What happens when you shred pinyon and juniper trees?

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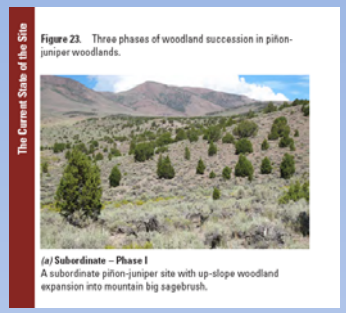
What do we have against these trees, anyway?

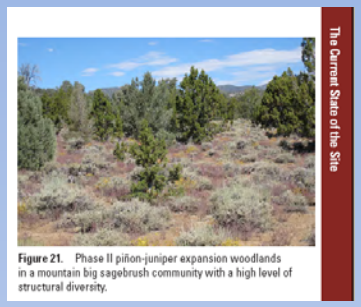
Courtesy Brad Jessop

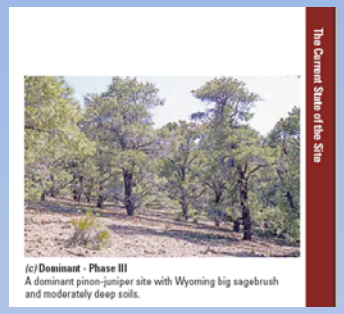
Stansbury Mountains 1901

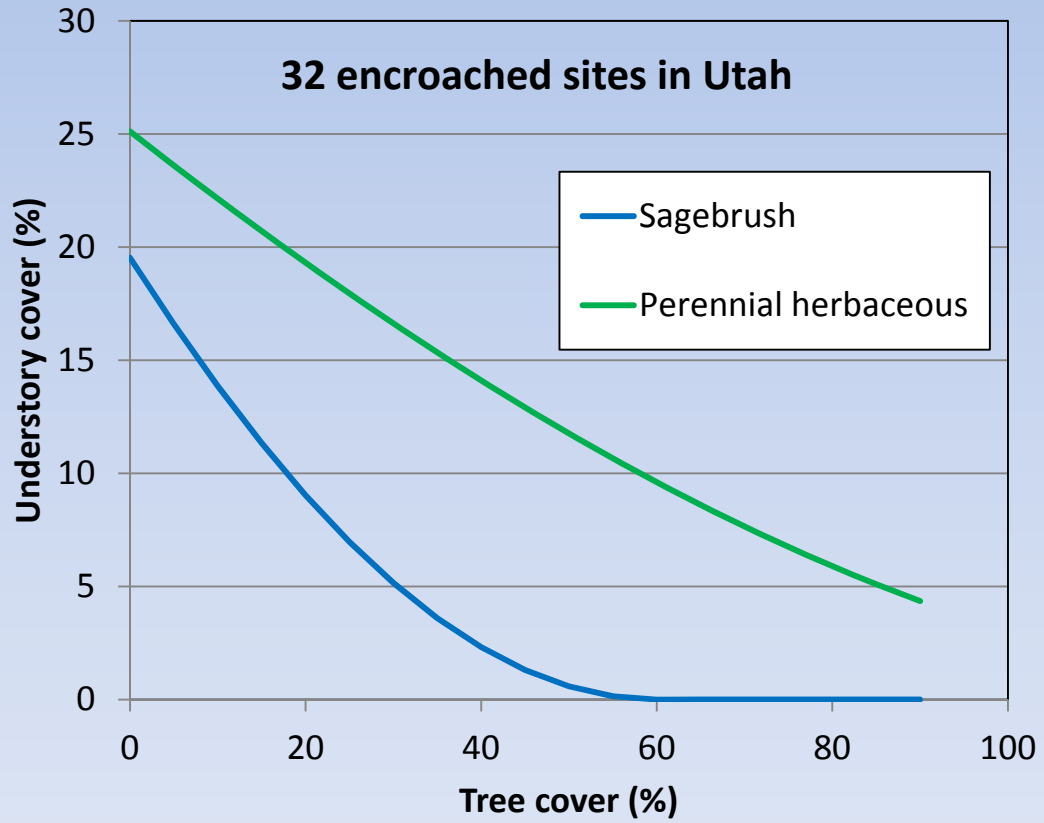
Stansbury Mountains 2004

Big Pole Fire August 2009


The Current State of the Site
Figure 23. Three phases of woodland succession in piñon-juniper woodlands.
(a) Subordinate – Phase I
A subordinate piñon-juniper site with up-slope woodland expansion into mountain big sagebrush.

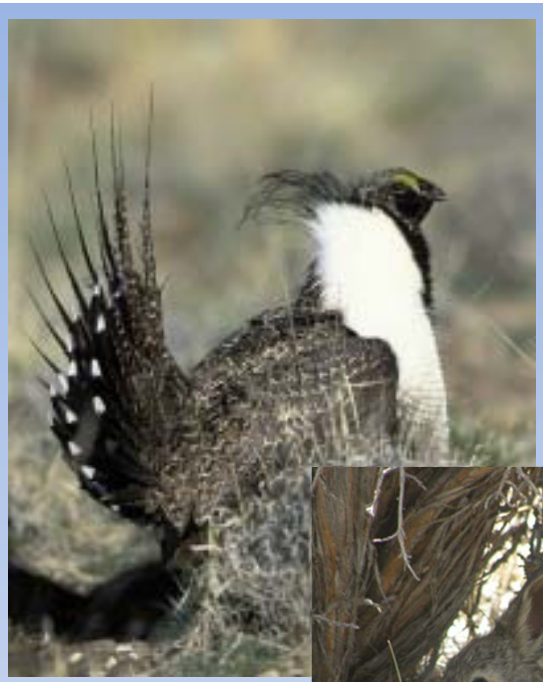

The Current State of the Site
Figure 21. Phase II piñon-juniper expansion woodlands in a mountain big sagebrush community with a high level of structural diversity.


The Current State of the Site
(c) Dominant - Phase III
A dominant pinon-juniper site with Wyoming big sagebrush and moderately deep soils.


32 encroached sites in Utah
Sagebrush
Perennial herbaceous
Understory cover (%)
Tree cover (%)
0
5
10
15
20
25
30
0
20
40
60
80
100

Decreases:

- Biomass
- Cover
- Diversity
- Carbon sequestration
- Wildlife habitat
- Watershed function

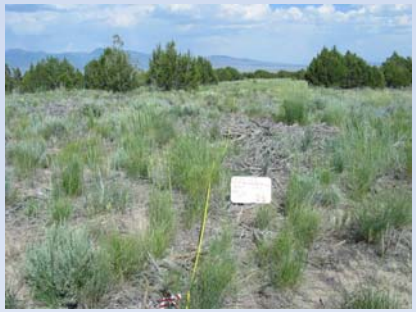


Increases:

- Erosion
- Catastrophic fires
- Weed invasion

Shredding changes fuels, but does shredding:

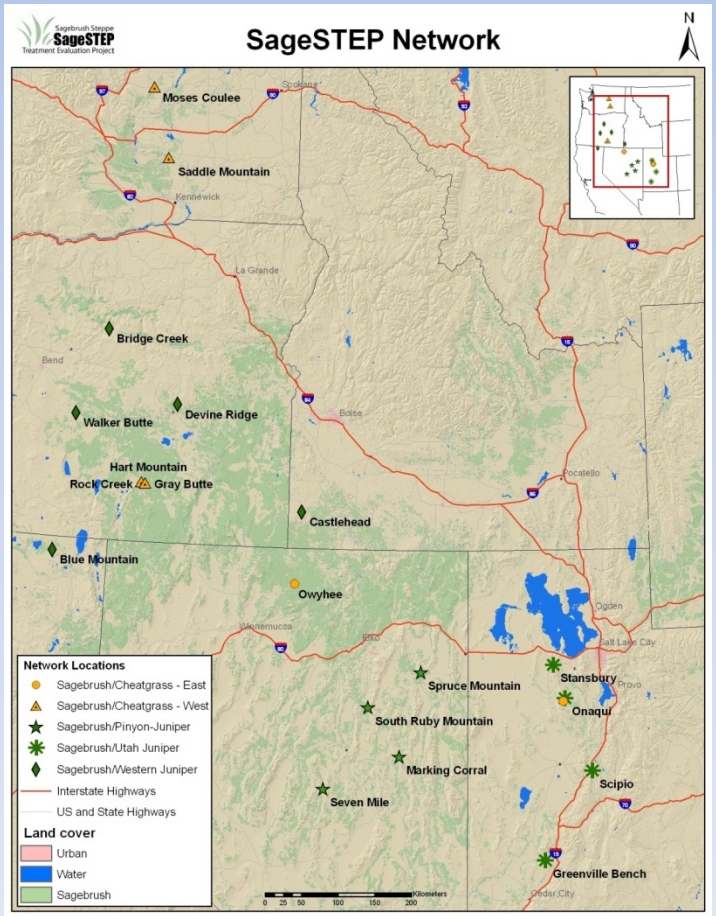
- Need to be done before tree cover gets too high?
- Increase desirable cover?
- Require seeding?
- Increase weed cover?
- Affect soil resources and fertility?
- Affect erosion?

