

# Fire Management

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## GLOBAL LANDSCAPE FIRE CHALLENGES: A DECADE OF PROGRESS



United States Department of Agriculture  
Forest Service

## In this Issue ...

Note: This issue of *Fire Management Today* contains articles about issues pertaining to wildland fire management around the world. The information presented here reflects the authors' own research and does not necessarily suggest endorsement by the U.S. Department of Agriculture (USDA). Likewise, the fire management practices portrayed are in accordance with the policies of the countries in question and do not necessarily reflect the policies of USDA.



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## On the Cover:



*Top left: Using prescribed fires for wildfire hazard reduction in pine plantations in Ukraine. Top right: Early-season prescribed fire in the Cerrado, Brazil. Center: Metal container of unexploded ordnance in eastern Europe, a hazard to firefighters. Bottom: Participants from nine countries at the Second Regional Symposium and Consultation on Regional Cooperation in Cross-Boundary Fire Management in South America, hosted by Chile in Viña del Mar on October 3–4, 2017.*

The USDA Forest Service's Fire and Aviation Management Staff has adopted a logo reflecting three central principles of wildland fire management:

- *Innovation:* We will respect and value thinking minds, voices, and thoughts of those that challenge the status quo while focusing on the greater good.
- *Execution:* We will do what we say we will do. Achieving program objectives, improving diversity, and accomplishing targets are essential to our credibility.
- *Discipline:* What we do, we will do well. Fiscal, managerial, and operational discipline are at the core of our ability to fulfill our mission.



**Firefighter and public safety  
is our first priority.**

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## Guidelines for Contributors

# WILDFIRES AND FIRE MANAGEMENT IN THE EASTERN MEDITERRANEAN, SOUTHEASTERN EUROPE, AND MIDDLE EAST REGIONS

Gavriil Xanthopoulos and Nikola Nikolov

The Eastern Mediterranean, Southeastern Europe, and Middle East regions have experienced tremendous political, social, and economic changes in the last 3 decades. This period has seen population movement

Weekend/summer houses are embedded in increasingly flammable vegetated areas.

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difficult sociopolitical postconflict conditions on the one hand and serious economic crises on the other have affected many aspects of life and development. In addition to the number of migrants, the number of international tourists has increased steeply—all of them equally at risk of becoming wildfire causes and victims.

Additionally, very high income and wealth disparity in many countries, with the great majority of people in poverty, have led to the development of fire-prone areas with highly

through internal displacement, border-crossing refugees, and general migration and immigration; in some cases, even borders have shifted. Armed conflicts and

