




The effects of frequent burning on nutrient cycling and insect herbivory: implications for forest health

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Fire as a management tool

- fuel reduction - asset protection
- forestry operations
- flora & fauna management
 - stimulate flowering
 - break seed dormancy

Long-term effects on biodiversity and ecological processes poorly understood

- nutrient cycling?
- implications for ecosystem health?

Ecosystem health

Resilience, Vigour, Stability, Biodiversity, Disturbance, Sustainable, Economically viable, Productive

Type, level and extent of insect damage on dominant plant species







Photo: Dieter Hothel




Processes influencing "health"

- Insect herbivory
- Decomposition

Invertebrates and ecosystem processes




1. Herbivory
 - a) Significant impacts on forest health and economic returns
 - b) Strongly correlated with leaf nutrients, particularly N
 - c) Outbreaks of pest insects associated with an imbalance in ecosystems or a sign of poor "health"
 - d) Associated with high stress environments e.g. frequent disturbance events
2. Decomposition
 - a) Influence NNP
 - b) Influenced by substrate quality, faunal composition

Objective

Investigate effects of long term frequent low intensity fire on *Eucalyptus pilularis* forests in New South Wales

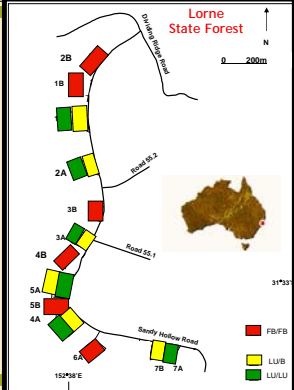


- a) nutrient cycling (N & C)
 - ⇒ soil
 - ⇒ leaf litter
 - ⇒ canopy leaves
- b) insect herbivory
 - ⇒ canopy leaves
- c) litter decomposition
 - ⇒ litterbag experiment

Experimental Design

Three Fire Treatments


- Long Unburnt (LU) fire excluded since 1970 (n=6)
- Long Unburnt/Burnt (LU-B) fire reintroduced in 2000 on 3 yr rotation (n=6)
- Frequently Burnt (FB) fire every 3 yrs since 1970 (n=6)


Lorne State Forest, NSW bushfire CRC

Coastal Blackbutt forest (*Eucalyptus pilularis*)


Fire treatments



Long Unburnt (LU)
Fire exclusion since 1970
 $21.6 \pm 7.5 \text{ tha}^{-1}$



Long Unburnt—Burnt
2 fires in last 6 yrs
 $11.4 \pm 4.8 \text{ tha}^{-1}$



Frequently Burnt (FB)
Fire every 3 yrs since 1970
 $9.4 \pm 3.8 \text{ tha}^{-1}$

Nutrients



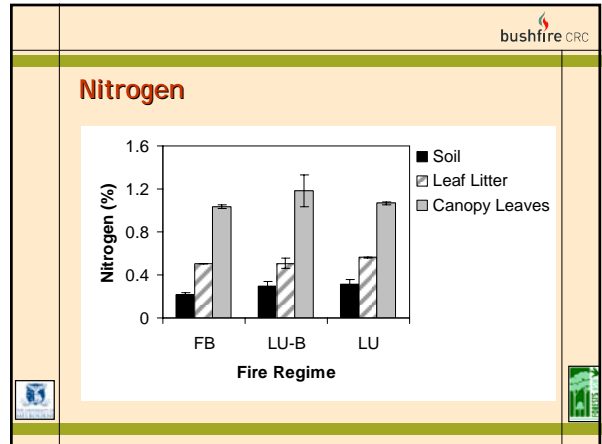
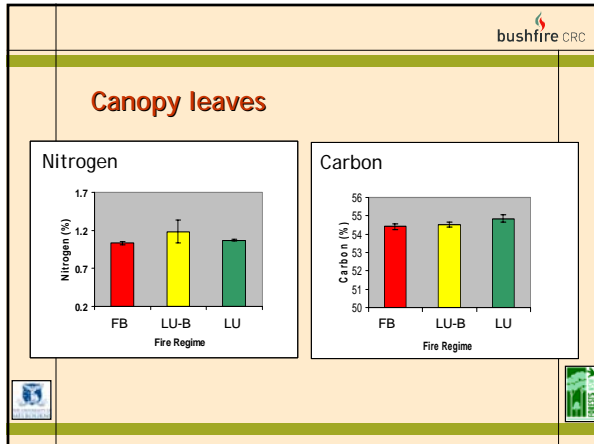
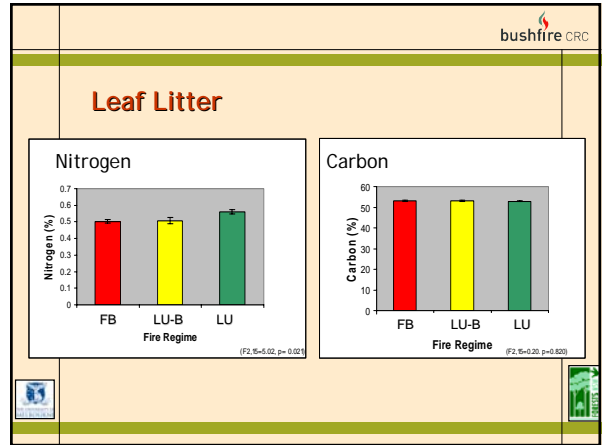
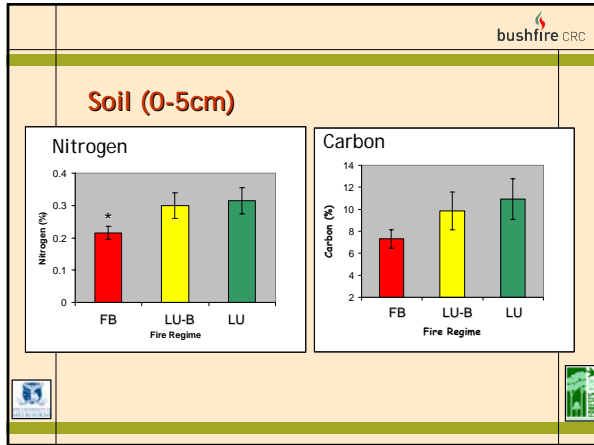
Soil Samples

