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Technical Note

Wildfires in 2020

Forest Fire in Eurovillas - Madrid (Spain)

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Abstract	This document includes a brief description of some of the forest fires affecting populated areas in Europe, which represent a good set of study cases for WUIVIEW project. Some of the fires have been visited and assessment performed for the validation of the VAT/SAT tools.
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(1) *Draft / Final*

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1. About this Technical Note

This document is a short report on some of the forest fire events that happened in 2020 in Spain which are relevant in terms of threat to populated areas. A brief description of the main aspects of the evolution of the fire are given, some observations about fire impact and spread through the settlements and the lessons learned in regard to fire prevention and operations. Some of these fires were visited and surveyed by team members of WUIVIEW project.

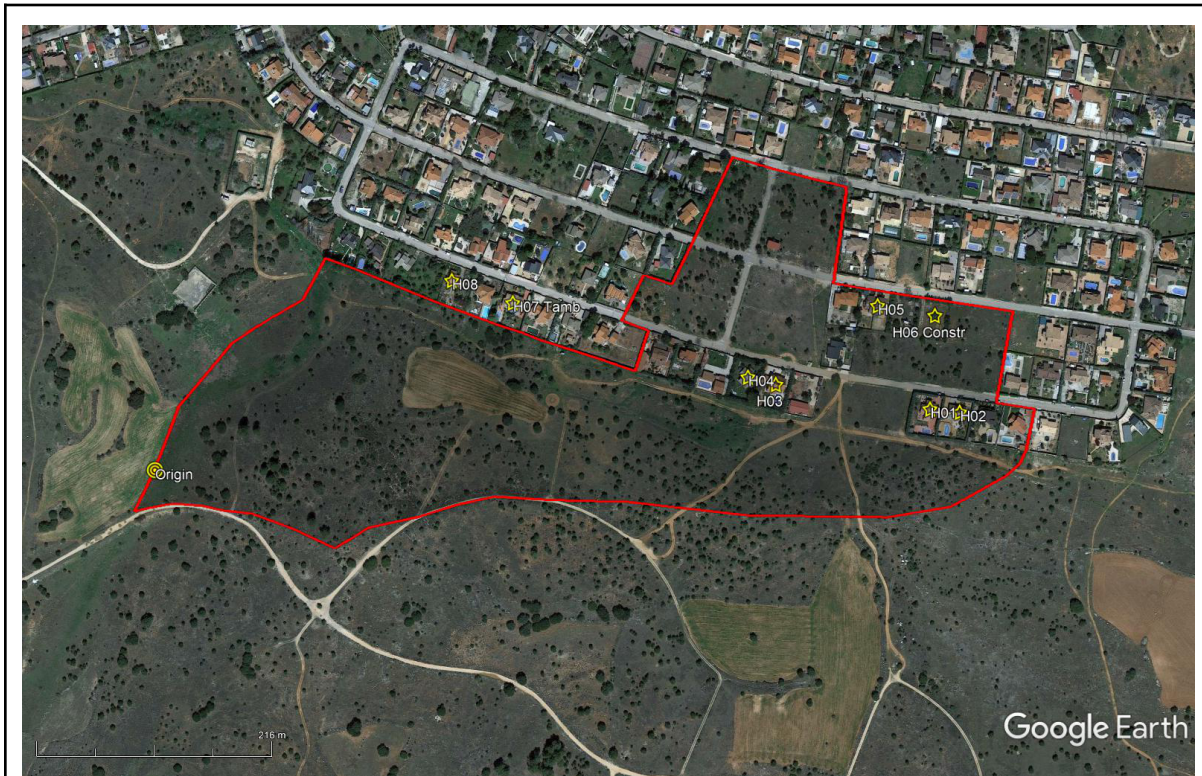
2. Introduction

Events of forest fires affecting populated landscapes are becoming increasingly frequent in Europe. Fire fighters in the member states convey that almost every of the fire outbreaks is eventually impacting in a settlement or affecting structures. Forest fires in the wildland-urban interface (WUI) pose a continuous challenge to fire fighters and civil protection bodies across Europe, primarily because of the complexity of managing threatened population, affected infrastructures and simultaneously deal with a fire environment presenting a fragmented front, projection of fire embers, combustion of residential fuels, production of toxic gases and frequently also entailing chained effects and hidden risks. Visiting fire aftermaths and systematically performing a survey on the factors conducting the fire, the effects on structures, the circumstances of accidents and consequences on victims and the performed operations for fire fighting, population protection and emergency management. Extracting lessons learnt from wildfires affecting the WUI must be done in the few days after the episode has subsided and as soon as the scenario has been stabilised and the risks minimised, so as to proceed safely in the aftermath. Under COVID-19 restrictions, visits have sometimes been a difficult task. Given that the time for surveying the affected area has been constrained, a good collection of images, videos and drone flights have been performed for further analysis in the office.

