FOREST FIRES IN SOUTHERN EUROPE

Report No 1

July 2001

DIRECTORATE-GENERAL ENVIRONMENT
CIVIL PROTECTION AND ENVIRONMENTAL ACCIDENTS

DIRECTORATE-GENERAL AGRICULTURE
ENVIRONMENT AND FORESTRY

JOINT RESEARCH CENTRE
EUROPEAN COMMISSION

Natural Hazards Project

ENVIRONMENT AND GEO-INFORMATION UNIT

Foreword

Forests are more than ever in need of protection to maintain not only their biological diversity, but also because they are the most important air-cleaning factor on our globe, apart from the oceans. They act as carbon sinks and as physical air filters. They help avoid floods and erosion by retaining precipitation in the soil.

Knowing this, it sounds cynical that forests may destroy themselves by burning, thus heavily damaging the environment. Nonetheless, forest fires are part of the cycle of nature and have always occurred. They create new niches for fauna and flora and help to fertilise the soil.

However, with the obvious effects of climate change, with the increasing number of tourists, of road and railway infrastructures as well as human settlements, the risk for forest fires and the vulnerability of forests have now reached a level beyond which further burning would seriously endanger these ecosystems and their sustainable management. On average, about 50 000 fires burn a surface of 500 000 ha every year in Europe.

Moreover, forest fires are an ever increasing threat to rural populations as well as to fire-fighting staff and rescuers. The loss of human lives was extremely high during summer 2000. In particular, 8 pilots and 11 fire fighters were lost, without counting the deaths of people living in the burnt areas. As Commissioner responsible for the Environment and Civil Protection, I am very concerned about people loosing their lives and taking a high risk by fighting forest fires or being forced to flee from them.

For these reasons, my firm intention is to support the fire fighting centres in the Member States. By giving them additional information on the daily risk levels of forest fires, these centres are in a position to better decide and co-ordinate their mutual assistance operations.

The present report highlights the actual situation on forest fires in the five most concerned Member States. The report also describes the common project on new technologies in the field of forest fires developed by the Directorates-general, Environment, Agriculture and Joint Research Centre.

By providing all this information, the report will improve the basis for decision making as well as the awareness of all those involved in fighting forest fires.

Margot WALLSTRÖM
Commissioner for the Environment

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Introduction

Forest fires in Southern Europe occur regularly, often without obvious reason. The measures to protect forest ecosystems against forest fires are multidisciplinary. They relate to fire prevention and to the improvement of forest fighting operations; they may consist in fire risk forecasting and early detection of forest fires, as well as in mapping of the burnt surfaces. To raise the public information awareness in all Member States, to train fire-fighters and to search for the causes of forest fires should be part of the complete package bundled to protect forests. As such measures require sound knowledge-based techniques, science should play an important role in forest fire management.

The forest fire season 2000 in the Southern Member States was characterised by an important loss of human lives and environmental damage. During the last two decades, the wooded area of the Community affected by fires represents more than ten million hectares. Since 1994 the burnt area in the Southern Member States is declining and since then the yearly average amounts to about 280 000 ha.

The present report is the first of its kind. It aims to assemble information on the latest evolution of forest fires in the Southern Member States of the European Community. Moreover, it shall reflect the efforts undertaken on Community level to support the national authorities as well as their operational fire-fighting centres.

The report refers to the estimated data of the burnt wooded area and of the number of forest fires occurred in the period 1980 to 2000. It analyses the evolution of these parameters during this period and draws conclusions out of them.

In the context of Community co-operation in the field of civil protection, the report describes the operations on mutual assistance between the Member States and the support offered between them during summer 2000.

As science and scientific advice are a key input to decision making, the Joint Research Centre of the European Commission started in summer 2000 a testing phase of a project allowing the daily definition of forest fire risk levels within the Community. Even if the project is already pre-operational, it shall be improved to deliver, on a daily basis and in prevision of one and three days, the necessary data concerning the daily risk level to the decision-making operational centres in the Member States. A supplementary activity has been proposed for the coming years, allowing to map fires larger than 50 hectares accounting for over 75% of the burnt area in Southern Europe. Finally, it is planned that all the information on forest fires be stored in a dynamic database to which other Community institutions and authorised users (civil protection and forest fire services) of the Member States will have access. These activities contribute already to the European capacity for global monitoring of environment and security (GMES) to be established by 2008 and thus they represent a valuable contribution to the European Union Strategy for Sustainable Development [1].

Moreover, within the bounds of the forest protection framework ruled by Regulation (EEC) No. 2158/92, the Member States and the Commission have agreed to create a Community information system on forest fires. In particular, it has been decided to establish an integrated system together with the Joint Research Centre in ISPRA. For the year 2000, the system incorporates the harmonised information of forest fire risk in Southern Europe and the mapping of burnt areas for those fires larger than 50 ha in this region.

[1] Commission's proposal to the Gothenburg European Council: COM(2001)264final

1 LOSS OF HUMAN LIVES DURING THE 2000 FIRE SEASON

The forest fire season 2000 in the Southern Member States was characterised by a significant loss of human lives. In fact, the levy paid by the fire fighters as well as by the other volunteers involved in the fire-fighting operations has been fairly high during the forest fire season 2000. As much as 30 people lost their lives while fighting the flames, a burden that is hardly bearable.

Table 1 shows the loss of human lives in the Southern Member States for the forest fire season 2000. The highest tribute was paid by Greece, who had also the highest amount of civilians perished due to the flames, whereas France lost the highest number of fire fighters on ground. Spain's balance of dead people for the year 2000 is equally unfortunate. Among those Southern Member States that had to carry a less harder burden in terms of loss of human lives figure both Portugal and Italy, with respectively 3 and 2 deceased people. As for Italy, 76 people were injured.

Table 1. Loss of human lives during forest fire-fighting in 2000

Number of dead people 2000	**PORTUGAL**	**SPAIN**	**FRANCE**	**ITALY**	**GREECE**	**TOTAL**
Fire fighters (staff on the ground)	2	3	6	-	-	11
Pilots	1	1	3	-	3	8
Other persons	-	2	-	2	7	11
Total	**3**	**6**	**9**	**2**	**10**	**30**

Source: DG Environment and Member States

Portugal: In Portugal, the fire fighting operations during the year 2000 cost the lives of three people. Among the staff on ground two fire fighters died in the flames, while among the pilots there has been one victim. It is to say, though, that these numbers are to be referred to as provisional, as the final data still has to be collected nation wide.

Spain: During the 2000 fire season, six people died in the fire-fighting operations. Of these, three were fire fighters, two were farmers and one was a pilot (one person died on the 18th June in San Pedro de Alcántara/Málaga, one person on the 4th July in Villafames/Castellon, one person on the 29th July in Olivella/Barcelona, one person on the 14th September in Pedro Bernardo/Avila and two people were killed in Villafranca del Bierzo/León).

France: In France, nine people died in the year 2000 due to fire-fighting operations. Of these, six died on ground operations and three were pilots. As a matter of fact, two fire fighters were killed in Cornillon on July, other two fire fighters died on August in a ground tanker/water tender that was caught by the flames on the Oriental Pyreneans, and two fire fighters died in Palasca, Corsica, in September. Moreover, of the total nine people, one person was killed during a helitanker accident in July in the Alps of the Haute-Provence and two members of an air tanker C130 died in the Ardèche in September.

Italy: During the fire fighting operations in the year 2000 two people got killed by the flames near Cortona on the 27th August and near Roburent on the 6th March.
Furthermore, the number of injured people amounts to as much as 76, among which figure both severely and less severely wounded people. The injured people were mostly rescuers from the fire fighting team, forestry workers and voluntary staff.

Greece: In 2000, seven people died in one night near the Greek border with Albania when a fast-moving fire burned through their sparsely populated village. A CL-215 aircraft was lost, killing two pilots. The loss of a PZL M-18 on Corfu cost the life of another pilot.

2 BURNT WOODED AREA DURING THE 2000 FIRE SEASON

2.1 The Community

During the two last decades, there has been a reduction in the burnt wooded area in nearly all five Southern Member States, even if the wooded area affected by fires still represents more than ten million hectares for the whole period of 1980 to 2000. In spite of this, it is to say that many hectares of this considerable burnt area were burnt several times mainly because most of the surface consists of shrubland or grazing land. Moreover, in many Member States natural regeneration or reforestation has helped to recover most of the national forest cover.

Throughout the past decade we can observe a remarkable decrease in the total amount of burnt wooded areas in Southern Europe. In relation to the decade of the 1980's, in the 1990's more than 1 million hectares of wooded areas have been spared by the fires which, in average terms, signifies a decrease of around 116.000 hectares per year during the past decade (see Table 2).

Despite this, the almost general diminishing tendency in the Community suffered a sudden interruption with the arrival of the 2000 fire season. This bad year caused some of the Member States to invert their trend, as shown by the example of Greece (see Fig. 3 and Fig. 8). In addition to the high total burnt wooded area for the year 2000, it is of great importance to underline that the loss of human lives as a result of forest fires reached a level that cannot be endured.

2.1.1 The burnt wooded area in the Southern Member States (1980-2000)

Figure 1 shows the development of the burnt wooded area at the Community level. The trend of the burnt wooded area for the period of 1980 to 2000 is shown for each of the five Southern Member States.

Fig. 1. Burnt wooded area in the Southern Member States (1980-2000)

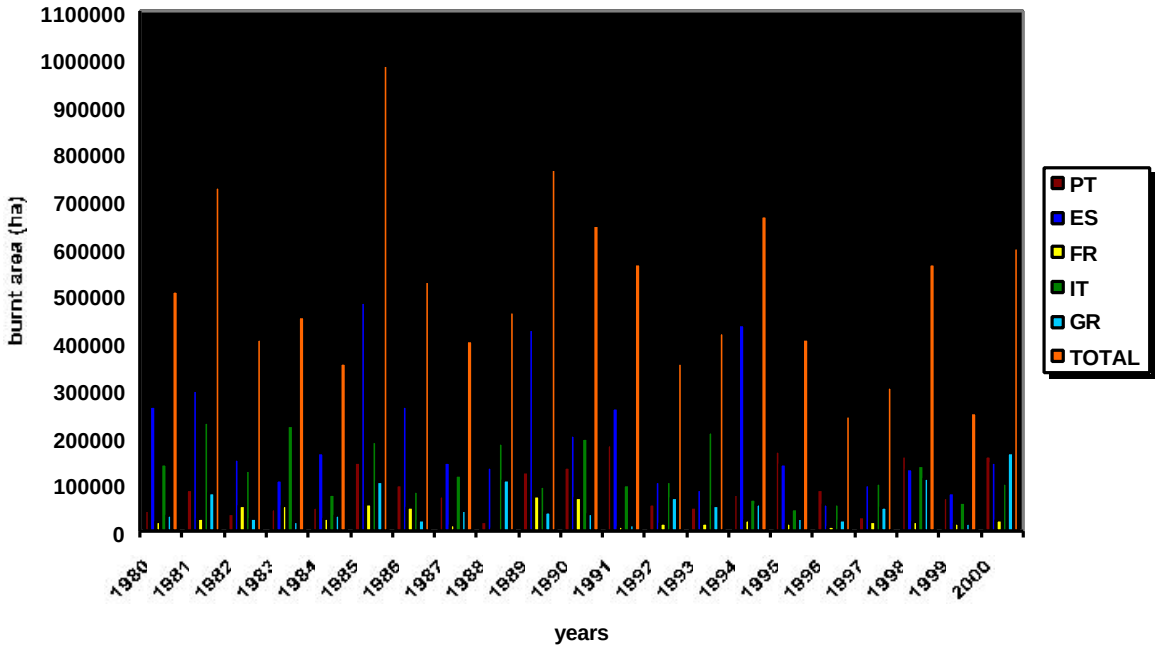


Table 2 illustrates the average burned wooded area on a decade basis as well as for the period 1989 to 2000, and the total burned wooded area for year 2000.

