Does non-native white sweetclover impact Alaskan floodplain plant communities?

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Invasive Species Ecological Impacts

Research conducted outside Alaska

- Invasive plants displace native species and alter native plant communities and ecosystem processes (Levine *et al.* 2003)
- Invasive species can displace native seedlings and mature plants

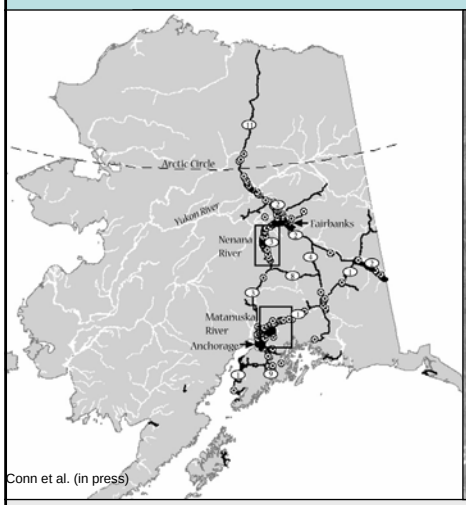
Research within Alaska

- Prior to our study, no data existed on the ecological impacts of invasive plants within Alaska
- Research regarding invasive plant impacts to natural habitats was a stated need for land managers of Alaska (CNIPM 2005)

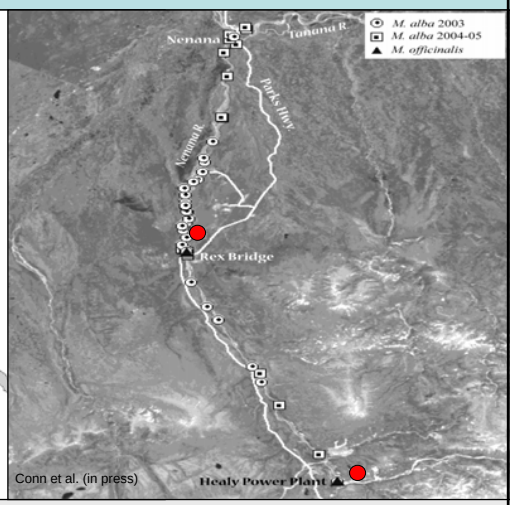
White Sweetclover (*Melilotus alba*)

- biennial legume
- grows 0.5 to 1.5 m in height
- common along roads in Alaska
- invasive along several river floodplains in Alaska

