Cheatgrass Soil Engineering/Perennial Grass Suppression of Cheatgrass: The Yin and Yang of Plant Competition in Northern Nevada

Cheatgrass modifies soil to favor its growth

Established perennial grasses suppress the growth of cheatgrass

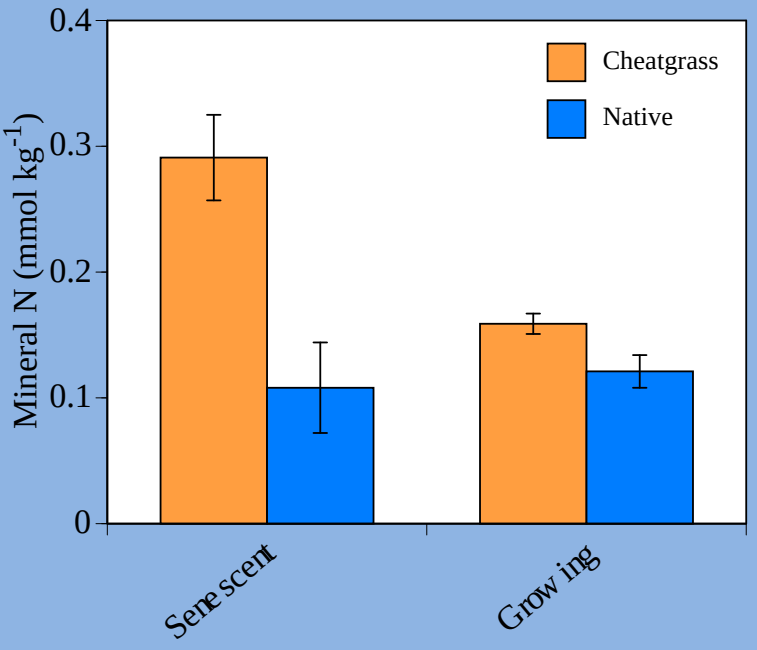
Cheatgrass Soil Engineering – A Case Study

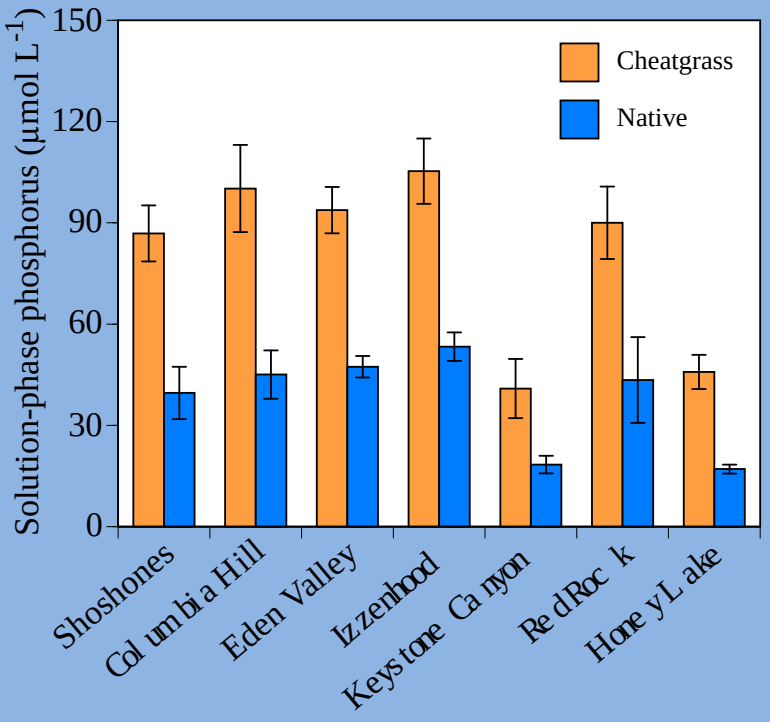
In 1998, cheatgrass began invasion of a winterfat community in the Honey Lake Valley.

In 10 years, the winterfat site had largely converted to cheatgrass dominance. Why? The soil is very infertile and loamy sand in texture.

Soil Engineering or Conditioning: The plant-induced modification of soil chemical, biological, and physical characteristics, whereby growth of the plant is facilitated.

Cheatgrass soil engineering makes nutrients more available than engineering by native vegetation.





Soil Engineering by Cheatgrass

Soil from area invaded by cheatgrass for 10 years.