Table 2. Average burnt wooded area (1980-2000)

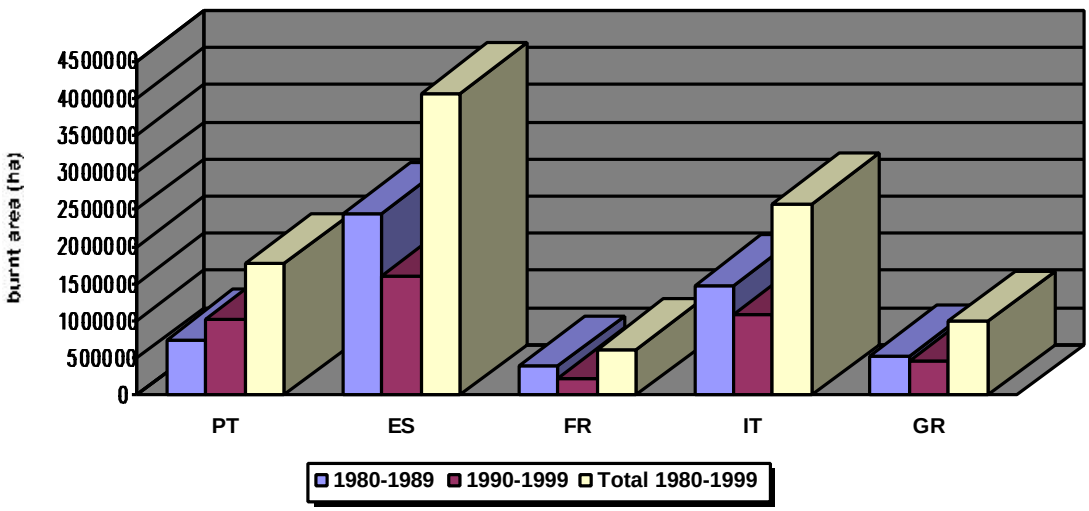
Burnt Area (ha) 1980-2000	**PORTUGAL**	**SPAIN**	**FRANCE**	**ITALY**	**GREECE**	**TOTAL**
Average 1980-1989	74 500	244 787	39 156	148 484	52 416	559 331
Average 1990-1999	102 203	161 237	23 024	108 890	47 174	442 529
Year 2000 (2.10.2000)	159 604 *	146 801	23 700 **	102 355 ***	167006 ****	599 466
Average 1980-2000	**91 737**	**200 335**	**30 738**	**127 433**	**55 376**	**505 622**

Source: DG Agriculture (2.10.2000) and Member States (*: 31.12.2000; Direccao Geral das Florestas, Portugal; **: 31.12.2000; Ministère de l'Intérieur, France; ***: 31.12.2000; Corpo Forestale dello Stato, Italy; ****: estimated; Ministry of Public Order, Greece)

2.1.2 The burnt wooded area in the Southern Member States (per decades)

Figure 2 shows the burnt wooded area for the period 1980-1989 and for the period 1990-1999 at Community level. The last column illustrates the total amount of burnt wooded area for the two last decades taken together.

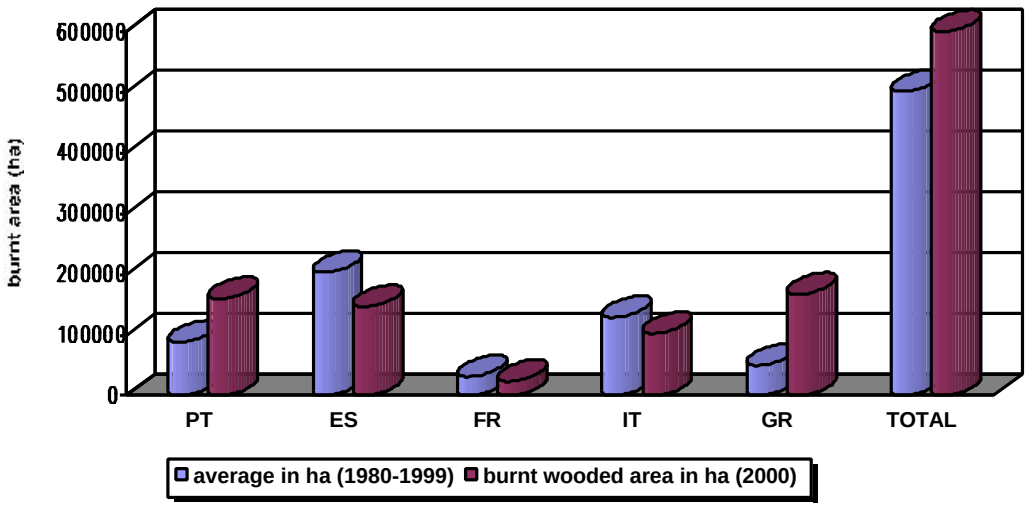
Fig. 2. Burnt wooded area (1980-1999)



2.1.3 The burnt wooded area in the Southern Member States (average and year 2000)

Figure 3 compares the amount of average burnt wooded area for the period 1980 to 1999 with the wooded area that was burnt just for the year 2000. The last two columns on the right of the table show the total average burnt area (1980-1999) compared with the amount of burnt area in the year of 2000 in all five Southern Member States.

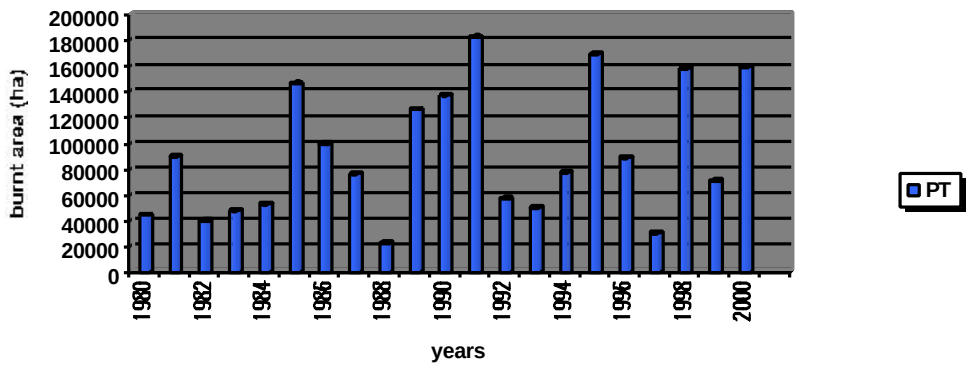
Fig. 3. Burnt wooded area



2.1.4 Portugal

Portugal's burnt wooded area has increased during the last two decades (see Fig. 4). The average burnt wooded area per year has risen from 74 500 ha to approximately 102 000 ha between the two last decades (see Table 2). This produced a total increase of around 277 000 ha in that period. This rising trend, although with some periods of lower burnt area, distinguishes Portugal from the other Southern Member States. Moreover, like in 1991, 1995 and 1998, the year 2000 has been very unhappy. In fact, during this past year Portugal suffered an increase in its burnt wooded area that lies ahead of its average amounts of both the decade of 1980's and 1990's (see Table 2 and Fig. 3.). With approximately 159.000 ha of burnt total area Portugal has a share of around 27% of the total burnt area in the year 2000 (see Fig. 9).

Fig. 4. Burnt wooded area in Portugal (1980-2000)

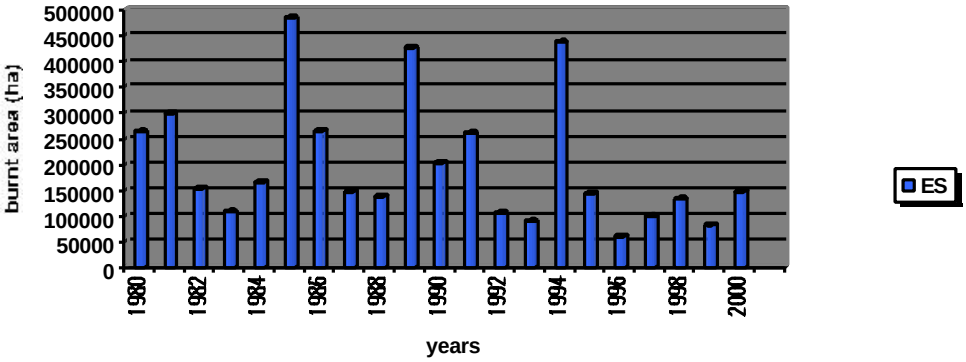


2.1.5 Spain

Spain's burnt wooded area has shown a decreasing trend since 1985, with the exception of two peaks in 1989 and 1994, although the year 2000 has shown a slight increase (see Fig. 5). For Spain, the average burnt wooded area per year has decreased between the last two decades from approximately 245 000 ha to 161 000 ha (see Table 2). This implied a total burnt wooded area decrease of about 835.000 ha during the same period.

Nevertheless, the public opinion, in line with that of the people involved in fire fighting, considers the year 2000 as being gloomy. This is mainly due to the concentration of big fires in the short period of beginning of August to mid-September. As a matter of fact, with 24% of total burnt area, it is quite evident that also Spain has been struck during last year's fires (see Fig. 9). Although the data for the year 2000 is still considered as provisional, we can already state that 10 to 20% of the nearly 147 000 ha of burnt area were not forested land.

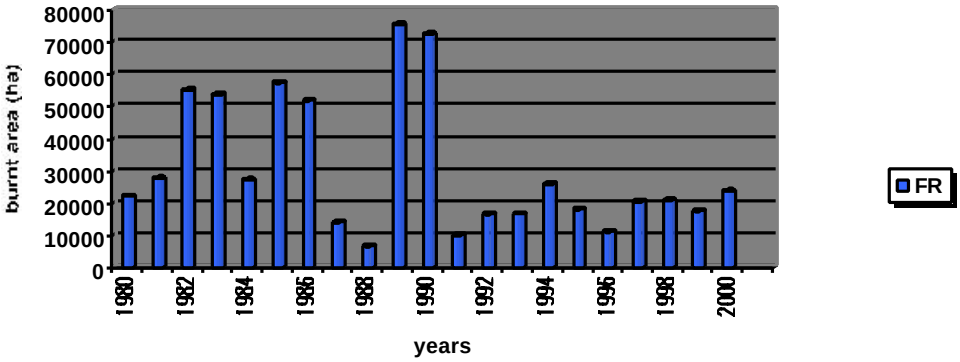
Fig. 5. Burnt wooded area in Spain (1980-2000)



2.1.6 France

The burnt wooded area in the South of France has decreased sharply after 1990 (see Fig. 6). France also succeeded in maintaining its total burnt wooded area under the 1 million ha margin during the last two decades (see Table 2 and Fig. 2). However, it should be noted that since 1980 the French burnt area is the smallest when compared to the other Member States (see Table 2 and Fig. 2).

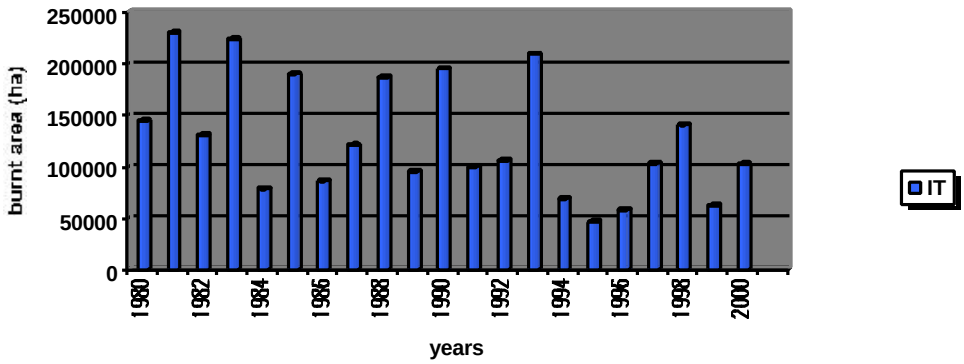
Fig. 6. Burnt wooded area in France (1980-2000)



2.1.7 Italy

During the last two decades, Italy has shown a decreasing trend of the burnt area per year (see Fig. 7). Italy managed to cut its overall burnt area from nearly 1½ million ha during the 1980's to a little more than 1 million ha during the past decade (see Table 2 and Fig. 2). In spite of this, Italy's total burnt area during the period 1980-2000 still lies fairly high above the 2½ million ha margin (see Fig. 2). The year 2000 lies in the trend, remaining under the yearly average amount of burnt wooded area for the period 1980-2000 (see Table 2 and Fig. 3). With approximately 102 000 ha burned, Italy had a share of around 17% of the total burnt area in the year 2000 (see Fig. 9).

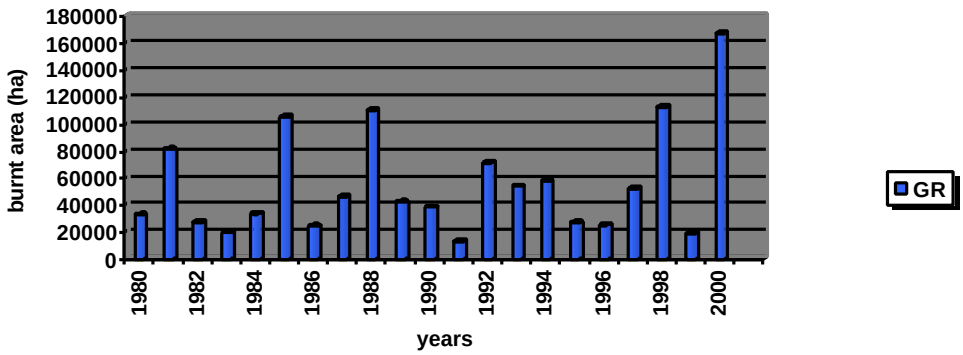
Fig. 7. Burnt wooded area in Italy (1980-2000)



2.1.8 Greece

Greece has suffered the least significant decrease between the last two decades, both in the average as well as in the overall burnt wooded area (see Table 2 and Fig. 2). It might be interesting to observe that in the year 2000 Greece had to put up with the worst year during the last two decades (see Fig. 8). In fact, the amount of burnt wooded area during the year 2000 is nearly three times the average amount for the total period of 1980-1999 (see Fig. 3). Nonetheless, the total burnt area between 1980 and 2000 is just little over the 1 million ha margin (see Table 2 and Fig. 2). With its 167 000 ha of burnt wooded area - accounting for 28 % of the total burnt area in that year – Greece suffered a severe leash-back in respect to the previous years (see Table 3 and Fig. 9).

