

The forest fires of 1995 and 1998 on Penteli mountain

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The 1995 fire on Penteli mountain

Introduction

1995 was a better than average year, with respect to forest fires, for Greece. The area burned was 27,203 hectares which is approximately half the area burned for each of the three previous years and much less than later fire seasons (e.g. 95,571 ha in 1998, 167,000 ha in 2000). However, in spite of the good overall results, one large fire at the mountain of Penteli, in Attica, a distance of a few kilometres NE of Athens, burned about 6,200 hectares in three days (21-24 July 1995) and created, both nationally and internationally, the impression of a catastrophic fire season (Xanthopoulos 1996). A short description of the evolution of this fire follows.

The start of the fire

The fire started around 07:50 on the Friday, 21st of July 1995, in a thick Aleppo Pine (*Pinus halepensis*) forest, under an unusually strong northerly “meltemi” wind with gusts reaching 75 km/hr. Meltemi wind is a regular phenomenon in the summer in the eastern part of Greece, affecting the Aegean sea and its islands, but they rarely reach such intensity. This wind had started blowing on the previous day and continued at this strength throughout the first two days of the fire. An extreme fire danger warning had been issued on July 19th for the next four days. Three other fires, at short distances from Penteli mountain, that erupted in the sixteen hours preceding the Penteli fire (a fire at Vouliagmeni lake at the SE outskirts of Athens on Thursday evening, a fire in the area of Kato Souli near Marathon village that burned through the night, and a fire from a garbage dump in the area of Keratea in the South part of Attica) were controlled successfully in spite of the adverse conditions. However, they drained resources from Penteli for their suppression and mop-up. These efforts were still in progress at the time the Penteli fire started.

The fire started next to the road that connects the area of Nea Makri with the area of Dionissos at a location called “Agios Petros” (Figure 1). There is quite heavy traffic on the road at that time, as people drive from their summer (vacation) homes to work in Athens. Thus the fire was reported immediately, through mobile phone, by drivers who stopped and tried unsuccessfully to extinguish it.

