

ADVANCES IN FOREST FIRE RESEARCH

2022

Edited by

**DOMINGOS XAVIER VIEGAS
LUÍS MÁRIO RIBEIRO**

Lessons from the 2021 Fire Season: An Opportunity for Greece to Reform its Wildfire Risk Governance

Palaiologos Palaiologou*¹; Kostas Kalabokidis²

¹Department of Forestry and Natural Environment Management, Agricultural University of Athens, Karpenisi, 36100, Greece, {palaiologou@aua.gr}

²Department of Geography, University of the Aegean, Mytilene, 81100, Greece, {kalabokidis@aegean.gr}

*Corresponding author

Keywords

Large-scale fires; fuel management; wildfire resilience; climate change adaptation; settlement protection.

Abstract

The 2021 fire season in Greece was disastrous in terms of area burned (140,000 ha), from six large-scale events (>10,000 ha) and one mega-fire in Evia Island (46,000 ha). These fires burned under extreme drought conditions and paradoxically, with moderate to low wind speeds, mostly inside low elevation conifer forests (*Pinus halepensis*) and shrublands. The concurrent burst and propagation of several large-scale events lead, once again, to the collapse of the firefighting mechanism, like what happened during the 2007 fire season when more than 260,000 ha burned. As a result, wildfires of 2021 were extinguished only when they reached the sea (Evia) or previously burned areas (western Attica), with firefighting forces completely unable to successfully contain them for weeks. The large number of reinforcements from other countries helped the government officials to understand and clarify (after debriefing) that with the current firefighting operational philosophy of the Greek Fire Service, it is impossible to contain large-scale wildfires. They detected several issues, including the total dependence on airborne firefighting means (Greece had during 2021 one of the largest aerial fleets in Europe), the inability of firefighters to operate inside forested areas, the prohibition of backfires, the slow creation rates, or complete lack, of vegetation clearings for creating new fuel breaks during firefighting, and the lack of appropriately previously treated areas. This sparked a debate among political parties and the society of what can Greece do from now on to prevent future mega-fires that can have devastating economic effects not only to the local population (e.g., northern Evia, an island that has based its local economy to forest products and recreational tourism), but also to the country's economy (>4 billion euros in 2021). Another important issue is the environmental impact caused by the loss of forest carbon pools, soil loss and erosion, increased water runoff and degradation of the aesthetic quality, all having a long-lasting effect on the affected areas. The above lead the Greek Government to take a series of measures that were proposed, including legislation changes, administrative organization reforms and adaptation of firefighting operational tactics. A breakthrough is considered the re-creation of six special forest fire operation crews (a total of 500 people) following the standards of the US smokejumpers or hotshots' crews. These crews are foreseen to be allowed to use backfires, after a necessary planned legislation reform. Another important legislation change was the simplification of bureaucracy that will enable landowners outside city limits to easily perform mild fuel reduction operations inside their property, currently illegal without permission. Despite these changes, an important component of improved fire risk governance is still missing. Fuel reduction is applied at the wrong scale, with inappropriate treatment methods, without proper planning and measurable outcomes and to landscape parts that can hardly influence fire propagation and intensity. In this work, we provide the context and a set of proposals and measures for fuel management that we believe are missing and if applied, can enhance prevention, and improve the firefighting effectiveness, considering ecological, economic, and operational issues.

1. Introduction

The importance of forest management in mitigating large forest fires risk for the protection of human lives and the wildland-urban interface (WUI) is increasingly emphasized. It is a fact that Mediterranean climate regions experience an ever-increasing trend for creating new and/or expand existing human settlements inside or close to natural areas which, in turn, cause pressures on the environment with the introduction of alien to native vegetation species, deforestation and human activities in wildlife areas that increase the fire risk (Moreira et al. 2011). As a result, the mixing of natural and human systems has created densely populated landscapes with large amounts of fuel that will certainly be affected by difficult to suppress near-future large-scale wildfires. The combination of forest cover increase, reduction of the annual recoverable timber and the consequent

accumulation of dead and live biomass (Figure 1) indicates the need to increase the annually managed area to reduce the rate of spread and fire intensity in locations where wildfires can damage residential areas, cultural monuments, ecological sites and values, and ecosystem services.