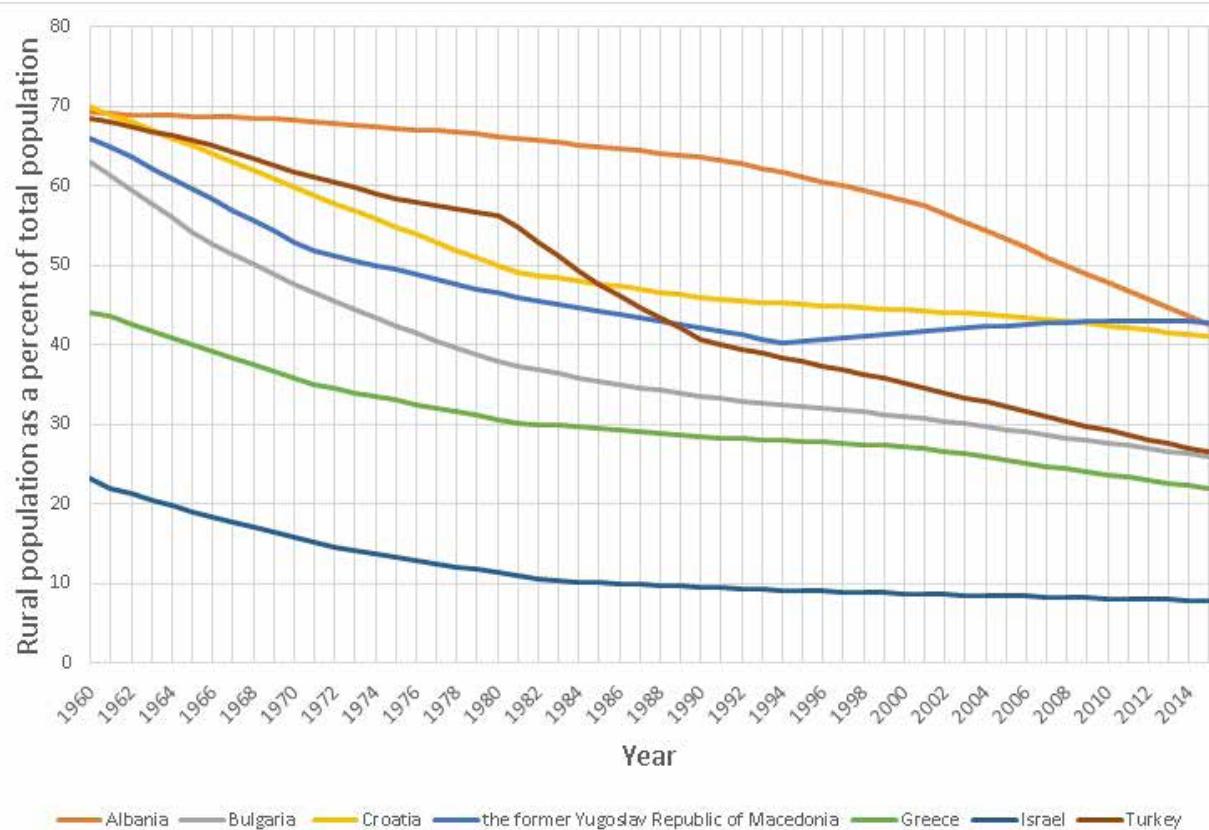


Figure 1—Rural population evolution as a percent of total population in seven countries in the region. Source: Gavriil Xanthopoulos, based on data from IndexMundi (2017).

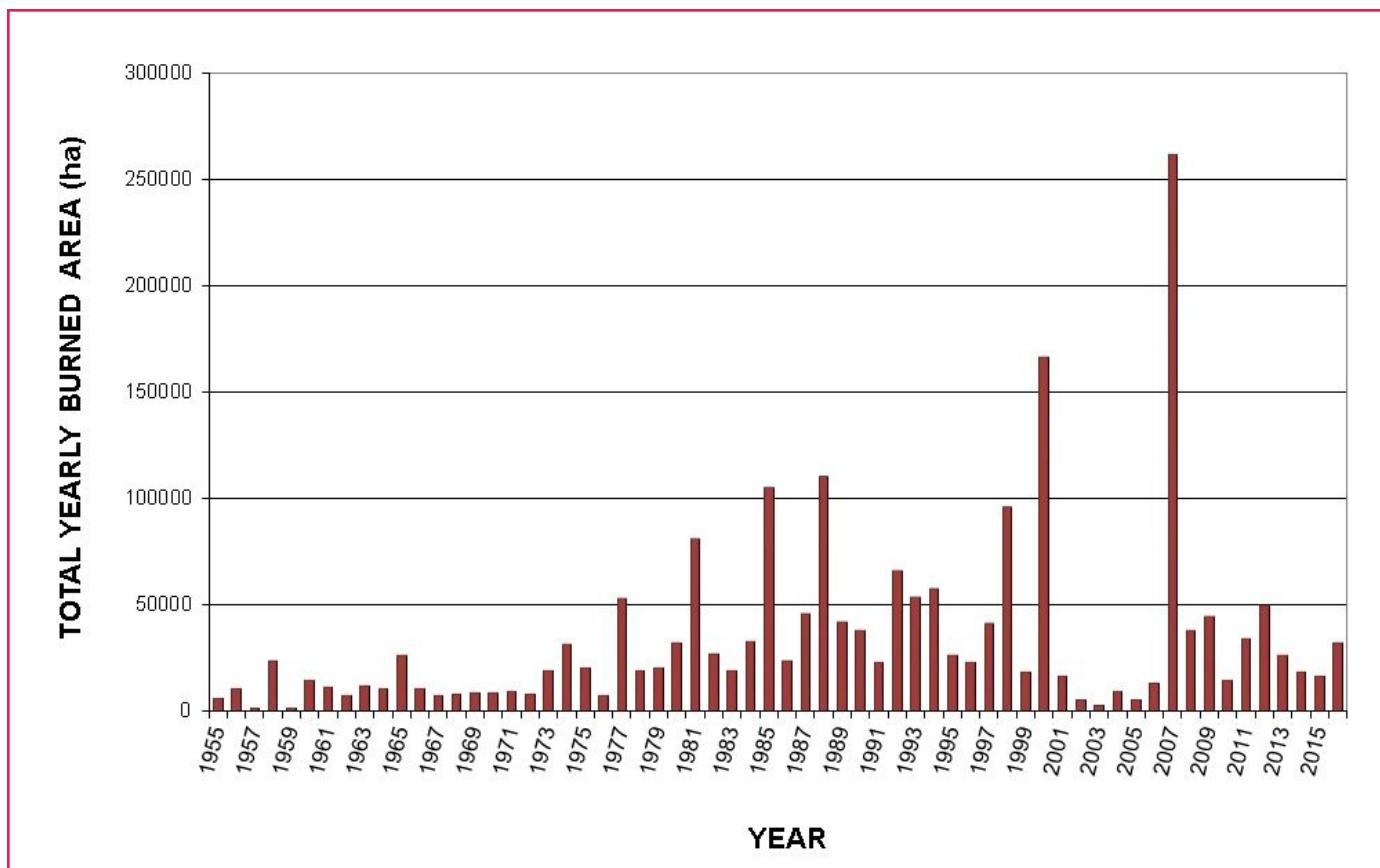


Figure 2—Evolution of the annual area burned in Greece, 1955–2016. Source: Gavril Xanthopoulos, based on Greek Forest Service and Greek Fire Service annual reports.

contrasting characteristics regarding settlement planning and function, building construction quality, and population behavior. The young are fleeing unemployment and poverty in rural areas and moving to big cities, leaving the old behind. At the same time, the wealthy can afford to flee overcrowded, polluted, and increasingly warming cities to build their residences on the urban fringes. Weekend/summer homes are embedded in increasingly flammable vegetated areas. The desired aesthetics and air quality of the countryside may become a death trap, mirroring the situation in the Western United States or parts of Australia.

