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NEDIES PROJECT

Lessons Learnt from Forest Fire Disasters

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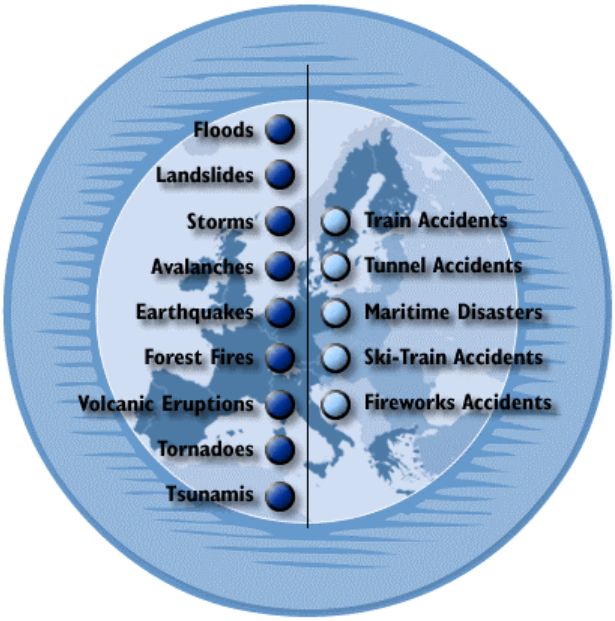

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ABSTRACT

The NEDIES project is being conducted at Ispra by the Institute for the Protection and Security of the Citizen (IPSC) of the EC Directorate General Joint Research Centre (JRC). The objective of the project is to support the Commission Services of the European Communities, Member State Authorities and EU organisations in their efforts to prevent and prepare for natural disasters and accidents, and to manage their consequences.

A main NEDIES activity is to produce "lessons learnt" reports based on experience gained from past disasters. This report discusses lessons learnt from recent forest fire disasters. It is based on the contributions presented at a NEDIES meeting held at Ispra JRC on 23 and 24 May 2002.

ACKNOWLEDGEMENTS

All the participants in the NEDIES meeting held at the DG Joint Research Centre, Ispra on 23 - 24 May 2002, at which the contributions to this report were presented, are kindly acknowledged for their participation in the discussion and suggestions. Special acknowledgement is given to Lorenzo van Wijk of the Institute for the Protection and Security of the Citizen, DG Joint Research Centre for his assistance in translating part of the French contribution in this report and Jesus San Miguel of the Natural Hazards Project of the Institute for Environment and Sustainability for his useful comments.

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1. INTRODUCTION

Forest fires are one of the most devastating forces of nature. It has claimed lives, damaged property and infrastructure and destroyed hectares and hectares of forest land, which provide economical and recreational resources to society. Forests are also the habitat of valuable flora and fauna and they play a fundamental role in safeguarding the dynamic equilibrium of the Earth.

Statistics has shown that there are many causes of fires (see for example, Figure 2.3.2.c [p.15] and Figure 3.4.1.c [p.60]). These causes can be complex, as they can be of the following nature:

- ***physical***, e.g. related to climatic changes;
- ***social***, e.g. related to behaviour regarding forest and forest use;
- ***structural***, e.g. forest protection and land use planning;

or a combination of them.

In Europe, forest fires occur regularly and fire fighters continuously risk their lives in their attempts to control and extinguish them. Fires have a life of their own nurtured by anything that assists them in their propagation towards the total destruction of anything that crosses their path. Fire fighters are challenged to obtain a real-time dynamic scenario of the overall situation, i.e. on the *demand side*: wind speed, fire development, landscape characteristics, etc.; on the *supply side*: number of fire fighters, their whereabouts, resources capacity and limits, etc.. The coordination of a fire fighting intervention is a very difficult task and requires specially trained personnel to carry it out.

This report presents the contributions from experts in the field of forest fire management. Chapter 2 portrays to the lessons learnt from various forest fire disasters experienced throughout Europe. The chapter is opened by a contribution from Italy regarding the winter 2002 fires in Cosenza, in the region of Calabria in Southern Italy. It is followed by the description of the forest fires in the districts of Guarda, Castelo Branco and Coimbra in Portugal. The third event portrayed is the the forest fires in Simsjön, Sweden, after which, the Romanian expert explains the lessons learnt from a long period of drought that triggered forest fires in a significant portion of Romania. Slovenia also experiences this type of disaster and an example is described regarding the forest fires near the town of Komen. The last contribution is from France, which shows the lessons learnt from a forest fire in Septeme les Vallons.

Chapter 3 describes other experiences in forest fire management. The first entry is from Finland, which offers some statistics on Finnish forest fire management. The next contribution is from Portugal, which gives some insight on the Portuguese forest fire service. This is followed by an analysis of forest fire problems in Bulgaria. The last contribution in this chapter portrays the experience in the management of forest fire in Romania.

Chapter 4 summarises the various lessons learnt contributions. It also offers some conclusions arising from the analysis of the contributions.

Two Annexes are also provided at the end of this lessons learnt report. Annex 1 offers useful information regarding forest fires, such as its definition, types of forest fires, a

checklist of precautions to assist people living in or plan to visit fire-prone areas, and interesting URLs. As research is a fundamental part in understanding the forest fire phenomenon and is crucial in giving feedback to all the phases of forest fire management, Annex 2 offers a list of forest fire projects funded by the European Commission.

This endeavour has been carried out within the framework of the NEDIES Project. NEDIES (Natural and Environmental Disaster Information Exchange System) is concerned with natural disasters and accidents, which occurred in EU Member States. It is carried out at the Institute for the Protection and Security of the Citizen (IPSC), DG Joint Research Centre of the European Commission. This report on lessons learnt from forest fires was made for the Civil Protection Services of the EU, Accessing and Candidate Countries, along with the organisations and people involved in the management of any type of natural disaster and accidents, and also the general public. Although the lessons learnt from forest fire disasters are addressed in the report, many of them could also be of help in the prevention of, preparedness for and response to other types of disasters.

The report is included in the website (**http://nedies.jrc.it**) of the NEDIES project.

2. LESSONS LEARNT

2.1 The forest fires in the Province of Cosenza (Italy)

A. Scipioni, D. Pontani and C. Allochis (*Department of Civil Protection, Rome*)

2.1.1 Date of the disaster and location

5 March 2002, Aiello Calabro, Lago, Domanico, Rogliano, Cosenza Province, Calabria, Italy.

2.1.2 Short description of the event

Territory

Weather conditions at the beginning of March were exceptionally warm. The temperature was remarkably high, reaching at times 26 to 28 degrees Celsius, and there were strong warm winds from the south-east (scirocco) that further worsened conditions that were favourable to the outbreak and spreading of fire. This phenomenon followed a prolonged period that was free of precipitation. The province of Cosenza is divided into 155 municipalities, and covers an area of 664,973 hectares, of which 543,766 hectares of mountainous area (81.8% of total).

Of a population of about 752,857 inhabitants, 443,391 live in mountain area. Wooded area accounts for 251,821 hectares, or about 37.9% of total area.

Fires in this area, as in many other provinces of southern Italy, are influenced by the vegetation and climatic conditions. Data collected over time shows that most fires start and spread in the summer, while the rest of the year sees a small number of small fires. As a result, stronger fire-fighting measures are put into place as part of the annual

"summer campaign", while normal institutional structures are active during the rest of the year.

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Forest Fire Event

On 5 March 2002, from 11.00 hrs to the late evening, there were 22 fire outbreaks located in just 15 municipalities in the area that goes between the Thyrrhenian Sea and the Salerno-Reggio Calabria highway north of the city of Paola. The municipalities involved were Aiello Calabro, Aprigliano, Cerisano, Cetraro, Dipignano, Domanico, Grimaldi, Lago, Longobardi, Mendicino, Paola, Rogliano, Sangineto, San Lucido e San Nicola Arcella. Approximately 1,000 hectares of forest were destroyed by both small and big fires.

Fire destroyed resinous high forests and coppice, both simple and composite. The distribution of outbreaks, which were limited to a small area, would make it appear that arsonists wanted to overload fire-fighting systems, purposely creating considerable damage. In fact, according to investigations carried out by the State Forestry Corps, 80% of the fires were purposely set, and most outbreaks were along state roads and highways (See Table 2.1.a).

2.1.3 Human consequences

Fortunately there were no victims or injuries due to the fires or during fire-fighting efforts, apart from a few people who suffered smoke inhalation.

2.1.4 Economics losses

Economic damage in terms of the loss of wood mass was approximately 950,000 Euro. Damage to the environment, in terms of ecological, soil protection, recreational, and naturalistic benefits, was instead much more consistent but difficult to quantify.

2.1.5 Prevention measures and related lessons learnt

Law 353/2000, "Framework law on forest fires", gives Regions responsibility for the forecasting, preventing, and active fighting against forest fires. In accordance with this law, the Region of Calabria adopted a protection plan for forests against fires. For each province of the Region, this plan is set out at three levels: provincial, mountain community and municipalities.

Wooded areas of the Province of Cosenza have been classified as being at high risk for fires in that repeatedly persistent and cyclical events, during summer months, seriously threaten ecological balances, the safety of people and goods, and contribute to the desertification of rural areas.

Only in recent years have fires been registered in autumn, but have never before been as serious as the one registered this year at the beginning of March.

On the basis of this analysis carried out by the Region of Calabria, detection and forecasting measures had not been strengthened as such measures are limited, according

the fire-fighting plan, to summer months which had been declared to be the most dangerous for fires.

Table 2.1.a - The Fires of 5 March 2002.

Area affected	Fire duration	Fire-fighting personnel involved	Resinous high forest	Area of Broad-leaved high forests (hectares)	Coppice, simple and with standards or composite (hectares)	Total area hit by fire (hectares)	Aircraft used?
DOMANICO (Grosse, Manche, Piè di Monte)	16 hours, 30 minutes	3		60	120	180	YES
ROGLIANO Colle D'Ascione, Colle	28 hours	80	110		100	210	YES
ROGLIANO Torno, Quaresima	18 hours	12	15		40	55	NO
AIELLO CALABRO Calendola, Chiagi, Tardo	22 hours	10	50	5	45	100	YES
AIELLO CALABRO Valle dell'Orso, Sciolle	20 hours 45 minutes	9	90		8	98	YES
LAGO Aria lupi, fuoco morto	24 hours	6	5		70	75	YES
LAGO Foresta Donnovoni	12 hours	0		10	20	30	NO
LAGO Rovettari, Vallenetta	25 hours	0		15	15	30	NO
LAGO Cafosa, Ritorto	13 hours	0		15	15	30	NO

A lack in the maintenance of access routes for fire-fighting equipment was noted, as was the easy spreading of fire from forests to uncultivated terrain densely covered by grassy vegetation that had become very dry due to drought.

It was also noted that fire-fighting teams had not been activated quickly, mainly due to bureaucratic-administrative problems that require financial coverage of each mission carried out.

Lastly, it should be noted that the Region of Calabria does not make use of teams of volunteers.

Lessons Learnt

- ⇨ Forest fires are not tied to rigid concepts of seasonality (summer/winter), but can actually occur at serious levels before the "fire season", under specific weather conditions related to prolonged periods of drought followed by an increase in temperature and African winds.
- ⇨ It would be preferable if regional plans foresaw a minimum number of teams in support of the institutional entities responsible for fire-fighting efforts.
- ⇨ Surveillance must be intensified, discouraging the damaging efforts of arsonists, in collaboration with police forces.
- ⇨ Greater value must be given to the role of A.I.B. (Servizio Antincendi Boschivi – Preventive Forest Fire Service) volunteers, which can be quickly activated.
- ⇨ As part of prevention efforts, it is necessary to carry out certain cultivation activities in order to improve the vegetation conditions of natural and forest environments, for the purpose of lessening the effects of fire passage and the spreading of fire itself, and to allow for profitable and active fighting efforts:
  - eliminating dry and easily flammable vegetation from road embankments;
  - clearing grass, bushes and plant residue from the sides of road- and railways;
  - eliminating highly flammable vegetation that covers uncultivated terrains on private properties located near urban areas;
  - creating parking areas for fire-fighting vehicles in forests;
  - creating water supply areas;
  - creating fire barriers;
  - carrying out maintenance and cleaning operations.

2.1.6 Preparedness measures and related lessons learnt

The following lessons were learnt in order to be prepared for forest fires.

Lessons learnt

- ⇨ It is necessary to set up an emergency A.I.B, (Servizio Antincendi Boschivi – Preventive Forest Fire Service) operative plan for winter months.
- ⇨ It is necessary to educate and train teams of volunteers at the municipal level.
- ⇨ It is important to increase investigative activities of the State Forestry Corps.
- ⇨ The surveillance on the part of police forces should be increased.

2.1.7 Response actions and related lessons learnt

The arsonists involved on March 5 were determined to out do the fire-fighting systems of Italy's southern Regions. It is sufficient to note that, on the same day in Calabria, around 4 p.m., a fire was reported in the municipality of San Roberto (province of Reggio Calabria), where 472 hectares of forest were destroyed. Many of the available fire-fighting units, about 98, and two fire-fighting CL415 aircraft were put to use in the area.

Other fires were then reported in the provinces of Crotone, Catanzaro, and Vibo Valentia. Fires in the province of Cosenza caused serious problems in public safety and order. The Prefecture ordered, for the entire afternoon of March 5, 2002, the closure of

highways and other roads around the affected area, and the evacuation of many homes near the flaming forests.

State fire-fighting fleets were also operating at 50% of their potentiality, in accordance with agreements signed with the contractor in question for the "non-summer" months.

On 5 March, a total of 5 CL415 aircrafts were available and they were deployed at the Ciampino and Reggio Calabria bases to take on the Region's requests for air-borne assistance. On that same day, the Joint Aircraft Operative Centre (Centro Operative Aereo Unificato - COAU), of the Civil Protection Agency, that coordinates the air-borne fire-fighting activities of state fleets, received requests for assistance from the Regions of Latium, Abruzzi, Campani and Calabria.

In the meantime, other fire-fighting aircraft coordinated by the COAU (medium helicopters made available by the State Forestry Corps and the Fire Brigades), were being deployed in the northern Regions of Italy, which are statistically at high risk of fires in the winter months.

Initially, forestry personnel of the local Command Stations and of the Fire Brigades were activated. Rogliano was the only municipality were forestry workers were available, while volunteers, even if in low numbers and disorganized, gave their support in almost all municipalities.

There were very limited efforts on the part of land personnel in the Lago municipality, so much so that the forestry personal of the Forestry Command Station was entirely deployed for the fire in the Aria Lupi area which hit 75 hectares of forest, while there were no ground team efforts for the other three fires.

The Prefecture ordered the use of local police men and equipment in order to give assistance to fire-fighting teams.

Lessons Learnt

- ⇨ It is essential to improve the coordination phase of the Operative Centre.
- ⇨ The coordination must improve between the operative structures of the various municipalities involved, including municipalities bordering on affected areas, for the purpose of having teams from municipalities not hit by fire and less exposed to the phenomenon in general.

2.1.8 Information supplied to the public and related lessons learnt

A weather bulletin describing conditions favourable to the outbreak of fires had been issued by the Watch Centre of the Joint Aircraft Operative Centre of the Civil Protection Agency on March 2, 2002, and was transmitted to Regions of southern Italy and to related Prefectures.

Citizens had been informed of the arrival of scirocco winds and the increase in temperature through mass-media weather forecasts, but no warning of the possible risk of forest fires was issued and police forces had not be notified to carry out greater surveillance.

It is natural that citizens do not connect information broadcasted by mass-media to the danger of forest fires, but rather to their recreational activities planned for the weekend.

On the other hand, the behaviour of arsonists is much different, especially those who act out of resentment toward public authority or who act in protest against authorities,

whether at the state or local level, and who are very aware of the conditions which are favourable to the spreading of fires that can quickly affect vast forest areas.

Lessons Learnt

- ⇨ It is necessary to increase prevention against the principal causes of fire by better informing the public of regulations regarding agricultural, forestry, and grazing activities.
- ⇨ It is important to ensure the coordination of hunting associations in defining strategies to prevent fires related to hunting activities.
- ⇨ It is essential to discourage forest fires related to building speculation through increased awareness of regulations and sanctions contained in Law 353/2000.

2.1.9 Other Comments

The March 5 emergency provided useful elements for programming and planning fire-fighting activities, focussing the attention on the fact that forest fires, as a result of climatic changes, are no longer tied to rigid concepts of seasonality (summer/winter), but can occur even in periods not considered at risk. Efforts must be mainly directed to forecasting and prevention activities, for the purpose of limiting as much as possible damages at the time of the fire emergency. It is important to identify roles and responsibilities of each entity involved in fire-fighting, as well as to train all fire-fighting personnel at all levels.

2.2 The forest fires in the districts of Guarda, Castelo Branco and Coimbra (Portugal)

José Pedro Godinho Oliveira Lopes (*Serviço Nacional de Protecção Civil, Carnaxide*)

2.2.1 Date of the disaster and location

9 – 21 September 2001, Guarda, Castelo Branco and Coimbra.

2.2.2 Short description of the event

On the 9th September 2001, at 11.55, a forest fire ignited at the village of Balocas, parish of Vide, District of Guarda. After a week in which more than 350 forest fires were being fought every day, which is considered to be the practical limit to achieve a good fire-fighting in the first intervention, the Balocas forest fire occurred in a place where fire fighters intervening in that area took nearly 45 minutes to get there and the helicopter of first intervention allocated to that area was engaged in the fight with another fire.

The area where the fire started is of accentuated relief, with slopes above 100%, dense vegetation of resin and bush, with vertical and horizontal continuity.

The meteorological risk index for that day and for the District of Guarda was risk 4 – Very High, as in previous several days.

Lessons learnt along the years have demonstrated that a fire occurring in that area in days in which the risk index is higher than 3 (high), cannot be extinguished in its initial phase, always originating a major forest fire.

Local changeable winds and convection currents resulting from the fire itself gave origin to a fast and inconstant progression, making it difficult to confine and control the fire.

In the premises of the Fire Fighters Command Post it was possible to monitor temperatures ranging from 34º to 36º, with 16% relative humidity and the thermal inversions recorded in the area originated rises of 2% in the temperature recorded at 00.00 hrs and 02.00 hrs of the morning of 10 September.

The lack of fuelbreaks, control lines, penetration paths for the fire-fighters vehicles and the pronounced relief made it possible to the fire to develop in 3 fronts, namely in the Districts of Guarda, Coimbra and Castelo Branco.

The front located in the District of Castelo Branco was extinguished on 12 September, the Guarda one was considered in smouldering ashes phase on 15 September. Due to the existing conditions of the vegetation and relief, the smouldering ashes phase operation was not effective, causing new furnaces which were only completely extinguished on 21 September.

2.2.3 Human consequences

During event no lives were claimed. However, 16 fire fighters were injured, 2 of whom were seriously injured, and 2 civilians were also injured.

2.2.4 Economic losses

As there was no calculation was available from the competent technical service, an average value of €487/ha was considered. The total cost of burnt material summed up to €336,248. An oil factory also was burnt, but the cost was not estimated. On 12 September 2001, there was a crash between 2 vehicles of the Fire Brigade of Lousã (PSL) and Góis (Self Support), resulting in minor damages. On 13 September 2001, the PSF vehicle from the Fire Brigade of Pampilhosa had an accident with significant damages.

Fire fighting costs

Ground Means: Not accounted for.

Aerial Means:

HBL € 15,098.73

HBM € 151, 493.40 (166 hours)

HBP € 416,253.93

AERTL € 38,867.33 (37 hours)

AERTP € 210,848.46 (28 hours)

Total cost with MA: € 832,561.85

Engines to open fuel breaks

Only those mobilised by City Halls were estimated. They totalled to 5 engines, which were used during 213 h 30 m. This corresponded to € 19,153.54.

Thus, a total cost of € 5,187,963.39 can be associated to this fire (not including human means, vehicles of Fire Brigades and logistics).

2.2.5 Prevention measures and related lessons learnt

A daily briefing was held among operational senior staff of the National Centre of Relief Co-ordination of the National Service of Fire Fighters, experts of the Directorate General of Forests and the Meteorology Institute, in order to analyse meteorological conditions, vegetation conditions and the inherent risk of fire.

In periods in which the risk is high, means of fighting (men, vehicles and aerial means), which enable to reinforce fire prone areas and thus subjected to a greater wearing out are transferred to Bases of Logistic Support, allowing the effective maintenance and capability of the first intervention.

The incredible number of fires recorded every day in Portugal, being sometimes 10 consecutive days with more than 500 fires daily and reaching the paramount number of 850 furnaces in a 24 hour period, makes it impossible to be able to have all the necessary means for a quick extinction of those furnaces, especially during days in which propagation is extraordinarily fast.

On the other hand, the difficulties of access to some areas and the existence of small villages or localities spread by the forest conditions the strategy of attack, which becomes compromised by the need to protect human lives and property.

Lessons learnt

- ⇨ It is essential not to make the serious mistake of carrying out monoculture practices. It is necessary to maintain all fuel breaks and to brush combustible material existing in forests, either through mechanical cleanliness of very difficult use due to the fragmentation of forest property, or through controlled burning.
- ⇨ Despite all the procedures which have been tried along the years, it is believed that the last big fires, from which the "Balocas" is an unfortunate example, have shown that something needs to be done to call people back to the forest, keeping it clean and accessible, and preserving without brushes the boundary areas of dwellings. Forest planning has to protect the heterogeneity of existing species, avoiding the continuity of the forest of the same specie, particularly of resinous along many hectares.
- ⇨ If it is managed to make the vertical and horizontal partition of Portuguese forests, it is essential to communicate to the Portuguese people that the responsibility belongs to everyone to prevent forest fires. It is believed that the forest risk index should be disseminated every day through the media, especially when that index surpasses 3 – High. If there is fear to entice arsonists or criminals to the practice of crime, the dissemination of risk would allow to make every citizen to become a forest watchman and would prevent many of the negligence's which occur by the lack of care involving many works carried out in the forest – the Balocas fire was allegedly caused by the clearance of blackberry-bush existing in the backyard of one of the houses of the village.

2.2.6 Preparedness measures and related lessons learnt

The Civil Protection System has, at several levels – municipal, district and national – Plans for Forest Fires which enable us to be prepared to cope, at each level, with a serious forest fire. By means of the activation of the plans, the civil protection authority disposes of a tool which enables to set in motion the structures and means which are available and that may be useful.

On the other hand, the National Fire Service, through the National Inspection and District Inspections prepares every year a National Plan for Forest Fires Operations, in which the attack mechanism – DICIF – is pre-defined. The National Operational Plan is the base for the District Operational Directions, through which the Commands of Fire Fighters receive the necessary instructions to carry out the attack mission to Forest Fires.

Lessons learnt

- ⇨ As a measure of preparedness to the most serious fires, it is important to emphasize the movement of means referred above which enables to place Groups of Rapid Reinforcement, Logistic Means and Aerial Means in strategic locations previously defined so that they may reinforce any area which has been seriously affected.
- ⇨ Unfortunately and as it happened during the "Balocas" fire, in the days of greater intensity of fires not always has it been possible to dispose of vehicles and men on reserve or aerial means which may be able to make surveillance flights and patrol.
- ⇨ This serious forest fire undoubtedly has alerted the need to be able, in the future, to change the situation in the country with the depopulation of the interior and the aging of people, the lack of profit and exploration of the forest with the abandonment of large areas leading to the piling of wooden material on the soil, turning the forest highly sensible to fire.
- ⇨ In the fire which is being analysed, although the procedures defined in DICIF – Plan of Fighting Forest Fires - have been adopted, it was possible to verify the difficulties in disposing of the necessary number of men and vehicles in the required moment due to the already referred excessive number of fires which took place in the country during the days in which the Balocas fire spread.
- ⇨ Civil protection authorities, particularly the Mayor of Seia, followed the development of the events but considered it was not necessary to activate neither the Municipal nor the District Plans of Forest Fires.

2.2.7 Response actions and related lessons learnt

Once the fire was declared and once it was not possible to extinguish it in a first intervention, the mobilisation of means of reinforcement started, first in the operational area and then in the operational sector of Guarda and neighbouring operational sectors, where the fire had already penetrated.

The light water bomber helicopter whose area of intervention includes the place where the fire began was mobilised to the location as soon as it was available, making Task Force with another helicopter which had been mobilised, taking on the aerial attack to one of the fronts, while light air tanks located at Lousã – neighbouring Operational Sector – were activated to intervene in another front.

The first Commander of Operations of this fire was the chief of the Group of First Intervention (GPI) of the Voluntary Fire Brigade of Loriga, the Commander of that Service having assumed that responsibility the minute he arrived at the location. Later, the Commander of the Operational Sector who had been alerted to support the Command Post of another fire was detoured and came to implement the next phase of the Operational Command System.

Due to the seriousness of the fire, the difficulties of access, the type of vegetation and existing and forecasted meteorological conditions, means of reinforcement have been mobilised totalising 11 Groups of Rapid Reinforcement amounting to, at the end of the fire as having participated in the attack a total of 194 Fire Brigades, 299 vehicles and 1041 men. Aerial means involved 2 light water bombers, 3 medium water bombers, 4 heavy water bombers, 2 light air tanks and 2 heavy air tanks.

Five engines to open fuel breaks and 2 platoons with 25 men of the Infantry Regiment where also committed in the support to the attack and the outcome of the fire.

Each one of the Commanders of Fronts had a Unit of Command and Transmissions which centralized communications of that front and reported to the Commander of Relief Operations of the Fire Fighters.

In each of the referred fronts, the Fire Brigade in whose Area of Prioritary Action the front developed assumed the responsibility of the logistic of forces committed to that attack front.

Lessons learnt

No lessons learnt were reported in the response phase.

2.2.8 Information supplied to the public and related lessons learnt

The Situation Centre of Civil Protection of the National Service of Civil Protection (CSPC/SNPC) and the National Centre of Relief Co-ordination of the National Service of Fire Fighters (CNCS/SNB) received daily meteorological information made available by the Meteorology Institute which included the following:

- Observations made in the meteorological network and used in the calculation of the fire danger index (FW1);
- Climatologic values;
- Meteorological features at 12 UTC and components of the Canadian index of fire danger;
- Classes of fire risk by districts;
- Probability (%) of the numbers of fire being >10, by district;
- Prediction of the trend of the fire danger index (FWI)
- Charts with prediction of winds every 3 hours;
- Weather forecast aimed at the prevention and attack of forest fires.

