PROGRAM B

The effects of fire on invertebrate biodiversity and ecosystem processes

Karl Brennan
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Outline

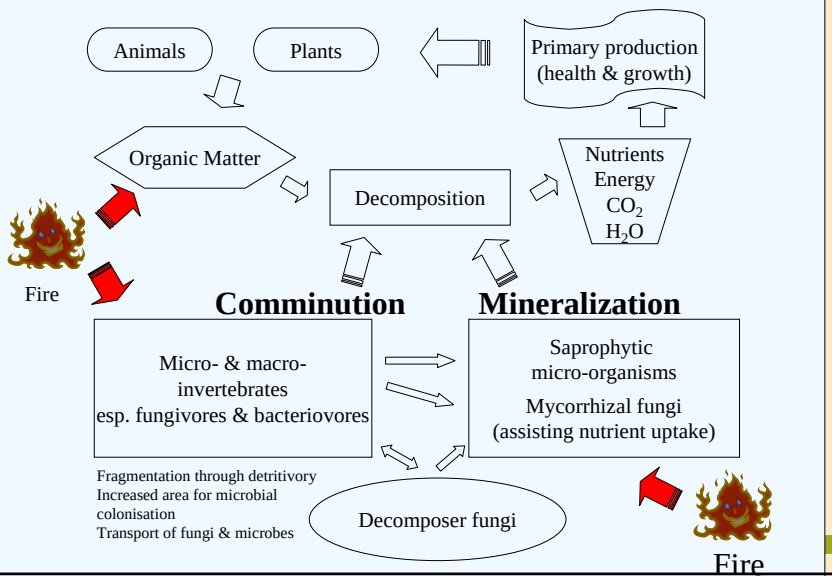
1. Effects of fire regime & invertebrates on decomposition of fine surface fuels in dry eucalypt forest
2. Effects of fire on food web structure in Tasmanian buttongrass moorlands
3. Mechanisms permitting *in situ* survival of invertebrates following fire

Outline

1. **Effects of fire regime & invertebrates on decomposition of fine surface fuels in dry eucalypt forest**
2. Effects of fire on food web structure in Tasmanian buttongrass moorlands
3. Mechanisms permitting *in situ* survival of invertebrates following fire

Effects of fire regime & invertebrates on the decomposition of fine surface fuels in dry eucalypt forest

Karl Brennan, Fiona Christie, Alan York & Josie Lawrence (University of Melbourne)



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Aim: To determine to what extent invertebrates mediate leaf litter decomposition and is there an interaction with the fire regime?

Methods

- Bulls Ground SF, near Port Macquarie, NSW
- Three fire treatments
  - Long unburnt (21.6 ±7.5 tha^{-1})
  - Frequently burnt (9.4 ± 3.8 tha^{-1})
  - Long unburnt → Frequently burnt (11.4 ± 4.8 tha^{-1})
- 10 g leaves in litter bags
- 20 bags per site, 6 sites (replicates) per fire treatment

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Leaf litter bags – May 2005

Entry by invertebrates permitted

Invertebrates excluded

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Leaf litter bags – 26 June 2006

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Leaf litter bags – 26 June 2006

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Results

?

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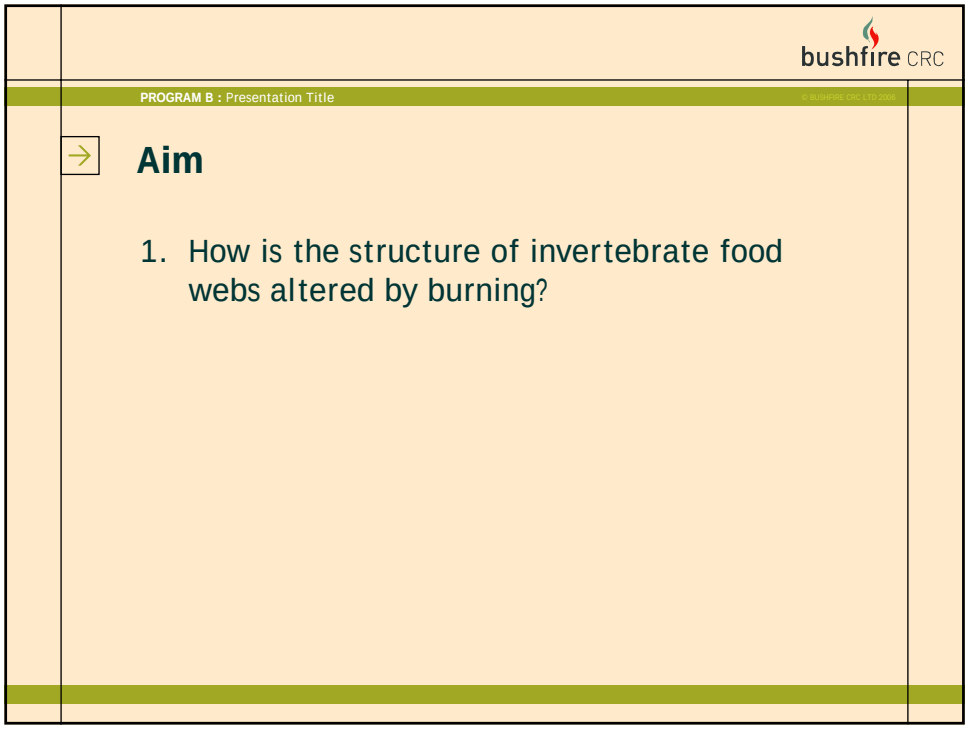
1. Effects of fire regime & invertebrates on the decomposition of fine surface fuels in dry eucalypt forest