### Changing Demographics: Impacts on Wildfires

The rural exodus (fig. 1) has greatly affected the demographics and social

structure of countries in the Eastern Mediterranean, Southeastern Europe, and Middle East regions as well as their financial conditions. For instance, the average age of the people remaining in farmsteads and villages is constantly increasing. Most important, however, are the consequences of reduced land cultivation: increasing fuel loads, uncontrolled ecological succession, replacement of traditional agropastoral land use by industrial forest plantations in some countries, and the resulting reduction of breaks in fuel continuity have led to an unprecedented increase in the flammability of landscapes. The increasing average size, intensity, and severity of wildfires throughout the Mediterranean Basin and its vicinity are evident.

The consequences of demographic change for wildfires are quite evident in Greece, for example, where the rural population as a percent of the total population has dropped from 44 percent in 1960 to 22 percent in 2016 (fig. 1). Concurrently, the annual area burned grew substantially (fig. 2), despite significantly increased investments for wildfire suppression after 1998 (fig. 3), when firefighting responsibilities were moved from the Greek Forest Service to the Fire Service. The lack of results can largely be attributed to a very low emphasis on and budget for fire prevention, as opposed to spending on suppression. On average, the annual area burned from 1979 to 1997 was 117,756 acres (47,654 ha), nearly identical to the 114,756 acres (46,440 ha) burned annually from 1998 to 2016, even though investments