Soil modified by cheatgrass invasion is a better medium for growth of cheatgrass than soil conditioned by native vegetation. Above-ground plant biomass over 3 times greater. Over 2 times greater root biomass at 10 cm, but similar root biomass at 40 and 80 cm. Significantly greater tissue N.

Soil from adjacent area not yet invaded by cheatgrass.

How Does Cheatgrass Engineer the Soil?

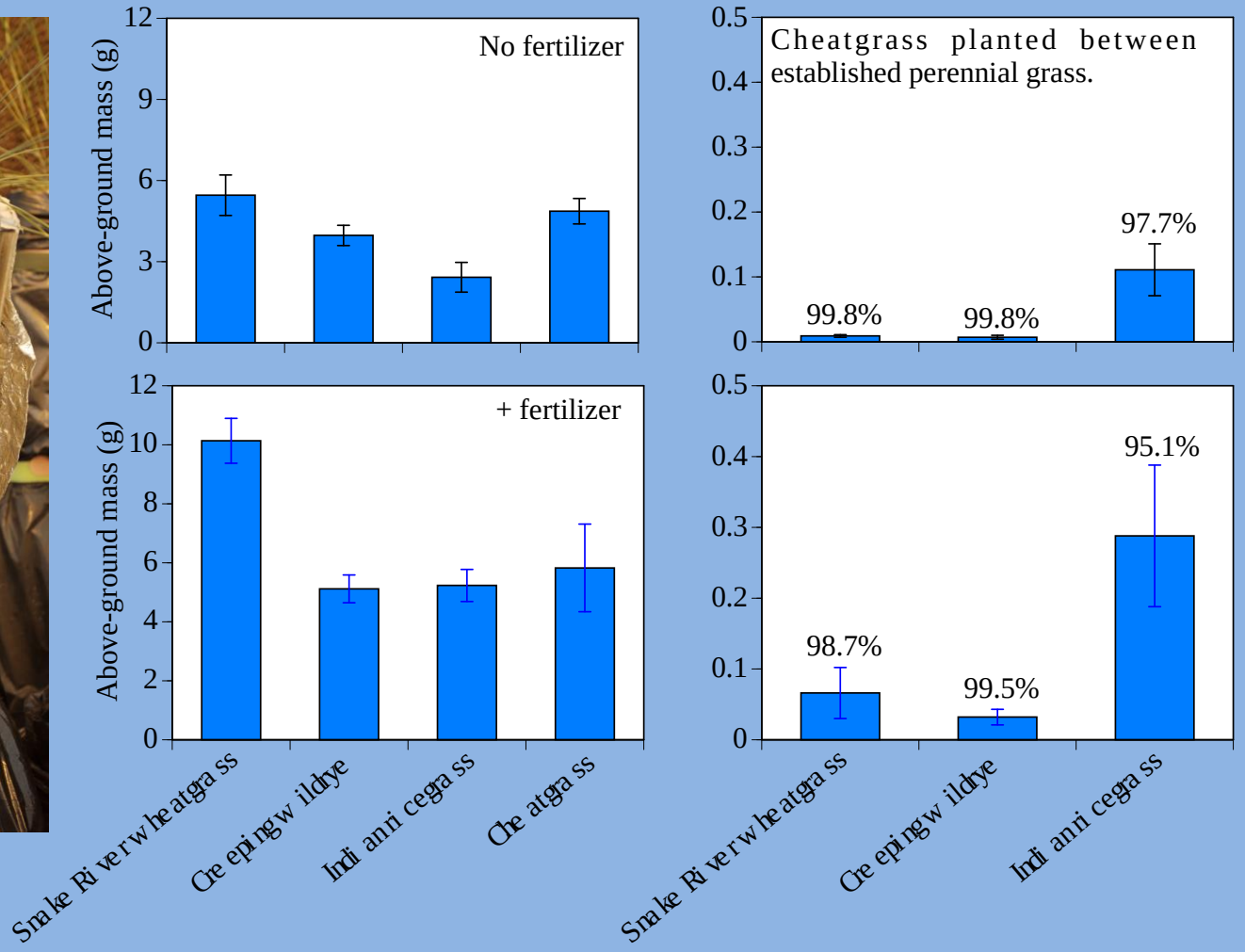
- Cheatgrass roots exude carbon into soil.
- Alters soil microbial community – more fungal dominated and greater microbial biomass.
- Greater enzyme activities of amidohydrolases and phosphatases.

