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Report No 3

Forest Fires in Europe

2002 fire campaign

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INTRODUCTION

The first report entitled 'Forest fires in Southern Europe 2000' was well received by the national competent authorities, by their civil protection services including their operational forest fire fighting centres, by the European Parliament and by non-governmental organisations. Under the circumstances, the expert group for forest fires of the European Commission Directorate General Environment decided at its meeting of October 2001 to continue the publication of the report on a yearly basis. This is the third bulletin of the series.

The "Forest Fires in Europe: 2002 fire campaign" bulletin describes the developments of the fire campaign in Europe in 2002. The bulletin consists on six separate sections. The first section describes the fire campaign in the Mediterranean countries. Most of the fires in Europe take place in this region, which suffers over 95% of the forest fire damages.

The second section presents the fire status in northern EU countries. Although the number of fires in these countries is limited, if compared to the EU Mediterranean region, the damage caused by forest fires is also considerable. Three countries, Germany, Finland and Austria, are already collaborating with the European Commission Directorate General Environment on forest fire activities. However, only the report for the first two countries is presented. Austria has been recently incorporated, and its report will be included in next year's bulletin.

The third section describes operations of mutual assistance that took place during the 2002 fire campaign. The following chapter, section four, presents an update of some of the public information campaigns in the Member States. It does not intend to be a comprehensive list of those, but just to acknowledge some of the improvements on this area that have taken place in the Member States.

The activities related to fire prevention and fire fighting in three accession countries that are already part of the forest fires network of the European Commission Directorate General Environment are presented in Section 5. These are Bulgaria, Cyprus and Romania. A summary of the fire fighting structure and fire statistics is provided for each country.

Finally, the sixth section is dedicated to the application of advanced methods for forest fire risk forecasting and forest fire damage assessment developed at the European Commission Directorate General Joint Research Centre as part of the of the future European Forest Fire Information System (EFFIS). These two modules are the European Forest Fire Risk Forecasting System (EFFRFS), which provides daily the 1, 2, and 3 day forecast of fire risk, and the European Forest Fire Damage Assessment System (EFFDAS), which performs the mapping and evaluation of damages caused by fires of at least 50 ha.

EFFIS will include, in addition to the mentioned modules, all the forest fire information that was collected by the Member States and provided to the EC through Regulation (EEC) No 2158/92 expired in December 2002 and stored in the so-called Community "common core database" on forest fires.

1. FIRES AND BURNT AREA IN THE SOUTHERN STATES

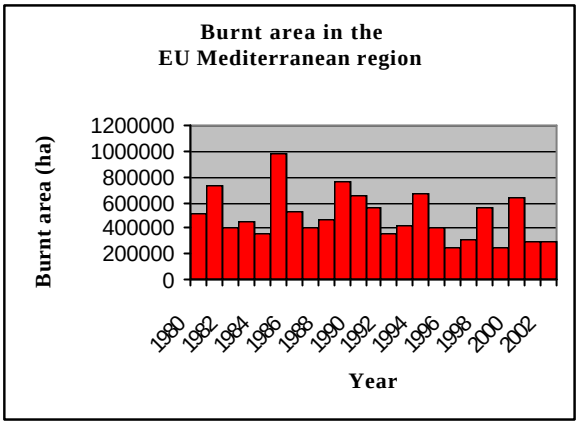
1.1 Southern Member States (1980 – 2002)

The year 2002 has been one of the best in the last decade. The number of fires was the smallest in the last 10 years in France, Italy and Greece. The situation in Spain and Portugal was not as favourable for several reasons. In Portugal meteorological conditions in the summer period did not deviate in excess from other years, but there were periods of intense heat and presence of winds during which many fires took place simultaneously. In Spain, as mentioned in the following paragraphs, the fire campaign extended during most of the year, with damaging fires in winter and spring months.

As a whole, figures for the Mediterranean region were good, with a number of fires below the average for the last decade and the last 23 years, for which data are analysed in this report. Also the burnt area was one of the smallest, only comparable to the burnt areas in 1996. These favourable figures confirm a stable or decreasing trend in burnt areas in the last decade. The number of fires seems to start a decreasing trend in the overall region, after a period (1996-2000) in which there was a marked increase of this figure.

Figure 1a confirms the stability in the number of burnt areas in the EU Mediterranean region, with the exception of the two disastrous years in 1998 and 2000. This figure also shows that there was a clear increasing trend in the number of fires during the period 1990-1996. Then, the number of fires was steadily high until 2000. The overall meteorological conditions in the Mediterranean region were fairly favourable during the summer month due to frequent rains. These conditions helped in containing fires in their early stages. The reports of the individual countries that follow this chapter show that the most damaging fires were concentrated in short time periods in which the meteorological conditions favoured fire ignition and spread.

Figure 2a compares the yearly average burnt area and number of fires for the period 1980 to 2002. This comparison is performed for each Member State (MS) and for the overall EU. Figure 2a shows that the burnt area in the year 2002 was below the average for the last 22 years in all countries, except Portugal. However, the overall figure for the EU Mediterranean region remains below the average for the last 23 years.



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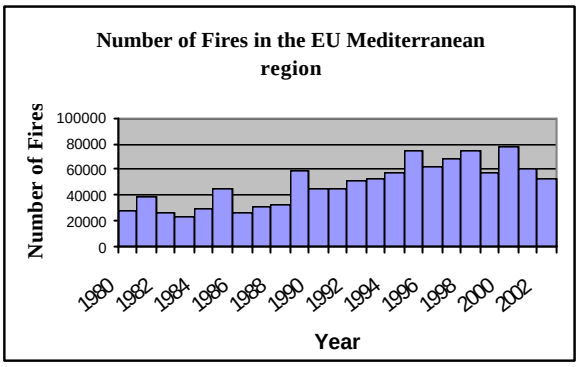

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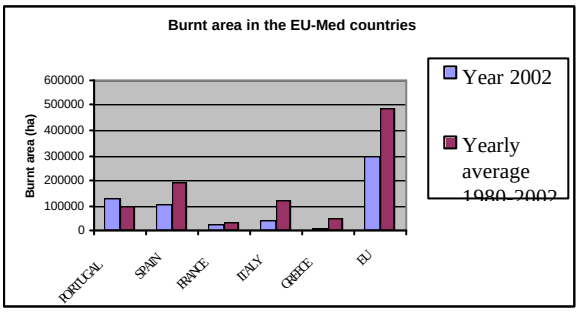
Figure 1. (a) Burnt area in the EU Mediterranean region in the last 23 years; (b) Number of fires in the EU Mediterranean region

Provisional data provided by: Direcçao Geral das Florestas, Portugal; Dirección General de Conservación de la Naturaleza, Spain; Ministère de l'Agriculture, France; Corpo Forestale dello Stato, Italy;) General Secretariate for Forests and the Natural Environment, Greece.

A total of 277967 ha were burnt in the EU Mediterranean region in 2002. This figure is well below the average for the last 23 years. In fact, it corresponds to only 57% of the average for this period (487697 ha). The number of fires in the region during 2002 was 53945. This figure is still above the average for the last 23 years (48779), but below the average for the last decade (58991).

A summary of the number of fires in the last 23 years, the average for the last two decades, and the figures for the year 2002 are presented in Table 1. This table presents also the corresponding figures for the burnt areas in the different periods.



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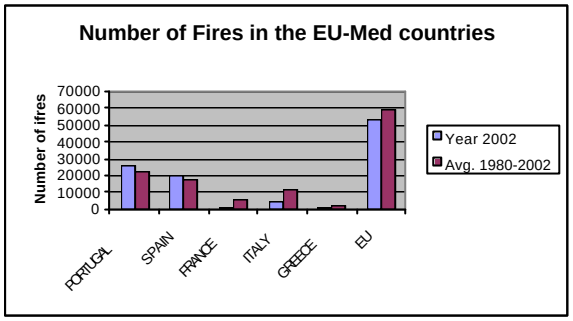

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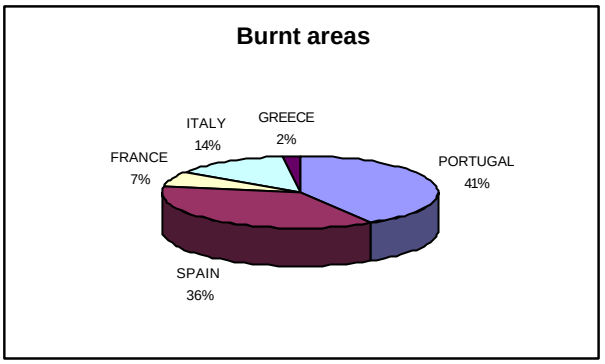
Figure 2. Burnt area and number of fires in the EU Mediterranean countries in the year 2002 as compared to average values for the last 23 years.

As in previous reports, a comparison of the contribution of each EU Mediterranean country to the overall figures is presented in Figures 3a and 3b.

Comparison of the contribution of each Member State to the total burnt area and the total number of fires in the year 2002 is presented in Figure 3.



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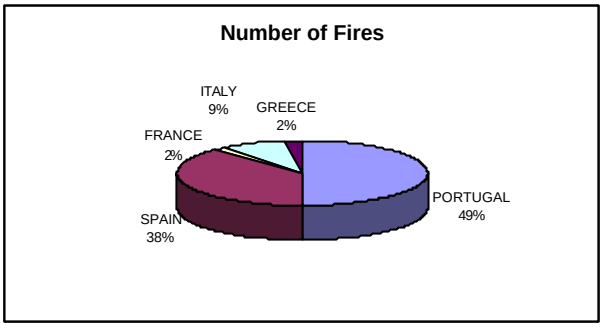

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Figure 3. Percentage of the total burnt area and the number of fires in each of the EU Mediterranean countries.

Table 1. Number of fires and burnt area in the Member States and the European Union in the last decades

Number of fires	PORTUGAL	SPAIN	FRANCE	ITALY	GREECE	EU
2002	26469	19929	900	4594	1141	53033
Average 1980-1989	6778	9514	4910	11571	1264	34036
Average 1990-1999	22250	18151	5489	11352	1748	58991
Average 1980-2002	16431	14806	4982	10939	1581	48739
TOTAL	377924	340529	114590	251593	36370	1121006
Percentage of total	50	38	2	9	2	100

Burnt Area (ha)	PORTUGAL	SPAIN	FRANCE	ITALY	GREECE	EU
2002	123910	86426	20850	40768	6013	277967
Yearly Average(1980-1989)	74486	244788	39157	148485	52417	559331
Yearly Average(1990-1999)	102203	161323	23024	108890	44108	442529
Yearly Average 1980-2002	93981	191400	29711	121982	49327	487697
Percentage of total (2002)	45	31	8	15	2	100
TOTAL	2161566	4402192	683358	2805593	1134514	11217029

Since the area of each country is different, and the area at risk within each country is also different, these comparisons cannot be used in an absolute way. It is interesting to note that the percentage contribution from each country is very similar for both burnt areas and number of fires. This seems to indicate a similar distribution of the fire size in all the countries. During 2002, 87% of the fires took place in Spain and Portugal, resulting in approximately 77% of the total burnt area in the region. Favorable meteorological conditions on the Eastern part of the EU Mediterranean region helped to maintain low numbers of fires and burnt areas in France, Italy and Greece. As mentioned in previous bulletins, it is foreseen to use the fire severity index instead of just the extent of burnt areas to establish objective comparisons among countries.

During the last two years, the tendency of the EU Mediterranean region towards increasing number of fires seems to be stabilized. This factor and a decreasing trend in the burnt areas may possibly be explained by the effect of the public information campaigns carried out in all the countries and the improvement in prevention and fire-fighting capacity of the EU Mediterranean member states.