Figure 8. Burnt wooded area in Greece (1980-2000)



2.1.9 The burnt wooded area in the Southern Member States

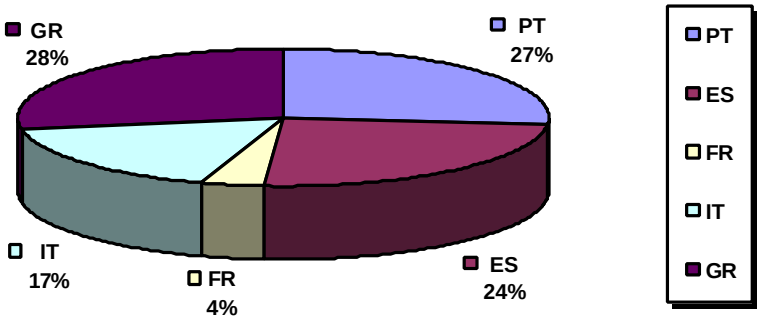
Table 3 shows the distribution of the burnt area per single Member State in the year 2000. Greece was the country with the largest area burnt, followed by Portugal, Spain, Italy and France. Figure 9 shows the percentage distribution by country.

Table 3. Burnt area per Member State for the year 2000.

Member State	Area burnt (ha)	Area burnt (%)
Portugal *	159 604	27%
Spain	146 801	24%
France**	23 700	4%
Italy***	102 355	17%
Greece****	167 006	28%
Total	**599 466**	**100%**

Source: DG Agriculture (2.10.2000), Member States and: *: 31.12.2000; Direcçao Geral das Florestas, Portugal; **: 31.12.2000; Ministère de l'Intérieur, France; ***: 31.12.2000; Corpo Forestale dello Stato, Italy; ****: estimated; Ministry of Public Order, Greece.

Figure 9. Distribution of the burnt area by country in year 2000 (%)



2.1.10 The fire severity index

As conditions within the Member States can be very different, also the comparisons made between Member States often end up being purely indicative. Therefore, in order to display more appropriate comparisons, the fire severity index has been established. This index represents the percentile of burnt wooded area within the risk area (i.e. the wildland area according to the FAO figures).

The following results shown in Table 4 may help to better understand the importance of forest fires in the southern Member States.

Table 4. Burnt wooded area (wooded and non-wooded) in the Southern Member States (yearly % of the wooded burnt area in comparison to the existing wooded area). The table shows the distribution of the burnt wooded area per Member State in the period 1991-2000 with respect to the total wooded area of the Member State.

Year	**FIRE SEVERITY INDEX (%)**				
	Portugal	**Spain***	**France****	**Italy**	**Greece**
1991	5.78	0.96	0.35	1.23	0.34
1992	1.56	0.39	0.62	1.31	0.29
1993	1.67	0.33	0.40	2.51	0.67
1994	1.32	1.62	0.84	1.51	0.90
1995	4.33	0.53	0.65	0.60	0.36
1996	2.82	0.22	0.49	0.72	0.33
1997	0.88	0.30	0.70	1.27	0.75
1998	3.71	0.49	0.80	1.83	1.37
1999	2.05	0.30	0.52	0.88	0.27
2000*	3.02	0.49	0.08	1.26	2.06
Average	**2.71**	**0.56**	**0.55**	**1.31**	**0.59**

*: Provisional data for the year 2000.

**: France: only heaths and Mediterranean areas which represent the risk area.

3 NUMBER OF FOREST FIRES DURING THE FIRE SEASON 2000

3.1 The Community

3.1.1 The number of forest fires in the Southern Member States (1980-2000)

Figure 10 shows the development of the number of forest fires at the Community level. This Figure shows, for all of the five Southern Member States, the yearly total number of forest fires for the period 1980 to 2000.

Figure 10. Number of forest fires in the Southern Member States (1980-2000)

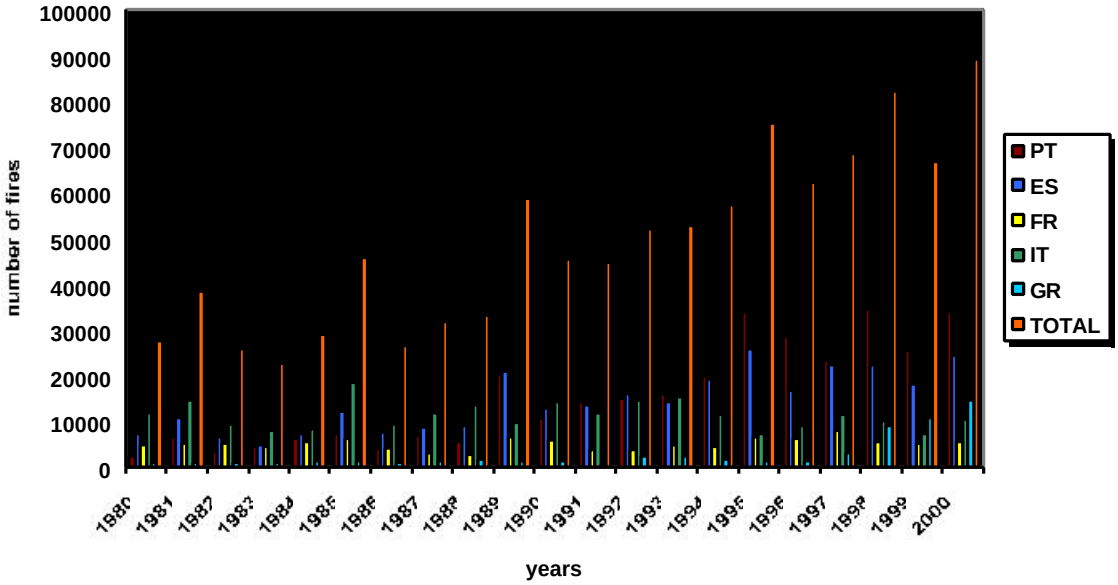


Table 5 illustrates the average number of forest fires on a decade basis as well as for the period 1989 to 2000, and the total number of forest fires for year 2000.

Table 5. Average number of forest fires in the Southern Member States (1980-2000)

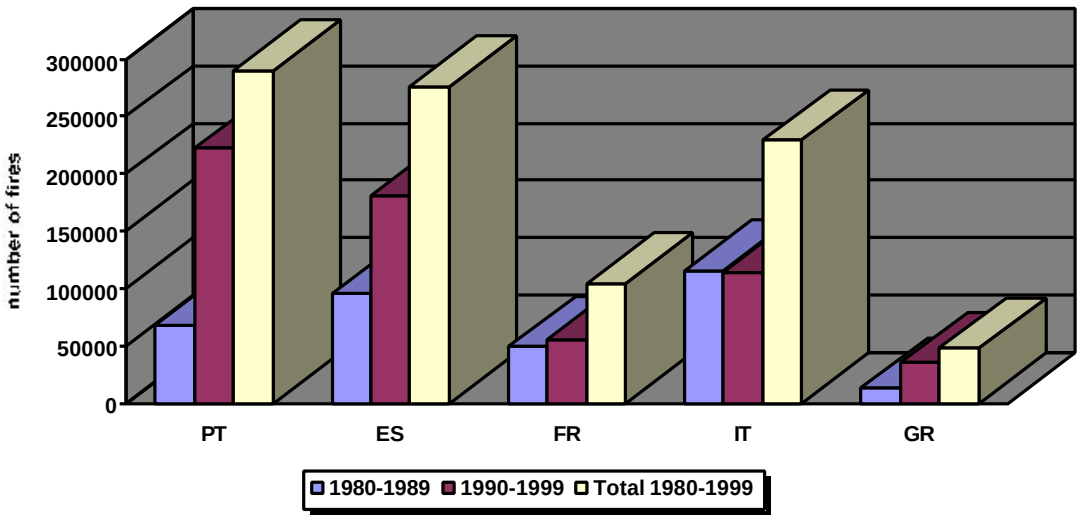
Number of Forest fires	PORTUGAL	SPAIN	FRANCE	ITALY	GREECE	TOTAL
Average 1980-1989	6 777	9 514	4 909	11 571	1 263	34 034
Average 1990-1999	22 250	18 140	5 489	11 352	3 500	60 731
Year 2000 (2.10.2000)	*34 109	24 312	**5 600	***10 629	****14 650	89 300
Average 1980-2000	**15 447**	**14 326**	**5 218**	**11 422**	**2 965**	**49 378**

Source: DG Agriculture (2.10.2000) and Member States (*: 31.12.2000; Direccao Geral das Florestas, Portugal; **: 31.12.2000; Ministère de l'Intérieur, France; ***: 31.12.2000; Corpo Forestale dello Stato, Italy; ****: estimated; Ministry of Public Order, Greece)

3.1.2 Number of forest fires in the Southern Member States (per decades)

Figure 11 shows the number of forest fires for the period 1980-1989 and for the period 1990-1999 at Community level. The third column of each Member State illustrates the number of forest fires for the two last decades taken together. It can be observed that there has been a general increase in the number of fires between the two decades.

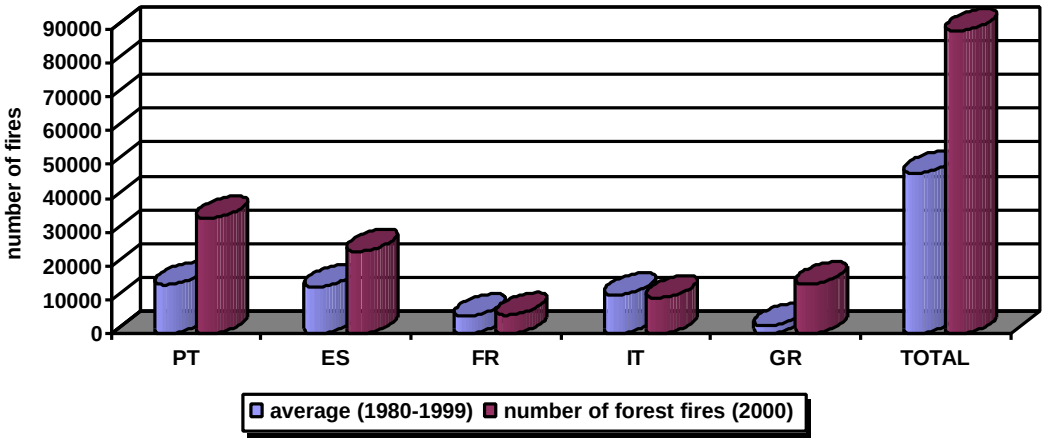
Figure 11. Number of forest fires (1980-1999)



3.1.3 The number of forest fires in the Southern Member States (average and year 2000)

Figure 12 compares the average number of forest fires for the period 1980 to 1999 with the forest fires occurred during the year 2000. The last two columns at the right of this Figure show the average number of forest fires for the period from 1980 to 1999 compared with the number of forest fires arisen in the year of 2000 in all five Southern Member States.

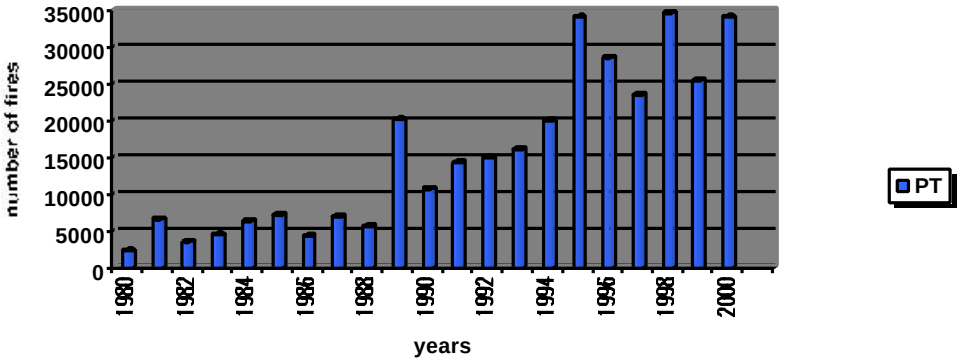
Figure 12. Number of forest fires (1980-1999 and 2000)



3.1.4 Portugal

Portugal's number of forest fires has increased steadily during the last two decades (see Fig. 13). The average amount of forest fires per year has risen from 6 777 to 22 250 between the last two decades (see Table 5), with a total number of forest fires increasing to approximately 150 000 in the same period (see Table 5). During the year 2000 Portugal suffered an escalation in the outburst of forest fires that lies well ahead of its average amounts of both the decade of 1980's and 1990's (see Fig. 12.). Indeed, the 34.000 fires occurred in the year 2000 represent 39% of the total amount of forest fires in the five Member States (see Fig. 18).