After operational treatment, this information was sent by the National Centre of Relief Co-ordination (CNCS) to all District Centres of Relief Co-ordination which passed them to the Fire Brigades. On their turn, the Situation Centre of Civil Protection (CSPC) makes the information available to their District Delegations of Civil Protection which passes them to the several authorities of civil protection.

In 2001 meteorological data recorded in the 4 stations of the national network which more closely involved the area where a fire was developing started to be available to the CNCS, whose co-ordinates Fire Fighters asked for in their request to the Meteorology Institute.

Fire Fighters have also in their Units of Co-ordination and Command a meteorological kit which enables the observation of temperatures, relative winds and humidity, besides the support they can have of the experts of the National Centre of Geographical Information (CNIG) whom, in most significant occurrences, go to the location and give their support to the Fire Fighters Command Post.

Only with these stations was it possible to verify meteorological changes originated by the characteristics of local relief and convection currents caused by the fire itself.

A report is made every day on fires which took place daily. Those reports are forwarded, through the operational structure of Fire Fighters, to the Secretary of State of the Home Office, responsible for this sector.

Lessons learnt

- ⇨ Media have a very important part in the dissemination of information and they may influence a strong support to fire fighting forces committed in the attack or, on the contrary, a feeling of contempt or even repulse. It is therefore essential that those responsible for attack have a Media Centre which analyses events beforehand and deals with the information which must be made available in time.
- ⇨ Media can as well co-operate in passing to the public the message of prevention to forest fires, or on the contrary, may entice arsonists or criminals to increase the number of intentionally caused fires.

2.2.9 Socio-economic implications of the disaster

As referred in this report, rural areas affected by the "Balocas" fire were previously subjected to a serious depopulation and aging of populations which did not allow due treatment of the forest layer.

As those who still live in that region make their living out of what benefits the forest may give them – exploration of resinous and wood, or agriculture of subsistence – a fire of this extension which destroyed everything on its path, took away the little they could count on to help them face the difficulties of a life in the interior. Thus, there is no doubt that this as many other big fires contributed or will contribute to a higher desertification of the affected areas.

It wasn't possible to any attack force to avoid the progression of the "Balocas" fire, nor the indirect costs resulting from the destruction of 8904 ha of forest and agricultural area. This being the case, it is important to face the problem of prevention in a consistent and efficient manner so that there will be no chance of any fire to start in a risk area, in a day in which the meteorological risk index indicates serious problems.

"THE BEST WAY OF FIGHTING A FIRE IS TO PREVENT IT"

2.3 The forest fires in Simsjön (Sweden)

L. Sandhal and R. Jansson (*Swedish Rescue Services Agency, Karlstad and Swedish Rescue Services Agency, Sollefteå*)

2.3.1 Date of the disaster and location

7-16 June 1997, Lake Simsjön, approximately 25 km south of Sollefteå, Sweden.

2.3.2 Forest fires background in Sweden

Sweden is a country with fairly large variations in climate and vegetation. It is about 1,600 km from north to south and about 400 km from east to west, and covers a total area of approximately 410,000 km^2. Sweden has a long coast with many islands and skerries, and there are also large mountainous regions in the northwest. There are also a large number of lakes and waterways in the country.

Sweden is mostly covered with boreal forest (i.e. about 70% of Sweden is forest) and the country's total forest area totals around 290,000 km^2. Forest industries and forestry have a long tradition and constitute a considerable part of the country's industrial activities. Forestry is pursued by multinational companies as well as by private individuals. Private individuals own approximately half of all forested land, companies own about 25% and about 25% is owned by the state.

Sweden has a population of 8.9 million. Population density on average is about 21 people per km^2, although there are considerable variations in this figure. In certain municipalities in the northern part of the country, the density is less than 1 person per km2. The bulk of the population and industrial activity is concentrated in coastal areas and in the south of the country.

The number of forest fires in Sweden varies considerably from year to year depending on temperature and precipitation. During the unusually dry summer of 1997, approximately 2,500 hectares of forest burned in five major forest fires.

In Figure 2.3.2.a, it is clear to see during the last 10 year period that 1997, 1994 and 1992 had the most fires. The outstanding characteristic for these years' statistics is that only a few large fires account for the majority of the burnt area. These larger fires often happen in extreme weather conditions which increase the spread of forest fires, often where the ground has dried out over a long period of time and where there have been no downpours for a month or more.

Figure 2.3.2.b and Figure 2.3.2.c show the types of cause of forest fires in relation to total are burnt (in ha) and number of fires respectively between 1997 and 2001.

Table 2.3.2.a shows a list of recent forest fires in Sweden.

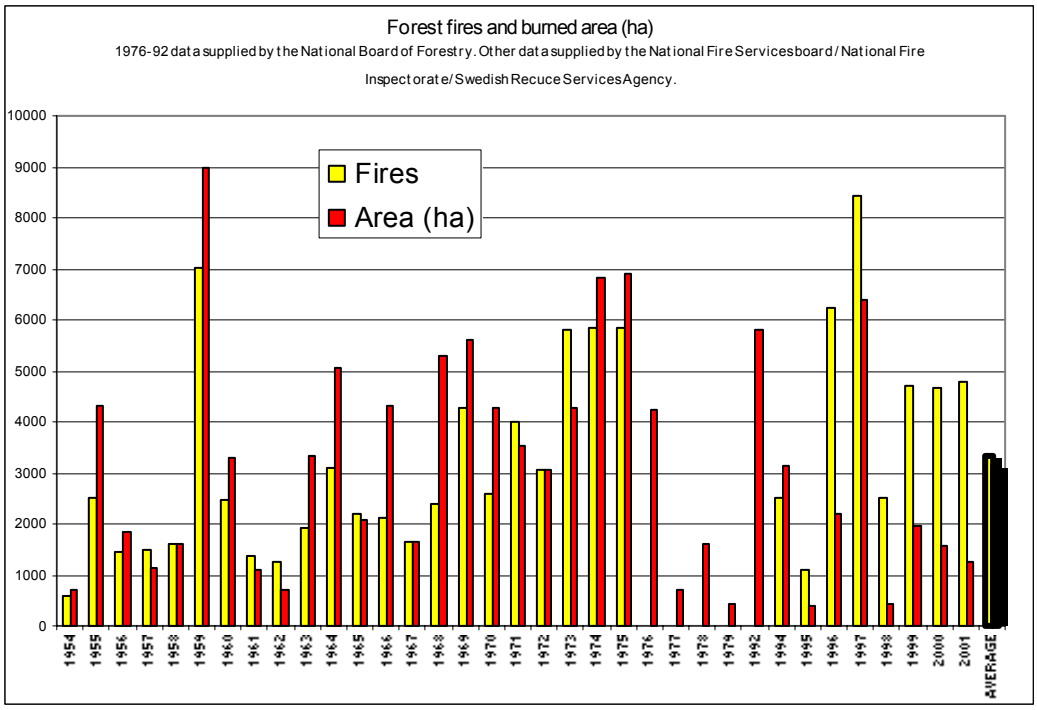

Figure 2.3.2.a – Forest fires and burned area

Table 2.3.2.a – Recent forest fires in Sweden.

Date	Type of fire	Cause of fire	Area burned (ha)	Place
7.5.00	forest	?	200	Ludvika
1.8.99	forest (part of National Park)	?	650	Tyresta
28.5.99	forest	re-ignition	250	Sundsvall
20.5.98	other wooded land	child playing with fire	250	Ale
12.8.97	forest on an island	lightning	250	Agön
7.8.97	forest	forest machinery	400	Ånge
7.8.97	"	chimney sparks	450	Simsjön/ Ollefteå
5.8.97	"	railway wagon	1000	Lit/Östersund
5.8.97	"	timber fellers burning after felling	400	Lycksele
21.7.94	forest / swamp	wilfully started	400	Trollhättan
10.7.92	"	?	1000	Vakemyr/ Osby
9.7.92	forest	?	1000	Kräklingbo/ Gotland

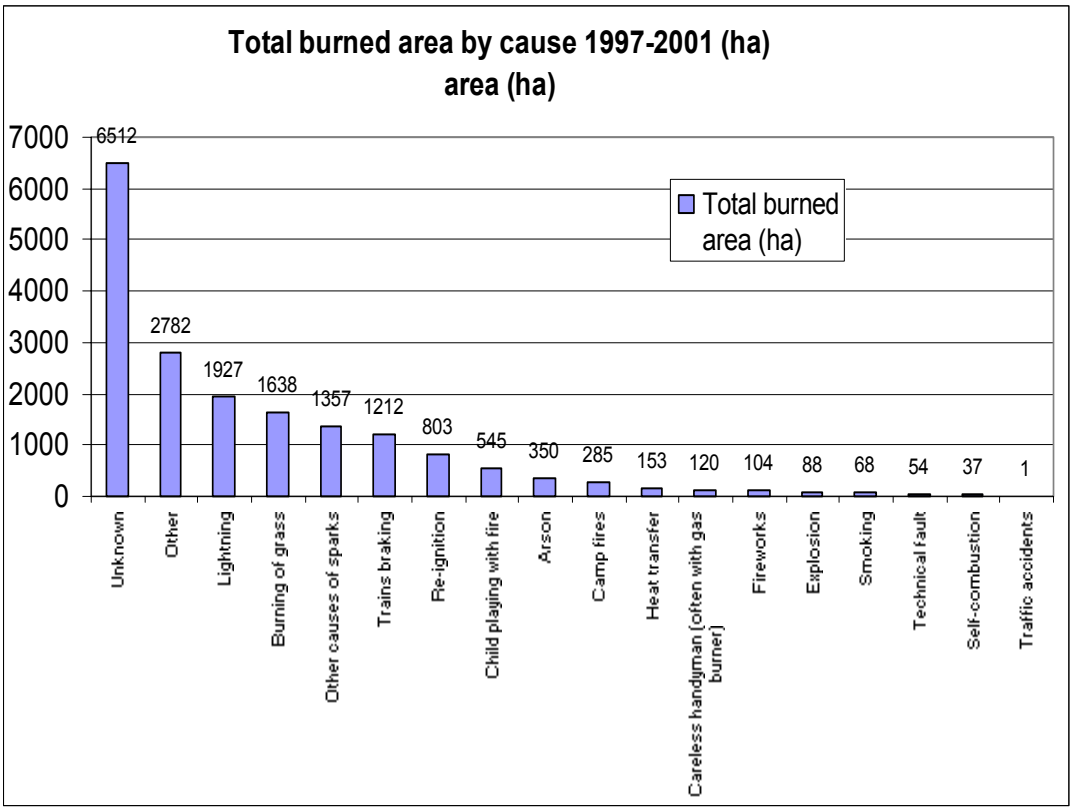

Figure 2.3.2.b – Causes of forest fires and total area burnt (in ha) between 1997-2001.

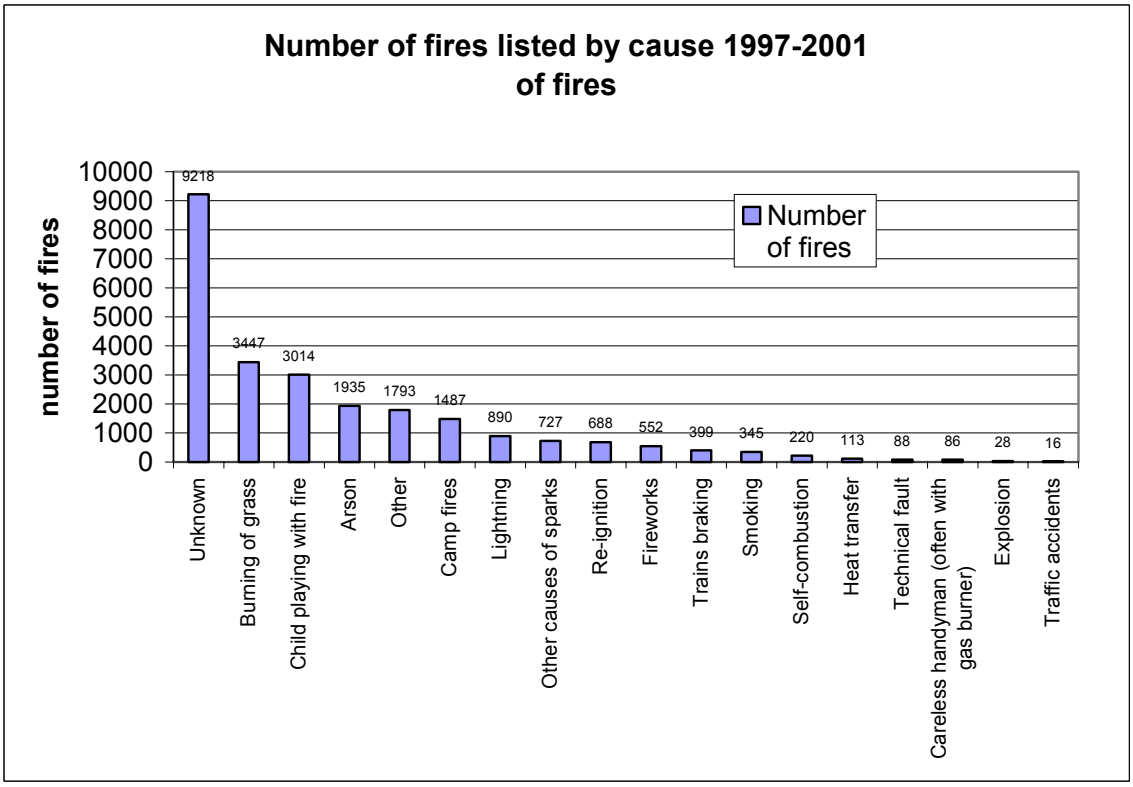

Figure 2.3.2.c – Number of forest fires according to type of cause between 1997-2001.

2.3.3 Description of the event

On Saturday 7 June at 1.43 in the afternoon, an alarm came through about a forest fire in the vicinity of a summer chalet area by Lake Simsjön, approximately 25 km south of Sollefteå. A leading fireman and three fire fighters turned out with a tanker vehicle and a forest fire vehicle, the standard call-out force at the time.

The part time fire-fighting force comprising a fire chief and four fire fighters was then called in for standby duty at the fire station.

While driving to the location of the fire, the rescue leader received information via the emergency service SOS Alarm that the fire was under control. However, the rescue leader decided to continue to the location of the fire, which could not be reached directly by road. As they had not been informed of this when the alarm was raised, they had not brought a boat with them. They parked the vehicles on the eastern side of the lake, and fire-fighting equipment was loaded onto a private boat in order to get to the fire. In the middle of the lake the engine developed a fault and the men had to try to row the motorboat to the shore. They could see that the fire was developing into crown fires while spreading rapidly to the northwest in dense spruce forest.

At that point the rescue leader returned back across the lake to carry out reconnaissance for a fire containment measure to the northwest, accompanied by an elderly local inhabitant who was very familiar with the forest area. The decision was taken at this time to attempt to stop the fire at a small forest track immediately before a slight incline. The rescue leader, who realised that this was the only chance we had before the ascent, installed a motor pump together with the local inhabitants at a large stream adjacent to the forest road. At the same time, the part-time fire force arrived at the site with two tanker vehicles.

The leading fireman was then given the order to man the full length of the forest road in order to stop the fire using a line of hoses along the road. This almost succeeded, with only a hose length missing in order to complete the containment line. At the very last minute the large pump installed at the stream was prevented from catching fire.

The rescue leader set up a temporary command post in a car at the crossroads just north of the lake, and received information that the helicopters were already engaged in fighting fires in Ånge and Östersund, both situated some 200 km from Sollefteå. A request was put in at this time for forestry machinery to create fire breaks; these arrived approximately 1½ hours later and were brought in on the north side to create the fire breaks.

The fire front was now spreading northwards. Approximately 2-3 km downwind there were some ten properties very close to the forest.

The rescue leader received information that reinforcements of available fire personnel were on their way, including reinforcements from the neighbouring municipality of Kramfors. A back-up management function was also being set up at the fire station. Two military vehicles (caterpillar tractors) with military service personnel from the regiments in the area were on their way to the fire. Volunteers from the area reported at the location of the fire following an appeal on local radio, and members of the forest fire defence force arrived. The Swedish Rescue Services Agency's college, situated just forty kilometres from the site of the fire, provided resources in the form of equipment.

At around eight o'clock in the evening the first helicopter arrived, a 'super pump' from Ronneby approximately 1,200 km from the location of the fire. The rescue leader went

along on the first water bombing flight to inspect the area of the fire. At that time crown fires were occurring immediately south of the homes and efforts were being concentrated on safeguarding them. The military helicopter was able to protect the homes by way of precision bombing with water, with fire personnel on the ground giving orders as to where the water bombs should be dropped.

During Saturday evening, a new command post was established in the vicinity of the fire. The command vehicle was a minibus equipped with special communication equipment. The fire chief and the leading fireman manned the vehicle. The back-up management function at the fire station continued to operate. Special press information and press contacts were carried out on a continuous basis.

The first fire personnel to have arrived were relieved at eight o'clock on Sunday morning. Throughout Sunday, work continued on putting out the fire with fire personnel, volunteers, local defence forces, landowners and military personnel.

The rescue leader who was carrying out inspections of the area by helicopter believed the situation to be stable. The water bombing continued throughout the day, while at the same time work began on building up a system of hoses along the entire western flank. During the afternoon the south-easterly wind picked up, and a helicopter discovered that there were four fire pockets in the area, increasing in strength. At three-thirty in the afternoon the fire broke through on the western flank. The personnel were redistributed in order to strengthen the manpower at the area where the breakthrough had occurred. At the same time the sector leader announced that the fire had broken through on the northern flank.

The fires were contained at eight o'clock in the evening.

In order to make the work easier, the fire site was then divided into sectors, each with a sector manager. The helicopters continued water bombing throughout the night and the fire diminished in intensity. There was also more smoke, making it very difficult to remain in the area of the fire.

On Monday 9 June water bombing of the area continued. Military reinforcements from KA 5 in Härnösand arrived, a total of 60 men. The helicopters rested during the night only to recommence water bombing in the morning. On Tuesday, the military helicopters finally finished their work at the fire site. A smaller helicopter from the county remained for surveillance and to extinguish any fires that may have arisen in the area. During Wednesday this helicopter also finished its duties in the area. Final extinction of the fire continued on the ground.

During Thursday, fires were discovered in the southern fire area, personnel were redistributed and a larger force was brought into the area of the fire. The fire was brought under control after approximately three hours' work.

Still no rain. On Friday the fire increased in the northern part of the fire area, and two helicopters were brought in to carry out water bombing in the area. The fire was once again under control by eight o'clock in the evening.

On Monday 16 June the rescue leader Kjell Sörlin finished his rescue service assignment and handed over to the landowners concerned their responsibilities in conjunction with the hand-over.

It was established that sparks caused the fire from lighting a fire in a residential fireplace, the assumption being that the sparks came out via the chimney and ignited the grass.

2.3.4 Human consequences

There were no human consequences during this forest fire event.

2.3.5 Economic losses

The relief effort involved 718 people.

4 helicopters were used for water bombing.

Fire appliances were used for 1,245 hours.

Motor pumps were used for a total of 720 hours, not including fire engines.

In total, 19,700 m of fire hose were used.

1,300 m of fire hose was destroyed.

The total burnt area covered 450 hectares.

The cost of the fire (fire brigade) amounted to SEK 3,163,000, approximately 350,000 Euro.

2.3.6 Prevention measures and related lessons learnt

Municipalities and county administrative boards can prohibit outdoor fires. This legal option for the control of the public use of fires outdoors has been used in various ways around the country. In the past it was usually the county administrative board that took the decision for the county. The local effect of implementing outdoor fire prohibitions has in certain cases been limited when the decision has covered larger areas. Therefore, in 2002, the Swedish Rescue Services Agency (SRSA) issued recommendations/ guidelines on how outdoor fire prohibitions ought to be handled, with the emphasis on the consideration of local conditions, and that a certain level of restraint might need to be exercised before the issue of fire prohibitions so that they aren't seen as unnecessary by the public. In addition, the options open to municipalities for making municipal decisions have been strengthened by the introduction of the web system mentioned below.

Daily fire risk prognoses were produced (1997) for about 40 areas of approximately 100-250 km by the Swedish Meteorological and Hydrological Institute (SMHI) using the WBKZ model. Fire risk is divided into six levels. The model, has for several years, been assessed as having certain shortcomings. And the model's areas have also been too large to provide a good picture of forest fire risks within the relatively varying landscape. Therefore the SRSA has commissioned the SMHI to develop a better system for the support of the municipal fire and rescue services.

A new web system was introduced in 2001, in which two forest fire risk models calculate fire risk, the FWI model and the HBV model. In addition, the system holds supplementary meteorological information, such as prognoses and data for precipitation, humidity, temperature, wind, thunderstorms, and registered lightning discharges. The system also contains information on grass fire risks. The data held in the FWI (see Figure 2.2.6.a) and HBV models is presented as squares for geographical areas of 22 km^2. The country is covered by a total of 1,200 squares.

The SMHI also issues specific warning information for the public, about large or major fire risks, via their usual broadcasts on TV and radio and via the press and Internet. This type of information has also been improved as regards urgency and geographical areas.

Because of financial cutbacks all support from the SRSA for forest fire monitoring with small aircraft has been stopped with effect from 1st January 2003. There will probably not be any forest fire monitoring during 2003 as no other stakeholders have shown any interest in assuming financial responsibility for it.

Lessons Learnt

- ⇨ In connection with the fire at Simsjön it was noted locally, via the media, the risks that can be involved when sparks spread or when outdoor fires are used when the ground is particularly dry. The northern part of the fire threatened several buildings. The fire and rescue service contributed locally with information to the media during the emergency, in order to inform the public to contact the fire & rescue service for advice and information about how to use outdoor fires and about current risk levels.

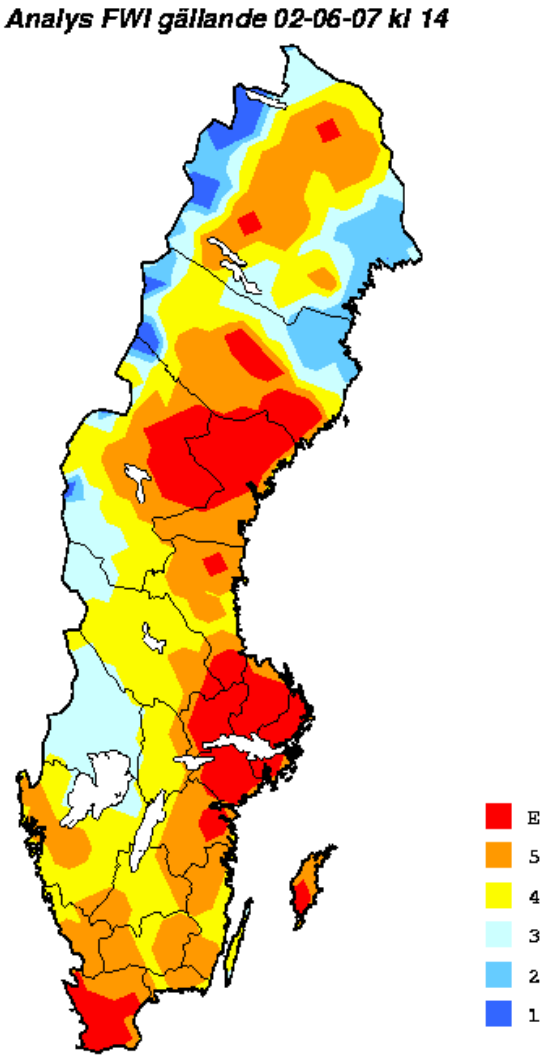

Figure 2.2.6.a - An example of a forest fire risk map showing FWI values.

2.3.7 Preparedness measures and related lessons learnt

There is no special planning over and above major alarms, forest fires and emergency service call-outs in accordance with the alarm plan via SOS Alarm. However, the forest fire phenomenon is generally recognised and is dealt with routinely as a regular emergency call-out. In each part of the municipality there are special forest fire defence forces with approximately 20 men in each unit, who can be called on when required. There is no provision for duty or preparedness.

Light aircraft are used for forest fire surveillance. The number of flights is dependent on the immediate fire risk prognosis.

The location of the forest fire was in the Sollefteå municipality 500 km north of Stockholm.

There was an easterly wind (6 m/second). According to the Weather Forecast Bureau of the Swedish Meteorological and Hydrographic Institute, which issues fire risk prognoses, there was a significant risk of fire on the day in question.

Lessons Learnt

- ⇨ The SRSA found it necessary to draw up a new instruction book for forest fire fighting operations, and so work on this book has now commenced.
- ⇨ The improved fire risk prognosis available on the Internet (see 2.3.6) is another aid to planning and preparation for forest fire fighting operations.

2.3.8 Response actions and related lessons learnt

The fire at Simsjön was a large fire – a major incident – extended over a long period of time, and involved a total of eight relieving incident commanders. Resources for the command & control of such a major incident in so small a municipality are extremely limited. A simple command post was established in the woods, from which a structure with various sectors was organised. Volunteers and other organisations, as well as full time fire fighters, were also involved in the extinguishing work.

The lesson learned from the use of eight incident commanders is that there ought to be fewer. Far too much time was required for the incident commanders to relieve and update each other. The ideal would be to have 2 or 3 incident commanders relieving each other; and each sector must have a sector officer with command skills so as to be able to direct the volunteer personnel and organisations involved if they lack experience of forest fire fighting

The majority of resources for fire fighting were employed during the day when the conditions for extinguishing were least favourable. Obviously it was easier to get people to work during the day. A lesson learnt, probably, is that the tactical opposite for the fire fighting operation should have been employed instead; in that the majority of resources should have been in operation during the night when it is considerably easier to extinguish and control fire. The possibility for executing such work during the night is relatively good in northern parts of Sweden because only a small period of the night is so dark that it would not be possible to see while working in the forest. (In that part of Sweden the sun only drops below the horizon for a few hours during June. And total darkness doesn't normally exist if the sky is clear.)

