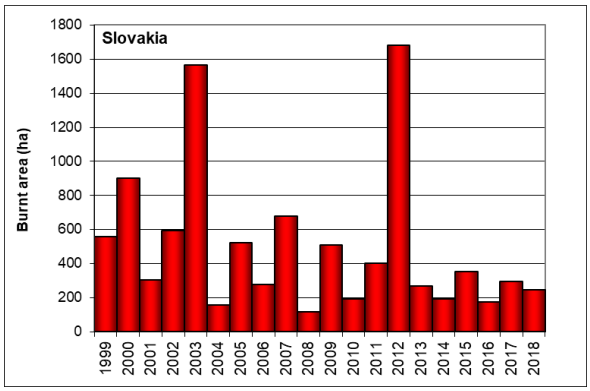


Figure 80. Number of fires and burnt area by month in Slovakia 2018.



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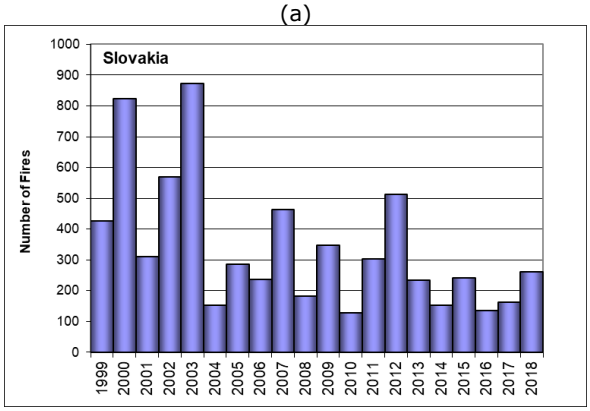

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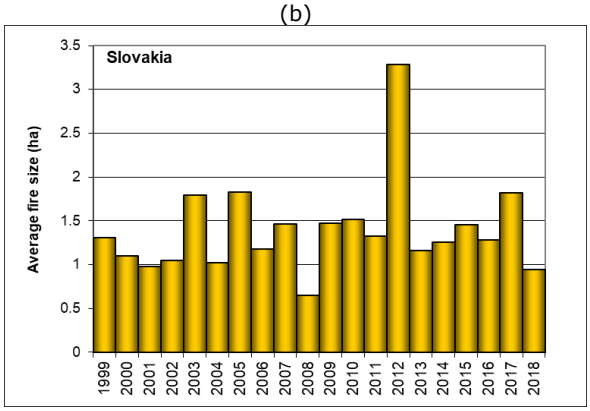


(c)

Figure 81. Burnt areas (a), number of fires (b) and average fire size (c) in Slovakia from 1999 to 2018.

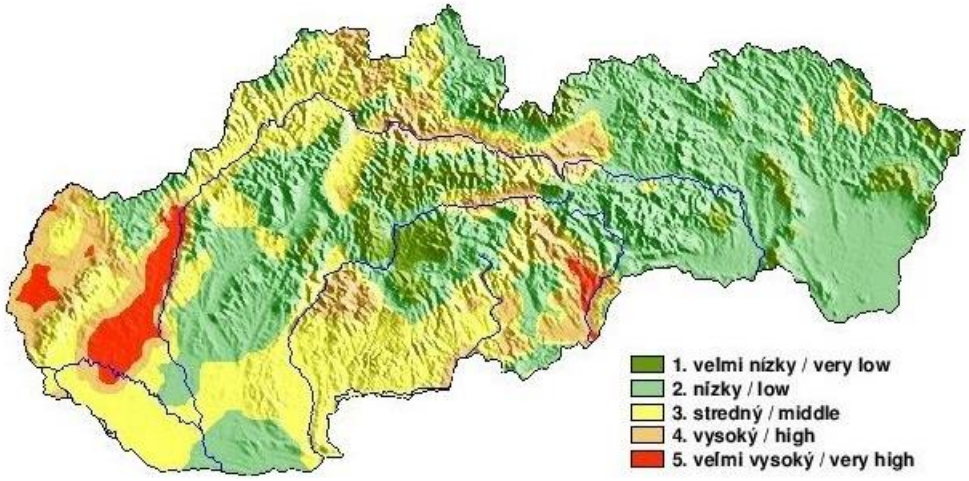


Figure 82. Information on the forest fire index - Slovak Hydrometeorological institute

Fire causes

Forest fire causes in 2018 are shown in Figure 83, and causes for the years 2008–2016 are presented in Table 24.

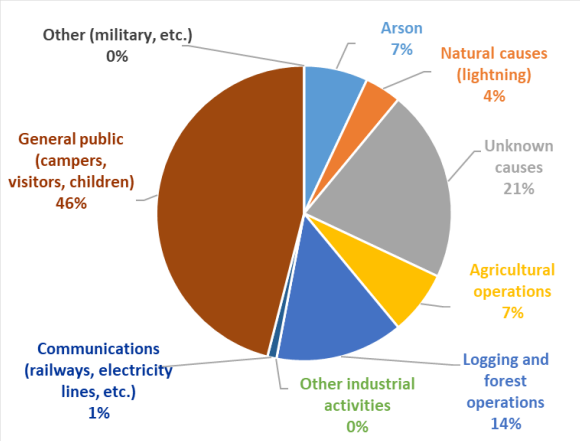


Figure 83. Causes of forest fires in 2018.

Fire prevention activities

- Provide information on the forest fire index through the internet page of the Slovak Hydrometeorological institute;
- Provide information through television when the forest fire index is high;
- Information campaigns;
- Prohibit fire dangerous activities in periods with high Fire index;
- Use of a stationary camera system for the early detection of forest fires.

Injuries and loss of human lives

During the 2018 fire season, two injuries and one human loss were reported in Slovakia.

Table 24. Forest fire causes for the years 2007-2018 (number of fires).

	Year	***2008***	***2009***	***2010***	***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***	***2018***
Basic information	Total fires	**182**	**347**	**123**	**303**	**517**	**233**	**153**	**242**	**136**	**162**	**262**
Known causes (Human)	Arson	7	18	6	8	42	33	26	23	12	11	19
	Negligence (see also B below)	154	286	94	244	409	177	112	167	98	108	179
Known causes (Natural)	Lightning	1	3	2	1	8	4	2	12	0	10	9
Unknown	Unknown	20	40	21	50	58	19	13	40	26	33	55
B: Supplementary information: Total negligence	Agricultural operations	25	51	25	59	135	26	24	26	21	20	19
	Logging/forest operations	19	52	25	21	56	15	18	21	14	21	37
	Other industrial activities	20	12	5	0	1	7	1	5	0	0	1
	Communications (railways, electricity lines, etc.)	3	7	2	1	7	3	1	2	1	2	2
	General public (campers, other visitors, children)	81	161	66	222	208	125	67	110	62	65	119
	Other (military, etc.)	6	3	0	0	2	1	1	3	0	0	1

Fire fighting in Slovakia in 2018 (*Photo credits M. Jagerčík*).

(*Processed: National Forest Centre - Forest Research Institute Zvolen, Slovakia; Source: Institute for Fires and Expertise of the Ministry of Interior of the Slovak Republic*).

1.2.23 Slovenia

In 2018, according to the data of the Forest Service, 32 forest fires were reported, with a total burnt area of 19.82 ha, of which 15.15 ha were in forest land (Table 25). The number of fires is the lowest since 2010, and the burnt area is the lowest since 2014. Only 5 of the 32 fires were over 1 ha, and the average fire size was 0.6 ha. Figure 84 shows the trends in terms of number of fires and burnt area during the last 15 years in Slovenia.

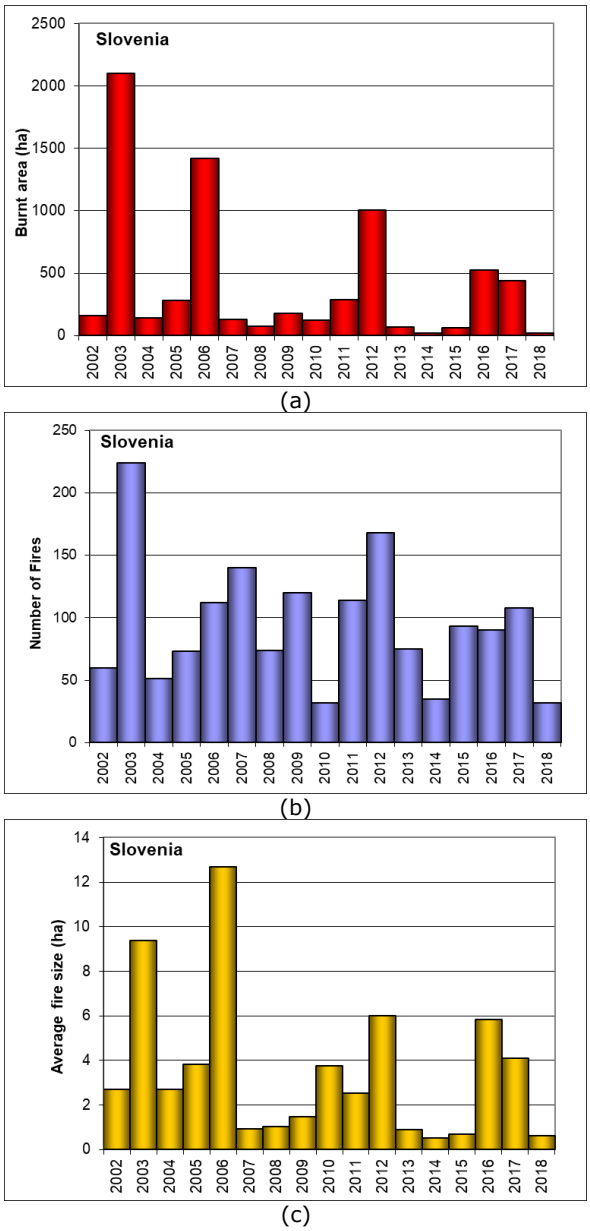
Table 25. Number of fires and burnt area in Slovenia in 2018

Number of fires	< 1 ha	27
	>= 1 ha	5
	>= 100 ha	0
	>= 500 ha	0
	Total	**32**
Burnt area	Woodland	12.32
	Bushes	2.83
	Non woodland	4.67
	Total	**19.82**

As was the case in previous years, the most affected region was Sežana, in which 59% of the fires (two-thirds of the burnt area) occurred (Table 26).

In 2018, 12 were of unknown origin. Of the rest, 6 were caused by lightning, 3 were deliberately started and the remaining 11 were reported as accidental or negligent.

(Source: Ministry of Agriculture and the Environment, Slovenia)



(a)

(b)

(c)

Figure 84. Burnt areas (a), number of fires (b) and average fire size (c) in Slovenia from 2002 to 2018.

Table 26. Number of fires and burnt area by forest management unit in Slovenia in 2018.

	Number of fires			Burnt area (ha)			
Region	**<1 ha**	**≥1 ha**	**Total**	**Forest**	**Scrub**	**Non wooded**	**Total**
Tolmin	1	2	3	2.92	2.81	0.36	6.09
Bled	0	0	0	-	-	-	-
Kranj	0	0	0	-	-	-	-
Ljubljana	1	0	1	0.08	-	-	0.08
Postojna	0	0	0	-	-	-	-
Kočevje	1	0	1	-	-	-	-
Novo mesto	5	0	5	0.03	0.02	-	0.05
Brežice	0	0	0	-	-	-	-
Celje	0	0	0	-	-	-	-
Nazarje	0	0	0	-	-	-	-
Slovenj Gradec	2	0	2	0.02	-	0.01	0.03
Maribor	1	0	1	0.35	-	0.02	0.37
Murska Sobota	0	0	0	-	-	-	-
Sežana	16	3	19	8.92	-	4.28	13.20
Total	**27**	**5**	**32**	**12.32**	**2.83**	**4.67**	**19.82**

1.2.24 Spain

Number of fires and affected surfaces

The provisional statistics for the period between January 1 and December 31, 2018, are compiled with the information sent by the autonomous regions on a weekly basis during the summer campaign and monthly for the rest of the year.

According to these data, the total number of fires has decreased by 43.19% with respect to the average of the last decade, with a decrease of 37.75% in the number of small fires (area ≤1 ha) and 53.67% in larger fires (area >1 ha) respectively. This year had the lowest number of fires in the last decade.

Table 27. Number of fires in 2018 compared with 10 year average.

	Average 2008-2017	*2018*
Number of fires <1ha	8280	5154
Number of fires ≥1ha	4293	1989
Total	**12573**	7143

Regarding the affected areas, there was a decrease with respect to the 10-year average of 66.16% in the wooded areas and 75.19% in forest areas. 2018 has been the year with the smallest area affected in the last decade and also throughout the historical series available since 1968, when the records of General Statistics of Forest Fires started.

Table 28. Burnt area in 2018 compared with the 10 year average.

	Average 2008-2017	*2018*
Burnt area other wooded land (ha)	30702.16	4739.03
Burnt area forest (ha)	101411.53	25162.44

Large fires

According to the provisional statistics compiled by the relevant departments in the autonomous regions, during 2018 there were 3 large forest fires (*Grandes Incendios Forestales*, GIF), a category which includes fires in excess of 500 hectares affected.

The first GIF took place in May, the next two occurred during the summer campaign.

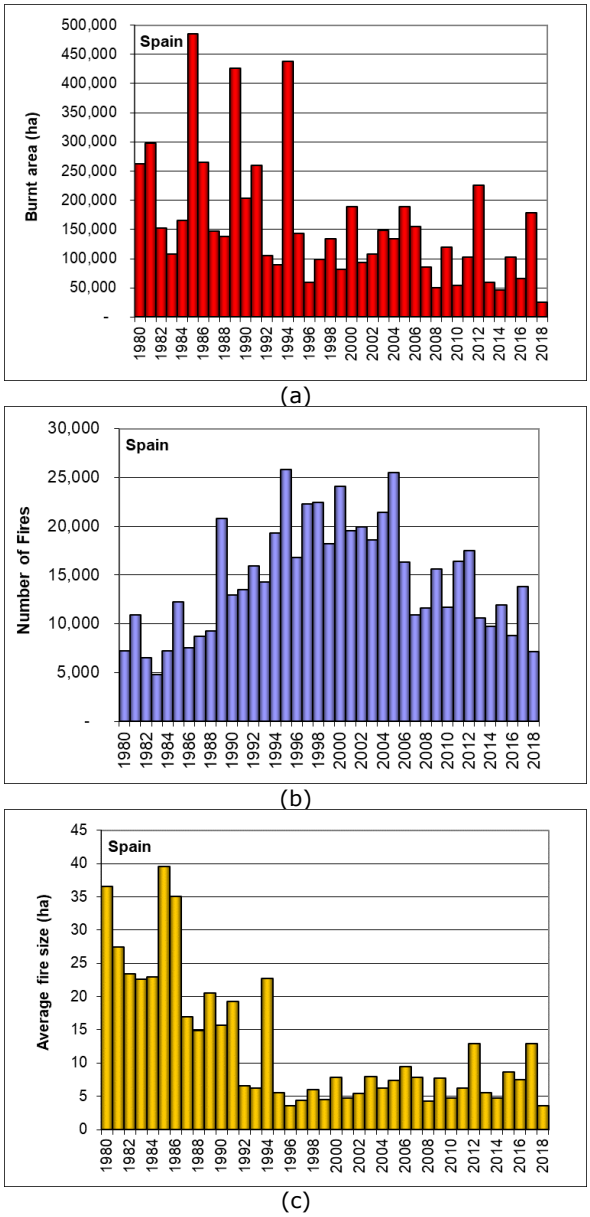
In total, the GIFs recorded represented 20.97% of the burnt area and only 0.04% of the total number of fires that occurred (Table 29). The two GIFs that occurred during the summer campaign accounted for 87.78% of the total area affected in the Mediterranean region.

Table 29. Large fires in 2018.

Province	*Municipality of origin*	*Start date*	*Burnt area (ha)*
León	Santa Columba de Curueño	12/05	645.00
Huelva	Nerva	02/08	1484.94
Valencia	Llutxtent	06/08	3146.69
Total burnt area			**5276.43**

* *Lluxtent fire shown in* Figure 88 *below*.

The yearly trends in terms of numbers of fires and burnt areas during the last 39 years in Spain are shown in Figure 85.



(a) (b) (c)

Figure 85. Burnt areas (a), number of fires (b) and average fire size (c) in Spain for the last 39 years.

Given the heterogeneity of the national territory in terms of meteorology, topography, vegetation and existing socioeconomic factors, forest fires are traditionally analysed by region according to four zones that are considered homogeneous. The defined zones are the following:

NORTHWEST: Includes the autonomous communities of Galicia, Asturias, Cantabria and the provinces of León and Zamora.

MEDITERRANEAN: Includes the autonomous coastal communities with the Mediterranean Sea, including its interior provinces.

CANARY ISLANDS: Includes the entire Canary archipelago.

INTERNAL COMMUNITIES: Includes the provinces of the rest of the non-coastal autonomous communities, except León and Zamora, as well as the Basque Country[1].

The distribution of the total number of fires by geographical area is shown in Figure 86.

It shows that the Northwest region suffered the greatest number of fires, with 42.61% of the annual total. It is followed by the Interior Communities with 35.11%, the Mediterranean area and finally the Canary Islands.

Regarding total forest burnt area the Northwest region represents 42.61% of the total, followed by the Mediterranean region, the Interior Communities, and, with much lower values, the Canary Islands.

Considering the wooded forest area, the highest burnt areas occurred in the Northwest and Mediterranean regions, close to 35%, followed by the Interior and Canary Islands.

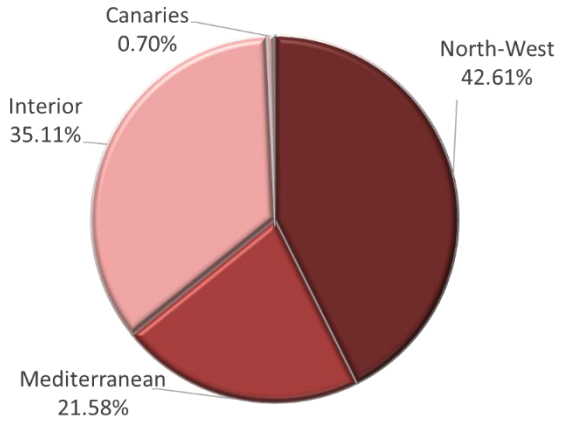


Figure 86. Number of fires in 2018 by geographic region.

1 Traditionally, the Basque Country has been included within the Northwest; however given that its fires are dissimilar to the rest of this region, in terms of number, area and causality, from now on it will be included in the so-called Interior communities.

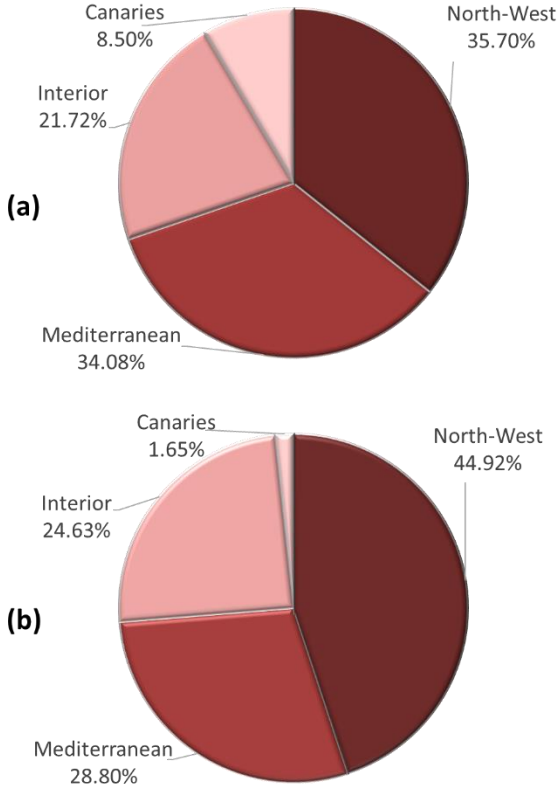


Figure 87. (a) burnt area of other wooded land (ha); (b) burnt area of forests (ha) in 2018 by geographic region.

Prevention measures

Training in fire management

MAPA (Food, Agriculture and Fishing Ministry) carried out the following training courses oriented to wildfire fighting professionals during 2018:

- Short course: "Wildfire affecting protected natural areas, between the threat and the conservation." (Madrid 4 April)
- Short course: "Rural environment actors and their role in wildfire prevention." (Madrid 12 April)
- Course: "Drones and their use in wildfires" (Madrid 13-16 November)
- Short course: "IT procedures and processes related to wildfires: EGIFWEB (HTML5 version)." (Madrid 21-27 November)
- Course: "Security and research of accidents in wildfires." (Madrid 10-14 December)

- Course for official certificate: "Incident Commander Intermediate (DTEB-B)" (26-29 November and 17-19 December).

Integral Prevention Teams (*Equipos de Prevención Integral*: EPRIF)

In 2018 the EPRIFs were operational from January 11 until May 31 and resumed work from November 5 to December 21, completing a maximum of 6 months of work at the end of the year.

During this period, the EPRIFs worked mainly on training activities and meetings with various groups, including ranchers, farmers, hunters and local administrations, in order to reconcile interests and raise awareness of forest fire prevention.

It is worth mentioning the treatment of 526 hectares with 100 prescribed and controlled burns. This helps to reduce the risk of forest fires by reducing forest fuel and creating discontinuities in the vegetation, while also achieving other objectives such as improving pastures, favouring the habitat of various species or improving accessibility in the forest. A total of 655 plots were prepared for burning, although the weather conditions did not allow all of the work to be completed.

For performing controlled burns, the EPRIFs located in Huesca, Tabuyo (León), Cangas del Narcea (Asturias), Pola de Lena (Asturias) and Gredos (Avila) received occasional support from the MAPA Preventive Work Brigades with bases close to the area of action.

Preventive Work Brigades (*Brigadas de Labores Preventivas*)

The MAPA Preventive Work Brigades acted, in collaboration with the autonomous administrations, from the beginning of the year until the beginning of the summer campaign. Once the summer campaign was over, preventive work was resumed, which ended in the middle of December, extending the work period to about 11 months.

During these two work periods, they carried out fire prevention work on more than 1 381 hectares of forest land, which included thinning, pruning and shrub removal.

In total, more than 400 workers distributed in the 10 Preventive Work Brigades carried out preventive forestry work in forests close to the surroundings of the BRIF bases. As already noted, the BLPs also work from time to time in support of EPRIFs in the execution of prescribed burnings.

Figure 88. Daroca BRIF in action with helicopter support in the Llutxent fire (Valencia), 07/08/2018

Figure 89. EPRIF La Palma executing a prescribed burning under trees with the help of the BLP Puntagorda, in the Municipality of Puntagorda 03/19/2018 (Island of La Palma / Santa Cruz de Tenerife)

Human resources: Reinforcement Brigades against Forest Fire (*Brigadas de Refuerzo contra Incendios Forestales*: BRIF)

MAPA deploys five BRIF-i during the winter-spring campaign in the north and west of the Peninsula, and ten BRIFs during the summer campaign distributed throughout the national territory.

In the summer campaign the BRIF are composed of three teams each comprising 2 supervisors and 14 specialists under the command of 1 technician. For transport and support for fire extinction they have two transport and extinction helicopters with 1 200 litre of capacity. In the Puerto del Pico (Ávila) aerial base a BRIF-B type brigade is available, which is smaller in size and similar to the brigades of the BRIF-i winter campaign, consisting of 7 specialists, 1 foreman and 1 technical staff equipped with a single helicopter.

These highly specialized helicopter transport personnel units can operate anywhere in the country where needed. BRIF personnel receive continuous education and training that allows them to act in the most demanding situations and the most complicated fires. The mastery of all techniques of extinction, including backburning, is essential in its performance.

In the 2018 campaign, the BRIF worked for 774 hours in 149 fire interventions and extinguished a total front length of 101 958 metres. The BRIF with the highest activity during this campaign was that of Pinofranqueado (Cáceres) with a total of 35 interventions combining the summer and winter campaigns.

During the winter campaign the most interventions were made by the BRIF of Ruente (Cantabria) with a total of 18; this BRIF is only operational during the winter-spring months.

Aerial means

The MAPA has an aerial means deployment managed from the Spanish Forest Fire Services, which covers the national forest area throughout the year. During the two periods of greatest occurrence of forest fires, winter and summer campaigns, the number of available means is strengthened.

During 2018, the MAPA air forces carried out a total of 715 interventions in forest fire suppression, in support of the means of the respective autonomous communities. In total they flew for 1 842 hours, making 8 786 discharges. The available air means are listed in Table 30.

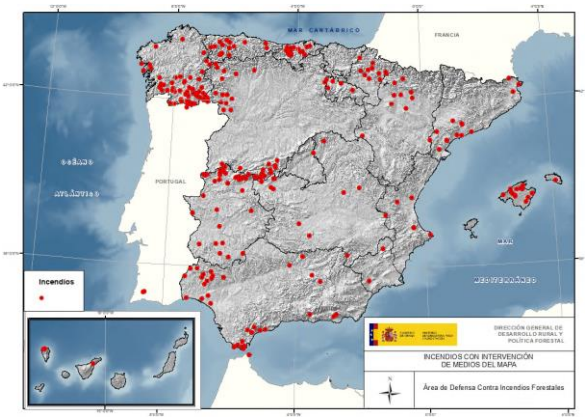


Figure 90. Location of air intervention actions made in 2018.

Table 30. Spanish air means in 2018.

	MAPA Means		Autonomous Communities Means	
	Nº Aircraft	Capacity (l)	Nº Aircraft	Capacity (l)
Amphibious Planes Canadair	18	99 000	-	-
Amphibious Planes Fire boss	6	18 600	7	21 700
Communication and Observation Planes	4	-	26	-
Mixed cargo aircraft on land-amphibian	10	31 000	21	65 100
Bomber Helicopters	8	36 000	25	39 000
Brigades transport Helicopters	19	22 800	123	134 600
RPAs (Remotely Piloted Aircraft)	4	-	-	-

Operations of mutual assistance

There were 12 interventions abroad, all in Faro, Monchique district in Portugal, between 6 and 9 August (Table 31).

Table 31. Interventions abroad in 2018.

Intervention Date	Base	Flight Time	Discharges
06/08/2018	Torrejon	008:25	17
06/08/2018	Matacán	007:55	18
06/08/2018	Torrejon	003:25	1
07/08/2018	Matacán	008:49	45
07/08/2018	Torrejon	009:00	34
07/08/2018	Torrejon	009:00	22
08/08/2018	Matacán	006:05	15
08/08/2018	Torrejon	008:45	28
08/08/2018	Torrejon	004:20	2

09/08/2018	Torrejon	009:00	9
09/08/2018	Torrejon	008:55	20
09/08/2018	Matacán	009:00	17

Injuries and loss of human lives

Injuries and loss of lives in the 2018 campaign are listed in Table 32.

Table 32. Losses in the 2018 season in Spain.

Affected Personnel*	Deceased	Injured	Location of Fire	Date
External to the firefighting service	1		Yeste (Albacete)	25/04
		1	Vejer de la Frontera (Cádiz)	03/07
		7	San Vicente de Alcántara (Badajoz)	04/08
		1	Llutxent (Valencia)	06/08
		2	Vilariño de Conso (Ourense)	22/08
Belonging to the firefighting service		1	Monterrei (Ourense)	29/08

**Information provided by the General Directorate of Civil Protection and Emergencies*

Big Data Projects Of The Spanish Forest Fires Service

In 2019 the Spanish Forest Fire Service began to work in some pilot Big Data projects for the purpose of process and analyse in combination different data bases, in order to get results to support forest fires management decisions.

Explanatory and predictive model about surface fire occurrence during summer months

Design of a model that makes it possible to explain the burned surface during a summer campaign (June, July, August, September and October) at national level, starting from the occurrence of fires in the last 20 years (period 1999-2018) and using the following variables as explanatory variables:

- Number of aerial means
- Spring rainfall (cumulative rainfall during March, April and May)
- Average summer temperature (obtained from the average monthly temperatures of July, August and September).

Prediction of daily activity in forest fires and means interventions based on historical records and meteorological information

It is proposed to classify and forecast the daily activity of aerial means of the Ministry of Agriculture, Fisheries and Food in forest fires, based on the following information:

- General Statistics on Forest Fires, studying active fires every day in the last 20 years.
- Activity of the fire protection device of the Ministry, quantifying daily activity values (interventions, flying hours, fires attended) on two dates: Previous day and Current day.
- Meteorological information at a provincial level of daily values of accumulated precipitation and average and maximum temperature.

The aim is to estimate for the current day, number of expected fires, estimated area and expected activity of aerial means.

Analysis of influence of aerial means and simulataneity of forest fires on the final surface affected of each forest fire

Design of an explanatory and, if possible, predictive model to know the burned surface of each fire at regional level in the last 20 years using the following as explanatory variables:

- Intervention of aerial means per fire, time of arrival of aerial means, number of participating means and water discharges carried out
- Accumulated daily rainfall in all the stations of the Autonomous Community
- Average daily temperature and maximum daily temperature of all Autonomous Community stations
- Average speed and wind direction of all the stations of the Autonomous Community
- Fire, location with coordinates, start and end date and affected surfaces

Analysis of the causality pattern of fire at municipal scale

The existence of specific patterns of causes is perceived in each territory (municipal scope), influenced by different socioeconomic causes, but the causal relationship of these has not been established so far.

This project would be about to explain these factors in order to know if they really influence the occurrence of fires, based on the following data:

- General Statistics of Forest Fires: all fires that have taken place in the last 20 years with information of surface, group and subgroup of causes.
- Socioeconomic data at municipal level, for the last 20 years: number of inhabitants,

age and sex ranges; number of companies, unemployment rate, GDP per capita, agricultural census (livestock holdings, agricultural area and number of livestock).

Summary of the climatic report of the year 2018

Air temperature

General characteristics

2018 was warm in Spain, with an average temperature of 15.5º C, a value that exceeds the annual average value by 0.4º C (reference period 1981-2010). It has been the twelfth warmest year since the beginning of the series in 1965 and the ninth warmest so far in the 21st century.

Episodes of extreme temperatures.

During the summer of 2018 episodes of temperatures above typical values were scarce. The only heat wave recorded in 2018 occurred from August 1 to 7 over the peninsula and the Balearic Islands.

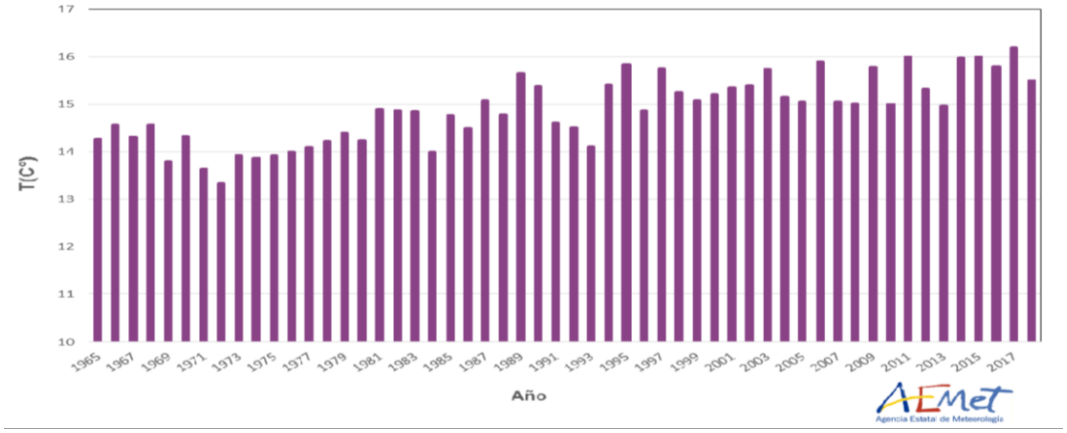


Figure 91. Series of annual temperatures average in Spain since 1965

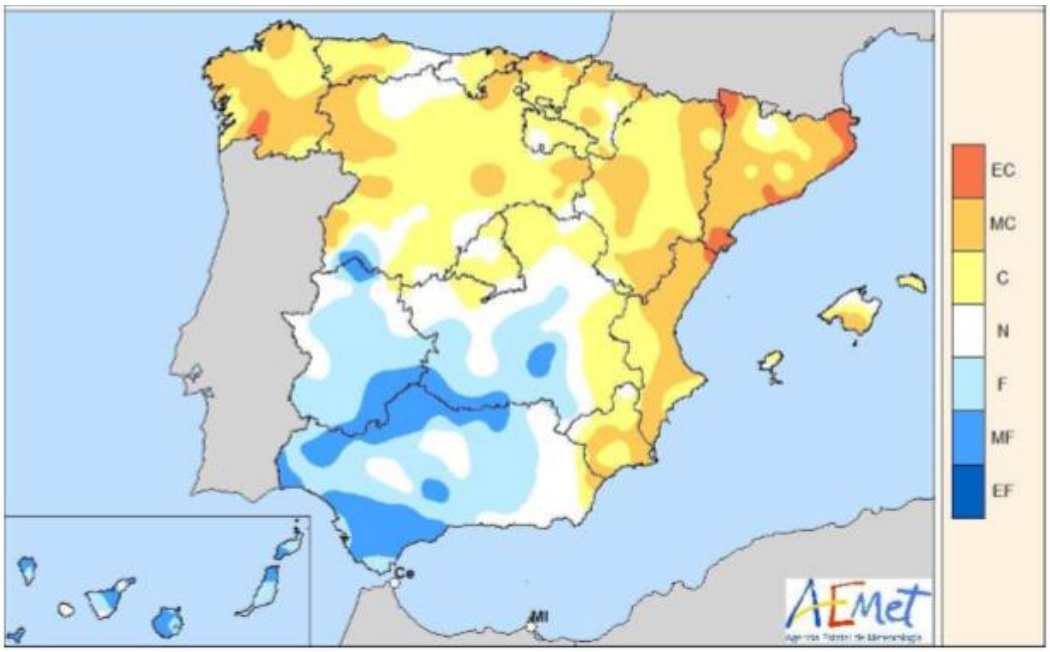


Figure 92. Temperature character – 2018 (*SOURCE: Meteorology Statal Agency. Ministry for the Ecological Transition*).

KEY

EC Extremely Warm: Temperatures exceed maximum value recorded in the 1981-2010 reference period.

MC Very warm: f <20%. The recorded temperatures are in the range corresponding to 20% of the warmest years.

C Warm: 20% ≤ f <40%.

N Normal: 40% ≤ f <60%. The recorded temperatures are around the median. F = Cold: 60% ≤ f <80%.

MF Very cold: f ≥ 80%.
EF Extremely cold: Temperatures do not reach minimum value recorded in the reference period 1981-2010.

Precipitation

Overall rainfall characteristics of the year

2018 was very humid all over Spain. The rainfall average in Spain was around 808 mm, 25% above the annual average value according to the 1981-2010 reference period, and which was mainly due to the fact that the spring was extremely humid. With available information, 2018 has turned out to be the fifth wettest since 1965 and the second wettest so far in the 21st century, behind 2010 when the cumulative rainfall was 869 mm.

This year ended up being humid or very humid in almost all of Spain, extremely humid in the centre and southwest of Aragón, and in some areas of Catalonia and the Balearic Islands, while it was only dry or very dry in western Galicia.

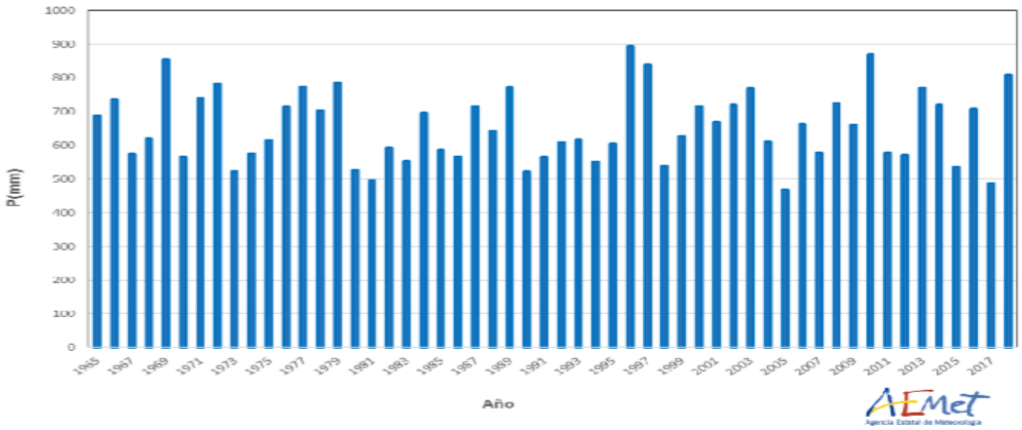


Figure 93. Series of annual rainfall average over Spain since 1965.

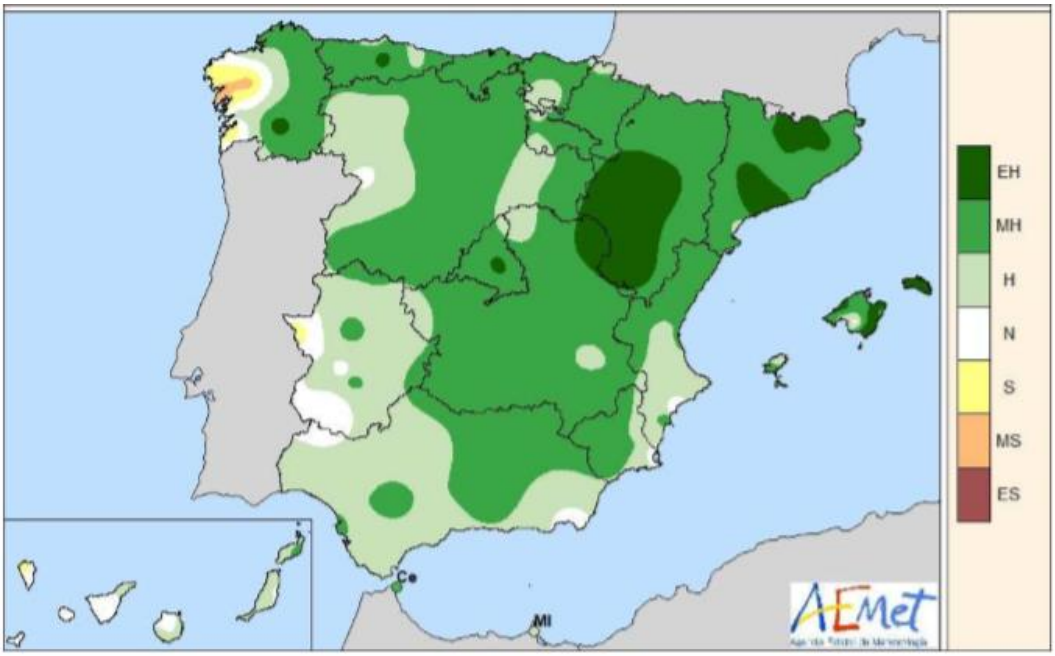


Figure 94. Precipitation character – 2018 (*SOURCE: Meteorology Statal Agency. Ministry for the Ecological Transition*).

KEY

EH Extremely humid: Precipitation exceeds maximum value registered in the reference period 1981-2010.
MH very humid: f <20%. The precipitations are in the interval corresponding to 20% of the wettest years.
H Humid: 20% ≤ f <40%.

N Normal: 40% ≤ 60%. The recorded rainfall is around the median.
S Dry: 60% ≤ f <80
MS Very dry: f ≥ 80%.
ES Extremely dry: Precipitation does not reach minimum value registered in the reference period 1981-2010.

It was the rainiest spring in the whole series since 1965, followed by the spring of 1971 in which precipitation was 313 mm and the one in 2013 with 288 mm.

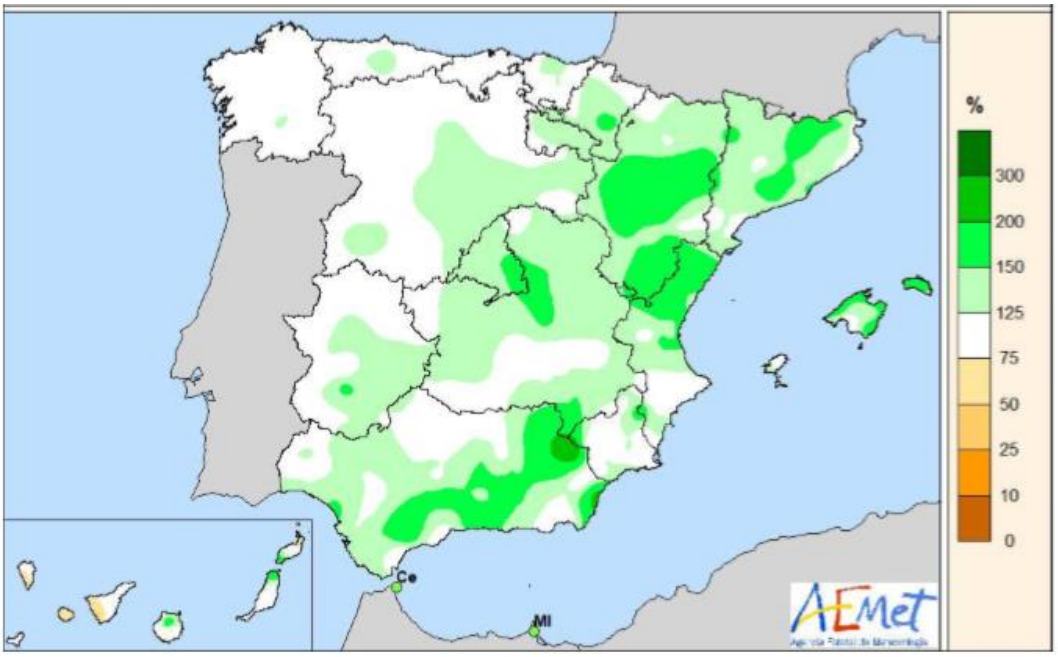


Figure 95. Percentage of accumulated precipitation in 2018 over the average (*SOURCE: Meteorology Statal Agency. Ministry for the Ecological Transition*).

Figure 96. Tabuyo del Monte BRIF returning from the Hermisende fire (Zamora), 28/08/2018.

(Source: Ministry of Agriculture, Fisheries and Food, Spanish Forest Fire Service, Spain).

1.2.25 Sweden

Fire danger in the 2018 fire season

The forest fire risk was extreme for Swedish conditions. During some days in the middle of July more than 23 000 ha burned in several major fires. During about two months, a large part of the country had an extreme and very high fire danger. There was less rainfall than normal. Many of the major forest fires were caused by lightning.

It was a very snowy winter and in early March there was a snow cover over the whole country and in parts of central and northern Sweden there was more snowfall than normal. The winter rainfall was above normal throughout the country except for in the mountain range. In some areas along the Norrland coast, there was twice as much rainfall as normal. Subsequently, slow melting with high flows in watercourses took place in some directions and the grass fire risk season started late and became short-lived and overlapped with the forest fire risk season.