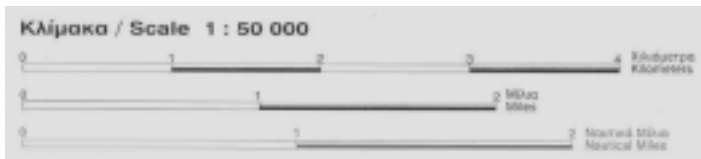
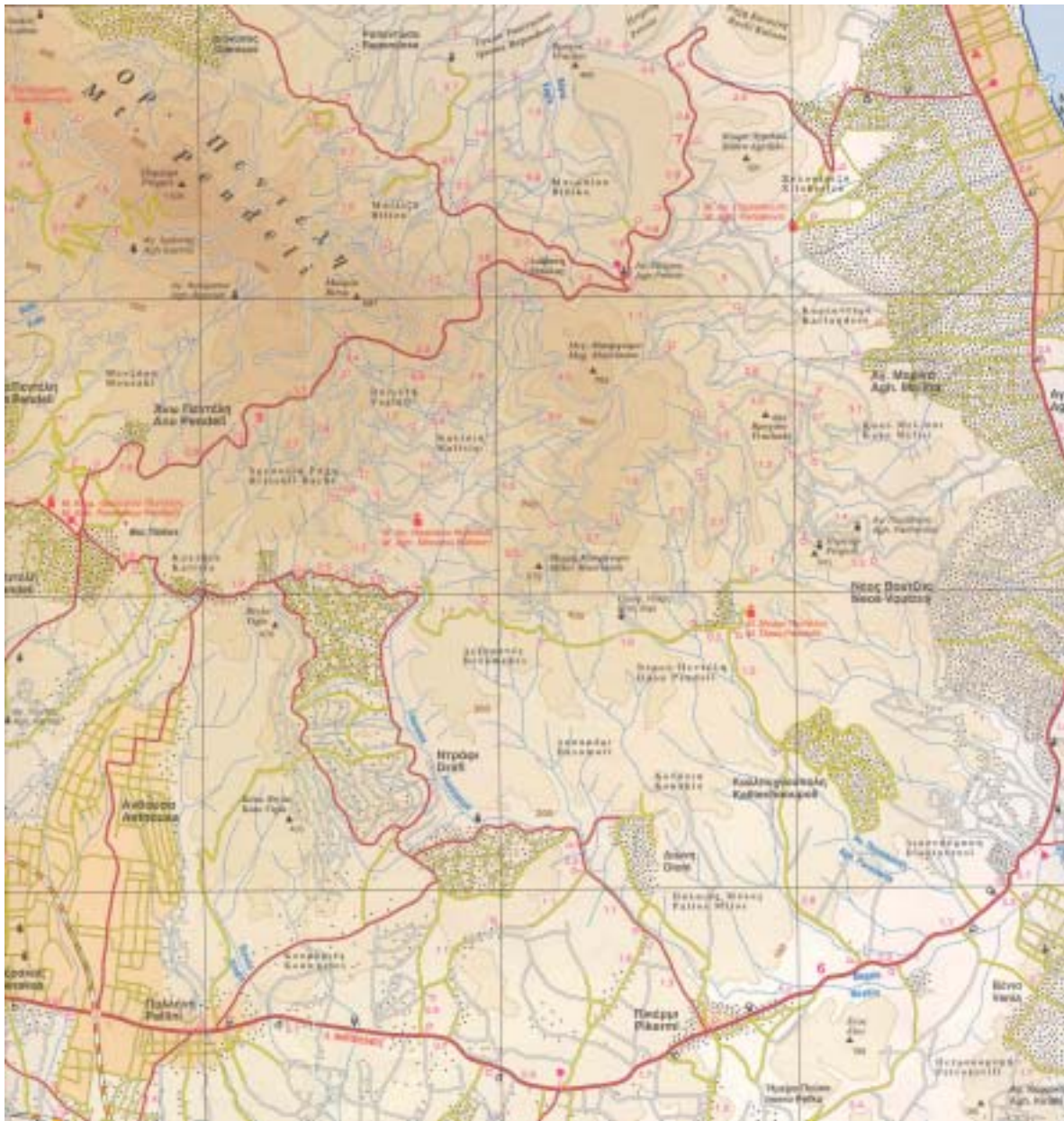


Figure 1. General map (1:50.000) of the eastern slopes of Penteli mountain where the fires took place. The extent of the urban-wildland interface areas is quite obvious.

Fire behavior

The fire accelerated quickly and in a very short time developed into a crown fire exhibiting extreme fire behavior. This is very common in Aleppo pine forests under such conditions as there is usually heavy understory and the trees are not very tall, leaving little gap between the two vegetation strata. The smoke plume was so thick that it shadowed Athens and reached well beyond Crete to the south (Figure 2).

Relative humidity was relatively high (>35%) and temperature was around 25 °C in the beginning. In spite of that, this wind-driven massive fire produced many firebrands and, according to witnesses, there was some, but not excessive, medium range spotting later in the day. The average observed rate of spread on the first day reached 1,7 km/hour for lengthy periods of time, especially around noon. It was relatively slower while passing through the area of Drafi (about 1,2 km).

