Outline

Justification of Research

- Why study aspen stands?
- Why build enclosures?
- Who else do enclosures affect?

Methods

- 1962 Enclosures; 2009 enclosures; control sites
- Mammals, birds, insects, plants
- General Ecology class at UNC

Results (Preliminary)

- Richness & diversity

Conclusion

- Did we get what we expected?

Background

Justification of Research

- Why study aspen stands?
  - Known for biodiversity
  - Alters biogeochemistry
  - Concern of future

Why Aspen?

Ecosystem Services:

- Habitat
- Landscape diversity
- Water Quality
- CO_2 sink
- Soil Improvement

Economic product (pulp)

Recreation

Allergen

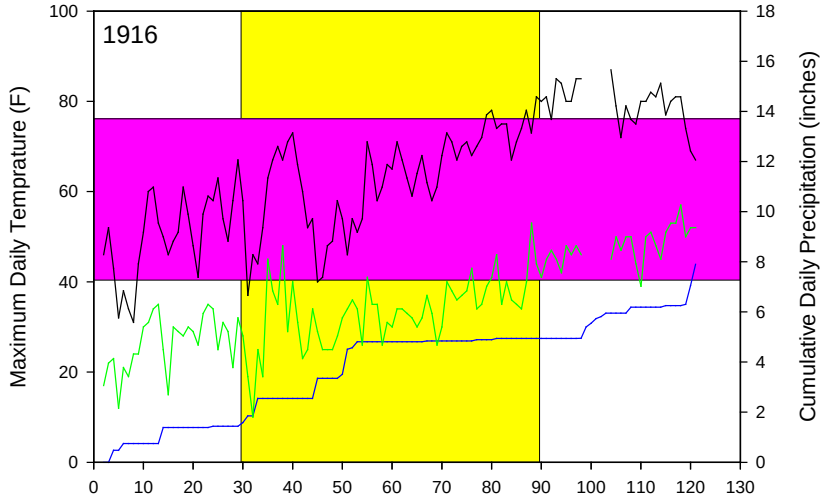
Aspen is a **USA-National Phenology Network** calibration plant species, so comparison data are available throughout the US.

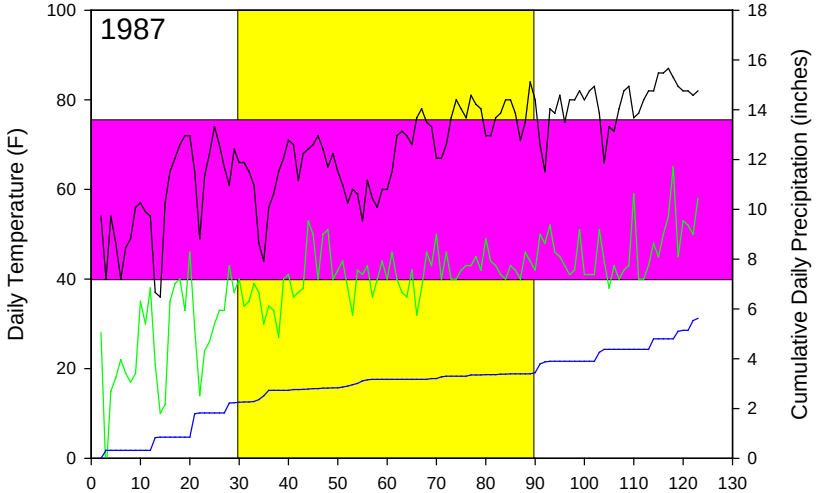
Sudden Aspen Decline (SAD)

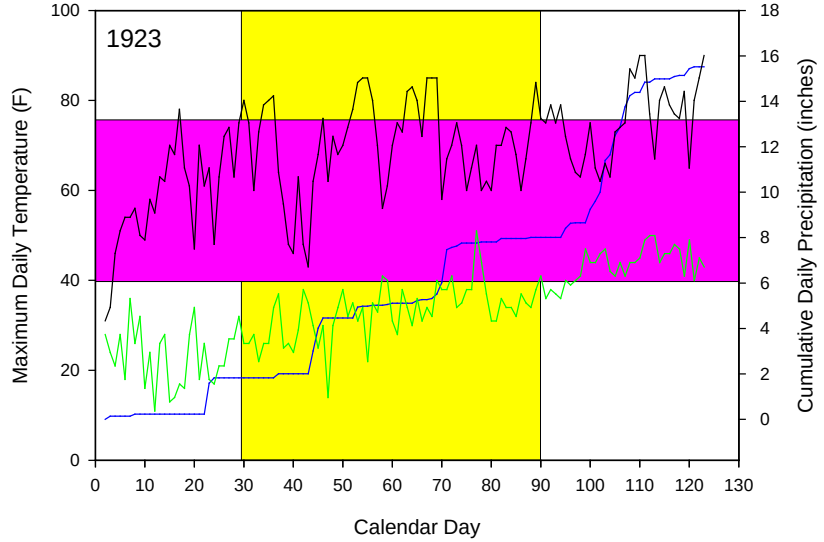
Looking at Timing Over Time

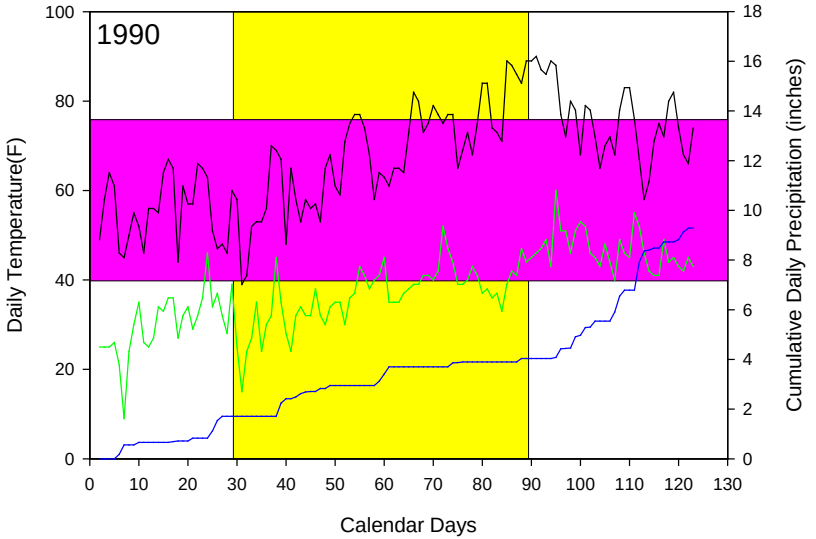
Yellow = reproduction window; Pink = seed temperature germination window

The data suggest temperature is not the limiting factor – moisture is.









Aspen is Unique

Aspen is the most widely distributed tree in North America

Aspen is clonal;

- New stems (ramets) grow from roots
- Root connections allow exchange of resources from one ramet to another
- Clones may be large (thousands of ramets)
- Clones may be old (thousands of years)
- Cloning allows for longevity because continual sexual reproduction is not necessary

Aspen is dioecious (each clone is either male or female) – for sexual reproduction, two different-sexed individuals must be in the same proximity (pollen is wind-dispersed)

Who is connected to whom and why?

What Do You Know About Clonal Plants?

Who Cares?

Clonal plants make up about 40% of the global plant diversity.

Clonal plants dominate about 1/3 of terrestrial plant systems.

Clonal plants make up a majority of the most invasive plant species.

