



J R C T E C H N I C A L R E P O R T S

# Forest Fires in Europe, Middle East and North Africa 2011

**Joint report of JRC and  
Directorate-General  
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*Joint  
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Centre*



# Forest Fires in Europe, Middle East and North Africa 2011

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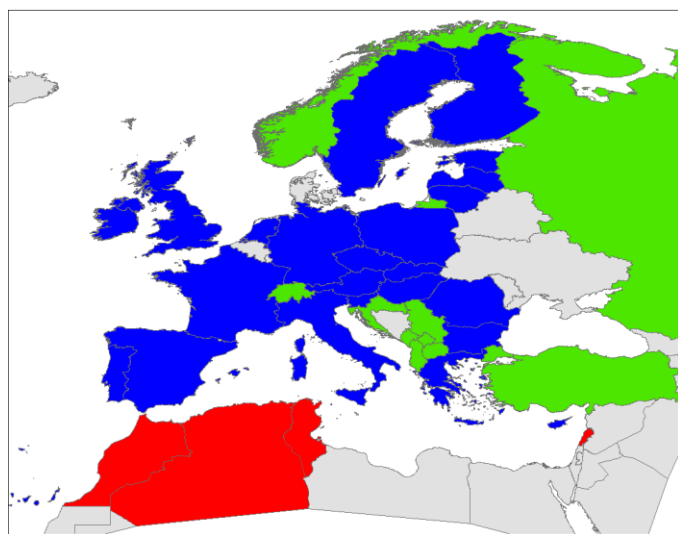
# 1 PREFACE

The European Forest Fire Information System (EFFIS) was established with the aim of providing harmonised information on forest fires at the European level. For this purpose collaboration with EU Member States and neighbouring countries has been ongoing since 1998. Since then, EFFIS has provided an ideal platform for countries to exchange good practices on fire prevention, fire fighting, restoration practices and other activities related to fire management.

Currently, EFFIS is further expanding to other countries with high or increasing fire risk. In 2011, with the support of Silva Mediterranea (FAO) and GIZ\*, the European Commission prepared the ground for involving Middle East and North African (MENA) countries in EFFIS activities and including them as members of its Expert Group on Forest Fires (EGFF). We have recently welcomed Morocco, Algeria, Tunisia and Lebanon as the southernmost newcomers to EFFIS.

As regards the Northern European countries, a particular interest has been shown in EFFIS activities to date. In 2012 Ireland, the Netherlands and Norway have designated national experts to become members of the EGFF.

To a certain degree, the new memberships may be regarded as an indicator of increasing fire danger in the respective countries, a greater awareness on the damages caused by forest fires and a need to increase preparedness with regard to the potential damage these may cause under various climate change scenarios.



Currently, 37 countries are signed up members of the EGFF, including 23 EU Member States (Austria, Bulgaria, 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), 10 European non-EU countries (Albania, Croatia, FYROM, Kosovo, Montenegro, Norway, Russia, Serbia, Switzerland and Turkey), and four MENA countries (Algeria, Lebanon, Morocco and Tunisia).

The EFFIS annual report on forest fires has become a highly appreciated documentation of the previous year's forest fires, the fire risk evolution, the fire danger forecast and damage assessments, and fire statistics based on data provided by the national experts. 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.

We are confident that we will further improve cooperation with the members of the EGFF especially with regard to fire prevention actions. 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.

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\* Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH



## 2 FOREST FIRES 2011 IN THE EUROPEAN COUNTRIES

### 2.1 SOUTHERN MOST AFFECTED COUNTRIES (1980 – 2011)



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

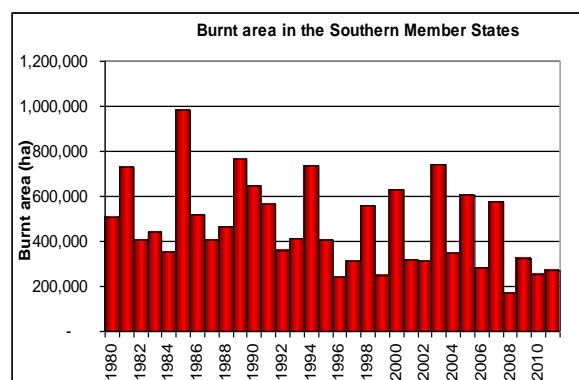
During 2011 fires in these 5 countries burned a total area of 269 081 ha. This is slightly higher than the area burnt in 2010, but among the lowest values since 1980 (only 1996, 1999, 2008 and 2010 were lower). The number of fires that occurred (55 543) is also higher than was registered in 2010, but slightly below the average of the last 2 decades (see Table 1 for details)

Figure 1a shows the total burnt area per year in the five 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. Overall, the total burnt area for all 5 countries in 2011 is around 62% of the average for the last decade and 58% of the long term average (32 years; Table 1)

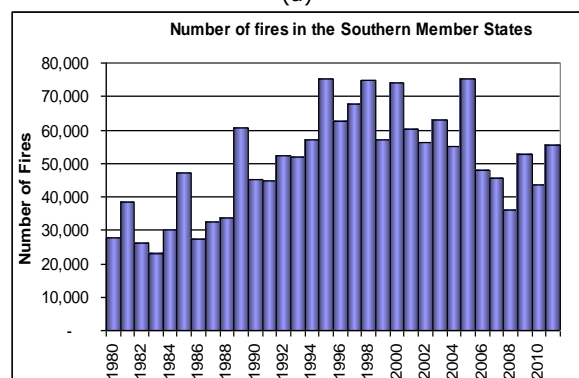
Figure 1b shows the yearly number of fires in the five southern Member States since 1980. After the increasing trend during the 1990s, which was also partly due to the improvement in recording procedures, the number of fires was stable for around one decade, and in the last decade a decrease was observed. However, in the last 5 years the trend has been slightly upward. Overall, 2011 was an average year in terms of number of fires.

Figure 1c shows the yearly average fire size in the 5 countries since 1980. There is a clear difference in average fire size before

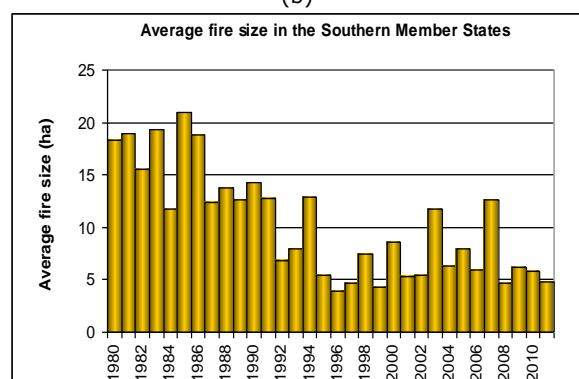
and after 1990. This is a similar trend to that observed in the number of fires and is also partly due to the same reasons (the additional fires that are recorded thanks to the improvements in the statistical systems are the smallest ones). But it is also largely due to the improvements of the fire protection services of the countries. Figure 1a and Figure 1b). In 2011 the number of fires was 27% more than that recorded in 2010, but the total burnt area increased by only 6%.



(a)



(b)



(c)

Figure 1. Burnt area (a) number of fires (b) and average fire size (c) in the five Southern Member States for the last 32 years.

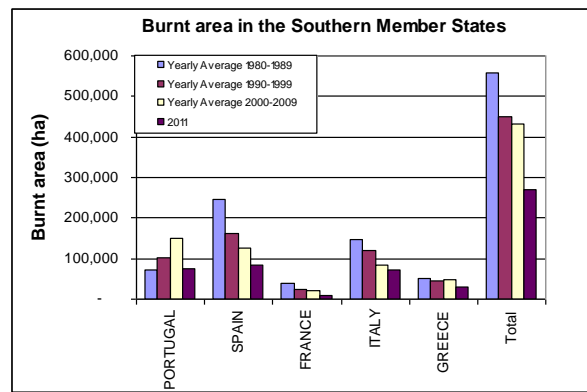
Figure 2 compares the yearly averages for burnt areas, number of fires and average fire size for the periods 1980-89; 1990-1999 and 2000-9 with the figures for 2011. It shows each of the 5 countries separately and also their total. It shows that 2011 was a reasonable year for southern Europe as a whole. The overall figure for the five southern Member States is below the averages of previous periods for burnt area and close to the average of the last decade for the number of fires and average fire size.

Figure 3 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 2011.

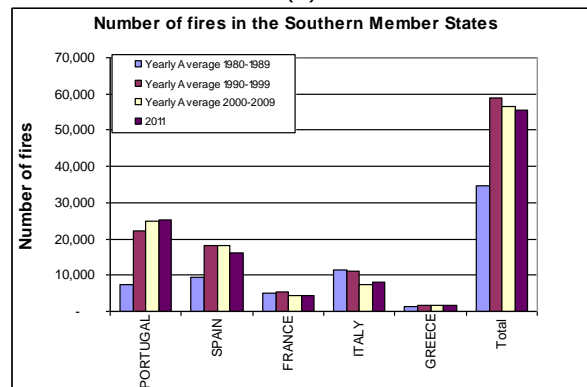
Table 1 gives a summary of the burnt areas and number of fires for the last 32 years, the average for the 1980s, the 1990s and the 2000s, and the average for the last 2 years, together with the figures for 2011 alone.

As previously mentioned, 269 081 ha were burnt in the five southern Member States in 2011, which is well below the average of the last 32 years. The number of fires in 2011 was 55 543, which is very close to the average of the last 10 years, although an increase on the last 2 years.

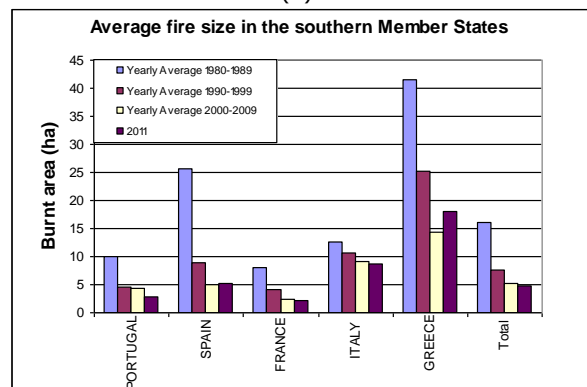
Since the area of each country is different, and the area at risk within each country is also different, the comparisons among countries cannot be absolute. It should also be borne in mind that since 2009 the figures for numbers of fires in Greece are incomplete and are therefore an under-representation of the true figure. During 2011 Portugal was the worst affected country in terms of burnt area, recording 45% of the burnt area for the whole of the five southern Member States. However, this was significantly below the burnt area recorded in 2010, and in 2011 Spain recorded the greatest number of fires (31%).



(a)



(b)



(c)

Figure 2. Burnt areas (a), number of fires (b) and average fire size (c) in the five Southern Member States in the year 2011 as compared with average values for previous decades.

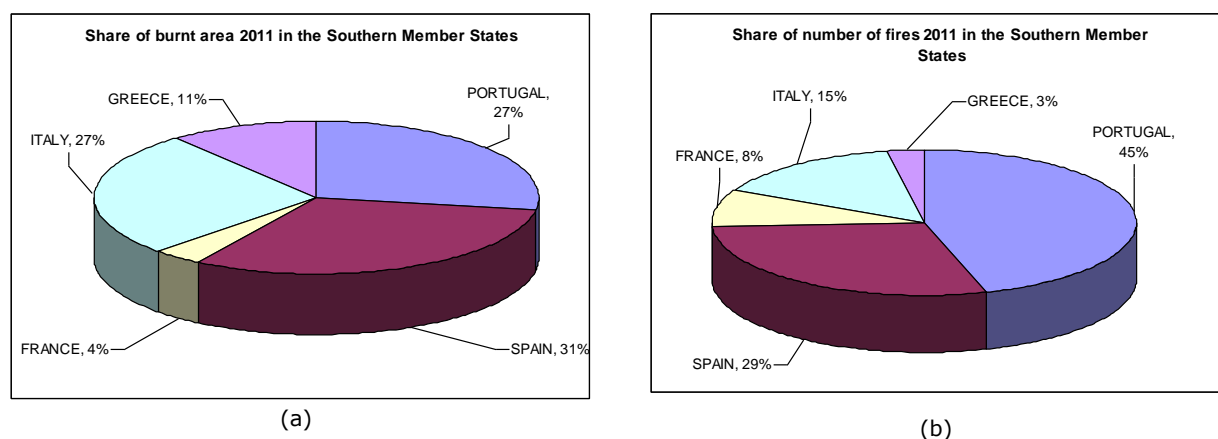


Figure 3. Share of the total burnt area (a) and the total number of fires (b) in each of the Southern Member State for 2011

Table 1. Number of fires and burnt area in the five Southern Member States in the last 32 years.

<i>Number of fires</i>	PORTUGAL	SPAIN	FRANCE	ITALY	GREECE(*)	TOTAL
2011	25 221	16 028	4 500	8 181	1 613	55 543
% of total in 2011	45%	29%	8%	15%	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	18 337	4 406	7 259	1 695	56 645
Average 2010-2011	23 624	13 875	4 200	6 533	1 333	49 564
Average 1980-2011	18 533	15 243	4 904	9 783	1 554	50 017
TOTAL (1980-2011)	593 052	487 788	156 931	313 042	49 723	1 600 536

<i>Burnt areas (ha)</i>	PORTUGAL	SPAIN	FRANCE	ITALY	GREECE	TOTAL
2011	73 813	84 490	9 630	72 004	29 144	269 081
% of total in 2011	27%	31%	4%	27%	11%	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	125 239	22 342	83 878	49 238	430 798
Average 2010-2011	103 452	69 630	9 965	59 271	19 056	261 373
Average 1980-2011	108 275	170 397	26 946	112 955	46 742	465 314
TOTAL (1980-2011)	3 464 789	5 452 717	862 262	3 614 546	1 495 735	14 890 049

(\*) Numbers of fires are incomplete since 2009

### 2.1.1 Portugal

#### *Fire danger in the 2011 fire season*

In 2011 the burnt area has decreased to 73 813 ha which represents 50% of the average of the previous decennium, which was 147 869 ha. However regarding forest fire numbers, there was an increase in 2011 to a total of 25 221 fires, representing an increase of 4.4% when compared to the average of fire numbers of the last decennium and an increase of 14.5% relating to 2010. These outcomes had high impact mostly on shrubland (73%), rather than woodland (27%).

Portugal was able to meet the targets set on the National Fire Plan<sup>2</sup>, in regards to the total burnt area per year (100 000 ha annual burned area).

According to the information provided by the National Meteorological Institute, 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 2011 (Figure 4).

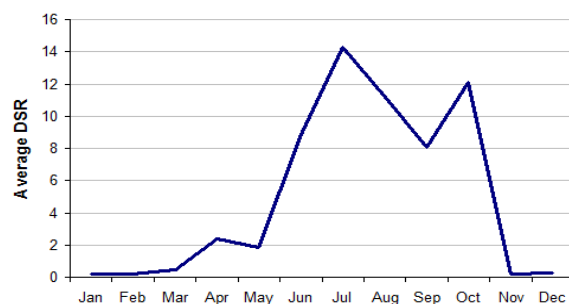


Figure 4. DSR variation in 2011

#### *Fire occurrence and affected surfaces*

In 2011 Portugal registered a total of 25 221 forest fires (80% <1ha), responsible for the burning of 73 813 ha (Figure 5). Forest fires affected mainly shrubland (73%). *Pinus pinaster*, *Eucalyptus globulus* plantations and *Quercus* sp. stands were the forest cover most affected by fires.

26.4% of the occurrences (6 652) were reported January-June; they burned about 10 084 ha (13.7% of the total burned area); Table 2.

In the summer period (July-September) there were 10 854 forest fires (43% total forest fires), which consumed approximately 36 022 ha (48.8% total burned area).

In 2011 the most critical month for forest fires was October with 7 455 forest fires (29.6% total forest fires) burning 27 606 ha (37.4% total burned area).

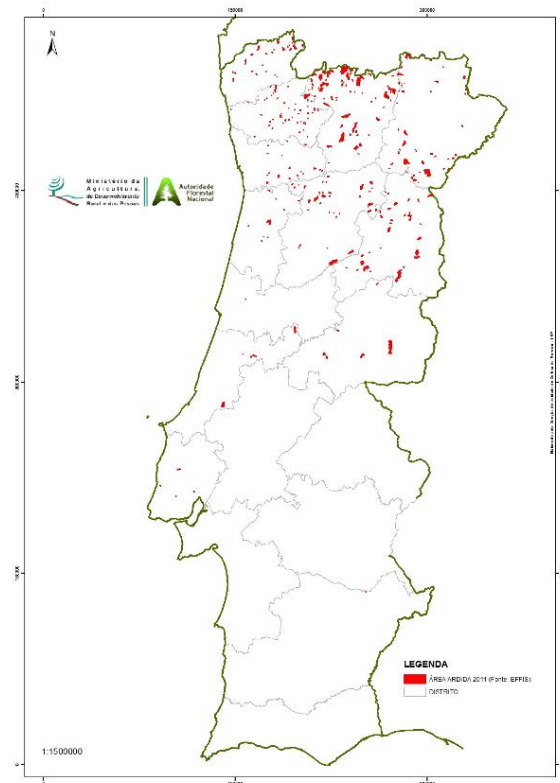


Figure 5. Burned areas in 2011, provisory data (Portugal). Source: EFFIS (2012)

Table 2. Forest fires in Portugal (monthly distribution)

Month	Number of Fires	Burnt Area (ha)		
		Wooded land	Shrub land	Total
Jan	213	82	681	763
Feb	380	147	853	1 000
Mar	1 057	493	1 644	2 137
Apr	1 180	745	1 761	2 506
May	766	285	350	635
Jun	3 056	1 577	1 466	3 043
Jul	4 335	4 164	7 268	11 432
Aug	3 963	4 205	14 423	18 628
Sep	2 556	1 143	4 819	5 962
Oct	7 455	7 185	20 421	27 606
Nov	90	10	51	61
Dec	170	7	33	40
<b>TOTAL</b>	<b>25 221</b>	<b>20 043</b>	<b>53 770</b>	<b>73 813</b>

Fire occurrence prevailed mostly in the urban districts, such as Porto, Braga, Viana do Castelo, Vila Real, Viseu (Northern region) and Aveiro, (Center Region), which registered 74% of the total number of fires (mainly very small fires). The Northern and Central regions of Portugal were the most

<sup>2</sup> In 2005 the Government, after the fire season, settled a reform on the national system for forest fire prevention and suppression, including the adoption of the National Fire Plan in May 2006, with the goal of 100 000ha burnt/annually by 2012.

affected by forest fires (70 439 ha – 95.4% total); Table 3.

In these regions are concentrated the main area of Eucalyptus and Pine stands and mountainous areas, where the usage of fire for pasture renewal of shrub pastures still has a strong prevalence.

Table 3. Number of fires and burned area in Portugal (NUTS2 – 2011).

NUTS2 Region	Number of fires			Burned Area (ha)		
	≥ 1ha	< 1ha	Total	Shrub land	Wooded land	Total
Norte	3 731	13 795	17 526	36 172	13 155	49 327
Centro	785	3 536	4 321	15 634	5 478	21 112
Lisboa	411	2 366	2 777	1 719	629	2 348
Alentejo	64	139	203	145	762	907
Algarve	51	343	394	100	19	119
<b>TOTAL</b>	<b>5 042</b>	<b>20 179</b>	<b>25 221</b>	<b>53 770</b>	<b>20 043</b>	<b>73 813</b>

The analysis of the yearly trends in the number of fires and burned areas in Portugal shows an increase in the total number of fires but a decrease of the burnt areas (Figure 7). Portugal registered 122 large fires ( $\geq 100$ ha), which corresponded to 52.7% of the total burnt area. There were registered 19 fires larger than 500 ha, which burned 17 392 ha. The largest fire of 2011 occurred in Guarda district, with 1 720 ha, on 17<sup>th</sup> August, and which lasted for 3 days.

#### Fire causes

In 2011 the National Guard proceeded with the criminal investigation of 16 232 forest fires (64.4% of the total registered in 2011). Intentional fires corresponded to 43% of the determined causes and Accidents or negligence were present in the ignition of 56% (Figure 6). Pasture renewal and agricultural burnings represented 71% of the accidents or negligence fires.

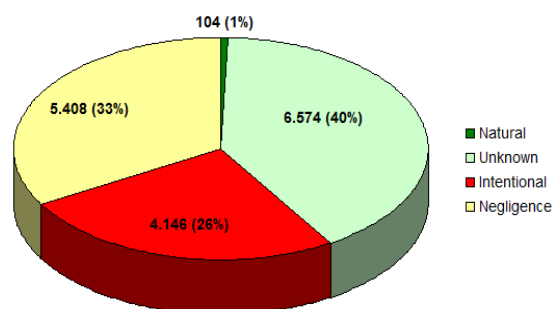
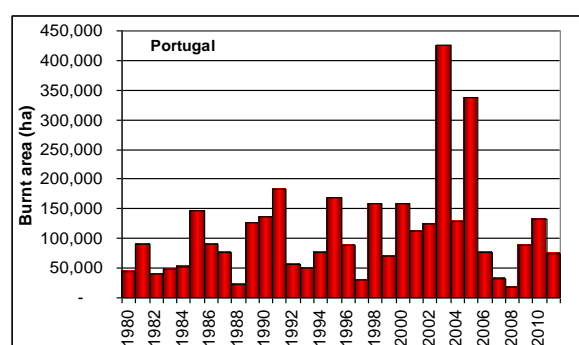
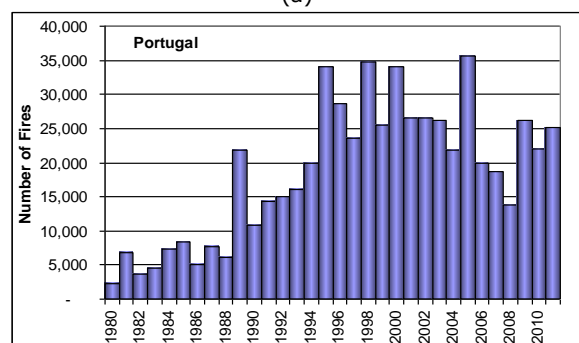


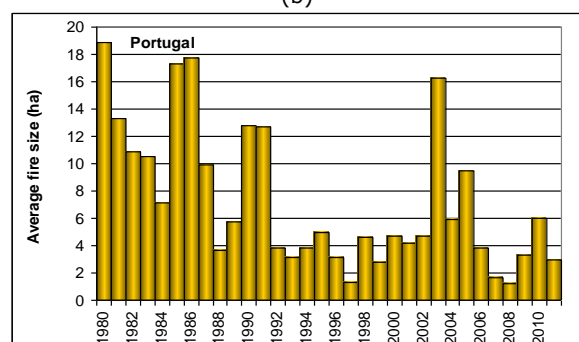
Figure 6. Main causes of forest fires in 2011



(a)



(b)



(c)

Figure 7. Burnt areas (a), number of fires (b) and average fire size (c) in Portugal for the last 32 years.

#### Fire fighting means

In order to cope with forest fires and to define an integrated fire-fighting strategy, the Portuguese National Authority for Civil Protection (ANPC), as is customary, established an Operational Directive for the forest fire season of 2011, with the following main purposes:

Define a unique structure for Direction, Command and Control, and a Special Structure to Fight Forest Fires (DECIF);

Regulate institutional coordination and the cooperation and involvement of the organizations belonging to the Portuguese Integrated System for Relief Operations (SIOPS).

The Operational Directive applies to all organizations and institutions which play a role in this field and is used as a base to elaborate both district and municipal

emergency plans. It is also used as a reference to elaborate all directives, plans and orders that are applied to organizations involved in the Special Structure to Fight Forest Fires (DECIF).

The Directive defines an operational concept based on the following principles:

- Unique command structure;
- Anticipation ability;
- Integrated response;
- Permanent safety;
- Dissuasive surveillance;
- Well-timed detection;
- Immediate dispatch;
- Strong initial attack;
- Unity of command;
- Operation maintenance;
- Unified public information management.

Under the scope of the Operational Directive, the distribution of the available means for surveillance, detection and fire-fighting operations, in 2011, was made into engagement phases. The number of means applied in each phase depended, amongst other factors, on the forest fire hazard and territory vulnerability expected for a given period. For example, during the most critical period, Charlie Phase (1JUL-30SEP), there were around 9 210 human resources, 2 022 vehicles and 41 aerial means available.

In order to improve and assure the fire fighting operations outside the critical period, terrestrial and aerial means were made permanently available during the Alfa and Echo phases.

In Table 4, there is a summary of all the fire-fighting means distributed by phases:

Table 4. . Fire-fighting means available per phase

<i>Phases</i>	<i>Elements</i>	<i>Vehicles</i>	<i>Aerial Means</i>
<i>Alfa (&lt; 15MAY)</i>	Means available on demand		2 - 7
<i>Bravo (15MAY-30JUN)</i>	6 438	1 476	24
<i>Charlie (1JUL-30SEP)</i>	9 210	2 022	41
<i>Delta (1OCT-15OCT)</i>	5 435	1 225	17
<i>Echo (&gt; 15OCT)</i>	Means available on demand		2 - 7

With respect to aerial means, they were of the following types:

- 34 Helis for initial attack;
- 5 Heavy Helibombers for enlarged attack;
- 20 Amphibious aircrafts for enlarged attack.

All means were guaranteed by different public and private entities/organizations (around 11) such as the National Authority for Civil Protection (ANPC), Fire Fighter Corps, National Guard (GNR), National Forest

Authority (AFN), Biodiversity and Environmental Conservation Institute (ICNB), Police (PSP), Army and Forest Producers Associations (AFOCELCA).

During 2011, in the case of Fire Fighter Corps they were responsible for the development of fire fighting operations covering all the Portugal districts (18), with a force of around 4 354 fire fighters and 1 011 vehicles, and they developed 32 087 forest fire fighting missions.

There were also a group of special teams that were involved in missions related mainly to surveillance, detection and initial attack actions. Their actions allowed the surveillance of suspicious and negligent activities, the early detection of forest fires and the timely development of initial attack actions. They were the Relief, Protection and Intervention Group (GIPS) and the Special Fire Brigade Force (FEB).

In the case of the GIPS, dependent on the National Guard, this force had around 654 elements and 81 vehicles, distributed among 11 districts. During 2011 they performed 4 703 initial attack heliborne missions, as well as around 1 105 fire fighting terrestrial operations.

With respect to the FEB, dependent on ANPC, it had 259 elements and 53 vehicles, distributed among 7 districts, and during 2011 they were involved in 1 386 initial attack heliborne missions, as well as 1 177 fire fighting terrestrial operations.

Apart from the data presented above, some of the main operational and logistic innovations associated with the implementation of the Operational Directive 2011 were:

- Increase of reinforcement capacity in terms of combat means, making available and ready to act: 1 forest fire combat group (GCIF) by district, each one including 26 fire fighters and their vehicles; 3 companies for reinforcement of forest fire combat (CRIF), each one including 96 fire fighters and their vehicles; at national level, 1 company for reinforcement of forest fire combat (CRIF), including 96 fire fighters and their vehicles; 2 groups for reinforcement of intervention on urban-forest interface, based on professional fire fighters.
- Increase of reinforcement capacity in terms of command and control, making available and ready to act: 1 operational command post team (EPCO) by district, with capacity to provide all the levels of

the operation management system; 6 operational command post teams (EPCO) pre-allocated; at national level, 2 operational command post teams (EPCO) and 2 reconnaissance and assessment situation teams (ERAS), pre-allocated depend on risk assessment.

- Increase of reinforcement capacity in terms of fire behaviour analysis, making available and ready to act: at national level 6 fire analysis and utilization teams (GAUF teams).
- During the most critical engagement phase (Charlie phase), the permanent availability of 12 bulldozers.
- Tactical concept change for the intervention of aerial means in initial and enlarged attack: initial attack scope of around 40 km for light helibombers; enlarged attack scope of around 70 km for heavy helibombers; enlarged attack scope of around 120 km for amphibious planes.

Under the scope of the same Operational Directive, during 2011 the Portuguese National Authority for Civil Protection also established an operational order (NOP 2203/2011) aiming at improvement of the Special Structure to Fight Forest Fires (DECIF) organization and readiness. Briefly the main purpose of this operational order was the reorganization of the structure to fight forest fires, grouping it in three main regions, in order to achieve a better management of the available resources to cope with forest fires over passing the possible constraints resulting from the territory administrative division. Each one of these operational regions (AGRUF), covering several and different districts, became responsible for managing all forest fire fighting operations happening in their respective region.

In addition, under the scope of the same Operational Directive, and taking into account what the Portuguese Authorities experienced during 2010 at Peneda-Gerês National Park, when natural and ecologically valuable areas burned more than was expected, the Portuguese National Authority for Civil Protection also established an operational national plan (PONGA) for this important national park. Its main purpose was to assure the permanent availability of human and technical resources in order to support all the surveillance, first intervention and initial attack operations immediately after the detection of a forest fire at Peneda-Gerês National Park. The main outcome from this operational plan implementation, comparing 2010 to 2011, was the reduction

from 3 900 to 0.5ha of burnt area, as well as in the number of ignitions from 27 to 4.

Besides the measures already described, due to the meteorological severity experienced during the month of October 2011, it became necessary to deploy and/or to engage additional national resources in order to reinforce the fire fighting means which were already developing fire fighting actions in order to cope with several out of season complex forest fires.

In order to face this situation, the Portuguese Authorities decided to extend the forest fire critical period beyond the 30<sup>th</sup> of September until the end of October, and authorized the reinforcement of available means for this same period.

In this context, the Portuguese Authorities decided to deploy in different situations, the following kind of means:

- 1 additional forest fire combat group (1GCIF) at the most vulnerable districts, at a total of 14;
- Maintain the availability and readiness of aerial means during all of October

#### *Policy measures*

Legislation "Decreto-Lei" no. 124/2006 from 28<sup>th</sup> June, with the changes introduced by the "Decreto-Lei" 17/2009 from 14<sup>th</sup> January.

In 2011 the publishing of Regulation no. 165/2011, established the period between 1<sup>st</sup> July and 30<sup>th</sup> September, as the critical period where special preventive measures prevailed.

Bilateral Commission on Forest Fires Prevention and Suppression (Portugal/Spain): there were no follow-up progresses in the Commission works.

#### *Forest fire prevention and information campaigns*

##### Information and Public awareness campaigns

Portugal developed a public awareness campaign for forest fires prevention under the slogan "All against fires/forest for all". Under funding by the National Forest Fund, several actions were taken:

1. National and regional awareness campaign in the media, warning for hazardous behaviours, promoted by the National Authority for Civil Protection (ANPC), National Forest Authority (AFN) and municipalities;
2. Awareness-raising actions in the direct interaction with schools, within the school

environment;

### 3. Production and distribution of flyers.

In the public information domain, the ANPC and the AFN made significant efforts on the availability of online information. To reach that goal, AFN published ten reports, between June 1<sup>st</sup> and October 31<sup>st</sup> and the Civil Protection services displayed on-line information of the most relevant forest fire incidents.

The Meteorological Institute also provided online information concerning the Fire Weather Index (FWI) and its forecast. AFN also provided the partners with an online service for FWI mapping.

#### Forest fires planning

The National Forest Authority kept its efforts in the forest fire planning at the local, municipal and regional (district) levels. The municipal planning objective is pursued by the technical support to the municipalities forest offices, based in the Municipal Plans for Forest Fire Prevention (5 years planning) and the Municipal Operational Plans, which are part of the previous plans and are updated on a yearly basis.

The municipalities' forest offices provide technical support to the Municipal Commission for forest defence. By the end of 2011 there were 257 municipal forest offices established and 271 Municipal Plans for Forest Fire Prevention and 251 Municipal Operational Plans approved. 97% of the municipalities are covered by Forest Fire Prevention Municipal Plans.

The regional level planning is assured by 16 Regional Forest Plans (for the entire continental land) and by regional maps of fire pre-suppression, updated each summer in cooperation with municipalities and District Commands for Relief Operations, at the district level.

#### Forest fuels management

Forest fuels management are one of the key-actions in the forest fire prevention domain. A total area of 19 856 ha were managed of which 1 147 ha with prescribed burning.

#### Protocol for unemployed people to work in forest defence

Under the 2010 Protocol established between the Ministério da Administração Interna (MAI), the Ministério da Agricultura, do Mar, do Ambiente e do Ordenamento do Território (MAMAOT) and the Ministério da Economia e do Emprego (MEE), a set of activities are developed with the goals:

the valorisation and protection of forests, reducing risks, effects and extent of forest

fires, promoting their afforestation and reforestation;

to contribute to the improvement of employability of unemployed persons registered at the Employment Centres, recipients of unemployment benefit or social unemployment and beneficiaries of social insertion income, through their inclusion in socially useful activities.

The activities to be undertaken under the Protocol MAI/MAMAOT/MEE, and in measures Contrato Emprego-Inserção (CEI) and Contrato Emprego-Inserção+ (CEI+), are mainly in projects targeted for forest fire prevention (protection against fire and civil protection).

#### Physical Implementation - Approvals:

Since the implementation of the Protocol, 272 projects involving 888 unemployed were approved, as shown in Table 5 (Projects covered by Entity Type)

Table 5. Protocol implementation figures

<i>Entity Type</i>	<i>Nº Projects Approved</i>	<i>Nº Unemployed</i>
Associations	52	108
Local governments	133	599
Fire departments	60	104
Cooperatives	2	7
Foundations	2	4
Public Entities	17	53
Other Private Entities	6	13
Total	272	888

#### *Loss of human lives in the 2011 fire campaign*

During 2011, forest fires in Portugal caused the death of 2 fire fighters, 1 of them due to a car accident and the other one due to health problems. One civilian died during forest fires. Some fire fighting vehicles were also destroyed after being caught by forest fires.

#### *Operations of mutual assistance*

During 2011, Portugal did not request assistance through the EU-Mechanism for Civil Protection. However, the bilateral agreement with Spain was activated, several times, for reinforcement of aerial means and ground fire-fighting forces in and outside the border area (15 km to each side of the border).

(Sources: Ministry of Agriculture, Rural Development and Fisheries - National Forest Authority and National Authority for Civil Protection, Portugal)



## 2.1.2 Spain

### *Fire danger in the 2011 fire season*

January started warmer than normal (temperatures around 2-3°C above the average) but it became very cold at the end of the month. Rainfall was below average all month. In February it was warmer than normal, but the fire risk remained low. March was a wet month and the number of fires and burnt area were significantly below the 10-year average (57% and 66% respectively).

April was unusually warm in practically the whole country with temperatures nearly 4°C above the average for the month, making it the hottest April since 1950. The highest temperatures were in the first part of the month, with values above 35°C in Murcia. Precipitation was normal considering the country as a whole, but drier than average in the northern third of the peninsular. Burnt area was 188% higher than normal.

In May temperatures remained higher than normal, particularly towards the end of the month when a large fire occurred in Ibiza (Table 7). Overall, however, the fire risk remained at a low level over most of the country and numbers of fires were around the average for the time of year.

The month of June was very warm, with an average monthly temperature of 21.5°C (1.5°C above normal). Rainfall was below average in general, but relatively wet in La Rioja, Navarra, the Balearic Islands and parts of Catalonia, Valencia, Aragon, Madrid and Andalusia. Fire risk remained low in the first part of the month, increasing later on, mainly due to the substantial increase in temperatures and low rainfall. Of note is the significant increase in risk in the Peninsula and the Balearic Islands at the end of the month due to a very warm air mass. Fire numbers and burnt area remained respectively at 11.5% and 52% lower than the 10 year average.

July was relatively cold across the north-western half of the peninsular, especially in parts of Galicia, Asturias, Basque Country and Castilla y Leon. Minimum temperatures reached values below 5°C to 6°C in elevated mountain areas and parts of the northern plateau and interior of the Basque Country. It was damp to wet across the northern part of the peninsula, but the rest of Spain was generally dry. There were episodes of heavy rainfall in north and northeast areas of the peninsula in the later part of the month, especially in Catalonia and the Basque

Country. Fire risk was consequently low in the north-western part of the peninsular (although high across most of the rest of the country). Both fire numbers and burnt area were below the 10-year average (23% and 84% respectively).

Temperatures increased in August, with a mean monthly temperature 1.4°C above the average for the month. Only in areas of Galicia, Asturias, Extremadura and the Canaries were temperatures around normal values. It was also generally dry in most of the country. The most pronounced rainfall deficit was in regions of the eastern part of the mainland, the Balearics and the centre of Andalusia, where the accumulated rainfall in August was below 25% of normal value. Fire occurrence was similar to July, with values of 40% and 85% below the 10-year average for numbers and burnt area respectively.

In September it was generally very warm and dry, with an average monthly temperature of 22.1°C. Fire risk increased progressively over the month because of the increased temperatures and low rainfall, although the number of fires and burnt area remained slightly below the 10-year average (26% and 13% respectively).

October was very warm, with a mean monthly temperature 2.1°C higher than average. The first half of the month was extremely warm (between 3-4°C above normal values), making it the warmest in Spain since 1961. Temperatures of 35°C were recorded in areas of western Andalusia, while most regions reached values above 30°C. From the 16<sup>th</sup>, temperatures began to fall and the first frost of autumn occurred in high mountain areas and in the interior of Galicia and the Basque Country, Castilla y Leon and south Aragon. It was also the driest October in the whole of Spain since 1998. As a result of this the number of fires totalled 3 462 and the affected forest area was 35 457 hectares. These figures are well above the average for October 2001-2010 (Number: 2738 Burnt area 731 ha). During the first 20 days of the month, there was a severe episode of forest fires in the northern third of the peninsular, in particular in Galicia, where 55% (1 915) of the fires occurred during October, with special emphasis on the province of Orense.

November was very warm overall, but in the later part of the month, temperatures (particularly minima) descended gradually approaching normal, and frosts began to register in parts of the peninsular. The weather also turned wet, with an average rainfall nationwide of 40% more than the

normal value for this month. Fire risk remained low throughout the month due to the lower temperatures and especially the significant increase in rainfall. 452 fires burnt 3 342 hectares in this month. These values are higher by 4% and 105% compared to the mean values for the month of November 2001-2010.

The month of December was slightly warmer than normal. It was also very dry in the greater part of Spain: the driest December since 1988 and the fourth driest of the last 50 years. The fire risk was low for most of the month, but rose to moderate in the Levante and the Ebro Valley during periods of drying winds from the west and north. There were 179 fires burning 1 015 hectares during the month of December. These values are lower by 55% and 47% than average values recorded for the month of December during the decade 2001-2010.

#### *Number of fires and affected surfaces*

The provisional numbers of fires and burnt areas for 2011 are shown in Table 8. In 2011, the number of fires are slightly below the average of the previous decade (2001-2010), 6.4% lower for the total number of fires in general and 12.3% lower for the number of fires over 1 hectare (Table 6). The percentage of small fires (<1 ha) is 66.47% of the total number of fires, slightly above the median which is 64.23%.

Table 6. Number of fires in 2011 compared with 10 year average

	10 year average 2001-2010	2011
Number of fires <1ha	11001	10655
Number of fires ≥1ha	6126	5373
Total	17127	16028

The distribution of fires by geographic area is shown in Figure 8. The highest number of fires occurred in the Northwest Peninsula (Galicia, Asturias, Cantabria, Basque Country, Zamora and León).

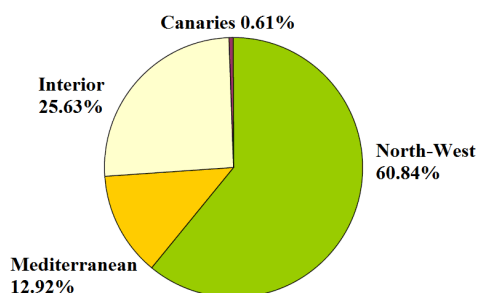


Figure 8. Number of fires in 2011 by geographic region

The monthly evolution of the number of fires over the year shows lower values almost every month except April and October, the latter extraordinary month in which the numbers of fires was 374% above average. Figure 9 shows monthly values distinguishing between fires above and below 1 ha in size. Both parameters are below average in each month, except in the months of April, June and October where the fires exceeded the average for the decade, especially in the month of October when the increase was quite pronounced.

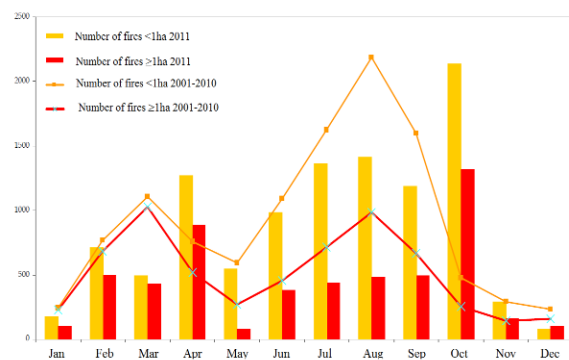


Figure 9 Annual progression of number of fires 2010

The evolution of burnt area over the months was also below the ten-year average, except in April and October, as occurred in the number of fires. Figure 10 shows the burnt area for each month of the year compared with the average of the decade 2001-2010, for both total area and forests. The significant burnt area in October is notable.

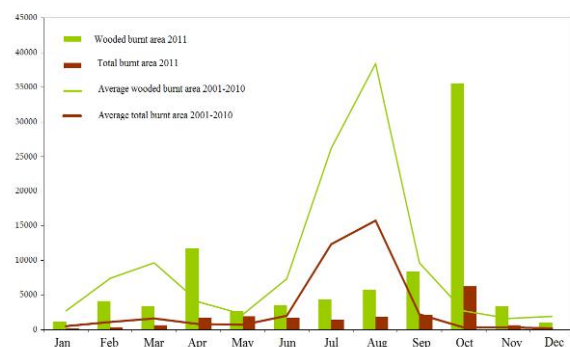


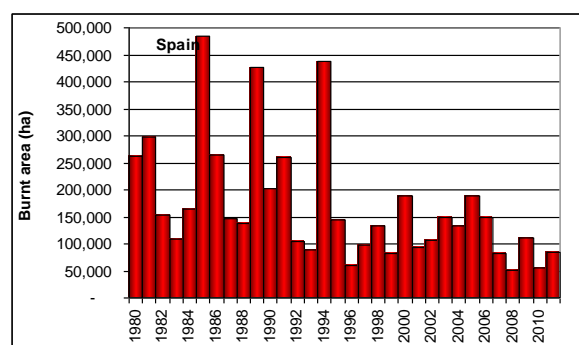
Figure 10 Annual progression of burnt area 2011

In 2011, according to information supplied to the Area of wildland fire management by the Autonomous Communities, there were 18 large fires (>500 ha), 12 of which occurred in the second half of October in Orense, Asturias and Leon. Large fires accounted for 17 887.35 ha which is 21% of the total area burnt in 2011. Table 7 gives the location, date and burned area of these large fires.

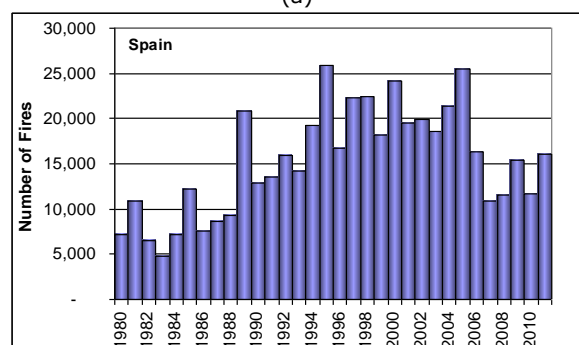
The yearly trends in terms of numbers of fires and burnt areas during the last 32 years in Spain are shown in Figure 11.

Table 7. Large fires in 2011

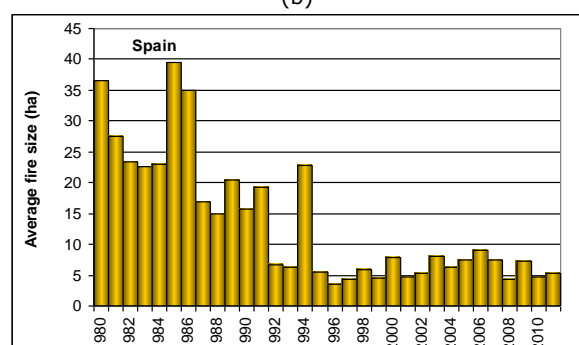
Province	Municipality of origin	Start date	Burnt area (ha)
Valencia	Benicolet	08/04	1449
Zamora	Lubián	09/04	538
Baleares	San Joan de Labritja	25/05	1576
Ávila	Navalacruz	19/08	709
León	Encineto	09/09	654
Asturias	Illano	27/06	537
Asturias	Cangas de Narcea	16/10	736
Asturias	Allande	16/10	2012
Asturias	Cangas de Narcea	17/10	901
León	Castrillo de Cabrera	18/10	580
Orense	Muiños	12/10	1000
Orense	Lobios	13/10	1000
Orense	Manzaneda	13/10	2000
Orense	Montederramo	15/10	770
Orense	Maceda	16/10	1175
Orense	Manzaneda	17/10	550
Orense	Vilariño de Conso	17/10	800
Orense	Laza	17/10	900



(a)



(b)



(c)

Figure 11. Burnt areas (a), number of fires (b) and average fire size (c) in Spain for the last 32 years.

### Prevention measures

#### Training in fire management

During 2011 the ADCIF (*Área de Defensa contra Incendios Forestales*) has developed the following courses for technicians responsible for defence and combating forest fires in various administrations:

- Advanced Course Management of Extinction: aimed at technical staff of the Autonomous Communities in order to qualify participants as directors of extinction, assuming functions of planning, operations and logistics.
- Advanced Course in Prevention with the participation of qualified technical personnel for appropriate prevention techniques adapted to the cause of the fire.

