PROGRAM B **B6 The Highfire Project:** High country fuels and ecosystem functions

Measuring and modeling fire effects on methane oxidation

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Aerobic soils are important sinks of atmospheric CH_4

Although the effects of fire on soil properties are relatively well known, less is understood about the effects of changed soil properties on methane (CH_4) oxidation by soil bacteria.

This project aims to improve our understanding and ability to predict the effects of fire on CH_4 oxidation.

The research presented describes how field measurements and laboratory studies can be used to model the effects of fire on CH_4 oxidation. Ammonium is used as an example as it increases in soil after fire and inhibits CH_4 oxidation.

Sites: Alpine ash (*Eucalyptus delegatensis*) forest, Bogong High Plains, Victoria. Wildfires in 2003 and 2006 caused crown death of dominant trees in some areas and removal of the understorey vegetation in others.

Methods: Changes in headspace CH_4 was measured using closed chamber techniques. Gas samples were analysed using gas chromatography.

Field: Chambers with modified lids for gas sampling were inserted into the soil.

Laboratory: Soil was incubated in specially modified fowlers jars.

1. Methane oxidation and soil properties vary between sites with different fire histories

Methane oxidation was significantly higher in the sites burnt in 2003 compared to sites less severely or more recently burnt (Fig 1a). Ammonium was significantly higher in soil at the site burnt in 2003 and 2006 (Fig 1b.).

It is assumed that CH_4 oxidation and soil properties were the same at all sites before fire, which may be not be true. Measurements would need to be made prior to the fire which is not always possible (i.e. a Before After Control Impact experiment).

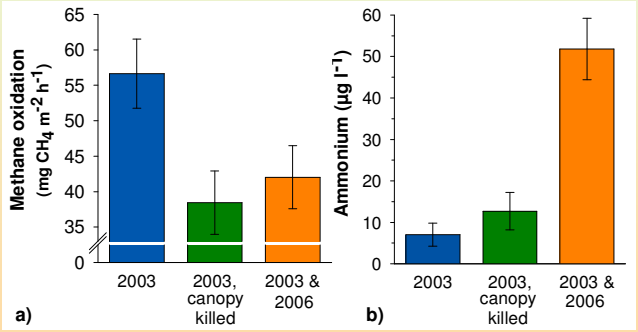


Figure 1. a) Field methane oxidation and **b) soil ammonium concentration at sites with different fire histories.** Dates show the years the sites were burnt. Error bars are standard errors. Bars are means of (from left to right): n =15, 10, 5 chambers (3, 2, and 1 sites).

2. Field CH_4 oxidation vs. soil properties

A weak relationship was found between ammonium concentration and CH_4 oxidation (Fig 2). This is most likely due to the effects of other soils properties such as soil moisture.

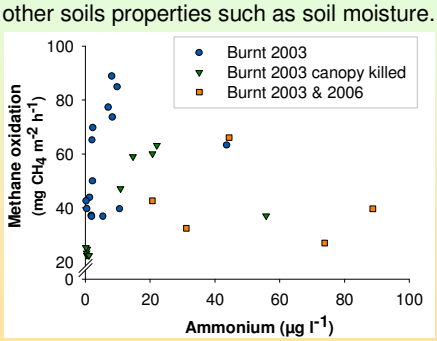


Figure 2: Field methane oxidation vs. soil ammonium concentration. Each dot represents one flux chamber.

3. Laboratory CH_4 oxidation vs. soil properties

Soil incubations can be used to determine the effects of individual soil properties by keeping other properties constant. The effects of interactions between soil properties can also be determined. Under controlled conditions ammonium concentrations in soil exerted a strong influence on CH_4 oxidation (Fig 3). Information gained from this technique must by used in conjunction with field data to allow reasonable interpretation.

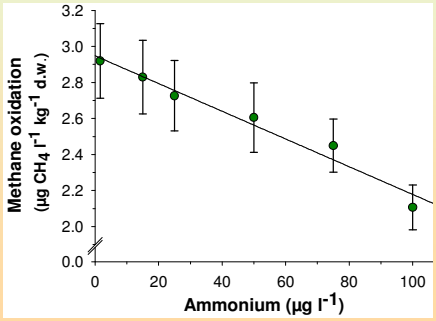
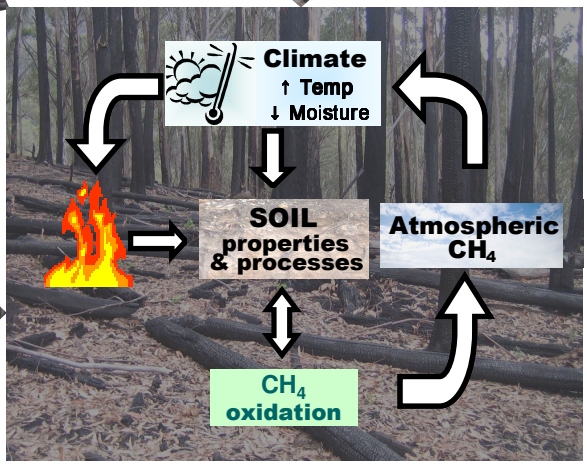


Figure 3: Laboratory methane oxidation vs. soil ammonium concentration. Each dot represents the mean of 5 samples and 3 replicates. Error bars are standard errors.



Laboratory incubations can be used to create a model for predicting the effects of fire on CH_4 oxidation. This model then needs to be tested and adjusted using field measurements.

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