The Crooked River National Grassland Westside Wildland Urban Interface Fuel Reduction Project

Effect of Juniper Cutting and Seeding on Vegetation

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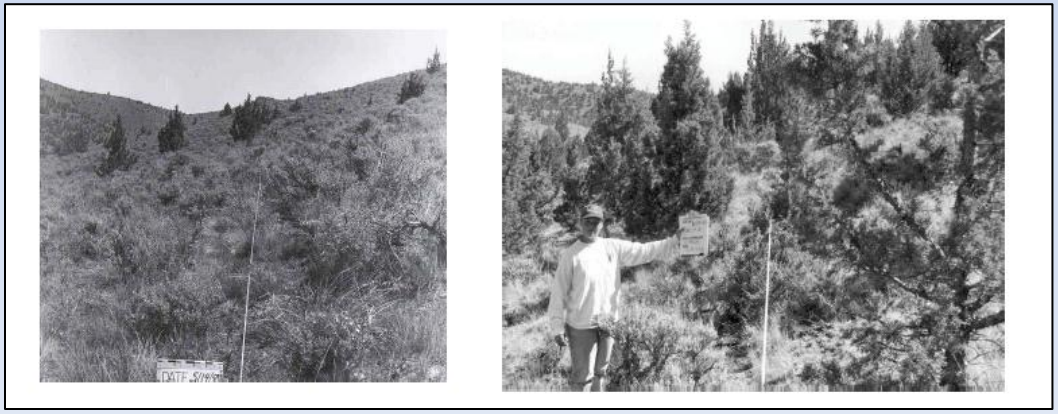
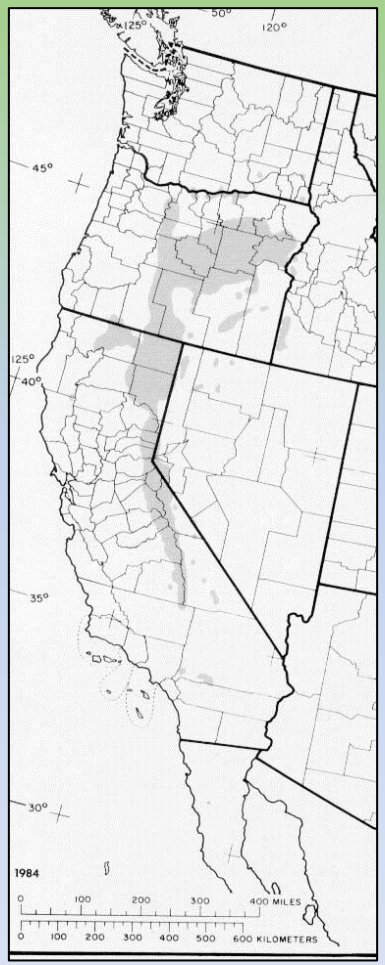
Research Supporting Sound Decisions

Introduction

- **Western juniper (JUOC) woodlands range expansion over the past 130 years**
- **Concern: loss of sagebrush and grassland habitat, other ecosystem changes**
- **Management focused on reducing tree densities, sustaining and promoting shrub and grassland species**
- **Active management such as cutting used since the 1960s**





Distribution of western juniper (*Juniperus occidentalis*)

Introduction

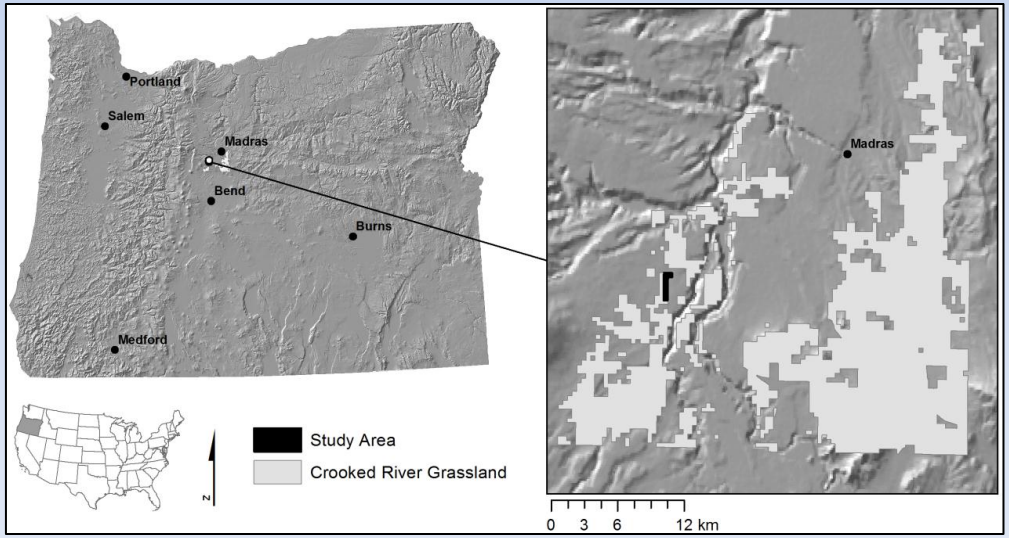
- **Western juniper woodlands also invaded by several noxious exotic annual grasses**
  - **Cheatgrass (*Bromus tectorum*)**
  - **Medusahead (*Taeniatherum caput-medusae*)**
  - **North Africa grass (*Ventenata dubia*)**

Introduction

- **Restoration and fuel reduction are challenging in invaded woodlands**
- **Can native seeding be used to suppress exotic weeds and assist with succession after juniper cutting?**
  - **We proposed a test of two experimental seeding treatments after fuel reduction activities to enhance native plant diversity and community resilience**

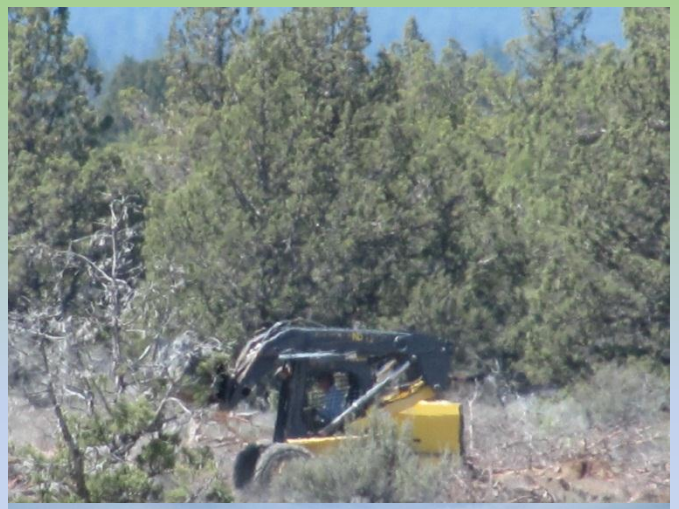
Crooked River National Grassland Westside Wildland Urban Interface Fuel Reduction Project

- The 720-acre project is located along the convergence of the Deschutes, Crooked, and Metolius Rivers on the Crooked River National Grassland (CRNG) managed by the US Forest Service
- Mean elevation about 820 m; precip about 21.5 cm
- The project was designed to
  - Reduce fuels and protect adjacent homes, and
  - Improve wildlife habitat and move the vegetation towards a more historical community composition