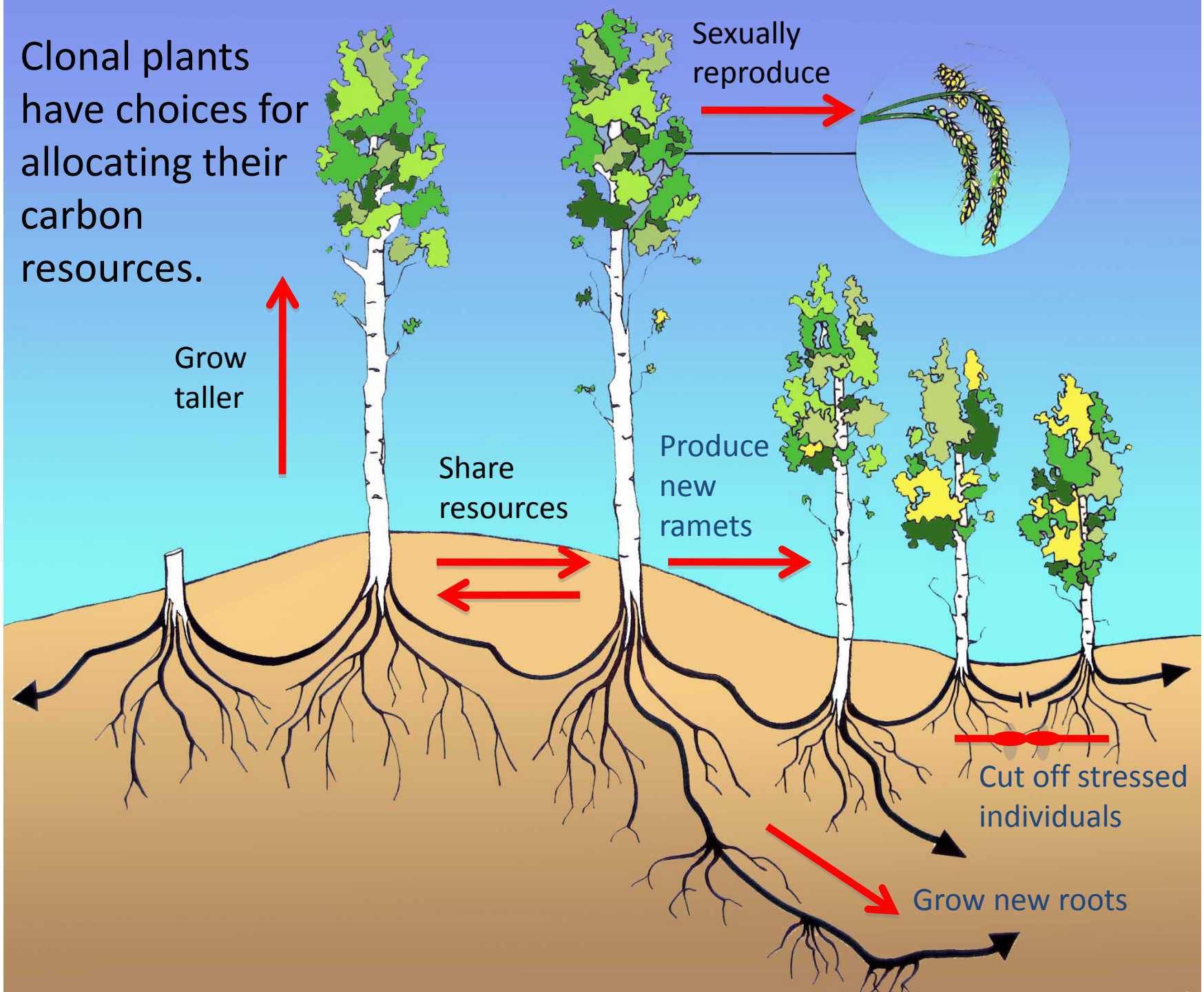
Nearly all biofuel plants are clonal.

How are they different from non-clonal plants?

Clonal plants work as modules and can forage for resources.

Clonal plants share resources, so part of their structure can be in poor environment. Shoot may be in sun while roots are in high moisture soil.

Clonal plants do not rely on sexual reproduction.


Clonal plants have choices for allocating their carbon resources.
Sexually reproduce
Grow taller
Share resources
Produce new ramets
Cut off stressed individuals
Grow new roots

Background

Justification of Research

Why build enclosures?

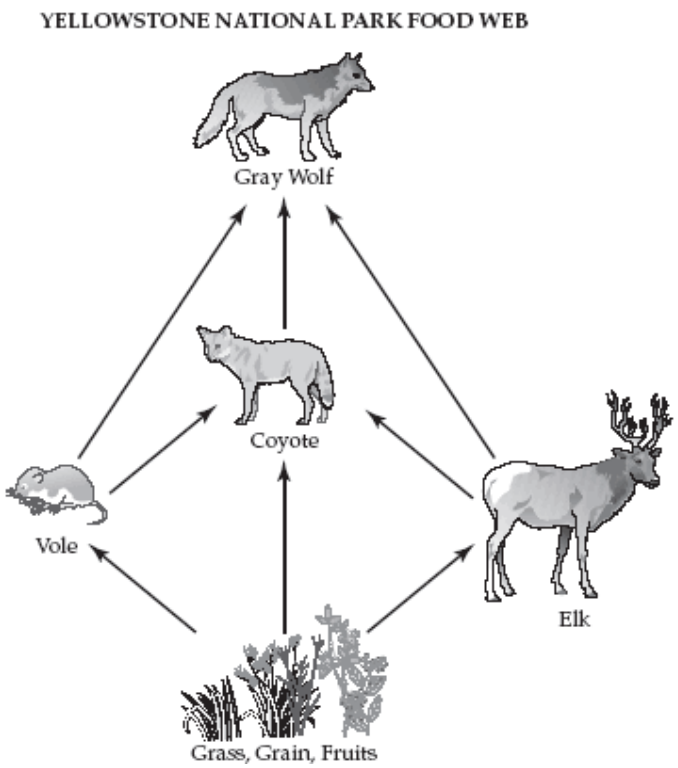
Compared to other plants,
aspen are yummy

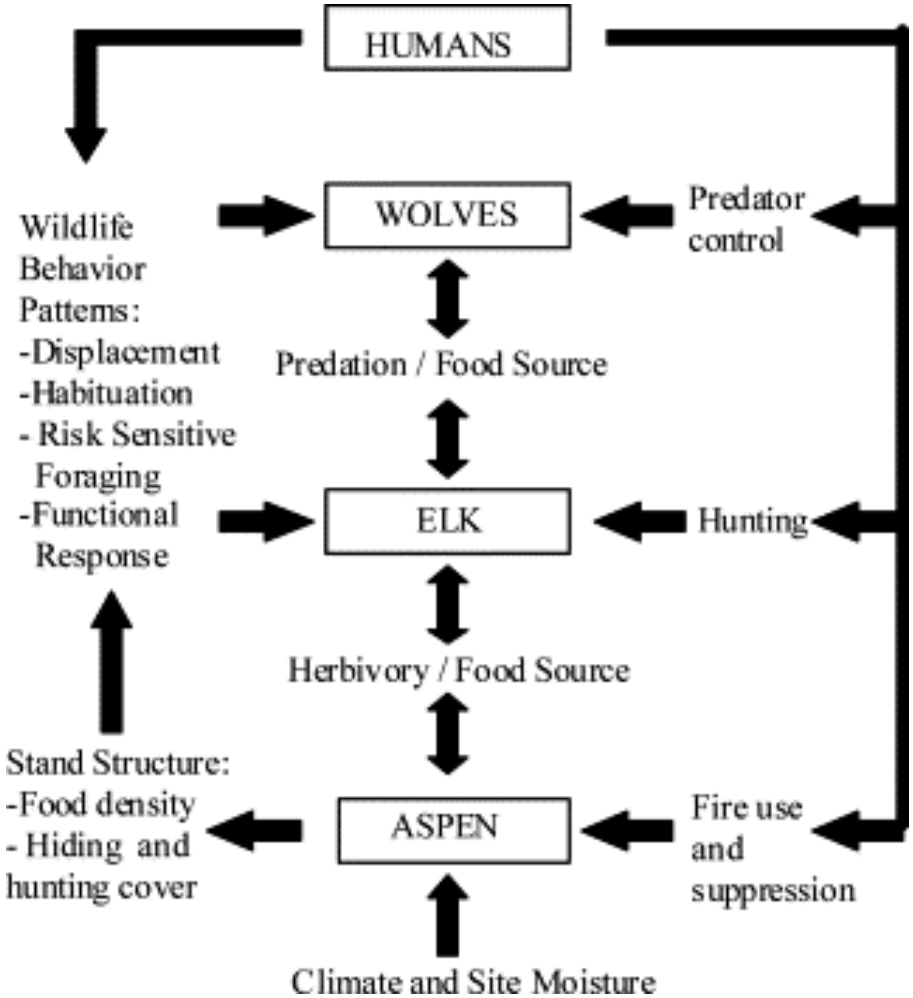
Browsers use leaves in summer
and bark in winter