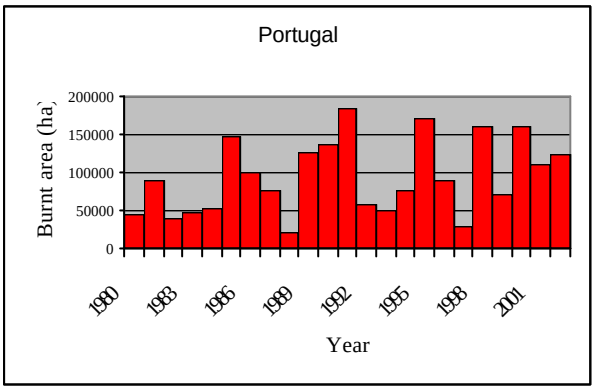
1.2. Portugal

Preliminary data collected in Portugal for the year 2002, showed 6489 fires, and 19.980 "fogachos" (area < 1 ha) that were responsible for 123910 ha of burned area. From this burned area, 53.2% represents forest land (65546 ha). There where also 4.482 ha of agriculture burned areas. The largest number of fires took place in the districts of Porto and Braga, in the Northern Region of Portugal. This region is characterised by a large density of population on the forest land, associate with a small dimension of the forest land. The largest burned area occurred in the Inland Districts of Portugal, in Castelo Branco and Vila Real where a total of 37.738 ha were burnt, 68.8% (25.983 ha) of those on forest land. In the districts of Guarda and Viseu a total of 26.176 ha where burnt, representing the burnt area in shrubland, 68.5% (17.993 ha) of the total in this districts. Analysing the monthly distribution we can conclude that the year of 2002 was characterised by a remarkable concentration of fires in summer period, particularly in the months of July and August, where 86% of total burned area occurred. The month of July was responsible for 50% of the total burned area, and for 56 % of the total forest burned area. In this period, 84 fires greater than 100 ha took place and they where responsible for 78 % (47.394 ha) of the total burned area. When compared, with the mean value for the last 5 years there was an increase of 72 % in the burned area. It was in this month that the biggest fire of 2002 took place, in the Castelo Branco district. It began on 13th of July at 17:35 and ended on 17th of July at 2:00 and was responsible for 4.852 ha of burned area, of those 4.590 ha on forest land. This situation was due to very unfavourable meteorological conditions, with high temperatures and strong East winds. The FWI classes confirm this scenario for the 14th of July, where the fire risk, one day after the fire started, reached the Extreme class in the Castelo Branco district. This period was characterised by very high values of fire risk, in the most Portuguese districts. As a consequence 27 fires larger than 100 ha took place and burnt 14.331 ha (24 % of the total month value).

In Portugal, the mapping of burnt area with Landsat satellite imagery is already an operative method since 1990, and since 1995 areas over 5 ha are assessed with an algorithm tested and adapted to the Portuguese conditions. Therefore, the cartographic information provided in addition to this report can be very useful for comparison. This cartographic information is useful not only for each member state, but for the overall Mediterranean countries, in order to develop other related products like Fire Risk Maps. This information would also be useful as a piece in other related areas like the National and Regional Action Programs, foreseen in the UN Convention to Combat Desertification. A summary of the fire situation in Portugal in the last decades is presented in Figure 4.

Analysing the distribution of the forest fires larger or equal than 50 ha, in 2002, we can notice that they only represent 5% of the total number of fires, but they were responsible for 79% of the total burned area. The higher number of fires occurred in the districts of Guarda, Vila Real and Viseu, representing 38% of the total incidents. From the total burned area, 57% corresponds to forest land and is manly concentrated in the districts of Castelo Branco and Vila Real.

From the total burned area, 4% belongs to Agriculture areas and are mainly located in the south area of Portugal, where Évora and Beja represent 47% of the total burned agriculture areas.



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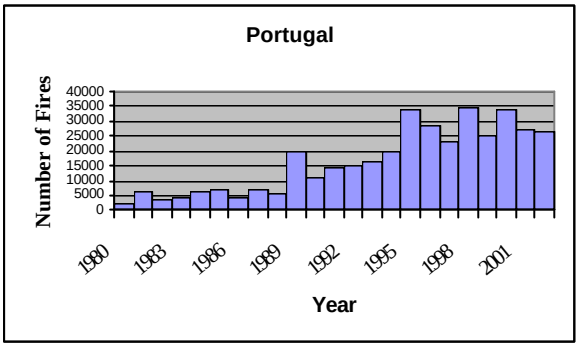

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Figure 4. Burnt area and number of fires in Portugal in the last 23 years.

Loss of human lives during the 2002 fire season.

In Portugal, preliminaries reports show that one pilot died in last July, in a plain crash, when he was in fire-fighting operations near Sertã (Castelo Braco district, in Centre region). Also 3 civilians (one in Braga district and two in Guarda district) died when they were trying to fight forest fires.

There were also at least 260 people injured (smoke intoxications, burns, wounds, etc) of which 90% were fire-fighters and 10% civilians.

(Source: Direcção-Geral das Florestas, Direcção de Serviços de Valorização do Património Florestal, Divisão de Protecção e Conservação Florestal, and National Service for Civil Protection, Natural Hazards Division)

1.3. Spain

The fire campaign in 2002 was spread along the whole year, with a large number of fires in non-summer months. Particularly, fires that took place in the first months of the year contributed largely to the total burnt area in the country. In terms of total figures, the number of fires was slightly higher than that of the last year. It was also slightly above the average for the last decade. However the area burnt in the country showed a slight decrement with respect to that of the previous year (93297 ha) and is below the average for the last decade (143177 ha). These trends match those of the overall Mediterranean region, where a slight decreasing trend has been shown in the number of fires and the burnt area in the last two years.

The first months of the year presented situations of high fire risk in the north of Spain due to desiccating south and south west winds. The number of fires in this area was well above the average for other years. Hydroplanes intervened 26 times in the region during this period. Although February presented favourable conditions in the north, the first 4 fires of the year took place on the 1st and 2nd of this month. Precipitations in the centre and south of Spain created favourable conditions during April and May. June was characterized by changing conditions from rainy periods to dry periods in which strong winds were predominant. Several large fires in Alcantara (Caceres, 600 ha), Gador (Almeria, 1000 ha) took place during this month. July was mainly rainy, and although the number of fires was high, most of these were extinguished with the first day. August was not too hot, as compared to previous years. However, west winds produced vegetation dryness in the border between Spain and Portugal, which provoked intervention of Spanish planes in Portuguese territory to stop incoming fires. The rest of the months of 2002 presented situations of low fire risk mainly due to frequent precipitations.

The total number of fires was 20841with a total burnt area of 86426 ha. Most of these fires (13728) were smaller than 1 ha. A total 13 of so-called large fires (larger than 500 ha) took place in 2002.The regions with the largest burnt areas were Galicia (26132 ha) where 10842 fires occurred and Asturias (15265 ha) with 1471 fires. As mentioned above, Asturias suffered several larger fires during the first months of the year.

Aerial means were used during most of the year due to total 3517 flight hours, with 7464 discharges over forest fires.

Fire fighting activities are competence of the autonomous regions in Spain. However, the Ministry of Environment, through the National Forest Plan, is in charge of the basic forest fire

activities and the support to forest fire fighting campaigns in the regions. They comprise:

(1) Coordination with the autonomous regions is carried out through the Comite de Lucha contra Incendios Forestales (CLIF-Committee for Forest Fire Fighting).

(2) Compilation and maintenance of the national forest fire database, which constitutes the oldest and most complete of Europe and is used to feed the European Union forest fire database, the support forest fire research activities in Spain.

(3) The meteorological fire risk map for the following day is produced in collaboration with the National Meteorological Service. Also the NDVI map indicating the degree of moisture content is distributed to the autonomous regions weekly.

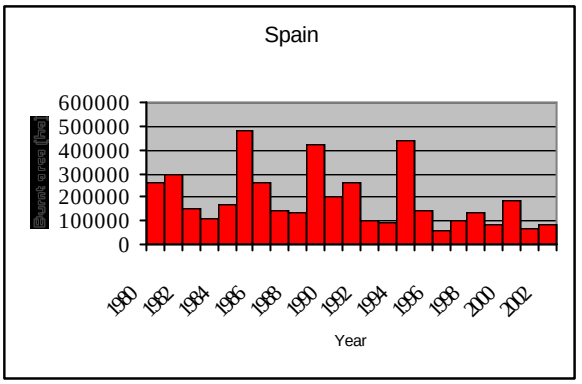
(4) Training activities included the production of two educational videos on individual fireman protection and physical test in firemen recruiting campaigns. Also courses for training fire fighting chiefs were conducted. It is important to mention that 3 other courses on the analysis of forest fire causes were conducted in 2002. They have permitted to reduce the level of uncertainty over the causes of forest fires from 50% to 20%.

(5) Finally activities for harmonizing methods for firemen recruitment, protection, and basic equipment were carried out.

Other activities included the support to research and development through the collaboration with universities and national and international research centre.

Subsidies to improve fire prevention measures were transferred to the autonomous regions. Also, in areas that suffer a large number of fires, special teams were deployed. These teams are in charge of investigating fire causes, promoting fire prevention education in the population, and the use of prescribed fire as a tool for fire control.

Figure 5 shows the evolution of the number of fires and burnt areas in Spain in the last decades.



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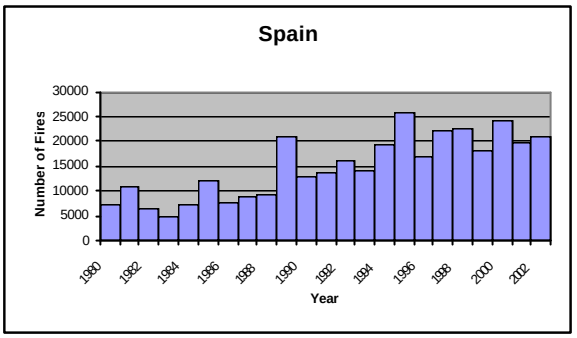

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Figure 5. Burnt area and number of fires in Spain in the last 22 years.

(Source: Ministerio de Medio Ambiente, Secretaria General de Medio Ambiente, Direccion General de Conservacion de la Naturaleza).

1.4. France

In 2002, 6300 ha were affected by forest fires in the Mediterranean departments. Of this area, 2500 h were burnt during the summer period in 700 fires. These figures are quite positive, since they are way below the average for the last decade, i.e. 10500 ha burnt annually by an average number of fires of 1500 (see Figure 6).

It should be mentioned that meteorological conditions were favourable during 2002, without intense dry periods and a limited number of days with strong winds. We would need to go back to 1997 to find similar mild meteorological conditions.

Only 5 fires larger than 100 ha took place in 2002, which is below the average 15 fires for the last decade. Four of them occurred in July 24th and 25th in Herault (24th, 147 ha), Aude (24th, 102 ha, Alpes-de-Haute-Provence (24th, 610 ha) and Bouches-du-Rhone(25th, 220 ha). The last one

took place on August 12th, in Couse-du-Sud and burnt 305 ha.

Cosica also presented a limited forest fire risk in 2002, with an accumulated number of extreme risk areas of 20, instead of the average 70 for the last decade. However, the area affected by fires was not reduced. It accounted for 510 ha, nearly double of the average for the last decade. In spite of this figure, the number of fires was exceptionally low, only 180 fires, while the decade average was 830. The number of fires in Corsica was never below 300.

Aerial means participated in 190 occasions on 27% of the number of forest fires. This figure is below that of last year (34%) probably due to the mild meteorological conditions.

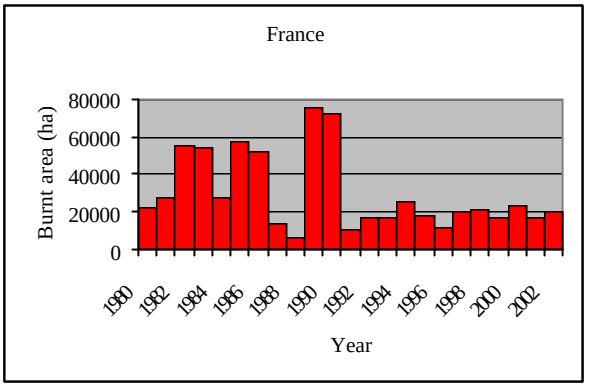
Fire risk was also low in the southwest and metropolitan areas of France. Only 900 ha were burnt by fires, as opposed to the 2300 ha average for the decade.

It is particularly interesting to mention that the area burnt during the summer period was exceptionally low, only 3500 ha, when compared to the decade average of 12800 ha. However damage by fires in the winter period was very high (20850 ha). This figure is above the average for the last decade and resulted because of large fires that took place in the winter in the southwest(12500 ha), the Pyrenees (9200 ha) and Gironde (2750 ha).

In summary, it could be said that the year 2002 presented a very particular profile, both in the geographic distribution of the fires, and in the temporal sequence in which they took place. In this year, only 30% of the fire damage occurred in the summer period, as opposed to the average 60% of the precedent decade.

