

16th Annual Invasive Species Workshop

Climbing by bird vetch: Advantages to vetch, consequences to the structural host

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The invasive species bird vetch (*Vicia cracca*) is a perennial, fast-growing climber that can envelope shrubs and small trees. The benefit of climbing for vetch and the consequences of aboveground competition for the host providing structural support were investigated using experimental and observational approaches. In an experimental garden on the University of Alaska Fairbanks campus, vetch plants grown for a single summer near potted aspen saplings produced 35% more aboveground biomass than vetch plants lacking the opportunity to climb. Height above the ground was positively associated with photosynthetically active radiation (PAR), due to shading by surrounding vegetation, an effect exacerbated by the relatively extreme angle of solar radiation at high latitude. Climbing by vetch significantly reduced the availability of PAR to aspen and reduced aspen growth by an average 53% relative to vetch-free controls. Similarly, unmanipulated aspen saplings growing naturally on a plot with vetch were frequently overtopped and accumulated no detectible growth across a growing season, while aspen within the same plot from which vetch vines were manually deflected gained significantly in both height and girth. In contrast to aspen, potted white spruce seedlings grown near vetch, though similarly overtopped, compensated for shading by producing higher levels of chlorophyll in needles and sustained only modest reductions in growth relative to vetch-free controls. The results indicate that climbing benefits bird vetch by increasing light availability. The consequent shading can have strong effects on the growth of the structural host, but the magnitude of those effects depends on the host species and is particularly detrimental for fast-growing species with high light requirements.

Climbing by Bird Vetch: Advantages to Vetch, Consequences to the Structural Host

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Bird vetch (*Vicia cracca*)

- Native to Europe and Asia:
open habitats (Cadbury 1971)
- First report in Ontario, 1860
(Aarssen et al. 1986)
- Rampart Experiment Station on
Yukon River in 1909
- Later to Fairbanks and Palmer
Experiment Stations (Klebesadel
1980)
- Noxious weed in Alaska



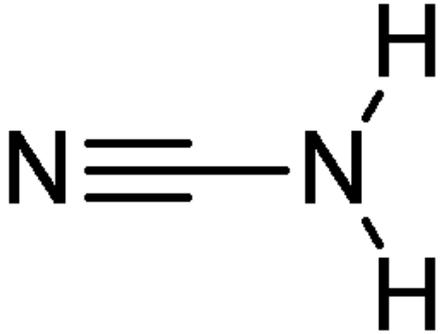
Bird vetch (*Vicia cracca*)

- Fairbanks: currently roadsides, grasslands, low density forest
- Threat to natural areas in future:
 - Likely recruitment limited
 - Can establish and persist under conditions of low fertility and low disturbance (Thompson et al. 2001)
 - Perennial, sexual and asexual reproduction
 - Persistent and resilient



