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Local population safety challenges and property self-protection issues during the mega-fire of 2021 in North Euboea, Greece

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Abstract

The fire in North Euboea in August 2021 was burning continuously for two weeks and destroyed an area greater than fifty thousand hectares, Greece's biggest ever from a single fire. The response planning of the Greek Civil Protection and the public fire management mechanism urged for preventive evacuation even in cases the fire front was tens of kilometers away from the villages requested to be evacuated. This was dictated by the loss of hundred two people in the fire of Mati three years ago (2018). The locals criticize that the government's decision left firefighters without permission to fight the flames even in the case where lives weren't threatened. The ad-hoc reaction of the local rural population, who self-organized themselves and substituted the absence of the public fire services, saved several houses and properties that would be condemned to be burned due to the dihard evacuation planning. Analysis of the information gathered from local authorities and citizens who participated in these ad-hoc response teams proves the potential of involving the local population as first responders in large wildfires and fire emergencies in the wildland-urban interface and rural areas.

1. Introduction

Wildfires severely affect the communities and the properties developed in the wildland-urban interface (WUI). Thus, these communities, whose living is directly linked with the natural landscape and the surrounding forest, must become more resilient and proactive about fires. A sound way to achieve this is to develop a Fire-Adapted Community, meaning a community that can deal with a wildfire with little or no assistance from firefighters (Ingram, 2015).

Local communities can be adapted to wildfires in different ways. On many occasions, the response of the firefighting mechanism focuses strictly on protecting structures and houses, which allows a significant growth of the firefront, developing heat loads beyond any control and causing substantial human lives and property losses. On other occasions, social power, environmental resilience, and fire management can be combined to improve the situation (Marey-Perez et al., 2021; Moritz, M.A et al., 2014; Twidwell et al., 2019).

Fire spread by a combination of a moving firefront and airborne burning and glowing embers. Building losses during wildfires occur because of structure ignition and exposure due to embers (called firebrands), radiant heat, and direct flame contact. Embers are light enough to be blown through the air and can result in the rapid spread of wildfire by spotting (Quarles L.C. et al., 2010, CALFIRE,n.d.), in which case the embers are blown ahead of the active firefront, starting new fires). In the case of villages and settlements where the peripheral buildings create a wall to the rapid fire propagation, the structures in the perimeter are exposed to radiant heat and flame contact. There it is usually concentrated, the firefighting effort. However, spotting embers may travel, land, ignite vegetation or accumulated debris inside the village or settlement, or even enter the home or attic through openings or vents, igniting furnishing or combustible debris in those locations. The roof is considered the most vulnerable design element, and the construction material is a critical factor in the structure's resilience. Houses with wood or shingle roofs are at high risk of being destroyed during a wildfire. Vents create openings for flying embers, while windows often break even before the home is on fire due to the flames' heat. The presence of homeowners can prevent the ignition or extinguish spot fires that cross over the fire defense line at the initial

stage. This opportunity is lost in case a flat evacuation order is issued. The above is empirical knowledge broadly available in the communities thriving in mountainous areas and near the forest.

In Australia, the "Prepare, Stay and Defend or Leave Early" policy emphasizes that in the case of bushfires, it is often the safest option for people to remain in their homes in case they are caught in the path of a bushfire. They are thus protected from the radiant heat of the oncoming fire and can take measures to protect their homes from being destroyed by the fire. (Loh, 2007)

Recent major wildfire disasters in Europe reveal that government authorities and civil society, notably rural communities, are not sufficiently prepared and coordinated to prevent and reduce the risk of wildfires. Such coordination is necessary to defend local communities and rural assets at stake against the adverse direct and indirect impacts and consequences of wildfires.

