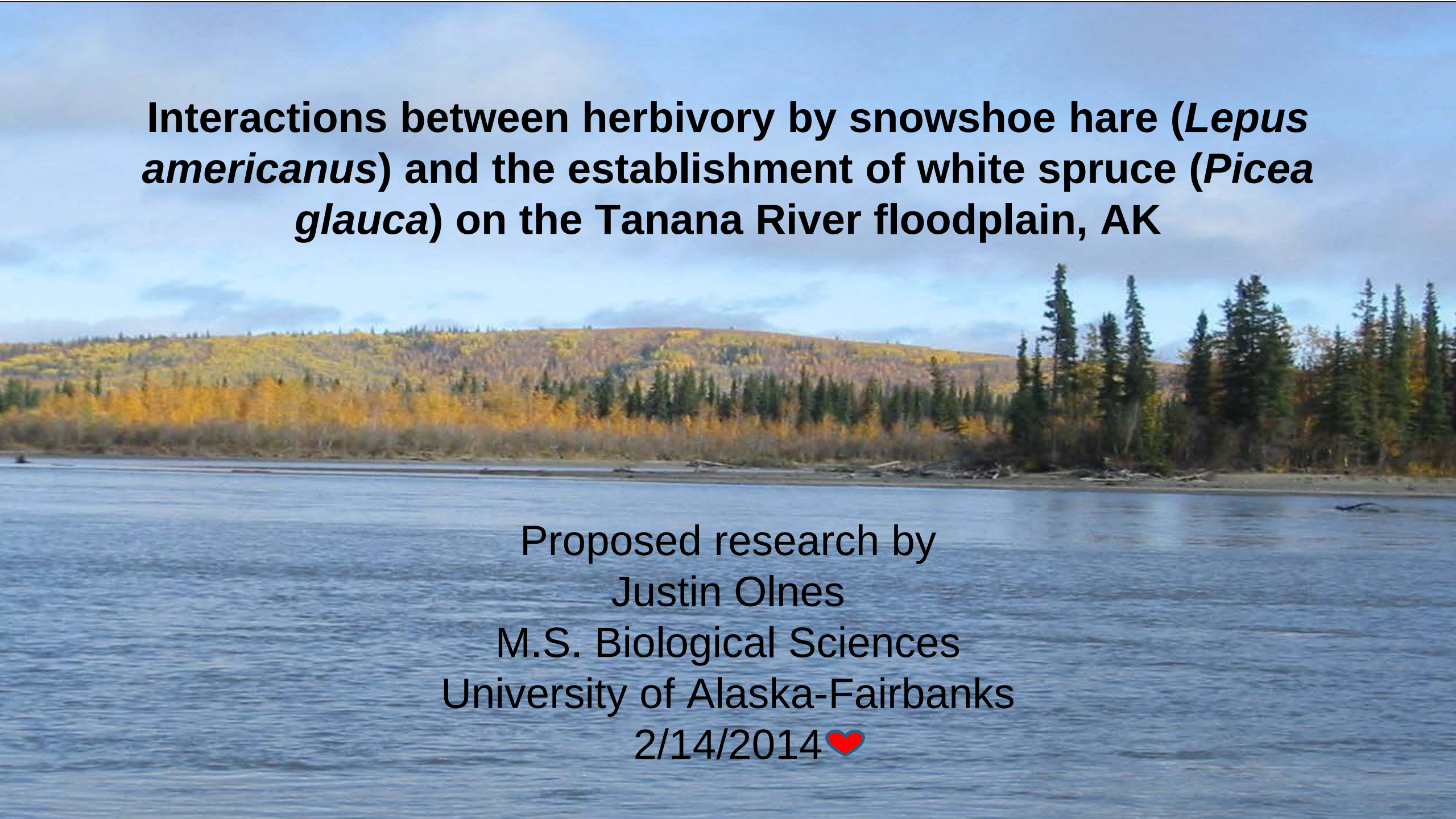

Interactions between herbivory by snowshoe hare (*Lepus americanus*) and the establishment of white spruce (*Picea glauca*) on the Tanana River floodplain, AK

Proposed research by
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2/14/2014❤