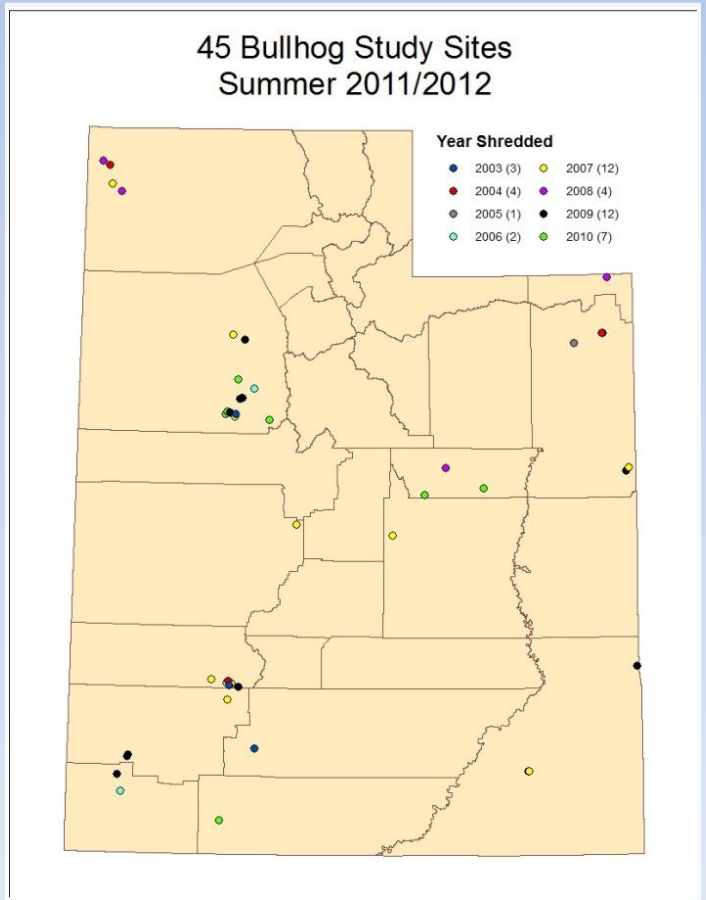


Extensive research

Tree reduction at different infilling phases on:

- Vegetation response
- Soils





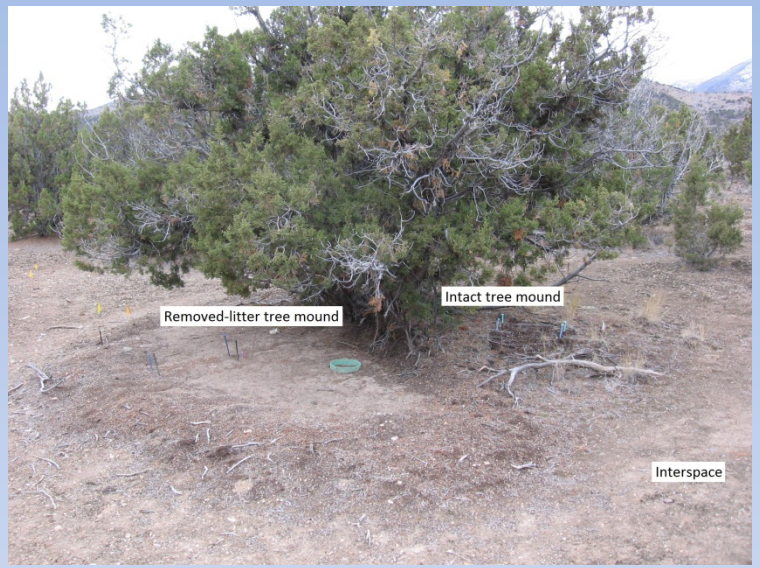
Encroached vs Tree sites

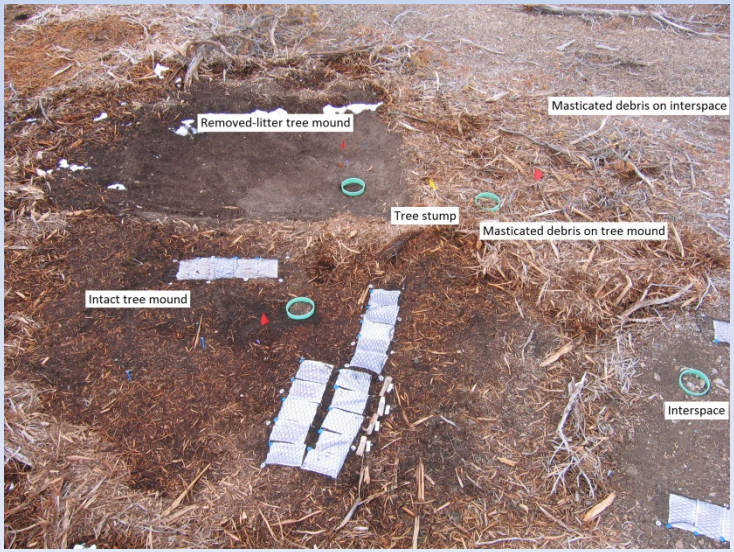
	Encroached	Tree climax
Soil depth	> 0.5 m	< 0.5 m
Coarse fragments	Lower	Higher
Tree age	< 150 years	> 150 years
Romme et al 2009	Wooded shrublands	Persistent woodlands

Mechanistic or microsite research

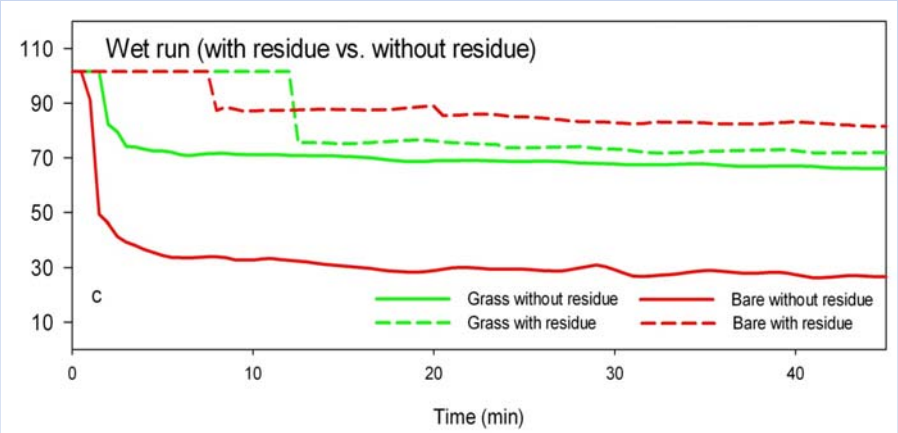
Effects of:
- Tree reduction
- Litter cover
- Shred cover

On:
- Hydrology
- Soil water/temperature
- C, N, nutrients
- Seedling establishment