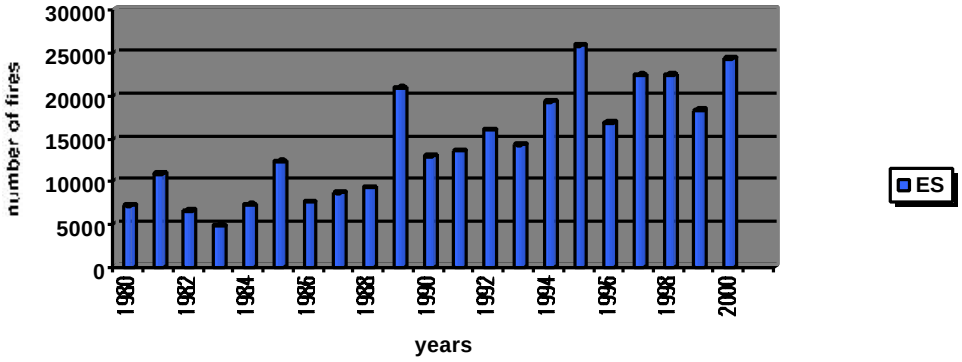
Figure 13. Number of forest fires in Portugal (1980-2000)



3.1.5 Spain

Spain's number of forest fires has increased steadily during the last two decades (see Fig. 14). The average amount of forest fires in Spain has increased from around 4500 fires to approximately 18000 fires

Figure 14. Number of forest fires in Spain (1980-2000)

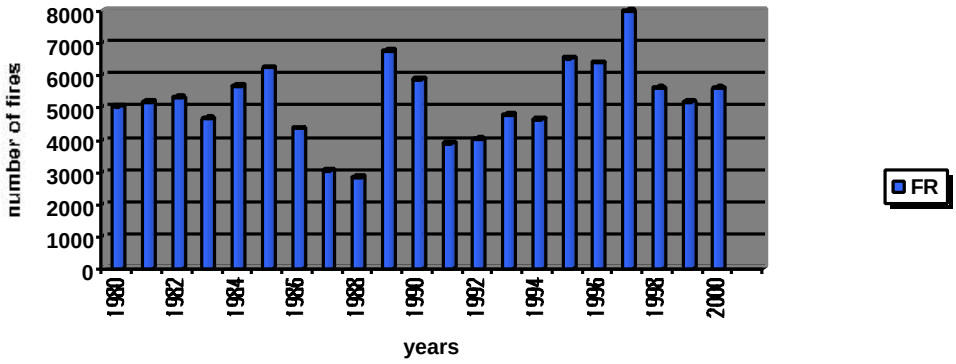


between the two last decades (see Table 5), while the total number of forest fires increased of over 80000 fires during the same period (see Fig. 11). However, as small fires were not registered in the 80s, the above mentioned conclusions have to be carefully interpreted.

3.1.6 France

In France, the average amount of forest fires per year has risen from 4 909 to 5 489 between the last two decades (see Table 5). The total number of forest fires increased by approximately 5 000 in the same period (see Table 5). Hence, France is the Member State with the smallest increase in the number of forest fires during the last two decades. In the year 2000, the number of forest fires in France represented only 6 % of the total number of forest fires in Southern Europe (see Table 6 and Fig. 18).

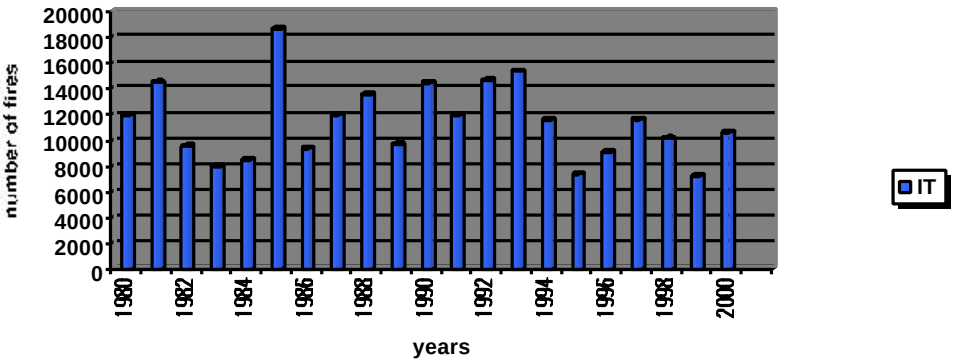
Figure 15. Number of forest fires in France (1980-2000)



3.1.7 Italy

From 1980 until 1993, the number of forest fires in Italy has been generally increasing, with an absolute maximum in 1985 (see Fig. 16). Only since 1993 there has been a descending trend in the number of fires. Despite this fact, Italy's number of forest fires decreased from little more than 115000 fires during the 1980's, to slightly over 113000 fires during the past decade (see Table 5). Nonetheless, Italy's total number of fires during the period 1980-2000 still lies fairly high, placing itself just sharply under the 240000 fires margin (see Table 5). On the other hand, the year 2000 remains slightly under the average amount of forest fires for the period 1980-2000 (see Table 5 and Fig. 12). With about 10.600 fires, Italy has a share of around 12 % of the total number of forest fires in the year 2000 (see Fig. 18).

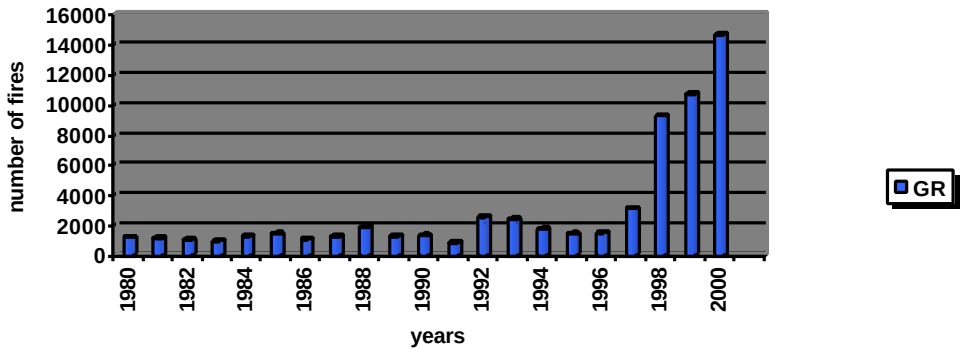
Figure 16. Number of forest fires in Italy (1980-2000)



3.1.8 Greece

The Greek Fire Service that became responsible for forest fires in 1998 records every call that they respond to including rural fires, while the policy of the Forest Service who was in charge until 1997 was to only record forest fires. For this reason it's not possible to compare the number of fires before and after 1998. Nevertheless, the year 2000 was most probably one of Greece's worst years during the last two decades (see Fig. 17). Nonetheless, Greece is the country with the least number of forest fires during the last two decades when compared to the other Southern Member States. For the year 2000, Greece has reached the third highest share. With its 14000 fires - which account for 16 % of the total number of forest fires in that year – Greece suffered another severe leash-back and another increase in the development of the outbreak of forest fires (see Table 6 and Fig. 18).

Figure 17. Number of forest fires in Greece (1980-2000)



3.1.9 Number of forest fires in the Southern Member States (year 2000)

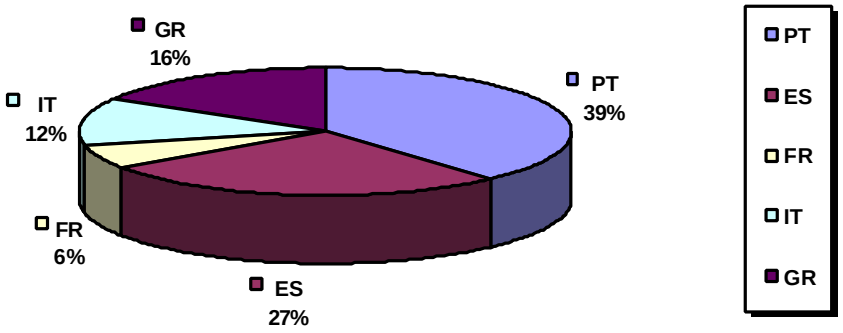
Table 6 shows the distribution of the number of fires per single Member State in the year 2000. Portugal was the country with the largest number of fires, followed by Spain, Greece, Italy and France. Figure 18 shows the percentage distribution by country.

Table 6. Number of forest fires per Member State for the year 2000

Member State	Number of forest fires	% of total number of forest fires
Portugal*	34 109	39%
Spain	24 312	27%
France**	5 600	6%
Italy***	10 629	12%
Greece****	14 650	16%
Total	**89 300**	**100%**

Source: DG Agriculture (2.10.2000) and Member States (*: 31.12.2000; Direccao Geral das Florestas, Portugal; **: 31.12.2000; Ministère de l'Intérieur, France; ***: 31.12.2000; Corpo Forestale dello Stato, Italy; ****: estimated; Ministry of Public Order, Greece)

Figure 18. Number of forest fires in % (2000)



4 GENERAL COMMENTS ON THE YEAR 2000 FIRE CAMPAIGN

4.1 Portugal

Portugal's forest area is about 3.3 million ha and private property constitutes 87% of the total forest area. The average size of the properties goes from 2 ha in the northern part to 100 ha in the south. Given the hydric factor (precipitation) which for continental Portugal represents 5 to 65% of Potential Evapotranspiration, and the low population density, the number of forest fires and the burnt area in Portugal are very impressive. It should also be noted that the North of Portugal has the highest number of forest fires in the country. In fact, it contributes with 56% to the total annual burnt area in Portugal.

4.2 Spain

Although in Spain forest fires occur during the whole year, in the year 2000 fires concentrated between 15th of July and 15th of September. While usually fires tend to happen along the coastal areas that are more sensitive to winds coming from the inner part of the country, during the year 2000 many of the bigger fires stroke the inner provinces of Spain.

Analysing the data until 31st of December 2000 we see how during last year the average burnt wooded area lies within the average of the whole past decade. Nonetheless, the year 2000 was perceived as being "very unfavourable" by both the widespread public opinion and by the civil protection experts. This is mainly due to two aspects: firstly, a particularly high concentration of fires occurred in just two months time and, secondly, fires affected various regions separately instead of focusing in a specific geographical area.

Even though comparison between the previous years and the year 2000 shows that last year can not be considered as a favourable one, it still can not be depicted as an "exceptional" year. In fact, the figure of the burnt wooded area in the year 2000 is lower than the average of the 1990's decade (see Table 2).

Strictly from the point of view of the Civil Protection, more forest fires occurred during the year 2000 than during the previous years. There were 46 fires in public service areas such as highways, train lines, electricity and telecommunication plants, and another 29 fires forced authorities to evacuate parts of the population. Even so, less than 0,4% of all forest fires in the year 2000 directly affected the Spanish population.

4.3 France

During the year 2000, 23700 ha of forest have been destroyed by the flames, which accounts for 0,1% of the sensitive natural spaces. Of these 23700 ha, nearly 18400 ha concerned the Mediterranean region of France, which again makes up 0,4% of the sensitive natural spaces. The highest percentage of sensitive natural space burned – 1,9% - has been reached in the island of Corsica as nearly 13.000 ha of forestland went on fire in solely two departments.

The total number of forest fires during the year 2000 in France has been estimated around 5600. Nevertheless, this figure is to be considered only as provisional and it might go through sensible changes due to the fact that some very small fires (< 1 ha) could not be included. In fact, fires need to be bigger than 1 ha in order to be considered as forest fires.

As far as the number of forest fires in the Mediterranean region of France is concerned, the final and definitive figure is 2400 fires for the year 2000.

4.4 Italy

During the year 2000, forest fire-fighting has been very difficult during July and August due to the severe drought resulting from the absence of rainfall and air temperatures higher than 40° C in many parts of Southern Italy. On such days, fire departments were called on more than 170 fires a day. In addition, winds made their interventions becoming very risky.

The southernmost regions (Puglia, Calabria, Campania) together with the islands of Sardinia and Sicily kept the record of the number of fires also in 2000, confirming that fires are usually more numerous in regions with low forestry ratio, such as Puglia and Sicily. Most of the fires are believed to be intentionally caused.