Background

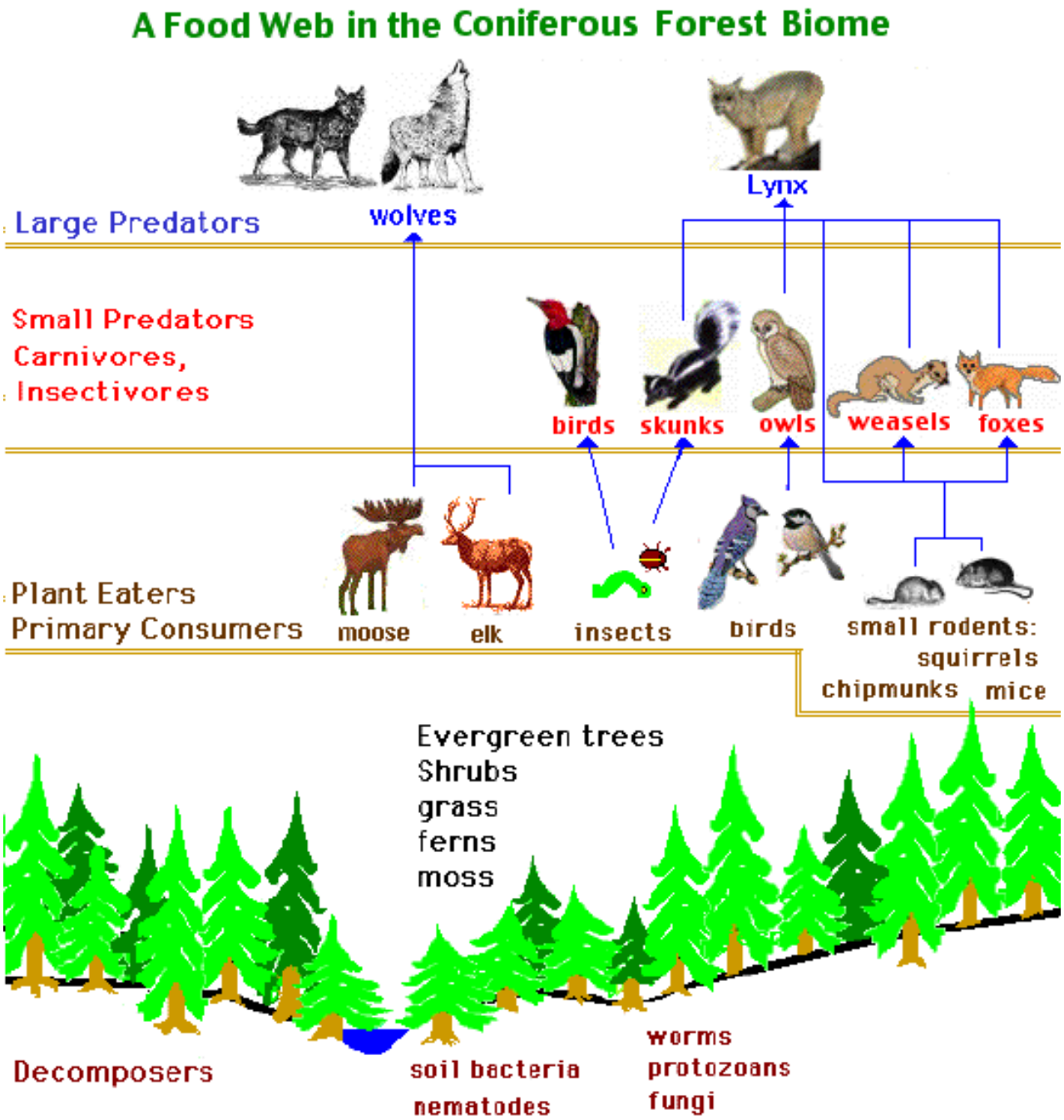
Justification of Research

Who else do enclosures affect?





Other studies have already shown enclosures affect more than just the large herbivore population.



Objectives

Research Objectives

Produce qualitative and quantitative data on the biodiversity (plants, fungi, bryophytes, insects, herps, birds, and mammals) of herbivore enclosures of aspen stands

Compare that data to areas still under browsing pressure.

The expectation is that community composition in areas excluded from browsing will be different and generally higher in diversity than areas with browsing.

Methods

Methods

Experimental Design

Three treatments

1962 Enclosure

2009 Enclosure

Control (no enclosure)

Sampling

Mammals

Birds

Herps

Insects (Terrestrial and Aquatic)

Plants

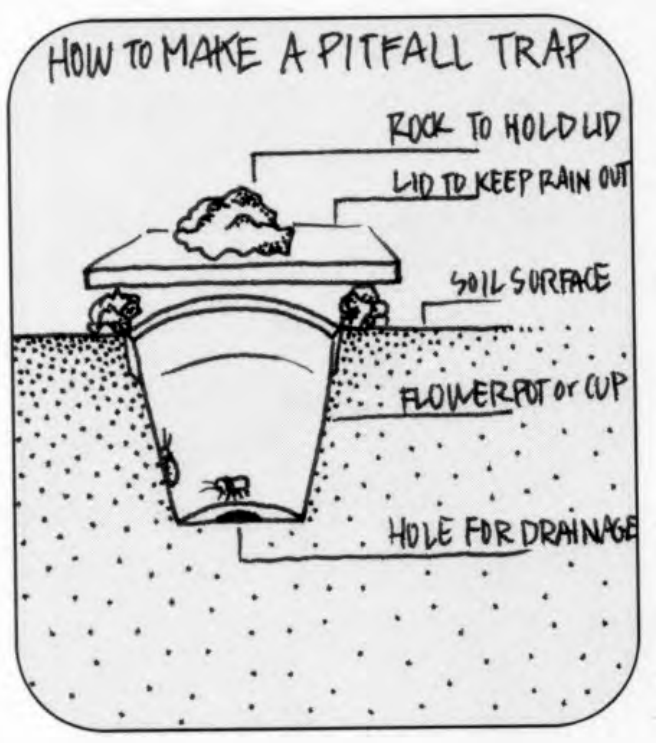
SOME DATA COME FROM STUDENT PROJECTS

1
2
Image © 2012 DigitalGlobe
© 2012 Google
Google earth
Imagery Date: 11/4/2004
40°22'21.86" N 105°36'38.71" W elev 8463 ft
Eye alt 11218 ft