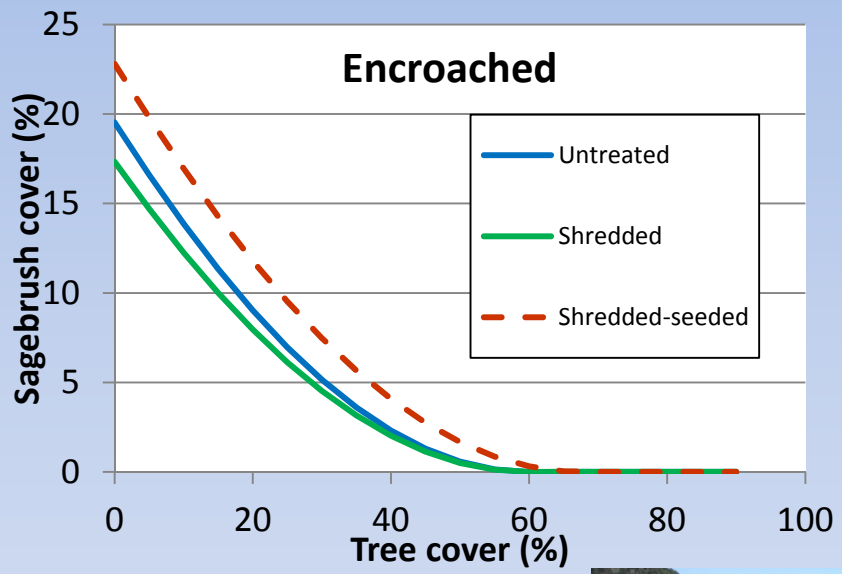


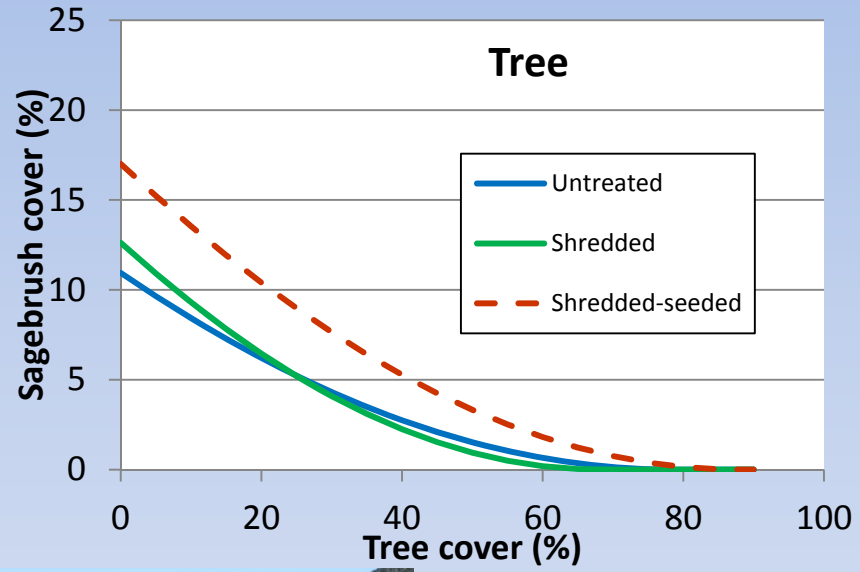
Shredding increases plant and litter soil cover, and….infiltration



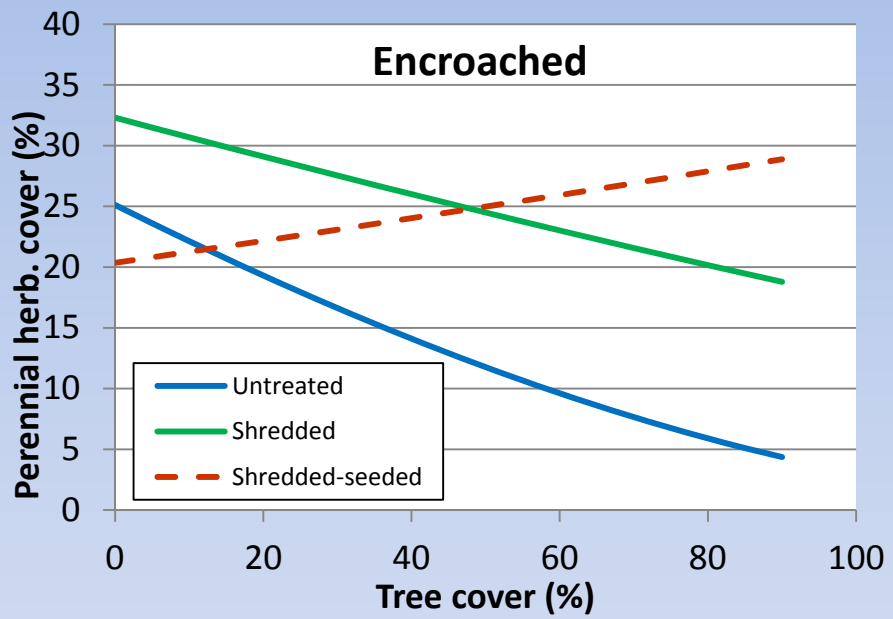
Cline et al. 2010

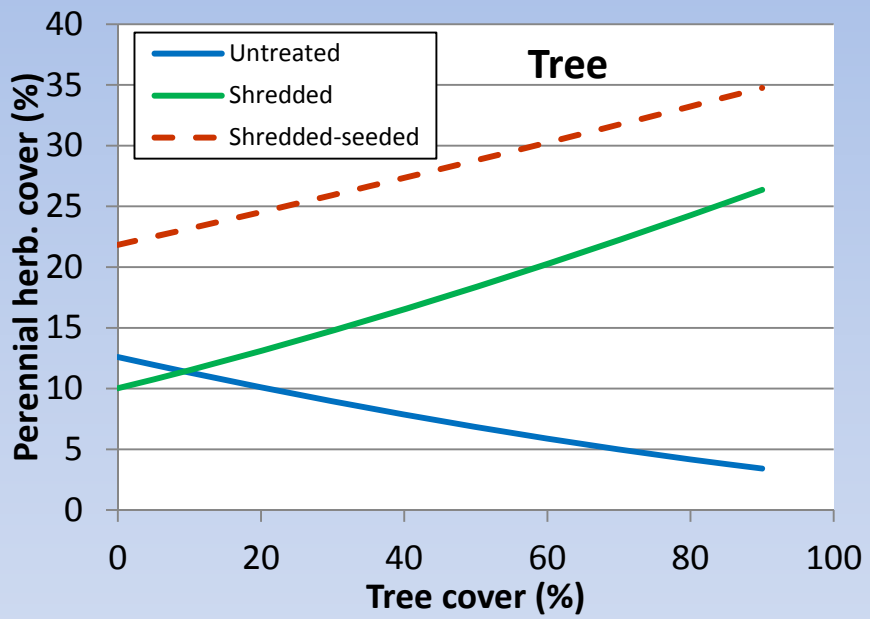
Shredding maintains shrub cover if you don’t wait too long