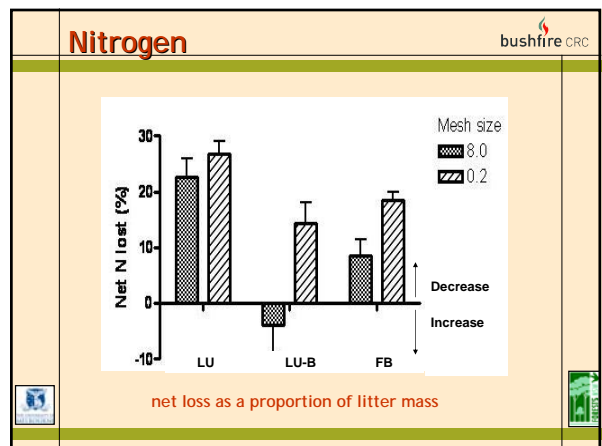
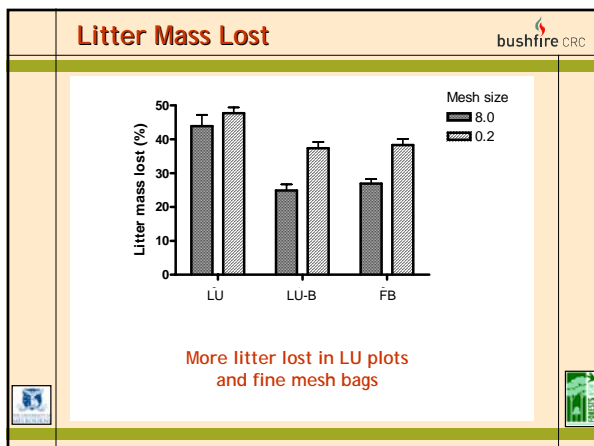
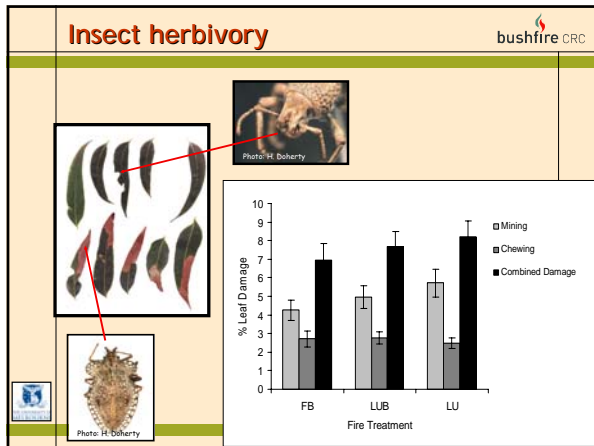





Canopy Sampling






Leaf Litter Collection





Summary of main findings 	
<p>General trend for</p> <ul style="list-style-type: none"> a) N depletion with FB in soil, litter b) lower levels of herbivory overall in FB sites <p>Decomposition of the leaf litter slower in FB sites</p> <ul style="list-style-type: none"> a) Slower nutrient turnover of N in FB sites b) fungi and micro organisms important in FB sites c) Lack of macro decomposers through burning? <p>However....</p> <p>No evidence to suggest that frequent burning has affected forest "health"</p>	 

Final points 	
<ul style="list-style-type: none"> • Low site quality - nutrient limited • Degree of resilience or resistance • Environments with multiple stresses - greater impacts? • Long-term studies provide important for predicting the effects of applied fire ecological processes and NPP <p>Management implications</p> <ul style="list-style-type: none"> • frequent burning may reduce rate of litter decomposition & amount of N in soil, potentially limiting NPP 	 



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