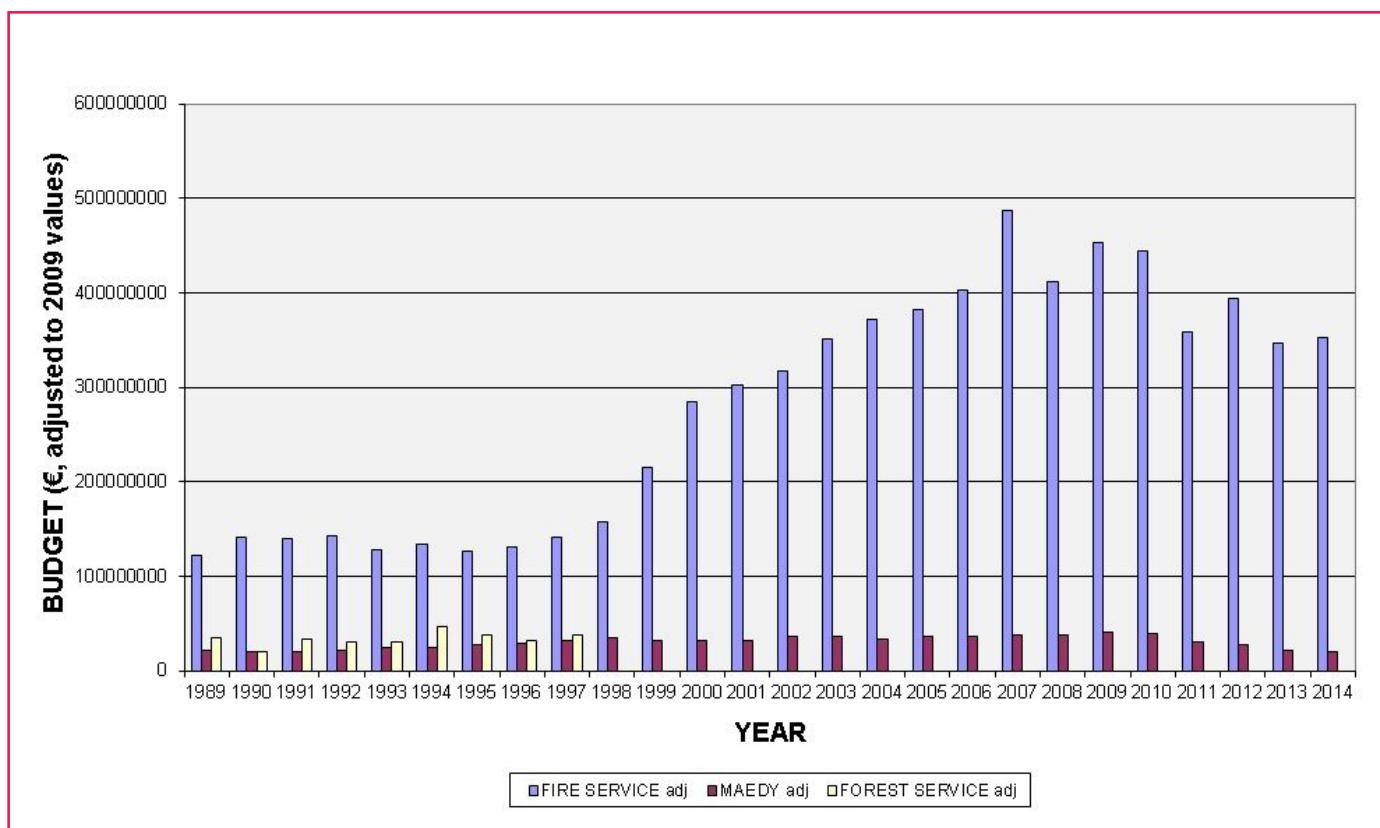


Figure 3—Fire suppression budget evolution in Greece, 1989–2014. The graph includes total fire-related budgets of the Fire Service; the Air Force unit MAEDY, which operates the fleet of light firefighting planes; and the Forest Service, which lost the responsibility for forest firefighting in 1998. The cost of the fleet of Canadair water bombers is not included. Source: Gavriil Xanthopoulos, based on Greek Forest Service and Greek Fire Service annual reports.

in firefighting in the latter period increased significantly. Despite higher investments, in 2007 Greece experienced its worst fire season in history, with 80 fatalities (mostly civilians) and 3,000 homes seriously damaged or destroyed. Furthermore, on July 23, 2018, a single fire that hit a wildland–urban interface area called Mati, which is situated next to the coast 16 miles (25 km) east of central Athens, destroyed the whole community, causing 99 fatalities (figs. 4, 5, 6). The community and the citizens were totally unprepared for an intense wildfire.

The situation is similar in the former Yugoslav Republic of Macedonia. The rural percentage of the population dropped from 72.4 percent in 1948 to 31 percent in 2008; more specifically, the agrarian percentage of the

population dropped from 71.52 percent in 1948 to 11.79 percent in 1994. As a result, large areas of arable land and pastures have been abandoned in the last 6 to

7 decades, and they have become grasslands, shrublands, or even forests. That is one reason for the growing annual area burned (fig. 7).

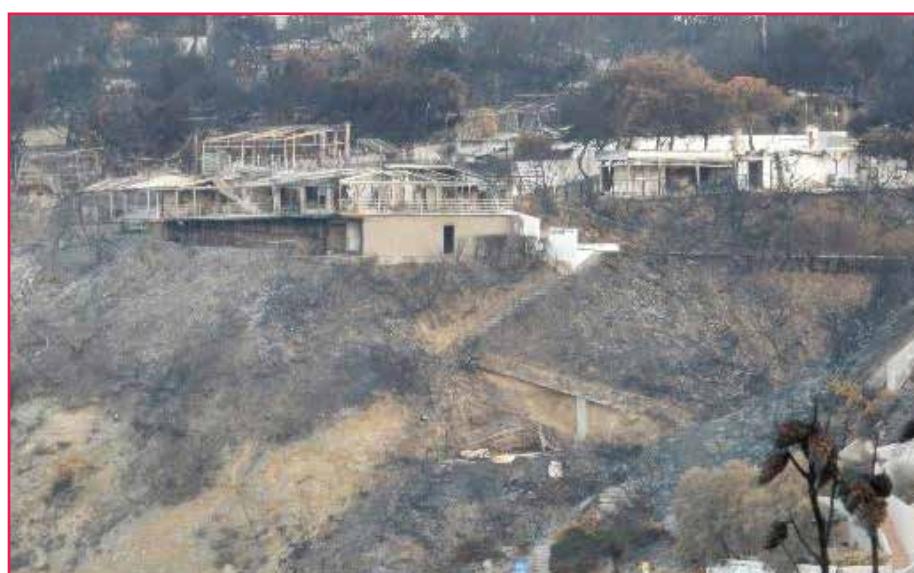


Figure 4—Burned buildings at the crest of the hill above the sea. People reached the sea in panic, with the fire behind them, but access down the cliff towards the water was not always possible.

Efforts to improve forest fire protection systems started in the early 1990s and strengthened during the last 10 to 15 years.

## Political and Economic Crises: Impacts on Wildfires

The 1990s were an extremely difficult decade for Southeastern Europe due to the breakup of the Federal Republic of Yugoslavia and the creation of new countries. Ethnic conflicts and civil war affected all countries in the region either directly or indirectly, exacting a high price. The impact of armed conflicts and the legacy of the former centrally planned economy created obstacles to the adoption of effective reforms and hindered socio-economic progress. Delayed and often unimplemented reforms made it impossible to establish fully

