

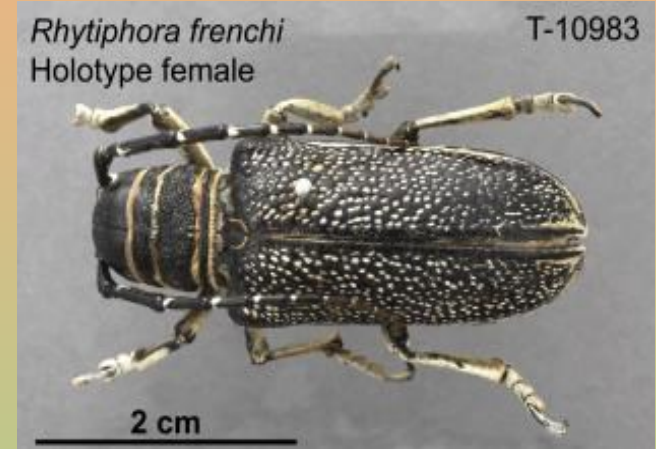
**Cerambycid
Beetles:
Potential Bio-
indicators of
Environmental
Change
Associated
with Fire
Affected
Habitat**



Why cerambycid beetles?



- Highly **abundant** and **diverse** native beetle family
- Multiple feeding habits (**living** and **dead wood**)
- Proven **traps** and **attractants** available to use



Primary Aims

- Assess the potential for using a common group of beetles as bioindicators.
- Determine whether there is a link between habitat affected by fire and the abundance of certain cerambycid beetles.
- Determine whether forest health is associated with cerambycid composition and abundance.

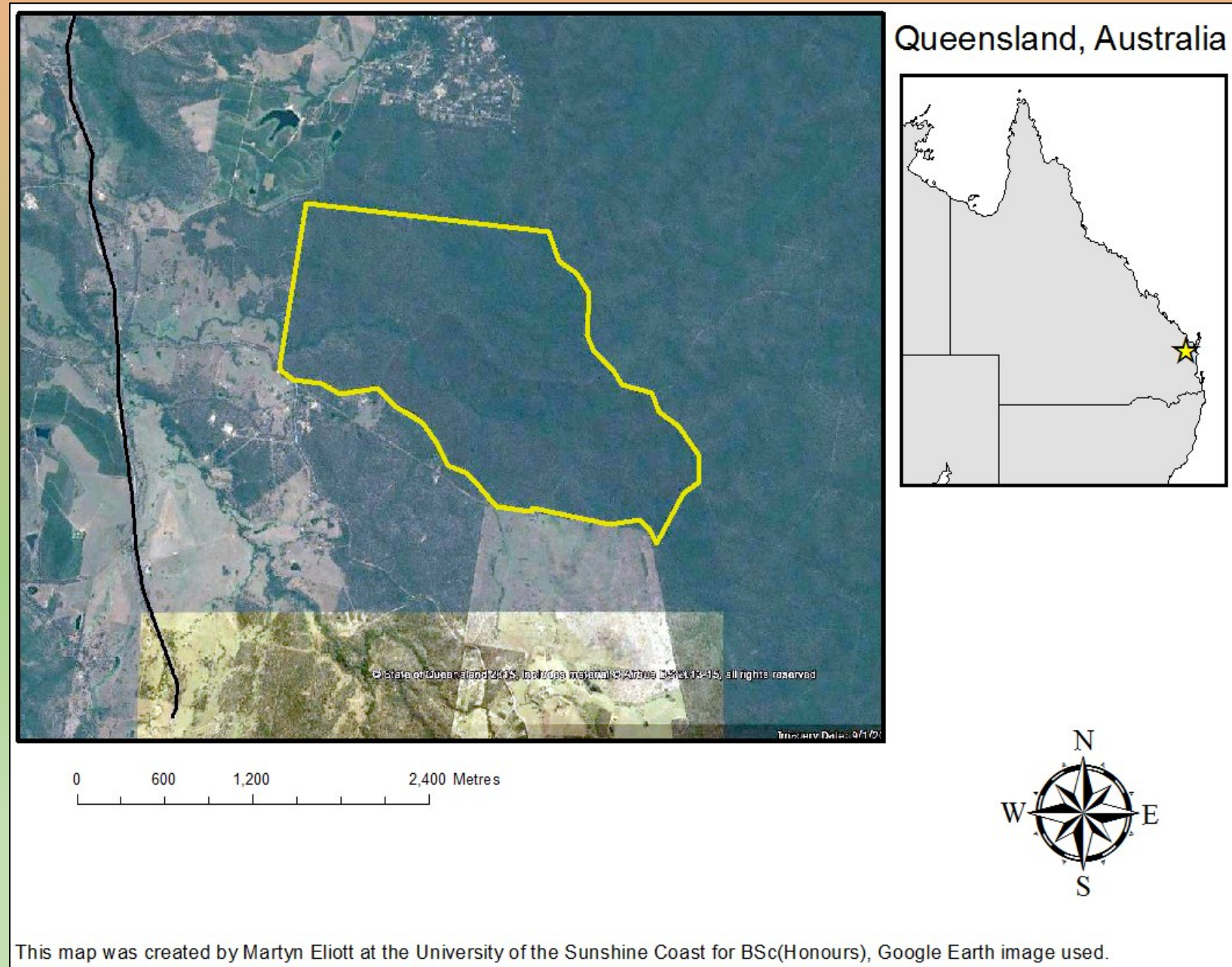
Hypotheses

- The composition of cerambycid beetles is affected by fire regime through changes in habitat.
- Composition of cerambycid beetles is related to indicators of forest health.