3. The forest fire in Eurovillas (Spain)

On August 28th 2020, a fire broke out near the community of Eurovillas, in the Autonomous Region of Madrid, Spain, in an area dominated by cured grass and sparse Mediterranean vegetation. The cause of fire was negligence on the use of fire by a local neighbor. The fire propagated quickly pushed by a 15 km/h wind blowing from SW and impacting by the left flank and front on the South limit of Eurovillas settlement, one of the largest in Madrid Autonomous Region. Although the initial fire was fast, the intensity was showing moderate intensity, due to the type of fuels burning, with a flame length ranging from 2 to 4 m, as deduced from pictures and the scorching height in the remaining trees. Firefighters were responding promptly within the first half hour, but the fire front was already impacting the first rank of gardens in the limit with the forested area.

For this spread over cured grass and sparse flammable shrubs, the presence of walls in the perimeter of some of the lots showed to be effective in reducing the propagation or even stopping it. Nevertheless, the presence of flammable species in the green hedges surrounding the houses (*Cupressus arizonica*) entailed a significant increase in the fire intensity and speed, affecting pergolas, small garden sheds with flammable materials, warehouses, greenhouses, vehicles and partially affecting houses. According to homeowners testimony, the fire spread very quickly, jumped unevenly, bursting and finally affecting severely the green hedges. One of the houses presented a significant amount of objects and materials under the porche, which did not burn as the wind was blowing in the opposite direction and the flames did not touch the zone.



A general view of the fire perimeter spanning over 14.9 hectares and presenting the origin, the main spread axis and the impact zone. Most of the lots had green hedges with flammable species.



An aerial view of the propagation inside the first and second rows of houses in the settlement, by the time the first aerial means arrived in the area. Note the intensity developed by the gardening elements, more particularly flammable green hedges, and some objects and materials involved, including some vehicles.



An aerial view of the final stages of the fire propagation, which continued inside the settlement through green hedges and gardens.



An aerial photo showing the behaviour of fire propagating inside the first two rows of properties, in particular note the intensity developed by green hedges.



The fire propagated mostly through tall cured grass and sparse vegetation, showing a medium intensity and high spread rate. Once inside the settlement the intensity tripled in some points, due to the flammable garden elements, producing thick and intense smoke.

