Even the richest soil, if left uncultivated will produce the rankest weeds.
~Leonardo da Vinci

Effects of the Maternal Environment on Cheatgrass Seed Dormancy

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One of the greatest advantages cheatgrass (*Bromus tectorum*) has is building large seed banks (Figure 1). Seed banks can persist during self dominance, post fire, post herbicidal control and even after successful establishment of long lived perennial grasses. The omnipresent seed bank can quickly transform the plant community (Figure 2).

The aim of this research was to document variability in seed dormancy of neighboring cheatgrass populations occupying distinct habitat types.

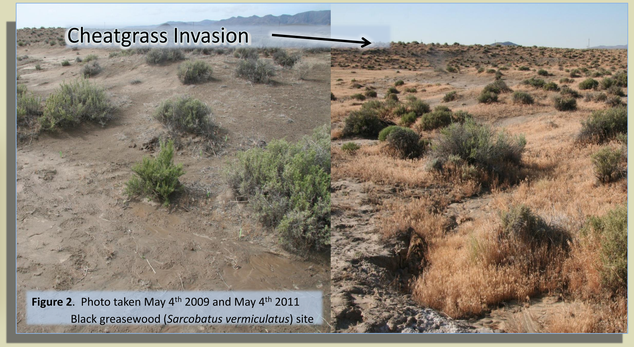
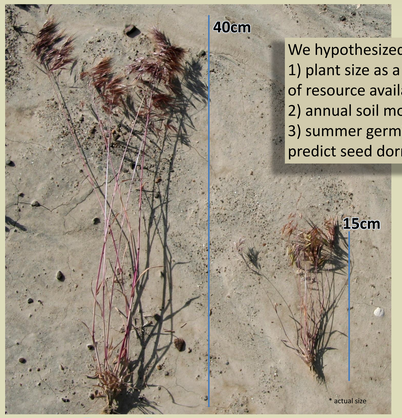


Figure 2. Photo taken May 4th 2009 and May 4th 2011
Black greasewood (*Sarcobatus vermiculatus*) site



We hypothesized that:
1) plant size as a function of resource availability,
2) annual soil moisture, and
3) summer germination can predict seed dormancy.

Bioassay test

(a measure of seed banks)

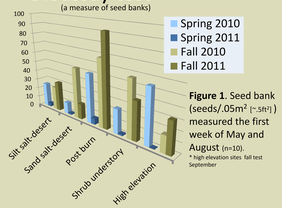
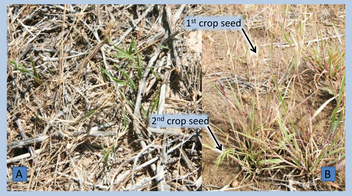


Figure 1. Seed bank (seeds/.05m^2 (~5cm)) measured the first week of May and August (n=10).
* high elevation sites fall test September

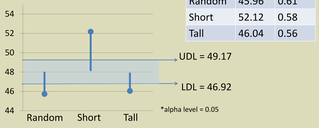
The drastic difference between May 2010 and 2011 seed banks can be explained by a warm wet fall and winter in 2010. Weather facilitated an early (October) and long germination period that extensively depleted the seed bank by May 2011.

3) Summer germination occurred at the silt salt desert sites suggesting a potential indicator of increased seed dormancy.



Black greasewood site June 17th 2009 (A) Summer germination, (B) single plant 2nd crop of seed production

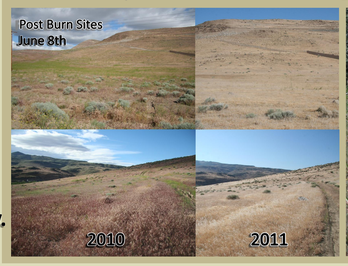
1) Size had a minor effect on dormancy. Small plants exhibited slightly increased seed dormancy.

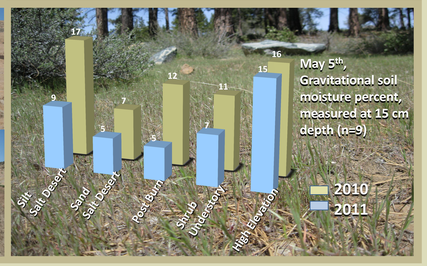


	mean	Std Err
Random	45.96	0.61
Short	52.12	0.58
Tall	46.04	0.56

2) Annual soil moisture as measured by gravitational percent did not predict seed dormancy.

Available soil moisture (bars) calculated by soil properties (matrix, EC) better fits dormancy rankings





Discussion

The results, arid sites have increased seed dormancy, concurs with most previous research.
However, if seed dormancy is an adaptation to avoid summer germination death risk, why are salt desert sites exhibiting summer germination where plants reach maturity and produce seed? Dormancy to avoid summer germination would then be maladaptive. In the end, those who leave the most offspring will succeed.

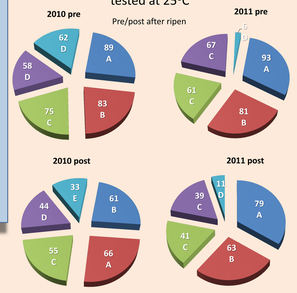
Methods

In 2010 and 2011 we collected random (all-plants), short (<10cm plant), and tall (>30cm plant) parent seed samples at each of 15 sites. Germination was tested pre/post after-ripening (<6 weeks and >16 weeks)(petri dish w/ germination paper in a dark incubator) at 4 temperatures (2°C, 15°C, 25°C and 2/15°C alternating). Each germination test ran 4 weeks.