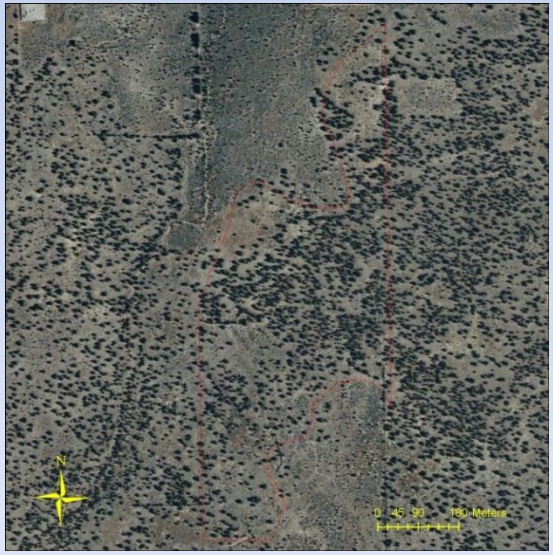


Crooked River National Grassland Project

- Fuel reduction consisted of chainsaw cutting all young or postsettlement western juniper
- Old-growth juniper trees not cut
- Slash was removed by skid-steer and/or hand piled (2-m diameter) and burned after overwintering



Pretreatment Vegetation



- Western juniper/mountain big sagebrush/Thurber's needlegrass
- Other species: antelope bitterbrush, yellow rabbitbrush, Sandberg bluegrass, bluebunch wheatgrass, and Idaho fescue
- Cover dominated by native species, large perennial bunchgrasses, Sandberg bluegrass, native annuals
  - Exotic grasses cover only about 3.4 %
- Juniper canopy cover varied across the site
- Used NAIP imagery to characterize areas as low juniper canopy cover (13%) or high cover (47%)
  - Plot selection included a range of canopy cover

Study Design

- **Two disturbance types or studies**
  - **1) burned slash piles, and**
  - **2) skid trails**
- **Both studies used GIS to randomly select plot locations (using juniper canopy cover), treatments randomly assigned**
  - **Native local seed**
  - **Native cultivar seed**
  - **No seeding**
  - **Control (no cutting, no seeding)**
- **N = 15 - 20**
- **Juniper cut/piled 2008**
- **Presenting posttreatment data from 2011, two years after seeding in 2009**

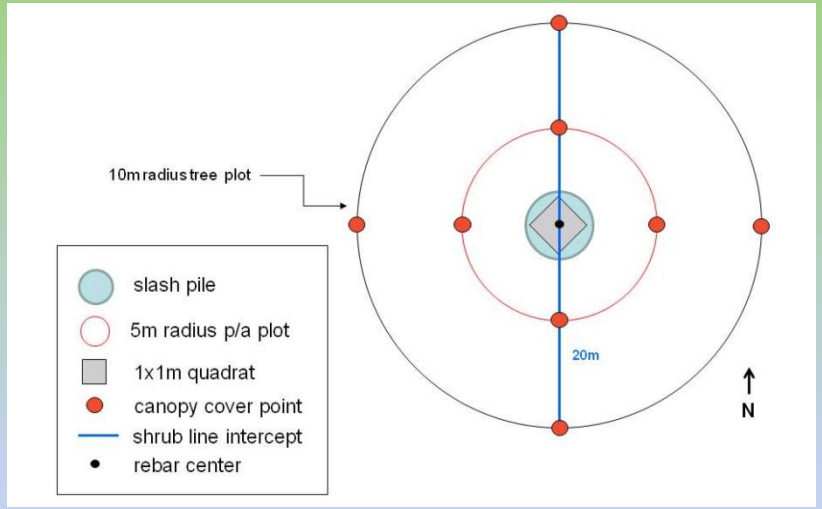
Seeding Treatments

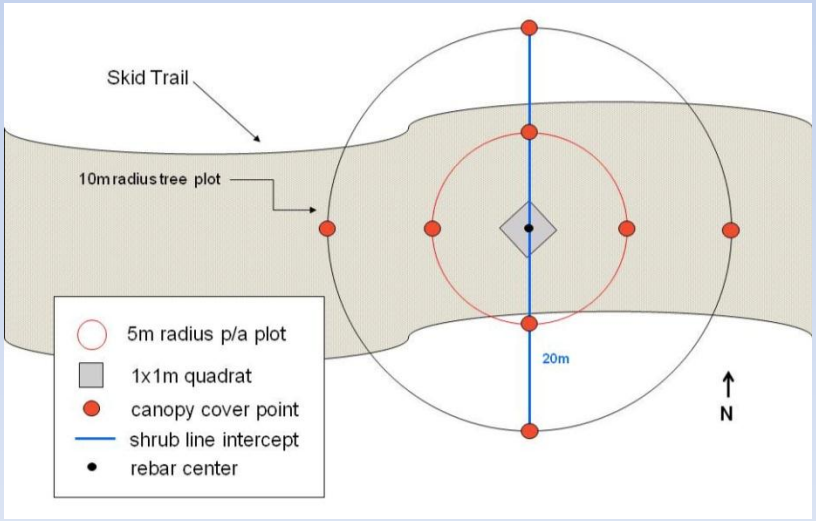
- **Seeding treatments**
  - **1) Native cultivar - a mix of largely available native species**
    - **Western yarrow*: Achillea millefolium,* ACMI, "Eagle Mountain"**
    - **Bottlebrush squirreltail*: Elymus elymoides,* ELEL, "Toe Jam Creek"**
    - **Bluebunch wheatgrass*: Pseudoroegneria spicata,* PSSP, "Anatone"**
  - **2) Native local - a mix of the same species but locally sourced**
- **Piles and skid trails were hand seeded onto light snow**
  - **Skid trails were raked prior to and after seeding**

Seeding rates:
ACMI: 0.2 kg PLS · ha^{-1} (1 lb · $acre^{-1}$)
ELEL: 1.8 kg PLS · ha^{-1} (10 lbs · $acre^{-1}$)
PSSP: 2.4 kg PLS · ha^{-1} (13 lbs · $acre^{-1}$)