Outline

Theoretical framework

-Plant-herbivore interactions

Background

-Snowshoe hares

-White spruce

Preliminary data and hypotheses

Significance

Plant-herbivore interactions

The impact of herbivory on dominant vegetation

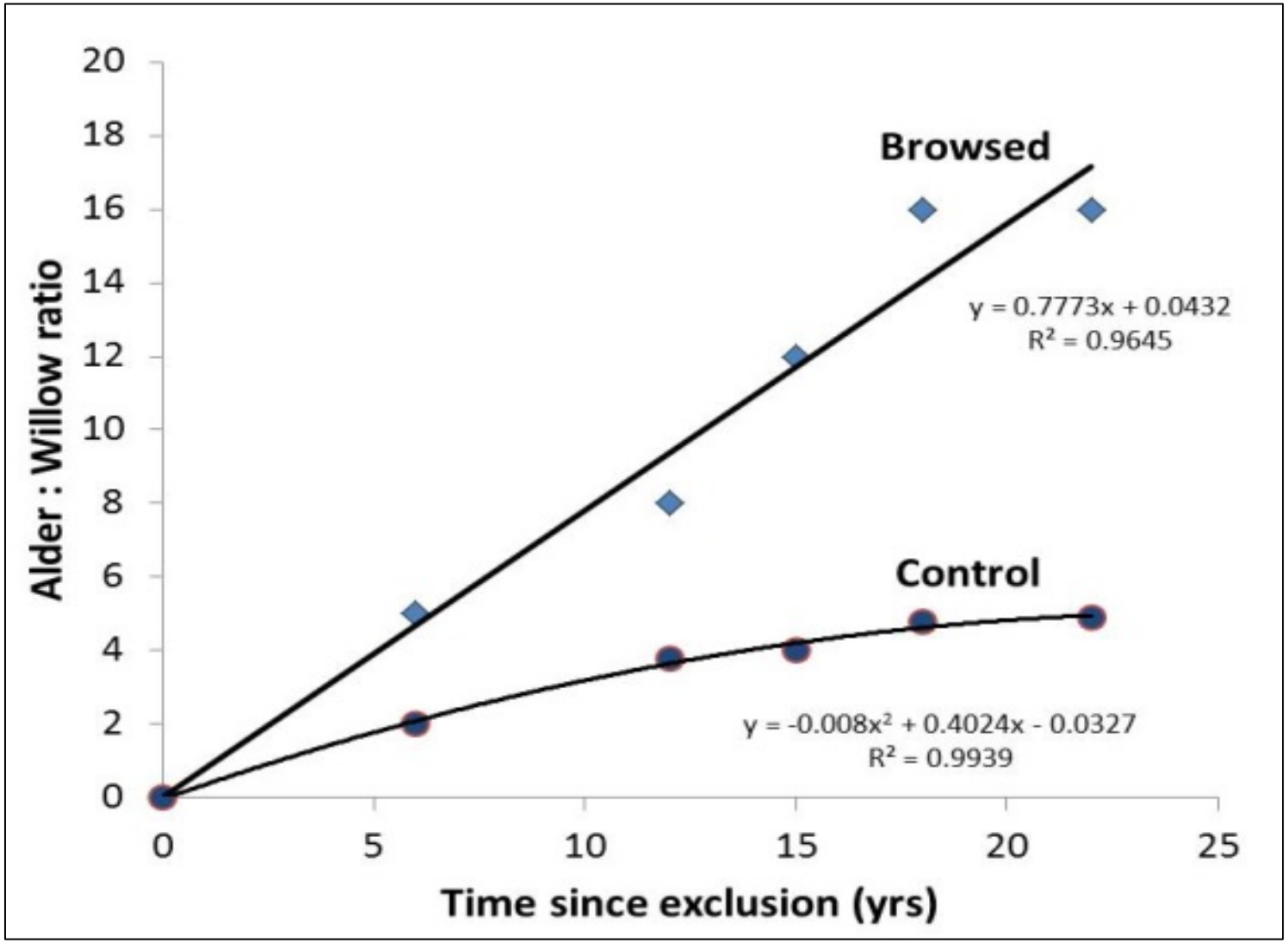
- Density of the herbivore

- Density of the plant species—is it dominant or rare?

- Secondary compounds and forage selection

Plant-herbivore interactions

The impact of herbivory on dominant vegetation

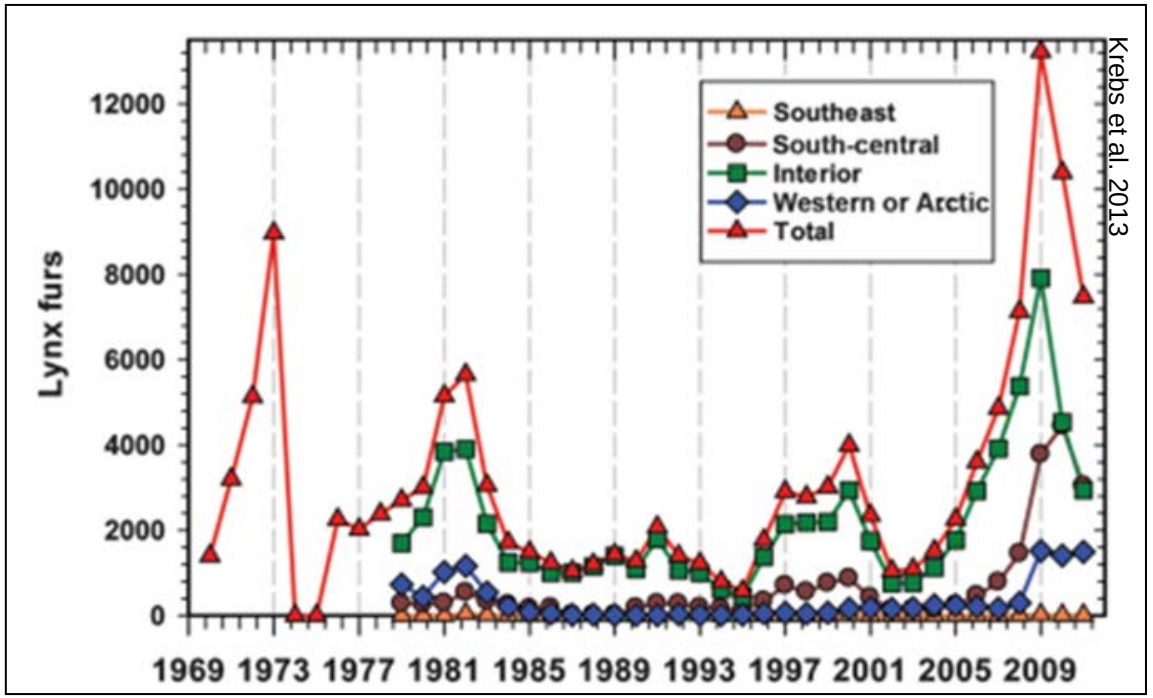


22-year record of changes in species composition (indexed by leaf litter biomass) in LTER FP1 sites

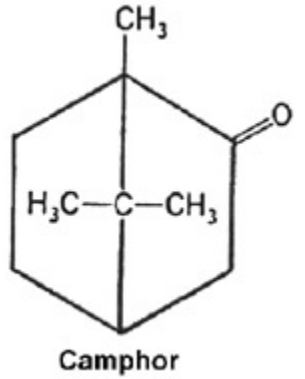
Snowshoe hares (*Lepus americanus*)