A degree of self-government is a characteristic of many such communities, expressed in the form of rejection of interference from outside, represented by externally generated rules and regulations. This stems from the fact that the population in rural and working landscape areas has developed the ability to be sufficient in self-protecting their villages due to their lifestyle. These communities conceptualize trust differently as well. In some cases, they may have minimal political confidence in government agencies but relatively high social confidence in local authorities, volunteer groups, or their neighbors. (Billings, 2021)

1.1. The North Euboea fire event

Fires are not uncommon in the pine forests of Euboea Island, but they swelled to massive proportions in the summer of 2021. Forests cover 23% of Evia, with 33% of this land burned (8% of the island's 'area) and approximately 10% of this area being agricultural land. The fire weather conditions were characterized by an extreme heatwave affecting Greece, Turkey, and the southern Balkan peninsula, lasting from the last days of July until the first ten days of August 2021. The heatwave was the worst recorded in the past 30 years.

The fire started in the afternoon of 03/08/202 and raged for two weeks, burning tens of thousands of hectares before it was contained and secured on the 17th of August. Despite low winds, due to the accumulated forest fuel loads developed because of the inadequate management in most of the forests in the area, flames wound their way up and down mountains and around villages, devouring one-third of the island's ' pine forests and olive groves. As a result, Evia's' wildfire is the country's most significant ever single fire. The total burned area was 51245 ha, and the affected area comprised two municipalities: Istiaia-Aidipsos & Mantoudi-Limni-AgiaAnna.

The fire extensively consumed the area's primary production, including timber, honey, resin, olives, and figs, and destroyed several assets, infrastructures, and touristic investments. However, the fire's extent, the size of the burned area, the number of the burned houses (150), and the burning of their surroundings were limited.

The result is quite attractive since it was achieved despite the policy adopted in 2021 by the General Secretariat of Civil Protection and the Hellenic Fire Service to evacuate several villages consistently in the vicinity of an active fire. The purpose of this policy is to avoid fatalities at any expense. The emphasis on evacuation resulted from heated political clashes in the aftermath of the East Attica fire of July 23, 2018, in the settlements of Neos Voutzas and Mati, which had caused 102 fatalities (Xanthopoulos G., Athanasiou M., and K.Kaoukis, 2022).

Due to the previous fatal fire in Mati (2018), with a hundred two lives lost, the government prioritized evacuations over the preservation of land. This was partly successful since only two fire-related deaths were reported in Euboea. However, multiple reports show that this diehard decision of the government left firefighters without permission to fight the flames even in case human lives weren't explicitly in danger. The General Secretariat of Civil Protection gave frequent orders to evacuate villages via 112 service messages during the fire. However, many residents ignored the alerts and stayed in their villages to defend their homes and properties. Their decision limited the damages to the houses and structures and contributed to the effectiveness of response at the local scale during the fire.

Several people from the villages challenged by the flames of the Euboea fire and stayed to defend their town, when interviewed by the media, claimed that if they had evacuated their villages, as the civil protection recommended, everything would have been burnt down to ashes perhaps even two days sooner. (Frost-Euronews, 2021).

During the fire and after its suppression, many residents and local citizens criticized the government's ineffective and passive reaction, which they consider to be the main reason for the unprecedented disaster. They experienced a situation where instead of the public firefighting service, volunteer fire corps and locals who defied evacuation orders and remained behind, fighting the fires with tree branches, garden hoses, and any means they had to ferry water have saved hundreds of houses and thousands of hectares from being burned. (Schmitz- DW, 2021; Frost-Euronews, 2021)

2. Methodology

The methodology used for gathering information and processing data to extract relevant knowledge comprised of the following techniques:

- Desk-based research from public sources, news press, and electronic media, including websites, online videos, and social media.
- Earth Observation data during and after the fire, including satellite imagery and information from relative data services.
- Collection and analysis of UAV recordings from villages within the fire perimeter, having more than one house burned, and representing various types of landscape and vegetation forms and
- Extended field visits focused on collecting testimonial information and recital of events from more than 45 residents who experienced the fire crisis in their villages. Open-ended questions were used in an interview format also linked with contextual discussions. The information regarding the exposure of the burned houses, the features (vulnerabilities) of the surrounding environment, and the fire proneness of the landscape on the broader area was recorded on-site, post-processed, and analyzed.

In addition, information on fire behavior and propagation characteristics were collected based on the observations of the personnel from local authorities and volunteer firefighters who substituted the firefighting mechanism inside the villages during the fire.