Traits That May Facilitate Establishment

- Nitrogen fixation
- Allelopathy
- Climbing



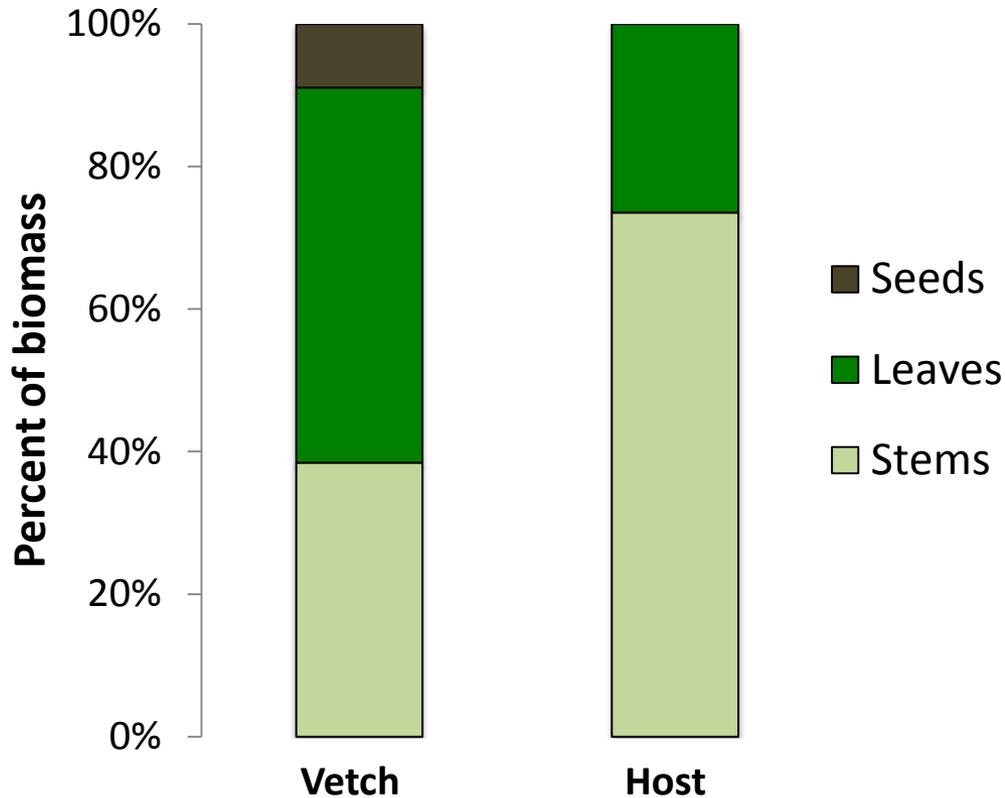




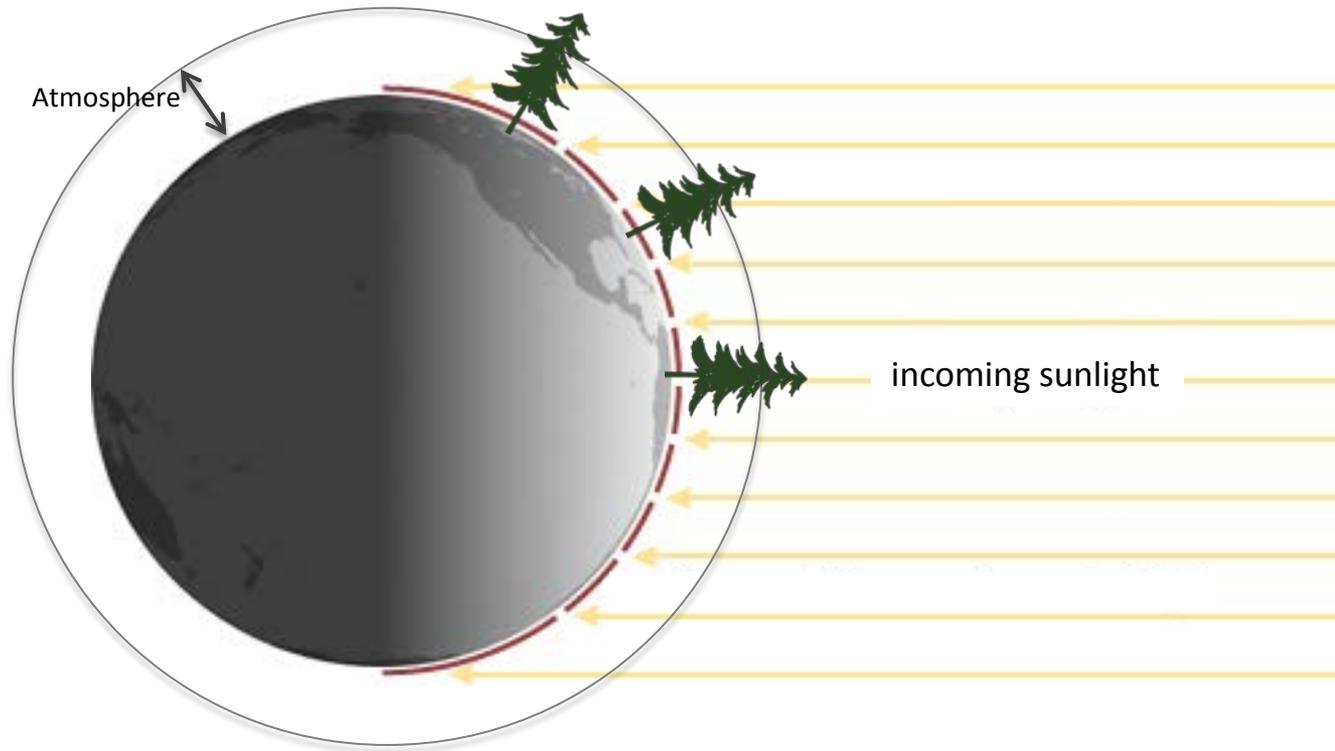




Advantages of Climbing: The host fights gravity

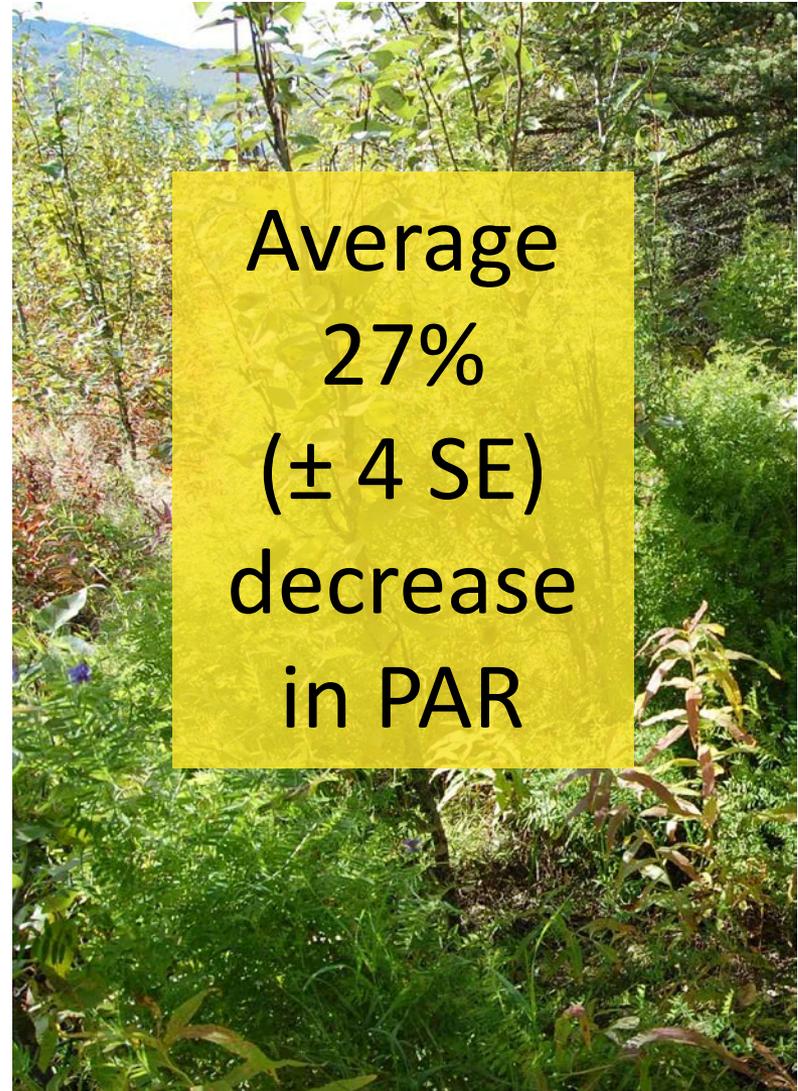


Advantages of Climbing



Disadvantage to Host

- Mid-summer 2014 survey
- 32 small trees / shrubs at 6 sites with vetch
