# Great Basin Native Plant Selection and Increase Project




# Progress from Partnerships…

## Goals

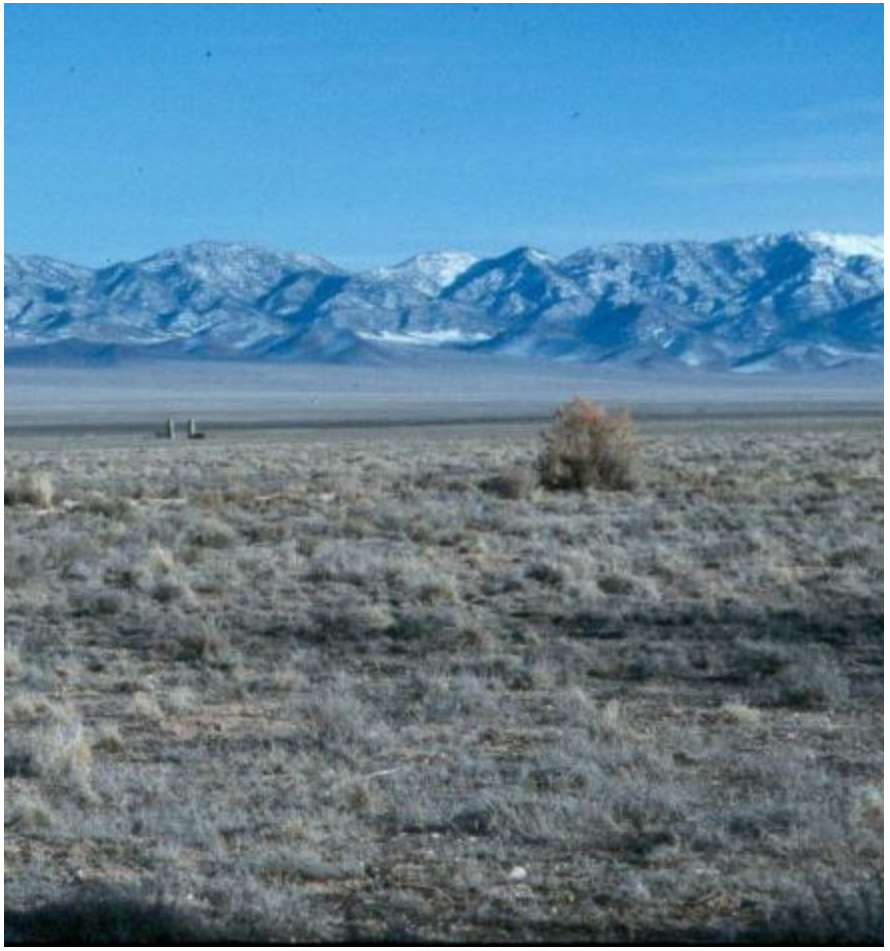
- Increase the availability of native plant materials, particularly native forbs
- Develop the technology required for native seed production and use

Region 4,6


# The Great Basin

**Public Lands**: 41 x $10^4$ $km^2$

**Total Area**: 55 x $10^4$ $km^2$

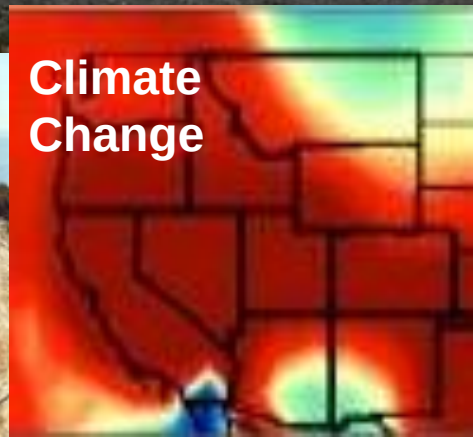
# So what's the problem?