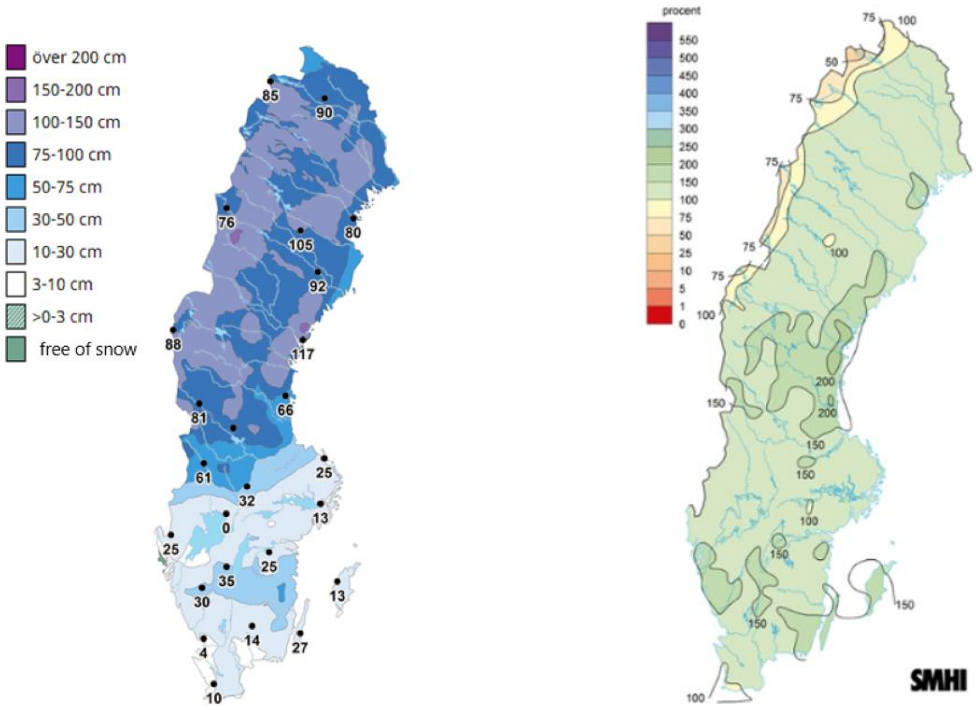


Figure 97. To the left: The snow depth on March 8, to the right: precipitation as a percentage of normal in winter 2018 (December, January, February). Source: SMHI.

During the spring (February, March, April) there was less rainfall in basically the whole country and the pattern continued during June and July. In large parts of the country, less than half of the normal precipitation came this month. July stands out especially with little rainfall.

Long-term high-pressure weather has led to a dry June, July and beginning of August, which is the main reason for 2018 being a year of high fire danger over most parts of the country at the same time. Dry air has also caused the vegetation to dry out, which can also easily be ignited and give a rapid spread of fire. The local rain showers that have occurred have only temporarily reduced the fire danger.

Fire occurrence and affected surfaces

During 2018 the number of fires recorded were 8181. The burned area consisted of 21 576 ha productive forest, 852 ha other wooded land, 1 805 ha other open land and 77 ha agriculture field or pasture.

There were 18 fires over 100 ha and 15 of those fires started in the period from the 14th to the 18th of July. Fires that started during this period resulted in a burned area of about 20 800 ha. Most of these fires were caused by lightning and some of the fires were taken down but rekindled days later. Three of the major fires burned in connection to a sparsely populated valley in the middle of Sweden and the burned area were about 9 500 ha.

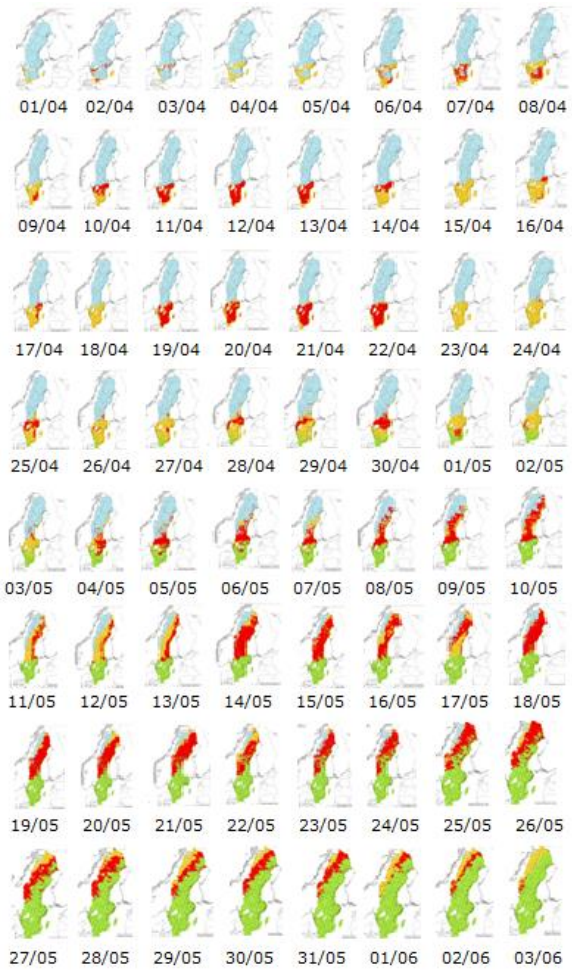


Figure 98. Maps of grass fire risk season 2018 shows periods of risk in combination with snow.

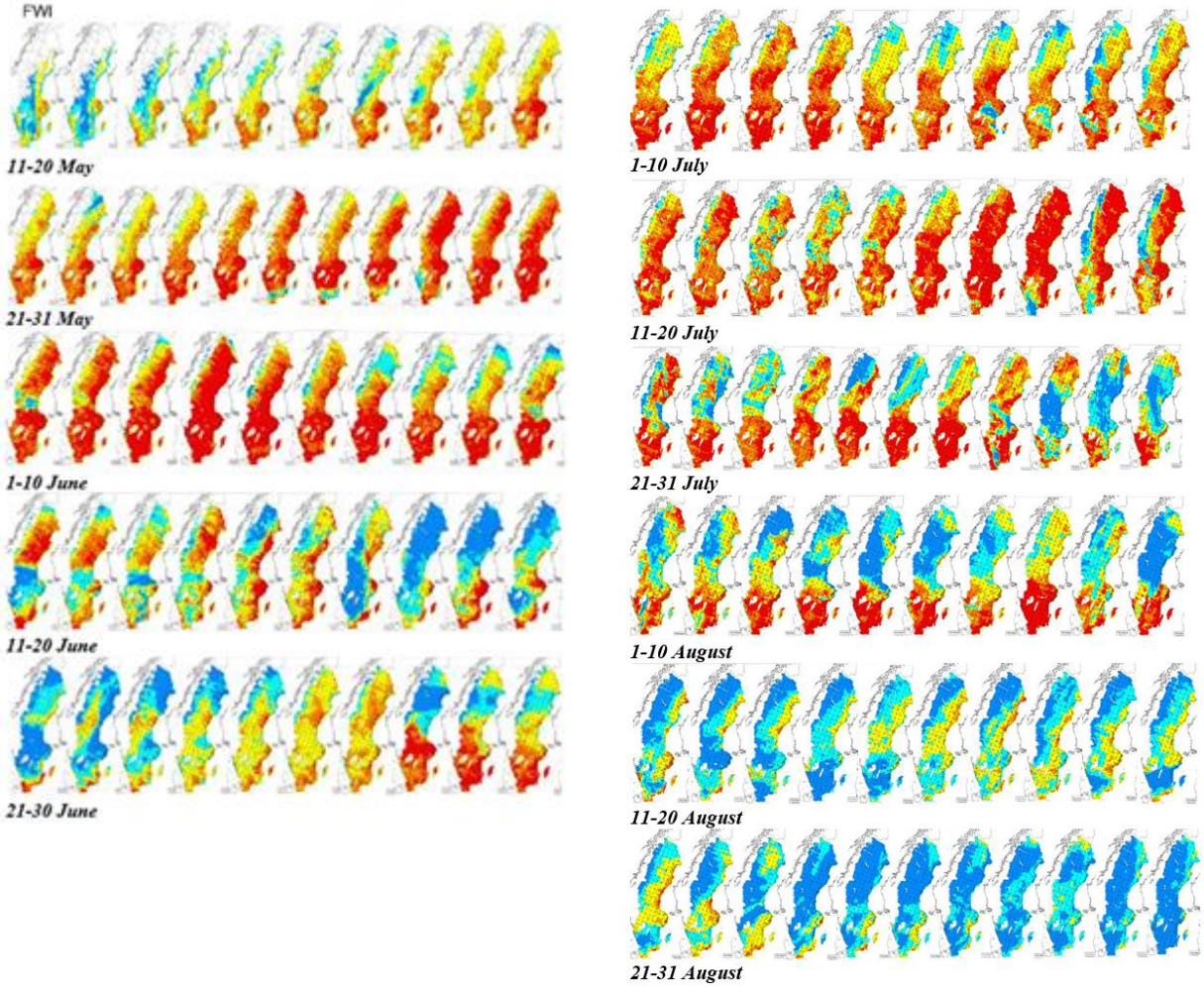
Key - Grass risk

- Snow
- Grass fire season ended
- Small/moderate hazard grass fire
- Large hazard grass fire

Key - FWI

- Very low fire risk (FWI value <1)
- Low fire risk (FWI value 1-6)
- Normal fire risk (FWI value 7-16)
- High fire risk (FWI value 17-21)
- Very high fire risk (FWI value 22-27)
- Extremely high fire risk (FWI value 28-)

Figure 99. (right) Maps of forest fire danger shows the long period and early start of the season 2018, based on the FWI-index (Swedish normalised index). In the middle of July several major fires occurred, most of them probably ignited from lightning. Some days after the lightning there was an extremely high fire danger.



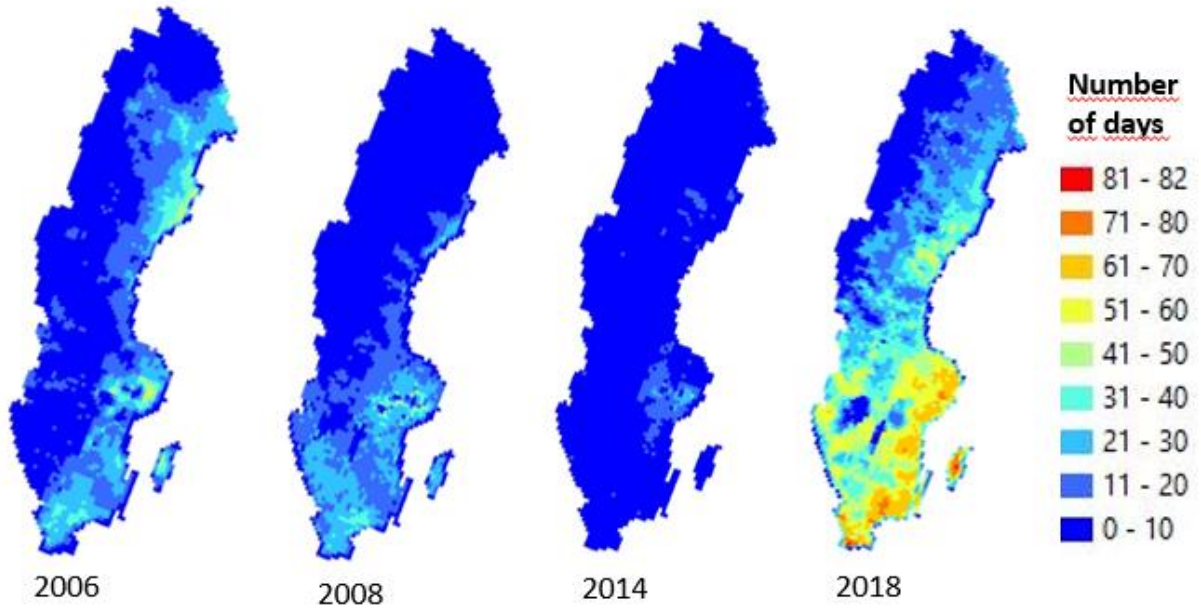


Figure 100. Example of years with major fires and longer periods with high fire danger. 2018 is outstanding in many days of high fire danger and high level of FWI in most part of the country.

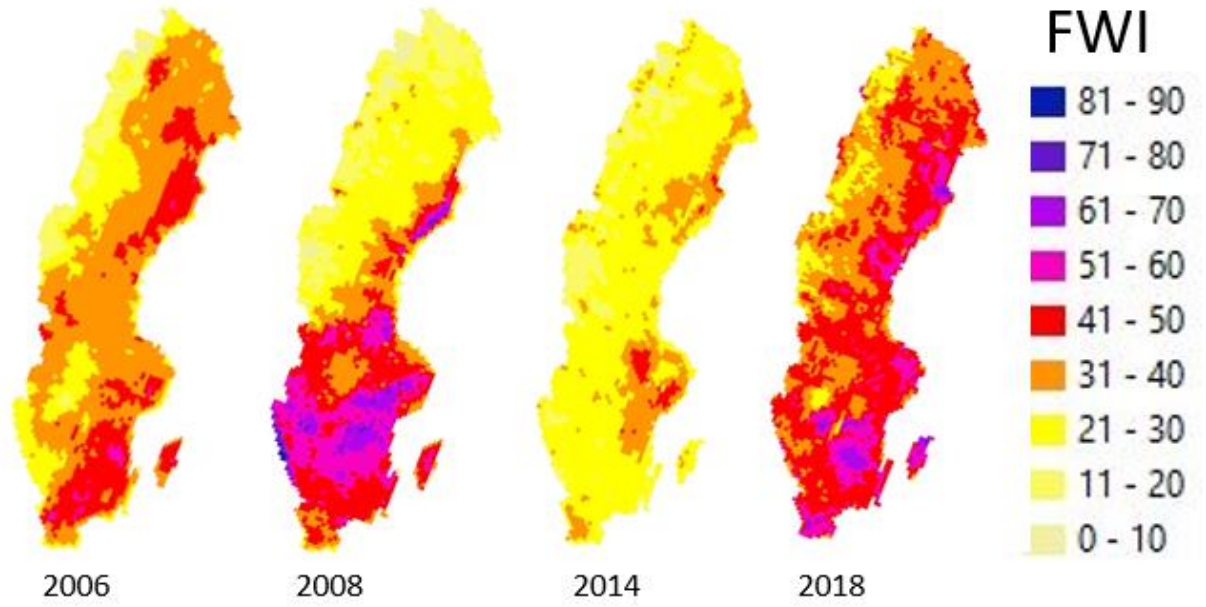


Figure 101. Example of years with major fires and the maximum value of the fire weather index (FWI). Note that the year 2014, when the major fire occurred in Västmanland (14 000 ha) only some smaller areas were affected by high danger.

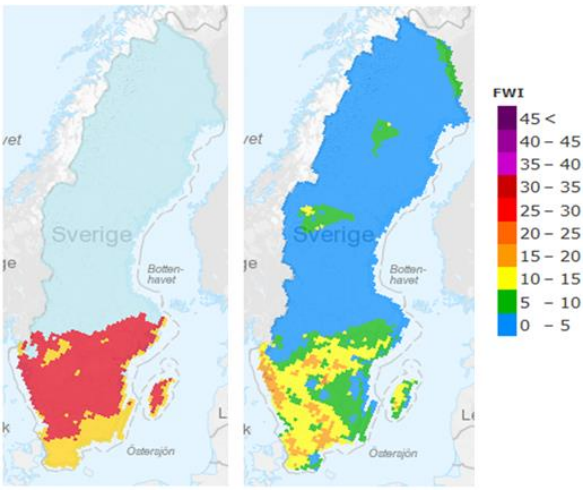


Figure 102. Both maps refer to April 13: to the left: grassland risk and to the right: Forest fire FWI.

The monthly pattern of fire numbers and burnt areas in 2018 are shown in Figure 103.

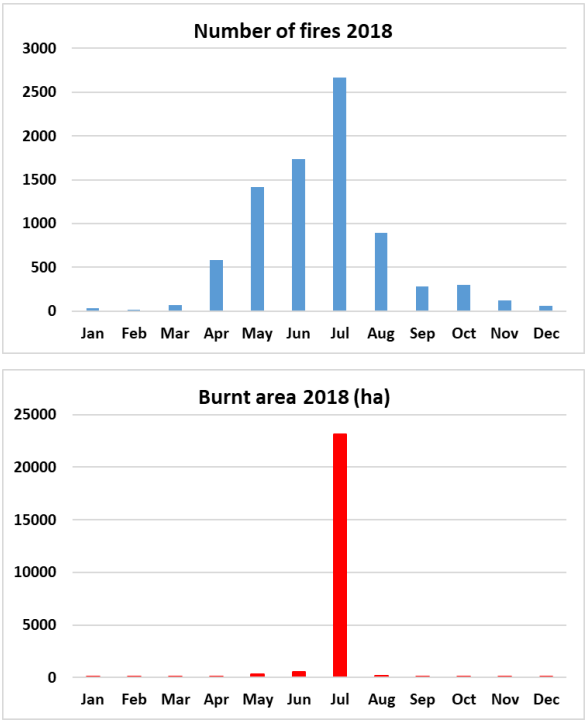


Figure 103. Total number of fires and burnt area (ha) by month in 2018.

The burnt area, number of fires and average fire size for the years 1998-2018 are shown in Figure 105.

Fire Causes

For more than 900 fires the cause was lightning and those fires affected more than 15 000 ha of burned area.

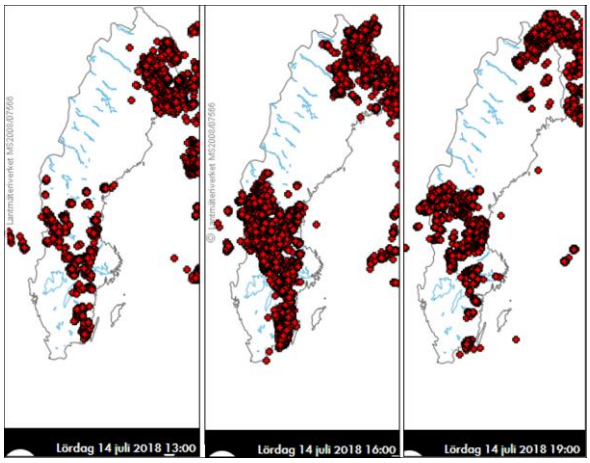
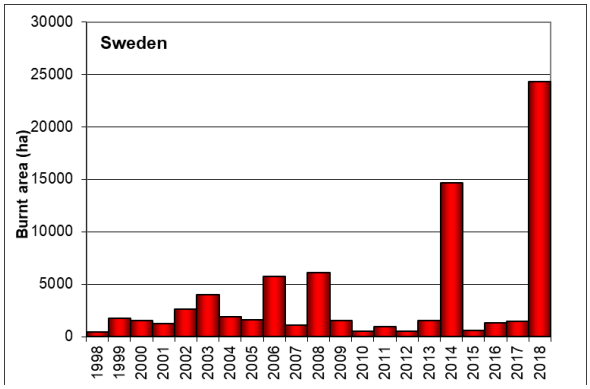
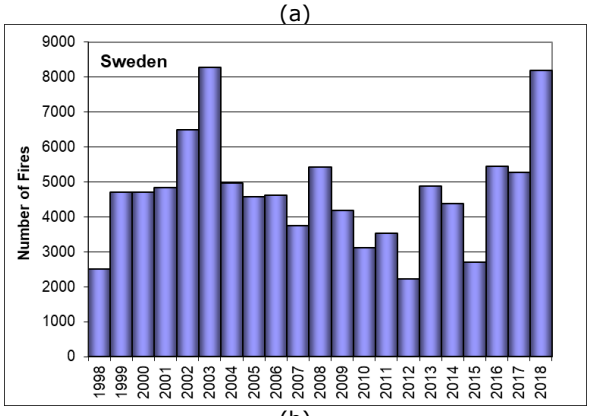


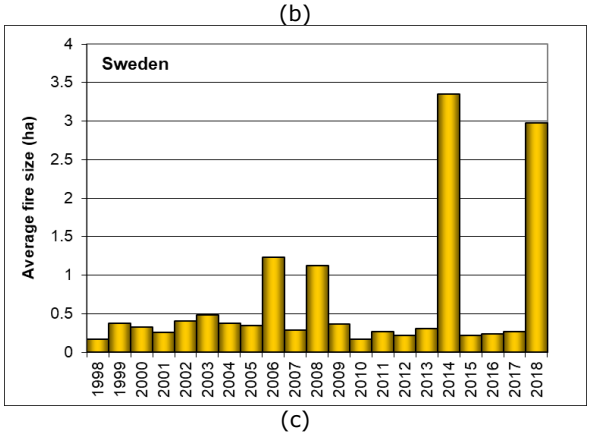
Figure 104. Example of lightning during one day. Recorded flashes during 3 periods in 3 hours on the 14th of July 2019.



(a)



(b)



(c)

Figure 105. Burnt areas (a), number of fires (b) and average fire size (c) in Sweden from 1998 to 2018.

International support

the summer in mid July, Sweden received international ground support consisting of more than 300 persons and 85 land vehicles from Denmark, Norway, Finland, France, Poland and Germany. Support from each country consisted of a combination of staff and vehicles, most of them self-supporting teams that worked according to the directions from the host nation support and the national authorities.

Sweden also received international support with flying resources consisting of a total of six fire-fighting aircrafts and 14 helicopters with associated personnel. In order to increase the national preparedness, Sweden requested support from the EU already in June.

The weather conditions were extreme and the fire risk levels remained very high, across the whole country, Italian aircrafts supported Sweden related to this request. This was unique and the first time a member country had used the EU civil protection mechanism to raise its preparedness even before having a major event to deal with. The airborne support in July came from Italy, France, Portugal, Germany, Lithuania and Norway. This was one of the largest UCPM missions inside Europe. In terms of personnel deployed, it was the single biggest forest fire operation since the creation of the Mechanism back in 2001.

Loss of life

A firefighter died in connection with work in a forest fire. In addition, about ten civilian people have been injured in various fires and transported to hospitals.

Figure 106. View over the "Kårböle area" where three major fires occurred within a period of two weeks. *Photo: Anders Granström.*

(Source: Swedish Civil Contingencies Agency (MSB); Risk & Vulnerability Reduction Department, Natural Hazards & Critical Infrastructure Section, Sweden).

1.2.26 Switzerland

Weather conditions and state of the forests 2018

In 2018, Switzerland experienced extreme weather conditions: combined effects of storms, heatwaves and drought caused major impacts on forests. As a result, 2018 was the second warmest year since the beginning of measurements in 1864.

In January, very abundant precipitation led locally to heavy snowfall in mountain areas, despite above average temperature. A storm named Burglind (or Eléanor) occurred on January 3rd on the North side of the Alps, causing significant damage in forests.

February and March were overall very cold, whereas in April a heat and drought period started, characterized by very bright sunny days and lasting until autumn. This caused a centennial drought period all over Switzerland, and in particular in the eastern part of the country that particularly lacked in precipitation. During eight months, between April and November, only 59% of total average precipitation (norm of 1981-2010) occurred. This represents a rain deficit of about 3 months for the summer 2018.

High temperature spells characterized the weather conditions throughout the year. On both sides of the Alps, maximum temperatures rose above 30 degrees for long periods and even late in the year; that is until October. Temperatures were on average 1.5 degrees warmer in comparison to the climate norm 1981-2010, which represents a new record since the beginning of measurements in 1864.

At the end of October, between 200 and 300 mm of rain were measured within a couple of days in the south of the Alps and in south-eastern Switzerland. The meteorological station of Arosa registered a new record of 72 cm of snow within 24 hours in October. In December, precipitation finally occurred in the north side of the Alps (Source: MeteoSwiss 2019).

Fire occurrence and affected surfaces

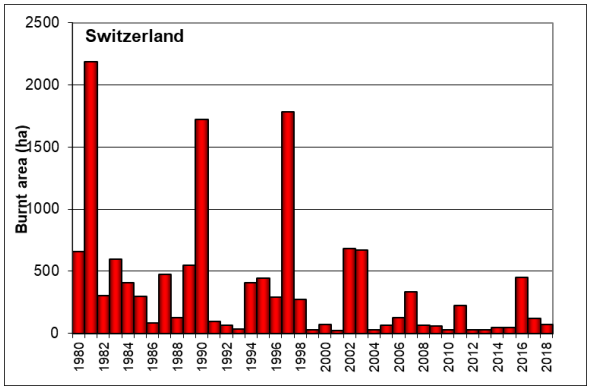
According to the SwissFire database, Switzerland recorded 153 fires and fire starts in 2018 (as reported by May 2019) that occurred in 14 different Cantons (Appenzell Innerrhoden, Berne, Basel Land, Jura, Grisons, Lucerne, Neuchâtel, Nidwalden, Sankt-Gallen, Solothurn, Ticino, Uri, Valais and Zurich) and burnt 68.76 hectares in total.

This corresponds to a slightly high occurrence in term of frequency and a low burnt area compared to the yearly average since 1980. Average fire size was 0.55 ha (Figure 107).

80% of the fires happened during the summer season (May to November), when 59% of the burnt area occurred. Monthly burnt area and number of fires are shown in Figure 108.

Fire Causes

The main cause of fires in Switzerland remains negligence. No loss of life or major damages to buildings were reported in 2018. (Source: WSL Federal Research Institute).



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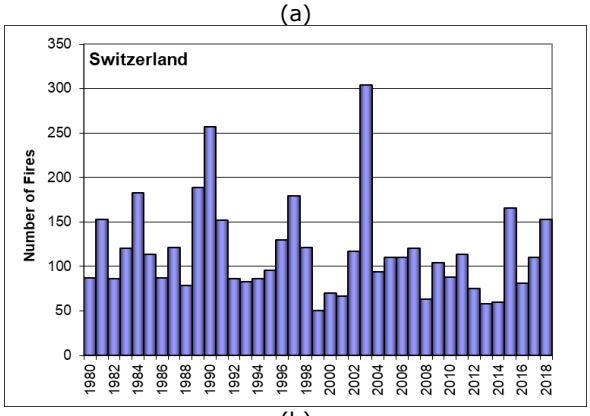

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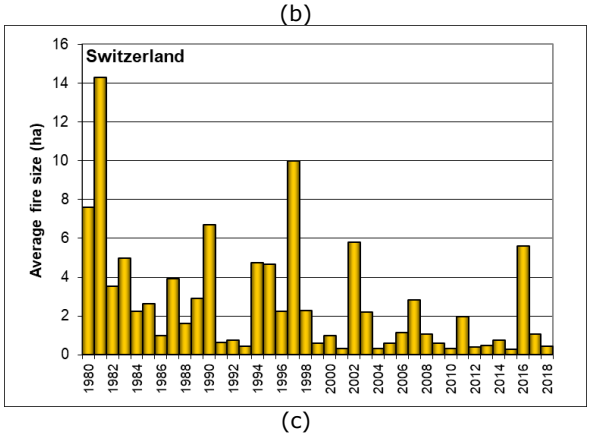

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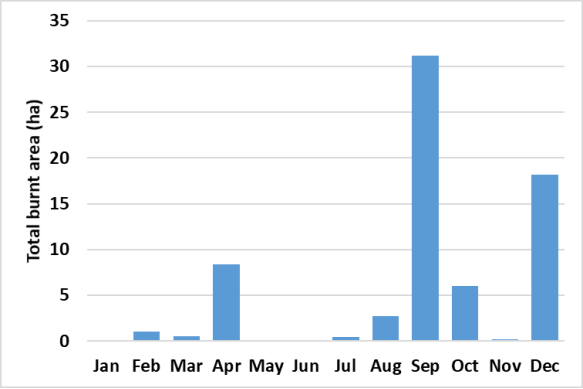
Figure 107. Burnt areas (a), number of fires (b) and average fire size (c) in Switzerland from 1980-2018.



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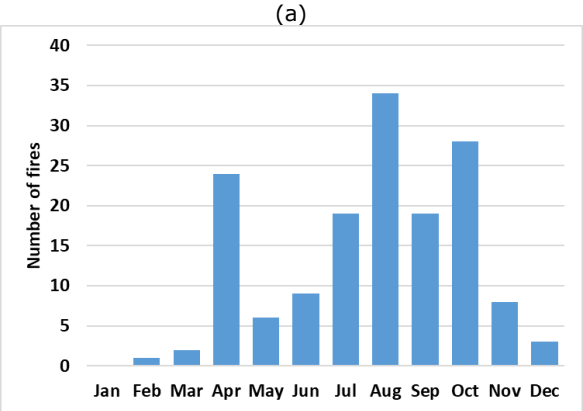

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Figure 108. Monthly Burnt areas (a) and number of fires (b) in Switzerland in 2018.

Fire prevention activities

The federal forest fire strategy in Switzerland focuses on prevention and information. It relies on the close collaboration of the Cantons (States) Federal Central State (Swiss Confederation). The extreme weather conditions occurring from spring to fall 2018 resulted all over Switzerland in a very intense year for the fire prevention point of view. This was particularly the case for the northern part of Switzerland, whereas the southern Switzerland experienced as usual a major danger peak towards the end of the winter just before the start of the vegetation season.

Because of the cold and fresh conditions in February and March, the fire danger remained low until April in most of the Cantons. After the radical change of the weather conditions in April, many Cantons recommended particular attention when making fires in or in the proximity of the forests. The fire danger was raised from "marked" to the highest danger level "very high" at the beginning of July. From that time on, Cantons successively decreed general fire bans in the open that lasted until the end of October.

In the Canton of Grisons the fire ban lasted from the 11/07/2018 to the 27/10/2018, which represents a record duration of 108 days.

This exceptionally long lasting ban period included also the Swiss national day (August 1st) when the population is used to celebrate with signal fires and fire-works. This was particularly challenging for the cantonal authorities and the Federal office for the environment (FOEN), requiring a lot of coordinated efforts for a sound communication at all levels (country, cantons and communities) in order to prevent multiple fires in the forests and in the landscape during the national day.

At the end of 2018, southern Switzerland (Grisons and Ticino) decreed fire bans on the very last day of December. The ban lasted up to spring 2019.

Media reported a lot of information about forest fires around the world in 2018 again (Greece and Portugal for instance). The increasing media coverage of wildland fires helps awareness raising within the population. The national website www.forest-fire-danger.ch has again registered a high number of visits, indicating the need for such platforms for the population and the media. (Source: FOEN, Federal office for the environment).

(*Sources: Federal Office for the Environment, WSL Federal Research Institute, MeteoSwiss*).

1.2.27 Turkey

Fire occurrence and affected surfaces

According to data derived from the General Directorate of Forestry, Department of Forest Fire Combating, in 2018 the total burnt area was 5 644.4 hectares. The number of fires was 2 167 in the same year.

In Turkey, the coast-line, which starts from Hatay and extends through the Mediterranean and Agean up to Istanbul, has the highest fire risk. In another words, approximately 57% (12.5 million ha) of Turkey's forest area is located in fire sensitive areas.

Forest fires mostly occurred during the period of April-November, particularly in June, July, August and September. When we look at the number of forest fires, we see that August ranked the highest with 482 fires but in terms of burnt area, July was the highest with 1 644.27 ha. (See Table 34). 72% of the forest fires occurred in four months (between June to September) and 4 502 hectares of forest area were damaged in this period.

Table 33 gives the forest fire statistics for Turkey 1990-2018.

Table 33. Forest fires in Turkey 1990-2018.

Year	Fire Number	Burnt Area (ha)
1990	1750	13742
1991	1481	8081
1992	2117	12232
1993	2545	15393
1994	3239	30828
1995	1770	7676
1996	1645	14922
1997	1339	6317
1998	1932	6764
1999	2075	5804
2000	2353	26353
2001	2631	7394
2002	1471	8514
2003	2177	6644
2004	1762	4876
2005	1530	2821
2006	2227	7762
2007	2829	11664
2008	2135	29749
2009	1793	4679
2010	1861	3317
2011	1954	3612
2012	2450	10455
2013	3755	11456
2014	2149	3117
2015	2150	3219
2016	3188	9156
2017	2411	11992
2018	**2167**	**5644**

The yearly trends in terms of numbers of fires and burnt areas in Turkey since 1990 are shown in Figure 109.

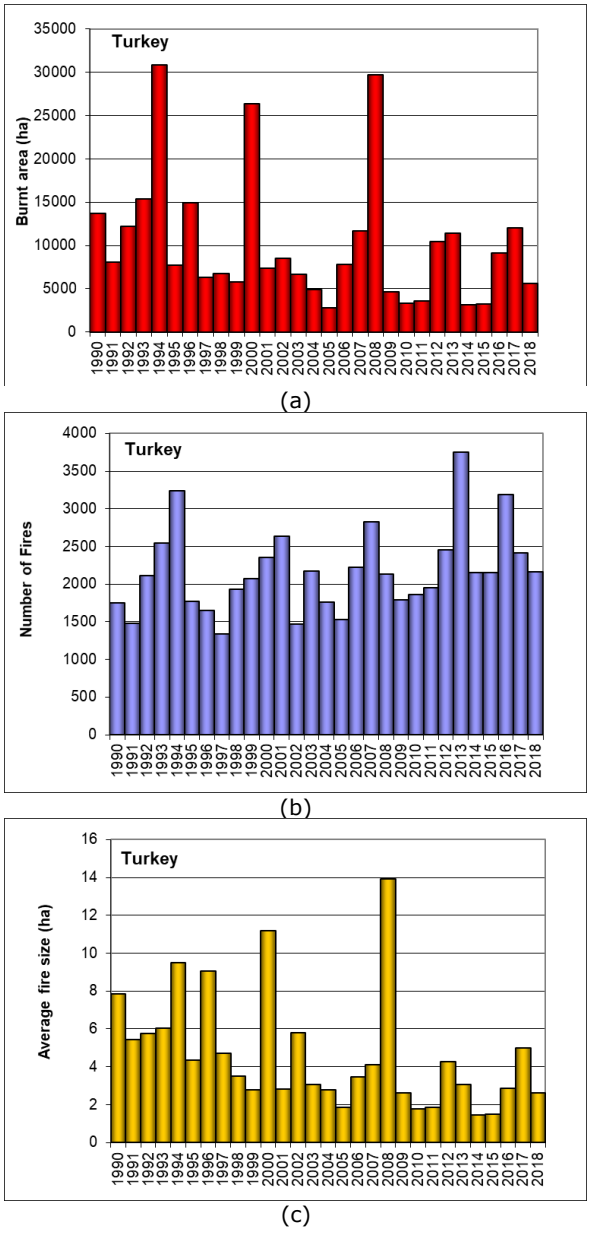


Figure 109. Burnt areas (a), number of fires (b) and average fire size (c) in Turkey from 1990 to 2018.

Fortunately, around 99% of the fire incidents were controlled before spreading. There was only one fire bigger than 500 hectares (526 ha), there were 4 fires between 200-500 ha (totalling 932 ha) and there were 7 fires between 50-200 hectares (totalling 554 hectares) as shown in Table 36.

Table 34. Monthly distribution of forest fires in Turkey 2018.

Month	Number Of Fires	Burnt Area (Ha)
Jan	5	0.73
Feb	29	13.21
Mar	35	41.05
Apr	162	121.89
May	117	704.33
Jun	227	390.68
Jul	391	1644.27
Aug	482	1265.65
Sep	453	1201.32
Oct	181	194.74
Nov	80	65.77
Dec	4	0.76
TOTAL	**2167**	**5644.4**

Fire Causes

In Turkey, 78% of forest fires take place in forested areas up to 400 metre altitude.

These areas are:

- High populated areas
- Areas of high migration
- Areas where there are valuable lands
- Places with cadastral problems
- Tourism areas

Most of the fires in Turkey were caused by human activities (89% in total) The causes of forest fires in 2018 are shown in Figure 110.

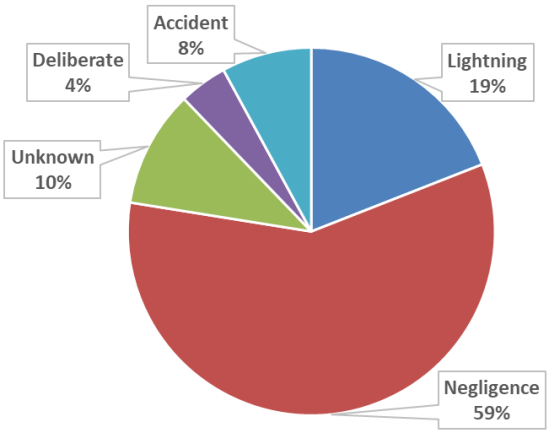


Figure 110. Fire causes in Turkey in 2018.

Fire Management

Fire management in Turkey is carried out under the responsibility of the General Directorate of Forestry (GDF). Duties are carried out by state forest enterprises functioning under regional directorates. Regardless of the high costs involved, all required activities are planned and implemented immediately. Fire management deals mainly with activities concerning early detection, prevention and control.

Early Fire Warning Systems

So far, a total of 776 fire towers have been built to detect fire and report to firefighting teams. With 230 cameras at 115 points, the fires detected in our forests in the fire sensitive zone are reported to the fire management centres and the teams are sent.

The system enables rapid detection of forest fire to visible range optical cameras (Fire management centres can also monitor the progress through these cameras)

Construction of Pools and Ponds

During 2018, for the purpose of shortening the periods of forest fire attack in forested areas where water sources are scarce, 3 102 fire pools and ponds were constructed and will continue to be constructed.

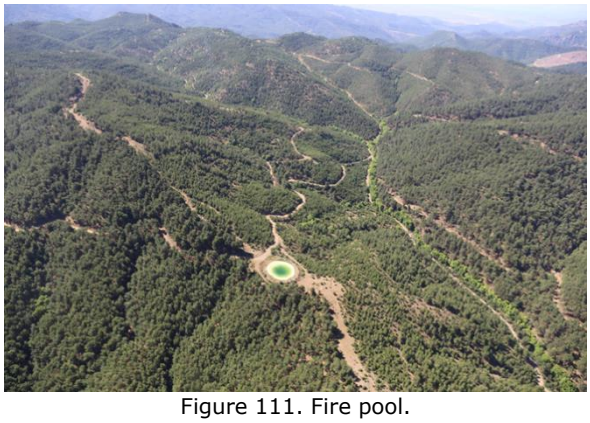


Figure 111. Fire pool.

Fire Fighting Means

In addition to forest fires, General Directorate of Forest has been intervening in agriculture fires for the recent years, which is about 2 847 non-forest incidents in 2018.

In 2018, 3 000 technical staff, 5 000 forest preservation officers and 12 000 workers were involved in detection, communication and suppression efforts. Ground and air equipment used for firefighting in 2018 are presented in Table 3.

Table 35. Firefighting forces in Turkey in 2018.

Land Means		***Aerial Means***	
Bulldozer	186	Leased Helicopter	24
Grader	179	Amphibious Aircraft	5
Fire Truck	1010	Administrative helicopter	6
Water Tank	281		
First intervention	559		

vehicle			
Motorcycle	856		

Preventive measures

Fire sensitive Regional Forest Directorates

- Planting fire resistant species when rehabilitating burning areas.
- Converting existing forest to fire resistant forest. (*YARDOP Project: Rehabilitation of Burned Areas and the Establishment of Forest with Fire Resistant Species Projects)*
- Creating differential elements (roads etc.) in order to stop probable fires starting in settlements and agriculture lands from going towards forest.
- Planting fire-resistant species along roadsides in order to hinder forest fire from turning into crown fire.

Forest Fires Early Warning System

With the fire watch towers, our forests are monitored 24 hours a day. The automatic early warning system analyses the smoke and reports it to the centre within 15 seconds. There are also 15 unmanned smart towers in our forests.

Figure 112. The early warning system for detecting forest fires and automatic fire-finding systems established and put into service via a joint project among GDF, Bilkent University and Scientific and Technological Research Council of Turkiye(TÜBiTAK) for a decade.
230 units cameras in 115 Fire Lookout Towers are being used for fire detection.

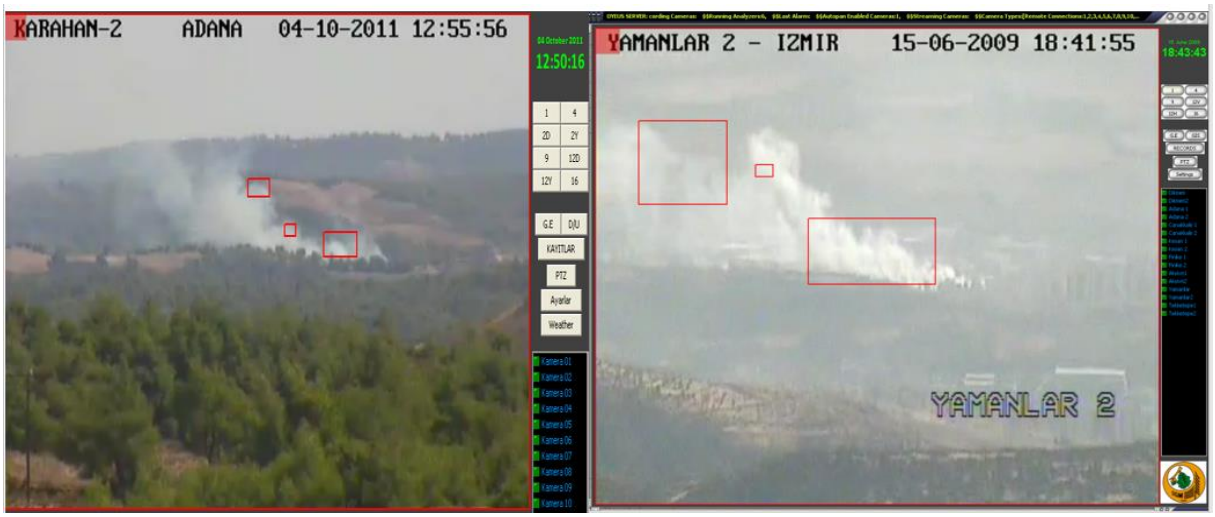


Figure 113. As soon as a fire is detected by RSS, 28 Fire Management Centres have been reported in 15 seconds.