- Measured light (PAR) penetration to main stem (time of day and directionality constant)
- Compared to PAR with vetch removed



Questions

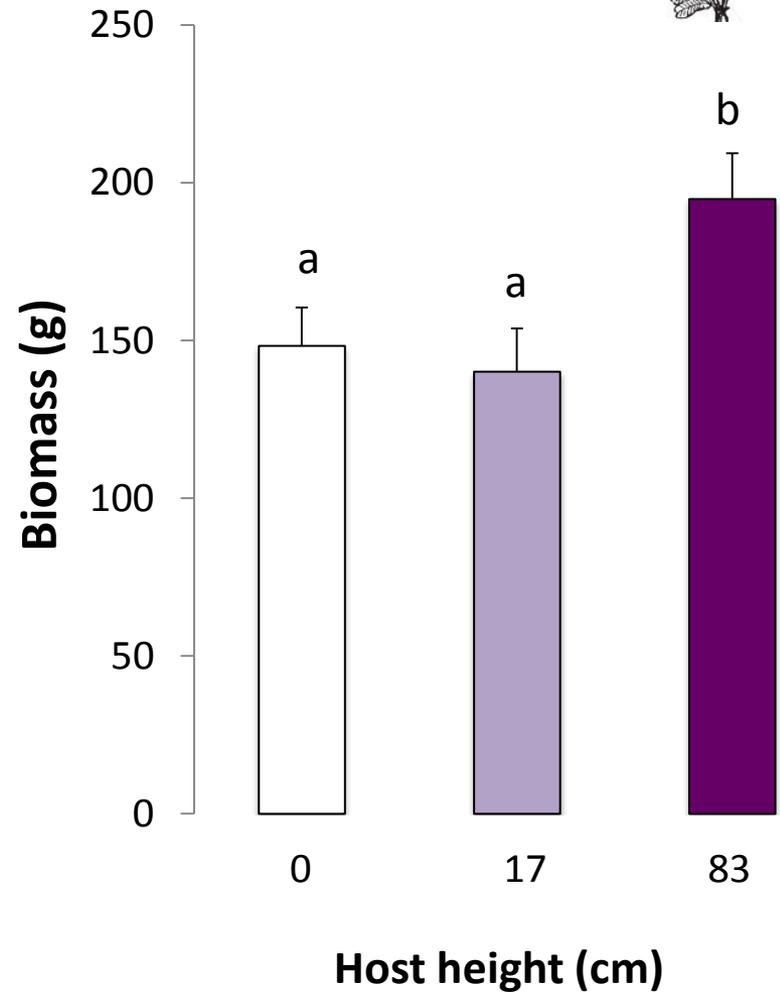
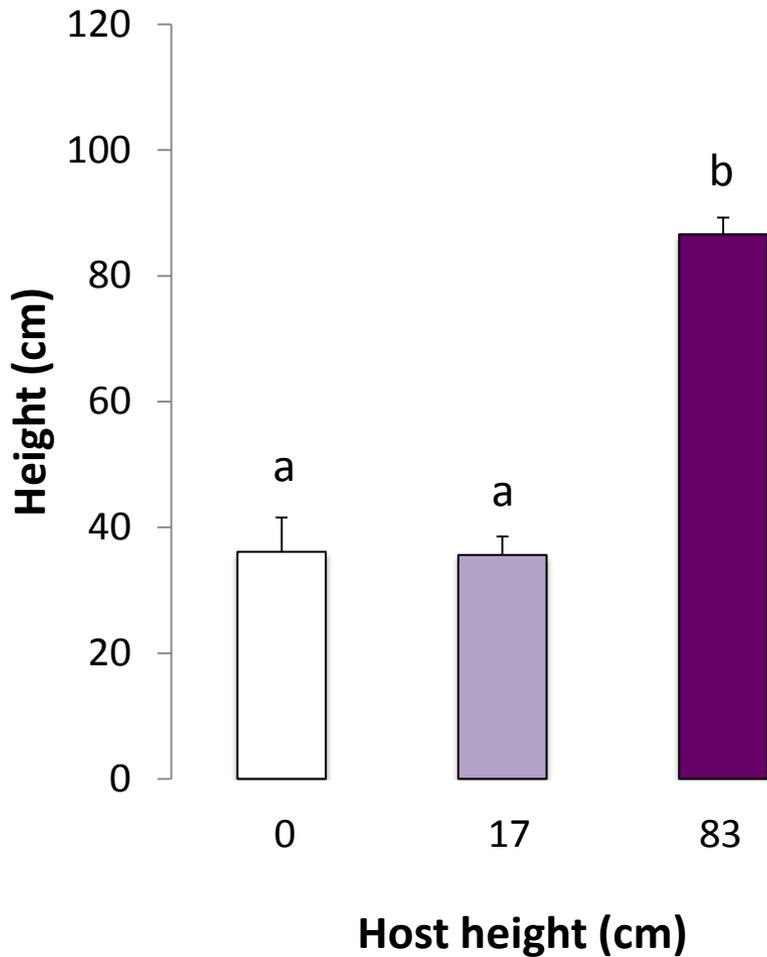
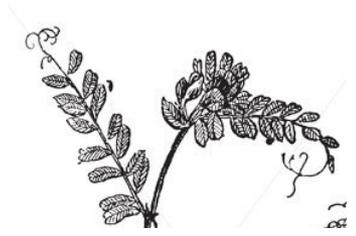
- What is the effect of climbing on vetch light capture and performance?
- What is the effect of shading by climbing vetch on host performance?
- Two experiments

