



Feeding Across the ESN:

Studying Herbivore-Ecosystem Interactions Following Fire in Black Spruce Forests

- Characterizing and inferring patterns and processes through measurements and experiments
- Studying consequences and extending time scales with long-term monitoring

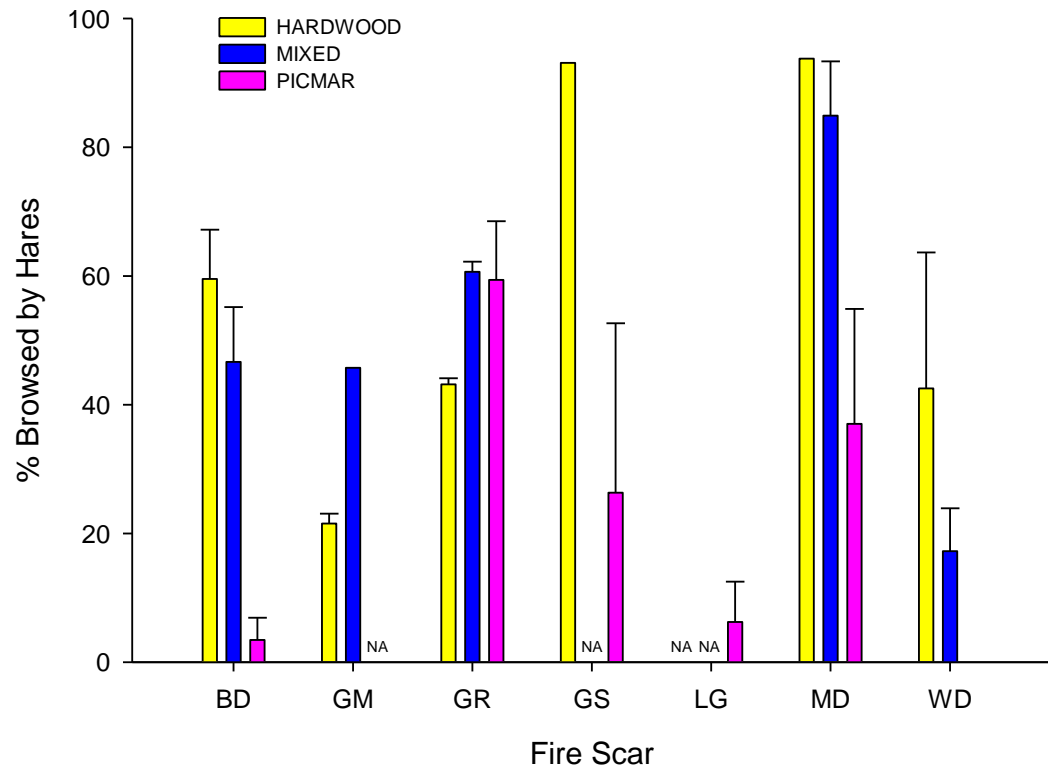


Browsing inventories on seedlings, saplings and trees

What are the most useful data we can collect now to a) help guide experiments and long-term monitoring, and b) inform modeling efforts?



Hare browsing on spruce seedlings at intermediate-aged sites (from 2011 releves)





