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Seed bank and existing plant community mismatch: Potential impacts on climate change induced species range shifts

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Background

- Climatic suitability for big sagebrush is predicted to shift under climate change[1]
- Areas of future increasing and decreasing suitability (Figure 1)[1]
- Big sagebrush can only regenerate via seed[2]
- Seed banks can buffer plant communities[3]
- Seed banks can also provide insight into future plant community composition[3]

How does the seed bank composition compare to the existing plant community composition in big sagebrush plant communities adjacent to the leading edge?

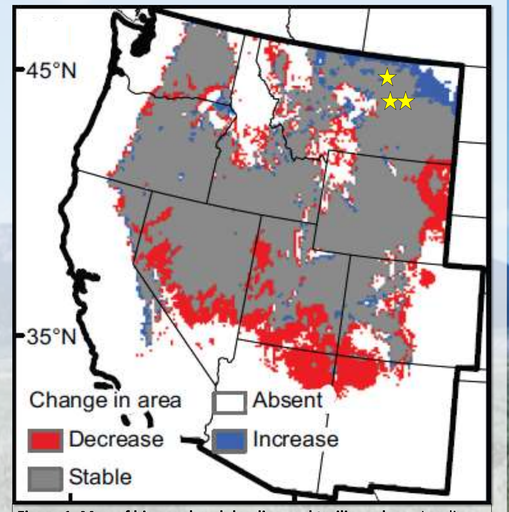
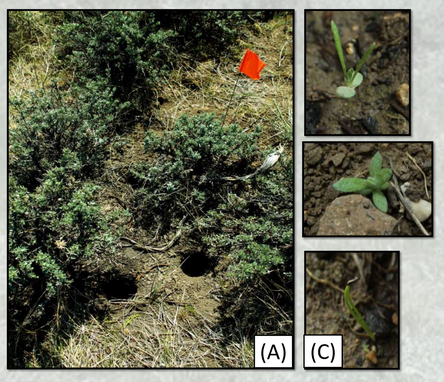


Figure 1. Map of big sagebrush leading and trailing edges. Leading edge is represented in blue, trailing edge is represented in red, and stable areas in grey. Yellow stars are site locations.

Modified from: [1]

Methods

- Sampled at 3 field sites adjacent to the leading edge (Figure 1, yellow stars)



Seed bank

- Cores (6.5cm diameter, 5cm deep)
- 3 cores under shrub canopy & 3 cores in surrounding interspace (1 set) – 30 sets per site (A)
- Transferred to greenhouse for seedling emergence (B)
- Seedlings identified then removed (C)

Plant Community

- 3 – 100m^2 plots at each site
- 30 – 0.10m^2 quadrats (species composition and cover)

Results

Seedling Emergence (Figure 2, grey)

- 65% Annual Forbs
- 15% Annual Grass
- < 2% Sagebrush
- 10% Perennial Grass

Plant Community (Figure 2, white)

- < 2% Annual Forbs
- 5% Annual Grass
- 34% Sagebrush
- 47% Perennial Grass

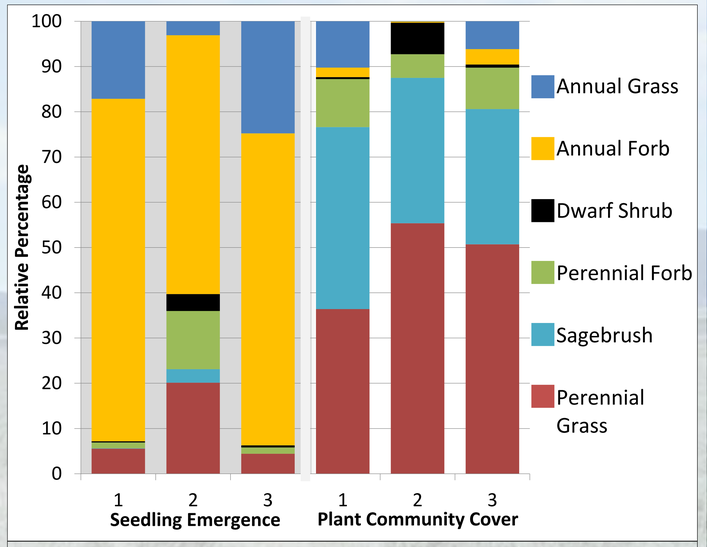


Figure 2. Relative seedling emergence and relative canopy cover across all sites (1-3). Values are the relative contribution of each plant type to the total seed emergence across the sites (the first 3 bars) and total plant community cover (the last 3 bars).

Seedling Emergence

	Site 1	Site 2	Site 3
Site 1	72		
Site 2	47	66	
Site 3	63	41	79

Plant Community

	Site 1	Site 2	Site 3
Site 1	78		
Site 2	64	71	
Site 3	73	64	78

Seedling Emergence vs. Plant Community

	Site 1 Seed	Site 2 Seed	Site 3 Seed
Site 1 Cover	17		
Site 2 Cover		29	
Site 3 Cover			13

Similarity

- 50% - Seedling emergence across sites
- 67% - Plant community across sites
- 20% - Seedling emergence vs. Plant community within the same site

Conclusions & Implications

- Over-representation of annual species in seed bank compared to plant community
- Under-representation of big sagebrush in seed bank compared to plant community
- Less than 30% similarity between seed bank and plant community composition
- The dominant species in these big sagebrush communities have a transient seed bank

Even though we expect an increase in habitat suitability for big sagebrush under future climate conditions at sampled locations, the current mismatch between plant community and the seed bank could impede big sagebrush range expansion into increasingly suitable habitat in the future.

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