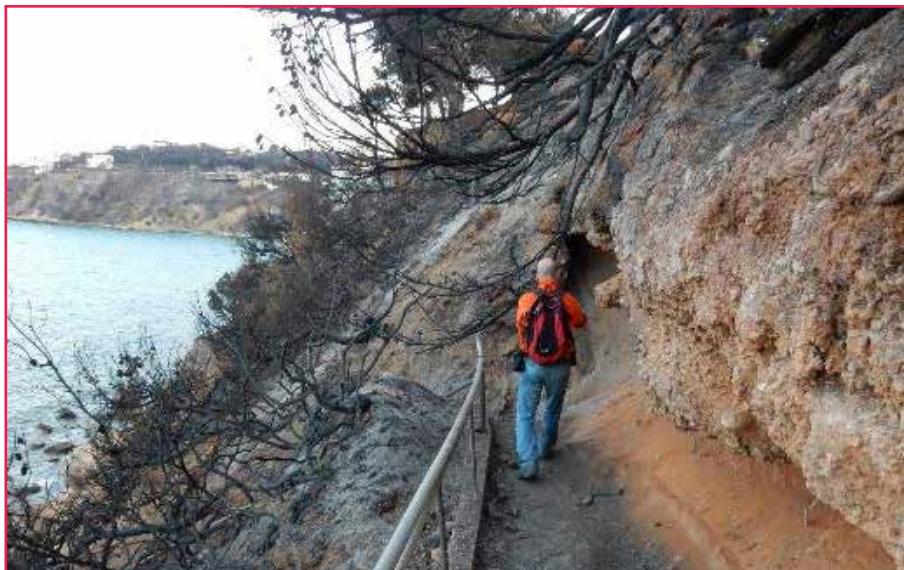


Figure 5—One of the extremely challenging paths along the cliff that many people used to get to the sea, with fire burning around them. Many people did not make it, while those who made it to the sea had to wait for hours to be rescued by boats, some of them finally drowning.

functioning market economies, which led to inferior economic performance, declining living standards, rising unemployment, and poverty. Underdeveloped infrastructure networks, limited foreign direct investment, and weak administrative structures also pose significant challenges.

In addition, the global economic crisis of 2007–8 has affected the region, raising additional financial constraints. External trade,

industrial production, and economic growth dropped sharply in 2009. Unemployment rates, which had been decreasing from very high levels, are predicted to rise sharply again, and the level of public debt remains very high across the region. After most Southeastern European countries performed well in the 2000s, studies show that almost all of their economies are declining or stagnating due to the economic crisis and the decrease in foreign direct investment.



Figure 6—One of the narrow streets near the sea where many people fleeing with their cars were caught in a traffic jam with flames burning trees, structures, and cars around them. The photo, taken 4 days later and after the burned cars had been removed, shows a traffic jam at the same point under “normal” conditions, without flames, smoke, or panic.

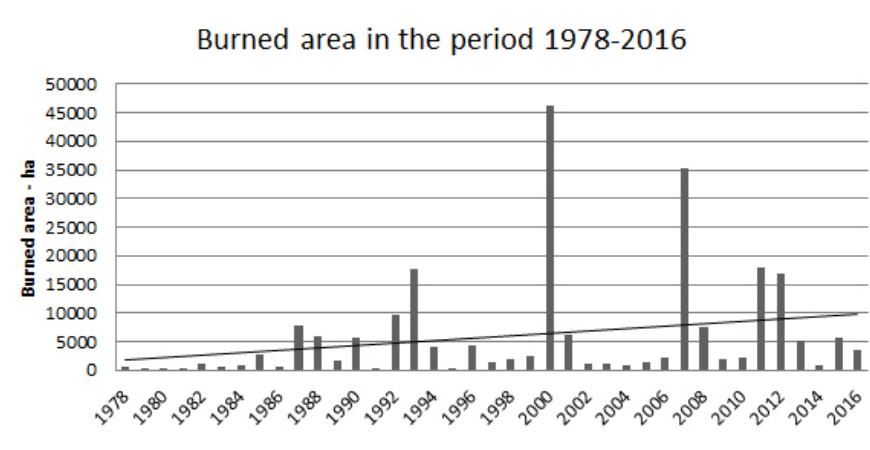


Figure 7—Evolution of the annual area burned in the former Yugoslav Republic of Macedonia, 1978–2016. Source: Regional Fire Monitoring Center, based on information from the Ministry of Agriculture, Forestry and Water Supply and Public Enterprise Macedonian Forests.

Political, social, and economic changes have significantly influenced fires on the landscape. Rural population decreases, changing age demographics, and land use changes worsened forest and rural fire problems due to increasing fire starts and fuel buildups. However, other factors have also contributed to variable fuel buildups across the region. Since the 1980s in Greece, for instance, the use of wood for heating and cooking has been gradually replaced by more convenient energy sources, a major reason for the accelerating accumulation of fuels. In other Southeastern European countries, the use of wood has continued, so fuel buildups have been less. Nevertheless, the Balkan countries gradually became aware of the problem of landscape fires and have begun investing in national fire protection systems.

## Enhancing Fire Management Capabilities

Efforts to improve forest fire protection systems started in the early 1990s and strengthened during the last 10 to 15 years. However, it is evident from the generally growing area burned across the region and the growing



Figure 8—A fierce wildfire burning on the fringes of the Greek capital Athens. The Mt. Hymettos Fire on July 18, 2015, revealed the vulnerability of urban and periurban areas as well as protected areas and greenbelts in the Eastern Mediterranean. Photo: Gavril Xanthopoulos.

Sharing fire management expertise between Southeast Europe and the countries of the Near and Middle East has become a notable regional effort.

frequency of disastrous fire seasons (including numerous fatalities) that the effectiveness and efficiency of forest fire protection systems is inadequate and that improvements are needed (fig. 8). Because funding for fire management programs will

continue to be limited in this time of financial difficulties, improvements will depend on higher effectiveness and efficiency of investments. These in turn will come through better utilization of scientific knowledge and strengthened



Figure 9—The final seminar of the project called Enhancing of the Ground and Aerial Forest Fire Suppression Capacities in the former Yugoslav Republic of Macedonia was supported by the USDA Forest Service and the Global Fire Monitoring Center and attended by fire management specialists from Serbia and the former Yugoslav Republic of Macedonia. Photos: Regional Fire Monitoring Center.



