

Obstacles to Improving Wildfire Risk Governance in Greece

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INTRODUCTION

A sequence of catastrophic wildfires that occurred during the past decades in Greece point to the need to re-examine the established wildfire risk governance policies. The most important regulations for fire suppression and fuel/forest management were established four decades ago (Law 998/1979). Wildfire suppression is now led by the Greek Fire Service, while pre-suppression vegetation management is supervised by the Greek Forest Service. The limited available budget is clearly distributed in favor of fire suppression (about \$410 million annually), with minor funding remaining for fuel management and ignition prevention programs (about \$25 million annually). Since a substantial improvement of fire suppression effectiveness is not anticipated to occur in the near future due to economic restrictions, fire prevention that includes managing landscape fuel conditions (quantity and spatial arrangement) might be the only available option for Greece to aid fire suppression and reduce the number of potential harmful fire events in a cost-effective way. Successful application and experiences from North America and South Europe proved that investing more in prevention provides the means to cope with the upcoming challenges that emerge from

climate change and, typical to Greece, the effects of land abandonment on fuel patterns.

Few studies have explained the current trends and beliefs of the Greek society on wildfire related issues (Henderson et al. 2005; Kalabokidis et al. 2008; Morehouse et al. 2011). One of the main objectives of this study was to understand the prevailing trends and perspectives of engaged stakeholders who can influence risk governance policies through their job position. Several questions were focused on prescribed fire use for fuel management and backfires for suppression, while others on evaluating the current policies and the role of state agencies in reducing the most important wildfire related problems. We hypothesized that prescribed fire use is lacking consensus and support, and that engaged stakeholders are more favorable on promoting suppression related policies, rather than adopting preventive fuel management measures.

FIRE AND SOCIETY IN THE GREEK LANDSCAPE

Radical population movements during the past 70 years shaped the Greek landscape, altering vegetation conditions and ownership patterns, mostly due to

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land abandonment and vegetation encroachment into formerly cultivated lands. Cultural reasons caused a remarkable land ownership fragmentation on private lands, with 80 percent of all private holdings be less than five hectares (Kasimis et al. 2012). This highly fragment landscape, with thousands of small ownerships without any regular activity makes their management difficult, especially in mountainous and rugged areas. In addition, private lands fragmentation makes management costlier and more laborious. The problem of illegally built structures in the wildland-urban interface increase suppression complexity and landscape fragmentation (Palaiologou et al. 2018). Regarding forest ownerships, 65 percent belongs to the state and 12 percent to local communities, 10 percent are of mixed ownership (i.e. public with private), 8 percent are private, and 5 percent belong to the church or other non-government organizations. On about 35 percent of all forests, some form of management is applied, mainly for timber production. Grasslands are mostly state owned and suitable for sheep and goat grazing, composed of grasses and short shrubs.

During 1974-2012, 180 wildfires burned between 500 to 2,000 ha, 99 wildfires burned between 2,000 and 7,000 ha, and 35 events evolved into large scale fires burning more than 7,000 ha. Only half of wildfires have a verified ignition cause, with most significant be the burning of agricultural lands and grassland for clearing unwanted vegetation (33%, arson (23%), negligence (12%), lightning (8%) and landfill fires (6%).

VEGETATION AND FUEL MANAGEMENT CULTURE

Greece implements a minimalistic application of fuel treatments (limited in extent, size and efficiency) that require in addition “active” fire suppression for benefits to be realized. The temporal scale of treatment effectiveness is usually ignored (i.e. treated areas are revegetated after a location based or vegetation type specific period), and the strategic allocation of treatments is narrowed only to fuel breaks that empirically consider the dominant travel paths of possible wildfires in the landscape.

Fuel reduction and timber production are regulated by the Greek Forest Service on both state and large

privately-owned forested lands, but with limited application to non-forested private lands. The main obstacles for increasing management on private forests are their small size and owner’s reluctance to invest due to reduced prospects for profit, in addition to conflicts caused by joint ownerships that can paralyze management decisions. Officially, regulated forest management is centered on harvesting for industrial timber production, mainly in northern Greece where productive forests of true-fir (*Abies* spp.), spruce (*Picea abies*), high-elevation pines (*Pinus nigra* and *Pinus sylvestris*), beech (*Fagus* spp.) and deciduous oaks (*Quercus* spp.) grow (Xanthopoulos 2004). The annual timber production is 1.1 million m³, 30 percent of which comes from private forests; one third is produced from conifers, with the majority of production (~65%) used as fuelwood.