Aboveground Competition Experiment

Experimental Garden

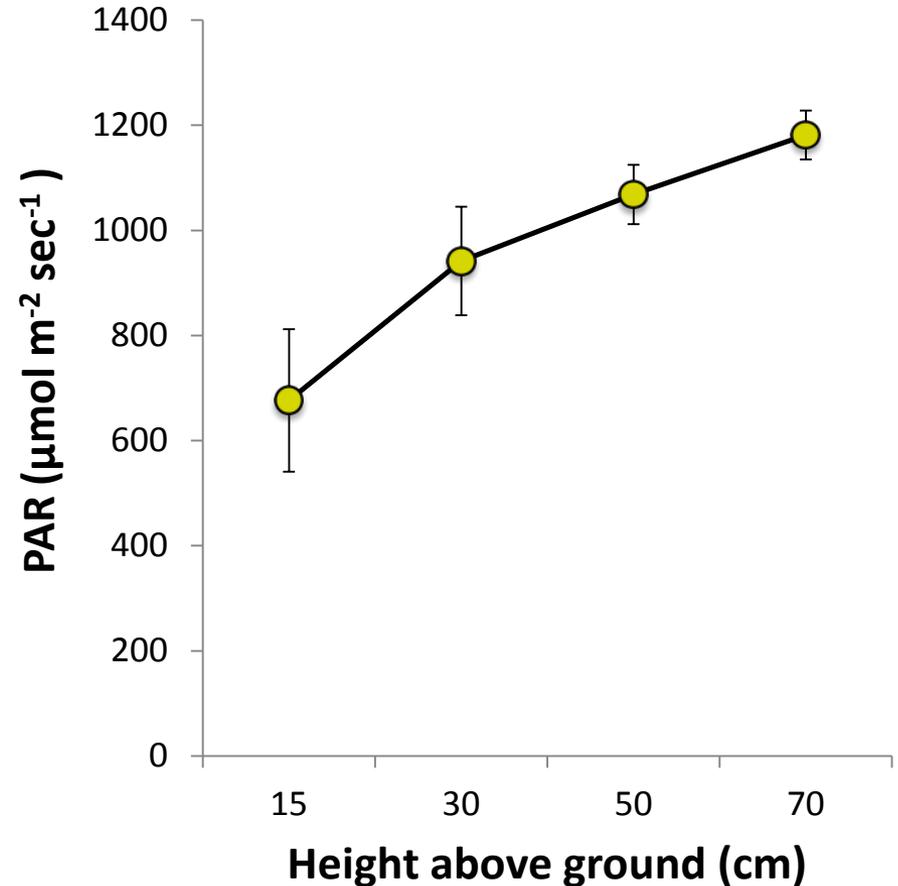
- Questions
 - Does the opportunity to climb increase vetch growth rates?
 - Does vetch reduce growth of structural host?
- Treatments
 - Aspen sapling (83 cm) alone and near vetch
 - Spruce seedlings (17 cm) alone and near vetch
 - Vetch alone
 - (Plants in pots, N = 10 per treatment)
- Measurements
 - Measured light (PAR at main stem), growth, spruce leaf traits

