Saproxylic beetles and the cumulative ecological effects of wildfire and forest harvesting

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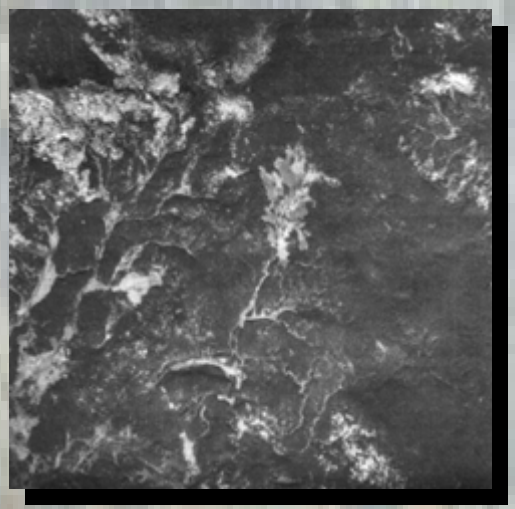
Talk Outline

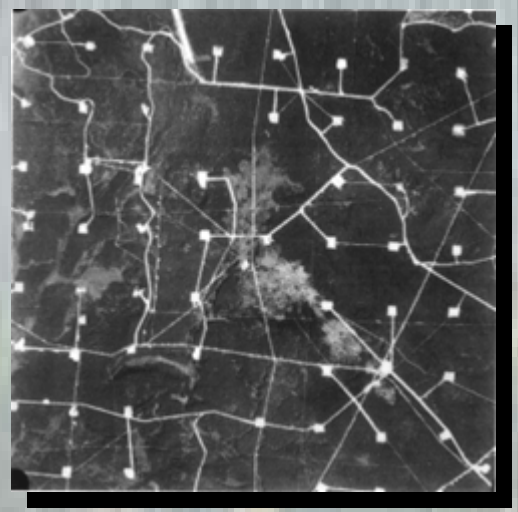
- background
- hypotheses
- study design
- preliminary results
- implications

Effects of disturbance combinations may be cumulative

Swan Hills area, Alberta, CANADA
Twp. 63, Rge. 11, W5th

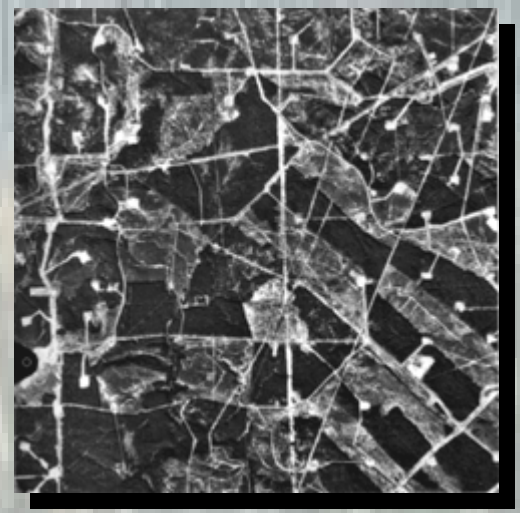


1949



1964

+ oil wells
+ access roads



1991

oil wells
+ access roads
+ logging

7 km

Source: Schneider 2002

Saproxylic Beetles?

ASRD 2001

Hypotheses

1. Combined effects of wildfire and forest harvesting on saproxylic beetles are greater than either disturbance alone. (Survey Approach)

2. Abundance of saproxylic beetle larvae is linked to changes in soil nutrients near burned trees. (Experimental Approach)

- May 23 - June 4, 2001
- ~ 120,000 ha

H1: Combined effects of wildfire and forest harvesting on saproxylic beetles are greater than either disturbance alone.

Survey Design:

1 Factor ANOVA (4 levels and 6 replicates = 24 sites)

Stand Treatments (age, density, plant composition, soil types, accessibility)

GRN **BRN** **HAR** **SAL**




H1: Combined effects of wildfire and forest harvesting on saproxylic beetles are greater than either disturbance alone.

Survey Design:

1 Factor ANOVA (4 levels and 6 replicates = 24 sites)

Stand Treatments

GRN **BRN** **HAR** **SAL**

Undisturbed in > 100yrs

H1: Combined effects of wildfire and forest harvesting on saproxylic beetles are greater than either disturbance alone.

Survey Design:

1 Factor ANOVA (4 levels and 6 replicates = 24 sites)

Stand Treatments

GRN **BRN** **HAR** **SAL**

Burned by Chisholm fire 2001

H1: Combined effects of wildfire and forest harvesting on saproxylic beetles are greater than either disturbance alone.