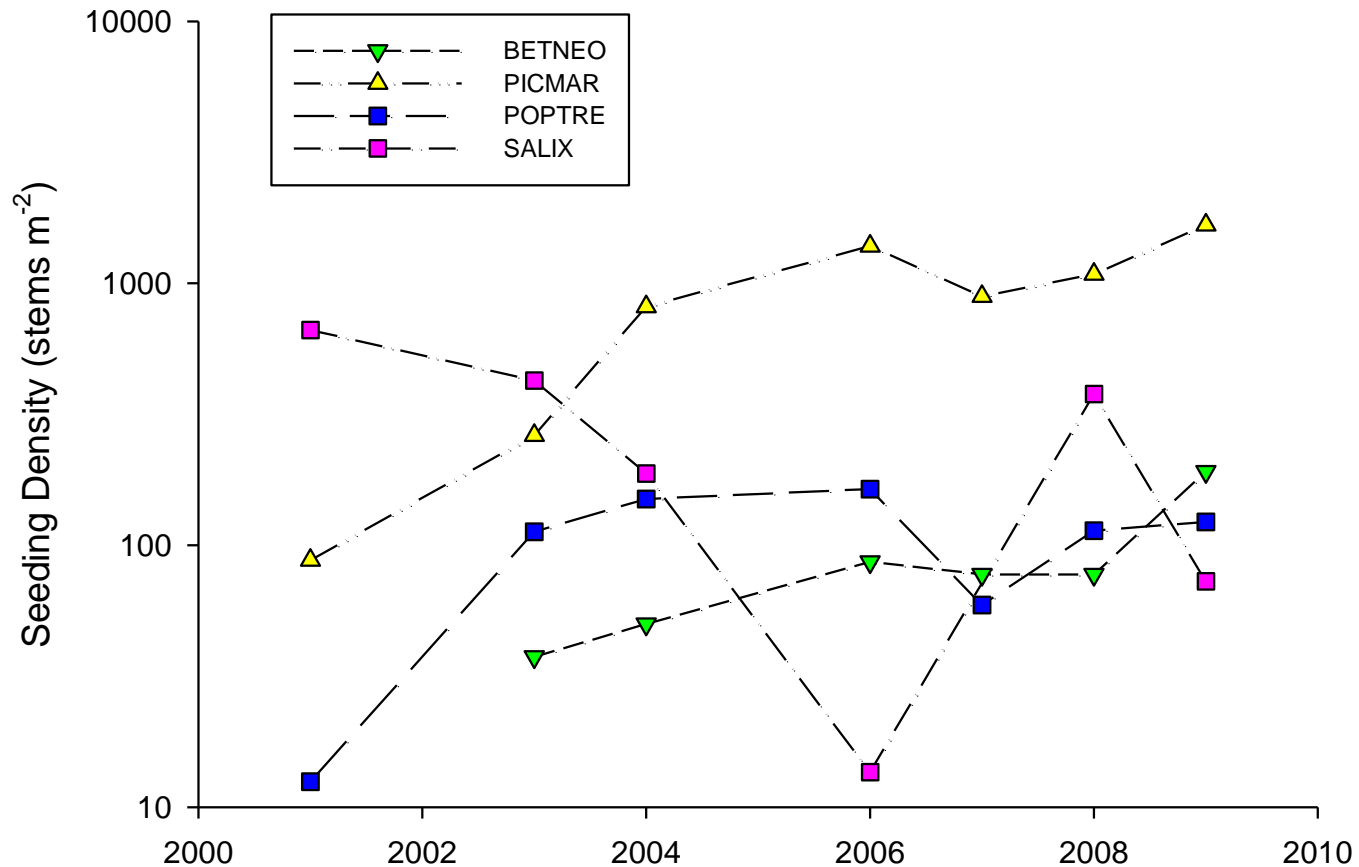
Herbivores are clearly capable of having profound effects on successional dynamics.

Where and how is this occurring, and where and how do we quantify these impacts?

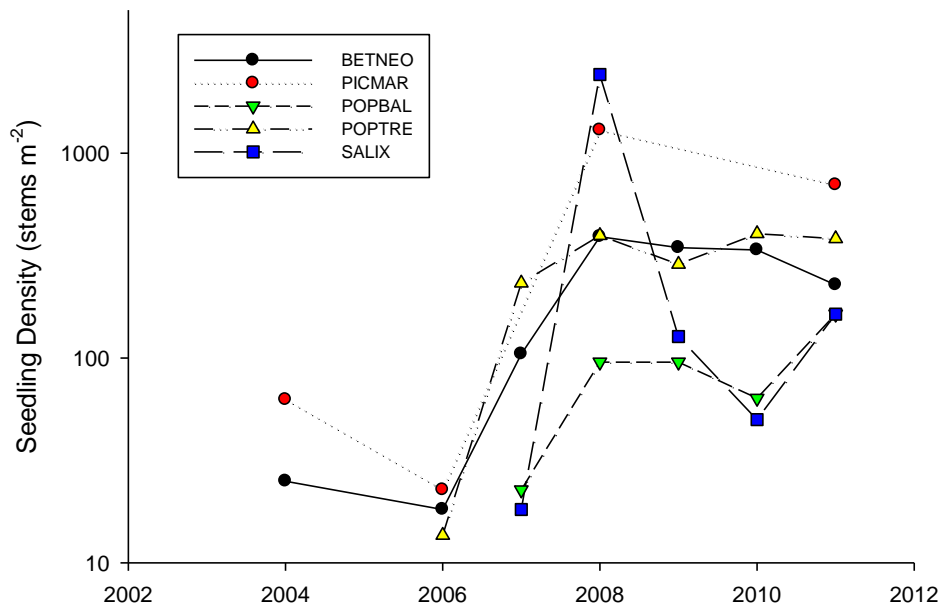
How do changing disturbance regimes affect linkages between vegetation, herbivore densities & browsing patterns, and humans across space and time?