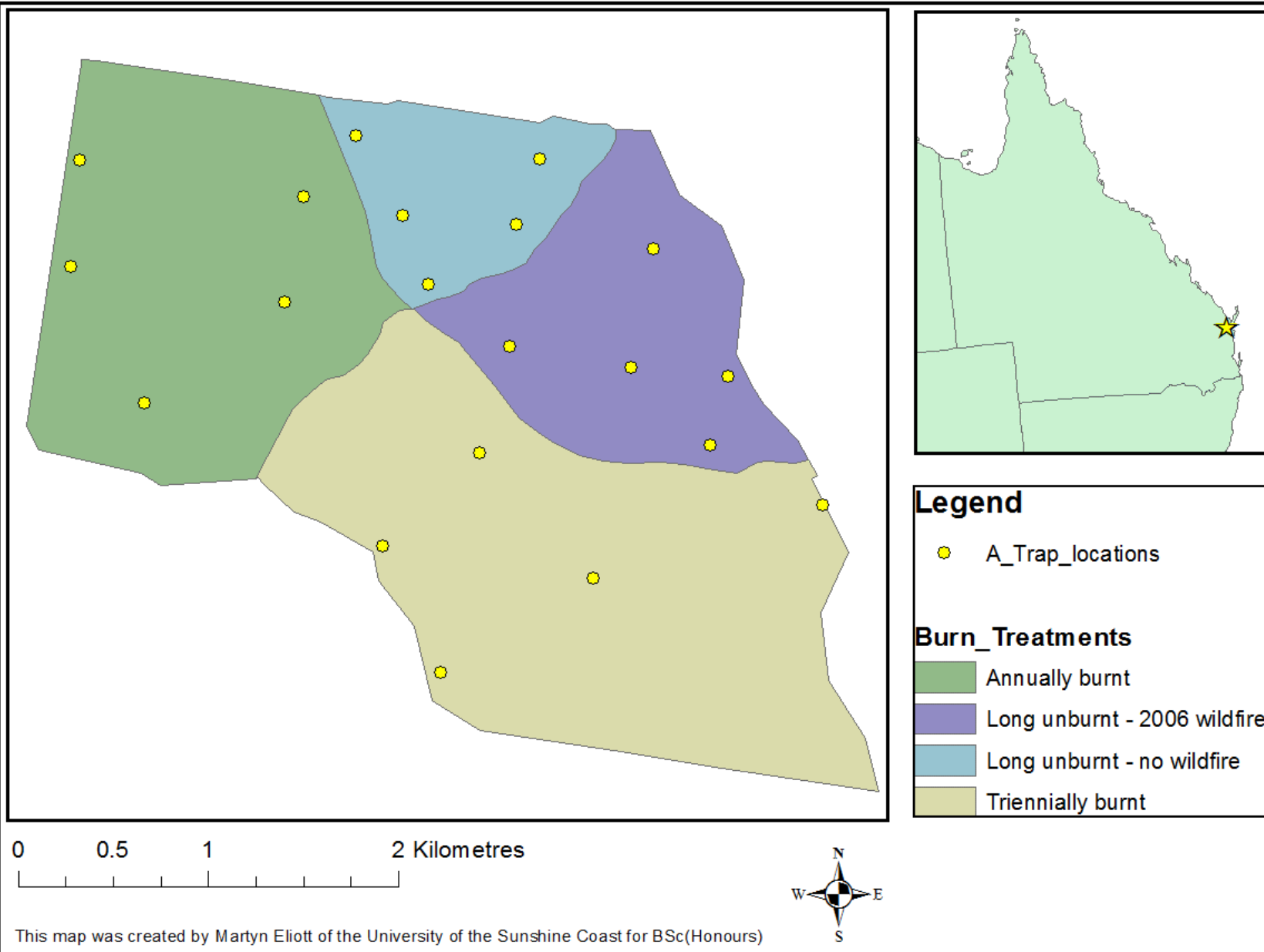
Bio-indicator – species, communities or processes that can be used to assess the quality of the environment and changes within it over time ₃

Study Area

- Bauple long-term fire experiment
- 50km North of Gympie, QLD
- Sub-tropical, warm wet summers, cool drier winters
- Approx. 55-115 m above sea level
- Maintained by Department of Agriculture and Fisheries (DAF)
- Dry sclerophyll eucalypt forest, spotted gum (*Corymbia citriodora* subsp. *variegata*) and co-dominant eucalypt species



Experimental Management Site



- Four fire treatments;
 1. **Annually** – 1952
 2. **Triennially** – 1973
 3. **Unburnt** – 1946
 4. Formally unburnt, **wildfire** – 2006
- **Five monitoring plots** in each treatment (total 20)
- Experiment approx. **900 ha** (9km²)
- **Selective logging** (1969-1974 & 1984-1992) & cattle grazing until 2000
- **Low intensity burns**, except the 2006 wildfire

Cerambycid Survey



- One trap baited with a generic cerambycid **pheromone** (3-hydroxy-2-hexanone)
- The other with a **kairomone** lure (ethanol and α -pinene)

- Two flight intercept panel traps at each plot
- Positioned randomly in insect flight paths



- Traps painted with fluon
- Traps hung between two 'star picket' posts
- Separated by at least 10 m
- Collection cups filled with 50 % propylene glycol solution in water, small volume of detergent