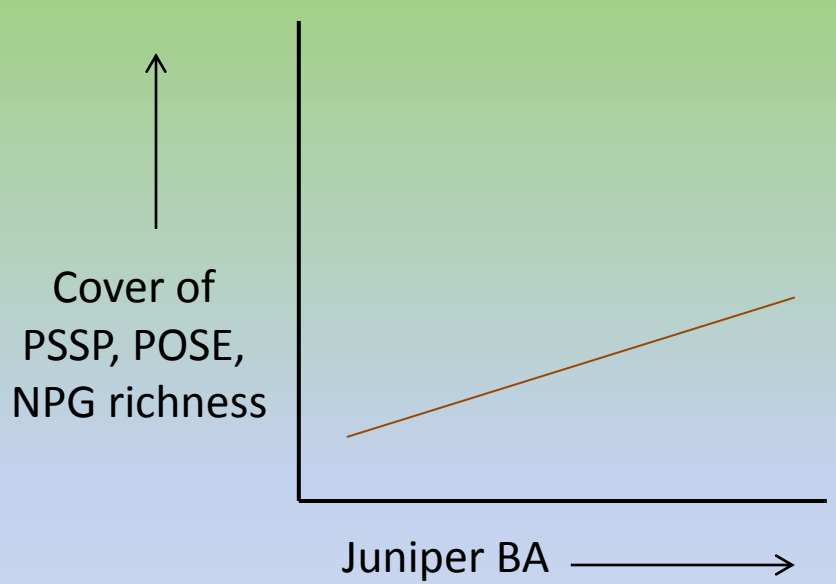
Sampling and Data Analysis

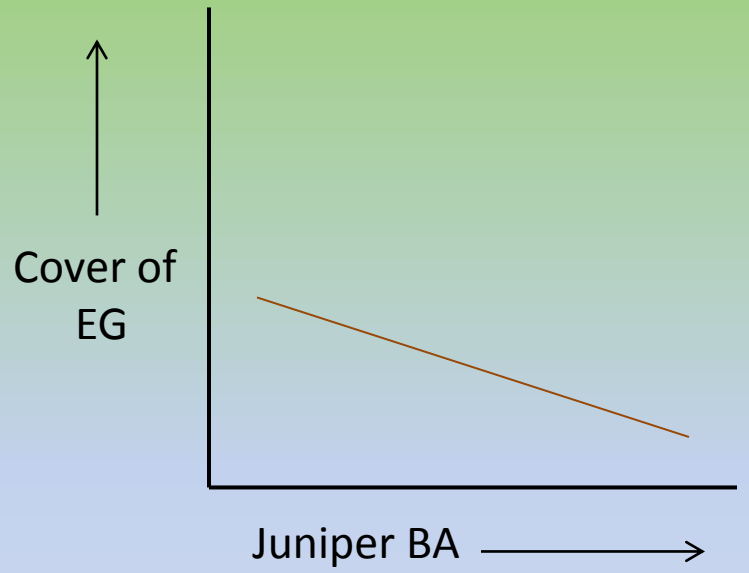
- **Data were collected in a series of nested plots**
  - **Canopy cover data: rectangular 1 x 1 m plot frame**
- **Response variables included species cover and richness**
  - **Species grouped into functional groups**
  - **Species specific analyses for seeded species and Sandberg bluegrass (POSE)**
- **Data analyzed as a completely randomized analysis of covariance (ANCOVA) using Proc Mixed in SAS 9.2**
  - **Covariate: Pretreatment juniper basal area**





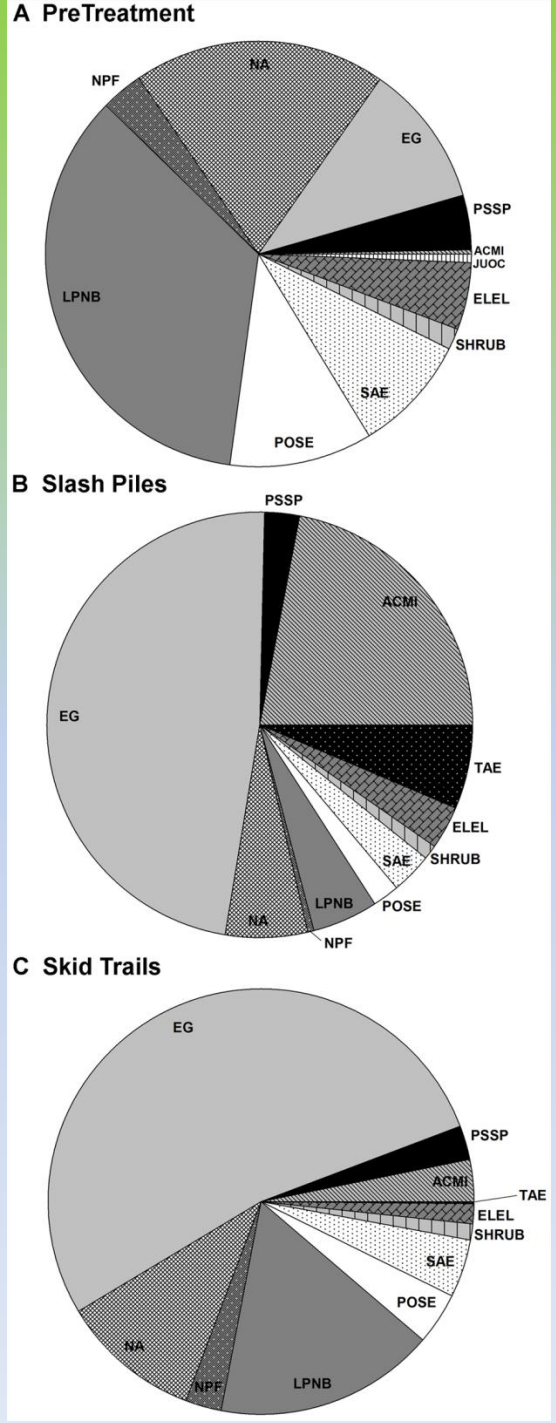
Pretreatment Relationships to Juniper Abundance





- **Pretreatment: positive relationship between juniper basal area and cover of bluebunch wheatgrass, Sandberg bluegrass, and richness of native perennial bunchgrasses**
- **Opposite trend was found for EG (exotic grass) cover**

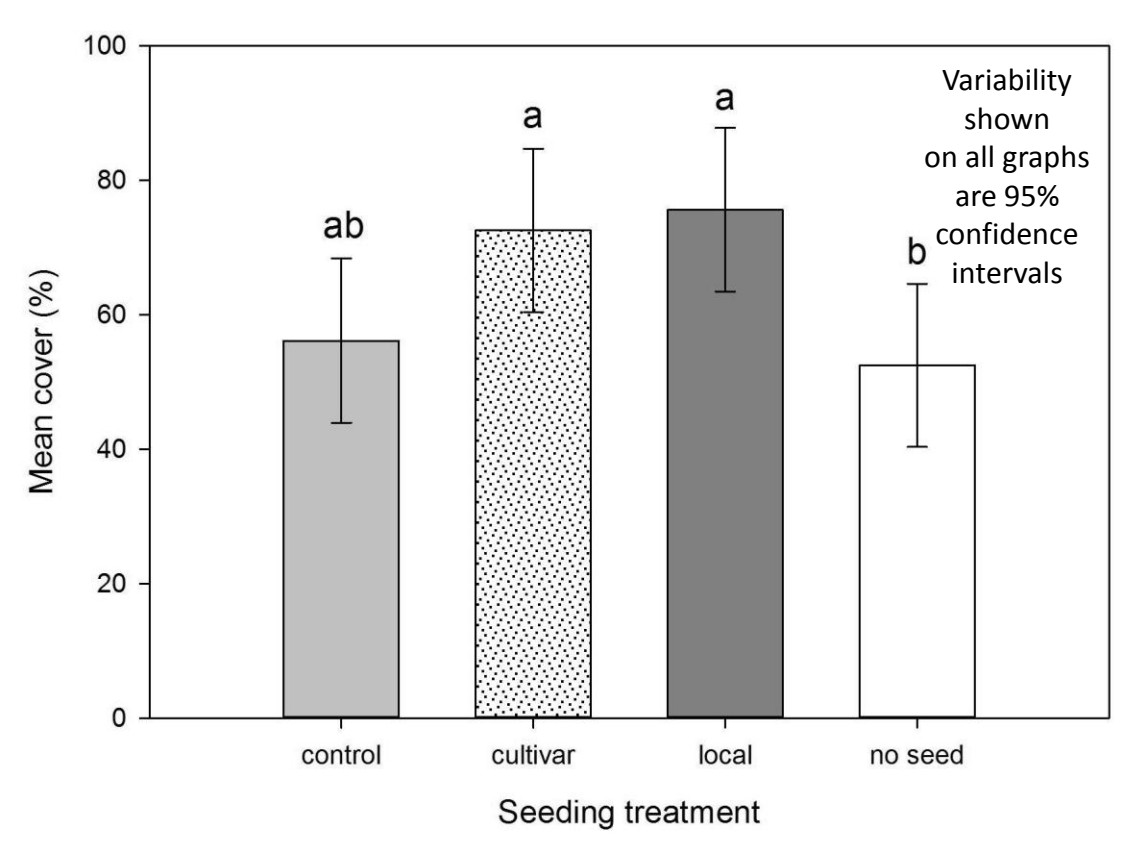
- General patterns across the study area for pretreatment (A) and post-treatment (B, C) changes in vegetation. Data include controls.