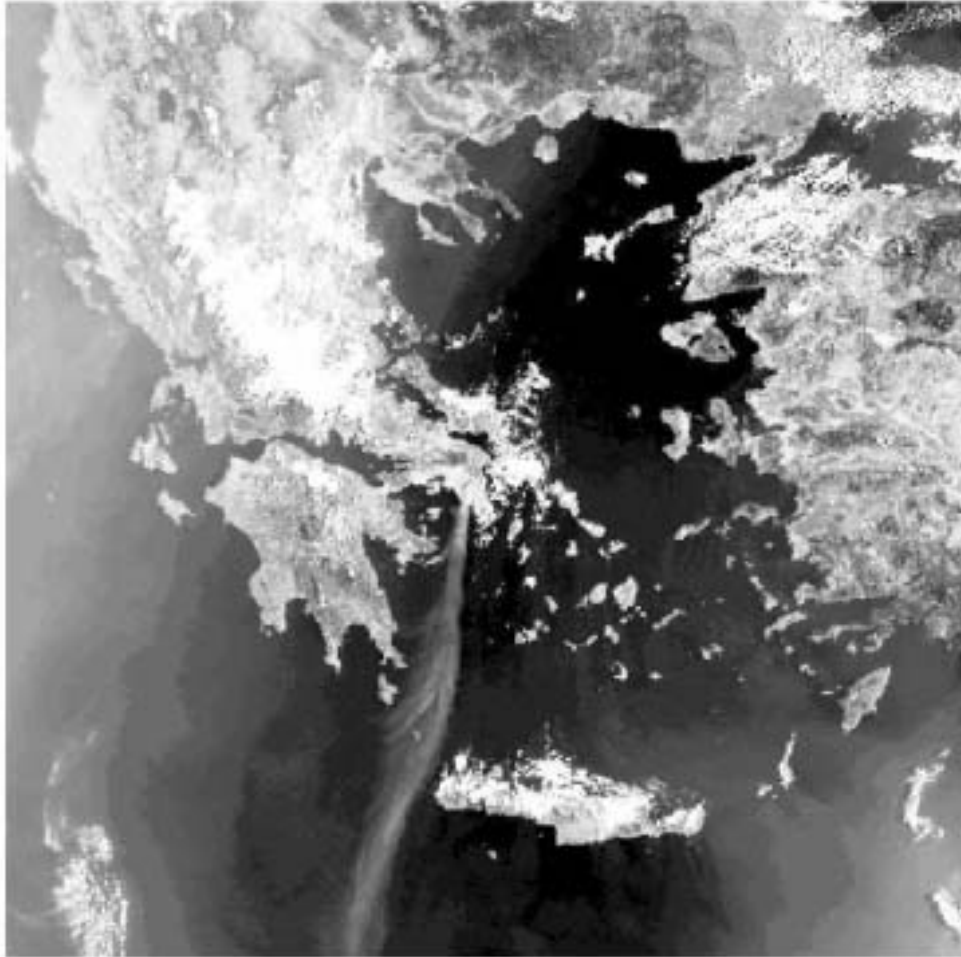


Figure 2. The smoke plume from the Penteli fire reaching well beyond Crete, and making the direction of the wind quite obvious. This NOAA-AVHRR Channel 1, satellite image was provided by Dr. Rosa Lasaponara.

Response to the fire

Two fire trucks, returning from the previous fires, were the closest ones and they were the first ground resources dispatched to the fire. They were there in about 20 minutes but they were unable to control the fire which, by that time, was spreading as a crown fire. The aerial means (amphibian Canadair CL-215 airtankers) that were already operating on two of the other fires in the area were diverted immediately to this fire but were unable to perform efficiently due to extreme wind-caused turbulence over the mountainous terrain. In less than an hour it was clear that the fire was going to be a real disaster as it headed towards an extensive urban-wildland interface area (Drafi) where individual homes were close to or even within the thick Aleppo pine forest. It passed through that general area between 10:30 and 11:30 and continued spreading southwards towards Pallini.