Survey Design:

1 Factor ANOVA (4 levels and 6 replicates = 24 sites)

Stand Treatments

GRN **BRN** **HAR** **SAL**

Clear-cut harvested in 2001

H1: Combined effects of wildfire and forest harvesting on saproxylic beetles are greater than either disturbance alone.

Survey Design:

1 Factor ANOVA (4 levels and 6 replicates = 24 sites)

Stand Treatments

GRN **BRN** **HAR** **SAL**

Salvaged following the Chisholm fire

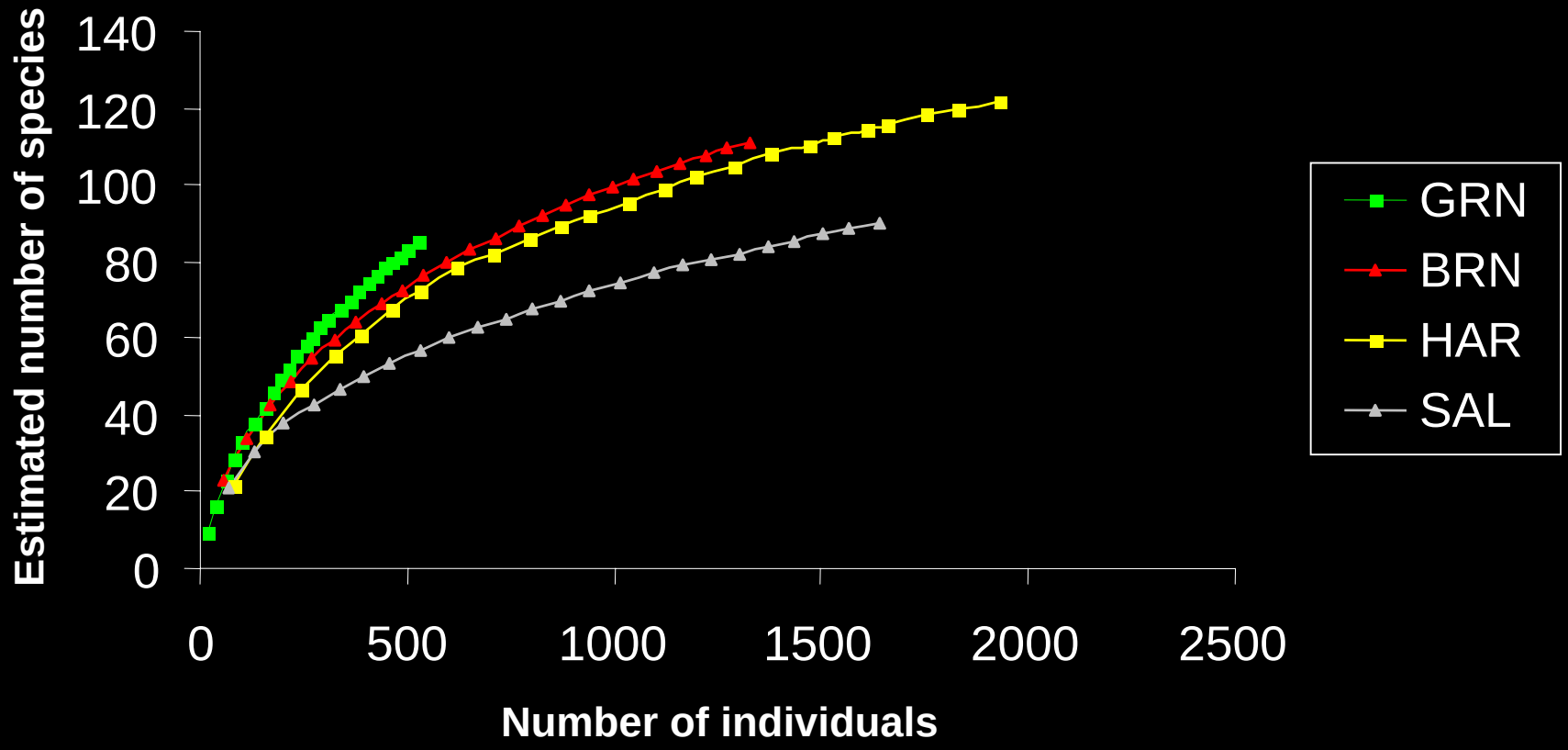
H1: Combined effects of wildfire and forest harvesting on saproxylic beetles are greater than either disturbance alone.