Lessons Learnt

- ⇨ Since the Simsjön fire, there have been several major forest fires, at which the municipalities concerned have required massive equipment resources. Until a few years ago such resources were held in dedicated supply depots for the civil defence organisation for use in the event of war. However, in recent years the government has shut down these depots, so those supplies are no longer available. The SRSA was later tasked by the government to establish and maintain depots dedicated for forest fire fighting equipment, as there is a clear need to support the municipalities in the event of major forest fires. These depots mainly contain older equipment from the now defunct civil defence depots, and certain surplus equipment from the armed forces.

2.3.9 Information supplied to the public and related lessons learnt

When the northern section of the fire threatened several buildings fire-fighters and appliances were positioned around the buildings in order, if possible, to protect the buildings from the fire front, which was moving towards them. Helicopters water bombed the fire to protect the buildings. Fire-fighters on the ground directed the helicopter in its water bombing; and kept residents informed of the development of the situation. One property was assessed as being so threatened that they prepared for evacuation, and were also advised to take their valuables with them. Luckily it was possible to save all buildings from the fire.

See Paragraph 2.3.6, which also contains general information to the public.

2.3.10 Other aspects

The rescue services in Sweden are a municipal affair.

The size of the emergency forces is diminishing in line with the reduction in subsidies. Numbers of military resources, crews, cross-country vehicles and helicopters are being drastically reduced in accordance with government resolutions.

How would we manage to extinguish a major forest fire today? It is probable that conditions are worse now than during the major forest fires in the summer of 1997.

Figure 2.3.10.a is a photo of the forest fire area. Figure 2.3.10.b is a diagram of fire risk, using wind speed as a surrogate of risk, whilst Figure 2.3.10.c is a diagram of temperatures. A map of some Forest Fires during the period of 5-7 June 1997 is portrayed in Figure 2.3.10.d.

Foto 5: Branden startade vid sjöns nordvästra sida i anslutning till somnarstugorna. Troligen har gnistor från eldningen i spis inne följt med upp genom skorsten och antänt det torra gräset. (Foto Stefan Sundkvist, Sollefteå)

Figure 2.3.10.a – Simsjön forest fire area.

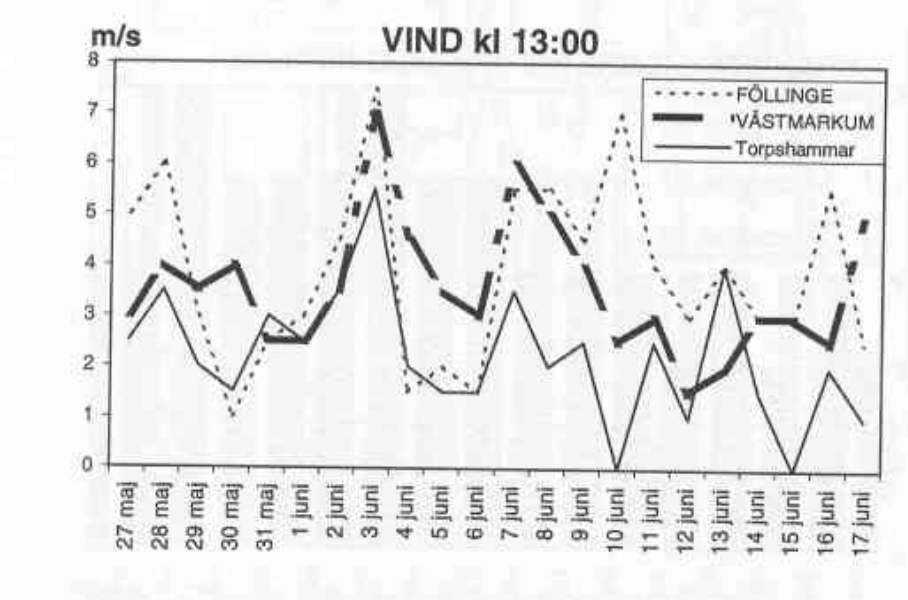

Figure 2.3.10.b – Wind speed as a surrogate for risk during the Simsjön forest fire.

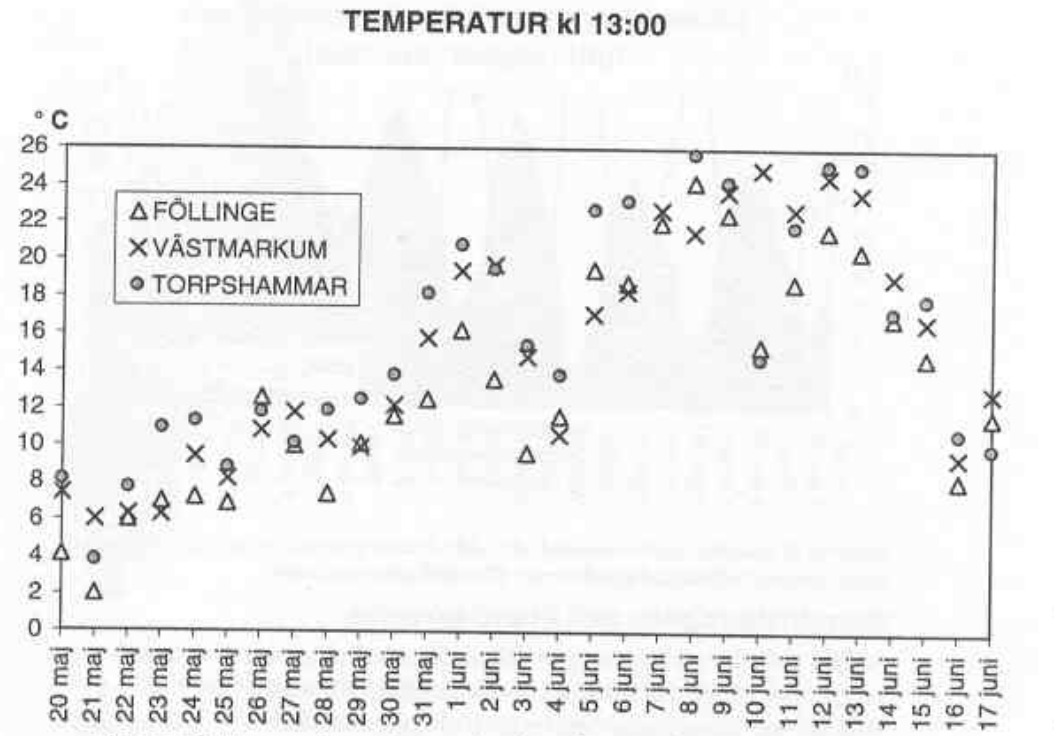

Figure 2.3.10.c – Temperature during the Simsjön forest fire.

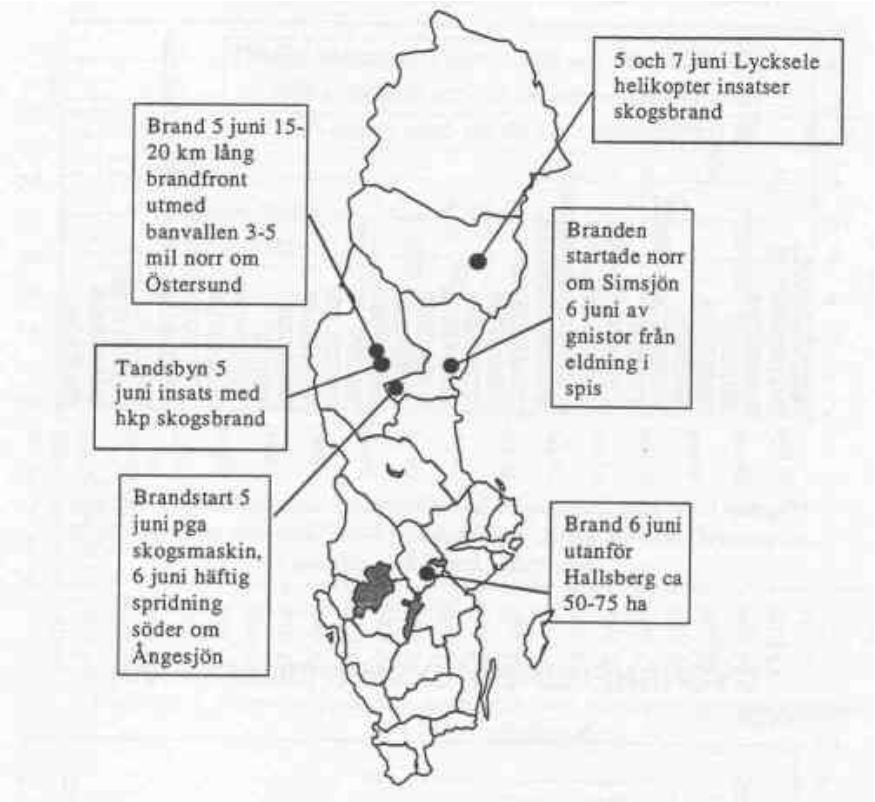

Figure 2.3.10.d – A map of some Forest Fires during the period of 5-7 June 1997

2.4 The forest fires in Romania

Septimius Mara (*Ministry of Waters and Environmental Protection, Bucharest*)

2.4.1 Date of the disaster and location

7 March 2002, 19 counties in Romania.

2.4.2 Short description of the event

In March 2002, the National Institute of Meteorology and Hydrology "INMHA SA" sent out a meteorological alert regarding the possibility of producing of strong winds in the mountain area, but also in the South and East part of the country. As a result of the fires produced on 7 March 2002, "INMHA SA" emitted a meteorological warning on 8 March 2002, regarding the continuation of the wind intensification in the most part of the country.

On the day of 7 March 2002, Romania was situated at a periphery of a large and very active lower baric pressure zone, which centred itself in the area of the Baltic countries, which determined in the Eastern, Central and Northwest of Europe, extreme meteorological phenomena, such as rain storms, snow storms, but especially the intensification strong winds. These were produced in the area of Romania, due to the high temperature differences between the regions of our country (values of 28 °C) and the others from the north vicinity of our country, but also due to a high baric pressure gradient (large pressure differences between Central and South East Europe). The squalls of wind were amplified also by the localisation of a tropical air mass, with speed over 100 km/h in the North and Centre of the country, along with the mountain areas (with the maximum speed of 145 km/hour at Ceahlaul-Toaca).

The day of 8 March was also windy in many areas because of the action of an atmospheric front, which caused the penetration of the cold air mass until the latitude of our country, simultaneously with the expulsion of the warm one. Only a limited area was not affected by this phenomenon.

On 7 March 2002 and during the night between 7 and 8 March, a record number of 332 fires were noticed, which affected almost half of the country's counties. The normal daily average number of fires is about 20 – 30. The fires were initiated mainly because of the fires initiated for cleaning up the waste vegetation from the rural properties. The persons who started the fires for this purpose were not aware about the risk due to the strong wind. From the total of over 300 fires, 40 affected the peripheral area of the forests, whose spreading into the inner forest mass was stopped by the operative action of human forces. 152 fires affected houses, 121 fires burnt dry vegetation and 19 fires reached buildings of some commercial societies. 19 out of 41 counties were affected by the fires (as shown in Figure 2.1.).

2.4.3 Human consequences

There was 1 death during the forest fires, along with one person injured and 30 people were made homeless.

2.4.4 Economics losses

The total economic loss of this disaster was 550,000 Euro. The breakdown between material losses and response action costs is as follows is 500,000 Euro for the former

(the values of damages represent all the effects of the wind combined with the forest fires effects all over Romania in 7 March 2002) and 50,000 Euro for the latter.

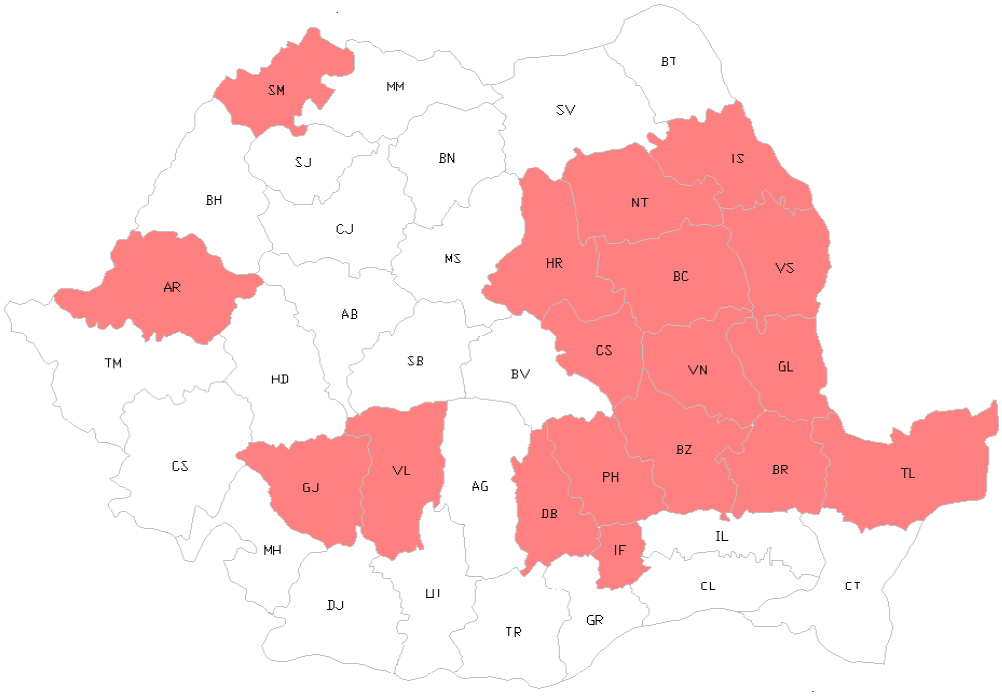

Figure 2.4.3.a – Map of the counties affected by the fires on 7 March 2002.

2.4.5 Prevention measures and related lessons learnt

The Order of the Ministry of Waters, Forests and Environmental Protection no. 1654/31.10.2000 was elaborated for the approval of the Norms for the prevention and extinguishing the forest fires. This led to the adoption of the method of the risk evaluation of forest fires, which is used in France (based on CEMAGREF research between 1988-4994), taking into account the similar structures of the forests of these two countries (as it is stipulated in the CE Regulation no. 92/2158/CEE regarding the forest protection against the fires).

The Governmental Decision (HG no. 1088/30 .11.2000) regarding the Approval of the "Regulation for defence against the mass fires" was elaborated and adopted, which deals also with the situation of public emergency generated by the affected forest areas, among other types of fires (generated by dangerous combustible substances, etc.).

Periodically the Commissions for defence against the disasters organised and undertook applied exercises in order to verify the preparedness of the population and intervention forces. The verification of the functioning of the alerting-warning system, including the equipment and the materials for intervention, was done at the established terms through the normative acts in force.

It has to be mentioned that in Romania, the activity for prevention and extinguishing of the fire are regulated by the Governmental Ordinance no. 60/1997, regarding the defence against the fires, approved by the Law no. 212/1997. As it is stipulated by this law, the central authority for forestry elaborates the norms for prevention and extinguishing of the forest fires.

Annually, until 20 January, and at the level of forestry directives, the National Autonomous Forest Administration (ROMSILVA) are drawing up, together with the county group of military fire fighters, the Intervention Plan at forest. This above mentioned Plan established measures which take into account also the guidance and the control of the prevention and extinguish the forest fires from the county level.

Also the forest fire prevention was undertaken in the frame of the whole technical and organizational measures, also by specific activities, planned and realised at the local and national level, according to the law, in order to assure the identification, evaluation, control and alleviating the risk of producing this of disasters.

The socio-economic development programmes drawn out at the national level. The must include the specific prevention measures in case of transformation of the normal forest fires into mass fires, the responsibility of this task being of the central or local public authority and the technical-administrative leading staff of the economical units and the public institutions.

It should be mentioned that the organisation, coordination and the control of the measures and actions for response in case of mass fire are undertaken at the national level by the Central Commission for mass fires, organised through the Ministry of Interior.

In the territory, the action and measures for defence against the mass fires were realised through the county, municipal, cities and communal commissions for defence against the disasters.

Lessons Learnt

The risk of fire in the forest from Romania was increased in the last years due some specific conditions as it follows:

- ⇨ lack of the education and the ignorance of the citizens of the rules of behaviour in the forest and in the surrounding areas;
- ⇨ lack of a modern surveying system by satellites, of the risk evolution in the forests.

2.4.6 Preparedness measures and related lessons learnt

At the initiation of the emergency situation generated by mass fires, were undertaken the following actions and measures:

- The Authorities declared the public emergency situation in the threatened areas.
- The technical Permanently Secretariat informed the president of the Commission for defence against disasters about the created situation and assured the activation of this Commission.
- The informational-decisional flux was intensified, increasing the frequency of the information, prognosis and warning transmission to the population, the economical units and public institutions from the endangered areas.
- The actions which are taken before the starting of the intervention operations were started, consisting of: recognising and continuously surveying the threatened zones, pre-warning and preparedness of the intervention forces and means, preparedness for evacuation, if the situation were to require it, of the people, goods, animals, belongings, and the disposal in safety conditions of the goods which cannot be evacuated.

- The prevention actions were intensified in the areas at risk or in the probable directions of the mass fires development in the forest area;
- The conditions for shelter, food and assistance in the evacuation camps (settlements) for the population and animals were ensured;
- According to the law, proposals regarding the utilisation of the reserve materials and means for intervention were formulated, including the presentation and recovering, by currently supplying in the limit of the allocated funds with this purpose.

The defence plans against the mass fires are the documents which are used as a basis for undertaking the prevention measures, the preparedness, the immediate intervention and the unitary coordination of these.

According to the law, these Plans are drawn out for counties and localities by the Commissions for defence against the disasters, whilst they are prepared by the technical-administrative board for the economical agents and public institutions.

When defense plans are drawn or updated, their evaluation has to be carried out. Furthermore, the zones with risk of producing and propagating mass fires in the forest area are established. The levels of high or very high risk are distinctly marked on the map of the risk zones, annexed to the defense plans. The responsibility for undertaking the defense plans is the task of the prefects, majors and boarding staff of the economical units or to the public institutions. Also, the defense Plans are revised any time it is necessary, as a result of the changes that happen in the area/objectives for which the Plans were drawn up for.

Lessons learnt

For establishing the tactical concept for extinguishing the forest fires the following are imposed:

- ⇨ analysis of the real situation, knowing the surface affected by the fire, structure of the combustible material, limits where the forest fire will spread, the possibilities of taking over the control of these, zones with the highest intensity and the necessary means for diminishing the potential of these;
- ⇨ taking into consideration the factors which favours the extension and the intensification of the fire, the exact hour of observation, the degree of sun radiation, the wind speed and its direction, etc.

2.4.7 Response actions and related lessons learnt

The application of the operative defence measures against the mass fires in forest area are carried out in a concerted manner on the basis of the operative plans for protection and intervention in case of disasters, of the counties, localities and the economical sites, called defence plans.

The coordination of the whole intervention operation in the situation of public emergency generated by the mass fires was dealt with by the competent legal authorities who have attributions and responsibilities regarding the conception, planning, organisation and the control in this field. These authorities are prefects, mayors and technical-administrative boarding staff of the economical units and public institutions. The procedures for the propagation limitation, extinguishing and elimination of the

consequences of the mass fires in forest area were established by the Regulations and the Instructions elaborated by the General Inspectorates of the Military Fire-fighters Corp.

During the extinguishing of the forest fires the following actions and measures were undertaken:

- The entry into action of the forces and means established by the defence plans against the disaster were concentrated and organised.
- The necessary works in the view of completing the water supply and other categories of extinguishing substances necessary in sustaining of the intervention actions were organised.
- The works for limiting the forest fire propagation were organised and undertaken, with the means at their disposition.
- The conditions for realisation of the force manoeuvre and the necessary works for intervention actions were ensured, according with the progress evolution of the operative situation.
- Information about the situation created and about the undertaken measures, along with formulated requests, was transmitted to the hierarchical superior defence Commissions against the disasters, according with the evolution of the operative situation.
- The population was informed about the measures and behaviour which have to be adopted in the disaster areas.

Immediately after the liquidation of the forest fires, the following necessary measures were undertaken:

- The causes and the circumstances of the bursting of the mass forest fires were established.
- The recovering of the action capacity of the intervention forces was ensured.
- The prevention measures of the fires and the rules of behaviour of the population in the affected areas were established, so as to prevent the burst of the new forest fires.

In order to re-establish the normal situation in the areas affected by forest fires, the Commissions for defence against the disasters and the technical administrative boards of the economical agents and public institutions decided to undertake the following measures and actions:

- to continue giving the necessary assistance to the affected persons;
- to reconstitute the necessary means for intervention and for getting into the operative situation;
- to re-establish communication ways, telecommunications lines, electricity and water network of the economical units;
- to prepare the conditions for reopening of the affected economical agents and the public institutions, including the reparation/reconstruction of the damaged or destroyed buildings in the disaster area.

Lessons Learnt

- ⇨ The methods for intervention in the conditions of a forest fire are established, according to the magnitude and the type of the forest fire (fire on the periphery of a forest which affects the dead vegetation, leaves, etc., on the pastures, on the plain terrain or on the slope with different degree of declivity, on a hill or a valley, etc.).
- ⇨ The contra-fire was the most efficient method for limitation of the extension of the fire because it reduces the radiant power of the fire that advances. Furthermore, a barrage made of soil situated a few meters in the front of the forest fire blocked the advance of the main fire.

2.4.8 Information supplied to the public and related lessons learnt

In the case of a forest fire, the informational-decisional system consists of the whole subsystems designed for detection, alarming, warning, notification, and data transmission and processing, taking the decision by the factors involved in the defence actions against the forest fires and the transmission to the interested factors.

In order to ensure the transmission of the updated information by the Commission for disaster defence, the type of the networks, frequency and the telecommunications means which will be used and where will be assured the permanence activity were established in due time, through the defence Plans.

The equipment and the technical means used were compatible between them and worked at the parameters established in the exploitation documentation.

The transmission of the information was realised according to the scheme of the decisional-informational flux, approved through the Plan for defence against the disasters.

The principal scheme of the decisional-informational flux are presented annexed (please see Figure no. 2.2., 2.3 and 2.4.).

The information of the Technical-Permanently Secretariat of the Commissions hierarchically superior about the situation from the disaster place, the evolution of this, of the negative effects produced, also the measures taken was realised through the operative Reports.

On the basis of the conclusions drawn out from the analysis of the intervention, the defence Commission against disasters prepared evaluation reports, which were sent to the hierarchically superior Commission, 10 days after the disaster. The same Commission also prepared proposals for the measures to improve the activity of prevention and extinguishing the fire.

Lastly, the evaluation Reports of the intervention, from the county Commission for defense against disasters, were submitted to the Central Commission for mass fires, in terms of 30 days after each disaster took place.

Lessons Learnt

- ⇨ Because of the permanent presence in the territory of the forestry personnel, in the most part of the cases, the rapid detection of the forest fires and the warning was generally accomplished. The success in locating and extinguishing the forest fire, in addition to limiting the loses was also due to the prompt intervention of the military

fire-fighters and forestry personnel, aided in more severe situations by militaries and in many cases, by the citizen from the affected areas,.

2.4.9 Socio-economic implications of the disaster

In the most part of the cases, the fires produced affected mostly several areas with an intense socio-economical activity, especially the villages and the surrounding properties, with a direct effect against the inhabitants from the rural area.

Generally, the fires were produced due to the non-observance of the norms for prevention and extinguishing the fires, due to the negligence in using the fire in open spaces, severely affecting both the villages and surrounding environment, represented also by the forests.

In order to alleviate the risk of producing such a kind of disaster, characterised by so many fires in less than 24 hours, almost affecting half of the counties, measures at the level of local public administration for intensifying the activity for fire prevention have to be taken into account. Furthermore, it is important to increase the frequency of the controls in localities, along with the promotion of actions to disseminate information and provide preventive education to the population, using all the means and methods, including mass media communication.

2.5 Analysis of the forest fire near Komen

Jošt Jakšra (*Slovenia Forest Service, Ljubljana*)

2.5.1 Date of the disaster and location

29 August 2001, Komen, Slovenia.

2.5.2 Description of the event

Extinguishing the first fire (29 August)

The place where the fire originated was mostly overgrown with shrubbery of sumach (Cotynus coggygria Scop.), hophornbeam (Ostrya carpinifolia Scop.), ash tree (Fraxinus Ornus L.) and high grass. In individual spots there were smaller groups of young pines (Pinus nigra Arn.). In the area where the fire broke out there are several forest roads and firebreaks.

Due to protracted drought (the last abundant precipitation was on 20 July 2001) caused great dryness of soil and plants, thus, the fire spread very quickly, with help from the wind. The fire spread as ground fire, as crown fire and in certain places it passed over to underground fire. There was a moderate southwesterly wind and thus the fire spread very quickly. Along the Komen-Branik road, the fire covered crowns of pine trees and leapt across the road and spread in direction of the hill Zajčevec.

At 15.37 hrs the fire was detected by a citizen and reported it to the Republic Information Centre (ReCO). ReCO gave the alarm to the voluntary fire fighting association (PGD) in Komen and the Service for fire fighting and saving (ZGRS) in Sežana. They were informed about fire near Komen, along the road Komen – Branik. PGD Komen was the first to arrive at the fire scene. They were equipped with three vehicles and twelve firemen. According to the first estimate, the request for additional

forces was made. At 16:10, PGD Sežana, PGD Štjak, PGD Senožeče, PGD Povir, PGD Divača and additional forces from ZGRS Sežana and PGD Komen were also activated (see Figure 2.5.2.a). Additional forces had to be transferred from the fire scene near the village of Beka, in the community of Hrpelje – Kozina, which was already roughly localized. At this fire scene, the central association PGD Materija remained and established itself.

Since the fire was spreading quickly and additional units had not yet arrived to the scene of the fire, due to the distance, at 16:05 a request for the preparation of helicopters was placed through ReCO Postojna for eventual fire extinguishing. When the additional units arrived to the scene of the fire, they were positioned with regard to the momentary situation at the fire scene.