5,400 parent plants were collected and
216,000 seeds were observed in this study.

Percent Seed dormancy

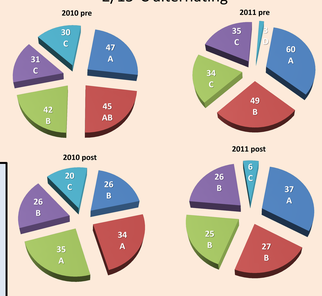
4 weeks
tested at 25°C
Pre/post after ripen



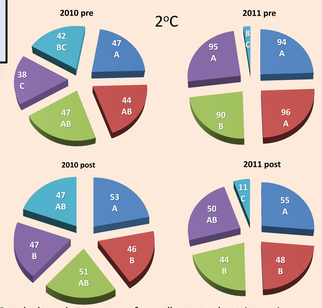
Seed dormancy ranking

[1] Salt Desert, [2] post burn
[3] Wyoming big sagebrush understory and [4] pine forest.

2/15°C alternating



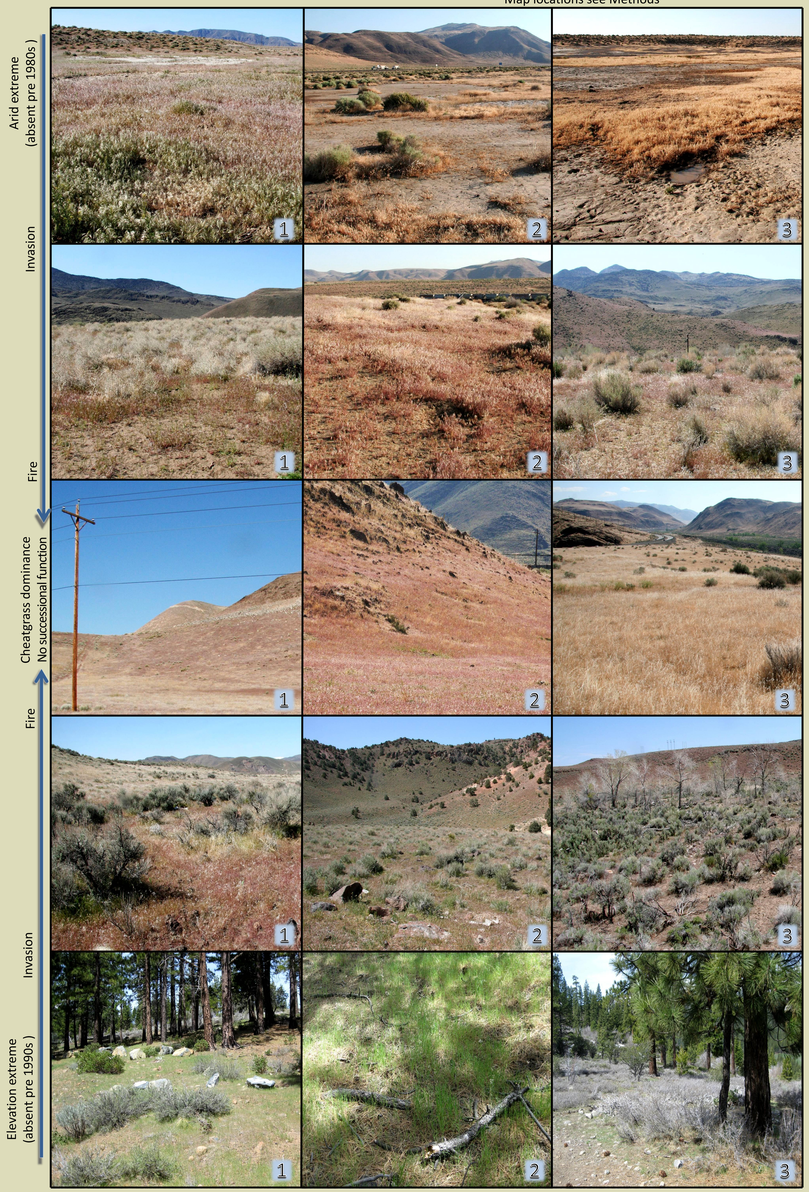
2°C



Results based on averages from all parent plant sizes using Tukey's HSD (n=27). Observed differences were not exhibited by 2nd gen seed produced under equal conditions in a greenhouse.
*Percent rounded to whole number, A-E represent significant differences (p<0.05)

Figure 3. Five habitat types with three replicate sites each.

*Map locations see Methods



Silt salt desert, Sarcobatus dominant, light silt loam (most dormant seed)

Sand salt desert, Atriplex-Psorothamnus dominant, sand

Post burn, Bromus tectorum dominant, gravelly loam

Shrub understory, Artemisia dominant, loam

High elevation, ~1500-1900m Pinus dominant, gravelly sandy loam (least dormant seed)