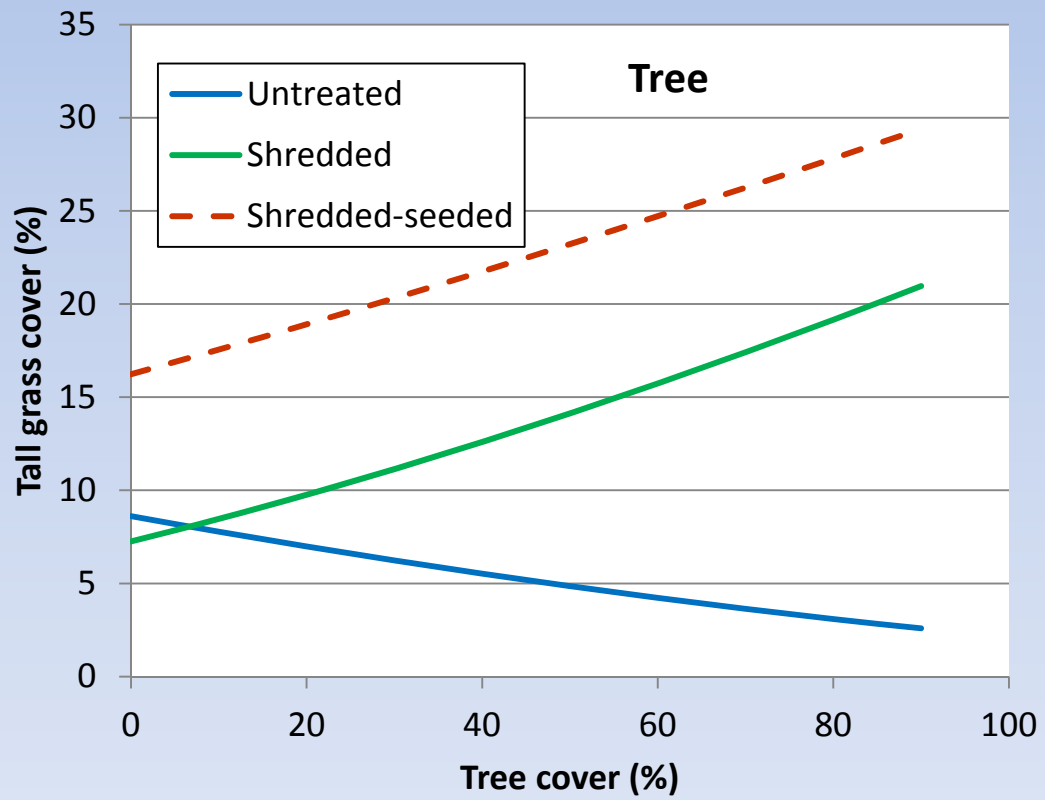


Shredding increases perennial herbaceous cover

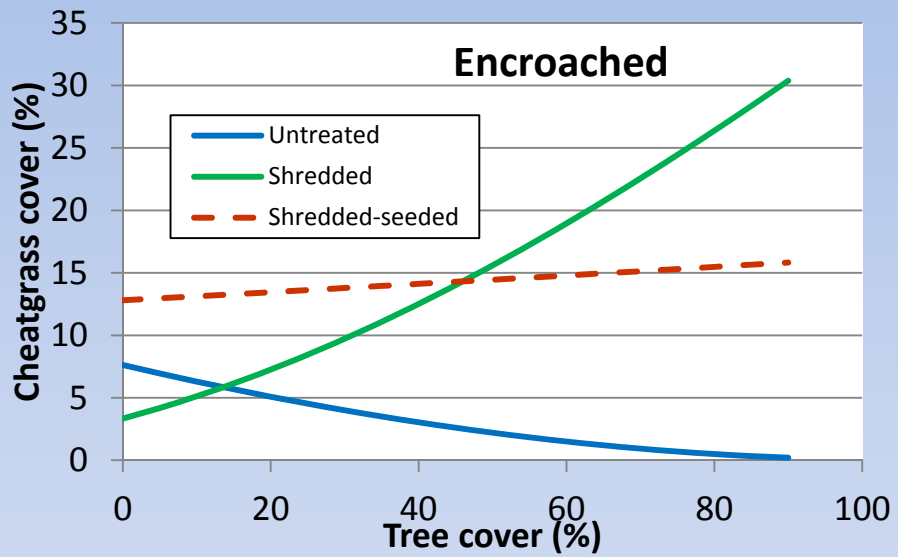


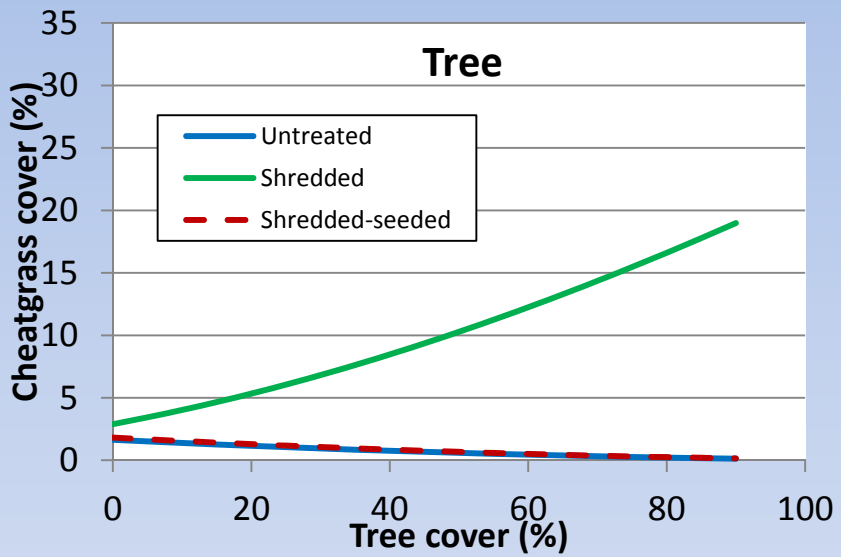


Shredding-seeding increases tall perennial grass cover, especially on tree sites

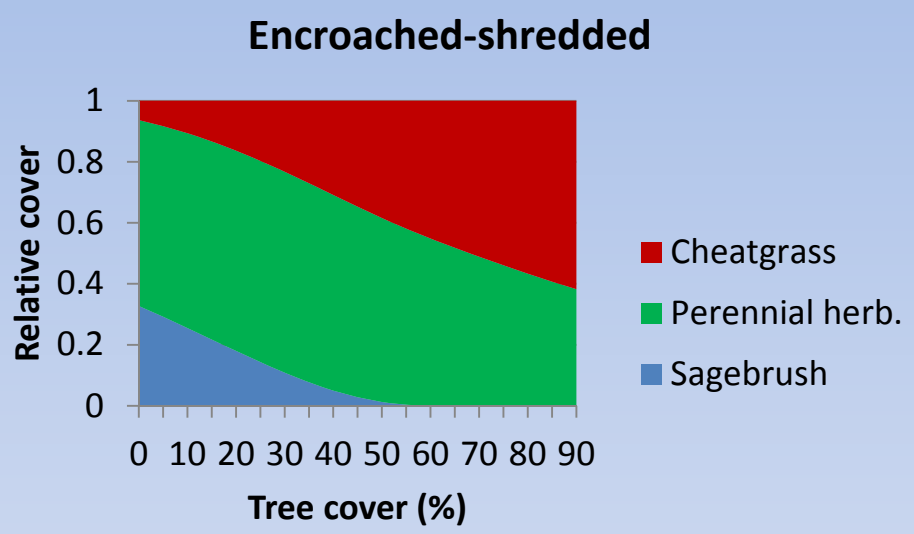


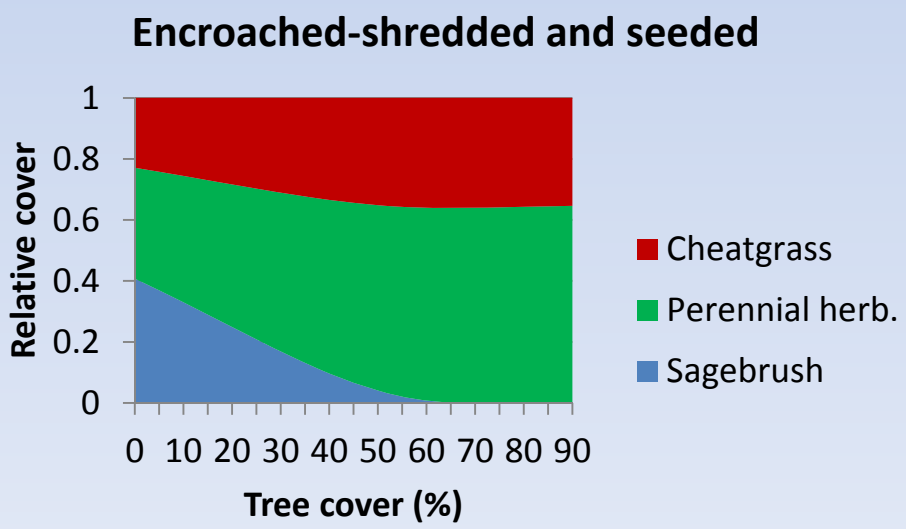
Shredding increases cheatgrass cover; seeding suppresses it