2. **Effects of fire on food web structure in Tasmanian buttongrass moorlands**

3. Mechanisms permitting *in situ* survival of invertebrates following fire


Effects of fire on food web structure in Tasmanian buttongrass moorlands
Karl Brennan, Fiona Christie, Alan York (University of Melbourne)
Michael Driessen (Tasmanian Dept. Primary Industries, Water & Environment)
Alastair Richardson & Peter Davies (University of Tasmania)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Aim
1. How is the structure of invertebrate food webs altered by burning?

Methods

- 23 sites four age classes since burning:
  a) < 1 year (5 sites)
  b) 3 to 5 years (5 sites)
  c) 7 years (3 sites)
  d) 17 to 19 years (5 sites)
  e) 32 to 45 years (5 sites)

- Invertebrates, plants and plant litter sampled for stable isotopes of d15N and d13C

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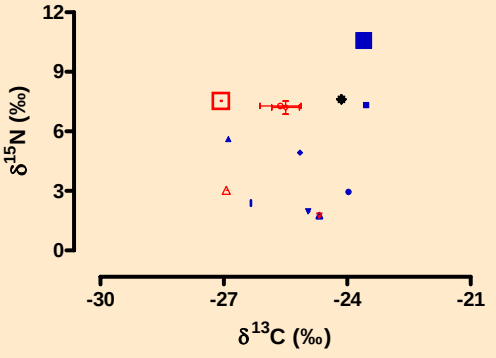
Results



RCW = Rufous canal west = long unburnt
RCE = Rufous canal east = recently burnt

- RCW Ground spiders
- RCW Leeches
- RCE Foliage beetles
- RCE Ants
- RCE Ground spiders
- RCW Harvestmen
- RCW Plant-dwelling beetles
- RCW Symphylans
- RCE Ground crickets
- RCW Foliage grasshoppers
- RCW Worms
- RCW Ground beetles
- RCE Beetles
- RCW Slaters

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Outline

1. Effects of fire regime & invertebrates on the decomposition of fine surface fuels in dry eucalypt forest

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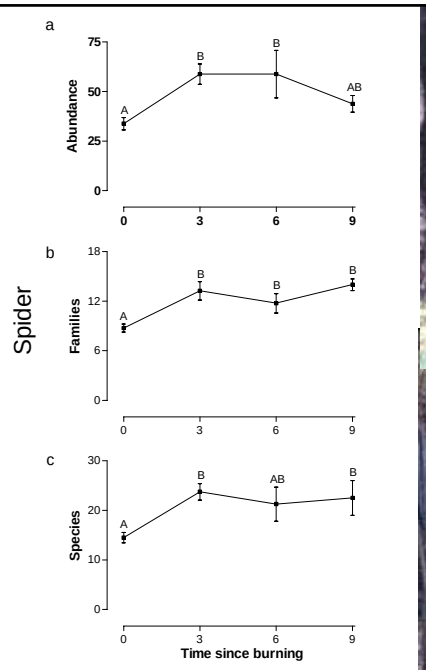
3. **Mechanisms permitting *in situ* survival of invertebrates following fire**



Source: Brennan *et al.* in press. *Forest Ecology & Management*

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Aims

1. **Do grasstrees offer a refuge in which invertebrates can survive a fire?**
2. **If so, are some microhabitats within grasstrees more likely to facilitate the survival of invertebrates than others?**
3. Are some taxonomic assemblages, trophic groups and life-stages of invertebrates more likely to survive than others?
4. **Does the zone maximising survival coincide with lower temperatures?**
5. Do animals also emigrate to escape?

