POTENTIAL NUTRIENT LOSS IN SMOKE AND ASH FROM DIFFERENT FUEL TYPES

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Casterton, Victoria
Stringybark woodland
Low productivity site

Bulls Ground State Forest, New South Wales
Blackbutt forest
Medium productivity site

Falls Creek, Victoria
Alpine Ash forest
High productivity site

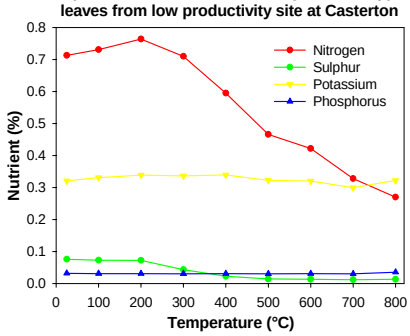
Introduction

A large variety of chemicals are released to the atmosphere in smoke when living and decomposing vegetation is combusted including important nutrients such as carbon (C), nitrogen (N) and sulphur (S). Losses of nutrients from fuels during fire are due to vaporisation of solutes as they reach boiling point (e.g. nitrate vaporises from living cells at 80 ˚ C) and oxidation of solid compounds to gaseous forms at higher temperatures (e.g. amino acids are oxidised at 200 ˚C). This process is called volatilisation and results in considerable losses of N and S, moderate losses of phosphorus (P) and small losses of other mineral elements. The aim of this project was to determine potential nutrient losses during prescribed and wildfires in relation to the impact of this loss on plant growth.

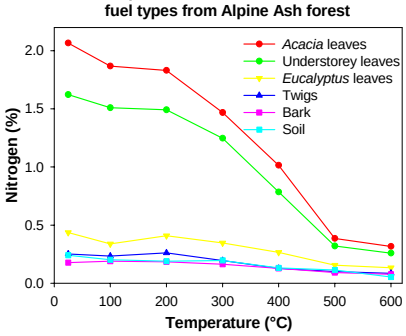
Method

Living (green leaves of *Eucalyptus* sp. and understorey shrubs) and dead fuels (litter, bark, twigs, organic matter) were collected from three habitats with a range of productivities. Fuels were systematically heated in an oven to 200 ˚C or combusted in a muffle furnace to 800 ˚C to determine loss of major nutrients (N, P, S and K). This heating regime represents the temperature range that may occur during prescribed burning (lower temperatures) and wildfire (higher temperatures). Fuel loads of each ecosystem were measured in the field or determined from published literature to model the potential loss of these nutrients.

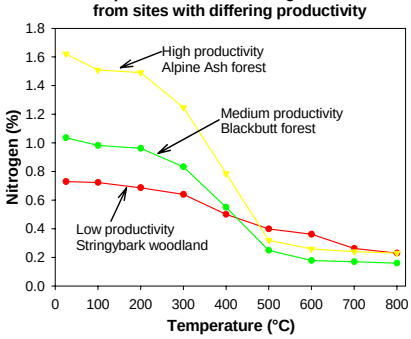
Comparison of nutrient loss from green *Eucalyptus* leaves from low productivity site at Casterton



Comparison of N loss from different fuel types from Alpine Ash forest



Comparison of N loss from green leaves from sites with differing productivity



Results

- N and S were lost to the greatest extent from all fuels, little loss of P and K
- Greater amounts of nutrients were volatilised from living fuels (green leaves) than dead fuels (twigs, bark, organic matter, soil)
- Greater amount of nutrients, particularly N, was volatilised from high productivity sites
- Potential losses of N from fuels during a high intensity wildfire (i.e. heating to 800 ˚C) are up to **376** t N 10 000 ha^{-1} fire at the *low productivity* site (Stringybark woodland), **581** t N 10 000 ha^{-1} fire at the *medium productivity* site (Blackbutt forest) and **551** t N 10 000 ha^{-1} fire at the *high productivity* site (Alpine Ash forest).

A key outcome of this research is better understanding of monitoring requirements for fuel management at the ecosystem scale