Although the conditions of fire risk were more favourable than those of last year, it should be recognized that the limited damage caused by fire was also result of a new strategy for preventive distribution of fire fighting means. This strategy should be maintained also in the winter period under high fire risk conditions. Along this line, the cooperation between the fire headquarters and the regional services of MeteoFrance will be extended to permit the Centre Operationnel de Gestion Interministeriel des Crises (COGIC) of Civil Protection to make use of all the available means.

(Source: Direction de la Defense et de la Securite Civilés (Sous-Direction de L'Organisation des Secours et de la Cooperation Civilo-Militare, Bureau de Coordination Interministerielle de Defense et de Securite Civiles: Elements sur la Campagne feuz de forests 2002 dans les departments Mediterraneens)



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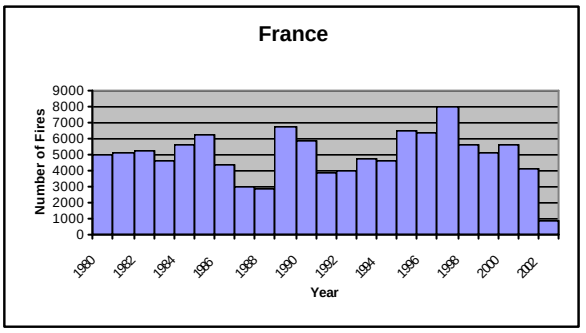

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Figure 6. Burnt area and number of fires in France in the last 22 years.

1.5. Italy

The year 2002 was characterized by a remarkable concentration of fires in the winter period, between January and March. A total of 2146 fires took place in this period, which corresponds to 46% of the total number of fires. They affected an area of 40768 ha, of which 20199 corresponded to wooded land. Mild average weather conditions during the summer limited the number of fires in this period. There was drought and frost from January to March, extending the fire danger occurred during December 2001. Prolonged lack of rain next to warm and strong winds resulted in high danger even in the south of the country. The rain was present in most of the summer period. The region that suffered the highest damage was Sardinia with 8782 ha

burned, followed by Calabria and Lombardia with 7985 and 4905 burned hectares, respectively. The highest number of fires occurred in Calabria (983), Sardinia (565), Piemonte (490) and Ligury (411). The average size of the fires was 15.5 ha in Sardinia and Veneto, 13.5 in Lombardy, and 13.0 in Sicily. These values are above the national average size (8.9 ha) of fires in the last years. March was the month that registered the highest number of incidents with a total of 1282 fires that burnt 13282 ha. This corresponds to 27% of the total number of fires. During this month there were, on average, 41 fires a day with an average daily burnt area of 428 ha. On the contrary, August was the month with the least number of fires, only 482 events. The overall figures for the number of fires and the burnt area were below the average for the last decades (see Figure 7).

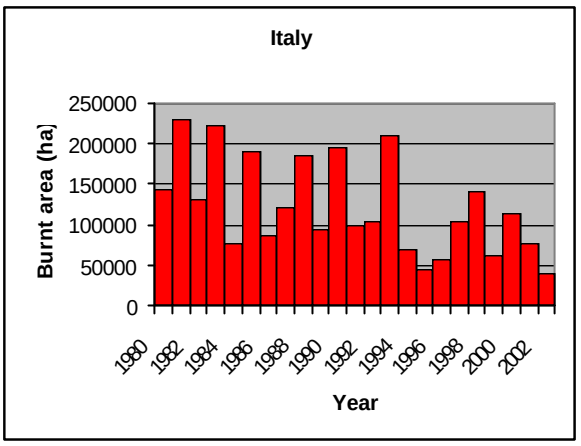
The main cause of fires was arsons, who caused 59.3 of the fires. The rest of the fires were due to negligence (17.8%), natural (0.7%) or unknown causes (22.2%)

Aerial fire fighting aircrafts were managed by the Joint Aircraft Operational Centre (JAOC) JAOC, in cooperation with the regions and the State Forestry Corps distributed the airplanes along the Tyrrhenian coast, from Genova to Reggio Calabria, Sicily and Sardinia. A total of 2964 hours were flown to attend 653 fires. This number of hours is below the average of the last three years, which was around 6000.

Improved performance in fire fighting in the last two years can be jointly attributed to favourable climatic conditions, the strengthening of the of forecasting and preventive measures, and the improvement of fire fighting interventions.

The Italian national law established in 2000 defined clearly the roles of the different entities involved in forest fire prevention and fighting. The objective of this new law is to establish mechanisms to monitor natural hazards, and environmental factors affecting the regions, and to build databases of forest fire information in order to develop programs for fire management, instead of solely fire fighting programs.

(Source: Ministry of Agricultural and Forestry Policy, State Forestry Corps, Forest Fire Service, Italy: Forest Fires in 2002).



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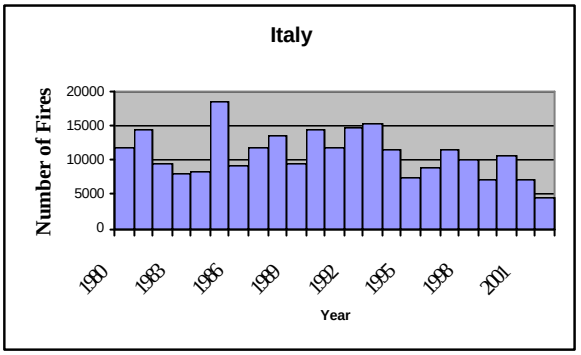

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Figure 7. Burnt area and number of fires in Italy in the last 22 years.

1.6. Greece

The results of the fire campaign of 2002 in Greece were a pleasant surprise. The number of forest fires according to data from the Ministry of Agriculture was decreased at about the half (45%) in relation to the number of fires in 2001. On the other hand, the 1/3 of the forestland was burnt in relation to the areas that had been burnt the year before. These figures are distinctly below those for the last decades (Figure 8).

During the campaign, there were no deaths or injuries in suppression activities. The fire campaign was also good in the neighbour countries, so there were no operations of mutual assistance.

The personnel involved in suppression efforts was about 15.500 persons from which 10.000 is the permanent personnel of the Fire Brigade which deals also with the structural fires and 5.500 is the seasonally hired personnel just for forest fire suppression activities. Fire Brigade of Greece owns at about 1.150 engines, which are involved in both structural, and forest fire suppression

efforts and few more small engines owned by Municipalities of high risk areas were involved occasionally in some incidents.

The good season may be attributed mainly to exceptionally good meteorological conditions during the campaign, which were unfavorable as far as the start and the expansion of fires and this resulted in more effective suppression efforts. So, only one fire exceeded 500 hectares and 83% of the fires did not exceeded one (1) hectare. This resulted to a total of burnt areas that it didn't exceed 4.500 hectares as far as forest fires are concerned and the total 7.500 hectares when we include also and fires in the agricultural areas. Mostly the rainfalls during July and August contributed to the reduction of burnt areas in relation to the years 2000 and 2001.

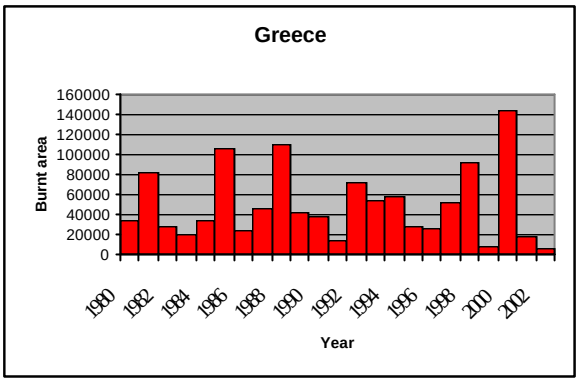
It should be noticed that the means used for fire suppression efforts during the three years did not change importantly. There were made nevertheless efforts for further improvement of the training of the personnel involved and the more efficient coordination and organization of the interfering parts and their prevention efforts. Especially for the campaign of 2002 should be mentioned the following:

- The law enactment for the more sufficient participation of the Municipalities to the forest fire suppression.

- The systematic registration of all the dumps of the country with the help of a special questionnaire enable to reveal the real expansion of the problem related to the danger of starting fires by their operation.

- The publication of a map for the forecast of fire danger, in a daily basis, from June to September. This map was directly disposable by the site of the General Secretariat of Civil Protection, from where the interested services and citizens could get informed.

The effort to further improve organization and cooperation among the interfering parts will continue. The fire suppression during 2003 will be based on a **Total National Planning** and on the **Regional ones**. Each Regional Planning will include the **Fire Suppression Plans** that will be conducted at the level of Prefect. For that reason, a work group will be founded in the base of each Prefect for the preparation of a detailed action plan. This is a step to further involve local authorities responsibly to actions.



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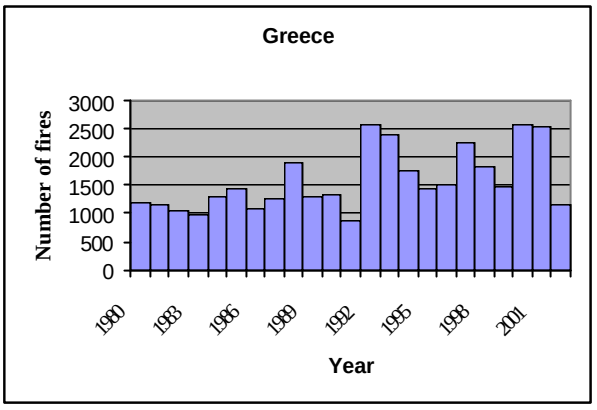


(a)

Figure 8.—Burnt area and number of fires in Greece in the last 22 years.

The Ministry of Agriculture – General Directorate for Development and Protection of Forest and Natural Environment, in addition to the already applied yearly prevention activities' programs, will add the following:

An additional removable network of water tanks will be established this year (2003) by the Ministry of Agriculture (Forest Service) to support suppression efforts and to expand the already existed network of the 1500 non-removable water tanks all over Greece. The establishment of this removable water tank network will start in May and is expected to be completed before the next fire campaign.

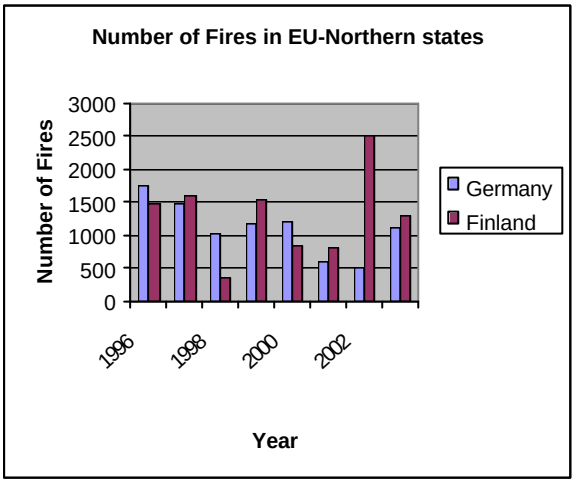
The establishment of another special meteorological station network devoted mainly to use for forest fire prevention is expected also to be completed by the end of this year.

(Source: Ministry of Agriculture, General Secretariat for Forest and Natural Environment, Protection of Forest and Natural Environment Directorate, Forest Prevention and Suppression Department).

2. FIRES AND BURNT AREA IN THE NORTHERN STATES

The analysis of the situation of Northern States is presented in a separate chapter because the fire figures in terms of number of fires and area burnt differ largely from those of the southern states that were presented in the previous chapter.

There are three non-Mediterranean countries actively collaborating with the Commission in topics related to fire prevention and fire fighting. These are Austria, Germany and Finland. Since the incorporation of Austria took place at the end of 2002, figures for this country will be only presented in the next fire campaign bulletin.