Diversity of Insects

Light Traps

Pitfall Traps



Diversity of Herpetofauna

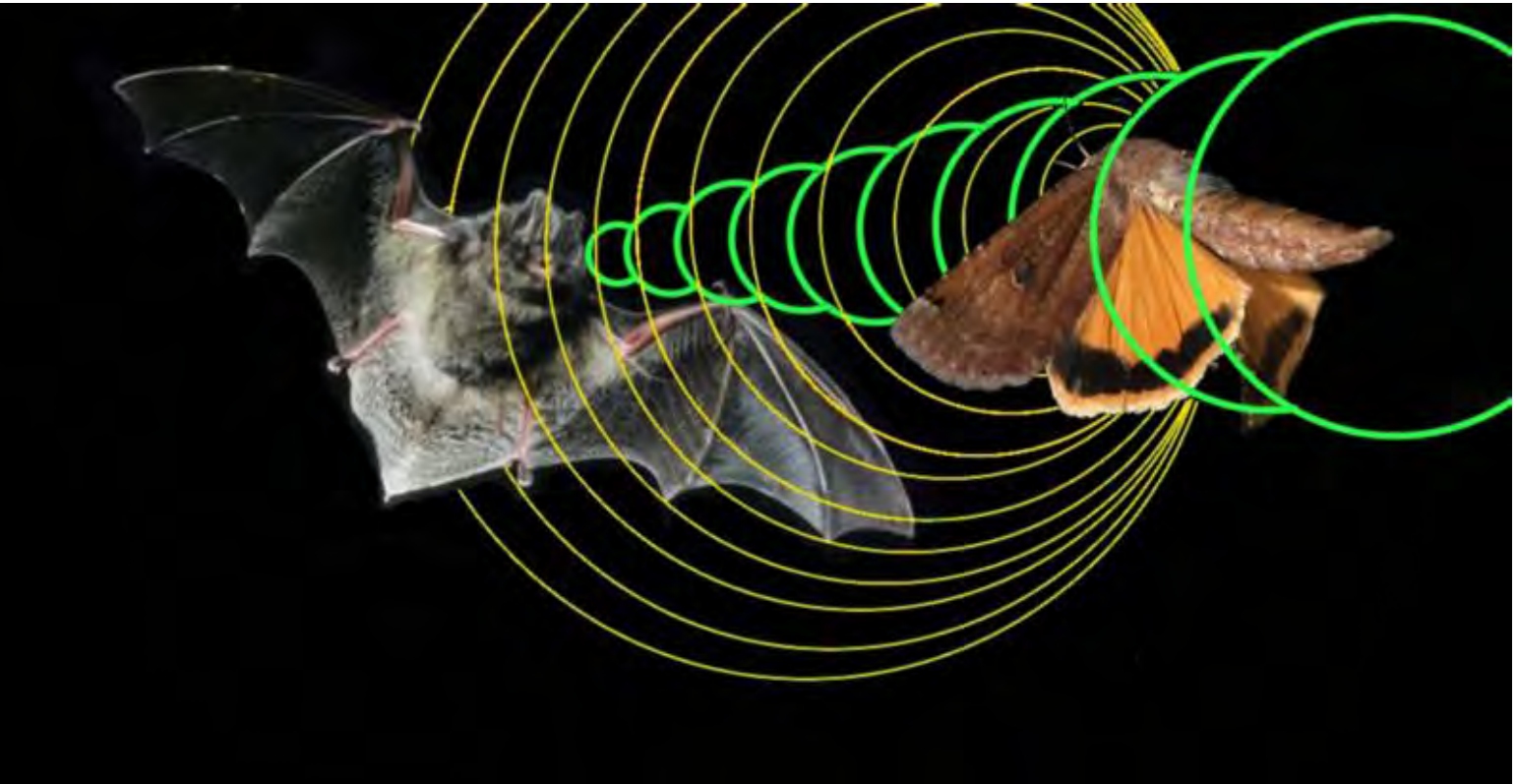
Jones Array Drift fence & Pitfall Traps

Diversity of Mammals

Motion-Activated Cameras

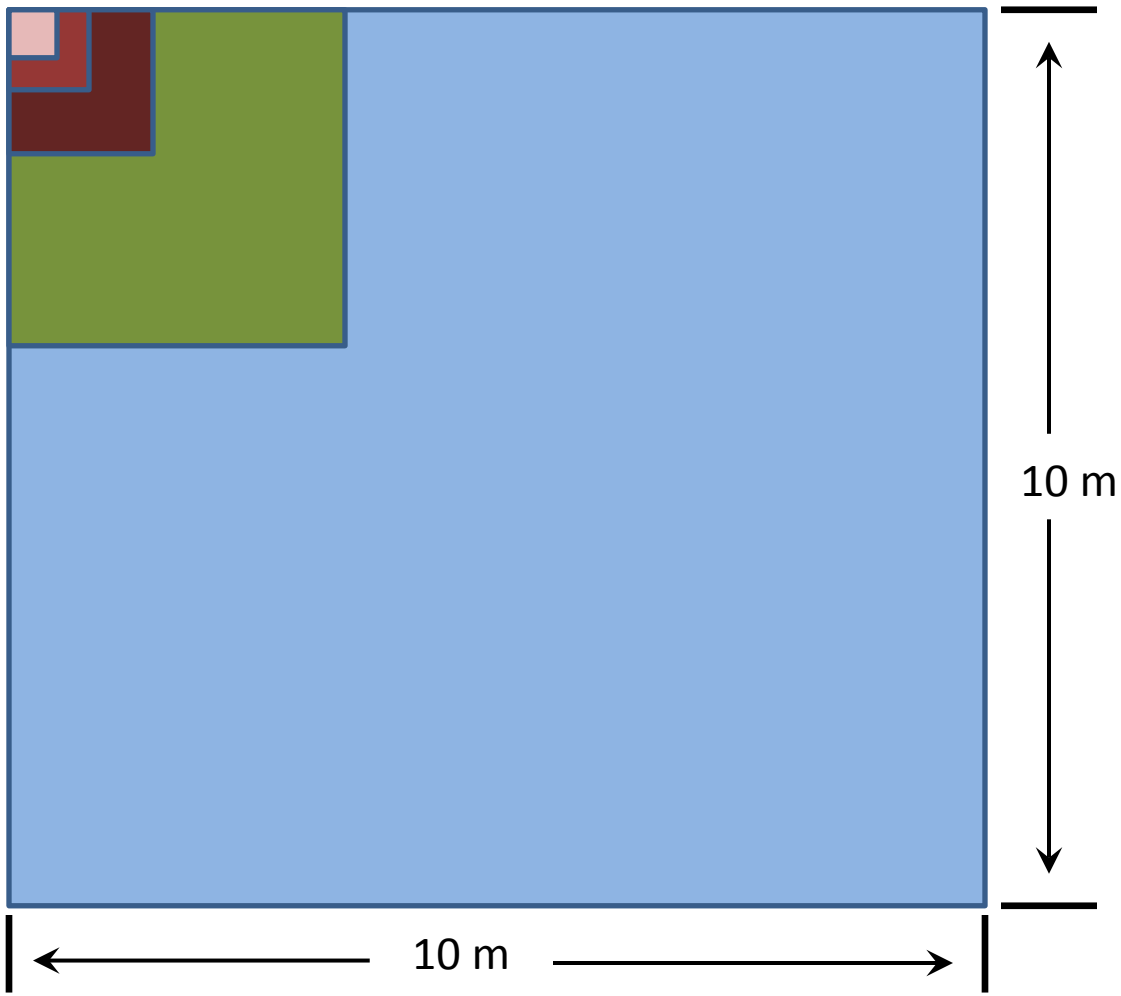
Sherman Live Traps

And the Flying Mammals



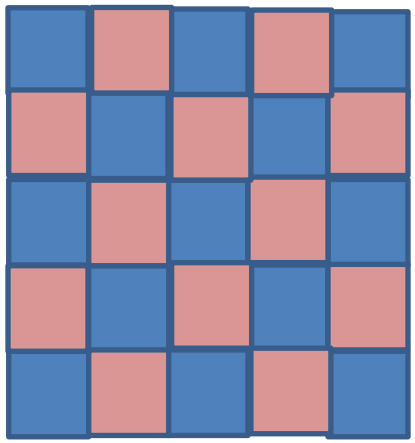
Diversity of Plants

Occurrence:
10cm, 33cm, 1 m, 3.14 m



