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Abstract

Effect of Incoming Wind on Combustion of Ornamental Vegetation at the Wildland–Urban Interface †

Anthony Graziani *, Karina Meerpoel-Pietri, Virginie Tihay-Felicelli, Paul-Antoine Santoni and Frédéric Morandini

Laboratoire Sciences pour l'Environnement, (UMR 6134 SPE), University of Corsica, 20250 Corte, France
* Correspondence: graziani_a@univ-corse.fr
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With global warming and rising occurrence of drought conditions, the risk of fire spreading at Wildland–Urban Interfaces (WUI) increases every year. In particular, during summer, the surrounding vegetation can reach extremely dry conditions. Under such critical atmospheric conditions, ornamental vegetation such as hedges or trees have been identified as a significant vector of fire propagation to homes [1–3]. Depending on vegetation's spatial distribution and wind conditions, flames can ignite non-structural elements, which can result in total house fire.

In this context, the present study focuses on the influence of incoming wind on the flame dynamics and heat transfers from an ornamental hedge burning at field scale. Four experiments were carried out at Corte (France) during spring. A 4 m × 1 m × 1 m (L × W × H) vegetation hedge was reconstructed with a welded mesh cage filled with 32 (±0.05) kg of dried rockrose (FMC = 10%). The experimental setup included three visible cameras, six heat flux gauges (total and radiant) and one anemometer. The heat flux sensors were located at 3 m from the hedge according to the current fire safety regulation in France.

The analysis of the heat fluxes allowed us to decompose the signal into four stages (growth, fully developed, decrease and extinction) corresponding to specific levels of heat flux and flame size. The convective heat transfer towards the sensors is particularly significant during the fully developed stage of the fire. A comparison of flame geometry, heat fluxes, and wind properties was performed with a cross-correlation approach. The results highlight that flame geometry shows a high level of correlation for stages where fire grows inside the hedge then reaches a fully developed regime. The wind also has a significant impact on heat fluxes received by the sensor and to the resulting heat constraint on the building materials.

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References

1. Maranghides, A.; Mell, W. A Case Study of a Community Affected by the Witch and Guejito Fires. *Fire Technol.* **2011**, *47*, 379–420. [CrossRef]
2. Ganteaume, A.; Jappiot, M.; Lampin, C.; Guijarro, M.; Hernando, C. Flammability of Some Ornamental Species in Wildland–Urban Interfaces in Southeastern France: Laboratory Assessment at Particle Level. *Environ. Manag.* **2013**, *52*, 467–480. [CrossRef] [PubMed]
3. Maranghides, A.; McNamara, D.; Vihnanek, R.; Restaino, J.; Leland, C. *A Case Study of a Community Affected by the Waldo Fire Event Timeline and Defensive Actions, Technical Note (NIST TN)*; National Institute of Standards and Technology: Gaithersburg, MD, USA, 2015. [CrossRef]