- Invasive species spreading and dominating landscapes
- Disturbance, fuel/fire potentials
- Reduced biotic and abiotic function
- Expanding population
- Climate change

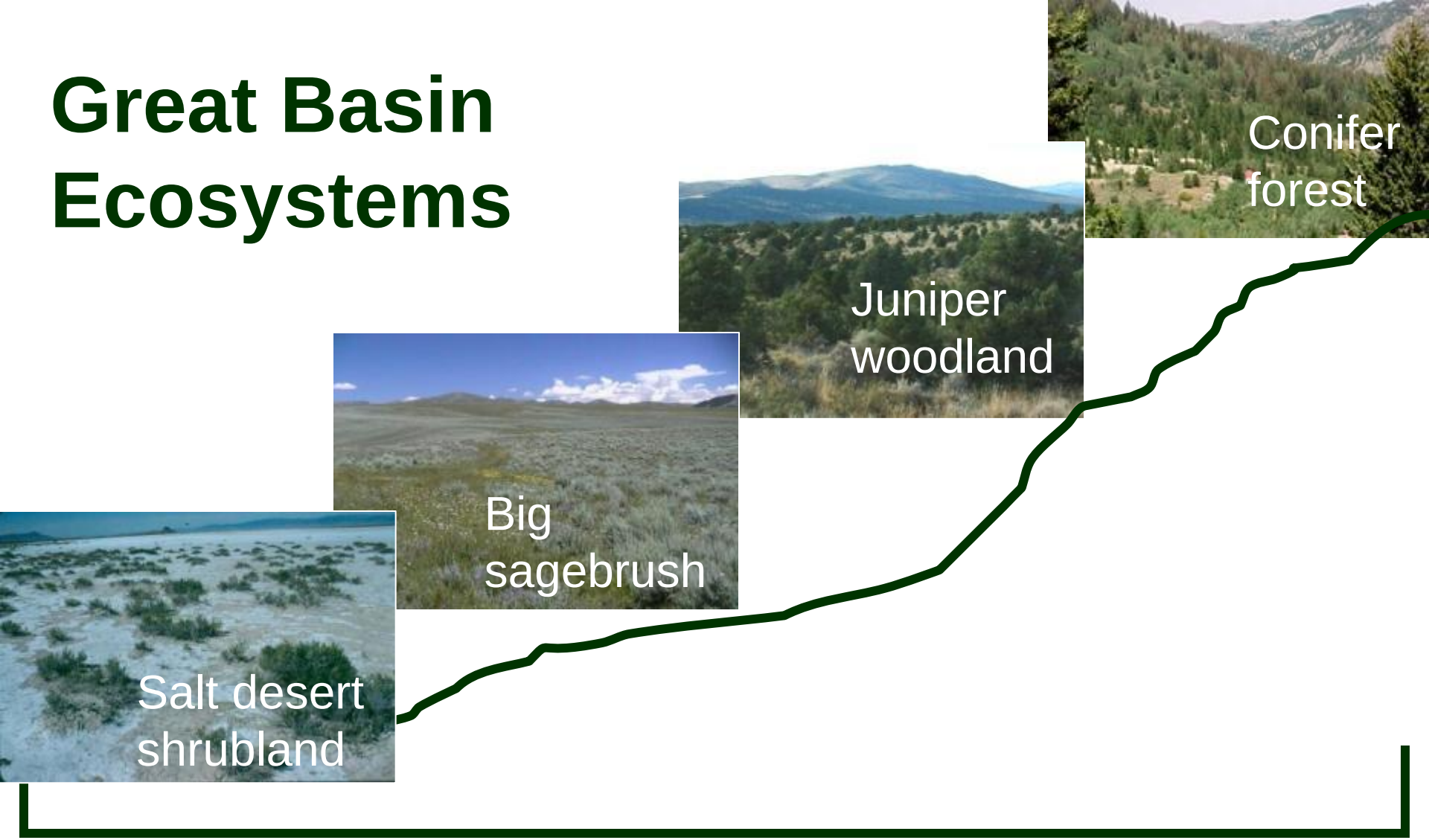






# Great Basin Ecosystems




**50 mm** **Annual Precipitation** **600 mm**

**750 m** **Elevation** **4000 m**

# Native Plant Program Elements:

- Needs assessment/species selection/genecology/plant materials
  *Which, from where, and how much?*
  *What about climate change?*
- Cultural practices
  *For agricultural seed production*
- Ecological restoration
  *Multiple disturbances –*
  *multiple species – multiple issues*
- Science delivery
  *Where's the info?*