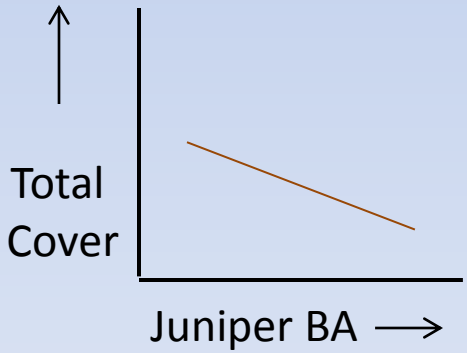


ACMI = yarrow; EG = exotic grass; ELEL = squireltail; JUOC = juniper; LPNB = large perennial native bunchgrass; NA = native annuals; NPF = native perennial forbs; POSE = Sandberg; PSSP = bluebunch; SAE = short annual exotic forbs; SHRUB = shrubs; TAE = tall annual exotic forbs.

Results – Posttreatment Slash Piles

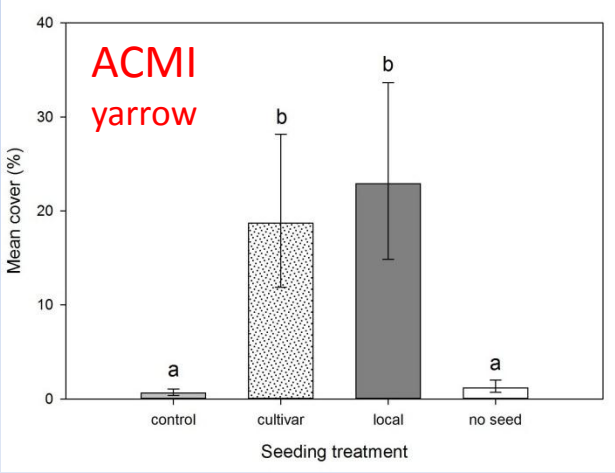
- **Total Cover – increased from about 31% to over 56%, mostly due to exotic grass increases, seeded species increases, and weather**
- **Seeding increased total cover compared to not seeding**
- **Pretreatment juniper basal area important**
  - **higher total understory cover was associated with areas with lower pretreatment juniper basal area**

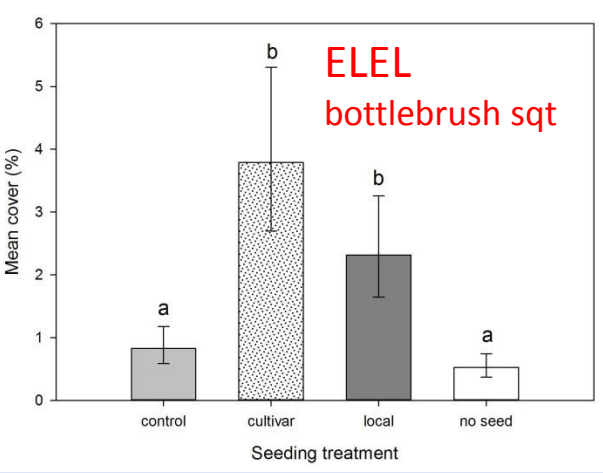


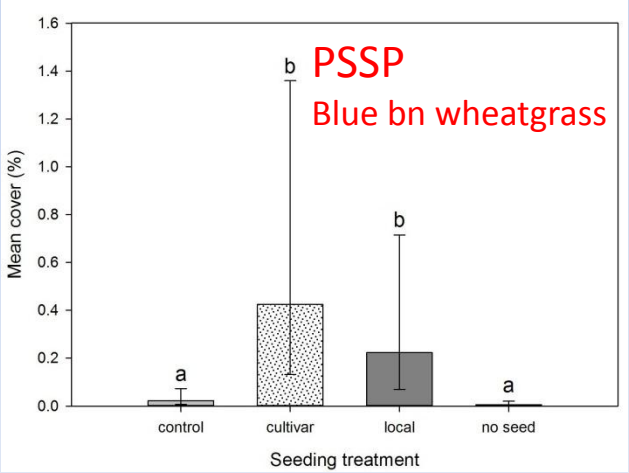


Results – Posttreatment Slash Piles

- **Seeded species**
  - **All species established in 2011 and had significantly higher cover in seeded plots**
  - **ACMI cover much greater than other two species**
  - **No significant difference in between cultivar and local seed mixes**
  - **Pretreatment juniper basal area not important**
  - **Germination conditions ideal in 2010, 163 % above average ppt, 2011 conditions slightly above average**



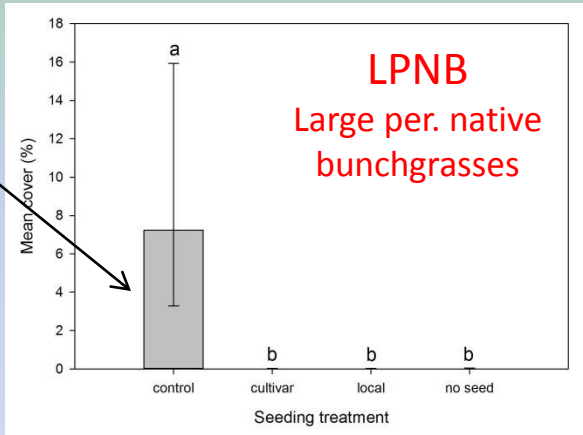


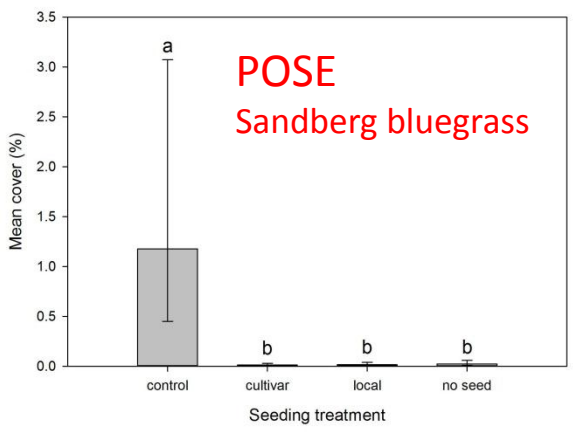


Results – Posttreatment Slash Piles

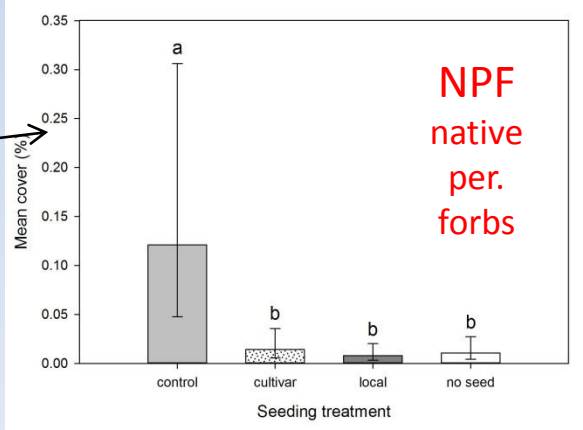
- **Native species – response fairly consistent**
- **Little recovery two years after cutting and burning (note seeded species are NOT part of these groups), native annual recovery better**
- **Pretreatment juniper BA important for POSE and native annuals:**
  - **higher POSE cover was associated with higher pretrt juniper BA; opposite trend for native annuals**

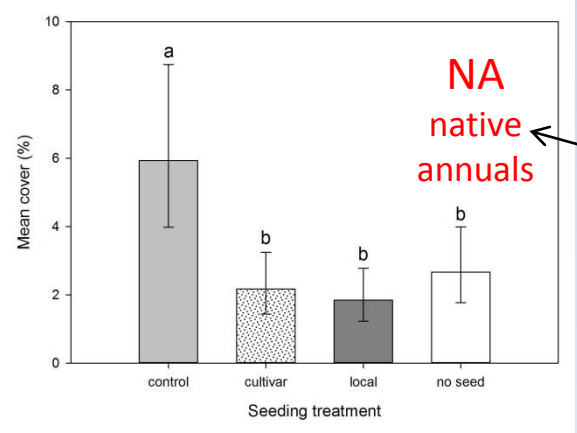
Mostly Thurber's needlegrass and Idaho fescue





Note differences very small!