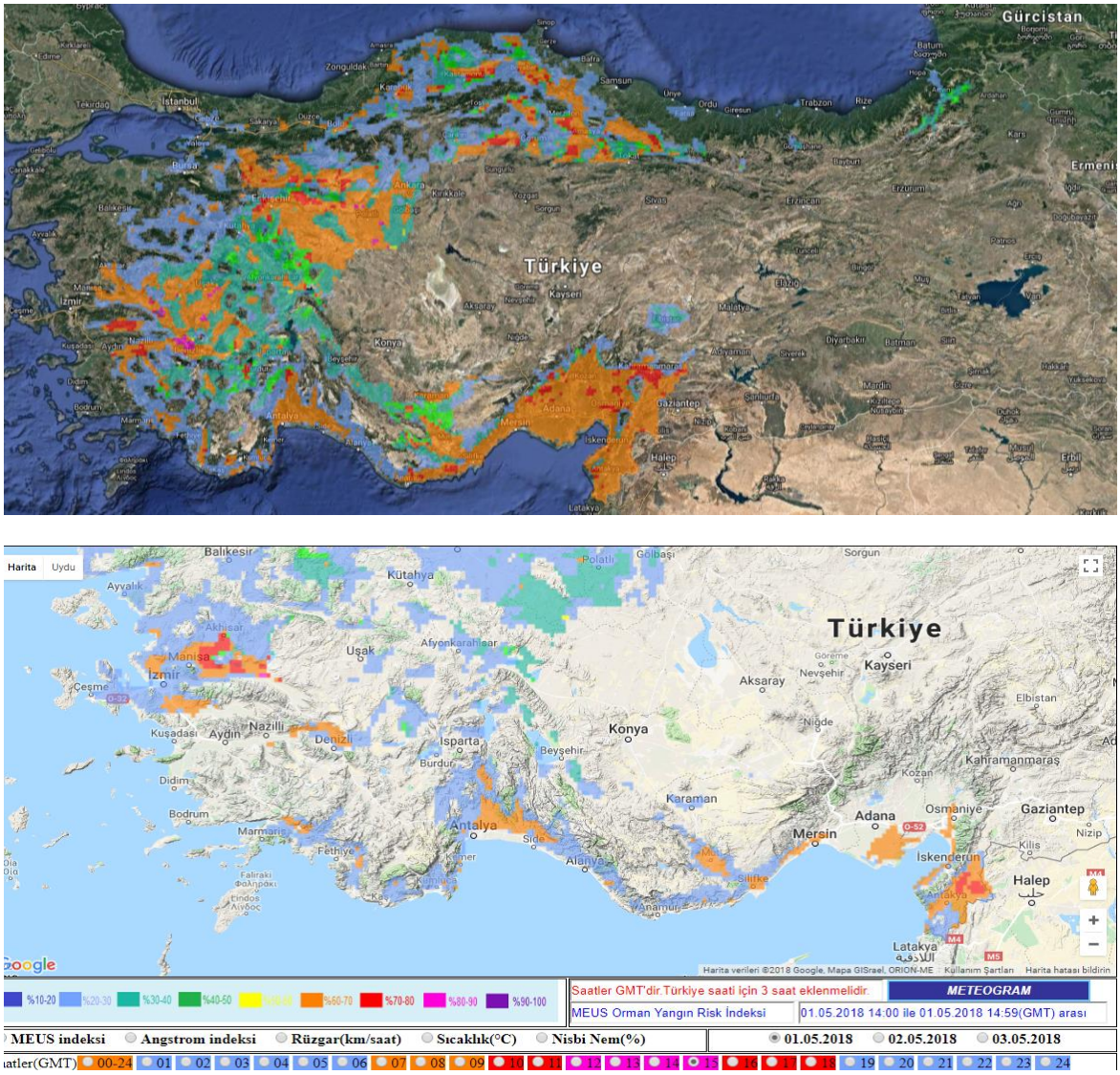


Figure 114. Daily forest fire risk for 15.05.2018

National Forest Fire Risk Estimations in Turkey

MEUS (Meteorological Early Warning System)

We have been using MEUS (meteorological early warning system) with wind, wind direction, temperature and humidity to create our 3-day daily fire risk maps. (Figure 6)

Fire Occurrence Prediction System

In 2018, we started to use Fire Occurrence Prediction System which is a GIS-based multi-criteria forest fire hazard analysis and mapping system. The system analyses the probability of starting forest fire with 12 criteria (Figure 115, Figure 116).

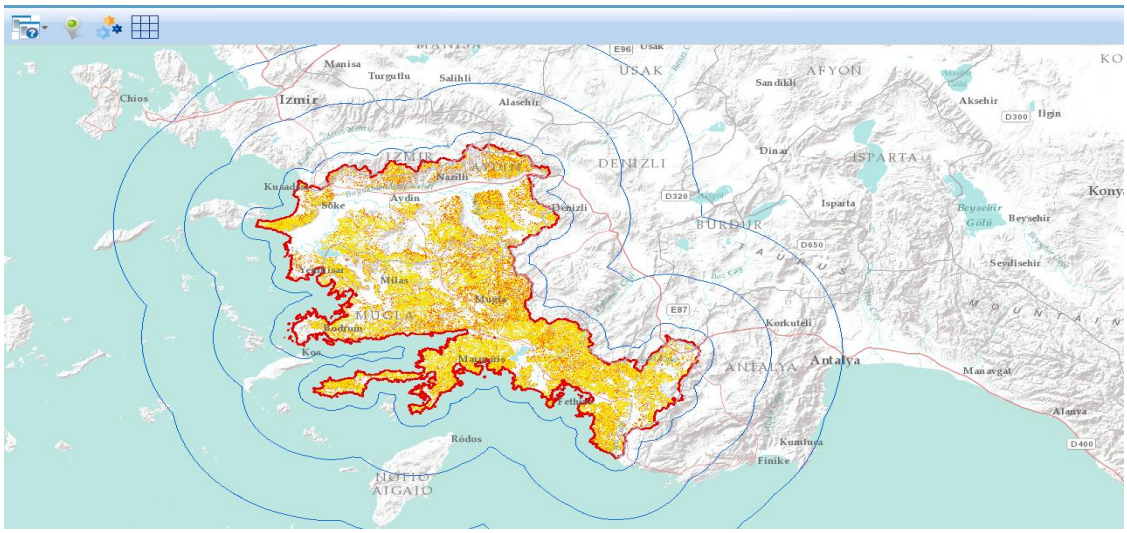


Figure 115. Fire Occurrence Prediction for Mugla Forest District

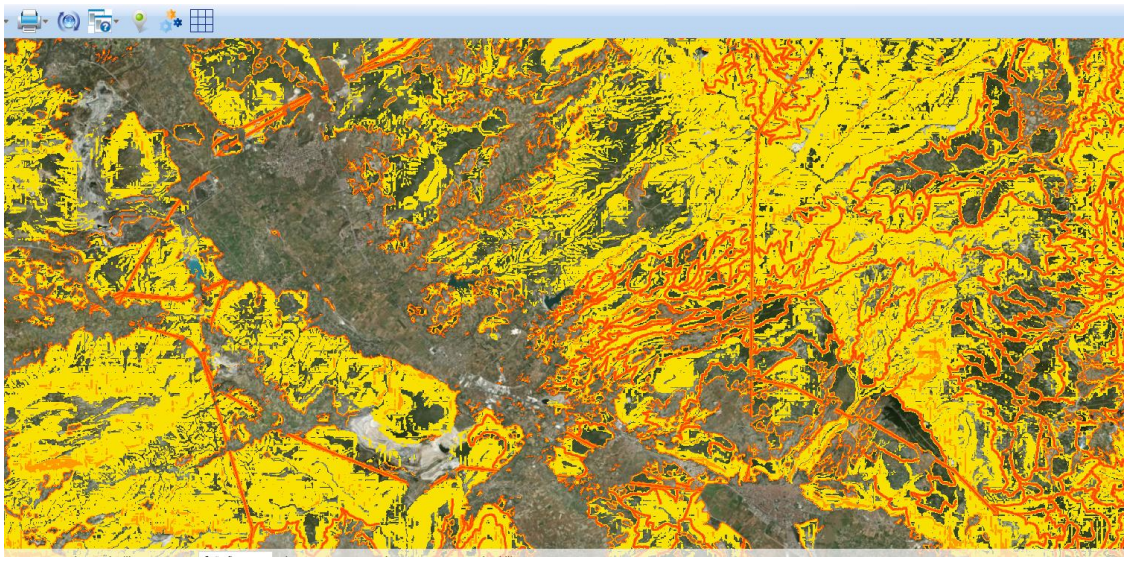


Figure 116. Fire Occurrence Prediction for Mugla Forest District in 2019

Education, Public awareness and information campaigns.

Several education/training and awareness raising campaigns have been carried out.

Training of Technical staff.

A Fire Expert Training Program has been put into effect for personnel who will take charge in forest fires. Subjects such as fire-fighting methods, application of fire-use, first aid etc., have been given to technical staff in this training program.

In 2012 the International Forest Fire Fighting School was opened in Antalya. The facilities provided training to forest fighting teams at national and international level with a forest fire simulator (Figure 117).

Training of Technicians

Information has been given to technicians about the use and maintenance of tools used to combat forest fires, such as GPS, meteorological equipment, electronic hand tools and communication devices.

Training of Workers

Training has been given to Forest Fire Workers about fire-fighting methods, first-aid and other technical subjects.

Figure 117. Forest Fire Fighting Simulator in Antalya International Training Centre.

Public awareness and information campaigns can be aggregated into 2 groups:

a) Awareness-raising activities for target groups.

- Activities for children and young people:

During 2018, conferences were held, plays were staged by Sincap Children Theatre, and brochures, books and magazines on forest were distributed to schools and other places to raise awareness about environmental, social and economic issues, fire causes and how they can be avoided.

- Activities for forest villagers, hunters and shepherds:

In our country, there are 16 000 villages located beside or inside forest areas and 6,2 million people living in these areas. Forest villagers are causing forest fires by going about their agricultural activities. So messages have been transmitted to them about the importance of human action in preventing fires.

Awareness-raising activities at national level:

- Activities for specific days and weeks. (World Forestry Day)
- Coordination meetings with local authorities.
- Cooperation with radio and television channels
- Cooperation with media and voluntary organizations
- Training of personnel working in travel agencies and tourist facilities in fire risk areas about forest fires and the preventative measures needed to be taken
- Training of soldiers and local fire departments.

Operations of mutual assistance.

In 2018, in response to requests for assistance, Turkey sent two amphibious aircrafts and 2 helicopters for forest fires in other countries.

Climate Change

According to regional climate change models; the importance of developing new strategies to prevent forest fires becomes clear, considering the possible risk scenarios regarding forest fire hazard, length of fire season and fire frequency in the Mediterranean.

Especially in the last 10 years, forest fire regime in Turkey, has been affected due to climate change. With this in mind, the fire-fighting strategy has also changed.

Forest fires vary in their causes, location and timing. So, by analysing forest fires in terms of their characteristics, target-oriented special preventive measures can be taken; thus, forest fire numbers can be reduced and fires can be extinguished before they grow.

The same prevention measures for all types of forest fires throughout the year, across the country, are both very expensive and unnecessary. For this purpose, thematic maps were formed by analysing the reasons for the forest fires, the time and location of the occurrence of 16 787 fires between the years 2013-2018. Thus, by evaluating where, which month and for what reason forest fires occurred, it will be possible to take timely customized preventive measures according to the main reasons of forest fires.

"*The best forest fire is the one that hasn't come out yet*".

When we act with this motto, it becomes clear how important a target-oriented "forest fires prevention and combat strategy" is. However, forest fire prevention efforts in our country have been largely ignored; huge budgets have been reserved for fighting forest fires.

The target-oriented plans prepared should be shared with the relevant institutions and organizations at the annual meetings and resource usage should be organised and measures should be taken together. For example, it is not possible to prevent stubble fires in Turkey, without working together with the Security Forces, Directorate of Agriculture and Directorate of Environment.

By using variable resource usage method, in which region of our country, when and which resources may be needed, the team and vehicle organisation will be given a dynamic structure.

Table 36. Number of fires and burnt area in 2018 by forestry regions and fire size class.

Region	<1.0 Ha		1.1 - 5.0 Ha		5.1 - 20.0 Ha		20.1 - 50.0 Ha		50.1 - 200.0 Ha		200.1 - 500.0 Ha		> 500. Ha		TOTAL	
	Nr Fire	Brt Area	Nr Fire	Brt Area	Nr Fire	Brt Area	Nr Fire	Brt Area	Nr Fire	Brt Area	Nr Fire	Brt Area	Nr Fire	Brt Area	Nr Fire	Brt Area
ADANA	112	20.7	7	17.2	4	40.3	0	0.0	1	85.0	0	0.0	0	0.0	124	163.2
AMASYA	76	20.2	10	32.3											86	52.5
ANKARA	35	8.4	8	16.9	2	24.7	1	30.0							46	80.0
ANTALYA	208	43.6	26	70.7	6	43.9	2	61.1	1	98.0	1	276.2	0	0.0	244	593.6
ARTVİN	3	0.9													3	0.9
BALIKESİR	54	9.2	6	14.3											60	23.5
BOLU	20	4.2	4	7.2	1	10.5									25	21.9
BURSA	32	8.2	7	18.5			1	35.7							40	62.4
ÇANAKKALE	50	11.3	3	8.1	1	23.7	1	31.7	1	55.0					56	129.8
DENİZLİ	28	6.6	4	8.9					1	68.8					33	84.4
ELAZIĞ	31	9.0	13	31.8	3	40.2									47	81.0
ERZURUM	4	2.5	5	17.4	2	13.4									11	33.3
ESKİŞEHİR	21	6.3	4	8.1											25	14.4
GİRESUN	11	7.3	5	7.7	1	15.7	1	20.3							18	50.9
ISPARTA	40	9.3	6	14.1	2	17.7									48	41.1
İSTANBUL	76	9.8	5	9.1	1	6.8									82	25.7
İZMİR	218	31.5	33	77.1	9	108.4	3	115.3	1	60.0	0	0.0	0	0.0	264	392.3
K.MARAŞ	121	43.4	27	68.0	12	128.0	4	132.0	2	187.0	2	405.0	1	526.0	169	1489.4
KASTAMONU	57	18.2	5	13.9	3	15.5					1	251.0			66	298.6
KAYSERİ	7	2.1	8	24.3	8	84.9									23	111.3
KONYA	13	6.0	4	7.6	1	14.0	2	78.6							20	106.2
KÜTAHYA	46	4.5	4	9.1	1	9.0	1	21.8							52	44.4
MERSİN	61	13.8	6	11.4	4	44.8									71	70.0
MUĞLA	325	47.7	20	51.8	7	56.4	3	76.5							355	232.4
SAKARYA	29	3.4	1	2.0	1	5.1	0	0.0	0	0.0	0	0.0	0	0.0	31	10.5
Ş.URFA	16	10.2	52	157.9	32	358.6	25	858.7							125	1385.4
TRABZON	10	4.9	7	20.2	1	6.5									18	31.5
ZONGULDAK	21	3.4	3	5.4	1	5.0									25	13.8
TOTAL	1725	366.7	283	730.9	103	1073.1	44	1461.7	7	553.8	4	932.2	1	526.0	2167	5644.4
%	79.6	6.5	13.1	13.0	4.8	19.0	2.0	25.9	0.3	9.8	0.2	16.5	0.1	9.3	100	100

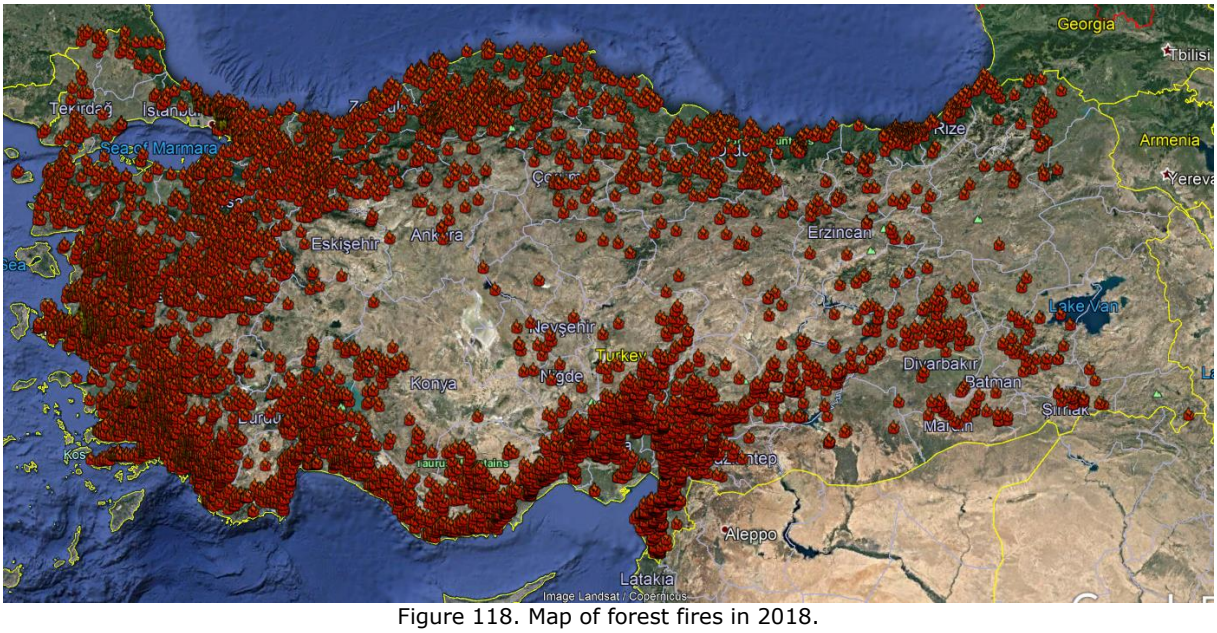


Figure 118. Map of forest fires in 2018.

(Source: Regional Forestry Directorate of Antalya, Turkey).

1.2.28 Ukraine

General Information

The area of Ukraine is 603 628 square kilometres and is divided into 24 oblasts (regions), one autonomous republic (Autonomous Republic of Crimea), and two cities of special status: Kiev, the capital, and Sevastopol. Twenty four oblasts (regions) and Crimea are subdivided into 490 raions (districts).

The total area of forest lands belonging to the forest fund of Ukraine is 10.4 million hectares, including 9.6 million hectares covered with forest vegetation. Total forest cover is 15.9%.

The forests of Ukraine grow in five natural and climatic zones: Polissia zone (forests), Forest-Steppe zone, Steppe zone, and two high-level zones, the Ukrainian Carpathians and the Crimea, which are significantly different in climatic conditions.

Forests of Ukraine are formed by more than 30 wood species, among which the most common are Scots pine (*Pinus sylvestris L.*), European oak (*Quercus robur L.*), European beech (*Fagus sylvatica*) and Norway spruce (*Picea abies*): Figure 119.

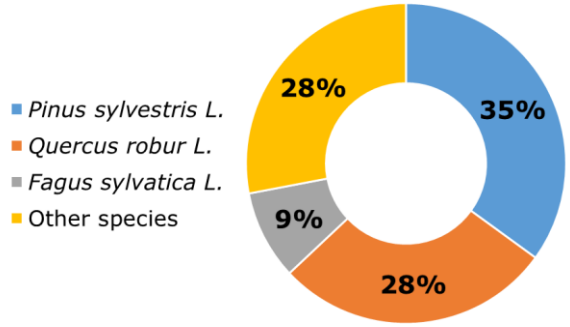
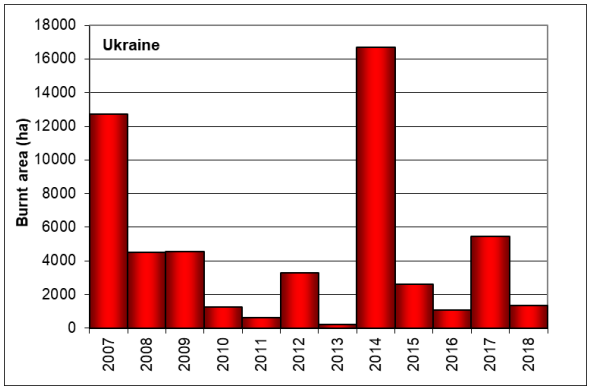


Figure 119. Distribution of forest area by species.

The most fire dangerous coniferous forests occupy 43% of the total area, in particular, pine stands – 35%, which grows in the North of Ukraine (Polissia zone) and in the South (Steppe zone) along the biggest rivers and also in the Crimea peninsula.

Fire occurrence and affected surfaces

The comparative charts for the total burnt area in the forests, number of fires and average fire size for 2007-2018 are shown in Figure 105. During 2018 there were 1 297 forest fires with a total area of 1 367 ha. The largest numbers of fires were registered in Kherson (258 cases), Luhansk (208) and Dnipropetrovsk (185) regions (Figure 122). The largest burnt areas were registered in Kherson (772 hectares), Luhansk (153 hectares), Kharkiv (96 hectares) and Dnipropetrovsk (81 hectares) regions. In 2018, there were 15 forest fires with an area of over 5 hectares.



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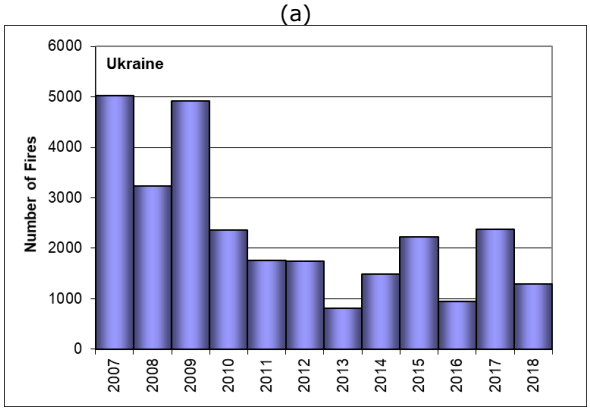

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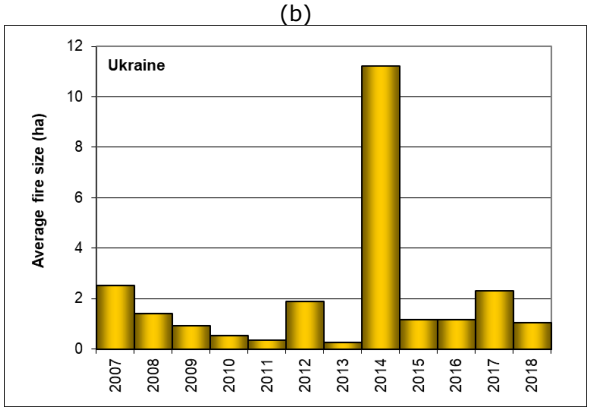


(c)

Figure 120. Burnt areas (a), number of fires (b) and average fire size (c) in Ukraine from 2007 to 2018.

Distribution of forest burnt areas according to types of fire is shown in Figure 121.

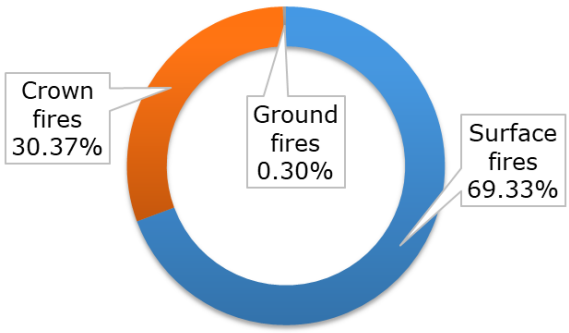


Figure 121. Burnt area distribution by type of fire.

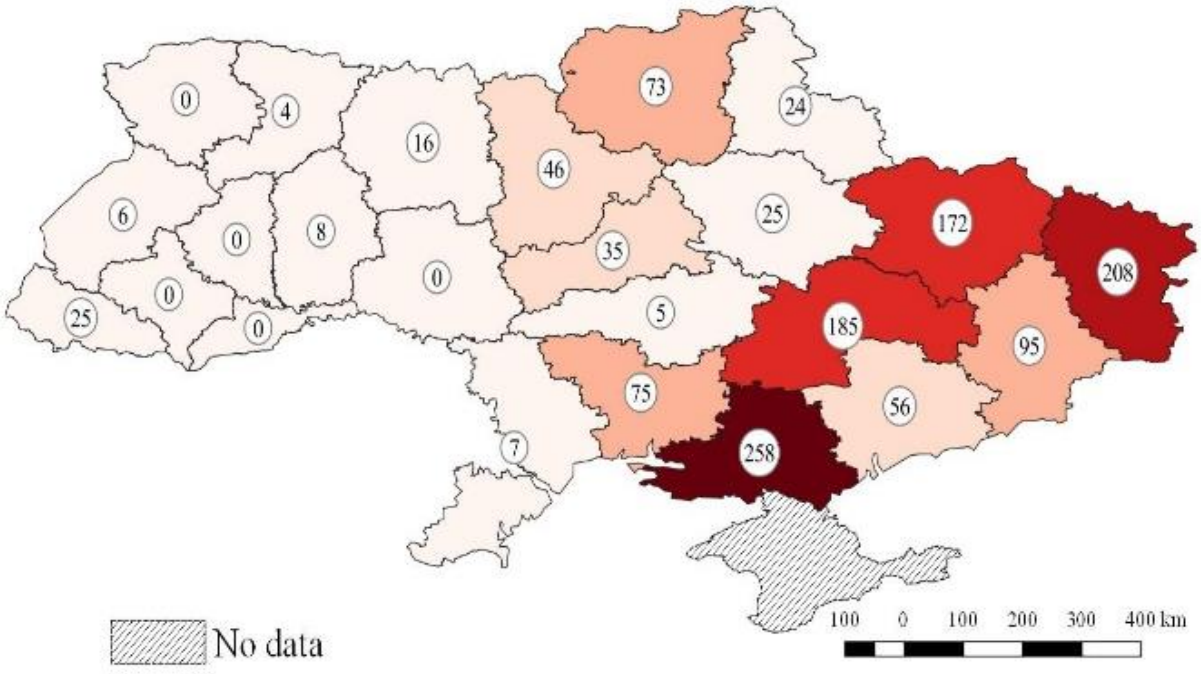


Figure 122. Number of fire incidents by regions (oblast) in 2018.

In 2018, the most affected month was June when 50% of the annual total burnt area were recorded. Taking into account the number of fires, the situation was also dangerous in May and August when 21.8% and 20.3% of forest fires occurred respectively Figure 123.

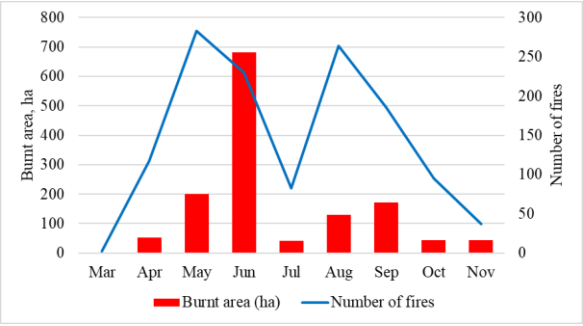


Figure 123. Number of fires and burnt area by month in Ukraine in 2018.

Fire causes

The majority of forest fires (82%) are caused mainly by the negligence of local people (1 074 incidents in 2018). The main cause of forest fires is the violation of the fire safety requirements in forests during the period of high fire danger. Agricultural burning is the cause of 0.6% of forest fires (8 cases). The fault of other organizations is 2.2% (29 cases), a result of lightning is 1.8% (23 cases). The fires of unspecified origin are 10.9% (142 fires in 2018).

Economic losses

The economic losses caused by forest fires are shown in Figure 6. In 2016 they were estimated to be around 8 619 200 Ukrainian hryvnia (UAH); in 2017 – 43 800 000 UAH, and in 2018 – 27 200 000 UAH (Figure 124).

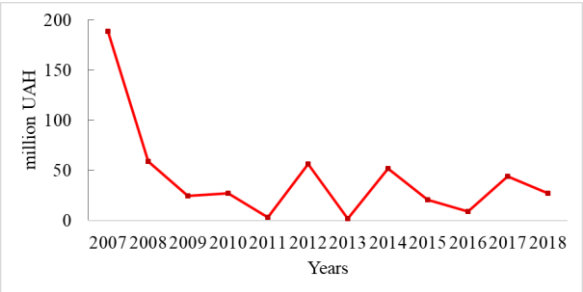


Figure 124. Economic losses caused by forest fires (data provided by the State Forest Resources Agency of Ukraine and State Service of Statistics).

Fire prevention activities

Forest fire protection is provided by 307 state forest enterprises, consisting of more than 1.7 thousand forestries and 288 forest fire stations. In the forests of the State Forest Resources Agency of Ukraine, there is a network of 491 fire and observation towers, of which 324 are equipped with television surveillance systems.

Protection of forests belonging to the scope of management of the State Forest

Resources Agency of Ukraine is carried out by the State Forest Guard officers, the total number of which is 17 thousand of persons, almost 15 thousand of which are directly involved in daily forest protection at the level of forestry. Direct protection of forests from fires is carried out by about 17 thousand workers of state forest protection. Technical equipment of forest fire departments includes 647 fire trucks, 433 firefighting modules on a four-wheel drive chassis and adapted equipment, over 1 000 motor pumps, 8 800 individual sprayers, 2 200 radio stations, etc.

Elimination of forest fires in the initial stage is the responsibility of the appropriate departments of forestry enterprises. If there is a threat of a large forest fire, units from the State Emergency Service of Ukraine, regional state administrations and other services are involved within their competence in order to extinguish the fire. In previous years, forest fires were mostly liquidated at the initial stage by the forces of the State Forest Guard (80%), but in 2018, the extinguishing of fires was mainly carried out with the involvement of significant forces and means of the State Emergency Service of Ukraine, which in turn increased the costs of their elimination.

In 2018, 76 km of firebreaks and 51 thousand km of fire-prevention mineralized lines were created, 247 thousand km of fire-prevention mineralized lines and firebreaks were restored.

Wildfires in the East of Ukraine (in the Joint Forces Operation)

Since 2014, part of Ukraine's territory remains temporarily occupied. Armed confrontation on the line of contact contributes to the occurrence of a large number of fires. Official statistics on forest fires are obtained only from the territories that are controlled by the Ukrainian government. Table 1 shows data from eastern regions of Ukraine before (2013 – prior to the conflict) and after the beginning of the war, during the most active fighting (2014-2015).

Table 37. Forest fires in the Eastern part of Ukraine.

Year	Region	Number of fires	Burnt area, ha	Economic damage, million UAH
2013	Donetsk	185	16	0.15
	Luhansk	145	27	0.16
2014	Donetsk	97	1282	0.15
	Luhansk	356	10274	31.02
2015	Donetsk	101	32	0.13
	Luhansk	353	1101	3.17

In 2014, 356 forest fires occurred in the Lugansk oblast under control of Ukraine over an area of 10 274 hectares, which is 61.6% of the total burnt area in Ukraine for 2014. The localization and extinguishing of fires were complicated because of the conflict, so in some cases it was impossible. There are no data from the temporarily occupied parts of the Donetsk and Lugansk regions and the Crimean peninsula. Therefore, one of the available tools for monitoring the wildfires in the occupied territories is the remote sensing methods (Figure 125)

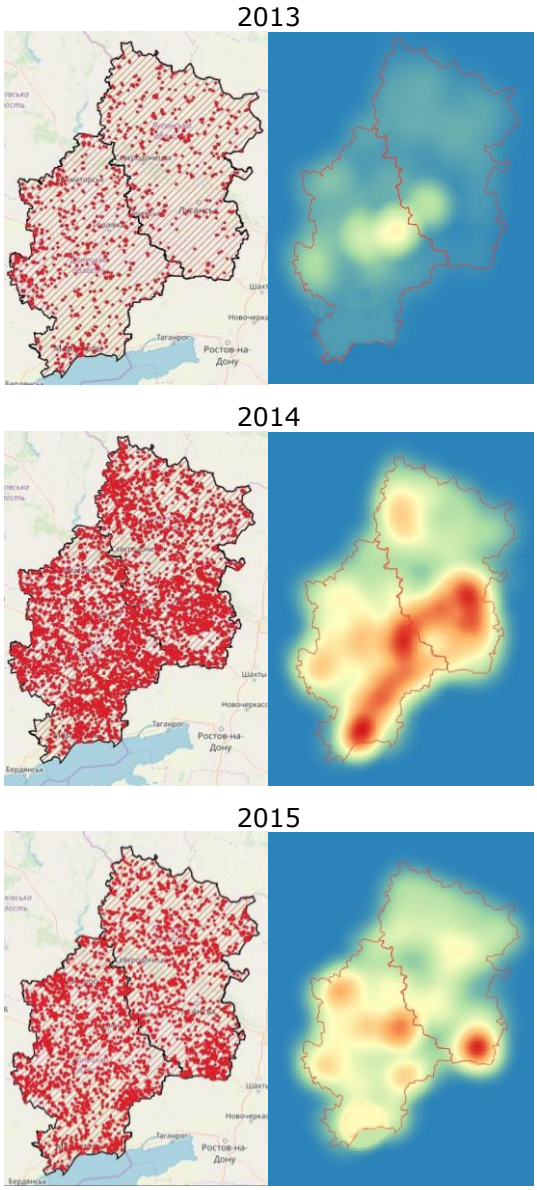


Figure 125. Thermal anomalies recorded by satellites Terra and Aqua in the East of Ukraine (zone of armed conflict). Satellite data provided by FIRMS.

(Source: Ukrainian Research Institute of Forestry and Forest Melioration, Ukraine)

1.2.29 United Kingdom

Introduction

Due to the significant processing periods for fire statistics, it is not possible to gain access to Incident Recording System data for Great Britain, gathered from Fire and Rescue Services when this report was requested. The UK report for 2018, as with last year, is therefore based on qualitative information submitted by representatives from the four devolved UK countries. European Forest Fire Information System indicates that the UK had an area burned 20 947 hectares, but this only records incidents over 30 hectares.

Parts of the UK experienced their second consecutive year of a prolonged dry period as well as several dry and very warm periods. These conditions provide the ideal environment for the development and spread of large and disruptive wildfires.

Fire danger in the 2018 season

The wildfire season in England started early with serious incidents in late February such as at Iping Common, East Sussex where the incident disrupted transport networks and threatened residential properties.

By April 2018, four serious wildfire incidents were occurring in Scotland. An example of biggest fires was at Strathnaver, Sutherland calculated at some 3 100 hectares in area. These wildfires occurred in the Spring of 2018 between March to May and accounted for 12 890 hectares, some 61% of the UK area burnt. These incidents resulted in risk to national infrastructure and the environment.

June saw several large wildfire incidents in northern England in the uplands and in Wales and Northern Ireland. A major incident was declared at Winter Hill, near Bolton, Lancashire for a protracted incident of 41 days (28th June – 8th August 2018) which burnt approximately 870 hectares. The Mossley incident (also called Saddleworth Moor) was significantly larger at approximately 1 000 hectares. Both incidents had risks to local and national infrastructure, residential and commercial properties and the environment, and numerous residential properties were evacuated. The Ministry of Defence estate had two significantly large wildfires at Salisbury Plain and Otterburn ranges. Wildfires occurred across Wales, examples being in Breidden Hill, Powys, Mynydd Cilgwyn, Carmel, across Gwynedd and Anglesey as well as the Vale of Rheidol, Ceredigion.

In Northern Ireland, a multi-agency response was required for multiple large wildfires in Glenshane Pass in County Londonderry.

July saw an increase in wildfire activity in southern England, the most serious incidents of short duration but located in the Rural : Urban Interface. For example, over 100 people were evacuated from a Natura 2000 site in Wanstead Flats, East London and residential and commercial property was destroyed and damaged in Marlow, Buckinghamshire during an arable fire. Both of these incidents resulted in disruption of transport routes and significant deployment of Fire and Rescue Service resources.

Less significant wildfire incidents continued thorough out summer into winter 2018.

Fire prevention activities and information campaigns

During 2018, the government-sponsored Natural Hazard Partnership (http://www.naturalhazardspartnership.org.uk/) sent out Daily Hazard Assessments to government departments, agencies and local authorities to highlight peak periods when wildfires were likely. This resulted in the longest AMBER assessment for wildfire since the system started, extending from June to August. In Scotland, the Scottish Wildfire Forum issued 21 wildfire alerts during 2018.

Throughout the high wildfire risk periods several coordinated wildfire awareness raising campaigns using social media were undertaken. Examples include the #WildfireAware campaign, which was initiated by the South East England Wildfire Group.

Similar approaches were undertaken by the National Fire Chiefs Council, Forestry Commission and Department for Environment, Food and Rural Affairs (DEFRA). Wildfire warnings were sent out via the Scottish Fire and Rescue Service and Scottish Wildfire Forum, via analysis by Fire Break Services.

Operations of mutual assistance

In response to a bilateral request from the Hellenic Fire Corps, the Forestry Commission working with the Foreign and Commonwealth Office undertook an impact assessment of the wildfire incidents in Kineta and Mati in Attica, Greece in early August. The United Kingdom provided two UCPM wildfire experts as support to the European Response Coordination Centre in mid-August.

In the UK, the National Fire Chiefs Council (NFCC) launched its Fire and Rescue Service Wildfire Tactical Advisors. These tactical advisors were first formally deployed at the Winter Hill and Mossley (Saddleworth Moor) incidents near Manchester.

Climate Change

In July 2018 DEFRA published its National Adaptation Programme with actions for Forestry Commission to help adapt forestland to wildfire incidents. This included the continuation of Wildfire Prevention Workshops, the development of a Fire Danger Rating System and mapping of fuels and risk.

Climatic conditions and how they impacted the fire season

In comparison to the 1981 to 2010 average, 2018 was warmer than average for the UK, although not as warm as 2017. May, June, July and December were all much warmer than average and key periods for summer wildfire incidents coincided with the summer arable crop harvest resulting in a large number of crop fires. 2018 was a relatively dry year, particularly across the north of the UK, with June a very dry month in the south. Notable extreme events during the year included a spell of severe winter weather in late February and early March, but this period of cold weather dried out various species especially *Calluna* and *Erica* resulting in numerous wildfire incidents.

Research activities aimed at improving fire management

The UK Wildfire Research Group met twice during 2018 proving opportunities for end users, such as government departments, agencies, land managers, Wildfire Forums and Fire and Rescue Services, to highlight priorities to numerous universities and research funders.

(*Source: Forestry Commission, UK*).

1.3 Comparison of Southern EU countries with longer time series (1980-2018)

The long time series of forest fire data available for these 5 large southern countries (Portugal, Spain, France, Italy, and Greece) justifies a separate analysis as has been the case in previous reports.

Figure 126a shows the total burnt area per year in the five large Southern Member States since 1980. The statistics vary considerably from one year to the next, which clearly indicates how much the burnt area depends on seasonal meteorological conditions.

The total burnt area in 2018 was 109 808 ha (Figure 126a), only around 12% of the total reported in 2017 and the lowest total for the 5 EU-med countries since EFFIS records began in 1980. Greece reported a slightly higher total than in 2017, but the burnt area for the other four countries was between 10% and 20% of the 2017 reported totals.

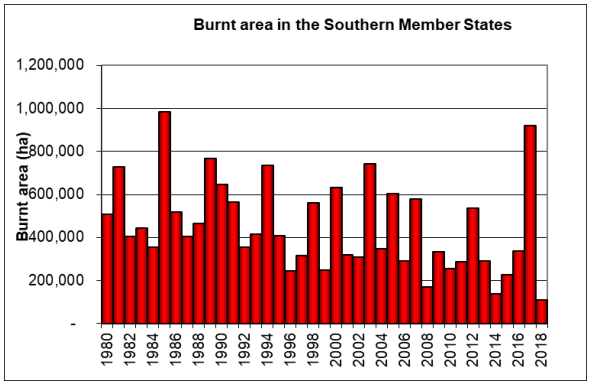
Figure 126b shows the yearly number of fires in the five southern Member States since 1980.

After the increasing trend during the 1990s, which was also partly due to the improvement in recording procedures, the number of fires was stable for around one decade, and in the last decade a decrease was observed. In 2018 the total number of fires was 26 434, well below long term averages and one of the best years since 1980 (see Table 38 and Annex 1 for details).

Figure 126c shows the yearly average fire size in the 5 countries since 1980. There is a clear difference in average fire size before and after 1990.

This is a similar trend to that observed in the number of fires and is also partly due to the same reasons (the additional fires that are recorded thanks to the improvements in the statistical systems are the smallest ones). However, it is also largely due to the improvements of the fire protection services of the countries.

In 2018 the average fire size of just over 4 ha was one of the lowest reported in almost 4 decades.



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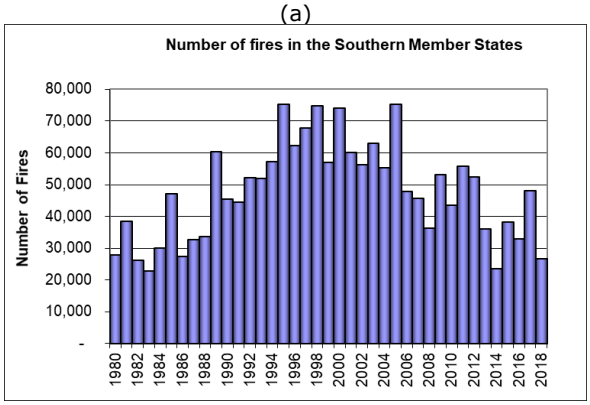

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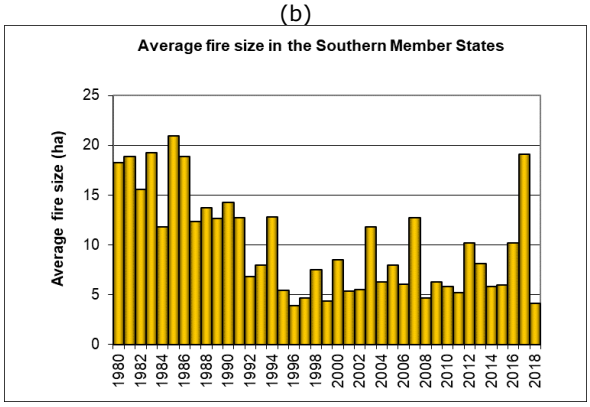


(c)

Figure 126. Burnt area (a) number of fires (b) and average fire size (c) in the five Southern Member States for the last 39 years.

Figure 127 compares the yearly averages of burnt areas, number of fires and average fire size for the periods 1980-89; 1990-1999, 2000-9 and 2010-2018 with the figures for 2018. It shows each of the 5 countries separately and also their total.

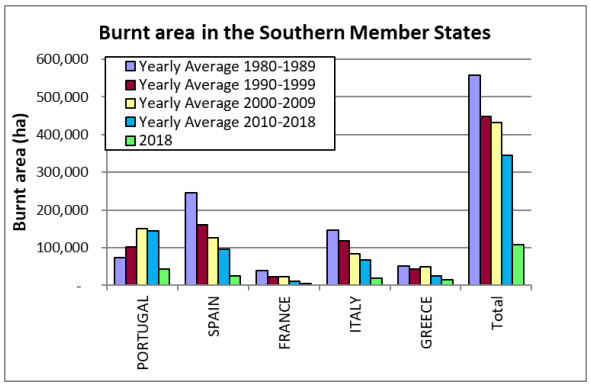
Table 38 gives a summary of the burnt areas and number of fires for the last 39 years, the average for the 1980s, the 1990s and the 2000s, and the average for the last 8 years, together with the figures for 2018 alone.

The total number of fires, burnt area and average fire size was lower than the averages for all previous decades. (Figure 127b).

Figure 128 shows the contribution of each of the five Member States in terms of burnt areas and number of fires to the overall figures for all five countries in 2018.

Since the area of each country is different, and the area at risk within each country is also different, the comparisons among countries cannot be absolute. It should also be borne in mind that since 2009 the figures for numbers of fires in Greece are incomplete and are therefore an under-representation of the true figure, which also affects the figures for average fire size and leads to an inflated figure for average fire size in Greece.

In 2018 Portugal was the most affected of the 5 EU-Med countries in terms of numbers of fires and burnt area. It had a slightly lower share of the number of fires compared with the past, but the share of burnt area was similar to that reported in the last 3 years. This was mostly because of the large fire in Monchique, which alone accounts for 25% of the annual total across the 5 countries.