How soon after fire does herbivory become important, and who eats seedlings?

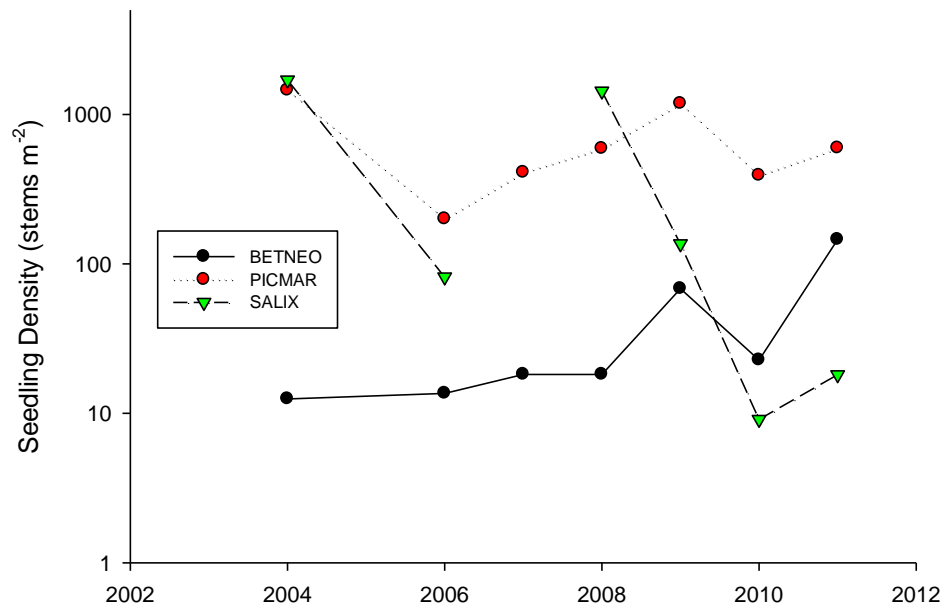
Helmer's Ridge (1998 Frost Fire)



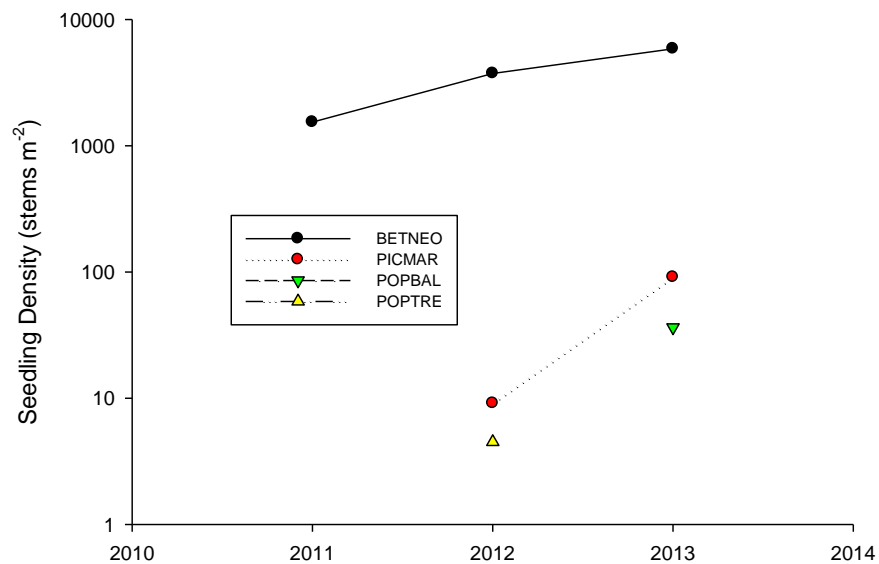
SL1A (2001 Survey Line Fire)



SL1B (2001 Survey Line Fire)



FP5C (2010 Willow Creek Fire)



Plant-herbivore interactions – Alix Conway (Ph.D)

- **Objective 1: Determine the impact of mammalian herbivory on the growth and survival of early post-fire regeneration.**



40x40 ft exclosures set up at ESN sites varying in species composition and growth.



In each exclosure, and control, 20 individuals of black spruce, trembling aspen, and paper birch have been tagged and measured.

- Objective 2: Estimate the sensitivity and response of woody tree species to winter and summer simulated browsing.