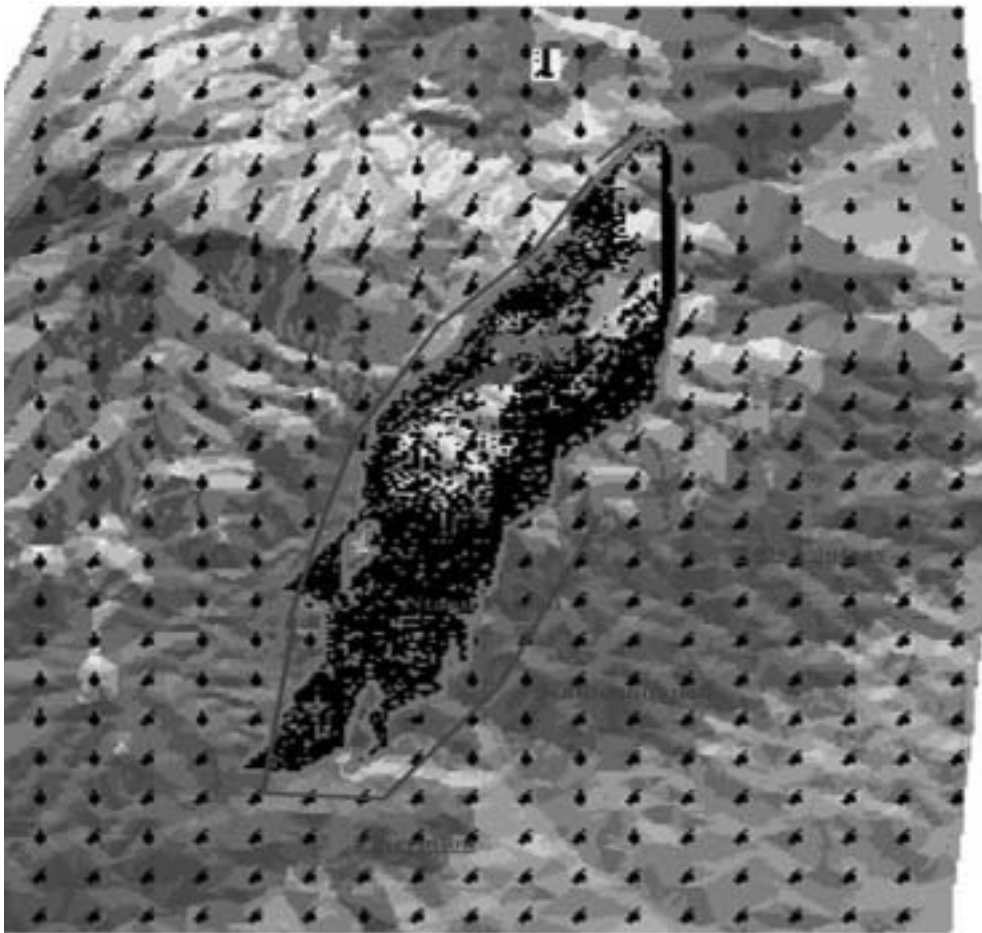


Figure 3. The outline of the 1995 fire on Penteli on July 21st at 13:30, and the simulated fire spread by a fire management information system (FMIS) developed by ALGOSYSTEMS S.A. (Varela et al. 1999).

In the meantime, the coordinating center kept sending to Penteli all available ground and air resources. There were some futile efforts to control the fire front, as the aerial means (both CL-215 and CHINOOK CH-47D helicopters with 5 m³ bambi-buckets) were not able to perform effectively under such conditions (wind, turbulence, heavy smoke). The ground forces were pushed away by the advancing front when they tried to make a stand on wide roads or relatively open areas. It soon became evident that it was not possible to stop the fire front and efforts by the fire trucks and crews of the Forest Service and the Fire Service concentrated on protection of homes, monasteries, other buildings, and of course people who were in the path of the fire.

The Firefighting Coordinating Center soon started bringing in resources from other parts of the country. In the next two days firetrucks arrived from as far as Thessaloniki in Northern Greece and Kalamata in the south end of Peloponnese, bringing the total number to approximately 100. However, coordination was quite poor as this responsibility sifted from operational people to ministers, and with the priority to save lives and homes the general picture of the fire, expected fire behavior, etc. was lost. There was no concerted effort to work on the flanks and the heel of the fire.