Sampling Design

- **summer months 2002 and 2003**
- **flight-intercept traps (4/site = 96 total)**
- **total beetles collected 15,326**
- **identification ~60% complete (187 species, 38 families so far!)**

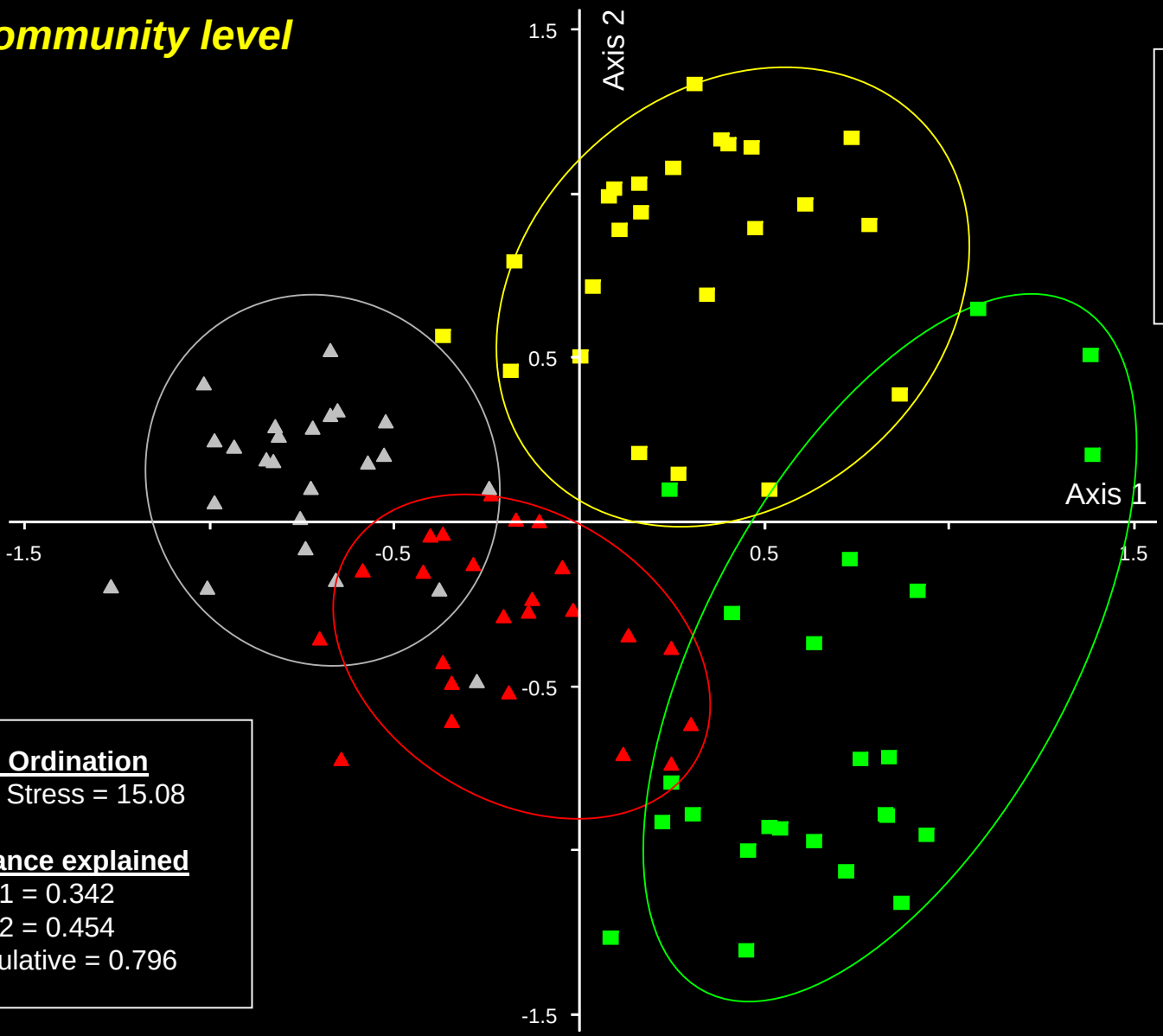
H1: Combined effects of wildfire and forest harvesting on saproxylic beetles are greater than either disturbance alone.

- diversity



H1: Combined effects of wildfire and forest harvesting on saproxylic beetles are greater than either disturbance alone.