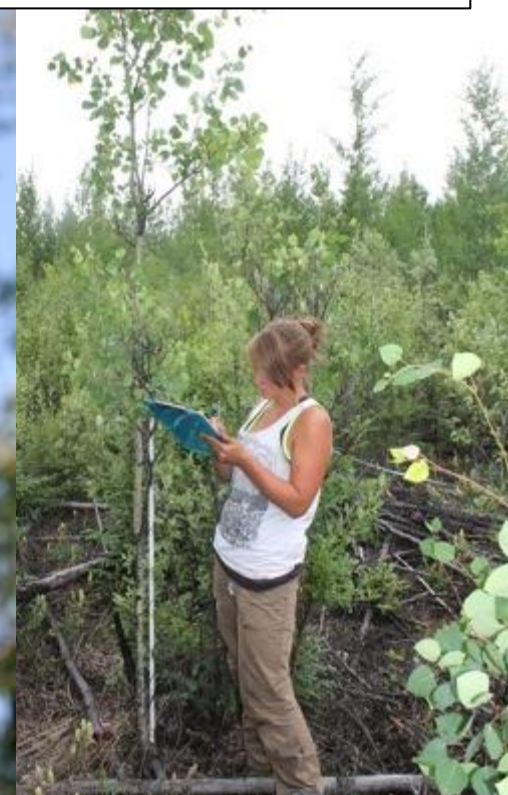
Three (6x6ft) exclosures have been set up in a lowland area that burned in 2004. Clipping experiments will take place in 2014 and 2015 by simulating winter and summer browsing. Tree architecture and growth of clipped paper birch, control unclipped trees, and spruce within each treatment (clipped vs unclipped) will be monitored.

- Objective 3: Expand inference about plant-herbivore interactions by reconstructing herbivory history.

Mid-successional stands varying in fire severity.



Use dendrochronological techniques to determine past episodes of herbivory and time to escape herbivory.



No Change

1 year difference

Minimum 2 year difference



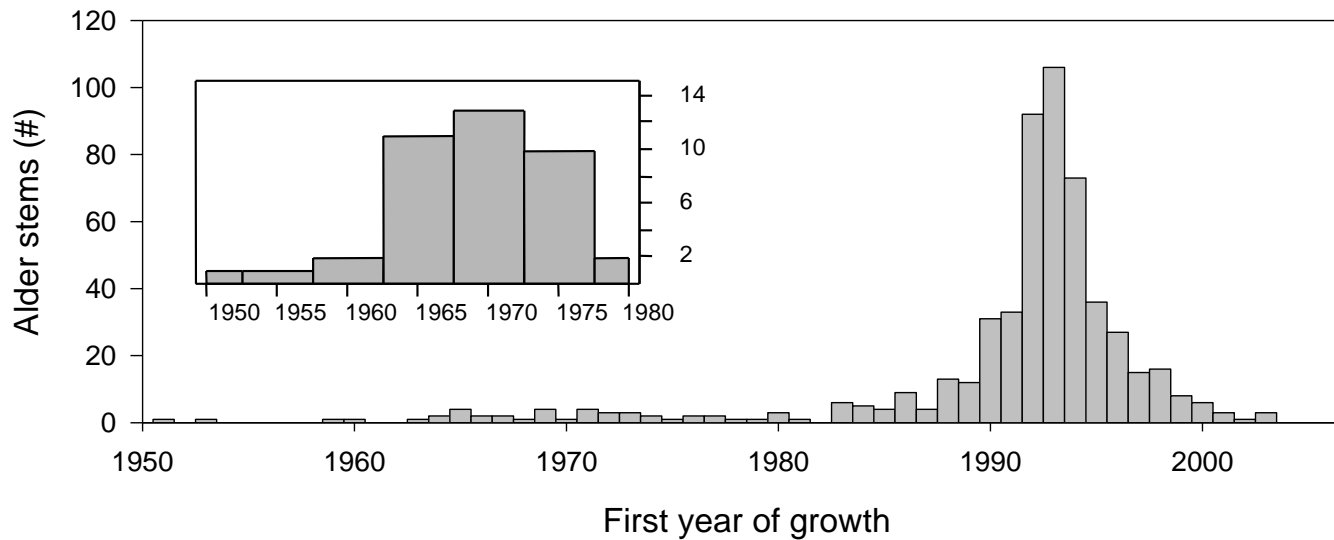
Detailed stem analysis that indicates browsing frequency and the effect on radial and vertical growth (stunted growth period).

- **Objective 4: Incorporate mechanistic description of herbivory and fire frequency into predictive models.**
 - Forest gap models (eg. FORSPACE) will be used to simulate successional trajectories including field data collected on tree species growth and responses to herbivory.