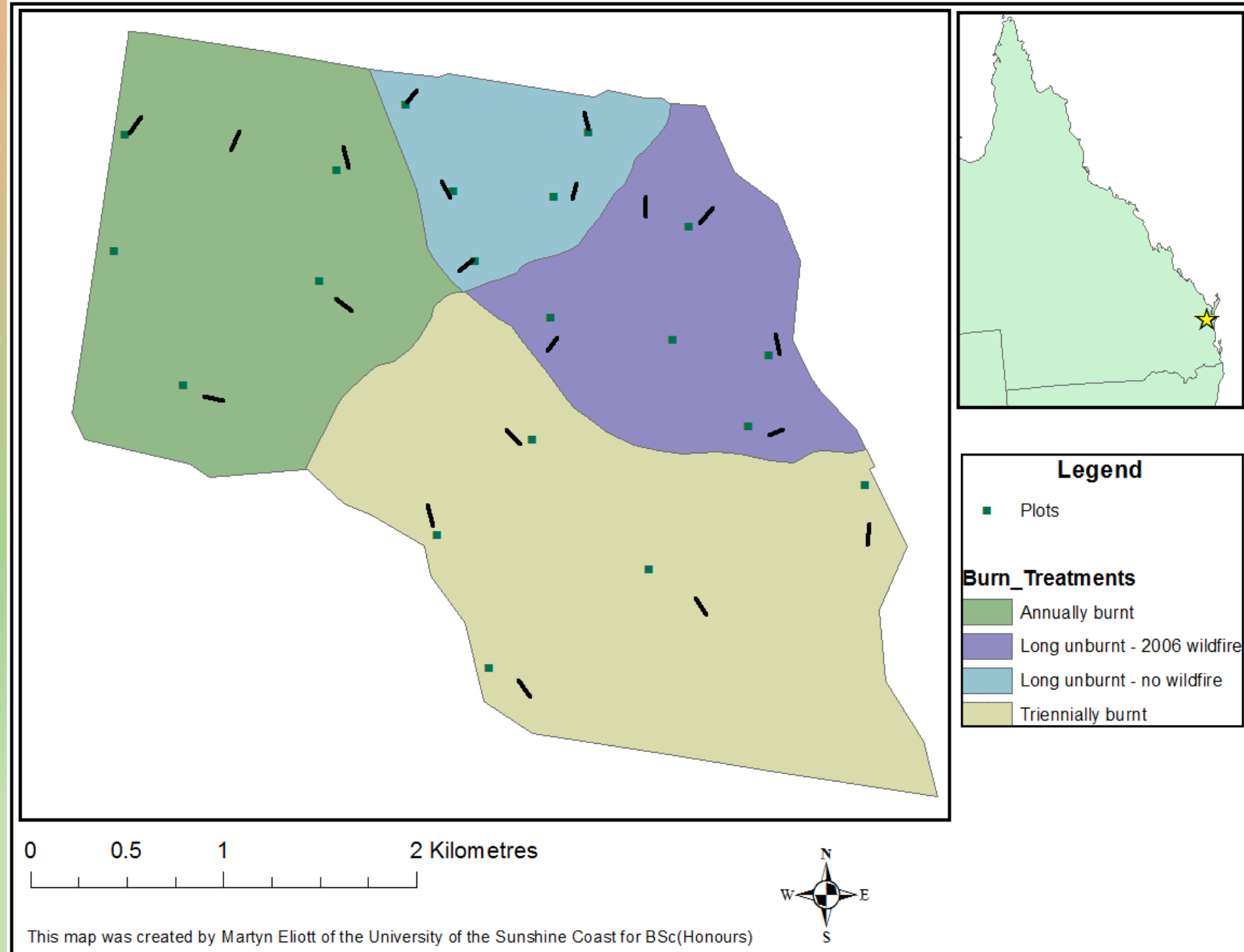
Collection No.	Start Date	End Date
1	02/03/2015	17/03/2015
2	17/03/2015	01/04/2015
3	01/04/2015	15/04/2015
4	15/04/2015	01/05/2015
5	01/05/2015	14/05/2015
6	14/05/2015	28/05/2015

- Traps maintained for **twelve weeks**, with clearances and re-baiting every two weeks
- This was to assist in determining a seasonal variation in cerambycid abundance
- Traps at each plot were rotated each clearance



Vegetation Survey

- Twenty, 100 m long, 10 m wide transects
- Survey recording live trees, dead trees and coarse woody debris
- Tree health measured using a dieback scoring system



Annual



Triennial



Unburnt



Wildfire



Living Trees

Live trees with >10 cm diameter at breast height (DBH):

- Diameter
- Tree species
- Proportion Primary Branch Dieback
- Five Grimes scores:
 1. Crown position
 2. Crown size
 3. Crown density
 4. Dead branches
 5. Epicormic growth

Annual



Triennial



Unburnt



Wildfire



Dead Trees

- Dead trees > 10 cm DBH
- Enabled basal area (m^2) to be calculated

Coarse Woody Debris (CWD)

- CWD > 10 cm diameter crossing centre of transect
- Enabled CWD volume to be calculated (m^3/ha)