- community level

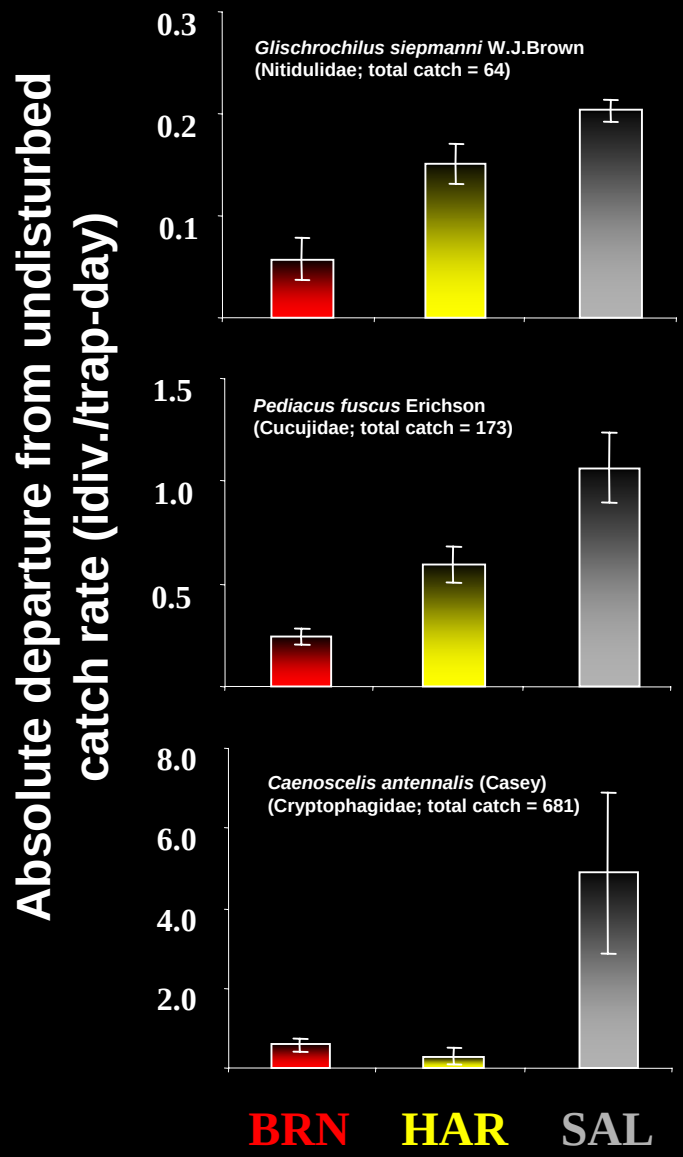


NMS Ordination
Final Stress = 15.08

Variance explained
Axis 1 = 0.342
Axis 2 = 0.454
Cumulative = 0.796

H1: Combined effects of wildfire and forest harvesting on saproxylic beetles are greater than either disturbance alone.

species level



H2: Abundance of saproxylic beetle larvae is linked to changes in soil nutrients in near burned trees.