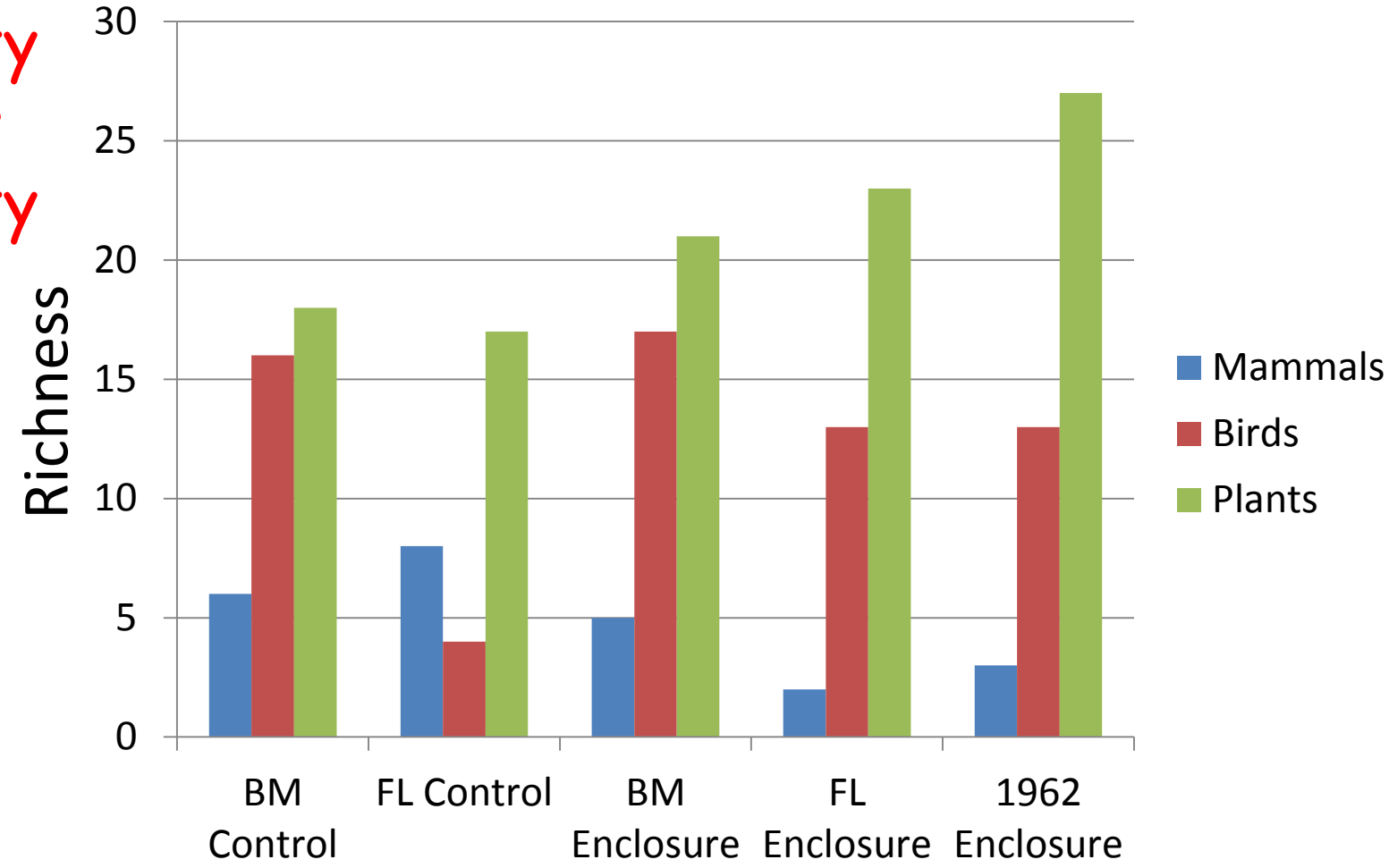
Carolina Vegetation Protocol

Vegetation Density Board

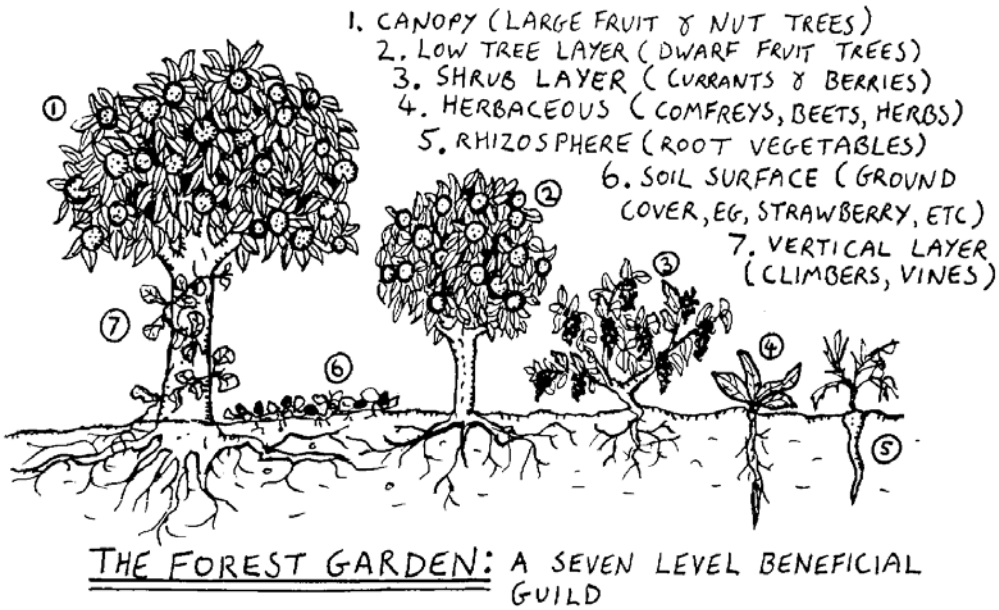


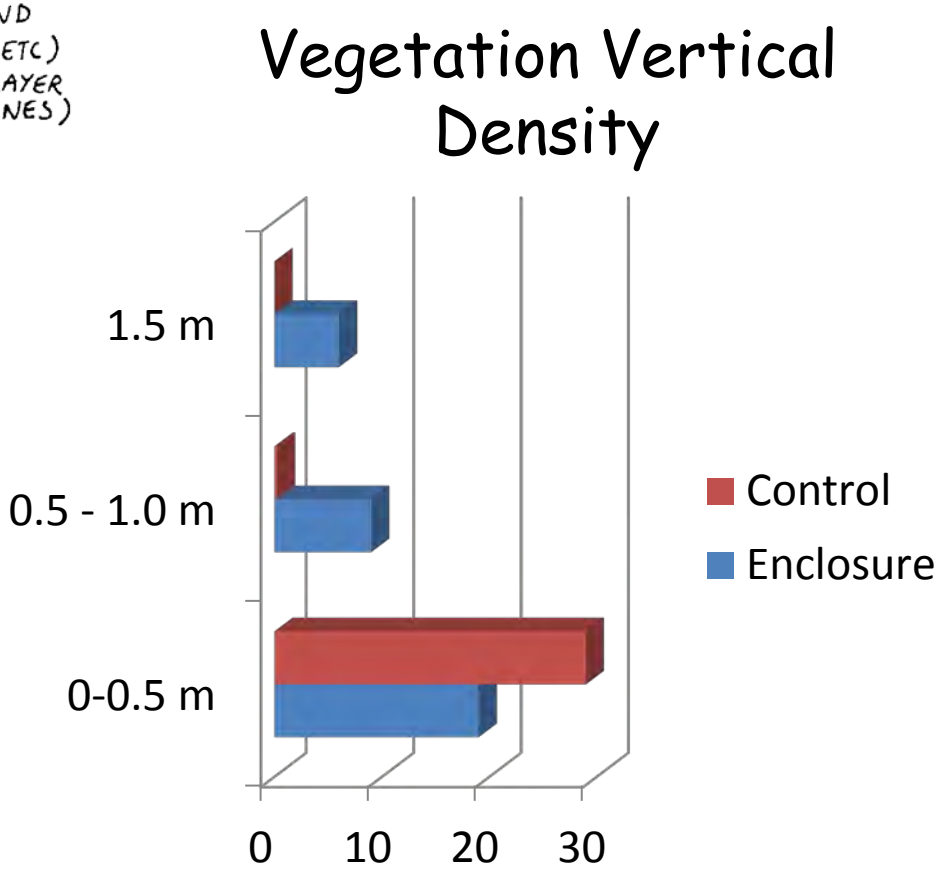
Results

Diversity Begets Diversity



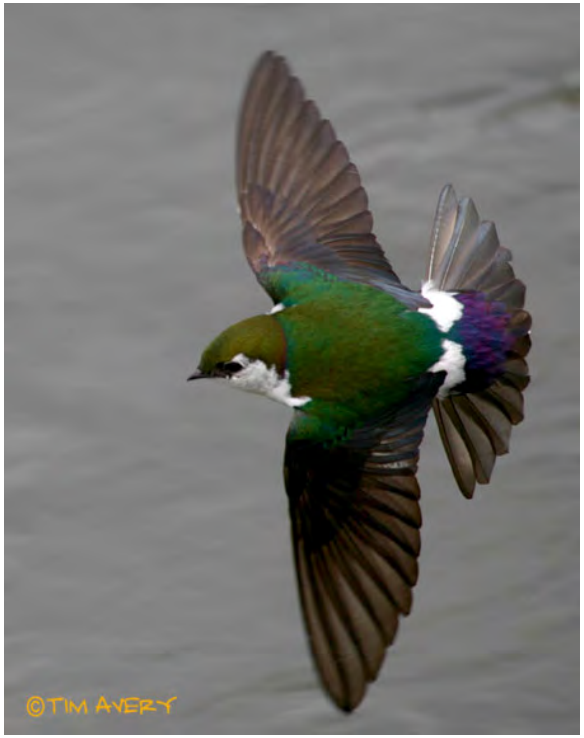
Structure Diversity = Biotic Diversity





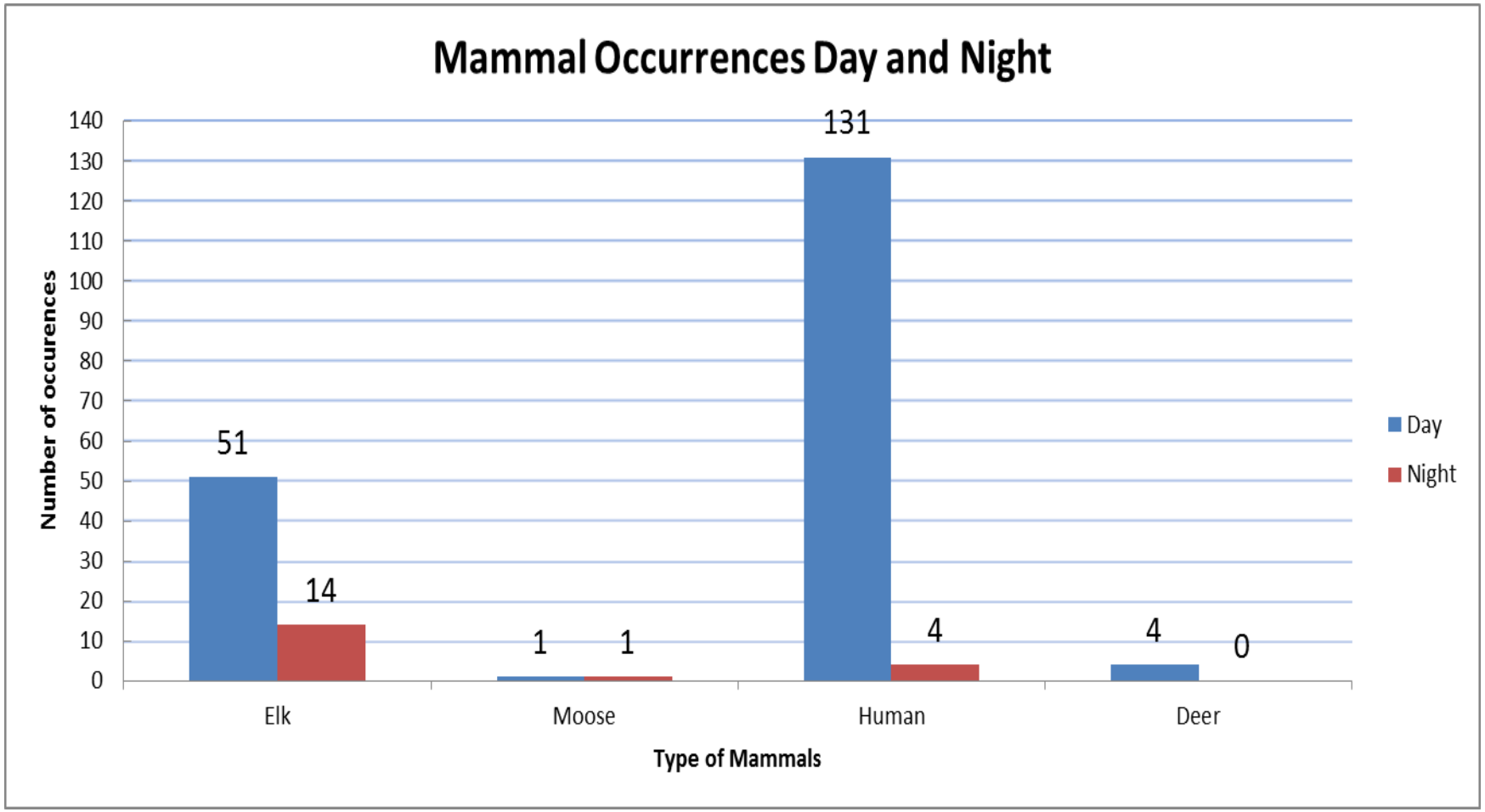
What do the pollinators have?