As firemen and equipment were still lacking at the scene, a request for activating PGD Kostanjevica and PGD Dornberg from the Fire-fighting Association Nova Gorica was made.

At 18.32 hrs the fire was roughly localized. Activities such as cleaning of the border of the fire scene and extinguishing of subjacent fires were still being carried out. All the same, at 19.51 hrs the fire broke out again, but it was immediately put out. Around 20.00 hrs the wind changed. A northeasterly wind began to blow.

At the scene of the fire, the already mentioned activities were carried out until 22.00 hrs, and then, with regard to the situation at the scene, it was decided that the main body of the force could leave the scene. The firewatchers, 17 firemen and 4 vehicles, who carried out the constant supervision over the scene of the fire, remained at the scene of the fire.

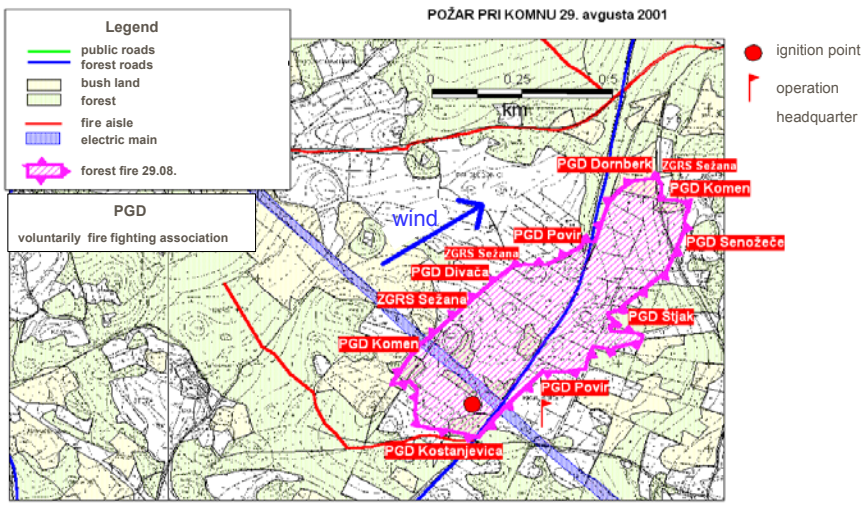

Figure 2.5.2.a - Map of fire on the first day and allocation of fire brigades and position of forces near the hamlet (small village) Jablanec.

Extinguishing the second fire (30 August)

During the night, the bora (see Figure 2.5.2.b), a strong north wind, became stronger and started blowing with gusts of 40 to 50 km/h (measured). In spite of the constant supervision of the scene of the fire, at 00.27 hrs the fire broke out again, and despite

quick intervention of firewatchers, it spread rapidly and covered 17 ha of serried pinewood.

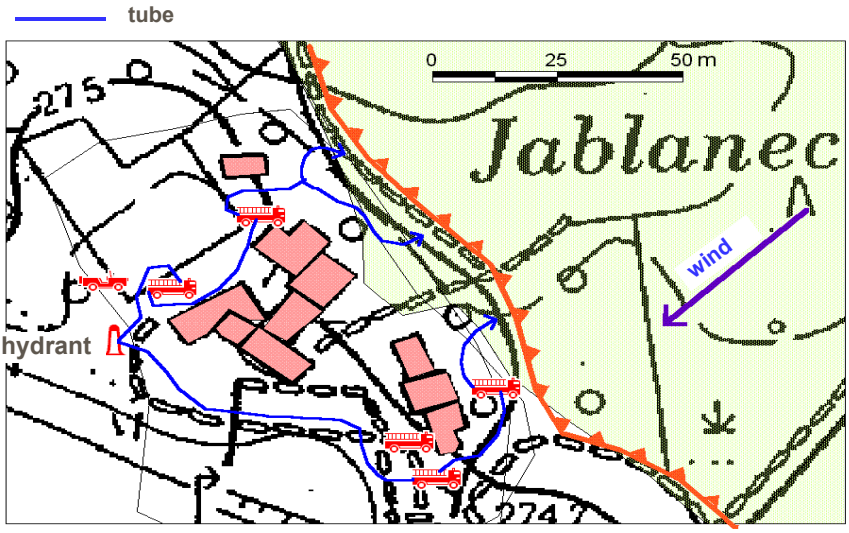

Figure 2.5.2.b - Settlement Jablanec, fire frontline and fire engine distribution.

The fire spread in the direction of the hamlet of Jablanec and the village Rubije. The fire spread on the ground, on top and by leaping over also by 200m from the fire line. At 01.15 hrs the fire neared dangerously the village Jablanec. Firemen prevented the fire to seize houses with successful intervention. All the same fire leapt over the hamlet and spread in direction of the village Rubije and road Komen - Škrbina.

At approx. 03.00 hrs, the bora became weak, but it still blew at 25 km/h (measured). For this reason the fire spread more slowly.

On the western part of the fire scene, the fire was most probably renewed due to a subjacent fire. Despite immediate intervention of the firewatchers, the fire spread very quickly with the help of the wind. The request for activating additional forces from PGD Komen, ZGRS Sežana, PGD Kostanjevica and other PGD in KGZ was made promptly. When the fire caught the serried stand of pinewood, it was found out that under the conditions at the scene of the fire, it would be impossible to put out the fire with the available forces. A decision was made that all the available forces had to be redirected to the hamlet of Jablanec to protect the dwelling houses and farm buildings.

At the same time, a smaller firemen team was sent to the hamlet to wake up the inhabitants and prepare all necessary for an eventual evacuation. The transferred units of PGD Komen and the first arrived units of ZGRS Sežana were positioned in the hamlet of Jablanec and then they started to water the buildings and the hamlet vicinity with water cannons from tank trucks. In the hamlet the following vehicles were positioned:

- GVV*-2, FAP 1616, 8.000 l of water
- GVC** 16/40, TAM 130, 4.000 l of water
- GVV*-2, TAM 260, 12.000 l of water
- GVV*-2, TAM 260, 12.000 l of water.

Where:

* = GVV è Fire multipurpose engine

** = GVC è Fire tank engine

The following vehicles were extinguishing the marginal fires near the hamlet, caused by leaping over of the fire:

- VGP-2, TAM 110, 1.500 l of water
- VGP-1, Land Rover 10, 450 l of water.

The vehicles were supplied from the hydrant. Simultaneously, the rescuing of small cattle, sheep, goats and pigs took place. Some villagers left their homes with their own vehicles.

The first units that arrived were from KGZ Sežana, which immediately positioned itself in the village of Rubije, in order to protect the village and to prevent the spreading of fire across the road in the direction of the village Sveto – Lipa along the road Komen – Škrbina. At 1:36 a request to activate the GZ Postojna, GZ Nova Gorica and GZ Koper was made. GZ Nova Gorica and GZ Postojna also arrived at the scene of the fire. Part of the forces was positioned to help protect the village of Rubije and along the road Komen –Škrbina, and also the road Komen – Branik (northern side of the firebreak at Rubije). With these forces the fire was encircled and the bora started to calm down, so the fire extinguishing was effective. See Figure 2.5.2.c for the positioning of all units activated.

Towards morning the greatest part of fire was already under control, nevertheless in certain parts, new fire centers appeared. Because of continuously renewed fires, the dimensions of the fire scene and tired firemen, a request for activating the helicopter was made.

All units remained at the scene of the fire, except for PGD Studeno, whose task was to prepare the heliport and to offer help with water loading by helicopter. All greater tank trucks with water were also redirected to the heliport. The helicopter landed at 07.54 hrs and immediately after setting up the tank, it started with extinguishing. In the first place, the helicopter extinguished the active centres of the fire near the hamlet of Jablanec and the southern part of the scene of the fire. The helicopter finished the extinguishing at 11.13 hrs. Then the first forces started to also withdraw themselves. At 13.00 hrs the fresh forces began to arrive at the scene of the fire. The majority of forces, which extinguished fire during the night, were replaced by 15.00 hrs. All were definitely replaced by 16.00 hrs. The firewatchers composed of firemen of ZGRS Sežana, PGD Povir and PGD Senožeče remained at the scene of the fire. At 23.00 hrs, the PGD Povir and PGD Senože withdrew themselves since the situation at the scene of the fire calmed down. At the scene of fire remained ZGRS Sežana. At 00.53 hrs, the fire was renewed, but it was successfully put out by the firewatchers with the help of PGD Komen.

All the activities at the scene of fire were ceased at 05.47 hrs due to abundant rains, which promised that the fire would not be renewed.

2.5.3 Human consequences

There were no deaths or injuries during this event. A partial evacuation was made in the hamlet of Jablanec. The firemen were overtired.

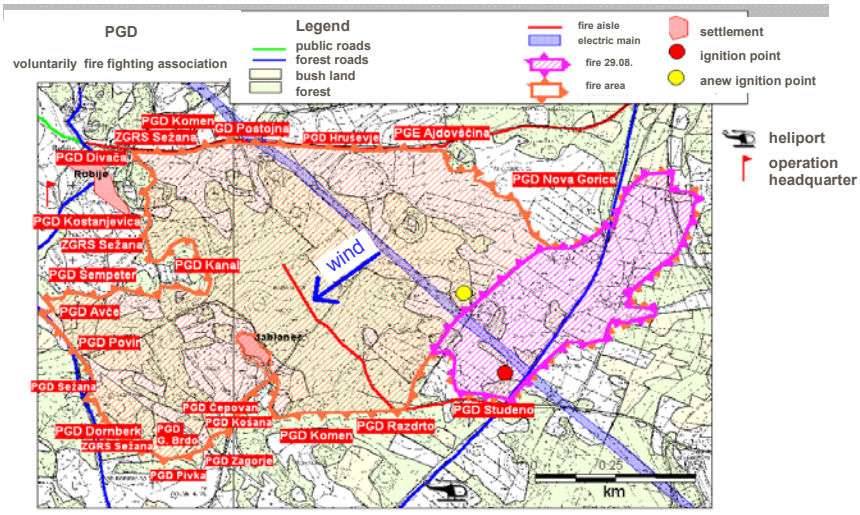

Figure 2.5.2.c - Map of fire on the second day and allocation of fire brigades and position of forces near the hamlet (small village) Jablanec.

2.5.4 Economics losses

During this event there were no losses on citizens' property or goods. There were some damage on fire engines and equipment. The greatest direct losses were damage on forest, firemen work, cost of vehicles and cost of helicopter. The total number of hours used for intervention was 2.283. Indirect economic losses will be the cost of artificial forest regeneration, which will be necessary for approximately one third of the burned forest area. The cost of ecological losses can only be estimates because it is not possible to evaluate this precisely. But in such a sensitive ecosystem such as a Karst forest is, the ecological losses are always high.

Table 2.5.4.a - Costs of intervention and damage in forest.

	Type of costs	Amount in SIT	Amount in €
1	Firemen work	5,050,700	22,448
2	Cost of vehicles	3,964,000	17,618
3	Cost of food for firemen	350,000	1,556
4	Costs of helicopter	1,700,000	7,556
5	Costs of fire-extinguishing means	200,000	889
6	Costs of reimbursement of firemen wages	Not known yet	Not known yet
7	Other costs (equipment)	Not known yet	Not known yet
8	Estimation of damage in forest	14,433,000	64,147
9	Estimation of forest regeneration	14,175,000	63,000
	Total	39,872,700	177,212

2.5.5 Prevention measures and related lessons learnt

The following lessons learnt are highlighted below.

Lessons Learnt

- ⇨ The personal protective outfit has so far proven to be adequate.
- ⇨ The vehicle fleet is out-of-date and only part of the smaller vehicles was renewed. It is necessary to update the vehicle fleet.

2.5.6 Preparedness measures and related lessons learnt

These are the lessons learnt in the preparedness phase.

Lessons learnt

- ⇨ It is necessary to immediately regulate and ensure the possibility of firemen participation at all times (contractual relation of the local community, state and employers).
- ⇨ The number of professional firemen is too small to secure effective professional management of national servicemen and other forces at all interventions, as well as operationally securing in time the periods when voluntary firemen cannot participate in intervention.
- ⇨ At the scene of fire, the work of firemen tends to be very good, as they have been self-sacrificing and disciplined.
- ⇨ Flow of information and residual help by ReCO Postojna were exemplary.
- ⇨ The cooperation with other services (police, inspectorate, foresters) was good (there was also a greater presence of foresters, who are good connoisseurs /experts/ of the area).
- ⇨ The command vehicle lacked modern equipment such as, telecommunication, hydrometeorogical and similar devices, so as to address the needs of fire in natural the environment. It is important that the command vehicle be better equipped.
- ⇨ It is necessary to have GPS to measure the area of the fire scene after the intervention and it would be particularly helpful so as to position the firemen more easily during the intervention itself.
- ⇨ It is essential that the firemen have corresponding maps of the disaster zone.
- ⇨ Firemen were well provided with food and beverage.

2.5.7 Response actions and related lessons learnt

These are the lessons learnt in the response phase.

Lessons Learnt

- ⇨ The response of firemen in the afternoon tends to be good.
- ⇨ Due to the extensiveness of the fire and the lack of firemen, the leading personnel from Headquarters also participated in extinguishing of fire. Thus, coordination from Headquarters was not initiated.
- ⇨ During numerous fires this year, it was shown that the decision by civil service in Sežana was correct, as the servicemen were actively included in all interventions and the proper number of men in all time periods was ensured.
- ⇨ While extinguishing of fire there were no accidents, nevertheless in cases of such extensive interventions, an ambulance car should be provided (it would be necessary to provide the means for this purpose as well).
- ⇨ Extinguishing of fire with helicopters was successful; unfortunately they cannot be used at night time.
- ⇨ The response of firemen at night time tends to be worse (some fire-fighting associations that participated in extinguishing of fire in the afternoon did not respond

or responded with smaller number of firemen than expected – the cause are unsolved relations with employers).

2.5.8 Information supplied to the public and related lessons learnt

First day of fire the public was informed through the local media. The fire was registered at 3:37 PA, at 4:18 PM about this fire were also informed inspector of natural and other catastrophes, mayor of the community Komen, Radio Koper and Radio 94. When the fire was speeded to the bigger surface, the entire national medium got the information through the Slovenian press agency – STA.

Lessons Learnt

- ⇨ Because the response of local people (locals) in helping themselves was good, it could be deduced that the information provided to the public was useful.

2.5.9 Other Comments

Similar fires can be expected also in future while the Karst is still in overgrown process. Jablanec is not an isolated example of forest practically touching the village.

Figures 2.5.10.a and 2.5.10.b are some photos during the devastating fire.

Figures 2.5.10.c and 2.5.10.d are photos taken after the forest fires had been extinguished.

Figures 2.5.10.a – Photo of fire (1).

Figures 2.5.10.b - Photo of fire (2).

Figures 2.5.10.c - Photo after forest fires were extinguished (1).

Figures 2.5.10.c - Photo after forest fires were extinguished (2).

2.6 The Septèmes-les-Vallons Forest Fires (France)

Philippe Michaut (*Direction de la Défense et de la Sécurité Civiles, Paris*)

2.6.1 Date of the disaster and location

25 – 28 July 1997, Septèmes-les-Vallons, France.

2.6.2 Short description of the event

The fire of Septèmes-les-Vallons took place between 25 and 28 July 1997 near the city of Marseille. It was a very exceptional forest fire because of the large area it affected, its intensity and the potential threat it emanated to the city of Marseille. Almost 3,500 hectares were devastated by the fire. Because of the imminent threat, a large scale intervention to protect the population living in the outer perimeter of the city was carried out.

Météo-France forecasted severe meteorological conditions. Furthermore, due to the dry and windy (100 km/hr) conditions in the area, it was not surprising that a fire started in Septèmes-les-Vallons at 11.30 hrs on 25 July 1997. The CIRCOSC de Valabre (in charge of coordinating the fire fighting management of forest fires in the Mediterranean area) responded to the forest fire event.

A surveillance vehicle of the National Office of Forests sent the alert signal at 11.40 hrs. Aerial means were asked for at 12.01 hrs. They flew from the Marignane at 12.23 hrs.

At 13.15 hrs, the fire started threatening the first inhabited areas, after spreading about for approximately 30 hectares. Priority was set towards protecting the 20-km stretch of affected built in environment, instead of fighting the forest fire. In the meantime, the

fire progressed via the treetops and also because of the change in the direction of the wind.

The fire was contained on 27 July thanks to favourable conditions that allowed the establishment of a frontal defence line i.e. rocky dunes and the management of forest defence against fires thanks to the establishment of specialised operational response teams, as well as the improvement of meteorological conditions during the night.

2.6.3 Human consequences

There were no lives claimed by the forest fire. However, about 20 people were injured and over a thousand people were temporarily evacuated.

2.6.4 Economic losses

It is not possible to quantify the economic loss. But what is sure is that a large area of forest was lost during this event.

Here below is a glimpse of the means that were engaged during this event:

- 20 aeroplanes with water bombs (276 flying hrs), which used 200 tonnes of water and other delaying material.
- 3 life-saving helicopters, which were also used to coordinate the manoeuvres.
- 300 marine fire fighters from BMP and 600 fire fighters from Bouches-du-Rhône.
- 730 fire fighters from other départements.
- 170 military men from UIISC.
- 100 other military men.

2.6.5 Prevention measures and related lessons learnt

Avoidance of carrying out rules: The landfill activity was suspended due to the forecasted risks. This rule did not seem to be respected (there is still an ongoing judiciary action). The warm waste residues were transported in the morning.

Terrain equipment: The large forestland was equipped with infrastructure to protect the forest against fires (DFCI - défense de la forêt contre l'incendie). There are 160 km of paths, 13 water sources, and the landfill from which the fire started, is protected by a large strip of land that had been initially deprived of bushes.

There were several lessons learnt during this fire.

Lessons Learnt

⇨ There are several disadvantages despite the existing protective infrastructure:

- The DFCI paths are not all linked to each other, thus this did not allow to obtain a coherent network.
- The absence of a network of fire hydrants near the houses was an obstacle to their protection.
- The area, which was supposed to be left without bushes, was indeed not made barren, but was covered by a blanket vegetation that accelerated the spread of the fire.

⇨ ***Monitoring and alert***: The start of the fire was signalled when the fire was still contained in the landfill. This means that the fire detection network worked well despite the difficulties linked to the hertzian transmissions.

⇨ ***Soil conditions***: in the forest fire area, there was a very penalising element: the fire mainly developed in an urban area, which made the intervention very difficult. Furthermore, the houses at risk from the fire were not separated by a natural buffer zone that was well delineated.

This meant that it was necessary to proceed with the elaboration of the « plan de prevention (PPR) des incendies de forêts » (forest fire prevention plan), which would allow taking into account forest fire risk operations in urban areas. Protective measures should be carried out both in areas where the danger is highest (where there is a high density of infrastructure) and in areas where the risk is not so obvious, i.e. areas where construction could potentially be promoted, but really should not be.

⇨ Regarding Mediterranean regions. They are characterised by densely populated areas, thus the legislation (Law of 1995) and regulation are difficult to enforce. The first PPRs (Plan de Prévention des Risques Naturels - Plan for Natural Hazards Prevention) for forest fires have only been approved recently.

2.6.6 Preparedness measures and related lessons learnt

The strategy used to protect the forest from fires is based on the principle of anticipation. The rapid response is an essential element for the success of response operations. The main objective is to be able to intervene at the start of the fire, i.e. within 10 minutes after the detection of the fire. Basically, the first fire fighters should be able to react by fighting a fire burning a surface area limited to less than 1 hectare.

There are specific operational prevention measures that have been planned to fight the fire:

- Terrestrial units (fire fighters, specialised military intervention and coordination units of the civil security) carry out a preventive scooping and mapping of the area at risk and position themselves in the high-risk zones of the forest.
- Aerial units are activated and are armed with water bombs.

These measures are highlighted in operational documents elaborated at the national and regional (départemental) level, i.e. national order of operations and regional order of operations, respectively.

The examination of the fire chronology shows that this mechanism was inadequately put into practice.

- The alert was given at 11.42 hrs;
- The request for aerial means was given 20 minutes later. However, the aircrafts did not take off until 12.23 hrs and were flying over the affected area ate 12.30 hrs.
- The first terrestrial units reached the fire approximately 30 minutes after it started.

As a consequence of these events, the first fire fighters who arrived at the scene of the fire found themselves having to deal with a fire that was too large to fight with the resources they had.

Lessons Learnt

Lessons learnt in this disaster management phase are described below.

- ⇨ Danger was under estimated because usually forest fire risk is generally lower at the end of the morning. As there was a need for a parsimonious approach to deploying water-bearing aircrafts with regards to the management of the different measures of intervention, the operational prevention measures were not activated in time (the activation of the water-equipped aircrafts was planned for 13.00 hrs as well as the deployment of terrestrial intervention within the sector.
- ⇨ The fire started in the sector, which is of the competence of the Batallion of the Marine Fire Fighters of Marseille, which is a unit under the supervision of the mayor of Marseille. The Battalion is basically a parallel structure of the departmental fire service, whilst the Bouches du Rhône takes care of the rest of the territory of Bouches du Rhône.
- ⇨ The necessary coherence between the two institutions was not adequately established. This was evident during the processes of preparing the monitoring plan, disseminating of the alarm, the rate of response of the terrestrial units and the speed at which the request for reinforcement at national level was carried out.
- ⇨ As a consequence of this fire, it was learnt that there is the need to activate a preventive mobilisation strategy for fire-fighting already in the morning when the risks are high, despite the typically logistical constraints that could result from this (these measures would have allowed to gain at least half an hour with regards to the intervention time).
- ⇨ After this forest fire, it became necessary to put together measures since the morning logistical constraints that could result from such an action (they would).

At the same time, operational procedures were defined in order to specify the intervention mechanism of the response units SDIS fire brigade of the Bouches du Rhône et and the BMP marine fire brigade of Marseille, along with their coordination.

2.6.7 Response measures and related lessons learnt

Despite the aerial assistance (4 CL 415 arrived first; 2 CL 415 were activated at 12.30 hrs, and a seventh at 12.45 hrs; 2 Fokker 27 were activated at 13.15 hrs) that was deployed in the area at risk, the speed at which the fire progressed (about 30 hectares/hr) did not give time for the intervention mechanism to establish fire blockage strips before the fire reached the inhabited areas.

The attempts to establish fire blockage zones to slow down the fire proved to be inefficient, even with the help of the aerial assistance (Fokkers). Thus, priority was given to the protection of threatened infrastructure from the progressing fire (left flank).

New attempts to establish blockage zones were useless despite terrestrial reinforcements. This led to the elaboration of a two-component strategy: protection of the people and goods in the urban area (main objective), fire fighting in the forest. However, the coordination of the life-saving operations still proved difficult, as the fire was difficult to address (in order to dispose of a sufficient delay in putting together the necessary amount of means to contain the fire).

Lessons Learnt

⇨ The following difficulties during the rescue operations were encountered:

- ***The presence of numerous electrical lines***. There was a 400,000 V line and four 200,000 V lines encountered during the intervention. The first line could not be cut, whilst the cutting of the other electrical lines would not allow the fire fighters to use the Marseille water pumps.
- ***The numerous emitters the Massif de l'Etoile area***. This led to the saturation of the radio network, making communication amongst units difficult.

⇨ It seems that the aerial reinforcement would have been an advantage only if the following issues were addressed.

- The process of setting up a barrier required to slow down the propagation of the fire was facilitated by the use of amphibian aeroplanes such as the CL 415, even if the ground intervention could seem overwhelmed by the power of the simultaneous intervention of aircrafts. This tactic would have allowed the efficient coordination of ground and aerial forces; however it was not adequately carried out.
- The use of aeroplanes was abundant: 4 CL 415 were initially activated, followed by 3 others. This progressive use of aerial means could be interpreted as having penalised the fire fighting operations, as it did not interrupt the initial development of the fire.
- The identification of agents (i.e. officers responsible for designating to the commander of the fire fighting operations which manoeuvres to apply), in charge of the aerial means should have been carried out in a more rigorous manner.
- It is necessary to integrate the lessons learnt during this event into management framework, which explains the tactical use of aerial means in fire fighting.

2.6.8 Information supplied to the public and related lessons learnt

No information was provided.

Other lessons learnt

⇨ The forest fires in urban areas of Marseille disrupted the existing organisational framework. Furthermore, the forest fires affected the "green lungs" of the city, as it destroyed 1,095 ha of forest and 2,335 ha of Mediterranean bush land that are part of the natural reserve near Marseille).

⇨ People were running out of their houses. Their actions were not risky because they were moving towards the city, through safe areas. However, their actions threatened the rescue operations because they prevented the efficient intervention of the rescue teams.

⇨ A characteristic of this operation will have been carrying out of evacuation procedures; almost a thousand people were harboured in a retirement home for a short and temporary period.

⇨ The evacuation was not efficient because it was not systematically planned in collaboration with the commander of the rescue operations. Unfortunately, there were

too many people involved (local civil servants, police, gendarmes, etc.), who were unorganised.

⇨ The absence of a plan during this event seemed to be penalising to the management of entire forest fire fighting interventions.

Note: Please contact ana.vetere@jrc.it, for the original report in French language.

3. OTHER EXPERIENCES IN FOREST FIRE MANAGEMENT

3.1 The Finnish Forest Fire System (Finland)

Taito Vainio and Rami Ruuska (*Ministry of the Interior, Helsinki*)

3.1.1 Introduction

With regards to any accident type, the goal of the Finnish Ministry of the Interior is first to analyse the magnitude of the problem. By doing this it is possible to tell what kind of accidents Finland has and what kind of a problem these certain accident types creates. After this it is relatively easy to focus on those accident types that make the biggest damage.

In each accident type the Ministry of the Interior tries, first, to prevent the accidents, second, to get as early warning as possible in order to get information about the accident and third, develop more effective response. Depending on the accident type the Ministry of the Interior is using different mixture of prevention, detection and response in order to minimise the damage. In this work Ministry of the Interior usually uses legislative, technical and educational means.

A great deal of accidents regardless of accident type is caused by human action. This suggests that most effective way to prevent accidents is information and education i.e. educating people to behave in way that reduces the risk of an accident or mitigates the damage.