Figure 10—The first Regional Consultation on Cross-boundary Cooperation in Fire Management was opened by the Minister for Agriculture, Forestry and Water Economy on November 11, 2016, in Skopje, Former Yugoslav Republic of Macedonia. Representatives from Albania, Bulgaria, the former Yugoslav Republic of Macedonia, Greece, Kosovo, and Serbia decided on high-priority actions to improve interoperability in joint cross-boundary responses to wildfires. Photo: Regional Fire Monitoring Center.

In Lebanon, like in the Balkans, abandonment of land cultivation is the main driver of increasing landscape flammability.

regional cooperation, including the proactive support of nonstate actors. To meet these challenges, in 2010 the Regional Fire Monitoring Center was established in Skopje, former Yugoslav Republic of Macedonia, with the support of the Global Fire Monitoring Center and the Council of Europe's Major Hazards Agreement (RFMC 2010a).

A regional analysis commissioned by the Hungary-based Regional Environmental Center titled “Environment and Security Initiative: Addressing the Risk of Forest Fires in the South Eastern Europe” analyzed the situation in six Southeastern European countries (Albania, Bosnia and Herzegovina, Kosovo, Former Yugoslav Republic of Macedonia, Montenegro, and Serbia) (Nikolov 2015). One of the goals of the project was to identify measures that could close the existing gaps in legislation, policy, implementation, and enforcement to

reduce the occurrence and impacts of wildfires in Southeastern Europe. The regional analysis included recommendations for improvements in the following areas related to forest fire management:

- Institutional and sectoral responsibilities in forest fire management,
- Fire management on terrain contaminated by unexploded ordnance and landmines,
- Specialized training and personnel,
- Volunteer firefighters,
- Specialized vehicles and equipment,
- Participation of civil society,
- Use of advanced data processing and information systems (wildland fire early warning and decision support systems), and
- Fire research and its application in forest and fire management.

At a closing workshop for the regional study, a roadmap was developed for reducing wildfire disaster risk by focusing on high-priority strategic activities. Priorities included focusing on fire prevention and strengthening international/cross-boundary cooperation in fire management (REC 2015).

## Sharing Expertise Through International Cooperation

International cooperation projects with tangible results are achievable

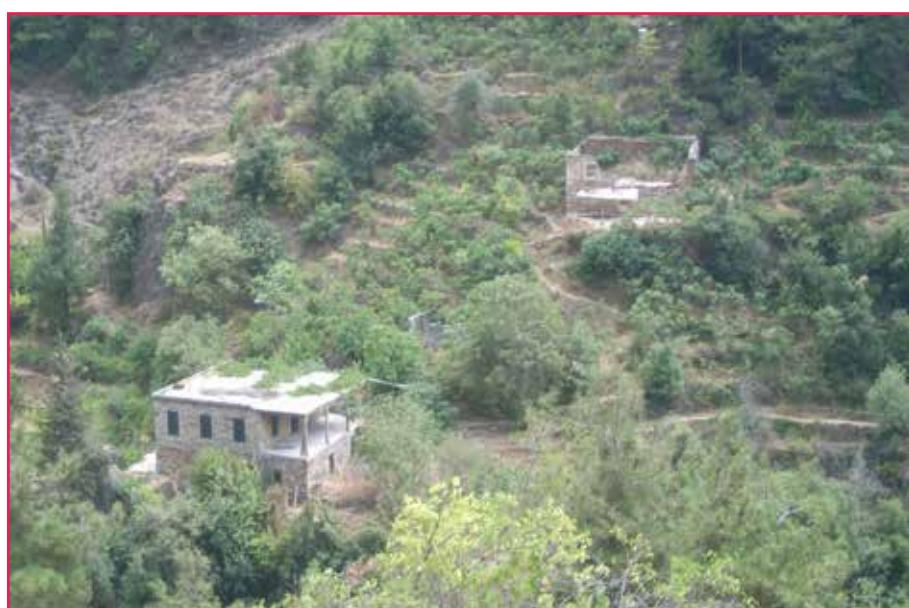


Figure 11—Abandoned terraces and collapsing former farmsteads in Lebanon’s Qadisha Valley reflect the trend of declining land cultivation and increasing fuel buildup and wildfire risk in the Eastern Mediterranean region. Photo: Global Fire Monitoring Center.



Figure 12—Forest fires burning in the mountain range of Golestan Province, Islamic Republic of Iran, close to the Caspian Sea and Turkmenistan border. The satellite image (MODIS Aqua, 250-meter resolution) captured wildfires and smoke plumes on December 6, 2010. Source: National Aeronautics and Space Administration.

by exchanging expertise in fire management. For instance, the Regional Fire Monitoring Center and the U.S. Department of Agriculture (USDA) Forest Service's International Programs launched a project called "Enhancing of the Ground and Aerial Forest Fire Suppression Capacities in the Former Yugoslav Republic of Macedonia" (RFMC 2010b). The project conveyed the experience and knowledge of the USDA Forest Service in coordinating ground and aerial resources in wildfire suppression. Experts from the former Yugoslav Republic of Macedonia and Serbia participated and benefited from this cooperative project (fig. 9).