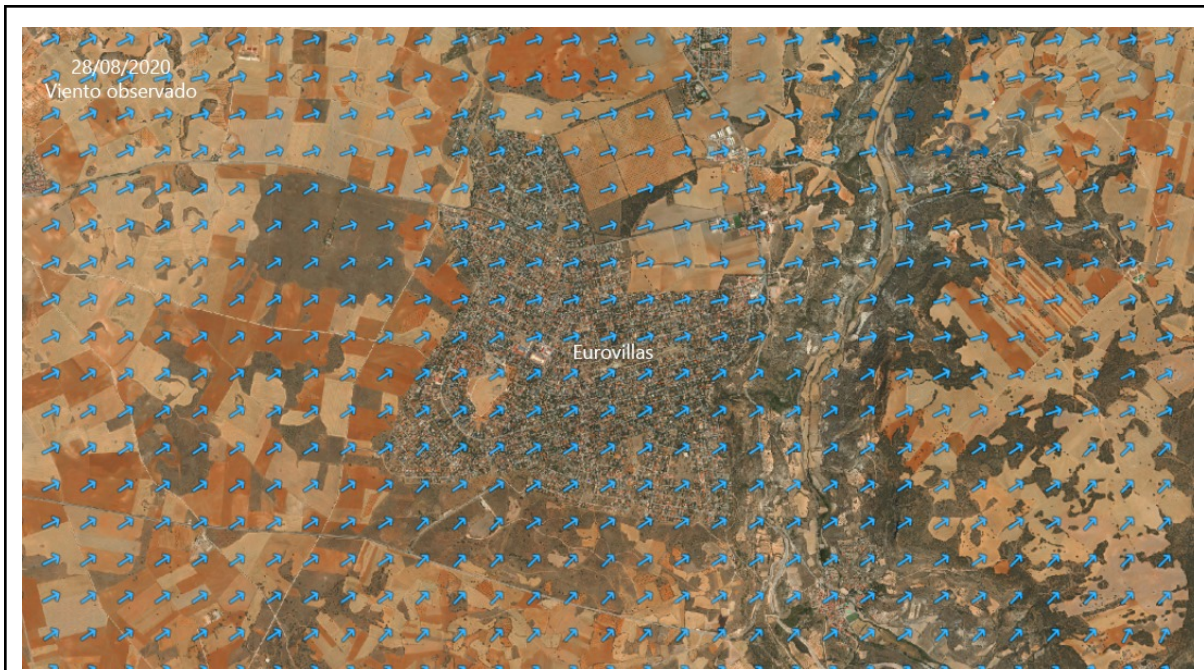


This drone picture shows a general view of the impact of fire front in the first rank of houses and green hedges. It is observed the role of these hedges in propagating the fire inside the settlement and how they contributed to the ignition and combustion of other objects and materials, such as pergolas and green houses (in the left-South corner of each parcel) and the affectation of houses. The angle formed by the main axis of propagation is clearly visible (wind blowing from WSW). In case of a wind blowing straight from the South, most likely the fire penetration could have been much more effective, through green hedges and gardens, complicating noticeably the whole event. The East limit of the community presents higher fuel loads and in case of a South wind, it is expected that the fire front could have increased the intensity even more.

A systematic survey was performed over all the affected lots and the impact area. Pictures were taken from the ground and airborne, all of them geotagged with geographical coordinates. Interviews were conducted with several of the residents and homeowners. Although evacuation was ordered for the affected area, many of the residents stayed trying to help with water buckets, or just watching the fire approaching the houses and threatening their properties.



An orthophotography showing some of the lots receiving the impact, the involved angles and the main axis of fire propagation (in yellow). As observed, the main impact took place in the front-left flank, a fact that partially reduced the penetration of fire and the associated consequences over gardens and buildings.



General component of wind in the moment of the fire event, as extracted from the official meteorological service (AEMET). The wind direction stayed constant over the whole episode.



A close view of one of the affected green hedges, receiving the main impact of the left flank. Observe that a separation from the forest fuels was in place, in which the fire reduced intensity. However the flames managed to initiate the combustion and propagation over the garden vegetation.



One of the lots affected was abandoned, with a considerable amount of dead vegetation all across the garden, including the pool. The parcel was enclosed by a tall, unmaintained hedge of Cupressus arizonica, which burned very efficiently, propagating the fire and affecting the neighbouring house.



Picture taken in the same street, from portal number 96 and wind blowing towards the camera. Observe the intensity of the green hedge burning at maximum intensity. The other land plots were covered with cured, very flammable tall grass, which easily started new spot fires after the hedge propagation projecting flying embers. People stayed taking pictures and moving the cars, helping with garden hoses and water buckets, ignoring the potential risk of a fire in the grass-covered lot encircling them. A lot of effort was put by residents on the garbage bins to avoid their ignition. A car is just turning in the grass field, another one is waiting for the fire to subside. As seen, people are taking part in the event, although they mostly ignore the potential risks. No one was injured.



In this general aerial view, we observe the abandoned lot (1) which was firstly affected by the fire front impact, and the further effect on the flammable green hedges, and a second abandoned lot (2) with some vehicles in it, which received the fire propagating from the previous one over the undeveloped lots covered with cured grass. This image clearly shows how the presence of continuous flammable vegetation in abandoned or undeveloped lots is a key factor for the fire penetration within the settlement. Also, how the presence of vehicles, sheds, warehouses, greenhouses, garages and any other place in which there is accumulation of machinery, fuels, other flammable materials and objects contribute to the escalation of risk in the fire event, originally a medium-intensity forest fire. The starting point lays approximately in the upper left corner of the photo.



The North limit of the first abandoned lot presented an overgrown flammable hedge, covering all perimeter including the access gate, which was occluded. This is the before (left) and after (right) of the same location.



The first abandoned lot (1) presented an overgrown hedge without any trace of treatment over several years, accumulating fine dead fuel in all extension. The house was not affected, as no objects were inside and because it was erected with unburnable materials. However, the neighbouring lot, the garage and the house was affected by the combustion of the green hedge, creating a high intensity flame which firefighters barely could suppress even with aerial means (helicopter) present in the area. Also, appreciate the effective spotting in the lot opposite and how this developed a new fire propagation towards the interior of the settlement.