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Methods

1. Study area: jarrah forest at Mundaring

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Methods

1. Study area: jarrah forest at Mundaring
2. Four unburnt grasstrees as controls
3. Five grasstrees experimentally burnt
4. Thermocouples measured flame temperature in different microhabitat regions within the grasstree

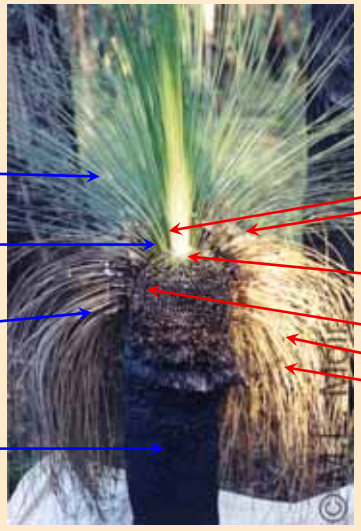
Microhabitat regions

Crown

Apical meristem

Dead skirt

Trunk



Thermal probe locations

Live 1
Live 2

Apical meristem

Dead 1
Dead 2
Dead 3

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Methods

1. Study area: jarrah forest at Mundaring
2. Four unburnt grasstrees as controls
3. Five grasstrees experimentally burnt
4. Thermocouples measured flame temperature in different microhabitat regions within the grasstree
5. Invertebrates sampled by hand

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Methods

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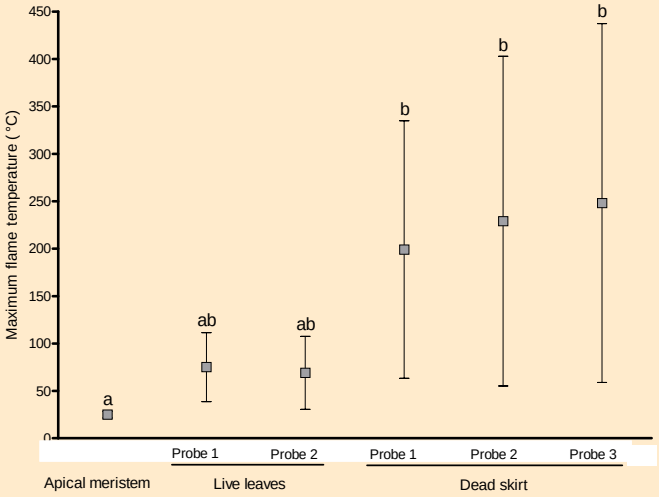
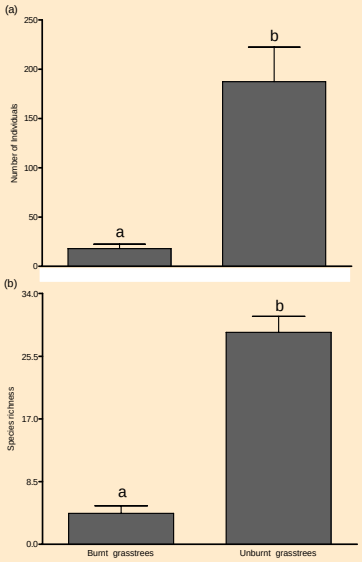
Max flame temperatures





Skirt

1. Blattodea 97% ⇨ 3.7%
2. Thysanura 95% ⇨ 0%
3. Pseudoscorp. 95% ⇨ 0%

Crown

1. Beetles 39% ⇨ 25%
2. Slater 35% ⇨ 17%
3. True bugs 9% ⇨ 3%
4. Spiders 6% ⇨ 4%

Conclusion

1. Grasstrees enable some invertebrates to survive fire *in situ*
2. Crown fauna more likely to survive
   - Fire selectively filters out skirt species - adults
3. Zone of lower temperature coincides with survivors
4. May enable more rapid recovery following burning
5. A global phenomena?