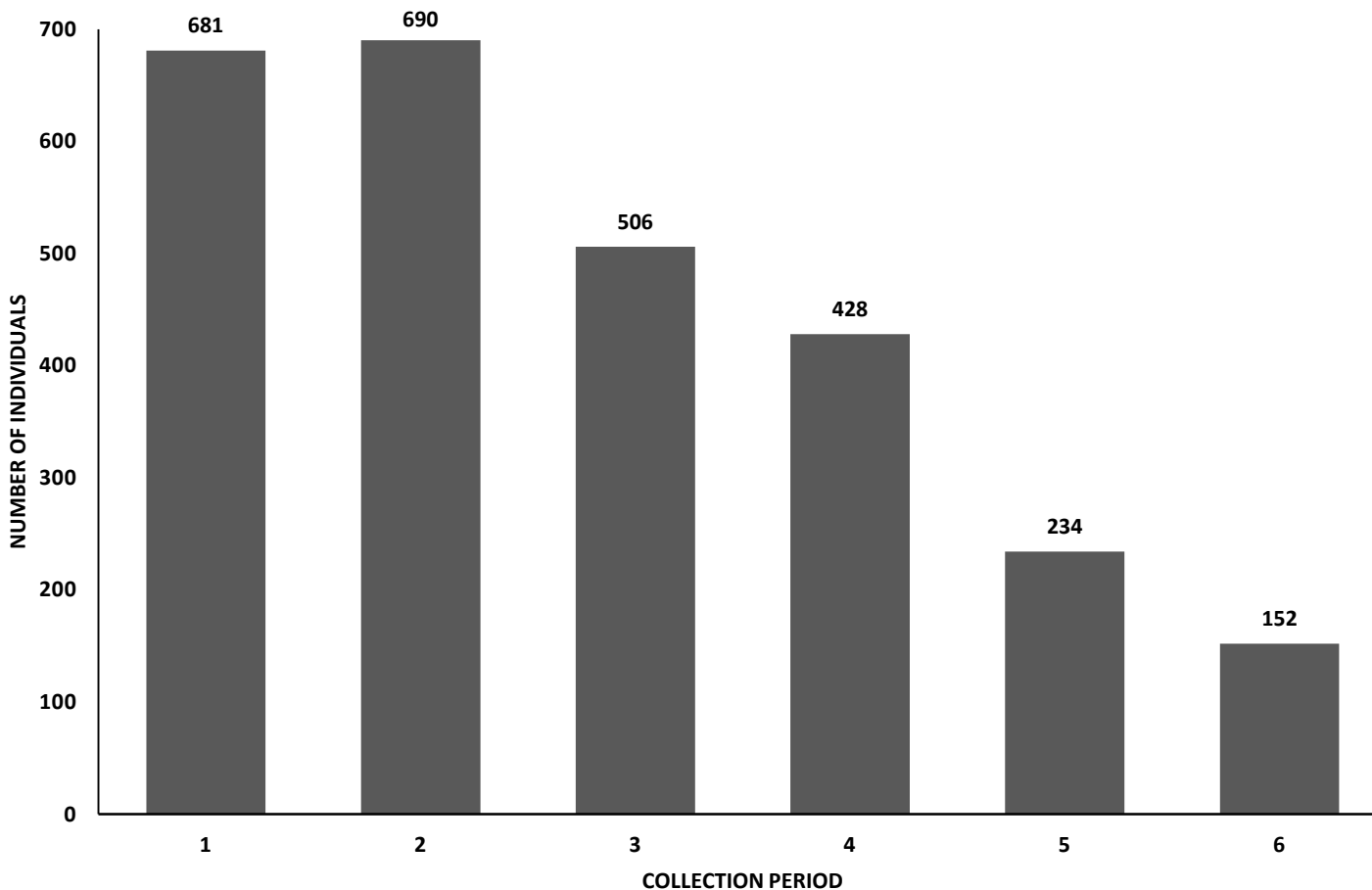
Borer Assessment



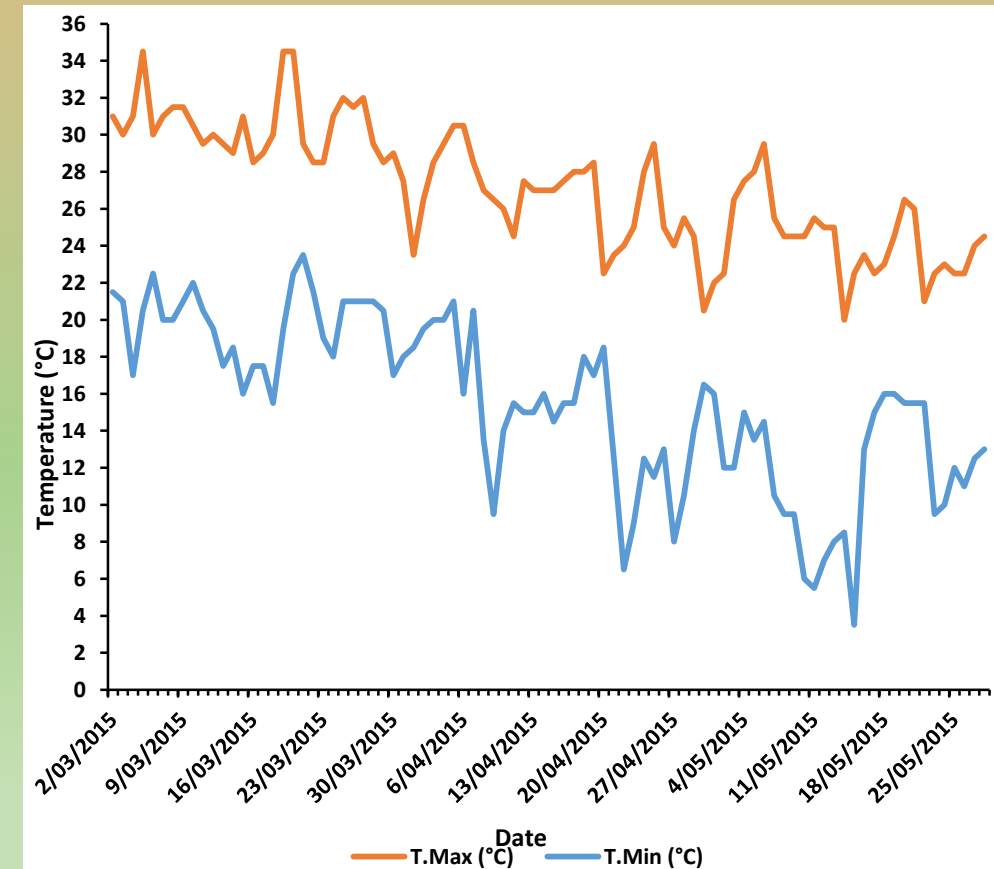
Cerambycid species	α -pinene + Ethanol	Pheromone
<i>Bethelium tillides</i>	1	1428
<i>Adrium sp.</i>	11	1111
<i>Bethelium signiferum</i>	0	125
<i>Zygocera pruinosa</i>	2	10
<i>Xylotrechus australis</i>	0	6
<i>Chlorophorus curtisi</i>	0	2
<i>Coptocercus biguttatus</i>	2	0
<i>Rhytophora c.f. vermicularia</i>	0	1
<i>Didymocantha sp.</i>	0	1
<i>Phoracantha recurva</i>	1	0
<i>Phoracantha mastersi</i>	1	0
Total cerambycid beetles	18	2684