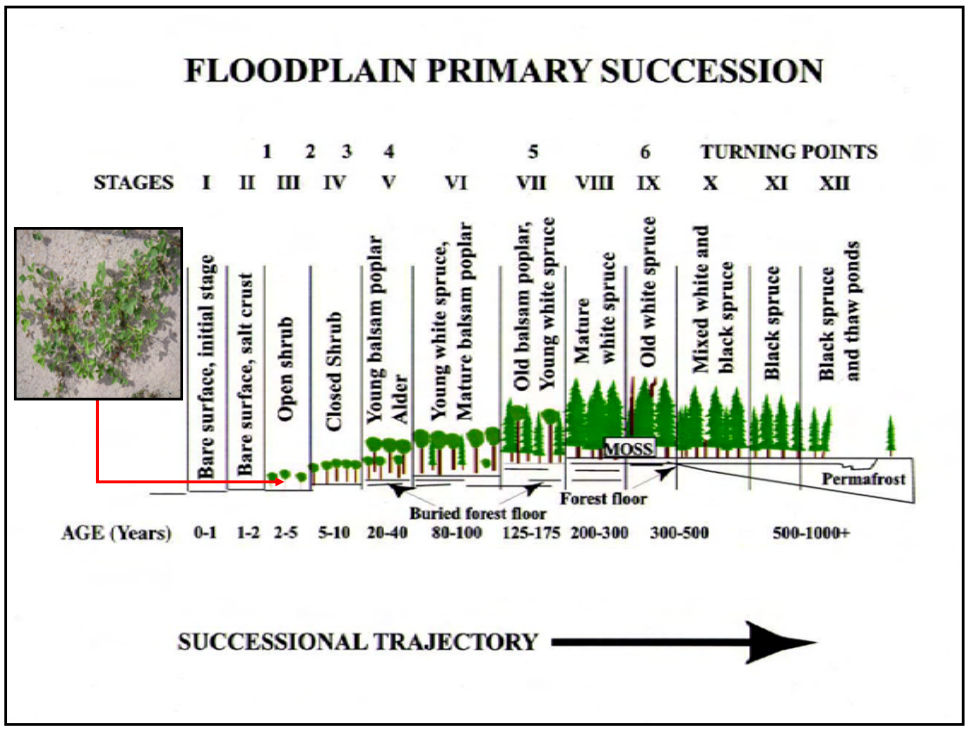
Sweetclover Distribution



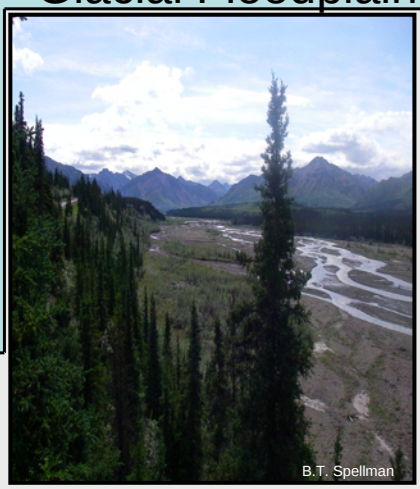
Distribution of sweetclover along roadsides in Alaska.



Sweetclover along the Nenana River. ● mark locations of our floodplain study sites.



Early Stages of Glacial Floodplain Succession



Teklanika River within Denali National Park and Preserve

Key Characteristics:

1) high disturbance
2) limited nutrients (i.e. Nitrogen)
3) sparsely vegetated
4) **vegetation is shade intolerant**

Model of Plant Population Dynamics (*Hedysarum alpinum*)

Seed production

Germination

RECRUITMENT

Overall Question and Hypothesis

Question:

- How does sweetclover affect the seedlings of native floodplain plants?

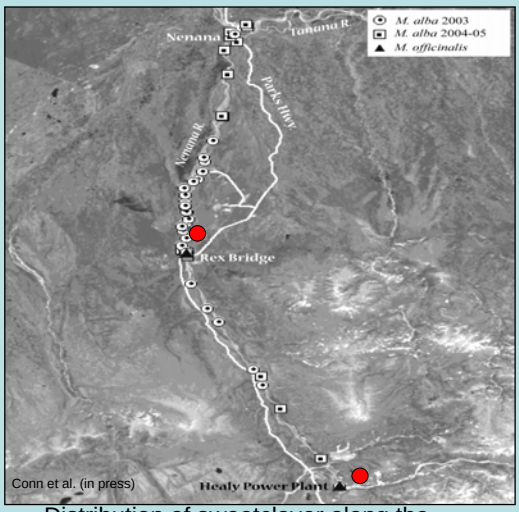
Hypothesis

- We predicted that sweetclover would reduce native seedling recruitment through competition

Experiments

1) **Sweetclover removal experiment** – determined the impact sweetclover has on native floodplain plant recruitment
2) **Sweetclover shading experiment** – determined if competition for light explained results observed from the removal experiment
3) **Seedling competition experiment** – determined competitive interactions between seedlings of sweetclover and two common floodplain legumes

Removal Methods



Distribution of sweetclover along the Nenana River. ● mark locations of our floodplain study sites.

- Experiment conducted along the Nenana and Healy River floodplains during the summer of 2006 and 2007

- Each year and site had 12 unique patches of sweetclover (>10 m^2); sweetclover cover in patches ranged between 30-90% cover