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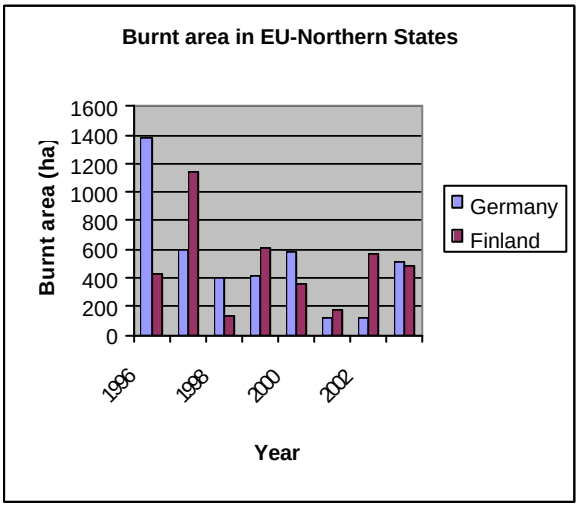

(b)

Figure 9. Number of fires and burnt area in EU-Northern states

A total of 513 fires occurred in Germany in 2002. This number is higher than that of the previous year, but still lower than the average for the last 12 years (1435) None of this fires was larger than 50 ha. Brandenburg was the lander with the highest number of fires (217), which burnt 36.1 ha. One of the reasons contributing to a large number of fires in this lander is the presence of sandy dry soils that favour vegetation dryness. The fires were mainly due to the presence of strong winds during the peaks of the fire season, high temperatures in the summer. In Germany these peaks occurred in two different periods, the first during the months of March and April, and a second on from May to September. Of the total number of fires, 27% corresponds to the first period, and 70% to the second one. This pattern is very similar to that of the southern Member States. The total number of hectares burnt in the country was 122, equalling the figure for the last year. This burnt area is by far below the average for the last 12 years (1054 ha). Figures of burnt areas and number of fires seem to go along the decreasing trend showed in the last years in Germany.

In Finland, the number of fires was 2512, higher than that of the previous year (822) and the average for the last 7 years (1303) for which data area available. However, the area burnt by these fires (513 ha) was only 17% higher than the average for the last 7 year (489 ha). The available data for Finland in the last 7 years does not show a clear trend in either the number of fires or the area burnt. Fairly large fluctuations exist in between years. A summary of the figures presented above for Germany and Finland is presented in Figure 9 and Table 2.

(Source: Landesschule und Technische Einrichtung fur Brand-und Katastrophenschutz for Germany, and Ministry of Interior for Finland).

3. OPERATIONS OF MUTUAL ASSISTANCE BETWEEN THE MEMBER STATES

During 2002, there were several operations on mutual assistance between Spain and Portugal. Portuguese authorities requested three times support of Spanish aerial means, in order to fight fires located near the border (specifically in Vila Real and Castelo Branco district, in the Northeast and Central region of Portugal).

There were also, by two times (in Vila Real and Bragança districts, Northeast region), a common action of ground and aerial means for fire fighting in the two sides of border (fight made by both the Portuguese and Spanish fire-fighters, disregarding geographic borders).

Finally, in Vila Real district, Portuguese fireman had been involved in prevention operations in Portuguese-Spanish border, due to the threat caused by fires occurring in Spain.

Table 2. Number of fires and burnt area in Northern states

Year	Number of Fires	Number of Fires	Burnt area (ha)	Burnt area (ha)
	GERMANY	FINLAND	GERMANY	FINLAND
1991	1846		920	
1992	3012		4908	
1993	1694		1493	
1994	1696		1114	
1995	1237		592	
1996	1748	1475	1381	433
1997	1467	1585	599	1146
1998	1032	370	397	131
1999	1178	1528	415	609
2000	1210	826	581	355
2001	587	822	122	179
2002	513	2512	122	573
Total	**17220**	**9118**	**12644**	**3426**
Average	**1435**	**1303**	**1054**	**489**
Average last 7 years	**1105**	**1303**	**517**	**489**

Source: Ministerium des Innern des Landes Brandenburg, Referat III/4, Germany; Ministry of Interior, Finland

4. INFORMATION TO THE PUBLIC

This chapter provides some update of to the information presented in previous bulletins regarding the campaigns that the countries carry out to inform the public and to promote the protection of the forests. Many countries continue the initiatives that they already started, which were already presented previous bulletins.

Several public awareness and education campaigns were conducted in Spain in 2002. Urban campaigns were carried out through television spots on national and regional channels. This activity was complemented by posting advertisements on buses, trains, newspapers and brochures. Rural campaigns were also conducted in northwest Spain, area that suffers repeatedly the highest number of fires, through theatrical representation of the play "the forest is mine" of J.C. Rubio. Additionally, campaigns to educate children were carried out in schools from September 2001 to April 2002 reaching over 100000 students.

The Greek government enhance the effort to train population and to educate the public in order to prevent fires. Several actions were taken on that direction, including:

- A common informing campaign between the three competent Ministries (of Interior Affairs, Public Administration & Decentralization, of Agriculture and of Public order) to make the public more sensitive on forest fires subjects.
- A special informing leaflets edition for prevention measures and for auto protection from forest fires.
- The organizing of seminars for the members of the Civil Protection education on the protection and the suppression of forest fires.
- The organizing, energizing and funding of volunteer groups Civil Protection authorities.

Portugal continued the efforts that were initiated the previous year, which included the publication of leaflets , for adults and children, containing recommendations for fire prevention that were distributed by the district and local structures of Civil Protection. In addition, Civil Protection and the National Fire-fighters Service organized a large information campaign named "Protecção é connosco" ("Protection is with us").

Also, the National Forest Rangers Corps, continue to carry out sensibilisation campaigns on the defence of forest against fires targeting the school population in priority municipalities.

Italy maintains a web page to promote forest fire prevention through slogans and educational information, including statistics of forest fires in the past years, means that are available for fire fighting, etc. The site also includes useful information for the public on how to act if a forest fire is spotted. It provides a free number (1515) to call from anywhere in the country to alert about forest fires. Finally, the web site contains a section dedicated to youngsters that explains the role of fire in the forest, the way fires start and spread, and what to do in the event of a forest fire.

5. FIRE SITUATION IN EU ACCESSION COUNTRIES

Common interest in forest fire management and fire prevention has lead to the collaboration with accession countries that have already participated in the meetings organized by DG ENV Civil Protection and the JRC for the international coordination of forest fire campaigns. Three of the countries that have already participated are Bulgaria, Cyprus and Romania. This chapter intends to provide an overview of the fire situation in these countries.

5.1. Bulgaria

The forest lands in Bulgaria comprise of 3,914,355 hectares (ha) and occupy 34% of the territory of the country. 3,398,307 ha (86.8%) of those are wooded areas; 138,671 ha (3.5%) are to be afforested; the unproductive forest lands are 295,832 ha (7.6%); and the forest pastures are 81,545 ha (2.1%). A significant part of the forests are artificially afforested during the last 50 years with coniferous plantations – 747,471 ha (19.1% / 22.0%).

The total volume of wood in the Bulgarian forests has been calculated to 526.1 million m^3. Bulgaria ranks 19 in woodiness in Europe. About 29% (1 million hectares) of the forests have their anthropogenic creation – they have been created through forestation of eroded or erosion-threatened forest lands and abandoned agricultural lands. Even this data show the significance of the Bulgarian forests not only at the national and regional scale, but as a part of the European green environment (system). When one adds the extremely precious biodiversity, which was kept in the forest ecosystems, one could say that Bulgaria is an important element of the world's forest treasure.

5.1.1. Characteristics of the fire situation in the country

Forest fires have never been a serious problem in Bulgaria when we look at the past thanks to the natural and climatic conditions in the country. They have become a problem and a threat during the last ten years and in the period 1999-2001 they were a real disaster. The basic reasons for that are:

- The global climate warming in the last decade;
- The social and economic changes in the country during the process of transition towards market economy;
- The change in the organization of the activities in the forestry sector;
- The unsuitable tree species composition (high percentage of coniferous plantations, untimely thinnings of the plantations and young stands);
- Few and outdated fire-fighting equipment;
- The lack of a reliable fire reporting and prognosticating system;
- The imperfect legislation (regulatory base) which causes the ineffective coordination between the different state and local authorities for the extinguishing of fires;
- Insufficient participation form the public organizations and the public as a whole.

5.1.2. The effect of forest fires on the society and the ecology during the 1990s

The dynamics of forest fires in the country shows that in the end of the nineteenth and the beginning of the twentieth century 3,000 hectares were burnt on average per year, until the middle of the twentieth century – around 1,600 – 1,800 ha and during the 50s and 60 of last century – around 800 – 1,000 ha per year. During the last ten years the problem became a crisis and in the period 1999-2001 it could be classified as a real disaster. All in all from 1999 to 2001 113,400 ha forests were burnt (around 3.9% of the whole territory of the

country) and in 2001 alone 57,400 ha were burnt. In the year 2000 alone one third of the fires covering a half of the area burnt until that year were burnt.

The analysis of the preconditions, reasons and factors leads to the conclusion that Bulgaria is joining the Mediterranean region with traditionally high risk of forest fires according to the parameters of the risk of fires on its territory. The consequences of the fires in the Sakar Mountain had the dimensions of a local ecological catastrophe, but the ones that followed during the next two years led those to the scale of a national natural disaster. The damages were not only economical ones but on a much bigger scale – inestimable damage on the conditions for the plants, led to erosion and destruction of the soils, to disturbing of the warmth and moisture balance of the ecosystems, to changes of the basic tree species, to the flora composition and the phytocenological structure, to change on the water flow character, to worsening of the sanitary condition of the neighboring unburnt stands, to sudden decrease of the CO_2 absorbing capacity of nature – all in all to total or partial destruction of the existing biogenocenosis.

Most of the fires on coniferous forests affected the whole trees and permanently harmed them (68%), which need artificial reforestation. The burnt deciduous forests are in the same condition (15%).

The regeneration of the harmed forest ecosystem could become reality in two ways:

- natural – for several dozens of years (in some cases 100-200 years) depending on the type of fire and the character of the burnt areas;
- through forestation, which decreases the regeneration period significantly and in some cases is the only possible solution.

It should be stated that if intensive erosion processes are allowed, the regeneration of the environment in its previous condition is practically impossible.

5.1.3. Data of the forest fires for the periods 1980-1990 and 1991-2002

Statistical forest fire data are provided in Table 3. The comparison of the data for the last two decades shows a drastic change in the fire situation in forests – the number of fires and the mean burnt area have increased 35 times. As it is obvious – the increase is not measured in percent but in tens of times. The data shown here are not extreme ones just for some of the years but are mean values for the last decades. Despite of the analyses made so far it is difficult to explain the comparison between the parameters of the fire situation in forests. If we take for an example the years 1991 and 200: the number of fires has increased 23 times and the mean area of a fire has increased 5 times, while the burnt area has increased 112 times!

5.1.4. Organizations responsible for the protection of forests from fires

The National Forestry Board, its bodies and units take part and control the execution of the obligations and the activities for the protection of forests and lands from fires.

Direct organization and execution of the fire protection activities in forests and forest fire fighting is being undertaken by the State Forest Districts and the Fire and Emergency Agency (Article 121, paragraph 4 of the Law for the Protection of Forests from Fires). During the season with high risk of fires the State Forest Districts employ fire observers that are equipped with communication devices (Article 121, paragraph 5 of the Law for the Protection of Forests from Fires). The State Forest Districts prepare an annually updated action plan for the activities needed for the protection from fires and also action plan for forest fire suppression (Article 121, paragraph 7 of the Law for the Protection of Forests from Fires).

The Head of the National Forestry Board issues an order defining the season with high risk of fires – article 121, paragraph 5 of the Forest Act (usually it lasts from April till October). When a fire breaks out in the forests the director of the State Forest District is in charge of leading fire suppression activities until the moment when the fire service arrives on site.

Table 3. Number of fires, burnt areas and fire causes in Bulgaria.

Year	Number of fires	Burnt area			Causes		
		Total	Forest	Other	human	natural	unknown
1980	67	173	173		57	1	9
1981	81	199	199		65		16
1982	110	168	168		85	1	24
1983	47	126	126		37		10
1984	51	98	98		16		35
1985	100	1151	1151		48	1	51
1986	57	340	340		37		20
1987	81	301	301		38		43
1988	101	462	462		53		48
1989	63	223	223				
1990	208	1041	1012	29			
1991	73	511	471	40			
1992	602	5243	4154	1089			
1993	1196	18164	10147	8017			
1994	667	18100	9708	8392			
1995	114	550	527	23			
1996	246	2150	1933	217			
1997	200	595	472	123	51	4	145
1998	578	6967	6060	907	147	6	425
1999	320	8291	4198	4093	84	9	227
2000	1710	57406	37431	19975	385	18	1307
2001	825	20152	18463	1689	187	19	619
2002	402	6513	5910	603	150	7	245
Mean 80-89	**76**	**324**	**324**		**48**	**1**	**28**
Mean 90-99	**420**	**6161**	**3868**	**2293**	**94**	**6**	**266**
Mean 00-2002	**979**	**28024**	**20601**	**7422**	**241**	**15**	**724**
Mean 90-2002	**549**	**11206**	**7730**	**3477**	**167**	**11**	**495**

It is compulsory for the foresters to take part in forest fire suppression (Article 77, paragraph 6 of the Forest Act and article 126, paragraph 1 of the Law for the Protection of Forests from Fires). The bodies of the NFB follow the instructions of the National Fire and Emergency Safety Service (NFESS) in the Ministry of Interior and assist them in doing their duties (Article 119 of the Forest Act and Article 97, paragraph 1 of the Law for the Protection of Forests from Fires).