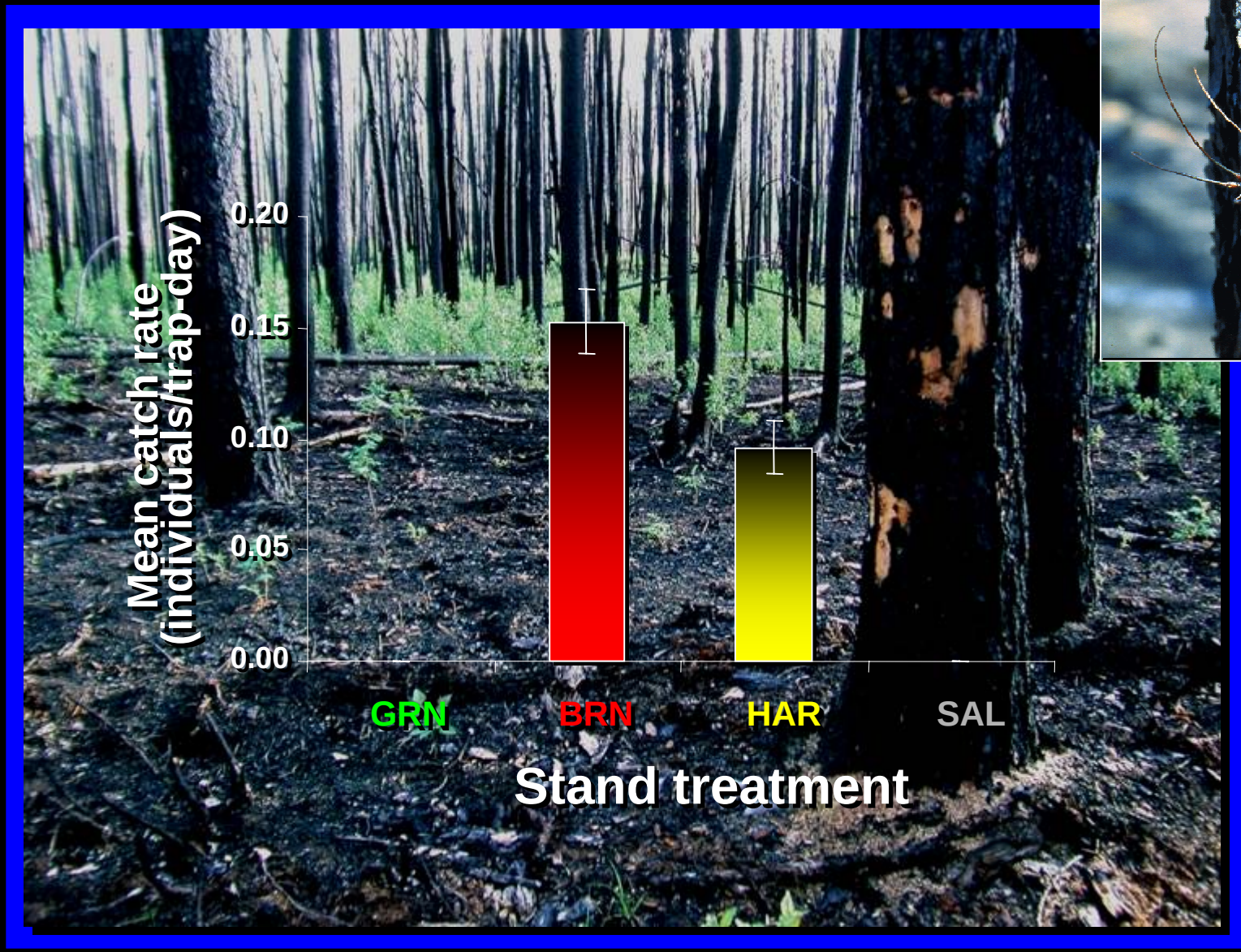


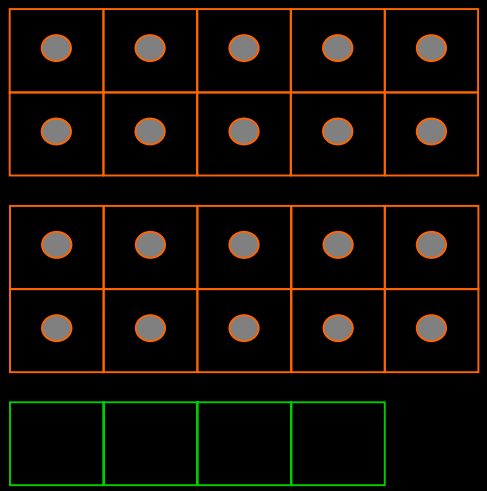
Photo: Matti Koivula 2002

H2: Abundance of saproxylic beetle larvae is linked to changes in soil nutrients in near burned trees.

H2: Abundance of saproxylic beetle larvae is linked to changes in soil nutrients in near burned trees.

Experimental Design:

1 Factor ANOVA (6 levels and 4 replicates = 24 enclosures)



Levels:

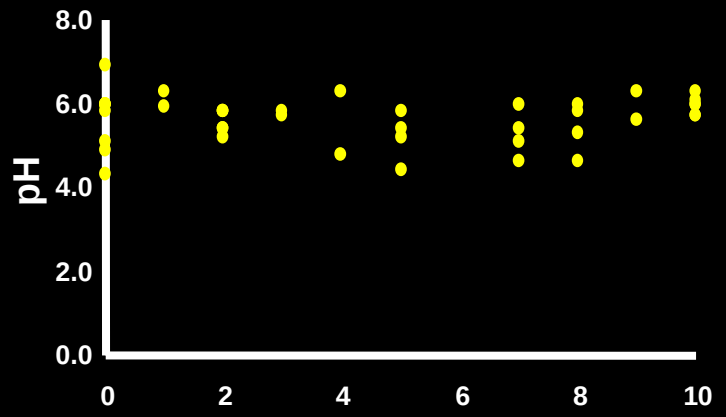
larvae abundance 0,2,5,8,10, Method CTRL