In many cases, heavy fires have threatened houses, residential areas and small towns, where residents have been evacuated or cautioned to leave their homes. In addition, wildfires have severely swept many protected areas (namely nature reserves and national parks such as Pollino, Gargano and Abruzzi) and areas of celebrated beauty, such as the island of Capri, the pine stand of Ostia near Rome or the coast near Amalfi.

(Source: Vittorio Leone, Faculty of Agriculture, University of Basilicate, Potenza, UN/ECE publication: International Forest Fire News, No.23-December 2000, p.84, GE.01-20957-March 2001)

4.5 Greece

Greece occupies an area of 130 875 km² at the southern tip of the Balkan Peninsula. Approximately 2.5 million hectares, 19.8 % of the surface area of Greece, is characterised as forested. However, only less than half of this area is covered by “tall” timber producing forests. Most of these are conifer forests. “Low” or coppice forests that mostly produce fuelwood occupy the remaining forest area. In addition to these forested areas there are approximately 3.2 million ha of partially forested areas and shrublands (occupied mostly by evergreen broadleaved shrubs).

The poor results of the last few years in coping with the problem of forest fires clearly indicate that there is a need for improvement, especially in regard to knowledge and organisation of the whole effort. Also, there is a clear need for better managed forests and serious fire prevention efforts. The latter objective requires a modernised Forest Service that will work in close cooperation with the Fire Service.

The Fire Service needs to improve its initial attack capability. Indirect attack should be recognised as a true alternative to direct attack and the methods for its application should become part of a basic training at all levels. The ground forces should learn to rely less on the help of aerial forces because they may be unavailable under certain conditions (extreme winds, too many simultaneous fires, night hours). Also, the Fire Service should evaluate its pre-suppression planning in order to maximise the effectiveness of its forces, especially the aerial ones. Good cooperation with the Forest Service is clearly necessary.

Some of the improvements needed in the Fire Service are:

- hiring new permanent, competent staff,
- changes in structure that will permit a central policy to be applied in all regions, including training in modern concepts and methods,
- a mission for active rangeland management by the Forest Service and education of shepherds, and
- active management of the low-elevation Aleppo and Brutia pine forests.

(Source: Gavriil Xanthopoulos, Advisor to the Ministry of Public Order, Athens, UN/ECE publication: International Forest Fire News, No.23-December 2000, p.76, GE.01-20957-March 2001)

A first step to undertake is the workshop of forest fire experts to be held in November 2001 in Chania/Crete. It will be organised jointly by the General Secretariat for Civil Protection of the Ministry of Interior and the Mediterranean Agronomic Institute of Chania. The workshop is a project co-funded under the Community action programme in the field of civil protection[2]. It aims to optimise dispatching resources for the control of forest fires by assessing the needs and the expected effectiveness of resource.

[2] OJ No L 327, 21.12.1999, p.53.

5 OPERATIONS OF MUTUAL ASSISTANCE

Since the adoption of Council Resolution of 8 July 1991 on mutual assistance[3], the following operations of mutual assistance have been launched in the field of forest fire fighting:

1991 Spanish aerial means in the central region of Portugal.
1992 Spanish aerial means in the Algarve region of Portugal.
1993 Spanish aerial means in the central region of Portugal;
German aerial means (pre-positioned due to the high risk) for Greece.
1994 French aerial means in the Catalonian region in Spain;
2 Portuguese aerial means (Antonov) in the Eastern part of Spain (during the fire-fighting operations one of the planes crashed killing the whole troupe).
1995 French Fokker in Athens, Greece;
1 German aerial mean (Shinouk) in the region of Achaia, Greece;
2 Italian aerial means (Canadair CL-415) for the Penteli fire, Greece.
1996 French (aerial) means in Turkey.
1998 2 French CL-415 in Italy; 4 French CL-215 in July in Catalonia, Spain;
3 French CL-415 in August in the region of Athens, Greece;
other French (aerial) means in Croatia.
2000 4 French CL-215 and 1 CL-130 in August in Catalonia, Spain.

To assist each other in emergency situations has not only become good tradition between the Member States but it is also a question of good neighbourhood. One needs a well developed spirit of solidarity to dislocate his own fire fighting means some 1000 km in order to assist another Member State, when at the same time the risk for forest fires is extremely high in the own country.

Most of the southern Member States have established agreements to assist each other, but still the decision for intervening is not easy to take. To facilitate such decision, one has to know the forest fire risk level in the neighboured Member States at very short term. A simple change of the wind direction may change such decisions in the very last moment. For that reasons, the southern Member States, with the help of the European Commission, started to define their daily forest fire risks during summertime[4]. At present, the risks are well known and allow for an improved mutual assistance.

For several reasons, it would not be an appropriate approach to create a European fire fighting fleet, as it is requested regularly through well-meant hints addressed to the European Commission. Only good equipment with planes and helicopters cannot solve the problem. Such means have to be at disposal in proximity of the endangered areas and above all, their dispatch should be well co-ordinated. It is more the combination of prevention and forest fire fighting measures that guarantees successful operation. It goes without saying that such a combination of measures must be based on sound scientific knowledge.

[3] OJ No C 198, 27.7.1991, p.1.

[4] EFFRFS-system, see chapter 5.

6 APPLICATIONS OF ADVANCED METHODS

The way in which the organisations in charge of disaster prevention are dealing with natural disasters is changing rapidly. New technologies such as space techniques, telecommunications and advanced modelling are improving every day. This chapter presents the work carried out in the field of forest fires for the development of forest fire risk forecasting methods. It also presents how the use of satellite imagery soon after the peak of the fire season (summer) permits obtaining early estimates of forest fire damages in the EU Mediterranean region.

This work is performed within Natural Hazards Project of Directorate-General Joint Research Centre in support to Commission services (Directorate-General Environment and Directorate-General Agriculture) dealing with the forest fire topic and the relevant organisations of the Member States. Both activities will be the core of the envisaged future European Forest Fire Information System.

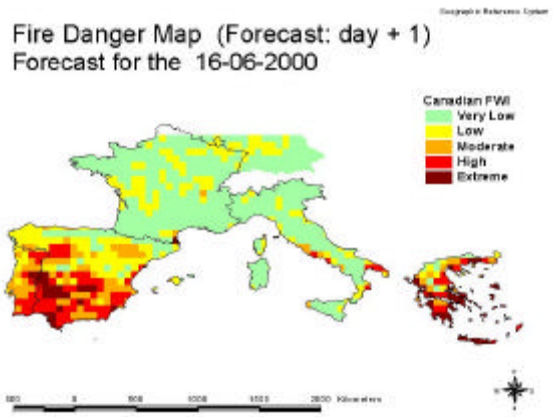
6.1 The European Forest Fire Risk Forecast System (EFFRFS)

The European Forest Fire Risk Forecast System developed by the Space Application Institute (European Commission, Directorate-General Joint Research Centre) allowed following the forest fire risk evolution throughout the 2000 campaign.

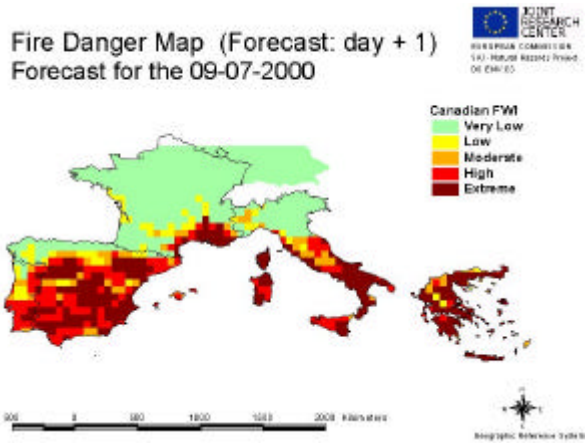
European and national one and three-day forest fire risk forecast maps are produced by the system. These maps are transmitted to the Directorate-General Environment/Civil Protection Unit, as well as to all civil protection and forest fire services in the Mediterranean region through a pre-operational user-driven service, referred to as Fire Risk Watch. Fire risk forecast maps arrive at all the services every morning over the Internet. A successful trial of data transmission via satellite has also been performed.

The provision of forest fire risk forecast started in June 15, 2000 and ended on September 30. Daily forest fire risk forecast for one and three days was delivered in the form of images to Portugal, Spain, France, Italy and Greece. Individual country maps in addition to EU maps were delivered every day to the Civil Protection Unit (European Commission, Directorate-General Environment) as well as to each Member State. Since this is the first year in which European maps of meteorological fire risk are provided, comparison with fire seasons in the precedent years is not possible. The analysis will concentrate in the fire risk trend in the different regions. The Canadian Fire Weather Index, which was requested by all countries, will be used for the purpose of this report.

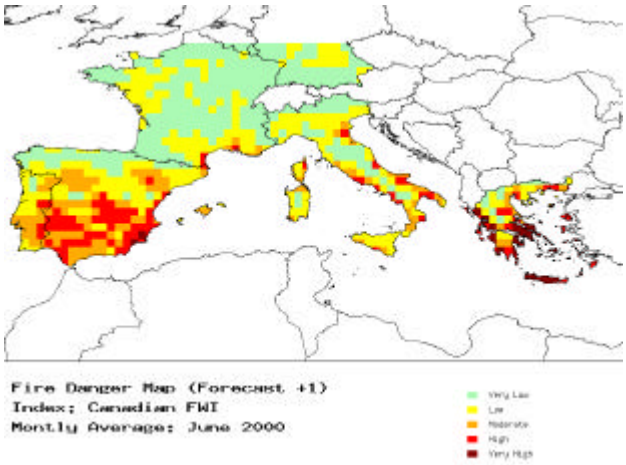
The situation at around mid-June presented a moderate fire risk for most of the Mediterranean basin.



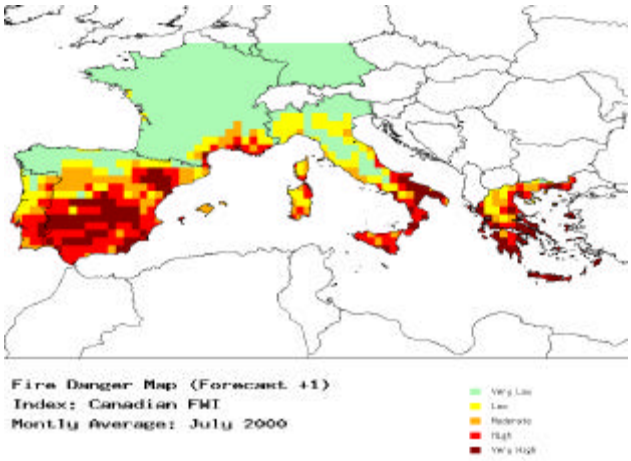
There was however extreme risk in some areas of Greece, principally in the south and along the south-eastern coast of Spain. This was due to windy and dry conditions. At the beginning of July the fire risk situation had not changed much except for the fact that the risk in southeast France and the west coast of Italy was increasing. The trend of increasing risk continued during the first weeks of July in these areas leading to very high risk all along the Mediterranean basin. Extreme risk can be observed on the coast of Spain, southern France, Italy and Greece. The fire risk increased also in areas of centre and south of Portugal due to high-speed winds. A large number of fires took place in these days on Eastern Spain, central and southern Italy and Greece.



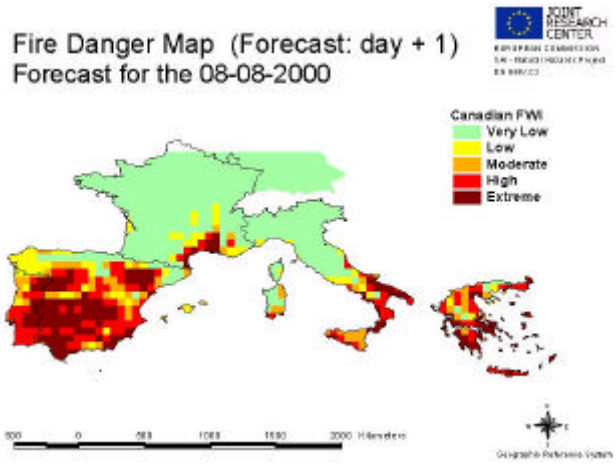
Favourable meteorological conditions helped to improve the situation in the second half of July. The average fire risk map for the months of June and July are presented below.