Fire-prone low elevation conifer forests and evergreen shrublands are largely left unmanaged and prone to fuel build-up due to funding shortages and lack of fire risk management culture. Despite these, management activities or disturbances are applied by farmers or livestock producers, sometimes unofficially, with traditional land use practices on agroforestry systems, including resin collection from conifers, grazing on silvopastoral systems, fuelwood collection, honey production and forage products. These traditional management practices are threatened by degradation, either through abandonment or intensification, which leads to their conversion to woodlands and crop monocultures, respectively (Papanastasis et al. 2009); or through repeated wildfires that change the landscape characteristics (changes in dominant vegetation types and land uses, erosion/desertification, livestock and farming activity reduction).

Current laws do not allow any intentional fire use, neither prescribed burns nor backfires during fire suppression. Prior to the major postwar-era land abandonment, fire was a widespread practice of local populations employed to clear forests from unwanted vegetation, the absence of which (through legal ban) has caused forest encroachment in formerly agricultural lands (Tedim et al. 2015; Zakkak et al. 2014). Reintroducing fire as a management tool may be an important strategy in resolving several ecological and management challenges on the Greek

landscape, but it can only be applied after a substantial legislative reform and strict guidelines.

KEY INFORMANT SURVEY

We conducted a web-based survey of a sample comprised of professionals in wildfire management and research and other engaged stakeholders interested in wildfires (local government officials, NGO's, community members etc.). The survey was conducted during the winter of 2017-2018 (December through February). We received 106 properly completed responses, from people living in 28 different municipalities in Greece, reaching approximately a 33 percent response rate. The questionnaire consisted of 22 questions, forming three different groups: general questions about the respondent status/expertise; beliefs about fire management and suppression; ranking/ comparison of different fire effects. Respondents were asked to rate the questions based on the situation, conditions and perceptions they have for the place of residence where they lived longest during their lives (place-based knowledge). We defined as experts those respondents that have experienced at least three fire incidents during their lives, and with good or excellent working experience on at least two of the following fire related activities: suppression, fuel management, research and study, post-fire rehabilitation and wildfire effects. The questionnaire was constructed with Qualtrics (Qualtrics, Provo, UT) using different question types (multiple choice, five-point Likert-scale, ranking order).

RESULTS

In this write-up, we focused on responses describing beliefs about fire management and suppression, and not on those received for the different fire effect categories. Our sample was comprised by mostly male respondents (80%), with one third of all respondents being younger than 35 years old and the majority (52%) between 35-54 years old. Experts comprised 45 percent of all respondents. One third of all respondents were working for the Fire Service.

A 28 percent of all respondents experienced more than ten fires, 30 percent less than two, and 50 percent more than five fires (fig. 1A). Most respondents believed that in their home region wildfires are caused due to

people's negligence, by arsonists pursuing specific objectives, or by the way the society/people function and live (fig. 1B). Only a minority of people (8% of all responses) believed that ignitions are from natural causes (lightning). When the question was framed differently, i.e. "when multiple wildfires occur across Greece who is responsible?" (fig. 1C), respondents rated higher the "arsonists pursuing specific interests", while they attributed additional influence on weather/ natural phenomena. Negligence was also rated high, while some respondents stated that arsonists with psychological disorders are those causing most of wildfires.

Respondents believed that improved collaboration among the fire management agencies is the most capable approach on reducing the wildfire related problems (fig. 1D), while better education and access to information for individuals and communities can play a major role in achieving this goal. There was limited support for fuel reduction since only a small percentage (9%) believed that fuel reduction activities can play a major role in dealing with wildfire related problems (fig. 1D), while responses related to increased fire suppression capacity (better patrolling or surveillance, acquisition of new firefighting resources and hiring of more firefighters) were also relatively few (15% of all responses).

In figure 2A, we noticed two main conflicting issues, the first on if all fires must remain illegal, and the second on allowing some natural fires to burn to achieve ecological objectives, with a slightly higher acceptance on allowing some of them to burn than remaining illegal. Respondents were very reluctant on fire use without a strict supervision and training, although they overwhelmingly agreed (~80%) on tolerance and protection of people involved in a possible accident. Most respondents (~75%) agreed that fire can effectively control and protect forests, and that fires are an inexpensive method for firefighting and removal of unwanted fuels (~65%), but with strong minorities disagreeing on the above issues (~25% and ~35%, respectively). Such strong minorities can be importantly influential, especially in issues regarding fires and legislative reforms to allow its use.