Results – Vetch Growth

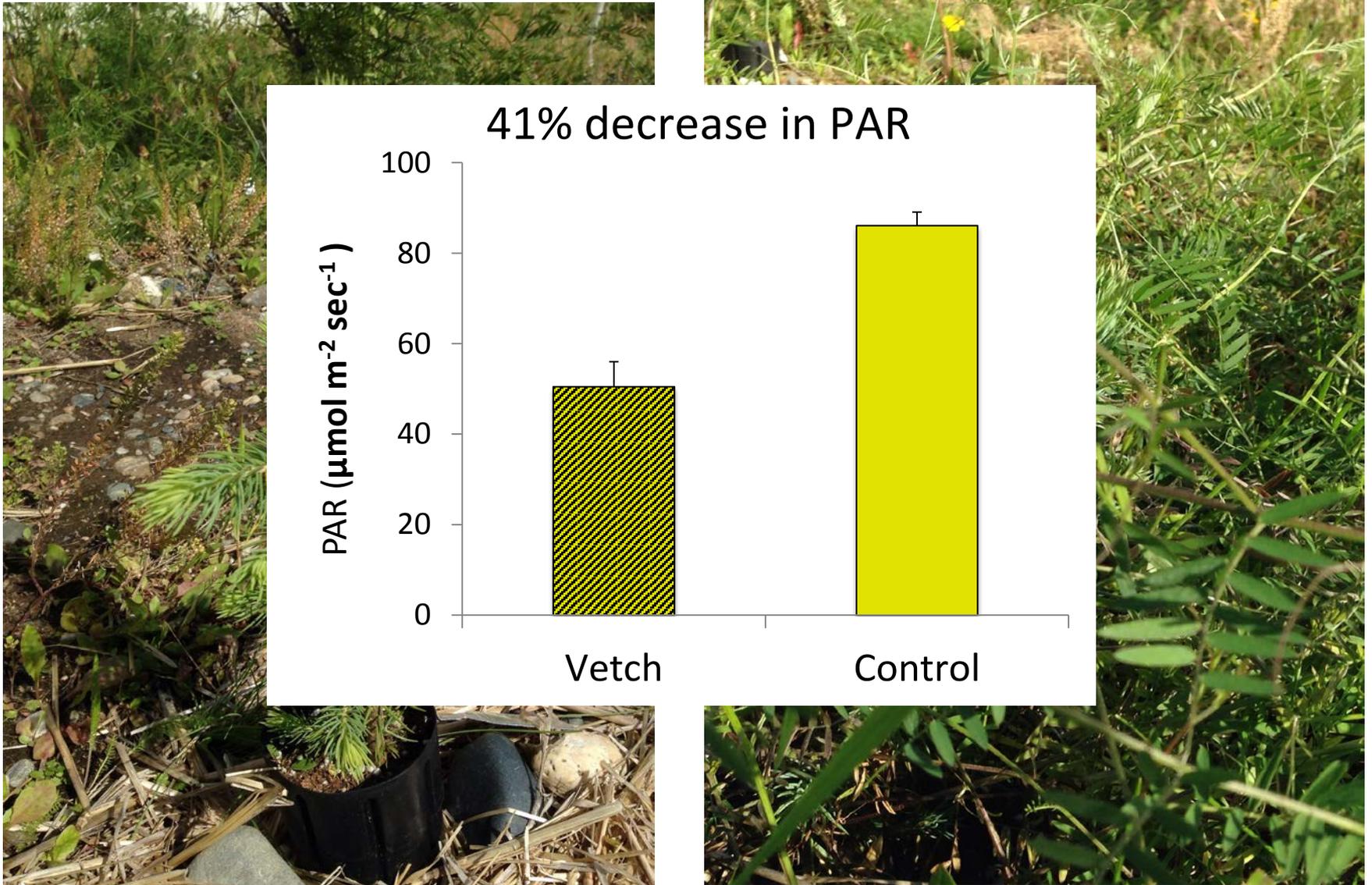


Height Increases Light

- 6 random sites within experimental garden
- Incidental shading by surrounding vegetation decreases with height