However, preventive work by itself is never enough. Even though it would be possible to cut out most of the man-made accidents, there still remains a wide variety of other shortcomings that cause accidents e.g. fires, car crashes, train accidents and so on. These shortcomings can be electrical, structural or mechanical, just to mention few of them. Therefore, measures that make early warning possible are needed. Early warning is needed because of at least two reasons: First, people in an accident need to get safe and away from the accident area. Second, the information on the accident needs to be delivered to the rescue organisation so that the rescue work can be started as early stage as possible. This is crucial in order to minimise the damage caused by any type of accident.

Usually the early warning measures are more or less technical applications supported by legislative and educational work. As an example of this there are regulations that claim e.g. smoke detection system or a sprinkler system in a certain building because of a great fire risk. In addition to this the people need to be educated to act in a certain way

in case of an alarm in order to be able to safe themselves and to do simple preliminary actions before the fire brigade arrives. These technical applications work usually in two ways, first, they help people to save themselves and second, they automatically deliver the alarm to the alarm centre.

The full benefit of early warning presupposes fast response by the fire brigade using adequate manpower and equipment. To ensure this, the municipalities should do so called risk assessment. After this a municipality decides how these assessed risks are going to be controlled, i.e. they decide the standard of service. To the standard of Manpower, equipment, response time to the different areas of a municipality and so on, should be included in the service.

All in all, it is possible to talk about a system. In Finland, there is a different system for each accident type. Each system is built on prevention, early warning and fast and organised response. Each accident type creates a certain kind of problem, thus it is always necessary to analyse how big a problem actually is i.e. how much damage on life, property and environment a certain accident type causes. After this it is necessary to make priorities in order to use scarce money as effective as possible, which means that it is important to choose those methods that give the best results.

The system can be described as follows (Figure 3.1.1.a):

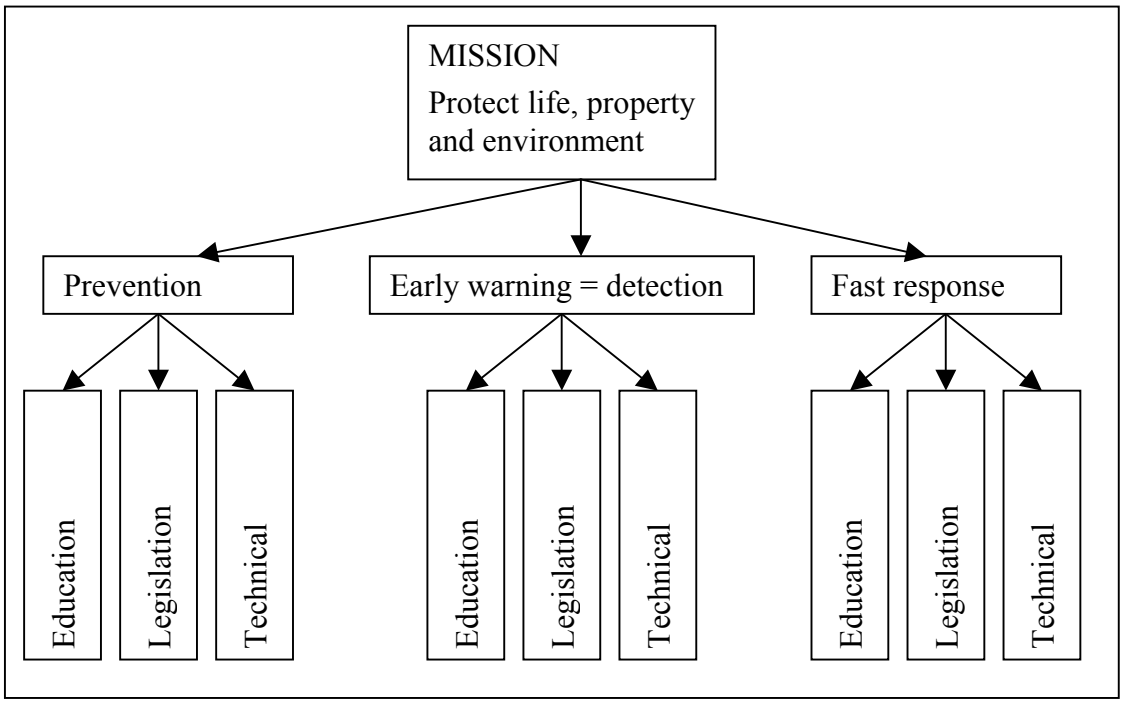

Figure 3.1.1.a – Scheme of a forest fire system.

3.1.2 History of forest fires in Finland

The total area of Finland is 338,145 km2, out of which the land area is 304,529 km2. Forests cover 68 % of the total area, i.e. 26 million hectares. About 54 % of the forest is privately owned, 33 % is owned by the state, 8 % is owned by companies and 5 % is owned by others.

The forest industry forms more than 30 % of Finnish exports, and therefore it can be considered an important sector of the Finnish economy. Finland is a scarcely populated

country, with a total number of inhabitants of 5.1 million people, i.e. 17 inhabitants per km2 of land. With regard to forest fires, these facts mean that there has to be some kind of system to prevent, detect and extinguish forest fires.

There are at least two factors that have to be taken into account in estimating how large the problem of forest fires actually is. Firstly, of course, is the number of forest fires. However, the number of forest fires gives only limited knowledge. Secondly, therefore, it is necessary to know how large is the total area that is burned in forest fires year by year. When these two factors are combined, it is then possible to find what the average size of a fire is. These two factors indicate how large the problem is and how the system, consisting of measures for prevention, detection and extinguishing, should work.

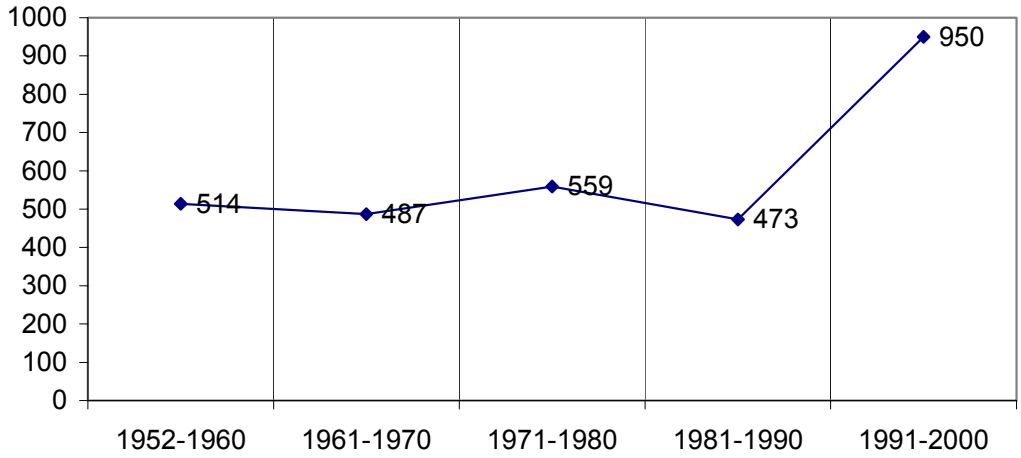

Figure 3.1.2.a - Average number of forest fires per year.

In Figure 3.1.2.a, the number of forest fires in Finland is presented as a function of time. In Finland, the number of forest fires can vary considerably depending on the weather conditions in the summer months (i.e. in May, June, July and August); at other times of the year, it is not likely that there are forest fires at all. The value that is presented in the graph is the number of forest fires on average per year in the particular time period. This gives better information about the tendency of the forest fires.

As presented in Figure 3.1..2.a, the number of forest fires has been quite stable from the 1950's to the 1990's. In the 1990's, the number of forest fires has been increasing. As was pointed out earlier, it is necessary to look at the other factor, i.e. the total burned area in the forest fires, and combine it with the number of the forest fires in order to be able to analyse the scale of the problem and effectiveness of the system to control the forest fires.

Figure 3.1.2.b shows clearly that the total burned area (in hectares) has been declining on average from the 1950's to the 1990's. In the 1990's, there has been a slight increase in the total burned area.

When the number of the forest fires and the total burned area are combined, it is possible to obtain the average size of a single forest fire, as shown in Figure 3.1.2.c.

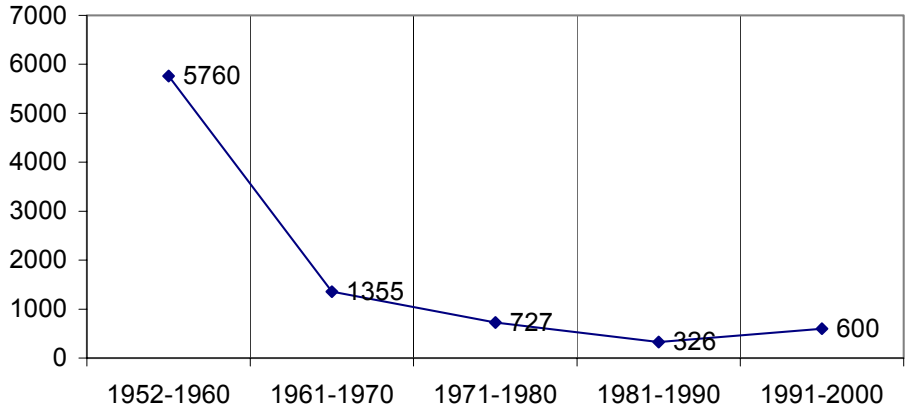

Figure 3.1.2.b - Average total burned area per year (in hectares).

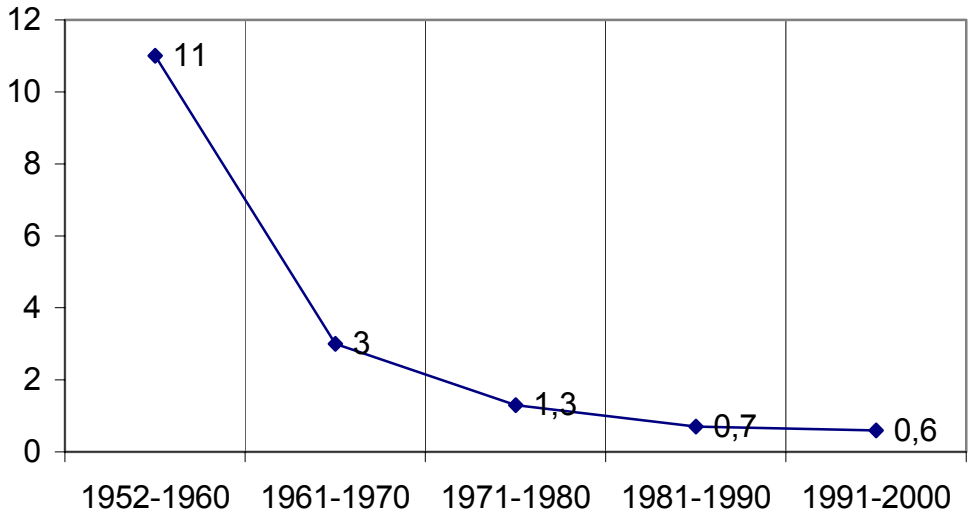

Figure 3.1.2.c - Average size of a single forest fire (in hectares).

Although the number of forest fires has been increasing in the 1990's, the total burned area is still relatively small. This means that the average size of a single forest fire has been decreasing all the time as shown in Figure 3.1.2.c. Taking into account the fact that the total burned area has been kept well under 1000 hectares a year, and that the average burned area per forest fire is only 0.6 hectares in the 1990's, it is possible to state that in Finland the management of forest fires has been quite successful, i.e. the Finnish system of prevention, detection and extinguishing is working relatively well. The small burned area per fire indicates that the forest fires can be detected quite quickly, and that the fire brigades can respond effectively.

3.1.3 Forest fire system

Forest fire is one of many accident types in Finland. To get a general picture of the problem, it is necessary to study the accident statistics. Forest fires form only approximately 2 percent of all the accidents where the fire brigade is alarmed. Usually, mainly property and environment are in danger in forest fires in Finland.

The forest fire system in Finland consists of prevention, early warning and extinguishing. As shown in the flow chart (Figure 3.1.1.a) above, in prevention educational, legislative and technical means are used. People need to be educated to behave in a safe way in the forests. This has been reinforced by legislation, which means that when the forest fire warning is issued it is against the law to set an open fire to the forest or near the forest. The forest fire warning is issued when the forest fire index has reached a certain level. Forest fire index is an example of technical application and it resembles how dry the forest is.

To get an early warning, the people are educated to react when they see that something is wrong. In practice this means that they do not ignore the situation and that they also call the number 112 to make the alarm. In legislation this is also considered as every man's obligation to inform the officials about the accident. Airborne surveys such as satellite systems are examples of technical applications.

The third part of the system is a fast response. According to the law, people are obligated to do what they can do to reduce the damage in an accident. What can be done depends on the type of the accident and the person. However, the goal of the education is to educate the people to do some simple preliminary actions before the fire brigade comes to the accident site. Also earlier mentioned risk assessment is based on law and the municipalities have to assess the risks, also forest fire risk, and they should have according the risk assessment the suitable manpower and equipment to handle forest fires. Extinguishing of the forest fires is done by technical means such as aeroplanes and helicopters let alone the equipment of the fire brigade.

3.1.4 The effectiveness of the present system

In estimating the effectiveness of the present system it is important to take the mission, i.e. to protect life, property and environment, as a starting point. In order to estimate, how good the present system actually is, it is necessary to turn to forest fire statistics. The most recent statistics that are available are usually taken at this point. This means that the forest fire statistics 1996-2001 is studied.

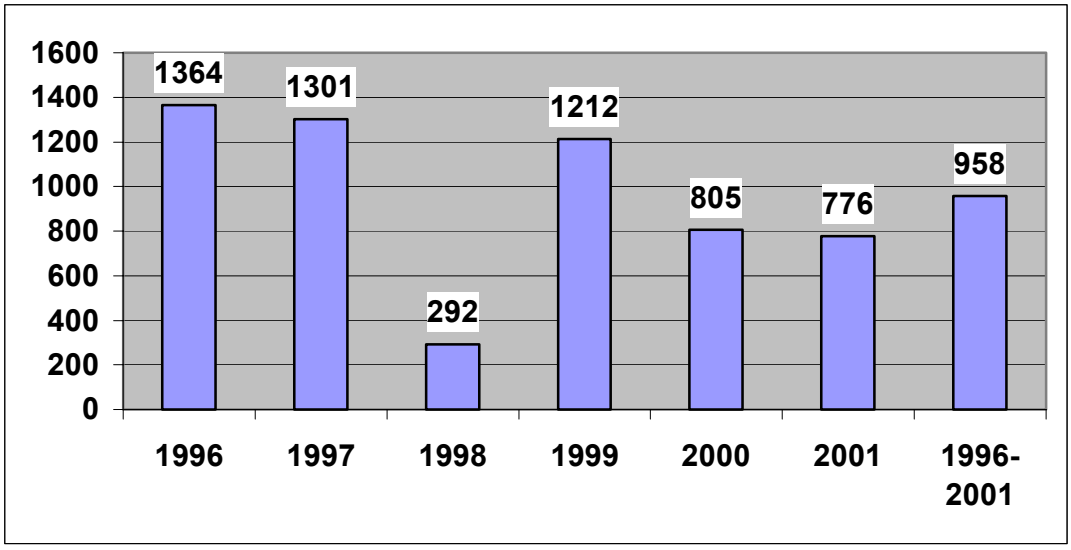

Figure 3.1.4.a - Number of forest fires.

As can bee seen in Figure 3.1.4.a, the number of forest fires is usually over 1000 forest fires per year. The summer 1998 was exceptionally wet and it is obvious that the number of forest fires remained very low. The last figure 1996-2001 is the average.

The total burned area is shown in Figure 3.1.4.b. The total burned area is quite small averaging 530 hectares in a year.

In Figure 3.1.4.c the blue colour indicates the average burned area in a single forest fire when the fire brigade has reached the area whilst in plum colour shows the average burned area in a single forest fire when the fire has already been extinguished. This graph clearly shows that fires do not escalate too much after the fire brigade has started the extinguishing. In 1997 the burned area expanded 50 percent from that point when fire brigade started its work up to the point when the fire was extinguished. In other years, enlargement was around 30 percent respectively. This means that a critical point is to get the early warning.

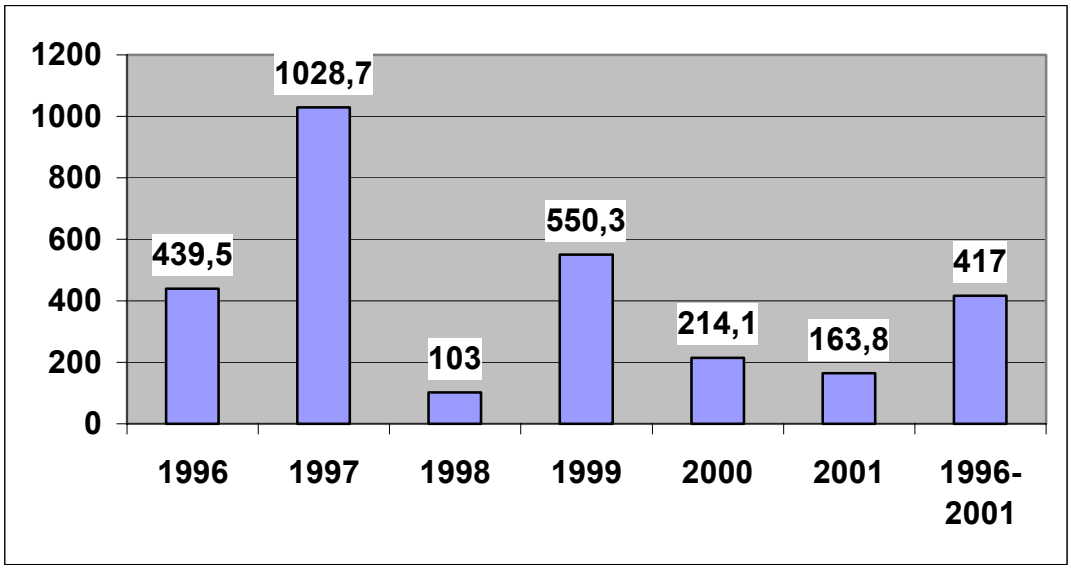

Figure 3.1.4.b - Total burned area in hectares.

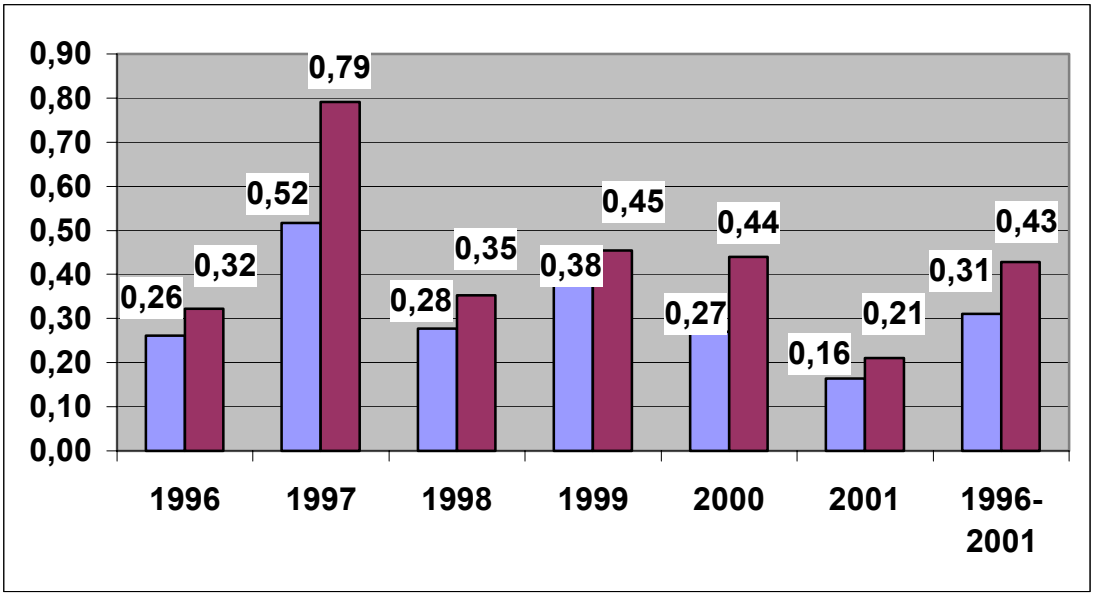

Figure 3.1.4.c - Average burned area in a single forest fire.

However, an even more precise analysis of the fires is needed. It would be important to know how these fires are divided by size. For this purpose, the same group criterion that was defined in the evaluation is going to be used.

In Figure 3.1.4.d, it can be observed that 98 percent of the fires are smaller than 3 hectares and 94 percent smaller than 1 hectare. What about the burned area that these fires caused? In Figure 3.1.4.e it can be observed that even though only 1 percent of the forest fires are bigger than 3 hectares, 55 percent of the burned area are still caused by these few fires out of which 39 percent of the burned area are caused by fires bigger than 10 hectares. Altogether in 1996-2001, Finland had 5750 forest fires and the total burned area was 2500 hectares. Over 800 hectares burned in 18 forest fires that were bigger than 10 hectares.

By using the information in Figure 3.1.4.c it can be concluded that big fires generally develop for a long time before the fire brigade arrive because they have already been big in size when the fire brigade arrived. This suggests that nobody has seen those big fires early enough to make the early warning. Figures 3.1.4.d and 3.1.4.e show, respectively, the percentage of forest fire sizes and the percentage of burned area according to its size between 1996 and 2001.

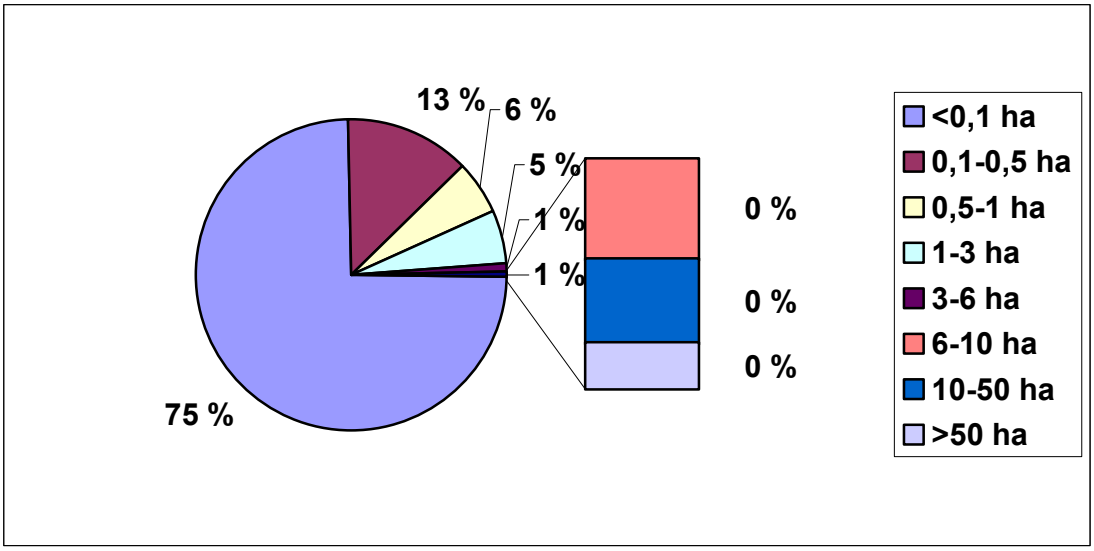

Figure 3.1.4.d - Percentage of different size forest fires in 1996-2001.

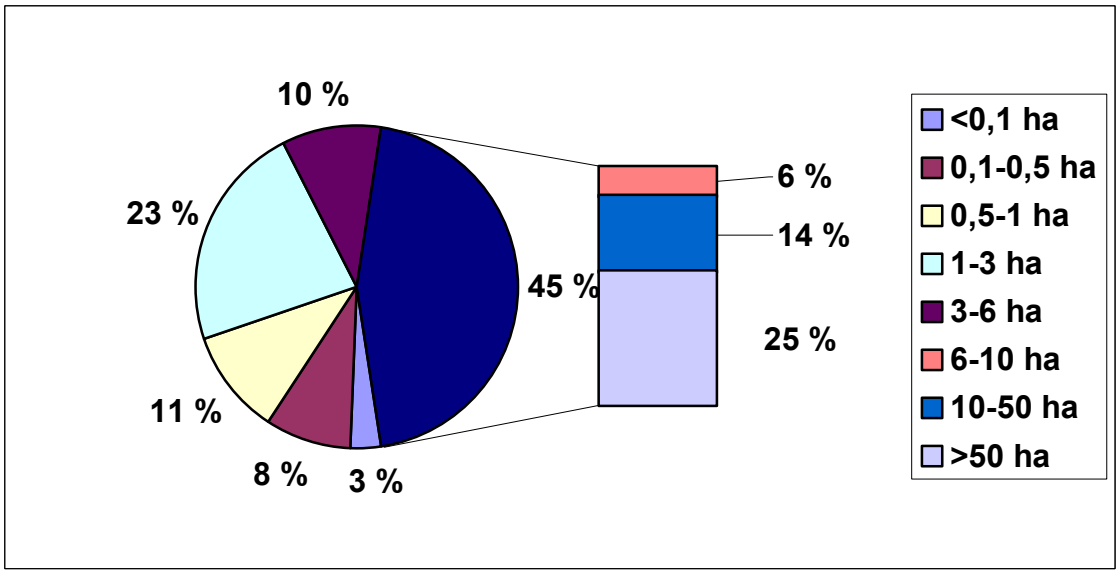

Figure 3.1.4.e - Percentage of the burned area according the size of the fire in 1996-2001.

Of course, regional differences are also of great interest to the forest fire management services. It could be assumed that in scarcely populated areas the forest fires tend to be big. It is only in (Lapland) Lappi and in Kanta-Häme that the average burned area per single forest fire is more than 1 hectare (see Figure 3.1.4.f). The reason for this is that it is enough for the few very large fires in 1997 in those areas to make the average quite large.