Evolution of the fire

The fire front reached the area of Pallini and the main road connecting Athens with Rafina (Marathon avenue) around 13:30. The area of Pikermi along the same road was reached later in the afternoon. There the vegetation continuity is broken by agricultural fields with various cultivations, including vines, and there are many vegetation free fields where near industrial installations homes etc. Hence, it was possible to control the fire along that road and in the agricultural fields around it. The main fire front was controlled by that evening. More than 2000 ha had burned by that time.

During that night the wind did not loose strength. As efforts concentrated on saving homes and lives where the fire had already passed and on the flanks, the heel of the fire kept widening. New “waves” originated there and aided by the effect of the topography on the wind, through the night, reached villages (Anthousa, Penteli) on the west flank creating more need for efforts to save lives and homes.

On Saturday, with the wind continuing at full force, the areas of Kallitechnoupoli and later Neos Voutzas, on the eastern flank of the fire (that in the meantime kept widening) faced destruction. The final strong firefighting effort was made on Sunday morning in the area close to Dionissos (location called “German cemetery”) at the heel of the fire. Mop-up efforts continued through Sunday and Monday. The fire was considered fully controlled on Monday 24th of July. The runs at the flanks during Saturday and Sunday increased the burned area to its final size.

Damages

The total burned area reached 6200 ha (figure 4). About 105 buildings of various types were heavily damaged or fully destroyed. Some of them were high quality houses built with reinforced concrete frame, clay-tile roofs etc. whereas most of them out-houses, mobile homes, small temporary buildings, farm-barns etc. made of flammable materials. Fortunately, and in spite of the adverse conditions, there was no loss of life.