Figure 1: Typical conditions of unmanaged low-elevation coniferous forests in Greece, having large quantity and continuity of dead and live fuels

The recent extreme wildfire season of 2021 has prompted forest management authorities and policy makers of Greece to reconsider the existing policies regarding fire risk governance. Of all the measures proposed and implemented so far by the Greek Government and other public agencies, the least emphasis has been given to the fuel reduction efforts and especially, how they should be applied to achieve a change in future fire behavior that can be utilized to improve the efficiency of firefighting. Recently, the Greek Government announced a 50-million-euro program that will fund fuel reduction and fire protection projects, but it is still unclear how these projects will be allocated on the landscape, what will be their size and arrangement, what forested ecosystems are eligible to receive these projects, what is their expected and measurable impact on the behavior of future wildfires, who will apply them and with what management methods.

With this work, we attempt to advice and guide the Greek Government's effort to plan and fund these projects and avoid pitfalls that will result in reduced effectiveness, rare or no encounter with future fires, and failure to protect settlements and other values-at-risk. In addition, we will start by describing the main lessons learned during and after the 2021 fire season and describe how they guided so far, and how they will, government efforts to improve fire risk governance and implement changes to established outdated forest (and fire) management policies of 50 years ago.

2. Lessons learned from forest fires of 2021

The most valuable lesson learned, especially for the cases when large-scale wildfires were approaching or burning inside the WUI, was that the existing firefighting tactics of waiting along the roadside, avoid getting into forested areas away from the road network, and spraying parts of the fire front or flanks with water, is a failed strategy. Not only it cannot contain or stop a typical raging large-scale wildfire with flame lengths of up to 50 m and spread rates of up to 10 km/h, but it keeps an important number of firefighting forces occupied to a lost cause. In addition, by giving emphasis to a passive and narrow scale strategy to protect homes and properties instead of an active that involves operational planning at a landscape level and inside forested areas, it gives space and time to the wildfire to escape or surpass the still suppression units. When this happens, firefighting forces start chasing the fire or desperately call for aerial support. The large dependence of ground

forces on aerial support to achieve alteration in fire behavior leads to requests that not only do not ensure airborne means are necessary but also are not in clear alignment with a wildfire's incident strategy and with agency and interagency general fire management goals and objectives (Stonesifer et al. 2021), increasing aircraft and personnel fatigue. As a result, the Greek Government decided to create a special firefighting unit with 500 persons divided into six crews, with training in the US to learn modern firefighting tactics, including the backfire technique (currently prohibited, but soon to be legalized).

Before the 2021 fire season, when homeowners and landowners wanted to protect their property from wildfires with preventive fuel treatments, they were required to either request a permission from the Urban Planning Agency, if their property was within urban area limits, or from the Greek Forest Service (GFS) if it was outside. For both cases, the owners were obliged to file a technical study with the trees that needed to be cut and then, after a time-consuming process (bureaucracy and corruption were the two reasons for multi-year delays in granting those permissions), get the permission; otherwise, they could have serious legal issues. Owners were reluctant to go through that process since it required both time and money and as a result, they let their property without any fuel treatment. The simplification of bureaucracy that enables landowners outside city limits to easily perform mild fuel reduction operations is an important legislation reform.

Finally, evacuation of settlements has become the mainstream policy of the Greek Civil Protection agencies. To avoid fatalities from wildfires approaching the WUI or urban boundaries, as was the case of the 2018 small scale event (1,300 ha) of Mati at the outskirts of Athens that killed more than 100 people, large-scale evacuations happen even in cases where there is low or no probability of the fire to enter the settlement.

3. How fuel treatments should be applied in Greece to improve their efficiency?

The three pillars for the suppression of large-scale wildfires are (Figure 2): 1) the combined suppression from ground forces and airborne means, 2) in areas with previously implemented fuel management, and 3) by applying passive fire suppression and indirect firefighting, such as the backfire technique. Prerequisite for the above is the existence of strategically allocated fuel treatment units, with adequate extent and treatment intensity. As the international experience shows, areas receiving fuel management must be able to drastically reduce the fire rate of spread even without fire suppression. To achieve this, a series of conditions must be met.

First, local government agencies have neither the planning expertise nor the technical skills to perform fuel treatments. We propose the entire fuel treatment funding to be transferred to the GFS, an agency with the necessary skills to accomplish this task, after a substantial increase from 25 million euros per year to at least 50 million euros. The GFS should oversee the application of the planned fuel treatments on all lands, even without the consent of the landowners. To allow this, a legislation reform is required. This is necessary because the fragmented landscape among multiple owners does not leave much space for consensus and collaboration; and as a result, the planned projects can be cancelled. The planning of project allocation should be done by considering (Palaiologou et al. 2021): a) the dominant weather patterns of each area, b) the vegetation and fuel conditions, c) the possibility of encountering a future wildfire, and d) their estimated impact on fire spread and intensity. This can be accomplished only if stochastic fire behavior modelling is applied. By simulating thousands of wildfires, we can account for different ignition locations and weather scenarios, and reveal hidden trends and patterns on the landscape from fires that have not happened yet but are highly possible to occur in the near future.