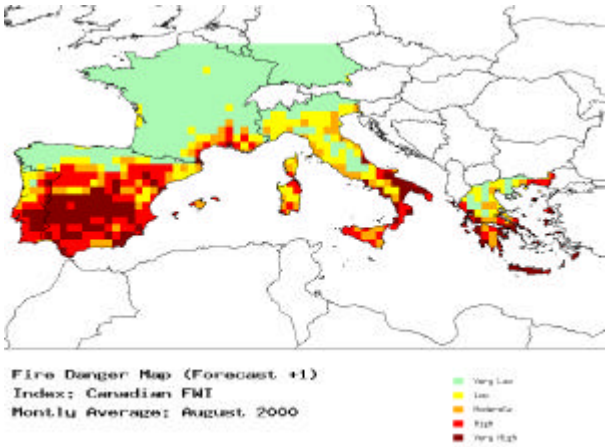
At the beginning of August, meteorological conditions worsened in most of the Iberian peninsula, northeastern Spain and southeast France, with persistent extreme risk.



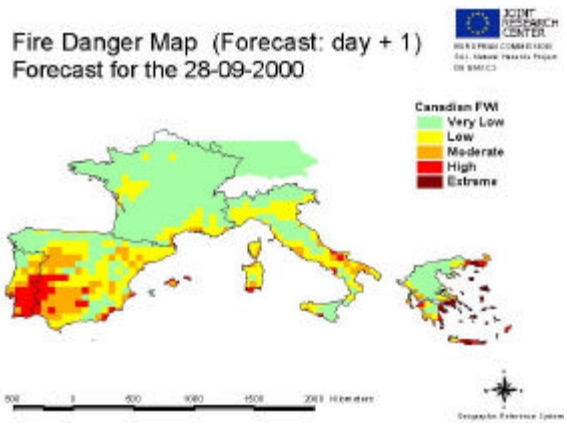
Conditions were also critical along the southern coastal areas of Italy and Greece. The trend continued until August 11th, in which most of the Iberian peninsula was at extreme risk. Conditions on the Eastern part of the Mediterranean basin improved, lowering the meteorological fire risk conditions in northern Greece and in most of the Italian peninsula. In Italy, extreme conditions only persisted in the southeast. During the following days the fire risk situation improved slightly leading to more favourable conditions. However this period only lasted about a week, since by the 20th of August, conditions worsened again. The average risk situation in the Mediterranean region is shown by the following image. Even though average values are not the best statistic because contrast between extreme risk and very low risk is eliminated, the August average risk map shows persistent high risk on most of the Iberian peninsula, the south coasts of France, Italy, and Greece.



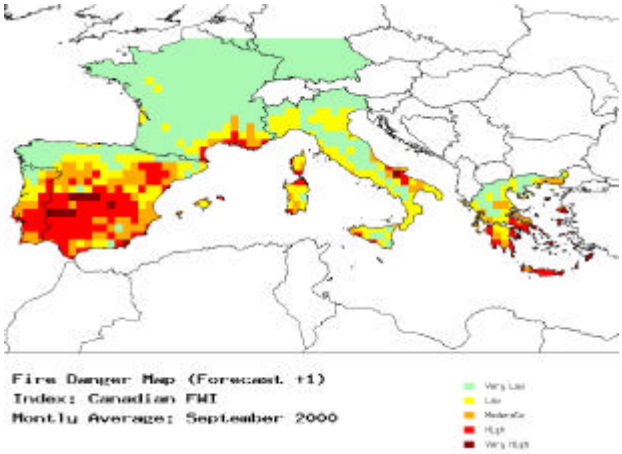
In the last ten days of August the overall fire risk diminished in continental areas, but all the coastal areas remained at high or extreme risk.



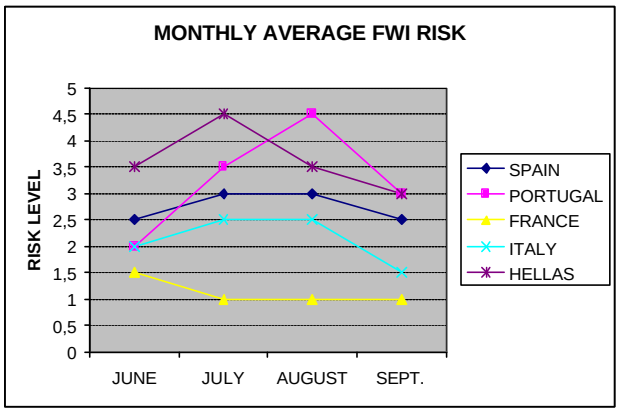
At the beginning of September, the fire risk situation showed a general improvement in most areas. However, the risk on the coastal areas of France and Greece raised in the following days. Although the overall risk for the region was lower, areas of France and Greece were still at high or extreme risk. The situation on the 8th of September showed high risk only in some areas of Spain and France, and Greece. It should be mentioned that meteorological risks do not take into account vegetation cover, which leads to high risk in some agriculture areas. This is the case for some areas of centre Spain and southern Portugal. This anomaly will be corrected in the indices to be provided in 2001. The risk decreased in the second week of September and this improvement continued until the end of the month. The situation by the end of September showed low risk in most of the Mediterranean region.



The average fire risk for the month of September is presented below.



A summary of forest fire risk by country from June to September is presented below.



6.2 Burnt area mapping and damage assessment

The information on areas burnt by fire at the European level is normally aggregated at administrative level and ignores the exact spatial location and extent of fires. Each country has its own methodology to assess burned areas, which leads to a lack of harmonization of the burnt area statistics.

In order to improve this harmonisation, a classification map of burned areas was done using satellite images from near the end of the year 2000 fire season. This burnt area map was used in conjunction with the EU-CORINE land cover (CLC) database to estimate the damage to forests and other land cover types. This methodology has the advantage of giving fast up to date evaluations of the burnt areas just after the end of the fire season. It can also be used as a basis to compare individual reports from each of the countries of the European Union.

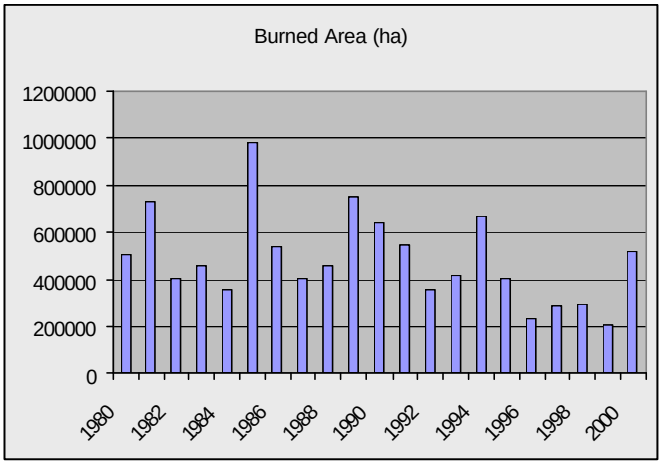
This activity has produced the first cartography of forest fire damages in the south of the EU for the year 2000. All fires larger than 50 hectares were mapped. Burnt areas larger than 50 ha account, in whole Mediterranean region, for 73 % of the total area burnt every year. However, this percentage varies from 53% in Italy to 86% in Greece. The burnt area, as detected by the analysis of the satellite imagery, resulted in a total surface of 386 697 hectares. The distribution by the five countries considered was as follows:

Table 7: Burnt area > 50 ha in the year 2000

Country	**Surface burned (hectares)**
Portugal	107 063
Spain	112 720
France	15 078
Italy	45 101
Greece	106 735
Total	**386 697**

According to statistics by country from previous years, it can be inferred that the total burnt area in the year 2000, i.e. including all fires, was approximately 519 334 hectares. This figure is near the average for the last decade.

Figure 19. Surface burnt by forest fires per year.



The intersection of the burnt area map with the CLC map provided the information on the burnt land cover classes that burnt. Table 6 shows the distribution of the area burnt by the Level 1 CLC classes. Approximately three-quarters of the total burnt area corresponds to *Forests and Semi-natural Areas.* The *Agricultural Areas* accounted for approximately 20 % of the total burnt area although most of these areas were occupied by *Land principally occupied by agriculture with significant areas of natural vegetation* and *Agro-forestry areas.* The *Unclassified land surface* accounted for 4.68 % of the total burnt. Visual analysis of the satellite images of these areas suggests that most of this unclassified area is covered by forests and shrubs.

Table 8: Distribution of the burnt area by land-cover classes.

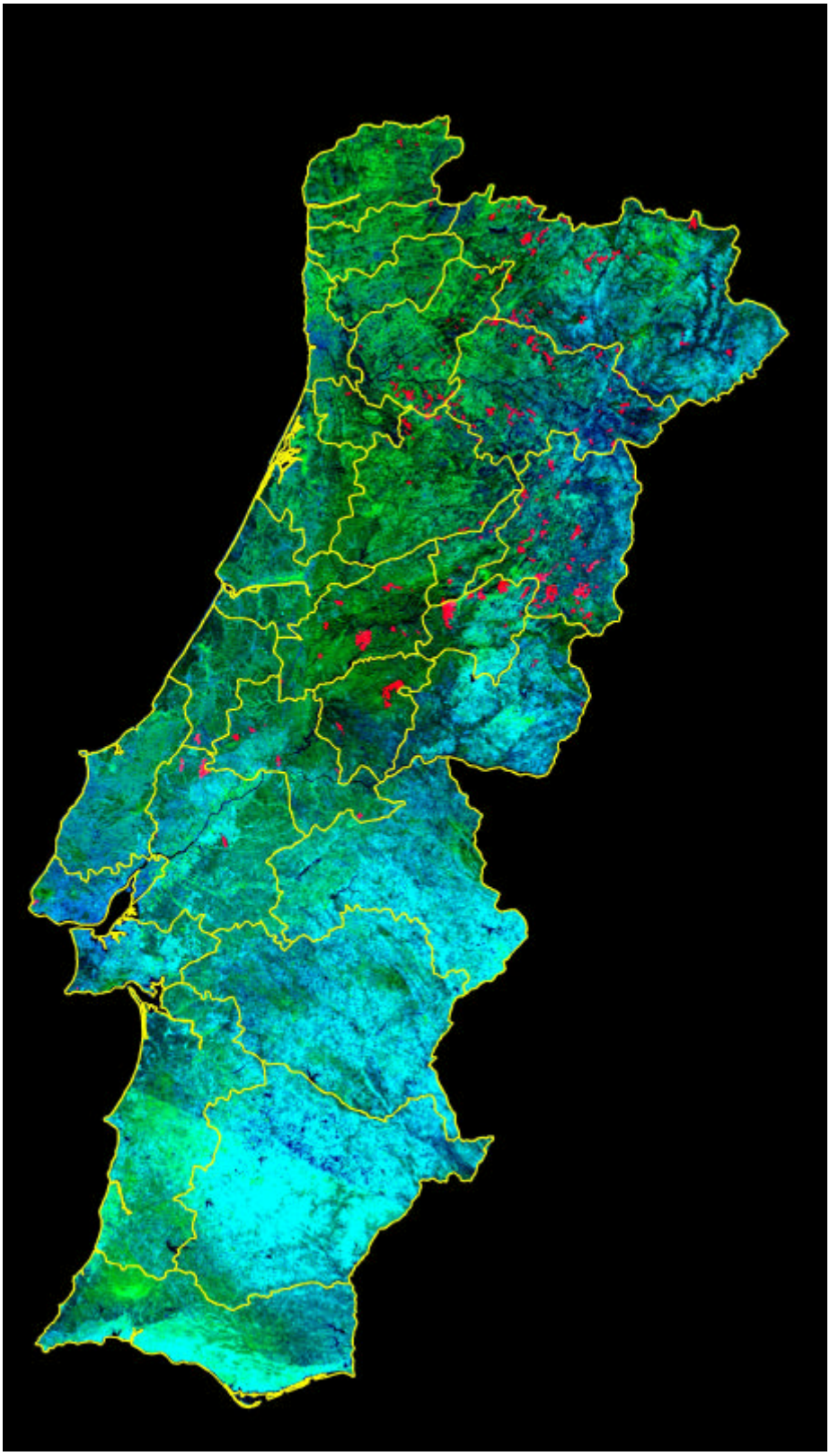
CORINE land-cover class	Burned area (ha)	(%) of total burned area
Artificial Surfaces	1160	0.30
Agricultural Areas	76976	19.91
Forests and Semi-natural Areas	289855	74.96
Wetlands	612	0.16
Unclassified Land	18094	4.68
Total	**386697**	**100**

By the overlapping of the CORINE land cover class map and the relief, it is equally possible to register the burnt areas after the land cover categories and after their inclination.