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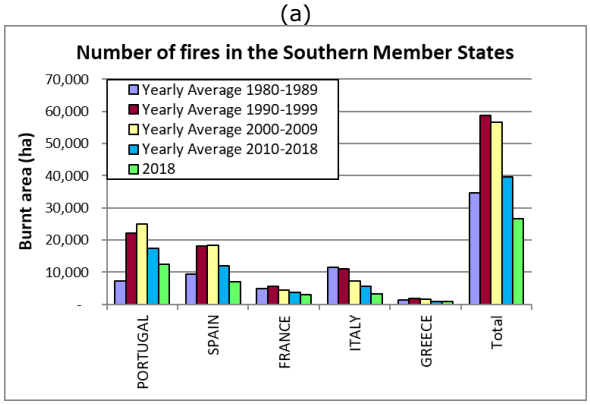

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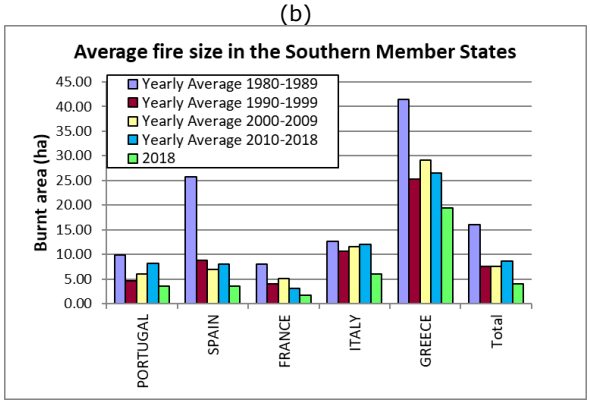
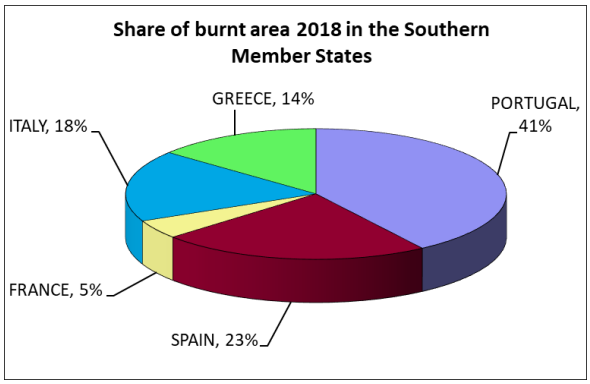


(c)

Figure 127. Burnt areas (a), number of fires (b) and average fire size (c) in the five Southern Member States in the year 2018 as compared with average values for previous decades.



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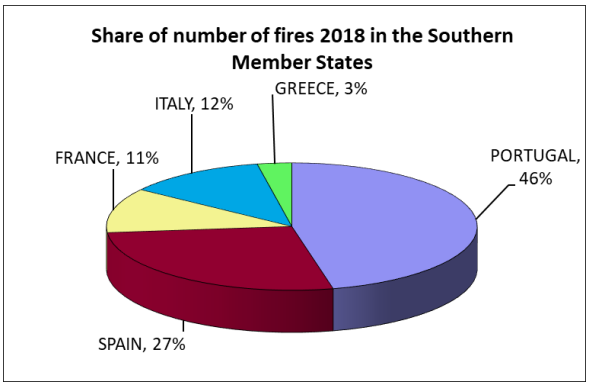


(b)

Figure 128. Share of the total burnt area (a) and the total number of fires (b) in each of the Southern Member State for 2018.

Table 38. Number of fires and burnt area in the five Southern Member States in the last 39 years.

Number of fires	PORTUGAL	SPAIN	FRANCE	ITALY	GREECE	TOTAL
2018	**12 273**	**7 143**	**3 005**	**3 220**	**793**	**26 434**
% of total in 2018	46%	27%	11%	12%	3%	100%
Average 1980-1989	7 381	9 515	4 910	11 575	1 264	34 645
Average 1990-1999	22 250	18 152	5 538	11 164	1 748	58 851
Average 2000-2009	24 949	18 369	4 418	7 259	1 695	56 690
Average 2010-2018	17 463	11 968	3 690	5 538	978	39 638
Average 1980-2018	18 025	14 566	4 663	8 970	1 432	47 656
TOTAL (1980-2018)	702 973	568 071	181 870	349 822	55 859	1 858 595

Burnt areas (ha)	PORTUGAL	SPAIN	FRANCE	ITALY	GREECE	TOTAL
2018	**44 578**	**25 162**	**5 124**	**19 481**	**15 464**	**109 808**
% of total in 2018	41%	23%	5%	18%	14%	100%
Average 1980-1989	73 484	244 788	39 157	147 150	52 417	556 995
Average 1990-1999	102 203	161 319	22 735	118 573	44 108	448 938
Average 2000-2009	150 101	127 229	22 362	83 878	49 238	432 809
Average 2010-2018	144 555	95 686	11 253	67 004	25 894	344 392
Average 1980-2018	116 894	158 834	24 200	105 104	43 351	448 383
TOTAL (1980-2018)	4 558 878	6 194 536	943 811	4 099 043	1 690 673	17 486 940

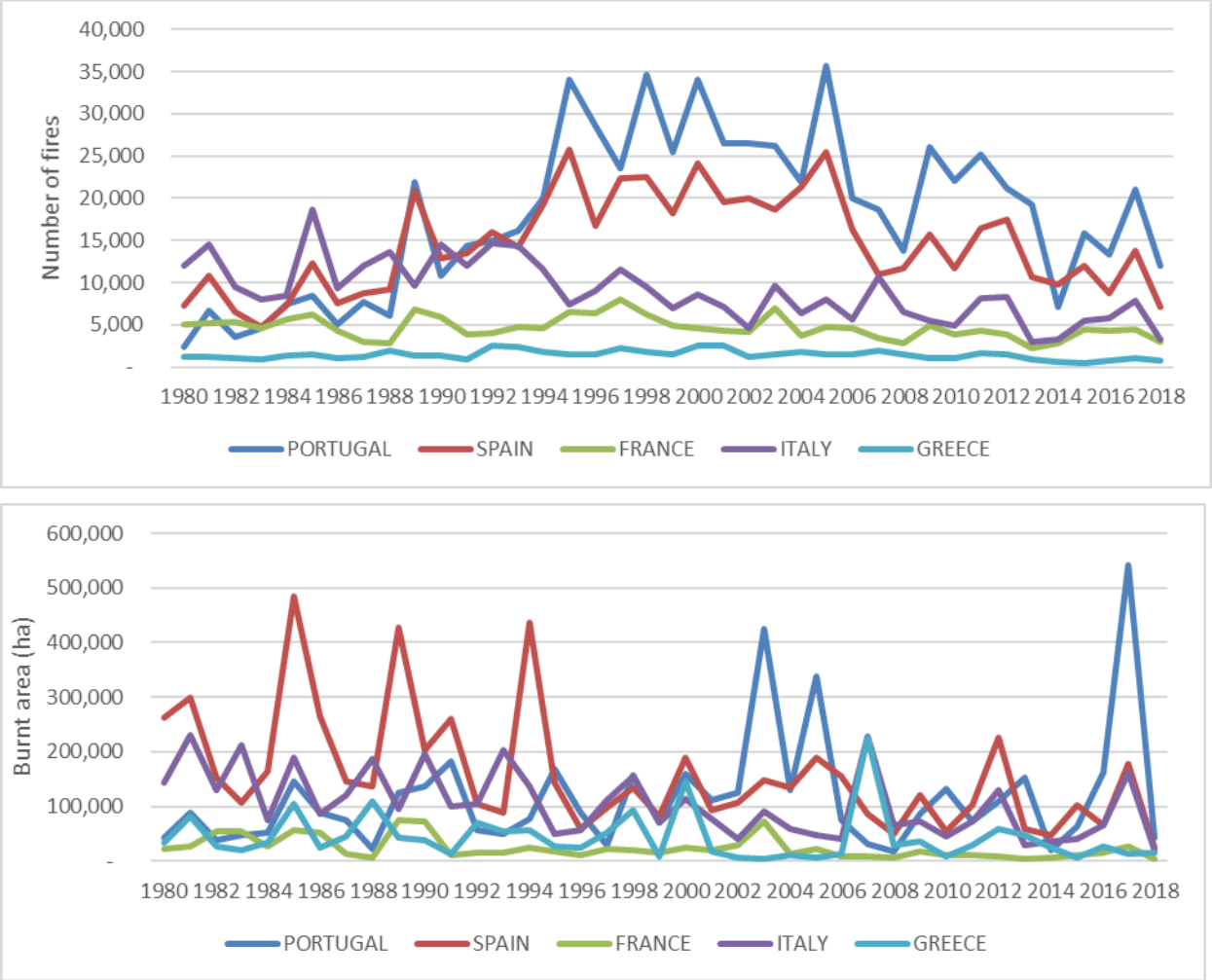
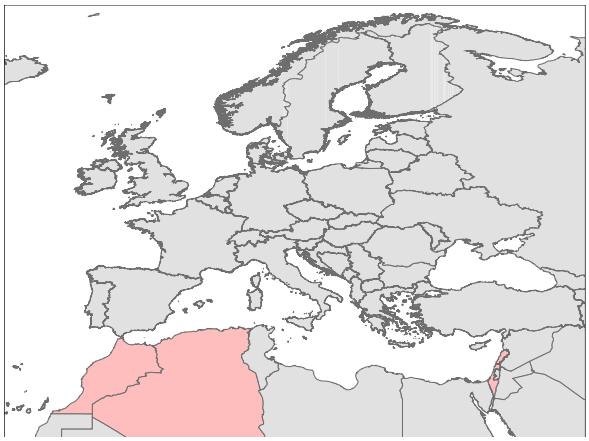


Figure 129. Time series showing the comparative number of fires and burnt area in the 5 large EU-Med countries.

1.4 Middle East and North Africa Countries



1.4.1 Algeria

Introduction

The geographical location of Algeria within the Mediterranean basin and the climatic conditions to which it is exposed, are at the origin of the characteristics which specify our country. In effect, it has a mountainous configuration in the north with an unsettled "southern Mediterranean" climate, purely dry and hot in summer, and there is a typically Saharan landscape in the south, distinguished by a particularly arid climate.

These variable climatic conditions favour the development of diverse plant species in the northern part of the country, where large areas of forest are generally dominated by discontinuous and irregularly vegetated stands. However, the southern region of the country is characterized by a very poor and highly adapted floristic composition, consisting mainly of scattered oases, mainly surrounded by palm groves.

During the warm season, this diverse floristic heritage forms a very important heat potential due to being very vulnerable to fire, as a result of the existence of a dry and resinous undergrowth and flagrant lack of preventive arrangements against fire.

Fire danger in the 2018 fire season

The summer of 2018 was characterized by mild temperatures for long periods. The peaks of heat were felt less and the fire risk in forests did not reach very high levels. The average area burned per fire during the 2018 season is in the order of 03 ha / fire, which is very low compared to the previous year.

Below is a representative diagram of the average areas burned by fires since 2012 (Figure 130).

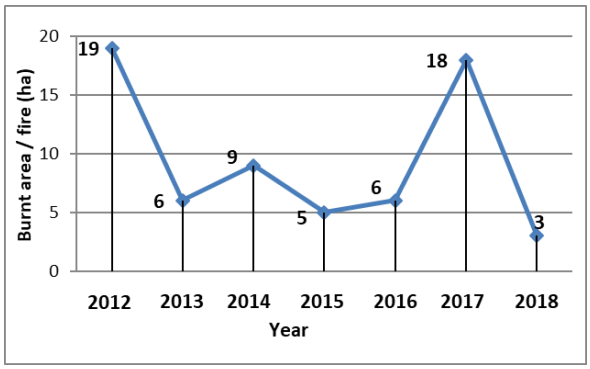


Figure 130. Average burnt area per fire for the last 7 years (ha/fire).

Fire occurrence and affected surfaces

The total area of forests, maquis and scrub affected by fire during the 2018 season is estimated at 2 312 hectares, from a total of 797 fires. In fact, the total area burned in 2018 has dropped significantly, representing only 5% of the area burned during the previous year's season.

The distribution of the total burnt area by type of vegetation (Figure 131), shows that forests were the land type most affected by fire: in fact almost half (45%) of the total area burned is within forest massifs. The other half of the overall area affected by fire is scrub and maquis with 30% and 25% respectively.

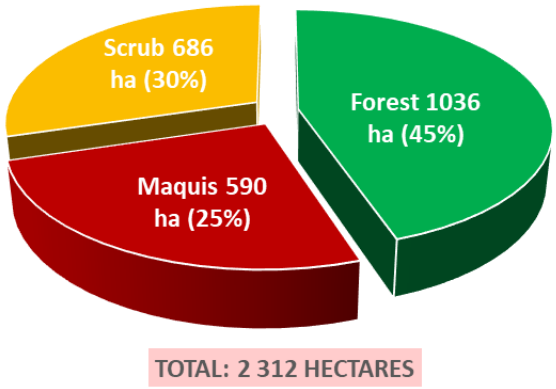


Figure 131. Burnt area in 2018 classified by vegetation type.

The distribution of the total area burned and the total number of fires during the five months of the fire campaign (Figure 132), reveals that the month of July was the most affected with about 56% of the total area burned. However, the month of August saw the highest number of fires, when more than 35% of the total were reported.

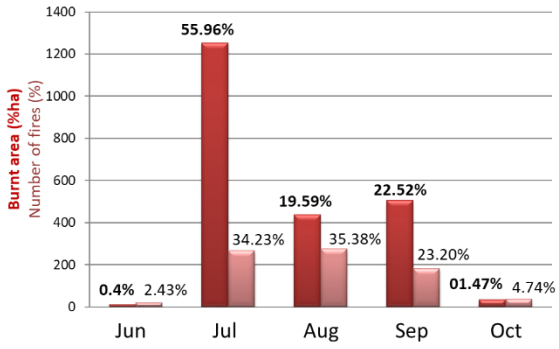


Figure 132. Burnt areas and number of fires during the five months of the fire season in 2018

The ten wilayas most affected by fires in forests, scrubland and brush during the last decade (2008-2018) (Figure 133) are generally those of the NORTHEAST of the country; only three wilayas in the WEST region of the country were seriously affected by forest fires.

In fact these ten wilayas accounted for about 65% of the total area affected by forest fires. Also 65% of the number of fires were recorded in these wilayas during the decade. However, five of the ten wilayas (namely Sidi Bel Abbes, Bejaia, Tizi-Ouzou, Taref and Jijel) accounted for 44% of the total area burned during the decade.

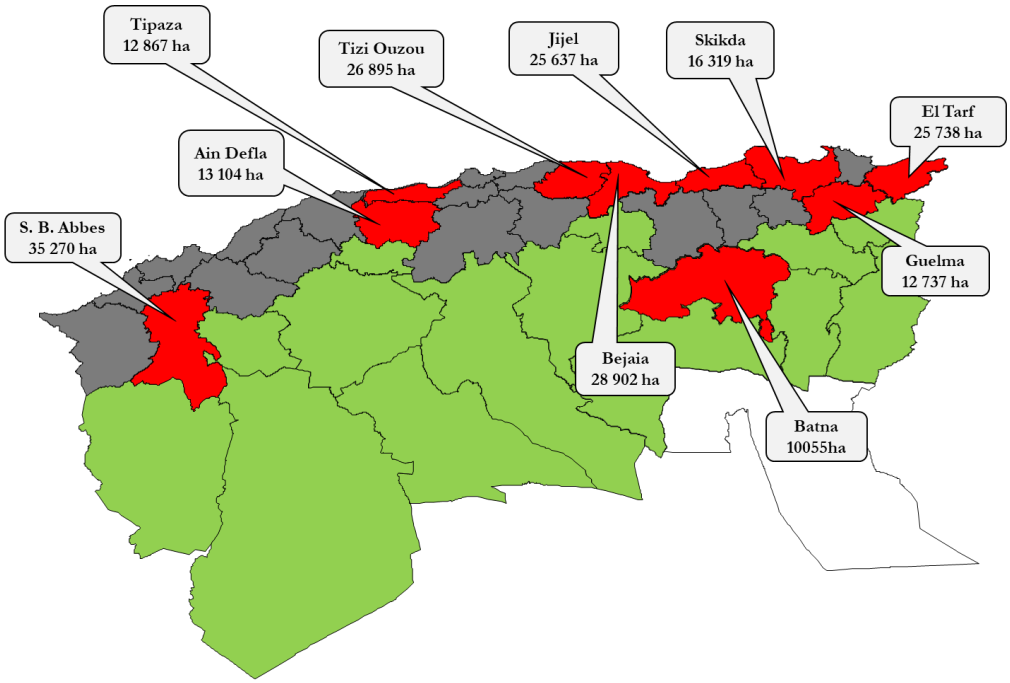


Figure 133. The ten Wilayas most affected by forest fires (2008-2018).

Forest fire prevention in 2018

As every year, the usual actions have been carried out by the different sectors involved in the campaign against forest fires. These preparatory actions can be grouped into the following main components:

1. Awareness actions:

- Organization of information and awareness tours for farmers and the rural population on the risk of fires in forests and harvests.
- Dissemination of leaflets and brochures containing preventive fire safety instructions for the benefit of citizens.
- Sensitization of the general public on the risks related to forest fires, through information flashes and programmes on local radio.

2. Preventive actions:

- Maintenance fire protection trenches in a number of forests.
- Maintenance of road laybys, railways and spaces under high tension lines crossing forests.
- Maintenance of forest tracks.
- Realization of new water points in the forests.

3. Organizational Actions:

- Update of the forest fire plans.
- Strengthening civil protection intervention units located near forest areas with appropriate human and material resources.
- Operation of "HEATWAVE ALERT" weather bulletins as well as forecast data on the forest fire risk and the distribution of

warning bulletins to the local services concerned.

4. Intersectoral Coordination Actions:

- Organization of "fight against forest fire" simulation exercises in coordination with the different sectors concerned.
- Establishment of operational committees for the coordination of control operations at national, Wilaya, Daira and Commune levels.
- Installation of community committees composed of farmers and citizens, who play an important role in prevention and first intervention in isolated and remote localities.

Monitor, alert, and response reinforcement

In accordance with Algerian regulations, the general organization of the fight against forest and maquis fires is structured as follows:

● Monitoring, warning and first intervention within the forest massifs are provided by the forest conservation services, through the establishment of look-out posts and small mobile brigades within the forest massifs.

● Actual interventions in case of major fires are provided by the means of the civil protection units.

In addition, it should be pointed out that an additional resource intended to reinforce operations to fight forest fires during large-scale fires was put in place by civil protection. This is currently composed of twenty-seven Mobile Columns, endowed with important human and material resources and distributed judiciously to cover all the forest regions as soon as possible. Ten other small mobile columns belonging to forest conservation services were also commissioned to cover the maximum of forest areas. Proximity measures consisting of firefighting equipment were regularly mobilized near the harvesting fields near the forests during the whole harvesting season and by recreational forests frequented by citizens.

Below is a representative diagram of the global national system (Figure 134), deployed by the different sectors concerned to support the campaign against forest fires for the year 2018.

Loss of human life

During the fire season of 2018, no deaths were recorded among citizens or firefighters. Only a few cases of minor injuries were reported during the interventions.

Mutual assistance operations between states

Algeria did not request any international assistance in the fight against forest fires of the 2018 season, and the intervention means of the Directorate General of Civil Protection did not participate in any intervention operation outside Algerian territory.

(Source: Direction Générale de la Protection Civile; Direction Générale des Forêts, Algeria).

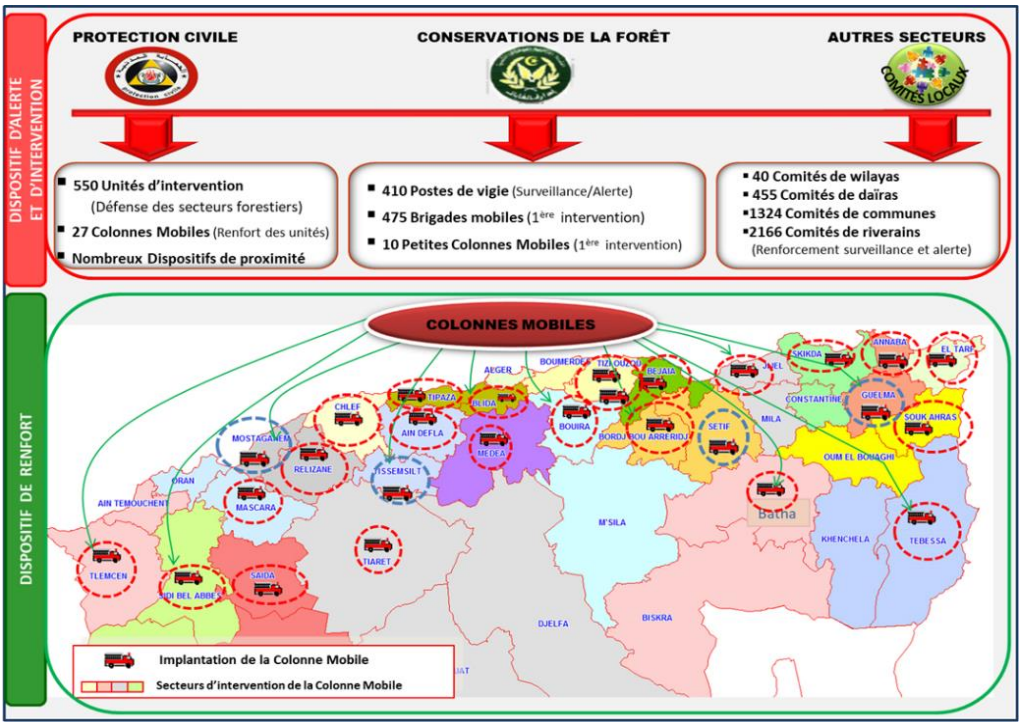


Figure 134. Resources used in the 2018 season in Algeria.

1.4.2 Israel

Israel forest fire season 2018 campaign

Israel's 2018 wildfires season was an average campaign.

During the season, 554 significant forest fires were recorded, reflecting an 8% decline over the previous season.

Meteorological data recorded during the season were normal for the period; an unusual fire danger index was noted only in November for several days (Figure 135).

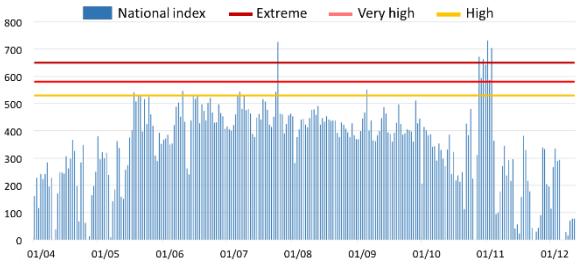


Figure 135. Daily forest fire forecasting 2018 (Source: Mr. Yiftah Ziv Israel Meteorological Service).

Fire occurrence and affected surfaces

The amount of area burned in 2017 is significantly lower than in 2016 due to the reasonable meteorological conditions during this season. The size of the area burned in 2018 increased significantly (26%) compared to the previous year due to numerous arson cases.

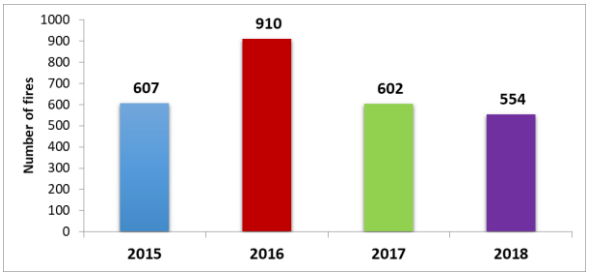


Figure 136. Number of fires in Israel 2015-2018.

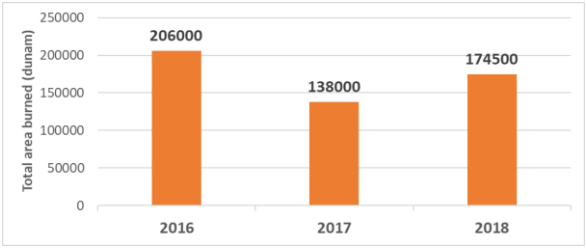


Figure 137. Burnt area in Israel 2016-2018.

The significant challenge facing the fire & rescue service in 2018 was ignition of nature reserves and agricultural areas using helium balloons.

From April to November, kites and helium balloons were launched from the Gaza Strip. The balloons and kites contained an ignition mechanism designed to ignite forests in Israeli territory.

This activity has caused considerable damage to agricultural land and natural resources.

Aerial means used during the 2018 campaign

In 2018 the firefighting squadron participated in 125 forest fires.

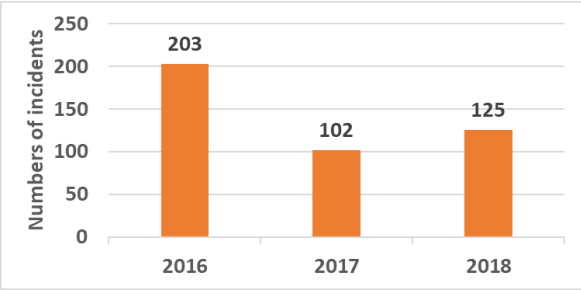


Figure 138. Number of operational incidents involving the firefighting squadron.

Figure 139. A helium balloon carries an ignition mechanism.

Figure 140. A viper snake burned in a Beery Nature Reserve.

(Source: Fire and Rescue Commission, Ministry of Public Security, Israel).

1.4.3 Lebanon

Fire danger in 2018

Lebanon's annual forest fire reports are completed within the framework of a collaborative work between the Ministry of Environment (MOE) and the Land and Natural Resources Program, Institute of the Environment, University of Balamand (LNR-IOE-UOB). The present information is mostly based on the 2018 fire report (MOE/UOB, 2019). Reported fires were based on field inspections only. Many other fires may have not been initially visited in the field, therefore remaining un-reported.

Fire season

The calculated start date of the fire danger season for 2018 was 5 February, 2018 and the calculated end date was 23 September, 2018. The peak month (in number of fires) was September (a total of 21 fires damaging a minimum area of 104.6 ha of vegetated land).

A total of 41 fires were reported, affecting a total area of 643.4 ha (Figure 141).

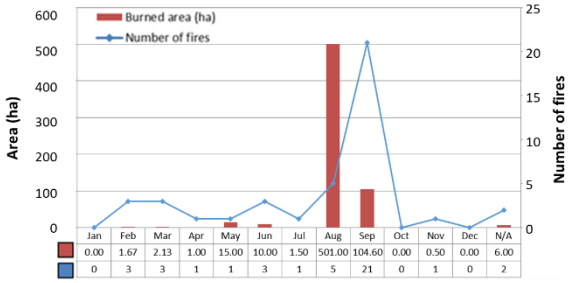
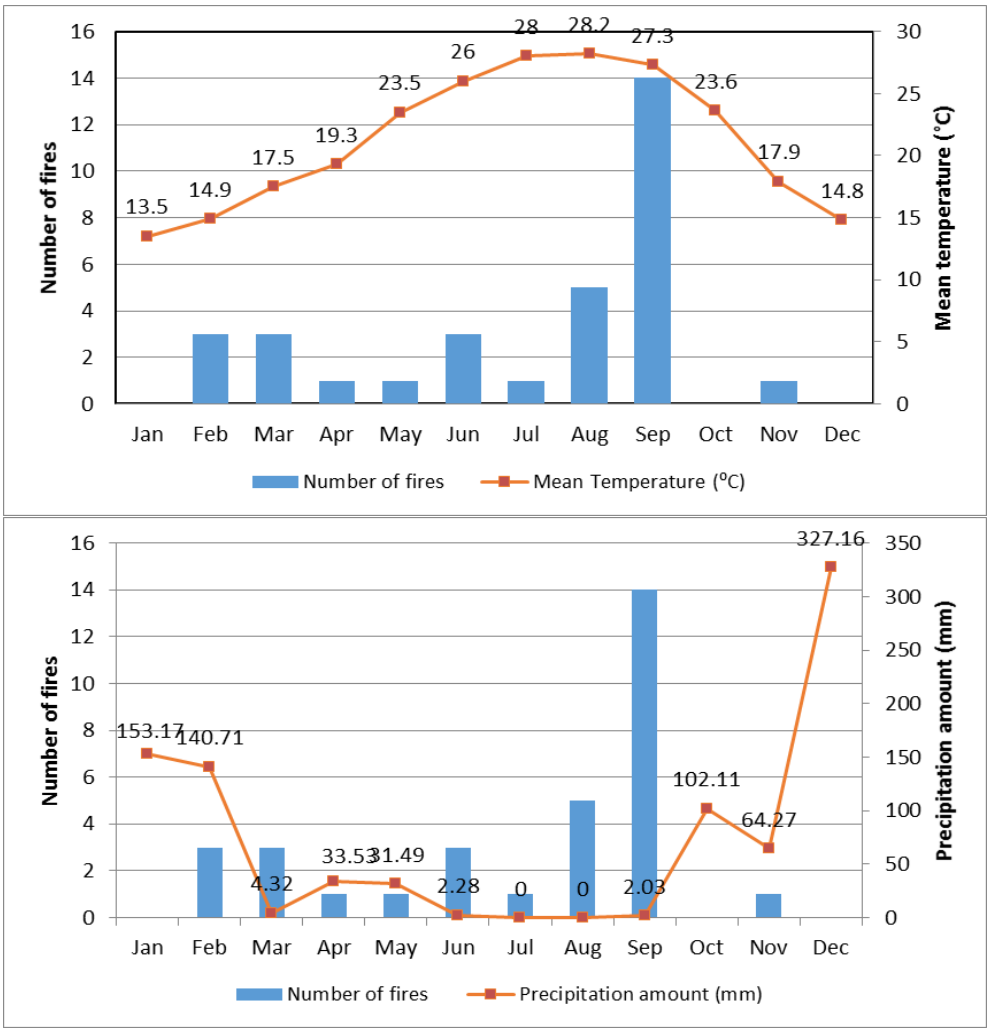


Figure 141. Monthly distribution of fire occurrence and fire affected areas in 2018 (source: MOE/UOB, 2019).

Fire season overview

The following graphs show the occurrence of fires in relationship to monthly precipitation and mean monthly temperature (Figure 142).



Observation data are reported by the weather station 401030 (OLBA) – Latitude: 34.45 and Longitude: 35.8 at an altitude of 5 m above sea level. These observations are presented for display purposes only and not for use in correlation analysis. en.tutiempo.net/climate/ws-401030.html

Figure 142. Fire occurrence in function of monthly mean temperature (upper) and monthly precipitation in 2018 (lower) (source: MOE/UOB, 2019).

Land use type

Land-use of fire affected areas (Figure 143) included agricultural land (80.31%), forest/woodlot (15.64%), and grassland (3.95%), among others.

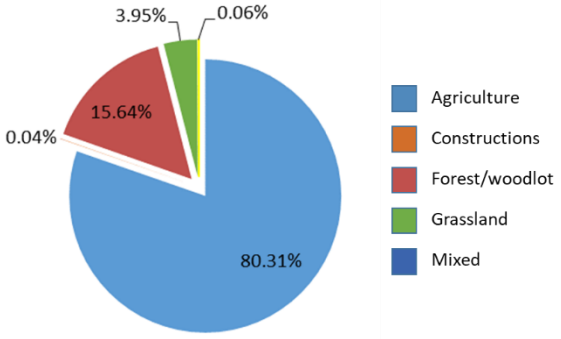


Figure 143. Land-use of fire affected areas (source: MOE/UOB, 2019).

Affected fuel type

81.2% of affected fuel types (Figure 144) was mixed forests, followed by broadleaved forest (13.27%) and grassland (3.46%).

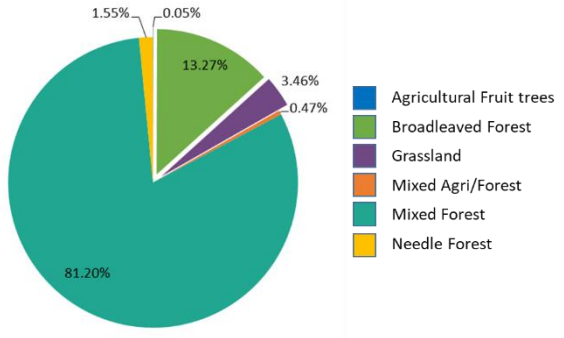


Figure 144. Distribution of fuel type affected by fires (source: MOE/UOB, 2019).

Causes of fire

Arson was reported as the main cause of fires for 78.49 % of the reported fire events. Furthermore, 12% of causes were due to neglect, while 9% had unknown causes (Figure 145).

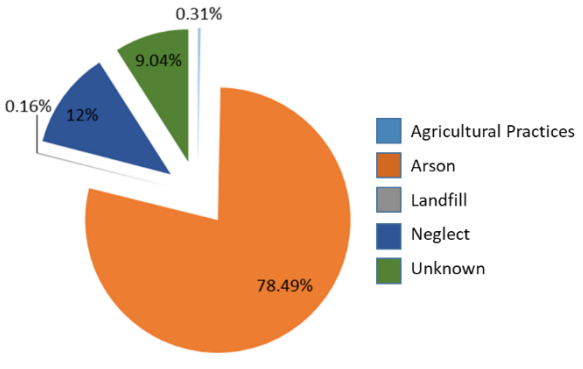


Figure 145. Distribution of main fire causes (source: MOE/UOB, 2019).

Intervention time

It was observed that 46.3% of first interventions in fire suppressions occurred within the first 20 minutes after the reporting time, while 24.4% of interventions happened after 20 minutes and before 1 hour from the reporting time (Figure 146).

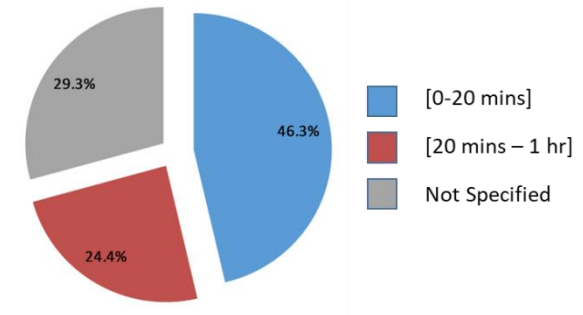


Figure 146. Times for intervention after reporting fires (source: MOE/UOB, 2019)

Fire duration

The largest number of fires lasted between 1 and 2 hours (48.78%). A total of 24.39% of fires lasted between 2 and 5 hours, and 17.07% of fires lasted between 5 and 12 hours. It was also observed that 2.44% of fires lasted between 12 and 24 hours. However, 4.88% of fires lasted more than 24 hours (Figure 147).

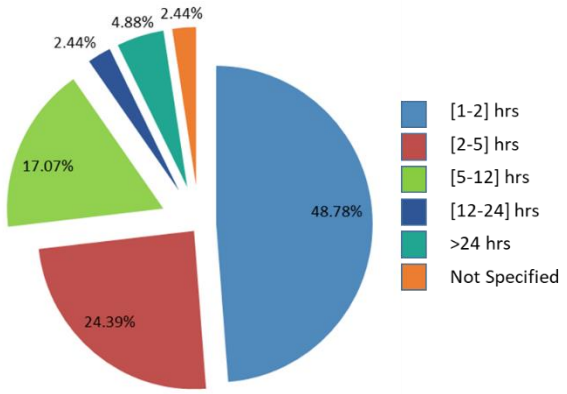


Figure 147. Fire duration (source: MOE/UOB, 2019).

Resources employed in fire suppression

The following human and technical resources were involved in fire suppression of reported fires (Table 39):

Table 39. Human and technical resources involved in fire control throughout 2018 (source: MOE/UOB, 2019).

	Number				Lebanese Army helicopters used
	Small Cars	Water Tanks	Other Cars	Human Resources	
Civil Defense	19	71	1	110	
Army	13	1	0	85	15
Internal Security	14	2	2	105	
Ministry of Agriculture	0	0	0	0	
NGO	1	0	0	5	
Local Resident	0	0	0	133	
Total	47	74	3	438	15

Climate change

The project: "Towards a better assessment and management of wildfire risk in the Wildland-Urban Interface (WUI) in Lebanon " was managed by LNR-IOE-UOB (2012-2016) and funded by USAID in agreement with the US National Academies of Science (NAS). The project aimed at developing the capacity of stakeholders in Lebanon to assess and manage wildfire risk in Lebanon's WUI in

light of future climate change and human development in wildland areas. The main achievements of the project included the launching of "FireLab", a web-application that produces detailed wildfire reports at both the country and village levels and provides a tool for fire danger forecast: (ioe-firelab.balamand.edu.lb).

The Smart Adaptation of Forest Landscapes in Mountain Areas (SALMA) is a 5-year project (effectively started in December 2016) implemented by the FAO in collaboration with the Ministry of Agriculture (MOA) and funded by the Global Environment Facility (GEF). The SALMA Project is expected to contribute to forest management through the development and implementation of Sustainable Forest Management Plans, with a particular focus on increasing the resilience of the forests to climate change, forest fires and insects, pests and diseases, and improving the livelihoods of the local communities. The Project involves funding community-based initiatives that promote green jobs and diversifies income sources of forest dwellers/users in response to the impacts of climate change.

The MOE with the support of the United Nations Development Programme (UNDP) and financing from GEF, started in 2016 the implementation of the Sustainable Land Management in the Qaraoun Watershed Project (SLMQ) aiming at embedding sustainability considerations in land use planning. The SLMQ project developed national forest management guidelines to guide the development of future management plans while taking into account environmental challenges such as climate change.

Research activities aimed at improving fire management

Mitri et al. (2016) modelled the effect of socio-economic and biophysical variables on fire occurrence in Lebanon and assessed Lebanon's wildfire potential in association with current and future climatic conditions (Mitri et al., 2015a). In addition, Mitri et al. (2015b) assessed the spatial distribution of wildfire risk in Lebanon resulting in the development of Lebanon's wildfire risk map. Mahfouz et al. (2016) investigated drought occurrence at a given time scale, while Salloum and Mitri (2014) investigated the yearly temporal pattern of fire activity and its relationship to weather in Lebanon during the past decade.

Mitri et al. (2014) developed a web-based application for improved wildfire risk management in Lebanon. In addition, Mitri et al. (2017) developed Lebanon's fire danger forecast system. Sakr et al. (2010) developed forest fire prediction methods based on artificial intelligence. Also, Sakr et al. (2014) facilitated the early detection of forest fires by using wireless sensor node and demonstrated that such a device, based on parameters such as temperature, humidity, smoke, CO, and methane gas, is capable of early forest fire detection. Also, Sakr et al. (2011) developed an efficient forest fire prediction system using only two weather parameters (i.e., the reduced-cost system proved to be especially beneficial in developing countries).

Finally, Fiorucci et al. (2013) modelled vegetation succession in fire affected areas in the Mediterranean. El Halabi et al. (2014a) assessed the regeneration of *Pinus brutia* after a fire. Also, El Halabi et al. (2014b) assessed post-fire regeneration of several shrub species on *Pinus brutia* burned sites.

References:

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EL Halabi, A., Mitri, G., and Jazi, M. (2014b). Monitoring post-fire shrub recovery on Pinus brutia burned sites. In "20th LAAS International science conference: New frontiers in sciences", pp. 137. LAAS/LU, Beirut.

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Mitri, G., Jazi, M., and McWethy, D. (2015a). Assessing Lebanon's wildfire potential in Association with current and future climatic conditions. In "Large wildland fires conference" (R. Keane, M. Jolly, R. Parsons and K. Riley, eds.), pp. 318-321. MT. Proc. RMRS-P-73. Fort Collins, CO: U.S. Department of Agriculture (USDA), Forest Service, Rocky Mountain Research Station, pp 318-321., Missoula.

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MOE/UOB, 2019. State of Lebanon's wildfires in 2018. Beirut, Lebanon.

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Sakr, G., Elhajj, I., and Mitri, G. (2011). Efficient Forest Fire Occurrence Prediction for Developing Countries using Two Weather Parameters. International Scientific Journal Engineering Applications of Artificial Intelligence 24, 888-894.

Salloum, L., and Mitri, G. (2014). Assessing the temporal pattern of fire activity and weather variability in Lebanon. International Journal of Wildland Fire 23, 503-509.

Salloum, L., and Mitri, G. (2014). Assessing the temporal pattern of fire activity and weather variability in Lebanon. International Journal of Wildland Fire 23, 503-509.

(Source: Land and Natural Resources Program, Institute of the Environment, University of Balamand, Lebanon).

1.4.4 Morocco

Background

In over 9 million hectares of forest domain representing more than 20% of the national area, forest formations in Morocco cover an area of 5 814 000 ha (broadleaves, conifers…) and 3 318 260 ha of *stipa tenacissima* (Figure 148), and are distributed among the different bioclimatic zones, from semi-arid to humid.

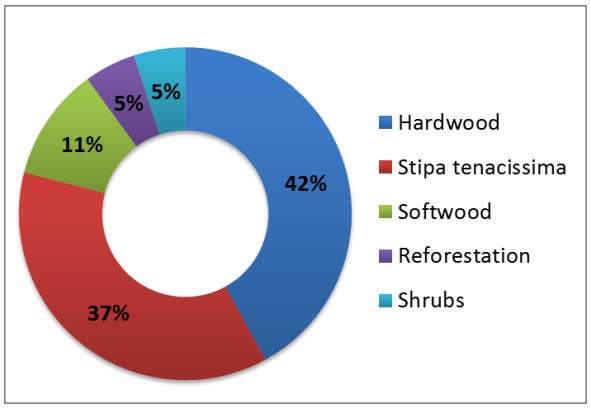


Figure 148. Composition of forest land in Morocco

As in Mediterranean countries, forested areas in Morocco are subject to a recurrent risk of fires that is favoured by the extreme flammability of forest species during the summer. The consequences of this risk are prejudicial in terms of social, economic and environmental components. Indeed, the forest land is an open space where access (except rare situations) is free. Riparian forest populations live in a subsistence economy (using forests for their needs of construction wood and firewood, various non-timber forest products, and pasture). Consequently, forests are under a very strong human pressure.

Through the analysis of annual reports of forest fires during the years 1960 to 2017, an average of 283 fires per year is calculated for an annual average area affected of 2 934 ha (HCEFLCD, 2017).

Although limited compared to the average area burned in other countries with similar conditions, especially the Mediterranean, this area is important in view of the major roles played by forests and the difficulties of their reconstruction and regeneration with regard to the national socio economic and environmental context.

To face the recurring and imponderable phenomenon of fire, a **National Plan of Prevention and Fight against forest fires** (in French: *Plan Directeur de Prévention et de Lutte Contre les Incendies "PDCI"*) was adopted with the participation of all institutional partners concerned by this issue: Ministry of the Interior (MI), High Commission of Forests, Water and combating Desertification (HCEFLCD), Ministry of Equipment and Transport (MET), Royal Gendarmerie (GR), Civil Protection (PC), Agency for Economic and Social Development for Northern Provinces and Prefectures (ADPN) and the Administration of Land Conservation, Cadastre and Mapping (ACFCC). The plan focuses on the actions of equipment and forest management for fire prevention, risk prediction, monitoring and warning and also on the coordinated operations to fight against forest fires.

Despite the efforts made at different levels by all institutions involved in forest fire management in Morocco, **the system calls for continuous improvements**, not only in terms of prevention and prediction, but also in terms of operational and organizational interventions.

Fire occurrence and affected surfaces

From 1960 to 2017

Through the analysis of the available data on forest fires in Morocco during the period 1960 to 2017, a total of 16 744 outbreaks of fire (Figure 149) and a total area damaged (but not lost) of 173 131 ha are reported, giving an average of 283 fires per year for an annual average area of 2 934 ha affected, with maxima of 11 000 ha in 1983 and 8 660 ha in 2004. The absolute minimum is recorded in 2002 with 593 ha.