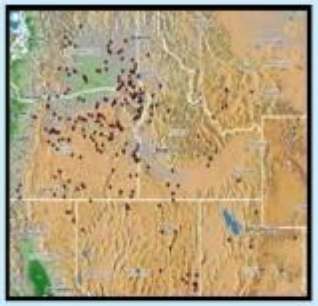
# Needs Assessment, Species Selection

- Scale: Local disturbance, seed zone, ecoregion
- Site condition
- Specific objectives


- Agricultural potential
- Quantity needed
- Ongoing surveys (S. Jensen)

# Ecological Genetics - Species-specific Seed Zones

## Evidence for adaptation –
## Correlation between traits and source environments



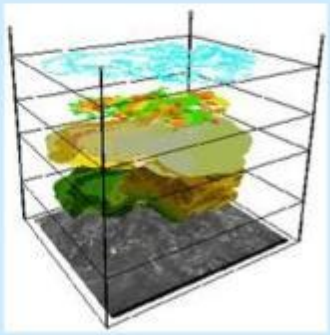
**Step 1:** Collect seed from many sources

**Step 2:** Grow families in common environments

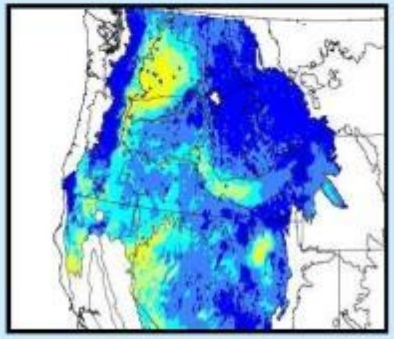
**Step 3:** Measure many adaptive traits

| Climate | Dry wt | Heading date | Leaf form |
|---|---|---|---|
| Annual temp | 0.28 | -0.36 | 0.44 |
| Warmest month | 0.22 | -0.33 | 0.48 |
| Coldest month | 0.37 | -0.37 | 0.37 |
| Temp differential | -0.31 | -0.09 | 0.53 |
| Precip | 0.33 | 0.07 | -0.48 |
| Aridity | 0.07 | -0.36 | 0.58 |
| Latitude | 0.33 | -0.32 | 0.11 |
| Elevation | -0.20 | 0.37 | -0.40 |