Temporal Cerambycid Beetle Abundance

Total Number of Cerambycid Beetles

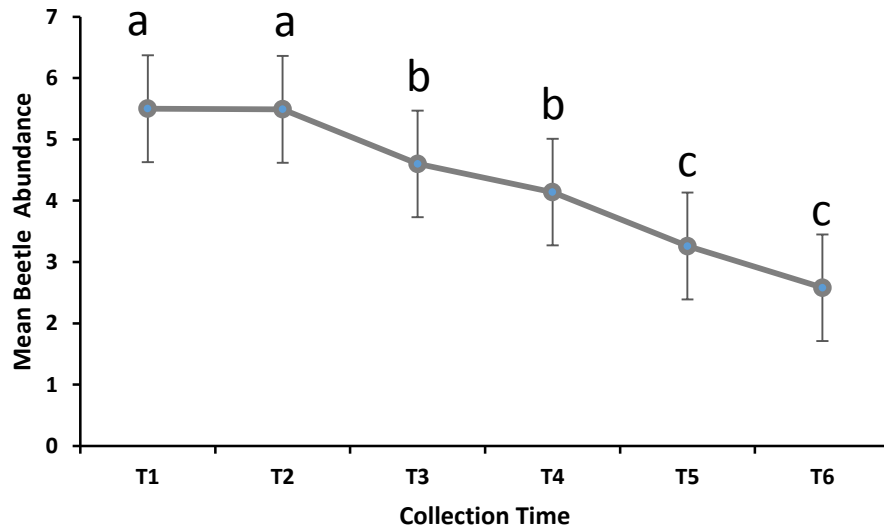


Temperature

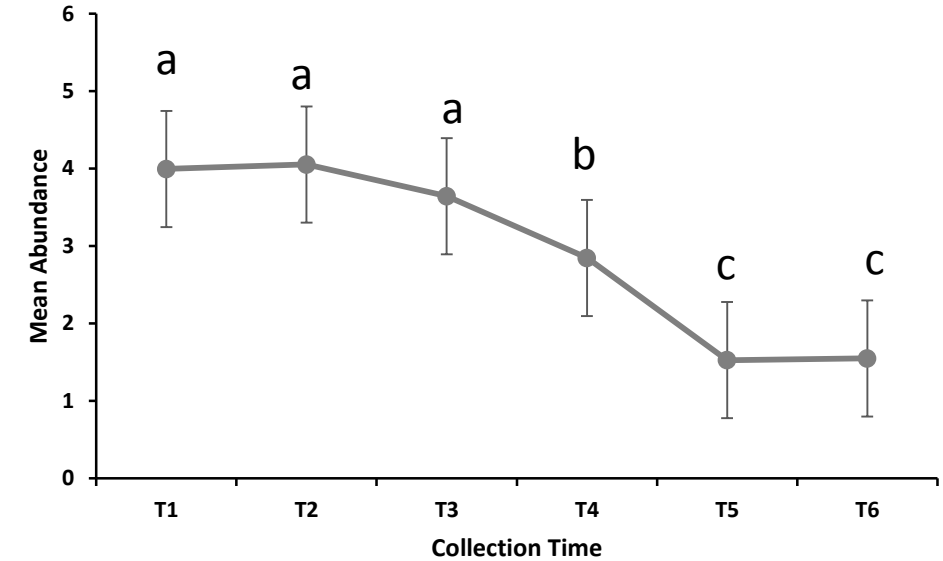


Temporal Variation in Abundance

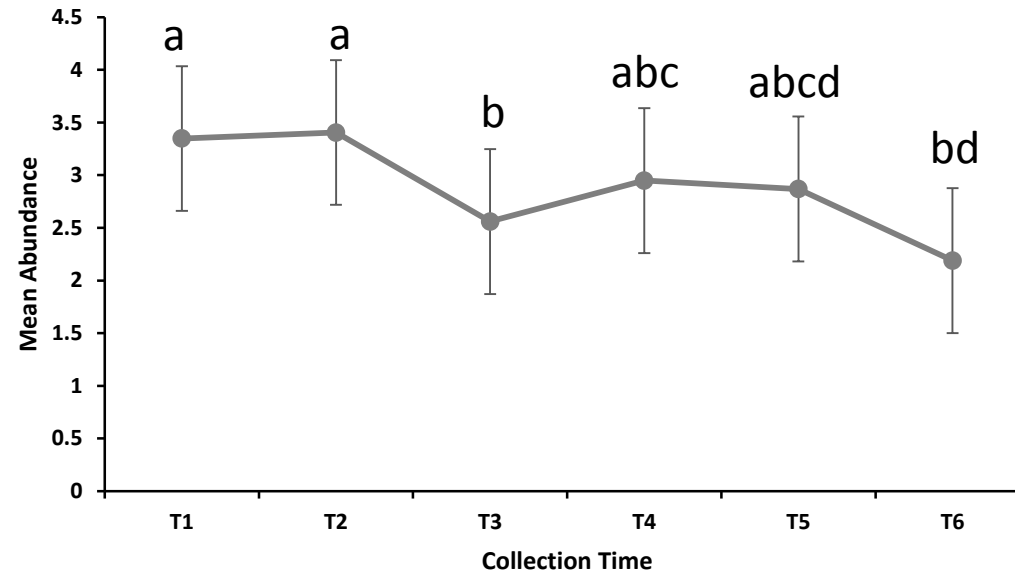
Cerambycid Beetles



Bethelium tillides



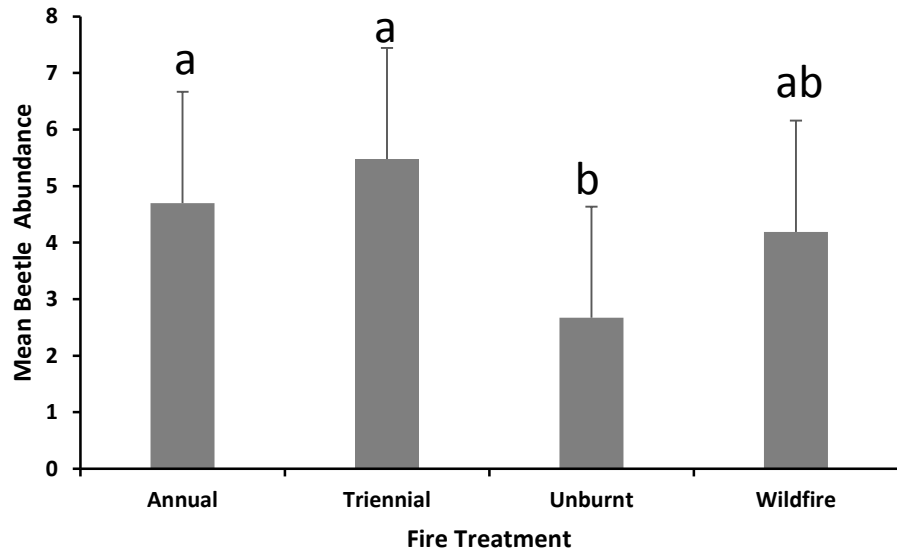
Adrium sp.



