Relationships Between Building Features and Wildfire Damage in California, USA and Pedrógão Grande, Portugal

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Inhabited areas adjacent to wildland, known as the wildland-urban interface (WUI), often experience wildfire damage. Although knowledge on external fire protection of buildings has greatly advanced through post-fire inspections and experimental studies, the intercomparison between studies in different regions is lacking. Here we quantitatively compare two large post-fire building damage inspection databases: the 2013-2017 California Department of Forestry and Fire Protection damage inspection in the USA, and the 2017 Pedrógão Grande Fire Complex post-fire investigation in Portugal. We compare the relationship between different building features and wildfire damage, and propose the Wildfire Resistance Index (WRI), a preliminary wildfire risk index applied to rural buildings. Results indicate that exterior walls, windows, and vent screens have the strongest correlation to damage level in California, and exterior walls and preservation level in Portugal. The correlation strength indicates each feature's relative importance in protecting the building from wildfire damage. The WRI value corresponds to the building's net number of fire-resistant features and has an inversely proportional relationship to the percent of destroyed buildings. In California 93% of buildings with a WRI of -0.4 were destroyed, compared to 73% of buildings with WRI of 1; in Portugal 75% of buildings with WRI of 0.5 were highly damaged or destroyed, decreasing to 44% of buildings with a WRI of 1. Results indicate that the amount of fire-resistant building features directly relates to the building's damage probability, and that the WRI can be used to quantify building wildfire resistance.