**Step 4:** Trait vs source environment



**Step 5:** GIS



**Step 6:** Seed zone map

*Pseudoroegneria spicata*

B. St. Clair, RC Johnson, N Shaw

**Present** | **2030** | **2060** | **2090**

*Douglas-fir*
*Seed zone #4*
*0-1000 ft*


*Seed zone*


*Climate*

B StClair

# Genecology Research

## Ongoing for key Intermountain species

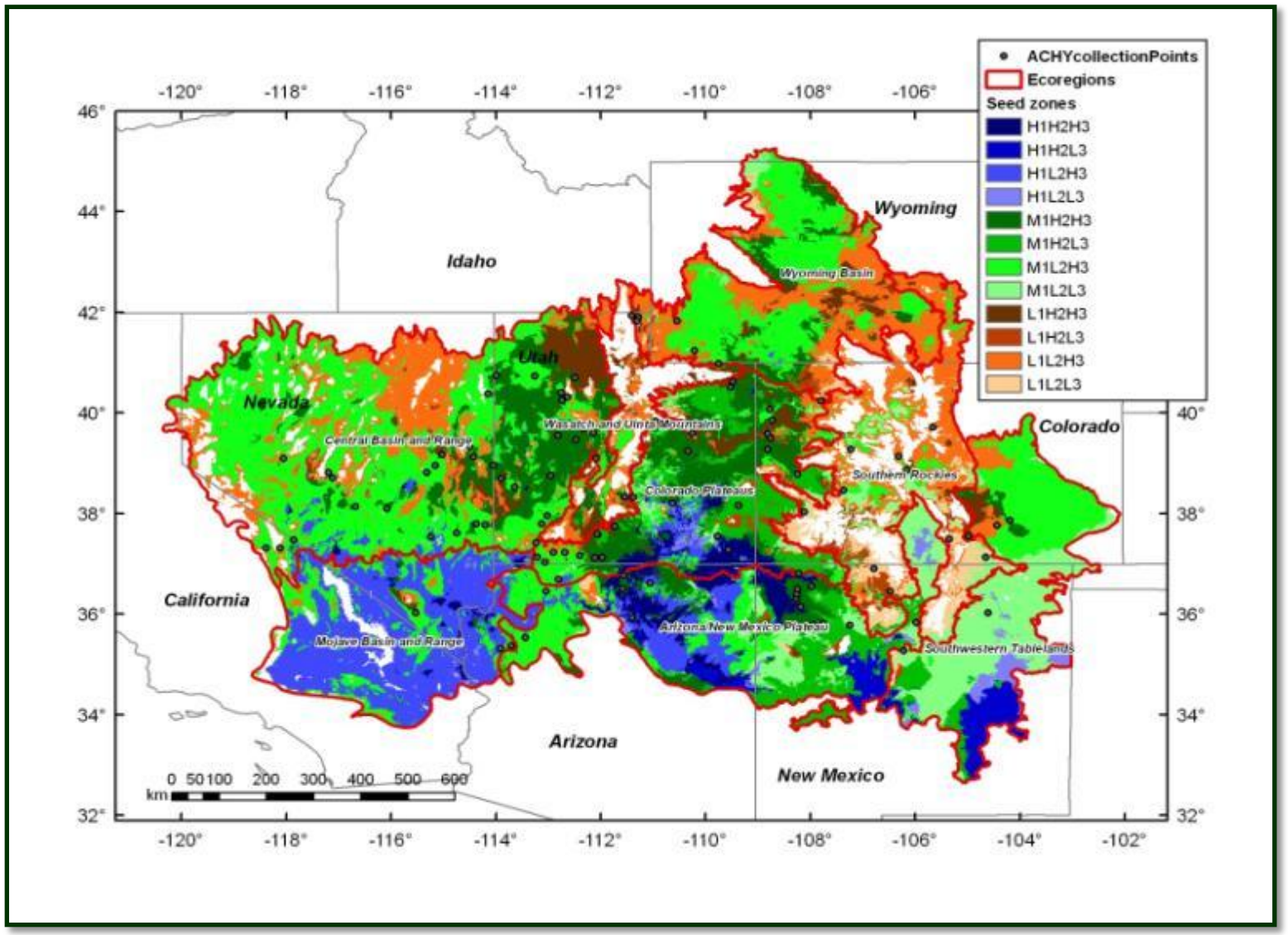
**RC Johnson, ARS**

- Basin wildrye (gardens planted)
- Bluebunch wheatgrass(nearly complete)
- Bottlebrush squirreltail (seeds collected)
- Indian ricegrass (complete)
- Mountain Brome (complete)
- Prairie junegrass (nearly complete)
- Sandberg bluegrass (data analysis)
- Thurbers' needlegrass (gardens planted)
- Sulphur-flowered buckwheat (started)
- Tapertip onion (complete)
- Big sagebrush (ongoing)