It should also be noted that, globally and since 1960, the trend of fire numbers and area affected by forest fires has never stopped increasing; but the shapes of the increases are not similar. Indeed, the increase in fire number has been continuous from an average of 242 between 1990-1994, to 455 forest fires in the last decade (2007-2016).

The period from 1960 to 1974, represents the portion where fire number and area burned are at the lowest levels (154 fires and 2 073 ha) compared to the averages for the period covering 1975 to 2014 (331 fires and 3442 ha).

We note that the area affected per fire, which reached a value of 6 ha during the period 2007-2017, has decreased by 40% compared to the national average recorded since 1960, which is 12 ha per fire (Figure 151 below).

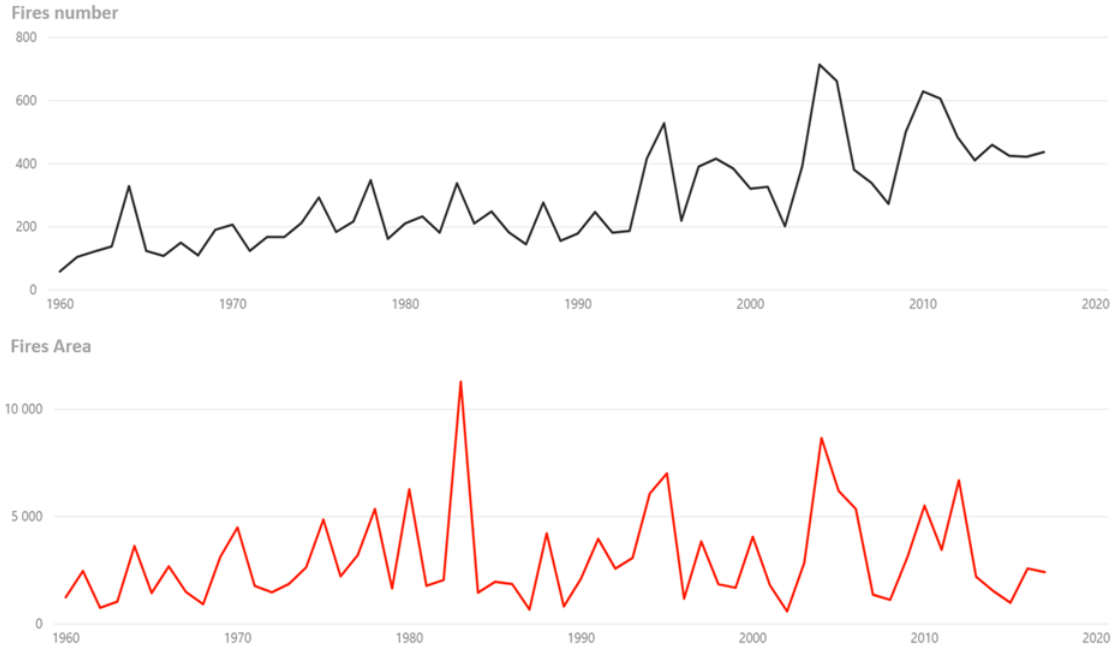


Figure 149. Evolution of forest fire number and area from 1960 to 2018 (HCEFLCD, 2019)

Over the past decade, the years 2004, 2005, 2010, 2011, 2012 and 2014 were exceptional both in forest fire numbers declared and in affected areas. Indeed, it is mainly the Rif and Pre-Rif provinces which were most affected because of the high sensitivity to fire of pine, cork oak and shrub formations and the strong pressure on land resulting from the use of fire as a cleaning land practice for cultivation.

<u>2018 fire season</u>

During 2018, there was recorded a total of 343 fires affecting an area of 841 ha, an average of 2.45 ha per fire.

Both the number of fires and the total burnt area have decreased in comparison to the average for the last decade 2008-2017, by 20% and 72% respectively (Figure 150).

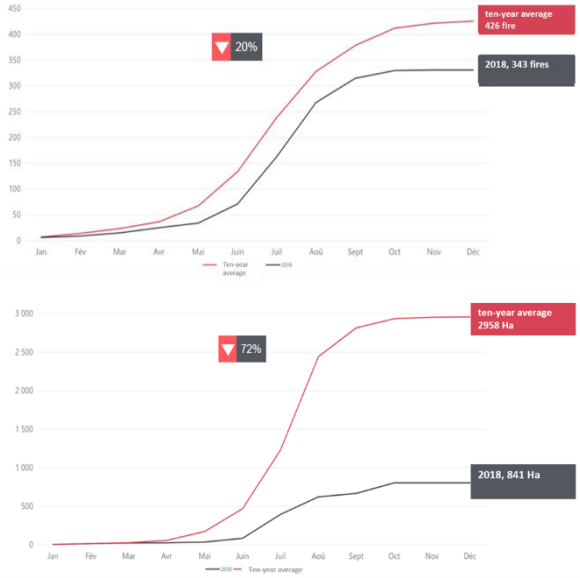


Figure 150. Evolution of number of fires (top) and burned area (bottom) in 2018 compared to the last decade.

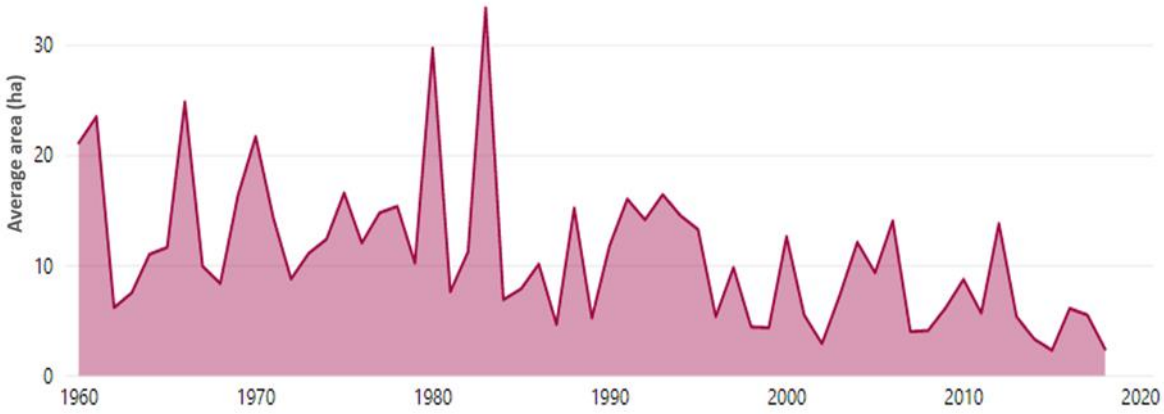


Figure 151. Evolution of area affected per fire from 1960-2018.

The distribution of fires recorded in 2018 (Table 40), based on the type of vegetation affected, is as follows:

- For wooded land, an area of 319 ha (38% of the total area burned) was affected by 106 fires (31% of the total number of fires);
- The shrub and herbaceous covers were affected by 237 fires that covered an area of 522 ha, equivalent to 69% respectively of the total number of reported fires and 62% of the total area burned.
- For wooded stands, the Eucalyptus is in first place with an area of 117 ha affected, equivalent to 14% of the total area burned in this category, followed by Pine trees with an area of 93 ha affected (11%).

Table 40. Distribution of fires, based on the type of vegetation affected in 2018.

Category		Species	Burnt Area (ha)	% Area	Number of fires	% Number
Wooded	broadleaves	Eucalyptus	117.07	13.92	18	5.25
		holm oak	70.52	8.39	17	4.96
		cork oak	22.43	2.67	12	3.50
		Acacia	1.61	0.19	3	0.87
		Quercus sp	0.60	0.07	1	0.29
	Broadleaves Total		***212.24***	***25.24***	***51***	***14.87***
	Coniferous	Pines	93.16	11.08	33	9.62
		Thuja	7.96	0.95	9	2.62
		Atlas cedar	4.67	0.55	9	2.62
		Moroccan fir	0.80	0.10	2	0.58
		Oxycedrus	0.05	0.01	1	0.29
		red cedar	0.04	0.00	1	0.29
	Coniferous Total		***106.67***	***12.68***	***55***	***16.03***
Wooded Total			***319.00***	***37.93***	***106***	***30.90***
Non Wooded		Alfa	44.33	5.27	11	3.21
		Shrubs	191.54	22.78	75	21.87
		grass cover	285.44	33.94	151	44.02
Non Wooded Total			***522.00***	***62.07***	***237***	***69.10***
Grand Total			**841.00**	**100.00**	**343**	**100.00**

The data relating to the distribution of fires according to size classes of affected areas are represented in Table 41. Indeed, 93% of reported fires were under control with the speed and efficiency required, since the area affected did not exceed 5 ha for each fire. It is also noted that only 4 fires (1.16% of the total number of fires) affected an area of over 50 hectares, representing over 48.51% of the total area burned.

Table 41. Distribution of fires according to classes of affected areas.

Size Class (ha)	Number		Area (ha)	
	Count	%	Area	%
0-5 ha	319	93.00	195.10	23.20
5-10 ha	10	2.92	60.62	7.21
10-20 h	7	2.04	95.93	11.41
20-50 ha	3	0.87	81.44	9.68
50-100 ha	3	0.87	242.93	28.89
>100 ha	1	0.29	164.97	19.62
Total	**343**	**100**	**841.00**	**100**

Distribution of fires

The data showing the distribution of fires by forest region are shown in Figure 152 and Figure 153 below. The Rif region (Tanger, Tetouan, Chefchaouen, Larache...) ranks first in terms of area affected with 316 ha (37 % of the total area recorded nationally) and it also ranks first in terms of the number of fires with 113 fires (33% of the total number).

The occurrence of fires is concentrated in the provinces of Rif and Pre-Rif (including Tangier and Tetouan); this situation is favoured by the terrain, the high sensitivity of forest stand types (pine, cork oak matorral...) and the intense human pressure on land resulting from the use of fire as a practice of cleaning land for their cultivation.

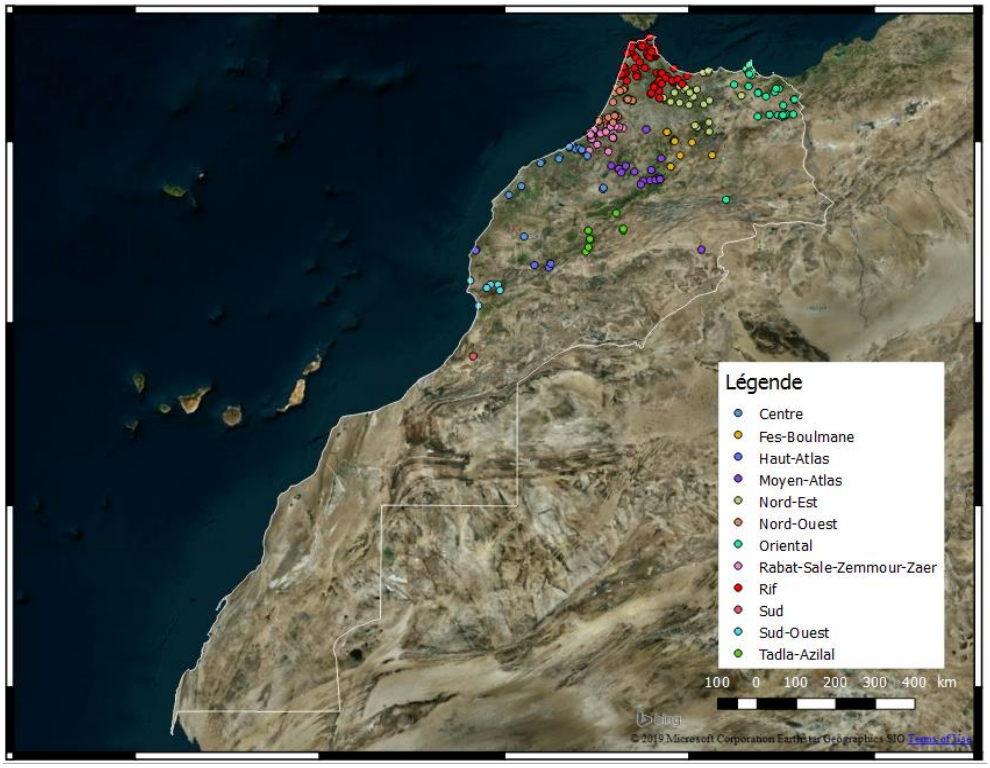


Figure 152. Location of the forest fires recorded in 2018 in Morocco.

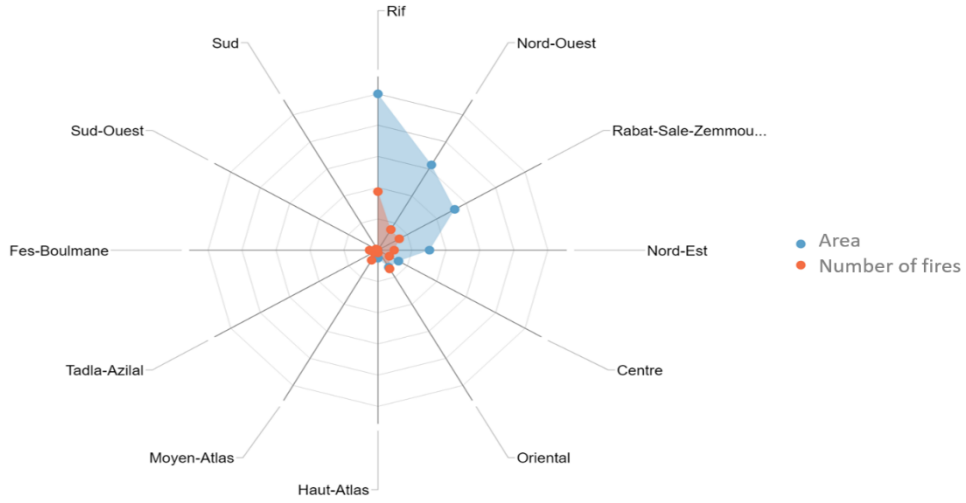


Figure 153. : Distribution of fires in Morocco by DREFLCD, area and numbers.

Firefighting means

The means mobilized by the different departments in 2018 in Morocco for the operations against forest fires, are as follows:

Loss of human lives

Three lives were lost in the 2018 season.

Activities	*Department*	*Quantity*
Monitoring and alerts	High Commission of Forests, Water and combating Desertification	**1200** watchers
	Ministry of the Interior	**1000** watchers
Ground intervention	High Commission of Forests, Water and combating Desertification	**332** forest fighters with **95** vehicles for the first intervention
	Civil Protection	**-**
	Auxiliary Forces	[Estimated at 300 persons]
	Royal Armed Forces	[Estimated at 300 persons]
Aerial control	Royal Gendarmerie	**18** Turbo Trush aircraft
	Royal Air Forces	**5** Canadairs CL415

Research activities aimed at improving fire management

A) New Strategy for forest fire management

In a context marked by increased sensitivity of natural and forest areas to the risk of fires, and the expected effects of climate change, Morocco is in the process of developing a new national strategy for the prevention and fight against fires. A plan was developed in 2001 to implement forest fire prevention and response policy. This plan, arrived at term, is being updated taking into account:

- The achievements and feedback from previous years in the planning and implementation of fire prevention, forecasting and coordination actions;
- All the elements of forest fire risk knowledge currently available;
- Expectations and new proposals from all stakeholders.

It must create a national technical, legal and operational framework in which territorial approaches related to forest fires prevention can be carried out.

The result of this project is the deliverance of:

- National plan for forest fire protection,
- Synthesis document about HCEFLCD Strategy and Partners for Fire Management,
- Pilot territorial plan for Tetouan province,
- Revision of the forest fire legislative framework.

B) Evaluation of Spectral Indices for Assessing Fire Severity

The current evolution of the forest fire regime poses new challenges to the usual practices of forest management plans and forest fires strategies. The implementation of wisely measured actions on the ground in terms of preventive silviculture, water points or fire breaks, requires a deep understanding and a fine mapping of the fire behaviour.

This paper focuses first on mapping the fire intensity in many provinces; most of them are the most affected regions by this scourge in Morocco. Also, accurate fire severity estimates are of paramount importance for modelling fire-induced trace gas emissions and rehabilitating post-fire landscapes. In Morocco high spatial and high spectral resolution data are used to evaluate the effectiveness of the spectral indices, including the widely used Normalized Burn Ratio (NBR), for assessing fire severity.

C) Adoption and implementation of incident command system

The Incident Command System (ICS) represents a core set of doctrine, concepts, principles, terminology, and organizational processes that enable effective, efficient, and collaborative incident management across all emergency management and incident response organizations and disciplines. The CRCF has adopted ICS and encouraged adoption of ICS by all partners.

D) Fire growth simulation modelling

A program was developed with USFS-Missoula to adopt fire growth simulation modelling systems, using spatial information on topography and fuels along with weather and wind files. It incorporates existing models for surface fire, crown fire, spotting, post-frontal combustion, and fire acceleration into a 2-dimensional fire growth model.

E) Implementing a new tool for fires evaluation based on google engine

F) Monitoring of post-fire regeneration dynamics

The establishment of an effective forest fire management plan to make forests more resilient and more resistant to fire requires an intimate knowledge of fire behaviour and

vegetation response after fire in order to take the appropriate measures in terms of fuel treatment (clearing, pruning and thinning) and also for post-fire restoration.

G) Several studies have been conducted on the impact of climate change on forest fires

H) Adopting Big Data Technologies to manage the weather data warehouse

I) Adopting Machine Learning techniques to improve the predictions models

(Source: Service de la Protection des Forêts, Haut-Commissariat aux Eaux et Forêts et à la Lutte Contre la Désertification, Morocco).

2 The European Forest Fire Information System (EFFIS)

The European Forest Fire Information System (EFFIS) has been established jointly by the European Commission services (DG ENV and JRC) and the relevant fire services in the EU Member States and European countries (Forest Services and Civil Protection services). Research activities for the development of the system initiated at JRC in 1998 and the first EFFIS operations were in the year 2000.

In 2003, EFFIS was embedded in the new Regulation (EC) No 2152/2003 (Forest Focus) [7] of the European Council and Parliament on monitoring of forests and environmental interactions until it expired in 2006. Since then EFFIS operated as a voluntary system of information on wildfires until 2015, when it became part of the EU Copernicus program, under the Emergency Management Services [3].

Acting as the focal point of information on forest fires, EFFIS supports the national services in charge wildfire management. Currently, the EFFIS network is made of 40 countries in Europe, Middle East and North Africa. EFFIS provides specific support to the Emergency Response Centre (ERCC) (formerly Monitoring and Information Centre (MIC)) of Civil Protection as regards near-real time information on wildfires during the fire campaigns and assists other DGs through the provision both pre-fire and post-fire information on wildfire regimes and impacts. It provides information that supports the needs of the European Parliament with regards to wildfire management, impact in natural protected areas and harmonized information on forest fires in the EU.

EFFIS also centralises the national fire data that the countries collect through their national forest fire programmes in the so-called EFFIS Fire Database. The EFFIS web services[5] allow users to access near-real time and historical information on wildfires in Europe, Middle East and North Africa.

EFFIS provides a continuous monitoring of the fire situation in Europe and the Mediterranean area, and regularly sends updates to EC services during the main fire season. The information about the on-going fire season is continuously updated on the EFFIS web site (up to 3 times, daily), which can be interactively queried[6]. EFFIS provides daily meteorological fire danger maps and forecasts of fire danger up to 10 days in advance, updated maps of the latest active fires, wildfire perimeters and post-fire evaluation of damage.

The EFFIS module for the assessment of meteorological forest fire danger is the EFFIS Danger Forecast. This module forecasts forest fire danger in Europe, part of North Africa and the Middle East, on the basis of the Canadian Fire Weather Index (FWI) [8], allowing a harmonized evaluation to be made of the forest fire danger situation throughout Europe and neighbouring countries.

The damage caused by forest fires in Europe and neighbouring countries is estimated using the EFFIS Rapid Damage Assessment module. Since 2000, cartography of the burned areas is produced every year through the processing of satellite imagery. In the year 2003, due to the availability of daily satellite imagery from the MODIS sensor on board the TERRA and AQUA satellites, the RDA provided frequent updates of the total burnt area in Europe. In 2007, the RDA was updated twice a day and currently, since 2016, it is updated 3 times a day. Further to the mapping of burnt areas, the analysis of which types of land cover classes are affected by fires is performed. This module uses MODIS satellite imagery with a ground spatial resolution of about 250 metres, which permits the mapping of fires of around 30 ha or larger. The burned area mapped by EFFIS corresponds, on average, to around 75% to 80% of the total area burnt in Europe each year.

[5] http://effis.jrc.ec.europa.eu

[6] see http://effis.jrc.ec.europa.eu/current-situation

2.1 EFFIS Danger Forecast: 2018 results

The EFFIS Danger Forecast was developed to support the Commission's Directorate-General for the Environment and the forest fire-fighting services in the EU Member States. From 2002, at the request of the Member States, operation of the EFFIS Danger Forecast was extended to six months starting on 1 May and ending on 31 October, and in 2006 to nine months, from 1 February to 31 October. From 2008 the EFFIS Danger Forecast system has run continuously throughout the year without interruption.

The geographic extent has been enlarged over the years from the initial extent that covered only the Mediterranean region. Now the system covers the whole of Europe and MENA (Middle East & North Africa) countries.

The meteorological data used to run the model has also changed during the years. At the beginning the system started using forecasted data provided by MeteoFrance with a spatial resolution of around 50 km. Then over time other providers were included, such as DWD (Deutscher Wetterdienst) and ECMWF (European Centre for Medium-Range Weather Forecast) and the resolution has improved. Now the system runs with three different data sets from three providers: ECMWF (the primary), Meteo France and DWD; with a spatial resolution in a range from around 10 km to 25 km.

In this chapter the fire danger trends assessed by EFFIS in the different countries during the 2018 fire season are presented, comparing them with previous years.

Through the Danger Forecast module of EFFIS the situation has been continuously monitored and the risk level analysed and mapped.

The following figures show fire danger through 2018 as determined by the average FWI values assessed during the fire season in the individual countries.

In 2018 the many of the northern countries experienced unusually high FWI values in spring and summer, while the southern countries had values in line with their average for most of the year.

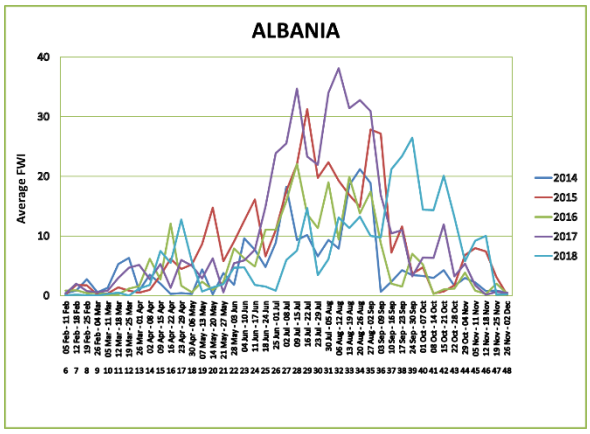
The graphs show the weekly averages of FWI over entire countries; therefore local peaks might have been flattened, especially in those countries such as France or Italy, where there are strong differences in fire danger level with changing latitudes; nevertheless the general trend is depicted providing relevant information about the fire danger level and trends of the year.

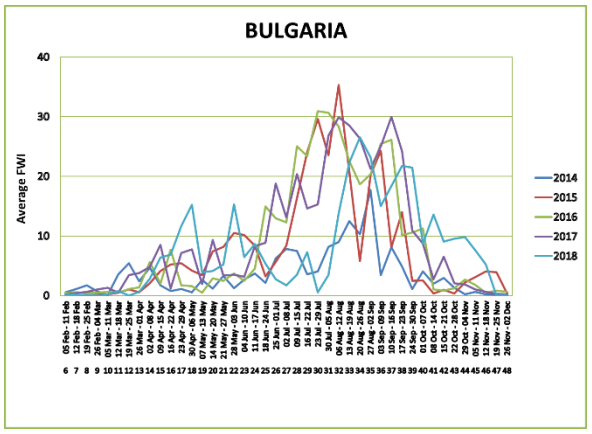
To allow a better comparison with past seasons, the curves of 2015-2017 are presented in conjunction with 2018 for all countries.

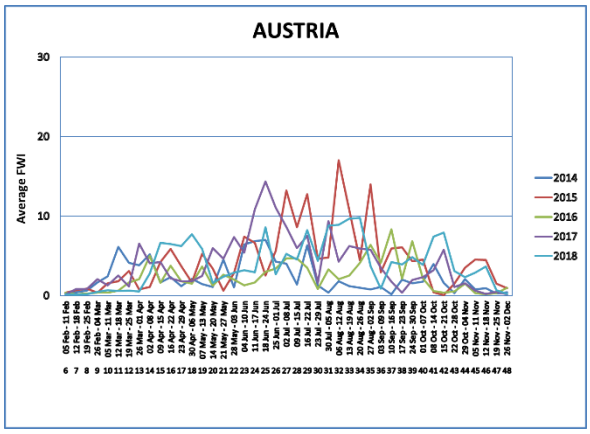
The countries analysed are those participating in the EFFIS network for which data are available, and are presented in alphabetic order within the two groups (European countries and MENA countries) in the graphs that follow.

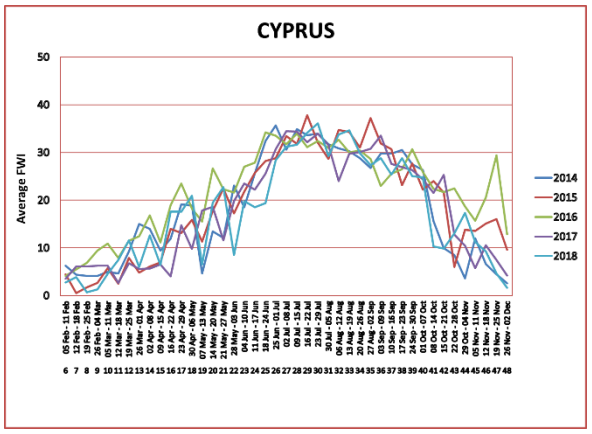
In order to make the graphs more readable, 4 colour-coded scales have been used to present the FWI: **0-30** for the most northern countries where fire danger rarely reaches high levels; **0-40** for central countries, **0-50** for the Mediterranean and Turkey, and **0-60** for the MENA countries.

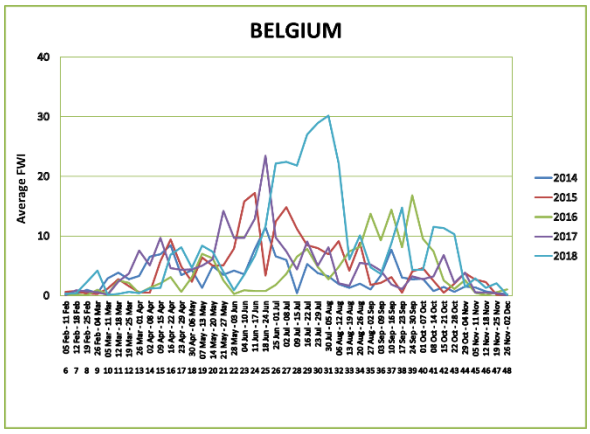
NB. *It is notable that the scale for northern countries has had to be increased from 0-20 to 0-30 to accommodate the high values seen in 2018 in these areas.*

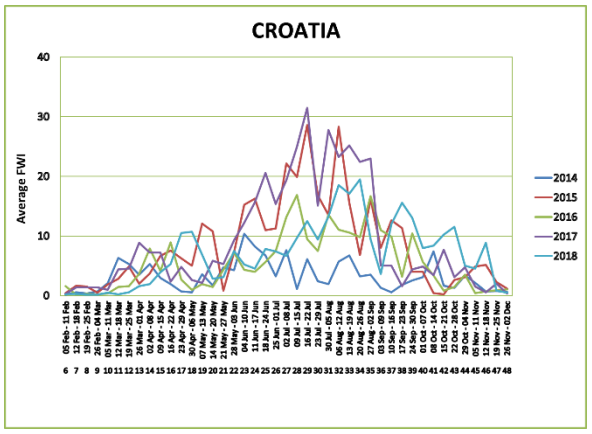

ALBANIA
Average FWI
2014
2015
2016
2017
2018

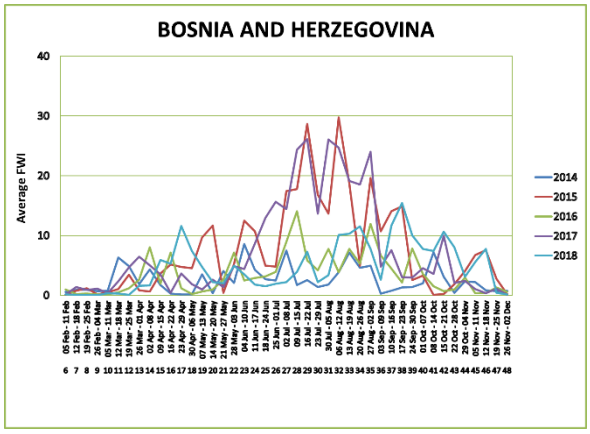

BULGARIA
Average FWI
2014
2015
2016
2017
2018

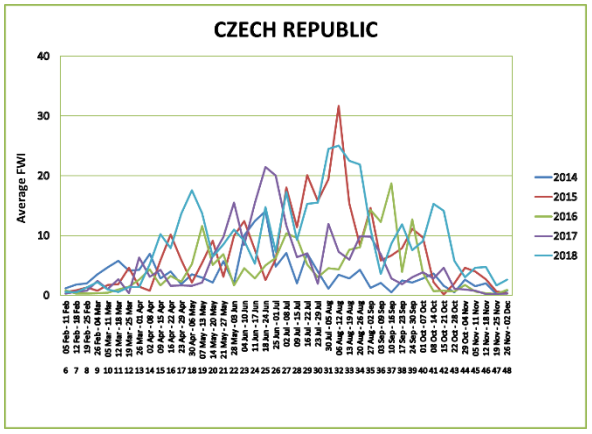

AUSTRIA
Average FWI
2014
2015
2016
2017
2018

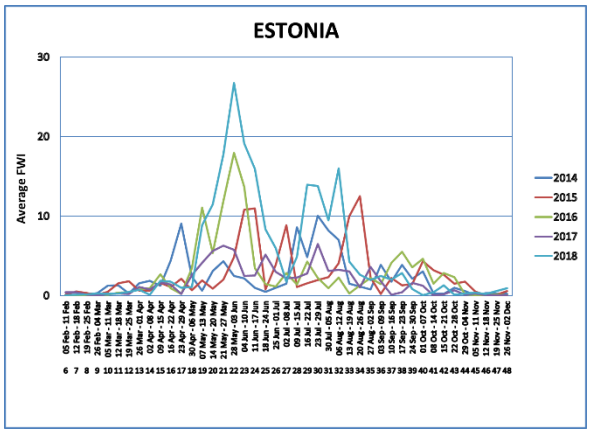

CYPRUS
Average FWI
2014
2015
2016
2017
2018

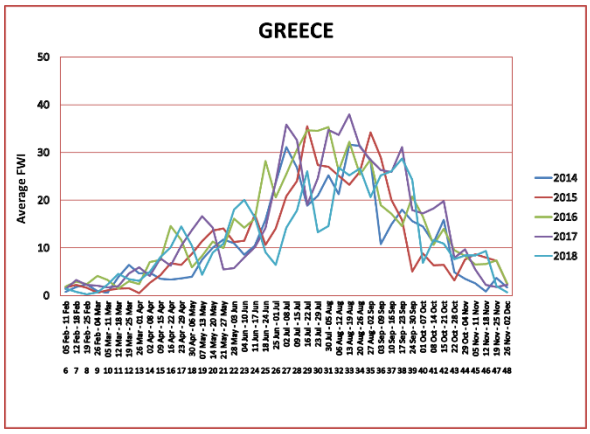

BELGIUM
Average FWI
2014
2015
2016
2017
2018

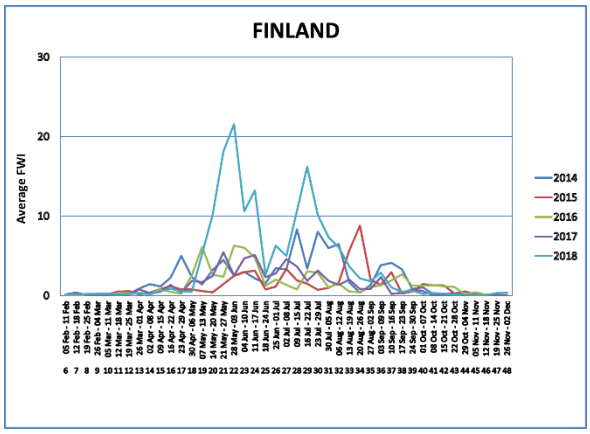

CROATIA
Average FWI
2014
2015
2016
2017
2018

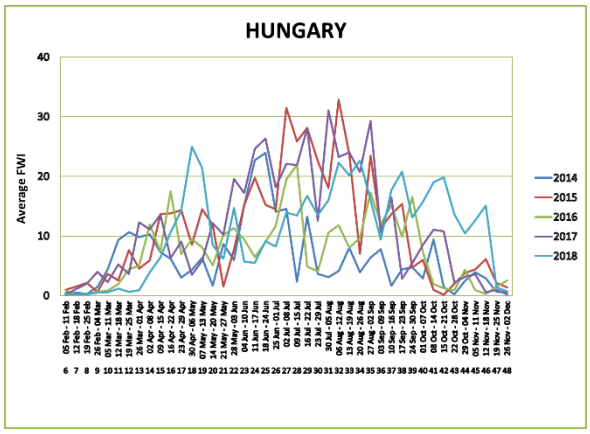

BOSNIA AND HERZEGOVINA
Average FWI
2014
2015
2016
2017
2018

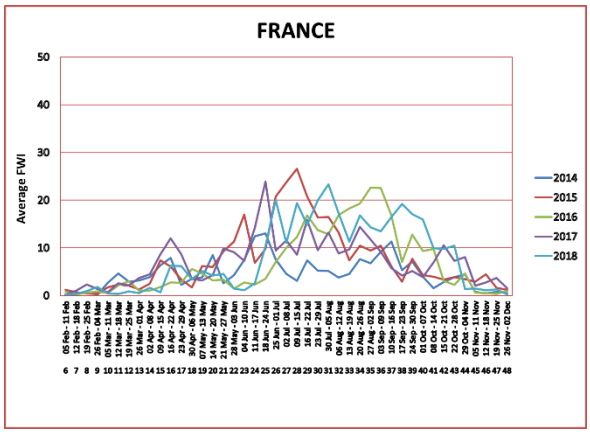

CZECH REPUBLIC
Average FWI
2014
2015
2016
2017
2018

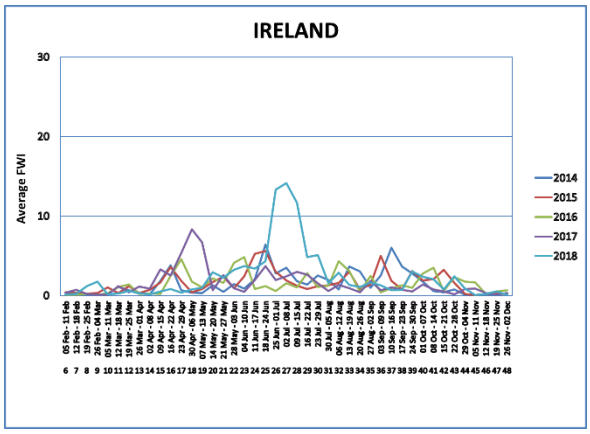

ESTONIA
Average FWI
2014
2015
2016
2017
2018

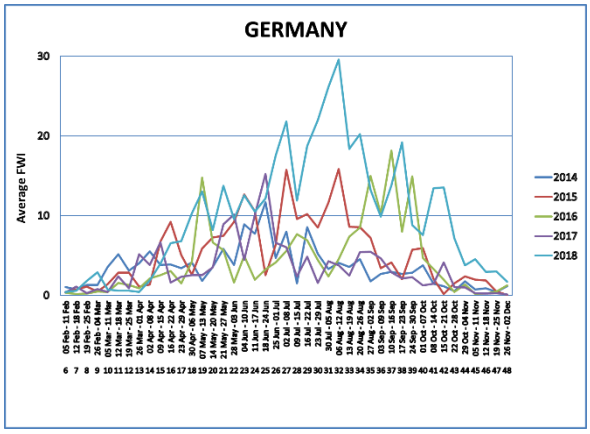

GREECE
Average FWI
2014
2015
2016
2017
2018

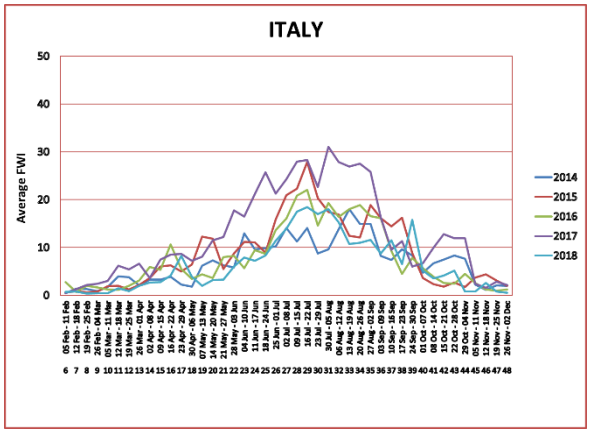

FINLAND
Average FWI
2014
2015
2016
2017
2018

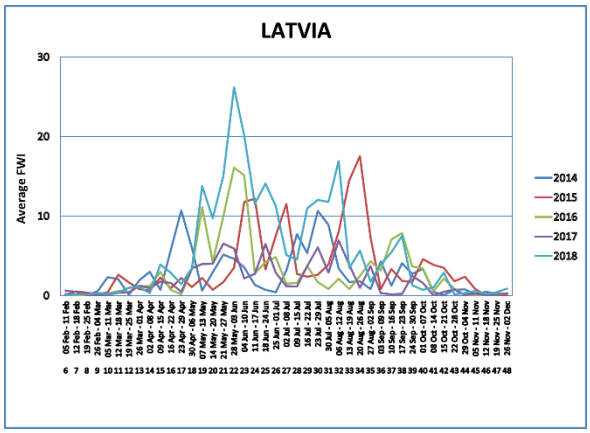

HUNGARY
Average FWI
2014
2015
2016
2017
2018

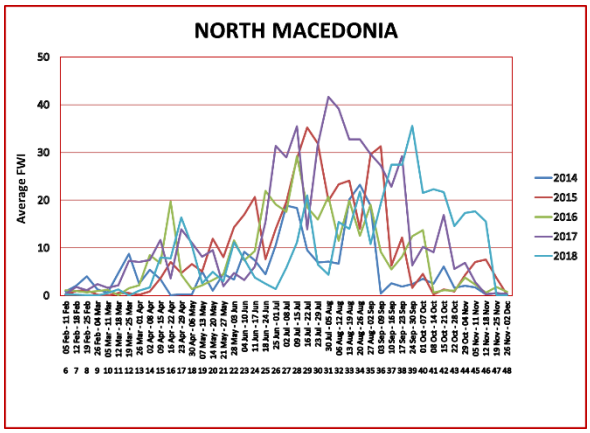

FRANCE
Average FWI
2014
2015
2016
2017
2018


IRELAND
Average FWI
2014
2015
2016
2017
2018


GERMANY
Average FWI
2014
2015
2016
2017
2018


ITALY
Average FWI
2014
2015
2016
2017
2018


LATVIA
Average FWI
2014
2015
2016
2017
2018


NORTH MACEDONIA
Average FWI
2014
2015
2016
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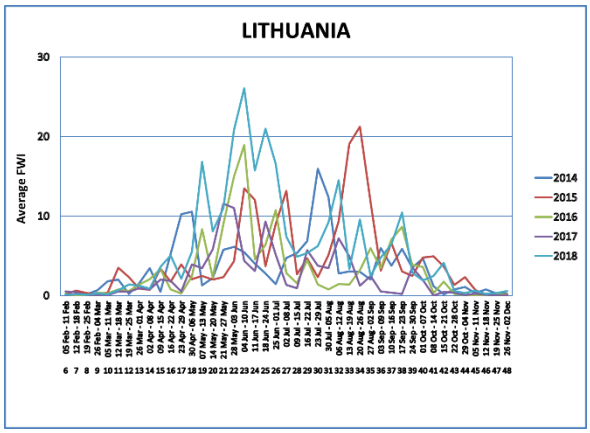
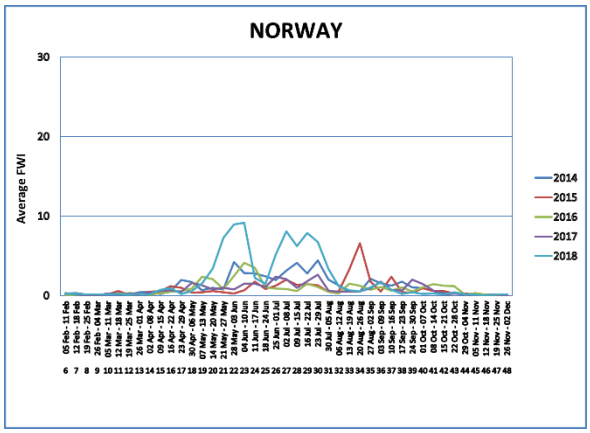
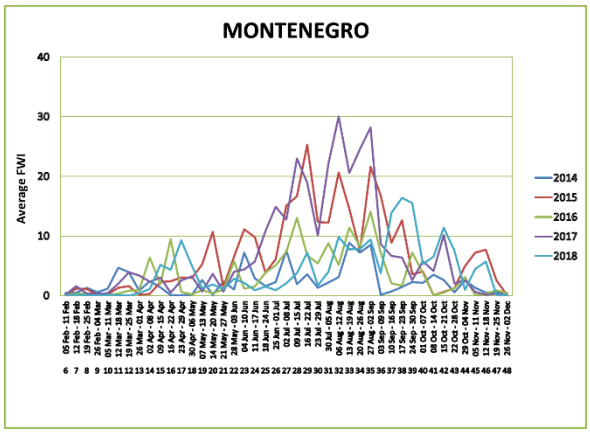
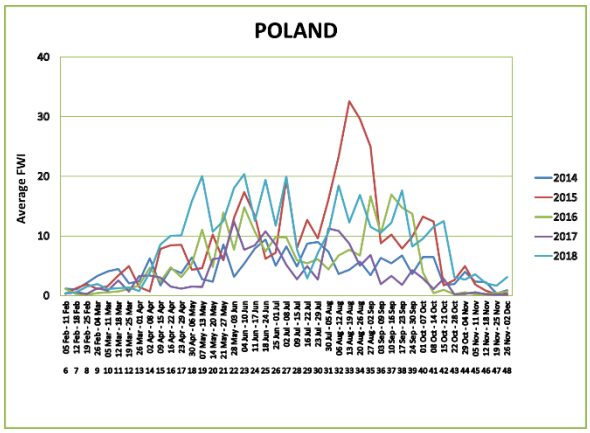
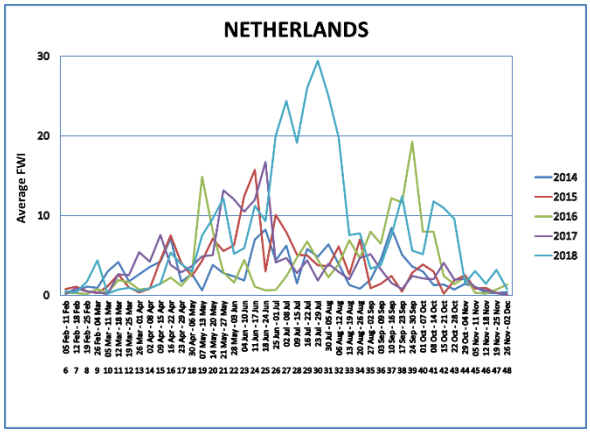
2018