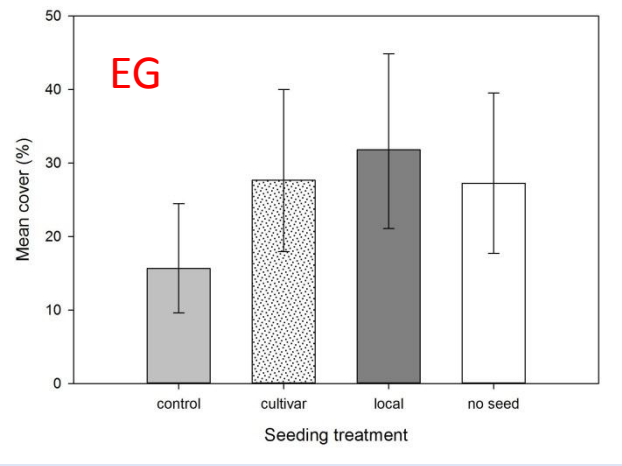


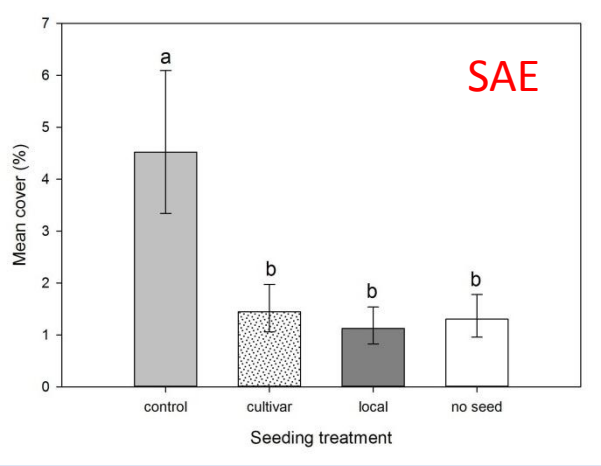


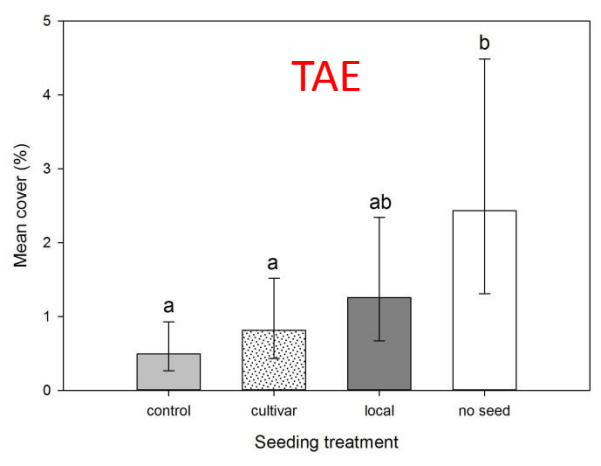
Mostly forbs but includes *Vulpia microstachys*

Results – Posttreatment Slash Piles

- **Exotic species three groups; response varied among functional groups**
  - **Exotic grass, EG - increased greatly across all treatments, even controls, mostly BRTE**
    - **Pretreatment juniper BA important**
      - **Higher EG cover was associated with areas with lower pretrt juniper BA (same as pretrt)**
  - **Small annual exotic forbs, SAE (e.g., *Holosteum umbellatum* and *Draba verna*) cutting and burning reduced compared to controls**
  - **Tall annual exotic forb cover, TAE (e.g., *Sisymbrium altissimum* and *Camelina microcarpa*) – not present prior to cutting and burning, but the cultivar mix significantly lowered TAE cover compared to the no seed treatment**

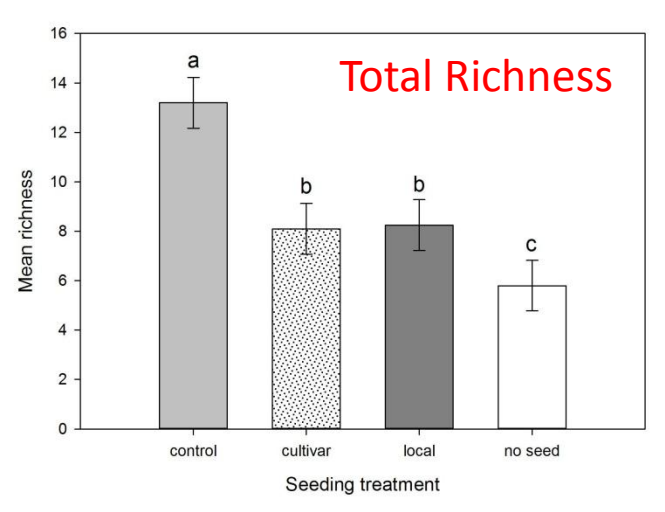






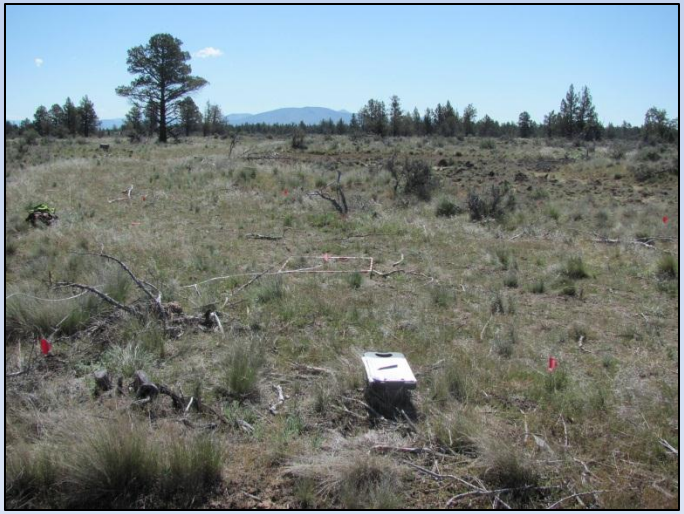
Results – Posttreatment Slash Piles

- **Richness**
  - **General pattern across all groups**
    - **Control areas had the highest richness, followed by the seeding treatments, no seed treatment having low richness**
    - **This pattern also true for exotic richness (significant)**
    - **Only group that showed a different pattern was native perennial forbs, with higher richness in seeded plots (but just due to ACMI)**
  - **Pretreatment juniper basal area important:**
    - **Native perennial grass richness – higher richness with higher juniper BA (also found pretrt)**
    - **Opposite relationship was detected for native annual richness**