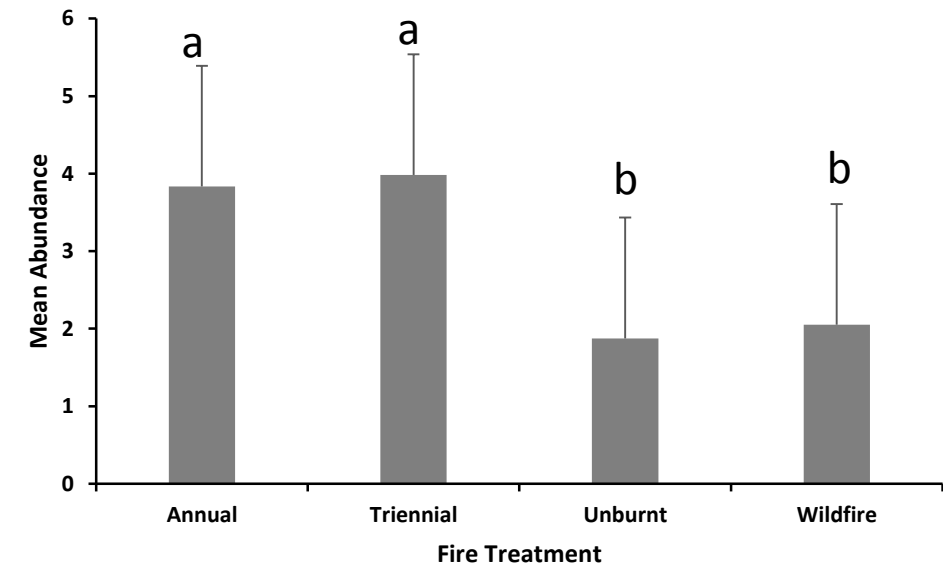
Means followed by different letters differ significantly at the critical LSD level.