The expenses for the extinguishing of forest fires are to be paid by the owners of the forests excluding the costs for the National Fire and Emergency Safety Service (Article 218, paragraph 1 of the Law for the Protection of Forests from Fires).

The NFESS is a specialized body in the Ministry of Interior, which executes fire emergency control, fire suppression and emergency safety actions (Article 108 of the Forest Act).

The fire-extinguishing activities consist of:

- Working out of plans for liquidating the consequences of incidents;
- Immediately sending of staff and equipment on the announcement of fire;
- Limiting and extinguishing of fire;
- Defining the ways, methods and means for the extinguishing;
- The rescuing of people and property;
- Paramedic help to the injured people;
- Organization and transport of the injured people to a hospital (Article 110 of the Law for the Protection of Forests from Fires).

The mayors of municipalities and towns organize groups for the extinguishing of forest fires yearly, then they send the lists of names to the State Forest Districts and to the regional department of the NFESS before the beginning of the season with high risk of fires, they organize the transport of these groups and of other local participants in the extinguishing to the fire place (Article 125, paragraph 1,2 and 3 of the Law for the Protection of Forests from Fires).

The organization, the basic functions and tasks of the state institutions, the local institutions and the regional state administrations, the trading enterprises and sole trader companies for non-admission, limitation and liquidation of the consequences of emergencies, averages and disasters are defined by the Statute-book for the organization and activities for the prevention and liquidation of the consequences of emergencies, averages and disasters – adopted with an Act of the Council of Ministers No. 18 of 23 January 1998.

5.1.5. Regulation of controlled burning of vegetable residuals

Currently the starting of a fire outside the precise places in forests is forbidden (Article 77, paragraph 3 of the Forest Act). It is forbidden to clear clear-cut areas by burning and other activities with fire in the forests during the season with high risk of fires (Article 124 of the Law for the Protection of Forests from Fires).

A basic problem in the country is the regulations adopted in 2000 for the revocation of the Law for the Protection of Agricultural Lands (LPAL) in its part concerning the burning of stubble-fields that had been used for decades.

What are the results of that?

During the period 1996-1999 the forest fires destroyed several dozens of thousands of hectares of forests. In early 2000 Article 6, paragraph 1 of the LPAL was revoked. That regulation had provided the possibility for conducting prescribed burning on stubble-fields and for reducing other vegetable residuals in agricultural lands, which had to be done on the basis of a permit from the phytosanitary and Fire Safety institutions. The mayor of the town or village had to supervise the prescribed fires. After the revocation of this regulation the number of uncontrolled fires and the area burnt in forest lands increased rapidly. It reached hundreds of thousands hectares per year. According to the statistics of the NFB during the last 5 years more than 80 % of the forest fires had been caused by fires started outside the wooded territory.

In this case we have to be realistic and professional in addressing this problem and perform as described in the following. Agricultural lands, that have been abandoned for years and aimed to be put in use again, have to be ploughed twice. The first ploughing has to be done deep. Then they have to be tilled twice or three times and in some cases they have to be treated with herbicides too. Obviously the burning of these lands is the easiest way of clearing them and that is what their owners or tenant farmers prefer. The grinding of the straw and other vegetable refuse after harvesting the yield could be done with the usage of special grinding devices, which are also too costly for most of the farmers. The gathering and taking of the vegetable residuals that can not be used for fodder out of the agricultural lands is also unprofitable.

In this situation there is a lot of uncontrolled and irresponsible starting of fires that created the preconditions for the starting of fires.

We think that the solution of the problem is a compromise one – the adoption of a interim decision for the permission of planned, well-organized and controlled burning of such areas.

At the same time efforts are made for the creation of suitable conditions for the construction of enterprises for processing of the excess biomass and its utilization for the production of energy, fodder, etc. Farmers must be encouraged to gather and sell the biomass that is of no use for them. This would help to solve the problem.

5.1.6. State policy in the field of forest fires

At present the National Forestry Board (Ministry of Agriculture and Forests, the Government) is facing the problem to regenerate the areas burnt during the period 1999-2001. This has to be done due to two basic reasons:

Ecological – The damage of the forest ecosystems and their environment and the danger of further degradation, e.g. increasing erosion, phytosanitary problems, etc., call for rehabilitation measures.

Legislative – the Forest Act does not allow a reduction of the existing land coverage by woody vegetation (Article 7, paragraph 2) and demands the regeneration of forests after a fire to be completed within two years (Article 43).

The protection of the stands located next to burnt forests is also a new problem for our forestry. Due to the scale of forest fires it gains bigger significance for the successful regeneration of burnt forests and non-admission of the ecological

damage both for the damaged trees and also for the neighbouring stands.

Reforestations currently conducted are still not sufficient both for the routine needs and for the burnt areas.

After the forest fires suitable conditions are in place that favour mass outbreaks of different pests and their spread to the neighbouring unburnt forests, thus worsening their phytosanitary condition.

The mix of different forest ownerships (state, municipality, private and other) and the different management of the forested lands (NFB and the Ministry of Ecology and Waters) also leads to the complication of the problem. It is especially complex in private forests. Data shows that 15% of the burnt forests are privately owned and 22% owned by municipalities. The lack of funding, qualification and readiness in the private owners for the fast regeneration of the forests and the little dimensions of their property impede the efforts for the regeneration of the burnt forests very much. The necessity of legislative and other forms of encouraging, stimulating, consulting and training of non-state forest owners with the aim of creating awareness and active participation for the execution of the reforestation.

Altogether the main aims of the policy include the creation of public awareness for forest fire prevention and the regeneration of forests damaged by fires with the help of the whole society.

(Source: National Forestry Board, Ministry of Agriculture and Forests, 55, Hristo Botev Blvd. 1040 Sofia, Bulgaria by Mr. V. Konstantinov, Chief Expert on Forest Fires).

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5.2. Cyprus

5.2.1. General

Fire is by far the most destructive single agent, threatening the forests of Cyprus and no real progress can be made in Forest development unless the forests are adequately protected. The long hot and dry summers, the frequent strong winds, the configuration of the ground and the flammability of the vegetation favour the outbreak and quick spread of fires. Furthermore the urbanization, the abandonment of rural areas and the increased number of visitors in the forest for recreation raise the fire hazard to very high levels.

The Forestry Department, which is responsible for the prevention and control of fires within or near the state forests is fully aware of the high fire danger and takes a series of preventive measures for:

- The elimination of outbreaks
- The quick detection
- The rapid intervention and effective control of forest fires.

5.2.2. Causes of forest fires

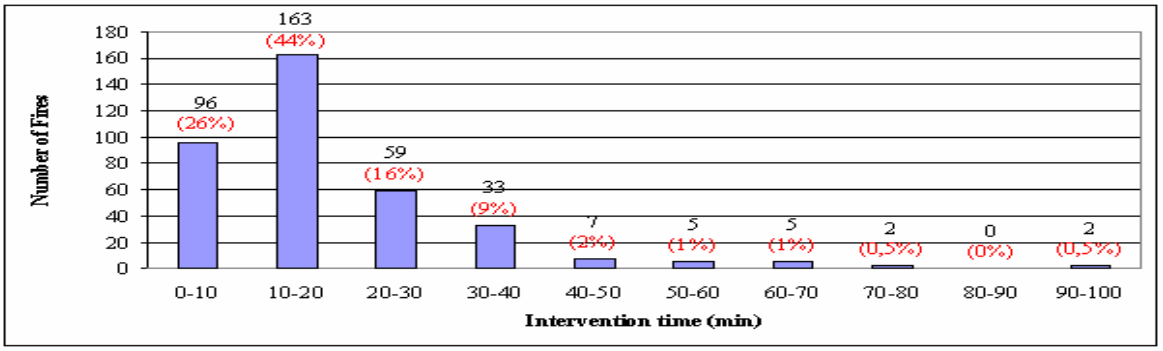
The main causes of forest fires are:

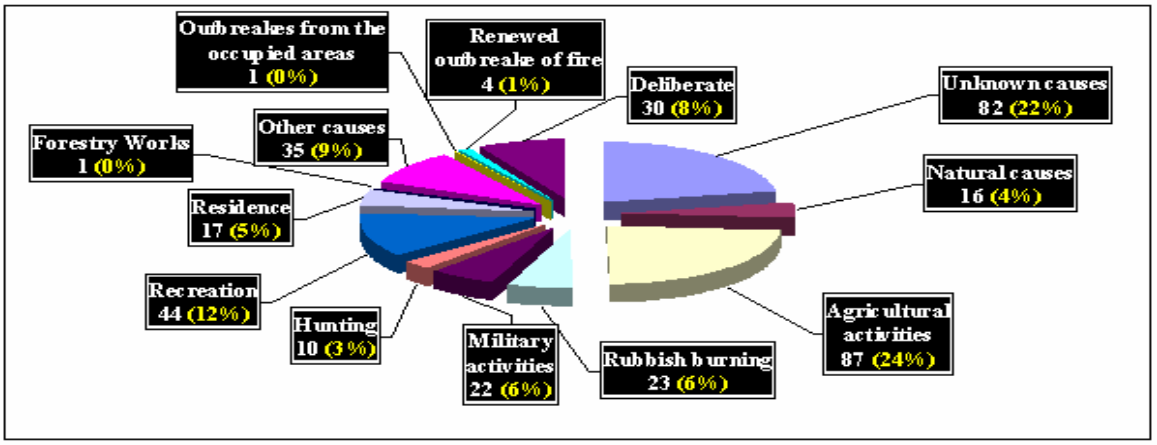
- Agricultural activities. Mainly the burning of the grass – gorse or stubble by farmers without taking the necessary precautionary measures.
- Recreation. Fires caused by careless visitors and picnickers when using fire for cooking and grilling. Burning cigarette ends and matches used by careless smokers.
- Military activities. Military exercises with ammunition or explosives of any kind.
- Burning of rubbish at non-organized rubbish dumps.
- Fires caused by people or machines engaged in any activity associated with forest engineering and forest production.

- Natural causes. Lightning causes some fires but these fires are not significant because these fires are usually accompanied by rainfall.
- Residence. The rise of the number of the country residences, compose a new cause of forest fires.
- Deliberate.
- Other causes. Fires can be occurred in lower extent also from other causes like, hunting during summer time, use of different tools and machinery e.t.c.

(Source: Forest Department, Louki Akrita, P.O.Box 1414. Nicosia, Cyprus by C. Papageorgiou, Forest Protection Officer).

Year	Number of fires	Burnt wooded land (ha)	Burnt non-wooded land (ha)	Total Burnt area
2000	112	2332	4528	6860
2001	105	778	3211	3989
2002	155	103	1771	1874
Total	***372***	***3213***	***9510***	***12723***



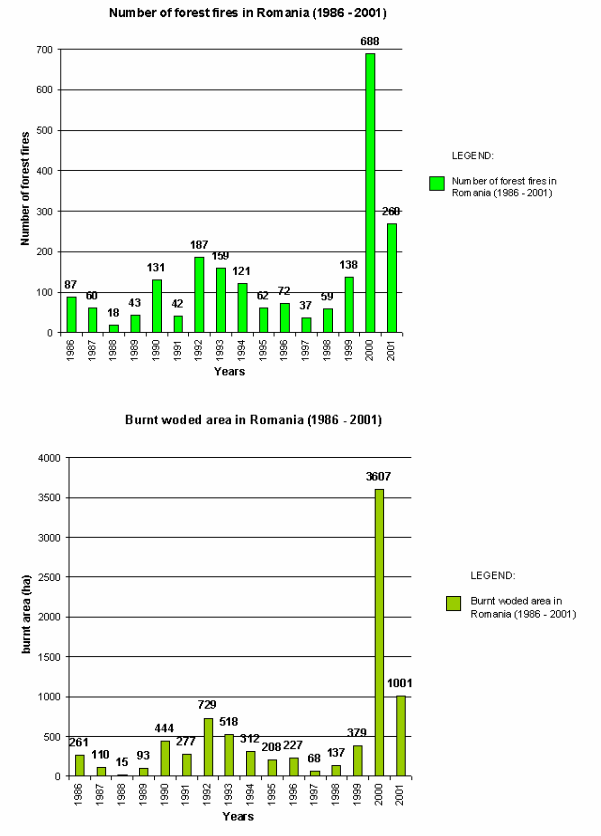


5.3. Romania

Forested areas in Romania occupy 6366666 ha, from which 6224970 are wooded areas. This figure corresponds to 26.7% of the national territory. Forests are mainly owned by the state (77%) and the rest 23% is private property. Forests are mainly on mountainous areas (67%) with the rest divided between hilly terrain (25%) and fairly flat areas (8%). Most of these forests are deciduous (70.2%), and only 29.8% correspond to evergreen, principally conifer, forests.