BNZ-LTER

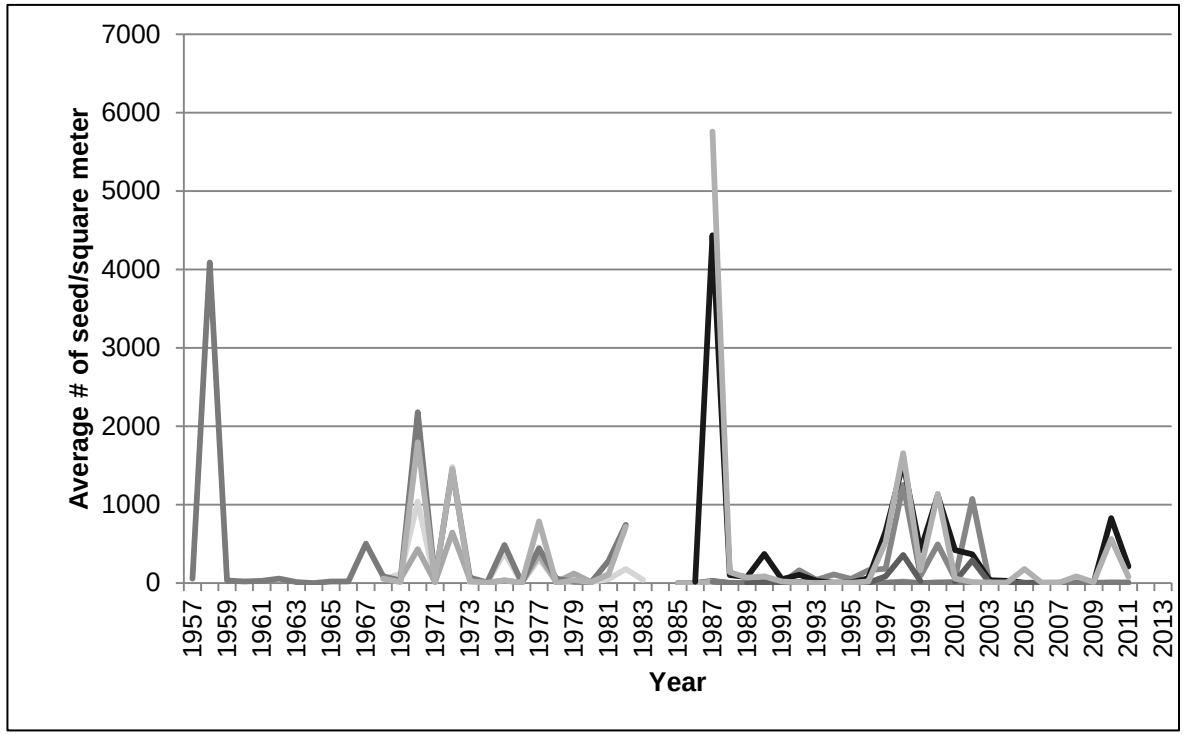
- Dominant herbivore of the boreal forest
- Total biomass can exceed that of all other vertebrate herbivores during population peaks(Krebs et al. 2001, Rexstad and Kielland 2006)

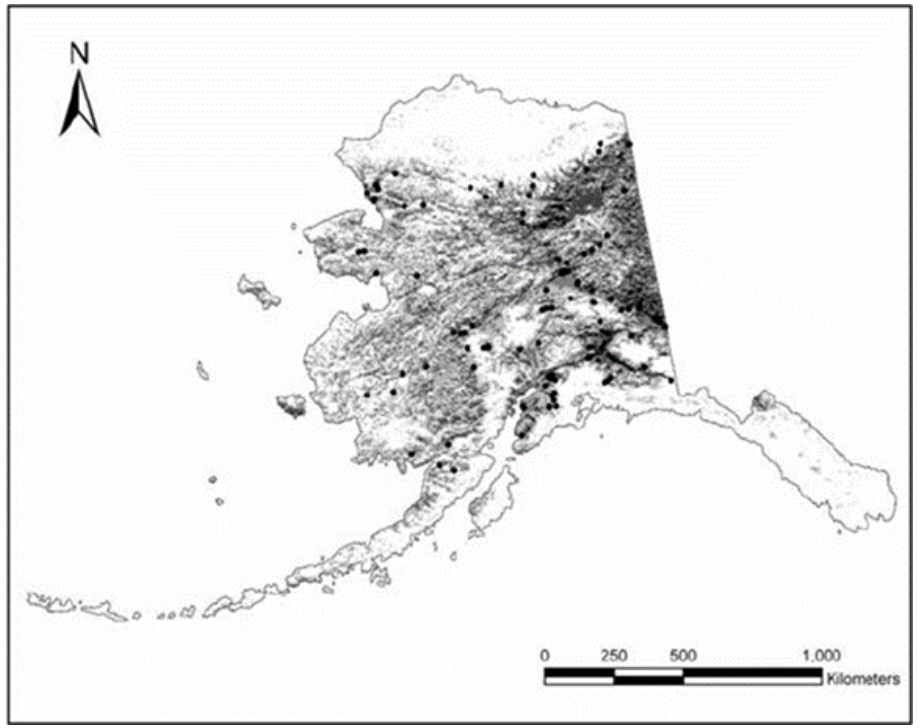


White spruce (*Picea glauca*)