Treatment Variation in Species Abundance

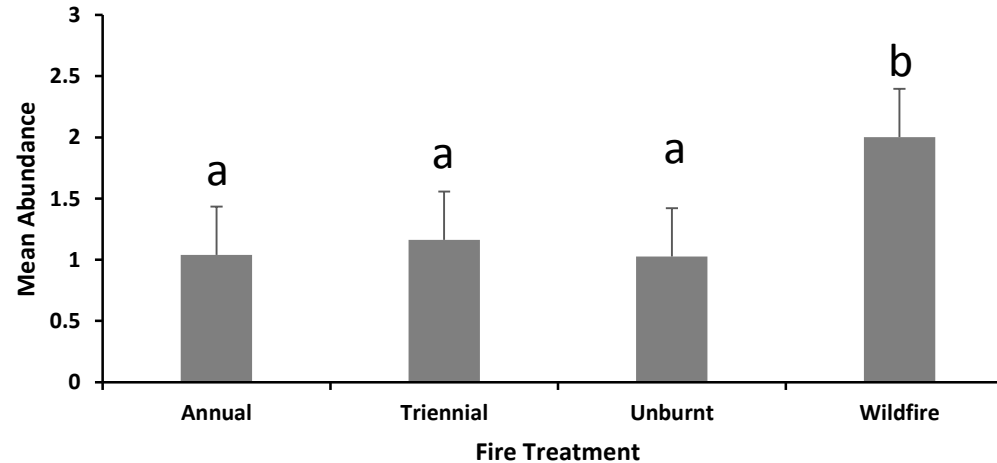
Total Cerambycid Beetles



Bethelium tillides



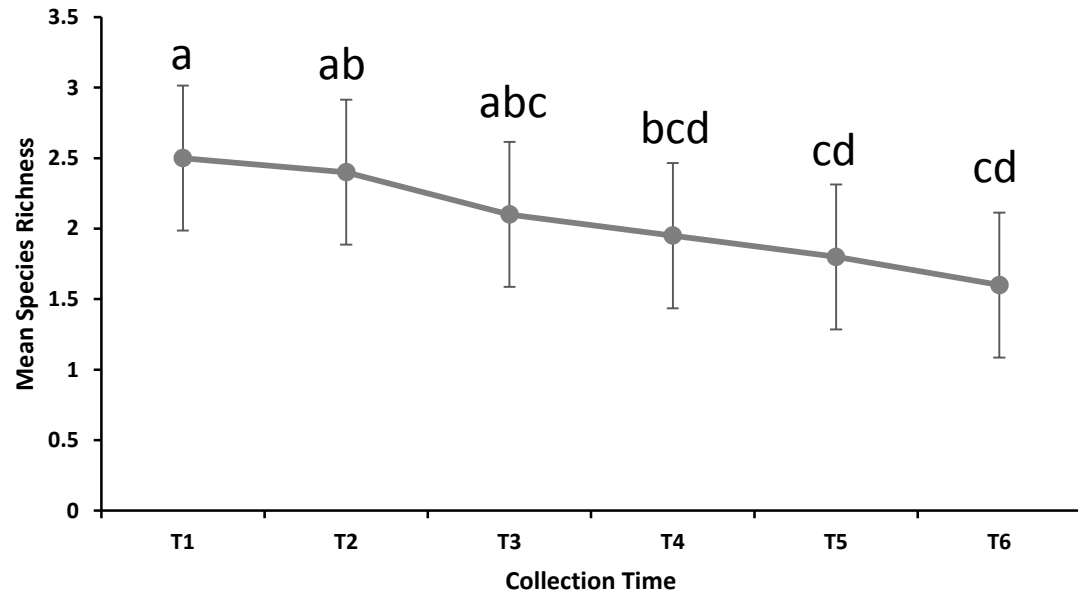
Bethelium signiferum



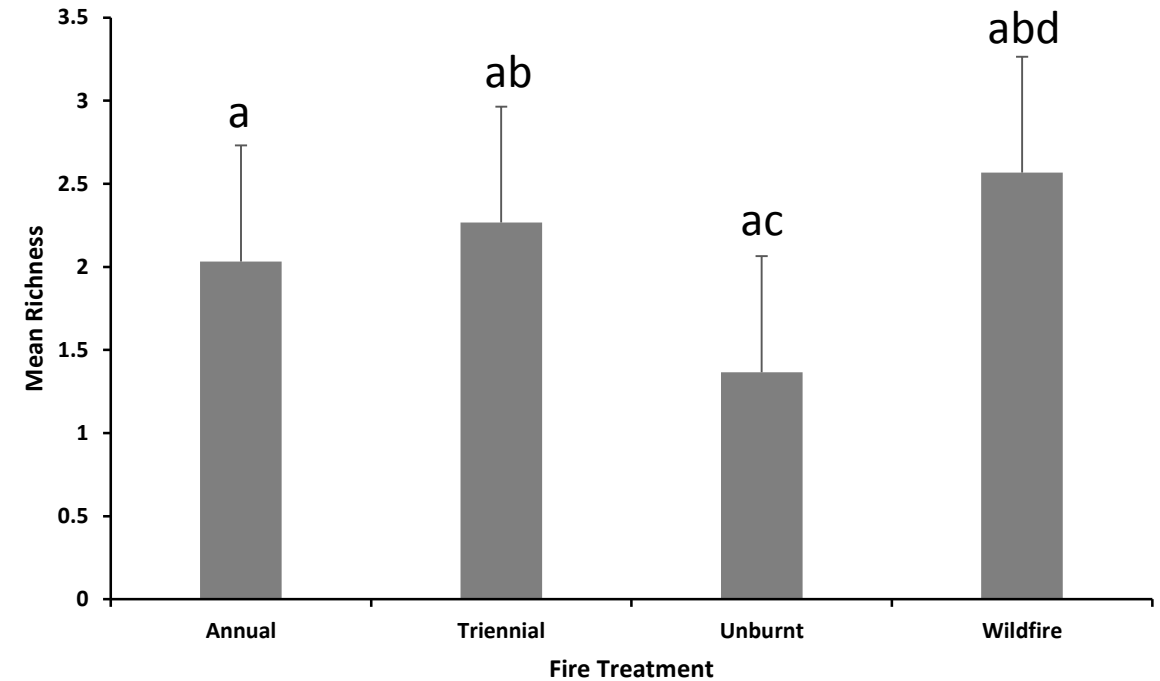
Means followed by different letters differ significantly at the critical LSD level.

Temporal & Treatment Variation in Species Richness

Temporal Variation



Treatment Variation



Means followed by different letters differ significantly at the critical LSD level.