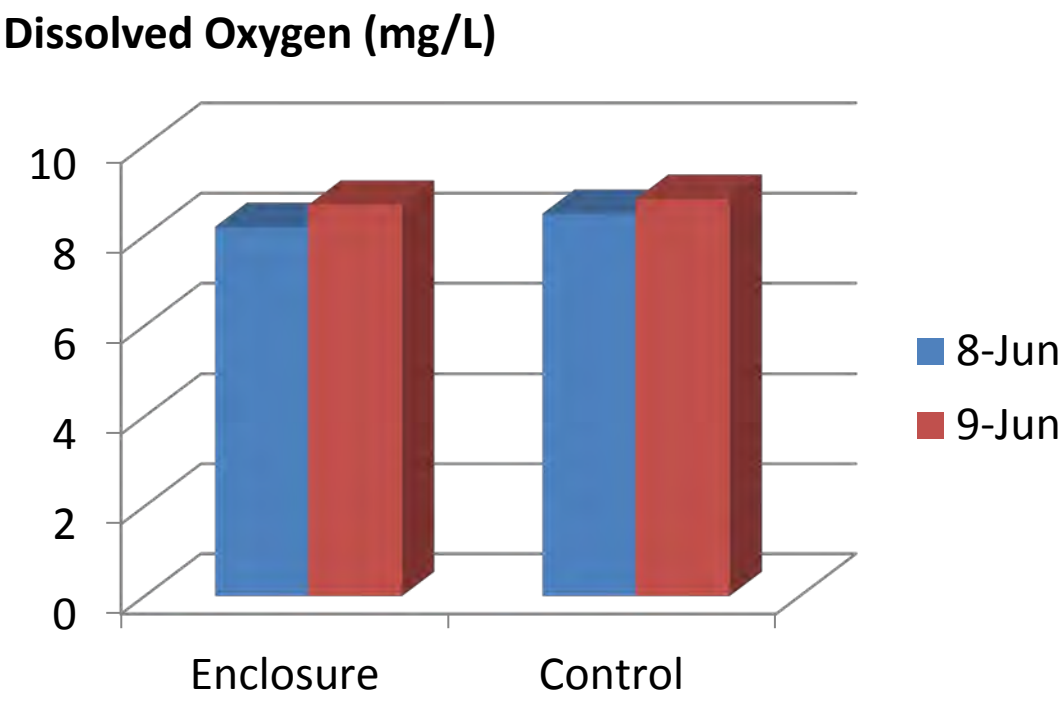
© Terry Sohl


©TIM AVERY

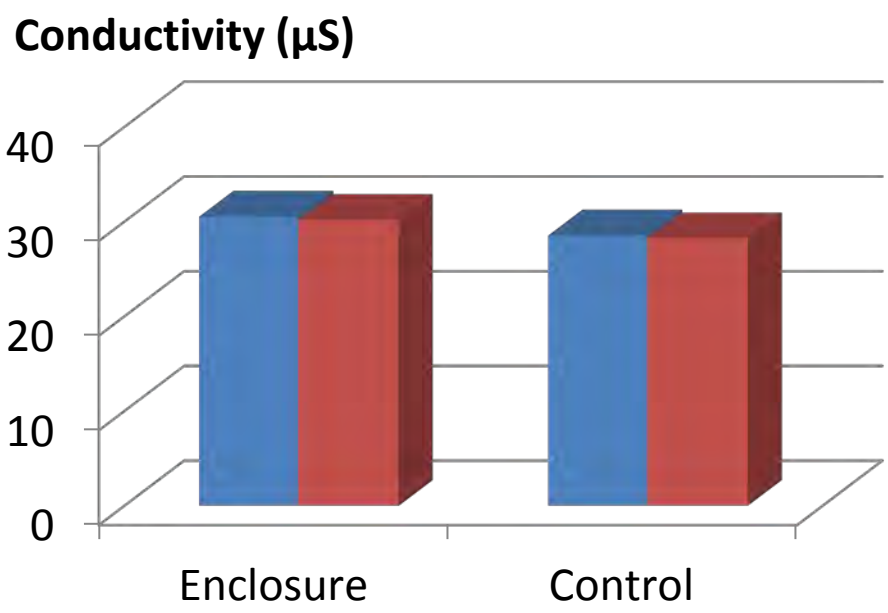
MOULTRIE
9℃
PM FLROUT03
MOULTRIE
8℃ 05/24/12 04:44PM UBMEXCL2
MOULTRIE
10℃ 05/28/12 11:32AM FLROUT03
MOULTRIE
17℃ 05/31/12 01:48PM FLROUT03

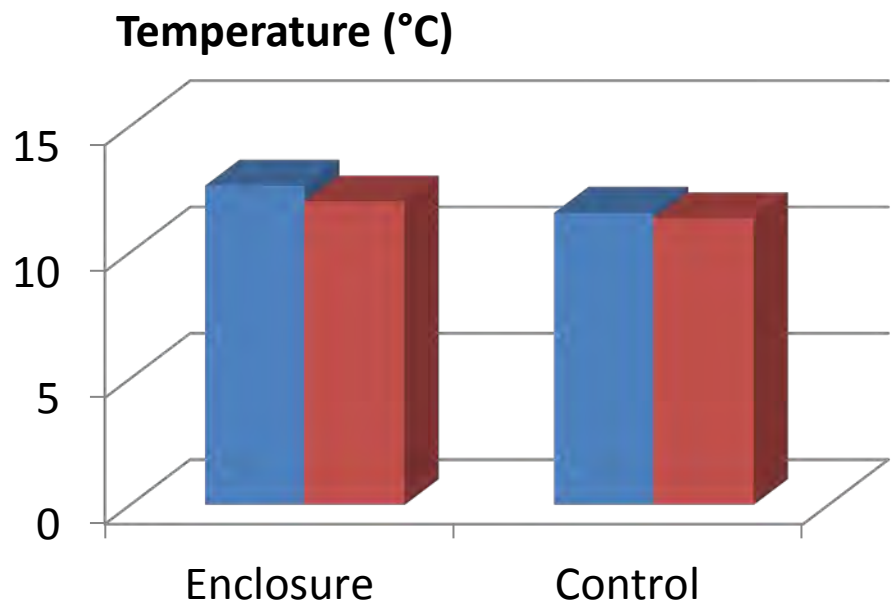
When are the large herbivores active?





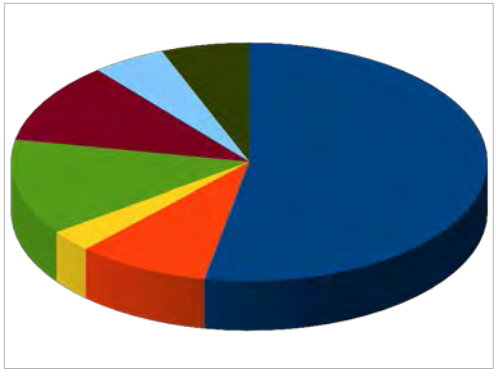
Slight differences in stream abiotic conditions, but …





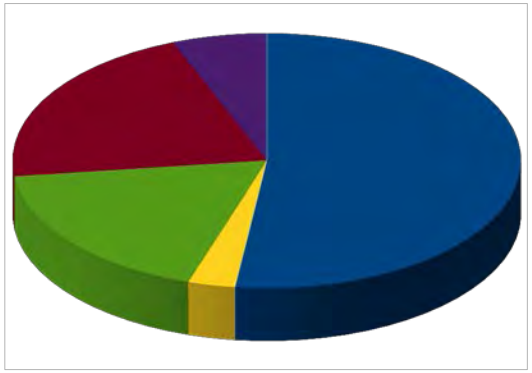
Stream Invertebrates

Enclosure Riffle



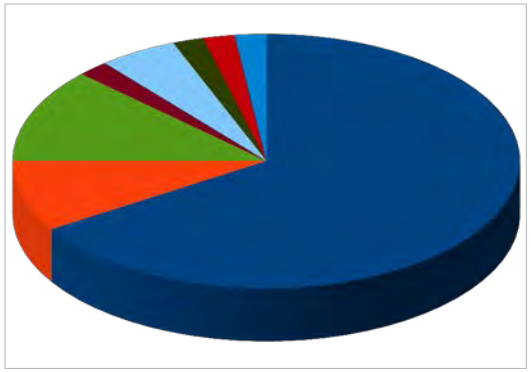
- Stonefly Larvae
- Mayfly Larvae
- Staphylinid
- Midge Larvae
- Cadisfly
- White Larvae
- Aquatic Beetle
- Leech
- Grubworm
- Freshwater Crabs
- White Snail
- Dragonfly Larvae
- Dipterain Larvae Black