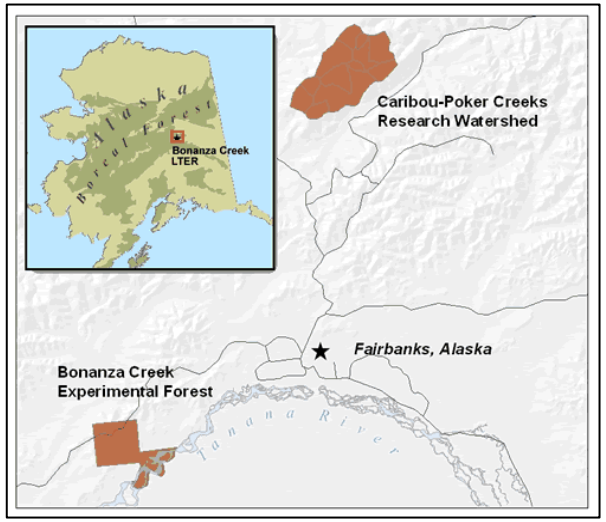
- Dominant conifer of the boreal forest
- Reproduces via masting events

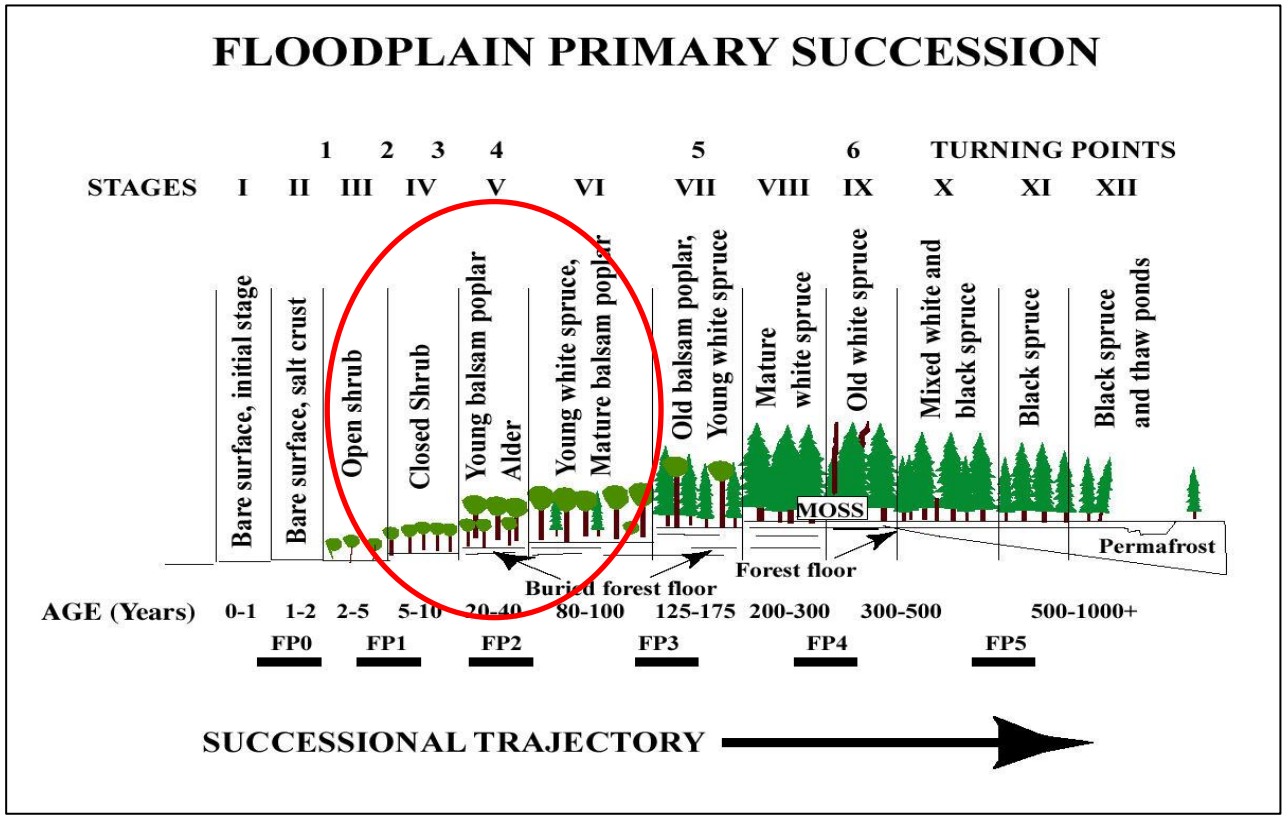




Ohse et al. 2009

Observations at BNZ-LTER





BNZ LTER

Question 1:

How does herbivory by snowshoe hares alter the survival and growth of white spruce seedlings within the floodplain at BNZ-LTER?