- Advanced Course in Fire Behaviour: Program covering current techniques for predicting fire behaviour, using software and geographic information systems.
- Advanced Course in Safety.
- Basic courses in fire extinction.
- Course of investigation of causes of forest fires and other environmental crimes.
- Course of fire management: collaboration with the Councils of Gran Canaria and Tenerife and the Canary Islands Government.
- Advanced Course Iberoamerican fire management: organized in collaboration with the Spanish Agency for International Development Cooperation (AECI), this course allows the exchange of experiences and knowledge transfer for fire management personnel from Latin American countries.

The ADCIF also participated in core courses in Defence against Wildfires, aimed at final year Forestry students.

#### Awareness raising and information campaigns

School campaign - This involved visits to schools across Spain by environmental educators, presenting the problem of forest fires to the school population, to raise awareness and involve them in prevention. A series of participatory contests are held within this program. In the 2010/2011 school year more than 1 000 centres were visited, presenting the campaign, providing materials and encouraging teachers and students to participate in the contests. Between 16 and 20 May the season finished at the National Centre for Environmental Education (Centro Nacional de Educación Ambiental CENEAM-Valsaín), with the presentation of the final awards. During the final phase, the Secretary of State for Climate Change presented certificates and token gifts in a ceremony held at the headquarters of the Ministry of Environment and Rural and Marine Affairs.

Rural campaign - During 2011, these campaigns consist of direct actions for the rural population, and consist of theatrical productions trying to raise awareness about the most common causes of forest fires and social problems, thus transmitting a message about the importance of human action in preventing fires. From its inception in March 2010 until its completion in May 2011 there were a total of 160 representations in areas of high fire risk, spread throughout the country.

#### Preventive Work Brigades (Brigadas de Labores Preventivas: BRIF)

The BRIF staff work on prevention measures outside the normal fire campaign season.

These silvicultural prevention efforts consist of the reduction and control of forest fuels, making forests more resistant to the initiation and spread of fire, and makes suppression actions easier in the event of fire.

Prevention work during the months when the risk of fire is lower, allows the fighting personnel to work continuously, increasing their experience in public service.

The BRIF staff were operational during the months of January to May 2011, subsequently joining their forces during the summer campaign.

#### Integral Prevention Teams (EPRIF)

The MARM has been in collaboration on prevention of forest fires with the Autonomous Communities for over 13 years. In 1998 Integral Forest Fire Prevention Teams (EPRIF) were created to develop an intervention in territory that directly affects the population, and the causes that often lead to fires. The work focuses primarily on supporting the rural population in conducting prescribed burns, and providing training and social awareness on the traditional uses of fire and its risks. The EPRIF operate between November and April.

During the 2010/2011 campaign there were 18 EPRIF teams distributed nationally in counties and areas of high fire risk, taking into account the special problems of the northwest peninsula and other specific locations of the State territory.

The 18 teams performed 318 prescribed burns, 130 awareness activities, and collaborated in the extinction of 26 forest fires, among other activities.

#### *Extinction activities*

#### Human resources: Teams of reinforcement against Forest Fires (BRIF)

There are 5 BRIF teams during the winter - spring campaign in the north and west of the Peninsula and ten BRIF during the summer campaign across the country. Helicopter transport units can operate anywhere in the country where they are needed. The BRIF are highly specialized teams whose personnel receive training to enable them to act in the most demanding situations.

#### Aerial means

Throughout 2011, the assets of the Ministry of Environment, Rural and Marine Affairs (MARM) carried out 2 262 fire interventions, with a total of 5 050 flight hours and 26 759 discharges.

#### *Operations of mutual assistance*

During 26<sup>th</sup> to 30<sup>th</sup> August, the MARM sent amphibious aircraft to assist in extinguishing forest fires in Greece, in response to the requested assistance. Amphibians, operated by 43 Army Air Group, assisted in one of the big fires in the region of Alexandroupolis, in the northeast of the country, which was affecting pine and oak tree forests and threatening populations. The two amphibious aircraft dispatched a total of 80:40 flight hours and 158 discharges in the mission to Greece.

Table 8. Forest Fires from January 1st to December 31st 2011 (provisional data, 28.01.2012).

PROVINCIA / COM. AUTÓNOMA	Num. Sinistros		SUPERFICIES				% SUPERFICIE respecto a la existente	
	Conatos < 1 ha	Incendios ≥ 1 ha	Forestal Leñosa			Forestal Herbácea	% ARBOLADA	% FORESTAL
			Arbolada	Matorral y M.Bajo	Total			
Alava	37	9	2,66	18,25	20,91	13,96	0,002	0,018
Gulpuzcoa	34	9	10,74	44,57	55,31	22,08	0,008	0,053
Vizcaya	30	25	120,46	122,74	243,20	60,25	0,030	0,190
<b>PAIS VASCO</b>	<b>101</b>	<b>43</b>	<b>133,86</b>	<b>185,56</b>	<b>319,42</b>	<b>96,29</b>	<b>0,034</b>	<b>0,084</b>
Barcelona	188	13	16,05	20,46	36,51	1,99	0,004	0,008
Girona	108	14	131,25	67,27	198,52	1,05	0,027	0,048
Lleida	92	23	49,15	289,04	338,19	49,63	0,022	0,053
Tarragona	134	22	124,86	323,06	447,92	6,78	0,008	0,154
<b>CATALUÑA</b>	<b>522</b>	<b>72</b>	<b>321,31</b>	<b>699,83</b>	<b>1.021,14</b>	<b>59,44</b>	<b>0,021</b>	<b>0,056</b>
A Coruña	894	282	1.340,61	1.022,78	2.363,39	0,00	0,311	0,468
Lugo	708	334	1.134,66	2.209,82	3.344,48	0,00	0,408	0,511
Ourense	1.576	1.042	4.987,77	22.590,00	27.577,77	0,00	2,450	4,795
Pontevedra	1.186	337	1.614,41	1.710,57	3.324,98	0,00	0,125	1,100
<b>GALICIA (*)</b>	<b>4.364</b>	<b>1.995</b>	<b>9.077,45</b>	<b>27.533,17</b>	<b>36.610,62</b>	<b>0,00</b>	<b>0,706</b>	<b>1,797</b>
Almería	83	26	21,05	436,32	457,37	0,00	0,015	0,077
Cádiz	74	12	15,09	413,92	429,01	0,00	0,007	0,119
Córdoba	51	7	77,54	94,73	172,27	0,00	0,016	0,026
Granada	66	15	21,69	261,90	283,59	0,00	0,008	0,044
Huelva	106	17	26,98	70,52	97,50	0,00	0,005	0,012
Jáen	109	17	14,35	66,07	80,42	0,00	0,003	0,013
Málaga	50	21	134,90	428,40	563,30	0,00	0,081	0,156
Sevilla	103	15	24,28	50,93	75,21	0,00	0,009	0,018
<b>ANDALUCÍA (**)</b>	<b>642</b>	<b>130</b>	<b>335,88</b>	<b>1.822,79</b>	<b>2.158,67</b>	<b>0,00</b>	<b>0,013</b>	<b>0,048</b>
<b>ASTURIAS (*)</b>	<b>913</b>	<b>756</b>	<b>525,52</b>	<b>11.472,22</b>	<b>11.997,74</b>	<b>106,74</b>	<b>0,124</b>	<b>1,580</b>
<b>CANTABRIA</b>	<b>89</b>	<b>384</b>	<b>643,27</b>	<b>2.507,45</b>	<b>3.150,72</b>	<b>142,30</b>	<b>0,311</b>	<b>0,909</b>
<b>LA RIOJA (*)</b>	<b>58</b>	<b>24</b>	<b>9,97</b>	<b>52,66</b>	<b>62,63</b>	<b>0,00</b>	<b>0,006</b>	<b>0,021</b>
<b>MURCIA (*)</b>	<b>111</b>	<b>15</b>	<b>458,18</b>	<b>0,74</b>	<b>458,92</b>	<b>0,07</b>	<b>0,171</b>	<b>0,094</b>
Alicante	99	24	70,31	239,95	310,26	30,53	0,066	0,132
Castellón	72	20	62,28	184,01	246,29	28,18	0,027	0,065
Valencia	170	37	570,69	1.211,03	1.781,72	43,02	0,196	0,312
<b>COM. VALENCIANA</b>	<b>341</b>	<b>81</b>	<b>703,28</b>	<b>1.634,99</b>	<b>2.338,27</b>	<b>101,73</b>	<b>0,112</b>	<b>0,193</b>
Huesca	99	30	61,31	79,32	140,63		0,012	0,015
Teruel	79	20	168,20	134,84	303,04		0,032	0,033
Zaragoza	162	46	37,36	213,16	250,52		0,012	0,034
<b>ARAGON (*)</b>	<b>340</b>	<b>96</b>	<b>266,87</b>	<b>427,32</b>	<b>694,19</b>		<b>0,019</b>	<b>0,027</b>
Albacete	63	24	29,22	39,02	68,24	97,20	0,008	0,026
Ciudad Real	67	30	22,66	87,46	110,12	119,46	0,005	0,026
Cuenca	128	28	303,17	54,57	357,74	89,90	0,048	0,055
Guadalajara	120	27	15,86	57,87	73,73	56,74	0,003	0,017
Toledo	149	110	347,37	146,36	493,73	755,40	0,113	0,243
<b>CASTILLA LA MANCHA</b>	<b>527</b>	<b>219</b>	<b>718,28</b>	<b>385,28</b>	<b>1.103,56</b>	<b>1.118,70</b>	<b>0,031</b>	<b>0,062</b>
Las Palmas de Gran Canaria	33	5	0	10,4	10,40	5,56	0,000	0,005
S.C. de Tenerife	54	6	5,7529	11,436	17,19	35,82	0,006	0,021
<b>CANARIAS</b>	<b>87</b>	<b>11</b>	<b>5,75</b>	<b>21,84</b>	<b>27,59</b>	<b>41,38</b>	<b>0,005</b>	<b>0,012</b>
<b>NAVARRA</b>	<b>473</b>	<b>108</b>	<b>112,94</b>	<b>461,39</b>	<b>574,33</b>	<b>20,30</b>	<b>0,027</b>	<b>0,101</b>
Badajoz	124	193	296,88	596,00	892,88		0,037	0,076
Cáceres	357	232	498,52	1.405,55	1.904,07		0,055	0,123
<b>EXTREMADURA (**)</b>	<b>481</b>	<b>425</b>	<b>795,40</b>	<b>2.001,55</b>	<b>2.796,95</b>		<b>0,047</b>	<b>0,103</b>
<b>ILLES BALEARS</b>	<b>128</b>	<b>29</b>	<b>2.220,78</b>	<b>11,14</b>	<b>2.231,92</b>	<b>239,79</b>	<b>1,334</b>	<b>1,136</b>
<b>MADRID</b>	<b>235</b>	<b>59</b>	<b>0,86</b>	<b>38,25</b>	<b>39,11</b>	<b>338,68</b>	<b>0,000</b>	<b>0,090</b>
Ávila	132	54	289,11	813,63	1.102,74	588,08	0,132	0,210
Burgos	161	68	194,56	319,10	513,66	98,26	0,044	0,075
León	264	385	825,43	7.070,47	7.895,90	406,31	0,170	0,787
Palencia	70	22	36,26	16,16	52,42	86,53	0,023	0,021
Salamanca	217	96	72,53	341,68	414,21	366,84	0,017	0,052
Segovia	58	16	55,38	11,71	67,09	116,47	0,025	0,020
Soria	65	14	136,68	23,60	160,28	18,15	0,036	0,027
Valladolid	60	30	57,63	12,19	69,82	105,92	0,050	0,048
Zamora	216	241	365,94	3.781,72	4.147,66	428,53	0,168	0,857
<b>CASTILLA Y LEÓN</b>	<b>1243</b>	<b>926</b>	<b>2.033,52</b>	<b>12.390,26</b>	<b>14.423,78</b>	<b>2.215,09</b>	<b>0,076</b>	<b>0,346</b>
<b>CEUTA</b>	<b>0</b>	<b>0</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,000</b>	<b>0,000</b>
<b>MELILLA</b>	<b>0</b>	<b>0</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,000</b>	<b>0,000</b>
<b>TOTAL</b>	<b>10.655</b>	<b>5.373</b>	<b>18.363,13</b>	<b>61.646,44</b>	<b>80.009,56</b>	<b>4.480,51</b>	<b>0,112</b>	<b>0,305</b>

(Source: Ministerio de Medio Ambiente y Medio Rural y Marino, Área de Defensa Contra Incendios Forestales, Spain).

### 2.1.3 France

#### *Fire danger in the 2011 fire season*

The meteorological profile of 2011 was particular: spring in France was characterized by a remarkable warmth and dryness leading to early drying of surface soils.

This situation was reversed in June and July, especially in the Mediterranean region, mitigating the effects of drought on plants during the summer period, theoretically the most dangerous time of year. 115 zones were classified by Météo France as at a level of very severe risk (average of the last 10 summers: 670), indicating a limited level of risk.

In the Southwest of France, and particularly in the Landes forest, which was made more vulnerable to fire after the 2009 storm, the danger of forest fires diminished only in mid-July.

The drought returned in September in the Mediterranean departments, aggravated by high temperatures and strong winds and leading to a resurgence of the danger of forest fires which remained high until the end of October.

#### *Fire occurrence and affected surfaces*

The results obtained in the field of the fight against forest fires in France in 2011 are positive since a total 9 630 ha were affected by around 4 500 fires, which represents less than half the average area affected during the last decade.

#### Mediterranean Departments

Whereas usually 70% of the areas affected by fire are located in the Mediterranean departments, these regions represented less than half of the burnt area in France, with 4 500 ha in 2011.

During the summer, 1 380 ha were affected by 650 fires. The area affected during the summer has never been this low since the 1973 introduction of the Prometheus database that provides comparable homogeneous data. This is only 11% of the average over the last 10 summers. The number of fires was also reduced, as the average is 1 100 fires.

Fire activity was most sustained in October when 1 260 ha were burnt by 310 fires. The department of Haute-Corse was particularly affected by this situation (690 ha).

In total, 80% of the fires of 2011 did not exceed 1 hectare, and 9 were over 100 hectares in size; the largest up to 350 ha (10 year average: 18 fires over 100 ha).

These fires were located in the following regions:

- Bouches du Rhone (Fos-Sur-Mer: 121 ha on July 1)
- Pyrenees-Orientales (vingrau: 250 ha on August 9 and Latour-de-carol: 110 ha on September 9)
- Lozère (Pourcharesses: 170 ha on August 21)
- Upper Corsica (pianello: 348 ha on October 5 and Volpajola: 170 ha on December 15)
- Hérault (poussan: 102 ha on October 7 and Azillanet: 111 ha on October 9).

#### Southwest regions

3 950 ha were burnt in the Southwest by 2 300 fires (average 5 800 ha and 2 250 fires). Although the departments of the Pyrenees were the most affected (1 650 ha affected by fires often associated with pastoral practices), 1 050 ha of forest lands were destroyed in the Landes forest (700 ha in the summer season) against 1 080 ha on average.

The operational situation was difficult in Aquitaine in early July, when the vegetation is particularly vulnerable. Large fires developed in the Landes forest in Gironde at Lacanau, on July 2 (306 ha). Another major fire subsequently developed in Saint-Médard-en-Jalles on September 28 affecting 108 ha, and in Landes at Luxey (108 ha on July 4).

1 200 hectares were affected in other metropolitan areas, but it was overseas, in the department of Reunion where the largest fire of 2012 occurred.

#### The fire at Maïdo in Reunion

Approximately 2 900 hectares of forests of Reunion located in a UNESCO World Heritage Site burned as a result of several arson attacks, which began on Wednesday, October 25. The biggest fire affected 2 770 ha in the Maïdo massif. It required the commitment of substantial reinforcements from the Mainland: 420 firefighters and military sections of the civil defence system, and two DASH water bombers. The operation was, from this point of view, unprecedented overseas, the last reinforcing elements involved not leaving the island until just before Christmas.

The yearly trends in terms of numbers of fires and burnt areas during the last 32 years in France are shown in Figure 12.

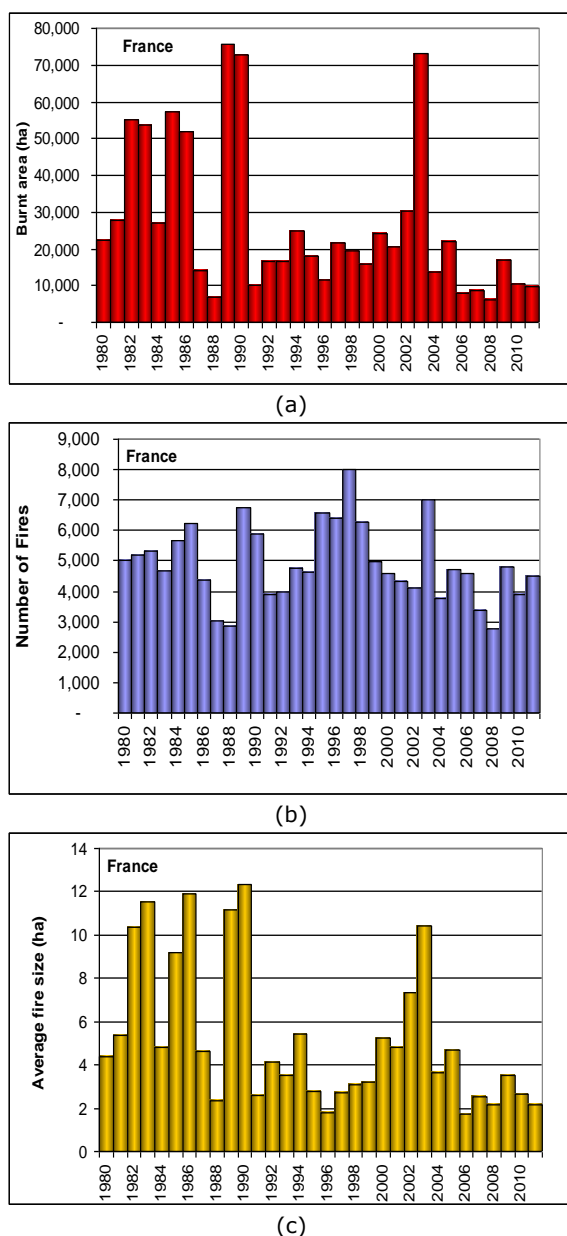


Figure 12. Burnt areas (a), number of fires (b) and average fire size (c) in France for the last 32 years.

### *Fire fighting means*

To support the local fire brigade, the Directorate General for civil security and crisis management mobilized:

- 23 water bombers (12 Canadair CL415, nine Tracker, dedicated to aerial lookout, 2 Dash whose primary mission is to provide a retardant containing line). The water bombers intervened in 280 fires in the Mediterranean departments and 40 times in the Southwest where a detachment of two CL415 was already positioned in the summer. In half the cases, these

interventions took place during aerial watch missions.

- 725 military sections of the civil defence system contributed in the fight against forest fires. In particular, they formed detachments for fire retardant interventions, a helicopter detachment, and provided two support elements on site. In total, they carried out 480 ground surveillance missions, mainly in Corsica, and made a hundred intervention operations.

- Under a protocol between the Ministry of Interior and the Ministry of Defence, three helicopters and 260 soldiers assisted with surveillance and fire fighting operations.

It should be noted that although the commitment of national resources was relatively limited during the summer, since in the Mediterranean region they intervened to reinforce the local fire department on 190 of the 650 fires recorded (29%, against 36 % on average), they were called upon until the end of December.

### *Forest fire prevention*

Several lines of effort have been followed to make the policy of forest fire prevention more effective in France during 2011:

#### Revision of legal provisions for the prevention of forest fires:

A study was conducted by the ministry responsible for forests at the end of 2010 on the consolidation of the Forestry Code, and including provisions for defence and the fight against fire. One objective is to enable more effective enforcement of legal obligations of clearing (around buildings and along infrastructure). This legislative and regulatory approach will come into force in 2012.

#### Updating the multi-year planning policies

The first generation of departmental or regional plans of protection of forests against fire (PPFCI), which are required in the departments and regions particularly vulnerable to fire, are gradually coming end of their period of validity. Thus the PPFCIs of Gard and Corsica are being evaluated for their renewal; ensuring more generally, to better integrate actions to protect natural areas against fire in the rural development of those areas susceptible to fires.



### Field activities

The terrestrial expenses against the prevention of forest fires in France were globally assured by the collectives, the State (Ministry in charge of Forests) and, in the particular case of the Landes forest, by an amount close to 150 million Euro in 2011.

In 2011 the Ministry of Forests, with the cooperation of the National Forest Office (ONF) and co-financing from FEADER (*Fonds Européen Agricole pour le Développement Rural* - European Agricultural Fund for Rural Development), funded a DFCI action plan of 28 million Euro. The collectives realize an annual average financial outlay of five times that of the state.

Through these cooperative efforts, more than a thousand people were mobilized for the terrestrial prevention of forest fires (not including firefighters of departmental Services for fire and rescue – SDSI - who are also mobilized as a preventive measure for ground surveillance in times of high risk): 175 specialised DFCI forest workers of the ONF, about 800 general forest fire staff, and dozens of forestry staff, commissioned officers and sworn members of the NFB.

The NFB, in association with the communities and SDIS concerned, has implemented a program of general interest missions in the Mediterranean area in which were made in 2011:

- Land management: 549 water points, 29 lookout stations, 880 km of DFCI maintained trails, 487 ha mechanical brashing, 561 acres of prescribed burns; and,
- 5527 surveillance patrols, including 106 interventions against starting fires. Some projects have received financing from FEADER.

### *Fire damage and loss of human lives*

Some fires threatened populated areas and some buildings were damaged. But the actions of emergency services served to protect the population and there were no casualties.

### *Operations of mutual assistance*

In 2011, the Directorate General for Civil Protection and Crisis Management was involved in an operation against forest fires enabled by MIC: two Canadair CL415 and a reconnaissance and liaison aircraft were made available to Greece, from August 26 to 29.

Two CL415 also intervened in Italy, in February, as part of the bilateral agreement between the two countries.

*(Source: Ministère de l'Intérieur – DGSCGC / SDPGC / BERR; Ministère de l'Agriculture et de l'Agroalimentaire : DGPAAT / SFRC / SDFB / BFTC, France)*



### 2.1.4 Italy

#### *Forest fires in the 2011 fire season*

Forest fires in Italy in 2011 occurred much more in comparison to the previous three years.

In 2011, there were 8 181 fires recorded, burning a total area of 72 004 hectares, 38 428 of which were wooded.

The yearly trend in terms of numbers of fires and burnt areas during the last 32 years in Italy are shown in Figure 13. In Figure 14 the affected wooded areas are compared with the total burnt area.

In Italy forest fires occur in all regions. In winter they are located mostly in the Alpine regions (especially the North-western regions), while in summer they are mostly concentrated in the Mediterranean regions (Southern regions and islands). In Liguria fires occur both in summer and winter at about the same frequency.

Table 9 contains the distribution of fires in 2010 by region. An analysis of the data shows that 2011 was a critical year.

In 2011 the number of fires was about 68% more than in 2010, while the wooded burned area was about 99% more. As usually, forest fires mainly occurred in southern regions.

As far as the number of fires is concerned, Campania was the most affected region with 1 435 fires, but the worst burned area occurred in Calabria (total: 14 437 ha; wooded: 8 174 hectares).

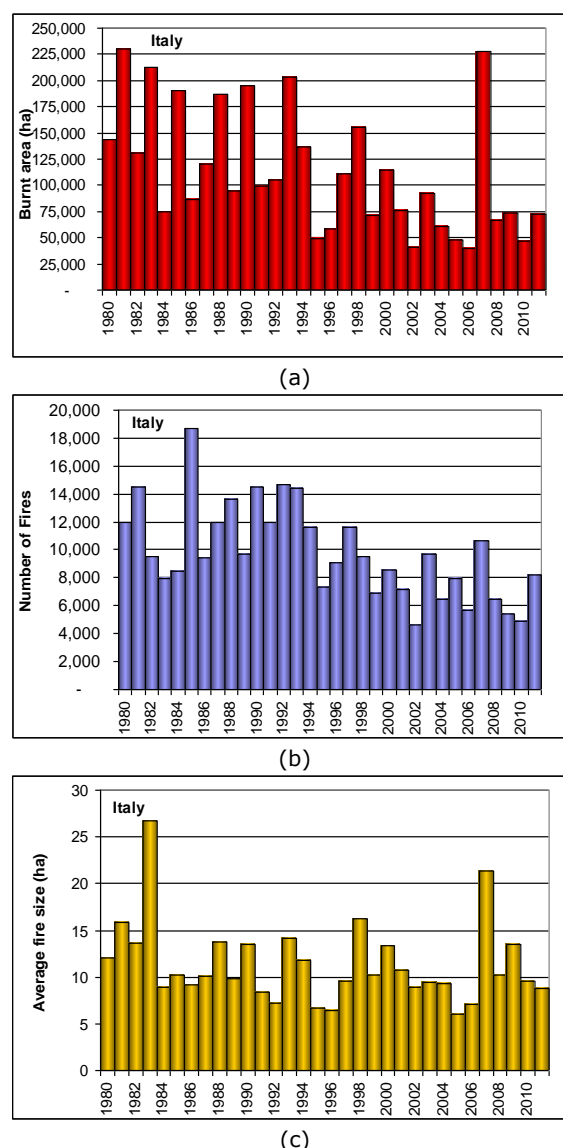


Figure 13. Burnt areas (a), number of fires (b) and average fire size (c) in Italy for the last 32 years.

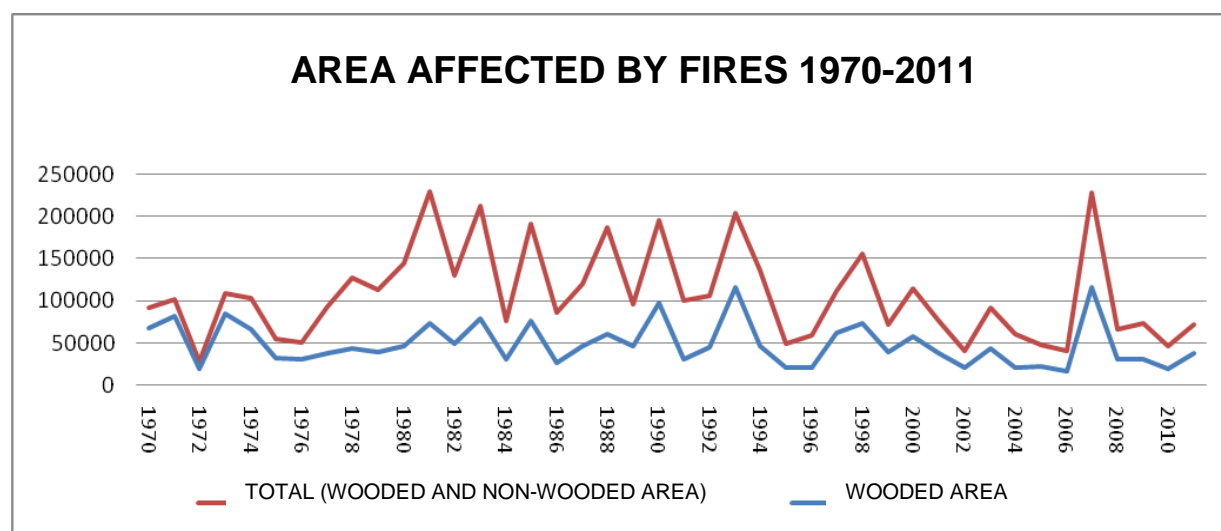


Figure 14. Area affected by fires 1970-2011, showing wooded and total burnt areas (ha)

Table 9. Forest fires by region in Italy 2011.

Region	Number	Surface area affected by fire (ha)			
		Wooded	Non wooded	Total	Average
ABRUZZO	136	440	776	1216	8.9
BASILICATA	295	1 513	1 545	3057	10.4
CALABRIA	1 238	8 174	6 262	14 437	11.7
CAMPANIA	1 435	5 738	2 388	8 126	5.7
EMILIA ROMAGNA	120	89	93	182	1.5
LAZIO	609	5 597	1 280	6 877	11.3
LIGURIA	293	1 301	216	1 517	5.2
LOMBARDIA	227	531	781	1 312	5.8
MARCHE	84	372	77	449	5.3
MOLISE	129	323	425	748	5.8
PIEMONTE	209	518	377	895	4.3
PUGLIA	580	3 327	3 845	7 172	12.4
TOSCANA	646	680	346	1 026	1.6
UMBRIA	123	217	89	306	2.5
VENETO	69	390	235	625	9.1
SARDEGNA	820	3 718	6 510	10 228	12.5
TRENTINO	43	12	3	15	0.3
FRIULI V. GIULIA	98	230	142	372	3.8
SICILIA	1 011	5 227	8 158	13 385	13.2
VALLE D'AOSTA	16	33	29	62	3.9
<b>TOTAL</b>	<b>8 181</b>	<b>38 430</b>	<b>33 577</b>	<b>72 007</b>	<b>8.8</b>

### *Fire fighting means and information campaigns*

Despite the reduction in number of fires and forest fires, Italy is among the European countries where the phenomenon is particularly serious.

In many Italian regions, the majority of fires are detected and extinguished when the fires are of minimal size, so that only few fires escape control. However, these few fires are those determining the greater part of the burned area and often also affect urban areas and infrastructures, causing serious damage and particular concern.

In synthesis in Italy:

- the number of fires has tended to decrease, although modestly; since 1985;
- there are significant variations from year to year and among regions;

The phenomenon of forest fires is not generalized throughout the country, as about 50 out of the 110 provinces are most affected and therefore these should receive special attention.

The fire fighting system, which in some regions has reached levels of excellence, is overall fragile.

In Italy the Regions have primary responsibility in the field of forest fires and, through conventions and programme agreements, empower the Italian Forest Corps in prevention, preparedness,

coordination in the regional operations rooms and in the survey of burned areas, and the National Service of Fire Brigades in active firefighting and coordination in the regional operations rooms.

The Italian Forest Corps also submits the forest fire prevention plans of national and regional parks and protected natural areas for examination.

For environmental emergencies (such as forest fires) there is the public phone number 1515 (Italian Forest Corps), active 24 hours a day, which coordinates the activities of specific emergency territorial centres, in addition to the specific number 115 (Fire Brigades).

Land-monitoring for fire prevention, investigation and law enforcements are carried out independently by highly specialized staff to identify causes of ignition, and are of paramount importance. Monitoring and analysis of forest fires are supported by computerized procedures that enable the updating of the "Territorial Dossier", built up for the management of all the territorial information, used both by police and civil protection authorities.

Over the last year the Italian State Forest Service has given special attention to the professional training of staff.

In the EU, officers of Italian Forest Corps are incorporated into the system of reinforced cooperation Fire 5 (*Force d'Intervention Rapide Européenne* 5 - Portugal, Spain,

France, Italy and Greece): three at level 1 (*general*), one at level 2 (*advanced*), one at level 3 (*self-training*) and one at level 4 (*Experts exchange*). Three officers are also qualified for interventions in international emergency and humanitarian relief.

#### *Fire causes and investigation activities*

Overall, the investigations against forest fire crimes in 2011 carried out by the territorial garrison of Italian Forest Corps, resulted in the reporting of 455 people to the Court of Justice, including 9 taken under arrest or under custody measures for fire arson.

Three motivational levels are usually at the basis of the phenomenon:

- a) negligence, that sometimes appears as irresponsibility, caused above all by the destruction of plant residue or cleaning land and wasteland;
- b) widespread illegality, linked to poaching wild boar; events caused by the people responsible and volunteers for extinguishing; reprisals;
- c) rural criminality, in situations where shepherds are linked to criminal contexts; intention to depreciate lands and woodland; intimidations; interests in subsequent construction and reforestation.

Regarding unintentional fire causes, the trend of previous years is confirmed.

Overall, during the period 2000-2011 the perpetrators who have been identified and reported to the Court of Justice correspond to 7.9% of the total number of deliberate fires. In 2011 the percentage was 7.3%. This percentage may be considered satisfactory, given the high number of crimes, the framework of widespread illegality that characterizes the phenomenon, the vastness of the territories in which they committed the offenses and the multiplicity of motives and causes behind forest fires.

The arrests were all made as a result of a complex investigative work in areas repeatedly affected by forest fires. Main investigations were carried out in most of the regions where the ignition points were identified, in order to collect evidence of traces of weapons or primers or combustion accelerators, in the search for the forest fire origin and cause.

#### *Loss of human lives*

In Table 10 the number of people that suffered injuries or lost their lives in forest fires during the period 1978-2011 in Italy is given. In 2011, 4 victims and 50 injured people were reported.

Table 10. Injured people and victims of forest fires in Italy (1978-2011)

	<i>Injured</i>	<i>Victims</i>
1978	47	3
1979	32	10
1980	31	4
1981	40	9
1982	27	6
1983	39	15
1984	19	6
1985	93	16
1986	38	9
1987	104	3
1988	80	6
1989	80	12
1990	119	10
1991	55	6
1992	50	6
1993	76	12
1994	37	1
1995	12	1
1996	14	2
1997	97	5
1998	81	6
1999	34	6
2000	70	2
2001	23	3
2002	37	5
2003	75	7
2004	35	2
2005	43	3
2006	17	1
2007	26	23
2008	30	4
2009	12	4
2010	55	3
2011	50	4
<b>Total</b>	<b>1678</b>	<b>215</b>

(Source: Ministero delle Politiche Agricole Alimentari e Forestali, Corpo Forestale dello Stato, Italy).

## 2.1.5 Greece

### *Fire danger in the 2011 season*

Fire danger through the 2011 fire season has not showed specific peaks, even during and after a heat wave in July (17-20/7/2011), except the night of the 24<sup>th</sup> of August. At that night in August, fire danger increased significantly, as did the number of forest fires and the corresponding burnt area. This was due to very strong winds and low humidity conditions in the north-eastern parts of Greece and katabatic winds in the western and southern parts of Greece. Especially in the Evros region (north-east part of Greece) a large forest fire occurred on 24/8/2011 near the city of Lefkimmi.

### *Fire occurrence and affected surfaces*

The number of forest fires as well as the burnt area of 2011 in Greece per region is indicated in Table 11. These provisional results of the fire campaign of 2011 in Greece, are the combined information according to data available from local Forest Service units and the availability of a mapping of burnt areas for 2011 based on 10

TM satellite images with spatial resolution of 30m from the NOA partner of the GMES/SAFER EU Project. And so, while the available information about the number of forest fires is not complete from some Regions (see\*) the respective information about areas burnt with the additional information of the mapping with satellite images should be satisfactorily sufficient.

From the results up to now, it is indicated that the burnt area this year was lower in comparison to the annual mean of the last decade. The peak of fire danger which started at 24th of August with very strong winds and low humidity conditions in the north-eastern parts of Greece and katabatic winds in the western and southern parts of Greece resulted in more fires and affected areas in the respective regions. So because of this we see a peak of damage in wooded areas in the north-east region of East Macedonia & Thrace and in the west parts - Ionian Islands and West Greece regions. The major fire occurred in Lefkimmi – Evros with damage of more than 5 000 ha on the 24th of August.

Table 11. Number of fires and burned area in 2011 by regional forest administration (provisional)

FOREST ADMINISTRATION AUTHORITIES	Total number of fires	fires <1 ha	fires 1-5 ha	fires 5-100 ha	fires 100-500 ha	fires >500 ha	Total Burned area (ha)	Wooded Burned area (ha)	Non wooded Burned area (ha)
REG. EAST MAC. THR. & REG. CENT. MACEDONIA	*167	102	25	36	3	1	8104.9	7319.4	785.5
REG. W. MACEDONIA & REG. IPEIROU	561	425	91	40	3	2	2741.1	1134.1	1607.0
REG. THESSALIAS	118	53	22	41	1	1	2140.9	1298.1	842.8
REG. IONIAN ISLANDS	*154	105	28	19	1	1	3166.3	3035.1	131.2
REG. W. GREECE	*220	193	16	11			3966.5	2286.9	1679.6
REG. ST. GREECE	*207	160	25	20	1	1	2524.3	2339.7	184.6
REG. ATTIKIS	*6	4	2				435.1	187.9	247.2
REG. PELOPONISOU	*142	88	31	20	2	1	1866.5	852.7	1013.8
REG. N. AIGAIU	*11	8	2	1			2021.5	65.5	1956.0
REG. S. AIGAIU	*10	10					466.8	154.7	312.1
REG. KRITIS	*17	12	2	3			1710.5	674.1	1036.4
<b>TOTAL</b>	<b>1613</b>	<b>1160</b>	<b>244</b>	<b>191</b>	<b>11</b>	<b>7</b>	<b>29144.4</b>	<b>19348.2</b>	<b>9796.2</b>

\* Counts not complete

### *Fire fighting means and information campaigns*

14 318 personnel are involved in suppression efforts, of which 8 932 are permanent personnel of the Fire Brigade which deals also with structural fires. There are 5 386 seasonally hired personnel just for forest fire suppression activities. The Fire Brigade of Greece owns around 1 701 engines, which

are involved in both structural and forest fire suppression efforts; and a few other small engines owned by Municipalities of high risk areas were involved occasionally in some incidents. Volunteers also assist in suppression efforts, by supplying water with trucks to the Municipalities' engines.

The aerial means used in the 2011 campaign are indicated in Table 12.

Table 12. Aerial means participating in the 2011 campaign

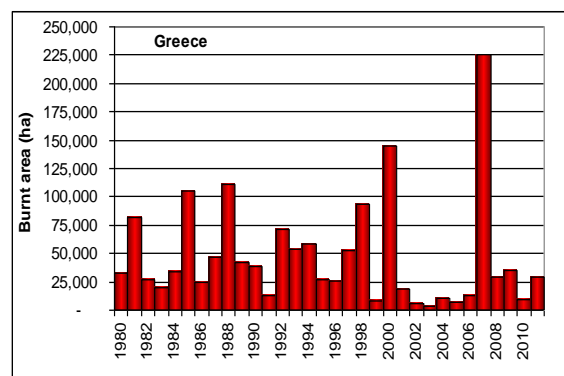
STATE OWNED MEANS			
AIRCRAFT	LARGE	CL-215	13
		CL-415	8
		C-130	1
		C-27	1
	SMALL	PEZETEL	18
		GRUMMAN	3
HELICOPTERS		H/P CHINOOK	2
		TOTAL	46
HIRED MEANS			
HELICOPTERS		H/P MI-26	2
		H/P SIKORSKY 64	3
		H/P MI-8	7
		TOTAL	12

### Fire prevention activities undertaken in 2011

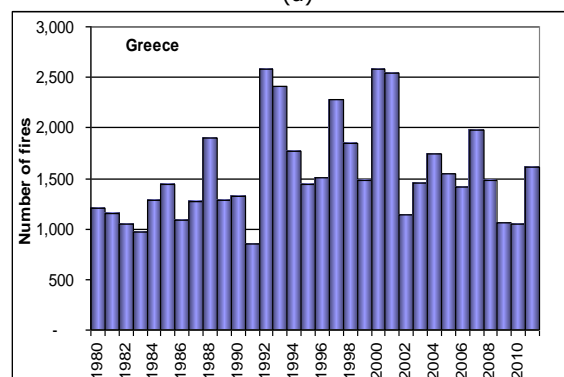
Special Secretariat of Forests:

Proposal for allocation of funds to Regional Forest Services to implement their annually planned fire prevention measures;

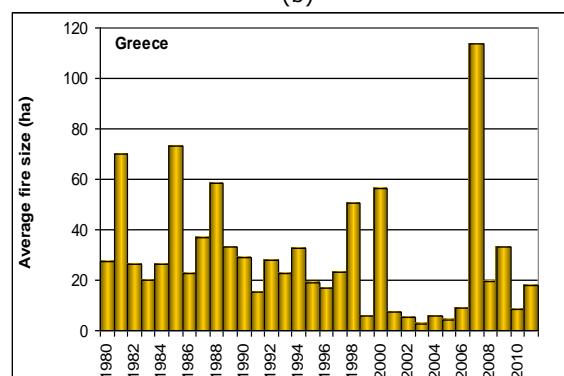
- Proposal for allocation of funds and issue of official guidelines to Regional Forest Services to implement patrolling during the fire season for fire prevention;
- Integrated to forest service the personnel of rural police (about 1 200 persons) and so assisted patrolling to prevent forest fires and other illegal activities that damage forests;
- Decentralized further the process of the actions taken by Municipalities to implement forest fire prevention measures;
- Activated the GMES/SAFER EU Project via the NOA partner for the Ioannina forest fire and disseminated the product maps to all involved agencies;
- Received from the NOA partner of GMES/SAFER EU Project product maps of burnt areas for the 41 of a total of 52 provinces of Greece by the end of the fire season.



(a)



(b)



(c)

Figure 15. Burnt areas (a), number of fires (b) and average fire size (c) in Greece for the last 32 years

#### General Secretariat of Civil Protection:

- Issue a new edition of National General Civil Protection Emergency and Contingency Plan for Forest Fires, due to new administrative law
- Issue national official guidelines to the competent authorities for planning, prevention, response and recovery due to forest fires, for the 2011 fire season
- Issue national official guidelines to the competent authorities for planning, prevention, response and recovery due to forest fires, for the 2011 fire season
- Issue the Daily Forest Fire Risk Map during the fire season
- Activated the GMES/SAFER EU Project for the Evros forest fire (Activation Date 26/08/2011) and disseminated the product maps to all involved agencies
- Proposal for the allocation of funds to municipalities for forest fires preventions measures.

#### *Injuries and loss of human lives*

During the fire campaign 4 persons died. 2 of them were fire fighters from the permanent personnel of the Fire Brigade, one, a fire officer during an operation in the region of east Mani – Lakonia – Peloponnesus on the 22/8/2011; and the other an engine driver in an accident with his vehicle during an operation in the region of Prespes – Florina – West Macedonia on the 7/11/2011. The other 2 persons were citizens who died because of fire impacts on their health.

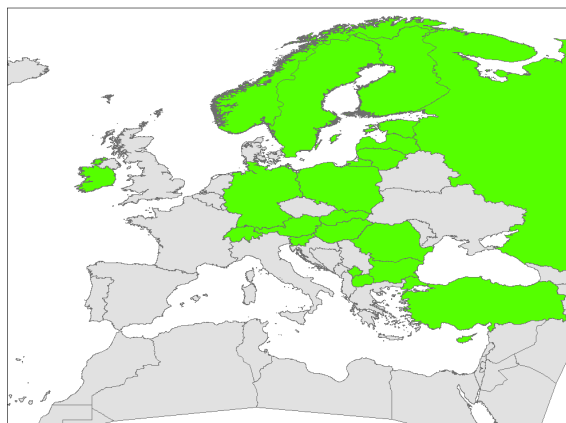
#### *Operations of mutual assistance*

2 CL-415 from France and another 2 from Spain participated in the suppression efforts to control the Lefkimmi – Evros fire which started at 24<sup>th</sup> August 2011.

*(Source: Ministry of Environment, Energy and Climatic Change. Special Secretariat of Forests. General Directorate for Development and Protection of Forests and Natural Environment, Greece)*

## 2.2 OTHER EUROPEAN COUNTRIES

This section presents data from the other countries (excluding the 5 Southern States as presented in the previous chapter).



### 2.2.1 Austria

#### *Fire danger in the 2011 season*

In Austria there were several days with a high level of forest fire danger. But the period was only one or two weeks. The number of fires has increased in relation to 2010.

#### *Fire occurrence and affected surfaces*

The area of Austria is 83 858 sq km and it is divided into 9 provinces, 15 towns with separate charter, 84 administration districts, and 2 350 municipalities. There are 4 567 voluntary fire brigades and 6 professional fire brigades (Vienna, Graz, Linz, Salzburg, Innsbruck, Klagenfurt). On average there are 2 fire brigades per municipality and a total of around 290 000 fire-fighters. Fire-fighters can follow special courses for forest fire fighting, in particular for actions in the mountain areas, and some of them are specialized for working with helicopters and airplanes. The response time for fires on the plains and near villages (excluding mountain areas) is between 10 and 15 minutes leading to a very small burnt area per fire (e.g.: ~1 000 m<sup>2</sup>). Largest burnt area was about 4 ha on average. 8 fires burned more than 5 ha.

Table 13 shows the number of fires and burnt area in Austria in 2011, calculated by the Austrian federal fire brigade association based on the reports of the different fire brigades.

Table 13. Number of fires and burnt area in Austria in 2011

<i>Fire type</i>	<i>No. of Fires</i>	<i>Burnt area(ha)</i>
<i>Wildland fires</i>	762	34
<i>Forest fires</i>	356	78
<b>Total</b>	1118	112

#### *Fire fighting means and information campaigns*

An average of two fire departments per community is standard. They have no special equipment. In the districts there is special equipment in store; for example extinguishing containers for helicopters etc. In the Alps and other mountains they will be supported by helicopters from the army or private companies.

In 2011 there were no special information campaigns for forest fire danger.

#### *Fire prevention activities*

The risks for forest fires in Austria are not a particularly sensitive topic for the Austrian inhabitants. But in the last years there has been a change in this topic.

- The communities write more regulations on forest fire danger.
- TV and radio reports on current forest fire hazard in Austria. (for example based on EFFIS database)
- A working group of the ÖBFV (Österreichischer Bundesfeuerwehrverband) worked intensively with the issue of forest fire danger.
- ÖBFV is planning an EU module for forest fire fighting with helicopter support. We have special equipment for forest fires in the mountains.
- We have created a new database for the Austrian fire service in cooperation with the University for Agricultural Science in Vienna. This is a part of an interregio project "ALP FFIRS". This project is now closed and we will start in 2013 with the new database all over Austria.