The Autonomous Administration of the Forests assured the measures for prevention, and extinguish the forest fires, including the activity of guarding the forestry domain under his administration, against the other damaging activities, such us illegal cuttings of the trees, degrading, illegal pasture or poaching. The prefects, the county and the local councils, the units of the Ministry of Defence, of the Ministry of the Interior and civil fire fighters, according to

their legal attributions, have the obligation to support the extinguishing of the fires in the forest areas. The physical persons located in the areas with forestry have the obligation to participate at in the extinction of these.
The co-ordination of the extinguish activity are assured, depending the magnitude and the location of the forest fire event, by the forestry personnel or by the fire fighters. The base principles which are took into account at the forest fire extinguish activity are the following: anticipation, extinguish of the fires in the preliminary stage and the limitation of the large extended forest fires. The evaluation of the losses are done by the forestry district in which territory was produced the forest fire, on the basis of the methodology established by the internal Order of the Minister of Waters, Forest and Environmental Protection, no 491/22.07.1992.
Taking into consideration the risk having fires in the forestry area, mainly due to the vegetation withering, the National Forest Administration (ROMSILVA) took at the level of the forestry territorial districts, a series of technically and organisational measures:



The number of camping places was increased the number of the places for camping, smoke and parking of the cars in the tourists forests and re-equipped the existed ones. Near the roads and railroads from the forest areas, with increased risk of fire, were realised isolating paths, by removing the vegetation and the potential combustible remains, by a width of 5-10 m;
Necessary work fore removing fallen trees were undertaken in due time to maintain the healthy situation of the forests.

The realisation of isolating barrages bands for soil protection has become mandatory at the limit of the roads and railways which crossed the forestry area. Additionally, an educational program for the public was organized. As part of this program, suggestive advertisements were posted near the most populated roads with warnings and educational messages. Also, broadcastings in local televisions and radios were launched with messages regarding the protection of forest against forest fires.

An operative command was installed at the local level for forest fires, in the case of these affecting large areas. This is lead by the prefect of the county, which apply the “Plan of defence and intervention in case of forest fires”.
According to this Plan, in this kind of situations, the forestry personal take action, together with the military and civilian fire-fighters, forestry workers, units belonging to the ministry of interior, civil protection units, of the army (especially the “mountain hunters”), citizens, mountain rescue teams, medical personnel.

The procedures for contention, extinction and elimination of the consequences of forest fires were established by the Regulations and the Instructions elaborated by the General Inspectorates of the Military Fire-fighters Corp.
In the case of a forest fire, the informational-decisional system comprise subsystems designed for detection, alarming, warning, notification, data transmission and processing, and decision taking by the actors involved in the defence actions against the forest fires. Once the decision is taking all the interested actors in the system are informed. The decisional and informational flux is made up of the following systems: counties and local disaster defence commissions, fire-fighters, Autonomous Administration of the Forests, forestry personnel, and other actors.

There area several aspects in which fire fighting in Rumania could be improved:

In Romania there are no institutions or specialised units for aerial interventions in the case of

producing of large forest fires and especially in the very difficult accessible areas. Intervention vehicles of the fire fighters in these mountains area due to their increased gauge.

There is a lack of a modern surveying system of the risk evolution in the forest area.

(Source: Ministry of waters and Environmental Protecion, Bld. Libertatii no. 12, sect. 5, Bucharest, Romania, by S. Mara, Counselor).

6. APPLICATIONS OF ADVANCED METHODS

The European Commission set up in 1997 a research group to work specifically on the development and implementation of advanced methods for the evaluation of forest fire risk -and for the estimation of burnt areas in the European Union. This group is currently working as part of the Institute for Environment and Sustainability of the European Commission Directorate-General Joint Research Centre (DG JRC). Since 1998, collaboration has been established with the relevant services of Member States, and under the coordination of DG ENV Civil Protection, aiming at developing a European Forest Fire Information System (EFFIS). EFFIS should not only contain the information derived through the advanced methods presented on this chapter, but it should also contain all the national data that the Member States area collecting through the national forest fire programs. The development of EFFIS will be possible as part of the new council regulation for the protection of forests, in which forest fires is one of the important aspects.

Indicators of forest fire risk were normally developed at the local or national levels. Until recently no mechanisms existed to estimate the risk of forest fires at the EU scale. As mentioned in the previous two bulletins, the work at DG JRC has focused both on the development of systems to provide forest fire risk forecast on the basis of existing fire risk indices, and on the development of new integrated forest fire risk indicators. All these indices show allow a harmonized evaluation of the forest fire risk situation in Europe during the fire campaign. As requested by the Member States, the fire campaign was extended in 2002 to 6 months. Consequently, the evaluation of forest fire risk in EFFIS started on the 1st of May, 2002, and ended on the 31st of October, 2002. Forest fire risk maps were computed and transmitted to the relevant services in the Member States and the European Commission via the European Forest Fire Risk Forecasting System that is part of EFFIS.

In the second part of this chapter the evaluation of the forest fire damages in Europe is performed. This evaluation is based on the damage caused by fires larger than 50 ha, which corresponds, on average, to 75% of the yearly burnt area in Europe.

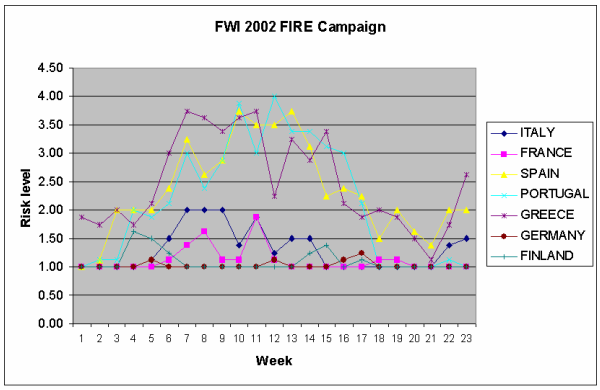
In addition to the evaluation of fire risk, DG JRC initiated an activity to estimate the annual damage caused by forest fires in the south of the EU. Modern methods based on satellite remote sensing and geographic information analysis are used for this purpose. This activity produced the first cartography of forest fire damages in the south of the EU in 2000. Since then, cartography of all the burned areas larger than 50 ha is produced every year through the processing of satellite imagery. Further to the mapping of burnt areas, the analysis of which types of land cover classes were affected by fires is performed. All the information is stored in a system referred to as the European Forest Fire Damage Assessment System (EFFDAS).

6.1. The European Forest Fire Risk Forecasting System (EFFRFS): Evaluation of the 2002 Campaign

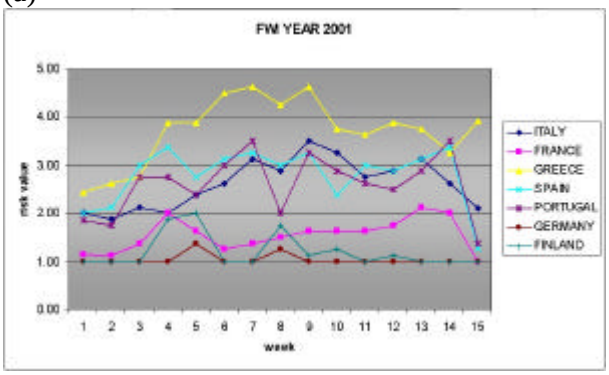
The European Forest Fire Risk Forecasting System (EFFRFS) was developed in support of the EC Directorate General Environment and the relevant forest fire-fighting services in the EU Member States. In the year 2002, under request of the Member States, the operation of the EFFRFS was extended to 6 months, starting the 1st of May and ending the 31st of October. The methods to compute fire risk were still the same seven methods that were used in previous years, including the Fire Potential Index introduced in 2001.

Overall, fire risk levels in 2002 were below the levels for the previous year. However, in some countries, such as Portugal, the levels of risk were higher than those of the year 2001, and even above of the year 2000 for the month July and the beginning of August. The conditions in Spain, as shown by the Canadian Fire Weather Index (FWI) were similar to those of the year 2000, in which a large number of fires took place burning large amounts of forests. However, the intermittence in weather conditions, with sporadic rains, permitted

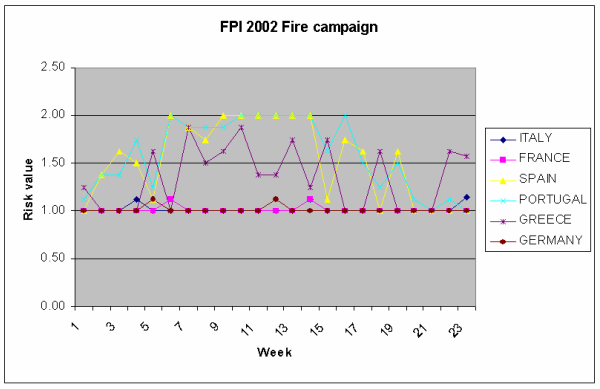
a better attack to fires in an early stage, and a reduced damage caused by fires. It should be noted, as shown in the monthly average maps of the FWI (see Figure 11), that the conditions in July and August in the area between Spain and Portugal were of very high fire risk. The forecasted fire risk reflected well the situation in the region during this period. The FWI forecast was also accurate in predicting the very high risk situation in France during the 3rd week of the month (week 11 on the axis of Figure 10), when the most damaging fires took place in the southern departments of the country. The plotting of the values of the FWI in France during 2002 shows an overall decrease of the fire risk, except for this particular period in July.



(a)



(b)



(c)

Figure 10. Evolution of fire risk in 2002 as determined by the Canadian Fire Weather Index (FWI) (b). Evolution of the FWI fire risk index in 2001. (c) Evolution of fire risk in 2002 estimated by the Fire Potential Index (FPI).

The levels of risk in Italy and Greece were very low when compared to those of the previous years. These low fire risk levels reflect the evolution of the fire campaigns in both countries.

In the northern states the levels of risk were low. When compared to the previous year, it is possible to notice a slight high risk period in Finland at the beginning of June, while no significant variation is observed in Germany.

As mentioned above, the computation of a new index started in the year 2001. This new index is referred to as Fire Potential Index (FPI) and is computed from three sources of information: fuel types, vegetation greenness (vegetation water stress), and fuel moisture estimates. The index, which presents an improved 4.4 km resolution when compared to the meteorological indices, is computed only over natural and semi-natural areas of the EU. The Fire Potential Index showed lower values than those of the year 2001.

Very positive feedback has been received from the Member States asking for the continuation and the improvement of the EFFRFS as part of the European Forest Fire Information System. Collaboration with the operational meteorological services in the Member States has been established in order to improve the resolution and accuracy of the EFFRFS by integrating additional data sources. This dialogue with users and other stakeholders should lead to an operational service for civil protection and forest fire services across Europe. This work contributes to the EU's aim of providing environmental information and services that can be aggregated to other existing global environmental information products in support of the Global Monitoring for Environment and Security (GMES) initiative.

References:

European Communities, 2001, Forest Fires in southern Europe: Bulletin of the 2000 fire campaign, SPI 01.85, p. 8.

European Communities, 2001, Forest fires in southern Europe: Report No. 1, July 2001, SPI 01.95, p. 40.

European Communities, 2002, Forest Fires in Europe: 2001 fire campaign, SPI.02.72, p. 27.