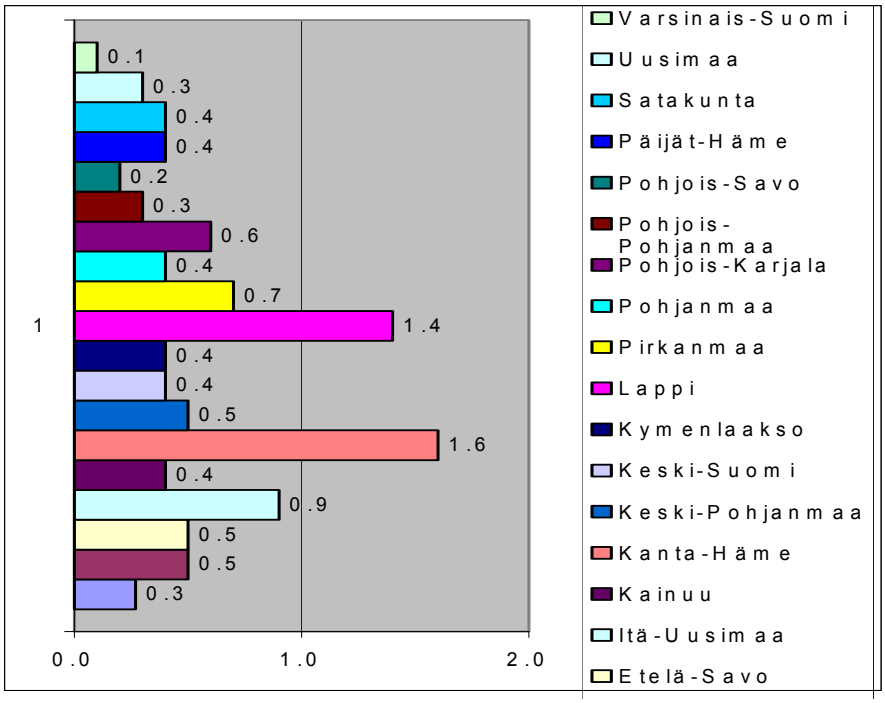

Figure 3.1.4.f - The average burned area per single forest fire in regions.

It seems to be possible that these big fires start in different regions i.e. not only in scarcely populated areas. It is also possible to look at the situation at provincial level. There are five provinces in Finland (see Figure 3.1.4.g). Most fires occurred in Western province. In Lapland and Oulu province (llh, olh) there were only altogether 17 percent of the fires.

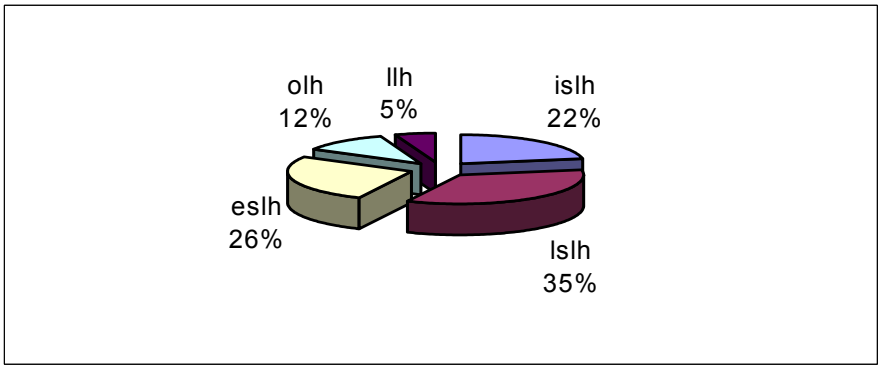

Figure 3.1.4.g - Proportion of the number of forest fires in provinces.

The burned area in different provinces is shown in Figure 3.1.4.h. In Lapland the burned area forms 14 percent out of the total burned area in Finland. Explanation for this is again a few very big fires in 1997. However, it is possible to say that 60 percent of the forest fires as well as burned areas can be found from Western and Southern provinces (lslh,eslh) in other words from the provinces where the most of the people are living.

In fact, most of the forest fires are caused by humans. Especially people who are living in the cities neglect the possibility of a forest fire just because of ignorance. People are no longer used to act in the forests.

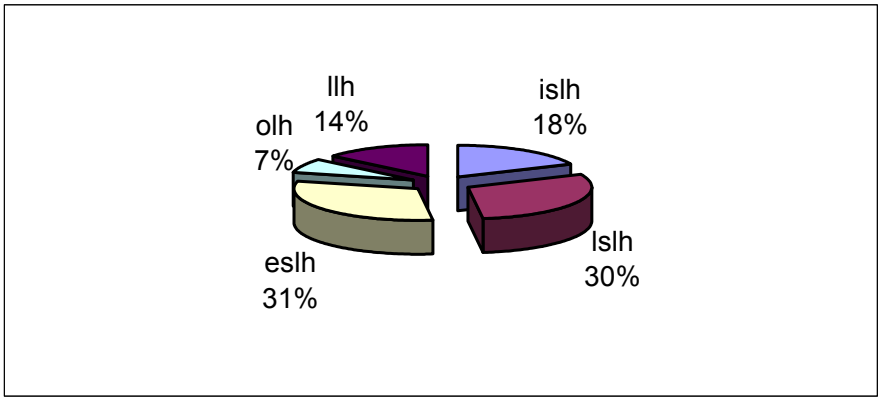

Figure 3.1.4.h - Proportion of burned area in Finnish provinces.

3.1.5 The vision of the future

In evaluating the Finnish system, it is possible to use these graphs presented in above. As it was said, it is necessary to take the mission as a starting point. The mission is to protect life, property and environment. In this respect, Finland has quite an effective forest fire system. Human lives are generally not lost and the damage that forest fires cause is relatively small. What actually is a problem with regards to forest fires in Finland? What is the Finnish vision? What do the Finns want to reach in the future?

If the statistics were to be analysed, it would be possible to say that Finland has a twofold problem. First, the number of forest fires is too high. Although the Finnish forest fire warning system and legislation are working, there is still the problem regarding the behaviour of the people. This means that in order to cut down the number of forest fires, the best way is to support information and education. In other words, there is not much need to concentrate on improving prevention measures in terms of technical applications or legislation.

Second, Finland has a limited number of very big forest fires. This is mainly a problem of early warning. It is felt that humans do usually not cause these big forest fires because they have been reported to be very big already when fire brigade has arrived. This means that they have been developed for some time before anybody has seen them therefore education or legislation is not the right solution to this problem. This leaves only technical applications. Airborne surveys are very expensive and that is not economically reasonable option. This, in fact, leaves satellite detection as the only tool that is affordable. With regards to the evaluation, an investigation is being carried out to get an answer on whether a satellite system offers a suitable tool to tackle at least some of these big fires. If the total burned area could be reduced by 20-30 percent, in practice, this would mean reducing it by 200-300 hectares. In other words, in order to benefit from the satellite system, Finland would need to reduce the total burned area by 50-100 hectares in a year.

The third part of the system that is fast and effective response seems to be in good shape and Ministry of the Interior is continuing the development work with air extinguishing.

3.2 The Portuguese Forest Fire Service (Portugal)

Antonio Fonseca (*National Fire Service, Guarda*)

3.2.1 The Organisation of the Fire Service in Portugal

The Portuguese State does not posses fire brigades. These belong to the city councils, private companies, and the great majority (91%) to volunteer fire fighter associations. From the legal point of view, those associations are entities of private law. The Portuguese government coordinates and supports the activity of the fire brigades through the National Fire Service, an organism that belongs to the Home Office.

Portugal has 444 fire brigades with 41,110 fire fighters. Among these, 24 are professional ones, 14 private and 406 volunteers. These fire brigades are distributed through 18 districts.

From the operational point of view, the Portuguese fire Service is divided in Operational Sectors (18) corresponding to the districts (see Figure 3.2.1.b). Each operational sector is subdivided in Operational Zones that group Fire Brigades whose areas of intervention present similar risks.

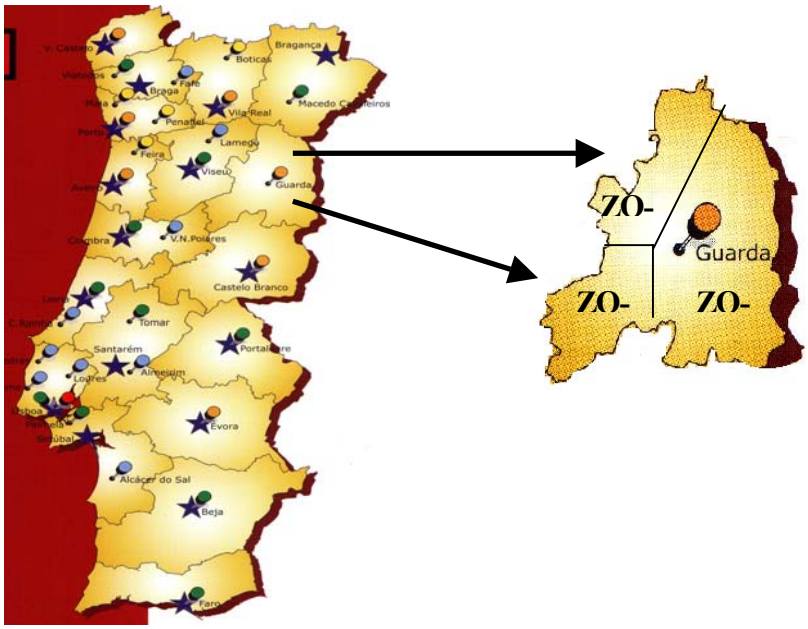

Figure 3.2.1.a – The 18 operational sectors in Portugal and an example of an operational sector with 3 operational zones.

3.2.2 The Forest Fires Combat Device

Portugal belongs to the Mediterranean climate zone, with hot and dry summers and mild and wet winters. The vegetation is of the Mediterranean type, with pines (wild and stone pines) and diverse species of oaks. The eucalyptus is explored in great surfaces for production of paper pulp (see Table 3.2.2.a).

In summer, given the characteristics of the vegetation and climate, the forest fires appear in great numbers, reaching for times considerable dimensions. The number of fires had increased considerably since 1980, seeming to have stabilized in 1995. In the

last year (2001) we have had 26,573 forest fires. Despite the constant increase of the number of the fires, the burned area in each fire had decreased in the last years.

Table 3.2.2.a - Forest area – species in Portugal.

Species	Area (ha)
Pine	1,043,300
Cork oak	730,000
Holm oak	471,000
Eucalyptus	676,500
Chestnut tree	53,800
Oak	134,200
Other leafy trees	87,400
Other resinous trees	37,500
Other woody areas	41,600
Total of forest	3,275,300
Untilled lands	2,071,000

Although the forest fires reach all the territory, they are concentrated in the northeast districts of Bragança, Guarda and Castelo Branco, where the burned surface had totalised in the last year (2001) 45% of the total amount of the country.

The forest fires combat device is a seasonal device created for the National Fire Service and the Fire Brigades, especially organized for the forest zones. The device has the following a strategic concept:

- To guarantee an immediate intervention in rising fires .
- To limit the development of fires.
- To maintain the capacity of first intervention within the Operational Sector, exactly when a spread fire exists.
- To guarantee a co-ordinated sharing of responsibilities in all situations.
- To guarantee that the first priority is the defence of people and their goods, and the protection of forest fire risk zones and areas of high economic value.

During the summer (normally July, August and September) the National Fire Service works together with the Groups of First Intervention of the Voluntary Fire Brigades (Figure 3.2.2.a), which consists of five firemen and one Fire Engine and Support Groups (Figure 3.2.2.b) with two firemen who provide a water tanker.

Tables 3.2.2.b-d show the terrestrial and aerial means of the forest fire seasonal device.

Table 3.2.2.b – Terrestrial means: fire fighters in Portugal.

FIREFIGHTERS	
FIRST INTERVENTION GROUPS	2872
HELICOPTER CARRIED GROUPS	101
SUPPORT PERSONEL FOR DE AERIAL CENTRES	78
OFFICERS FOR COMMAND AND CCOORDINATION	67
TOTAL OF FIREFIGHTERS	3118

3.2.2.a – GPI: Group of first interveção.

Figure 3.2.2.b – GAP: Support Group.

Table 3.2.2.c – Terrestrial means: vehicles in Portugal.

VEHICLES	
FIRE ENGINES	506
WATER TANQUERS	110
GREAT CAPACITY WATER TANKERS	40
COMAND AND COMUNICATION VEH´CLES	23
OPERATIONAL COMMAND VEHICLES	41
SUPPORT VEHÍCLES	6
TOTAL OF VEHICLES	726

Table 3.2.2.d – Aerial means in Portugal.

AERIAL MEANS	
LIGHT HELICOPTERS	15
MEDIUM SIZED HELICOPTERS	5
HEAVY HELICOPTERS	4
LIGHT PLANES	10
AMPHIBIOUS PLANES	2
TOTAL OF AERIAL MEANS	36

It is presumed that these groups guarantee the first intervention, in case of a forest fire, being later strengthened by fire fighters who are set in motion from its residence or workstations. In case the Operational Sector reaches a critical limit of mobilization of the available staff (more or less 80% of the GPI), Groups of Reinforcement are mobilized of other zones of the country that present availability for such. These Groups of Reinforcement are detached from the operations, or placed in Logistic Support Bases as a measure of prevention.

During forest fire period of the year, the fire risk is calculated daily. When a very high or extreme risk is expected, fire services put in action some measures to face the possible fires that can occur. These measures are:

- Aerial monitoring
- Terrestrial patrolling
- Dislocation of terrestrial means for reinforcement
- Temporary dislocation of aerial means.

Forest Fires Statistics in Portugal

Figures 3.2.3.a-d are some graphs portraying some basic statistics in Portugal regarding forest fires.

In Figure 3.2.3.a it can be observed that after 1995 it seems that the increase of the number of fires is stationary. Figure 3.2.3.b shows that in long term, the total of burned area seems constant.

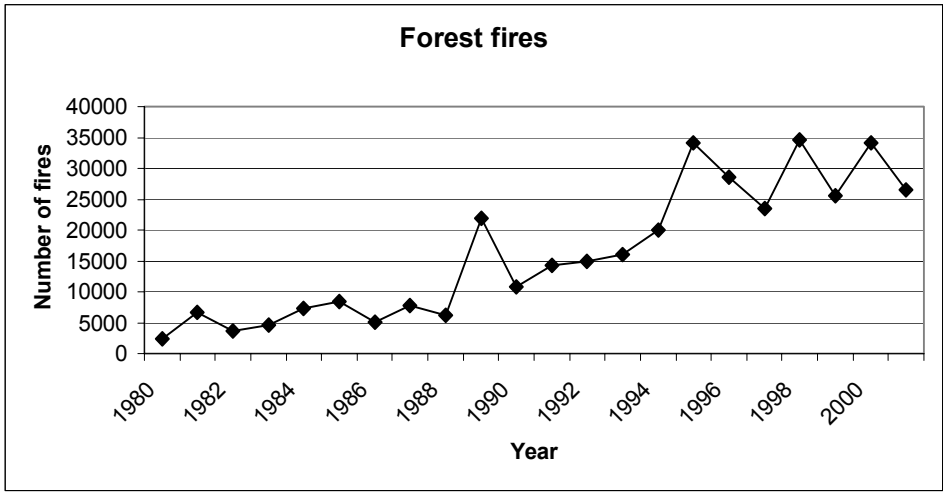

Figure 3.2.3.a – Number of forest fires in Portugal.

The burned area in each fire decreases consistently, as portrayed in Figure 3.2.3.c. Lastly, Figure 3.2.2.d describes the fires statistics in Portugal. It can be observed that forest fires are the highest percentage amongst all other types of fires in Portugal.

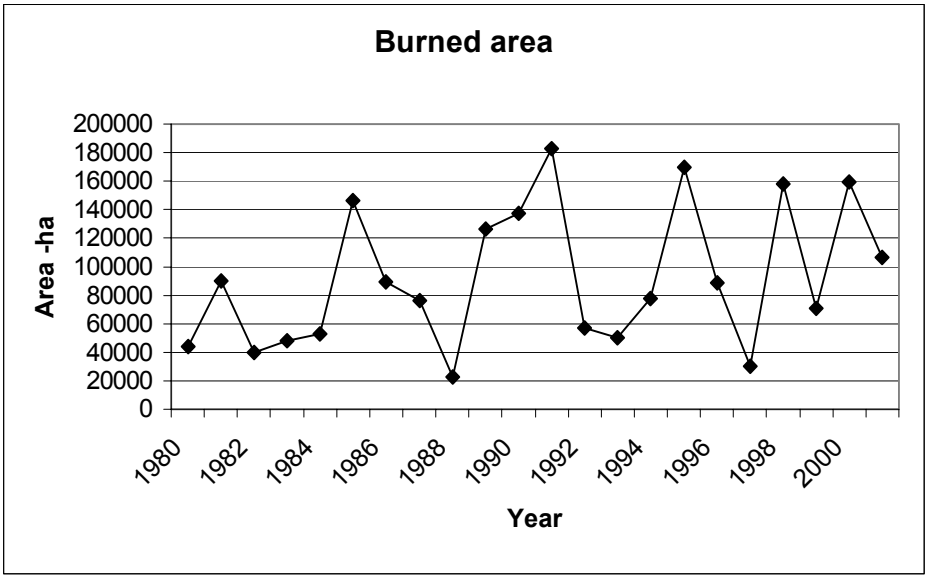

Figure 3.2.3.b – Burnt area statistics in Portugal.

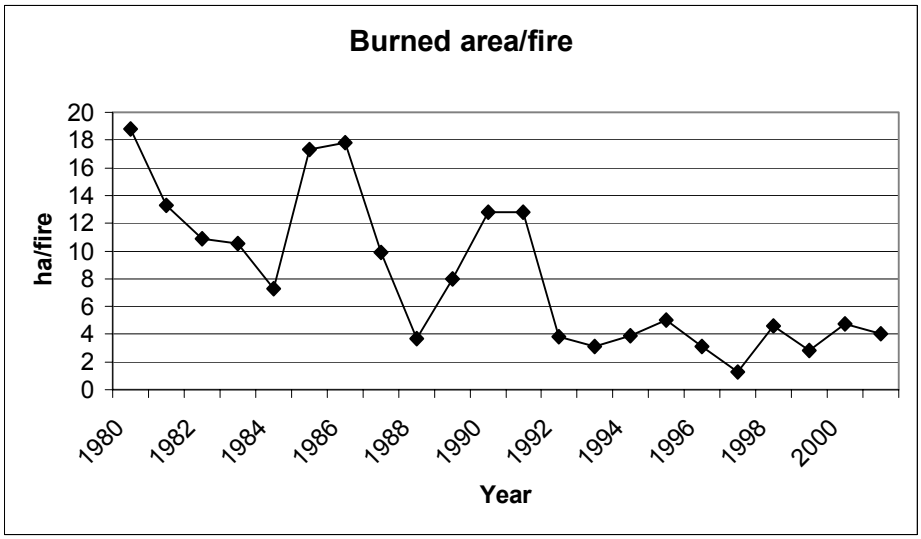

Figure 3.2.3.c – Burnt area/fire ratio statistics in Portugal.

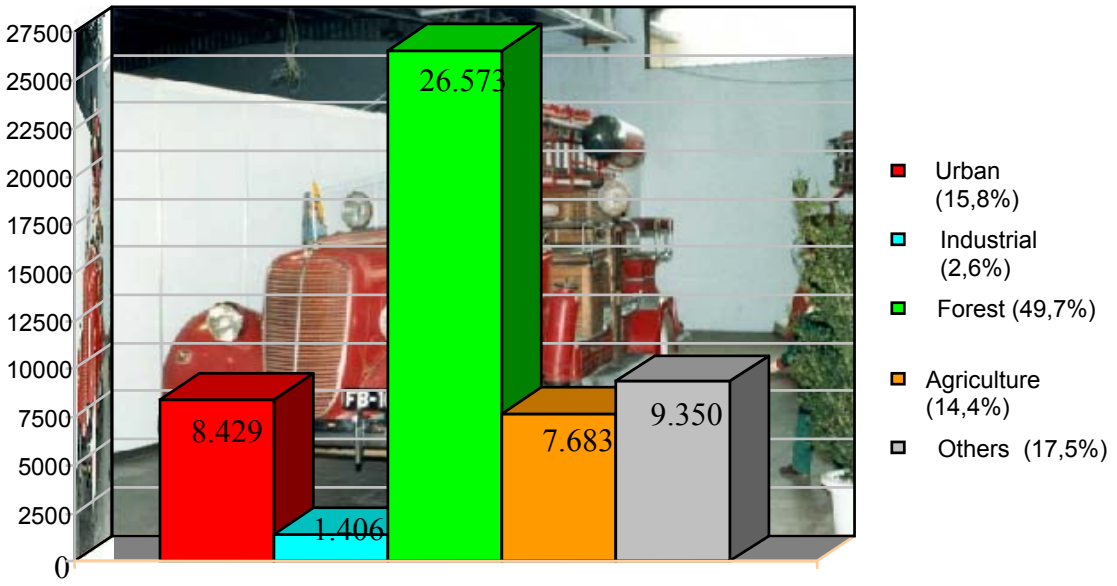

Figure 3.2.3.d – Fires in Portugal.

3.3 Analysis of Bulgarian forest fire problems (Bulgaria)

Vladimir Konstantinov (*National Forestry Board at the Ministry of Agriculture and Forests, Sofia*)

3.3.1 Introduction

The forests in Bulgaria occupy a total of 3.39 million hectares and comprise 34% of this country. With regards to wood area, Bulgaria ranks 19th in Europe. About 29% (1million ha) of its forests are of anthropogenic origin. They have been established mainly by forestation of eroded and erosion-endangered forest territories and abandoned farmlands. Even only these data reveal the importance of the Bulgarian forests not only nationwide and region wide, but also as a part of the European green-zone system. Bulgaria is an important part of the world forest resource, considering its highly valued biodiversity, as it is conserved in forest ecosystems.

Based on historical evidence, forest fires did not occur as a serious problem and threat for Bulgarian forests, due to nature and climatic peculiarities. Forest fires became a problem and threat during the last decade and emerged as a real disaster during the last three years.

The basic reasons for that are:

- Global warming of the climate during the last decade;
- Socio-economic changes in the country in the process of transition to a market economy are often with a negative dimension;
- Structural and organizational changes in the forestry sector, which in many cases were not implanted properly on local and regional level;
- Unfavourable composition of tree species and age structure (high percent of conifer plantations; delayed thinning of plantations and young stands);
- Outdated equipment for fight against forest fires;

- Lack of reliable system for alerting and predicting of forest fires;
- Imperfect legislation, which leads to insufficient coordination between the different governmental institutions and local authorities in the process of putting out of forest fires;
- Insufficient involvement of the public organizations and the society as a whole.

3.3.2 Forest Fires in the last 11 years

The fire situation in the forests is influenced by a large number of factors: natural, socio-economic, social, organizational, resource, etc.. Regardless of the analyses that were made, it is difficult to explain the comparison of the parameters of fire situation in forests for the years 1991 and 2000 – the number of fires increased by 23 times, the average area per fire – 5 times, and the burnt–down total area – 112 times! Table 3.3.2.a shows some statistics regarding the number of forest fires between 1991 and May 2001.

The primary analyses of the causes of the 6531 fires that burst out during the decade reveal that only 1% of these were due to a natural phenomenon – the lightnings during the so-called "dry thunder storms" - while the remaining 99% were due, to a greater or lesser extent, to either human actions or inaction. The analyses also reveal that the causes of about 65% of the fires have not been found, thus remaining unknown. Of all the causes of forest fires that are known in Bulgaria 72% result from non-observance of the fire-prevention rules, by people in or near the forests. The inference from this is that without a clear idea of the causes of fires, fighting these would be ineffective. This failure can be explained with the weak points of the organization and carrying-out of the activities for finding the causes of these fires. The other factor of this failure is the insufficient preparedness of the persons involved in this activity, especially those who work for the State forestry's.

Table 3.3.2.a - Statistics regarding the number of forest fires between 1991 and May 2001.

Year	number of fires	total area, ha	forested area, ha	not forested area, ha
1991	73	511	492	19
1992	602	5,242	4,602	640
1993	1,196	17,269	15,600	1,469
1994	667	14,107	12,903	1,204
1995	114	550	529	21
1996	246	2,150	1,933	217
1997	200	777	685	91
1998	578	6,967	5,913	1,054
1999	320	8,291	7,636	655
2000	1,710	57,406	51,192	6,214
2001	825	20,138	17,982	2,156
2002*	266	3,610	3,410	200

* until May 2002.

The established forest plantations consist mainly of coniferous species (Scots pine, Austrian pine, and Norway spruce). Most of them are in the low mountain forest-vegetation belt and in the lower portion of the medium mountain forest-vegetation belt. It was in these forest plantations where most of the forest fires burst out and raged in the

recent three years (1999-2001). Only in the fire-peak year 2000 there were 1,710 forest fires and the burnt forests amounted to a total of over 57,000 ha.

The forest fires were nationwide and they affected protected-nature territories of significant conservational importance for our nature. The most severely damaged places were the national parks Rila and Central Balkan. In Rila National Park unique formations of rare, protected and endemic species, such as Rila primrose, Bulgarian avens, dotted-flowered gentian, yellow gentian, golden columbine, Rila fesque, etc., were destroyed. Three reserves in Central Balkan National Park, namely Kozya Stena (Goat Wall), Sokolna (Falcon Place) and Djendema (The Hell) were damaged, as well as a part of the unique reserve Chervena Stena (Red Wall), in the West Rhodopes, and, to a lesser extent, Pirin National Park.

The dynamics of the forest fires in the country show that 3,000 ha per year were burnt down in the end of the 19th century, as in average. The corresponding data about the first half of the 20th century and the period from the 1950s up to the 1980s are 1.6-1.8 thousand ha and 800-1,000 ha, respectively. In the recent 10 years the problem with forest fires obtained the nature of a crisis, yet the situation in 1999-2001 could be defined as catastrophic. From 1991 to 2001 a total of 132 thousand hectares of forest areas (about 3.5% of the forest lands in the country) were burnt down, 57.4 thousand of these in the 2000 year. It was just in the year 2000 when 1/3 of the forest fires destroyed 1/2 of the total area burnt down until then.