In November 2016, in response to severe fire seasons in the region in the previous 10 years—and also to the growing effectiveness of the national forest fire protection systems and improving regional cooperation—the first Regional Consultation on Cross-boundary Cooperation in Fire Management was organized in Skopje, former Yugoslav Republic of Macedonia.

The consultation, an initiative by the Global Fire Monitoring Center and Regional Fire Monitoring Center, was supported by the Secretariat of the Council of Europe's Major Hazards Agreement.

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### Fire prevention activities must become a priority, especially to maximize the effectiveness of limited funding.

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The regional consultation was attended by 39 participants from institutions, state organizations, and nongovernmental organizations responsible for fire management and land management in the former Yugoslav Republic of Macedonia and neighboring countries (Albania, Bulgaria, Greece, Kosovo, and Serbia) (fig. 10). The consultation highlighted the contributions of cross-boundary cooperation in improving the effectiveness and

efficiency of fire management. Key recommendations included:

- Sharing expertise in interagency coordination and cross-boundary cooperation in fire management,
- Holding annual preparedness meetings and exercises,
- Coordinating aerial firefighting, and
- Providing early warning of wildfires near borders and timely communication about other relevant fire management issues.

Sharing fire management expertise between Southeastern Europe and the countries of the Near and Middle East has become a notable regional effort. Cooperation between Israel and its neighbors during fire emergencies in 2010 and 2016 has been followed by cooperative projects between Lebanon and the Islamic Republic of Iran.

In Lebanon, like in the Balkans, abandonment of land cultivation is the main driver of increasing landscape flammability. For instance, the Qadisha Valley, a UNESCO World Heritage Site since 1998, is



Figure 13—The International Fire Management Week in Mazandaran, Kelarabad, Islamic Republic of Iran, was opened by Colonel Ghasem Sabz Ali, Commander of the Forest Guard (Forest, Rangeland and Watershed Management Organization). The meetings were an opportunity to exchange fire management methods with neighboring countries. Local hand crews demonstrated their rapid-attack equipment and initial-attack skills. Photos: Global Fire Monitoring Center.

in a region where landscapes have been shaped by hundreds of years of land cultivation. Recent changes in demographics and land use, along with political instability, resulted in dramatic changes to the Qadisha Valley. As the intensive cultivation of olive groves, terraces, and gardens ended, live and dead vegetation accumulated, resulting in a growing wildfire hazard (fig. 11). Integrated fire management principles have therefore been introduced to strengthen local community-based participatory approaches aimed at protecting the area's natural, cultural, and spiritual values from wildfire (GFMC 2010).

Close cooperation between two of the Global Fire Monitoring Center's regional wildland fire networks (for Southeast Europe/Caucasus and for Central Asia) also resulted in cooperative strategic conferences. The meetings were held in the South Caucasus and the Middle East, a region in which fire-sensitive mountain forests are increasingly affected by climate change and wildfires (fig. 12). In 2016, the first International Fire Management Week was held in the Islamic Republic of Iran, where the EuroFire Competency Standards were introduced in the Persian language

and regional cooperation in fire management was discussed (fig. 13). In Greece, the Government responded to the wildfire disaster that affected Mati on July 23, 2018. Prime Minister Alexis Tsipras established an independent commission headed by Professor Johann Georg Goldammer of the Global Fire Monitoring Center and staffed by well-known Greek forest fire experts to study the underlying causes of the worsening fire problem in the natural, cultural, and periurban landscapes of the country and to present a forward-looking plan that will address the current gaps and weaknesses and will guide future fire management.

In February 2019, the commission handed over the report to the Government of Greece. The recommendations for new holistic approaches in landscape fire management are currently being reviewed by the Parliament and the key ministries concerned (Goldammer and others 2019).

## Fire Prevention

Fire prevention activities must become a priority, especially to maximize the effectiveness of limited funding for fire

management. Reducing the number of fires, particularly during high fire danger conditions, limits the occurrence of severe events that exceed the suppression capacity of national fire management organizations. The correlation between high fire incidences and very large fires has been recognized by studies internationally. Furthermore, the potential for arson as a method of terrorism becomes a challenge for planning. The terrorism threat and the lessons learned from fire disasters since 2007, including the weaknesses of fire management organizations, have spurred fire prevention efforts.

The European research project "Linking Civil Protection and Planning by Agreement on Objectives" developed a disaster prevention methodology. The methodology was applied to forest fire prevention in many parts of Greece from 2013 to 2014. The approach was participatory; it involved convening local authorities, volunteers, and the public to discuss problems associated with local forest fires. The goal was to identify the most important fire causes, to reach an agreement on specific prevention

objectives, and to develop ideas for risk mitigation through open brainstorming (Greiving and others 2012). An ad hoc working group, formed on the spot by volunteering participants, undertook to act on the ideas with support from the others and from local authorities as needed; the results were encouraging.