LITHUANIA
Average FWI
2014
2015
2016
2017
2018


NORWAY
Average FWI
2014
2015
2016
2017
2018


MONTENEGRO
Average FWI
2014
2015
2016
2017
2018


POLAND
Average FWI
2014
2015
2016
2017
2018


NETHERLANDS
Average FWI
2014
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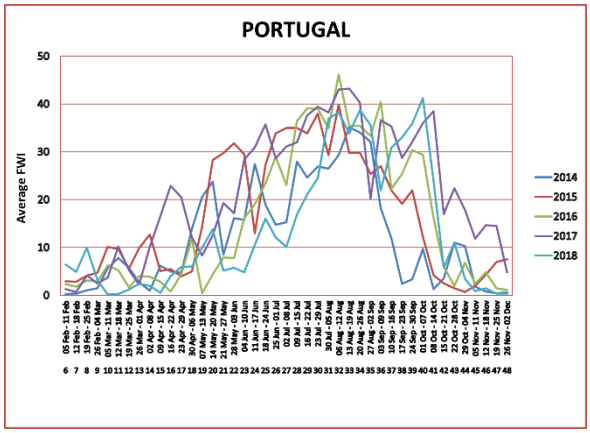
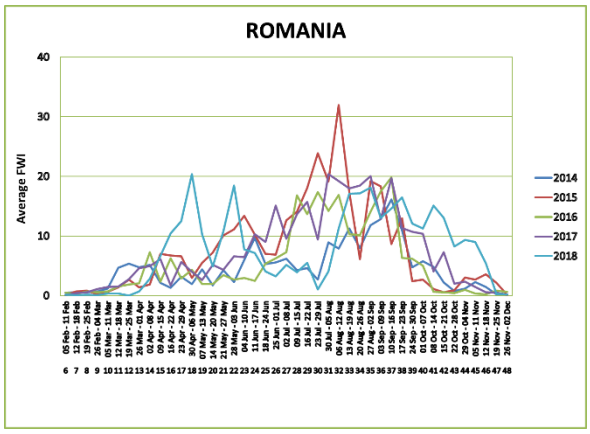
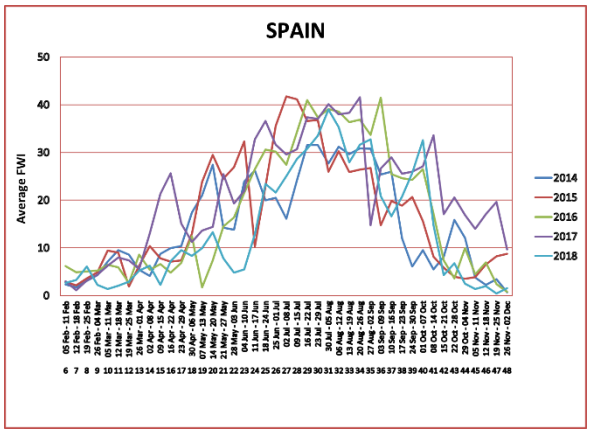
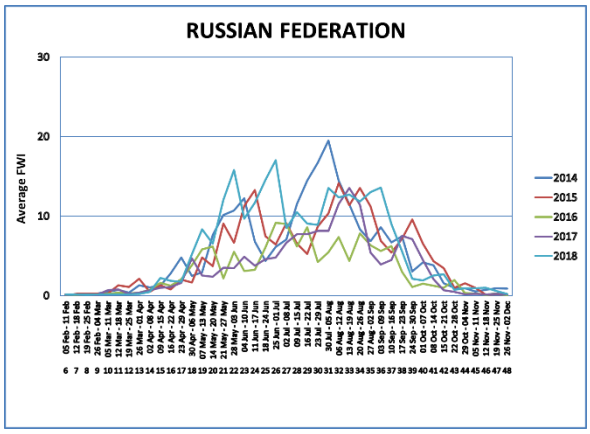
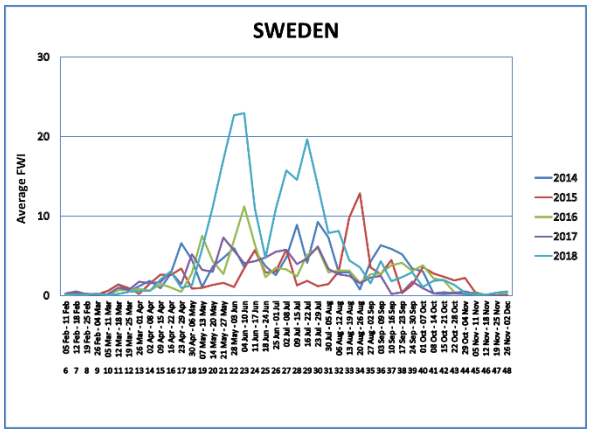
2016
2017
2018

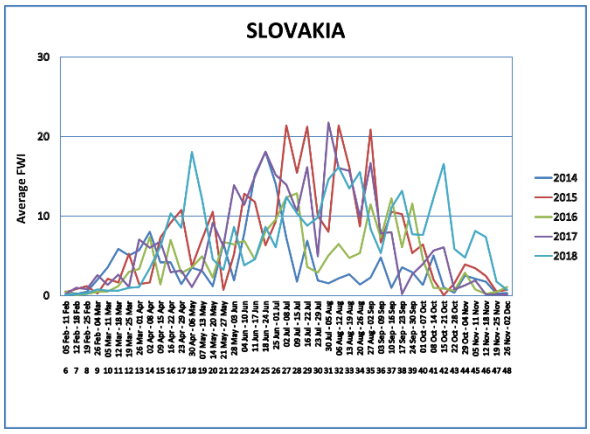

PORTUGAL
Average FWI
2014
2015
2016
2017
2018

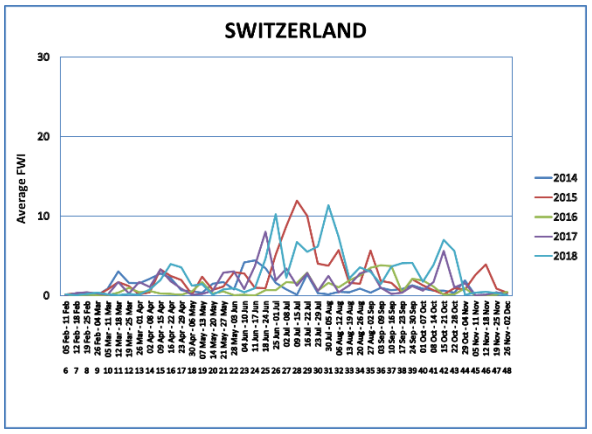

ROMANIA
Average FWI
2014
2015
2016
2017
2018

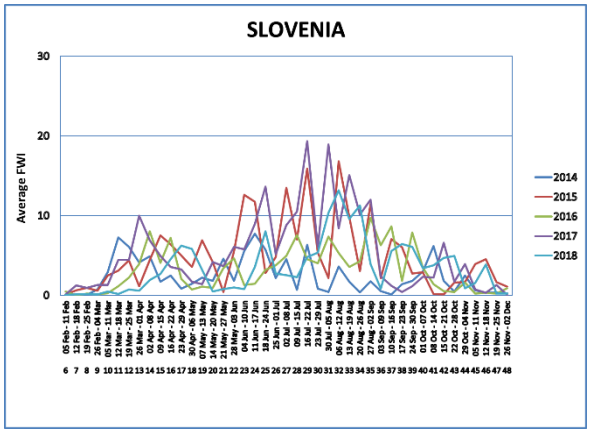

SPAIN
Average FWI
2014
2015
2016
2017
2018

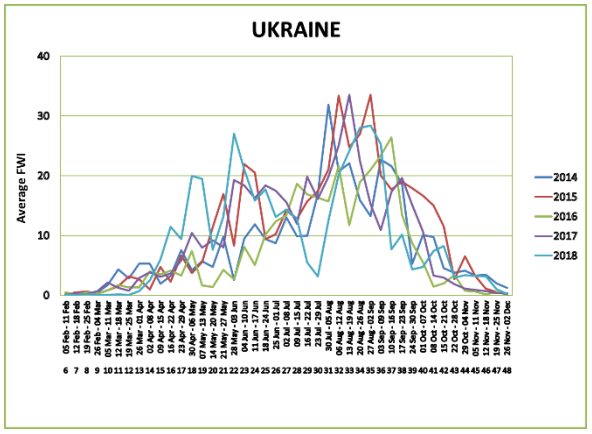

RUSSIAN FEDERATION
Average FWI
2014
2015
2016
2017
2018


SWEDEN
Average FWI
2014
2015
2016
2017
2018

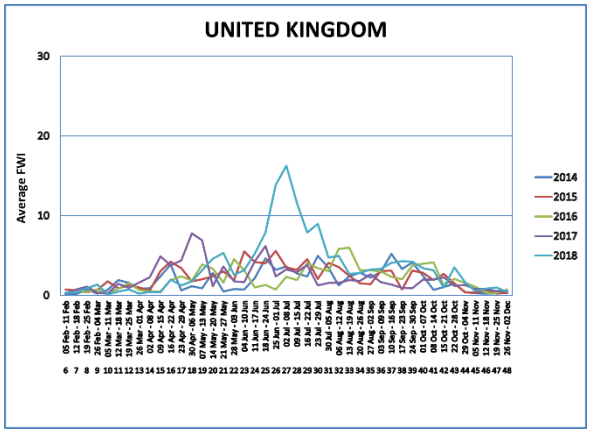

SLOVAKIA
Average FWI
2014
2015
2016
2017
2018

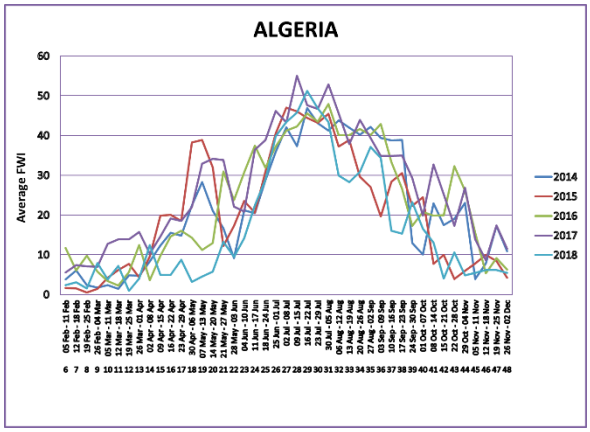

SWITZERLAND
Average FWI
2014
2015
2016
2017
2018

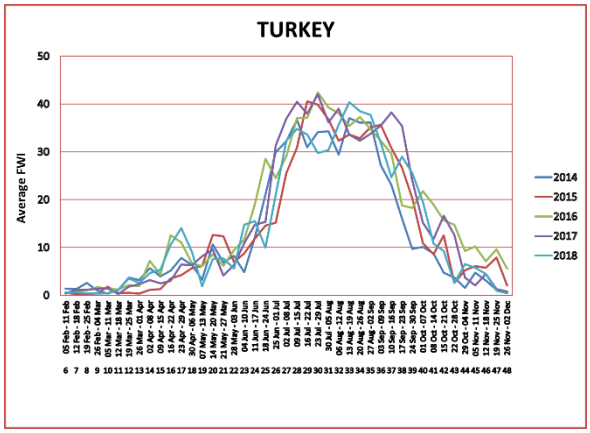

SLOVENIA
Average FWI
2014
2015
2016
2017
2018

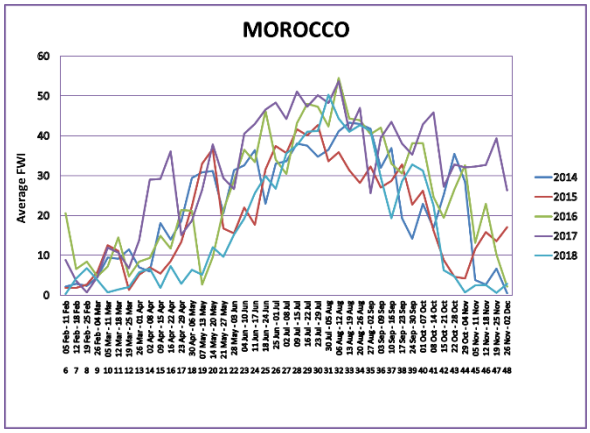

UKRAINE
Average FWI
2014
2015
2016
2017
2018

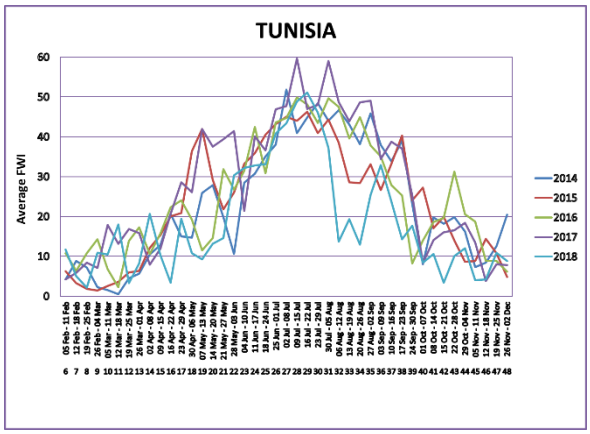
MENA Countries











As mentioned previously, weekly country averages tend to flatten local fire danger peaks, which as a consequence become less evident, especially in those countries such as France or Italy, where there are strong differences in fire danger level with changing latitudes.

Therefore, to show more clearly the seasonal changes in FWI in the larger EU Mediterranean countries, i.e. Portugal, Spain, France, Italy and Greece, their territory has been further divided for fire danger reporting, according to the map shown in Figure 154. The division criteria are mainly administrative and should be taken as provisional, since other fire risk reporting sub-regions, with a specific focus on environmental criteria, might be proposed in the future.

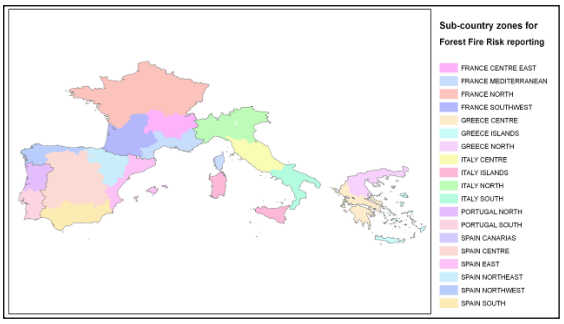


Figure 154. Sub-country regions identified for fire danger trend reporting in the five largest Mediterranean Member States.

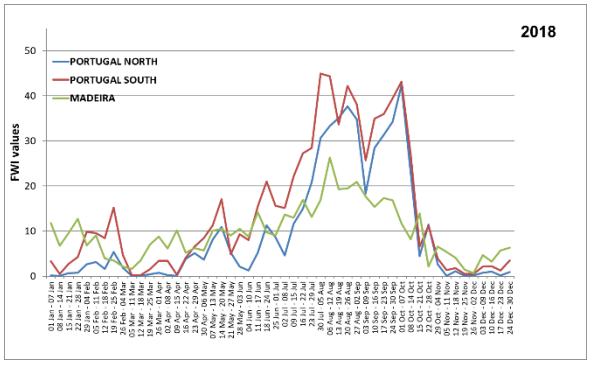


Figure 155. Fire danger trends in 2018 as determined by the Fire Weather Index (FWI) in the regions identified for Portugal.

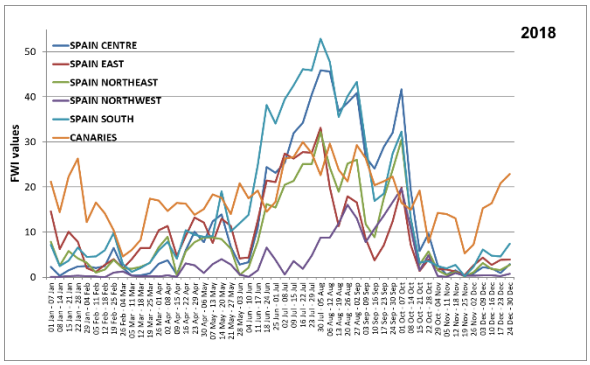


Figure 156. Fire danger trends in 2018 as determined by the Fire Weather Index (FWI) in the regions identified for Spain.

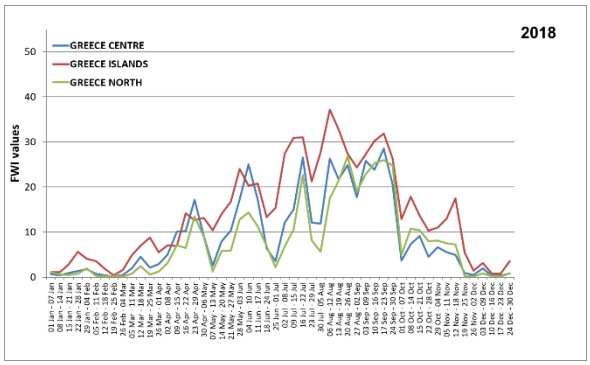


Figure 157. Fire danger trends in 2018 as determined by the Fire Weather Index (FWI) in the regions identified for Greece.

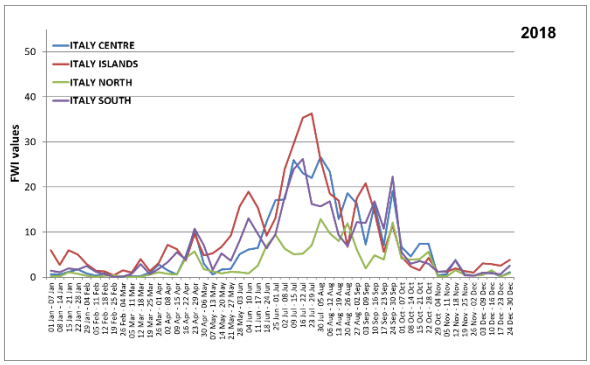


Figure 158. Fire danger trends in 2018 as determined by the Fire Weather Index (FWI) in the regions identified for Italy.

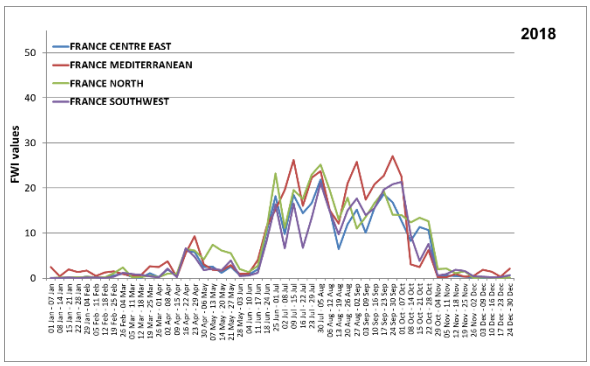
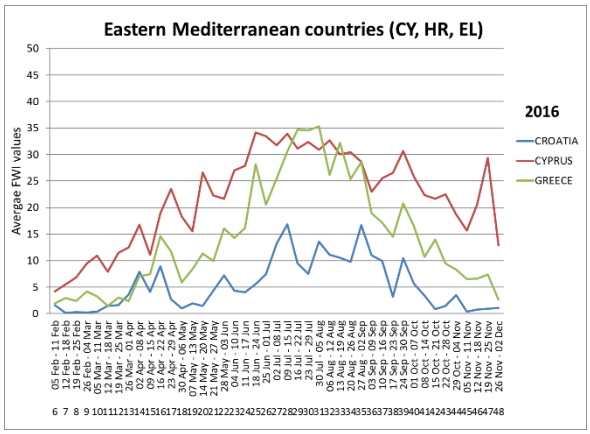
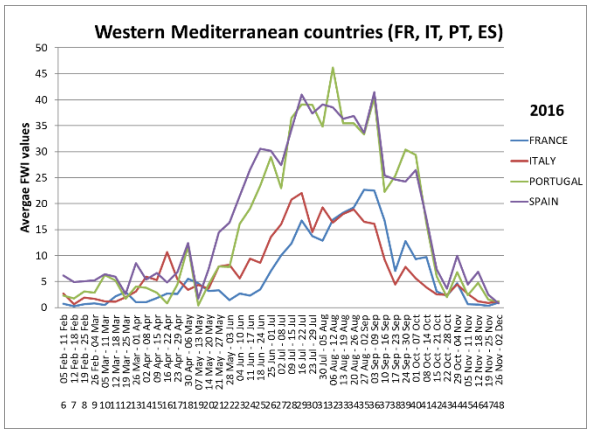
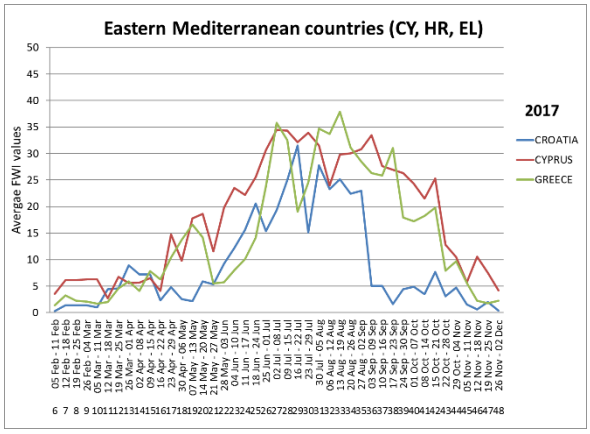


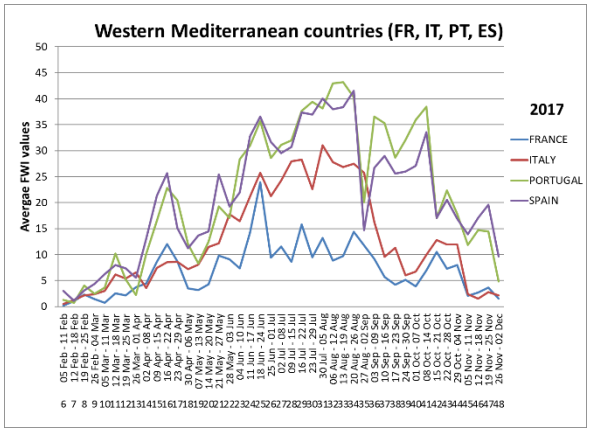
Figure 159. Fire danger trends in 2018 as determined by the Fire Weather Index (FWI) in the regions identified for France.

To facilitate the comparison among the different countries in EU, in the next graphs (Figure 160 to Figure 166), the fire danger trends as determined by FWI are shown for countries grouped by main bioclimatic type (e.g. Mediterranean, temperate or boreal). Data are given for 2016-2018.









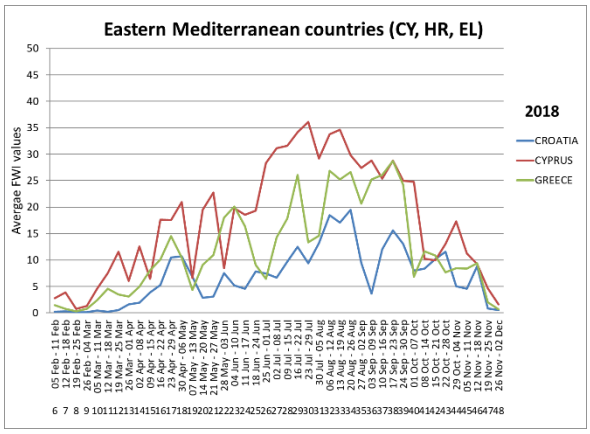


Figure 160. Fire danger trends 2016-2018 in eastern EU Mediterranean countries (CY, HR, EL).

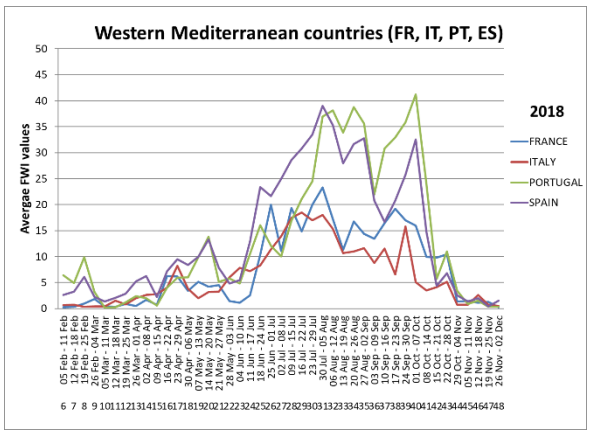
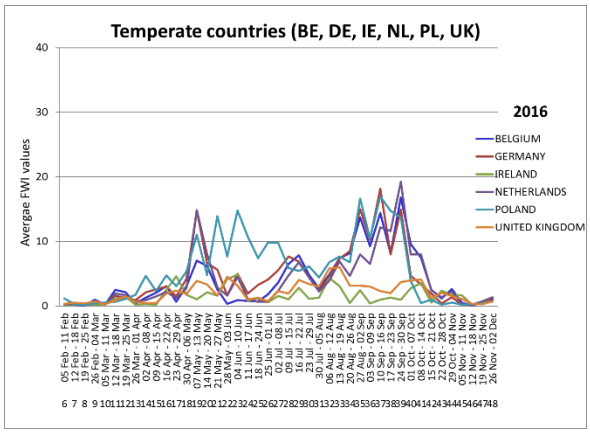
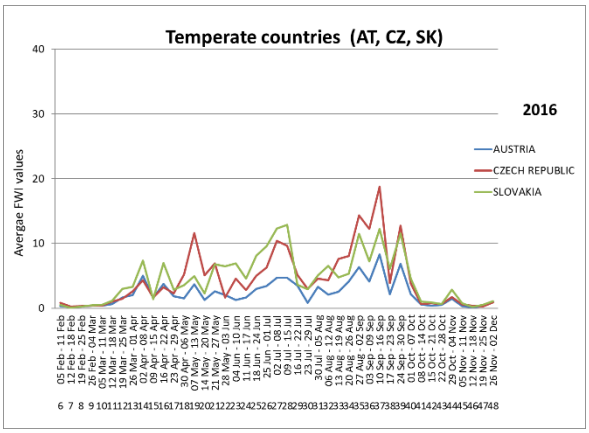
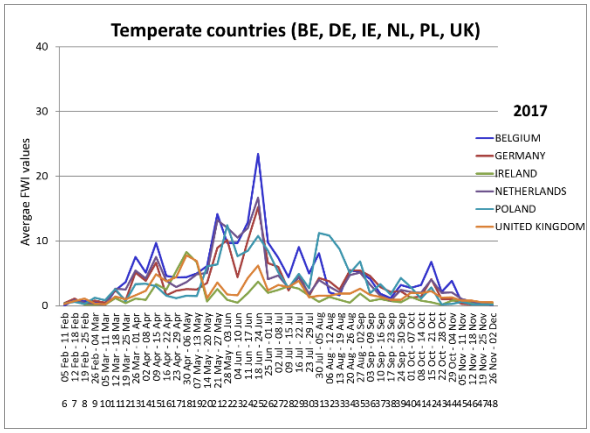
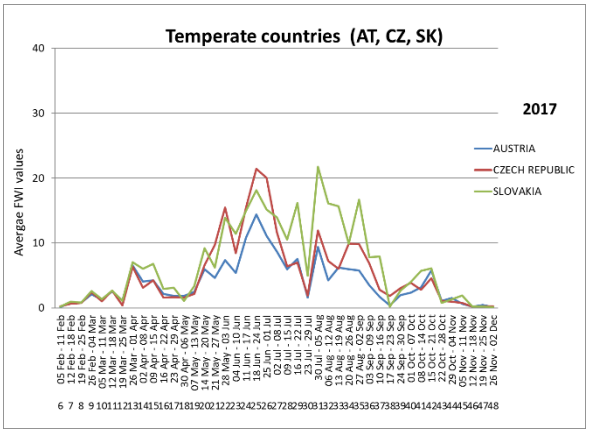


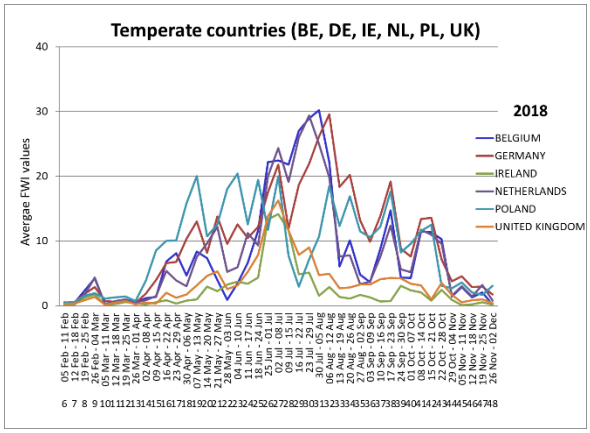
Figure 161. Fire danger trends 2016-2018 in western EU Mediterranean countries (FR, IT, PT, ES).











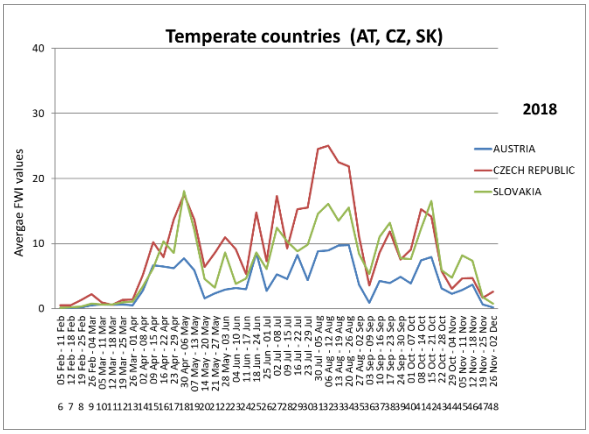
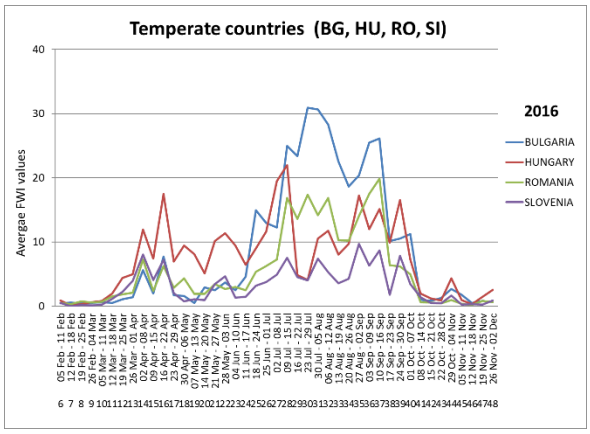
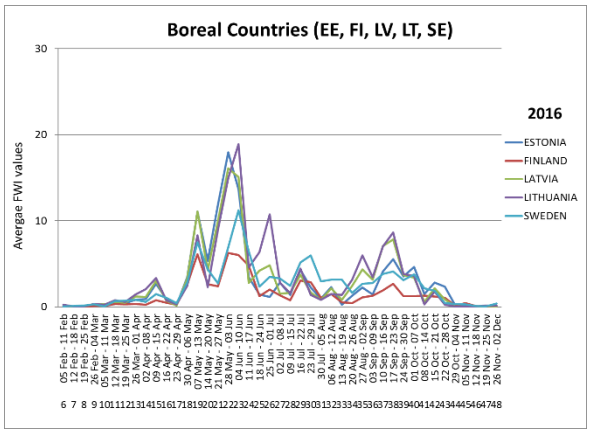
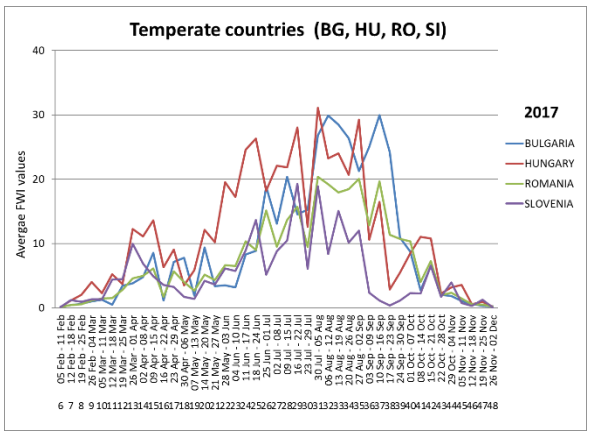


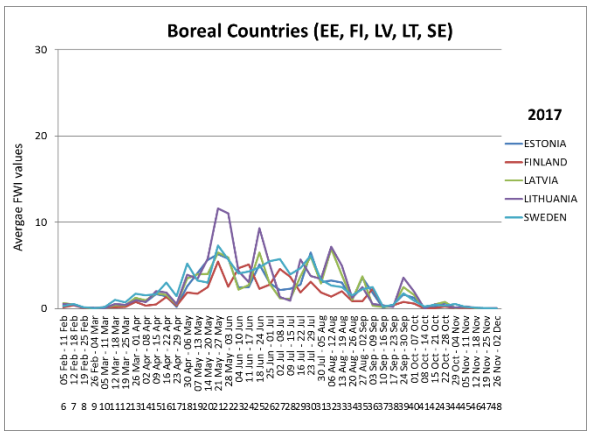
Figure 162. Fire danger trends 2016-2018 in some northern EU temperate countries (BE, DE, IE, NL, PL, UK).

Figure 163. Fire danger trends 2016-2018 in some central EU temperate countries (AT, CZ, SK).









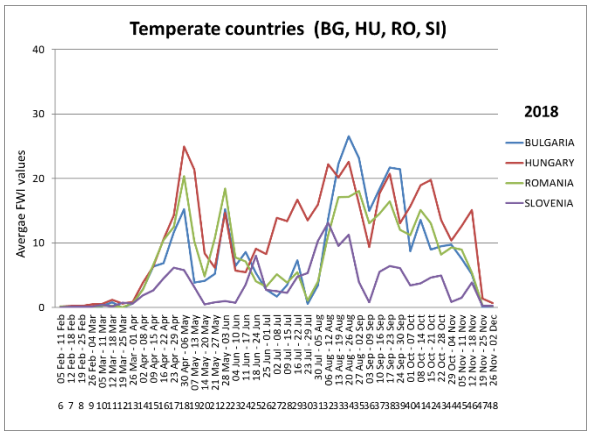


Figure 164. Fire danger trends 2016-2018 in some eastern EU temperate countries (BG, HU, RO, SI).

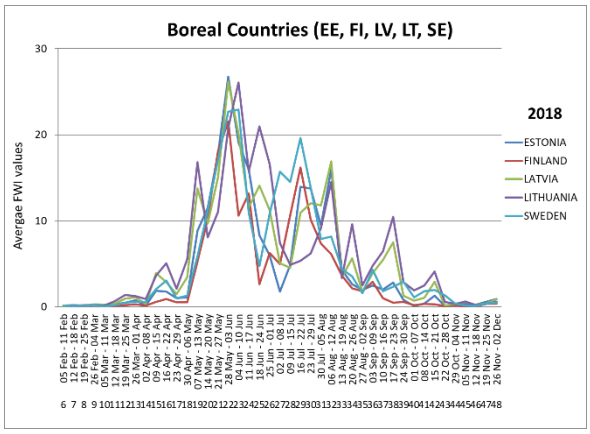
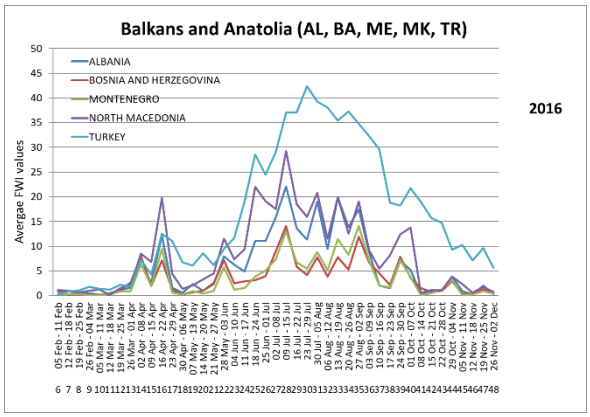
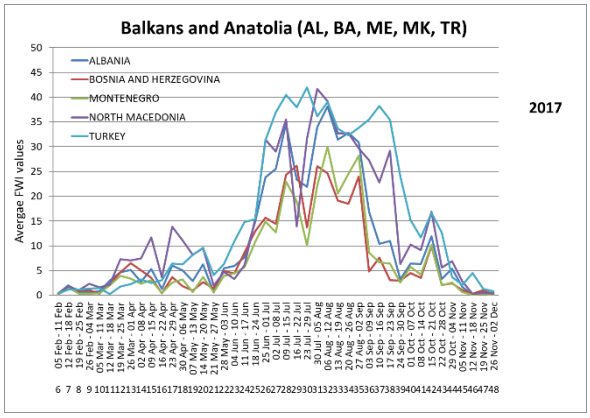


Figure 165. Fire danger trends 2016-2018 in some EU boreal countries (EE, FI, LV, LT, SE).





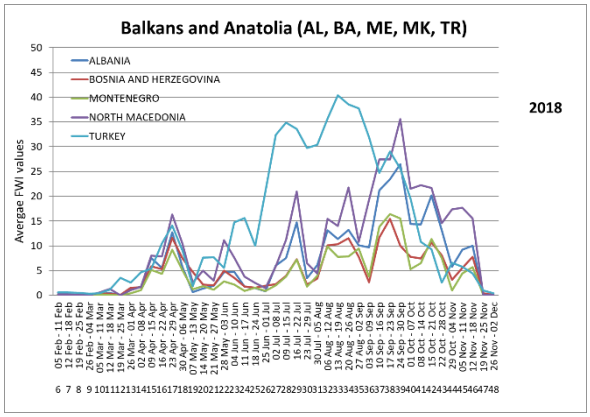
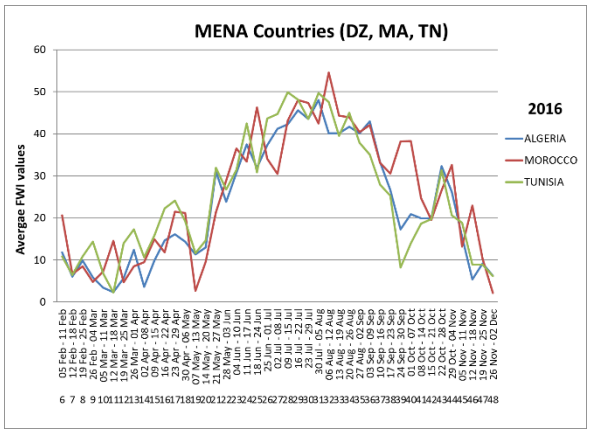
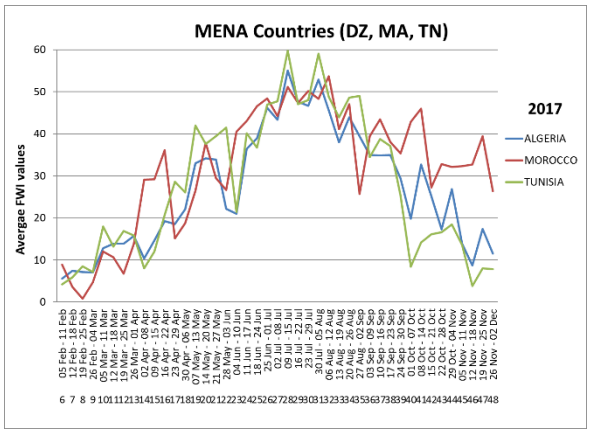


Figure 166. Fire danger trends 2016-2018) in the Balkans and Anatolia (AL, BA, ME, MK, TR).





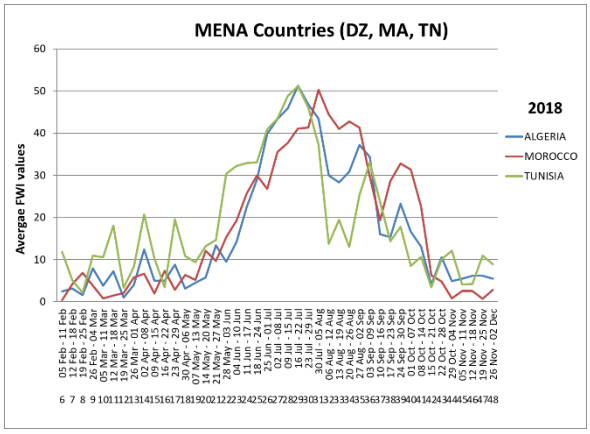


Figure 167. Fire danger trends 2016-2018 in MENA countries (DZ, MA, TN).

As in previous years, the Member States gave very positive feedback on the danger assessment activity, urging that the EFFIS Danger Forecast should be continued and improved as part of the European Forest Fire Information System. This dialogue with users and other stakeholders is bound to result in an improved civil protection and forest fire service across Europe, and helps meet the EU's aim of providing environmental information and services that can be combined with other global environmental information products, in support of the Copernicus (formerly Global Monitoring for Environment and Security - GMES) initiative.

2.2 The EFFIS Rapid Damage Assessment: 2018 results

The Rapid Damage Assessment module of EFFIS was set up to provide reliable and harmonized estimates of the areas affected by forest fires during the fire season. The methodology and the spatial resolution of the satellite sensor data used for this purpose allows all fires of about 30 ha or larger to be mapped. In order to obtain the statistics of the burnt area by land cover type the data from the European CORINE Land Cover 2006 (CLC) database were used. Therefore the mapped burned areas were overlaid with the CLC data, making it possible to derive damage assessment results comparable for all the EU countries.

EFFIS Rapid Damage Assessment is based on the analysis of MODIS satellite imagery. The MODIS instrument is on board both the TERRA (morning pass) and AQUA (afternoon pass) satellites. MODIS data has 2 bands with spatial resolution of 250 metres (red and near-infrared bands) and 5 bands with spatial resolution of 500 metres (blue, green, and three short-wave infrared bands). Mapping of burnt areas is based mainly on the 250 metre bands, although the MODIS bands at 500 metres resolution are also used, as they provide complementary information that is used for improved burnt area discrimination. This type of satellite imagery allows detailed mapping of fires of around 30 ha or larger. Although only a fraction of the total number of fires is mapped (fires smaller than 30 ha are not mapped), the analysis of historical fire data has determined that the area burned by wildfires of this size represents in most cases the large majority of the total area burned. On average, the area burned by fires of at least 30 ha accounts for about 75% of the total area burnt every year in the Southern EU.

Since 2008, EFFIS has included Northern African countries in the mapping of burned area, following the agreement with FAO *Silva Mediterranea*, the FAO statutory body that covers the Mediterranean region.

The results for each of the countries affected by forest fires of over 30 ha are given in the following paragraphs in alphabetical order, followed by a section on the MENA countries.