The analysis of the prerequisites for and, causes and factors of forest fires suggest the inference that Bulgaria, with respect to forest-fire-hazard parameters, should be associated with the traditionally fire-endangered Mediterranean region. And if the consequences of the forest fires in Sakar Mountain, in 1999, had the size of a local catastrophe - the damages that succeeded in the following two years resulted in a national, natural calamity. Not only were economic losses suffered, but inestimable, much greater damages were also caused to the growth conditions, as a result of erosion, soil destruction, disturbance of the thermal and water balance of ecosystems, change of the main tree species, radical changes in the floristic composition and phytocoenotic structure, change in the water-runoff nature, aggravation of the sanitary state of adjacent intact stands, drastic reduction of the CO_2-fixation capacity, so that the existing biogeocoenosis was completely or partially destroyed.

Crown fires (68%) dominated in the coniferous forests, thus converting these into permanently damaged stands requiring artificial regeneration. Similar is the state also of 15% of the burnt-down deciduous forests, after crown fire. A disturbed forest ecosystem can be restored in two ways:

- ***Natural***, for a period from a few up to a few tens of years (in some cases 100-200 years), as dependent on the kind of forest fire and the inventory characteristics of the burnt-down site;
- ***By reforestation***, which reduces the regeneration period much, and is, in particular cases, the only solution.

It should be pointed out that if forest-restoration operations should be delayed and intensive erosion processes be not prevented, it would be practically impossible to restore the environment to its former state.

In the recent 2 years, restorative reforestation was carried out on a total of not more than 1,200 ha of burnt-down areas. The preliminary plans made at the National Forestry

Board show that now there are a total of 21,700 ha of burnt-down areas to be restored by reforestation. Funds amounting to 64.7 million levs (32.4 million Euro) are necessary for the purpose, only for the first year of the plantations lifetime. For additional care in the course of 3-5 years after the reforestation, about 37 million levs (18.5 million Euro) will be necessary. Besides, the funds that can be provided by the National Forestry Board, for forest-establishment operations, amount to 18 million levs (9 million Euro) per year. It should not be forgotten that all funds for restoring forests after fire are outside the planned budget, so these cannot be planned in advance.

Judging by the data presented, the main factor that hampers solving the problem seems to be the deficit of funds for restoring the large, total burnt-down area. This deficit results from the limited budget of the National Forestry Board and the reduced revenues it receives. However, a profound consideration reveals that the situation is of comprehensive nature, great magnitude, and dynamism.

Extreme problems arise, one after the other: peak of the forest fires and slump in reforestation; desertification due to climate change leading to forests having high fire hazard potential; deficit of funds and organization-caused impediments and complicated mutual relations between the sides in the process; carrying-out restitution and the appearance of many but petty forest owners who, in most of the cases, live far away from their property and are estranged from the problems of its management, and insufficient motivation of employees; etc..

The Government faces the necessity of urgently solving the problem (carrying out restorative operations). It is determined by two main groups of reasons:

Environmental - determined by the damages caused to forest ecosystems and the environment, and the hazard of increasing these with the development of erosion, the arising of phytosanitary problems, etc.

Legislation-imposed - the Forestry Act does not allow reduction of the existing woodiness (Article 7, Paragraph 2) and requires that forests shall be restored in 2 years after the fire has been extinguished (Article 43).

Forest fires burst out unevenly according to years and regions, and this makes prognosticating them and planning the operations to carry out very difficult, especially the preceding seed-collection, and the production of seedlings for a term of 1-4 years. The experience gained from history teaches that not taking steps to restore forests results in a slump in economic activity and leads to irreversible aggravation of the environment, especially around settlements.

Considered in this way, the problem is outlined as greater and, with respect to its essence, environmental, social, and economic. The impediments that result from organization are substantial.

Protecting stands that are situated next to burnt-down forests is a relatively new problem for our forestry sector. However, it becomes more and more important for the restoration of burnt-down forests and for limiting the damages to the environment of as the impacted growing stock so the adjacent stands, because of the sizes of the forest fires.

Forest fires provide conditions for the mass propagation of insect pests, such as bark beetles, weevils, borers, tree wasps, etc. The increased frequencies of these pests result in attacks on adjacent intact forests, with aggravation of their phytosanitary state.

So far, the structural reform that was made in the forestry sector, namely allowing companies and sole traders to carry out forest-establishment operations, has been going with difficulties and its quality is insufficient. Forestation cannot meet the current demand for it, with respect to either areas, or quality. It is also insufficient to restore the fire-damaged areas. The present kind of organization does not guarantee the participation of a sufficient number of qualified personnel, nor does it guarantee motivation of implementers and effective control.

The different kinds of ownership (state, municipal, private, etc.) and the management of different forest territories by the National Forestry Board and by the Ministry of the Environment and Waters also lead to the development of the problem. It is extremely difficult with private forests. The available data show that 15% of the burnt-down forests are private and other 22% are municipal. The lack of funds, the comparatively low qualification, motivation and training of private forest owners, as well as the small-area form of forest property, make the restoration of burnt-down forests extremely difficult. The necessity of legal and other ways of helping, stimulating, advising and training the owners of non-state forests, to actively participate in the operations to re-establish burnt-down forests, is obvious. This is a part of the great goal - to form public awareness of the restoration of fire-damaged forests.

3.3.2 References

Carlson, D.P.Reich, P.Bolstad and L.Frelich, 1999. Patterns of fire severity and plant response of a 1,200-ha crown fire in the boreal forest. University of Minnesota, St.Paul, MN 55108 USA.

David, A. and V.Parker, 1999. Recovery of northern coastal scrub after fire along a fire-intensity gradient. San Francisco State University, San Francisco, CA 94132 USA.

Lyubenov, K. and P.Panov, 2001. The Forest Fires in Bulgaria in 1991-2000. Typescript (in Bulgarian).

Ministry of Agriculture and Forests - National Forestry Board. 2001. Report of the National Forestry Board for the Period 1997-2001. (in Bulgarian).

Tashev, A. 2001. Effects of Forest Fires on Forest Ecosystems. In Gora (Forest) No.6, pp.9-11 (in Bulgarian).

3.4 The Romanian Experience in the Management of Forest Fires between 1986 – 2001 (Romania)

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3.4.1 Introduction

In the first half of May 2002 in Romania, an increased deficit in the quantity of precipitation was recorded compared to the 5 months before. The presence of a drought phenomenon was first identified, and afterwards, it transformed into one of the worst meteorological and hydrological drought ever recorded in the country.

In addition, the beginning of the year 2000 was characterised by two distinct time intervals characterised by different hydro-meteorological phenomena, as described below.

- The first 4 months of the year was very wet due to large amounts of precipitation. This resulted in significant maximum discharges on the rivers from the north of the country and consequent flooding.
- The rest of the year was characterised by meteorological drought, which started at the beginning of the summer.

The period April-June was characterised by a warm weather and the temperatures recorded exceeded the normal values for that period in almost all of the country. Daily records of maximum temperature at many meteorological stations from the south of the country were registered. Due to this increased thermal regime, the precipitation deficit was gradually generalised all over the country.

The months of July-August were very warm, with many hot days and tropical nights in the plain area. During July the highest maximum temperature value ever recorded during the meteorological observation period was exceeded, thus achieving a new record of temperature of 43.5 °C at Giurgiu on 5 July.

The highest temperature value recorded in August was 41 °C in the south west of the country. During the entire summer, the drought phenomenon was worsened by the very low relative humidity of the air, which was less than 30%, associated with tropical nights with maximum temperatures of 17-20 °C, coupled with very low reserves of soil humidity.

In August, a precipitation deficit was also recorded in most of the territory. In September the thermal regime was normal whilst the precipitation measurements were normal, but in some areas they were above average for the month.

In the period October-December the monthly average thermal regime was higher than usual. At many meteorological stations, the daily minimum and maximum values of temperature observed were higher than usual.

The precipitation deficit was persistent and a long lasting drought established itself all over the territory. One of the consequences of this phenomenon was the drying up of the forests, which favoured the development of forests fire in Romania in 2000, severely affecting the forests almost 10-fold more, in terms of number of fires and burnt hectares of forests, as compared with the previous “normal” years (as shown in Figures 3.4.1.a and 3.4.1.b).

In Romania, 1904 forest fires were recorded during 1986-2000, which affected 7384 hectares of forest.

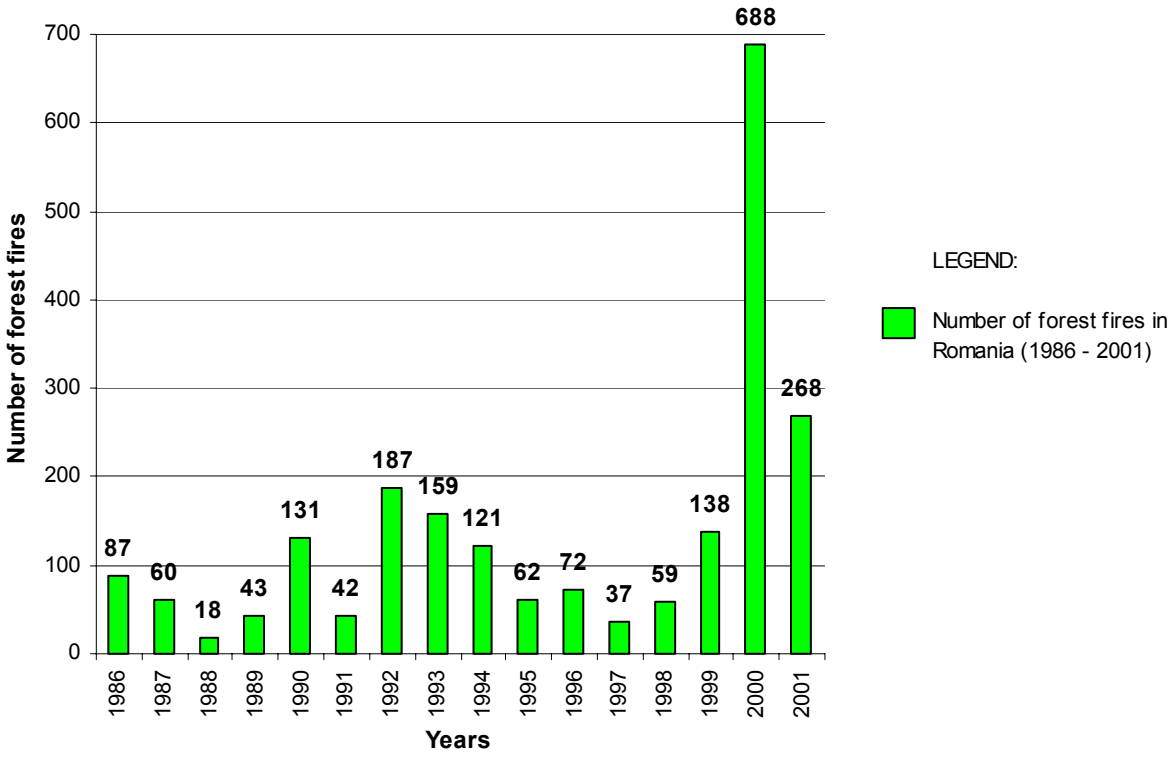

Figure 3.4.1.a – Number of forest fires in Romania (1986 - 2001).

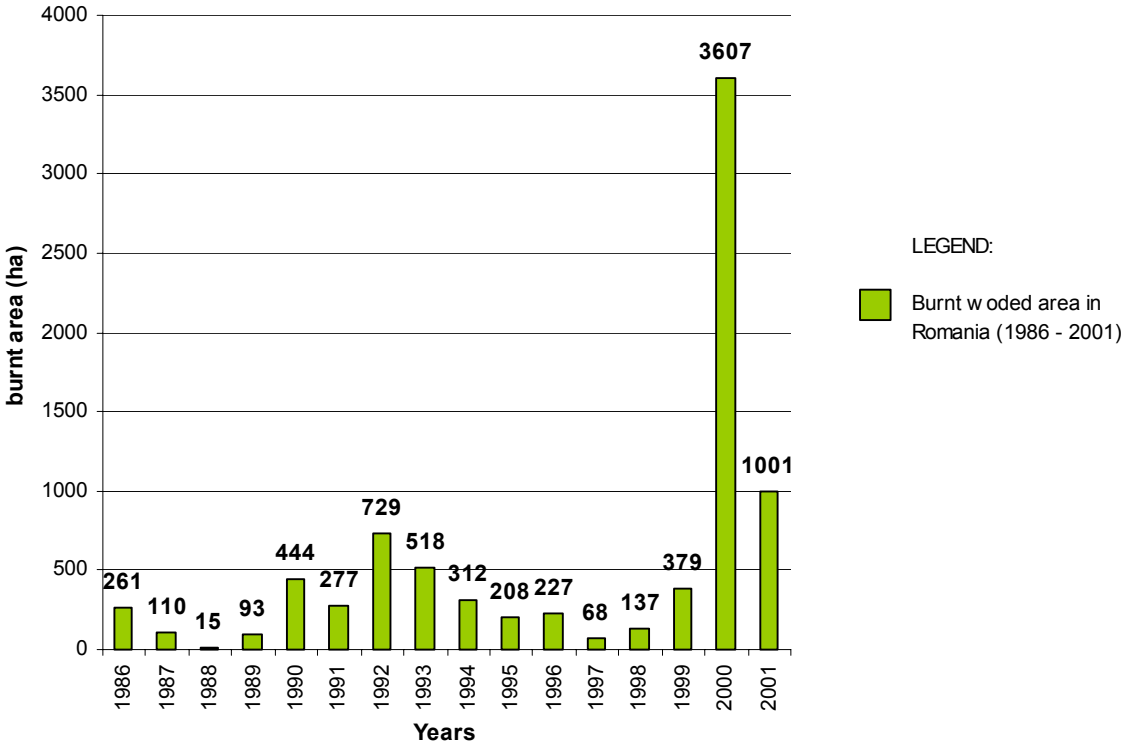

Figure 3.4.1.b – Burnt wooded area in Romania (1986 - 2001).

The most devastating forest fire was produced during 17-23 June 2000, in the perimeter of the forestry district Novaci from Gorj county. The burnt surface was about of 179.3

ha, from which 46.3 ha affected the peripheral areas of the forest and 133 ha the inner part of the forest. The estimated value of the damages produced due to this disaster event over exceeds 70,000 Euro.

During 2000, the major causes of forest fires was represented by the agricultural practices of the people from the rural area, represented by the cleaning of the fields by uncontrolled ignition of the dried plant wastes (as shown in the Figure 4.3.1.c and 4.3.1.d).

The most severe year in terms of economical losses due to the forest fires was 2000, due to the worsening of the weather conditions (as shown in Figure 4.3.1.e).

In the last 10 years, during the forest fires intervention was recorded a single human loss, on 20.11.2000, an inhabitant that participate at the extinguishing of a fire forest in Alba county.

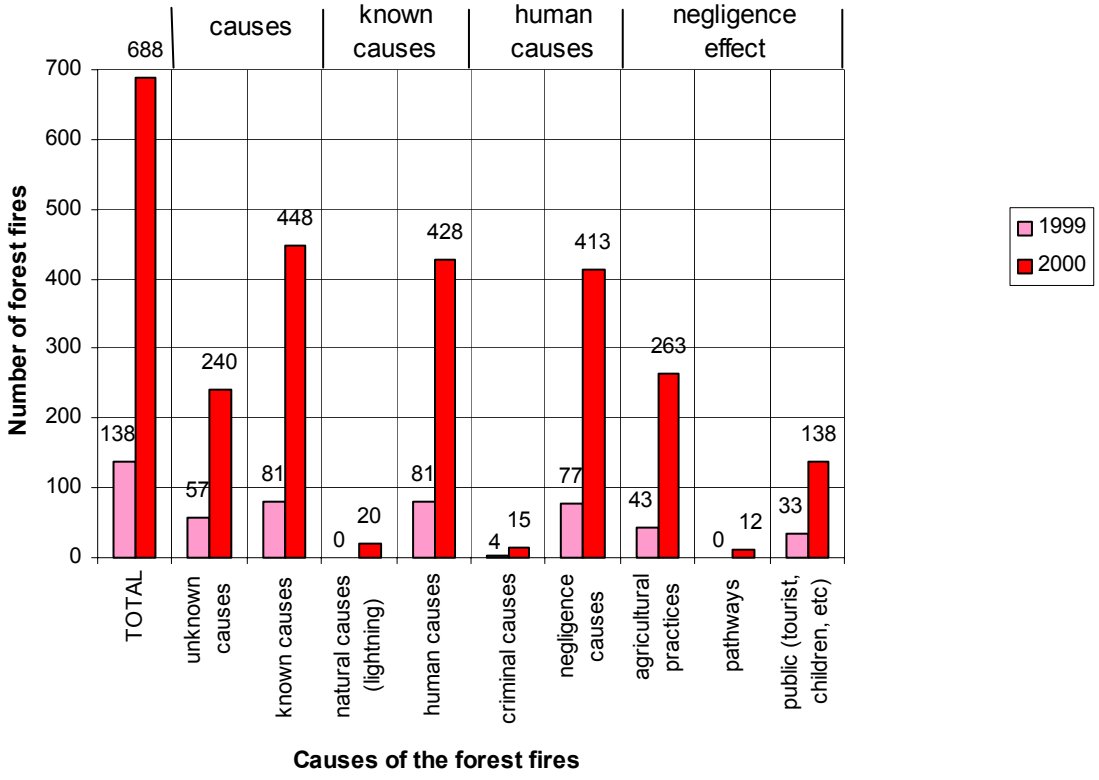

Figure 3.4.1.c – Causes of forest fires in Romania – comparison between the number of forest fires in 1999 and 2000.

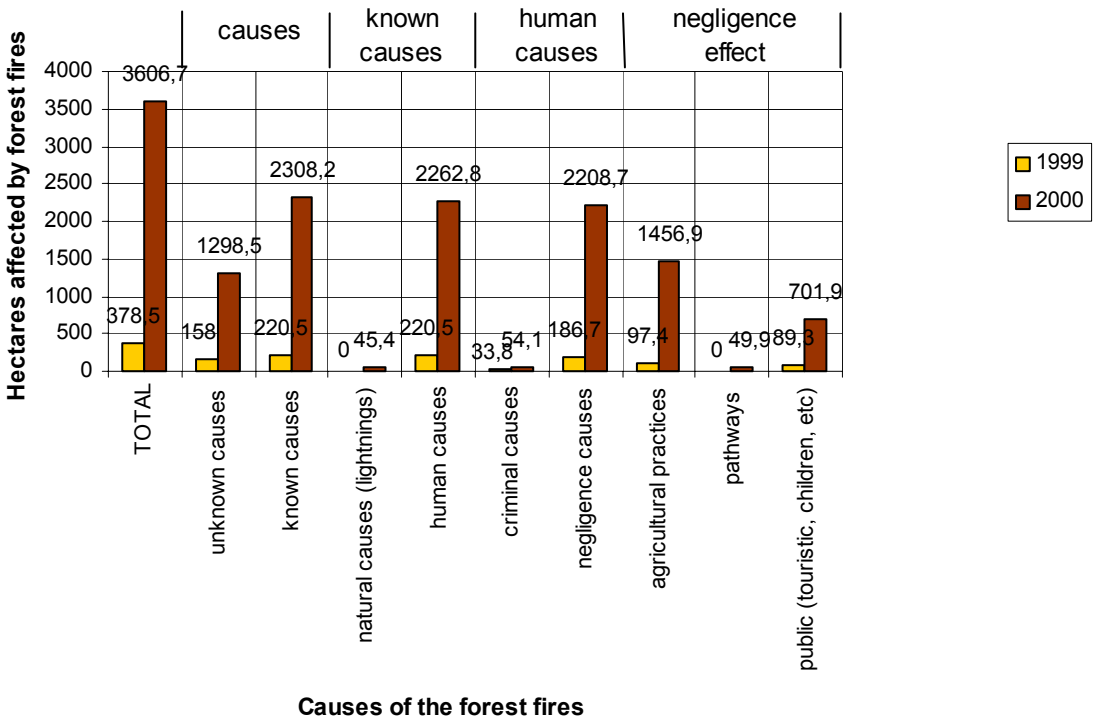

Figure 3.4.1.d – Causes of forest fires in Romania – comparison between the surfaces affected by forest fires in 1999 and 2000.

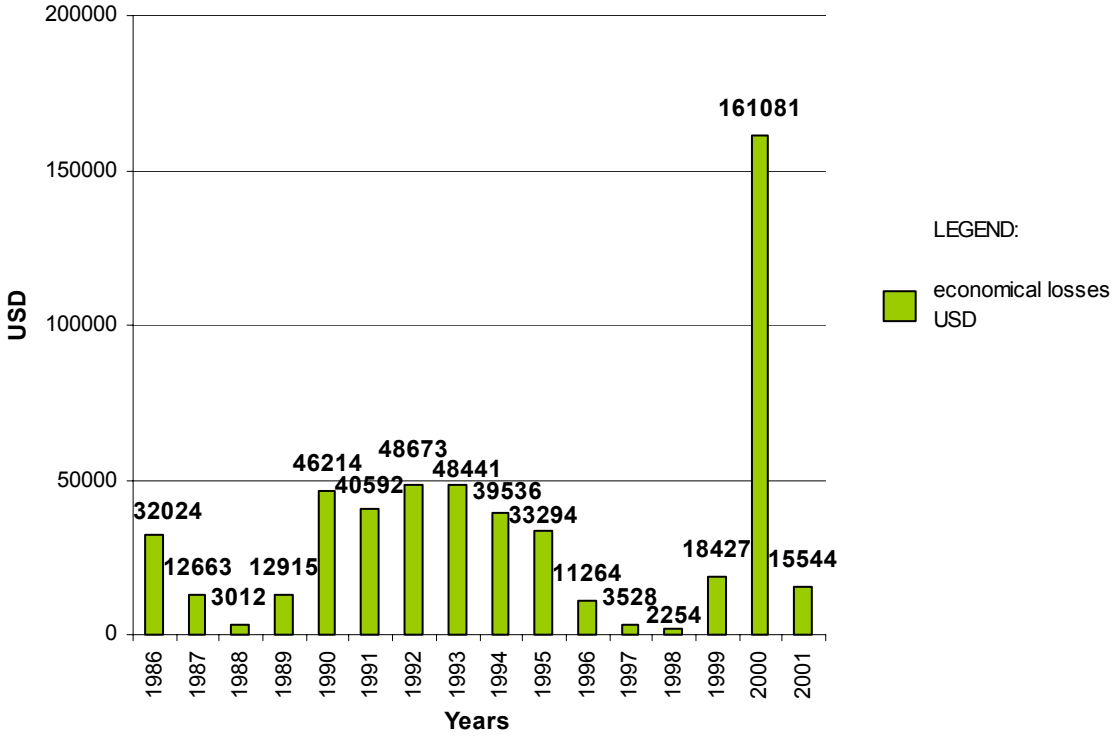

Figure 3.4.1.e – Economical losses due to forest fires between 1986 – 2001.

3.4.2 Lessons learnt in the prevention phase

Taking into consideration the risk of producing the fires in the forest area, mainly due to the vegetation weathering, the National Forest Administration (ROMSILVA) at the level of the forestry districts in the territory took a series of technical and organisational measures as follows:

Technical measures:

- The number of the places for camping, smoke and parking of the cars in the tourists forests were increased 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.
- The hygiene works were undertaken in due time and were carried out qualitatively by removing the dried fallen trees.
- During the design phase of the forestry roads, it was essential to take into consideration that they had to be accessible for the fire fighters vehicles and that they had to follow an optimum pattern in order to aid the limitation of a possible forest fire.
- The pastoral borders of the forest areas with high risk of fires were also delimited by a trench dug with a width of 0.5 m, along to the same altitude topographic curve.
- The realisation of isolating barrages bands by soil, at the limit of the roads and railways which crossed the forestry area, was carried out.
- The creation of belts of deciduous species both at the limit and the inner part of the coniferous forests.

Organisational measures:

At the same time, complex patrol actions were planned, especially in the most vulnerable forest areas and with an increased tourists traffic, especially during the drought periods and during the weekends.

Furthermore, the importance of the self-consciousness of the people involved in the forest preservation, especially the ones from the peripheral areas of the forests, also the tourists, shepherds, forest fruits collectors, bees farmers, the forestry workers from the district units was stressed. They needed to know and strictly follow the specific norms for protection and extinguishing the forest fires.

A sustained programme of instructive-educational actions geared for the public was developed. Suggestive panels and placards with textual warnings and drawings were positioned in the most treaded on pathways of the forest area. Useful information regarding the protection against forest fires was also broadcasted by the local radio and television.

On the basis of the defence plans against the disasters, together with the Civil Aviation Department, aerial patrolling missions were organised for observing and alarming the presence of the fires, during the draught periods and in the areas with increased risk for forest fire.

Lessons learnt

⇨ Prevention actions are incorporated into a forest fires defence strategy which consists of:

- risk evaluation and analysis of the produced fires, the forecasting of the conditions which favour the triggering of the fires and the monitoring of forest fire risk;
- establishment of coordinated actions for diminishing the highly increased frequency of the forest fire causes;
- assurance of the specific forestry measures for the limitation of fire propagation and for the reduction of material loses, on the basis of forest development projects;
- surveillance of the forestry fund and the human activities in the forest areas for the timely detection of the fire centres;
- awareness raising and education of the citizens regarding the necessity of forest protection against fires.

3.4.3 Lessons learnt in the preparedness phase

At the local level, when forest fires affect a large area, an operational command unit is set up, which is led by the prefect of the county, who applies the "Plan of defence and intervention in case of forest fires".

According to this Plan and in this kind of situation, the forestry personnel take action, together with military and civilian fire-fighters, forestry workers, units belonging to the ministry of interior, civil protection units, army units (especially the "mountain hunters"), citizens, mountain rescue teams and medical personnel. All these above mentioned forces represent the "System of intervention forces for defence against the mass forest fires", which is divided into three types of forces: specialised, complementary and auxiliary.