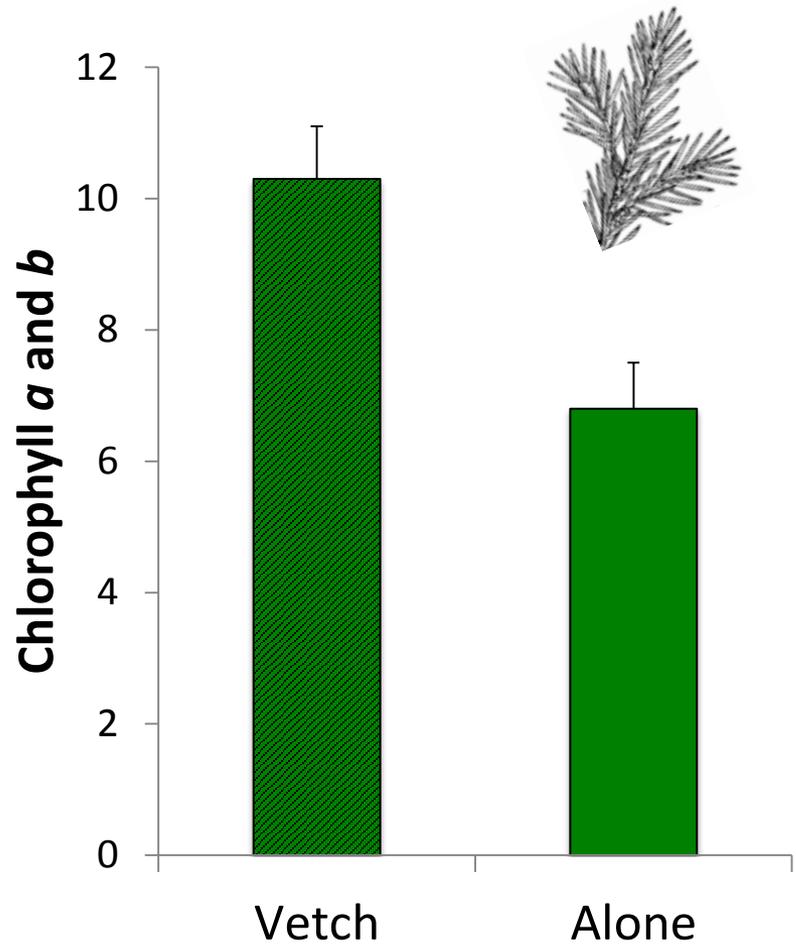
Spruce



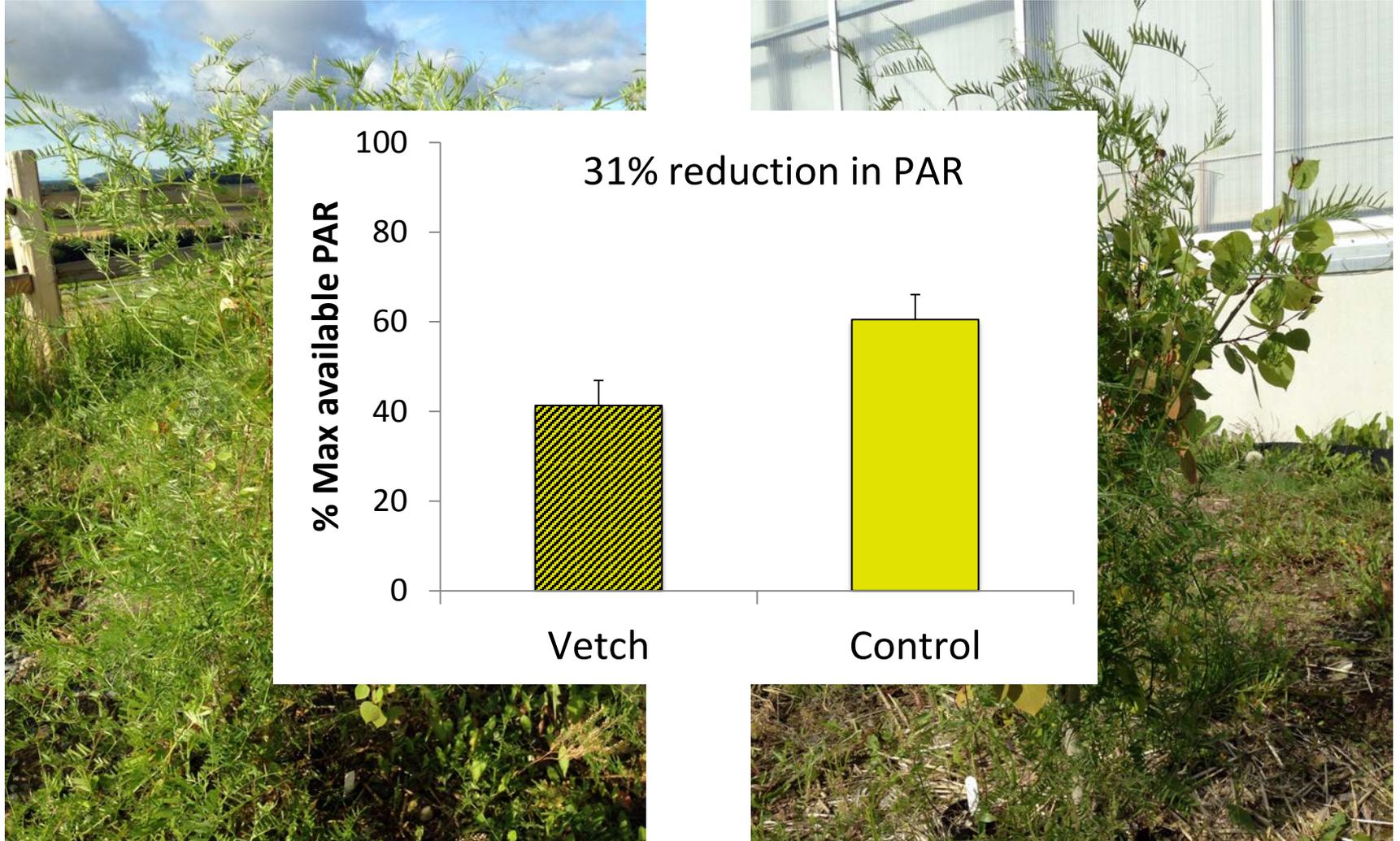
Growth Results - Spruce

Effect of vetch on host

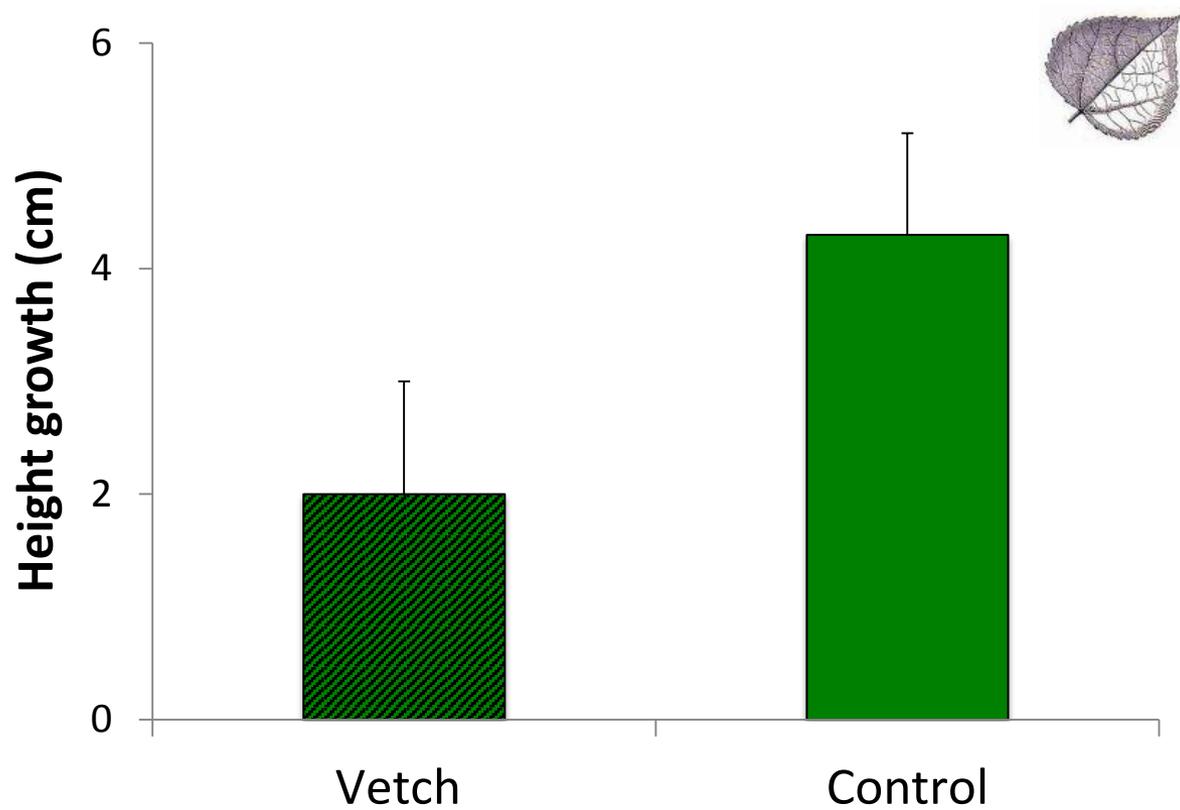
- True height – none
- Stem diameter – none
- Needle mass, length – none
- N shoots – reduced
- Spruce compensated for shading



Aspen



Growth Results - Aspen



Aboveground Competition