An additional initiative is a handbook under the title “Defense of Villages, Farms and Other Assets Against Wildfires: Guidelines for Rural Populations, Local Communities and Municipality Leaders in the Balkan Region,” published by the Global Fire Monitoring Center under the Council of Europe’s Major Hazards Agreement. The handbook was translated from English into other languages and adapted for use in Bosnia and Herzegovina, Croatia, the former Yugoslav Republic of Macedonia, Greece, Montenegro, and Serbia, with more languages to follow (GWFN, n.d.).

The examples above highlight the need to:

- Involve the public in and inform the public about efforts to reduce fire starts, and
- Solicit public comment on and contributions toward making wildland–urban interface and periurban areas (and people themselves) safer in the event of devastating fires.

Insightful and pragmatic approaches based on evidence from around Europe point to the need for changes in legislation to support the development of *Fire Smart Territories*, a new concept for sustainable land management. *Fire Smart Territories* includes the use of fire and is based on training and empowering people (Tedim and others 2016).

## Fire Suppression

Many weaknesses in fire management, including fire suppression, have become evident in the last 10 to 15 years throughout the Eastern Mediterranean region. Many countries have witnessed terrible disasters. During the 2007 fire season, Greece suffered 80 fatalities; international assistance from numerous countries in the form of both aerial resources and ground crews helped the country bring the blazes under control (Xanthopoulos 2007). Similarly, the Mount Carmel Fire in Israel on December 2–4, 2010, claimed 44 lives. Because Israel lacked the necessary resources to control the blaze, especially from the air, 17 countries responded to Israel’s call for assistance and generously gave aid, including the use of firefighting planes. In 2011, in response to the Mount Carmel Fire, Israel formed an aerial firefighting squadron consisting of seven Air Tractor F-802 planes.

Since these events, there have been numerous cases of cross-border cooperation in the region, especially through aerial assistance. An example was the Eurichou Fire in Cyprus in June 2016, when the country received aerial resources from France, Great Britain, Greece, Israel, and Italy. Unfortunately, due to a prolonged financial crisis since 2009, Greece has been unable to maintain the sizable contracted aerial resources it once could afford. The national aerial fleet of Canadair CL-215s and CL-415s has continued to deteriorate due to old age and imperfect maintenance.

With countries facing tough times financially and wildfires becoming more aggressive, future steps must include careful selection and better use of aerial resources. At the same

time, ground firefighting must improve. European fire managers must revive forgotten methods, such as the use of prescribed fire and backfiring techniques, especially when high-intensity wildfires preclude direct attack. Firefighter training is required for adopting these tools and for improving overall ground fire suppression.

## Training in Fire Management and Suppression

In some of the Balkan countries, firefighters are recruited from the forestry sector’s permanent employees (such as forest workers and forestry engineers) but generally only for fire suppression activities, not for prevention. Emergency responders are often given some level of specialized training in fighting wildfires to complement their primary roles in civil protection, urban firefighting, or military service. But when wildfire suppression is only one aspect of the firefighters’ work rather than their professional focus—as is the general rule in most Balkan countries—then their effectiveness falls short. It is therefore important that actors involved in fire prevention and suppression activities acquire additional skills and specialized equipment to meet all the challenges of landscape-scale fire management.

Xanthopoulos and others (2016) give an overview of training systems in Mediterranean Europe, with an emphasis on the Balkan countries. The report discusses significant weaknesses in training, such as the failure to consider the impacts of fire challenges in the context of what the authors call “global change” (“planetary-scale changes in the Earth system,” including changes in population, climate, resource use, energy development,

and other areas). Overall, more advanced firefighter training is needed, including standardization and exchange of experiences between countries. Training must be specialized—specifically tailored to forest firefighting—because such training is lacking in countries where urban fire services carry the responsibility for this task.

During its European EuroFire research project (2006–2008), the Global Fire Monitoring Center produced some very useful training material that can form the basis for standardized forest firefighting training (GFMC 2006). By early 2016, the freely available EuroFire Competency Standards and Training Materials had been translated for use in Armenia, Azerbaijan, Bosnia and Herzegovina, Brazil (Portuguese), Croatia, France, the former Yugoslav Republic of Macedonia, Georgia, Germany, Greece, Iran, Korea, Latin America (Spanish), Mongolia, Montenegro, Russia, Serbia, Turkey, and Ukraine. In 2018, translations into languages serving Southeast Asia will follow (in Indonesian, Malaysian, and Thai).

## Region-Specific Solutions

The challenges of forest fire management in the Eastern Mediterranean, Southeastern Europe, and Middle East regions have much in common with the challenges faced around the world. However, the challenges are also associated with characteristics specific to these regions, ranging

from historical development to population characteristics and from financial development to environmental influences on the forest fire problem.

Region-specific difficulties will require locally tailored solutions—solutions that will achieve effective and efficient fire management. Rational, scientifically based fire management policy and organization, supported by careful international knowledge transfer and strengthened regional cooperation, are the best way forward.

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