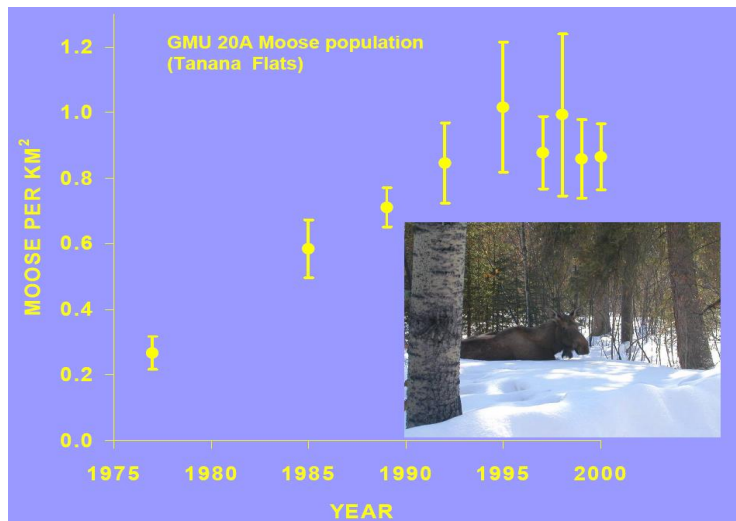


Length of time trees are stunted in vertical growth due to herbivory can be used as an important parameter in forest simulation models to describe lag in volume accumulation.

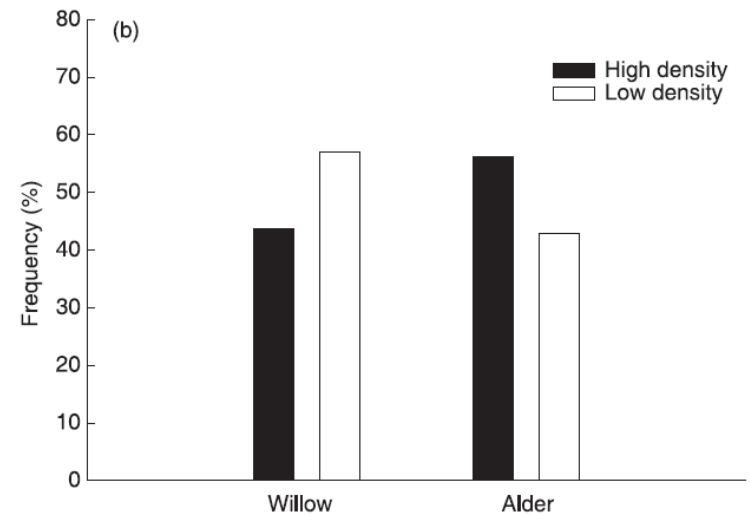
Effects of browsers on plant community composition



Nossov et al. (2011)