Garden Experiment Conclusions

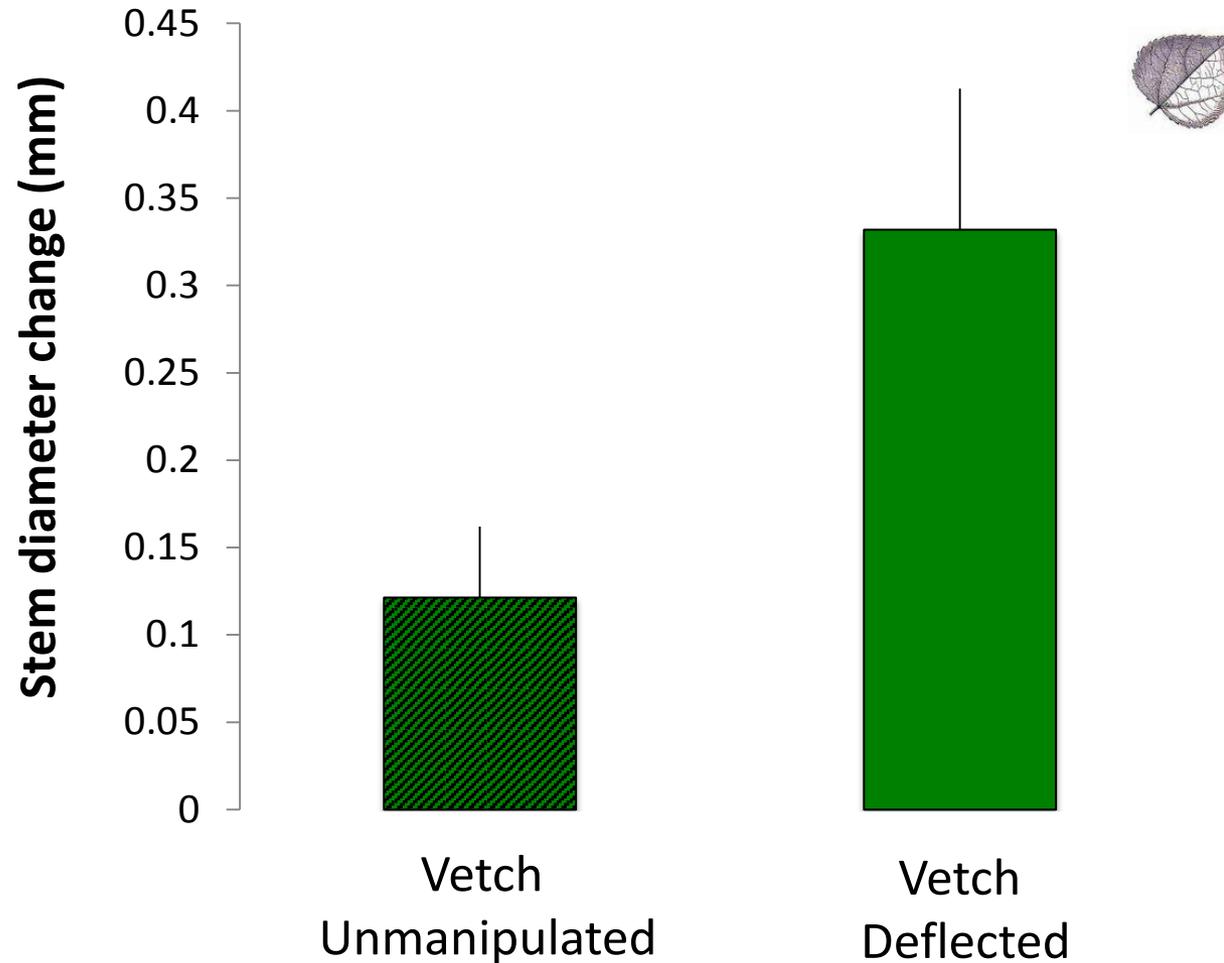
- Consequences of shading dependent on host species
- But -
 - Representative of natural conditions?
 - Abundant water and nutrients
 - In nature, plants often nutrient-limited, not light-limited
 - More likely to detect competition?
 - Pot restrictions on growth?
 - Less likely to detect competition?