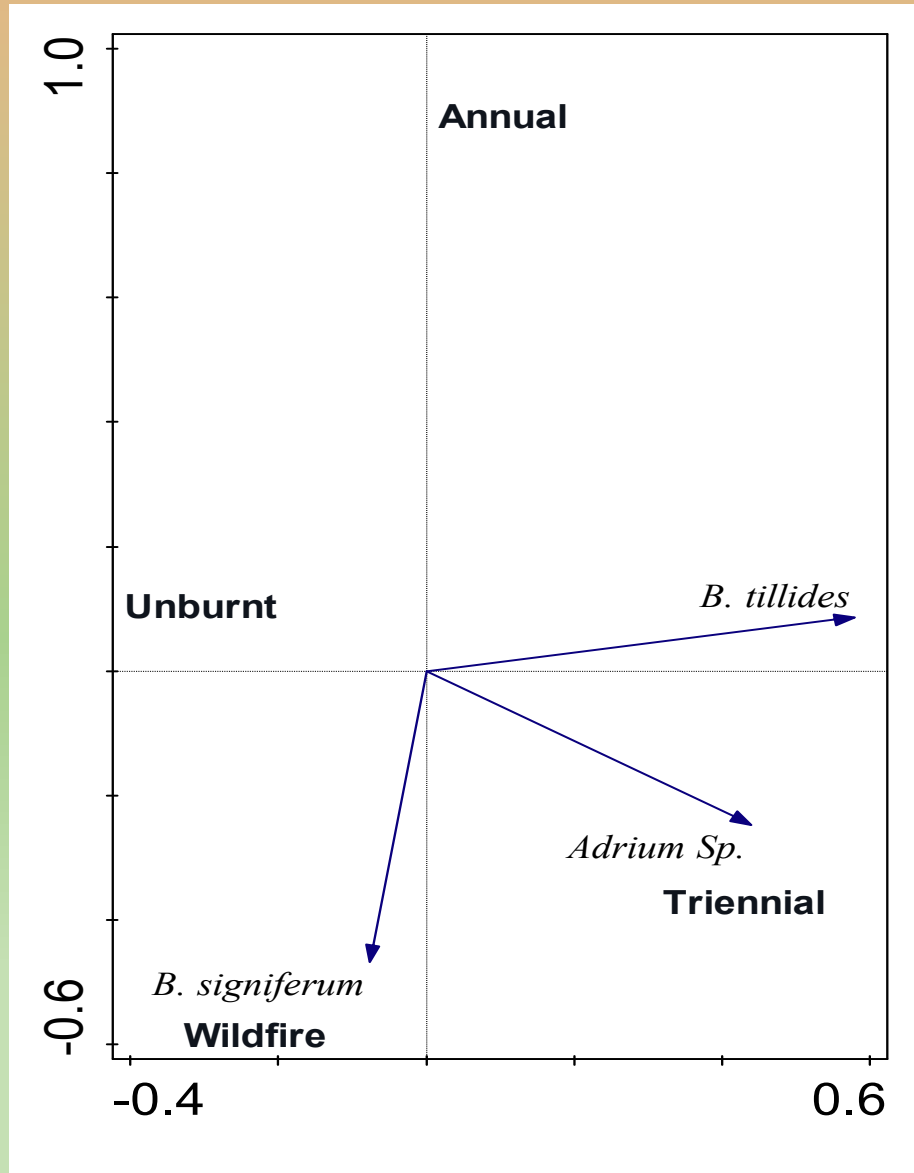
Borer Assessment

Annual	3
Triennial	15
Unburnt	21
Wildfire	13

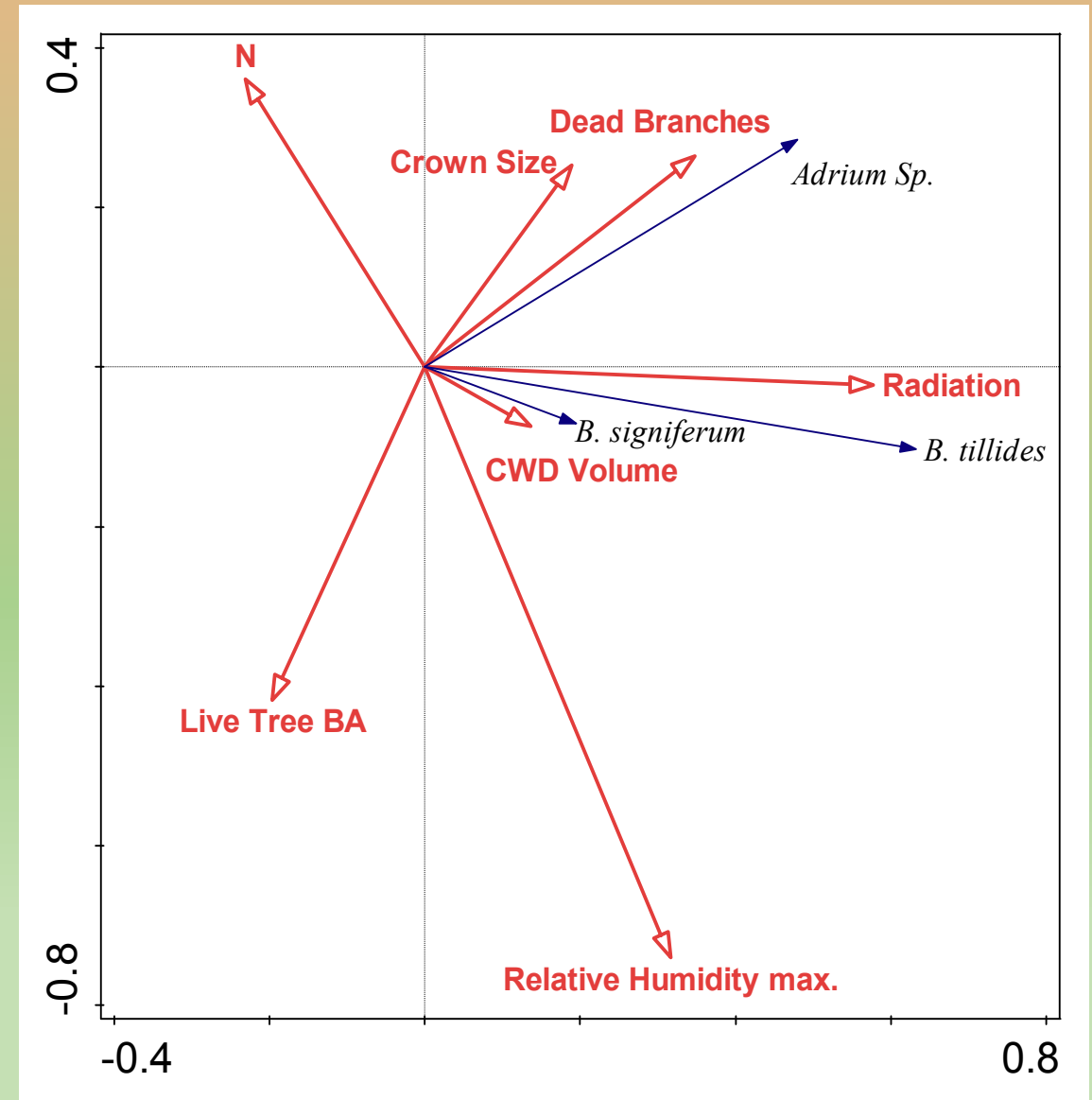
Tree Species	Common Name	Number
<i>Corymbia intermedia</i>	Red Bloodwood	1
<i>Eucalyptus fibrosa subsp. fibrosa</i>	Broad-leaved Ironbark	1
<i>Lophostemon confertus</i>	Brush Box	6
<i>Cyclophyllum coprosmoides</i>	Coastal Canthium	1
<i>Eucalyptus tereticornix</i>	Forest Red Gum	4
<i>Eucalyptus siderophloia</i>	Grey Ironbark	1
<i>Alphitonia excelsa</i>	Red Ash	1
<i>Angophora leiocarpa</i>	Smooth Barked Apple	1
<i>Corymbia citriodora</i> subsp. <i>variegata</i>	Spotted Gum	5
<i>Lophostemon suaveolens</i>	Swamp Box	15
<i>Unknown 1</i>	Unknown 1	1
<i>Unknown 2</i>	Unknown 2	1
<i>Eucalyptus acmenoides</i>	White Mahogany	14

Redundancy Analysis

Treatments



Other Variables



Conclusions

- Composition (abundance and species richness) of cerambycid beetles affected by fire regime
- This was mostly driven by the response of the three most abundant species trapped
- Link between fire-affected habitat and abundance of three main species collected at the site
- A measure (Grimes score) of tree health was associated with abundance of one species in particular
- Some cerambycid species show good potential to be used as indicators of forest habitat change associated with fire, and to a lesser extent tree health
- Longer term studies are needed to verify/expand on these findings, possibly also investigating other beetle families, such as scolytids (bark beetles) and platypodids (Ambrosia beetles)

Acknowledgments

- **South East Queensland Fire and Biodiversity Consortium**
- **Queensland Government, Department of Agriculture and Fisheries (DAF)**
- **University of the Sunshine Coast (USC)**
- A special thanks to my supervisors and co-supervisors, **Neil Tindale, Simon Lawson, Tom Lewis, Valerie Debusse and Andrew Hayes**
- Supervisors and volunteer for their help and support during my field work
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