Figure 1—Questions about the respondent beliefs on fire ignition responsibility, wildfire management policy and experience with wildfires.

Respondents overwhelmingly agreed that societies can do much to confront wildfire (fig. 2B), a finding that is in accordance with the responses in figure 1D, where most respondents believed that socially related improvements can reduce wildfire related problems (e.g. collaboration, education and officially defined ownership boundaries). In general, wildfires were not seen as a natural process and part of ecosystem functioning (fig. 2B), since almost 45 percent of the respondents stated that wildfires cause only negative impacts and effects, with more than 75 percent disagreeing that there is a fire deficit in Greek

landscapes. There is little tolerance for uncontrolled fires and the clear majority agreed that they should be extinguished as soon as possible. Regarding climate change, most of the respondents (>90%) agreed that it can increase the number, intensity and area burned by wildfires. About 80 percent of the respondents agreed that it is people's responsibility to remove vegetation and fuels from their property. Respondents also acknowledged that the Greek Forest Service, which currently has little involvement in the field, should become more engaged on all stages of wildfire management.

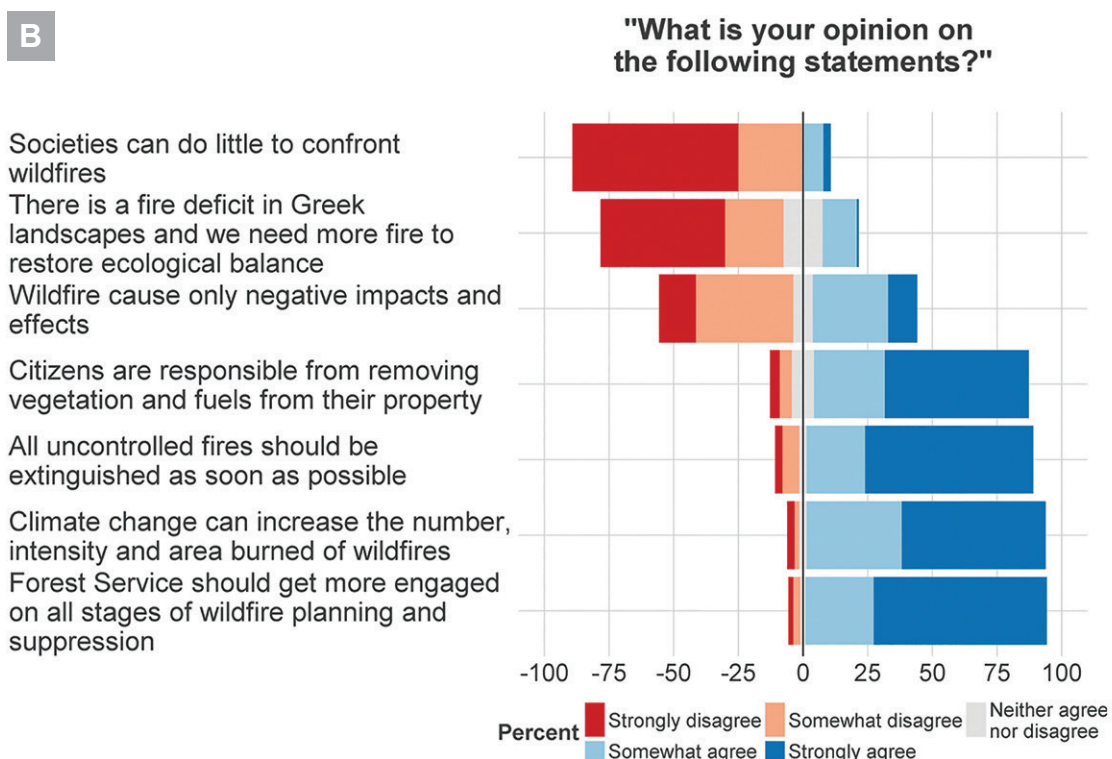
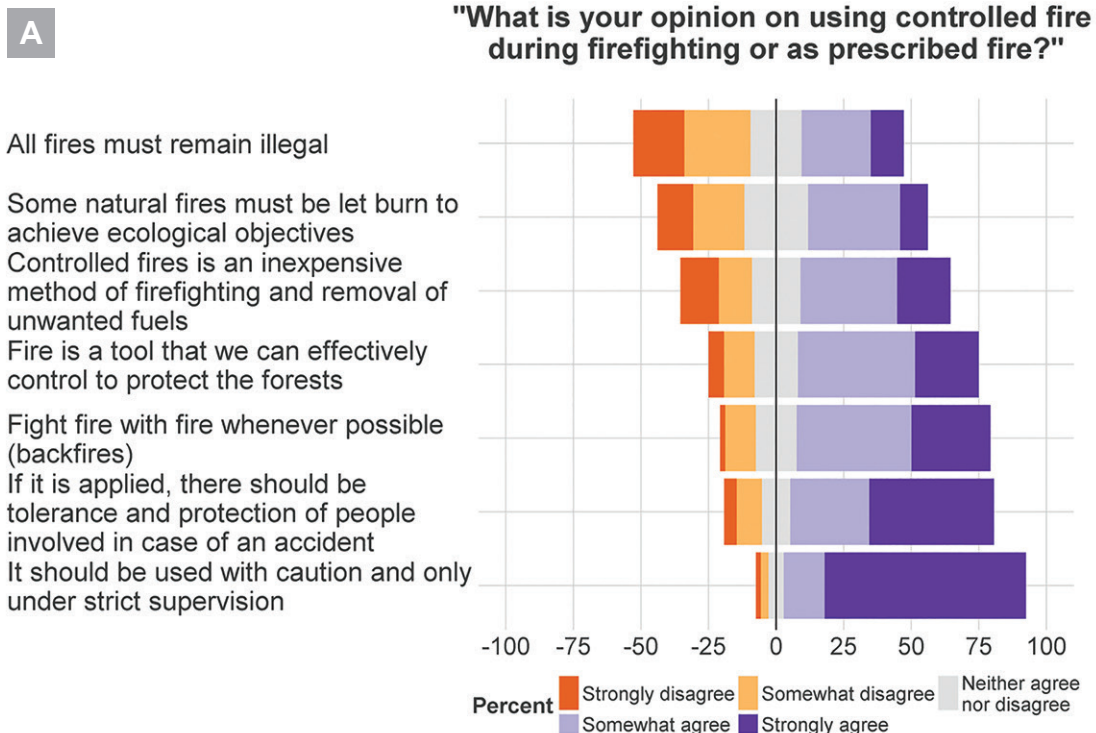


