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Building Damage at the Wildland-Urban Interface: Case Studies California, USA and Pedrógão Grande, Portugal

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Abstract

The wildfire risk of life and property loss is especially high in inhabited areas located adjacent to, or intermixed with, the wildlands; these areas are referred to as the wildland-urban interface (WUI). Advancing knowledge on building vulnerabilities to wildfire threats is crucial to increase buildings' ignition resistance and reduce risk. This research presents a novel comparison of two large cross-geographical post-fire building damage inspection datasets: the California Department of Forestry and Fire Protection (CAL FIRE) post-fire building inspection program dataset, including 17500 buildings, and the dataset from the published Pedrógão Grande fire complex impact on buildings investigation, including 1035 buildings (Ribeiro et al., 2020). By statistically analysing the relationship between various building characteristics and final building damage, this analysis aims to extend quantitative knowledge on how building components characteristics affect building wildfire survivability in two distinct geographical regions. The Bayes Factor is calculated to quantify the relationship strength between each individual building characteristic considered and final building damage. Results indicate extremely strong evidence of dependence between the number of windowpanes, vent presence, and exterior material, with final building damage in the Californian dataset, and extremely strong evidence of dependence between preservation level and exterior material with damage level in the Portuguese dataset. A Home Fire Resistance Index, corresponding to the number of fire-resistant building components present, is calculated for each building in the CAL FIRE dataset. Clear trends indicating an increase in wildfire building survivability percentage, and decrease in percentage of buildings destroyed by wildfire, are observed as the Home Fire Resistance Index increases. Linear models are fit to describe these trends and predict an increase in 1.66% of buildings classified as experiencing 'no damage', and a decrease in 4.72% of building classified as 'destroyed,' per each increasing value of the Home Fire Resistance Index (or each additional fire-resistant building feature present in the building). This analysis identifies the building components most strongly related to buildings' wildfire ignition resistance in the datasets considered, and emphasises the importance of holistic building fire resistance to wildfire. This is the first quantitative analysis considering and comparing two large (including over

1000 buildings) and cross-geographical wildfire building damage inspection datasets in literature.

Keywords: wildland-urban interface, vulnerability, wildfire safety, building damage

References

Ribeiro, L. M., Rodrigues, A., Lucas, D., & Viegas, D. X. (2020). The impact on structures of the pedrógão grande fire complex in June 2017 (Portugal). Fire, 3(4), 1–22. https://doi.org/10.3390/fire3040057

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