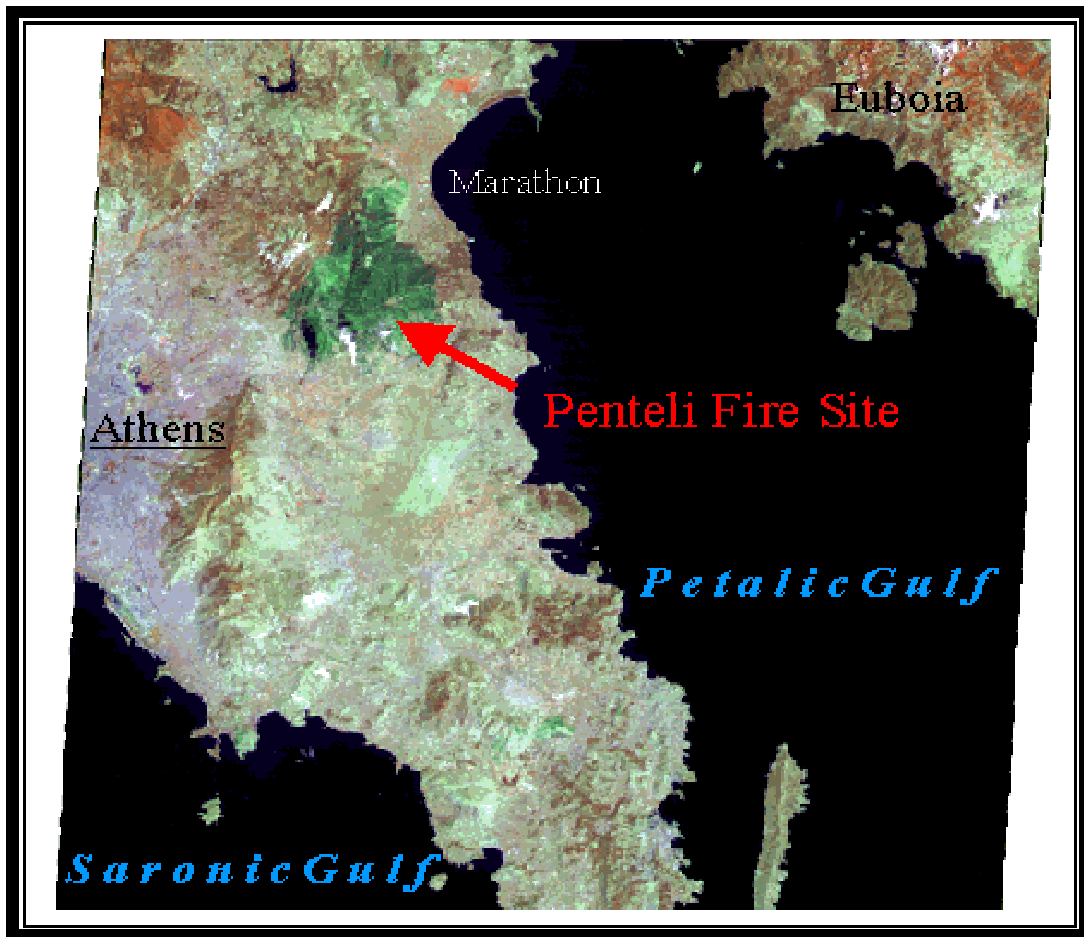


Figure 4. The final burned area of the 1995 fire. Image Source: “Land Use Change Interactions with Fire in Mediterranean Landscapes” (LUCIFER) project.

Firefighting resources

Ground forces

- About 100 fire trucks of the Forest Service and the Fire Service were dispatched to this fire. Some of them were sent from areas at distances exceeding 500 km from Athens.

- Approximately forty tanker-trucks belonging to the municipalities were used for the supply of the firefighting trucks with water.
- More than 1150 firefighters and 1400 soldiers were also involved. They were supported by a large number of volunteers.

Aerial firefighting means

- Nearly all the heavy aerial firefighting means of the country were involved in the suppression efforts.
- Nine CL-215 amphibian water bombers, one MAFFS equipped C-130 air tanker and two army CHINOOK CH-47D helicopters were used for class A foam, fire retardant and water drops respectively, while two army BELL UH-1H "Huey" helicopters were used for reconnaissance and coordination.
- This fleet was augmented, after the first day, by two Canadair CL-415 water bombers that were sent by the Italian government and one FOKKER-27 airtanker plus one BE-20 lead-plane sent by the French government

The 1998 fire on Penteli mountain

Introduction

1998 was a very special year for forest firefighting in Greece. In May 1998, a law transferred the responsibility of forest firefighting from the Forest Service to the Fire Service (Xanthopoulos 1999, Eftichidis and Varela 2000). The latter historically had been involved in forest firefighting but on a secondary role, mainly firefighting from roads, protecting housing areas in the Wildland urban interface etc. It lacked appropriate equipment (clothing, long and small-diameter hoses, etc.) and most important it did not have the previous experience of full responsibility for coordinating a large forest fire. Given the late transfer of the responsibility, just before the start of the fire season, it did not have time to work on these deficiencies and to correctly incorporate the material it received from the Forest Service (e.g. service the fire trucks it received, work on the forest maps, etc.). Given all these, and the development of a hostile environment between the personnel of the two Services, the scene was set for disaster. The problems started in the beginning of July and kept worsening as the fire season turned out to be windy combined with very low relative humidity. In August, the fire on Penteli mountain became one of the worse fire disasters of that year that added 7.500 ha to the burned area of that year, bringing the total up to the final figure of 95.571 ha.

The start of the fire

The fire started at 22:00 on 2 August near the village of Stamata northeast of Athens and north of the area of Dionissos under relatively calm conditions (light NE wind at less than 2 BF, air temperature at 27 °C, and relative humidity around 30% at that time). Unfortunately, as it was not close to a road and access to it was difficult, it was not attacked

aggressively and effectively through the night, in spite a meteorological forecast that predicted strong winds for the next day.