#### *Injuries and loss of human lives*

In 2011 there were no deaths (either firefighters or civilians) during forest fires.

(Source: The Austrian Federal Fire Brigade Association, Austria)

2.2.2 Bulgaria

In 2011, according to the data of the Forest Service, 635 forest fires were reported, with a total burnt area of 10705 ha, of which 6883 were of forest land. The yearly trends since 1991 for the number of fires and burnt area in Bulgaria are shown in Figure 58.

There were two main peaks in activity; one in the Spring; in particular in March; and the other in Autumn with the greatest amount of damage occurring in September (Figure 16).

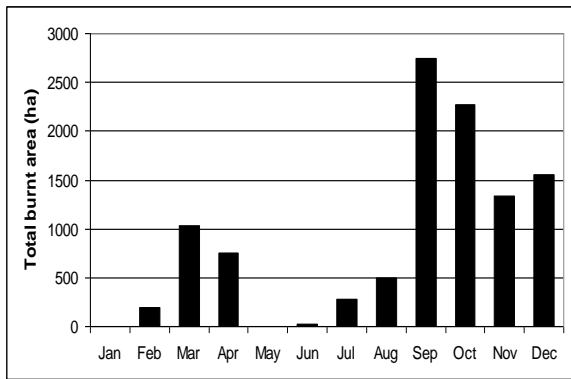


Figure 16. Numbers of fires by month in 2011

In 2011, two-thirds of the fires were caused by negligence (mostly through stubble or pasture burning: Figure 17).

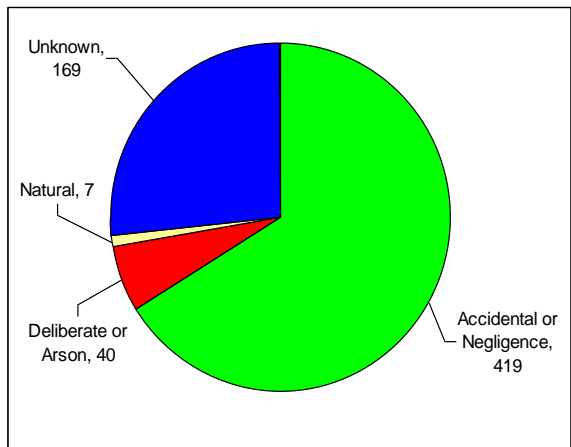
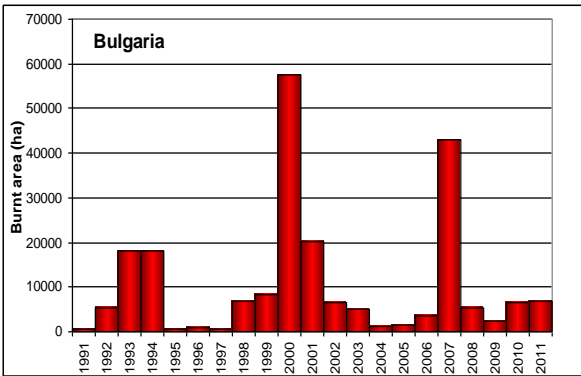
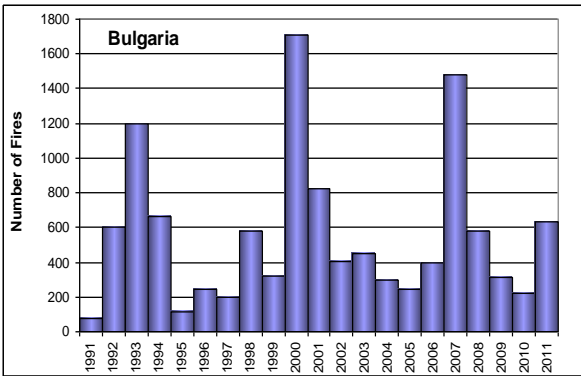


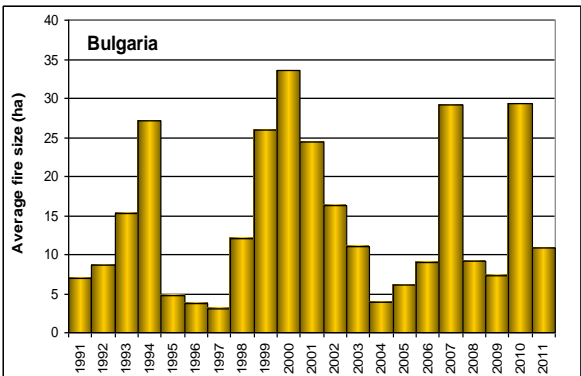
Figure 17. Causes of fires in Bulgaria in 2011



(a)



(b)



(c)

Figure 18. Burnt areas (a), number of fires (b) and average fire size (c) in Bulgaria from 1991 to 2011

(Source: Executive Forest Agency, Forest Fire Management, Bulgaria)



### 2.2.3 Cyprus

#### *Fire danger in the 2011 fire season*

The weather in Cyprus from January to May 2011 was relatively wet and warm, with periods of unstable weather conditions giving rain, isolated thundery showers and snow over the mountains. The fire danger during this period was generally low. During the summer of 2011, Cyprus suffered an intensive drought period with very limited precipitation during June and negligible precipitation during July and August. The mean air temperature during this period was about 1°C above normal. However, the summer of 2011 was milder and without the extreme temperature conditions that prevailed in the island during the summer of the year 2010. Fire danger was high throughout the summer period. During September and October 2011 the weather was warm but with unstable weather conditions during certain days, giving local showers and isolated thunderstorms, resulting in the reduction of the fire danger to low levels. In November and December 2011 the weather was wet and cold with local rain, isolated thunderstorms, hail and snow.

#### *Fire occurrence and affected surfaces*

Both the number of forest fires and the total burnt area during 2011 were lower compared to the year 2010. In 2011, a total number of 85 forest fires affected an area of 1599 ha, of which 1220 ha were forest and other wooded land. At a percentage of 47% of the total number of the fires, the burnt area was smaller than 1 ha. Moreover, 7 forest fires with burnt area larger than 50 ha, were recorded.

Table 14. Number of forest fires and burnt areas in Cyprus from 2005 to 2011

Year	Number of fires	Burned area (ha)		
		Total	Forest and other wooded land	Agriculture and other artificial land
2000	285	8 034	2 552	5 482
2001	299	4 830	778	4 052
2002	243	2 196	166	2 030
2003	427	2 349	921	1 428
2004	221	1 218	667	551
2005	185	1 838	962	876
2006	172	1 160	888	272
2007	111	4 483	3 704	779
2008	114	2 392	1 997	395
2009	91	885	460	425
2010	133	2 000	1 559	441
2011	85	1 599	1 220	379

The trends regarding both the number of fires and burnt areas over the last 11 years (2000-2011) are shown in Table 14 and Figure 19.

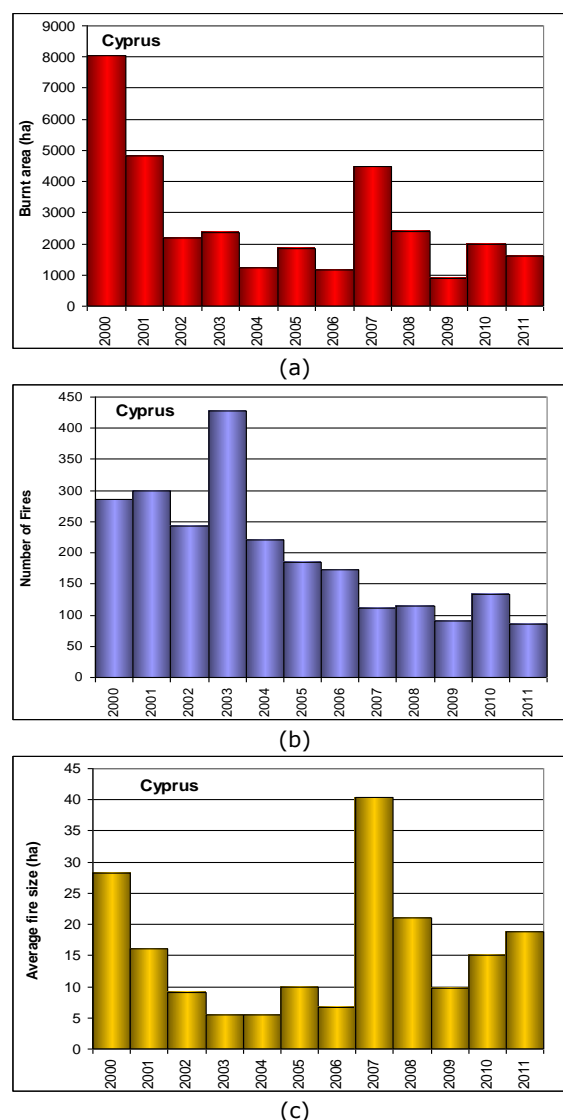


Figure 19. Burnt areas (a), number of fires (b) and average fire size (c) in Cyprus from 2000 to 2011.

#### *Fire Causes*

Regarding the causes of forest fires, 55% were caused accidentally or by negligence. Intentional fires (arson) corresponded to 32% and natural causes to 7%. Out of the total number of fires caused accidentally or by negligence, almost half of these fires (47%) were due to different agricultural activities, mostly related to burning grass-gorse or stubble.

#### *Injuries and loss of human lives*

One forest fire fighter was slightly injured during the suppression of a fire on the 20th of August 2011.

### *Fire fighting means and information campaigns*

Throughout the year and especially during the summer period, a campaign aiming to raise environmental awareness of the population was undertaken. Information was mostly given through television, radio and print media and through a number of presentations at schools and army camps. Moreover training programmes on fire prevention and suppression methods were organized for the members of the fire fighting ground forces, as well as for members of other governmental services, Non-Governmental Organizations (NGOs) and volunteer groups. For the detection of forest fires, 27 lookout stations and an automatic detection system were used. Forest fires were also detected by forest officers on patrol as well as by people living nearby or passing through forested areas. A number of 420 forest fire fighters were recruited during 2011 and were involved in forest fire detection and suppression efforts. In addition to a large number of fire engines and crawler tractors that were used for firefighting during 2011, the two fire fighting aeroplanes of the Department of Forests and the three leased fire fighting helicopters were also used in several fire fighting operations.

### *EU and other programmes*

#### *MED Protect – An integrated European Model to Protect Mediterranean forests from fire*

The project PROTECT – An Integrated European Model to Protect the Mediterranean Forests from Fire – is co-financed by the European Regional Development Fund (ERDF), in the framework of the MED Programme. The project comes from the necessity to wide spread an integrated model for the prevention of forest fires with focus on the protection of the environment and the promotion of a sustainable territorial development. The Province of Macerata in Italy is the lead partner of the project which includes 8 other partners comprising 5 territorial partners from Spain, Greece, Croatia, Portugal, Cyprus and 3 universities from Italy, Portugal and France. The project objectives are to develop shared methods and techniques to map, evaluate and monitor hazards, to develop an efficient and eco-compatible model for forest maintenance and valorisation of the biomasses coming from such forests and to carry out training and communication activities in order to develop a responsible behaviour of citizens and tourists in the areas under risk. On April 7th, 2011, the First European Dissemination Conference of the MED Protect project was

organized in Cyprus by the Department of Forests. Almost 80 delegates attended the conference, and all speakers stressed the importance of the Mediterranean forests and the need for their effective protection against fires.

#### *CALHAS - Development of an integrated analysis system for the effective fire conservancy of forests*

Cyprus also participates in the CALCHAS project, a forest monitoring project aiming at the protection of forests against fire. The innovation provided by this project is the use of a forest fire simulation tool which is capable of estimating the evolution of a wild forest fire. CALHAS project is co-financed by the European Programme LIFE+ (Environment policy and Governance). This tool can estimate the evolution of a fire by regarding as input parameters the ignition points, the actual environmental conditions, the vegetation of the area and spatial information (isocontours and ground elevation). This tool offers a platform for contingency planning, training of the authorities and taking prevention measures against fires. The expected results are the installation of a network of meteorological stations appropriately installed in 2 different forest areas, one in Greece and one in Cyprus, in order to feed the developed system with on-line data, and the development of an integrated analysis system for the effective fire conservancy of forests.

#### *FIREWATCH: G.I.S.-Assisted Wireless Sensor Networks for Forest Fires*

The project FIREWATCH is co-financed by the Cypriot Research Promotion Foundation (RPF) and the European Regional Development Fund in the thematic area of Sustainable Development Programme and aims to design and develop a ubiquitous fire detection and prediction system, based on state of the art technologies in Wireless Sensor Networks (WSNs), Geographical Information Systems (GIS), Terrain Analysis & Digital Terrain Modeling and Collaboration Systems. The use of FireWatch will enable real-time detection and prediction of forest fires at a high fidelity compared to traditional satellite and camera-based approaches. Additionally, the use of modern terrain analysis and geographical information will enable the involved authorities to take better course of actions in the case of fires (e.g., optimal navigation paths to fires) as well as save precious time by patrolling mainly the areas that are identified by FireWatch as high risk. Furthermore, via the geographical information analysis, authorities will also

know the real-time evolution of fires (i.e. fire spreading direction). FireWatch is scheduled to be deployed during 2012.

#### *Operations of mutual assistance*

There were no operations of mutual assistance during 2011.

(Source: Ministry of Agriculture, Natural Resources and Environment, Department of Forests, Cyprus).

## 2.2.4 Estonia

### *Fire occurrence and affected surfaces*

In 2011 a total number of 1396 forest fires and wildfires were recorded; 24 of these were classified as forest fires. Forest fires and wildfires destroyed 2 buildings. In 2010 there were recorded 1 737 forest fires and wildfires, 30 of these were classified as forest fires. Forest fires and wildfires destroyed 1 building.

Table 15. Forest fires in Estonia 2000-2010

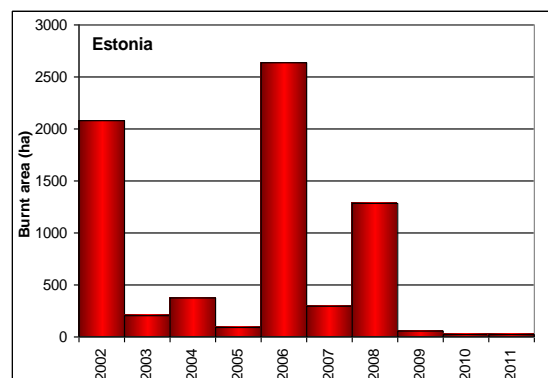
Year	Number	Burnt Area (ha)	Average area (ha)
2000	158	683.9	4.3
2001	91	61.8	0.7
2002	356	2081.7	5.9
2003	111	206.6	1.9
2004	89	378.9	4.3
2005	65	86.5	1.3
2006	250	3095.6	12.4
2007	64	292.4	4.6
2008	71	1279.8	18.0
2009	47	59.3	1.3
2010	30	24.7	0.8
2011	24	19.3	0.6

Forest fires in 2011 were recorded in 10 counties. The highest number of fires (8) was in Ida-Viru county. The first fire in 2011 was recorded in April, the last one in August. The largest fire of 2011 occurred in Juni in Harju county Kuusalu, burning an area of 5.0 ha.

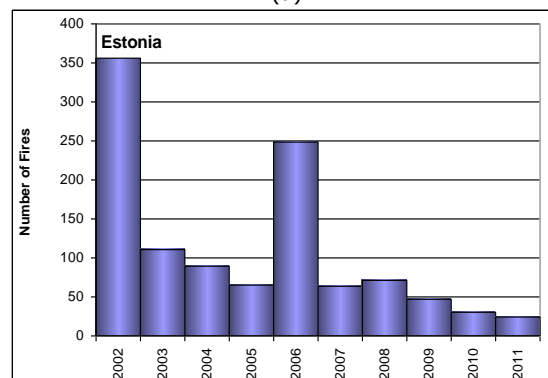
### *Fire fighting means and intervention campaigns*

The Estonian Rescue Board is responsible for fighting forest and wildfires. The Estonian Rescue Board cooperates in its operations with the Police and Border Guard Board, Estonian Defense Forces, Environmental Board, State Forest Management Centre, Private Forest Centre, Environmental Inspectorate and local governments.

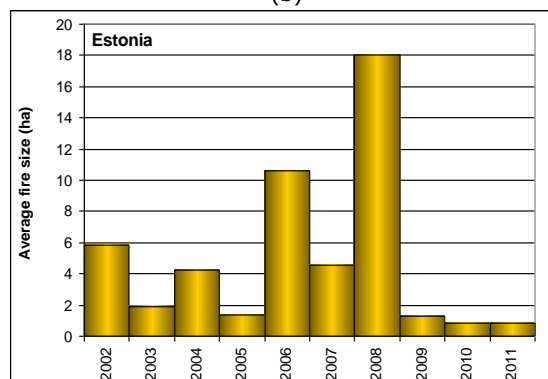
Regional cooperation training sessions in fighting forest fires and wildfires are held for institutions engaged in the process. Forest fires are evaluated as one of the largest emergency situation in Estonia. The burnt area, number of fires and average fire size for the years 2002 – 2011 are shown in Figure 20.



(a)



(b)



(c)

Figure 20. Burnt areas (a), number of fires (b) and average fire size (c) in Estonia from 2002 to 2011

### *Fire causes*

In 2011, 96 % of forest fires were of human direct or indirect origin. 75 % fires were caused by accident/negligence.

(Source: The Estonian Environment Information Centre, Ministry of the Environment, Estonia).

## 2.2.5 Finland

### *Fire danger in the 2011 fire season*

Based on information from the Finnish meteorological institute, the summer of 2011 was quite hot and dry in July, similar to conditions in 2010.

### *Fire occurrence and affected surfaces*

Forest fires for the year 2011 in Finland were at the normal and average level. The amount of wildfires was almost the same as in previous years. There were 2 770 wildfires in Finland last year, of which 1 215 were reported as forest fires. The total burnt area was 874 ha of which 580 ha was forest land. The average burnt forest area per fire was 0.48 ha. Burnt area, number of fires and average fire size are presented in Figure 21.

### *Fire fighting means and information campaigns*

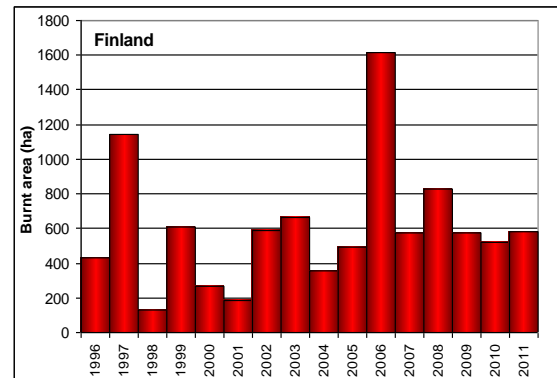
- Finnish military forces acquired some new NH 90 helicopters, which were available for extinguishing forest fires.
- We also started more initiatives for co-operations between other authorities such as the border guard.
- Training continued for the forest fire aerial officer.
- Instructions for extinguishing fires by helicopter were published.
- Development and integration between operative forest fire management system and prediction system for smoke spread.

### *Fire causes*

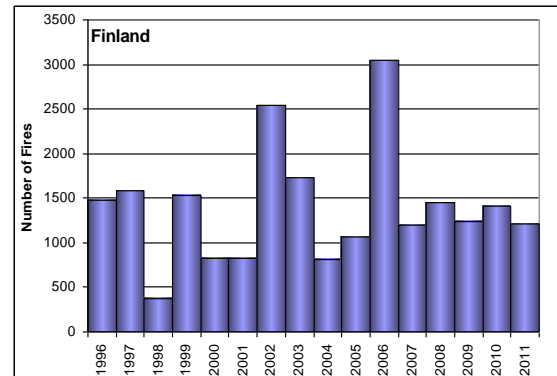
The most common causes of wildfires in 2011 were human actions (2 out of 3 fires), mainly by accident. The second most common cause was natural (12% of fires. In 2010, the fire cause could not be found for just over 10% of the fires.

### *Loss of human lives*

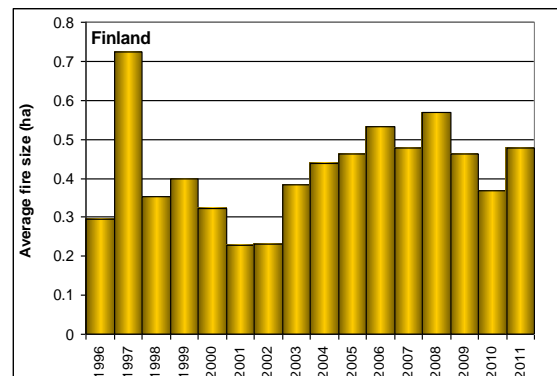
In Finland one person died in forest fires in 2011. Also 17 people were injured in different wildfires, resulting in minor burns. Some of the wildfires caused damage to buildings and also a few wildfires were caused by fires in buildings or vehicles.



(a)



(b)



(c)

Figure 21. Burnt areas (a), number of fires (b) and average fire size (c) in Finland from 1996 to 2011.

### *Fire prevention activities in 2011*

There was more cooperation with institutions such as the Finnish meteorological institute, for example projects for improving situation awareness. There was also cooperation with Russia in achieving containment of the forest fires since 2005.

### *Operations of mutual assistance*

Forest fire experts were sent to Russia. There was also other information sharing with the Russians.

(Source: Ministry of Interior, Finland)

## 2.2.6 FYROM

The Republic of Macedonia covers a total area of 25 713 km<sup>2</sup>, with 997 000 ha of forest land and 1 244 000 ha of agricultural land.

As a result of very specific natural and geographical features there are two climatic types that collide in Republic of Macedonia: Mediterranean and Continental, which results in cold and severe winters and hot and dry summers. The annual average air temperature is 11.3 degrees Celsius with average precipitation of 983.7 mm/m<sup>2</sup> and average sunshine period of 2450 hours per year.

### *Fire danger in the 2011 fire season*

The fire danger in the 2011 season in Macedonia was at a minimum level. The majority of fires occurred in the late spring and during the summer months.

### *Fire occurrence and affected surfaces*

During the year 2011 there were 2 883 fires, of which 523 were forest fires, affecting a total area of 36 034.78 ha. The forest land affected was 17 308.4 ha and 48 % of the total numbers of fires were forest fires.

The comparative charts for burnt area, number of fires and average fire size for the years 2007-2011 are shown in Figure 22.

The number of fires and burnt area according to types of fires for the year 2011 are shown in Figure 23.

### *Fire fighting means and information campaigns*

Fire prevention and fire fighting activities were undertaken along with public information campaigns. For the purpose of awareness

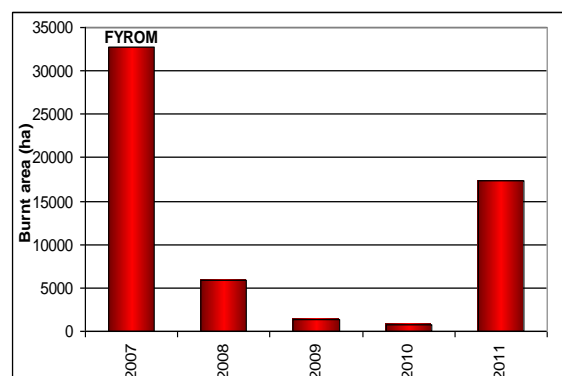
raising, media events such as press conferences, short reports and announcements on the TV and radio were organized.

Three planes of the Protection and rescue directorate were also engaged for fire extinguishing during the 2011 forest fires.

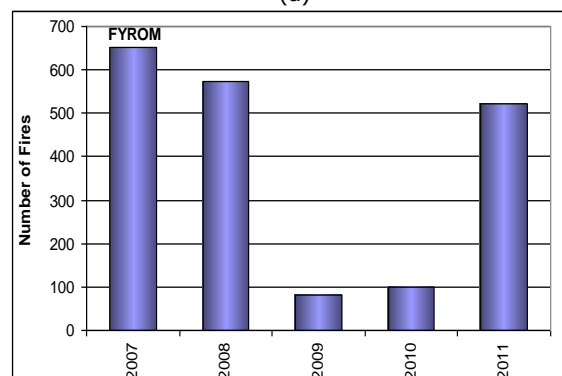
626 flights were made, lasting 250 hours and 45 minutes, during the period of time from July until September 2011.

### *Injuries and loss of human lives*

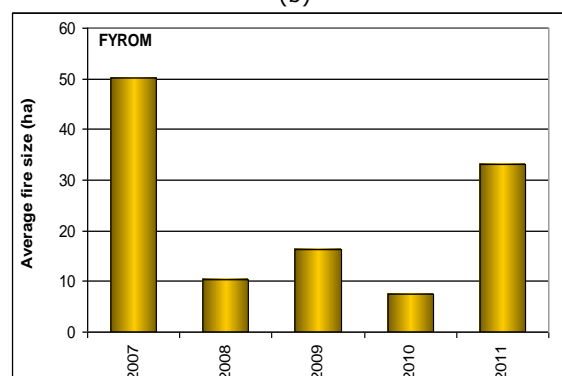
During the 2011 fire season there were 7 injured and no lost lives during rescuing and protecting from fires.



(a)



(b)



(c)

Figure 22. Burnt areas (a), number of fires (b) and average fire size (c) in FYROM from 2007 to 2011

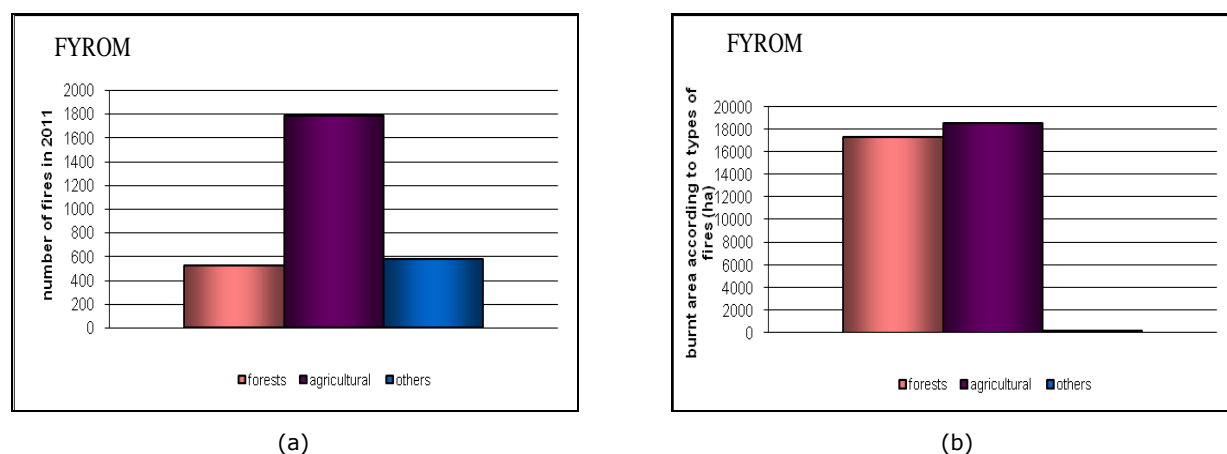


Figure 23. Number of fires (a) and burnt area (b) according to the type of fires in FYROM in 2011

(Source: Protection and rescue Directorate, Sector for analysis and research, FYROM)

## 2.2.7 Germany

### Fire occurrence and affected surfaces

A total of 888 forest fires were reported in Germany in 2011, corresponding to a burnt area of 214 ha (47.6 ha in deciduous forests and 166.4 ha in coniferous forests).

As in 2010, the most affected province (Land) in terms of burnt area was Brandenburg. However, in 2011 the average fire size was much smaller; 225 fires burnt 46.1 ha, much less than the 298.3 hectares that were burnt in a similar number of fires (253) in 2010. Bayern was the second most affected province, with a total of 82 ignitions and 42.4 ha of burnt area (Table 16).

Table 16. Burnt area in total and by forest type, and total number of fires, Federal Republic of Germany, 2011

	Burnt area (ha)			Number of fires
	Coniferous forest	Broadleaves forest	Total	
Baden-Württemberg	3.8	2.6	6.4	44
Bayern	38.2	4.2	42.4	82
Berlin	0.0	0.0	0.0	0
Brandenburg	43.8	2.3	46.1	225
Bremen	0.0	0.0	0.0	0
Hamburg	0.0	0.0	0.0	0
Hessen	4.1	10.1	14.2	46
Mecklenburg-Vorpommern	11.5	0.6	12.0	34
Niedersachsen	25.9	2.2	28.1	132
Nordrhein-Westfalen	10.9	6.3	17.2	56
Rheinland-Pfalz	3.2	3.4	6.6	67
Saarland	0.0	0.0	0.0	0
Sachsen	9.7	4.3	14.0	100
Sachsen-Anhalt	12.3	8.6	20.9	72
Schleswig-Holstein	0.2	1.0	1.2	5
Thüringen	2.8	2.0	4.8	25
<b>Germany</b>	<b>166.4</b>	<b>47.6</b>	<b>214.0</b>	<b>888</b>

In 2011 the majority of fires occurred in May (345 ignitions, 67.7 ha burnt; Figure 24).

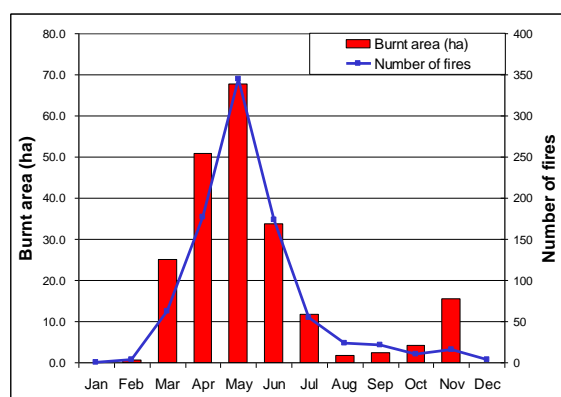


Figure 24. Number of fires and burnt area by month in Germany in 2011

The trend of the burnt areas, number of fires and average fire size in Germany for the years 1991-2011 are shown in Figure 26.

#### *Fire causes and impacts*

The main causes of forest fires during 2011 are shown in Figure 25. Within the category of negligence fires, the majority (122) were caused by the general public (campers, visitors, children etc.).

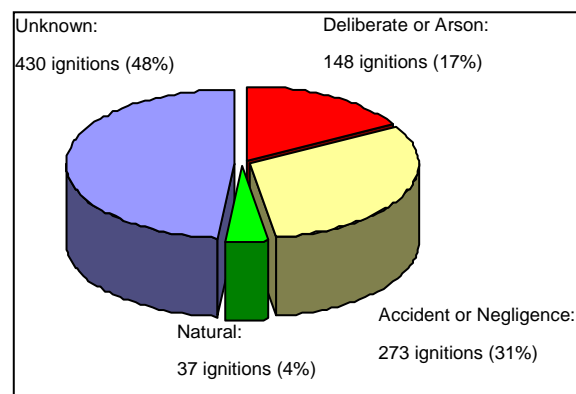
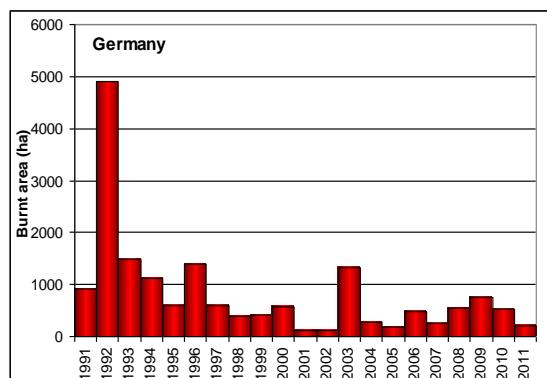
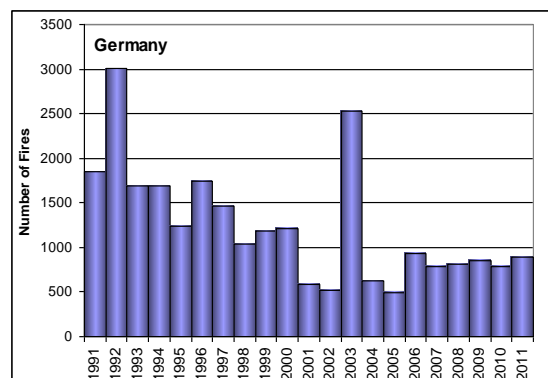


Figure 25. Causes of forest fires in 2011

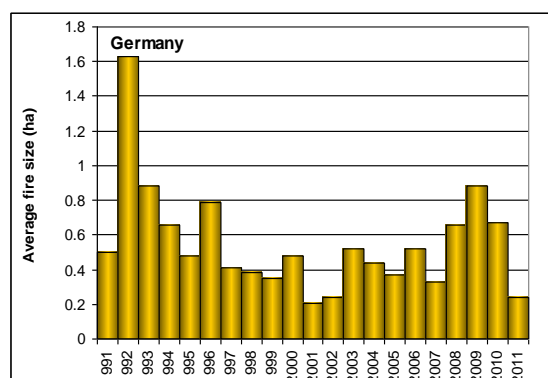
The economic damage caused by forest fires in 2011 is estimated to be 0.9 million Euro, a small decrease from the 1.2 million reported in 2010. The yearly average from 1991 to 2011 is 2.1 million Euro. In 2011, approximately 2.1 million Euro were spent on prevention measures and surveillance activities.



(a)



(b)



(c)

Figure 26. Burnt areas (a), number of fires (b) and average fire size (c) in Germany from 1991 to 2011.

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

## 2.2.8 Hungary

### *Fire danger in the 2011 fire season*

FWI values were reported throughout the vegetation period. In 2011, the annual rainfall was significantly less than in the previous years.

In April, the fire danger started to rise but it did not reach the "very high" level during the year. There were only some short periods (days) when the FWI values reached the "very high" level. A total fire ban was ordered on two occasions by the Forestry Directorate last year, when lighting any fire was prohibited outdoors.

Although the fire dangerous period was forecast from April, there were several fire events in the north part of Hungary from the beginning of March.

Table 20 below shows that 15-20% of the vegetation fires are forest fires in annual average in Hungary.

### *Fire occurrence and affected surfaces*

Fire databases between Forestry Directorate and Fire Service were linked in 2010. Thus the Forestry Directorate could receive day-to-day fire reports.

Data about forest fires are prepared by GIS analyses using fire data from linked database, so we could detect more forest fires than in previous years. Much of the sharp rise in the number of fires shown in Figure 31 is therefore due to the improvement in reporting.

Table 17. Number of fires and burnt areas

Year	Total number of wildfires	Forest fires		Other land types
		Number	Burnt area (ha)	Number
<b>2007</b>	6 691	603	4 636	6 088
<b>2008</b>	6 639	502	2 404	6 137
<b>2009</b>	8 658	608	6 463	8 050
<b>2010</b>	3 120	109	878	3 011
<b>2011*</b>	8 436	2 021	8 055	6 415

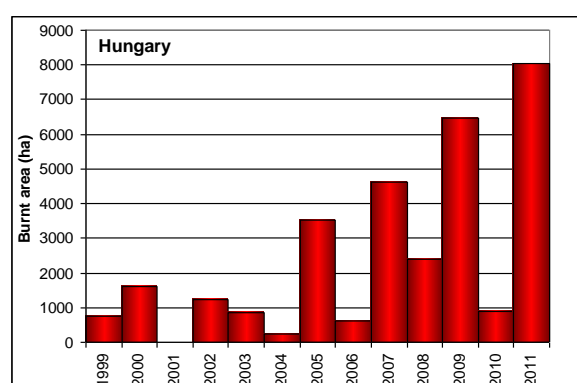
*\*Database linking between Forestry Directorate and Fire Service*

Two-thirds of the burned areas are short grass vegetations burned by the forest fire, as shown in Table 18 below. The numbers of forest fires are in close connection with vegetation fires in agricultural areas. The causes of fire are often poorly handled wasteland or grass fires spreading to the forest, or bad handling during slash burning in the intensively managed forests.

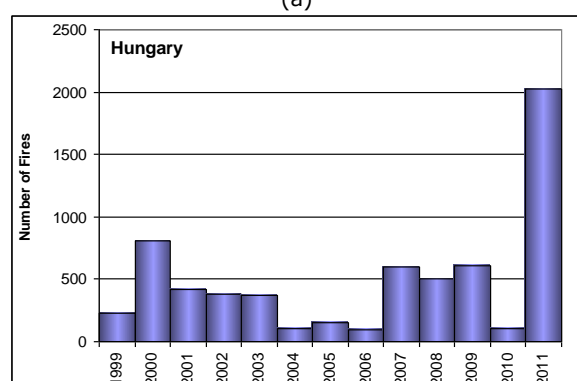
Table 18. Burnt area in 2011 by land type

Burnt fuel types in forest fires	Total burnt area (ha)
Forested land	<b>1 189</b>
Other wooded land	<b>1 721</b>
Other land	<b>5 146</b>
<b>Total</b>	<b>8 055</b>

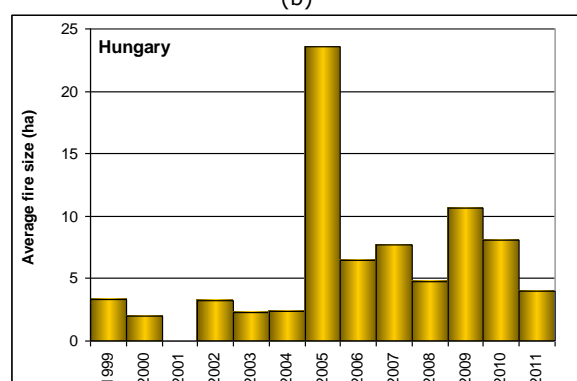
The yearly trends in terms of number of fires and burnt area during the last 13 years in Hungary are shown in Figure 27.



(a)



(b)



(c)

Figure 27. Burnt areas (a), number of fires (b) and average fire size (c) in Hungary from 1999 to 2011.

The data of 2011 demonstrate the trend that there are two separate forest fire danger periods in Hungary. Between 2002 and 2011, most forest fires occurred in February-April and July-August. In 2011, the interval between March and May was the most critical. 54% of fires were started in this part of the year (Figure 28).



Most fire events in spring started in Northern Hungary. The number of non-forest fires is also very high. One third of vegetation fires start in this region. A total of 1 189 hectares of forest was burned or affected by fire during 2011. Further, more than 1 721 hectares of grass vegetation and more than 5 100 hectares of bush vegetation were destroyed in forest fires.

Fires in Hungary can be classified into two categories. Fires smaller than 5 ha (fires in afforestation, surface fires) are in the first category, while crown fires and bigger surface fires are in the second one. The sizes of forest fires in 2011, excluding some special fire events, were not bigger than 2-5 hectares and two-thirds of fires were smaller than one hectare.

The fires are detected early so that the fire service can start the fire-fight quickly. These are usually low-intensity surface fires where dry grass and small branches are burning.

Nearly 95% of fires are between 1-50 hectares. The cause of human-induced fires is usually negligence. Fires above 100 hectares occur very rarely in Hungary. There were only 27 cases of such fires in 2011.

Ground fires are not significant. 97% of the forest fires registered in 2011 were surface fires. This is the most common type of fires in Hungarian forests. This means more than 90% of the affected area. There were only 15 crown fires which affected 125 hectares forest stands.

#### *Fire causes*

95 % of fires are human-induced. Most fires are induced by (adults' and infants') negligence, and only a small proportion of fires are caused by arsonists. Typical forest fire causes are incorrectly extinguished fires of hikers, and illicit agricultural fires. Natural cause is not relevant in Hungarian forest stands. The majority of the total burned area was the result of incorrectly extinguished fires. There are a lot of fires with unknown causes. The cause of the fire is not verifiable directly in many cases. The Hungarian fire investigators register them as "unknown" if the circumstances of the forest fires are undetermined.

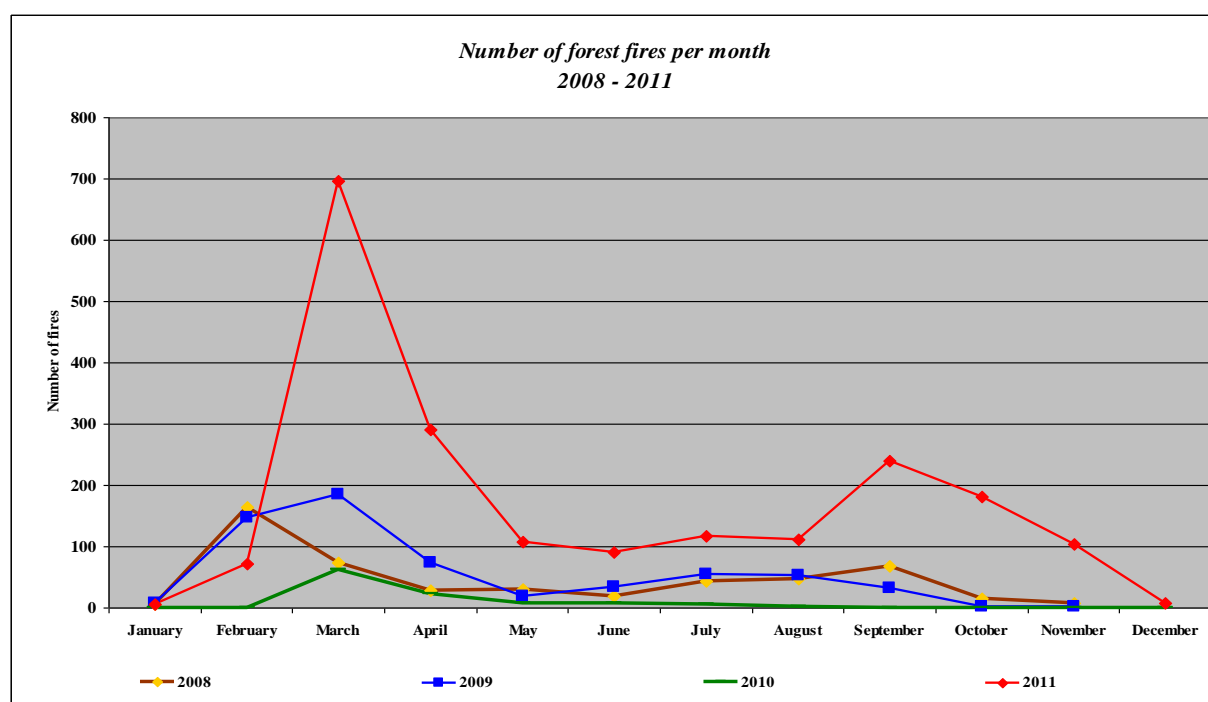


Figure 28. Forest fires by month 2008-2011

### *Fire fighting means*

On average, fires were extinguished less than an hour after the alarm was raised. Fire service arrived at the fire in 30 minutes on average. Small fires are extinguished in half an hour.

### *Fire prevention activities and fire campaigns*

Cooperation agreement was renewed between the authorities about fire prevention activities. In the framework of the new agreement, special forest maps were developed for fire fighters and some new rules have come into force for the fire prevention system.

The use of the FWI was integrated into the fire ban system in 2011. Its values were taken into consideration during the whole fire season.

Fire prevention and fire fighting activities were presented very well by spokesmen of Fire Service and forest authority and by media in the frame of awareness-raising campaigns in the last fire season. Media events such as a press conferences, short reports and announcements in newspapers and on the radio and TV were organised accordingly. Supplying data from fire database to forest owners, managers and to media is a daily task.

Expert presentations and demonstrations about forest fire prevention and suppression were organised by FD for fire management and forest managers. The webpage of Forestry Directorate is continuously updated with fire prevention information. There was a flyer issued about fire prevention activities for managers and fire fighters, which can be downloaded from the FD webpage.

The forest authority and Disaster Recovery Directorates jointly controlled the forest areas where the forest managers had to make forest fire protection plans in 2011.

### *Injuries and loss of human lives*

There were no casualties either among fire fighters or civilians during fire fighting in 2011. Fire service equipment was not heavily damaged. There were no deaths or personal injuries during fire fighting in 2011.

*(Source: Central Agricultural Office, Forestry Directorate, Hungary)*

## **2.2.9 Ireland**

### *Introduction*

Despite a long standing reputation for generally mild and moist weather, problems with fire are not unknown in Irish forestry. Almost 11% of Ireland is under forest, and forestry plays an increasingly important role in the Irish economy. In 2010 2.88 million m<sup>3</sup> of timber was harvested, mainly for export. A national afforestation programme enables the planting of over 6 000 ha of new forest every year, and private plantations now account for over 50% of the national forest estate.

### *Wildfire patterns in Ireland*

Against the background of an expanding, and highly fragmented forest estate, the issue of fire is of increasing concern. Between 2000 and 2009, an average of 3 500 wildfire incidents were recorded annually by fire and rescue services in Ireland. Types of incidents ranged from small unattended outdoor fires to more serious extensive wildfires involving hundreds of hectares of upland vegetation. Forest losses associated with these fires are usually between 350 and 500 hectares destroyed annually, but may be in excess of 750 hectares in bad fire years where suitable weather conditions permit. Both 2010 and 2011 are considered to be catastrophic years for fire, by Irish standards, with over 1 500 hectares of forest lost in both years, although these damage levels and losses appear modest by European standards.

