The Carboniferous has a rich plant fossil record that captures numerous well-preserved in situ assemblages.
Carbiferous charcoal records indicate prevalent wildfire associated with higher than present atmospheric Oxygen levels.
Our understanding of the behavior and paleoecological impacts of wildfire under hyperoxic conditions is limited.
Methods for modeling extant wildfires and their impacts can be applied to paleo-landscapes.
My aim is to combine experimental hyperoxic combustion work using extant plants as paleofuel analogs with wildfire models applied to reconstructed paleo-landscapes, in order to better characterize the role of fire in Carboniferous ecosystems.

Types of Wildfire

- **Crown Fire**: canopies of taller trees, emergents.
- **Ladder Fuels**: intermediate height trees and shrubs, lower branches on tall trees, vines. Critical to surface fire to crown fire transition.
- **Surface Fuels**: duff, litter, surface logs, shrubs, grasses. Most consumed layer during wildfire; critical to suppression and restoration efforts.
- **Ground Fuels**: deep duff, roots, buried logs. Sometimes smolders instead of undergoing flaming combustion.

Describing Wildfire

- **Fire Behavior**: Rate of spread, Fireline intensity, Torching & crowning, Fuel consumption, Smoke vs. flaming
- **Ground & Surface Fuels**: Crown base height, Canopy cover & distribution, Canopy density & fuel load
- **Ladder & Crown Fuels**: Crown base height, Canopy cover & distribution, Canopy density & fuel load

Describing Wildfire

- **Topography**: Slope, Peaks & valleys
- **Weather**: Wind, Relative humidity

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Proposed Research

Use a combination of simplified physical descriptions of fire behavior and empirical measurements. Most commonly used programs are based on the Frandsen-Rothermel equations, which model fire spread as a series of ignitions.

Benefits of pseudoempirical models:
- Computationally fast, widely implemented, effective within well-defined scope.
- Drawbacks: Inherently limited outside of original experimental scope; require empirical input; limited ability for modeling crown fire; unable to model smoldering combustion or spotting behavior.

Example programs: BEHAVE, FLAMMAP, NEXUS, FARSITE

Methods for modeling extant wildfires and their impacts can be applied to paleo-landscapes, in order to better characterize the role of fire in Carboniferous ecosystems.

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References