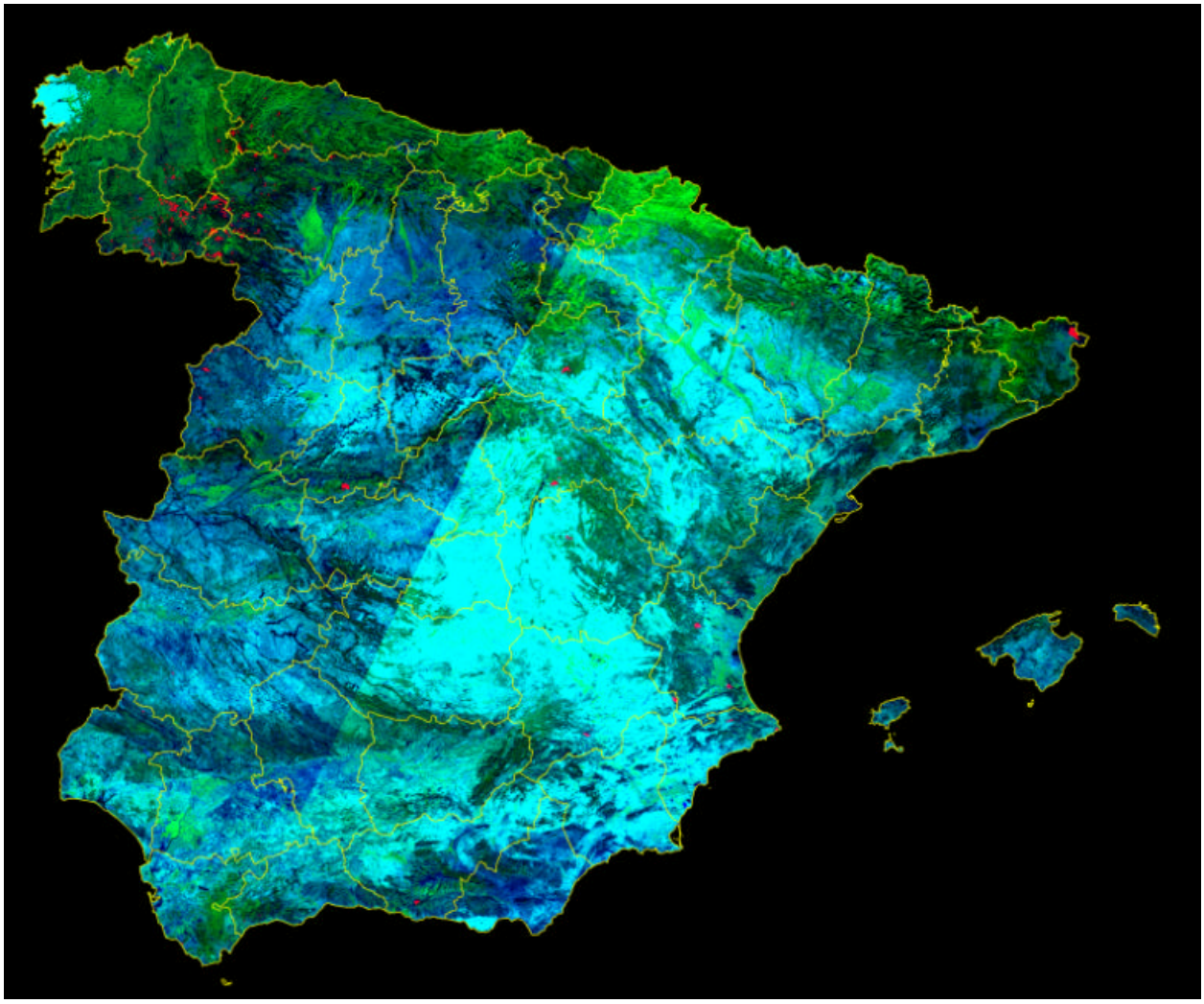
This fire map has various points of interest:

- the map shows the situation of the forest fires already 4 months after the end of the year, while by normal procedure one must wait until the Member States verify their national data and transmit them to the Commission services. This procedure usually takes up to 18 months.
- the map can be largely distributed, in particular to all Member States, and it gives a homogenous, coherent and harmonised view of the situation at Community level.
- fires are geo-referenced, i.e. fires are ordered by their latitude and their longitude. This allows both to put them in relation to other data sources, and to follow up the evolution of burnt areas for years to come.
- burnt areas can be ranked on behalf of categories of soil usage in order to make the data collection very precise, and they can be classified by their inclination. This last element permits to evaluate the erosion risks thereby related.

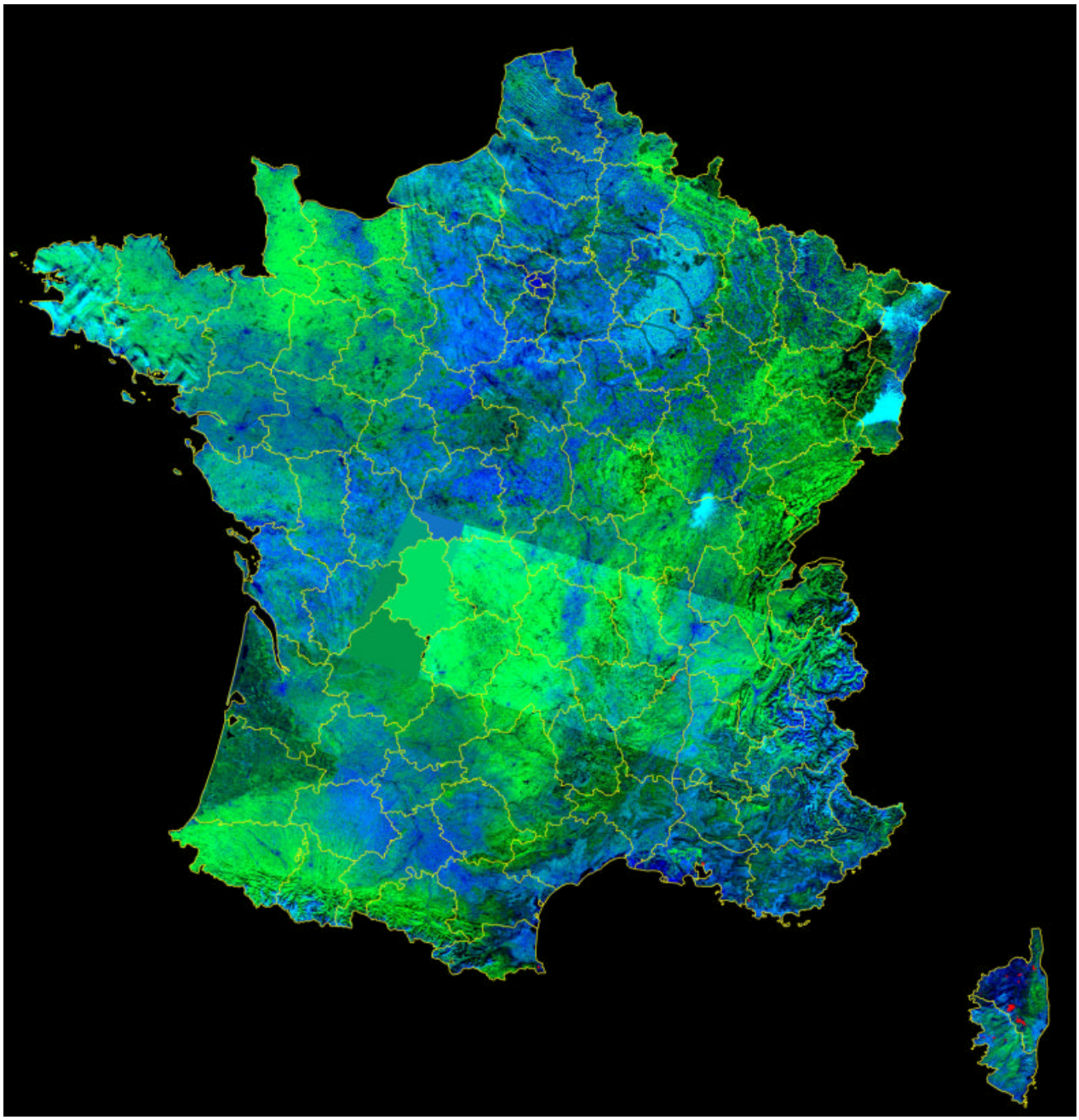
- It is highly recommended to continue this work in the future in order to deliver maps produced on an annual basis The images of burnt areas for Portugal, Spain, France, Italy and Greece are provided in the figures below. Burnt areas are shown in red over a colour-composite of the satellite images.
-



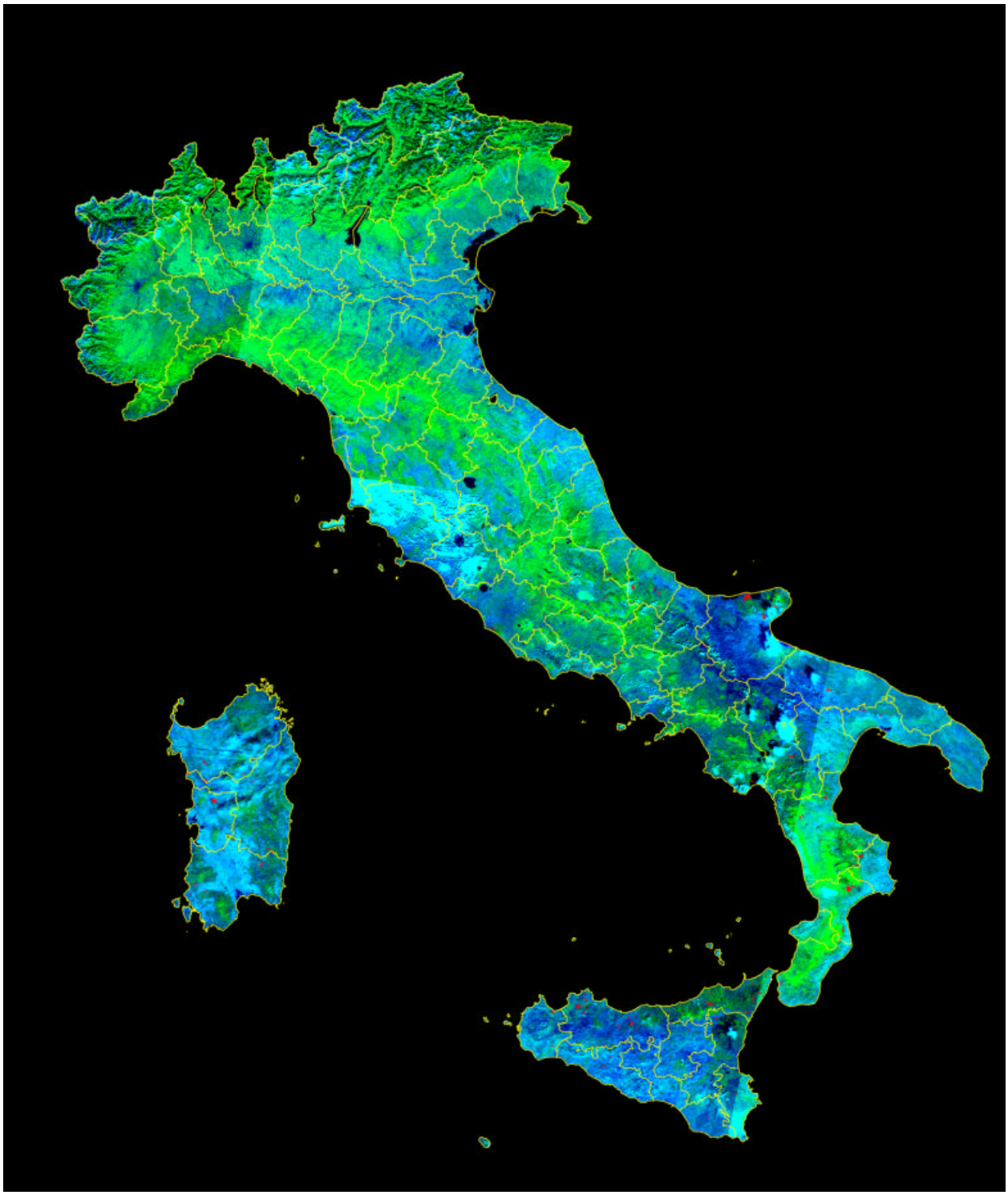
As shown on the image, burnt areas in Portugal concentrate on the centre and northern regions. The southern part of Portugal, mainly dedicated to agriculture, is less affected by forest fires.