Control Riffle



- Stonefly Larvae
- Mayfly Larvae
- Staphylinid
- Midge Larvae
- Cadisfly
- White Larvae
- Aquatic Beetle
- Leech
- Grubworm
- Freshwater Clams
- White Snail
- Dragonfly Larvae
- Dipterain Larvae Black

Enclosure Pool



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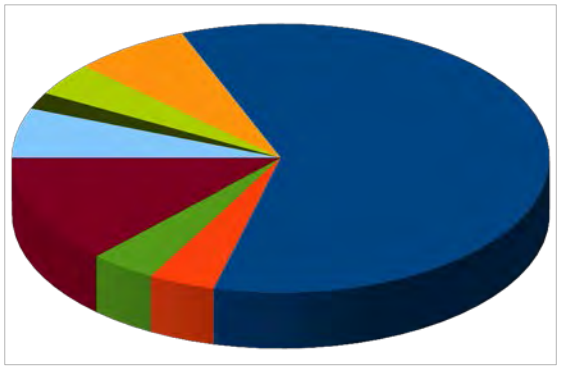
Control Pool



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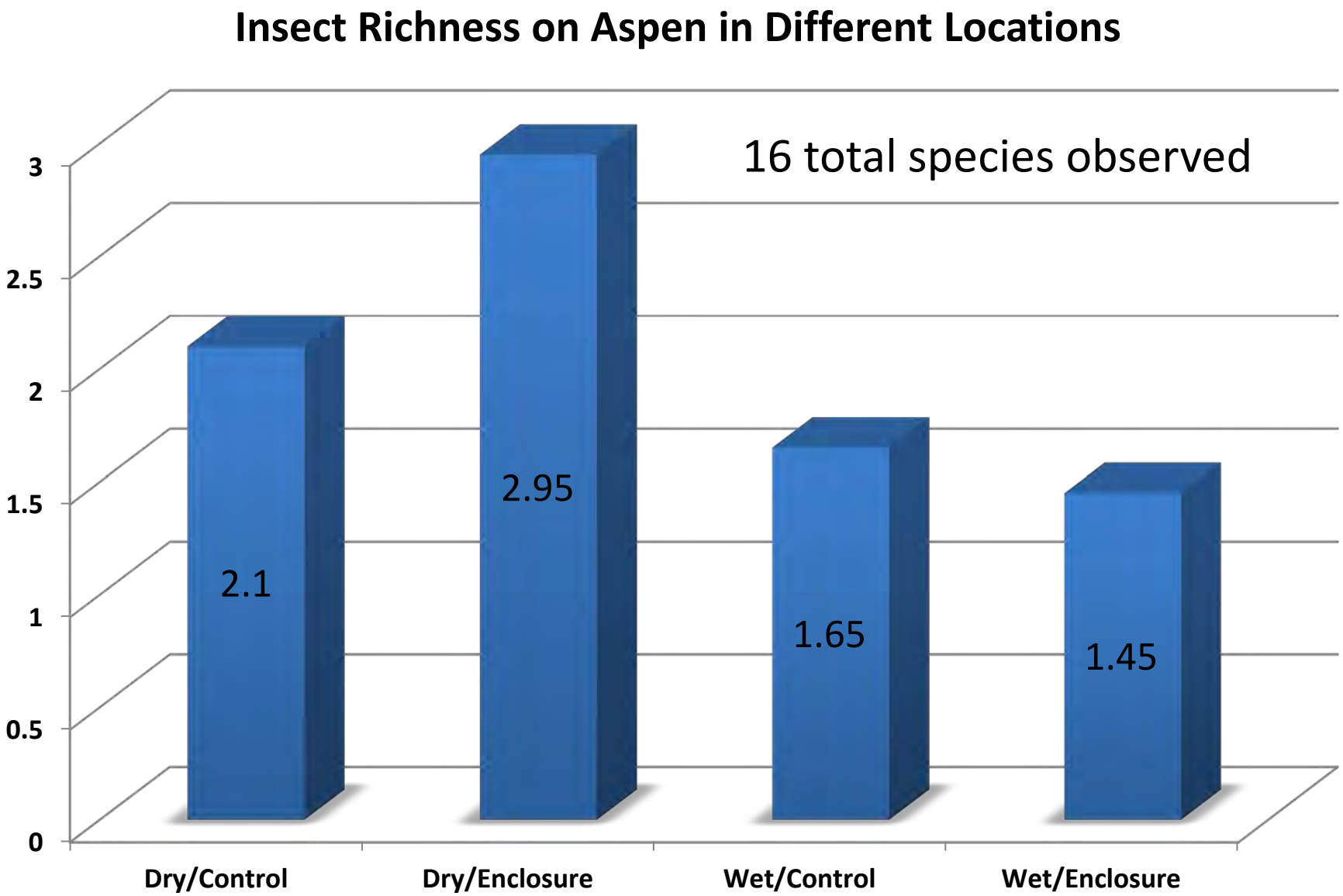
- Dipterain Larvae Black

In 1977, Furniss and Carolin compiled a list of 33 species that use the Aspen tree for nutrition