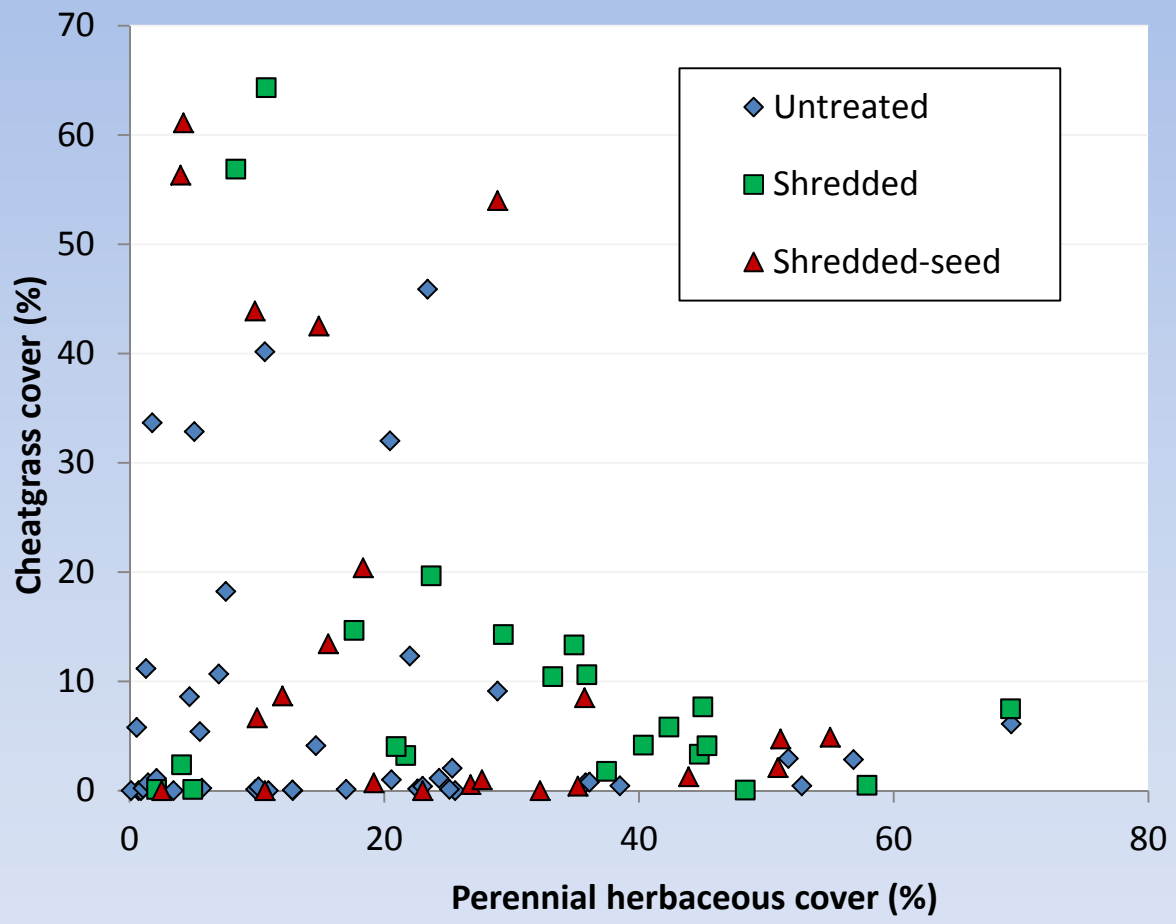


Community response





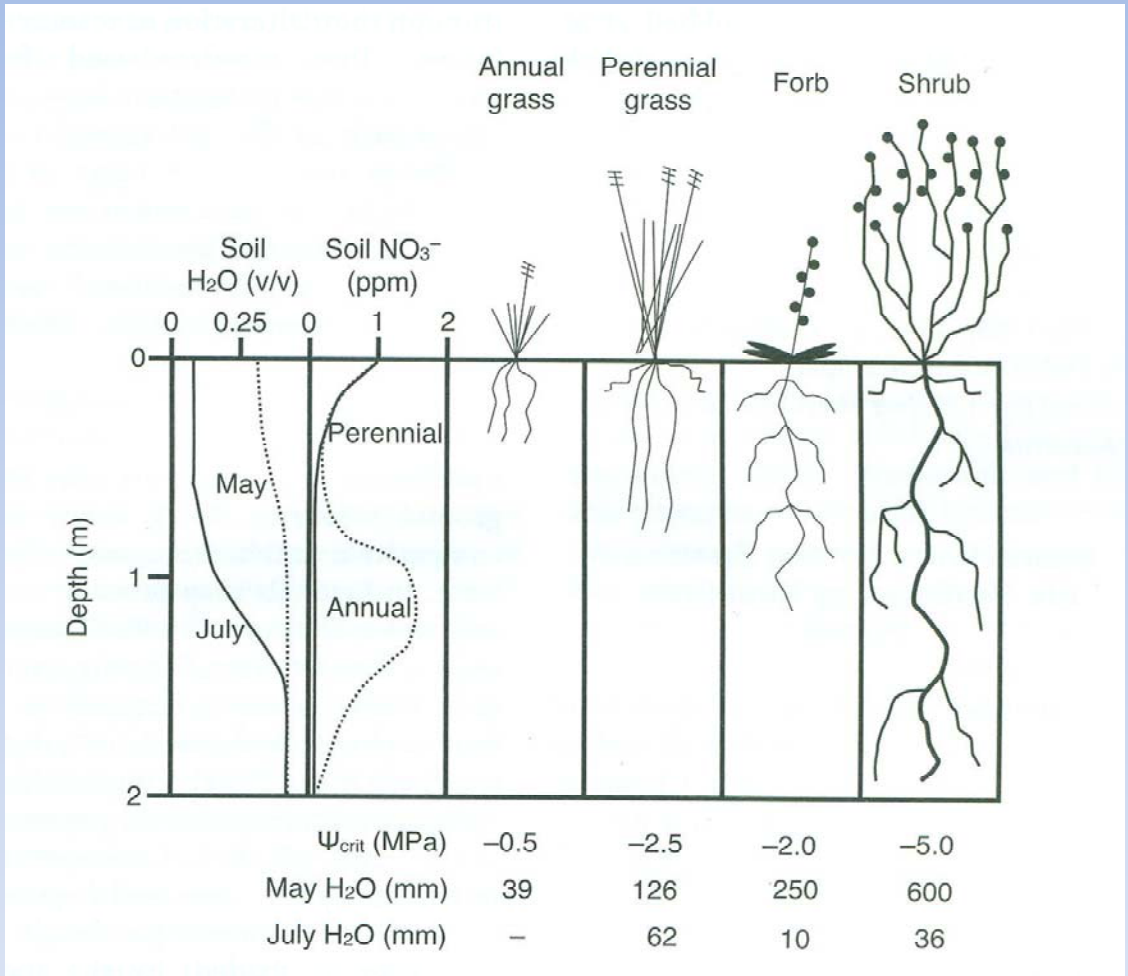
More perennial herbaceous cover=less cheatgrass cover



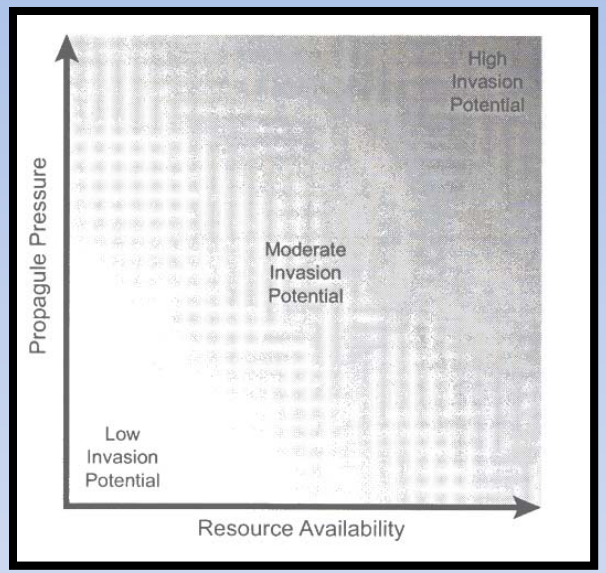
Why these responses?

- Nutrients?
- Microbes?
- Soil water?
- Soil temperature?