- ***Specialised forces***. They are made up of large units and sub-units of military fire-fighters, public services of civilian fire-fighters and private civilian fire-fighters (composed of commercial societies at the local level). These forces are specialised on precise activities and missions focused on:
  - prevention and extinguishing of the fires, co-ordination, control and provision of technical assistance in this field, according to the law;
  - rescue and/or protection of the endangered citizens, animals and belongings;
  - provision of first aid medical assistance, evacuation of the population and securing of public institutions and economical units, depending on the forces and means available.
- ***Complementary forces***. They are organised in due time at the level of specialised institutions of the local and central public administration, according to the needs established by the scenarios described in the defence plans. This category consists of police, gendarmes, border police, Civil Protection Command unit, the "Corps of the Public Safeguards", sanitary and veterinary inspecting units and formations, and also, other safeguarding units for people and goods. These forces are prepared to carry out activities such as:
  - application of precautionary measures regarding the public order during the public emergency situation generated by mass fires in forest areas;

- guidance of the traffic in the direction and in the established zones;
- population evacuation of the public institutions and economical units;
- limitation of the disaster magnitude and liquidation of the consequences with the endowment means;
- ensuring of the necessary connections;
- ensuring of the urgent medically assistance;
- development of the actions for aid of the people, of the animals and goods, the evacuation and the transportation of the victims, supply with food and specialised sanitary assistance for the affected persons.

- ***Auxiliary forces***. They are organised and prepared in due time to take action according to the defence plans and are made up of the population and the employees of the economical agents and public institutions from the endangered areas.

The specific materials of intervention which are ready to be used in this kind of situation are the following: intervention vehicles with pumping tankers and engine-pump, jigsaws, bulldozers, tractors, trailers, light fire extinguishers, and various other tools (e.g. axes, shovels, spades, pick-axes, mowing, pitchfork, brooms and buckets), fuels, etc.

Lessons learnt

⇨ In order to have an efficient preparedness phase, the endowment with means and equipment of intervention has to be done in a concerted way. In the forest area, the necessary supply of materials for forest fire extinguishing has to be secured according to the risk level, which has a corresponding potential damage value represented by density of the points. This density has to be increased in the forest areas close to human settlements, tourist resorts, land endangered by erosion, or strategic objectives. For this type of increased forest fire risk, it is necessary that the water reservoir supply is located at a maximum distance of 3-4 km between one another and the density of the access network to be at a minimum distance of 2 km for every 100 ha of forest.

3.4.4 Lessons learnt in the response phase

The Autonomous Administration of the Forests ensures the application of prevention measures, extinguishing of forest fires, including the activity of safeguarding the forestry domain under its administration against other damaging activities, such us illegal cuttings of the trees, soil degradation, illegal pasture or poaching. According to their legal attributions, prefects, county and local councils, units of the Ministry of Defence, units of the Ministry of the Interior and civil fire fighters, have the obligation to support the extinguishing of the fires in the forest areas. The physical persons located in forest areas have the obligation to participate in the extinguishing of fires.

The organisation framework of the activity of forest fire extinguishing is carried out on the basis of the intervention Plans, which are drawn up at the restraint levels (cantons, districts) and at the county level. In these Plans for intervention the conception of intervention and the specific methods of fighting against fires, along with information dissemination and alarming according to emergency type, are stipulated. On the forestry maps the access roads, the water sources and the strengthen points in which are stored intervention materials are marked. The co-ordination of the extinguishing activity, depending on the magnitude and the location of the forest fire event, is ensured by the

forestry personnel or by the fire fighters. The basic principles which are taken into account during forest fire extinguishing are the following: forecasting, extinguishing of the fires in the preliminary stage and limitation of the extent of forest fires. Forecasting implies that a detailed knowledge of the forest area characteristics is required to anticipate in due time the evolution of the phenomenon and to extinguish the forest fires in the initial stage. This means that it is very important to detect a fire as soon as it is produced and to intervene in less than 10 minutes after is produced.

After the forest fire is extinguished, losses caused by the fires are evaluated. This operation is made by a commission specially set up for this purpose, through decisions enforced by the leading forestry directorates. The president of the commission, in his quality of delegate from the forestry directorate, participates in all the activities regarding the reconnaissance and evaluation of damages.

The evaluation of the losses is carried out by the forestry district in which territory was produced. This is based on the methodology established by the internal Order of the Minister of Waters, Forest and Environmental Protection, no. 491/22.07.1992. The value of the damages produced is deducted according to the effective costs on the basis of the legal documents recorded in the accounting process.

The values of the losses, i.e. mainly the value of related works or used means for the forest maintenance and the wood material, which result from the above mentioned documents, are diminished according to the value of the recovered materials.

If there is total loss, the value of the damages is represented by the integral costs of the respective works of reforestation, as the works of forest maintenance are no longer efficient.

In the case of a young forest plantation, the value of the losses recorded after a forest fire disaster, are represented by the cost of the works carried out until the fire took place, registered in bills regarding measures for: soil preparation, cost of spreading the reforestation materials, plantation activity, plantation maintenance, including the prevention and combating of pests. If these works are no longer necessary for the preparation of the new forest plantation, the land preparation damages are not anymore totalled.

Lessons learnt

- ⇨ In Romania institutions or specialised units did not exist for aerial interventions in the case of producing of large forest fires and especially in the very difficult accessible areas.
- ⇨ The intervention vehicles of the fire-fighters are difficult to be used in the mountains area, due to their increased gauge and specialised types of vehicles for forest fire intervention did not exist.

3.4.5 Information dissemination

The decisional and informational flux, which includes the following systems: counties and local disaster defence commissions, fire-fighters, Autonomous Administration of the Forests through the forestry personnel, functioned properly, corresponding with the actual technical facilities and endowment.

Lessons learnt

⇨ The major response inefficiencies that took place consist of the following:

- incomplete supply of radiotelephones or mobile telephones of the personnel involved in the operational activities;
- non-ensured permanence at some rural halls (during the free days);
- lack of radars, which can supply complete information regarding the dangerous meteorological phenomena over the Romanian territory (such us strong winds, etc);
- lack of a modern satellite system to monitor the risk evolution in the forest area.

3.4.6 Socio-economic aspects

In the year 2000, the annual reforestation totalled approximately 50-55 thousand ha in the last 5 years. This value does not counter balance the cutting-down of trees not does it stop the effect of some natural disasters (in the last 5 years these calamities affected more than 10 million cubic meters of wood mass), such as soil erosion (the erosion was very intense on 2 million ha), landslides, etc.

Also the forests have essential functions such as, maintaining the biodiversity, providing a habitat for wild fauna and flora, protecting the landscape, being a tourist area, etc.). They also play an important role in the hydrological cycle and any perturbation experienced generates changes in the hydrological process (water cycle) which, in the mountain areas, can compromise the slope stability and the fight against avalanches. Furthermore, the realisation of other means of artificial protection is very costly and difficult to apply. The forests have an esthetical value which cannot be neglected and which has to be taken into account in the evaluation of the damages.

That is why the 2 billion of ha of land that is heavily eroded, along with the other approximately 700,000 ha affected by landslides represent the real necessities for reforestation. This must be made a priority in ecological reconstruction programmes that must take into account the many beneficial effects which can be obtained from the economical, social and ecological features of forests, in the short term, as well as in the long term.

3.4.7 International dimension of the disaster and international media considerations

According to some estimates at the international level (under FAO or WMO), coupled with the studies of the Romanian researchers, there is a warning of a progressive tendency of the atmosphere, associated with the extension of the drought and aridity phenomenon in the south-eastern part of Europe in the next few years. The phenomenon is also favoured by some uncontrolled human activities (water resources exhaustion and pollution).

The drought phenomenon on Romania's territory is a specific characteristic driven by the location of our country. Romania is in an excessively temperate climatic area with very large deviations of the climatic, agro-climatic and hydrological parameters from the normal values. This phenomenon tends to repeat itself every 15-25 years, but not in a strict cycle.

In Romania, the phenomenon is confirmed by the drought experienced during the last decade. The evaluation of trends, extension, migration and future evolution of the

drought and aridity phenomenon is of a special interest to the countries in the affected area.

4 RECAP OF LESSONS LEARNT

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It is understandable that the lessons learnt from forest fire disasters will inevitably be event specific. Each disaster will be dictated by a unique demand and supply mechanism. From the *demand side*, the fire will have its characteristics, the landscape will be of a particular style, the climate will have a specific scenario, etc.. On the other hand, from the *supply side*, the response will have a disaster management scheme native to the country and location in which the disaster has struck.

This chapter aims to summarise general lessons learnt that have been retrieved from the forest fire disasters portrayed in this report, which have been grouped according to the disaster management phase (prevention, preparedness and response). Furthermore, where relevant, the lessons learnt have been grouped into the following areas:

- Regarding the hazard
- Regarding coordination of activities
- Regarding planning issues
- Regarding maintenance of infrastructure
- Regarding training
- Regarding allocation of resources
- Regarding the public.

Lastly, lessons learnt regarding the dissemination of information are also summarised.
It is important to bear in mind that the lessons learnt are not ordered according to their importance, but mainly according to “logical” considerations.

4.1 Lessons learnt concerning prevention measures

Regarding the hazard

⇨ Forest fires are not tied to rigid concepts of seasonality (summer/winter), but can actually occur at serious levels before the "fire season", under specific weather conditions related to prolonged periods of drought followed by an increase in temperature and African winds.

Regarding planning issues

⇨ It would be preferable if regional plans foresaw a minimum number of teams in support of the institutional entities responsible for fire-fighting efforts.

⇨ Surveillance must be intensified, discouraging the damaging efforts of arsonists, in collaboration with police forces.

- ⇨ It is essential not to make the serious mistake of carrying out monoculture practices. It is necessary to maintain all fuel breaks and to brush combustible material existing in forests, either through mechanical cleanliness of very difficult use due to the fragmentation of forest property, or through controlled burning.
- ⇨ Something needs to be done to call people back to the forest, keeping it clean and accessible, and preserving without brushes the boundary areas of dwellings. Forest planning has to protect the heterogeneity of existing species, avoiding the continuity of the forest of the same specie, particularly of resinous along many hectares.

Regarding maintenance of infrastructure

- ⇨ The vehicle fleet is out-of-date and only part of the smaller vehicles was renewed. It is necessary to update the vehicle fleet.
- ⇨ As part of prevention efforts, it is necessary to carry out certain cultivation activities in order to improve the vegetation conditions of natural and forest environments, for the purpose of lessening the effects of fire passage and the spreading of fire itself, and to allow for profitable and active fighting efforts:
  - eliminating dry and easily flammable vegetation from road embankments;
  - clearing grass, bushes and plant residue from the sides of road- and railways;
  - eliminating highly flammable vegetation that covers uncultivated terrains on private properties located near urban areas;
  - creating parking areas for fire-fighting vehicles in forests;
  - creating water supply areas;
  - creating fire barriers;
  - carrying out maintenance and cleaning operations.

Regarding allocation of resources

- ⇨ Greater value must be given to the role volunteers, which can be quickly activated.
- ⇨ The personal protective outfit has so far proven to be adequate.

Regarding the public

- ⇨ It was noted locally, via the media, the risks that can be involved when sparks spread or when outdoor fires are used when the ground is particularly dry. The fire and rescue service should contribute locally with information to the media during the emergency, in order to inform the public to contact the fire and rescue service for advice and information about how to use outdoor fires and about current risk levels.
- ⇨ It is essential to communicate to the people that the responsibility belongs to everyone to prevent forest fires. It is believed that the forest risk index should be disseminated every day through the media, especially when that index is high. If there is fear to entice arsonists or criminals to the practice of crime, the dissemination of risk would allow to make every citizen to become a forest watchman and would prevent many of the negligence's which occur by the lack of care involving many works carried out in the forest.

4.2 Lessons learnt concerning preparedness measures

Regarding coordination of activities

- ⇨ The cooperation between services (police, inspectorate, foresters) should be promoted.
- ⇨ It is necessary to set up an emergency forest fire operative plan for winter months.
- ⇨ Although the procedures defined in forest fire plans have been adopted, there are still difficulties in transforming them into goof forest fire management practice.

Regarding planning issues

- ⇨ As a measure of preparedness to the most serious fires, it is important to emphasize the movement of means referred above which enables to place special groups such as Rapid Reinforcement, Logistic Means and Aerial Means, in strategic locations previously defined so that they may reinforce any area which has been seriously affected.
- ⇨ The fire risk analyses and maps should be made available on the Internet, as it could be an aid in planning and preparing for forest fire fighting operations.
- ⇨ It is essential that the firemen have corresponding maps of the disaster zone.
- ⇨ Firemen should be well provided with food and beverage during the intervention.

Regarding training

- ⇨ It is necessary to educate and train teams of volunteers at the municipal level.
- ⇨ Instruction manuals for forest fire fighting operations could be useful to fire fighters and assist in their training.
- ⇨ At the scene of fire, the work of firemen should be self-sacrificing and disciplined.

Regarding allocation of resources

- ⇨ It is important to increase investigative activities of the forest fire authority.
- ⇨ The surveillance on the part of police forces should be increased.
- ⇨ In the days of greater intensity of fires it is not always been possible to dispose of vehicles and men on reserve or aerial means which may be able to make surveillance flights and patrol.
- ⇨ It is important to establish and maintain depots dedicated for forest fire fighting equipment, as there is a clear need to support the municipalities in the event of major forest fires.
- ⇨ It is necessary to immediately regulate and ensure the possibility of firemen participation at all times (contractual relation of the local community, state and employers).
- ⇨ It is important that the number of professional firemen should be sufficient to secure effective professional management of national servicemen and other forces at all interventions, as well as operationally secure the periods when voluntary firemen cannot participate in intervention in time.

- ⇨ The command vehicle should contain modern equipment such as, telecommunication, hydrometeorogical and similar devices, so as to address the needs of fire in natural the environment. It is important that the command vehicle be better equipped.
- ⇨ It is necessary to have GPS to measure the area of the fire scene after the intervention and it would be particularly helpful so as to position the firemen more easily during the intervention itself.

Regarding the public

- ⇨ Flow of information should be targeted to the right people and should be efficient.

4.3 Lessons learnt concerning response measures

Regarding coordination of activities

- ⇨ It is essential to improve the coordination phase of the Operative or Command Centre.
- ⇨ The coordination must improve between the operative structures of the various municipalities involved, including municipalities bordering on affected areas, for the purpose of having teams from municipalities not hit by fire and less exposed to the phenomenon in general.

Regarding planning issues

- ⇨ During extensive interventions, an ambulance car should always be ready in case accident occur while extinguishing of fire
- ⇨ Extinguishing of fire with helicopters is always very helpful. Unfortunately they cannot be used at night time.

Regarding training

- ⇨ The response of firemen at night time tends to be worse. It would useful to also train firemen regularly for night time interventions.

4.4 Lessons learnt concerning dissemination of information to the public

- ⇨ It is necessary to increase prevention against the principal causes of fire by better informing the public of regulations regarding agricultural, forestry, and grazing activities.
- ⇨ It is important to ensure the coordination of hunting associations in defining strategies to prevent fires related to hunting activities.
- ⇨ It is essential to discourage forest fires related to building speculation through increased awareness of regulations and sanctions.
- ⇨ Media have a very important part in the dissemination of information and they may influence a strong support to fire fighting forces committed in the attack or, on the contrary, a feeling of contempt or even repulse. It is therefore essential that those responsible for attack have a Media Centre which analyses events beforehand and deals with the information which must be made available in time. Media can also co-

operate in passing to the public the message of prevention to forest fires, or on the contrary, may entice arsonists or criminals to increase the number of intentionally caused fires.

⇨ It is essential that self-help information is circulated amongst the public, so that they may help themselves.

4.5 Closing Considerations

Regarding forest fires

The contributions have shown that humans tend to cause most of the forest fires registered in Europe. They trigger fires through negligence, accidentally, or via intentional arson. Examples of accidental and negligent acts could be unattended campfires, burning debris, sparks and irresponsibly disposed cigarettes. The remaining causes of fires are mostly started by lightning, but may also be caused started by other natural phenomena such as volcanic eruptions or earthquakes.

There is a strong need for an improved awareness in Europe of forest fires and their related risks. In order to address this necessity, the European Commission has already laid the foundations with the help of the Science and Society strategy launched by DG Research within the Sixth Framework Programme (FP6).

The themes that address the above-mentioned research policy are:

Science & governance

This theme promotes the effective use of scientific advice and encourages interaction between experts, civil society groups and policy-makers. It is working to ensure that this is a two-way process – so that scientific know-how feeds into other aspects of EU policy, and that scientists are aware of the implications of their research. Its guiding principles are openness, excellence and effectiveness.

Scientific awareness

This theme stimulates an interest in science and improves awareness of the benefits and impact of collaborating in European research. It encourages communication and dialogue with the public. This is particularly important with issues that cause public concern, such as forest fires.

The Science and Society Action Plan

As part of its work, science and society has produced an Action Plan which will mobilise people and resources from across the European Union.

The Action Plan was agreed by the Commission in December 2001. This is a major key document which sets out a common strategy to make science more accessible to European citizens. Its main themes are to: promote scientific education and culture in Europe; produce a science policy closer to European citizens; and to produce responsible science to guide policy-making. It includes 38 actions to make the programme concrete.

For more information on this issue, please visit:

http://www.cordis.lu/rtd2002/science-society/home.html

Regarding forest fire management

From the discussions during the meeting, the following considerations were made:

- It is essential to focus on the present fire risk, i.e. in real time. This of course depends on various variables such as, type of fire, wind speed, vegetation type, etc. Furthermore, the risk could be increased during the development of the fire, if the fire management is carried out in an inefficient manner.
- The use of the internet is becoming more and more important, as the number of people with internet access is increasing.
- It is the State's role to set up large resources in depots so as to ensure a better management of resources to fight forest fires. Many problems arise due to lack of resource and bad management.
- Training of fire fighters is vital both for the rescuing of potential forest fire victims and the survival of fire fighters during life threatening interventions.
- The early assessment of the fire is of utmost importance. It is not enough to have a good monitoring system. It is essential that the expert behind the system is able to work well with the coordination group so as to assist in making quick and adequate forest fire management and fire fighting decisions.

Identified needs

The Civil Protection Authorities identified the following needs:

- It essential that the civil protection world and the research world collaborate more together. Research should be involved in all phases of disaster risk management so as to assist in its improvement. For example, there is a need to have light equipment for the fire fighters, along with special fire resistant uniforms. Through research equipments can become lighter and lighter, whilst materials can be created that will higher and higher temperatures.
- Disseminating risk information is very difficult. It essential that socio-economic research is carried to assist authorities in this area. This way, the potential impacts are evaluated and the public's opinions on acceptable risk are taken into account before decisions are taken.
- There is still a need to better clarify the New Mechanism (Council Decision of 23 October 2001 on *establishing a new mechanism to facilitate reinforced cooperation in civil protection assistance interventions*) so as to understand when it can be used.

ANNEX 1
Useful information on forest fires

WILDFIRE DEFINITION

A wildfire is a highly destructive fire or any uncontrolled burning in grasslands brush or woodlands.

(source: http://www.co.boulder.co.us/sheriff/pdf/oem/wildfire.pdf)

A definition of key terms linked to wildfires can be found at this URL :

http://nrfa.fire.org.nz/projects/wta/analysisreport/AppendixD.PDF

FOREST FIRE TYPES

FEMA Classification

(source: http://www.fema.gov/hazards/fires/wildlan.shtm)

According to the Federal Emergency Management Agency, USA, there are three types of forest fire:

Surface fire. Burns along floor of forest. (most common type)

Ground fire. Burns on or below the floor of the forest; often started by lightning.

Crown fire. Burns the tops or crowns of the trees, rapidly spread by the wind and jumping from crown to crown.

CHECKLIST OF FOREST FIRE PRECAUTIONS (slightly modified)

(source: http://www.fema.gov/hazards/fires/wildlanf.shtm)

This checklist aims to advice people living or planning to take a holiday in fire-prone areas.

WHAT TO DO BEFORE

- Learn and teach safe fire practices.
  - Build fires away from nearby trees or bushes.
  - Always have a way to extinguish the fire quickly and completely.
  - Never leave a fire--even a cigarette--burning unattended.
  - Obtain local building codes and weed abatement ordinances for structures built near wooded areas.

- Use fire-resistant materials when building, renovating, or retrofitting structures.
- Create a safety zone to separate the home from combustible plants and vegetation.
  - Stonewalls can act as heat shields and deflect flames.
  - Swimming pools and patios can be a safety zone.
- Check for fire hazards around home.
  - Install electrical lines underground, if possible. Keep all tree and shrub limbs trimmed so they don't come in contact with the wires.
  - Prune all branches around the residence to a height of 8 to 10 feet (0.7 to 0.9 metres). Keep trees adjacent to buildings free of dead or dying wood and moss.
  - Remove all dead limbs, needles, and debris from rain gutters.
  - Store combustible or flammable materials in approved safety containers and keep them away from the house.
  - Keep chimney clean.
  - Avoid open burning completely, and especially during dry season.
  - Install smoke detectors on every level of your home and near sleeping areas.
- Make evacuation plans from home and from neighbourhood.
- Plan several routes in case the fire blocks escape route.
- Have disaster supplies on hand:
  - Flashlight with extra batteries.
  - Portable, battery-operated radio and extra batteries.
  - First aid kit and manual.
  - Emergency food and water.
  - Non-electric can opener.
  - Essential medicines.
  - Cash and credit cards.
  - Sturdy shoes.
  - Develop an emergency communication plan.
  - In case family members are separated from one another during a forest fire (a real possibility during the day when adults are at work and children are at school), have a plan for getting back together.
- Ask an out-of-state relative or friend to serve as the "family contact." After a disaster, it's often easier to call long distance. Make sure everyone knows the name, address, and phone number of the contact person.
- Fire-Resistant Building Materials
  - Avoid using wooden shakes and shingles for a roof. Use tile, stucco, metal siding, brick, concrete block, rock, or other fire-resistant materials. Use only thick, tempered safety glass in large windows and sliding glass doors.
  - Contact your local emergency management office or American Red Cross chapter for more information on forest fires.

WHAT TO DO DURING

- Turn on a battery-operated radio to get the latest emergency information.
- Remove combustible items from around the house.

- Lawn and poolside furniture.
- Umbrellas.
- Tarp coverings.
- Firewood.
- Take down flammable drapes and curtains and close all Venetian blinds or non-combustible window coverings.

- Take action to protect your home.
  - Close all doors and windows inside your home to prevent draft.
  - Close gas valves and turn off all pilot lights.
  - Turn on a light in each room for visibility in heavy smoke.
  - Place valuables that will not be damaged by water in a pool or pond.
  - If hoses and adequate water are available, leave sprinklers on roofs and anything that might be damaged by fire.
  - Be ready to evacuate all family members and pets when fire nears or when instructed to do so by local officials.

WHAT TO DO AFTER

- Take care when re-entering a burned forestland area. Hot spots can flare up without warning. Check the roof immediately and extinguish any sparks or embers. Check the attic for hidden burning sparks. For several hours afterward, re-check for smoke and sparks throughout the home. If trapped in a forestland Fire.
- You cannot outrun a fire. Crouch in a pond or river. Cover head and upper body with wet clothing. If water is not around, look for shelter in a cleared area or among a bed of rocks. Lie flat and cover body with wet clothing or soil.
- Breathe the air close to the ground through a wet cloth to avoid scorching lungs or inhaling smoke.

INTERESTING URLs ON FOREST FIRES

NATURAL HAZARDS Project at the Joint Research Centre

Information on forest fire risk evaluation and forest fire detection in Europe.

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

United Nations International Strategy for Disaster Reduction (UN-ISDR) Inter Agency Task force Working Group 4 on Wildland Fires

The Working Group supports the mandate of the ISDR Inter-Agency Task Force for Disaster Reduction (IATF) by establishing an interagency and inter-sectoral forum on Wildland Fire of UN and non-UN agencies and programmes to facilitate the creation of mechanisms of information and task sharing to prevent and reduce the negative impacts of vegetation fires on the environment and humanity.

http://www.unisdr.org/unisdr/WGroup4.htm

FEMA-wildfires

It contains background information on forest fires.

http://www.fema.gov/hazards/fires/wildlan.shtm

Global Fire Monitoring Center (GFMC)

The GFMC website provides daily global updates on early warning of wildfires, fire occurrence, fire causes and impacts, and prevention strategies. It also provides other interesting links on forest fires.

http://www.fire.uni-freiburg.de/

FIREWISE

It contains educational information for people who live or take vacation in fire-prone areas. It was designed to raise awareness regarding the challenges of living with forest fires.

http://www.firewise.org/

International Fire Information Network

It contains relevant information on forest fires.

http://sres.anu.edu.au/associated/fire/index.html

USGS Wildland Fire Research

The U.S. Geological Survey provides information on forest fires and their management.

http://www.usgs.gov/themes/Wildfire/fire.html

USGS and Wildland Fire

It provides information on wildfire-related publications.

http://firescience.cr.usgs.gov/index.html

ANNEX 2

FOREST FIRE RESEARCH PROJECTS FUNDED BY THE EUROPEAN COMMISSION

MEGAFIRES – Remote sensing of large wildland fires in the European Mediterranean basin project which produced a map of danger.

PROMETHEUS – A project which aims to limit the damages on vegetation.

MINERVE - Fire events risk assessment through remote sensing.

FOMFIS - Forest Fire Management and Fire Prevention System

CLIFF - Cluster Initiative for Flood and Fire emergencies

FORFAIT - Forest fire risk and hazard assessment: a holistic approach

AUTO-HAZARD PRO - Automated Fire and Flood Hazard Protection System

ERAS - Extension Retardant Application System

FIRE STAR - A decision support system for fuel management and fire hazard reduction in Mediterranean wildland-urban interfaces

SHAEP - Un système héliporté d'aspersion verticale développé pour la lutte contre les incendies de forêts.

SPREAD – Forest fire spread prevention and mitigation

WARM – Wildland urban area fire risk management

Source: http://www.cordis.lu