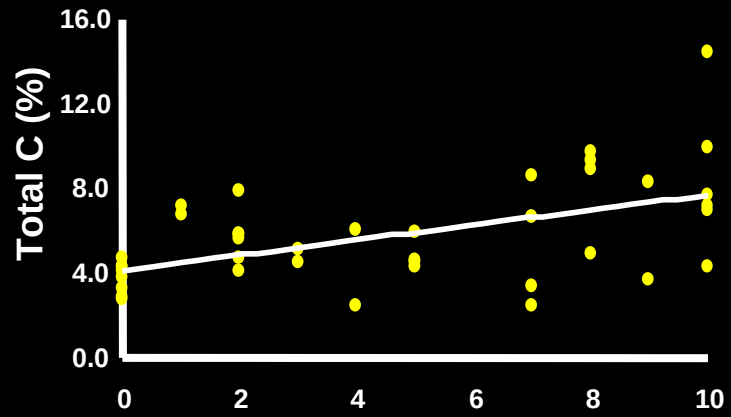
Larvae allowed to feed for 2 years, soil samples collected once per yr

H2: Abundance of saproxylic beetle larvae is linked to changes in soil nutrients in near burned trees.

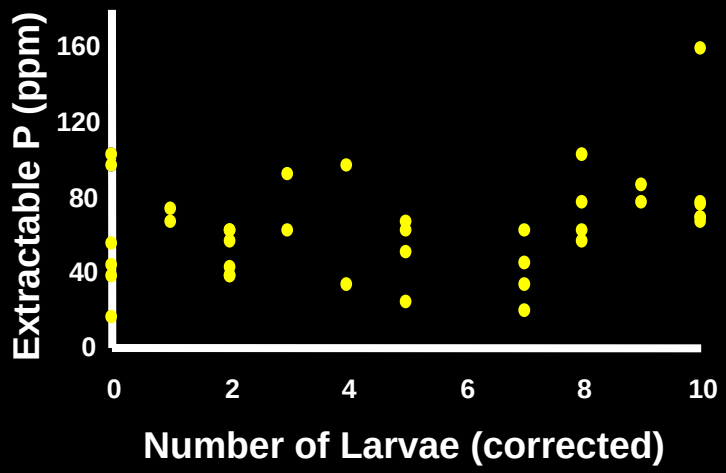
- Both years combined

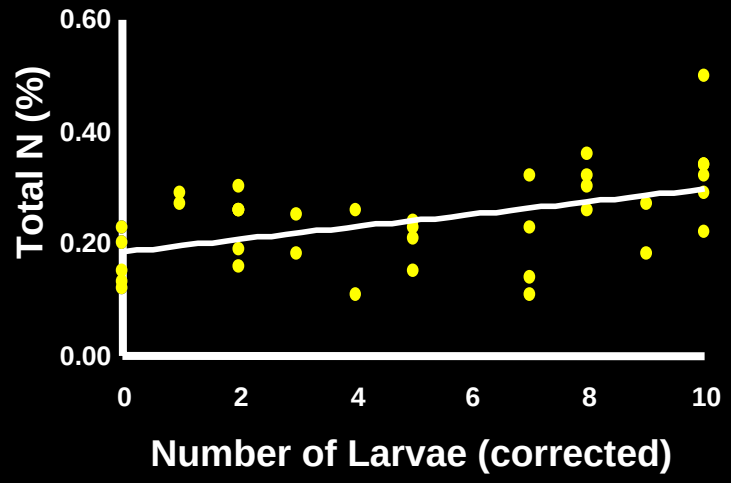
- Larval abundance corrected for mortality





R^2 = 0.2747
p = 0.0005
n = 40





R^2 = 0.2504
p = 0.0010
n = 40

Summary

- early support for both hypotheses:

H1: Combined effects of fire and harvesting

Community-level

- salvage logging reduced saproxylic diversity and altered species assemblages more either fire or harvesting alone

Species-level

- combined effects of fire and harvesting were greater than either disturbance alone for several species (*e.g. M. scutellatus* absent from SAL stands)

H2: linking beetle abundance to soil nutrients

- increased abundance of larval *M. scutellatus* increased total C and total N in the soil

Implications?

Fire + Harvesting

Woody Debris Decomposition
Soil Chemistry
Forest Regeneration

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