Results – Skid Trails

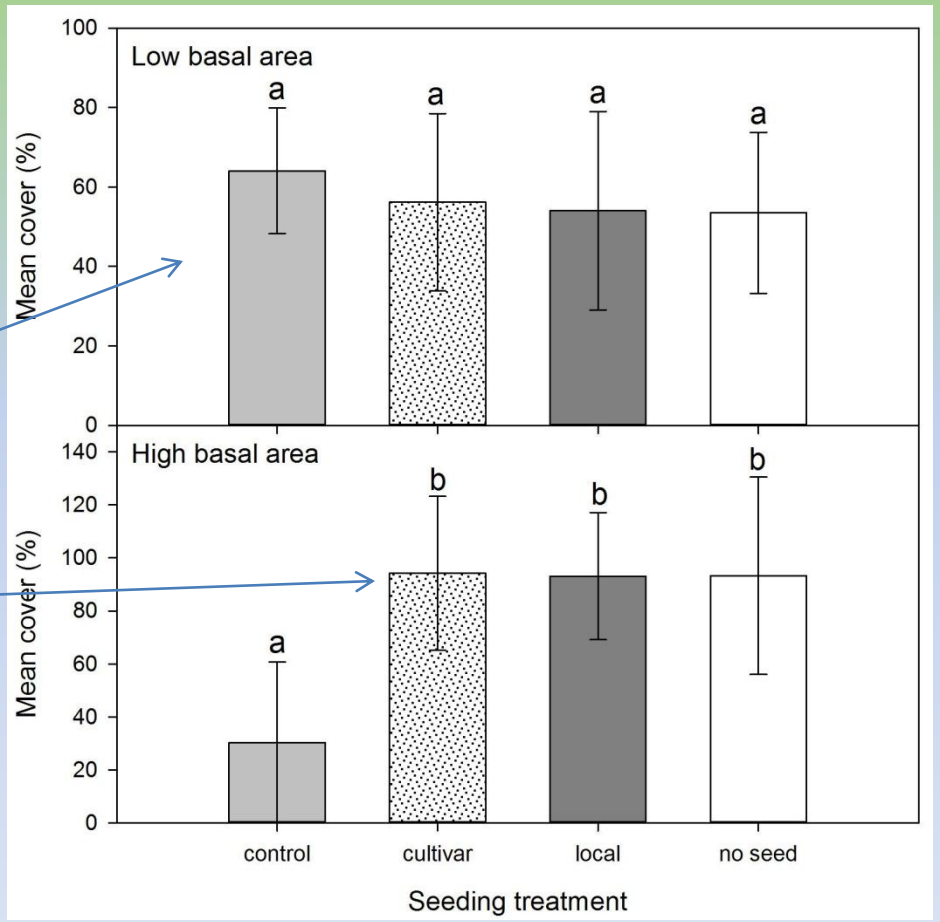
- **Results often different than slash pile results, different disturbance type**
  - **High variability in disturbance levels and presence of extant vegetation**
  - **Exposure of large areas of bare soil that were repeatedly disturbed**
    - **Soils were often compacted**
  - **Hand raking was the only seed preparation that was done**
  - **Don’t have pretreatment understory vegetation data for these plots**
  - **Pretreatment juniper basal area reconstructed from stumps**



Results – Posttreatment Skid Trails

Total Cover

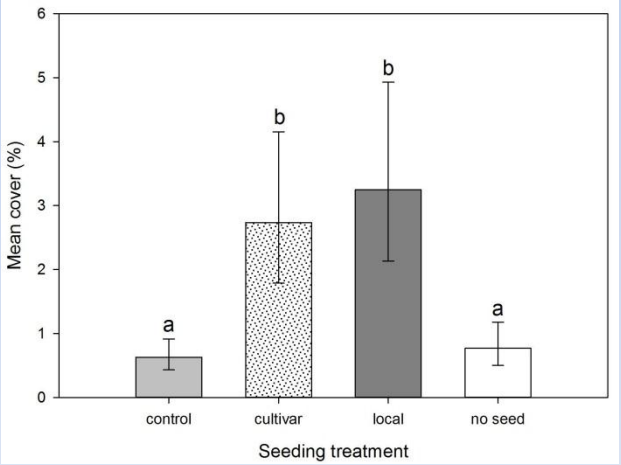
- **Significant interaction with pretreatment juniper basal area**
  - **No difference in total cover with low basal area**
  - **Areas with high basal area had higher cover in cut areas, even in areas not seeded**
  - **Probably related to greater disturbance in higher BA areas**
- **Seeding did not increase total cover**



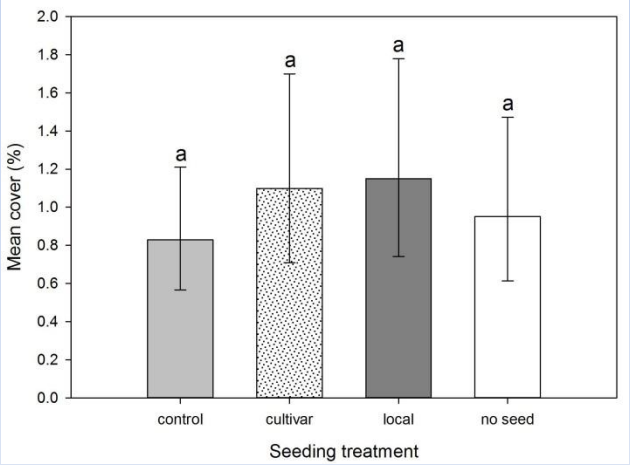
Results – Posttreatment Skid Trails

Seeded species

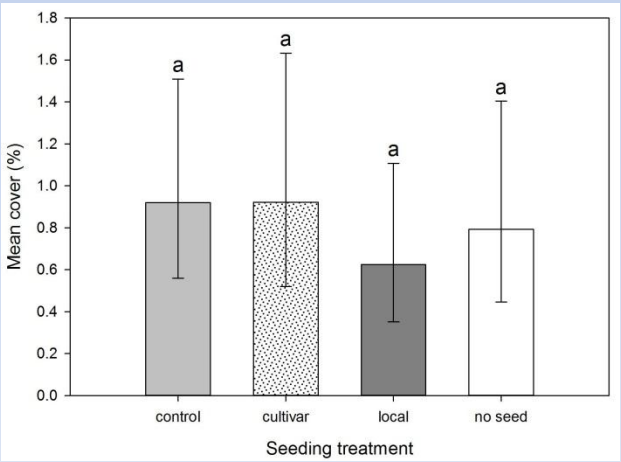
- **ACMI and ELEL did not establish as well; only ACMI and had significantly higher cover in seeded plots**
- **No significant difference in between cultivar and local seed mixes**
- **Pretreatment juniper basal area not important and did not interact with treatment**