Resource growth pool



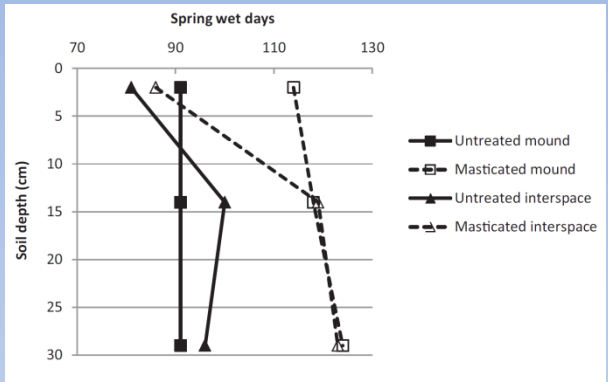
Ryel et al. 2008; Leffler and Ryel 2012



Brooks 2008

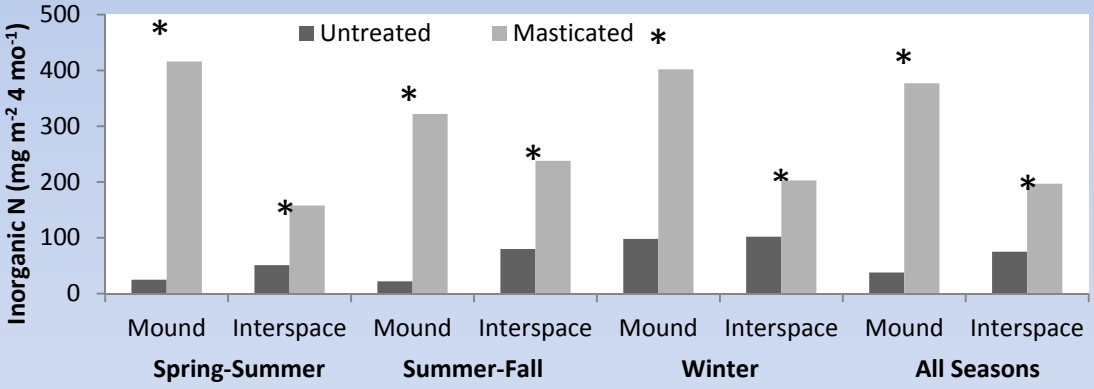
Shredding increased:

- Time of soil water availability and temperatures

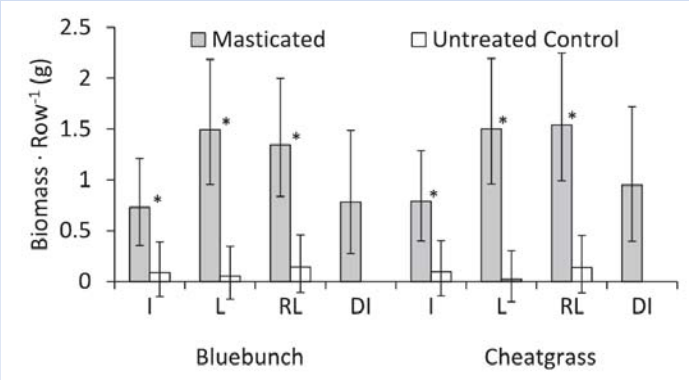


Young et al 2013 FEM

- Inorganic N

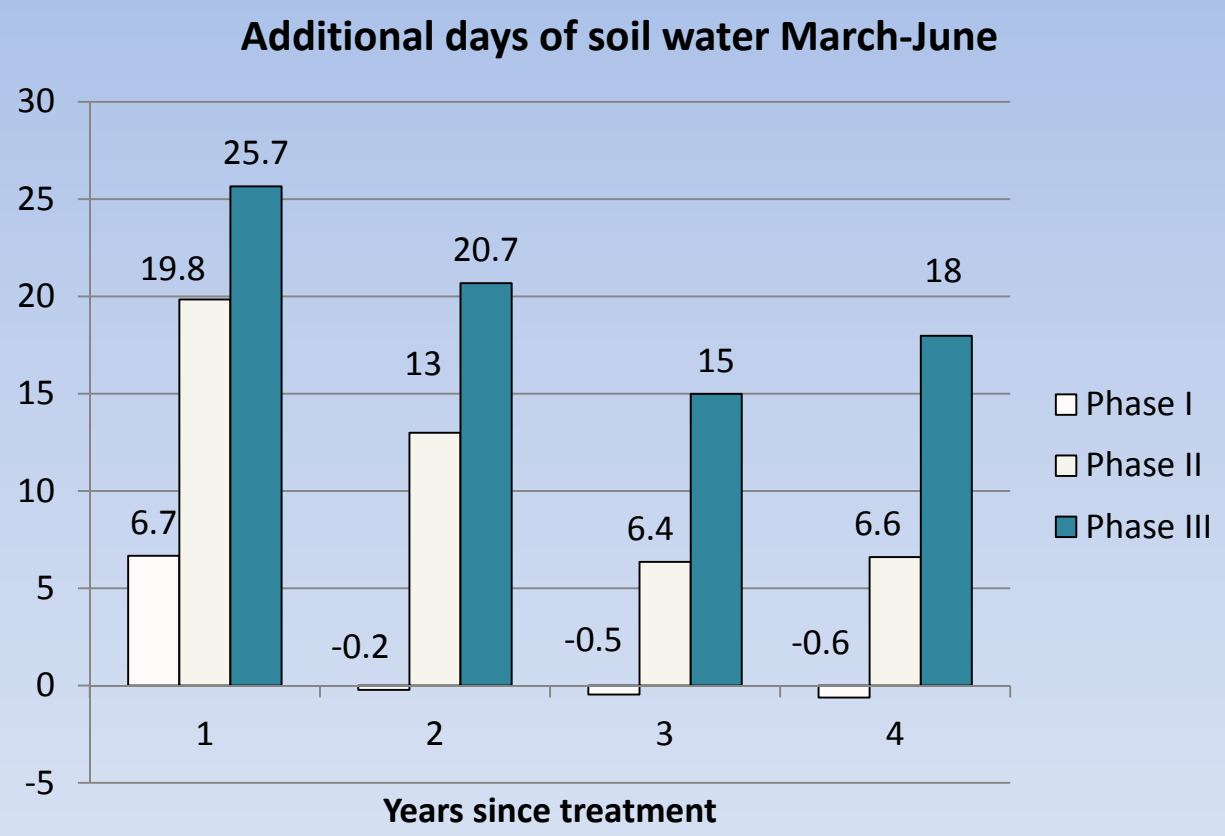


- Seedling biomass



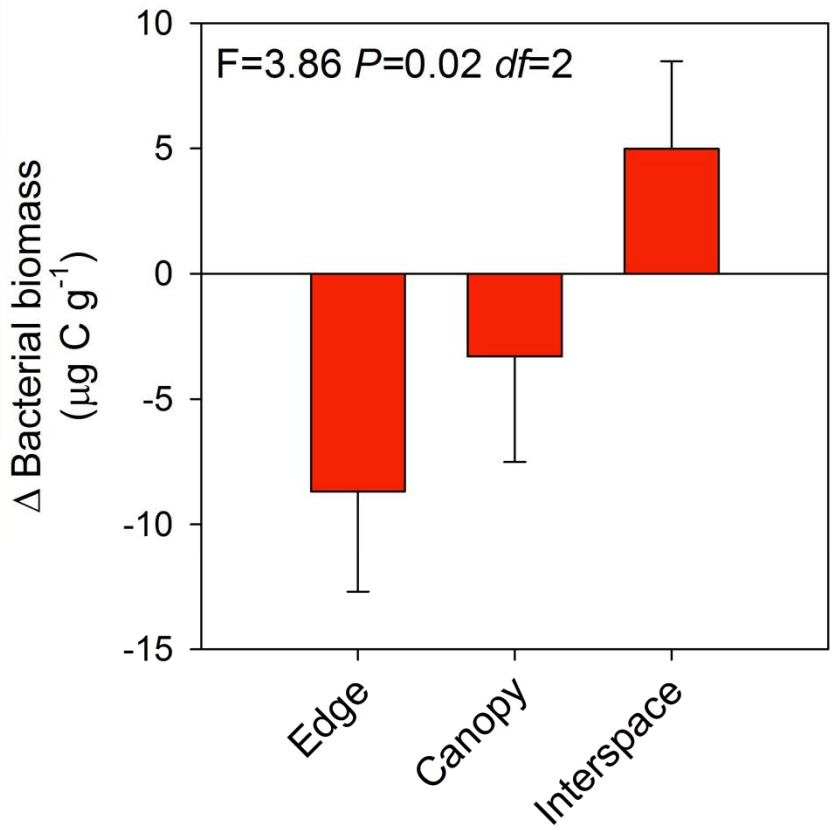
Young et al 2013 REM

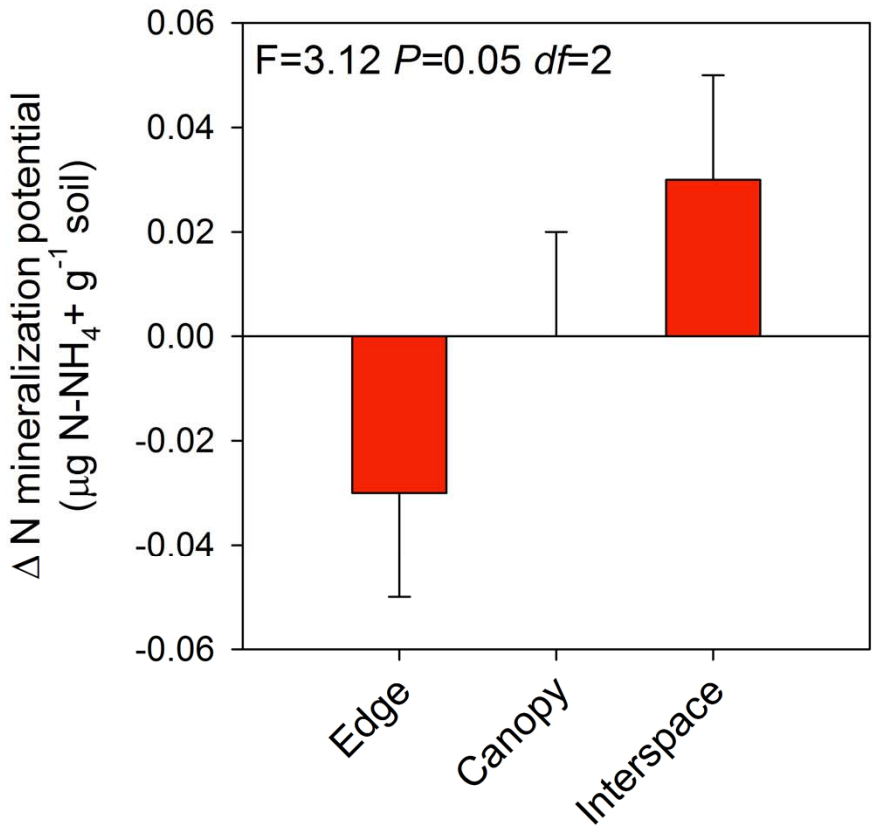
Killing trees increases available soil water most where more initial tree cover



Bacteria in microsites responded differently to shredding

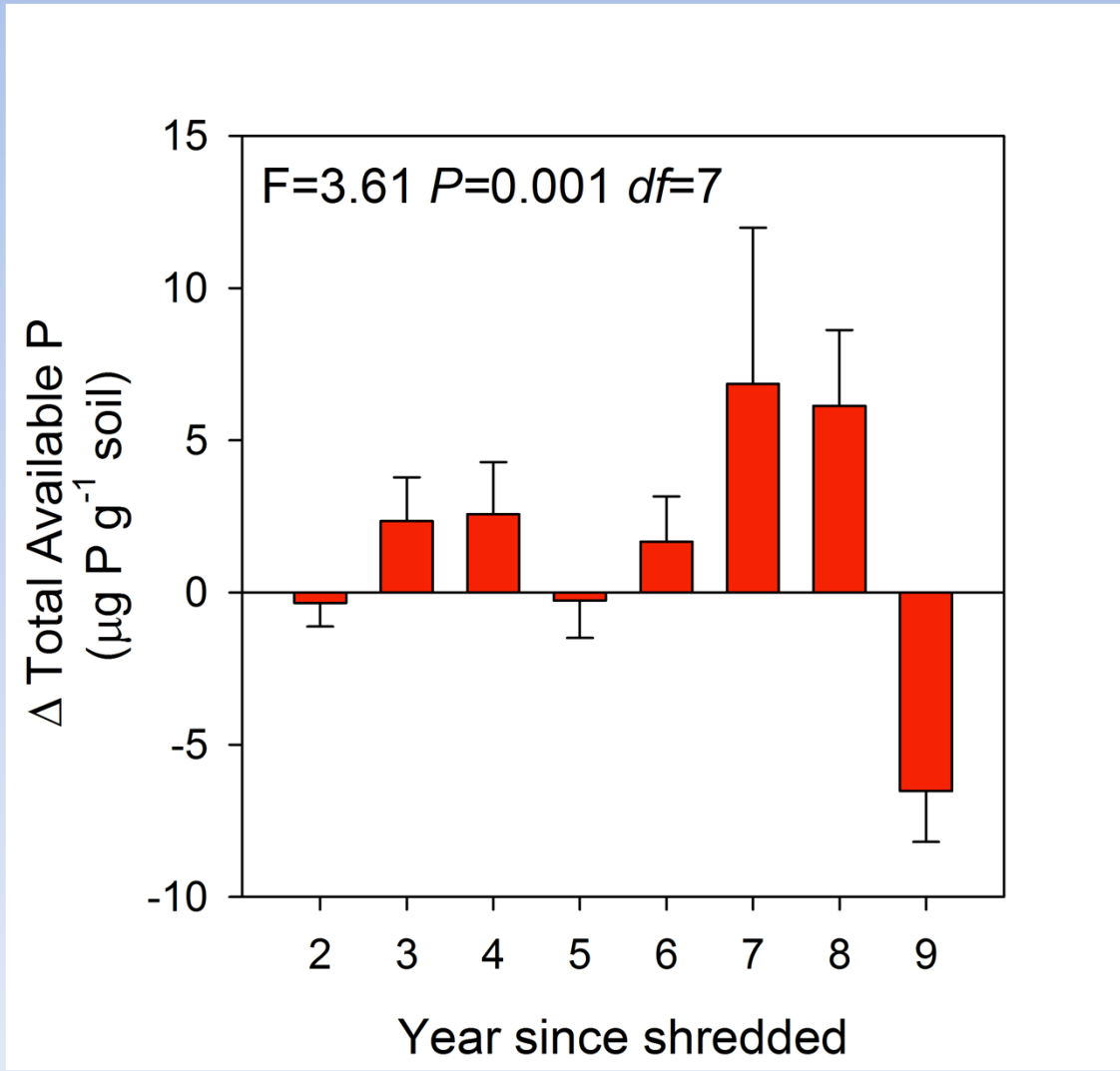
- Bacterial activity and N mineralization stimulated in Interspaces but depressed in Edges
- Activity in Canopy buffered against changes possibly due to layer of duff between soil and shredded material