Ireland's fire season occurs much earlier than in Southern European conditions. Most incidents occur between March and June. Despite high annual rainfall levels, Spring weather patterns in Ireland regularly feature prolonged dry periods and dry easterly and northerly winds associated with Mid-Atlantic and Continental high pressure systems. Fires frequently occur even where quite low temperatures exist, and where humidity ratings exceed 50%. Where humidity ratings are lower, senescent upland vegetation (*Calluna*, *Ulex*, *Molinia*) can be induced to a highly flammable condition very rapidly, even within a few hours following rain. Due to a variety of demographic, physical and political factors, recent years have seen a reduction in livestock grazing levels and farming intensity in upland areas, with a resulting increase in fuel loads in hazardous vegetation. This situation has not been helped by the traditional approach to the use of prescribed burning in upland areas.

Most wildfire incidents have their origins in agricultural burning, traditionally associated with extensive grazing practices in upland areas and along the western coast of Ireland.

#### *Fire suppression and prevention capabilities prior to 2011*

Due to the relatively low level of forest fires experienced in Ireland, and the infrequency of very large scale events, specialised forest fire fighting units do not exist in Ireland. Fire fighting is carried out by local fire and rescue services operated by Local Authorities. Until recently, these services were mostly configured for dealing with urban and structural fire fighting. *Coillte Teoranta*, the Irish State forestry Board, have a well developed fire fighting capability within their own forest estate, and all field staff receive fire fighting training. Aerial firefighting capability is available and aviation contractors are retained throughout the year to provide firefighting services to *Coillte Teoranta*, as and when required. In contrast, the private forestry sector is very poorly equipped to deal with fire issues, in terms of planning, equipment and trained personnel.

The Irish Meteorological Service *Met Eireann* operates a Fire Weather warning system using the Canadian FWI model, and this system is used to define fire risk for use in activating public awareness and advertising measures by the Irish Forest Service, as well as alerting forest managers and owners as to the need for increased fire vigilance during peak danger periods.

Following on the severe fire season in 2010, a working group was established by the Irish Forest Service to investigate these concerns and make recommendations in terms of improvements. Short term measures included an increase in awareness activities and increased co-operation between Government Departments in relation to fire prevention activities.

#### *2011 fire season*

Over 1500 hectares of forest were destroyed in Ireland during 2011. Data regarding the number of incidents etc. is not currently available.

In both 2010 and 2011, the normal fire season followed an unprecedented and highly unusual period of extreme cold weather, where low temperatures induced a higher than normal level of hazard in fuels, not only in upland vegetation, but also in lowland pasture lands, not normally associated with fire activity.

Between May 1st and May 5th 2011, over 1 200 hectares of forest was destroyed in a spate of wildfires in the Northwest of Ireland, in counties Donegal, Mayo and Sligo-Leitrim. Strong easterly winds and low humidity created ideal conditions for fire spread, and large quantities of accumulated fuels in upland areas meant that fire spread was both rapid and intense. Local Fire and rescue services were almost overwhelmed and the Irish Defence Forces was deployed to assist in suppressing the fires. At one point a 20 km fire front existed and Army helicopters and private aviation contractors were deployed to attack fires in difficult upland terrain. Over 20 000 hectares of open upland terrain was damaged as a consequence. Four dwelling houses were destroyed.

Private forest holdings within the affected areas were highly vulnerable to fire given their smaller areas, and the younger age of trees and proximity to ladder fuels. 835 hectares of State owned forestry was destroyed, and over 700 hectares are thought to have been destroyed within the private sector.

EFFIS derived datasets and imagery were used for the first time in Ireland to rapidly determine the damaged area, and forest losses within this area. In contrast with Southern European fires most Irish fires are too small for MODIS detection; however a small number are detected annually. Historic EFFIS data was used to determine spatial and temporal patterns of fire activity, in order to focus fire prevention measures into critical high risk areas for the remainder of the fire season.

#### *Responses to the 2011 Fire Season*

- Following the severe fire incidents experienced in 2011, Irish Fire and rescue officers, and some forestry personnel have undertaken training in wildland fire management techniques, in conjunction with UK Fire authorities. At present over 60 Fire and Forestry officers have received this training.
- With the assistance of Washington State University, the Irish Forest Service conducted intensive consultation with upland farming representatives during August 2011 to ascertain the background to traditional burning activity and practice, and a general public consultation exercise was carried out with regard to draft prescribed fire guidelines. Responses from NGO's, farming and forestry interests and Fire and rescue services were received and evaluated.

- A Prescribed Burning Code of Practice was developed in Autumn 2011, for use within the farming, forestry and conservation sectors to guide the safer application of fire under Irish conditions. This code of practice will also form the basis for future training programmes related to fire in agriculture and forestry. The code is available at:  
*<http://www.agriculture.gov.ie/media/migration/forestry/landandforestfires/CofPPrescribedBurningFinal90212.pdf>*.
- 50 agricultural advisers, forestry extension officers, farmers and conservation officers received prescribed fire training as part of a pilot programme in December 2011. A wider training programme is being developed in conjunction with farming associations and local development interests for local delivery to farmers in areas where fire is used as part of normal farming activity.
- A major fire readiness exercise was held in February 2011. This event proved very useful in highlighting to Fire and Rescue authorities and forest managers the procedures and command structures in place within different agencies, and permitted smoother integration of resources later in the fire season. Further events of this type are envisaged.
- There is increased interest in the use of helicopters for fire fighting in difficult conditions. Training and awareness events have taken place aimed at increasing interoperability between fire authorities and the Irish Defence Forces and private aviation contractors.
- A greatly enhanced and coordinated public awareness campaign was implemented in 2012, and this campaign was focussed using EFFIS derived spatial data. Both EFFIS and FWI data are used to define fire danger and to guide the issuing of general fire warnings by the Forest Service. The graphical display used to present EFFIS data is thought to be more accessible to a wider user group than other warning models currently used; however locally derived Met Eireann FWI data remains the primary source of data for fire condition monitoring by the Forest Service. Farmers in receipt of commonage (extensive grazing) supports received direct communication from the Department of Agriculture Food and the Marine in relation to the responsible use of fire. A synopsis of the Prescribed Burning – Code of Practice Ireland was issued and Single Farm Payment Conditions and Penalties associated with burning were highlighted.
- Recognising the highly localised aspect of fire incidence, county-level Wildfire Interagency Groups have been established on a pilot basis in several high risk counties, mainly along the west coast of Ireland. These groups permit a high degree of cooperation and coordination of fire prevention and response activities between stage agencies and landowners in affected areas. Further groups are expected to be established during 2012.
- There is a wider recognition within the private forestry sector to develop integral fire prevention and suppression capabilities within private forestry. This issue is now the subject of an EU LIFE application currently prepared on behalf of the sector, and with the support of the State Agencies most concerned with this issue.
- Wild Fire incidence during the 2012 fire season shows a marked reduction over normal expected fire activity, despite extreme fire danger conditions in March.

#### *Injuries and loss of human lives*

No direct casualties occurred during 2011.

In 2010 one person was killed directly as a consequence of wildfire. It is thought that between 2000 and 2010, up to 10 people may have died in connection with outdoor fires, mainly as a result of cardiac arrest during agricultural burning activities.

The Forest Service of the Department of Agriculture, Food and the Marine wishes to express their gratitude to the JRC staff and EFFIS members who provided valuable assistance to the Irish Authorities both during and following the May Weekend fires of 2011.

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

## 2.2.10 Kosovo

### *Background: Forest resources*

Considering that the information on forests (mainly on trunks) was gathered in the period before and during the 1990s, and the planning done in the period before the war was done only for public lands, one of the most urgent identified actions was the validation of data and re-instatement of capacities for the development of an assessment on forest resources Kosovo wide; namely a Forest inventory. This type of information is crucial for strategic decisions, establishment of sector policies and for monitoring of forest trends. Considering these urgent requirements, during 2003–2004, a forest inventory was performed over the whole country. The main results and conclusions have provided the base for implementing strategy, and were elaborated and summarised as follows:

- 379 200 ha were classified as forest lands through the interpretation of aerial photos and surveys in the field. Another 85 600 ha were also classified as forest land through the interpretation of photos but there was no survey due to mines and other logistic obstacles. 278 880 ha out of the total area of the forest land (both surveyed and not surveyed) were classified as public forest lands and 185 920 ha as private forest lands. This total area figure (464 800 ha) is little bit higher (6-8%) compared to previous measurements.
- Deciduous forests comprise more than 90% of the forest lands. The dominant species of the deciduous forests are oak and beech. Coniferous forests cover 7 % of the forest land and there the dominant species are fir, spruce and pine;
- The total standing volume in public forests is estimated at 33.5 million m<sup>3</sup>. Of this volume, 25.9 million m<sup>3</sup> are trees with a stem diameter of >7 cm DBH. In private forests, the total standing volume is estimated at 19.5 million m<sup>3</sup> of which 14.5 million m<sup>3</sup> are trees with a DBH > 7 cm;
- Annual growth of trees in the surveyed areas and with a DBH of >7 cm, is calculated to be 1 165 million m<sup>3</sup>; for not surveyed areas (85 600 ha) that are mostly located close to mined areas or in unvisited parts, it seems reasonable not to include this increase in the bases for the annual growth of allowable annual cuts;

- A considerable area of the forest lands are bare lands (20 000-30 000 ha). Some of these areas are eroded and have a weak soil stratum, besides a weak fertility, but a considerable part is adequate for afforestation;

40% of public forest lands and 29% of private forest lands have been subject to uncontrolled or illegal activities of utilization. Comparing to all applicable standards, these figures are very high. The situation is very critical particularly in coniferous forests, where if immediate measures are not taken, the existence of wide forest areas will be endangered. The inventory results also confirm that the low forests, especially private ones, are subject to excessive utilization. The results also indicate that many new forests and those of middle age have an urgent need for managerial intervention, starting from cleanings/thinning to the commercial thinning.

### *Fire occurrence and affected surfaces*

After illegal logging, forest fires were in the past, and still are, one of the most pernicious of forest compounds by causing damages such as, economical, environmental, recreational, health, social, etc. In 90% of cases, the cause or incentive of forest fires is the human factor. In 10% the causes are natural (lightning).

In 2011, 1 629 hectares of forests were affected by fires. These fires were mainly superficial fires and the total area burnt was 2 324.63 ha, from 120 fires. The wood volume damaged by fires in 2011 was 31 155.07 m<sup>3</sup>, and the damage value was 1 878 112.19 Euro.

The most severe case in 2011 was in the region of Peja, forest management unit "Hajla". The forest comprised pine and fir species, the fire started on 12/09/2011 and finished on 17/09/2011. The fire damages were 9 440.00 m<sup>3</sup>, with a cost of 670 240 00 euro. Participants in fire fighting/extinguishing were employees from Kosovo Forest Agency, fire-fighters, Ministry of Agriculture and Rural Development, with all the operational mechanism that is generally mobilised for prevention of fires.

The MAFRD officials say that there is a big risk in agricultural lands after harvesting, because fires may occur due to human carelessness, and are impacted by the high temperatures and hot winds. Therefore, the ministry has decided to approve an operational plan for protection of forests in Kosovo and a special care in protection from fires and other causes that damage the forests.

The Ministry of Agriculture, Forestry and Rural Development – Kosovo Forest Agency, has experience from 2007, where thousands of hectares were involved in fires. Fortunately, in 2011 there were fewer forest fires; nevertheless the risk is permanent when we consider the temperatures that are present during the summer season.

Kosovo Forest Agency, within its capacities and responsibilities, has performed required activities in this direction. Plans have been developed for protection from fires, including awareness campaigns with brochures, television spots, different notifications, mobilization of staff, identification of places with a potential risk, determination of observation points, identification and preparation of water sources, opening of protection fire breaks, etc.

Regarding cooperation with other institutions, Kosovo Forest Agency has had continuous cooperation with the Emergency Department, Situation centre within the office of Prime minister, where under the patronage of the prime minister an awareness campaign was conducted in this direction. There has also been cooperation with other bodies such as KFOR, etc.

The vigilance and care of each resident, and not burning of agriculture remains and fences by the farmers, are necessary for prevention of distribution of fires. Appeal is made to each citizen, wherever they are, to be careful in any actions they do in or close to the, because a small careless act on their part can cause significant damages.

Table 19. Forest fires by region

<i>Region</i>	<i>Burnt area (ha)</i>	<i>Number of fires</i>	<i>Cost €</i>	<i>Fire damage in m<sup>3</sup></i>
<b>Pristina</b>	529.68	16	990 805	75 286
<b>Mitrovica</b>	386.00	20	30 350	-
<b>Peja</b>	190	11	1 292 756	11 646
<b>Prizreni</b>	554.1	n/a	231 705	-
<b>Ferizaj</b>	271.96	17	1 961	218
<b>Gjilan</b>	494.3	65	-	-
<b>Total</b>	2040.04	129	2 517 227	87 150

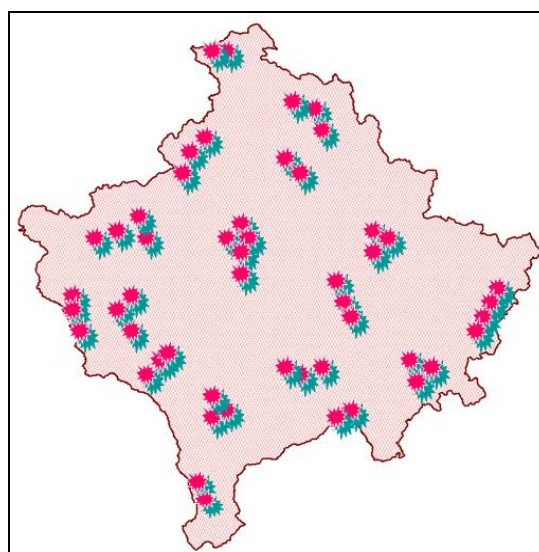


Figure 29. Regions with a high potential risk from fires

(Source: Kosovo Forest Agency, Kosovo)

## 2.2.11 Latvia

### *Fire danger in the 2011 fire season*

In 2011 the forest flammable period was set from April 28 and continued until September 15.

### *Fire occurrence and affected surfaces*

In total, 360 forest fires were discovered and extinguished in 2011, during which 115 hectares were burnt. Of these, 37 hectares of forest, 49 hectares of young stands and 29 hectares of other wooded land were affected.

Table 20 shows the distribution of numbers of fires and burnt areas by month during the fire season, and Figure 30 shows the locations of the fires in 2011.

In 92 % of cases the fires were detected and put out before the burned area had reached 1 hectare.

Traditionally, the highest number of forest fires was in the vicinity of the two biggest cities in Latvia – Riga and Daugavpils (85 fires, 36.7 ha affected area, and 142 fires, 15.6 ha, respectively).

Table 20. Number of fires and burnt areas by month

Month	Number of forest fires	Burnt area (ha)
April	62	44.9
May	89	37
June	122	12
July	59	8
August	20	12
September	4	0.9
October	3	0.1
November	1	0.1
<b>Total</b>	<b>360</b>	<b>115</b>

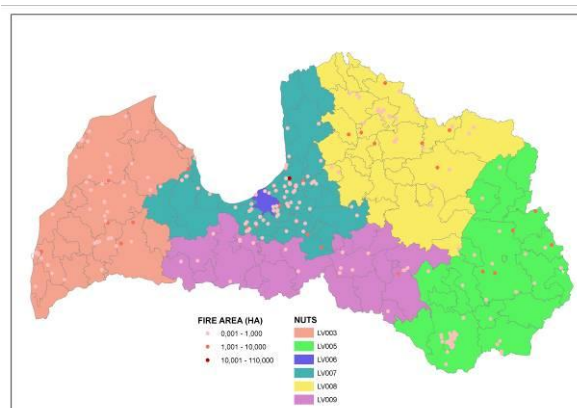
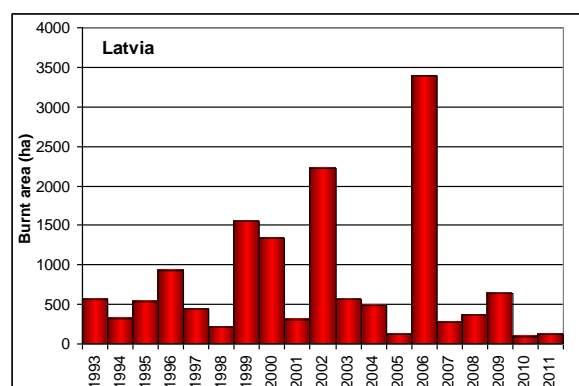
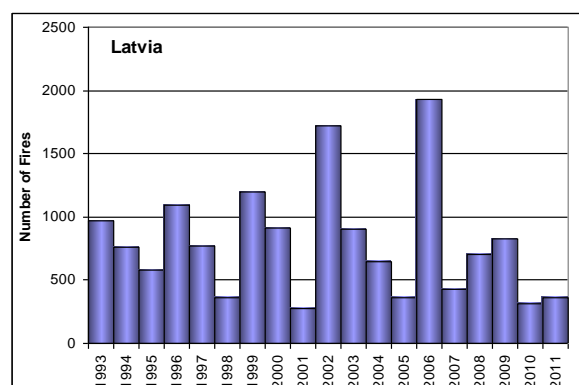


Figure 30. Map of forest fire locations in Latvia in 2011

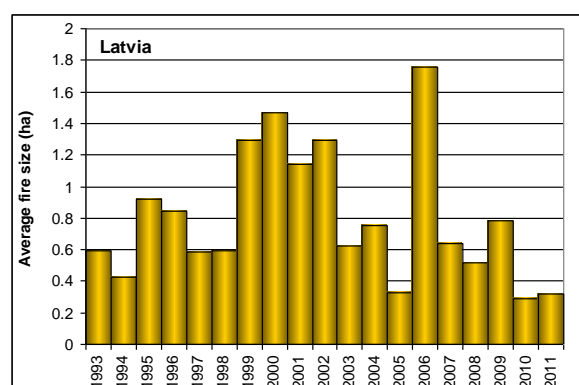
The yearly trends in terms of number of fires and burnt area during the last 19 years in Latvia are shown in Figure 31.



(a)



(b)



(c)

Figure 31. Burnt areas (a), number of fires (b) and average fire size (c) in Latvia from 1993 to 2011.



### Preventive measures

Under the acts of law, fire prevention measures are imposed on forest owners (managers). In 2011 joint stock Company "Latvian state forests" which manages state-owned forests (1.59 million hectares) spent 50178 LVL on fire preventive measures, and Ltd. company "Riga city forest" which manages forests belonging to Riga municipality (66.5 thousand hectares) spent 6087 LVL. (Table 21).

Table 21: Expenditure on fire prevention measures in Latvia in 2011

<i>Title</i>	<i>Costs, LVL</i>
<i>Latvian State forest</i>	
Creating new fire breaks, 18km	1186
Existing fire break cultivation, 3590km	46821
Water point, warning sign renovation	2171
<b>Total</b>	<b>50178</b>
<i>Riga City Forest</i>	
Existing fire break cultivation, 504km	6087
<b>Total</b>	<b>56265</b>

In 2011 the State forest service bought 10 new MB Unimog U4000 firetrucks and 23 Toyota Hilux jeeps (equipped with Fireco 400l water tank and high pressure water pumps).



(Source: State Forest Service, Forest Fire Control Unit, Latvia)

## 2.2.12 Lithuania

### Fire danger in the 2011 fire season

Forest fires during the year 2011 in Lithuania settled at a low level. The amount of wildfires was very low and the total burnt area was almost the same as the long term average. The number of fires was influenced substantially by the weather conditions in spring and summer.

### Fire occurrence and affected surfaces

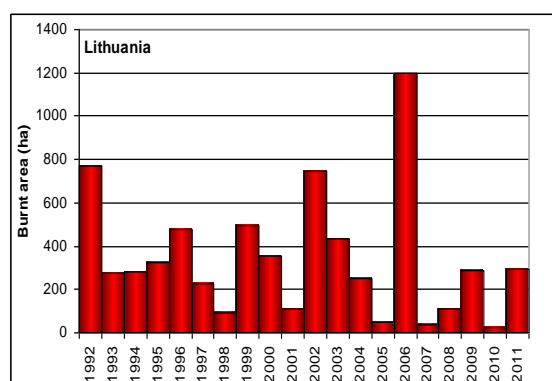
In 2011, according to the data of the Directorate General of State Forests, 142 forest fires occurred and damaged 293 ha of forest.

The average fire area in 2011 had increased dramatically because of 1 forest fire in Šilutė state forest enterprise in 06/06/2011 (nearby Traksėdžiai peat bog 268 ha of forest land was burnt, mainly peat land). All other fires were less than 2 ha. Most of the fires (55 %) were in April. The total damage was estimated to be 20 000 euro. The yearly trends in terms of number of fires and burnt area during the last 20 years in Lithuania are shown in Figure 32.

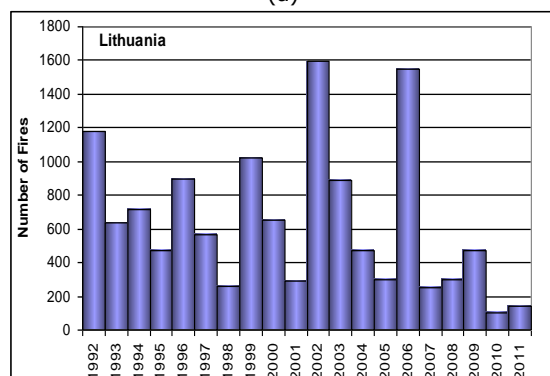
### Fire fighting means and information campaigns

As part of the process of implementing the State forest fire program approved by the Minister of Environment and developing a forest fire monitoring system, the Directorate General of State Forests organized the implementation of the Single automatic forest fire monitoring system in Lithuania. It has been acknowledged that it is useful to use automatic above-ground forest fire monitoring systems these days in Lithuania. These systems enable us to ascertain the exact primary forest fire ignition location and organise forest fire extinction efficiently. According to the measure 'Regeneration of the forestry and the implementation of preventive measures' of The Rural Development Program in Lithuania in 2007-2013, forest enterprises in territories where the forests are of the first and second fire risk levels have an opportunity to receive EU support for purchasing and installing automatic above-ground forest fire monitoring systems.

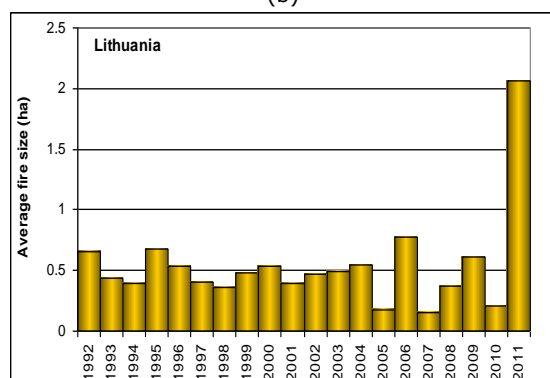




(a)



(b)



(c)

Figure 32. Burnt areas (a), number of fires (b) and average fire size (c) in Lithuania from 1992 to 2011.

In 2008 the Directorate General of State Forests organized the preparation of a study concerning forest fire detection systems in Lithuania. On the basis of this study, the technical work group analyzed the situation and recommended to implement above-ground automatic forest fire detection systems in Lithuania's forests. The technical work group recommended the detectors to be installed on the towers of mobile operators, because they are higher and have electrical connections and safety systems. The system consists of detectors, communication equipment and a central stand. The detector consists of a turn mechanism and camera with special optical sensor, which is sensitive for smoke and flame (Figure 33).



Figure 33. Automatic forest fire detector

The sensor is able to scan about 700 km<sup>2</sup> territory (camera turns around in 8 minute periods) and to detect smoke of size 10m x 10m in a distance of 10 km from the tower (40 km in good weather conditions). Forest fire detection systems will be installed in 24 state forest enterprises and in Kuršių nerija national park, whose forest plots are rate as high (1st) and middle (2nd) for forest fire risk. Installation will be performed on 84 towers of mobile operators and state forest enterprises (total 25 central stands and 84 detectors). Forest fire detection systems should help to detect the exact location of the forest fire with better precision, helping the fire brigades to arrive at the fire faster and extinguish the fire more efficiently.

#### *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 2011.

(Source: Forest department, Ministry of Environment of Lithuania)

### 2.2.13 Norway

#### *Fire danger in the 2011 season*

Fire danger in Norway varies from north to south since the country is 1 750 km long and there may be high forest fire index in an area and little or no fire risk in other areas at the same time. Normally the fire season starts in the south-west in March-April. 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 forests are in the eastern part of Norway. The fire season 2011 started as usual, but from the middle of May it started to rain and the Forest Fire Index was relatively small for the summer and autumn.

#### *Fire occurrence and affected surfaces*

In 2011 there were only registered 45 fires from the Norwegian Fire Services, 47 ha of forest land and 72 ha of other wooded land (wildland).

There is probably an under-reporting caused by the new reporting system in the Directorate for Civil Protection and Emergency Planning.

The largest fire was in Flekkefjord and was almost 300 ha.

Figure 34 shows the registered burnt area and number of fires between 2002 and 2011.

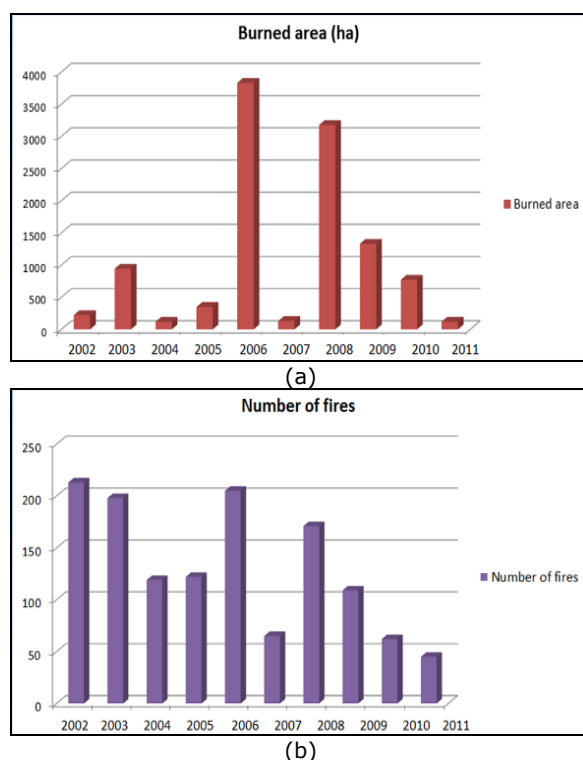


Figure 34. Burnt areas (a) and number of fires (b) in Norway from 2002 to 2011

#### *Fire fighting means and information campaigns*

The Directorate for Civil Protection and Emergency Planning has an agreement with a private helicopter company for a Bell 214 with a 3000 litres bucket. This helicopter is available for the Fire Services in the period from 15th April to 15th September (24/7). In dry periods preparedness can be increased by involving more helicopters.

The helicopter was in use for 6 fires, with 81 hours flying time and drop of 1 500 tonnes of water. The helicopter had a cost approximately €1 000 000.



Photo: Nils-Erik Haagenrud

The Directorate for Civil Protection and Emergency Planning has established an expert team that supports the local fire chief officer when they have large fires (when the helicopter is used).

The Norwegian fire service 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.



Exercise 2011. Photo: Dag Botnen

### Fire prevention activities

2011 was the warmest and wettest year recorded over the past 100 years in Norway. There was a short period in April to May where the forest fire index rose to a high level, mainly in the southern part of Norway.

The municipalities are responsible for the Fire Services in Norway and the Fire Service is responsible for prevention and action regarding forest fires. Still, some activities are assigned to Governmental Authorities.

The Fire Services are responsible for the following activities:

- Monitoring the forest by air (plane).
- Information campaigns
- Prohibit fire dangerous activities when there is a high Fire Index
- The Governmental Authorities are responsible for the following activities:
- Provide information on forest fire index through the internet (The Norwegian Meteorological Institute).
- Provide information through television (Forecast) when the forest fire index is high (The Norwegian Meteorological Institute).
- General prohibition on lighting fires in the forest or wildland in the period from 15th April to 15th September, regulated by law. (The Directorate for Civil Protection and Emergency Planning).

### Injuries and loss of human lives

No human lives are lost in fires related to Forest Fires for 2011.

### Operations of mutual assistance

There were no operations of mutual assistance in 2011.

(Source: Directorate for Civil Protection and Emergency Planning (DSB), Norway)

## 2.2.14 Poland

### Fire danger in the 2011 fire season

The seasonal nature of the occurrence of fires is strictly related to the weather conditions. The diagrams (Figure 35-Figure 39) show the variations of air temperatures, precipitation, pine (*Pinus sylvestris* L.) litter moisture, relative air humidity and the national degree of forest fire danger risk (NDFDR) in the 2011 fire season. They also present the number of fire outbreaks.

The mean monthly air temperatures were higher (by about 1 °C) than the long-term mean values in the entire country. In April, temperatures at 9 a.m. oscillated around 10°C, and reached 15°C in the second part of the month. At 1 p.m. the air temperature oscillated around 12 °C, and in the later part of the month increased to 20 °C. In May the air temperature at 9 a.m. increased by 4 °C (to 16.3), and at 1 p.m. it was around 21°C. The highest air temperatures were in June, and reached 20.8 °C at 9 a.m. and 24.9 °C at 1 p.m. In July the air temperature decreased to 19.1 °C in the morning hours and 22.4 °C at 1 p.m. In August the temperature at 1 p.m. increased to the level seen in June; however the mornings were cooler than in June and amounted to 19.7°C. The next decrease of temperature appeared in September to the level 14.9°C in the morning and 21.2°C at 1 p.m.

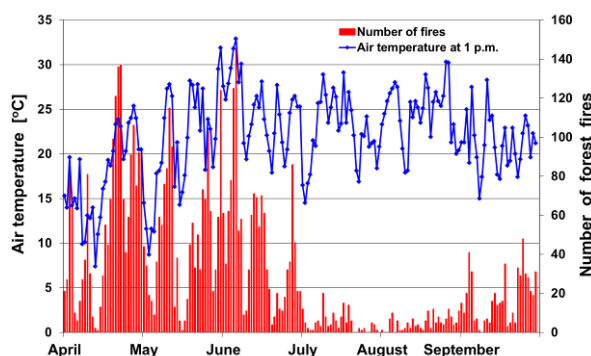


Figure 35. Air temperatures and numbers of forest fires in fire season 2011

The precipitation levels during the fire season in 2011 varied both in terms of the occurrence of precipitation events in time and their geographical distribution. In the first three months of the fire season it rained every day, but the amounts of rainfall were not large. In April there were 26 days with less than 2 mm rainfall; in May and June it rained 20 days every month. The average daily precipitation in April was 1.1 mm, in May a little more (1.5 mm) and in June it increased to 1.8 mm. The most abundant

rainfall appeared in July and reached 6.4 mm daily. In August rainfall decreased to 2.3 mm daily, and in September the average daily precipitation was only 1.1 mm.

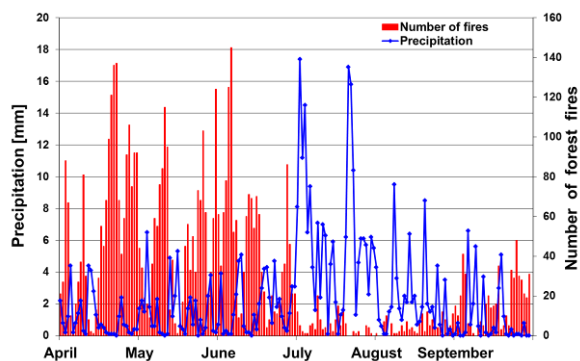


Figure 36. Precipitation and numbers of forest fires in fire season 2011

The mean litter moisture values at the national scale varied between 10% and 58%. Through the second half of April, all of May and July the litter moisture was found to be below thresholds of fire-safety. The litter moisture at 9 a.m. averaged 28% in April and May and 27% in June; however at 1 p.m. it was 23% in April and 22% in May and June. In July the litter moisture was the highest in the fire season: 43% at 9 a.m. and 38% at 1 p.m. Then the litter moisture decreased, reaching 34% at 9 a.m. in August and 30% in September, while at 1 p.m. it was measured at 28% and 25% respectively.

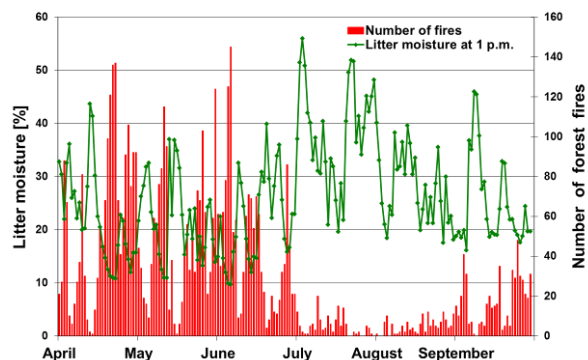


Figure 37. Litter moisture and numbers of forest fires in fire season 2011

Relative air humidity was also found below thresholds of fire-safety in the second half of April and May, for both of the daily observation times. In comparison with April, relative air humidity in May decreased from 69% to 65% and was 66% in June at 9 a.m. At 1 p.m. values ranged from 48% in April to 47% in May, then in June increased to 50%. Relative air humidity increased in July: at 9 a.m. it was 83%, in August 78% and in September it reached 86%. However values at 1 p.m. were 69% in July, 57% in August and 59% in September.

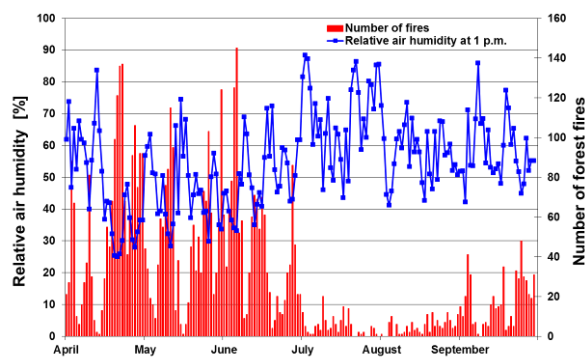


Figure 38. Relative air humidity and numbers of forest fires in fire season 2011

The highest forest fire danger occurred in May, June and April. April was a month with raised forest fire danger risk (NDFDR = 1.9). In May and June the forest fire danger increased at 9 a.m. to a level of 2.0. The lowest forest fire danger was in July (value of NDFDR decreased to 1.0 at 9 a.m. and 0.8 at 1 p.m.) and a little higher in August (NDFDR = 1.4 in both observation times). Forest fire danger was also raised in September at 1 p.m. (NDFDR = 1.6).

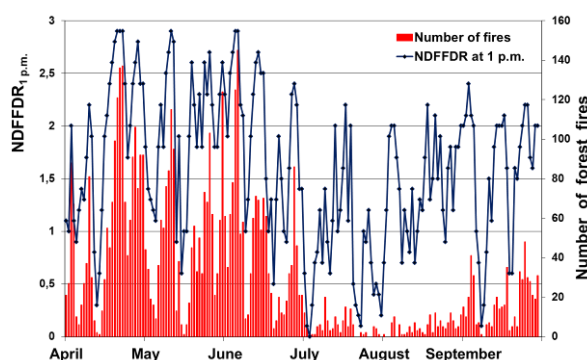


Figure 39. The National Degree of Forest Fire Danger Risk and numbers of forest fires in fire season 2011

The percentage share of the occurrence of the third degree of forest fire danger for the fire season was 24.5% on average, which was 1.5% lower compared with the period 2001-2010. In June it reached its maximum value of 42%, in May 39% and in April 38%. But in July it was only 7%, and 10% in August and September.



### Fire occurrence and affected surfaces

In 2011 in Poland, a total of 9 220 fires broke out (5 909 forest and 3 311 other non wooded natural land) with a surface area of 2 850 ha (1 659 forest and 1 191 ha other non-wooded natural land (Table 22 and Figure 41), about two times more than in 2010.

The greatest proportion of fires occurred in April (25%, i.e. 2 348 fires) - Figure 40. April was followed by May (22%) and June (21%). The lowest number of fires in the fire season (April – September) occurred in July and August (around 2%). 80% of fires occurred in the fire season.

The largest number of fires in 2011, similarly to last year, occurred in Mazowieckie Province (17%, i.e. 1 613 fires). The lowest number of forest fires occurred in Warmińsko-Mazurskie Province (142) and Podlaskie Province (173). The largest burnt forest areas were recorded in Mazowieckie Province (411 ha), Śląskie Province (347 ha), Świętokrzyskie Province (316 ha) and Podlaskie Province (296 ha), with the smallest areas in Pomorskie Province (43 ha), Warmińsko-Mazurskie Province (48 ha) and Opolskie Province (55 ha). These data are illustrated in Figure 42-Figure 44.

Small forest fires, i.e. with a surface area of less than 1 ha, represented 92% of all the forest fires in 2011 (Figure 45), with the burnt area amounting to 36%. The largest share of the burnt area (52%) was recorded for fires of between 1 ha and 10 ha, with their number representing 8%.

Table 22. Forest fire database for Poland in the period 1994-2011

Year	Number of forest fires	Burnt area [ha]	Forest fires average area [ha]
1994	10 705	9 325	0.87
1995	7 678	5 403	0.70
1996	7 923	14 537	1.83
1997	6 817	6 766	0.99
1998	6 165	4 222	0.68
1999	9 820	8 629	0.88
2000	12 426	7 089	0.57
2001	4 480	3 466	0.77
2002	10 101	5 210	0.52
2003	17 087	21 551	1.26
2004	7 006	3 782	0.54
2005	12 049	5 713	0.47
2006	11 541	5 657	0.49
2007	8 302	2 841	0.34
2008	9 090	3 027	0.33
2009	9 162	4 400	0.48
2010	4 680	2 126	0.45
2011	9 220	2 850	0.31
<i>Yearly Average in the Period</i>			
1996-2000	8 630	8 249	0.96
2001-2005	10 145	7 944	0.78
2006-2010	8 555	3 610	0.42

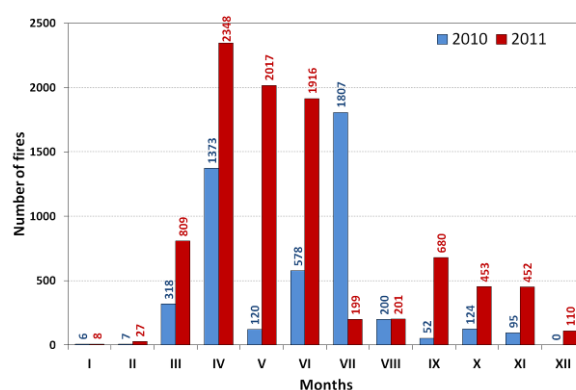


Figure 40. Distribution of number of forest fires by months in 2010 and 2011 in Poland

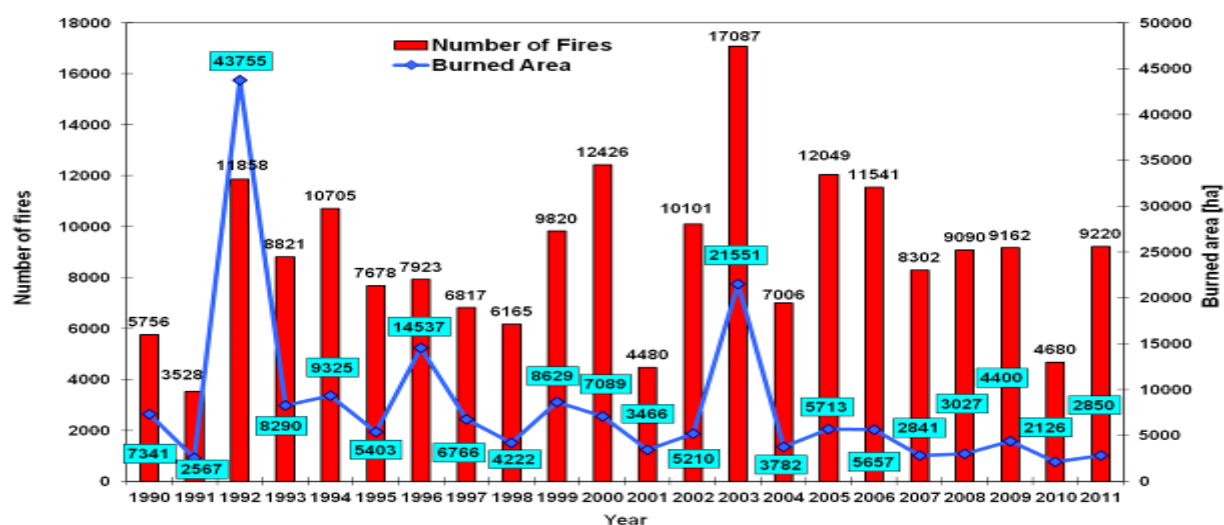


Figure 41. Total number of fires on high forest and area burned in Poland in the period 1990-2011

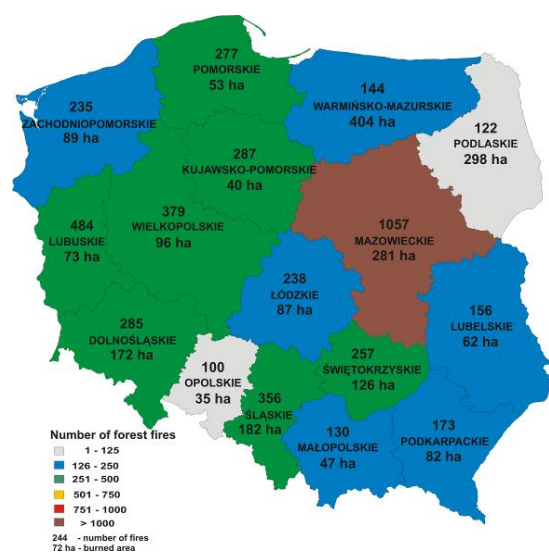


Figure 42. Number of forest fires and burned areas by provinces of Poland in 2010

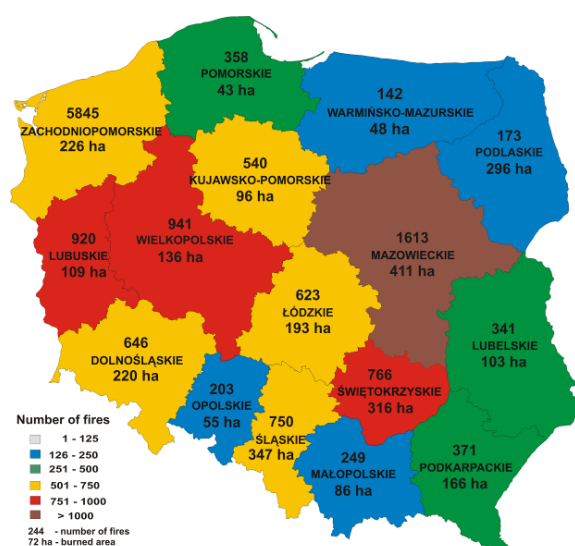


Figure 43. Number of forest fires and burned areas by provinces (NUTS2) in 2011

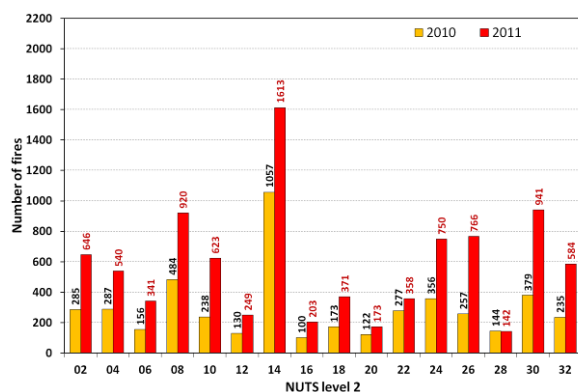


Figure 44. Distribution of the number of forest fires by province (NUTS2) in 2010 and 2011 in Poland

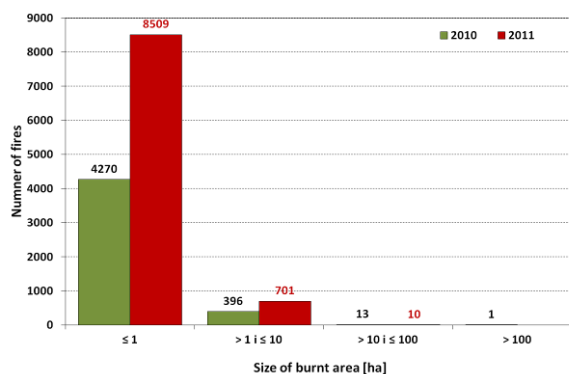
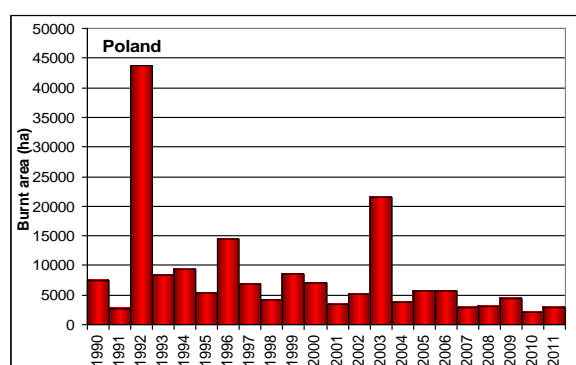
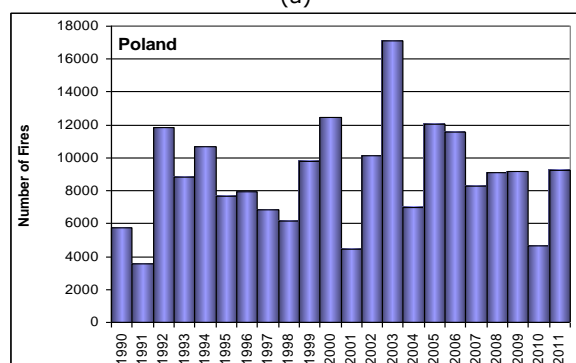


Figure 45. Distribution of the number of forest fires by size of burnt area in the years 2010 and 2011 in Poland

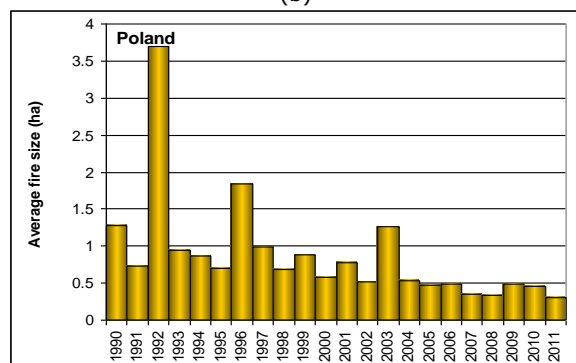
The burnt area, number of fires and average fire size for the years 1990 - 2011 are shown in Figure 46.