Aboveground Competition Experiment

Natural Setting

- Study plot – grassland slope colonized by abundant small aspen (0.5 – 1 m)
- N = 40 aspen
- 2 treatments:
 - Vetch contacting aspen deflected to side (not pulled)
 - Vetch unmanipulated
- Measured stem diameter (growth), actual height

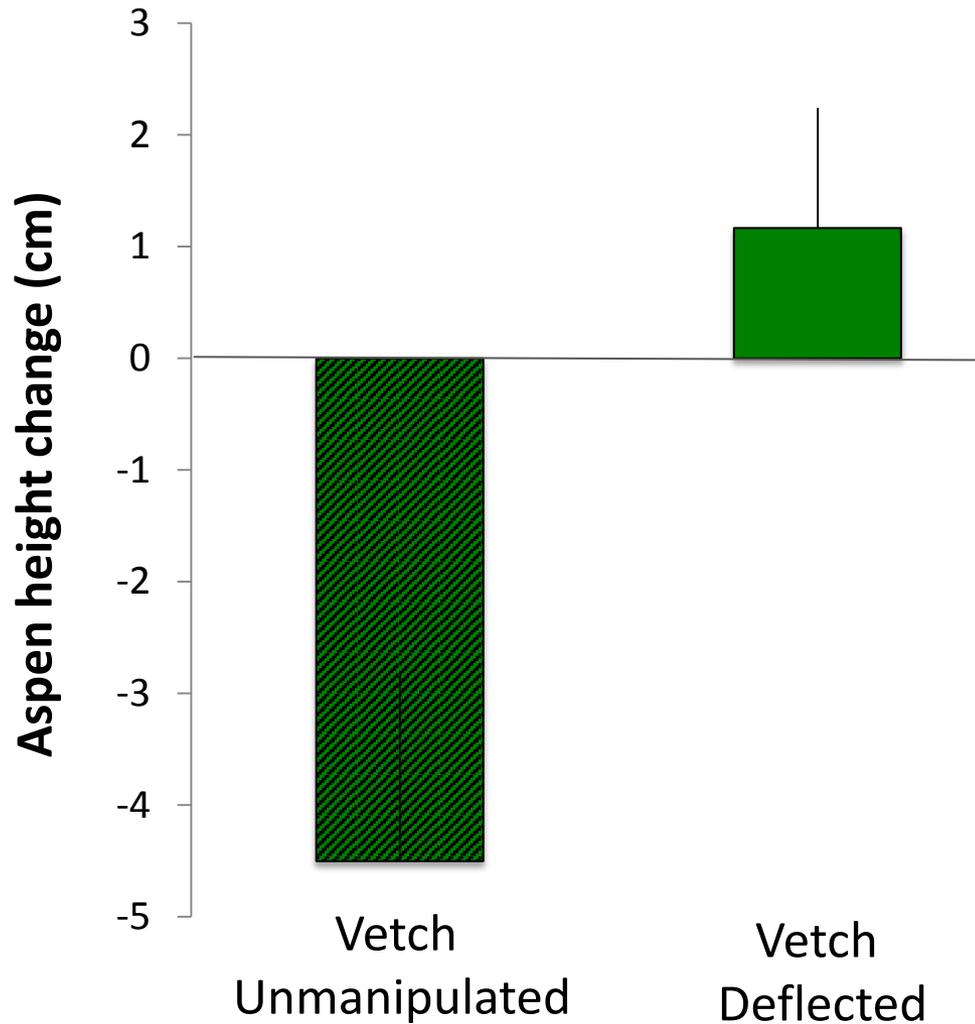
Results – Natural Setting



Results – Natural Setting



Results – Natural Setting



Survivorship?

Conclusions

Where bird vetch invades forest edge or interior, has the potential to alter recruitment dynamics of native trees

Some host species more vulnerable than others



Thanks to...

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