Removal Methods

control | sweetclover - | vegetation -

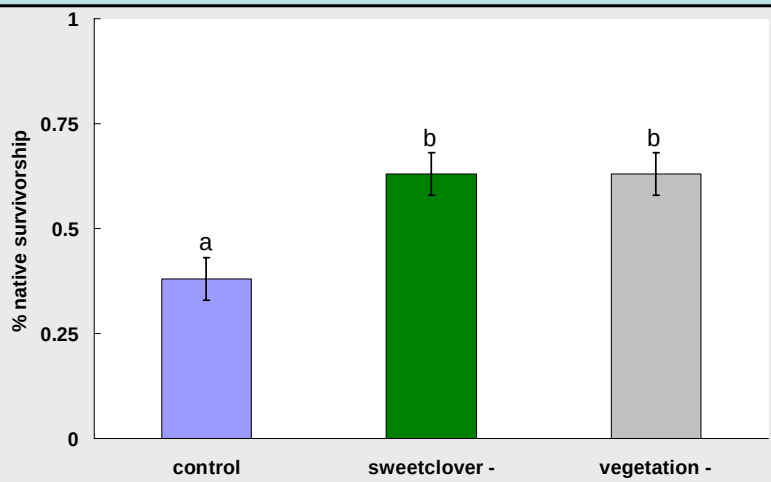
Removal Methods

In September,

- Measured variables - % native seedling survival and # of native seedlings that survived
- In 2007, seedlings were identified to functional group

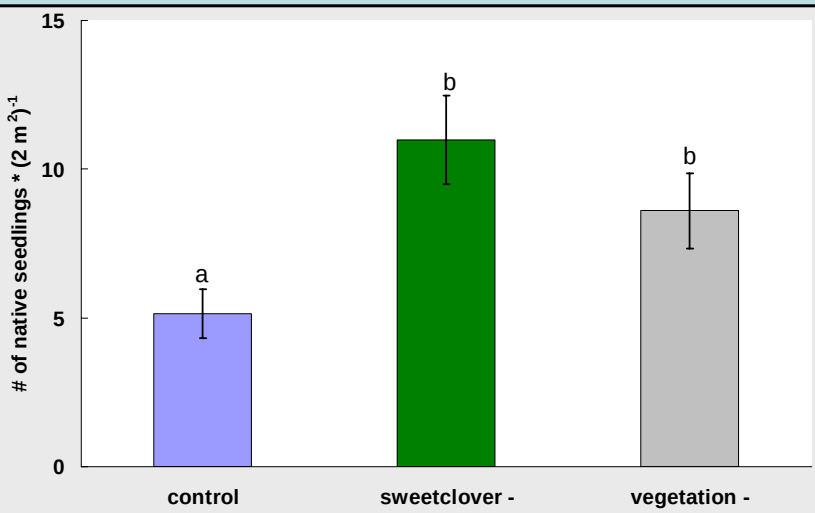
Functional Groups – Tree/Shrub, Forb, Legume, Graminoid

Removal Experiment Results



Mean percent survivorship (± SE) of native seedlings at a control and two treatments. Different letters indicate statistically significant differences p>.05.

Removal Experiment Results



Mean count of native seedlings (± SE) at a control and two treatments. Different letters indicate statistically significant differences p>.05.

Removal Experiment Results

native seedling richness and abundance

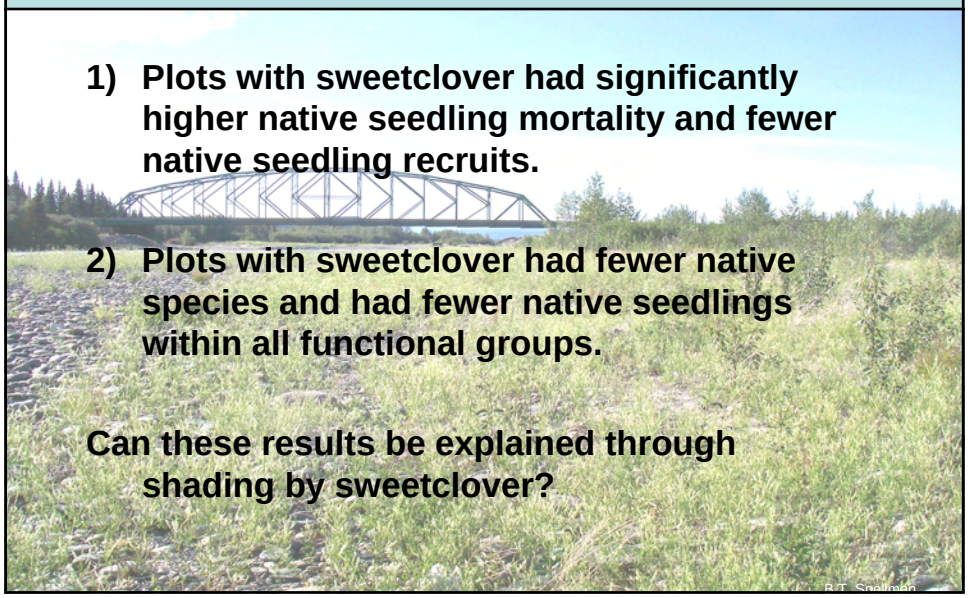
# of native species					
treatment	Tree/shrub	Forb	Legume	Graminoid	Total
control	2	5	2	3	12
sweetclover -	2	7	3	4	16
vegetation -	3	6	3	2	14