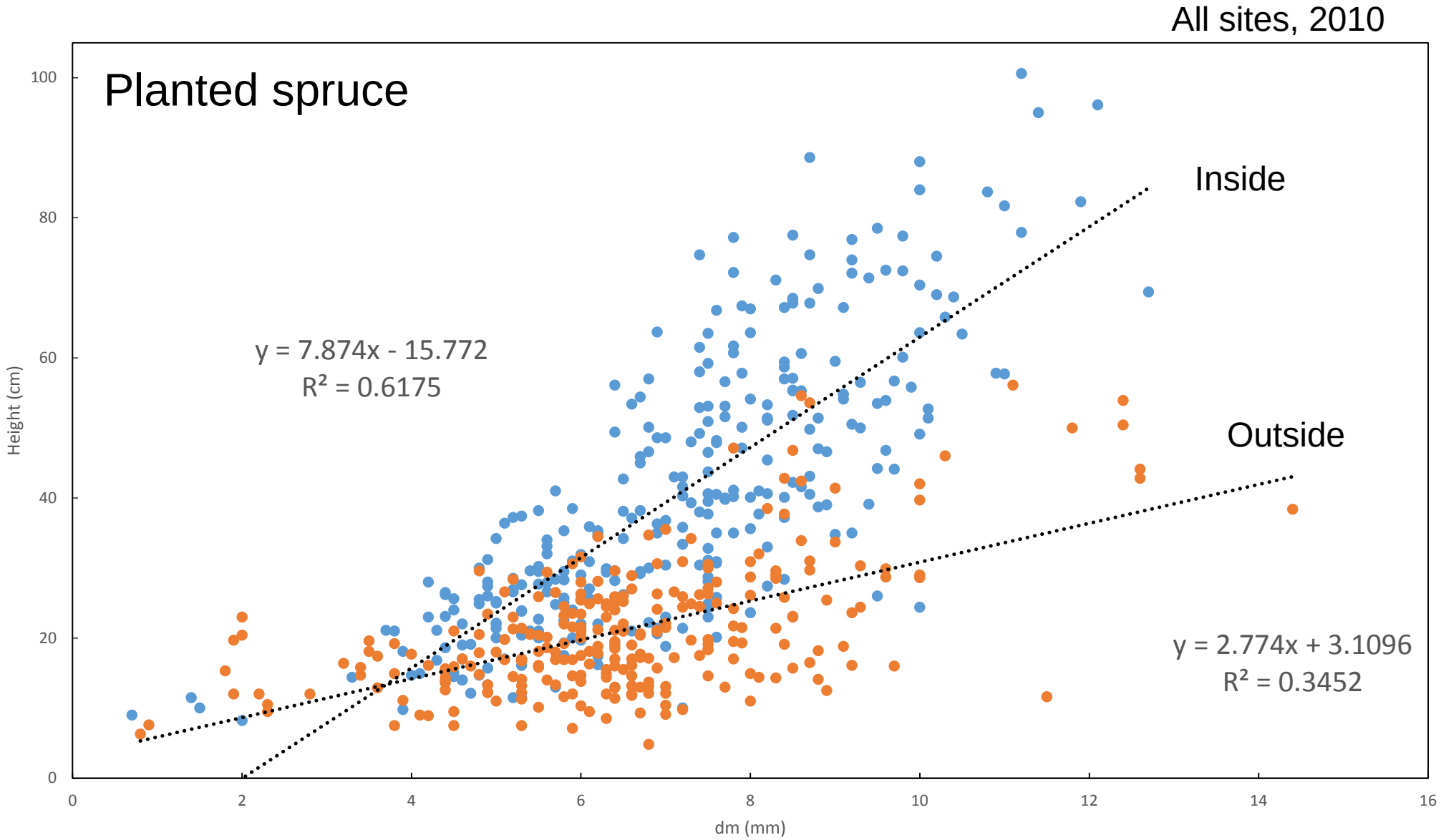
Question 2:

Does a relationship exist between white spruce age structure along the floodplain and the population cycle of snowshoe hares at BNZ-LTER?

Question 1:

How does herbivory by snowshoe hares alter the survival and growth of white spruce seedlings within the floodplain at BNZ-LTER?