(a)



(b)



(c)

Figure 46. Burnt areas (a), number of fires (b) and average fire size (c) in Poland from 1990 to 2011.

### Fire causes

Human activity was the main cause of forest fires; specifically arson represented almost half of the fires (43%), followed by carelessness of adults (33%) and unknown causes (more than 16%) (Figure 47).

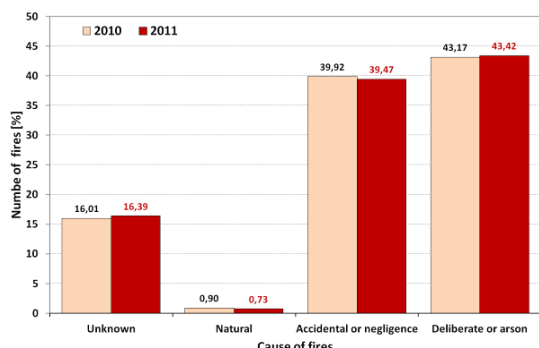


Figure 47. Distribution of the number of forest fires by causes in 2010 and 2011 in Poland

### Fire fighting means and information campaigns

In 2011, as part of information and promotion activities, the following measures in the State Forests National Forest Holding (State Forests NFH) were taken:

- about 12 thousand lectures in schools and youth camps,
- about 9.5 thousand information boards were erected,
- about 500 communications were provided in the mass media on fire danger and the principles of safe behaviour in forests,
- More than 150 thousand posters, information leaflets and calendars related to forest fires were disseminated.

In forest areas, works were carried out to prevent the conditions for fire outbreaks and to reduce their spread, by repairing 6 165 km of fuel breaks and building 79 km of new fuel breaks; in addition, forests were cleaned over a surface area of 27 thousand ha, by reducing the quantity of inflammable biomass.

The observation system of the State Forests NFH consisted of:

- 639 fire protection lookout points, including 200 equipped with a system of TV cameras,
- 8 patrol airplanes.

The effectiveness rate of fire detection by fire protection lookout points was 35%, airplanes detected 2% of fires and civilians notified of 54%. The other 9% of fires were detected by fire protection patrols.

The communication and alarm network in the State Forests NFH consisted of: 7 591 radio-telephones, including 1 278 base sets, 2 971 mobile sets and 3 342 hand held sets.

Water supply for fire suppression purposes was provided by 12 044 water supply points, including 4.5 thousand natural points and 2 673 artificial ones. Moreover, water was supplied by about 4.7 thousand hydrants located in the vicinity of forests.

The State Forests NFH had its own equipment, consisting of:

- 25 fire suppression airplanes and 7 helicopters,
- 379 patrol and fire suppression vehicles,
- 16 medium and heavy vehicles,
- 276 portable pumps.

These means were used to extinguish 6% of all the fires, whereas the other fires were suppressed by units of the State Fire Service and voluntary fire brigades.

In 2011, the fire protection costs incurred by the State Forests NFH amounted to 70.5 million PLN (16.4 million EUR).

Information on Poland's National Forest Fire Information System can be found on [https://bazapozarow.ibles.pl/ibl\\_ppoz/faces/index.jsp](https://bazapozarow.ibles.pl/ibl_ppoz/faces/index.jsp) and Poland's Forest Fire Danger Map, which is updated daily from April to September (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)

### 2.2.15 Romania

In România, a small precipitation deficit was recorded in the Southern part of the country during the summer of 2011, which generated a soil drought due to the moisture deficit beginning in the month of September and worsening in December covering significant parts of the country (Figure 49-Figure 51).

At the level of the whole country the thermal regime in 2011 was above the climatological norm. The positive deviation from the normal values was  $0.3^{\circ}\text{C}$  higher than the average reference period 1961-1990 (Figure 48).

The precipitation regime during 2011 was below normal, and the average quantity falling at the level of the whole country (500.4 mm), comparing with the climatological norm (637.9 mm), resulted in a deficit of 22 %. The higher levels of rainfall in the months of June and July could not compensate for the precipitation deficit from the other remaining ten months (Figure 52). A meteorological record was the month with the greatest deficit in precipitation, November, just with 1.5 mm at the level of the whole country. The soil drought occurred from September and became successively stronger during December, because of the precipitation deficit especially in the south-east, east and locally in the western part of the country.

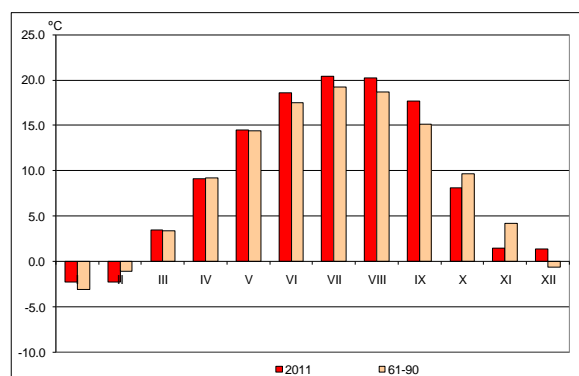


Figure 48. Average monthly temperature in Romania during 2011, compared with the climatological norm (1961-1990)

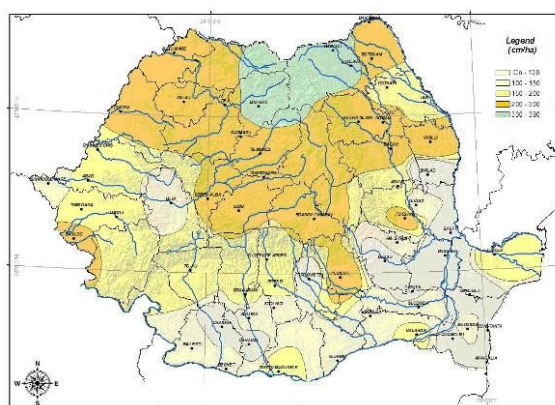


Figure 49. Water soil reserve at the beginning of September 2011 in the depth layer of 0-20 cm

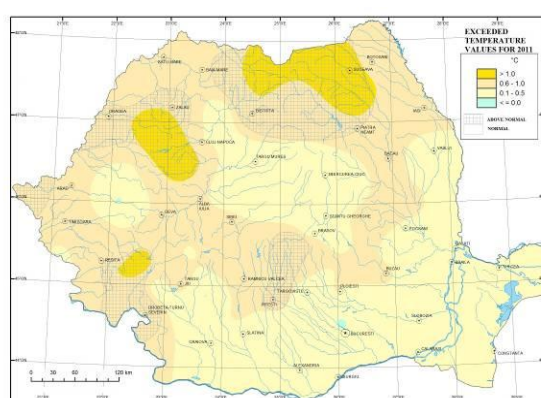


Figure 50. The deviation of the monthly average temperature in 2011 comparing with the multiannual average temperature (1961-1990).

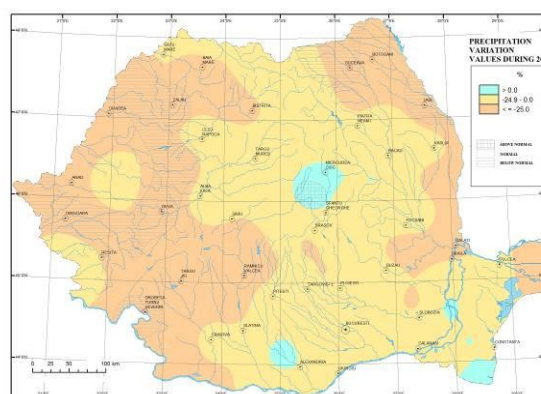


Figure 51. The deviation of the total monthly precipitations in 2011 comparing with the multiannual average values (1961-1990).



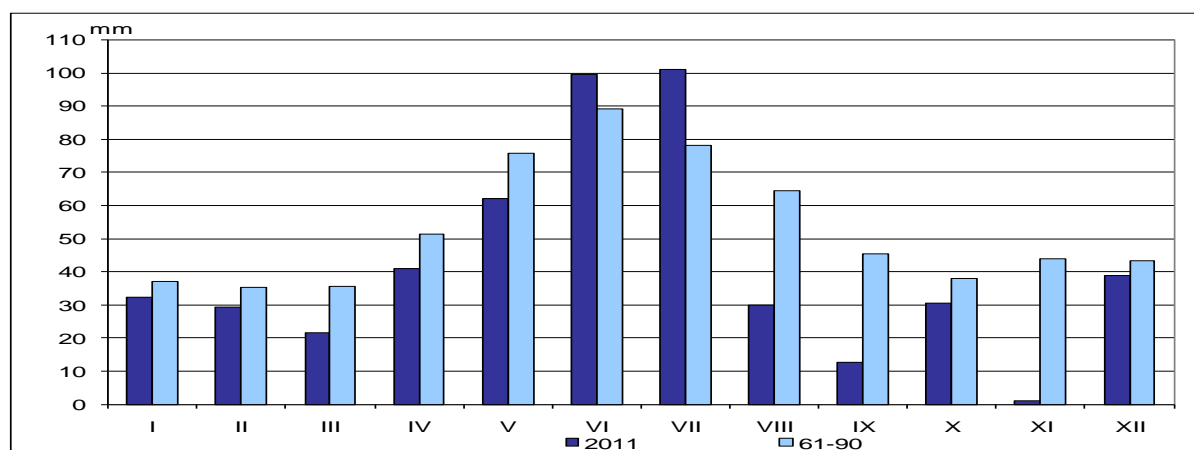


Figure 52. The monthly average precipitations recorded during 2011, compared with normal climatological values (1961-1990)

### Fire occurrence and affected surfaces

The trend of the burnt areas, number of fires and average fire size in Romania for the years 1986-2011 are shown in Figure 54.

### Fire damages and injuries

The economical losses due to forest fires were high compared with previous years, even though the population and the authorities intervened for extinguishing the forest fires at an early phase, but costs are still relatively low compared with other European countries (especially the Mediterranean). The low economical losses are also determined by the geographical condition of our country, and also by the composition of the forests. The economical losses assessed are relatively small because the damages are calculated only for substitution forest value and timber values, and also because young forests were most affected by fires (Figure 53).

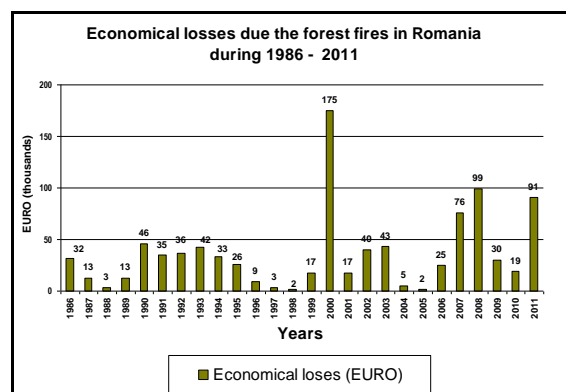
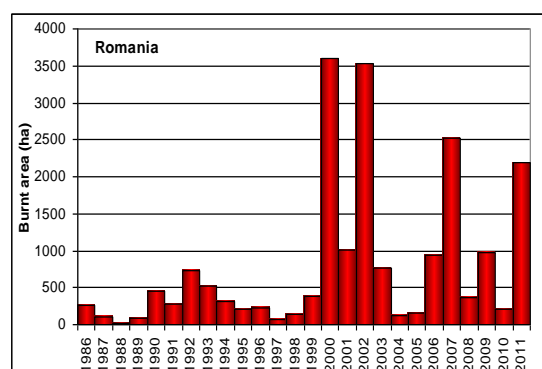
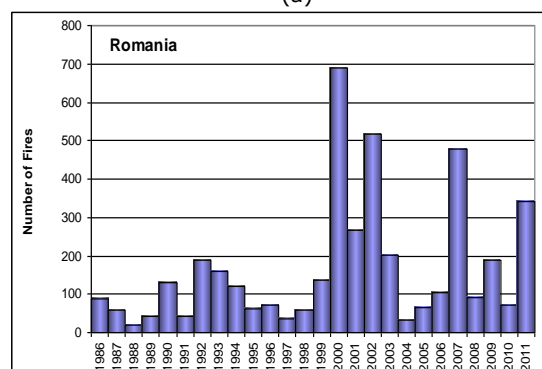


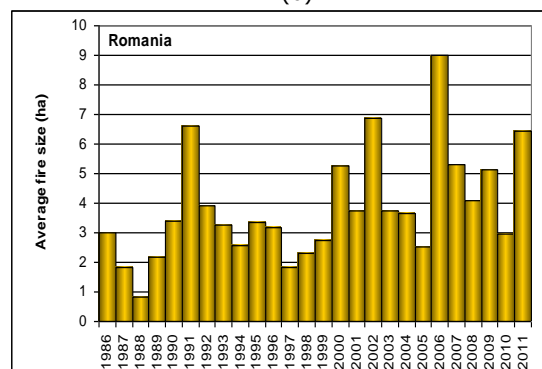
Figure 53. Economic losses due to forest fires in Romania from 1986 to 2011



(a)



(b)



(c)

Figure 54. Burnt area (a), number of fires (b) and average fire size (c) in Romania from 1986 to 2011

### *Fire fighting means and information campaigns*

The prevention and extinguish measures are assured by the Ministry of Agriculture and by the Ministry of Administration and Interior, with their structures (ROMSILVA, Forest Inspectorates (ITRSV), Emergency Situation Inspectorate (ISU) and county and local responsible authorities). A collaboration protocol is also established between these structures at both national and at county level.

ROMSILVA is responsible for the national (3 467 000 ha) and private forests (1 126 000 ha) that are under its administration and ITRSV is responsible for the private forests that are administrated by private structures (private forest districts) (1 807 000 ha).

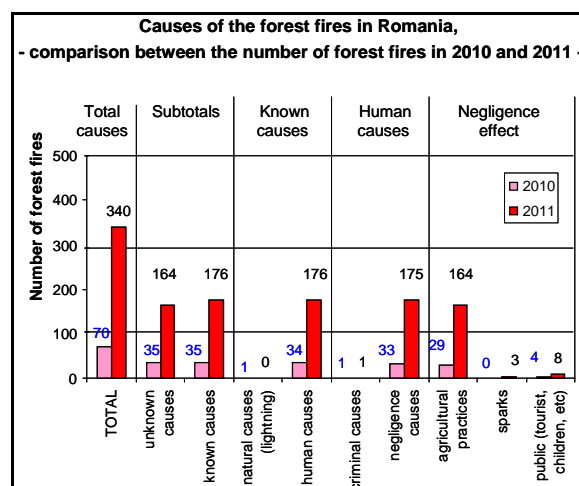
(source: [www.madr.ro](http://www.madr.ro), [www.mmediu.ro](http://www.mmediu.ro)).

The main legal base is assured by Law 46/2008, also called The Forest Code.

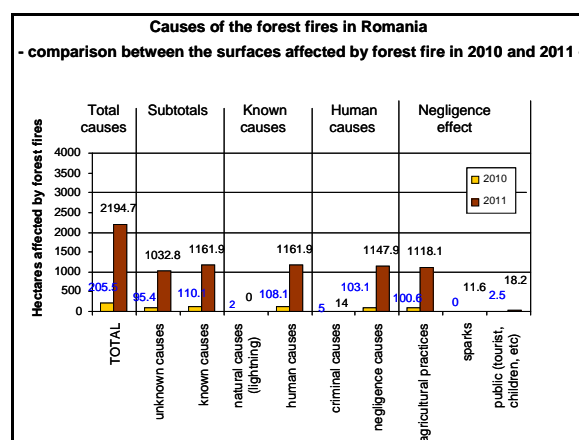
### *Fire causes*

During 2011, as in recent years, the major causes of forest fires were represented by the agricultural practices of people from rural areas, including the cleaning of fields by uncontrolled ignition of dried plant wastes.

The major causes of forest fires with respect to both number of fires and burnt area, compared with last year, are presented in Figure 55.



(a)



(b)

Figure 55. Comparison of forest fires causes in Romania: 2010 and 2011. (a) Number of fires; (b) Burnt area (ha)

(Source: Ministry of Environment and Forests, Romania)

## 2.2.16 Russian Federation

### *Fire prevention activities*

Fire prevention activities in 2011 included the following:

- Construction of forest roads for fire-prevention, 6 200 km
- Reconstruction of forest roads for fire-prevention, 11 700 km
- Maintenance of roads of fire-prevention appointment, over 10 000 km
- Construction of fire-prevention fire lines and barriers, over 200 000 km
- Care of fire-prevention mineralized strips, barriers, over 600 000 km
- Prescribed burning activity, 1.2 million ha.

### *Fire danger*

In comparison with 2010 there were increased monthly average temperatures in the Siberian Federal District in April–June, in the North West Federal District in June, and in the Ural Federal District in September. For the whole of the territory of the Russian Federation, October was abnormally warm.

Analysis of precipitation levels showed a decrease in the average amount of precipitation in comparison with 2010: in the Central Federal District in May, in the Northwest Federal District in June, and in the Far East Federal District in July. In the majority of other regions the average amount of precipitation increased.

As a whole in 2011 the average amount of precipitation was 22 % more than in 2010.

Forest Fire Danger based on weather conditions in the Russian Federation is determined by Nesterov's technique and is characterized by the corresponding class of fire danger (KPO) on a scale from 1 to 5 (the main criteria: quantity of rainless days, humidity of air, temperature).

The analysis of Fire Danger shows that in comparison with last year High and Extreme fire danger was observed in Far East Federal District (April, August, October), Siberian Federal District (April, May, October), and also in North West Federal District (June). In the majority of other regions average value of KPO was up to standard or decreased.

### *Fire occurrence and affected surfaces*

There were 20 851 forest fires in total in the Russian Federation, burning an area of 1 636 232 ha. Mainly large fires were burning in Siberia, Far East and North West Federal Districts (90%) out of total area burned.

In total, over 17 thousand fire engines, tractors and other mechanisms, and about 200 aircraft were mobilized in fire fighting events

### *Injuries and loss of human lives*

During the 2011 fire season one fire fighter died in Rostov oblast during a crown fire.

### *Operations of mutual assistance*

Under Interagency agreement, forces of Emergency Ministry and resources of other agencies were involved during extreme fire events.

Under interregional agreements 1.6 thousand fire fighters were involved in fire fighting assistance in the other regions of Russian Federation.



(Source: Aerial Forest Fire Centre, Russian Federation)

### 2.2.17 Slovak Republic

#### *Fire danger in the 2011 fire season*

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

#### *Fire occurrence and affected surfaces*

A total number of 303 forest fires were reported in Slovakia in 2011. The total burned area was 402.55 ha. The average burned forest area per fire was 1.3 ha. The largest recorded fire started on the 10<sup>th</sup> April and ended on the 12<sup>th</sup> in the district of Staré Hory. In this event, about 64 hectares of forest were burned.

Figure 56 shows the pattern of fire occurrence and burnt area by month during the year. The burnt areas, number of fires and average fire size for the years 1999–2011 are shown in Figure 57.

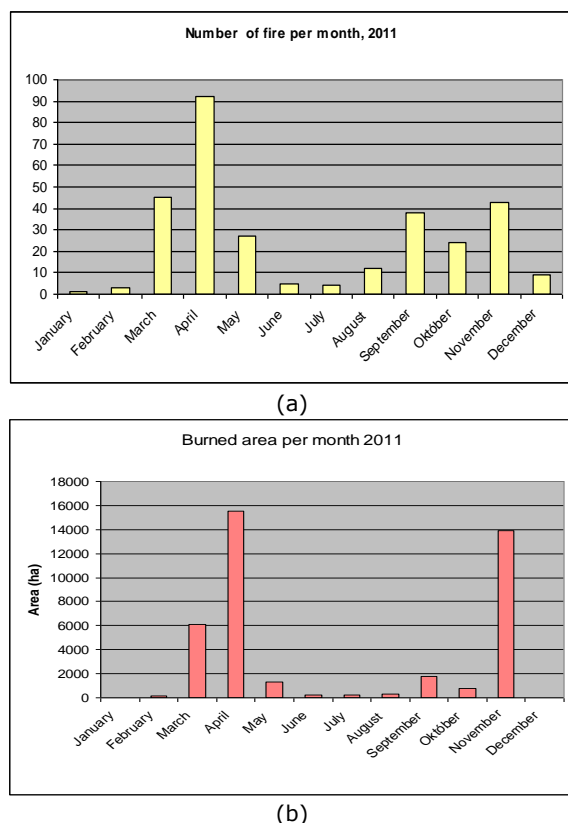


Figure 56. Number of fires and burnt areas by month in 2011

#### *Injuries and loss of human lives*

Four injuries were reported in Slovakia during the fire season of 2011.

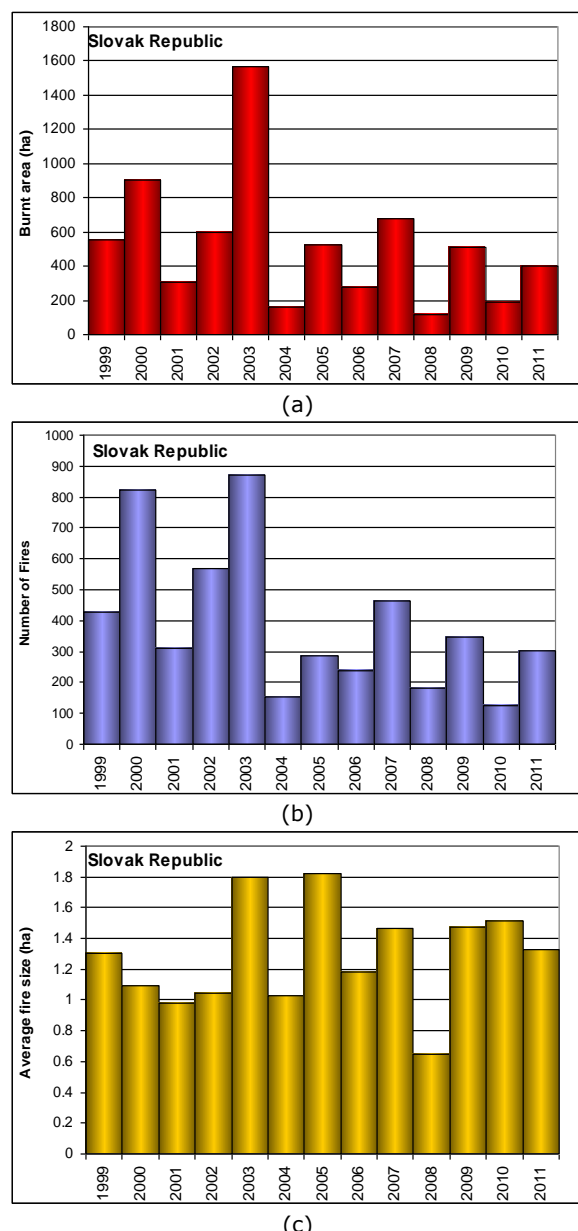


Figure 57. Burnt areas (a), number of fires (b) and average fire size (c) in the Slovak Republic from 1999 to 2011.

#### *Fire causes*

Forest fire causes for the years 2002–2011 are shown in Table 23.

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

Table 23 Fire causes in Slovak Republic in 2002 – 2011 (number of forest fires).

	<i>Year</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>	<i>2008</i>	<i>2009</i>	<i>2010</i>	<i>2011</i>
<b>Basic information</b>	Total fires	570	852	155	286	237	463	182	347	123	303
<i>Known causes (Human)</i>	Arson	18	31	8	7	8	11	7	18	6	8
	Negligence (see also B below)	525	780	138	261	201	416	154	286	94	244
<i>Known causes (Natural)</i>	Lightning	4	3	1	2	3	6	1	3	2	1
<i>Unknown causes</i>	Unknown	23	38	8	16	25	26	20	40	21	50
<b>Supplementary information: Total negligence</b>	Agricultural operations	239	280	38	91	22	110	25	51	25	59
	Logging and forest operations	4	2	2		10	23	19	52	25	21
	Other industrial activities	13	12	0	1	3	2	20	12	5	0
	Communications (railways, electricity lines, etc.)	2	3	1	2	2	3	3	7	2	1
	General public (campers, other visitors, children)	263	477	96	163	163	278	81	161	66	222
	Other (military, etc.)	4	6	1	4	1	0	6	3	0	0

## 2.2.18 Slovenia

In 2011, according to the data of the Forest Service, 114 forest fires were reported, with a total burnt area of 288.12 ha, of which 123.35 were of forest land. Although the number of fires is almost double that reported in 2010, the total burnt area is only slightly more than last year, leading to a reduced average fire size.

The worst affected region was Sežana, in which 76% of the fires (79% of the burnt area) occurred: Table 24.

The yearly trends in terms of number of fires and burnt area during the last 9 years in Slovenia are shown in Figure 58.

Table 24. Number of fires and burnt area by forest management unit in Slovenia in 2011.

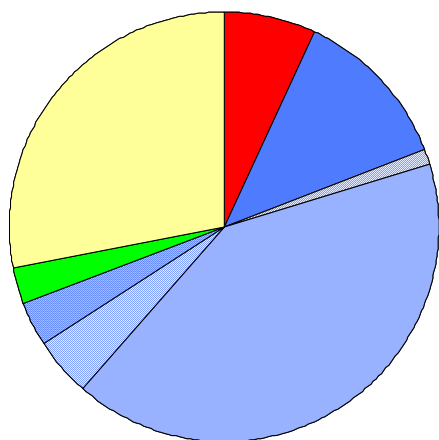
<b>Forest management unit</b>	<b>Number of fires</b>					<b>Burned area (ha)</b>			
	<1 ha	>=1 ha	>100 ha	>500 ha	Total	Wooded area	Bushes	Non wooded area	Total
<i>Tolmin</i>	1	1			2	1.12		3.30	4.42
<i>Bled</i>	2				2	0.70			0.70
<i>Kranj</i>	2	1			3	3.16			3.16
<i>Ljubljana</i>	7				7	1.75			1.75
<i>Postojna</i>		2			2	0.30	3.70	35.00	39.00
<i>Kočevje</i>					0				0.00
<i>Novo mesto</i>	1	2			3	2.12	4.65		6.77
<i>Brežice</i>	2				2	0.95	0.01		0.96
<i>Celje</i>	2				2	0.90			0.90
<i>Nazarje</i>					0				0.00
<i>Slovenj Gradec</i>	1				1	0.37			0.37
<i>Maribor</i>	2				2	0.39			0.39
<i>Murska Sobota</i>		1			1			1.00	1.00
<i>Sežana</i>	57	30			87	111.59	27.37	89.74	228.70
<b>Total</b>	<b>77</b>	<b>37</b>	<b>0</b>	<b>0</b>	<b>114</b>	<b>123.35</b>	<b>35.73</b>	<b>129.04</b>	<b>288.12</b>

### Fire Causes

In the year 2011, nearly two-thirds (62%) of the fires were caused by negligence (Table 25).

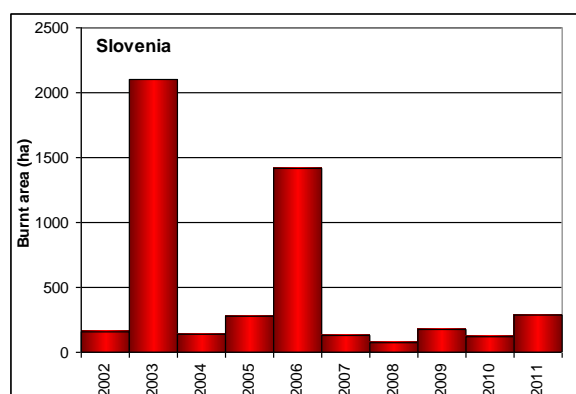
Table 25. Fire causes in Slovenia in 2011 (number of forest fires and burnt area).

Fire Cause	Number	Burnt area (ha)
Arson	8	18.5
Negligence	71	223.2
Natural (lightning)	3	4.1
Unknown causes	32	42.3
<b>Total</b>	<b>114</b>	<b>288.1</b>
<b>Negligence subcategories:</b>		
Agricultural operations	14	13.3
Logging and forest operations	1	0.02
Other industrial activities	0	0
Communications (railways, power line etc.)	47	121.9
General public (campers, children etc.)	5	0.6
Other (military, etc.)	4	87.4

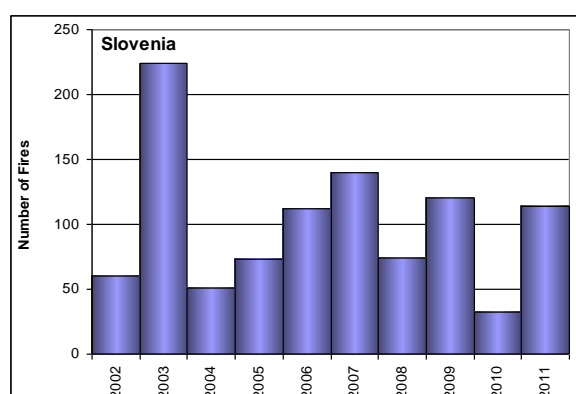


### Injuries and loss of human lives

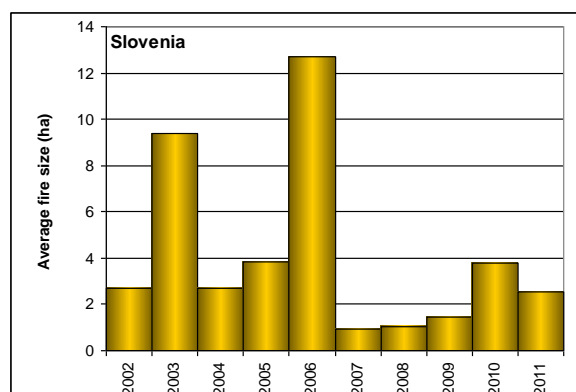
No casualties were reported in Slovenia during the fire season of 2011.



(a)



(b)



(c)

Figure 58. Burnt areas (a), number of fires (b) and average fire size (c) in Slovenia from 2002 to 2011

(Source: Forest Service, Slovenia)

## 2.2.19 Sweden

### *Fire danger in the 2011 fire season*

The fire danger was rather low in the season. The humidity was high from the beginning of July and the effect of this gave moderate and not critical fire behaviour. However April was drier and warmer than normal. The fire season 2011, similar to 2009 and 2010, had fewer fires and less burned area than the mean of the last 14 years. Most of the fires in 2011 appeared in April and May and normally affected the old grass from the year before.

### *Fire occurrence and affected surfaces*

During 2011 the number of fires recorded were 3 534, burning 349 ha of forest land, 310 ha of other wooded land and 286 ha of other land.

The largest fire which was recorded started on the 8<sup>th</sup> of May. In this fire, about 82 ha burned.

The fire danger maps below show how the fire risk changes from May to July (FWI-index normalised to Sweden).

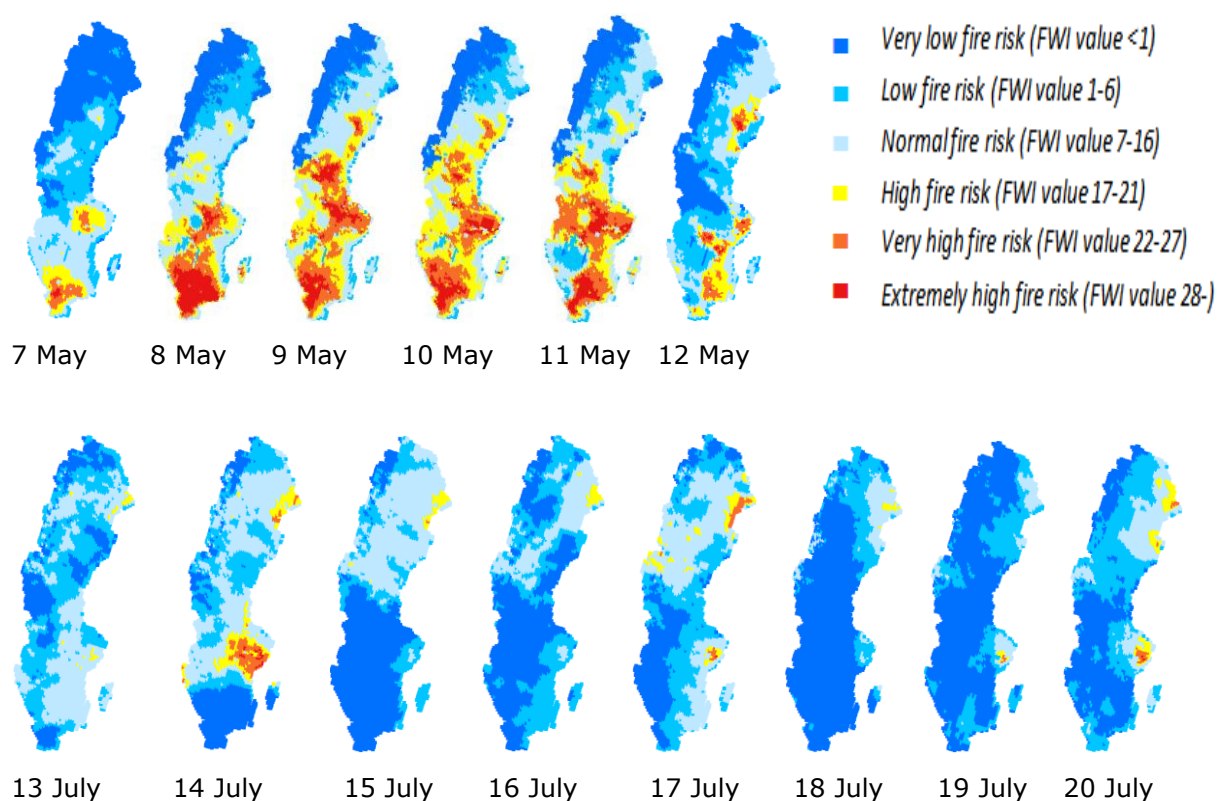


Figure 59. Fire Risk in Sweden May-July 2011 (normalised to Sweden)

### Grass fire risk 2011

The grass fire risk changes much from day to day. The new grown green grass reduces the fire risk when it has grown high enough. Sweden has more than five months of grass fire risk, from February (starts in the south and finish in the north) to the end of June

Figure 60 and Figure 61 show the pattern of fire occurrence and burnt area by month during the year. Figure 62 shows the dates and areas burned for the 16 largest fires of the season.

The burnt area, number of fires and average fire size for the years 1998 – 2011 are shown in Figure 63.

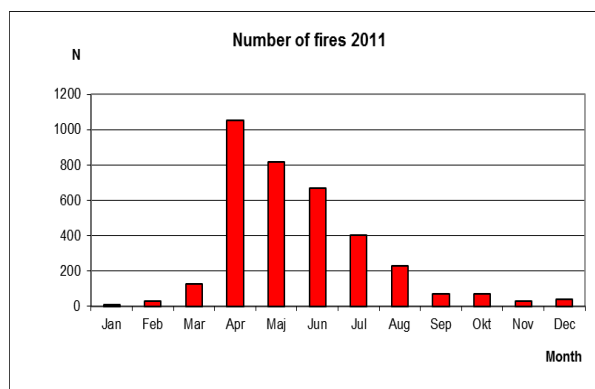


Figure 60. Fire frequency by month in 2011

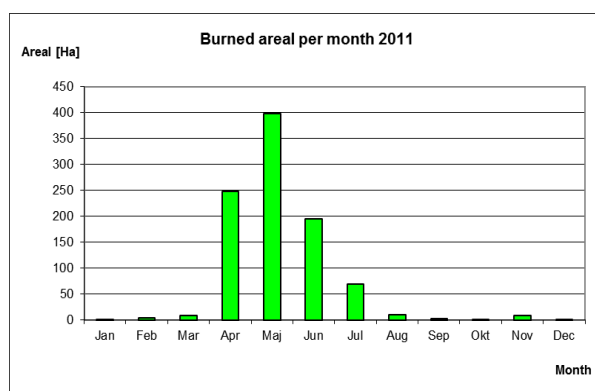


Figure 61. Burnt area by month in 2011

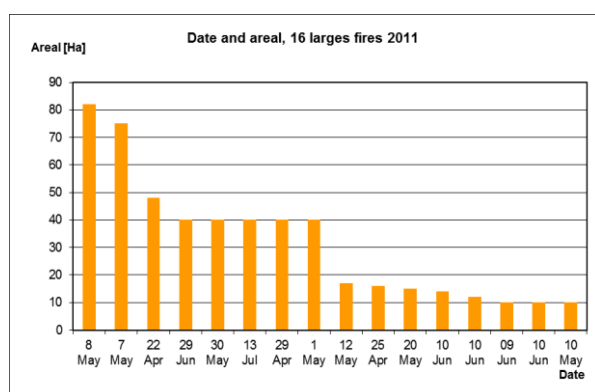
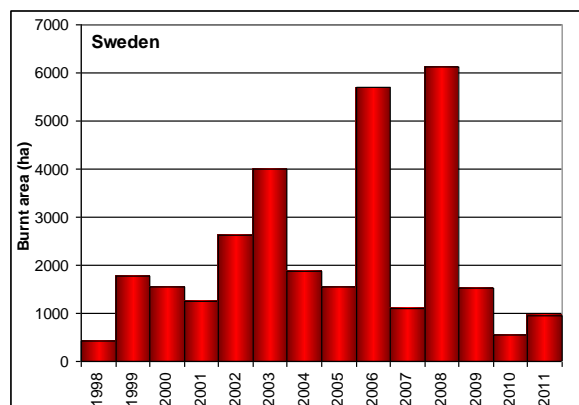
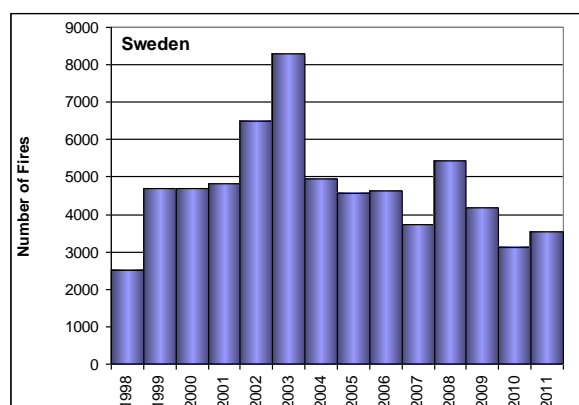


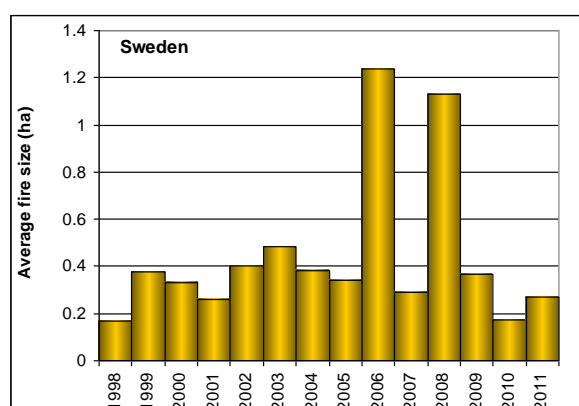
Figure 62. Date and area of the 16 largest fires in 2011



(a)



(b)



(c)

Figure 63. Burnt areas (a), number of fires (b) and average fire size (c) in Sweden from 1998 to 2011.

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



## 2.2.20 Switzerland

### *Weather conditions and state of the forests 2011*

During the year 2011, Switzerland experienced mild and dry winter conditions (especially in January and February), followed by the warmest spring and the second warmest autumn since the beginning of instrumental weather measurements in 1864. Overall, 2011 was the warmest ever measured in Switzerland in combination with dry and sunny conditions as well. March and April were warm and dry too: at the beginning of April, Switzerland experienced spells with 24-26°C in the North, reaching even over 31°C in the South. The unexpected "summer conditions" at the beginning of April drastically increased fire danger in the forests with increased evaporation, direct solar radiation on the forest floor (lack of "green" vegetation at this time of the year) drying out the branches, grasses and leaves on the forest floor. May temperatures were about 2-4°C over the 1960-1990 mean too. The first significant precipitation occurred in May, though this set back fire danger only locally (local thunderstorms). Cool temperatures and wet conditions occurred in July and in the first half of August, definitely reducing fire danger to minimum. Hot spells occurred again in the second half of August. Autumn was overall very warm. Precipitation occurred in September and very heavy rain spells led to damaging local floods at the end of October. November was warm and rather dry again, although significant precipitation (snow) occurred at the end of the month and in December, especially in the North of the Alps. In the South, the situation remained rather dry, leading to increased fire danger.

### *Prevention in 2011*

Prevention and information are in the focus of the federal forest fire prevention strategy. In Switzerland, even small fires may jeopardise the protective function of the forests. Since January 1<sup>st</sup> 2011, the revised Federal Warning and Alerting Act became legally binding and forest fires, as all other natural hazards, are evaluated using a 5-level danger scale: low, medium, marked, high, very high. It also became legally binding for the cantons to constantly communicate the level of fire danger in order to have a complete picture of danger at the federal level. The cantons have direct contact with field conditions and the capacity to evaluate the state of fuel in the forests (soil

moisture, wood, grass, turgidity, etc.). The federal government coordinates and informs over the national territory. The Federal Office for the Environment website has an updates table with an overview of fire danger and measures decreed in the regions.

In the very dry first half of 2011, warnings were issued over the entire Swiss territory; the use of fire was restricted or banned during several weeks, and the situation was critical especially in southern and western Switzerland. There was proactive information all across Switzerland. Communication of fire danger, restrictions, bans and other prevention measures and recommendations occurred mainly by means of radio, television and newspapers, or over the internet. Fire prevention received a privileged echo in the national and regional medias, so that general awareness was raised all over Switzerland. The population respected well the warnings and bans, which explains the low occurrence of forest fires even during long and extremely dry episodes.

A notable forest fire for Swiss conditions occurred in Visp, Valais on April 26<sup>th</sup> 2011, burning over 100 ha of protective forests. The cause is due to an intense building fire at the wildland-urban interface, recalling the importance of taking into account this interface in the long-term prevention strategy. The strong winds led the fire into the wildland and the forest. Significant emergency soil stabilization and ashflow protection works were built. The main communication axes were closed several days and long-term stabilisation works are still under construction (State May 2012).

### *Fire occurrence and affected surfaces*

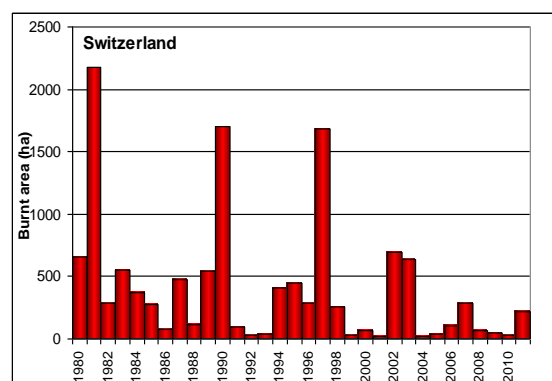
For 2011, fires from canton Ticino, Grisons, Uri, Berne, Basel, Argovia, St Gallen and Valais were recorded in the database.

A total of 76 forest fires were registered in 2011 (as reported by May 2012), burning 222.24 hectares, which corresponds to a medium-low occurrence since 1980 (Figure 64). Average fire size was 2.96 ha and median fire size 0.1 ha.

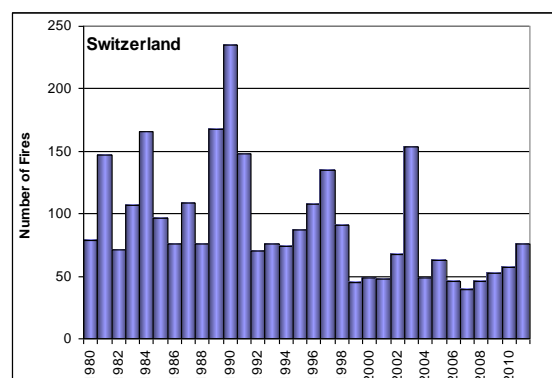
59% of the fires happened during the winter season (November to April), when also 97% of the burned surface occurred.

### *Injuries and loss of human lives*

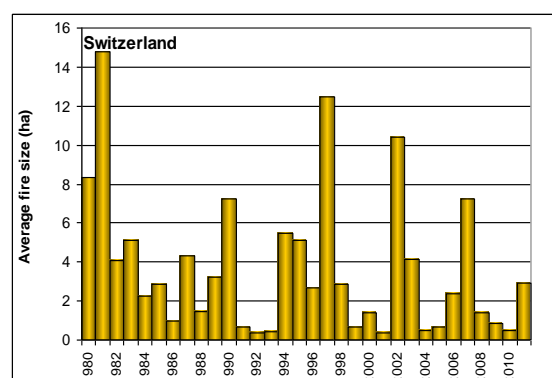
No loss of life or major damage to buildings were reported in 2011.