The total area burned in 2018, as shown by the analysis of satellite imagery, is shown in Table 42. These figures may also include agricultural and urban areas that were burned during the forest fires. Figure 168 below shows the scars caused by forest fires during the 2018 season.

In 2018 fires of greater than 30 ha were observed in 38 countries and a total burnt area of 204 861 ha was mapped. This is less than one-sixth the amount burnt in 2017 and lower than the long term average. However, large fires were recorded in more countries than usual, and parts of Northern Europe had a worse than average year. (Figure 174 below).

Table 42. Areas burned by fires of at least 30 ha in 2018 estimated from satellite imagery.

Country	*Area (Ha)*	*Number of Fires*
Albania	3280.27	14
Algeria	1716.09	21
Belgium	165.27	5
Bosnia & Herzegovina	3139.29	12
Bulgaria	2025.09	15
Croatia	1289.06	7
Cyprus	441.31	7
Denmark	463.2	4
Estonia	440.04	9
Finland	411.09	11
France	2636.07	23
Germany	3702.16	36
Greece	12065.71	34
Hungary	95.92	2
Ireland	2868.48	29
Israel	105.3	2
Italy	14649.08	147
Kosovo under UNSCR 1244	1393.73	12
Latvia	2546.39	8
Lebanon	74.14	2
Libya	272.48	4
Malta	31.94	1
Montenegro	4404.2	23
Morocco	1132.65	17
North Macedonia	2391.15	18
Norway	352.52	10
Poland	397.46	5
Portugal	37356.63	86
Romania	3340.96	42
Serbia	5799.87	46
Spain	12792.79	104
Sweden	21604.83	74
Switzerland	26.27	1
Syria	1570.59	22
The Netherlands	182.95	3
Tunisia	986.09	6
Turkey	40678.31	271
United Kingdom	18032.26	79
TOTAL	**204861.6**	**1212**

Figure 168. Burnt scars produced by forest fires during the 2018 fire season.

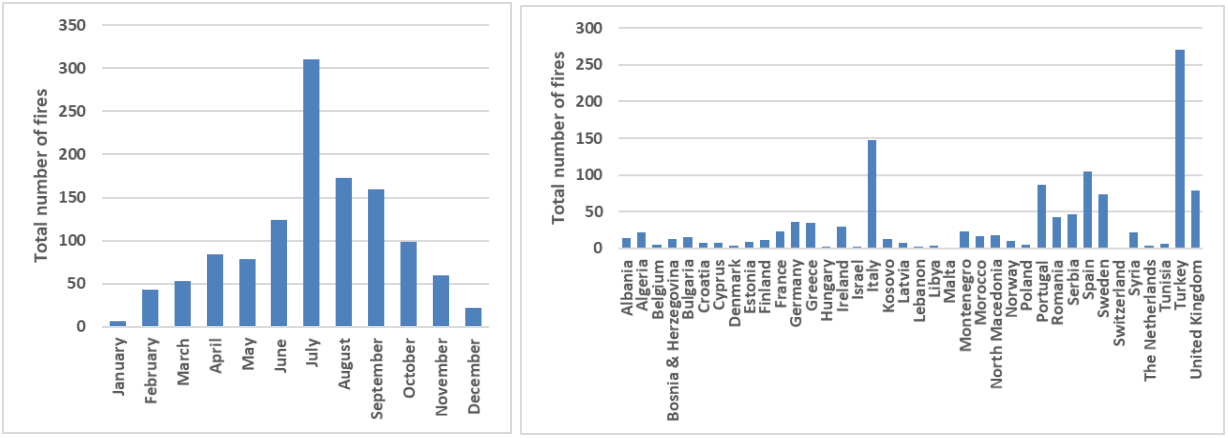


Figure 169. Total number of fires >30 ha by month and country in 2018.

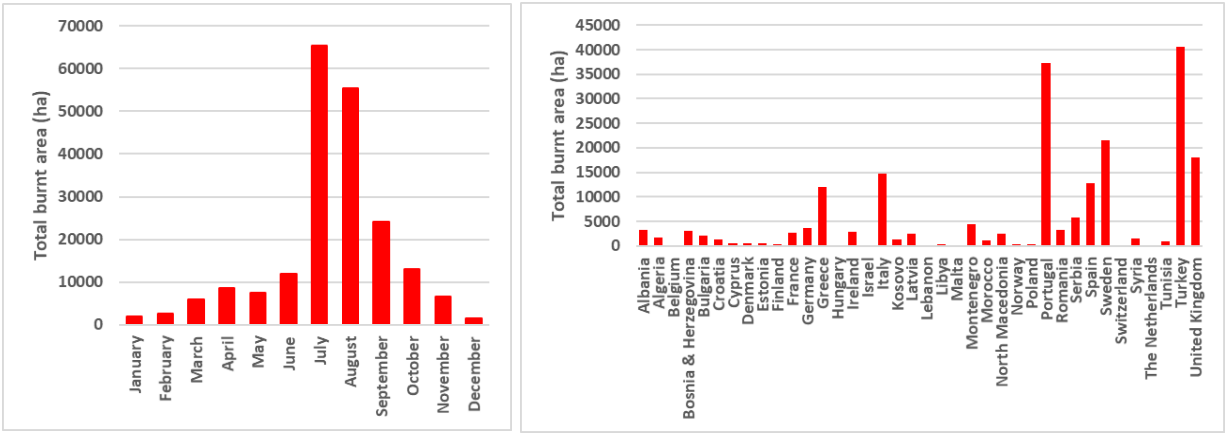


Figure 170. Total burnt area of fires >30 ha by month and country in 2018.

Damage to Natura2000 and other protected sites

Of particular interest is the analysis of the damage caused by fires to the areas protected within the Natura2000 network, as they include habitats of especial interest which are home for endangered plant and animal species.

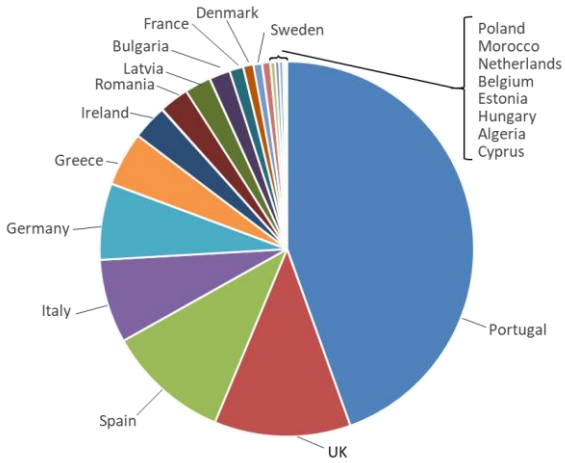
The category of Natura2000 areas only exists in the countries of the European Union. Information on other protected areas outside the EU is presented for those countries for which the information is available. The area burnt within the Natura2000 and other protected sites is presented below.

The total burnt in protected areas in 2018 was 49 835 ha, less than a quarter that recorded in 2017. Portugal was the most affected country in 2017, accounting for around 45% of the total Natura2000 burnt area, almost all from a single large fire in Monchique. UK and Spain account for around 12% and 10% respectively.

Summary	Total Area (Ha)
EU28	**137538.68**
Other European countries	**61465.6**
Middle East and North Africa	**5857.34**
Natura2000 and protected sites	**49834.7**

Country	*Area (Ha)*	*% of Nat2K Area*	*Number of Fires*
Belgium	165.27	0.043	5
Bulgaria	898.38	0.024	8
Cyprus	0.3	0	1
Denmark	456.69	0.119	4
Estonia	74.4	0.009	1
France	601.41	0.009	12
Germany	3291.95	0.06	32
Greece	2331.38	0.065	15
Hungary	58.85	0.003	1
Ireland	1500.8	0.165	17
Italy	3588.64	0.062	34
Latvia	1118.02	0.153	4
Poland	339.99	0.006	3
Portugal	22185.18	1.161	21
Romania	1293.18	0.03	19
Spain	5274.39	0.038	51
Sweden	360.74	0.006	15
Netherlands	182.02	0.032	3
UK	5869.65	0.333	29
EU28 total	**49591.2**		**275**

Country	*Area (Ha)*	*% of Non EU Prot Area*	*Number of Fires*
Algeria	26.86	0.016	1
Morocco	216.57	0.028	2
Total	**243.43**		**3**



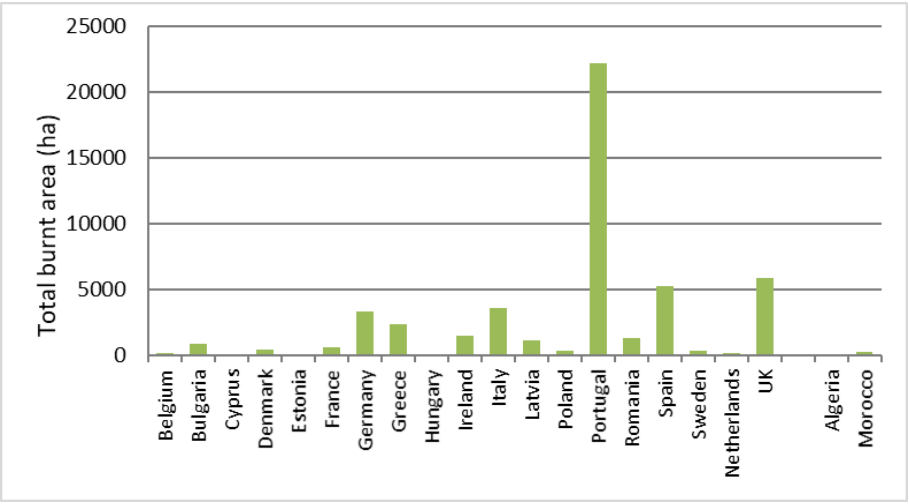


Figure 171. Burnt area in Natura2000 sites and other protected areas in 2018.

Affected land cover types

58% of the burnt area in 2018 was in Forest and Other Wooded Land, as identified by the CORINE Land Cover Type classification system (Figure 172).

This is similar to the proportion burnt last year, although the total amount is significantly lower. The historic average proportion burnt in Forest and Other Wooded Land is around 45%.

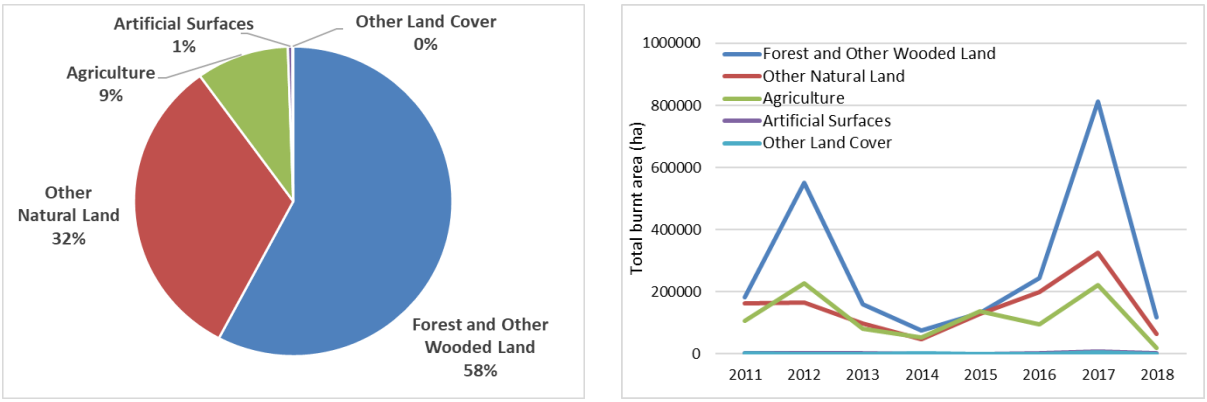


Figure 172. a) Proportions of land cover types affected in 2018 (all countries); b) Total burnt area by land cover type 2011-2018 (all countries).

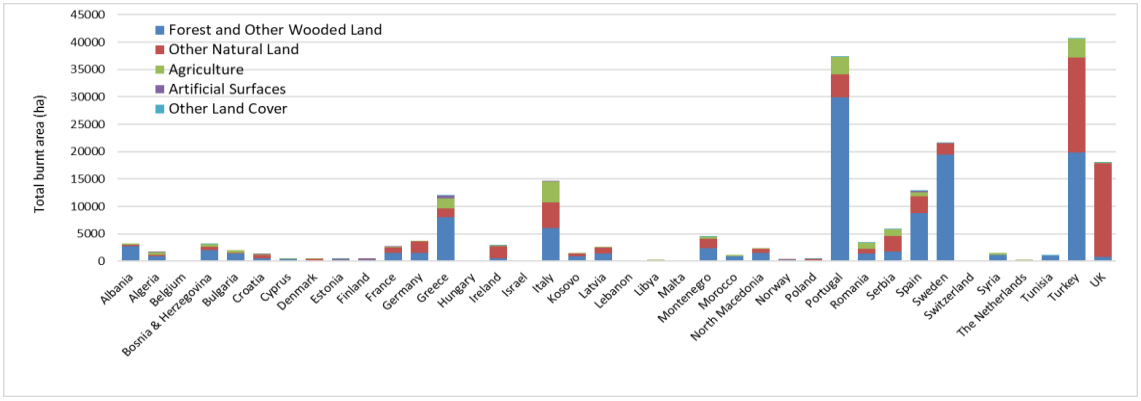


Figure 173. Burnt area in each country in 2018 by CORINE land class

European countries

In 2018, 22 of the EU28 countries were affected by fires of over 30 ha: (Belgium, Bulgaria, Croatia, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Malta, the Netherlands, Poland, Portugal, Romania, Spain, Sweden, United Kingdom), burning 137 539 ha in total (only around 14% of the amount that was recorded in 2017).

Of this total, 49 835 ha (36%) were on Natura2000 sites. Although Portugal was again the country with the highest burnt area, its total was a small fraction of the area lost to fire in 2017 and one of the lowest totals of the last 10 years (only 2014 was lower). Italy recorded more fires than any other EU28 country, as shown by Figure 169 and Figure 170 above.

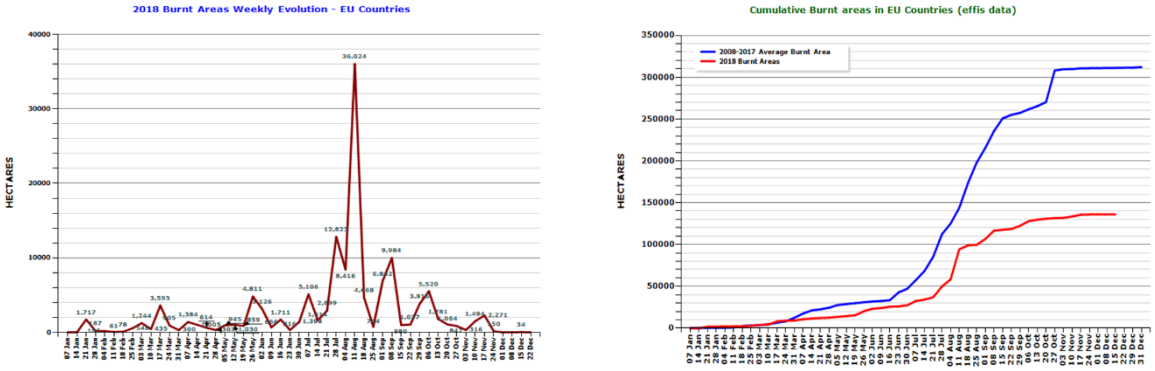


Figure 174. Burnt area weekly evolution and cumulative burnt area in 2018 (European Union countries).

Burnt areas are split into different land cover types using the CLC 2006 database unless otherwise specified.

2.2.1 Albania

The total burnt area of 3 280 ha recorded in Albania was less than 10% of the amount recorded in 2017, and the lowest since 2014. There were 14 fires of over 30 ha in 2018 (compared with 223 in 2017). Most of them occurred in September and October, relatively late in the year. The burnt area scars left by the 2018 fires in Albania can be seen in Figure 175.

Table 43. Distribution of burnt area (ha) in Albania by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	2727.54	83.15
Other Natural Land	294.91	8.99
Agriculture	257.82	7.86
TOTAL	**3280.27**	**100**

2.2.2 Belgium

Large fires are relatively rare in Belgium, but in 2018 there were 5 fires over 30 ha which burnt a total of 165 ha between February and September. The fires occurred in Other Natural Land, all on Natura2000 sites.

2.2.3 Bosnia and Herzegovina

Bosnia-Herzegovina had very few large fires in 2018, and the season's total was the lowest recorded since 2009. Most of the damage occurred in August and September, although there was a fire of over 800 ha mapped in April. In total there were only 12 fires over 30 ha mapped in the year. Visible fire scars caused by forest fires in Bosnia-Herzegovina can be seen in Figure 175 below.

Table 44. Distribution of burnt area (ha) in Bosnia-Herzegovina by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	1982.47	63.15
Other Natural Land	653.57	20.82
Agriculture	491.75	15.66
Artificial Surfaces	0.19	0.01
Other Land Cover	11.3	0.36
TOTAL	**3139.28**	**100**

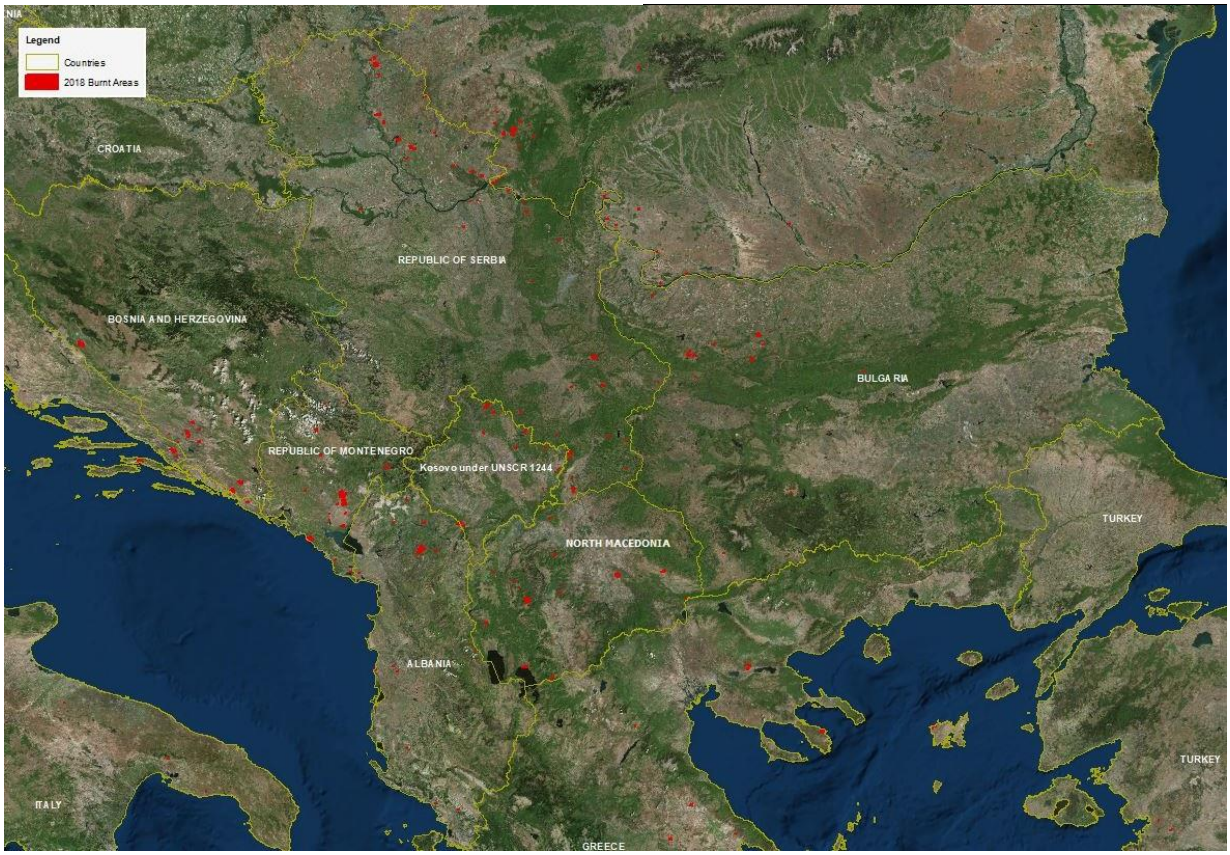


Figure 175. Visible fire scars in Eastern Europe in 2018.

2.2.4 Bulgaria

Bulgaria also had the best year since 2014, with less than half the burnt area recorded compared with 2017. A total of 15 fires of over 30 ha were mapped, the majority in October. Of the annual total, 898 ha occurred on Natura2000 sites, amounting to 44% of the total and 0.024% of Natura2000 land. The scars caused by these fires can be seen in Figure 175 above.

Table 45. Distribution of burnt area (ha) in Bulgaria by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	1331.75	65.76
Other Natural Land	206.86	10.21
Agriculture	486.48	24.02
TOTAL	**2025.09**	**100**

2.2.5 Croatia

In common with the rest of the Balkans, Croatia had a light season with only a small fraction of the burnt area compared to 2017. There were 7 fires over 30 ha between July and September burning a total of 1 289 ha. Almost all of the damage occurred in September. The scars caused by these fires can be seen in Figure 176. Table 46 presents the distribution of the mapped burnt area by land cover type.

Table 46. Distribution of burnt area (ha) in Croatia by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	585.8	45.44
Other Natural Land	598.59	46.44
Agriculture	104.42	8.1
Artificial Surfaces	0.25	0.02
TOTAL	**1289.06**	**100**

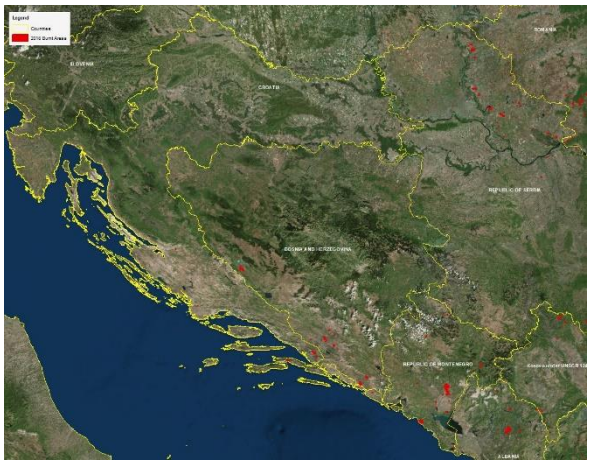


Figure 176. fire scars in Croatia in 2018.

2.2.1 Cyprus

Cyprus had a relatively good year with 7 fires over 30 ha occurring between May and November. Of the 441 ha total, practically none (0.3 ha) occurred on Natura2000 sites. Table 47 presents the distribution of the mapped burned area by land cover type.

Table 47. Distribution of burnt area (ha) in Cyprus by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	396.3	89.8
Other Natural Land	40.32	9.14
Agriculture	4.69	1.06
TOTAL	**441.31**	**100**

2.2.2 Denmark

Denmark had a second year with unusual fire activity after the 2017 season. 4 fires occurred in May and October, burning a total of 463 ha, 98% of it on Natura2000 sites.

Table 48. Distribution of burnt area (ha) in Denmark by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	7.09	1.53
Other Natural Land	438.4	94.65
Agriculture	17.71	3.82
TOTAL	**463.2**	**100**

2.2.3 Estonia

Estonia is not usually affected by large fires, but in 2018 there were 9 fires over 30 ha between May and August, burning 440 ha. 74.4 ha of this occurred on Natura2000 sites, amounting to 17% of the total and 0.009% of the Natura2000 land in Estonia.

Table 49. Distribution of burnt area (ha) in Estonia by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	279.77	63.58
Other Natural Land	156.35	35.53
Agricultural Areas	2.4	0.54
Other Land Cover	1.51	0.34
TOTAL	**440.04**	**100**

2.2.4 Finland

Like Denmark, Finland also experienced a second year of unusual fire activity, with 11 fires burning a total of 411 ha between May and July. No Natura2000 land was affected.

Table 50. Distribution of burnt area (ha) in Finland by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	301.33	73.3
Other Natural Land	47.16	11.47
Agriculture	62.36	15.17
Artificial surfaces	0.25	0.06
TOTAL	**411.09**	**100**

2.2.5 France

After two severe fire seasons, France had a light year, similar to 2015. There were fires of over 30 ha mapped in from January to December, but unusually, almost two-thirds of the total burnt area occurred early in January. This included the largest fire of the year which burnt 1 266 ha in Corsica, and which accounted for around half the annual total of the country. In total there were 23 fires of over 30 ha, affecting 2 636 ha. Of this, 601 ha were on Natura2000 sites, corresponding to 23% of the total area burned, and 0.009% of the total Natura2000 areas in the country.

Table 51 presents the distribution of the mapped burnt area by land cover type. The burnt scars left by the fires occurring in the southern region of the country and in northern Corsica are shown in Figure 177.

Table 51. Distribution of burnt area (ha) in southern France and Corsica by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	1571.92	59.63
Other Natural Land	984.41	37.34
Agriculture	78.86	2.99
Artificial Surfaces	0.88	0.03
TOTAL	**2636.06**	**100**

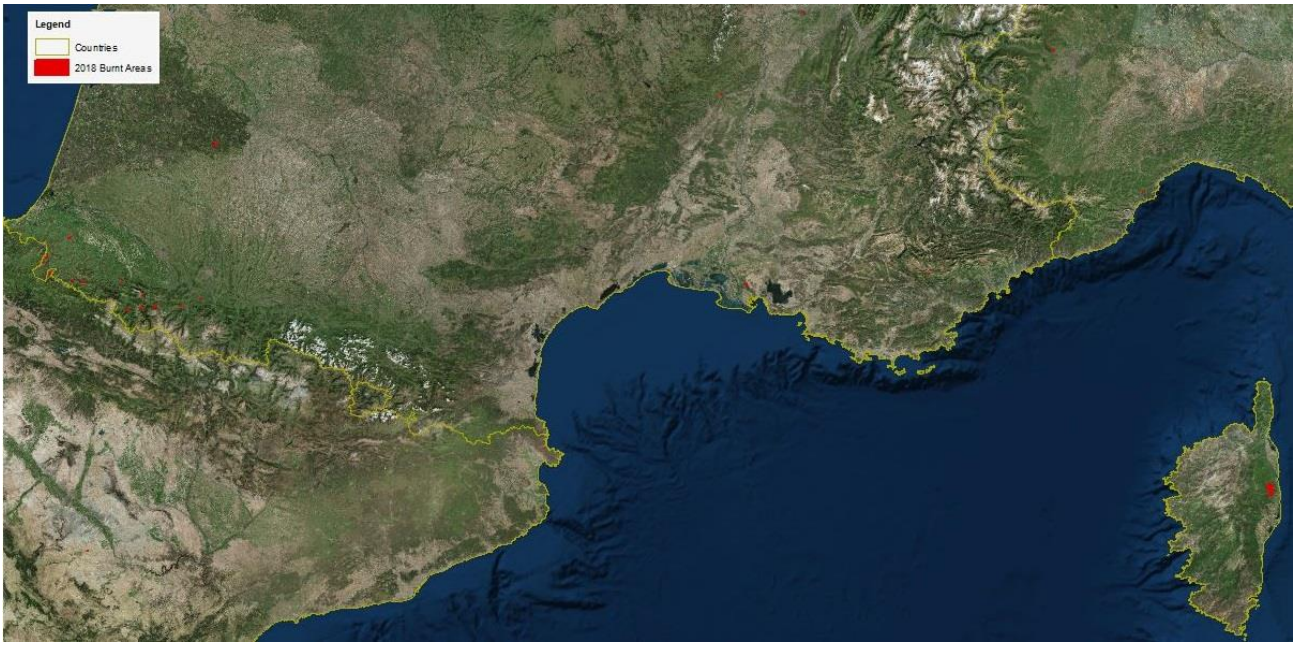


Figure 177. Visible burnt area scars in the South of France and Corsica in 2018.

2.2.6 Germany

Germany's fire season was the worst for years, with 36 fires over 30 ha burning 3702 ha, significantly more than the previous 5 years combined. Fires occurred every month between February and September, although the worst of the season was in the later part of the year. The biggest fire of the year burned over 1 000 ha in Emsland in September. Of the annual total, 3 292 ha occurred in Natura2000 sites, amounting to 89% of the total and 0.06% of the Natura2000 area in the country.

Table 52. Distribution of burnt area (ha) in Germany by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	1456.01	39.33
Other Natural Land	2189.38	59.14
Agriculture	56.77	1.53
TOTAL	**3702.16**	**100**

Figure 178. Fire scars in Germany in 2018.

2.2.7 Greece

Although Greece had a relatively light year for burnt area in 2018, with around two-thirds of the previous year's total affected by large fires, it also experienced one of the most deadly fires worldwide in terms of human casualties.

In July two fires started on the same day in Attiki province. The larger one in Kineta covered more than 5 000 ha, but it was the second slightly smaller one (over 1 000 ha) in Mati that resulted in the eventual deaths of 100 people.

In total 12 066 ha from 34 fires was mapped of which 2 331 ha occurred on Natura2000 sites, amounting to 19% of the total and 0.065% of the total Natura2000 area of Greece.

Fires occurred from January to November, but over 70% of the damage occurred in July, as a result of the two in Attiki province. There were four other fires over 500 ha. Table 53 presents the distribution of the mapped burnt area by land cover type. Figure 179 shows the burnt area scars in Greece, including the two large fires in Attiki.

Table 53. Distribution of burnt area (ha) in Greece by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	8030.91	66.56
Other Natural Land	1611.8	13.36
Agriculture	1878.04	15.57
Artificial Surfaces	488.69	4.05
Other Land Cover	56.26	0.47
TOTAL	**12065.71**	**100**

Figure 179. Burnt area scars in Greece in 2018.

2.2.8 Hungary

In Hungary only two fires of over 30 ha were mapped. Both occurred late in the season (October and November) and the second one (59 ha) occurred on a Natura2000 site, representing 61% of the burnt total and 0.003% of the Natura2000 area in the country.

Table 54. Distribution of burnt area (ha) in Hungary by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	3.41	3.56
Other Natural Land	58.85	61.36
Agriculture	33.65	35.08
TOTAL	**95.92**	**100**

2.2.9 Ireland

Ireland continued a pattern of alternating good/bad years with less than 50% of the damage that was recorded in 2017. There were 29 fires of over 30 ha which burnt a total of 2 868 ha. The fire season lasted most of the year, with fires recorded from February to October. 52% of the burnt area (1 501 ha) was recorded in Natura2000 sites, corresponding to 0.165% of the total Natura2000 land in the country. The most affected land type was Other Natural Land, as shown in Table 55.

Table 55. Distribution of burnt area (ha) in Ireland by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	567.79	19.79
Other Natural Land	2197.45	76.61
Agriculture	82.31	2.87
Other Land Cover	20.92	0.73
TOTAL	**2868.48**	**100**

2.2.10 Italy

After the disastrous year in Italy in 2017, the fire season of 2018 was a quiet one, with 14 649 ha constituting only around 10% of the burnt area compared with last year. Although the number of fires over 30 ha was the second highest recorded (only Turkey had more), it was also less than one fifth of those registered in 2017. There were 147 fires between April and October, with 60% of the damage occurring in July. Notable large fires occurred in Palermo and Pisa regions, both over 1 000 ha, and there were also two other fires over 500 ha (compared with 41 fires over 500 ha in 2017). Of the year's total, 3 589 ha occurred on Natura2000 sites, corresponding to 24% of the total and 0.062% of the Natura2000 land in Italy. Table 56 presents the distribution of the mapped burnt area by land cover type.

Figure 180. Burnt area scars in central and southern Italy.

Figure 181. Burnt area scars in Pisa region in Italy.

Table 56. Distribution of burnt area (ha) in Italy by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	6057.83	41.35
Other Natural Land	4697.26	32.07
Agriculture	3800.49	25.94
Artificial Surfaces	93.48	0.64
TOTAL	**14649.06**	**100**

2.2.11 Kosovo under UNSCR 1244

In Kosovo, 12 fires of over 30 ha burned a total of 1394 ha, around one third of the 2017 total. The fires occurred late in the season, between September and November. Table 57 shows the classification of the burnt area by land type.

Table 57. Distribution of burnt area (ha) in Kosovo by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	914.46	65.61
Other Natural Land	433.3	31.09
Agriculture	45.96	3.3
TOTAL	**1393.72**	**100**

2.2.12 Latvia

Latvia's fire season was the worst for several years, in common with many other northern countries. 8 fires over 30 ha burned a total of 2 546 ha between March and August, including one of 1 483 ha that occurred in Kurzeme region in July and another over 500 ha in Pieriga region in June. 1 118 ha of the damage occurred in Natura2000 sites, corresponding to 44% of the total and 0.153% of the total Natura2000 area of the country. Table 58 presents the distribution of the mapped burnt area by land cover type.

Table 58. Distribution of burnt area (ha) in Latvia by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	1359.87	53.4
Other Natural Land	1177.28	46.23
Agriculture	9.23	0.36
TOTAL	**2546.39**	**100**

2.2.13 Malta

In Malta a fire of 32 ha burned mixed land. No Natura2000 area was affected.

Table 59. Distribution of burnt area (ha) in Malta by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	5.54	17.35
Agriculture	24.42	76.48
Artificial Surfaces	1.97	6.18
TOTAL	**31.94**	**100.01**

2.2.14 Montenegro

23 fires over 30 ha were mapped in Montenegro, burning 4 404 hectares, less than 10% of the amount of damage recorded in 2017. Fires were recorded through the year from March to November, although almost all of the damage occurred in August and September. Table 60 shows the classification of the burnt area by land type.

Table 60. Distribution of burnt area (ha) in Montenegro by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	2338.99	53.11
Other Natural Land	1762.35	40.02
Agriculture	302.82	6.88
Other Land Cover	0.04	0
TOTAL	**4404.2**	**100**

2.2.15 The Netherlands

In the Netherlands three fires in February, March and July burned a total of 183 ha. Practically all of this (99%) occurred in Natura2000 sites, corresponding to 0.032% of the Natura2000 area of the country.

Table 61. Distribution of burnt area (ha) in the Netherlands by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	12.77	6.98
Other Natural Land	170.04	92.95
Agriculture	0.13	0.07
TOTAL	**182.95**	**100**

2.2.16 North Macedonia

After 2017, the worst year since 2012, North Macedonia had the best year for 8 years, with only 18 large fires burning a total of 2 391 ha. The first fires were recorded in April, but three-quarters of the damage was in October and November. Visible scars from these fires can be seen in Figure 175 above.

Table 62. Distribution of burnt area (ha) in North Macedonia by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	1558.19	65.16
Other Natural Land	688.33	28.79
Agricultural Areas	144.62	6.05
TOTAL	**2391.14**	**100**

2.2.17 Norway

In Norway there were 10 fires over 30 ha that burned a total of 353 ha, slightly more than was recorded in 2017. All but one of the fires occurred in July.

Table 63. Distribution of burnt area (ha) in Norway by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	272.81	77.39
Other Natural Land	79.71	22.61
TOTAL	**352.52**	**100**

2.2.18 Poland

There were 5 fires over 30 ha in Poland burning a total of 397 ha. The biggest one was in September and affected 272 ha. Of the total, 340 ha (85%) occurred on Natura2000 sites, corresponding to 0.006% of the Natura2000 area of the country.

Table 64. Distribution of burnt area (ha) in Poland by land cover types in 2018.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	76.37	19.21
Other Natural Land	320.25	80.57
Artificial surfaces	0.81	0.2
Other Land Cover	0.04	0.01
TOTAL	**397.46**	**100**

2.2.19 Portugal

Portugal was the second most affected country in terms of burnt area in 2018, after Turkey. However, the total amount of damage was a fraction of the amount recorded in 2017. 86 fires over 30 ha burned a total of 37 357 ha, less than 7% of 2017's total and the lowest mapped since 2014. Although fires were recorded from February to December, practically all the damage resulted from a single fire in Monchique (Algarve region) in August, which burnt 27 635 ha and which alone accounts for three quarters of Portugal's annual total (Figure 182). There were only 5 other fires over 500 ha (compared with 59 over 1 000 ha in 2017).

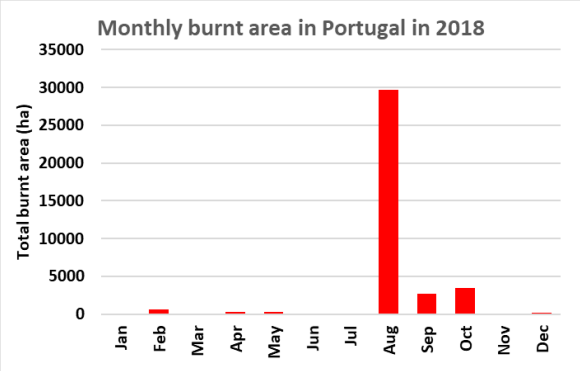


Figure 182. Monthly burnt area in Portugal in 2018.

The Monchique fire was also the largest fire mapped anywhere across Europe, Middle East and North Africa in 2018, and covered the same area as the next 10 largest fires combined.

However, to put this in perspective, the same data are reproduced below in comparison with the 2017 mapped monthly burnt areas in Portugal.

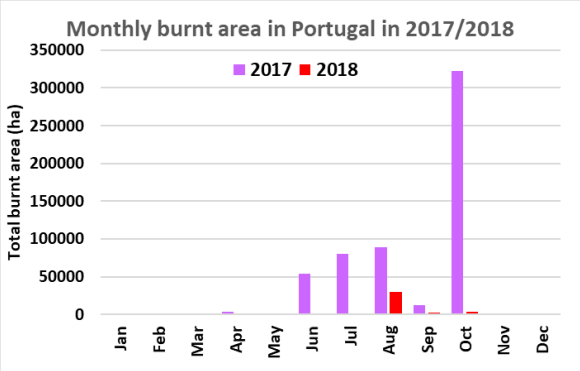


Figure 183. Monthly burnt area mapped in Portugal in 2017 and 2018.

The mapped burnt areas in Portugal in 2018 can be seen in Figure 184.

22 185 ha of the burnt area mapped in 2018 occurred on Natura2000 sites, corresponding to 59% of the total area burnt, and 1.161 % of the total Natura2000 areas in Portugal.

The distribution of the mapped burnt area by land cover type is shown in Table 65. Forest and Other Wooded Land was heavily affected, accounting for 80% of the mapped burnt area.

Table 65. Distribution of burnt area (ha) in Portugal by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	29932.14	80.13
Other Natural Land	4166.36	11.15
Agriculture	3178.68	8.51
Artificial Surfaces	73.55	0.2
Other Land Cover	5.88	0.02
TOTAL	**37356.61**	**100**

Figure 184. Burnt area scars in Portugal in 2018.

2.2.20 Romania

After the worst fire season seen for several years in 2017, the 2018 season in Romania was relatively quiet and close to the long term average (excluding 2017). There were 42 fires over 30 ha burning a total of 3 341 ha between January and November, but nearly half of the damage occurred late in the year in November (Figure 185). Of the total, 1 293 ha (39%) of the mapped burnt area was on Natura2000 sites, a lower proportion than in recent years. This represents 0.03% of the total Natura2000 area of Romania. Table 66 presents the distribution of the mapped burnt area by land cover type.

Table 66. Distribution of burnt area (ha) in Romania by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	1448.55	43.36
Other Natural Land	753.24	22.55
Agriculture	1123.62	33.63
Artificial Surfaces	12.65	0.38
Other Land Cover	2.89	0.09
TOTAL	**3340.95**	**100**

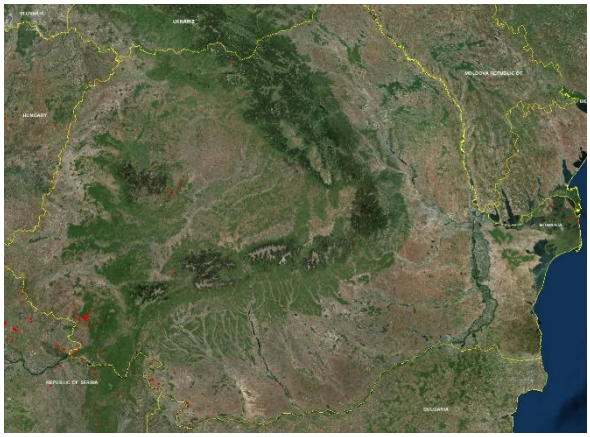


Figure 185. Burnt area scars in Romania in 2018.

2.2.21 Serbia

The fire season in Serbia was better than that of 2017, although above the low amounts mapped in 2013-5. There were 46 fires over 30 ha, burning a total of 5 800 ha. Fires were mapped from April to November, but most of the damage occurred late in the year in October and November.

Table 67 presents the breakdown of burnt area by land cover type. Figure 186 shows the location of these fires.

Table 67. Distribution of burnt area (ha) in Serbia by land cover type in 2016.

Land cover	*Area*	*% of total*
Forest/Other Wooded Land	1770.71	30.53
Other Natural Land	2800.31	48.28
Agriculture	1199.63	20.68
Other Land Cover	29.22	0.5
TOTAL	**5799.86**	**100**

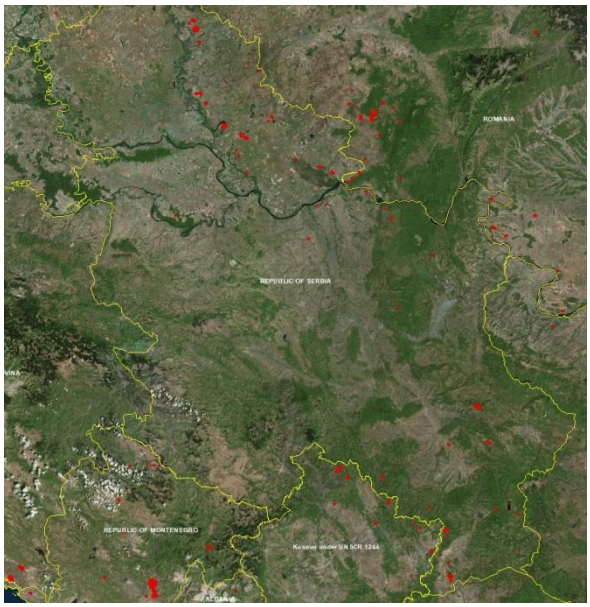


Figure 186. Burnt area scars in Serbia in 2018.

2.2.22 Spain

After a bad year in 2017, Spain recorded the lowest burnt area since 2008. There were 104 fires over 30 ha resulting in a total burnt area of 12 793 ha, less than 10% of the previous year's total. Although fires were mapped in almost every month of the year, 48% of the damage occurred in August, mostly because of two very large fires that occurred in Valencia (3 228 ha) and Huelva (1 744 ha) regions.

Of the total burnt area mapped in 2018, 5 274 ha were on Natura2000 sites, corresponding to 41% of the total area burned, and 0.038% of the Natura2000 areas in Spain. Table 68 presents the distribution of the mapped burnt area by land cover type. The most noticeable fires in Spain during 2018 are shown in Figure 188.