Figure 2—Likert scale questions about the respondents' opinions on controlled fire use and their perceptions on several wildfire related issues.

DISCUSSION

Analysis of questionnaire responses revealed that landscape fragmentation, legal barriers for wildland fire use and prescribed fires, weak collaboration among the major stakeholders and agencies, the lack of fuel management culture, funding unavailability and lack of knowledge on the spatial scale of risk (where fires start, how they spread and who can be potentially affected) are major obstacles on improving wildfire risk governance in Greece.

A legal reform to allow fire to be used as a tool during fire suppression and fuel management can encounter strong opposition. Results revealed that respondents tend to have a negative attitude towards wildfire and uncontrolled burns, with most people expressing a strong belief that fires are causing negative effects. There is weak support to legitimize some fires and respondents strongly agreed that all uncontrolled fires should be extinguished as soon as possible. Any wildfire has the potential to burn into some private property scattered in the highly fragmented land tenure system, and this is probably one of the reasons that societies want all fires to be confronted. However, results suggested that respondents can possibly accept the use of controlled fire, under the condition that it will be used with caution and strict supervision, with a weak majority of people in favor of fire use for resource benefits (although, they disagree that there is a fire deficit).

Most experts believed that an effective wildfire policy should account for the way society and agencies function and interact. Respondents acknowledged that the lack of a national cadaster and the fuzzy boundaries among ownerships was one of the major sources of wildfire related problems. There was also a strong belief that arsonists are behind most ignitions, but negligence of citizens accounts for more ignitions in local spatial scales.

CONCLUSION

The challenge of confronting large wildfire events in Greece will require the adoption of holistic approaches that will consider the new socioeconomic reality and incorporate recent advancements in wildfire science, targeted at reducing the wildfire spread rate and

intensity by modifying the fuel patterns at a landscape level. Negative views on some policy change reforms (e.g., fire use) can be dealt with improved education and campaigns that will showcase success stories of implementation. Finally, training of the Forest Service personnel on the results of successful fuel management projects in Europe and elsewhere may help towards fuel management in places and scales that can create a change in Greece's future wildfire trajectory.

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