UQ Fire Project #2019.07

EFFECT OF CHARACTERISTIC LENGTH ON THE IGNITION OF NATURAL FUEL BEDS

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Keywords
Bushfires, solid fuel ignition, experimental

Background and motivation
Bushfires are major natural disasters affecting Australia and other countries around the world with similar climates. Extreme weather behaviour such as prolonged droughts, low ambient moisture, and high temperatures create ideal conditions for the rapid spread of bushfires. In the context of bushfires, a natural fuel bed refers to vegetation, either live or dead, that is accumulated in the ground. This layer of vegetation plays an important role in the ignition and spread of surface fires. Natural fuel beds consist of different types of materials and sizes. From a heat transfer perspective, particle size plays a major role in the energy balance of the fuel particles, suggesting that smaller particles have higher heat losses that larger ones.

This project is aimed at supporting bushfire research being conducted at the University of Queensland. Results from this project will be used to further explore the role of other fuel bed characteristics on the ignition and flame spread of natural fuel beds.

Research objectives
This research aims at establishing how particle size affects the ignition characteristics of homogeneous fuel beds and determine the relative importance of this characteristic in comparison to more established ones such as moisture content, surrounding air velocity and fuel density among others.

Methodology
This project will use the ignition and flame spread small-scale tunnel and other available equipment at the UQ Fire Safety Engineering Lab. The student will be required to perform a literature review and develop a reasonable understanding of the potential effects of particle size in order to develop a suitable test matrix.

Recommended literature
[1] Finney, M., et al. (2013). On the need for a theory of wildland fire spread. International Journal of Wildland Fire, 22, 25-36. http://dx.doi.org/10.1071/WF11117

[2] Rothermel (1972). A mathematical model for predicting fire spread in wildland fuels. USDA Forest Service, Intermountain Forest and Range Experiment Station, Research Paper INT-115.

[3] Yedinak, K., et al. (2010). An examination of flame shape related to convection heat transfer in deep fuel beds. International Journal of Wildland Fire, 19, 171-178. https://doi.org/10.1071/WF07143

[4] Anderson, W.R., Catchpole, E.A. and Butler, B.W. (2010). Convective heat transfer in fire spread through fine fuel beds. International Journal of Wildland Fire, 19, 284-298. https://doi.org/10.1071/WF09021