The analysis aimed to gain, as extensively as possible, an understanding of the fire conditions to which the properties and their owners were exposed, the safety challenges they faced, and their assessment of the situation. Organizational prerequisites, societal and solidarity aspects, good practices for self-protection, and interaction with the local authorities were elaborated with the residents of the villages in the context of locally organized open discussions.

3. Results

The local population of the North Euboea's villages is familiar with living in a forest and agricultural region and forest fires. Due to their professional activity and relation with the forest and rural environment, they have local knowledge of the forest. They have the skills required for addressing an active fire situation. They own and can use agricultural machinery, pumps, small tanks, etc., which help protect properties and infrastructure without public services. The protection of the houses was facilitated by the fact that most of the dwellings and structures in the area were made of concrete, although they may also have some wooden elements. The information analysis showed that several isolated properties (mainly villas or farms) exist in the vicinity or inside the forest in this type of rural landscape. The mainland areas fall in the classic Mediterranean villages, with dense construction elements developed around a central "village square." The outer area of these villages is surrounded by pine forests (*Pinus brutia*) and patches of olive trees. In the coastal areas of the North Euboea, like in most of the touristic regions in Greece, the WUI is similar but has a linear than circular development with the forest surrounding the built part from one side.

Based on the information gathered, the damage caused by the fire around many settlements and other points of economic activity (e.g., orchards with houses or other buildings, farms, etc.) was limited compared to the fire consequences to their surroundings (Figure 1). This mainly concerns settlements and places reached by the fire after the second day. In this case, the residents had the time to organize themselves and respond to the fire almost exclusively on their own.

In most cases, especially after the second day, the residents did not follow the warnings and prompts for evacuating their places and were self-organized, deciding to remain in their villages. This spontaneous reaction, supported by the capabilities of the rural population, led to saving many houses and properties. Self-organization in ad-hoc groups of volunteers and solidarity with neighbors' property was proven the critical success factor for protecting homes and properties.

Several houses were protected this way by these self-organized ad-hoc citizen groups. As a result, they experienced no damage, even if placed in the middle of burning dense and high vegetation. On the contrary, uninhabited or evacuated houses within the boundaries of the settlements or located in remote forest areas suffered significant damage (Figure 2).

For safety reasons, camps and touristic resorts inside the forest were evacuated immediately following the official warning for an urgent evacuation order. All assets falling in this category were utterly burned down to ashes.



Figure 1. Houses with minor damages due to the construction material and existence of defensible space



Figure 2. Houses with significant damage due to pure or aged construction materials

4. Discussion

The involvement of local communities in forest fire management, the use of their skills, and capabilities, such as the contribution of their resources to protect properties and infrastructures in the absence of public civil protection services, need to be considered within the wildfire management organization. However, this can be

an efficient strategy, particularly in the case of villages and settlements whose populations thrive and work in the forest.

Homeowners and the local populations are the first responders and the critical stakeholders for addressing the lack or the inefficiency of the public firefighting and civil protection organization. In light of the ongoing climate change and global warming, it is imperative to invest in the knowledge, skills, and capabilities of the local communities, as a complementary resource, in managing large-scale wildfire events. Civil protection organizations must integrate the local society into the fire management cycle by exploiting all existing capabilities and human resources in holistic fire protection and resilience plan.

Moreover, wildfire management regarding the security and protection of local communities needs to be addressed mainly at the local level. The community needs to be prepared and ready before the fire occurrence to manage the fire threat efficiently and effectively. Adequate maps per community/settlement need to be developed, prioritizing the protection need of the municipalities in the broader region. Assets at risk, location of vulnerable populations, and in-place sheltering possibilities need to be identified and communicated to the community and local authorities. Self-protection of villages entails the preparation of simple plans depicting who will stay on-site in case an evacuation is issued due to the fire and what they must do. Similarly, the plan needs to foresee who will evacuate and how. Such plans need to be updated, discussed, and shared within the community and with all stakeholders involved in fire management every year.

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