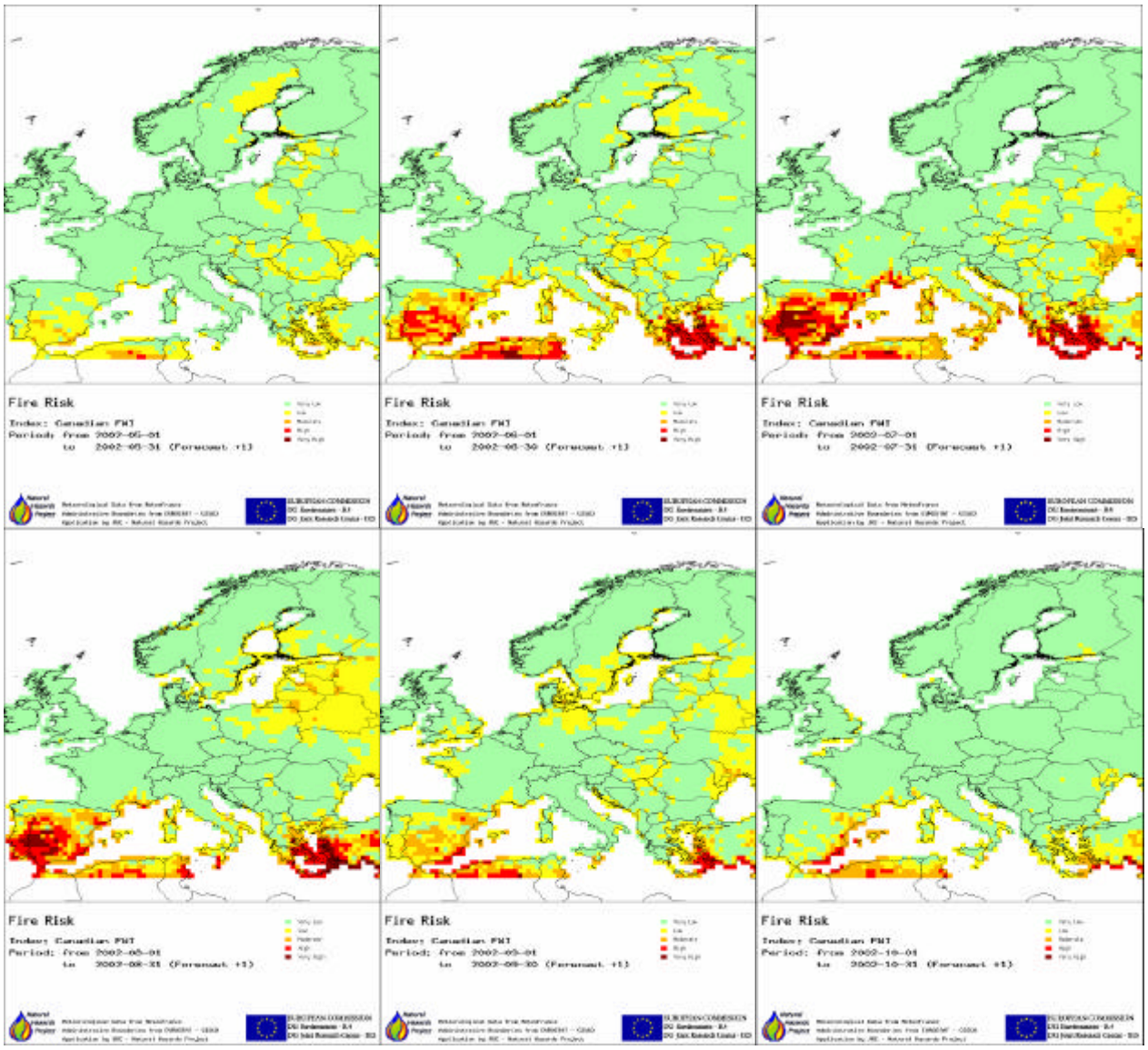


Figure 11. Evolution of the monthly fire risk in the European Union as determined by the Canadian Fire Weather Index.

6.2. The European Forest Fire Damage Assessment System (EFFDAS): Evaluation of the 2002 Campaign.

The information on areas burned by fire at the European level is normally aggregated at administrative level and ignores the exact spatial location and extent of fires. There are two facts that prevent a thorough analysis of the impact of forest fires in the EU. On the one hand each country has its own methodology to assess burned areas, which leads to the lack of harmonization of the burned area statistics and the impossibility to compare fire damages from region to region. On the other hand, although the extent of burnt areas is estimated, no cartography of these is produced. Only the mapping of very large fires is carried out in some countries.

In order to improve the harmonization of burnt area data and statistics a map of burnt areas is derived from the classification of satellite images acquired at the end of the fire season (usually, end of September or October every year). This burnt area map is further used in conjunction with the EU-CORINE land cover (CLC) database to estimate the damage to forests and other land cover types.

The methodology has the advantage of giving fast up to date evaluations of the burned areas just after the end of the fire season. It also provides a harmonized system that permits the comparison of fire damages between the different regions of the European Union. The satellite imagery used is acquired by the Indian IRS satellite. These type

of satellite images present a ground resolution of 180 meters which permits detailed mapping of fairly small fires. Traditionally, mapping of burnt areas has been performed with low spatial resolution satellite imagery acquired by the NOAA Satellites, which only permitted the mapping of burnt areas larger than 1000 ha. However, in the case of the EU, fires larger than 1000 ha represent only the 15% of the area that is burnt every year. Therefore, in order to derive accurate maps of burnt areas, up to the spatial resolution of 50 ha, the medium spatial resolution provided by the IRS satellite (180 meters) was selected for this application. Burned areas larger than 50 ha account, in whole Mediterranean region, for 75 % of the total area burnt every year. The EFFDAS produced already the cartography of forest fire damages in the south of the EU for the years 2000 and 2001.

Also in the year 2002, the fires larger than 50 hectares were mapped. The evaluation of each of the five Mediterranean countries is presented in the following paragraphs.

It should be mentioned that in the year 2002, due to meteorological fire danger conditions many large fires occurred during the winter months, mainly from January to April. The countries that were most affected by these winter fires were Spain, France, and Italy. Due to the importance of these fires, and being known that at the end of the summer the majority of these fire scars are no longer visible in the satellite imagery, EFFDAS had to be adapted to process also images from the winter period in order to map these fires. However, due to lack of acquisition images during this winter period it was not possible to obtain proper images for the area covering Italy and partially also for France. Being that the majority of the area burned in these two countries occurred during winter and spring 2002, the results of EFFDAS for these two countries have to be taken with care. The presence of clouds in most of the available summer images for Italy and Greece also contributed to the underestimation of the total burnt area in these EU Mediterranean countries.

The area burned in 2002 by fires larger than 50 ha, as detected by the analysis of the satellite imagery, resulted in a total surface of 154001 hectares (Table 4). Assuming that this figure represents the 75% of the total burnt area, it is possible to estimate the total burnt surface in 205335 ha, bearing in mind however the lack of information on many winter fires.

Table 4. Burnt areas in fires larger than 50 ha.

Country	Surface burned (hectares)
Portugal	86714
Spain	56357
France	4067
Italy	4687
Greece	2176
Total	**154001**

PORTUGAL

Forest fire damages in Portugal larger than 50 ha increased in relation to 2001 but was still considerably lower than for year 2000. Again, the fire damage concentrated in the north and center part of the country. The analysis performed on satellite imagery at the JRC has resulted in an estimate of 86714 ha burnt by fires larger than 50 hectares. The intersection of the burned area map with the CORINE land cover database provided the information on the land cover classes that burned. Table 5 presents the damage assessment. It can be observed on this table that the burnt areas was mostly forest and semi-natural areas, although the agricultural areas burnt are quite significant.

Table 5. Distribution of bunt areas by land cover class in Portugal.

CORINE land-cover class	Burned area (ha)	(%) of total burned area
Artificial Surfaces	23	0.03
Agricultural Areas	14251	16.43
Forests and Semi-natural Areas	72332	83.41
Wetlands	123	0.14
Unclassified	8	0.01
Total	**86714**	**100**

According to statistics by country from previous years, it can be inferred that the total burnt area in the year 2002, i.e. including all fires, was approximately 115619 hectares. This figure is larger than the average for the last 23 years (93981 ha).

Figure 12 presents the fires that were detected on the satellite imagery. Burnt areas are shown in red over a color-composite of the satellite images. As shown on the image, fires in Portugal concentrate on the center and northern regions.

SPAIN

Forest fire damages in Spain larger than 50 ha increased largely in relation to year 2001, although are still substantially lower than for year 2000. As it generally happens most of the fire damage concentrated in the north and centre part of the country, although this year the winter fires concentrated in the northern regions

The analysis performed on satellite imagery at the JRC has resulted in an estimate of 56357 ha burnt by fires larger than 50 hectares. Considering that that, on average, these fires constitute 75% of the total burnt area, the overall estimate for the burn surface in Spain from the analysis of satellite imagery is of 75143 ha.

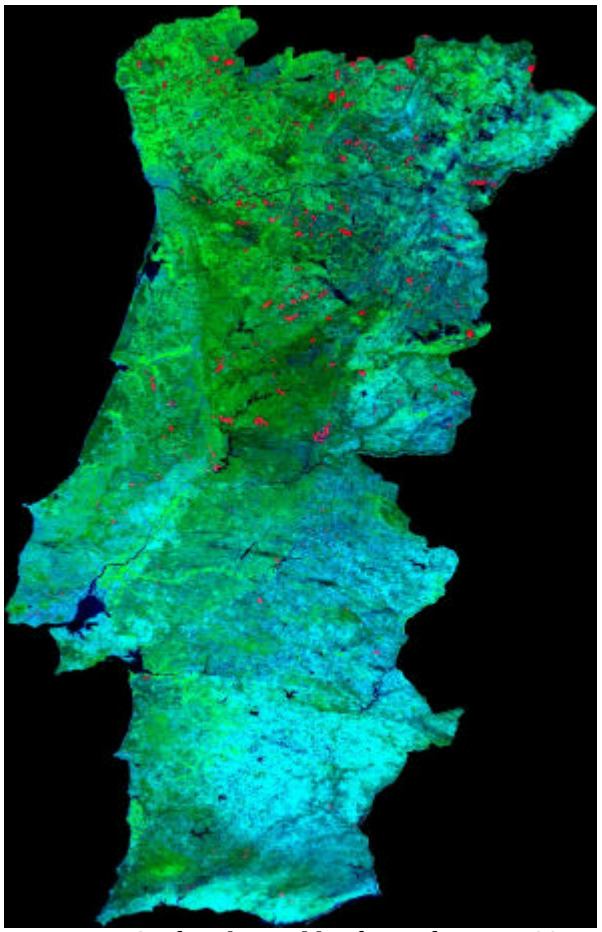


Figure 12. Surface burned by forest fires in 2002.

The intersection of the burned area map with the CORINE land cover database provided the information on the land cover classes that burned.

This distribution (Table 6) shows some important burnt areas were extended into agricultural areas.

Table 6. Distribution of bunt areas by land cover class in Spain.

CORINE land-cover class	Burned area (ha)	(%) of total burned area
Artificial Surfaces	19	0.03
Agricultural Areas	8169	14.49
Forests and Semi-natural Areas	48103	85.35
Wetlands	77	0.14
Unclassified	8	0.01
Total	**56357**	**100**

One of the regions that presented high forest fire damage was Galicia, as show on Figure 13. However, largest fires took place in other regions, such as Asturias or Extremadura. The image in Figure 15 presents the fires that were detected on the satellite imagery in Galicia. Burnt areas are shown in red over a colour-composite of the satellite images.

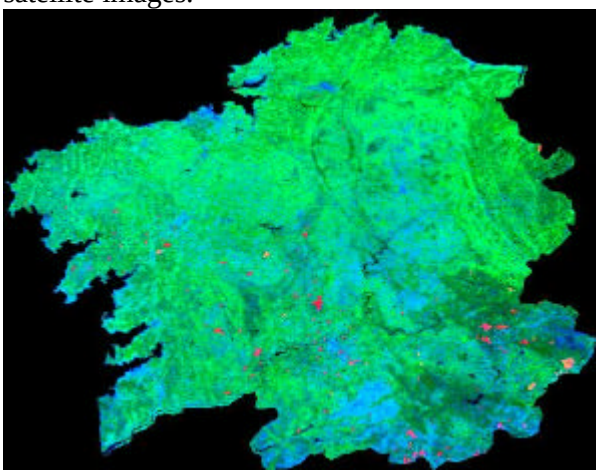


Figure 13. Forest fire damage in Galicia

FRANCE

The damage caused by forest fires larger than 50 ha in France in 2002 was slightly lower than in 2001 but still significantly lower than in year 2000. However, these figures are not reflecting many large fires that occurred during the winter. Unlike in previous years, most of the burnt area concentrated in the south-west of the country and during the winter season.