Combined count from all plots in 2007

abundance of native species					
treatment	Tree/shrub	Forb	Legume	Graminoid	Total
control	0.5	7.8	1.6	8.1	18.1
sweetclover -	6.3	10.3	2.8	16.1	35.5
vegetation -	2.6	15.6	1.6	2.5	22.3

Mean within control and removal plots in 2007

Removal Experiment Conclusions

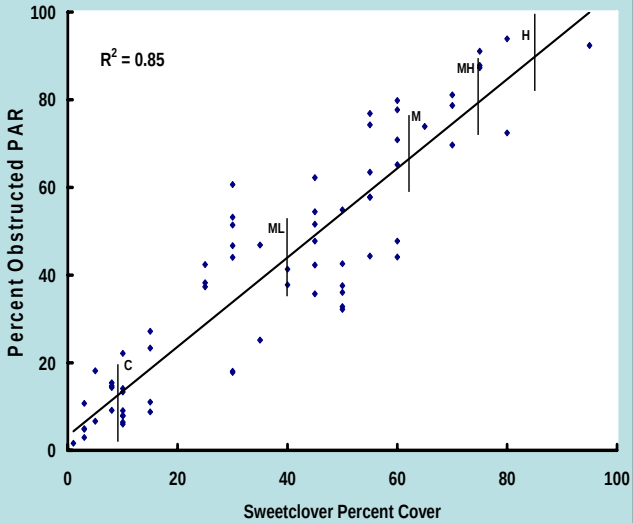


1) **Plots with sweetclover had significantly higher native seedling mortality and fewer native seedling recruits.**

2) **Plots with sweetclover had fewer native species and had fewer native seedlings within all functional groups.**

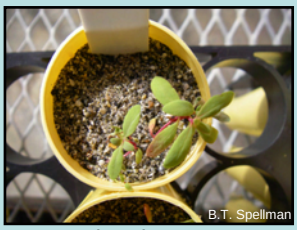
Can these results be explained through shading by sweetclover?