Perennial Grass Suppression of Cheatgrass

Definition: Reduction in plant above-ground growth, root proliferation, plant vigor, reproductive ability, due to the presence of a competing plant.

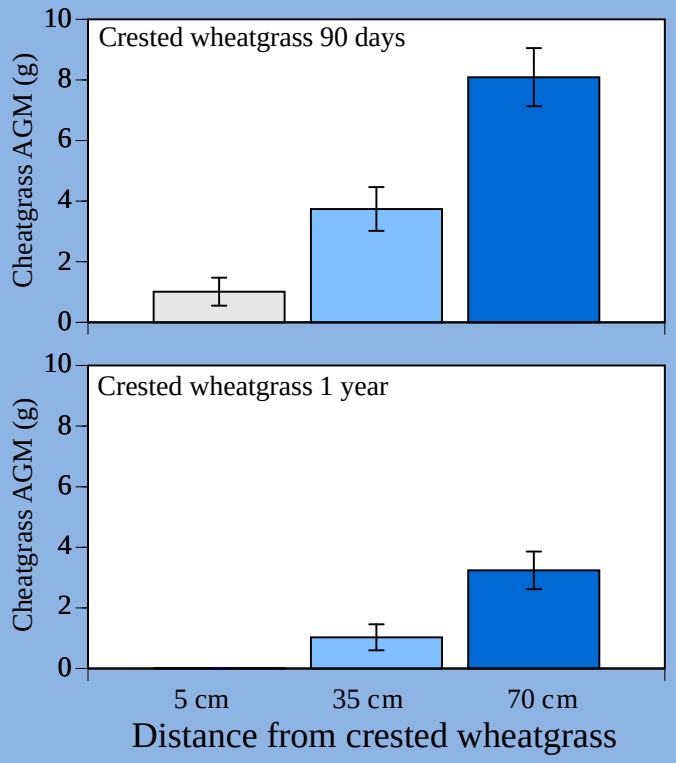
Established perennial grasses suppress cheatgrass.

Perennial Grass Suppression of Cheatgrass

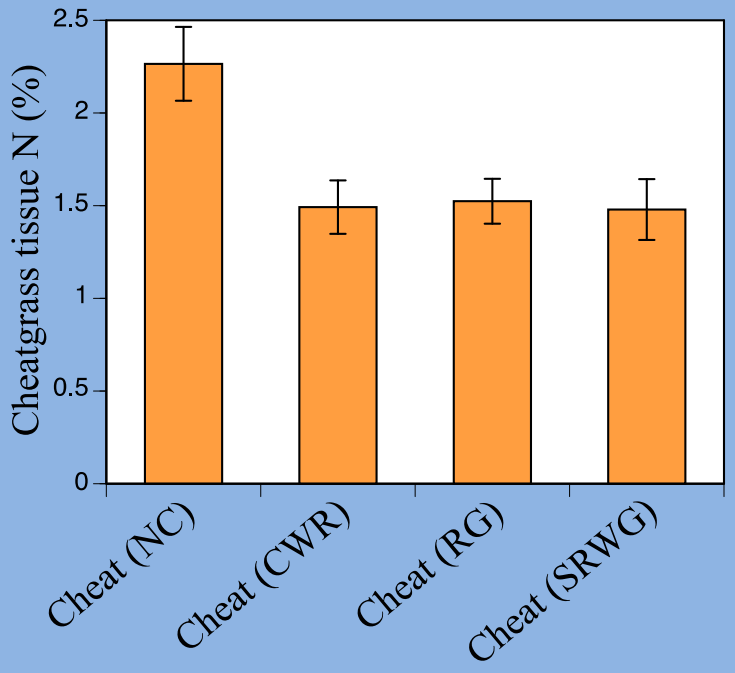


Perennial Grass Suppression of Cheatgrass

Cheatgrass planted 5, 35, and 70 cm from established crested wheatgrass and allowed to grow for 70 days. Experiment 1 – crested wheatgrass established for 90. Experiment 2 – crested wheatgrass established for 1 year.