After the best candidate sites are found, it is necessary to consider the scale and arrangement of the applied projects and also, the fuel treatment methods applied to maximize their efficiency. Small scale or isolated projects should be avoided, and the treated area should be large enough to counter the scale of a large wildfire. Projects should form a network or create a protective “umbrella” around values-at-risk or settlements if this is the fuel treatment priority (Ager et al. 2013). One of the most important challenges for forest managers is to consider and decide between competing landscape management priorities, and such a challenge creates a complex spatial trade-off problem (Ager et al. 2017). Developing a broader set of forest management priorities tailored to specific areas should be based on fire regimes, human values, and land uses. Different arrangement and scale of fuel treatments and management methods are required when the priority is settlement protection vs. strategic containment vs. ecological restoration of forested ecosystems vs. timber production (Ager et al. 2013).

Regarding the fuel treatment methods, the combination of mechanical treatments, mostly thinning, pile burning, and grazing is a promising choice that does not require legislative reforms. Ideally, prescribed fire can further reduce implementation costs, but it is currently illegal. To avoid hazardous fuel accumulation, logging residuals should be either lopped and scattered or piled to be burned when conditions allow it. Also, pruning of trees that are left after thinning is suggested to break the continuity of the ladder fuels. Finally, the forests most in need to receive fuel treatments are the low elevation conifer forests (*Pinus halepensis* and *P. brutia*), especially those mixed with shrubs in the understory. In addition, cold tolerant species such as fir (*Abies* spp.) on higher elevations present an aggressive expansion against other forested ecosystems. Combined with climate alterations and severe droughts, these young coniferous forests present an ever-increasing fire risk. Fuel management is required there as well to restore the ecological balance (these ecosystems were intensively treated up to the 1980s with traditional agroforestry practices, including the use of fire to clean the forest understory).



Figure 2: Combined suppression from ground forces and airborne means near roads and fuel breaks

4. Conclusion

The main problem is that Greece perceives wildfires as a suppression problem rather than a forest management one. Instead of covering fire suppression with a “veil” of heroism that expects from the “heroes” to enter the fire like ancient warriors in battles, we propose the use of improved firefighting tactics and combine them with preventive forest management. Claims that the problem of mega-fires and their transmission into settlements will be solved by hiring more firefighters or by purchasing additional aerial firefighting equipment, unfortunately, do not recognize the nature and ecology of wildfires, nor are they aware of the latest scientific data. Wildfires are a complex problem and require the synergy of many actors, methodologies and practices to mitigate their dire effects, and only partially. It is considered *a priori* knowledge that there is no way to eliminate fires from the fire-adapted ecosystems of Greece, and they will continue to manifest no matter how many measures are taken. It is impossible to deal with each ignition, or with simultaneous high-intensity wildfires, regardless of how many firefighters and aircraft the country possesses. Therefore, fuel management with proper application is crucial to improve the chances of successful containment of large-scale wildfires.

5. References

Ager, A.A., Vaillant, N.M. and McMahan, A., 2013. Restoration of fire in managed forests: a model to prioritize landscapes and analyze tradeoffs. *Ecosphere*, 4(2), pp.1-19.

- Ager, A.A., Vogler, K.C., Day, M.A. and Bailey, J.D., 2017. Economic opportunities and trade-offs in collaborative forest landscape restoration. *Ecological Economics*, **136**, pp.226-239.
- Moreira, F., Viedma, O., Arianoutsou, M., Curt, T., Koutsias, N., Rigolot, E., Barbati, A., Corona, P., Vaz, P., Xanthopoulos, G. and Mouillot, F., 2011. Landscape–wildfire interactions in southern Europe: implications for landscape management. *Journal of environmental management*, **92**(10), pp.2389-2402.
- Palaiologou, P., Kalabokidis, K., Ager, A.A., Galatsidas, S., Papalampros, L. and Day, M.A., 2021. Spatial optimization and tradeoffs of alternative forest management scenarios in Macedonia, Greece. *Forests*, **12**(6), p.697.
- Stonesifer, C.S., Calkin, D.E., Thompson, M.P. and Belval, E.J., 2021. Is This Flight Necessary? The Aviation Use Summary (AUS): A Framework for Strategic, Risk-Informed Aviation Decision Support. *Forests*, **12**(8), p.1078.