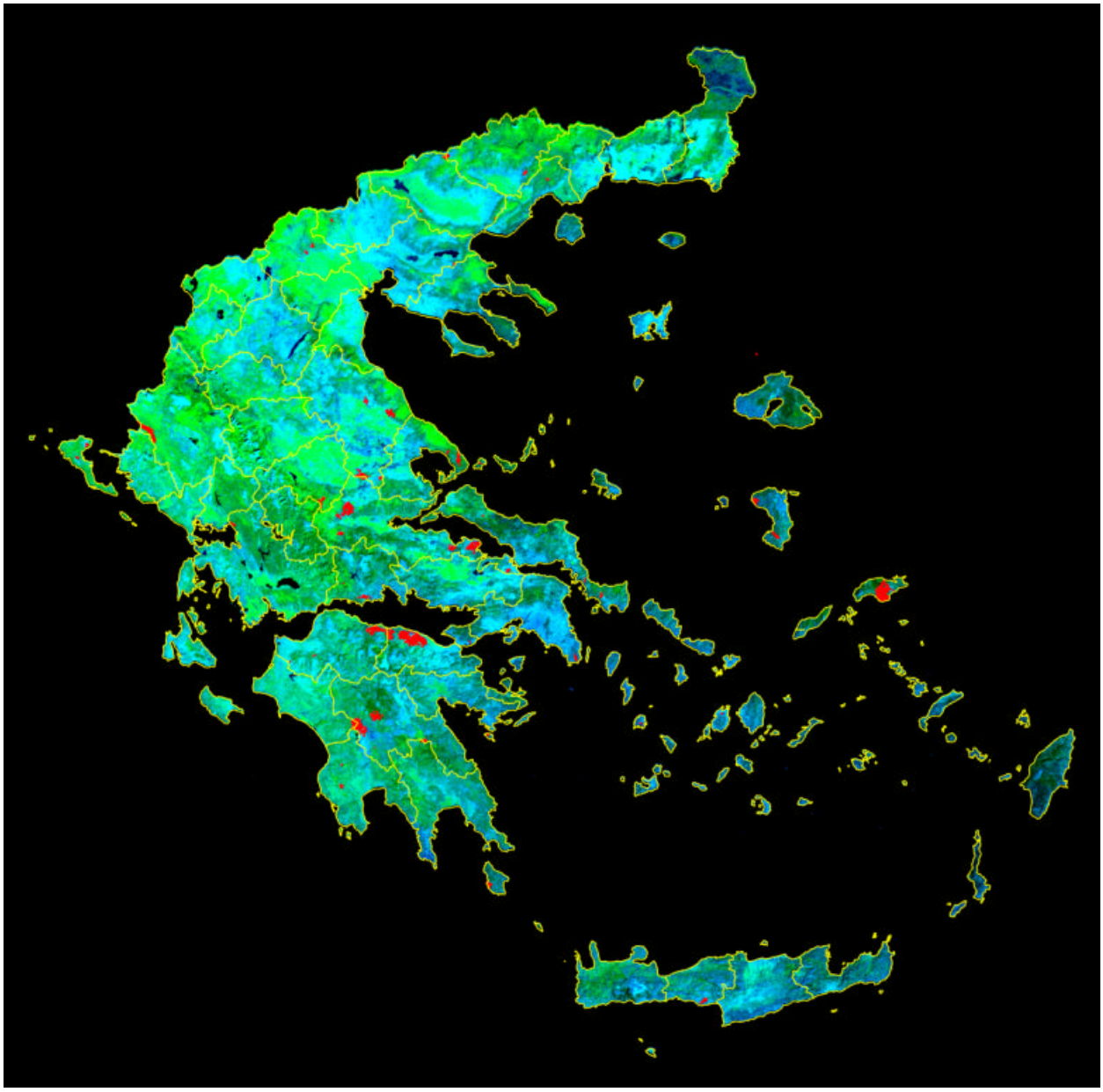
Most of the burnt areas in Spain can be observed on the Northwest.



Burnt areas in France concentrate mainly on Corsica and on the Southeast.



In Italy, most of the large fires took place in Sardinia and the south of Italy (Puglia, Basilicata, Calabria and Sicilia).



The image of Greece shows clearly the large fires that took place in the Peloponesus peninsula, in the Greek borders with Albania in the region of Ipiros, in Ftiotida and Pilio, and some of the burnt areas in the Greek isles of Samos, Chios and Corfu.

7 INFORMATION TO THE PUBLIC

Most of the Member States inform their citizen in order to avoid forest fires or to keep the fire risk at low level. Others are very reluctant arguing that such information leads arsonists to set fires in times of high vulnerability. A certain tendency can be noted: Northern Member States, where arsonists play a minor role, count on the comprehensiveness of their citizen whilst some Member States in the Southern Community made less good experiences by informing the public.

Others are convinced by sensibilisation campaigns, as the example of Spain shows clearly:

> Several campaigns have been launched by television, by spots showed in trains and busses, by magazines containing recommendations for preventing fires. 300 environmental active groups (GAM) have been created in schools by voluntary pupils.
>
> Furthermore, as a new experience 3 Spanish teams for prevention of forest fires (EPRIF) have been created in 1999. Their tasks are to investigate the fire reasons, to improve informing the public, to promote controlled burning and to assist in fire fighting when appropriate. To co-ordinate these activities 5 teams for early alert and first attack by four-wheel drive vehicles were at disposal.
>
> Moreover, a specific campaign, aimed at preventing rural fires from spreading into the forest, is organised to remind farmers their responsibilities.

In order to help the public get a better access to the forest fire information system, the Member States and the Commission have planned to introduce a page on forest fires on the web site of the Commission. This page will contain some elements explaining the Regulation (EEC) No 2158/92 [5]related to the forest fire protection system, areas at fire risk, protection plans, links to other specialised web sites (see Figure 20 below), as well as a more interactive part concerning the information system on forest fires (see Figure 21 below). Previously established maps or new ones can always be added using an interface that enables the user to explore the cartographic maps developed by the Joint Research Centre and that also allows him to check and make use of diverse databases via the Internet.

As a matter of course, the types of possible enquiries and the degree of accessibility of the web site will be decided by the Commission and the Member States.

Also, in order to enhance better information to the public, a call for proposals for a Community co-operation in the field of Civil Protection has been published on 12th May 2001 in the Official Journal of the European Communities[6]. The main objective of this initiative is to improve public information, education and awareness so as to help the citizens to protect themselves more effectively wherever they may be in the Community. Actions on how to be prepared for and how to react in the case of forest fires are included.

[5] OJ No L 217, 31.7.1992, p. 3.

[6]OJ No C 140, 15.5.2001, p.17.

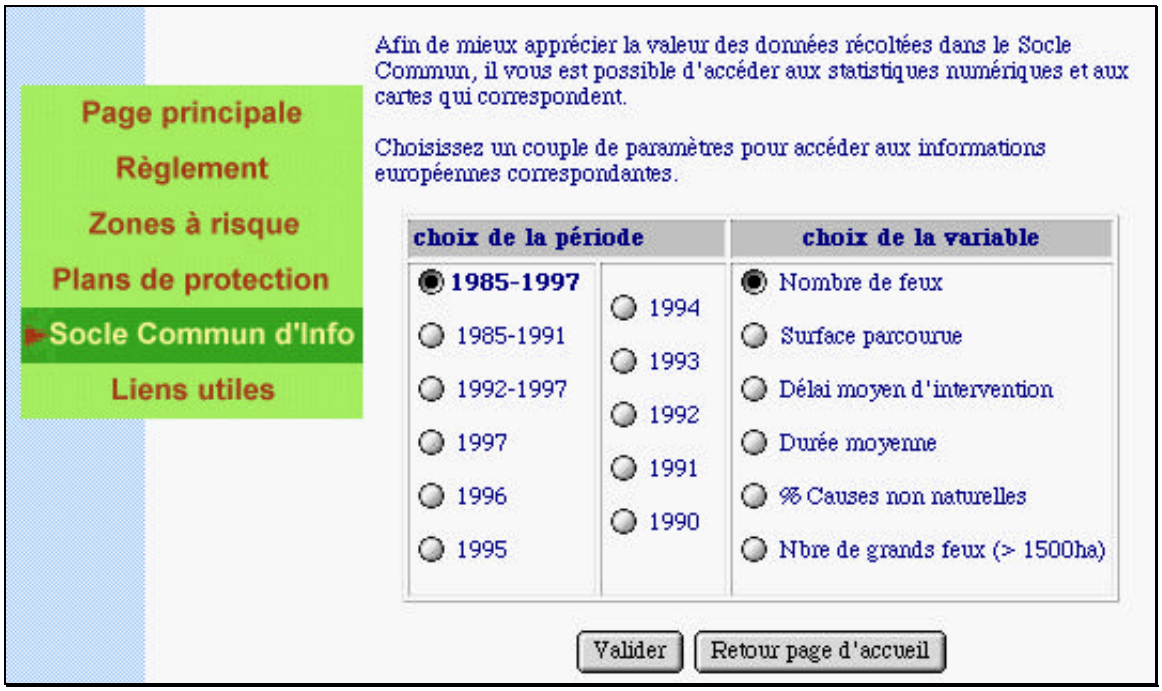


Figure 20. Example of a possible interface that would allow the user to get access to the database

Figure 21. Example of a link to another web site about forest fires in Europe and elsewhere.

8 ANNEX

Table 9. Burnt wooded area in the Southern Member States (period 1980 - 2000)

Burnt Area (ha) 1980-2000	PORTUGAL	SPAIN	FRANCE	ITALY	GREECE	TOTAL
1980	44.260	263.017	22.176	144.302	32.965	**506.720**
1981	89.798	298.288	27.711	229.850	81.417	**727.064**
1982	39.557	152.903	55.145	130.239	27.372	**405.216**
1983	47.812	108.100	53.729	223.728	19.613	**452.982**
1984	52.713	165.119	27.202	78.326	33.655	**357.015**
1985	146.255	484.476	57.368	189.898	105.450	**983.447**
1986	99.522	264.887	51.860	86.240	24.514	**527.023**
1987	76.268	146.662	14.108	120.697	46.315	**404.050**
1988	22.435	137.734	6.701	186.405	110.501	**463.776**
1989	126.235	426.693	75.566	95.161	42.363	**766.018**
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	57.012	105.277	16.607	105.695	71.410	**356.001**
1993	49.963	89.267	16.695	209.314	54.049	**419.288**
1994	77.323	437.635	25.872	68.828	57.908	**667.566**
1995	169.612	143.484	18.118	46.466	27.202	**404.882**
1996	88.867	59.825	11.210	57.986	25.310	**243.198**
1997	30.535	98.503	20.500	103.015	52.373	**304.926**
1998	158.369	132.813	20.880	140.432	****112.802	**565.296**
1999	70.613	82.216	17.605	61.989	****19.050	**251.473**
2000 (2.10.2000)	*159.604	146.801	**23.700	***102.355	****167.006	**599.466**
TOTAL	**1.926.491**	**4.207.050**	**645.508**	**2.676.105**	**1.162.915**	**10.618.069**
Average	**91 737**	**200.335**	**30.738**	**127.433**	**55.376**	**505.622**

Source: European Commission, DG Agriculture (2.10.2000) and Member States (*: 31.12.2000; Direccao Geral das Florestas, Portugal; **: 31.12.2000; Ministère de l'Intérieur, France; ***: 31.12.2000; Corpo Forestale dello Stato, Italy; ****: estimated; Ministry of Public Order, Greece)

Table 10. Number of forest fires in the Southern Member States (period 1980 - 2000)

Number of forest fires 1980-2000	PORTUGAL	SPAIN	FRANCE	ITALY	GREECE	TOTAL
1980	2.349	7.190	5.040	11.963	1.207	**27.749**
1981	6.640	10.878	5.173	14.503	1.159	**38.353**
1982	3.567	6.545	5.308	9.557	1.045	**26.022**
1983	4.503	4.791	4.659	7.956	968	**22.877**
1984	6.377	7.203	5.672	8.482	1.284	**29.018**
1985	7.218	12.238	6.249	18.664	1.442	**45.811**
1986	4.348	7.570	4.353	9.388	1.082	**26.741**
1987	6.977	8.670	3.043	11.972	1.266	**31.928**
1988	5.643	9.247	2.837	13.558	1.898	**33.183**
1989	20.155	20.811	6.763	9.669	1.284	**58.682**
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	4.008	14.641	2.582	**52.140**
1993	16.101	14.254	4.765	15.380	2.406	**52.906**
1994	19.983	19.263	4.633	11.588	1.763	**57.230**
1995	34.116	25.827	6.545	7.378	1.438	**75.304**
1996	28.626	16.772	6.400	9.093	1.508	**62.399**
1997	23.497	22.319	8.000	11.612	3.118	**68.546**
1998	34.676	22.338	5.600	10.155	****9.282	**82.051**
1999	25.477	18.237	5.170	7.235	****10.723	**66.842**
2000 (2.10.2000)	*34.109	24.312	**5.600	***10.629	****14.650	**89.300**
TOTAL	**324.388**	**300.864**	**109.587**	**239.865**	**62.285**	**1.036.989**
Average	**15.447**	**14.326**	**5.218**	**11.422**	**2.965**	**49.378**

Source: European Commission, DG Agriculture (2.10.2000) and Member States (*: 31.12.2000; Direccao Geral das Florestas, Portugal; **: 31.12.2000; Ministère de l'Intérieur, France; ***: 31.12.2000; Corpo Forestale dello Stato, Italy; ****: estimated; Ministry of Public Order, Greece)

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