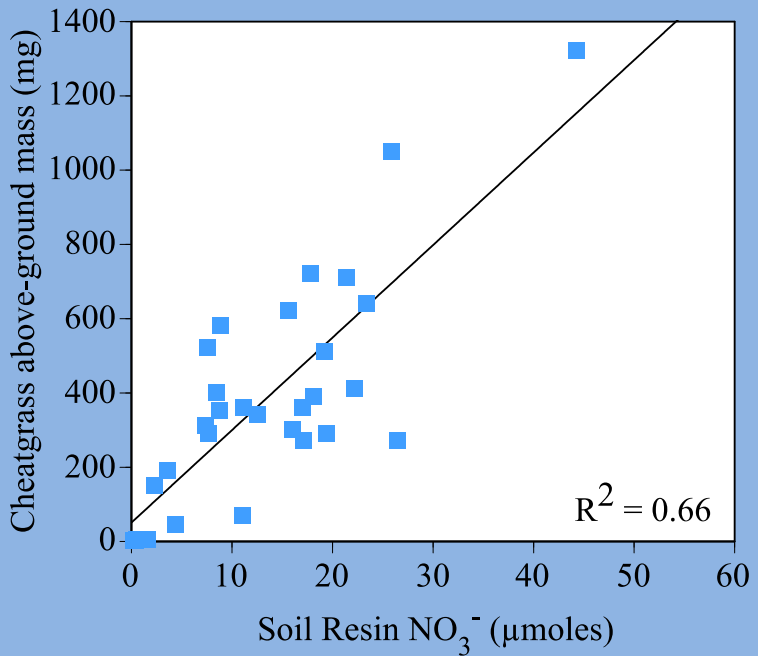


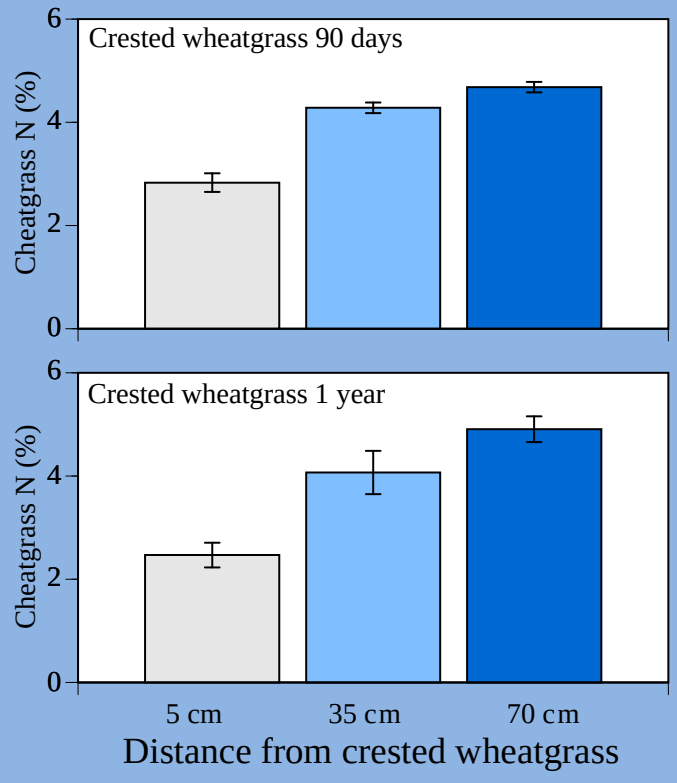
How do Perennial Grasses Suppress Cheatgrass?



Soil Nitrogen Availability

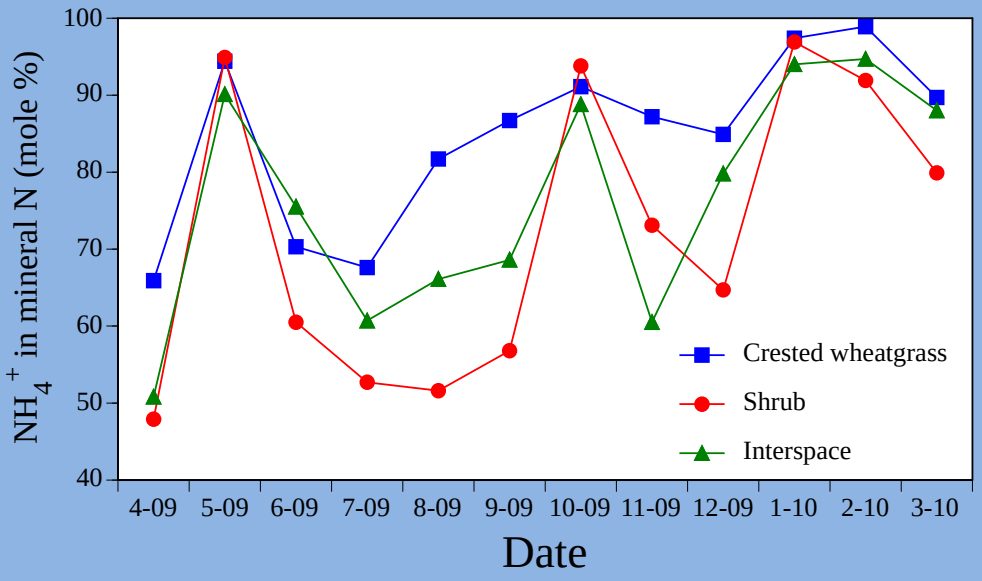
- Cheatgrass grown in competition with established perennial grasses have less tissue N.
- Strong relationships between soil N availability and cheatgrass biomass.





