FINDINGS

The validity of using dynamic heating regimes and VHFlux apparatus as a standardised method has been demonstrated.

Flammability of live plants, do we need a new testing approach?

Tim Miller[1], Alex I. Filkov[2,3], Trent D. Penman[3]

[1] Department of Environment, Land, Water and Planning, Victoria
[2] Bushfire and Natural Hazards CRC, Victoria
[3] University of Melbourne, Victoria

The aim of this study was to determine the impact of different heating regimes on flammability of live vegetation and to propose a new testing method.

Introduction

Understanding live vegetation fuel properties and how they behave when exposed to radiant heat and flame allows us to better predict fire behaviour during wildfire events. Current methodologies of testing flammability of live vegetation are limited in their ability to provide accurate quantification due to their reliance on static heat flux exposure, which does not accurately replicate how live plants experience radiative heat flux during a wildfire in their natural environment. This study aims to determine a more effective, replicable and accurate method of testing flammability.

Methods

Two heating regimes were tested for this study – a static heat flux to reflect current methods and a dynamic (increasing) heat flux to more accurately replicate real conditions of an approaching fire front. Piloted-ignition and unpiloted-ignition were also tested for both of these heating regimes. A Variable Heat Flux (VHFlux) Apparatus developed by The University of Melbourne was used to test flammability *of Acacia floribunda, Cassinia arcuata*, *Pinus radiata* and bark from *Eucalyptus obliqua* samples (Figure 1). Time (s) to pyrolysis (production of volatile products), smouldering, flaming ignition, complete consumption and radiant exposure (the radiant energy received by a sample over a time of heating) were used as ignitability measures.

Results

It was observed that time (Figure 2) and radiant exposure required to reach flaming ignition were higher under a dynamic heating regime. During static heating regime experiments, it was noticed that ignition would occur in multiple stages. More than 70% of samples reached flaming ignition in piloted experiments, whereas less than 40% reached flaming ignition in unpiloted experiments. The exception was Bark which had 100% ignition success in both ignition types.

Discussion

Our study has proposed a new standardised methodology for testing ignitibility of live plant species, with potential for extending further to flammability metrics. The validity of using dynamic heating regimes as a standardised method has been demonstrated, with clear differences observed between heating regimes for time and radiant exposure required for ignition and other ignitibility measures. The influences observed on ignitibility due to the pilot ignitor and species characteristics were heavily outweighed by the influence of the heating regime.

The VHFlux apparatus allows for flammability testing of live plant samples using dynamic heating regimes where parameters can be controlled to create repeatable and accurate testing in a controlled environment. This far exceeds the suitability of current methodologies.

Adoption of this methodology is recommended to ensure more realistic data on flammability of individual plant species and plant communities. This will ultimately lead to better informed, more accurate, and dynamic wildfire behaviour modelling.

For more information, please email alexander.filkov@unimelb.edu.au

Figures

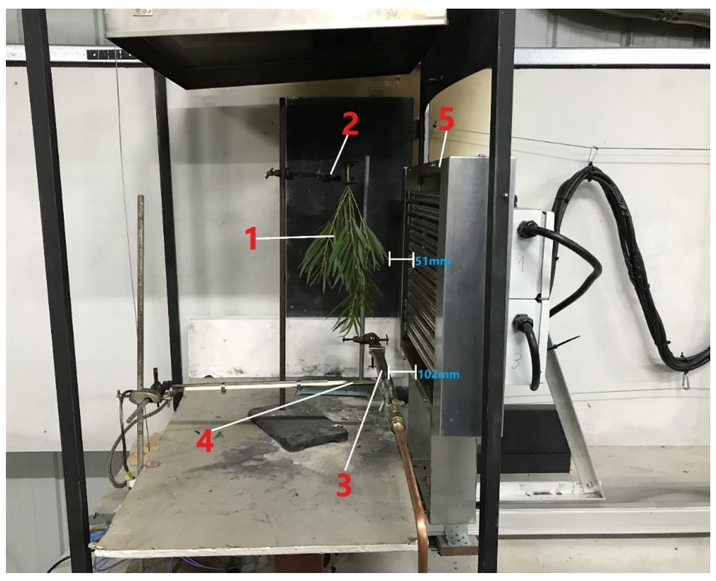

Figure1: Experimental design: 1) sample, 2) clamp, 3) pilot igniter, 4) spark igniter, 5) radiative panel.

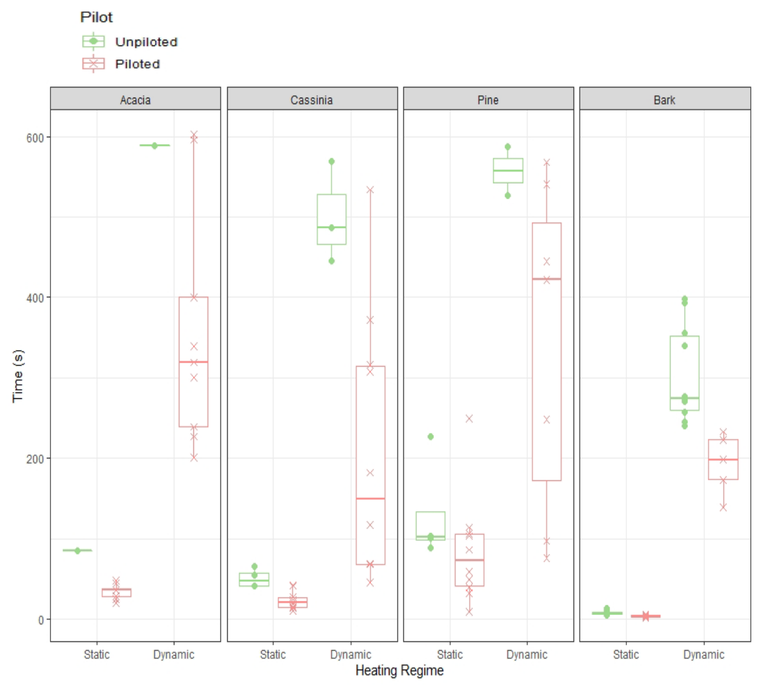

Figure2: Time (s) to flaming ignition comparing static and dynamic heating regimes (x-axis) in both unpiloted (green) and piloted (red) experiments.

Australian Government
Department of Industry, Science, Energy and Resources
Business Cooperative Research Centres Program
THE UNIVERSITY OF MELBOURNE