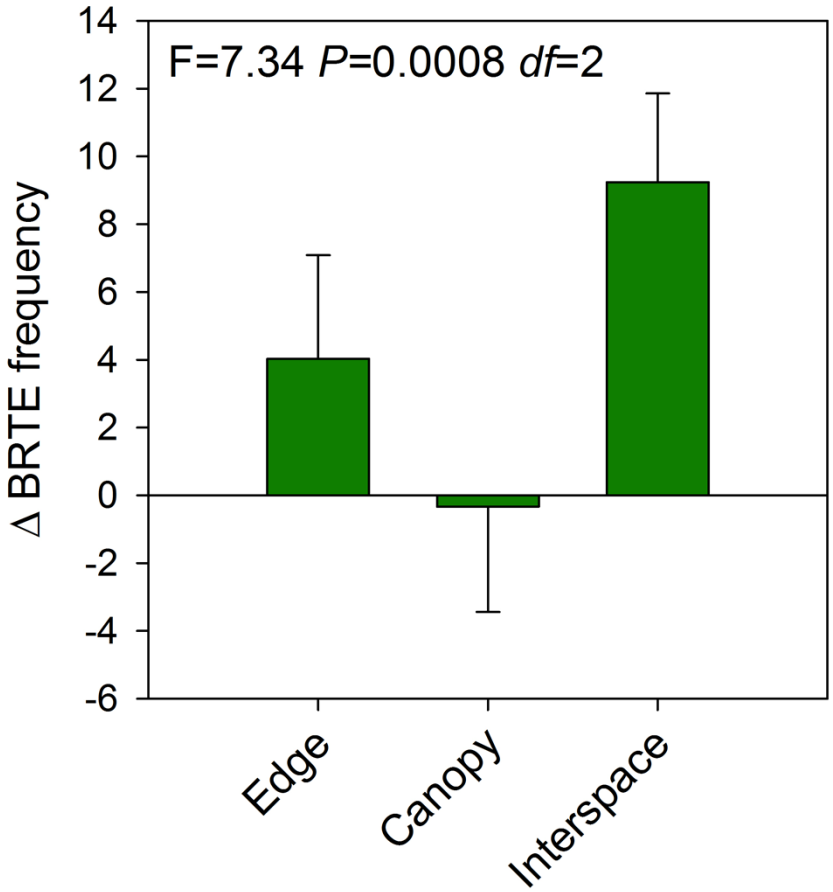


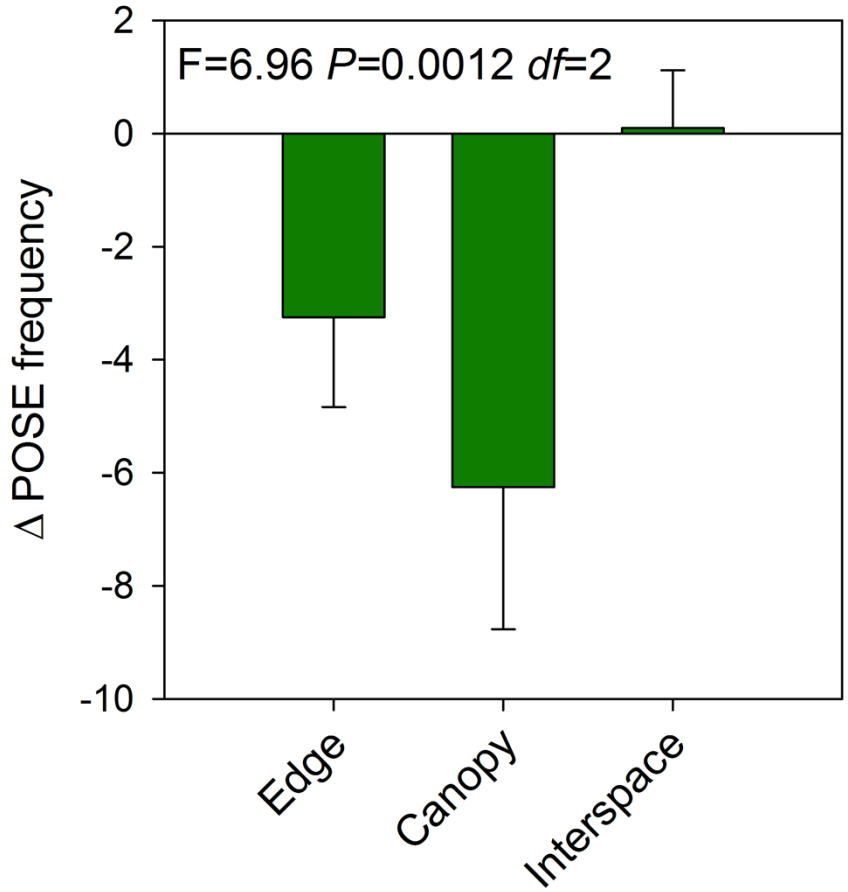
Shredding enhanced P availability in all microsites

- P increased as shredded and duff material decomposed in edge, canopy, and interspace

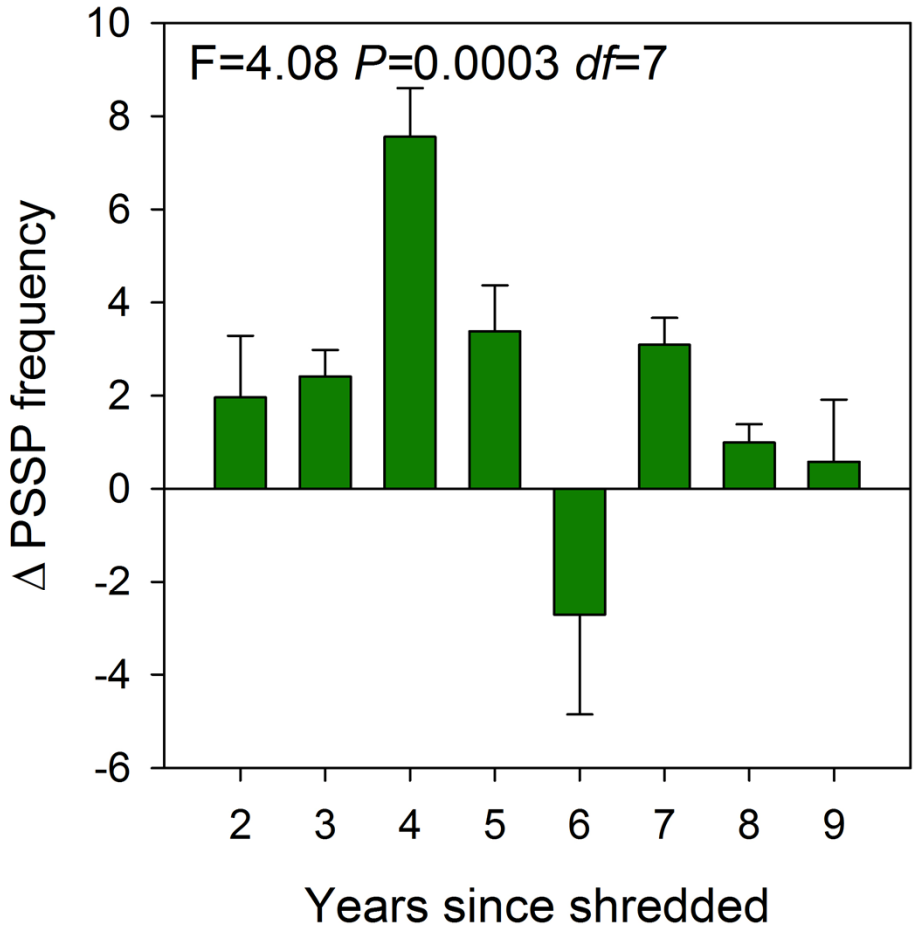


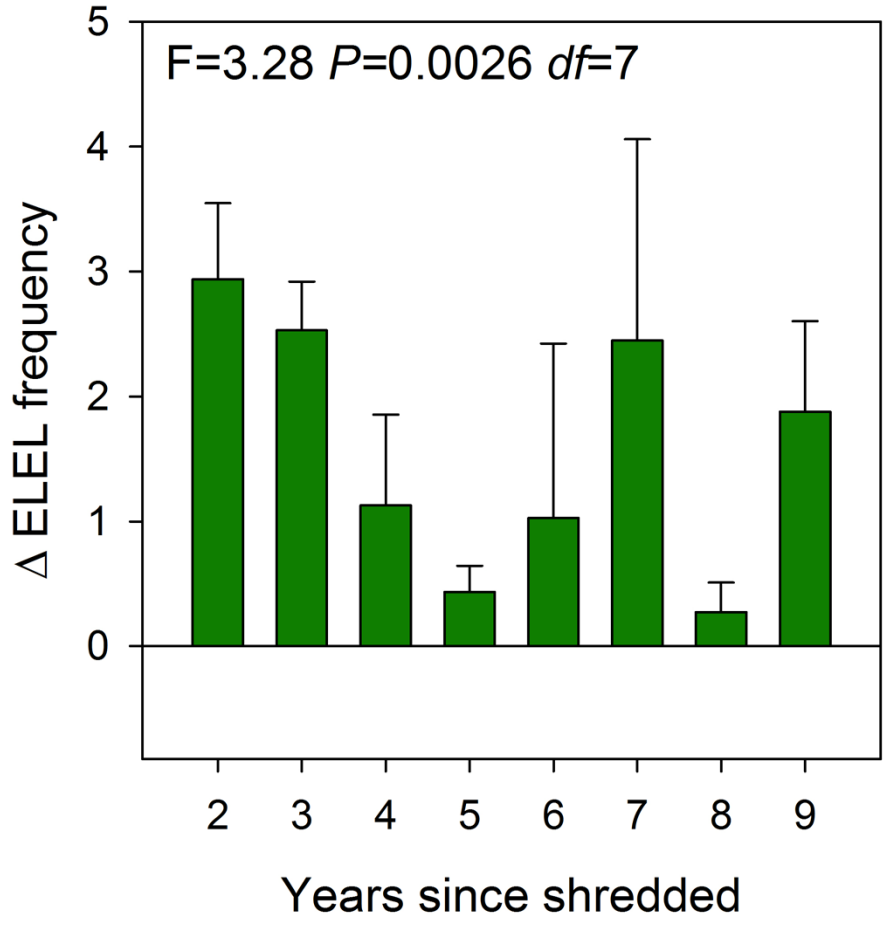
Grasses demonstrated species-specific responses to shredding





Other grasses, *Pseudoroegneria spicata* and *Elymus elymoides*, increased following shredding





Conclusions

- Shredding modifies environment and increases resources
- Shred at low –mid tree cover to maintain shrub/herbaceous community
- Shredding at high tree cover= herbaceous dominance
- Weedy sites should be seeded