How do Perennial Grasses Suppress Cheatgrass?

Controlling the dominant form of mineral N?

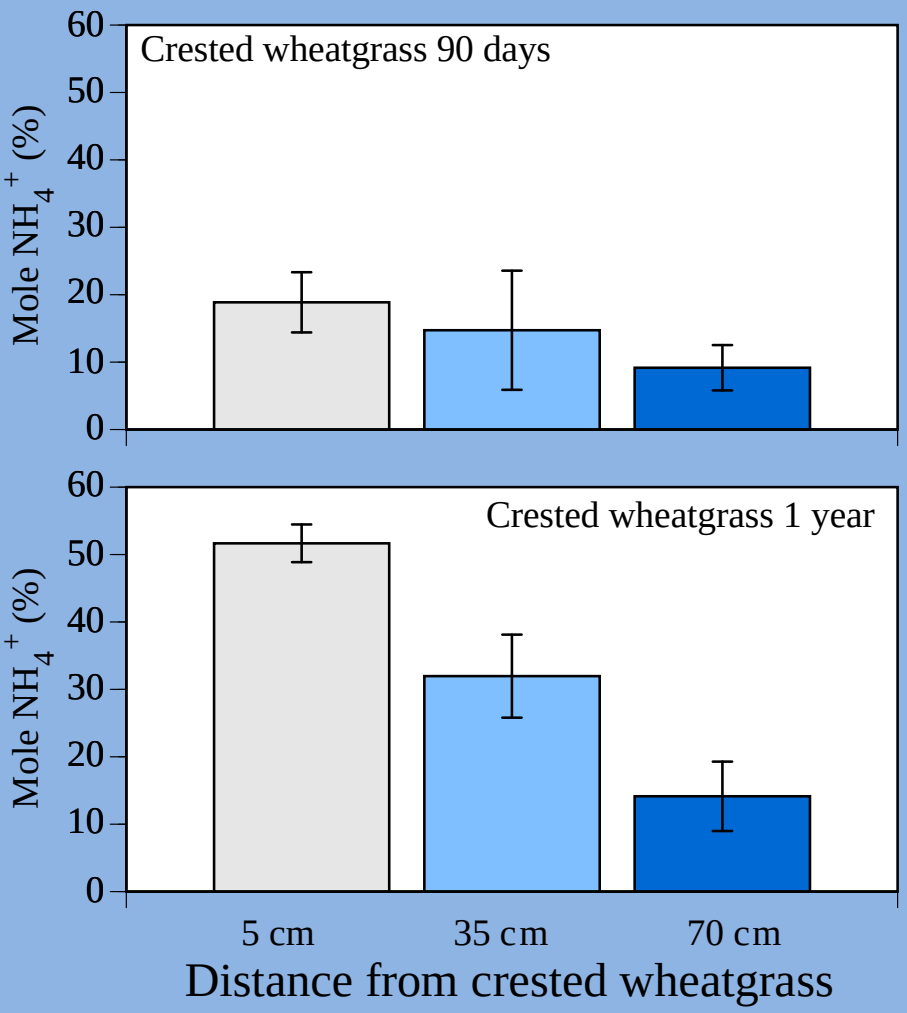


In a long-established crested wheatgrass planting, that effectively suppresses cheatgrass, the dominant form of mineral N was in the NH_4^+-N form

Cheatgrass prefers NO_3^--N

As soil dries, transport of NH_4^+-N to plant root very slow

Controlling the dominant form of mineral N



In our greenhouse study, the longer perennial grass established, the greater molar proportion of NH_4^+-N

Do perennial grasses retard nitrification?

How do Perennial Grasses Suppress Cheatgrass?