ACMI
yarrow

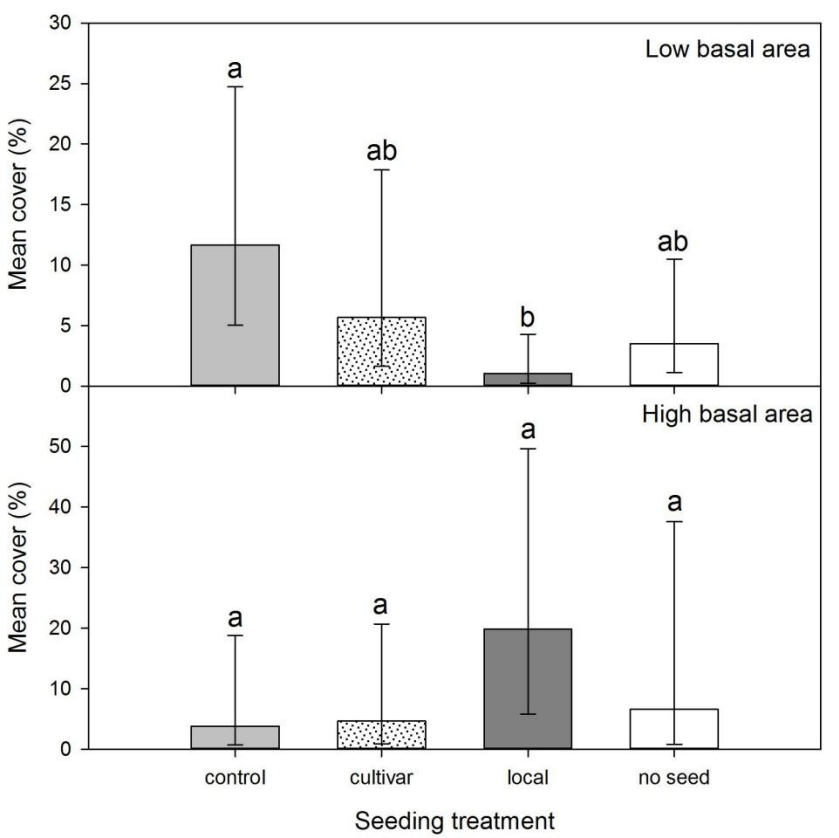


ELEL
bottlebrush squireltail



PSSP
Bluebunch wheatgrass

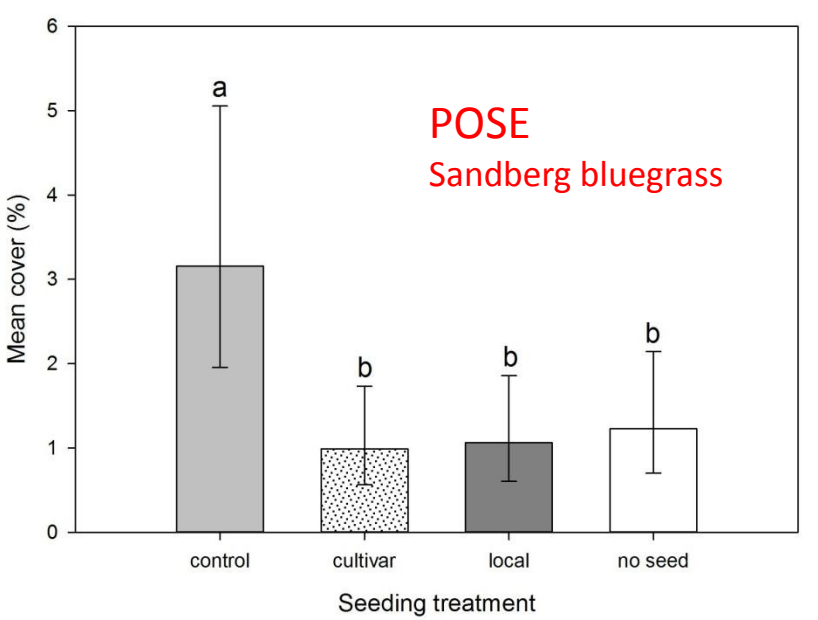
Results – Posttreatment Skid Trails

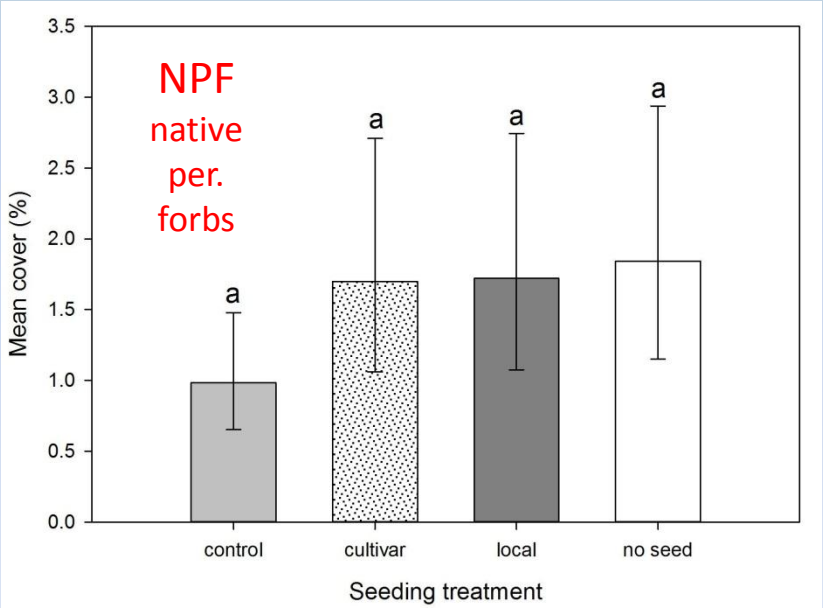


- **LPNG – large perennial native bunchgrasses** mostly Thurber's needlegrass and Idaho fescue
- **Significant interaction with pretreatment juniper basal area**
  - **With low juniper basal area (top), cutting and skid trail formation reduced cover (local)**
  - **With higher juniper basal area (bottom), no effect**

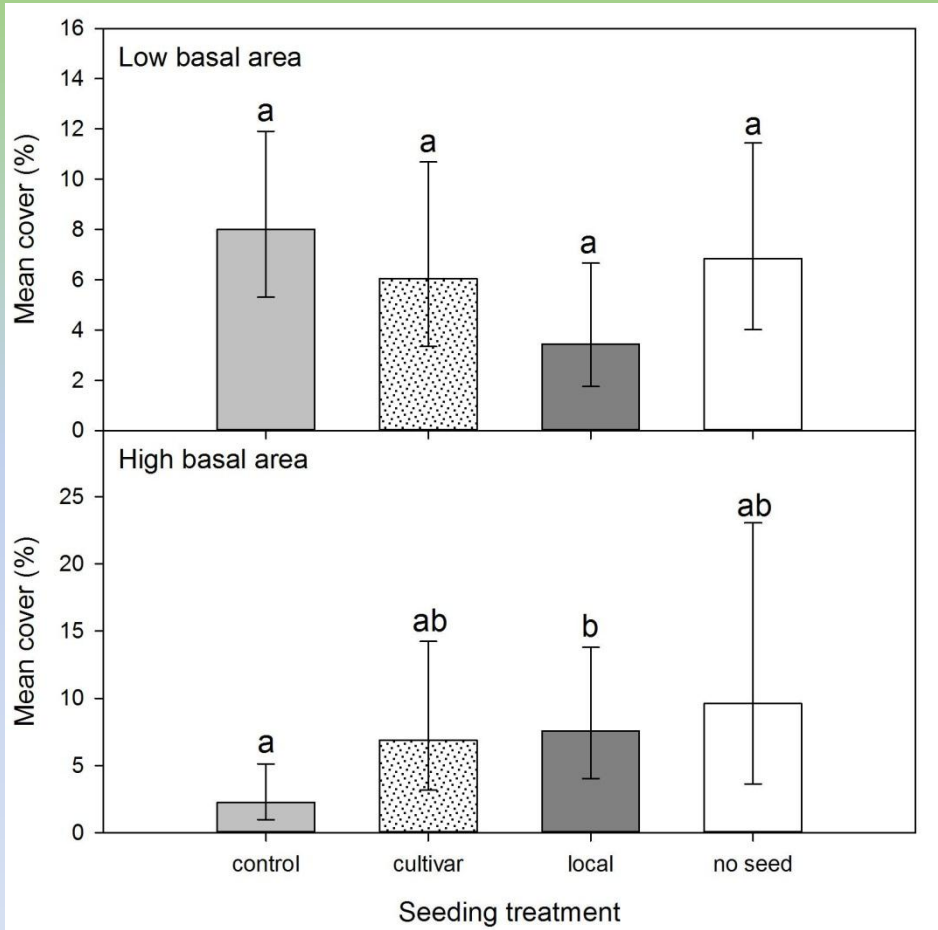
Results – Posttreatment Skid Trails

- **POSE – cutting and skid trail formation lowered cover, similar to slash piles**
- **NPF – no effect**