K. Kielland

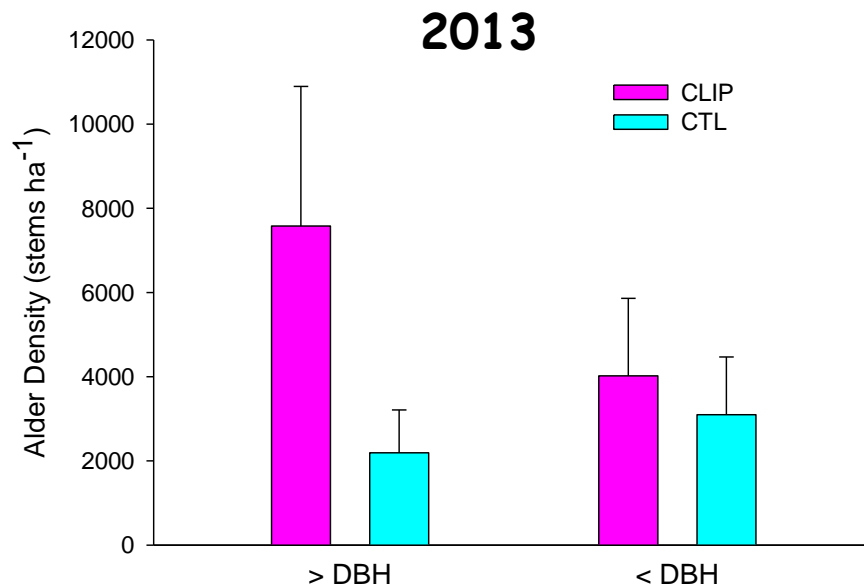
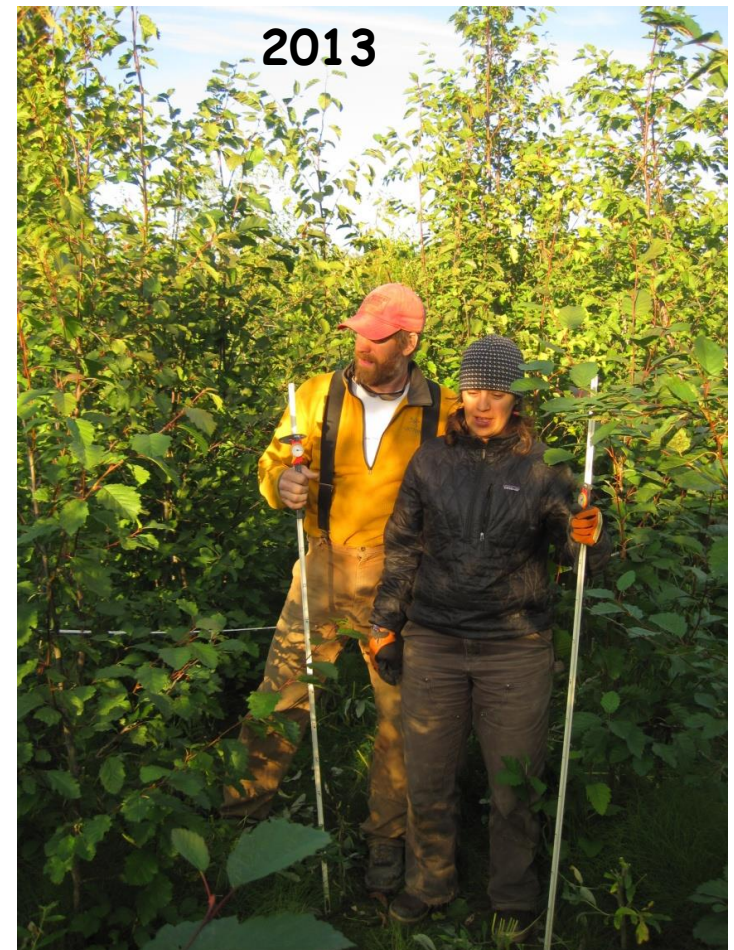


Butler et al. (2007, 2008)

2009



Yukon River Willow Clipping Experiment





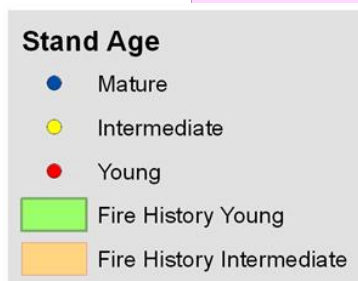
Alder in intermediate-aged
fire scars:

Why isn't it everywhere??

- Role of herbivores?
- Legacies of fire or human disturbance?
- Spatial and temporal patterns?
- Consequences for N cycling

Long-Term Monitoring Program:

- Density and browsing intensity of shrubs, and tree seedlings and saplings
- Exclosures
- Pellet counts
- Insect & pathogen surveys?



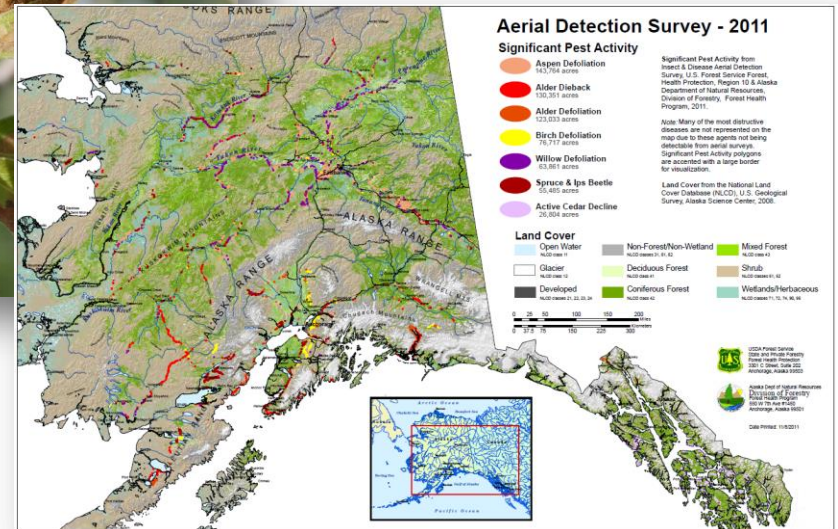
Using the ESN to understand the role of pests and pathogens in regulating forest dynamics at regional scales