Table 68. Distribution of burnt area (ha) in Spain by land cover type in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	8752.32	68.42
Other Natural Land	3038.05	23.75
Agriculture	841.91	6.58
Artificial Surfaces	144.2	1.13
Other Land Cover	16.3	0.13
TOTAL	**12792.78**	**100**

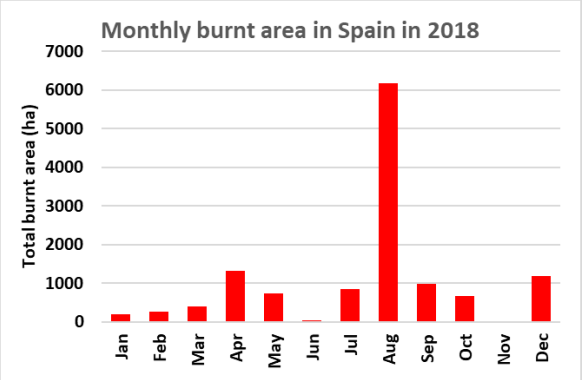


Figure 187. Monthly evolution of burnt area in Spain in 2018.

Figure 188. Burnt area scars in the Iberian Peninsula in 2018.

2.2.23 Sweden

Sweden had the worst fire season in memory. The total burnt area of 21 605 ha from 74 fires over 30 ha registered as the third highest of the year after Turkey and Portugal, an unusual ranking for a northern country.

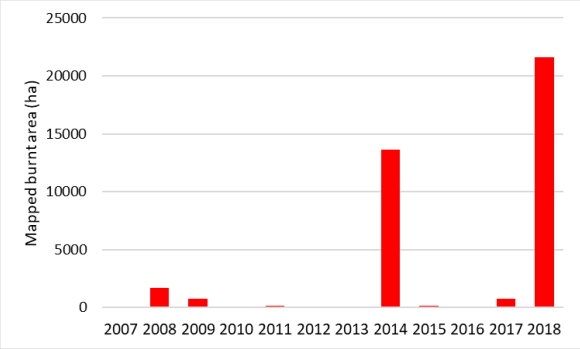


Figure 189.Total mapped burnt area in Sweden 2007-2018.

Fires were mapped from April to July, although practically all the damage occurred in July (Figure 190). The third largest fire of 2018 occurred in Sweden and covered nearly 4 000 ha in Jamtlands Ian in mid-July.

Although this is not as large as the fire that occurred in Västmanland County in 2014 (over 12 000 ha), the difference in 2018 was that the burnt area resulted from numerous fires (52 in July alone) as opposed to one single large outlier.

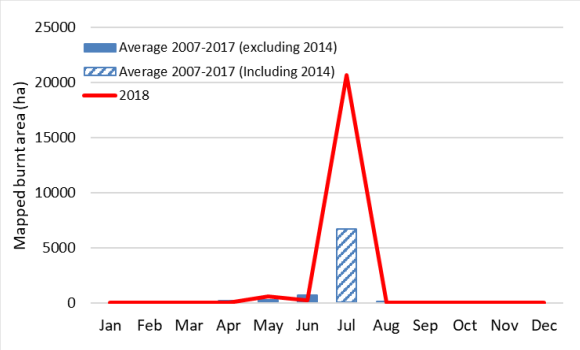


Figure 190. Monthly mapped burnt area in Sweden compared with long-term average (with and without outlying year 2014).

Most of the burnt area occurred in Forest and Other Wooded Land (Table 69).

Table 69. Distribution of burnt area (ha) in Sweden by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	19458.27	90.06
Other Natural Land	2108.13	9.76
Agriculture	18.64	0.09
Other Land Cover	19.79	0.09
TOTAL	**21604.82**	**100**

Of the total burnt area mapped, 361 ha occurred on Natura2000 sites, amounting to 1.7% of the total and 0.006% of the Natura2000 area of the country. Most of the Natura2000 land cover affected was in Coniferous forest.

Burnt area scars of the fires mapped in Sweden in 2018 are shown in Figure 191.

Figure 191. Burnt area scars in Sweden in 2018.

2.2.24 Switzerland

In September a fire of 26.27 ha was mapped, affecting mostly forest and Other Wooded Land.

Table 70. Distribution of burnt area (ha) in Switzerland by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	25.05	95.37
Artificial surfaces	1.22	4.63
TOTAL	**26.27**	**100**

2.2.25 Turkey

Despite being the country most affected by fires over 30 ha in 2018, with 40 678 ha mapped from 271 fires over 30 ha, Turkey's fire season was its best since 2014. The burnt area total was slightly less than last year and one third of that recorded in 2016. Fires were mapped from February to November, but the majority occurred between July and September.

Unlike previous years, Forest and Other Wooded Land was the most affected land type. Table 71 presents the distribution of the mapped burned area by land cover type. The visible scars from forest fires in the south-east of the country are shown in Figure 192.

Table 71. Distribution of burnt area (ha) in Turkey by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	19783.71	48.63
Other Natural Land	17360.34	42.68
Agriculture	3516.62	8.64
Artificial Surfaces	7.73	0.02
Other Land Cover	9.76	0.02
TOTAL	**40678.15**	**99.99**

Figure 192. Burnt area scars in Turkey in 2018.

2.2.26 United Kingdom

In common with other more northerly countries, it was a bad year for the UK, which was the fourth most affected country in 2018. There were 79 fires of over 30 ha, which burned a total of 18 032 ha, the most for at least 7 years. In addition to the usual large fires seen in Scotland early in the season there were others in later months, including one on Saddleworth Moor in July, which burned over 1 000 ha and was of particular concern because of its proximity to Manchester. There were 10 fires of more than 500 ha. Of the total, 5 870 ha occurred on Natura2000 land, amounting to 32.6% of the total burnt area and 0.333% of the Natura2000 land in the UK. After Portugal, this was the greatest loss of Natura2000 land in the 2018 season. Other Natural Land was by far the most affected land type (Table 72).

Table 72. Distribution of burnt area (ha) in the UK by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	800.31	4.44
Other Natural Land	17075.73	94.7
Agriculture	76.51	0.42
Artificial Surfaces	79.69	0.44
Other Land Cover	0.01	0
TOTAL	**18032.25**	**100**

Figure 193. Burnt area scars in the UK in 2018.

2.3 Middle East and North Africa

The 2018 fire season in North Africa and the Middle East was significantly better than average, with a total burnt area recorded over the region of 5 973 ha, just over 5% of the average over the past 8 years.

2.3.1 Algeria

Algeria's fire season was the best for 10 years, with only 21 fires over 30 ha mapped. A total of 1 716 ha were affected, only around 2% of the long term average. Most of the fires occurred in July and August and only 27 ha affected protected areas. The burnt scars left by these fires can be seen in Figure 194 below. The Globcover land cover map from ESA was used to split the burnt area into different land type categories, harmonised with CLC terminology, and the distribution of burnt area by these land cover types is given in Table 73.

Table 73. Distribution of burnt area (ha) in Algeria by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	889.13	51.81
Other Natural Land	295.34	17.21
Agriculture	500.54	29.17
Artificial Surfaces	31.08	1.81
TOTAL	**1716.09**	**100**

2.3.2 Israel

There were two fires over 30 ha mapped in Israel, one in May and the other in July, burning a total of 105 ha.

Table 74. Distribution of burnt area (ha) in Israel by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	21.17	20.11
Other Natural Land	46.18	43.86
Agriculture	37.94	36.03
TOTAL	**105.3**	**100**

2.3.3 Lebanon

In Lebanon two fires in July and August burned 74 ha, a slight increase on the 2017 figures. Table 75 presents the distribution of the mapped burnt area by land cover type using the Globcover land cover map, harmonised with CLC.

Table 75. Distribution of burnt area (ha) in Lebanon by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	16.78	22.64
Other Natural Land	17.07	23.03
Agriculture	40.28	54.33
TOTAL	**74.14**	**100**

2.3.4 Libya

There were four fires over 30 in Libya in May and June, covering a total of 273 ha, a slight increase on 2017. Table 76 presents the distribution of the mapped burnt area by land cover type using the Globcover land cover map, harmonised with CLC.

Table 76. Distribution of burnt area (ha) in Libya by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	170.71	62.65
Agriculture	101.77	37.35
TOTAL	**272.48**	**100**

Figure 194. Burnt area scars in eastern Algeria and Tunisia in 2018.

2.3.5 Morocco

Morocco's fire season was better than the previous two years. 17 fires burned a total of 1 133 ha between February and August, around a third of the 10-year average. Of the annual total, 217 ha occurred in Protected Areas, amounting to 19% of the total burnt in the year and 0.028% of the total protected areas of the country. The distribution of burnt area by land cover types, using Morocco's own land cover map but with terminology harmonised with CLC, is given in Table 77 and the burnt area scars left by the fires are shown in Figure 195.

Table 77. Distribution of burnt area (ha) in Morocco by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	889.07	78.5
Other Natural Land	13.67	1.21
Agriculture	229.9	20.3
TOTAL	**1132.64**	**100**

Figure 195. Burnt area scars in Morocco in 2018.

2.3.6 Syria

Syria's total mapped burnt area was the lowest since 2011. Fires were mapped from May to September, but 90% of the damage occurred between June and August. There were 22 fires of over 30 ha, resulting in a total burnt area of 1 571 ha. The Globcover land cover map, harmonised with CLC, was used to split the burnt area into different land type categories. Table 78 shows the distribution of burnt area in Syria by land type.

Table 78. Distribution of burnt area (ha) in Syria by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	1109.94	70.67
Other Natural Land	29.93	1.91
Agriculture	430.72	27.42
TOTAL	**1570.59**	**100**

2.3.7 Tunisia

In Tunisia it was the best year for forest fires since 2009, with a total burnt area only 5% of that mapped in 2017. There were 6 fires greater than 30 ha recorded in July and August burning a total of 986 ha, although 95% of the damage occurred in July. Figure 194 above shows the burnt scars left by these fires. The distribution of burnt area by land cover types using Tunisia's own land cover map but with terminology harmonised with CLC, is given in Table 79.

Table 79. Distribution of burnt area (ha) in Tunisia by land cover types in 2018.

Land cover	*Area burned*	*% of total*
Forest/Other Wooded Land	979.41	99.32
Other Natural Land	4.67	0.47
Agriculture	1.49	0.15
Other Land Cover	0.52	0.05
TOTAL	**986.09**	**100**

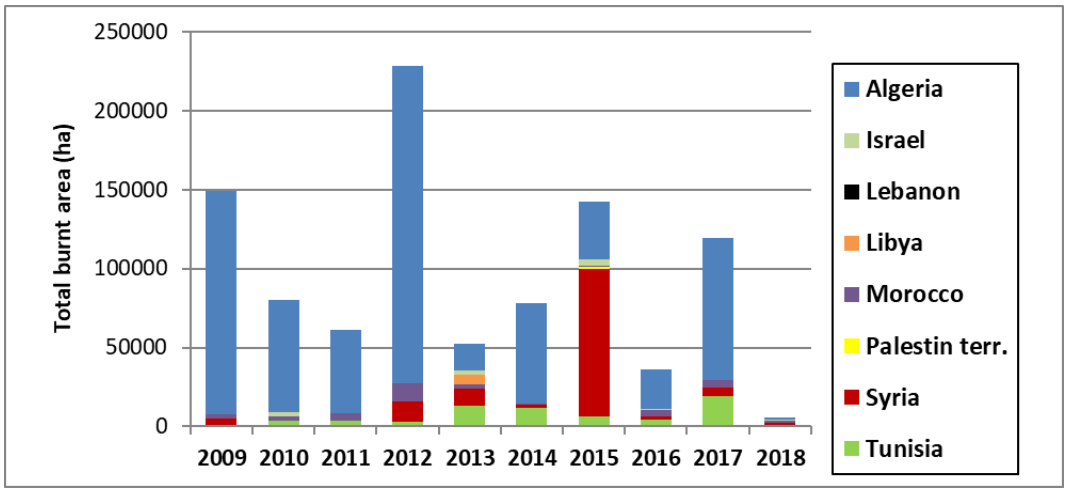


Figure 196. Overview of fires in the MENA region in the last 10 years.

2.4 EFFIS Applications

2.4.1 The Current Situation Application

The current situation allows the user to view and query map layers, giving an indication of the fire situation across Europe for the current date and surrounding short term time frame.

The application is normally updated between March and October.

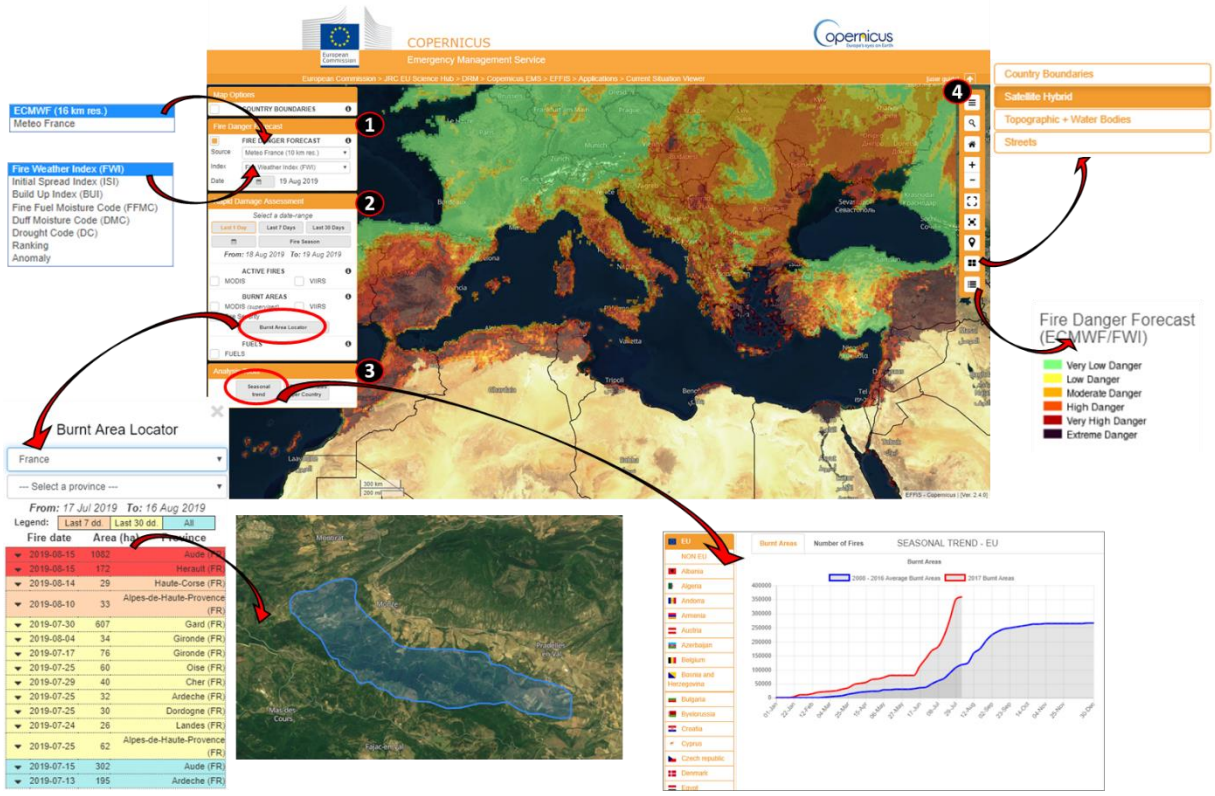
In the Fire Danger Forecast section ① two different sources and 8 different indices can be displayed, for the current day and up to 8 days in the future.

The Rapid Damage Assessment ② allows the user to display active fire information and burnt area information from two sources.

In the Analysis Tools section ③ there is a Burnt area locator, where the burnt area for the whole area or for a given country/region can be displayed. A close-up view of the individual fire perimeter is shown if the user clicks on a specific fire.
The Seasonal Trend button displays the current cumulative burnt area or number of fires mapped in EFFIS, alongside the long term average.

A tool bar ④ has a number of controls for changing the view and displaying the legend.

This application can be accessed at
http://effis.jrc.ec.europa.eu/static/effis_current_situation/public/index.html



2.4.2 The Fire News Application

The purpose of this application is to display geo-located news items about forest fires from a number of sources. News items are added to the map daily by team members during the fire season. The resulting list can be sorted by any of the displayed variables and filtered by date, size class or country.

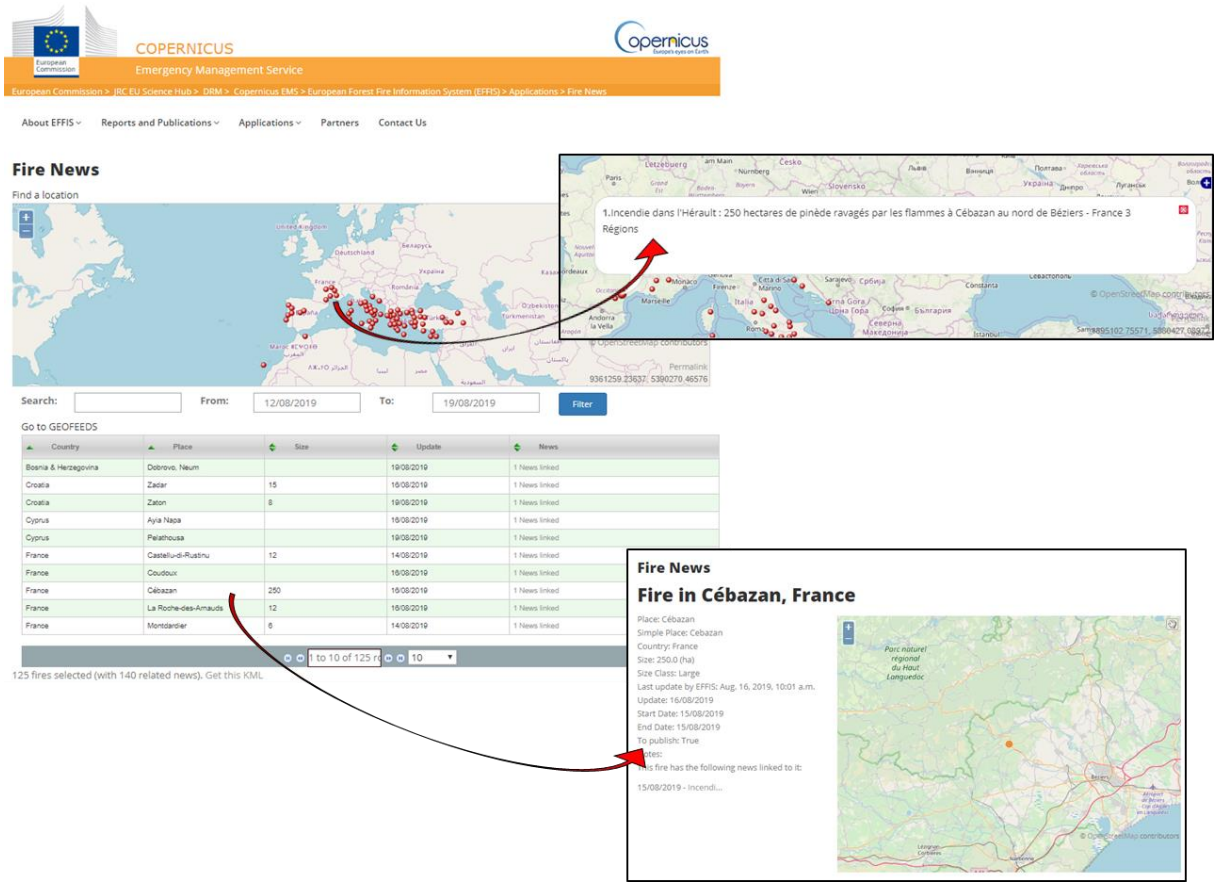
[**N.B.** *It is important to note that not all fires are displayed here: only those reported in the media with an identifiable location. Fires are not always reported individually (or at all) in the press, and the space devoted to them depends on other current world events*].

Clicking on a point on the map gives a link to the original news item associated with that point.

Clicking on the name in the list gives a table with details of the fire and a close-up of the map.

By default the display shows fires occurring in the last week, but the **From** and **To** boxes can be used to select other time periods – even for past years. The Search box allows the user to narrow down the display from among the total selected in the date filters.

This application can be accessed at http://effis.jrc.ec.europa.eu/applications/fire-news/



2.4.3 The EFFIS Fire Database

The Fire Database is an important component of EFFIS, containing the forest fire information compiled by countries in Europe, Middle East and North Africa.

The Regulation EEC No 804/94 [11] (now expired) established a Community system of information on forest fires for which a systematic collection of a minimum set of data on each fire occurring, the so called "Common Core", had to be carried out by the Member States participating in the system. This regulation was replaced by the Forest Focus regulation in 2003.

Following the Forest Focus regulation (EC) No 2152/2003 [7], concerning monitoring of forests and environment interactions in the Community, the forest fire common core data was continued to be recorded in order to collect comparable information on forest fires at Community level.

Since 2000 the forest fire data provided each year by individual EU Member States and other countries in Europe, Middle East and North Africa are checked, stored and managed by JRC within EFFIS. In 2012 the 4 MENA countries submitted data for entry into the database, bringing the number of countries now contributing to 27 (Algeria, Bulgaria, Croatia, Cyprus, Czech, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Lebanon, Morocco, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Tunisia and Turkey). The database currently contains 2.83 million individual fire event records (2.09 million forest fires).

Access to the information

The individual records are not made available; however users can request custom annual or monthly summaries of burnt area or number of fires by country, NUTS2 or NUTS3 region from the point of contact.

More detailed information about the database can be found in the technical report "*The European Fire Database: Technical specifications and data submission*" EUR26546 EN [12], which can be downloaded from:

http://effis.jrc.ec.europa.eu/reports-and-publications/effis-related-publications/

Table 80. Information requested for each fire event.

ID	Unique Fire identifier	FIREID
TIME OF FIRE	Date of first alert [YYYYMMDD]	DATEAL
	Time of first alert [HHMM]	TIMEAL
	Date of first intervention [YYYYMMDD]	DATEIN
	Time of first intervention [HHMM]	TIMEIN
	Date of fire extinction [YYYYMMDD]	DATEEX
	Time of fire extinction [HHMM]	TIMEEX
LOCATION OF FIRE	Province Code (national nomenclature)	PROVCODE
	NUTS3 code	NUTS3
	Commune Code (national nomenclature)	CODECOM
	Commune Name (national nomenclature)	NAMECOM
	Latitude [decimal degrees]	NORTH
	Longitude [decimal degrees]	EAST
SIZE OF FIRE (Ha)	Burnt Area FOREST	BAFOR
	Burnt Area OTHER WOODED LAND	BAOW
	Burnt Area OTHER NON WOODED NATURAL LAND	BAONW
	Burnt Area AGRICULTURE AND OTHER ARTIFICIAL LAND	BAAGR
CAUSE OF FIRE	Certainty of knowledge of Presumed Cause (New EU code)	CAUSE_KNOWN
	Presumed Cause (New EU categories code)	CAUSE_EU
	Presumed Cause (Country detailed categories code)	CAUSE_CO

General notes on Table 81: 2017 data are still undergoing validation checks and are not presented.

The totals given in this table do not always match the published number of fires for a number of reasons:

1. Purely agricultural fires are stored in the database if submitted by the country, but are excluded from forest fire calculations;
2. Some countries do not report detailed records for the whole of their territory and the information is only available in summary form.

Table 81. Summary of data records stored in the Fire Database.

	BG	CH	CY	CZ	DE	EE	ES	FI	FR	GR	HR	HU	IT	LT	LV	NL	PL	PT	RO	SE	SI	SK	TR	DZ	LB	MA	TN
1980		87																2349									
1981		153																6730									
1982		86																3626									
1983		120								945								4542									
1984		183								1184								7356									
1985		114					12235		3732	1417			12931					8441									75
1986		87					7514		2657	1088			6115					5036									89
1987		121					8816		2116	1234			8506					7705									207
1988		79					9440		2240	1798			9785					6131									158
1989		189					20250		3321	1203			8328					21896									70
1990		257					12914		3297	1283			11560					10745									118
1991		152					13529		2372	1036			7580					14327									97
1992		86					15956		2708	2008			10044					14954									182
1993		83					14253		4766	2707			14317					16101									183
1994		86			706		19249		4728	1955			7153				24361	19983									131
1995		96			525		25557		6539	1494			5505				23816	34116			44						13
1996		130			822		16586		6401	1527	2363		6064				23582	28626		4854	47						13
1997		179			276		22320		8001	2271	2648		11608				25068	23497		7057	55						98
1998		121			592		22003		6289	605	4096		9565				21342	34676		2503	143						-
1999		50			794		17943		4881	513	2592		6956				32646	25477		4707	55						-
2000		70	285		930		23574		4343	1469	5477		8609				31809	34109		4708	100						-
2001		67	299		373		19099		4259	1313	2505		7227				24511	27982		4831	60						-
2002		117	243		278		19929		4097	572	3428	429	4607				38154	28738		6490	64						-
2003		304	427		1238		18616		7023	622	4904	373	9716				79013	26941		8282	227						-
2004		94	221	957	300		21396		3767	739	1704	104	6341	430	647		36315	26945	34	4955	50	153					-
2005	251	110	185	653	299	65	25492	2631	4698	718	2180	150	7918	267	365		46542	40965	64	4573	74	287	1530				-
2006	393	110	172	697	717	248	16334	6314	4608	764	2210	97	5651	1444	1929		35630	23647	105	4618	106	238	2227			347	216
2007	1479	120	111	809	435	64	10932	2813	3382	1226	3759	603	10736	245	426		31303	23956	478	3787	129	463	2706			304	292
2008	582	63	114	470	560	71	11656	3161	2781	1071	228	502	6648	272	716		35786	18619	91	5420	68	182	2135			267	259
2009	314	103	91	520	575	47	15642	2746	4808	354	181	608	5423	471	890		30912	29218	190	4180	122	347	-			487	199
2010	222	88	133	731	525	30	11722	3100	3828	540	131	109	4884	106	319		24443	25013	70	3120	33	123	1861			597	264
2011	635	114	85	1341	515	24	16417	2871	4283	953	279	2021	8181	137	373		39011	38118	340	3534	114	303	-			568	262
2012	876	75	78	1555	451	5	15978	1050	3713	-	570	2657	10345	81	162		53907	30740	911	2213	168	517	2449	5036	99	484	493
2013	408	58	135	671	355	15	10797	2864	2061	-	137	761	2077	119	420		25652	27372	118	4907	75	-	3755	-	-	411	-
2014	151	60	68	870	251	91	9806	3637	1729	-	43	1042	1821	155	695		38115	11387	83	4374	35	-	-	-	-	460	-
2015	439	166	87	1738	594	67	11810	1644	2891	-	176	1069	5424	247	704		60176	23175	250	2700	93	-	-	-	-	425	-
2016	584	82	119	899	407	84	-	2101	2761	-	176	452	-	98	641		25791	16104	174	5454	90	-	-	-	-	422	-
2017	513	110	-	988	176	61	-	2263	3201	-	328	1454	-	80	423	321	25193	21006	447	5276	108	-	-	-	-	423	-

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All reports from past years can be found in

http://effis.jrc.ec.europa.eu/reports-and-publications/annual-fire-reports/

Annex – Summary Tables of Fire Statistics

Statistics on burnt area divided into forest and non-forest area are supplied in the individual country reports, where available.

NOTE

Every effort is made to ensure that the published figures are correct. However, at the time of printing some data are provisional and may be changed in the future. Where there is a discrepancy between figures published in different reports, the later report should be taken as the definitive version.

Table 82. Number of forest fires in five Southern Member States (1980-2018)

Year	*PORTUGAL*	*SPAIN*	*FRANCE*	*ITALY*	*GREECE*	*TOTAL*
1980	2 349	7 190	5 040	11 963	1 207	27 749
1981	6 730	10 878	5 173	14 503	1 159	38 443
1982	3 626	6 545	5 308	9 557	1 045	26 081
1983	4 539	4 791	4 659	7 956	968	22 913
1984	7 356	7 203	5 672	8 482	1 284	29 997
1985	8 441	12 238	6 249	18 664	1 442	47 034
1986	5 036	7 570	4 353	9 398	1 082	27 439
1987	7 705	8 679	3 043	11 972	1 266	32 665
1988	6 131	9 247	2 837	13 588	1 898	33 701
1989	21 896	20 811	6 763	9 669	1 284	60 423
1990	10 745	12 913	5 881	14 477	1 322	45 338
1991	14 327	13 531	3 888	11 965	858	44 569
1992	14 954	15 955	4 002	14 641	2 582	52 134
1993	16 101	14 254	4 769	14 412	2 406	51 942
1994	19 983	19 263	4 618	11 588	1 763	57 215
1995	34 116	25 827	6 563	7 378	1 438	75 322
1996	28 626	16 771	6 401	9 093	1 508	62 399
1997	23 497	22 320	8 005	11 612	2 273	67 707
1998	34 676	22 446	6 289	9 540	1 842	74 793
1999	25 477	18 237	4 960	6 932	1 486	57 092
2000	34 109	24 118	4 603	8 595	2 581	74 006
2001	26 533	19 547	4 309	7 134	2 535	60 058
2002	26 488	19 929	4 097	4 601	1 141	56 256
2003	26 195	18 616	7 023	9 697	1 452	62 983
2004	21 870	21 396	3 775	6 428	1 748	55 217
2005	35 697	25 492	4 698	7 951	1 544	75 382
2006	19 929	16 354	4 608	5 634	1 417	47 942
2007	18 722	10 936	3 364	10 639	1 983	45 644
2008	13 832	11 655	2 781	6 486	1 481	36 235
2009	26 119	15 643	4 800	5 422	1 063	53 047
2010	22 026	11 721	3 900	4 884	1 052	43 583
2011	25 221	16 414	4 500	8 181	1 653	55 929
2012	21 176	17 503	4 105	8 252	1 559	52 595
2013	19 291	10 626	2 223	2 936	862	35 938
2014	7 067	9 771	2 778	3 257	552	23 425
2015	15 851	11 928	4 440	5 442	510	38 171
2016	13 261	8 817	4 285	5 818	777	31 933
2017	21 002	13 793	4 403	7 855*	1 083	48 136
2018	**12 273**	**7 143**	**3 005**	**3 220**	**793**	**26 434**
% of total in 2018	**46%**	**27%**	**11%**	**12%**	**3%**	**100%**
Average 1980-1989	7 381	9 515	4 910	11 575	1 264	34 645
Average 1990-1999	22 250	18 152	5 538	11 164	1 748	58 851
Average 2000-2009	24 949	18 369	4 418	7 259	1 695	56 690
Average 2010-2018	17 463	11 968	3 690	5 538	978	39 638
Average 1980-2018	18 025	14 566	4 663	8 970	1 432	47 656
TOTAL (1980-2018)	702 973	568 071	181 870	349 822	55 859	1 858 595

Table 83. Burnt area (hectares) in five Southern Member States (1980 – 2018)

Year	*PORTUGAL*	*SPAIN*	*FRANCE*	*ITALY*	*GREECE*	*TOTAL*
1980	44 251	263 017	22 176	143 919	32 965	506 328
1981	89 798	298 288	27 711	229 850	81 417	727 064
1982	39 556	152 903	55 145	130 456	27 372	405 432
1983	47 811	108 100	53 729	212 678	19 613	441 931
1984	52 710	165 119	27 202	75 272	33 655	353 958
1985	146 254	484 476	57 368	190 640	105 450	984 188
1986	89 522	264 887	51 860	86 420	24 514	517 203
1987	76 269	146 662	14 108	120 697	46 315	404 051
1988	22 434	137 734	6 701	186 405	110 501	463 775
1989	126 237	426 693	75 566	95 161	42 363	766 020
1990	137 252	203 032	72 625	195 319	38 594	646 822
1991	182 486	260 318	10 130	99 860	13 046	565 840
1992	57 011	105 277	16 593	105 692	71 410	355 983
1993	49 963	89 267	16 698	203 749	54 049	413 726
1994	77 323	437 635	24 995	136 334	57 908	734 195
1995	169 612	143 484	18 137	48 884	27 202	407 319
1996	88 867	59 814	11 400	57 988	25 310	243 379
1997	30 535	98 503	21 581	111 230	52 373	314 222
1998	158 369	133 643	19 282	155 553	92 901	559 748
1999	70 613	82 217	15 906	71 117	8 289	248 142
2000	159 605	188 586	24 078	114 648	145 033	631 950
2001	111 850	93 297	20 642	76 427	18 221	320 437
2002	124 411	107 464	30 160	40 791	6 013	308 839
2003	425 726	148 172	73 278	91 805	3 517	742 498
2004	129 539	134 193	13 711	60 176	10 267	347 886
2005	338 262	188 697	22 135	47 575	6 437	603 106
2006	75 510	155 345	7 844	39 946	12 661	291 306
2007	31 450	86 122	8 570	227 729	225 734	579 605
2008	17 244	50 322	6 001	66 329	29 152	169 048
2009	87 416	120 094	17 000	73 355	35 342	333 207
2010	133 090	54 770	10 300	46 537	8 967	253 664
2011	73 813	102 161	9 400	72 004	29 144	286 522
2012	110 231	226 125	8 600	130 814	59 924	535 694
2013	152 756	58 985	3 608	29 076	46 676	291 101
2014	19 929	46 721	7 493	36 125	25 846	136 114
2015	64 443	103 200	11 160	41 511	7 096	227 410
2016	161 522	65 817	16 093	47 926	26 540	317 898
2017	540 630	178 234	26 378	137 103*	13 393	895 738
2018	**44 578**	**25 162**	**5 124**	**19 481**	**15 464**	**109 808**
% of total in 2018	**41%**	**23%**	**5%**	**18%**	**14%**	**100%**
Average 1980-1989	73 484	244 788	39 157	147 150	52 417	556 995
Average 1990-1999	102 203	161 319	22 735	118 573	44 108	448 938
Average 2000-2009	150 101	127 229	22 362	83 878	49 238	432 809
Average 2010-2018	144 555	95 686	11 253	67 004	25 894	344 392
Average 1980-2018	116 894	158 834	24 200	105 104	43 351	448 383
TOTAL (1980-2018)	4 558 878	6 194 536	943 811	4 099 043	1 690 673	17 486 940

Table 84. Number of forest fires in other countries (1990-2018)

Country / Year	Algeria	Austria	Bulgaria	Croatia	Cyprus	Czech Rep.	Estonia	Finland	Germany	Hungary	Latvia	Lebanon	Lithuania	Morocco	Netherlands	North Macedonia	Norway	Poland	Romania	Russian Federation	Slovakia	Slovenia	Sweden	Switzerland	Turkey	Ukraine
1990	-	-	-	-	-	-	-	-	-	-	604	-	-	179		-	-	5756	131	-	-	-	-	257	1750	-
1991	-	-	73	-	-	-	-	-	1846	-	225	-	-	247		-	-	3528	42	-	-	-	-	152	1481	-
1992	-	-	602	325	-	-	-	-	3012	-	1510	-	1180	182		-	-	11858	187	-	-	-	-	86	2117	-
1993	-	113	1196	372	-	-	-	-	1694	-	965	-	634	187		-	-	8821	159	-	-	-	-	83	2545	-
1994	-	108	667	181	-	-	-	-	1696	-	763	-	715	417		-	-	10705	121	-	366	-	-	86	3239	-
1995	-	55	114	109	-	1331	-	-	1237	-	582	-	472	528		-	-	7678	62	-	254	-	-	96	1770	-
1996	-	24	246	305	-	1421	-	1475	1748	-	1095	-	894	220		-	-	7923	72	-	662	-	-	130	1645	-
1997	-	40	200	305	-	1398	-	1585	1467	-	768	-	565	391		-	-	6817	37	-	535	-	-	179	1339	-
1998	-	71	578	441	-	2563	-	370	1032	-	357	-	258	416		-	-	6165	59	-	1056	-	2503	121	1932	-
1999	-	16	320	223	-	1402	-	1528	1178	229	1196	-	1022	385		-	-	9820	138	-	426	-	4707	50	2075	-
2000	-	41	1710	706	285	1499	158	826	1210	811	915	-	654	321		-	-	12426	688	-	824	-	4708	70	2353	-
2001	-	58	825	299	299	483	91	822	587	419	272	-	287	327		-	117	4480	268	-	311	-	4831	67	2631	-
2002	-	108	402	176	243	604	356	2546	513	382	1720	-	1596	202		-	213	10101	516	-	570	60	6490	117	1471	-
2003	-	243	452	532	427	1754	111	1734	2524	375	900	-	885	392		-	198	17087	203	-	872	224	8282	304	2177	-
2004	-	71	294	204	221	873	89	816	626	104	647	-	468	714		-	119	7006	34	-	153	51	4955	94	1762	-
2005	-	86	241	147	185	619	65	1069	496	150	365	-	301	662		-	122	12049	64	-	287	73	4573	110	1530	-
2006	-	133	393	181	172	697	250	3046	930	97	1929	-	1545	381		-	205	11541	105	-	237	112	4618	110	2227	-
2007	-	256	1479	345	111	805	64	1204	779	603	425	-	251	340		652	65	8302	478	-	463	140	3737	120	2829	5024
2008	-	186	582	275	114	470	71	1456	818	502	700	-	301	273		573	171	9090	91	-	182	74	5420	63	2135	3231
2009	-	139	314	181	91	514	47	1242	763	608	823	-	471	501		80	109	9162	190	-	347	120	4180	104	1793	4922
2010	-	146	222	131	133	732	30	1412	780	109	316	-	104	629		99	62	4680	70	32300	127	32	3120	88	1861	2368
2011	2487	274	635	280	85	1337	24	1215	888	2021	360	-	142	606		523	49	8172	340	20851	303	114	3534	114	1954	1761
2012	5110	264	876	569	78	1549	5	417	701	2657	162	-	81	484		483	24	9265	911	19535	517	168	2213	75	2450	1743
2013	2443	202	408	137	135	666	15	1452	515	761	422	-	123	411		186	42	4883	116	9754	233	75	4878	58	3755	806
2014	4629	147	151	43	68	865	91	1660	429	1042	698	-	155	460		62	133	5245	83	17058	153	35	4374	60	2149	1486
2015	2383	293	429	177	87	1748	67	745	1071	1069	704	107	247	425		106	29	12257	250	12238	242	93	2700	166	2150	2225
2016	3150	148	584	151	119	892	84	933	608	452	641	260	98	422		60	345	5286	174	10089	136	90	5454	81	3188	945
2017	2992	271	513	329	92	966	61	881	424	1454	423	92	80	433	321	301	264	3592	447	10051	162	108	5276	110	2411	2371
2018	797	159	222	54	131	2033	-	2427	1708	530	972	41	211	343	949	19	887	8867	158	-	262	32	8181	153	2167	1297

Table 85. Burnt area (hectares) in other countries (1990 – 2018)

Country / Year	Algeria	Austria	Bulgaria	Croatia	Cyprus	Czech Rep.	Estonia	Finland	Germany	Hungary	Latvia	Lebanon	Lithuania	Morocco	Netherlands	North Macedonia	Norway	Poland	Romania	Russian Federation	Slovakia	Slovenia	Sweden	Switzerland	Turkey	Ukraine
1990	-	-	-	-	-	-	-	-	-	-	258	-	-	2188		-	-	7341	444	-	-	-	-	1723	13742	-
1991	-	-	511	-	-	-	-	-	920	-	69	-	-	3965		-	-	2567	277	-	-	-	-	96	8081	-
1992	-	-	5243	11131	-	-	-	-	4908	-	8412	-	769	2579		-	-	43755	729	-	-	-	-	65	12232	-
1993	-	88	18164	20157	-	-	-	-	1493	-	570	-	274	3078		-	-	8290	518	-	-	-	-	37	15393	-
1994	-	129	18100	7936	-	-	-	-	1114	-	326	-	279	6072		-	-	9325	312	-	-	-	-	408	38128	-
1995	-	92	550	4651	-	403	-	-	592	-	535	-	321	7018		-	-	5403	208	-	-	-	-	446	7676	-
1996	-	7	906	11214	-	2043	-	433	1381	-	927	-	478	1185		-	-	14537	227	-	-	-	-	293	14922	-
1997	-	28	595	11122	-	359	-	1146	599	-	448	-	226	3845		-	-	6766	68	-	-	-	-	1785	6316	-
1998	-	110	6967	32056	-	1132	-	131	397	-	211	-	93	1855		-	-	4222	137	-	-	-	422	274	6764	-
1999	-	6	8291	6053	-	336	-	609	415	756	1544	-	494	1688		-	-	8629	379	-	557	-	1771	30	5804	-
2000	-	42	57406	68171	8034	375	684	266	581	1595	1341	-	352	4064		-	-	7089	3607	-	904	-	1552	70	26353	-
2001	-	25	20152	16169	4830	87	62	187	122	-	311	-	113	1806		-	895	3466	1001	-	305	-	1254	21	7394	-
2002	-	162	6513	4853	2196	178	2082	590	122	1227	2222	-	746	593		-	221	5210	3536	-	595	161	2626	681	8514	-
2003	-	189	5000	27091	2349	1236	207	666	1315	845	559	-	436	2858		-	942	21551	762	-	1567	2100	4002	673	6644	-
2004	-	20	1137	3378	1218	335	379	358	274	247	486	-	253	8660		-	117	3782	123.7	-	157	138	1883	31	4876	-
2005	-	14	1456	3135	1838	227	87	495	183	3531	120	-	51	6198		-	346	5713	162	-	524	280	1562	67	2821	-
2006	-	86	3540	4575	1160	53	3096	1617	482	625	3387	-	1199	5360		-	3829	5657	946	-	280	1420	5710	127	7762	-
2007	-	61	42999	20209	4483	316	292	576	256	4636	272	-	38	1367		32665	128	2841	2529	-	679	128	1090	337	11664	12731
2008	-	27	5289	7343	2392	86	1280	830	538	2404	364	-	112	1127		5915	3174	3027	373	-	118	75	6113	68	29749	4521
2009	-	72	2271	2900	885	178	59	576	262	6463	646	-	287	3108		1307	1329	4400	974	-	510	177	1537	60	4679	4575
2010	-	50	6526	1121	2000	205	25	520	522	878	92	-	21.5	5511		737	769	2126	206	2300000	192	121	540	27	3317	1239
2011	13593	89	6883	15555	1599	337	19	580	214	8055	115	-	293	3460		17308	121	2678	2195	1636232	403	288	945	225	3612	612
2012	99061	60	12730	24804	2531	634	3	86	269	13978	90	-	20	6695		10021	60	7235	6624	1900000	1683	1006	483	30	10455	3311
2013	13396	110	3314	1999	2835	92	79	461	199	1955	217	-	25	2207		3027	47	1289	421	1416659	270	66	1508	29	11456	220
2014	43125	108	916	188	669	536	78	881	120	4454	591	-	162	1540		846	770	2690	217	3738207	192	18	14666	46	3117	16677
2015	13010	154	4313	9416	652	344	83	143	526	4730	615	753	71	992		1798	143	5510	1671	2875350	353	65	594	47	3219	2625
2016	18370	24	6340	7100	3205	141	123	310	283	974	467	1871	26	2585		450	1884	1451	675	2419254	175	526	1288	454	9156	1101
2017	53975	31	4569	48543	428	170	33	460	395	4933	265	264	53	2414	232	5619	525	1023	2459	1459099	295	441	1433	118	11993	5474
2018	2312	19	1453	1506	1136	492	-	1228	2349	906	2864	643	110	841	572	95	3279	2696	1341	-	248	20	24310	69	5644	1367

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