Results – Posttreatment Skid Trails

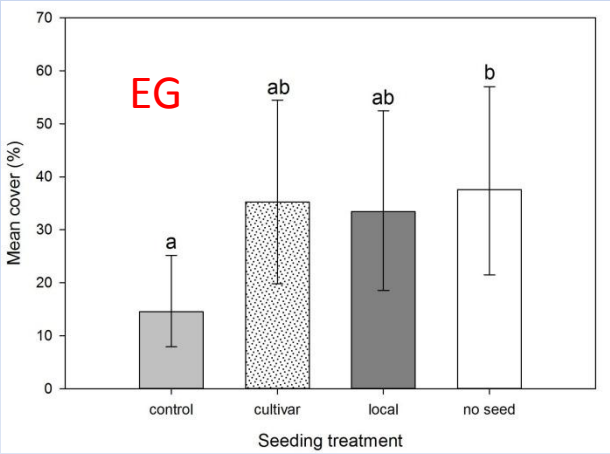


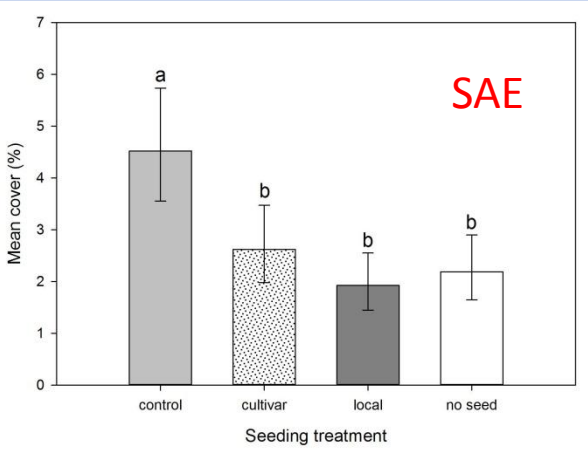
Native annuals

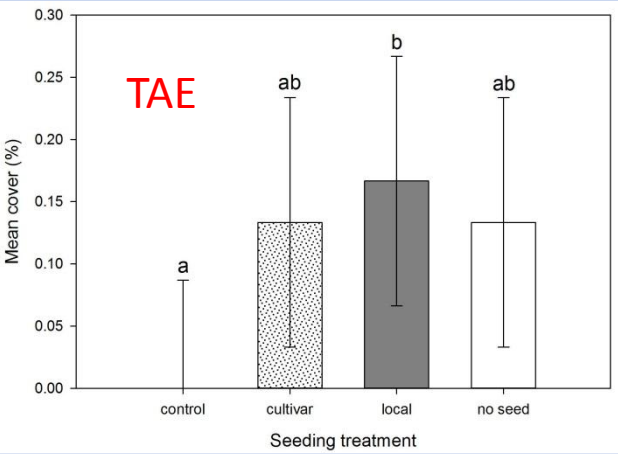
- **Treatment response depended on pretreatment juniper basal area**
  - **Low basal area – no effect (top)**
  - **High basal area (bottom) – greater cover (local) as compared to control**

Results – Posttreatment Skid Trails

- **Exotic species three groups; response varied among functional groups**
  - **Exotic grass, EG – higher cover in treated areas, BRTE**
    - **But only significantly higher (2 – 4 %) in areas that were not seeded**
  - **Small annual exotic forbs, SAE (e.g., *Holosteum umbellatum* and *Draba verna*) all treatments reduced compared to controls (similar to slash piles)**
  - **Tall annual exotic forb cover, TAE (e.g., *Sisymbrium altissimum* and *Camelina microcarpa*) – not present prior to treatment, but treatments increased cover (local); note very small values**

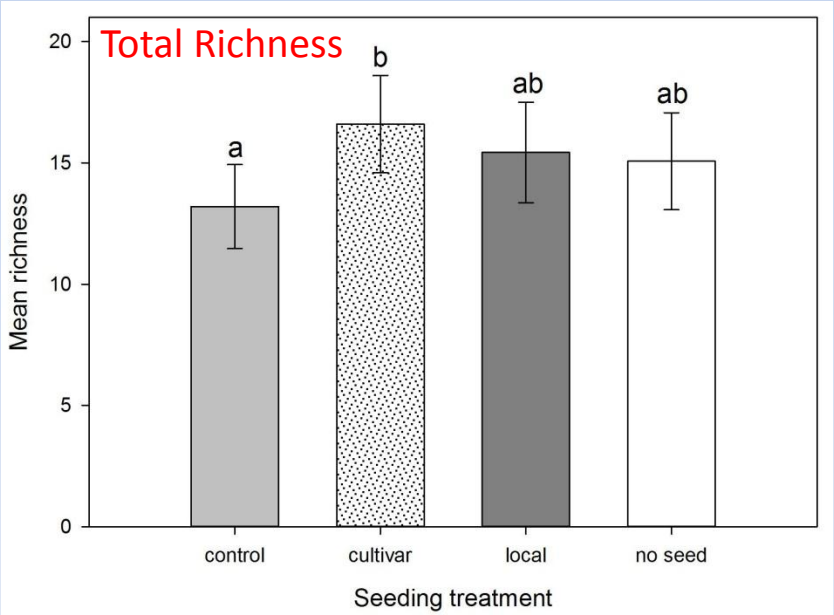






Results – Posttreatment Skid Trails

- **Richness**
  - **Different pattern as compared to slash pile**
  - **Treatments generally increased richness (total, exotics, native annuals, native perennial forbs).**
  - **No effect for native perennial grass richness**
  - **The cultivar seed mix lowered exotic richness compared to the local mix, but only when pretreamtnet juniper basal area was high**



Key Points

- **Keep in mind results are only short term**
  - **Remeasurements are needed to determine longer term outcomes**
- **Seeding:**
  - **Increased total cover (slash), established native plants, might be important in the long-term for succession**
  - **Reduced exotics somewhat, TEAFs**
  - **But area was still highly invaded by exotic grass!**
  - **Seeding may only be successfully suppress exotics IF**
    - **Seeded species are well established (cover > 20%)**
    - **Propagule pressure is low**
      - **For exotic annuals, this might mean no seed source**
    - **Seeded species are good functional analogs**

Key Points

- **Posttreatment seeding of slash piles was more effective than skid trails**
  - **Slash piles small, no intense burning**
  - **Immediate seeding of skid trails, along with better seed bed prep may have lead to a different outcome??**
- **Western yarrow was most successful seeded species**
- **Few differences in establishment and effectiveness with local vs. cultivar seed mixes**
  - **Local sources may be a good option especially when concerned with maintain local genetic resources**

Key Points

- **In the short term, fuel reduction activities (cutting, slash pile burning, skid trail formation) may have facilitated further conversion of this woodland to an exotic grassland.**
- **Maintaining juniper may be a better option in some cases to preserve ecological function and key species such as bluebunch wheatgrass and native bunchgrass richness, and to avoid exotic annual grass invasion**
- **If juniper canopies must be removed, extensive management intervention prior to and after treatment to lower exotic species propagule pressure and continue to reestablish native perennial species may be critical in obtaining restoration goals.**

ACKNOWLEDGEMENTS

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Q&A?

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