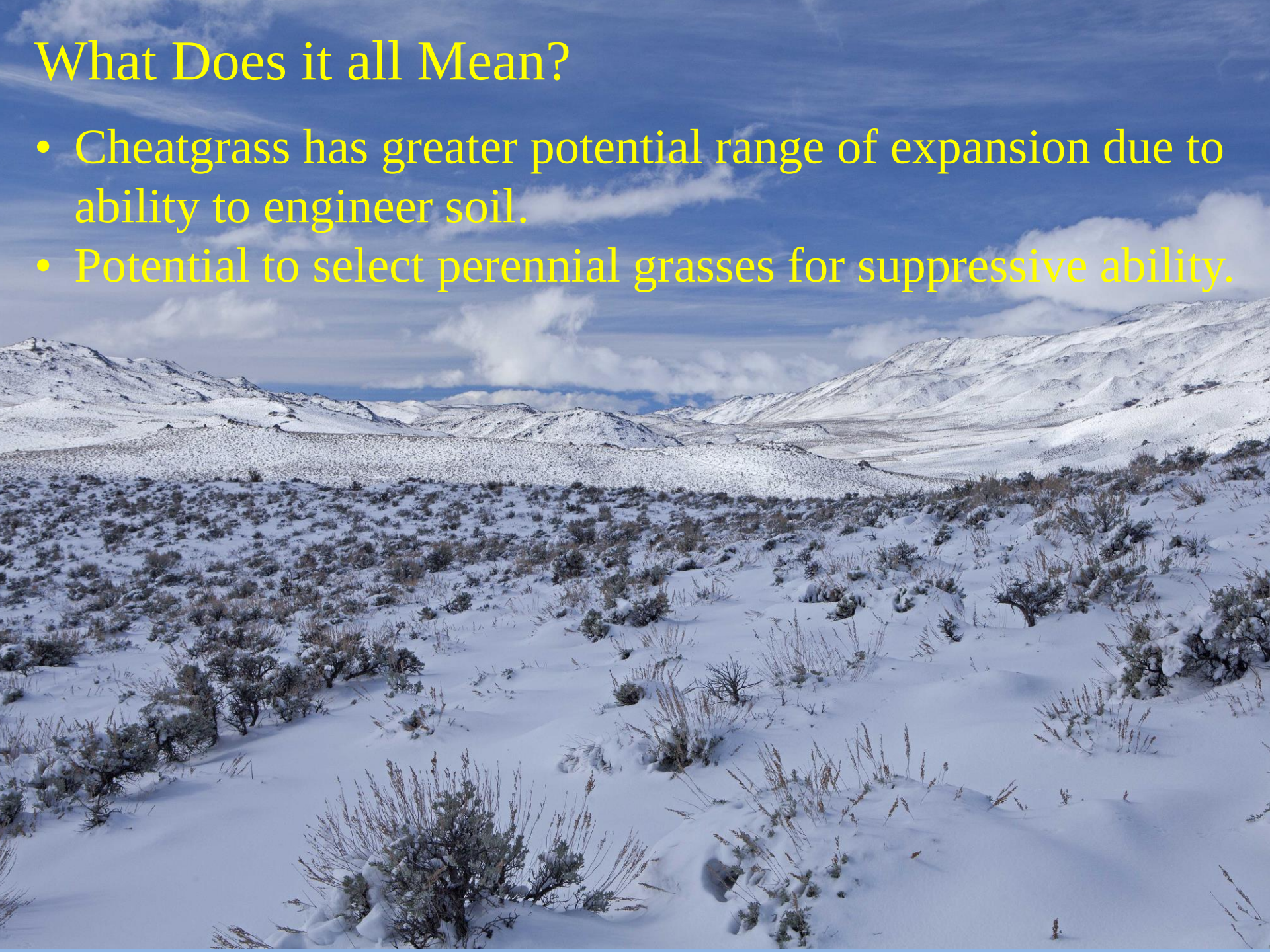
Allelopathy/Biological Soil Space

Suppressed cheatgrass is characterized by lack of lateral rooting and poorly developed root hairs.

- 2(3*H*)-benzoxazolinone exuded from ryegrass inhibits lateral root formation.
- Cheatgrass roots simply cannot enter soil space occupied by roots of crested wheatgrass.

What Does it all Mean?

- Cheatgrass has greater potential range of expansion due to ability to engineer soil.
- Potential to select perennial grasses for suppressive ability.



Questions?