***Cooperative among BLM, FS RMRS and ARS**

# Seed Zones for Indian Ricegrass

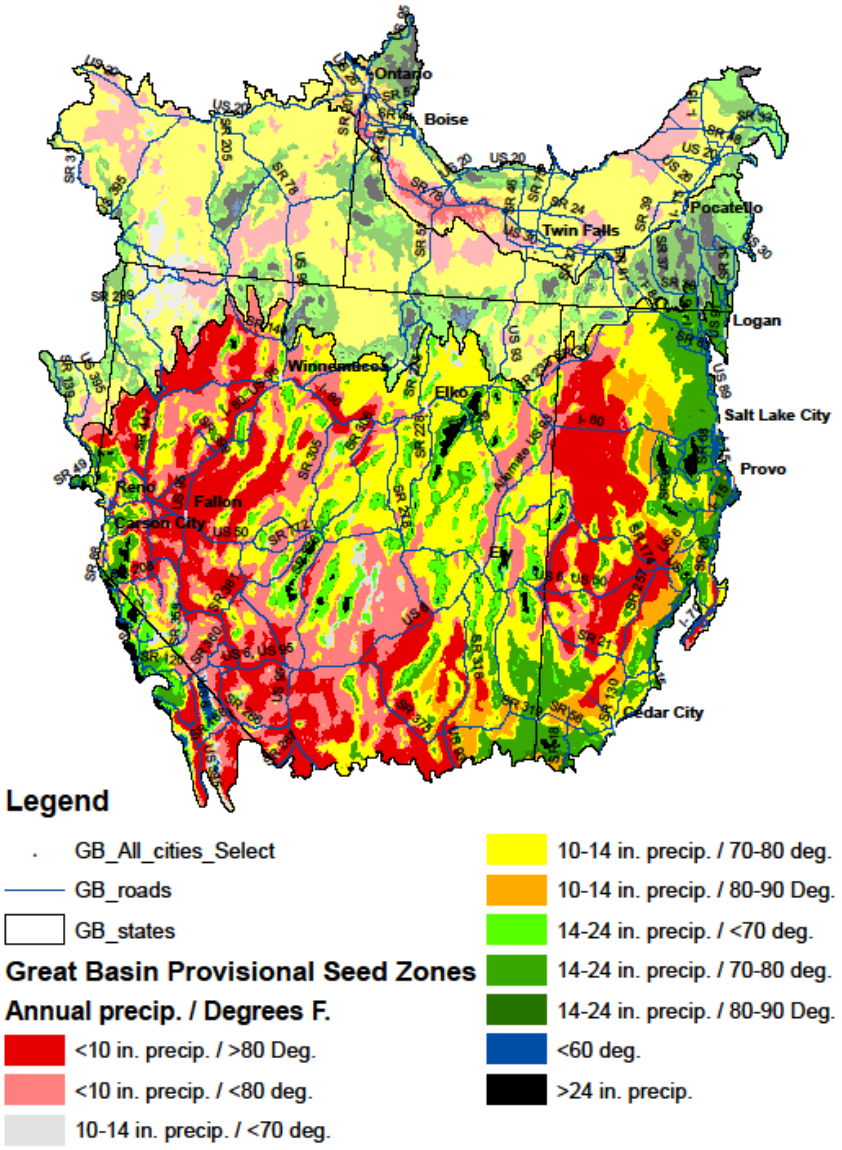
R.C. Johnson, M. Cashman, E. Leger, and K. Vance-Borland