A view of another lot affected in this event. The combustion of this corner (left), and the greenhouse present, was initiated and consolidated by the combustion of the green hedge. The developed flames affected the closest façade of the building, entailing the entrance and partial destruction of the corresponding room. Practically all of the houses affectation was due to the combustion of the surrounding vegetation, in particular flammable green hedges.



The presence of garden sheds and small warehouses represent points in which the fire frequently involves other materials and objects, thus increasing the intensity in a semi-confined combustion. Observe also that even with a low to medium intensity fire, such as this propagating over cured grass in an abandoned lot, all vehicles and small structures are vulnerable to the pass of the flames. These situations frequently demand attention and resources from firefighters to avoid and escalation of the risk in the emergency management. For example, some gas canisters were found exposed to the flaming and post-frontal combustion which, eventually, may pose a risk to firefighters operating in the area.



Flame impingement in the structures was observed in the places where vegetation was touching or surrounding façades. The effects were more noticeable in the corners and hedges, as in this case. Heat dose was enough to initiate the destruction of masonry and insulating materials.



A view of the North limit of the abandoned lot. Observe the combustion efficiency over the flammable green hedge. No fire fighting operation was performed at this point. The helicopter was assigned to the suppression of fire in the front and to the control of the propagating flames inside of the other abandoned lot, in which several vehicles burned.



Observe how the presence of a small wall (70 cm) and fire-resistant plants in the lot hedge contributed to reduce the likelihood of the fire jumping inside the parcel and spreading the propagation into the settlement. This is a good example of a proper fire-adapted design of gardens.



A view of the garden of the lot next to the previous one, also with a wall. Observe the lack of vegetation horizontal continuity, the presence of watered soil and fire-resistant vegetation, which contributed greatly to stop fire propagation. The plants are charred, but did not propagate the fire. This is a positive and very graphic counterexample of the flammable species found in other lots in the same fire event.



The wall encircling the lot, about 1 m tall, was very effective receiving the flame impact of the surface-propagating fire over the cured grass. This is a very effective design in which the exterior (wall) and the interior of the garden work together to stop the fire and minimize consequences. This should be an example to follow in the rest of the lots in contact with the wildland. It is very clear that lots in the perimeter loaded with flammable vegetation and other materials and objects represent a threat to the rest of the community, as in these points the fire increases intensity and initiates the projection of flying embers. The presence of flammable hedges and undeveloped lots with cured grass in the interior of the community,

increases the chances of fire to propagate, thus extraordinarily complicating the WUI scenarios.



Another undeveloped lot, with an abandoned vehicle which was engulfed by flames and created local high intensity combustion, which was attended by firefighters. The presence of a house under construction, with plastic elements in the façade, and a second residential house in the other side, pushed fire fighters and residents to take part in the suppression of this particular lot (see picture below)





A detail of the house under construction that was noticeably affected. Despite the relatively low fuel load in the lot, the presence of other materials, objects (including gas canisters) and vehicles, complicated the overall operation, in which residents took part voluntarily. This aspect is repeatedly observed in wildfires affecting WUI areas, in which fire fighters are overwhelmed and citizens take over the suppression activities, ignoring the risks they are facing, including chained events (such as combustion of highly flammable products, production of toxic gases or explosion of canisters).

4. Conclusions

This is one of a series of forest fire events visited by the WUIVIEW team from which a number of conclusions and lessons can be extracted.

- A low to medium intensity fire does not necessarily entail low consequences. It much depends on the increase of fire activity in the first row of properties, the garden design and the objects and materials present in it.
- Flammable species, such as *Cupressus arizonica*, are extremely efficient increasing the intensity of fire and propagating the flames around the houses, into the neighbouring lots and through the interior of the settlement. Firefighters have serious difficulties in suppressing fires catching this type of vegetation, particularly in abandoned, overgrown hedges encircling the property.

- The presence of non treated lots, abandoned parcels and vehicles contribute to the escalation of risk and propagation of fire inside the settlement. Neglecting the observation of this rule in one single parcel entails threatening the whole community.
- People do not perceive risks until they are imminent and, frequently, unavoidable. Reactions vary enormously, but in general residents and homeowners are reticent to leave the fire event area, mostly if their properties are under evident threat, and try to contribute in the suppression activities without the proper equipment and knowledge.
- Most of the affectation of houses and other buildings have been due to the combustion of the nearby flammable materials and vegetation, more particularly green hedges.
- The presence of walls and well designed, well maintained gardens contribution to the control and the propagation of fire inside the lots and the settlement. This particular case presents designs which have contributed to the stopping of the fire in the initial impact of the incoming fire front. This should be copied to the rest of the properties in the perimeter of the settlement.