Sweetclover Shading along the Healy River



Species used in Shading Experiment

Chamerion latifolium



river beauty

Hedysarum boreale spp. *mackenzii*

northern sweetvetch

Hedysarum alpinum

eskimo potato

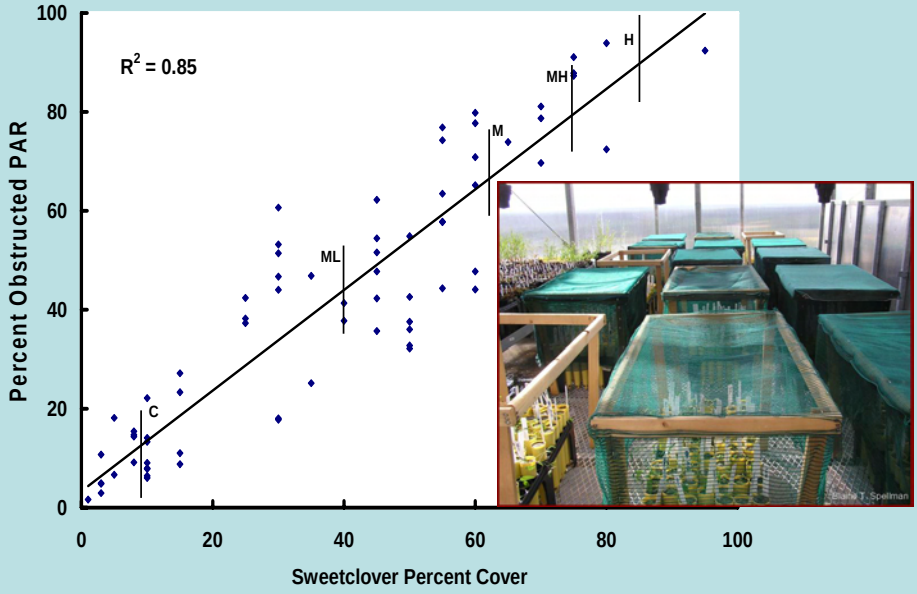
Salix alaxensis

feltleaf willow

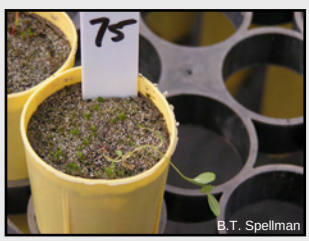
Alnus incana spp. *tenuifolia*

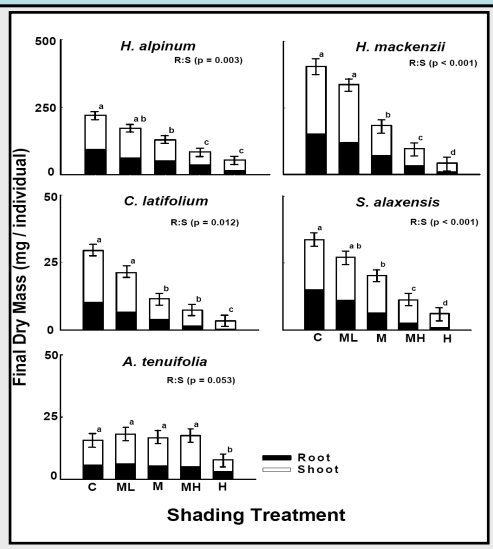
thinleaf alder

Shading Methods

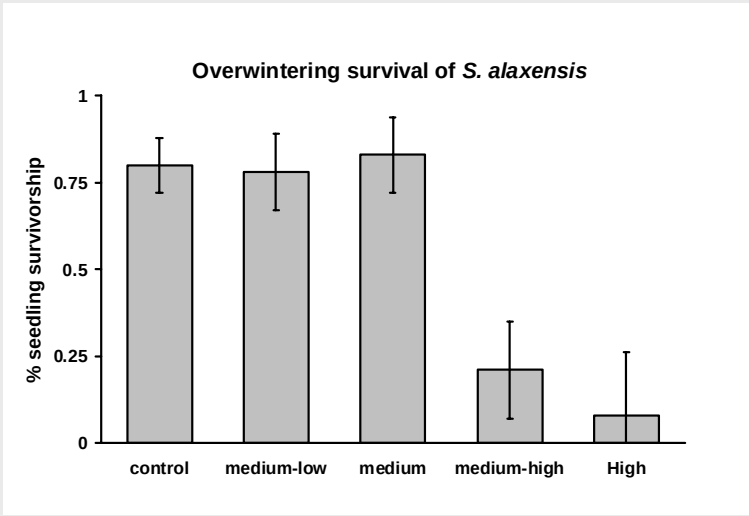


Shading Results





Shading Results



Shading Conclusions

1) Sweetclover shaded 1 to 94% of the available light along the Healy River floodplain.
2) Shading stressed and led to increased mortality of Alaskan floodplain species.
3) Depending on a species' tolerance to shading, sweetclover may have major or minor impacts to Alaskan plant populations.

Overall Conclusions

- Sweetclover impacts Alaskan floodplain plant communities through altering native seedling recruitment.
- Competition for light can stress and lead to increased mortality of common Alaskan floodplain plant species.

Management Implications

endemic species

Salix setchelliana

Lupinus kuschei

Both species were found along floodplain study sites and may warrant conservation efforts.

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