(a)



(b)



(c)

Figure 64. Burnt areas (a), number of fires (b) and average fire size (c) in Switzerland from 1980 to 2011.

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

## 2.2.21 Turkey

### Fire danger in the 2011 fire season

In 2011, the total burnt area was 3 612 hectares, the best figure for the last 5 years and 30% less than that of last year. The number of fires, however, increased reaching 1 954 in the same year.

### Fire occurrence and affected surfaces

In Turkey, the coast line, which starts from Hatay and extends over the Mediterranean and Aegean up to İstanbul, has the highest fire risk. In another words, approximately 60 % (12 million ha) of Turkey's forest area is located in fire sensitive areas.

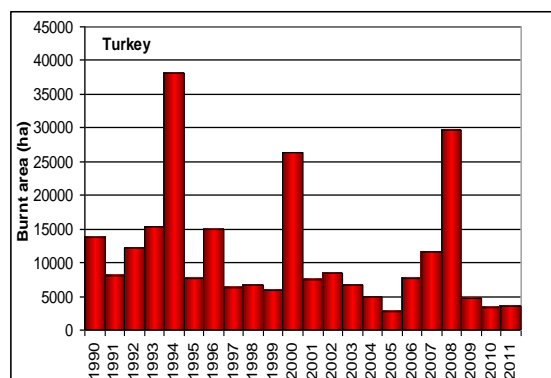
Forest fires mostly occur during the period of May-November, particularly in June, July and August. When we look at the number of forest fires, we see that August ranks the highest with 482 fires damaging 1 765 ha of forest (49 % of the total burned area: see Table 26). 90 % of the forest fires occurred during the fire season (between May and November) in 2011 damaging 3 348 hectares of forests.

Table 26. Monthly distribution of forest fires in Turkey

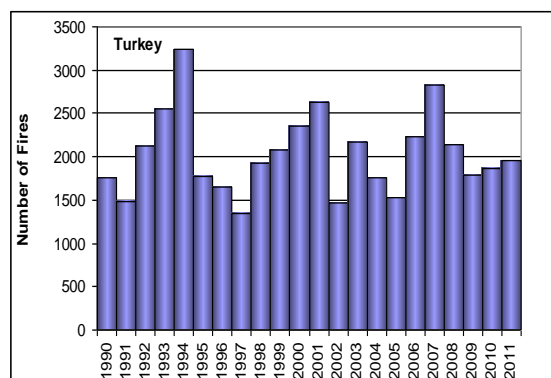
Month	Number of Fires	Burnt Area (ha)
Jan	10	17
Feb	17	14
Mar	37	37
Apr	26	11
May	36	18
Jun	120	63
Jul	332	385
Aug	482	1765
Sep	518	635
Oct	188	305
Nov	92	177
Dec	96	184
<b>TOTAL</b>	<b>1954</b>	<b>3612</b>

Fortunately, around 78 % of the fire incidences were controlled before spreading. There were no fires bigger than 500 hectares and there were only three fires that exceeded 100 hectares (totalling up to 858 hectares): see Table 29.

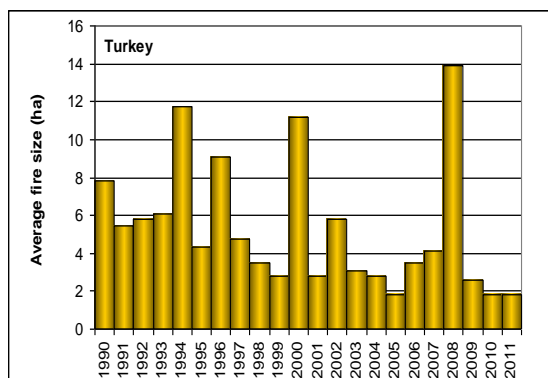
The burnt area, number of fires and average fire size for the period of 1990-2011 are shown in Figure 65.



(a)



(b)



(c)

Figure 65. Burnt areas (a), number of fires (b) and average fire size (c) in Turkey from 1998 to 2011

### Fire causes

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

These areas are:

- Densely populated areas
- Areas of high migration
- Areas where there are valuable lands
- Places with Cadastral Problems
- Tourism Areas

Most of the fires were caused by human activities (88 % in total). The causes of forest fires in 2011 are shown in Figure 66.

The causes of accident / negligence / carelessness include cigarette stubs, agricultural and forest-related activities (stubble burning, pruning of residues, clearing of fallow and slopes), shepherd fires, long-distance power lines, picnic fires, and hunting.

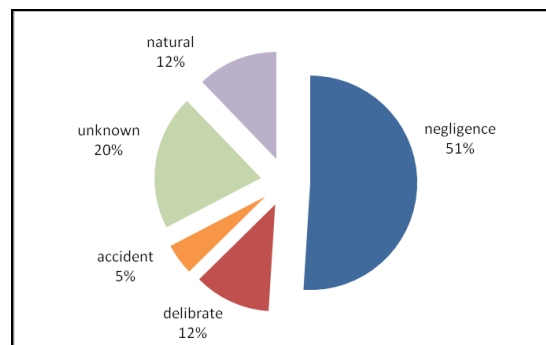


Figure 66. Main causes of forest fires in 2011

### Expenses

In relation to fire expenses, during 2011, 107 006 m<sup>3</sup> wood was damaged due to forest fires (total burnt area 3 612 ha); this figure includes 50 002 m<sup>3</sup> of total damage and 65 179 partial damage to planted trees. This corresponds to about 1.5 million \$US in loss. In 2011, 13 805 000 \$US has been allocated for reforestation of burnt areas.

For suppression, in 2011, 90 937 000 \$US were spent for different kinds of fire fighting means and 161 209 000 \$US was spent for fire extinction workers. With regard to aerial means, expenses are shown in Table 27.

Table 27. Expenditures made for aerial means

Aerial Means	Flight hours	Expenses (\$US)
21 Helicopter	4850	36 300 000
6 Amphibious Aircraft	1191	14 170 000
14 Turkish Aircraft (Dromaders)	682	2 792 600
Total		53 262 600

### Fire fighting means

In addition to forest fires, General Directorate of Forest has been intervening in agricultural fires for the recent years, which is a high burden with about 3 000 non-forest incidences in 2011.

In 2011, 2 500 technical staff, 5 000 forest preservation officers and 11 000 workers were involved in detection, communication and suppression efforts. Ground and air equipment used for fire fighting in 2011 are presented in Table 28.

Table 28. Land and aerial means in 2011

<i>Land Means</i>		<i>Aerial Means</i>	
Bulldozer	184	Leased Helicopter	21
Grader	156	Leased Aircraft (Dromaders)	14
Trailer	50	Amphibious Aircraft (CL 215 Canadair)	6
Fire Truck	973	Administrative helicopters (owned by forestry organisation)	6
Water Tank	282		
First intervention vehicle	467		
Motorcycle	856		

Table 29. Number of fires and burnt area in 2011 by region and fire size class

### *Preventive measures*

#### In Fire Sensitive Regional Forest Directorates

- Planting fire-resistant species in rehabilitating burning areas
- Converting existing forests to fire-resistant forests (YARDOP Project).
- Creating differential elements (road etc.) in order to stop probable fires in settlements and agriculture lands from spreading towards forest
- Planting fire-resistant species along roadsides in order to hinder forest fire from turning into crown fire.

#### Early Fire Warning Systems

- So far, a total of 776 fire towers have been built to detect fires and to report to suppression teams.
- The system enables rapid detection of forest fires through visible range optical cameras. (Fire Command Centers can also monitor the progress through these cameras).

#### Construction of Pools and Ponds

- During 2011, for the purpose of shortening the periods of forest fire attacks in forested areas where water sources are scarce, 250 fire pools and ponds were constructed and will continue to be constructed (1565 pools and ponds in total)

### Creation of fire risk maps

- Weather values such as wind, temperature, humidity are taken from meteorology to create fire risk maps.
- With the aid of fire risk maps, risk points and areas are determined and their coordinates submitted to mobile teams. Thus, in addition to monitoring the forest, teams are mobilized towards fire risk areas and points.

#### *Education, Public awareness and information campaigns*

Several education and awareness raising campaigns have been carried out.

#### *Injuries and loss of human lives*

Unfortunately, one member of staff (a fire fighter) was lost during fire suppression operations in 2011.

#### *Operations of mutual assistance*

In response to requests for assistance, Turkey sent its aerial means to forest fires in Albania. The assistance provided is summarized in Table 30.

Table 30. Assistance provided to other countries by Turkey during 2011

<i>Country</i>	<i>Aircraft type</i>
Albania	1 Amphibious Aircraft (CL 215 Canadair)

Number of fires and burnt area in 2011 by region and fire size class														
Region	A <1.0Ha		B 1.1 - 5.0Ha		C 5.1 - 20.0Ha		D 20.1 - 50.0 Ha		E 50.1 - 200.0 Ha		F 200.1 - 500.0 Ha		TOTAL	
	Nr Fire	Br Area	Nr Fire	Br Area	Nr Fire	Br Area	Nr Fire	Br Area	Nr Fire	Br Area	Nr Fire	Br Area	Nr Fire	Br Area
<b>ADANA</b>	64	25.85	322	46.10	5	62.00	3	88.50					88	222.45
<b>ADAPAZARI</b>	49	21.86	7	19.60	1	20.00	1	45.00					58	106.46
<b>AMASYA</b>	51	23.67	35	79.40	7	55.00							93	158.07
<b>ANKARA</b>	50	17.91	20	45.89	2	11.50			1	90.00			73	165.30
<b>ANTALYA</b>	137	36.81	12	27.98	3	27.10							152	91.89
<b>ARTVİN</b>	2	1.50	2	3.50	1	15.00							5	20.00
<b>BALIKESİR</b>	55	14.54	13	32.00	9	110.40			2	263.90			79	420.84
<b>BOLU</b>	19	9.85	11	27.52	1	6.40	1	39.50					32	83.27
<b>BURSA</b>	50	17.84	17	51.40	5	51.70							72	120.94
<b>DENİZLİ</b>	62	21.81	10	27.50	4	67.00							76	116.31
<b>ELAZIĞ</b>	2	0.30	6	23.00	6	50.00							14	73.30
<b>ERZURUM</b>	1	1.00	3	7.00	3	32.00							7	40.00
<b>ESKİŞEHİR</b>	21	10.44	8	21.00	3	23.00							32	54.44
<b>GİRESUN</b>	9	4.40	6	16.20	1	6.19							16	26.79
<b>ISPARTA</b>	40	10.23	13	30.75	2	26.00			1	60.20			56	127.18
<b>İSTANBUL</b>	165	28.74	5	12.30	2	26.00							172	67.04
<b>İZMİR</b>	167	42.45	20	50.30	5	45.00	3	105.60	1	137.40	1	352.00	197	732.75
<b>K.MARAŞ</b>	60	22.17	13	35.50	4	41.70			1	105.00			78	204.37
<b>KASTAMONU</b>	53	12.94	9	20.80	1	6.00							63	39.74
<b>KAYSERİ</b>	27	15.25	21	49.20	4	39.20	2	57.20					54	160.85
<b>KONYA</b>	19	8.43	6	15.00	7	55.00							32	78.43
<b>KÜTAHYA</b>	40	12.33	1	2.00									41	14.33
<b>MERSİN</b>	74	23.22	21	48.45	3	42.00							98	113.67
<b>MUĞLA</b>	246	49.30	17	40.10	3	36.00	1	40.00					267	165.40
<b>ŞURFA</b>	10	7.70	10	26.87	1	10.00							21	44.57
<b>TRABZON</b>	7	3.61	10	33.38	4	36.00							21	72.99
<b>ZONGULDAK</b>	46	15.99	10	19.63					1	55.00			57	90.62
<b>TOTAL</b>	1526	460.14	322	812.37	87	900.19	11	375.80	7	711.50	1	352.00	1954	3612
<b>%</b>	78.10	12.74	16.48	22.50	4.45	24.92	0.56	10.40	0.36	19.70	0.05	9.74	100.00	100.00

(Source: General Directorate of Forestry,  
Forest Fires Department, Turkey)

## 2.3 MENA COUNTRIES



### 2.3.1 Algeria

#### *Fire danger in the 2011 fire season*

Algeria has an area in forest and maquis estimated at 4 115 908 ha; the actual forests representing about 42% of this area. The forest and maquis massifs are mainly concentrated in the northern and central regions. Forty out of the 48 wilayas that form the regions of Algeria, are concerned by the risk of forest fires, which remains the major factor of degradation of this heritage, with an annual average of about 2 000 fire starts, usually causing between 25 000 and 30 000 ha area of forest and scrub burnt annually.

The climate change-related effects observed in recent years in Algeria, especially in the northern part which is characterized by a hot, dry summer, have helped to reduce the level of wildfire danger. Indeed, the shift in the usual rainy season, extending late into spring, has kept a good supply of soil water during summer, resulting in a more sustainable supply of vegetation, which may subsequently be less vulnerable to fire during the summer.

#### *Fire occurrence and affected surfaces*

The period from June 1 to October 31 2011 saw the outbreak of 2 487 forest and scrub fires, which burnt a total area of 13 593 ha, of which 9 174 ha (67%) was forests and 4 420 ha (33%) was maquis.

Broken down by region of the country's forest fires during 2011 is shown in Table 31, and Table 32 shows the information by month.

Table 31. Number of fires and burnt area by region

REGIONS	Number of fires	Total burnt area (ha)		
		Forest	Maquis	Total
East Region (15 wilayas)	1099	5656	2832	8488 (62%)
Central Region (13 wilayas)	1127	2791	1405	4196 (31%)
West Region (12 wilayas)	261	727	182	909 (07%)

Table 32. Number of fires and burnt areas by month

Month	Number of fires	Total burnt area (ha)		
		Forest	Maquis	Total
June	87 (3%)	188	47	235 (2%)
July	372 (15%)	649	815	1464 (11%)
August	878 (35%)	2818	1016	3834 (28%)
September	998 (40%)	5437	2498	7935 (58%)
October	152 (6%)	82	44	126 (1%)
Total	2487	9174	4420	13593

#### *Forest fire prevention*

The prevention campaign against forest fires was initiated in early 2011, through many actions performed in the wilayas concerned by the risk of forest fires:

#### Preventive work

- Development and maintenance of firebreaks, forest tracks and water points in the forests.
- Clearing brush on road verges and railways crossing the forest.
- Manufacture of buffer zones around farms bordering forests.
- Maintenance of clear areas under high-voltage power lines that cross the forests.

#### Awareness campaigns

- Promotion of conferences in several schools.
- Organization of exhibitions and open days for citizens, on the risk of forest fires and distribution of pamphlets and posters, with forest fire prevention measures.
- Organization of tours to remote rural areas, to raise awareness among local populations on the precautions to take to prevent the outbreak and spread of wildfire.

- Promotion of television and radio programs on national and local channels on the theme wildfire.
- Talks by the imams of mosques and religious causes on the importance of preserving the forest heritage.

#### Organizational

- Update the "forest fires" plans specifying the procedure for implementing preventive measures and the mobilization of control, for the 40 wilayas concerned by this risk.
- Enabling operational committees, responsible for coordination of control operations at national level, also at the level of wilayas, daïras and communes.
- Set up local committees composed of farmers and citizens, which play an important role in prevention and first response, given their proximity to forests.
- Organization of simulation exercises "wildfire interventions" with the participation of all stakeholders.

#### *Monitor, alert, and response reinforcement*

The system set up during the campaign of 2011, is composed as follows:

Monitoring and alert: Provided by 388 dependent lookout positions in the *conservations forestieres*, spread over the important regions of the 40 wilayas concerned by the risk of forest fires.

First response: Provided by 456 small mobile brigades of *conservations forestieres*, each brigade generally composed of one 600 CCF light L and two intervention elements.

Intervention: Provided by 413 intervention units of the civil protection, spread over the 40 wilayas. Each unit has in its sector at least one forest region to defend; these units are equipped with appropriate control methods.

Reinforcements: Provided by 22 mobile firefighting units, under the Directorate General for Civil Protection, and distributed judiciously to arrive to reinforce the intervention units as soon as possible; each column consists of nine fire engines and a staff of 52 operational elements.

Additional resources: Assured by the application of human and material resources from other administrative services, and mobilized according to the "forest fire" plans

or by decision of the Wali of the wilaya where necessary.

#### *Loss of life*

Although some forested wilayas are notable for the large number of remote villages in the forests, no serious threats to human lives were recorded during the 2011 fires.

Moreover, with the exception of some cases of minor injuries reported during the interventions, there were no deaths among staff, when responding to wildfires campaign of 2011.

#### *Mutual assistance operations between states*

During 2011, Algeria did not request any assistance, as part of the fight against forest fires. The Directorate General of Civil Protection, for its part, did not participate in any operation against forest fires abroad.

(Source: *Direction Générale de la Protection Civile; Direction Générale des Forêts, Algeria*)

### 2.3.2 Morocco

#### Background

In Morocco, forest formations cover an area of 5 814 000 ha, composed of 63% of broadleaf species (holm oak, cork oak, acacia, argan ...) and 20% of conifers (cedar, fir, juniper, pine ...). The remainder, 17%, is occupied by low formations (matorrals and secondary species). The forest cover rate in the country varies from 3% to 40%.

As in Mediterranean countries, forested areas in Morocco are subject to a recurrent risk of fires that is favored 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 population lives 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 2010, it is calculated that there is an average of 267 fires per year for an annual average affected area of 3 037 ha (HCEFLCD, 2010).

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 the prevention, risk prediction, monitoring and

warning as well as on the coordinated operations to fight against forest fires.

Despite the efforts made at different levels by all institutions involved in forest fires management in Morocco, **the system calls 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 2010

Through the analysis of the available data on forest fires in Morocco during the period 1960s to 2010, a total of 13 599 outbreaks of fire (Figure 67) and a total area damaged (not lost) of 154 878 ha is reported, giving an average of 267 fires per year for an annual average area of 3037 ha affected, with maxima of 11 000 ha in 1983 and 8 660 ha in 2004 (Figure 68). The absolute minimum is recorded in 2002 with 593 ha (Figure 68).

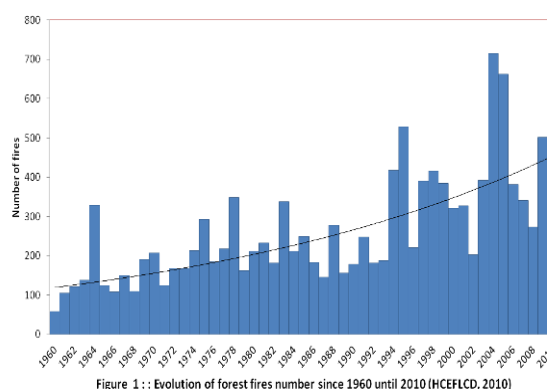


Figure 1 :: Evolution of forest fires number since 1960 until 2010 (HCEFLCD, 2010)

Figure 67. Evolution of forest fire numbers from 1960 to 2010

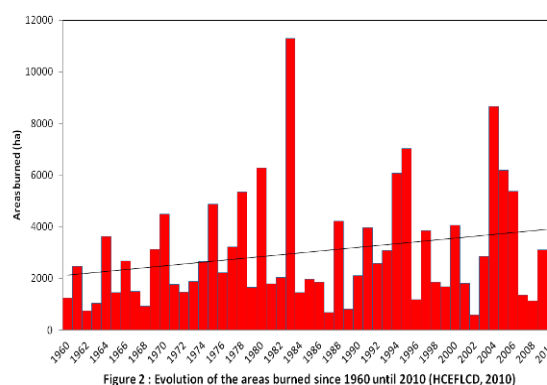


Figure 2 :: Evolution of the areas burned since 1960 until 2010 (HCEFLCD, 2010)

Figure 68. Evolution of the areas burned from 1960 to 2010



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 431 forest fires between 2005-2009 and has even reached 629 forest fires in 2010 (Figure 67).

The period from 1960 to 1974, represents the portion where fire number and area burned are at their lowest levels compared to the averages for the period covering 1960 to 2009 (267 fires and 3 035 ha). The increases compared to the average area affected were recorded between the period 1975-1979 (+14.10%) and 1980-1984 (+50.64%) (Table 33).

Table 33. Forest fires in Morocco from 1960-2009 (per decade)

	Area burned (ha)	Average of the area affected per year	Differences in area compared to the mean (%)	Fire number	Average fire number per year	Differences fire number compared to the mean (%)	Average area affected per fire
1960-1964	9 149	1 830	-39.70	753	151	-41.92	12
1965-1969	9 680	1 936	-36.21	683	137	-47.31	14
1970-1974	12 287	2 457	-19.04	880	176	-32.31	14
1975-1979	17 317	3 463	+14.10	1 204	241	-7.31	14
1980-1984	22 859	4 572	+50.64	1 175	235	-9.62	19
1985-1989	9 548	1 910	-37.07	1 010	202	-22.31	9
1990-1994	17 812	3 562	+17.36	1 212	242	-6.92	15
1995-1999	15 591	3 118	+2.73	1 940	388	+49.23	8
2000-2004	17 981	3 596	+18.48	1 956	391	+50.38	9
2005-2009	17 160	3 432	+13.08	2 157	431	+65.77	8
1960-2009	149 384	3 035	-	12 970	260	-	12

During the period 1995 to 2009, we deduce that monitoring and fighting against forest fires measures have improved, because from 1995 to 1999, fire number has increased by almost **+49.23%** over the average, but the burned area increased by only **+2.73%**. In the same way, during the period 2005 to 2009, fire number has increased by almost **+65.77%** over the average, while the burned area has evolved only by **+13.08%** (Table 2).

This is also corroborated by area affected per fire indicator which reached, during the period 2005-2009, the value of **8 ha**, representing a decrease of 33% compared to the national average recorded since 1960, which is **12 ha per fire** (Figure 69).

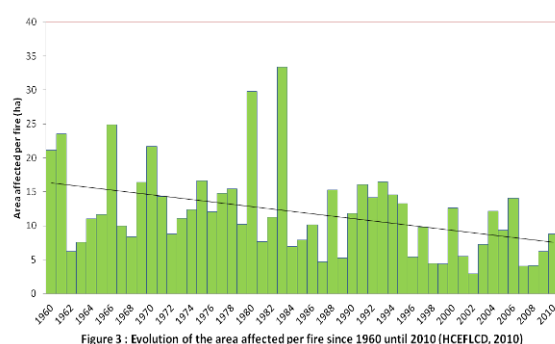


Figure 69. Evolution of the area affected per fire from 1960 to 2010

### 2011 fire season

During 2011, there was recorded a total of 606 fires affecting an area of 3 460 ha, an average of 5.7 ha per fire.

The distribution of fires recorded in 2011, based on the type of vegetation affected, is as follows:

- For wooded land, an area of 1 247 ha (36% of the total area burned) was affected by 183 fires (30% of the total number of fires), averaging 6.8 ha per fire;
- The shrub and herbaceous covers were affected by 423 fires that covered an area of 2 213 ha, equivalent to 70% respectively of the total number of reported fires and 64% of the total area burned.

For wooded stands, the species thuya (*Tetraclinis articulata*) is in first place with an area of 486.2 ha affected, equivalent to 46% of the total area burned in this category, followed by pine trees with an area of 411 ha affected (44%)

<i>Category</i>	<i>Species</i>	<i>Number</i>	<i>% Number</i>	<i>Area</i>	<i>% Area</i>
<i>Coniferous</i>	Cedar	17	3	11	0.32
	Juniperus oxycedre	1	0.5	0.01	0
	Red Juniperus	4	1	6	0.16
	Pines	79	13	474	14
	Thuya (tetracolis articulata)	14	2	486	14
<b><i>Subtotal coniferous</i></b>		<b>115</b>	<b>20</b>	<b>977</b>	<b>28</b>
<i>broadleaves</i>	Acacia	1	0	2	0.06
	Arganr	7	1	32	0.92
	Carob tree	1	0.5	2	0.06
	Cork oak	19	3	80	2.31
	holm oak	24	4	52	1.50
	Eucalyptus	14	2	33	0.95
	Oleaster	2	0	69	1.99
<b><i>Subtotal broadleaves</i></b>		<b>68</b>	<b>11</b>	<b>270</b>	<b>8</b>
<i>Others</i>	Shrub	170	28	1256	36
	Herbaceous	253	42	957	28
<b><i>Subtotal others</i></b>		<b>423</b>	<b>70</b>	<b>2 213</b>	<b>64</b>
<b><i>General total</i></b>		<b>606</b>	<b>100</b>	<b>3 460</b>	<b>100</b>

The data relating to the distribution of fires according to size classes of affected areas are represented in the table below (Table 34). Indeed, 85% of reported fires were under control with the speed and efficiency required, since the area affected has not exceeded 5ha for each fire. It is also noted that only 6 fires (1% of the total number of fires) affected an area of over 100 hectares representing over 45.5% of the total area burned.

Table 34. Distribution of fires according to size classes of affected areas

<i>Size Class (ha)</i>	<i>Number</i>	<i>% Number</i>	<i>Area</i>	<i>%Area</i>
[0-5]	520	86	546	16
[5-10]	47	8	368	11
[10-20]	20	3	293	8
[20-50]	7	1	238	7
[50-100]	6	1	441	13
[100-250]	6	1	1575	46
<b>Total</b>	<b>606</b>	<b>100</b>	<b>3460</b>	<b>100</b>

The data showing the distribution of fires by forest region are reported, below, in Table 35 and Figure 70.

Table 35. Fire numbers and area affected by forest region

<i>Region</i>	<i>Number</i>		<i>Area (Ha)</i>	
	<i>Count</i>	<i>%</i>	<i>Area</i>	<i>%</i>
Rif	176	29	202	6
Sud-Ouest	101	17	1 230	36
oriental	81	13	349	10
Nord Est	67	11	1 214	35
Centre	45	7	47	1
Moyen Atlas	13	2	70	2
Haut-Atlas	21	3	156	5
Rabat-Salé-ZZ	38	6	58	2
Nord Ouest	22	4	40	1
Fès-boulmane	24	4	20	1
Sud	8	1	45	1
Tadla-Azilal	10	2	29	1
<b>Total</b>	<b>606</b>	<b>100</b>	<b>3 460</b>	<b>100</b>

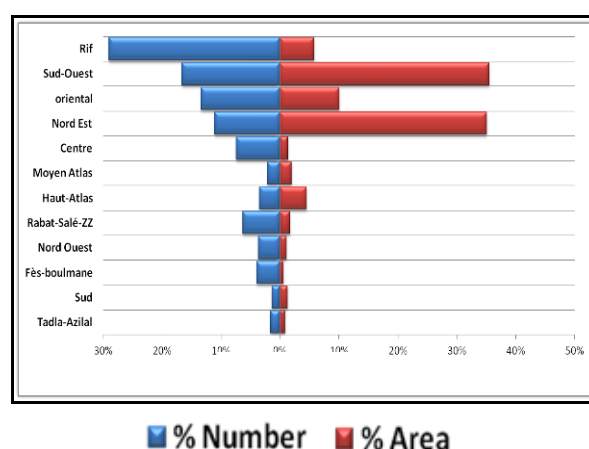


Figure 70. Fire numbers and area affected by forest region

The Rif region occupies first place in terms of number with 176 fires, equivalent to 29% of the total number of fires recorded nationally (Table 35). This region has seen, despite the large number of fires, only 6% of total area burned, an average of 1.15 ha per fire, which is an exemplary performance in relation to the history of the region. It is followed by the south-west (101 fires, equivalent to 16% of the total number of fires) which has surpassed the record in terms of area burned with 1 230 ha (35% of the total area burned).

The occurrence of fires is concentrated in the provinces of Rif and Pre-Rif (including Tangier and Tetouan); this situation is favored 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.

#### *Fire fighting means*

The means mobilized by the different departments in 2011 in Morocco for the operations against forest fires, are as shown in Table 37:

#### *Fire Causes*

Natural fires (lightning) are very rare. forest fires of unknown origin represent a dominant share (95%). Almost all forest fires result from human action, either intentionally or by negligence (Table 36).

Table 36. Causes of fires

<i>Origin</i>	<i>Cause</i>	<i>Number</i>		<i>Area</i>	
		<i>Count</i>	<i>%</i>	<i>Area</i>	<i>%</i>
Accidental	accidental	7	1.17	66.10	1.91
	Manufacture of coal	2	0.33	4.50	0.13
	Food cooking	7	1.16	11.30	0.33
	Landfill	3	0.50	1.00	0.02
	cigarette butt	1	0.17	7.00	0.20
	land Culture	1	0.17	0.02	0.00
	Burning of stubble	2	0.33	1.11	0.03
unknown	unknown	575	95	3 365	97
Intentional	deliberate	3	0.50	0.62	0.02
	voluntary (Known)	1	0.17	3.25	0.09
Natural	lightning	4	0.66	0.02	0.00
Total General		606	100	3 460	100

Table 37. Fire fighting means in Morocco

<i>Activities</i>	<i>Department</i>	<i>Quantity</i>
<b>Monitoring and alerts</b>	High Commission of Forests, Water and combating Desertification	<b>837 watchers</b>
	Ministry of the Interior	<b>NC</b> [Estimated to 500 watchers]
<b>Ground intervention</b>	High Commission of Forests, Water and combating Desertification	<b>280 forests fighters with 80 vehicles for the first intervention</b>
	Civil Protection	<b>NC</b>
	Auxiliary Forces	<b>NC</b> [Estimated to 300 persons]
	Royal Armed Forces	<b>NC</b> [Estimated to 300 persons]
<b>Aerial control</b>	Royal Gendarmerie	<b>Ten (10) Turbo Trush aircraft</b>
	Royal Air Forces	<b>Two (2) C130 aircraft and Two (2) Canadairs</b>

**NC** : Not Communicated

#### *Information campaigns*

In Morocco and before 2005, the program of public awareness conducted by the HCEFLCD and its partners did not have a national scope, but was limited mainly to setting up of panels of awareness along the roads, distributing posters and organizing meetings of provincial committees around the issues of forest fires.

Since 2005 and until 2011, the HCEFLCD has gradually accumulated experience in designing and disseminating educational materials to raise awareness, and has succeeded in building a real communication device that drives the public to realize that a simple act, of negligence or innocent, may cause natural, environmental, or economic damage and even sometimes dramatic loss of human lives. Thus, during this period the following activities were undertaken:

- the design and broadcasting in different languages, during prime time during the risk season, of 10 television spots and 7 radio messages, specific and generic, with a consistent and diversified content aimed at attracting attention and curiosity, showing the problem of forest fires and the revealing solutions.
- the distribution of posters, leaflets and brochures written in Arabic and French in public places: schools, government offices, roads, highways, bazaars, villages, etc;
- posting signs of awareness in the vicinity of major roads and highways, especially at the exit of large cities, and those leading to the most sensitive forest areas.
- The organization of press briefings to raise awareness of print and audiovisual media on progress of the campaign of prevention and fight against forest fires

#### *Loss of human lives*

No lives were lost in the 2011 season.

*(Source: Service de la Protection des Forêts, Haut-Commissariat aux Eaux et Forêts et à la Lutte Contre la Désertification, Morocco)*

### **2.3.3 Lebanon**

#### *Fire danger in the 2011 fire season*

Recent reports indicate increases in fire frequency and severity. The forest fire situation in Lebanon is significantly determined by predominating climatic conditions with prolonged summers (extending from June to October and sometimes even longer), virtually no rain and average daytime temperatures well in excess of 30°C, reducing the moisture content of forest litter to below 5%. Under these conditions, a small addition of heat (a spark, a match, a cigarette butt) can still be enough to start a violent fire. The steep slopes and the summer and eastern dry autumn winds characterized by high speed and strong desiccating power aggravate the situation. Preliminary studies conducted at the Institute of the Environment (University of Balamand) showed that the length of the fire season has increased in the last two years and the fire occurrence peak month was shifted towards the end of the season.

#### *Fire occurrence and affected surfaces*

Data on fire occurrence and affected surfaces is available from several sources (e.g. Directorate General of Civil Defense, Internal Security Forces, Lebanese Army, Ministry of Environment, Ministry of Agriculture, and some local NGOs) but are still not always mutually consistent and still not homogenized and unified. However, an attempt has been made in 2008 to adopt the forest fire common ID card based on the decision taken by the Presidency of Council of Ministers number 256 dated on 1/3/2008. The use of this ID card by involved administrations during post fire assessment will lead to the unification of information and data. Forest fires affect many parts of the country. Overall, data on the number and extent of forest fires are still sketchy. In 2005, the Ministry of Agriculture reported that a total of 1 200 ha of natural forests are burned every year. Based on different reports, forest fires data related to the years 2004 to 2006 indicated 129 fires in 2004 (resulting in 585 ha of burned forest areas), 117 fires in 2005 (approximately 440 ha of burned forest areas), and 144 fires in 2006 (approximately 874 ha of burned forest areas), spread all over Lebanon. The number of yearly burned areas has tremendously increased in the year 2006-2007 (more than 3 500 ha of burned forests), due to the July war of 2006 and to the October 2007 fires, which burned large forested areas in only a few days. Another peak of occurred fires and extent of burned areas was observed in 2010.

#### *Fire fighting means and information campaigns*

The Directorate General of Civil Defense owns a modest fleet of fire engines with a maximum water capacity of 7 600 litres. The EU funded project "Towards developing a National Strategy for forest fire management" provided basic tools and equipment to the Lebanese Army, Ministry of Agriculture, municipalities, and some local community groups. In 2008, the project established a temporary operations room in the Directorate General of Civil Defense to coordinate fire-fighting efforts. Most recently, the Lebanon Recovery Fund project entitled "Integrated Forest Fire Management in Lebanon" supplied the Directorate General of Civil Defense with four new trucks as well as basic tools and equipment for early intervention. Also, a Spanish Cooperation funded project supplied the same Directorate

with different tools (e.g. the new Libancarto software) and equipment for fire fighting. Nearly 200 volunteers from the Civil Defense and the Lebanese Army were trained on forest fire control during the past two years. Moreover, the Ministry of Interior and Municipalities put efforts to develop the capacity of civil defense fire brigade in early and effective forest fire control and cover the financial and technical needs of the Directorate of Civil Defense. In addition, the Ministry of Interior and Municipalities expressed its willingness to improve the capacity of Internal Security Forces in forensic investigation in determining the cause and origin of forest fires. In 2009, the Lebanese Army acquired 3 Sikorsky N61 fire-fighting helicopters. These helicopters are supposed to provide support to the country's modest aerial fire fighting fleet which comprises of half a dozen Lebanese Army helicopters (Bell UH-1 Iroquois) equipped with carry buckets.

#### *Operations of mutual assistance*

Several initiatives, projects and activities were elaborated in the last years among which we cite the EU funded project "towards the development of a national strategy for forest fire management" implemented by the Association for Forests, Development and Conservation in partnership with the Ministry of Environment. The project helped in:

- 1) developing a National Strategy for forest fire management,
- 2) providing basic fire fighting tools and equipment,
- 3) establishing a centralized fire operations room, and
- 4) conducting focused training on Incident Command System and Forest Fire Forensic Investigation with the support of the United States Forest Service (USFS) and USAID.

The Lebanon Recovery Fund project "Integrated Forest Fire Management in Lebanon" implemented by FAO in coordination with the Ministry of Environment, Ministry of Agriculture, and the Association for Forests, Development and Conservation aimed at creating an enabling environment for the Government of Lebanon to prevent future forest fires and enhance the effectiveness of fire fighting, among others.

The project "Strengthening Lebanese capabilities in forest fire control operations and prevention" executed by Tragsa with the support of the Spanish Agency for International Development Cooperation (AECID) provided support to the efforts of

the Ministry of Interior and Municipalities to control and prevent forest fires. Part of this project was to improve fire control in a forest environment and also to evaluate and define the best technical solution for the forest fire prevention in Lebanon. In the summer of 2011, CIMA Research Foundation, on behalf of the Italian Civil Protection Department, implemented RISICO system at the Lebanese Civil Defence headquarters. Such activity fell within the project "Strengthening the National framework to mitigate rural-forest fire risk", funded by Italian Ministry of Foreign Affairs/Italian Cooperation. [RISICO system](#) aimed at the prediction and prevention of forest fires, providing potential fire risk bulletins on a daily basis. In addition, the Institute of the Environment at the University of Balamand implemented in 2011 the project "Fuel type mapping in North Lebanon for improved forest fire management" awarded by the National Council for Scientific Research in Lebanon. Also, the Institute of the Environment started the development of a project called "Testing a Pilot Forest Fire Alerting System in Farid and Daad Karam" in partnership with the Electrical and Computer Engineering Department at the American University of Beirut. The scope of the project was to develop a local forest fire early detection and prevention system which can be transferable to other forest sensitive sites in the country.

#### *Fire causes*

Lack of data on forest fires and their causes are a major obstacle in understanding the nature of forest fires. Statistics on the causes of forest fire are far from being complete, but it is evident that people set the majority of fires. The most common direct causes of fire are the following:

- Farmers who use fire to eliminate crop stubble and push back the forest to make room for agricultural expansion. In spite of the obvious risks, farmers might set fire to agricultural residues even when large out-of-control fires are burning in the same area.
- Careless smokers and excursionists who throw lit cigarettes on the forest litter or along the roads and light cooking fires without taking the necessary precautions to extinguish them properly.
- Burning solid wastes (municipal wastes and those left by tourists and recreational users) and the disposal of garbage by burning being often carried out in conditions of high fire risk without taking the necessary precautions.

- Arsonists that set fires for destruction, vengeance, conflicts, and changes in land-use classification.
- Fireworks

### *Policy measures*

The problem of forest fires in Lebanon is complex. It concerns all the aspects related to forest management, prevention, suppression, and post fire management. At the administration level, it is a problem having several authorities involved in this subject from different institutions and a problem of forest policy and legislation, as much as it is a problem of equipment and capacity building. Despite the increased efforts, fire issues increasingly threaten forest ecosystems and economic development in Lebanon.

Fires in Lebanon have harvested during the past 5 years large green areas, noting that the percentage of forest cover has declined in a short period of time in Lebanon in recent years to 13% of its total area, after it had constituted around 35% in the years 1960-1965. This has given rise to concern at national and international levels resulting from the risk of loss to forest cover. Shortly after the disastrous forest fires that broke out in late 2007, damaging more than 2 000 hectares of land only in few days, the Lebanese Prime Minister formed and chaired a ministerial committee (Decision number 119/2007 on 6/11/2007) comprising the Minister of National Defense, the Minister of Interior and Municipalities, the Minister of Agriculture, and the Minister of the Environment to follow up forest fire prevention activities and to restore damaged forest areas. Also, a National Executive and Technical Forest Fire Prevention and Forest Restoration Committee was formed through the Decision number 118/2007 (on 6/11/2007). This committee was chaired by the Ministry of Environment and included representatives from the following ministries and institutions: the Ministry of Agriculture (MoA), the Ministry of National Defense (Lebanese Army), the Ministry of Interior and Municipalities (the General Directorate of the Civil Defense and Internal Security Forces), the Higher Relief Council (HRC), the Council for Development and Reconstruction (CDR), the Prime Minister office, in addition to the Association for Forests, Development and Conservation (AFDC). This committee worked on drafting recommendations to address forest fire management issues. Consequently, the European Commission funded a project entitled "towards the

development of a national strategy for forest fire management". Accordingly, a National strategy for forest fire management was developed and endorsed by the Lebanese Council of Ministers in 2009. The aim of the Strategy was to reduce the risk of intense and frequent forest fires whilst allowing for fire regimes that are socially, economically and ecologically sustainable. The Strategy acknowledged that decisions about fire management were best made within a risk-management framework, known as the 5Rs, namely,

- (1) Research, information and analysis;
- (2) Risk modification, including fire vulnerability reduction and prevention of harmful fires;
- (3) Readiness, covering all provisions intended to improve interventions and safety in the event of fire;
- (4) Response, including all means of intervention for fire suppression; and
- (5) Recovery, including the rehabilitation and ecological restoration of healthy forest conditions, and the support to individuals and communities in the short- and medium term aftermath of the fire.

Although a National strategy for forest fire management was developed in 2009, it has not yet been implemented. However, there are current efforts to launch the implementation of the Strategy. Currently, the Ministry of Agriculture is in the process of developing a National Forest Plan which is supposed to take into account what has been agreed on in Lebanon's National Strategy for forest fire management.

### *Fire prevention and information campaigns*

The Spanish funded project "Strengthening Lebanese capabilities in forest fire control operations and prevention" which started in 2011 provided support to the development of a forest fire national prevention plan in Lebanon. The plan is expected to be published in September 2012. National campaigns to raise awareness on the risk of fires have been conducted by several ministries (e.g. the Ministry of Environment and the Ministry of Interior and Municipalities) in partnership with National and local NGOs (e.g. the Association for Forests, Development and Conservation) and with the support of International organizations (e.g. the Italian cooperation, FAO, USAID, etc.)

*(Source: Biodiversity Program, Institute of the Environment, University of Balamand, Lebanon)*

### 3 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 fires services in the EU Member States and European countries (Forest Services and Civil Protection services).

EFFIS is the EC focal point of information on forest fires aiming to support the national services in charge of the protection of forests against fires in the EU and neighbouring countries, and also to provide the EC services such as the Monitoring and Information Centre (MIC) of Civil Protection and the European Parliament with up to date and harmonized information on forest fires in Europe.

Research activities for the development of the system initiated in 1998 and the first EFFIS operations were in the year 2000. In 2003, EFFIS was officially established in the context of Regulation (EC) No 2152/2003 (Forest Focus) of the European Council and Parliament on monitoring of forests and environmental interactions.

The purpose of EFFIS is to provide information for the protection of forests against fire in Europe addressing both pre-fire and post-fire conditions. It also centralises the national fire data that the Member States collect through their national forest fire programmes. A web mapping interface has been set up on the EFFIS website<sup>3</sup> which allows users to access EU wide information about forest fires and other related environmental data.

EFFIS monitors 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 are also daily updated on the on the EFFIS web site, which can be interactively queried<sup>4</sup>. EFFIS provides daily meteorological fire danger maps and forecasts of fire danger up to 6 days in advance, updated maps of the latest hotspots (active fires) and fire perimeters. The damage caused by forest fires in the European and Mediterranean region is also estimated from the burned area maps of EFFIS.

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), allowing a harmonized evaluation 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 of the TERRA and AQUA satellites, the RDA provided frequent updates of the total burnt area in Europe. Since 2007 the RDA is updated up to two times every 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 40 ha or larger. The burned area mapped by EFFIS corresponds, on average, to 75% to 80% of the total area burnt in Europe each year.

Other EFFIS modules have been developed and are currently in a final validation stage. Such modules are aimed to provide an assessment of atmospheric emissions from forest fires and of the socio-economic impact of forest fires in Europe.

#### 3.1 EFFIS DANGER FORECAST: 2011 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. Since 2002, at the request of the Member States, operation of the EFFIS Danger Forecast has been 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.

In this chapter the fire danger trends assessed by EFFIS in the different countries during the fire season 2011 are presented, comparing them with previous years.

<sup>3</sup> <http://effis.jrc.ec.europa.eu>

<sup>4</sup> see <http://effis.jrc.ec.europa.eu/current-situation>



**In the Mediterranean region**, conditions were relatively cool and wet in the first part of the summer, but this situation changed in August. Driven by very high to extreme fire weather conditions, fire activity increased significantly in the last days of August in South-eastern regions of Europe, affecting mostly Greece and the Balkan area. In **western regions** (Spain, Portugal and France) there was a late peak of activity in October. **In Central and Northern EU regions**, unusually hot and dry weather over temperate Europe during spring induced remarkable fire activity in this region, significantly affecting countries such as Belgium, Ireland and the United Kingdom, which are normally safely excluded from the main forest fire arena.

Through the Danger Forecast module of EFFIS the situation has been continuously monitored and the risk level analyzed and mapped.

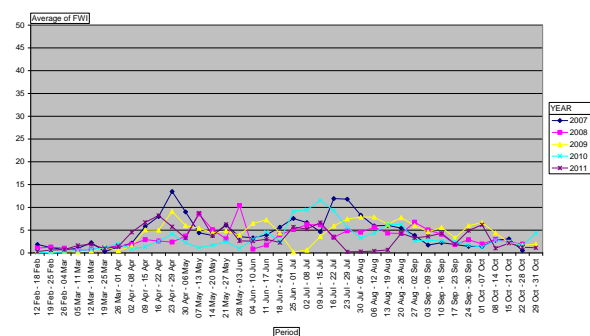
The following figures show fire danger through 2011 as determined by the average FWI values assessed during the fire season in the individual countries.

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.

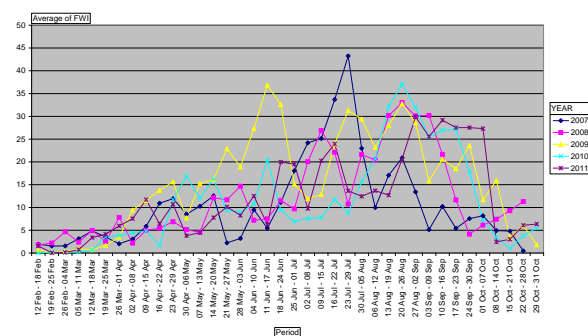
To allow a better comparison with past seasons, the curves of 2007-2010 are presented in conjunction with 2011 for all countries.

The countries analyzed are those participating in the EFFIS network and are shown in alphabetic order in the graphs that follow.