The analysis performed on satellite imagery at the JRC has resulted in an estimate of 4067 ha burnt by fires larger than 50 hectares. The damage assessment performed using the CORINE landcover database is presented in Table 7. It can be observed on this table that the burnt area was mostly forest and semi-natural areas, although

more than 7% of the burnt areas corresponded to agriculture.

Table 7. Distribution of bunt areas by land cover class in France.

CORINE land-cover class	Burned area (ha)	(%) of total burned area
Artificial Surfaces	65	1.60
Agricultural Areas	301	7.40
Forests and Semi-natural Areas	3758	92.40
Wetlands	0	0
Unclassified	8	0.20
Total	**4067**	**100**

One of the regions that presented high forest fire damage was the south-west of France. Figure 14 presents the fires that were detected on the satellite imagery. Burnt areas are shown in red over a colour-composite of the satellite images.

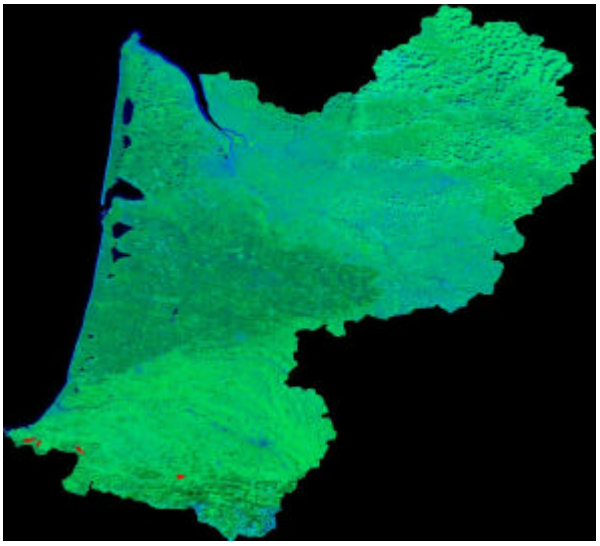


Figure 14. Forest fire damage in southern France

ITALY

Unlike in the other Mediterranean countries, the area burned represented by fires larger than 50 ha in Italy is only around 52%. This fact next to the unavailability of good winter images lead to a high underestimation of burnt areas as detected from satellite imagery. The burnt area in Italy in 2002 decreased from the previous year and was by far below the average of the last 23 years. However, even in the south of Italy, due to an overwhelming cloud cover it was not possible to map the large majority of the burnt areas.

Being so, the analysis of burnt area through the use of satellite images resulted in only 4687 ha, which is way below the figure reported by the Corpo Forestale dello Stato of 40768 ha.

A region that suffered a fairly large number of fires was Sardinia in southern Italy. This is the area shown in Figure 15.

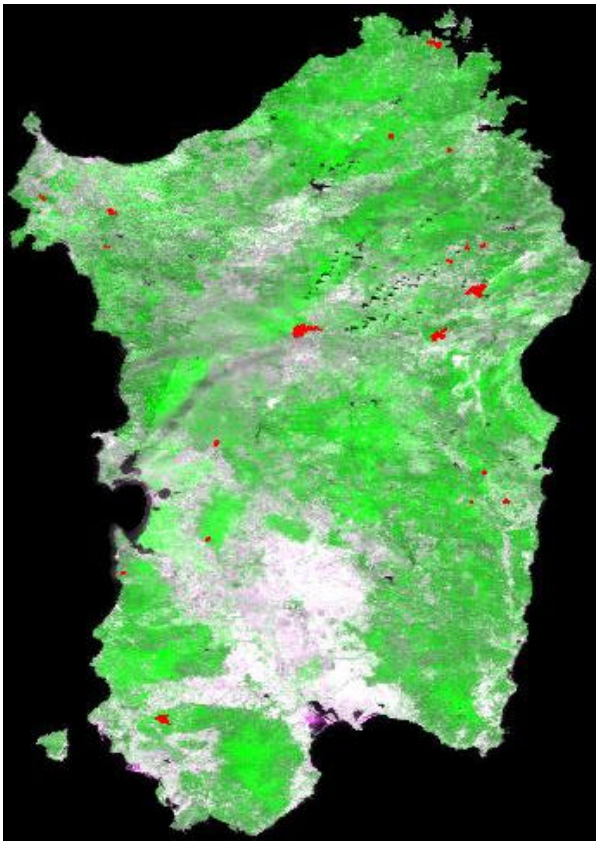


Figure 15. Surface burned by forest fires in Sardinia.

The damage assessment was performed using the CORINE land cover database and is presented in Table 8.

Table 8. Distribution of bunt areas by land cover class in Italy.

CORINE land-cover class	Burned area (ha)	(%) of total burned area
Artificial Surfaces	1	0.02
Agricultural Areas	998	21.29
Forests and Semi-natural Areas	3681	78.54
Wetlands	0	0
Unclassified	8	0.17
Total	**4687**	**100**

This analysis shows that the burnt areas were mostly forests and semi-natural areas.

Most of the burnt areas in 2002 were concentrated in the northern regions during winter, and as usual in Sicily, Sardinia, and Calabria during the rest of the year.

GREECE

The damage caused by forest fires larger than 50 ha in Greece in 2002 was even lower than in 2001 and much lower than in year 2000. The analysis of satellite imagery for the detection of burnt scars for those fires larger than 50 ha resulted in an estimate of 2176 ha. According to statistics by country from previous years, it can be inferred that the total burnt area in the year 2002, i.e. including all fires, was approximately 2901 hectares. This estimate is bay far below the estimate provided by the General Secretariat for Forest and the Natural Environment of Greece. As mentioned in previous chapters, mild weather conditions helped in the early extinction of forest fires, which may have resulted in many fires of small size that are hardly detectable from satellite imagery. An example of one of the few fires larger than 50 ha can be seen in Figure 16 in Southern Peloponnesus.

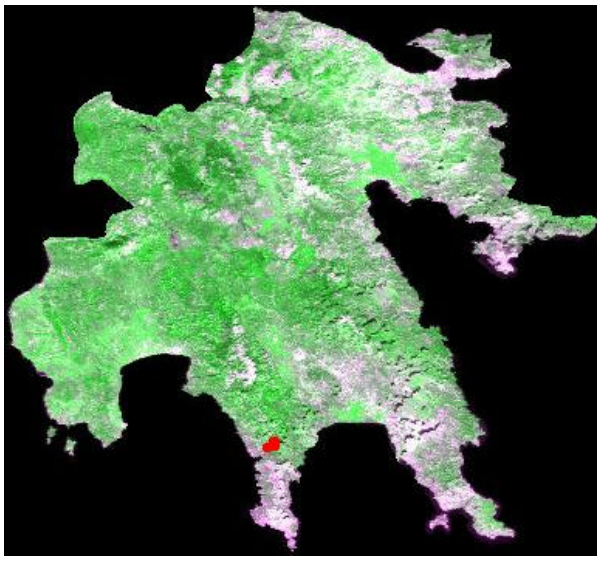


Figure 16. Burnt area in Southern Peloponnesus.

The damage assessment performed by the intersection of the burnt area maps obtained from satellite images and the CORINE landcover database is presented in Table 9. In 2002 an important part of the burnt areas were mapped on agricultural areas.

Table 9. Distribution of bunt areas by land cover class in Greece.

CORINE land-cover class	Burned area (ha)	(%) of total burned area
Artificial Surfaces	0	0
Agricultural Areas	995	45.73
Forests and Semi-natural Areas	1173	53.91
Wetlands	0	0
Unclassified	8	0.37
Total	**2176**	**100**

7. ANNEX

7.1. Table 10.: Burnt wooded area in the Southern Member States (period 1980 – 2002)

Burnt Area (ha)	PORTUGAL	SPAIN	FRANCE	ITALY	GREECE	EU
1980	44260	263017	22176	144302	32965	506720
1981	89798	298288	27711	229850	81417	727064
1982	39557	152903	55145	130239	27372	405216
1983	47812	108100	53729	223728	19613	452982
1984	52713	165119	27202	78326	33655	357015
1985	146255	484476	57368	189898	105450	983447
1986	99522	264887	51860	86240	24514	527023
1987	76268	146662	14108	120697	46315	404050
1988	22435	137734	6701	186405	110501	463776
1989	126235	426693	75566	95161	42363	766018
1990	137252	203032	72625	195319	38594	646822
1991	182486	260306	10130	99860	13046	565840
1992	57012	105277	16607	105695	71410	356001
1993	49963	89331	16695	209314	54049	419288
1994	77323	437635	25872	68828	57908	667566
1995	169612	143468	18118	46466	27202	404882
1996	88867	59814	11210	57986	25310	243198
1997	30535	98503	20500	103015	52373	304926
1998	158369	133643	20880	140432	92901	565296
1999	70613	82217	17605	61989	8289	251473
2000	159604	188586	23700	114648	145033	631571
2001	111165	66075	17000	76427	18221	288888
2002	123910	107472	20850	40768	6013	299013
Burnt Area (ha)	PORTUGAL	SPAIN	FRANCE	ITALY	GREECE	EU
2002	123910	107472	20850	40768	6013	299013
Yearly Average(1980-1989)	74486	244788	39157	148485	52417	559331
Yearly Average(1990-1999)	102203	161323	23024	108890	44108	442529
Yearly Average 1980-2002	93981	192315	29711	121982	49327	488612
Percentage of total (2002)	41	36	7	14	2	100
TOTAL	2161566	4423238	683358	2805593	1134514	11238075

Source: European Commission, DG Agriculture and Member States For 2002: Direcçao Geral das Florestas, Portugal; Dirección General de Conservación de la Naturaleza, Ministerio de Medio Ambiente, Spain; Ministère de l'Agriculture, France; Corpo Forestale dello Stato, Div XII, Italy; General Secretariate for Forests and the Natural Environment, Greece.

7.2. Table 11. Number of forest fires in the Southern Member States (1980-2002)

Number of fires	PORTUGAL	SPAIN	FRANCE	ITALY	GREECE	EU
1980	2349	7190	5040	11963	1207	27749
1981	6640	10878	5173	14503	1159	38353
1982	3567	6545	5308	9557	1045	26022
1983	4503	4791	4659	7956	968	22877
1984	6377	7203	5672	8482	1284	29018
1985	7218	12238	6249	18664	1442	45811
1986	4348	7570	4353	9388	1082	26741
1987	6977	8670	3043	11972	1266	31928
1988	5643	9247	2837	13558	1898	33183
1989	20155	20811	6763	9669	1284	58682
1990	10745	12913	5881	14477	1322	45338
1991	14327	13530	3888	11965	858	44568
1992	14954	15955	4008	14641	2582	52140
1993	16101	14253	4765	15380	2406	52905
1994	19983	19263	4633	11588	1763	57230
1995	34116	25828	6545	7378	1438	75305
1996	28626	16771	6400	9093	1508	62398
1997	23497	22319	8000	11612	2273	67701
1998	34676	22445	5600	10155	1842	74718
1999	25477	18237	5170	7235	1486	57605
2000	34109	24312	5600	10629	2581	77231
2001	27067	19631	4103	7134	2535	60470
2002	26469	19929	900	4594	1141	53033
Number of fires	PORTUGAL	SPAIN	FRANCE	ITALY	GREECE	EU
2002	26469	19929	900	4594	1141	53033
Average 1980-1989	6778	9514	4910	11571	1264	34036
Average 1990-1999	22250	18151	5489	11352	1748	58991
Average 1980-2002	16431	14806	4982	10939	1581	48739
TOTAL	377924	340529	114590	251593	36370	1121006

Source: European Commission, DG Agriculture and Member States For 2002: Direcçao Geral das Florestas, Portugal; Dirección General de Conservación de la Naturaleza, Ministerio de Medio Ambiente, Spain; Ministère de l'Agriculture, France; Corpo Forestale dello Stato, Div XII, Italy; General Secretariate for Forests and the Natural Environment, Greece.

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In the frame of the INFOREST action, the Institute for Environment and Sustainability of the Joint Reseach Centre (JRC) of the European Commission is working to the creation of the European Forest Fire Information System (EFFIS). Together with the relevant services of the Member States, and coordinated by the Civil Protection and Environmental Accidents Unit of the European Commission Directorate General of Environment, the JRC edits the yearly report of each fire campaign. It is not the scope of the report to make comparison among the different data sources, but to provide a comprehensive overview of the forest fire situation in Europe.

Further information on advanced methods can be found in the prototype site of the EFFIS at:

http://natural-hazards.jrc.it/fires