The effects of fire on invertebrate food web structure in the buttongrass moorlands of Tasmania

Fiona Christie[1], Karl Brennan[2] and Alan York[1]

1 School of Forest & Ecosystem Science, The University of Melbourne, Creswick 3363, VIC

2 Department of Environment and Conservation, Kalgoorlie 6430, WA.

This research aims to investigate the cycling of carbon and nitrogen through the decomposer and herbivore food webs using stable isotope analysis (δ13C and δ15N) and to determine how fire affects food web structure and ecosystem functioning

Background

Low intensity fires are used extensively in the management of Tasmania's Buttongrass Moorlands, despite being little known about the long term effects of repeated burning on ecosystem functioning. **Understanding patterns of species loss and the impacts on ecological functioning are fundamental to predicting the long term effects of fire.** In the Buttongrass, invertebrates play key roles in the decomposition and mineralisation of organic matter and the mobilisation of nutrients contributing directly to peat formation. Stable isotope "signatures" can enable us to determine taxon relationships within the food web and make inferences about potential flow on effects from fire induced changes in structure (Fig. 1).

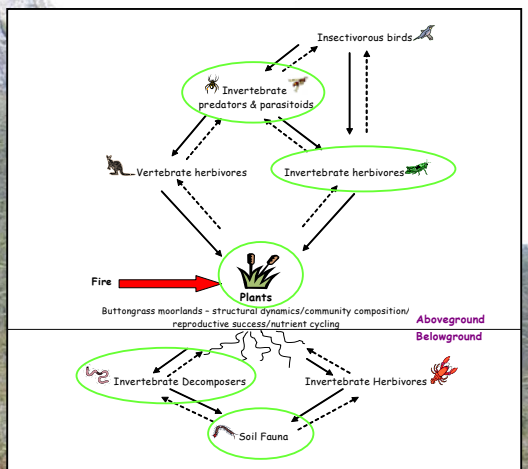

Figure 1: Simplified concept diagram outlining potential top-down (solid arrows) and bottom-up (dashed arrows) impacts on plant and animal assemblages. Changes in composition, abundance and richness at any level may cause changes in the abundance and species composition at other trophic levels with subsequent effects on rates of herbivory and decomposition.

Represents components of the food web which were sampled

Methods

- Plants, and invertebrates were collected from Buttongrass Moorlands representing five different age classes (time since fire).
- Samples represented a wide range of functional groups including decomposers, primary producers, herbivores and predators and identified to species/morphospecies.
- Specimens were oven dried and ground to a fine powder for analysis through the Isotope Ratio Mass Spectrometer (IRMS) to determine natural abundances of δ13C & δ15N.

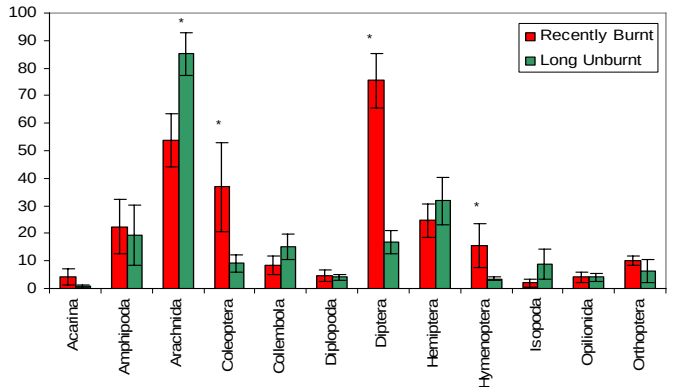

Fig 2: Mean abundance of invert. orders from recently burnt and long unburnt sites. Error bars represent SE of the mean (n = 5). * significant 0.05.

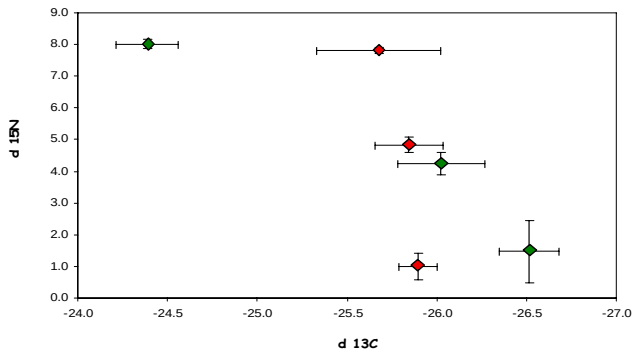

Fig 3: Dual isotope plot for δ13C & δ15N values of invert predators (spiders), herbivores (Hemiptera: *Ontiscus barbaris*) and Buttongrass (*Gymnoschoenus sphaerocephalus*) at recently burnt (◆) and long unburnt sites (◆).

Key findings to date

- Buttongrass moorlands support a diverse invertebrate fauna with almost 6000 individuals from 24 orders collected.
- Greater than 25% were spiders (Fig. 2).
- Recently burnt sites supported significantly more Arachnids, Coleopterans and Hymenopterans than long unburnt sites.
- Preliminary results to date show a decrease in δ13C but no change in δ15N with time since fire for many taxa (Fig. 3).

Implications and future direction

Further analyses of δ13C and δ15N from representative invertebrate and plant taxa will be used to trace the flow of nutrients through the ecosystem and determine the impact of fire on food web structure and predict the stability of ecosystem processes and nutrient cycling.

Acknowledgements

Michael Driessen & Jayne Balmer (DPIW) , Lake St Clair Parks & Wildlife Staff, Alastair Richardson, Peter Davies & Todd Chaudry (UTas), Bron Appleby, Josie Lawrence, Amanda Ashton & Kath Whittaker