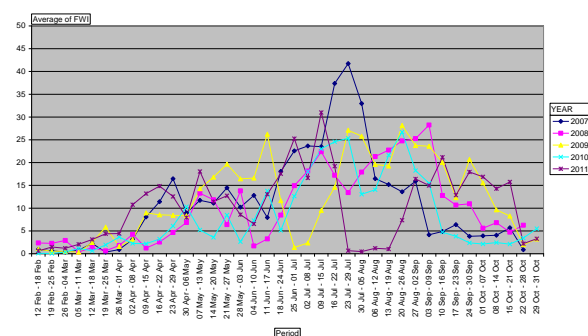
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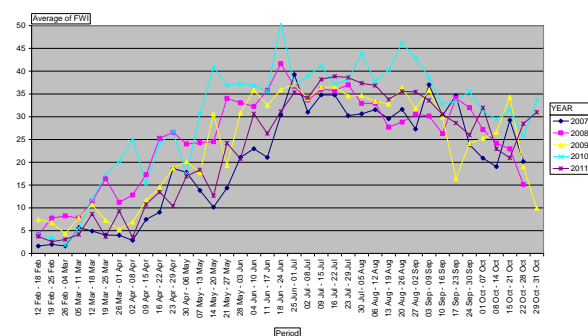
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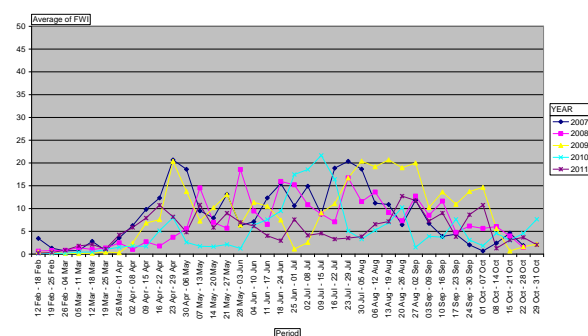
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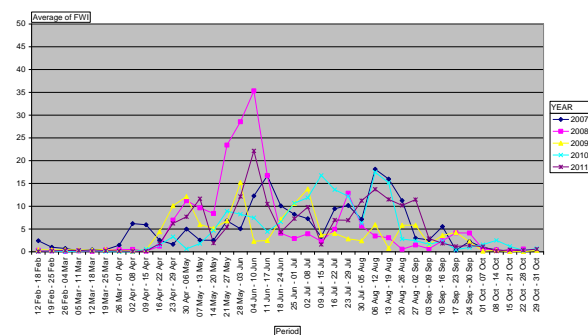
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Country: CZECH REPUBLIC

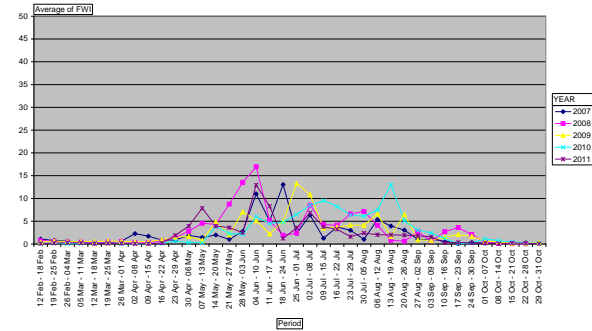


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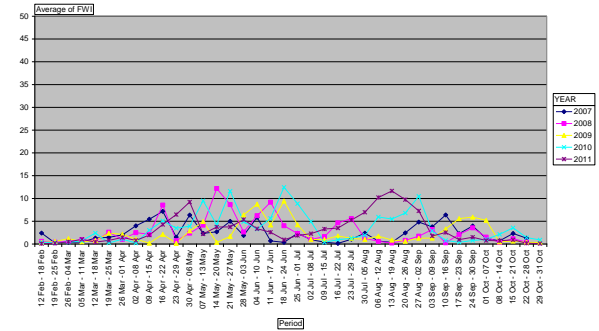




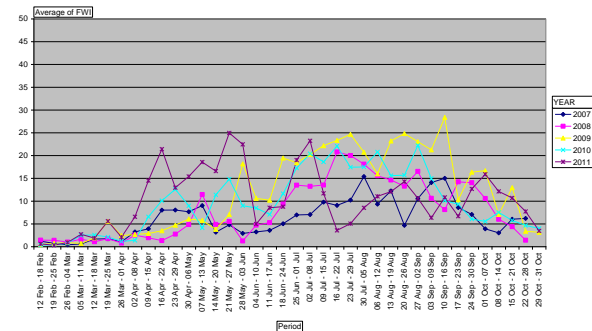
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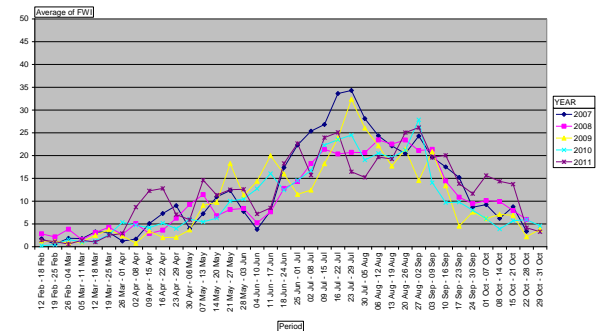
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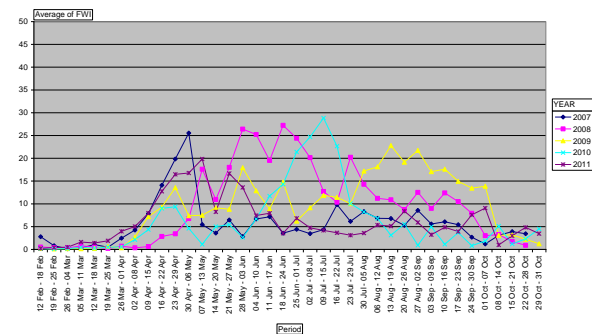
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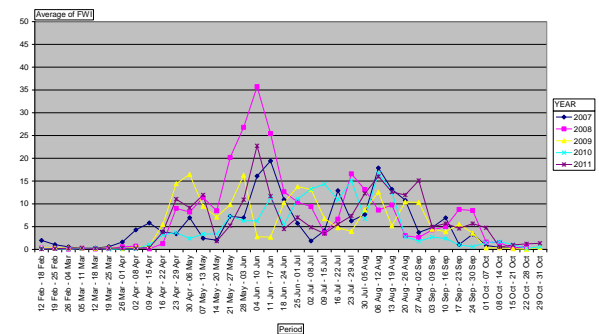
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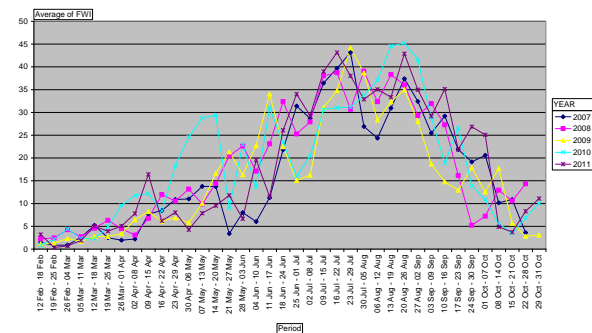
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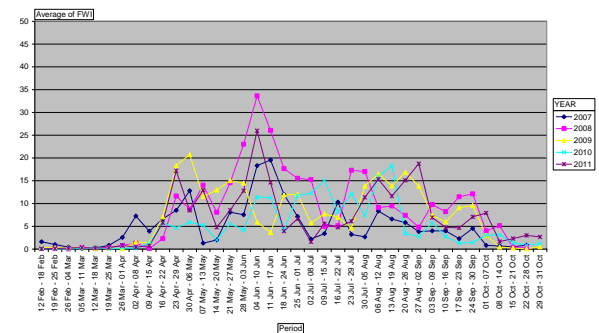
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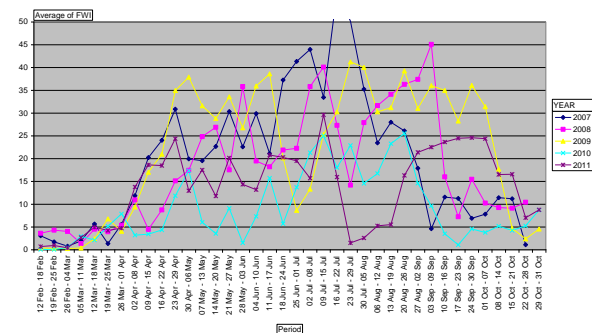
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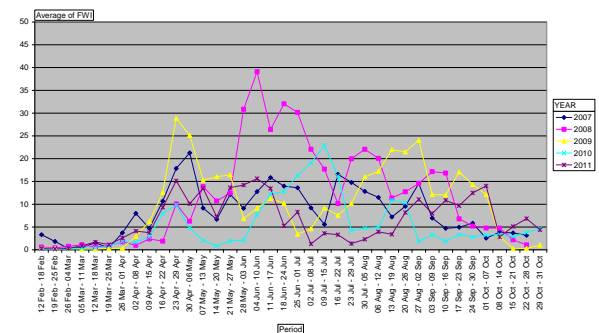
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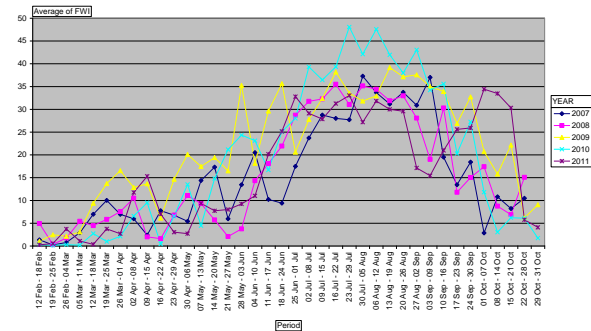
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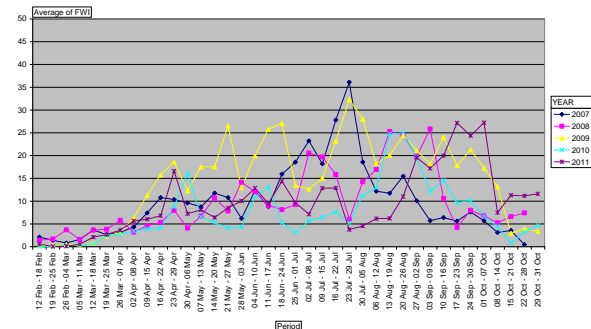
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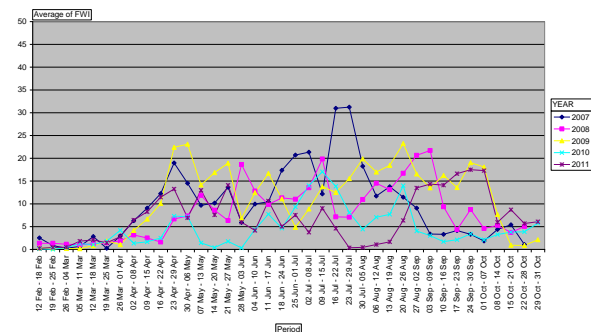
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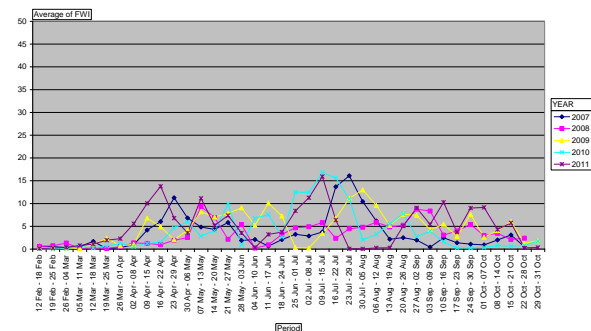
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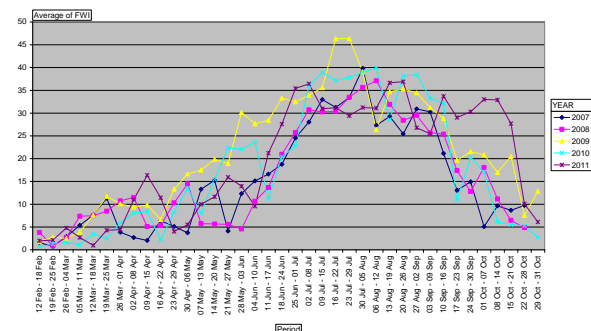
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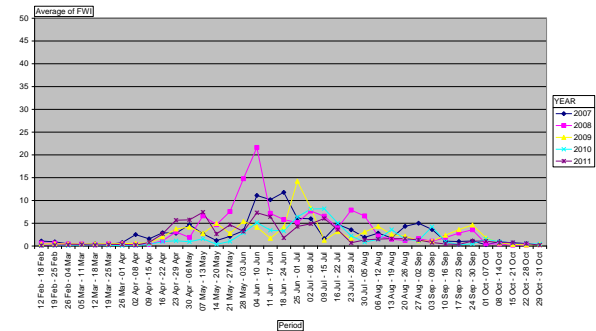
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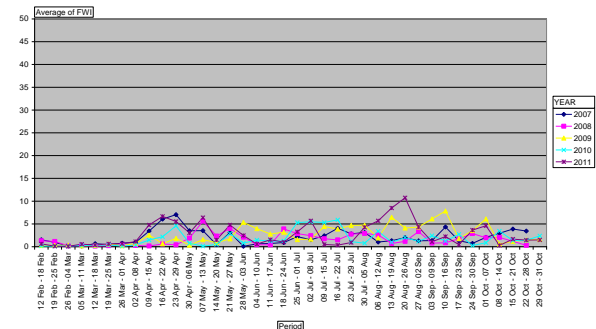
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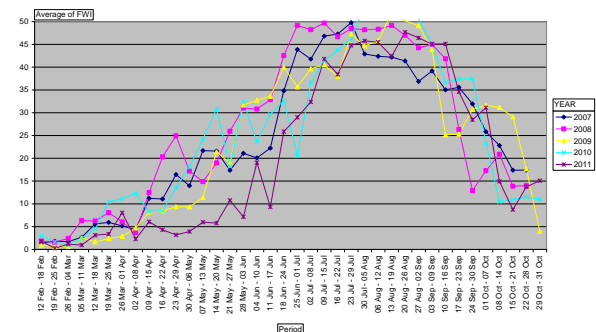
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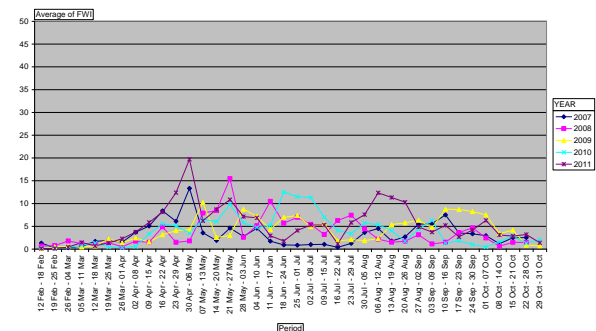
Country: SWITZERLAND



Country: TURKEY



Country: UNITED KINGDOM



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 71. 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.

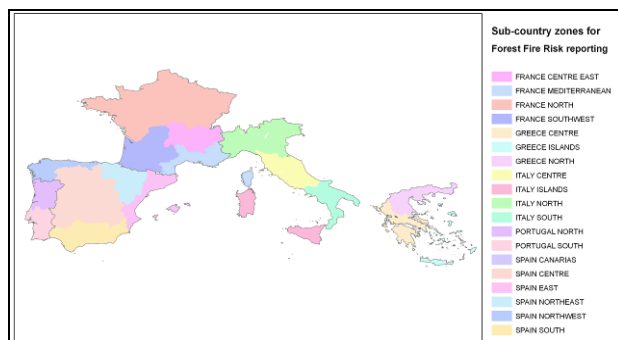


Figure 71. Sub-country regions identified for fire danger trend reporting in the five Mediterranean most affected Member States.

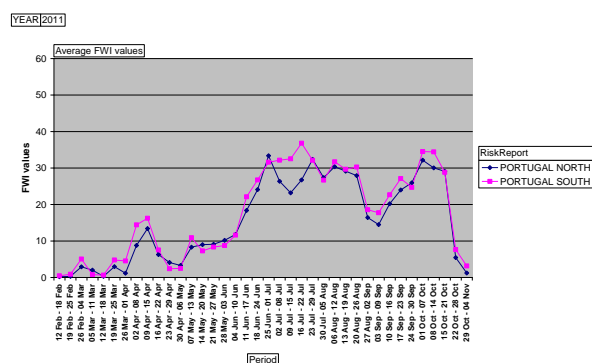


Figure 72. Fire danger trends in 2011 as determined by the Fire Weather Index (FWI) in the regions identified for Portugal

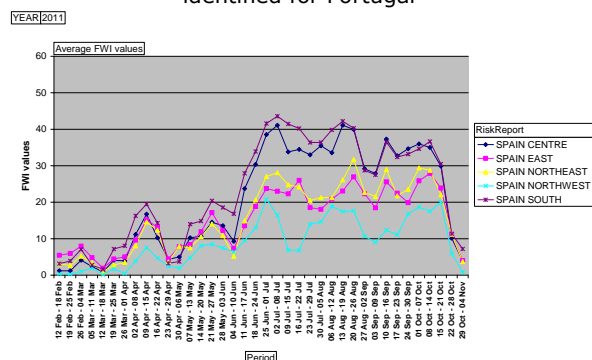


Figure 73. Fire danger trends in 2011 as determined by the Fire Weather Index (FWI) in the regions identified for Spain

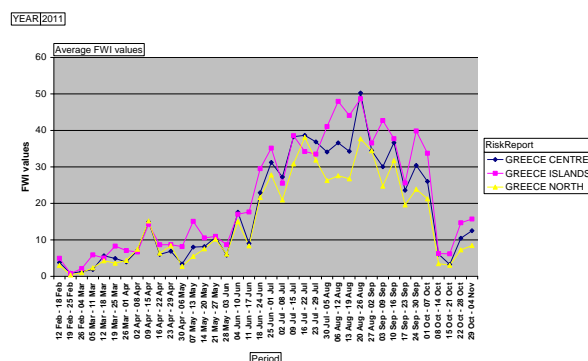


Figure 74. Fire danger trends in 2011 as determined by the Fire Weather Index (FWI) in the regions identified for Greece

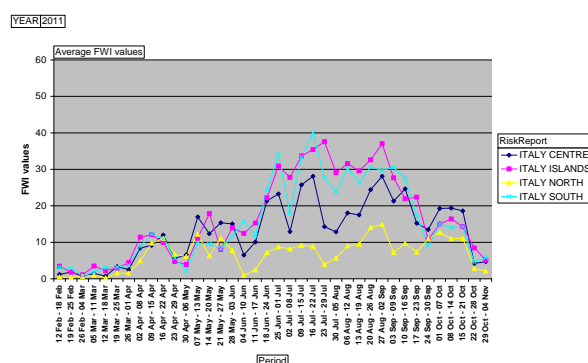


Figure 75. Fire danger trends in 2011 as determined by the Fire Weather Index (FWI) in the regions identified for Italy

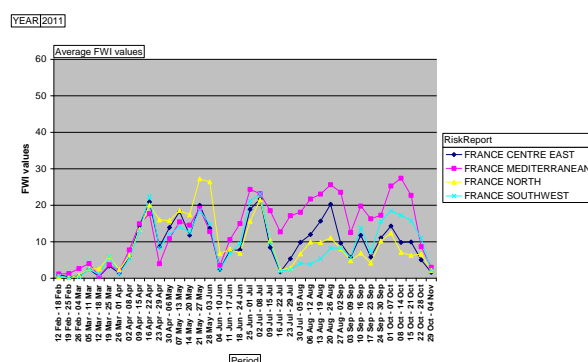


Figure 76. Fire danger trends in 2011 as determined by the Fire Weather Index (FWI) in the regions identified for France.

To facilitate the comparison among the different countries in EU, in the next graphs (Figure 77 to Figure 82), the fire danger trends as determined by FWI are shown for Member States grouped by main bioclimatic type (e.g. Mediterranean, temperate or boreal) and for Candidate countries. Data are given for 2009 to 2011.

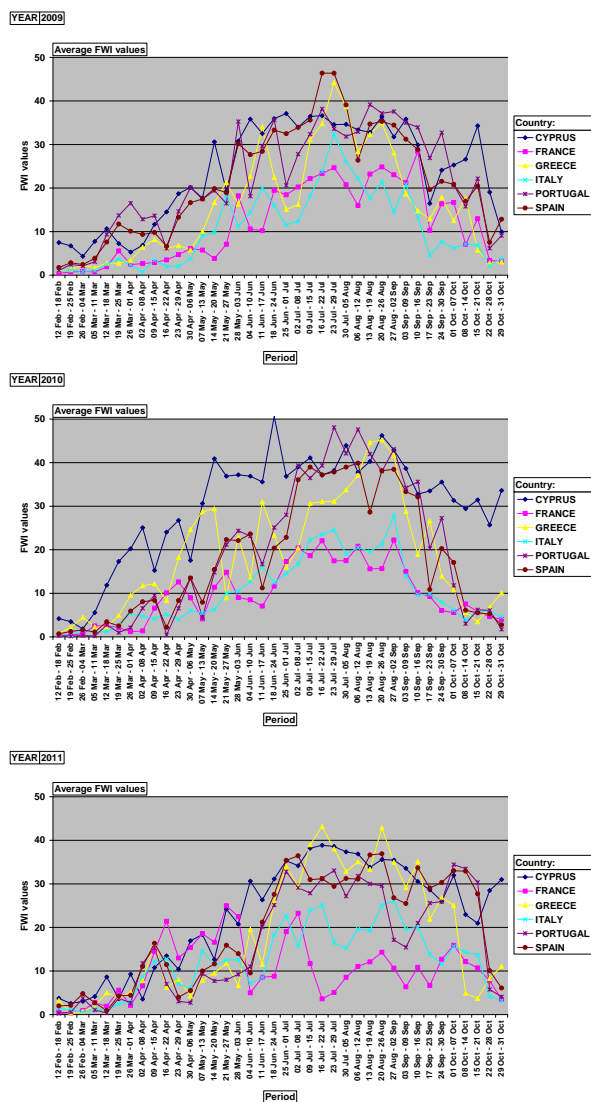


Figure 77. Fire danger trends 2009-2011 in EU Mediterranean countries (CY, FR, GR, IT, PT, ES).

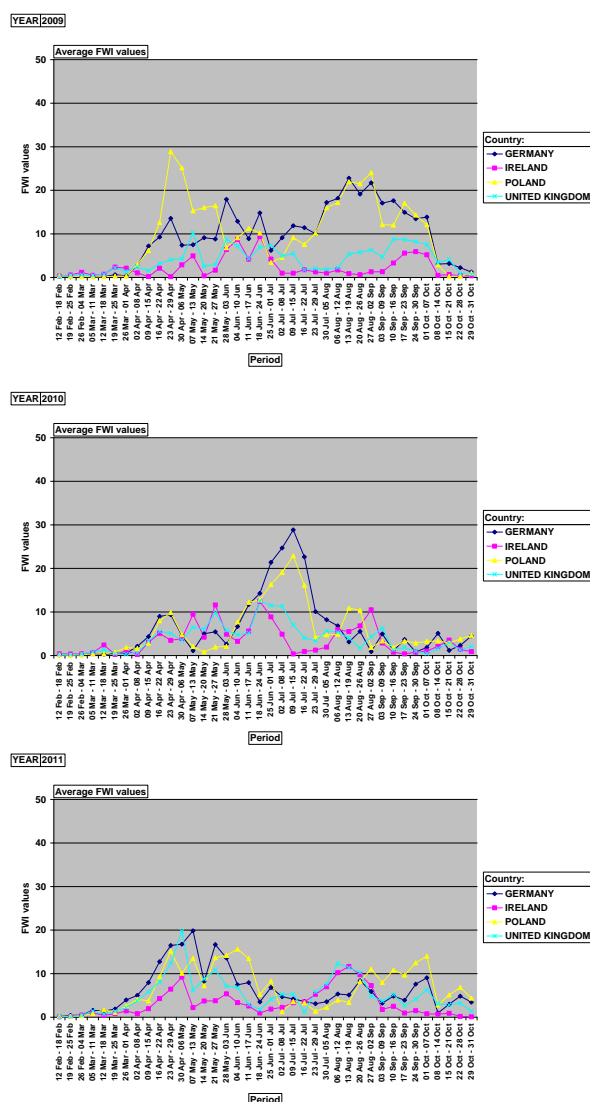


Figure 78. Fire danger trends 2009-2011 in some EU temperate countries (DE, IE, PL, UK).

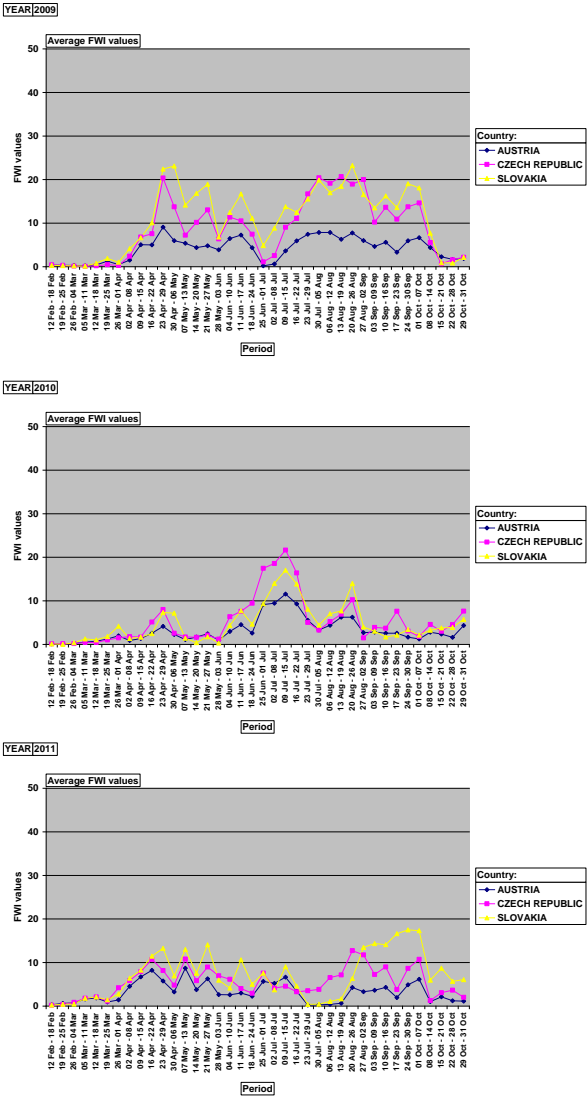


Figure 79. Fire danger trends 2009-2011 in some EU temperate countries (AT, CZ, SK).

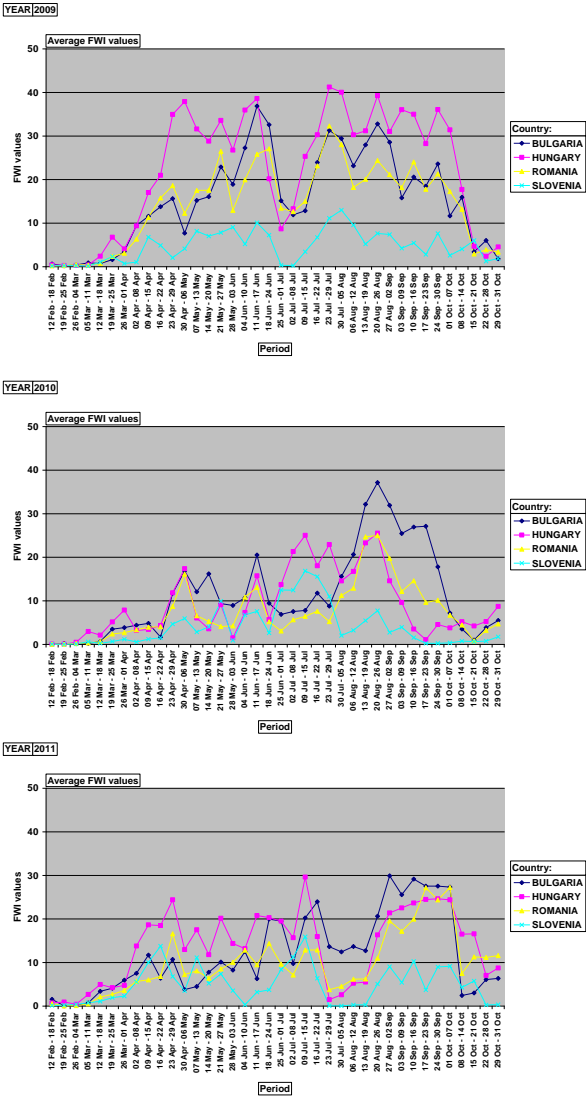
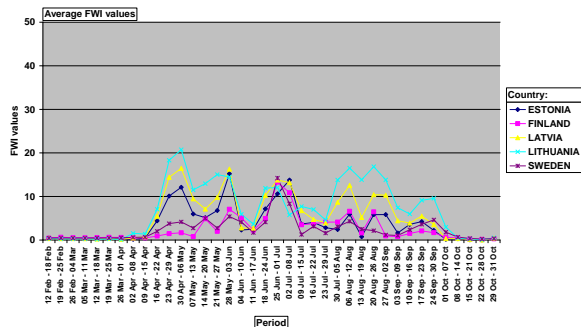
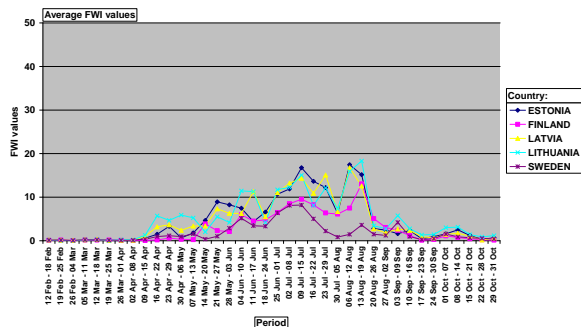


Figure 80. Fire danger trends 2009-2011 in some EU temperate countries (BG, HU, RO, SI).

YEAR 2009



YEAR 2010



YEAR 2011

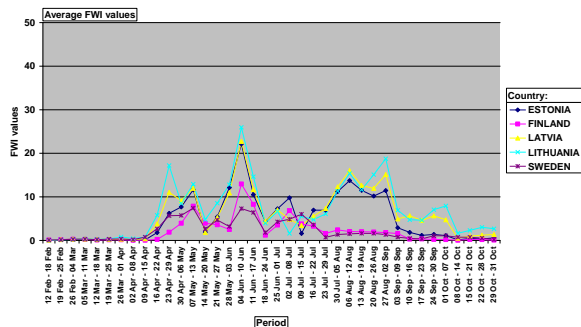
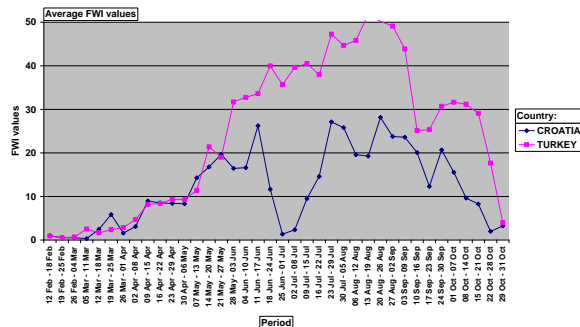
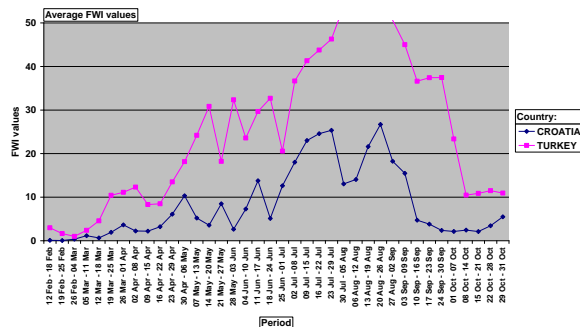


Figure 81. Fire danger trends in the last 3 years (2009-2011) in some EU boreal countries (EE, FI, LV, LT, SE).

YEAR 2009



YEAR 2010



YEAR 2011

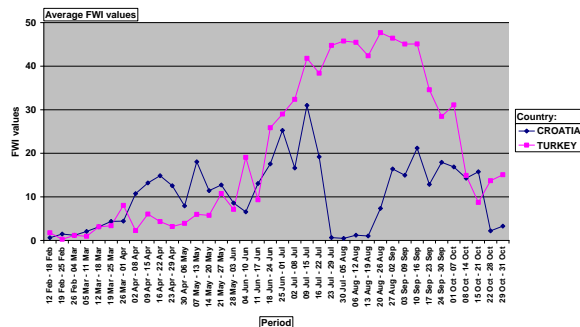


Figure 82. Fire danger trends in the last 3 years (2009-2011) in EU candidate countries (HR, TR).

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 Global Monitoring for Environment and Security (GMES) initiative.

### 3.2 EFFIS RAPID DAMAGE ASSESSMENT: 2011 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 the mapping of all fires of about 40 ha or larger. In order to obtain the statistics of the burnt area by land cover type the data from the European CORINE Land Cover 2000 (CLC) database were used. Therefore the mapped burned areas were overlaid to the CLC data, allowing the derivation of 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 meters (red and near-infrared bands) and 5 bands with spatial resolution of 500 meters (blue, green, and three short-wave infrared bands). Mapping of burnt areas is based mainly on the 250 meters bands, although the MODIS bands at 500 meters 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 about 50 ha or larger. Although only a fraction of the total number of fires is mapped (fires smaller than 40 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 40 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. This is intended to be a first step towards the enlargement of EFFIS to the non-European countries of the Mediterranean basin.

The results for each of the EU southern European countries mostly affected by forest fires (Portugal, Spain, France, Italy, Greece, and Cyprus) are given in the following paragraphs. In addition, an analysis for other countries in the region that had large forest fires is also presented. In 2011, fires of

greater than 40 ha were observed in 25 countries and approximately 50% more burnt area was mapped than in 2010. In 2011, Portugal, Spain and Albania were the three countries most affected in terms of total burnt area and number of fires. 2011 was a bad year for several of the more Northern countries, in particular the UK and Ireland, which were affected by several fires larger than 40 ha in the first half of the year.

As was the case for 2010, the worst month for fires was August, when approximately one third of the burnt area of the season occurred.

The total area burned in 2011 by fires larger than 40 ha, as shown by the analysis of satellite imagery, was 455 847 ha (Table 38). These figures may also include agricultural and urban areas that were burned during the forest fires.

Table 38. Areas burned by fires of at least 40 ha in 2011 estimated from satellite imagery.

<i>Country</i>	<i>Area (Ha)</i>	<i>Number of Fires</i>
Albania	53308.75	201
Algeria	52984.35	279
Belgium	2180.39	3
Bosnia	17100.3	34
Bulgaria	11589.64	23
Croatia	17379.58	31
Cyprus	939.24	3
France	4830.67	23
FYROM	20463.8	47
Greece	36872.79	89
Ireland	16675.47	15
Italy	37557.18	253
Montenegro	17763.93	50
Morocco	4666.83	15
Norway	641.27	1
Portugal	64840.52	319
Romania	333.24	1
Serbia	1056.9	4
Spain	64598.1	304
Sweden	142.64	1
Switzerland	73.93	1
The Netherlands	147.58	1
Tunisia	3520.34	17
Turkey	8984.94	11
United Kingdom	17195.03	44
<b>TOTAL</b>	<b>455847.4</b>	<b>1770</b>



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. However, the category of Natura2000 areas only exists in the countries of the European Union. Information on other protected areas outside the EU is not available and is thus not presented in this report. The area burnt within the Natura2000 sites is presented in Table 39. Around 50% more area was affected in 2011 than in the previous year.

Table 39. Area burnt in 2011 within Natura 2000 sites.

Country	Area (Ha)
Belgium	2144.01
Bulgaria	9352.87
Cyprus	52.44
France	690.97
Greece	11849.27
Ireland	9629.84
Italy	11986.65
Portugal	16904.78
Romania	333.24
Spain	27254.97
Sweden	142.64
The Netherlands	147.58
United Kingdom	8535.57
TOTAL	99024.83

In 2011 there were three peaks of fire activity – one in April-May, particularly affecting northern regions, the normal large peak in August, in which fires were concentrated in more southern and eastern areas, and a late peak in October which affected the Western Mediterranean region in particular. Significant fires occurred relatively late in the year, with France, Spain and Portugal registering maximum damage in October (Figure 83).

Figure 84 shows the scars caused by forest fires during the 2011 season. There are visible burnt scars in northern countries such as the UK and Ireland, in addition to the extensive damage observed in Portugal, Spain, southern Italy, northern Africa and the Balkans.

Figure 85 below shows the distribution of damage by month throughout the year.

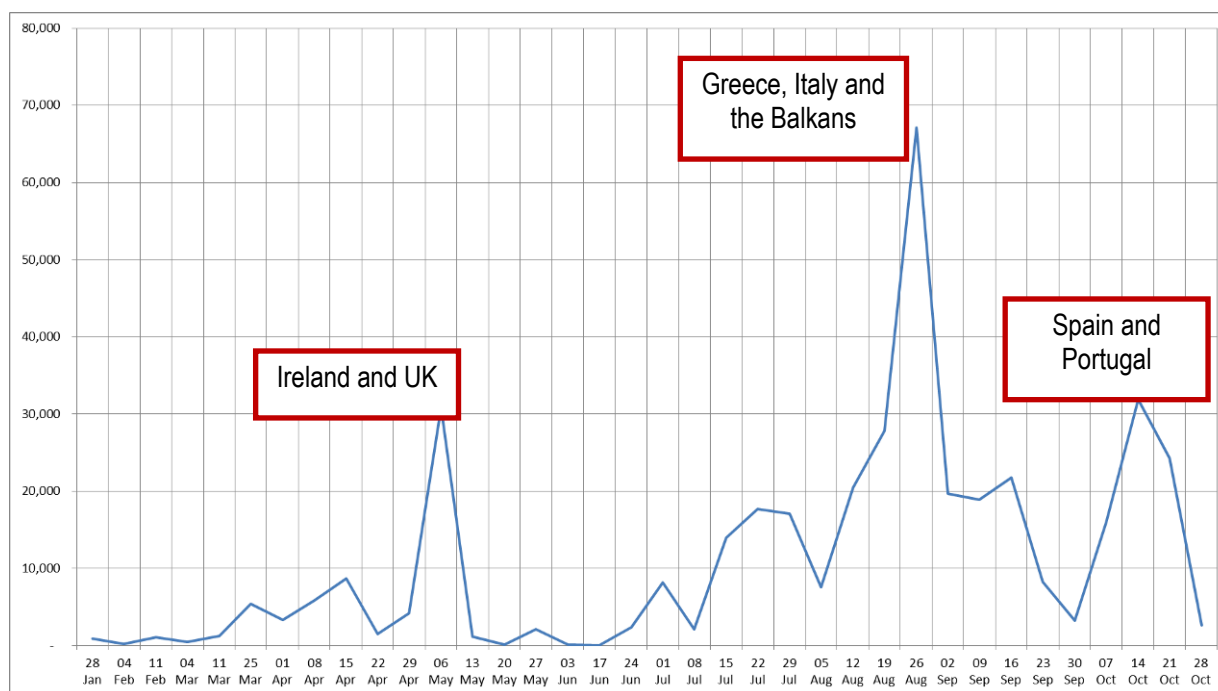


Figure 83. Weekly evolution of burnt area in Europe in 2011

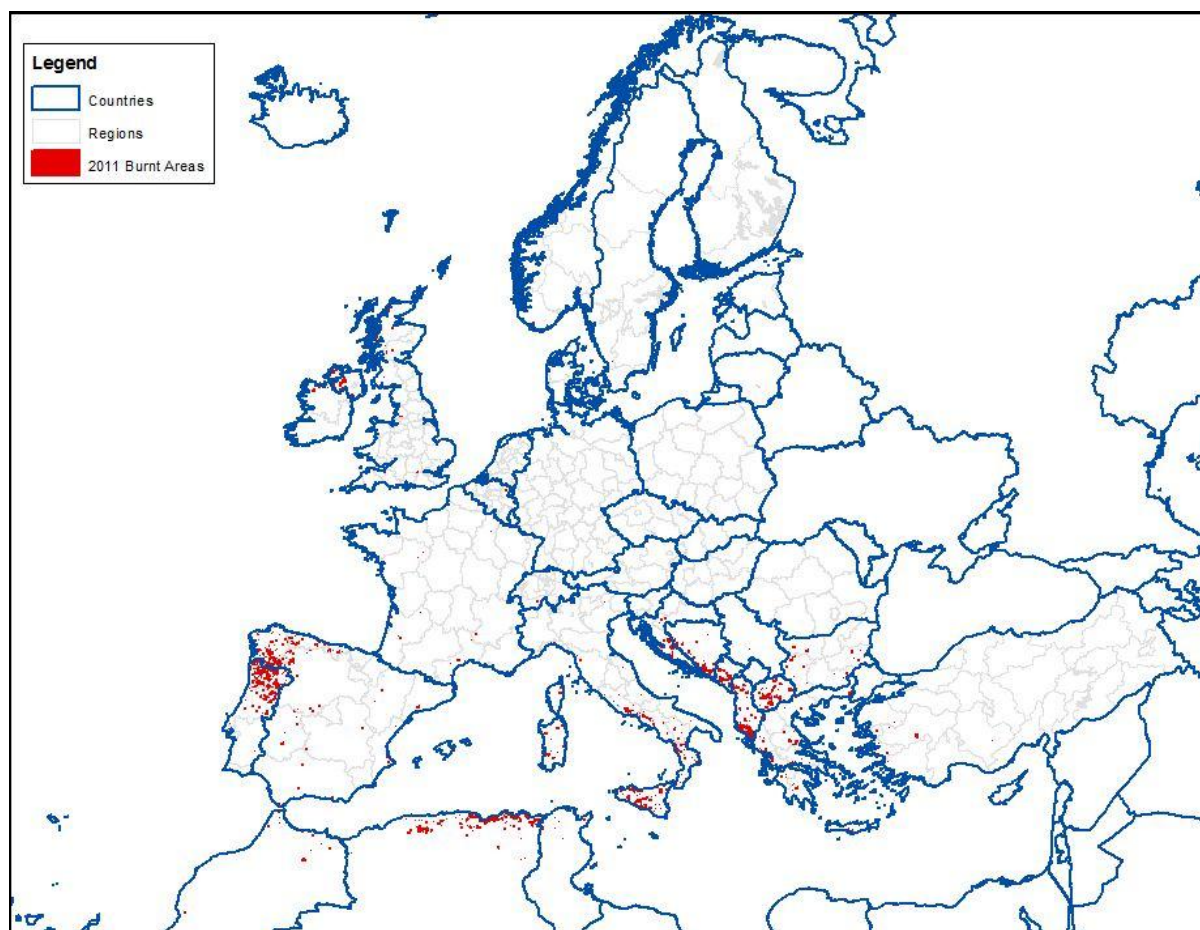


Figure 84. Burnt scars produced by forest fires during the fire season 2011.

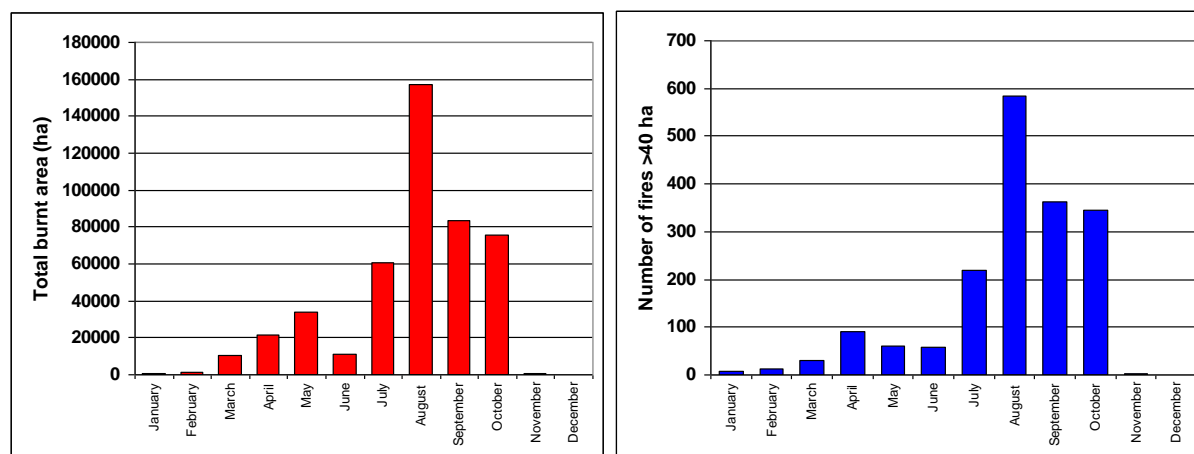


Figure 85. Total burnt area and number of fires >40 ha by month in 2011

In 2011, 13 of the EU27 countries were affected by fires of over 40 ha: (Belgium, Bulgaria, Cyprus, France, Greece, Ireland, Italy, Netherlands, Portugal, Romania, Spain, Sweden, UK), burning a total of 257 902 ha. Of this total, 99 025 ha (38%) were on Natura2000 sites.

## Southern most affected countries

For the Mediterranean countries, particularly in the west, the fire season continued late in the year, and as well as the normal peak in August, significant fires were also mapped in October.