Significant Insects

Black Ichneumon Wasp

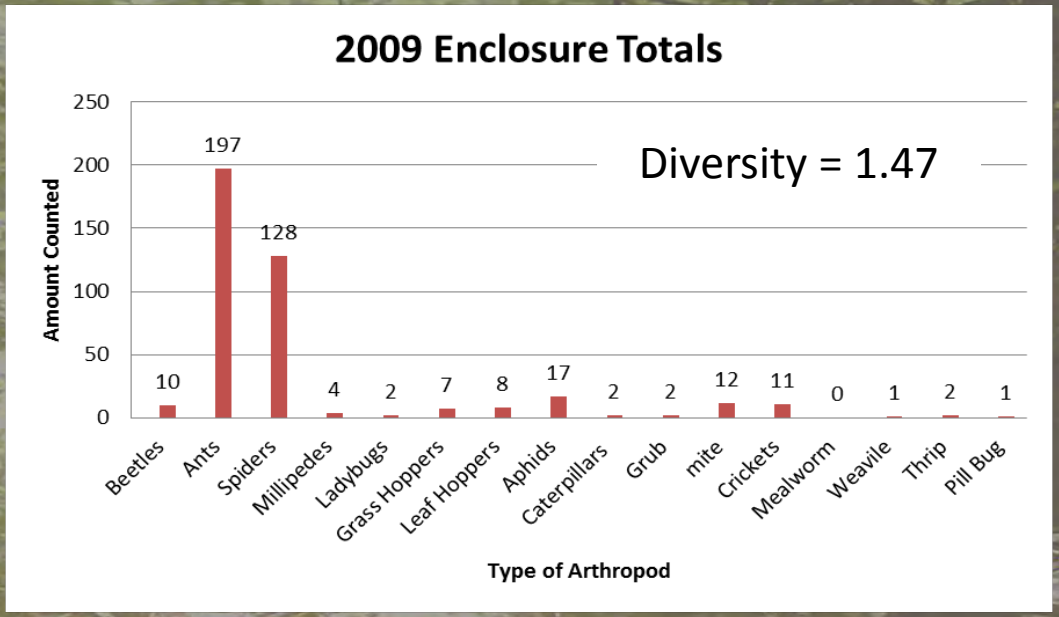
Flat Headed Poplar Borer

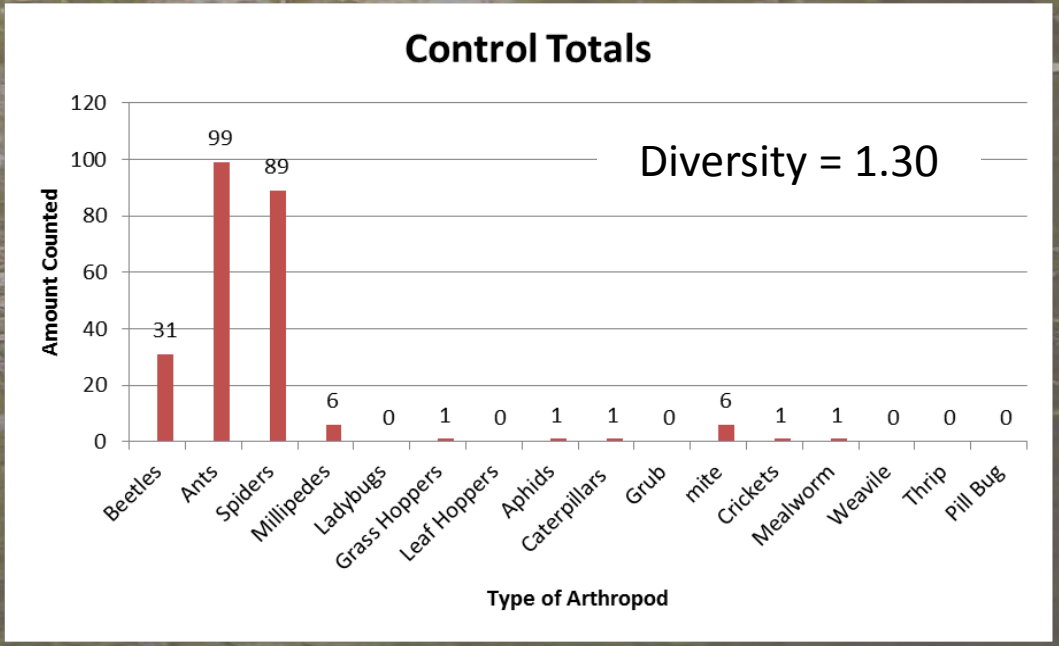
Ant and Aphid Mutualism

- Aphids feed on sugary fluids in tree branches
- They secret waste that has a high sugar content called Honey Dew
- Ants love this Honey Dew and "milk" the aphids for this waste
- The ants also serve as protectors for the aphids when they need to move to a new tree/food resource

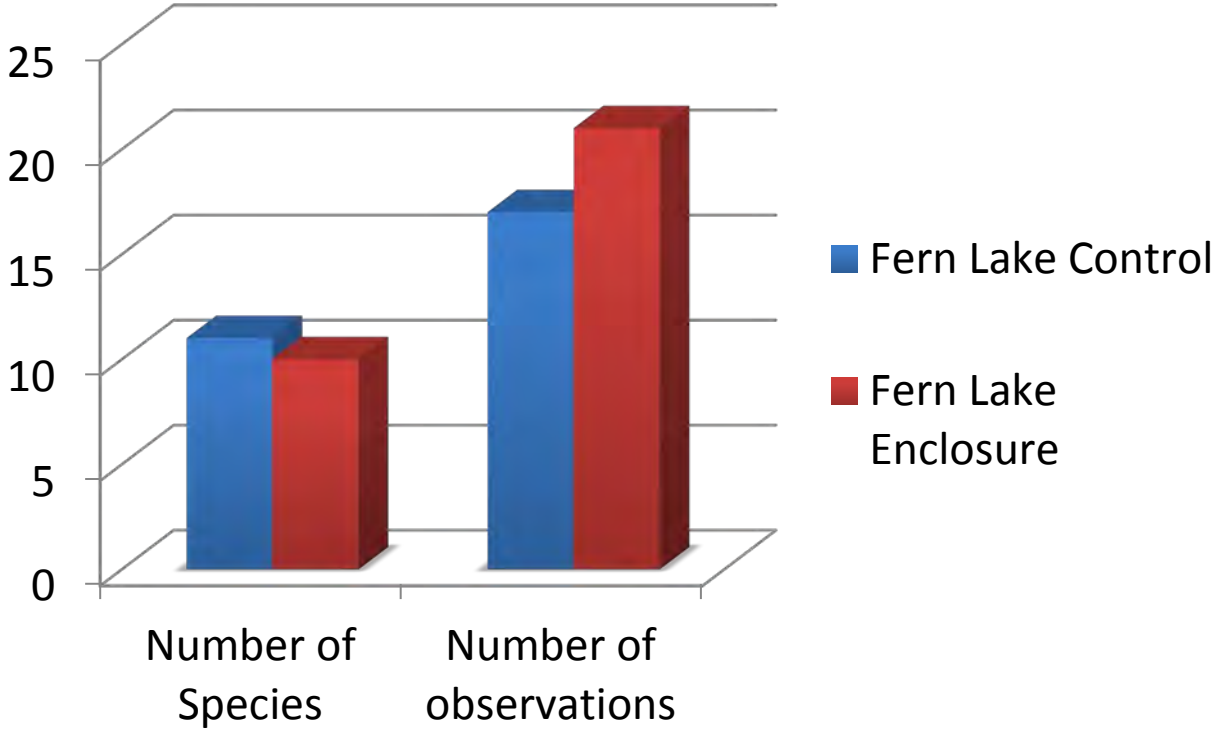
*We think this is why there was such high populations of ants on the Aspen Trees

Ground Insects





Butterflies

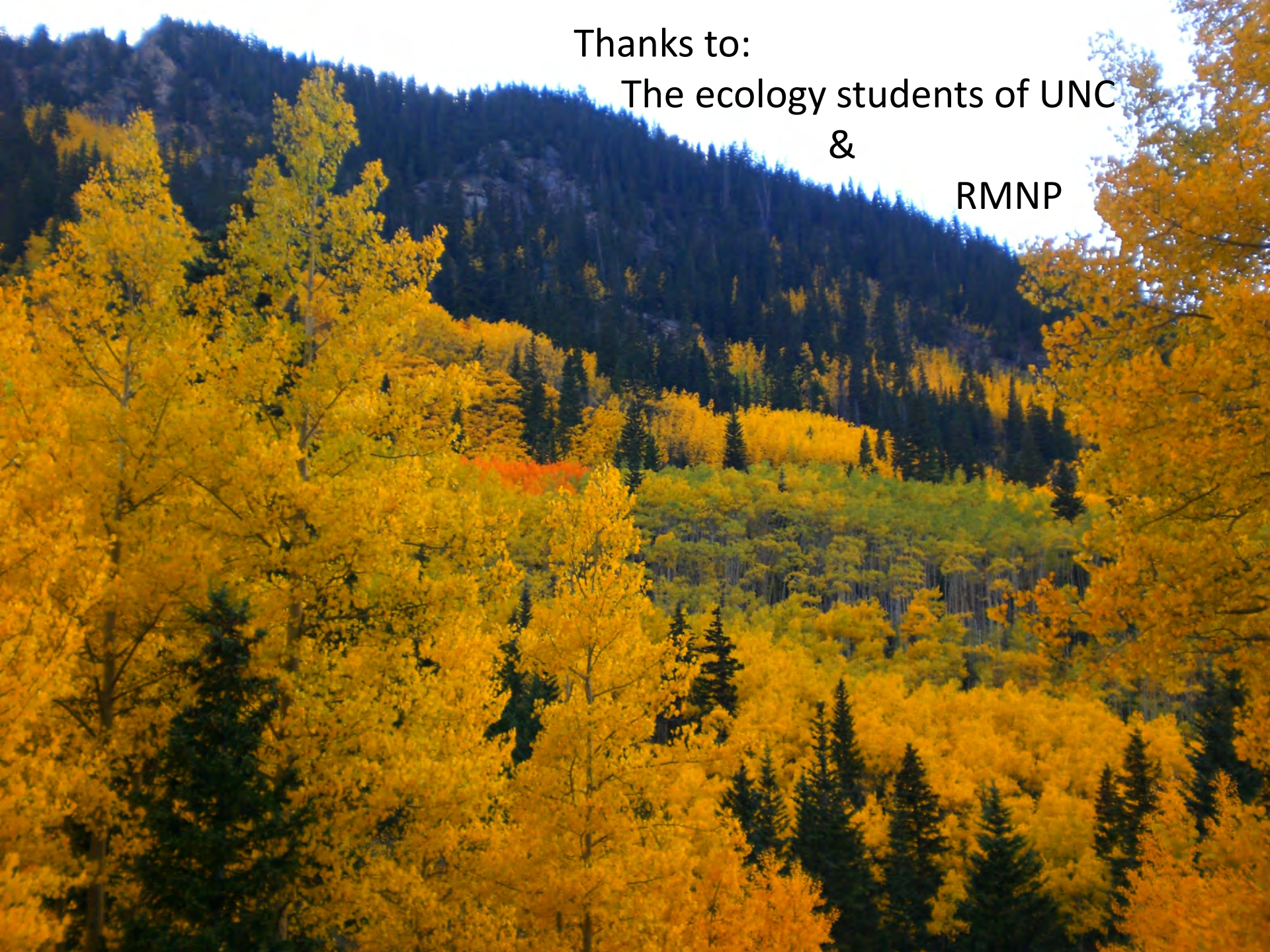


Conclusions

Major Conclusions

Structure is different without browsing pressure

Diversity 'appears' higher inside enclosures (except for large mammals)


Thanks to:
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&
RMNP