experiments



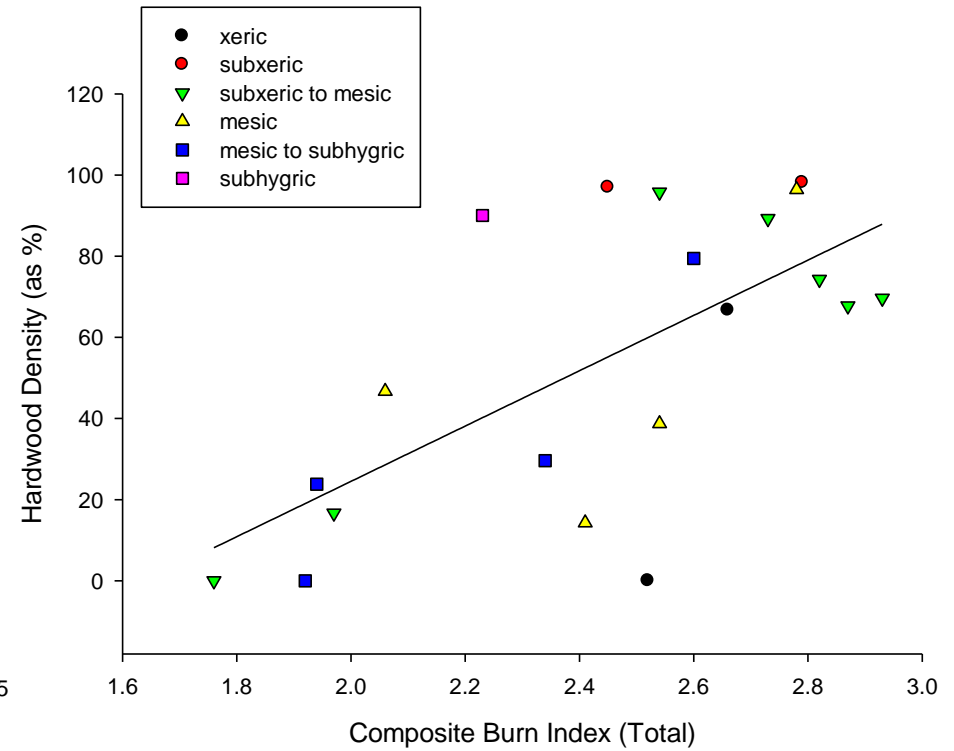
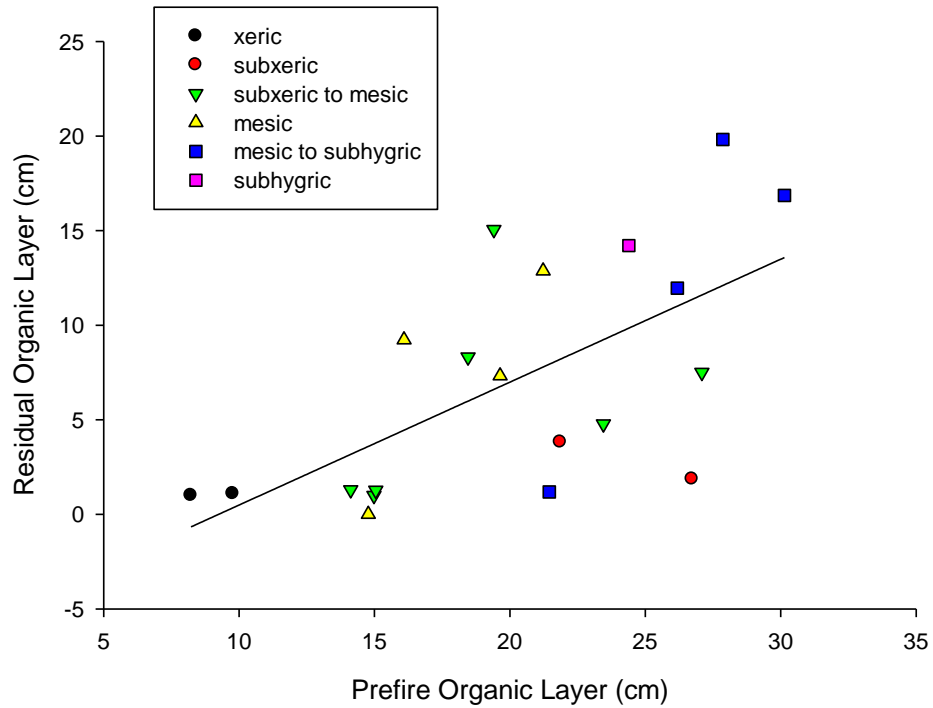
short-term studies & long-term experiments