### 3.2.1 Portugal

As was also the case in 2010, Portugal was the country most severely affected by fires in 2011. 319 fires of at least 40 ha were mapped in 2011, over one half of which occurred relatively late in the season in October. This, however, was only half of the burnt area registered in 2010 (127 891 ha). The total burnt area mapped in 2011 was 64 841 ha. This area includes 16 904.78 ha on Natura2000 sites, corresponding to 26 % of the total area burned, and 0.88 % of the total Natura2000 areas in Portugal. Table 40 presents the distribution of the mapped burnt area by land cover type using the CLC 2000 map. In terms of land cover, of the total burnt area mapped, 23 104.72 ha were burnt in forest and other wooded lands, 10 557.09 ha were on agricultural land and 30 925.07ha in other natural lands. Figure 86 shows the most noticeable fires in Portugal in 2011.



Figure 86. Impact of forest fires in Portugal in 2011

Table 40. Distribution of burnt areas (fires of at least 40 ha) by land cover class in Portugal.

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	23104.72	35.63%
Other Natural Land	30925.07	47.69%
Agriculture	10557.09	16.28%
Artificial Surfaces	84.92	0.13%
Other Land Cover	168.72	0.26%
<b>Total:</b>	<b>64840.52</b>	<b>100%</b>

### 3.2.2 Spain

Spain was the second country most affected by fire in 2011. As was the case for Portugal, a large proportion of the damage (58%) occurred late in the season in October. Of a total mapped burnt area of 64 598.1 ha, 27 254.97 ha occurred on Natura2000 sites, corresponding to 42% of the total area burned, and 0.2% of the Natura2000 areas in Spain. Table 41 presents the distribution of the mapped burnt area by land cover type using the CLC 2000 database. In terms of land cover, from a total of 64 598.1 ha of burnt area mapped, 29 577.73 ha was forest land and other wooded lands, 28 754.15 ha was on other natural lands and 5 895.76 ha were agricultural land.

The most noticeable fires in Spain during 2011 are presented in Figure 87, showing the extensive damage in the Northwest part of the country.

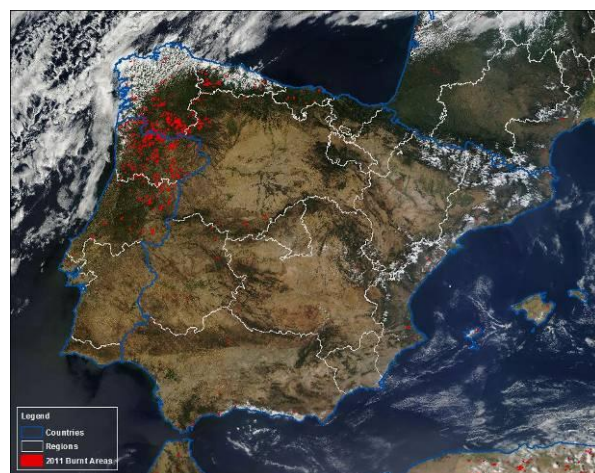


Figure 87. Impact of forest fires in Spain in 2011.

Table 41. Distribution of burned area (ha) in Spain by land cover type

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	29577.73	45.79%
Other Natural Land	28754.15	44.51%
Agriculture	5895.76	9.13%
Artificial Surfaces	140.05	0.22%
Other Land Cover	230.41	0.36%
<b>Total:</b>	<b>64598.1</b>	<b>100%</b>



### 3.2.3 France

The total mapped burnt area in France was slightly higher than in 2010, with most of the damage occurring late in the season. 8 large fires in October contributed 70% of the damage for the entire year. The total burnt area mapped in France was 4 830.67 ha. From this area 690.97 ha were on Natura2000 sites, corresponding to 14% of the total area burned, and 0.01% of the total Natura2000 areas in the country. Table 42 presents the distribution of the mapped burnt area by land cover type using the CLC 2000 database. In terms of land cover, from a total of 4 830.67 ha of burnt area mapped, 4 116.03 ha of land were burnt in forest and other wood lands, 117.36 ha were on agricultural land, and 594.53ha were other natural lands. A small area of artificial surfaces, including urban, industrial and social areas, was also affected.

The largest fires, which occurred in the south of France and in Corsica, are shown in Figure 88.

Table 42. Distribution of burnt areas (fires of at least 40 ha) by land cover type in France.

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	4116.03	85.21%
Other Natural Land	594.53	12.31%
Agriculture	117.36	2.43%
Artificial Surfaces	2.53	0.05%
Other Land Cover	0.22	0%
<b>Total:</b>	<b>4830.67</b>	<b>100%</b>



Figure 88. Burnt areas in southern France in 2011.

### 3.2.4 Italy

The total burnt area in 2011 was similar to last year (34 379 ha) and close to the 10 year average of 35 701 ha mapped burnt area. August was the worst period with nearly half of the annual damage occurring in this month. The total burnt area was 37 557.18 ha from 253 fires over 40 ha, of which 11 986.65 ha were on Natura2000 sites. This corresponds to 32% of the total area burned, and 0.21% of the total Natura2000 area in the country. Table 43 presents the distribution of the mapped burnt area by land cover type using the CLC 2000 database. In terms of land cover, from a total of 37 557.18 of burnt area mapped, 12 938.11 ha of land were burnt in forests and other wooded lands, 10 686.76 ha were agricultural land, and 13 864.84 ha were other natural lands. Figure 89 shows the distribution of major forest fires in central and southern Italy, Sicily and Sardinia.



Figure 89. impact of forest fires in Italy in 2011.

Table 43. Distribution of burnt areas (fires of at least 40 ha) by land cover type in Italy.

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	12938.11	34.45%
Other Natural Land	10686.76	28.45%
Agriculture	13864.84	36.92%
Artificial Surfaces	32.99	0.09%
Other Land Cover	34.48	0.09%
<b>Total:</b>	<b>37557.18</b>	<b>100%</b>

### 3.2.5 Greece

The 2011 fire season in Greece was worse than that of 2010, although still below the average mapped in the last 10 years and well below the peak of over 271 516 ha mapped in 2007. The peak time of the season occurred in August, when 70% of the total of the season was burnt. In particular, there was a large fire on August 25-27 in the region of Alexandroupolis, in which over 3 500 ha were burnt. Of the total burnt area in 2011, 11 849.27 ha were on Natura2000 sites, corresponding to 32% of the total area burned and to 0.33% of the Natura2000 areas in the country. Table 44 presents the distribution of the mapped burnt area by land cover type using the CLC 2000 map. In terms of land cover, from a total of 36 872.51 ha of burnt area mapped, 16 454.5 ha were forests and other wooded land, 10 734.91 ha were other natural land, 9 572.11 ha were agricultural areas, and 110.99 ha were artificial surfaces.

Figure 90 shows the damage caused by forest fires in Greece.

Table 44. Distribution of burnt areas (fires of at least 40 ha) by land cover class in Greece.

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	16454.5	44.63%
Other Natural Land	10734.91	29.11%
Agriculture	9572.11	25.96%
Artificial Surfaces	110.99	0.3%
<b>Total:</b>	<b>36872.51</b>	<b>100%</b>



Figure 90. Satellite image showing impact of forest fires in Greece in 2011.

### South and East Europe

In the South-east of Europe the worst part of the fire season occurred in August. The area as a whole was quite badly affected by forest fires compared with 2010.

### 3.2.6 Cyprus

The 2011 fire season in Cyprus was mild, with a total burnt area of 939.24 ha caused by 3 fires burning in July and August. 52.44 ha of this occurred on Natura2000 areas, corresponding to 5.58% of the total area burned, and 0.03% of the total Natura2000 areas in the country. Table 45 presents the distribution of the mapped burned area by land cover type using the CLC 2000 database. 645.76 ha were burnt in forests and other wooded lands and 293.48 ha were in agricultural areas.

Figure 91 shows the damage caused by forest fires in Cyprus.

Table 45. Distribution of burned area (ha) in Cyprus by land cover types.

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	645.76	68.75%
Agricultural Areas	293.48	31.25%
<b>Total:</b>	<b>939.24</b>	<b>100%</b>



Figure 91 Satellite image showing impact of forest fires in Cyprus in 2011

### 3.2.7 Albania

The 2011 fire season was rather intense in Albania, making it the third worst country affected (after Portugal and Spain) in 2011. Over 200 fires of at least 40 ha occurred over summer (all but two in July-September) burning at total of 53 308.75 ha – more than in the last 3 years combined. Table 46 presents the distribution of the mapped burned area by land cover type using the CLC 2000 database. 28 203.23 ha were burnt in forests and other wooded lands, 19 742.86 ha in other natural lands, 4 986.21 ha in agricultural areas and 376 ha in artificial surfaces, i.e. urban, industrial or social areas and other land cover types. Figure 92 shows the damage caused by forest fires in the Albanian territory; in particular in the southern part of the country.

Table 46. Distribution of burned area (ha) in Albania by land cover types.

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	28203.23	52.91%
Other Natural Land	19742.86	37.03%
Agriculture	4986.21	9.35%
Artificial Surfaces	349.98	0.66%
Other Land Cover	26.47	0.05%
<b>Total:</b>	<b>53308.75</b>	<b>100%</b>



Figure 92. Forest fires in Albania in 2011

### 3.2.8 Bosnia-Herzegovina

Similarly to Albania, Bosnia-Herzegovina suffered a worse year in 2011 than the last three years combined. There were two main periods of activity in Bosnia: one in March/April when about a third of the annual damage occurred, and a second period starting in July and peaking in September. Table 47 presents the distribution of the mapped burnt area by land cover type using the CLC 2000 database. In terms of land cover, 10 276.11 ha were burnt in forests and other wooded lands, 5 369.06 ha occurred in other natural lands, and 1 404.45 ha burned agricultural areas. A small amount was also registered against artificial surfaces and other land cover types. Visible fire scars caused by forest fires in Bosnia-Herzegovina can be observed in Figure 93.

Table 47. Distribution of burned area (ha) in Bosnia-Herzegovina by land cover types.

<i>Land cover</i>	<i>Area</i>	<i>% of total</i>
Forest /Other Wooded Land	10276.11	60.09%
Other Natural Land	5369.06	31.4%
Agriculture	1404.45	8.21%
Artificial Surfaces	36.99	0.22%
Other Land Cover	13.68	0.08%
<b>Total:</b>	<b>17100.3</b>	<b>100%</b>



Figure 93: Impact of forest fires in Bosnia-Herzegovina and Croatia in 2011



### 3.2.9 Bulgaria

The 2011 fire season in Bulgaria was the worst since 2007, although still significantly lower than the 67 598 ha mapped in that year. The greatest peak of activity was in September, when 14 fires accounted for nearly two-thirds of the annual total. Natura2000 areas suffered in particular this year: 9 352.87 ha of the total burnt area (81% of the fires) occurred within these sites, corresponding to 0.25% of the Natura2000 areas in the country. Table 48 presents the distribution of the mapped burned area by land cover type using the CLC 2000 database. In terms of land cover, from a total of 11 589.64 ha of burnt area mapped, 2 685.4 ha were forests and other wooded land, 5022.2 ha were other natural land, 3 805.63 ha were agricultural areas, and 76 ha were artificial surfaces and other land cover types.

Table 48. Distribution of burned area (ha) in Bulgaria by land cover types.

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	2685.4	23.17%
Other Natural Land	5022.2	43.33%
Agriculture	3805.63	32.84%
Artificial Surfaces	76.36	0.66%
Other Land Cover	0.06	0.00%
<b>Total:</b>	<b>11589.64</b>	<b>100%</b>

### 3.2.10 Croatia

The 2011 season in Croatia was the worst in several years. The season started early in March, when over 3 000 ha were burnt, and continued to October, with the maximum damage occurring in July (37% of total burnt area). Table 49 presents the distribution of the mapped burnt area by land cover type using the CLC 2000 database. From a total of 17 379.58 ha of burnt area mapped, 9 969.97 ha occurred in forest and other wooded lands, 4 090.39 ha in other natural areas and 3 288.05 ha in agricultural areas. The visible scars left by fires in 2011 can be seen in Figure 93 above.

Table 49. Distribution of burned area (ha) in Croatia by land cover types.

<i>Land cover</i>	<i>Area</i>	<i>% of total</i>
Forest /Other Wooded Land	9969.97	57.37%
Other Natural Land	4090.39	23.54%
Agriculture	3288.05	18.92%
Artificial Surfaces	29.48	0.17%
Other Land Cover	1.69	0.01%
<b>Total:</b>	<b>17379.58</b>	<b>100%</b>

### 3.2.11 Former Yugoslav Republic of Macedonia (FYROM)

In 2011, FYROM suffered its worst year for fires since 2007 (although the total was still well under that year's mapped total of 40 282 ha). Over 40% of the damage occurred in August. Table 50 presents the distribution of the mapped burnt area by land cover type using the CLC 2000 map. In terms of land cover, from a total of 20 463.8 ha of burnt area mapped, 8 634.61 ha were burnt in forests and other wooded lands, 3 950.91 ha were other natural lands, and 7 871.86 ha were in agricultural areas.

Table 50. Distribution of burned area (ha) by land cover types in FYROM.

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/ Other Wooded Land	8634.61	42.19%
Other Natural Land	3950.91	19.31%
Agriculture	7871.86	38.47%
Artificial Surfaces	6.42	0.03%
<b>Total:</b>	<b>20463.8</b>	<b>100%</b>

### 3.2.12 Montenegro

The burned area mapped in Montenegro in 2011 was 17 763.93 ha from 50 fires which occurred mostly in August and September. This is the worst year since the 19 272 ha that were burnt in 2007. Table 51 presents the distribution of the mapped burnt area by land cover type using the CLC 2000 map. In terms of land cover, from a total of 1 692.84 ha of burnt area mapped, 1 018.92 ha occurred in forest and other wooded lands, 79.19 ha in agricultural areas, and 989.84 ha) occurred in other natural areas.

Table 51. Distribution of burned area (ha) in Montenegro by land cover types.

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	10798.47	60.79%
Other Natural Land	5390.83	30.35%
Agriculture	1567.63	8.82%
Artificial Surfaces	7	0.04%
<b>Total:</b>	<b>17763.93</b>	<b>100%</b>



### 3.2.13 Romania

In Romania a single large fire burned 333.24 ha in August. The entire area was part of a Natura2000 site, and represented 0.01% of the total Natura2000 area of Romania. Table 52 presents the distribution of the mapped burnt area by land cover type using the CLC 2000 database.

Table 52. Distribution of burned area (ha) in Romania by land cover types

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Other Natural Land	320.49	96.17%
Artificial Surfaces	12.75	3.83%
<b>Total:</b>	<b>333.24</b>	<b>100%</b>

### 3.2.14 Serbia

Three large fires in August and one late in the season in November burnt a total of 1 056.9 ha in Serbia. This was the worst year for large fires in Serbia since 2007, although nowhere near the 34 830 ha registered for that year. Table 53 presents the distribution of the mapped burnt area by land cover type using the CLC 2000 database.

Table 53. Distribution of burned area (ha) in Serbia by land cover types.

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	432.44	40.92%
Other Natural Land	528.5	50%
Agriculture	95.97	9.08%
<b>Total:</b>	<b>1056.9</b>	<b>100%</b>

### 3.2.15 Turkey

In 2011 there were 11 fires of over 40 ha in Turkey, most of them occurring in August and burning a total area of 89 84.94 ha. . The CORINE Land Cover database has not yet been developed in Turkey, so the Globcover land cover map from ESA was used to split the burnt area into different land type categories. Table 54 shows the distribution of burnt area by land type. The visible scars from forest fires in the west of the country are shown in Figure 94.

Table 54. Distribution of burned area (ha) in Turkey by land cover types.

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	2059.24	22.92%
Other Natural Land	1540.05	17.14%
Agriculture	5385.66	59.94%
<b>Total:</b>	<b>8984.94</b>	<b>100%</b>

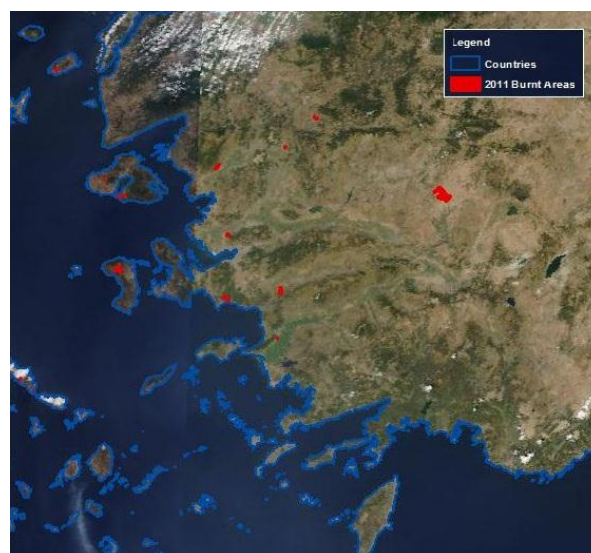


Figure 94. Forest fires in Western Turkey in 2011

## Central and Northern Europe

In these countries the fire season was concentrated in April and May, with all the mapped fires over 40 ha occurring in these two months.

### 3.2.16 Belgium

In April 2011 a large fire burned 1 400 ha in Belgium. This was followed by two more in May bringing the total burnt area from fires greater than 40 ha in Belgium to 2 180.39 ha. 98% of this area was on NATURA2000 sites, representing 0.56% of the total NATURA2000 area in the country. Table 55 presents the distribution of the mapped burnt area by land cover type using the CLC 2000 database.

Table 55. Distribution of burned area (ha) in Belgium by land cover types.

<i>Land cover</i>	<i>Area</i>	<i>% of</i>
Forest /Other Wooded Land	340.17	15.6%
Other Natural Land	1795.39	82.34%
Agriculture	17.06	0.78%
Other Land Cover	27.78	1.27%
<b>Total:</b>	<b>2180.39</b>	<b>100%</b>

### 3.2.17 Ireland

2011 was one of the worst years for forest fires in Ireland in recent times. Due to intense drought conditions and high temperatures during April, a series of fires started throughout the country, in particular in the north-western region. These were predominantly located in upland areas on land principally occupied by peatland and forestry. Some of them reached considerable size, with one in County Donegal affecting an area of over 8 000 hectares. This fire had a drastic impact in the Natura2000 site of Gannivegil Bog, with 2 043 ha burnt out of the total 2 171 ha of this protected area. In total, during April and May, 15 fires of over 40 ha burned a total of 16 675.47 ha. 58% of this (9 629.84 ha) was in Natura2000 sites, representing 1.06% of the Natura2000 areas in the country. Table 56 gives an overview of the distribution of the mapped burnt area by land cover type using the CLC 2000 map and Figure 95 shows the scars left by the fires.

Table 56. Distribution of burned area (ha) in Ireland by land cover types.

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	1096.81	6.58%
Other Natural Land	14585.79	87.47%
Agriculture	387.54	2.32%
Other Land Cover	605.33	3.63%
<b>Total:</b>	<b>16675.47</b>	<b>100%</b>



Figure 95. Fires in UK and Ireland in 2011.

### 3.2.18 The Netherlands

The Netherlands also suffered a large fire in the early part of the fire season: in this case in May. The fire burned 147.58 ha, all of which was in a Natura2000 site, representing 0.03% of the total NATURA2000 areas in the country. Table 57 presents the distribution of the mapped burnt area by land cover type using the CLC 2000 database.

Table 57. Distribution of burned area (ha) in the Netherlands by land cover types

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	54.62	37.01%
Other Natural Land	92.96	62.99%
<b>Total:</b>	<b>147.58</b>	<b>100%</b>

### 3.2.19 Norway

In Norway a large fire in May burned 641.27 ha. The CORINE Land Cover database has not yet been developed in Norway, so the Globcover land cover map from ESA was used to split the burnt area into different land type categories. The majority of the land cover affected was forests and other wooded lands (Table 58).

Table 58. Distribution of burned area (ha) in Norway by land cover types

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	595.28	92.83%
Other Natural Land	44.04	6.87%
Other Land Cover	1.94	0.3%
<b>Total:</b>	<b>641.27</b>	<b>100%</b>

### 3.2.20 Sweden

The large fire that occurred in Sweden in April burned 142.64 ha, all of which was in a Natura2000 site. Table 59 presents the distribution of the mapped burnt area by land cover type using the CLC 2000 database.

Table 59. Distribution of burned area (ha) in Sweden by land cover types

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	1.33	0.93%
Other Natural Land	141.31	99.07%
<b>Total:</b>	<b>142.64</b>	<b>100%</b>

### 3.2.21 Switzerland

In April a single large fire burned nearly 74 ha in Switzerland. The CORINE Land Cover database has not yet been developed in Switzerland, so the Globcover land cover map from ESA was used to investigate the land cover type affected. All the burnt area occurred in forest and other wooded land.

Table 60. Distribution of burned area (ha) in Switzerland by land cover types

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	73.93	100%
<b>Total:</b>	<b>73.93</b>	<b>100%</b>

### 3.2.22 UK

2011 was also a bad year for the UK. 44 fires over 40 ha occurred in April and May, burning 17 195.03 ha of land. Half of this (8 535.6 ha) was on Natura2000 sites, representing 0.48% of the Natura2000 areas in the country. Figure 95 shows some of the scars left by fires in 2011. Table 61 above gives an overview of the distribution of the mapped burnt area by land cover type using the CLC 2000 map.

Table 61. Distribution of burned area (ha) in the UK by land cover types

<i>Land cover</i>	<i>Area burned</i>	<i>% of total</i>
Forest/Other Wooded Land	1481.66	8.62%
Other Natural Land	15519.73	90.26%
Agriculture	144.47	0.84%
Other Land Cover	49.17	0.29%
<b>Total:</b>	<b>17195.03</b>	<b>100%</b>

## North Africa

North Africa overall had the best fire season for three years. However, much of this is due to the greatly reduced burnt area mapped in Algeria. In Tunisia the picture was similar to last year, and Morocco suffered the greatest burnt area for 3 years. Total burnt area for these three countries from 2009 to 2011 is presented in Table 62.

Figure 96 shows the damage caused by fires in Northern Africa.

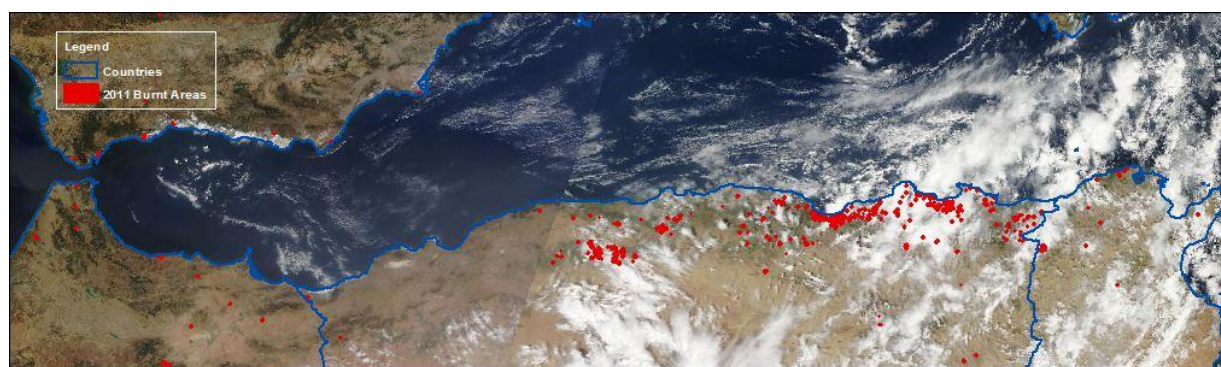


Figure 96: Impact of forest fires in North Africa in 2011

### 3.2.23 Algeria

The fire season in Algeria was better than the previous two years, with a lower burnt area mapped than 2009 or 2010. The season was at its most intense in August and September: over 80% of the fires over 40 ha occurred in these two months. The burnt scars left by these fires can be seen in Figure 96 and the distribution of burnt area by land cover types is given in Table 63.

Table 63. . Distribution of burned area (ha) in Algeria by land cover types.

<i>Land cover</i>	<i>Area</i>	<i>% of total</i>
Forest /Other Wooded Land	16068.21	30.33%
Other Natural Land	1951.94	3.68%
Agriculture	34470.14	65.06%
Artificial Surfaces	492.62	0.93%
Other Land Cover	1.44	0%
<b>Total:</b>	<b>52984.35</b>	<b>100%</b>

### 3.2.24 Morocco

In contrast to Algeria, Morocco suffered more large fires than in the previous two years with a total mapped burnt area almost as great as 2009 and 2010 combined. The worst month was August when 43% of the fires over 40 ha occurred. Figure 96 shows the burnt scars left

Table 62. Distribution of burnt area (ha) in North Africa 2009-2011

	<i>Area 2009</i>	<i>Area 2010</i>	<i>Area 2011</i>
Algeria	141925.13	70747.05	52984.35
Morocco	2111.86	2826.08	4666.83
Tunisia	128.96	3551.14	3520.34
<b>Total:</b>	<b>144166</b>	<b>77124</b>	<b>61172</b>

The CORINE Land Cover database has not yet been developed in these countries, so the Globcover land cover map from ESA was used to split the burnt area into different land type categories.

by these fires, and the distribution of burnt area by land cover types is given in Table 64.

Table 64. . Distribution of burned area (ha) in Morocco by land cover types.

<i>Land cover</i>	<i>Area</i>	<i>% of total</i>
Forest /Other Wooded Land	1697.86	36.38%
Other Natural Land	329.77	7.07%
Agriculture	2639.19	56.55%
<b>Total:</b>	<b>4666.83</b>	<b>100%</b>

### 3.2.25 Tunisia

In Tunisia the fire season was comparable with last year with a similar total burnt area mapped. All fires over 40 ha occurred between July and September, 83% of them in August. Figure 96 shows the burnt scars left by these fires, and the distribution of burnt area by land cover types is given in Table 65.

Table 65. . Distribution of burned area (ha) in Tunisia by land cover types.

<i>Land cover</i>	<i>Area</i>	<i>% of total</i>
Forest /Other Wooded Land	2380.08	67.61%
Other Natural Land	64.01	1.82%
Agriculture	1074.91	30.53%
Other Land Cover	1.34	0.04%
<b>Total:</b>	<b>3520.34</b>	<b>100%</b>

### 3.3 EUROPEAN FIRE DATABASE

#### *Background*

The European Fire Database is an important component of EFFIS containing forest fire information compiled by EU Member States and the other countries members of the EFFIS network.

The first steps to create a forest fire database were taken under the **Regulation EEC No 2158/92** (now expired), which set up an action framework focussing mainly on measures for the prevention of forest fires. Under the regulation, a first forest fire information system, referred to as the Common Core Database, was established in order to collect information on forest fires, their causes and to improve the understanding of forest fires and their prevention.

Detailed rules for the application of this forest fire information system were given in the subsequent **Regulation EEC No 804/94** which made the systematic collection of a minimum set of data on each fire event a matter of routine for the Member States participating in the system. The Common Core Database covered six Member States of the Union: Germany, Portugal, Spain, France, Italy and Greece. Regulation 2158/92 was renewed for five years in 1997 and expired on 31 December 2002.

The **Forest Focus Regulation (EC) No 2152/2003** was built on the achievements of the two previous Council Regulations on the protection of Community's forests against atmospheric pollution and forest fires. According to the implementing rules of the Regulation, monitoring of forest fires in Europe continued to be recorded in order to collect comparable information on forest fires at Community level.

The forest fire data provided each year by individual EU Member States through the above-mentioned EU regulations, and additional data coming from other European countries have been checked, stored and managed by JRC within EFFIS. The database is now known as the **European Fire Database**.

#### *Structure and collected information*

The database contains four types of information: about the time, location, size and cause of the fire (Table 66).

Before being accepted into the database, the submitted data pass through a validation phase. The checks include the following:

##### Time of fire

- Is the date valid?
- Does the date given in the file match the year given in the filename?
- Does the date/time of intervention/extinction occur after the initial date/time of alert?
- Is the duration of the fire reasonable given its size?

##### Location of fire

- Do the place names exist and are they correctly spelt?
- Are the commune name/code/NUTS codes consistent with each other?
- Is the correct (up to date) code used?
- If information is missing, is it possible to obtain it from cross-referring other data?
- If North/East values are given, are they plausible?

##### Size of fire

- Are the values plausible (e.g. correct units)?
- Have the categories (Forest, Non-forest, etc.) been assigned correctly?

##### Cause of fire

- Is the mapping between the country cause code and EU code consistent/correct?

#### *Data stored in the database*

In 2011 Slovenia started to send data for the database, bringing the number of countries now contributing to 22 (Bulgaria, Croatia, Cyprus, Czech, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and Turkey). The database currently contains over 2 million individual fire event records (1.66 million forest fires). See Table 66 for a summary.

#### *Access to the information*

Access to summarised information from the database is provided through the EFFIS web interface



<http://effis.jrc.ec.europa.eu/fire-history>, which allows the users to retrieve general information such as maps of the number of fires, burnt area and average fire size for a selected year and for the countries for which data are available (Figure 97). The data can be displayed at country, NUTS1,

NUTS2 or NUTS3 level and may be filtered to exclude fires below a certain size, while an interactive graphical facility allows the user to display the same fire statistics over time. Further analysis possibilities are planned for the future.

Table 66. Information collected 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
SIZE OF FIRE (Ha)	Longitude [decimal degrees]	EAST
	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	Presumed Cause (EU categories code)	CAUSE_EU
	Presumed Cause (Country detailed categories code)	CAUSE_CO

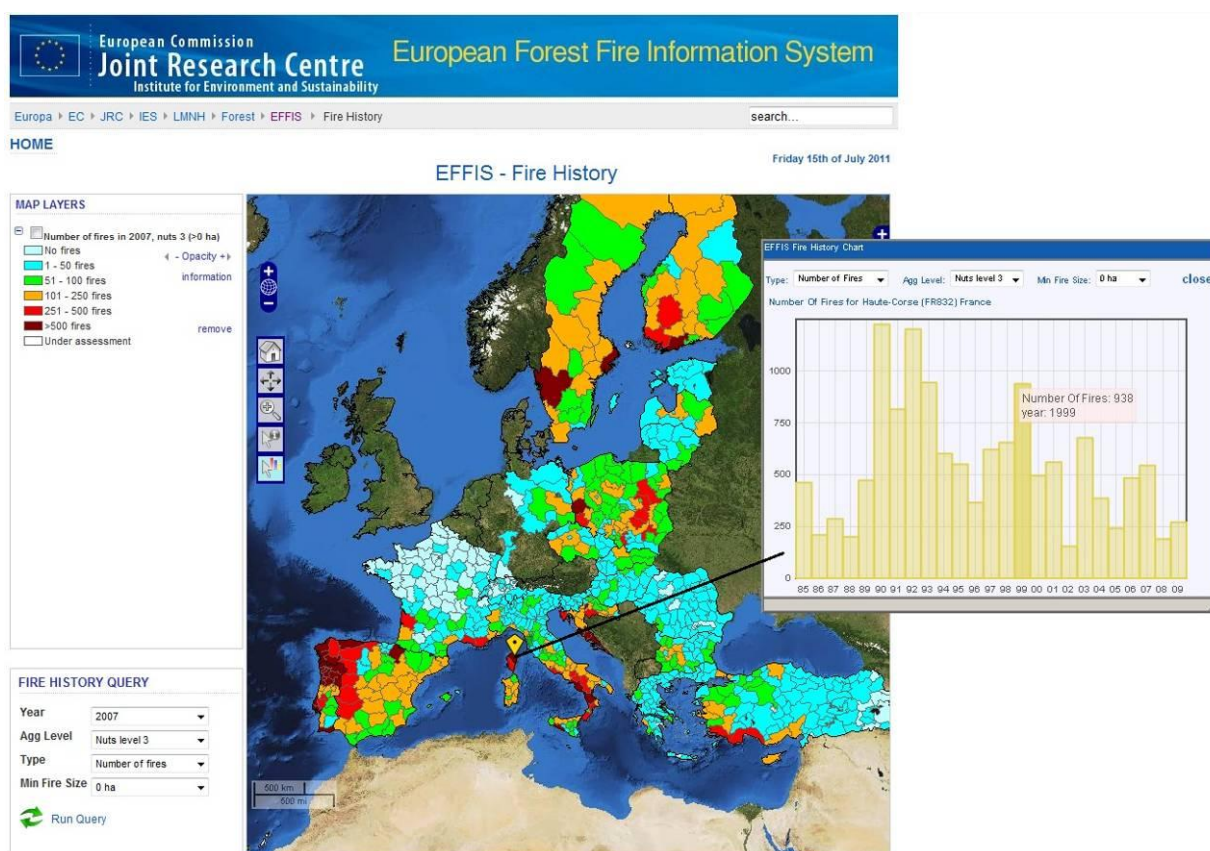


Figure 97. Access to the information stored in the European Fire Database from EFFIS web interface

Table 67. Summary of data records stored in the European Fire Database

COUNTRY	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Bulgaria																										251	393	1479	582	314	222
Croatia																	3147	3795	5485	3856	7897	4045	4713	6937	2859	3372	3581	5176			
Cyprus																					285	299	243	427	221	185	172	111	114	91	133
Czech rep.																									957	653	697	809	470		
Estonia																										65	248	64	71	47	30
Finland																									2285	2631	6314	2813	3161	2746	3100
France						3732	2657	2116	2240	3321	3297	2372	2708	4766	4728	6539	6401	8001	6289	4881	4343	4259	4097	7023	3767	4698	4608	3382	2781	4808	3828
Germany															706	525	822	276	592	794	930	373	278	1238	300	299	717	435	560	575	525
Greece				945	1184	1417	1088	1234	1798	1203	1283	1036	2008	2707	1955	1494	1527	2271	605	513	1469	1313	572	622	739	718	764	1226	1071	354	540
Hungary																							429	373	104	150	97	603	502	608	109
Italy						12931	6115	8506	9785	8328	11560	7580	10044	14317	7153	5505	6064	11608	9565	6956	8609	7227	4607	9716*	6341*	7918*	5651*	10736	6648	5423*	4884
Latvia																									647	365	1929	426	716	890	319
Lithuania																									430	267	1444	245	272	471	106
Poland															24365	23822	23587	25070	21346	32650	31811	24513	38154	79018	36320	46546	35634	31311	35804	30914	24443
Portugal	2349	6730	3626	4542	7356	8441	5036	7705	6131	21896	10745	14327	14954	16101	19983	34116	28626	23497	34676	25477	34109	27982*	28738*	26941*	26945*	40965*	23647*	23956*	18619*	29218*	25013
Romania																									34	64	105	478	91	190	70
Slovakia																									153	287	238	463	182	347	123
Slovenia																44	47	55	143	55	100	60	64	227	50	74	106	129	68	122	33
Spain						12235	7514	8816	9440	20250	12914	13529	15956	14253	19249	25557	16586	22320	22003	17943	23574	19099	19929	18616	21396	25492	16334	10932	11656	15642	11722
Sweden																	4854	7057	2503	4707	4708	4831	6490	8282	4955	4573	4618	3787	5420	4180	3120
Switzerland	79	147	71	107	166	96	76	109	76	168	235	148	70	76	74	87	108	135	91	45	49	48	67	155	49	63	46	65	46	52	57
Turkey																										1530	2227	2706	2135		1861

2011 data are still undergoing validation checks and are not presented

\* Data changed since last year

**NB.** 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 this information is only available in summary form

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## ANNEX I – SUMMARY TABLES OF FIRE STATISTICS

Table 68. Number of forest fires in five Southern Member States (1980-2011)

Table 69. Burnt area (hectares) in five Southern Member States (1980 – 2011)

Table 70. Number of forest fires in other European countries (1990-2011)

Table 71. Burnt area (hectares) in other European countries (1990 – 2011)

### **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 68. Number of forest fires in five Southern Member States (1980-2011)**

<i>Year</i>	<i>PORTUGAL</i>	<i>SPAIN</i>	<i>FRANCE</i>	<i>ITALY</i>	<i>GREECE</i>	<i>TOTAL</i>
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	21 394	3 775	6 428	1 748	55 215
2005	35 697	25 492	4 698	7 951	1 544	75 382
2006	19 929	16 355	4 608	5 634	1 417	47 943
2007	18 722	10 915	3 364	10 639	1 983	45 623
2008	13 832	11 612	2 781	6 486	1 481	36 192
2009	26 119	15 391	4 800	5 422	1 063*	52 795
2010	22 026	11 722	3 900	4 884	1 052*	43 584
2011	25 221	16 028	4 500**	8 181	1 653*	55 543
% of total in 2011	45%	29%	8%	15%	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	18 337	4 406	7 259	1 695	56 645
Average 2010-2011	23 624	13 875	4 200	6 533	1 333	49 564
Average 1980-2011	18 533	15 243	4 904	9 783	1 554	50 017
TOTAL	593 052	487 788	156 931	313 042	49 723	1 600 536

\* Incomplete data

\*\* Provisional figure

**Table 69. Burnt area (hectares) in five Southern Member States (1980 – 2011)**

<i>Year</i>	<i>PORTUGAL</i>	<i>SPAIN</i>	<i>FRANCE</i>	<i>ITALY</i>	<i>GREECE</i>	<i>TOTAL</i>
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	148 827	7 844	39 946	12 661	284 788
2007	31 450	82 048	8 570	227 729	225 734	575 531
2008	17 244	50 321	6 001	66 329	29 152	158 621
2009	87 416	110 783	17 000	73 355	35 342	323 896
2010	133 090	54 770	10 300	46 537	8 967	253 664
2011	73 813	84 490	9 630	72 004	29 144	269 081
<i>% of total in 2011</i>	27%	31%	4%	27%	11%	100%
<i>Average 1980-1989</i>	73 484	244 788	39 157	147 150	52 417	556 995
<i>Average 1990-1999</i>	102 203	161 319	22 735	118 573	44 108	448 938
<i>Average 2000-2009</i>	150 101	125 239	22 342	83 878	49 238	430 798
<i>Average 2010-2011</i>	103 452	69 630	9 965	59 271	19 056	261 373
<i>Average 1980-201</i>	108 275	170 397	26 946	112 955	46 742	465 314
<i>TOTAL (1980-2011)</i>	3 464 789	5 452 717	862 262	3 614 546	1 495 735	14 890 049

**Table 70. Number of forest fires in other European countries (1990-2011)**

<i>Country</i>	<i>1990</i>	<i>1991</i>	<i>1992</i>	<i>1993</i>	<i>1994</i>	<i>1995</i>	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>1999</i>	<i>2000</i>	<i>2001</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>	<i>2008</i>	<i>2009</i>	<i>2010</i>	<i>2011</i>
<i>Austria</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	954 <sup>6</sup>	912 <sup>6</sup>	750 <sup>6</sup>	-	218	192	356
<i>Bulgaria</i>		73	602	1196	667	114	246	200	578	320	1710	825	402	452	294	241	393	1479	582	314	222	635
<i>Croatia</i>	-	-	-	-	-	-	-	-	-	-	7797	4024	4692	6923	2853	3368	3571	5176	-	-	-	-
<i>Cyprus</i>	-	-	-	-	-	-	-	-	-	-	285	299	243	427	221	185	172	111	114	91	133	85
<i>Czech Rep.</i>	-	-	-	-	-	1331	1421	1398	2563	1402	1499	483	604	1754	873	619	697	-	-	-	-	-
<i>Estonia</i>	-	-	-	-	-	-	-	-	-	-	-	-	356	111	89	65	248	64	71	47	30	24
<i>Finland</i>	-	-	-	-	-	-	1475	1585	370	1528	826	822	2546	1734	816	1069	3046	1204	1456	1242	1412	1215
<i>FYROM</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	652	573	80	99	523
<i>Germany</i>	-	1846	3012	1694	1696	1237	1748	1467	1032	1178	1210	587	513	2524	626	496	930	779	818	858	780	888
<i>Hungary</i>	-	-	-	-	-	-	-	-	-	229	811	419	382	375	104	150	97	603	502	608	109	2021 <sup>7</sup>
<i>Latvia</i>	604	225	1510	965	763	582	1095	768	357	1196	915	272	1720	900	647	365	1929	425	700	823	316	360
<i>Lithuania</i>	-	-	1180	634	715	472	894	565	258	1022	654	287	1596	885	468	301	1545	251	301	471	104	142
<i>Poland</i>	575 <sup>6</sup>	3528	11858	8821	10710	7681	7924	6818	6166	9820	12428	4480	10101	17088	7219	12803	11828	8305	9091	9161	4880	9220
<i>Romania</i>	131	42	187	159	121	62	72	37	59	138	688	268	516	203	34	64	105	478	91	190	70	340
<i>Slovakia</i>	-	-	-	-	366	254	662	535	1056	426	824	311	570	872	153	287	237	463	182	347	127	303
<i>Slovenia</i>	-	-	-	-	-	-	-	-	-	-	-	-	60	224	51	73	112	140	74	120	32	114
<i>Sweden</i>	-	-	-	-	-	-	4854	7057	2503	4707	4708	4831	6490	8282	4955	4573	4618	3737	5420	4180	3120	3534
<i>Switzerland</i>	235	148	70	76	74	87	108	135	91	45	49	48	67	154	49	63	46	39	46	52	57	76
<i>Turkey</i>	1750	1481	2117	2545	3239	1770	1645	1339	1932	2075	2353	2631	1471	2177	1762	1530	2227	2829	2135	1793	1861	1954

<sup>6</sup> Database undergoing validation – figures may change in future<sup>7</sup> Change in database compilation protocol

**Table 71. Burnt area (hectares) in other European countries (1990 – 2011)**

<i>Country</i>	<i>1990</i>	<i>1991</i>	<i>1992</i>	<i>1993</i>	<i>1994</i>	<i>1995</i>	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>1999</i>	<i>2000</i>	<i>2001</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>	<i>2008</i>	<i>2009</i>	<i>2010</i>	<i>2011</i>
<i>Austria</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	74 <sup>8</sup>	75 <sup>8</sup>	48 <sup>8</sup>	-	22	37	78
<i>Bulgaria</i>	-	511	5243	18164	18100	550	906	595	6967	8291	57406	20152	6513	5000	1137	1456	3540	42999	5289	2271	6526	6883
<i>Croatia</i>	-	-	-	-	-	-	-	-	-	-	129883	27251	74945	77359	8988	21407	18782	63719	-	-	-	-
<i>Cyprus</i>	-	-	-	-	-	-	-	-	-	-	8034	4830	2196	2349	1218	1838	1160	4483	2392	885	2000	1599
<i>Czech Rep.</i>	-	-	-	-	-	403	2043	359	1132	336	375	87	178	1236	335	227	53	-	-	-	-	-
<i>Estonia</i>	-	-	-	-	-	-	-	-	-	-	-	-	2082	207	379	87	2638	292	1280	59	25	19
<i>Finland</i>	-	-	-	-	-	-	433	1146	131	609	266	187	590	666	358	495	1617	576	830	576	520	580
<i>FYROM</i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32665	5915	1307	737	17308
<i>Germany</i>	-	920	4908	1493	1114	592	1381	599	397	415	581	122	122	1315	274	183	482	256	538	757	522	214
<i>Hungary</i>	-	-	-	-	-	-	-	-	-	756	1595	-	1227	845	247	3531	625	4636	2404	6463	878	8055 <sup>9</sup>
<i>Latvia</i>	258	69	8412	570	326	535	927	448	211	1544	1341	311	2222	559	486	120	3387	272	364	646	92	115
<i>Lithuania</i>	-	-	769	274	279	321	478	226	93	494	352	113	746	436	253	51	1199	38	112	287	22	293
<i>Poland</i>	7341	2567	4375 <sup>8</sup>	8290	9171	5306	14120	6598	4019	8307	7013	3429	5593	28554	4338	7387	5912	2844	3028	4400	2126	2850
<i>Romania</i>	444	277	729	518	312	208	227	68	137	379	3607	1001	3536	762	124	162	946	2529	373	974	206	2195
<i>Slovakia</i>	-	-	-	-	-	-	-	-	-	557	904	305	595	1567	157	524	280	679	118	510	192	403
<i>Slovenia</i>	-	-	-	-	-	-	-	-	-	-	-	-	161	2100	138	280	1420	128	75	177	121	288
<i>Sweden</i>	-	-	-	-	-	-	1588	5873	422	1771	1552	1254	2626	4002	1883	1562	5710	1090	6113	1537	540	945
<i>Switzerland</i>	1705	96	27	34	404	444	286	1685	261	30	68	17	697	640	23	41	108	282	65	43	26	222
<i>Turkey</i>	13742	8081	12232	15393	38128	7676	14922	6316	6764	5804	26353	7394	8514 <sup>†</sup>	6644	4876	2821	7762	11664	29749 <sup>†</sup>	4679	3317	3612

<sup>8</sup> Database undergoing validation – figures may change in future<sup>9</sup> Change in database compilation protocol

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## **Abstract**

This is the 12<sup>th</sup> “Forest Fires in Europe” report published by the European Commission. The area covered by the report has been enlarged to include also Middle East and North Africa countries, thus also the title of the report has been changed accordingly. The report contains a summary of the 2011 fire season in Europe, the Middle East and North Africa with official statistics on the number of fires and burnt areas compiled by the contributing countries. In addition to country reports with a summary of the past fire season provided by the countries, the report Forest Fires in Europe, Middle East and North Africa informs about the latest developments in terms of forest fire prevention and initiatives of the European Commission to support forest fires fire protection activities in the European Union. Furthermore it provides the results of the European Forest Fire Information System (EFFIS) operating during the fire season, with special emphasis on the EFFIS Danger Forecast, providing daily maps of meteorological fire danger forecast of EU, and the EFFIS Rapid Damage Assessment, performing the daily mapping and assessment of main land cover and Natura2000 areas affected by fires of at least 40 ha during the fire season.

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