Acknowledgements

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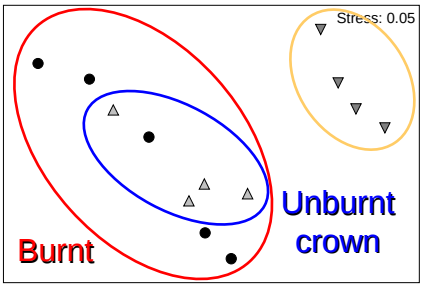
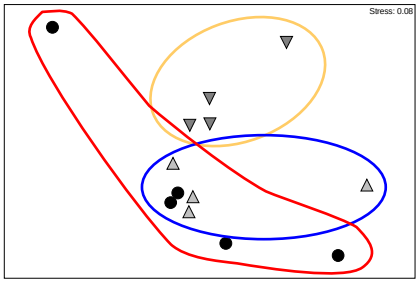
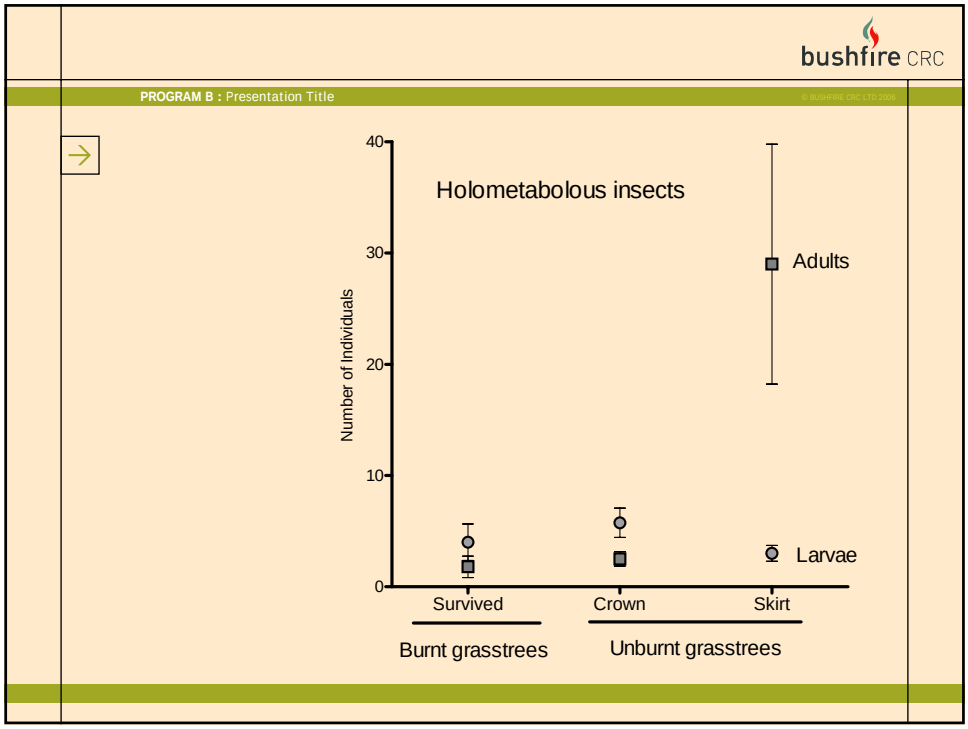


Unburnt skirt

Similarity in invertebrate orders

Similarity in invertebrate species

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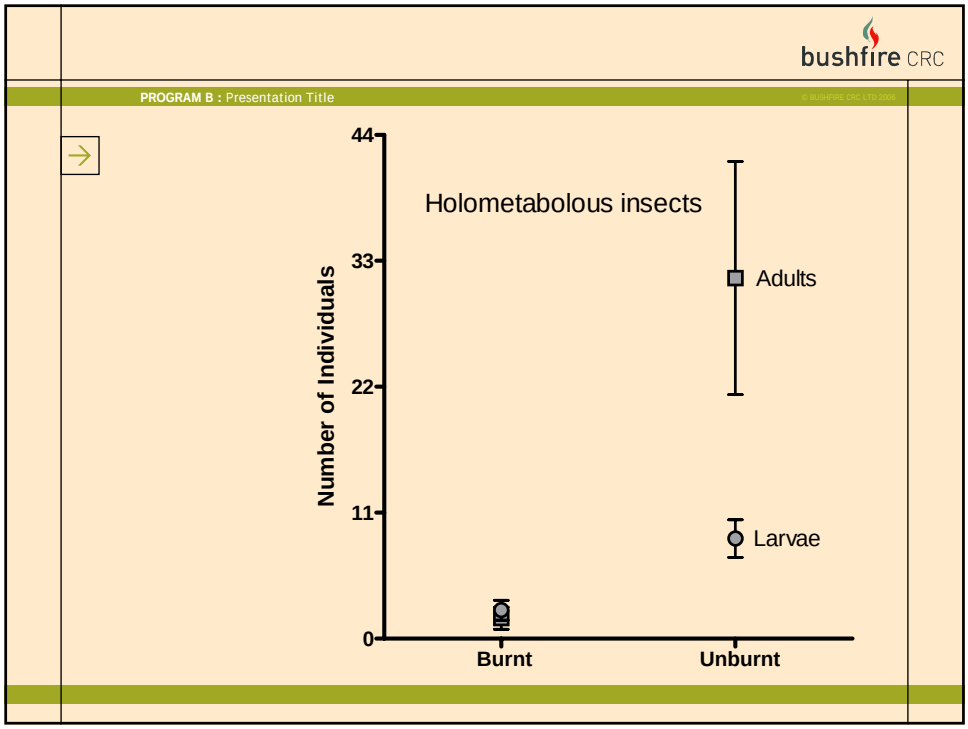
Holometabolous insects
Number of Individuals
40
30
20
10
0
Adults
Larvae
Survived
Crown
Skirt
Burnt grasstrees
Unburnt grasstrees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Holometabolous insects
Number of Individuals
44
33
22
11
0
Adults
Larvae
Burnt
Unburnt