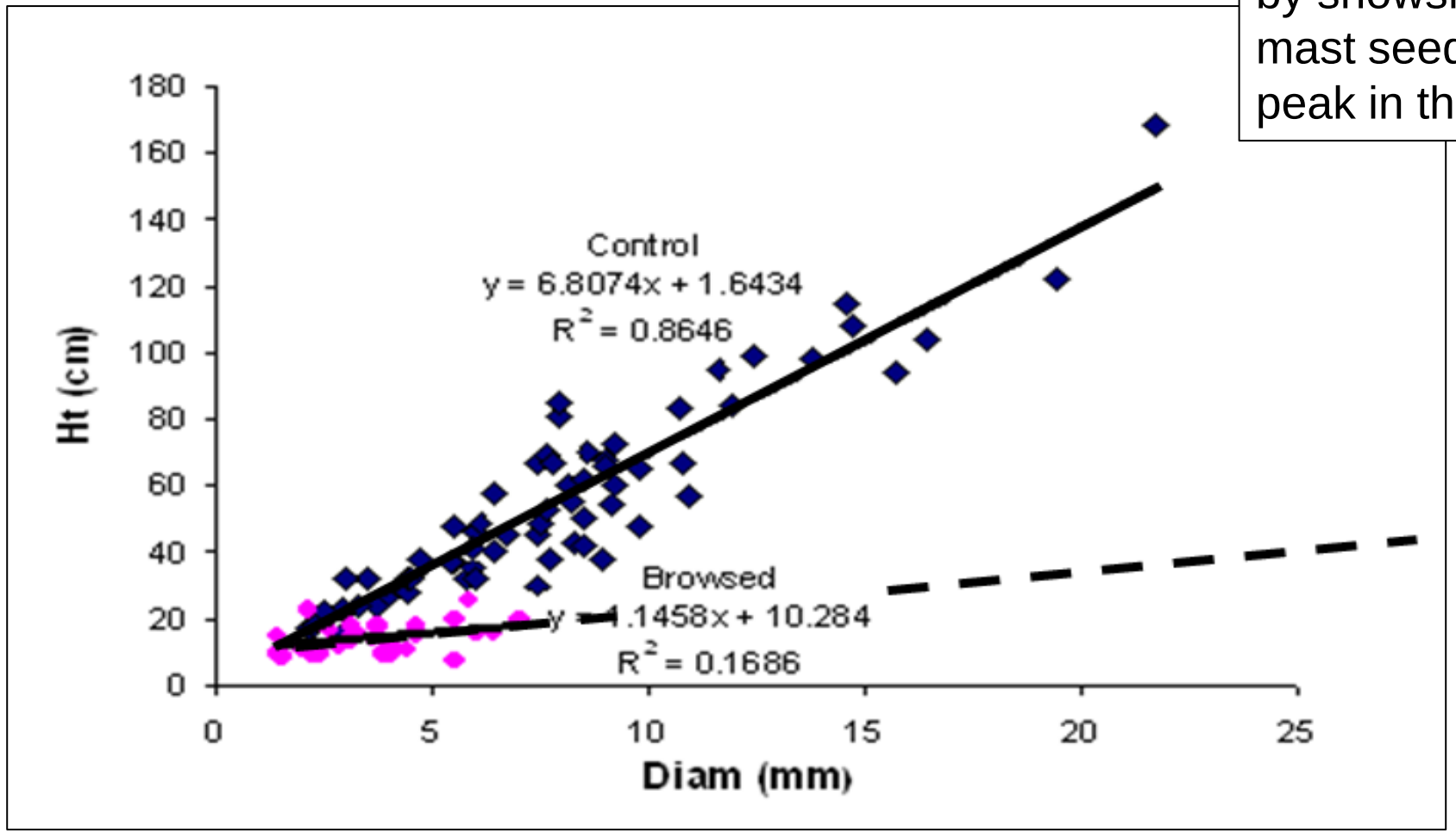
Question 1: Preliminary Data



Question 1: Preliminary Data

Hypothesis: The survival and growth rate of white spruce within floodplains is significantly reduced by snowshoe hare herbivory when mast seeding events coincide with a peak in the hare cycle.

Natural spruce



Question 2:

Does a relationship exist between white spruce age structure along the floodplain and the population cycle of snowshoe hares at BNZ-LTER?

Question 2: Theoretical Concept

Hypothesis:
Age structure of floodplain white spruce influenced by:

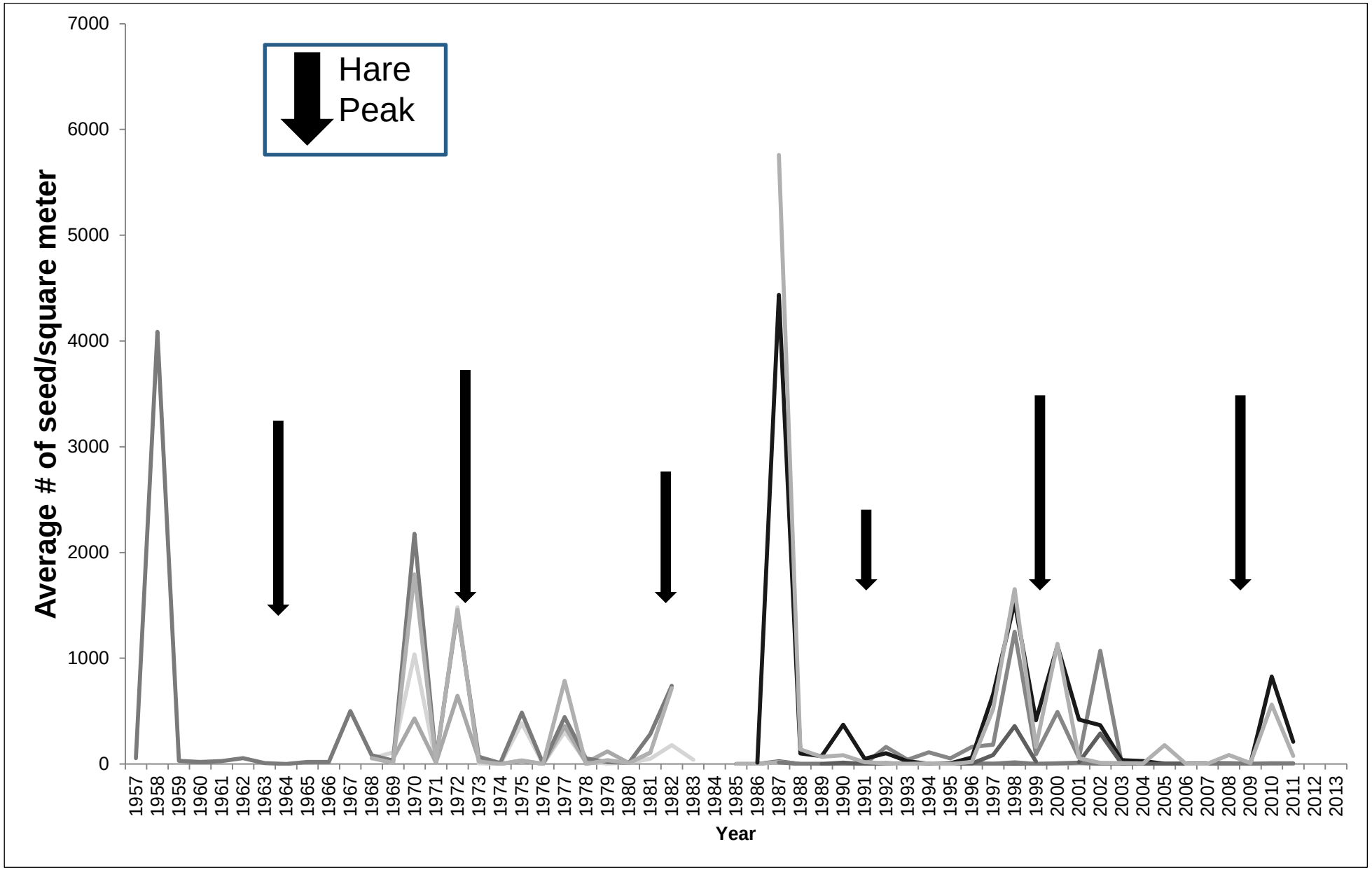
- Mast event history
- Snowshoe hare population abundance
- Flood event history

$$Y_t = M_t - H_t - H_{t+1} \ldots - H_{t+n} - F_t \ldots F_{t+m}$$

Y_t: number trees established for year *t*
M_t: magnitude of cone production for year *t*
H_t: Abundance of snowshoe hares for year *t*
F_t: Flood level of Tanana River for year *t*
n is the number of years it takes for a white spruce to outgrow risk of browsing by snowshoe hares
m is the number of years it takes for a white spruce to outgrow risk of damage or burial by flooding