Early next morning the firefighting forces were still waiting the fire on a road. The CL-215 did not appear with the first morning light as requested. When they did, around 08:00, it was too late. The wind had started picking up, the fire accelerated, it crowned in thick Aleppo pine (*Pinus halepensis*) forest and started spotting making all efforts to stop it along roads totally ineffective.

Fire behavior

Initial spread, during the night, was quite slow due to the low wind. However, in that dry fire season the fuels were very dry and the night air relative humidity at 30% was a bad omen for the next day.

On the 3rd of August, once the meltemi wind picked-up to roughly 7 BF, the fire crowned quickly. As relative humidity dropped to less than 15% during the day the fire soon started producing heavy medium and some long-range spotting. The wind speed did not preclude aerial firefighting as in 1995, but the spotting made all efforts to stop the fires along roads ineffective.

Coordination tried but failed to stop the fire from entering the area burned in 1995. When the fire entered this area, which by this time was covered by some regeneration of small pines, resprouting shrubs and mainly heavy grass growth, fire spread rate became very fast. The fire quickly reburned practically all the area burned in 1995.

Average observed rate of spread, including the runs in the pine forest, was about 1,2 km/hr. Runs in the light fuels of the reburned area at times exhibited higher rate of spread but the average was also affected by firefighting efforts. This fire, as it was fanned by a strong wind, can clearly be described as a wind-dominated fire, the same as the 1995 one (Rothermel 1991). This is common in most fires in Greece occurring under full-strength meltemi wind.

Response to the fire

The most important event characterizing initial response to the fire was the half-hearted effort to reach the fire during the night. A bulldozer was used to develop an access road to the fire. It did not complete the job due to the rugged topography, stopping a few hundred meters from it. Then the effort was practically abandoned, waiting for the fire on the road. The firefighting forces attacking the fire were relatively inexperienced in forest firefighting, especially in using hand tools away from roads.

The second event was that the fire was not attacked from the air immediately after sunrise. By 08:00 of August 3rd, the wind speed increased sharply and the fire accelerated, and

reached quickly the roads where the firefighters were waiting for it. They were unable to stop it there as well as on the asphalt road connecting Dionissos to Nea Makri a few km further down its path. There 15 fire trucks lined-up hoping to stop the fire but the advancing crown fire front quickly pushed them away.

Evolution of the fire

The fire front reached practically the same line where the previous fire was stopped due to favorable fuel conditions.

After the initial burn of August 3rd and the mop-up efforts of August 4th, in the morning of August 5th, the fire restarted under windy conditions, probably due to incomplete mop-up. This time it affected unburned forest in the area of Penteli village at the base of Penteli mountain, entering deep in the wildland-urban interface, reaching even the central square of the village and burning many buildings.

The fire was finally controlled on the 5th of August, while mop-up efforts continued for two more days.

Damages

The final burned area exceeded 7.500 ha. This fire destroyed the forest that had remained on the mountain of Penteli after the fire of 1995, and reburned most of the previously burned area diminishing the probability for natural regeneration of pine there due to lack of seed. Hundreds of houses and other buildings (hospitals, restaurants, factories, a school, etc.) were destroyed or suffered significant damage. A 67 year old man who lived in the village of Penteli was caught by the fire and died as he was fleeing his home.

Firefighting resources

All the available firefighting resources of the Fire Service in Attica and from other parts of the country were assigned to this fire. In total there were more than 100 firetrucks as well as all the available water-trucks of the municipalities. Also, the majority of the fleet of 15 Canadair CL-215s made drops on this fire, as well as Army CHINOOK CH-47D helicopters. After the disaster in the wildland-urban interface area, local people volunteered to develop patrols trying to prevent further arson. However, although the actual cause of the fire was never identified, evidence (area, distance from Athens, time and conditions of start) shows that the fire was not started to create the havoc it did. The disaster can clearly be attributed to ineffective initial attack due to lack of appropriate action and not due to inadequate dispatched forces.

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