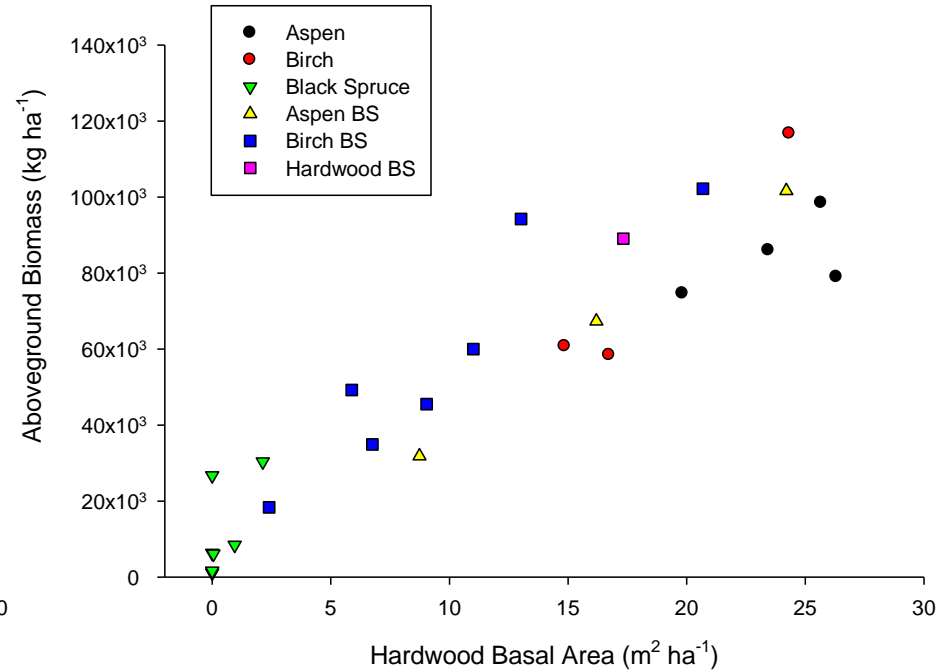
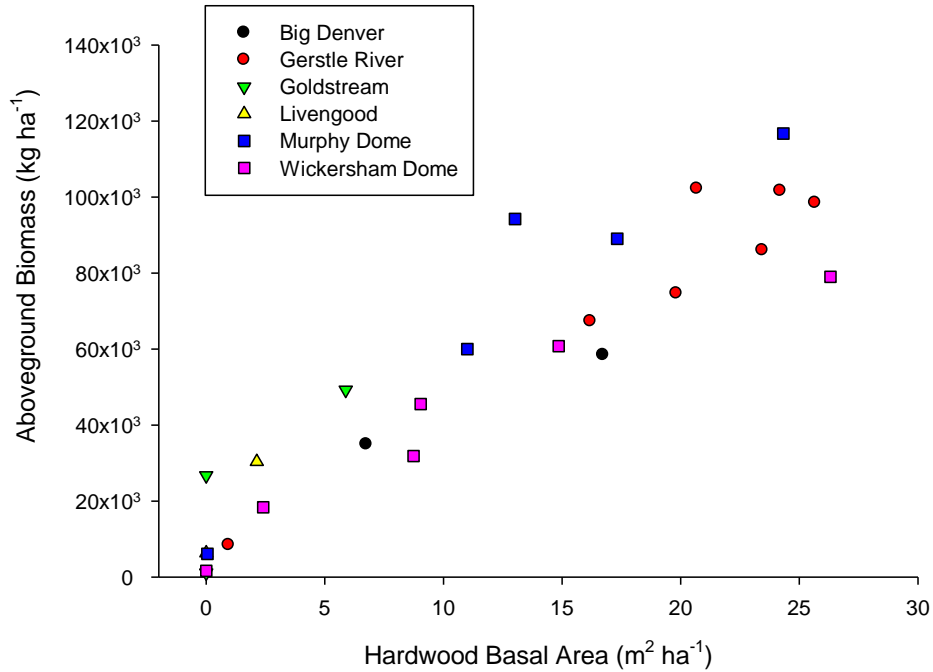
aerial surveys



Young Sites



Intermediate-Aged Sites



Mature Sites