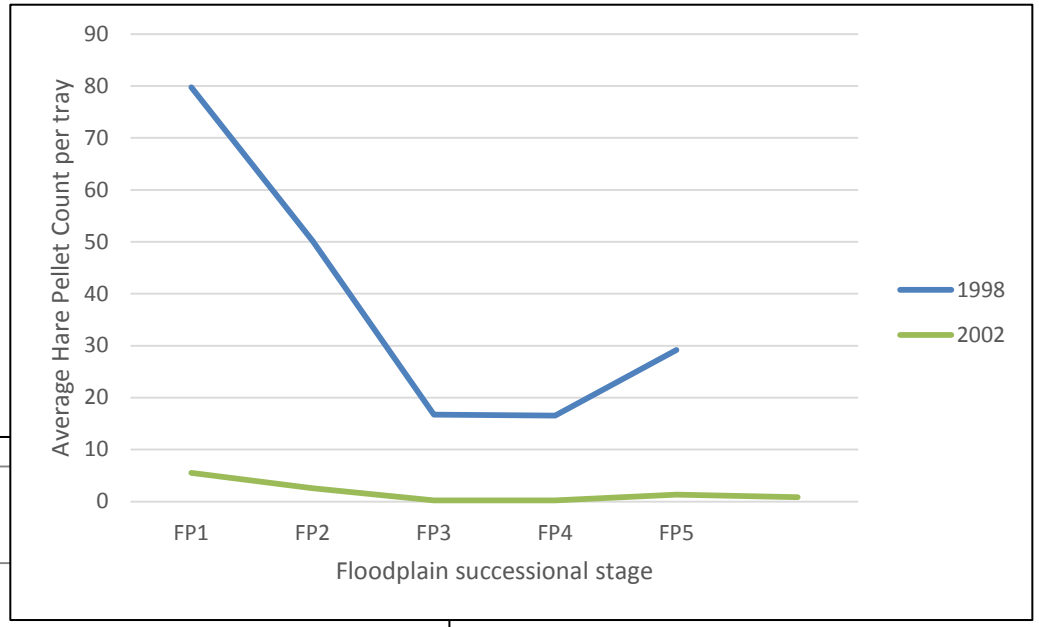
Question 2: Preliminary Data

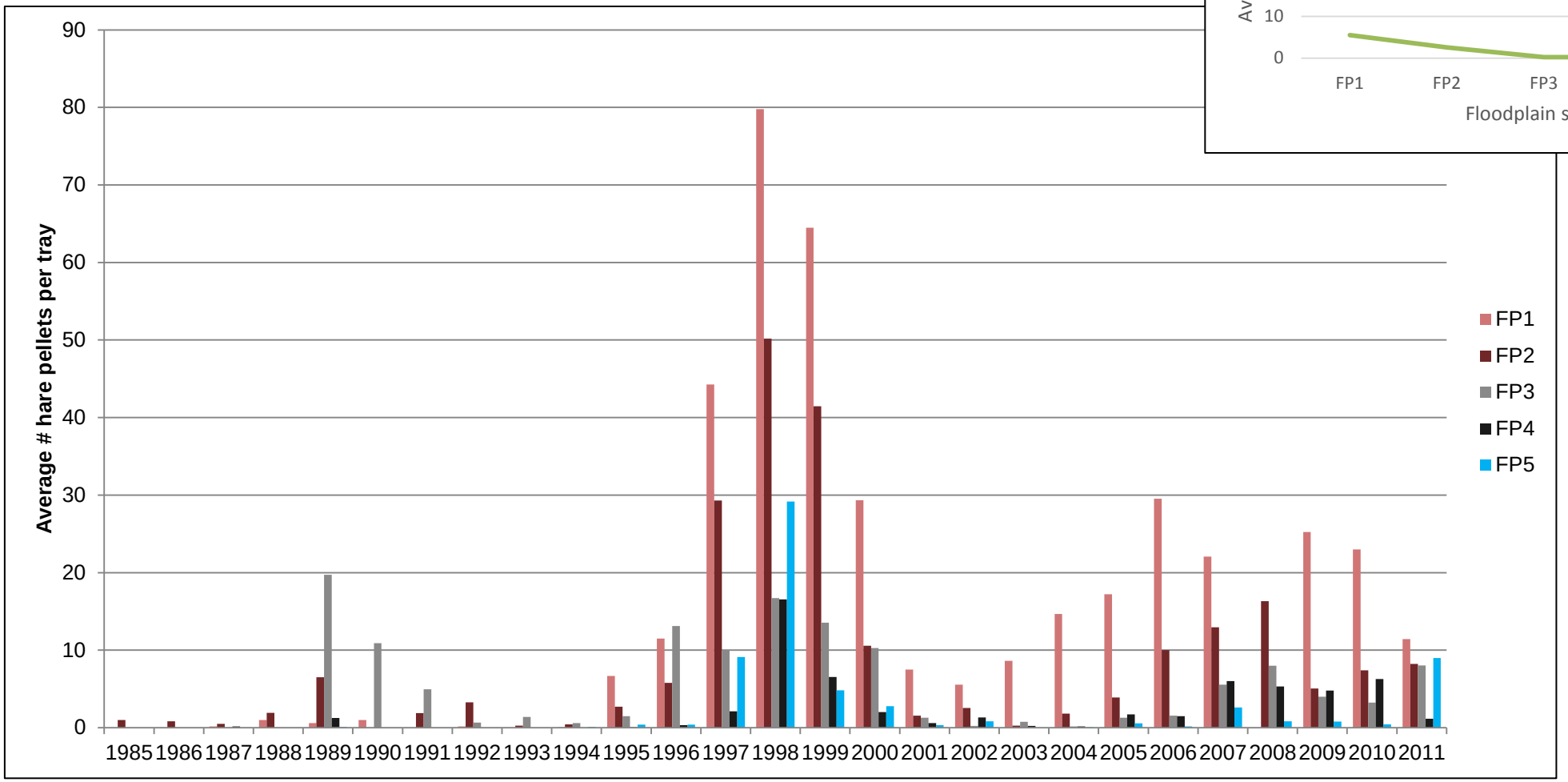
White spruce seedfall data at BNZ-LTER



Question 2: Preliminary Data

hare pellet data (from litter traps)

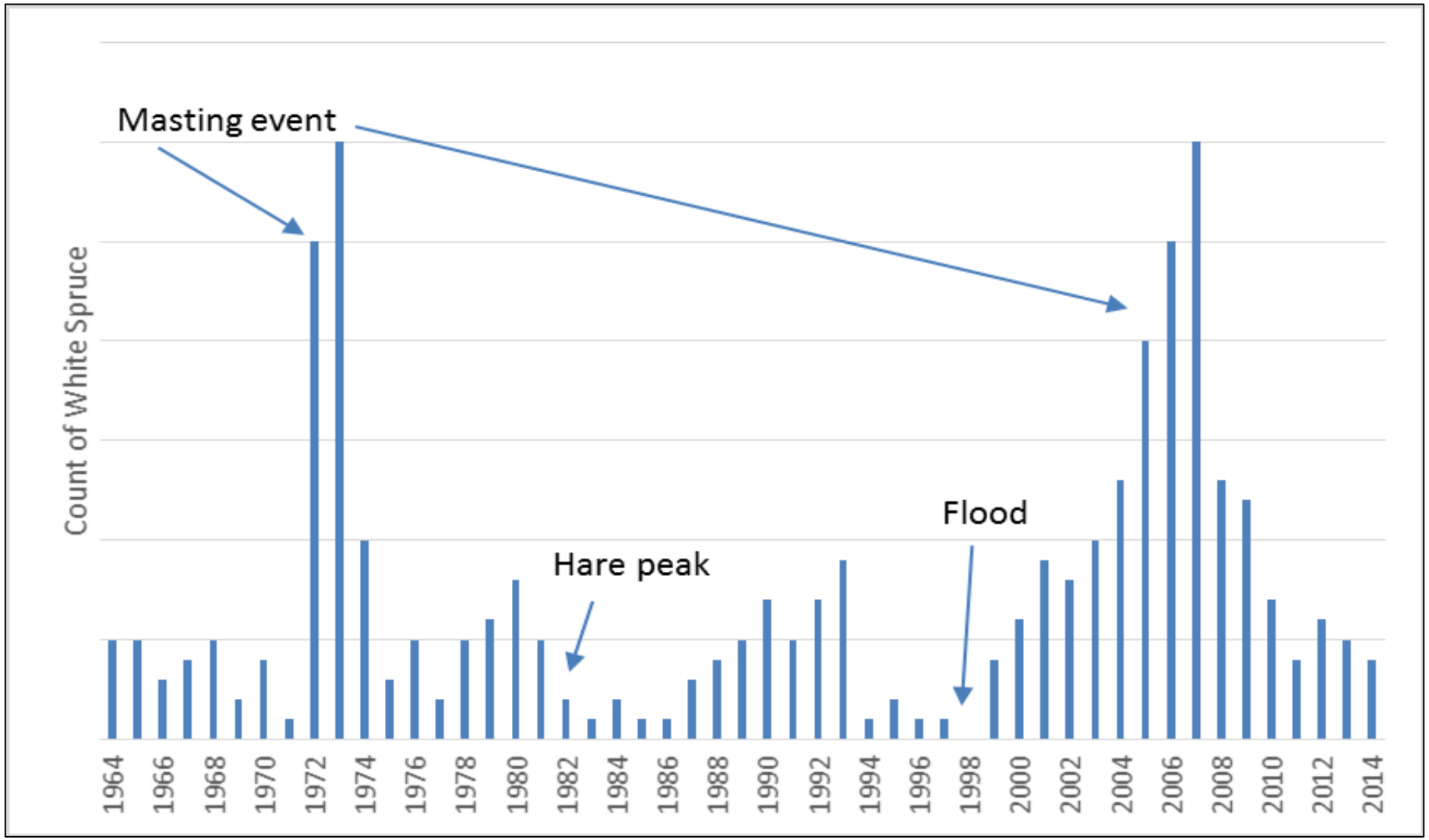




Question 2: Hypothesis

Age structure of floodplain white spruce influenced by:

- Mast event history
- Snowshoe hare population abundance
- Flood event history



Significance

Projected climate change and polar amplification

- Increased drought stress reducing annual growth in white spruce (Barber et al. 2000)
- Reduced seed production and seed viability (Roland et al. 2013)

- Snowshoe hares may benefit from increased fire frequency (Bryant 1994)

Reduced presence of white spruce on the landscape

No retrospective study on white spruce age structure has been conducted for floodplains of interior Alaska

No research has investigated the impact of snowshoe hare herbivory on conifers, like white spruce, in interior Alaska

“Indeed, it is all too clear that every surviving oak is the product either of rabbit negligence or of rabbit scarcity. Some day some patient botanist will draw a frequency curve of oak birth years, and show that the curve humps every ten years, each hump originating from a low in the ten year rabbit cycle.”

- Aldo Leopold, *A Sand County Almanac*