# **Species Selection**:

## Great Basin Provisional Seed Zones

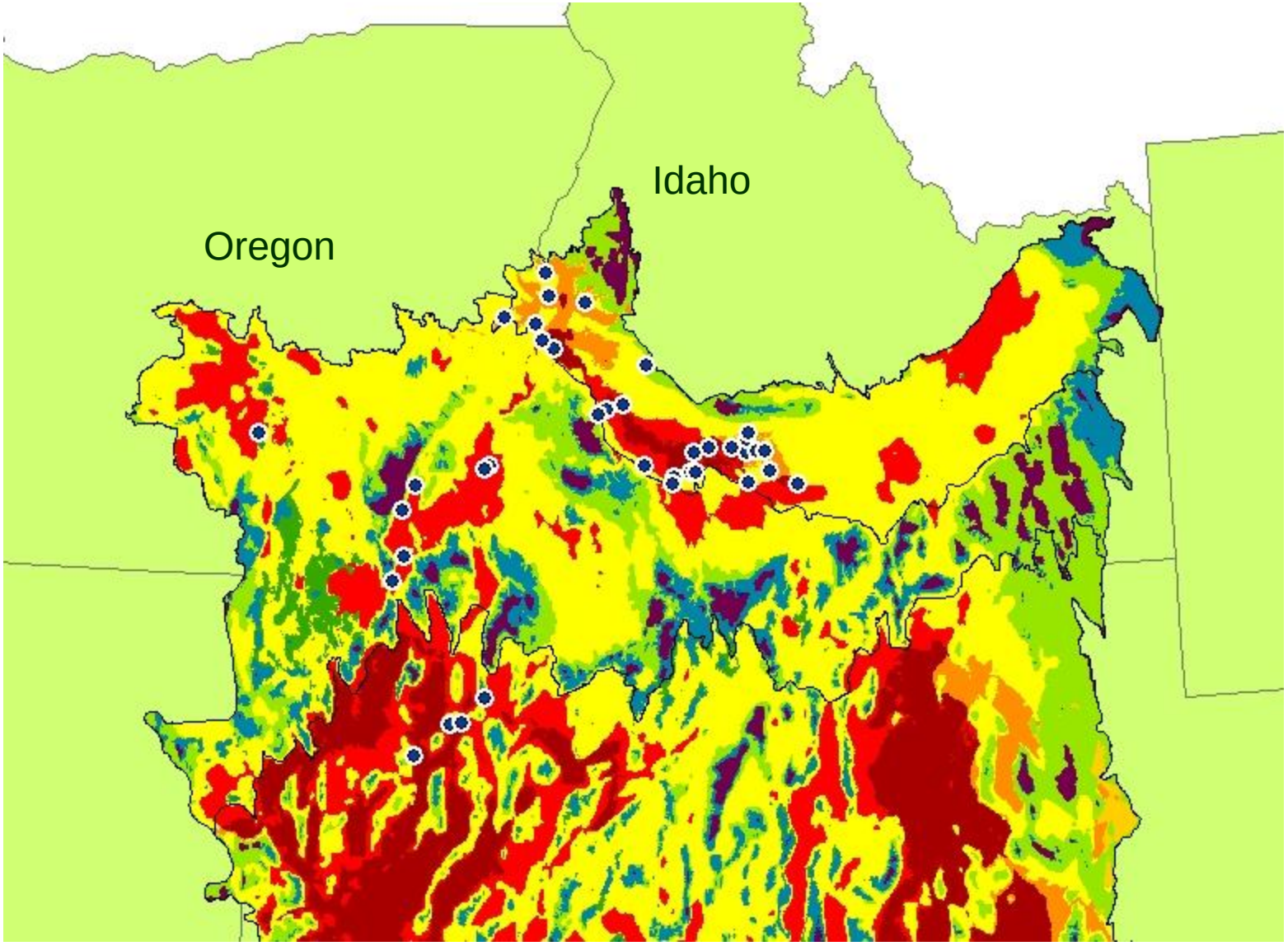
A. Bower et al. (2011)




Based on:

- Annual precipitation
- Average maximum daily summer temperature
- Local knowledge

# *Penstemon acuminatus* Collection Sites



# Western Wildland Environmental Threat Assessment Center Seed Zone Mapper

## Provisional Seed Zones

- Nation wide
- Regional

## Empirical Seed Zones

- Eight species to date
- Literature for each

## Map Formats

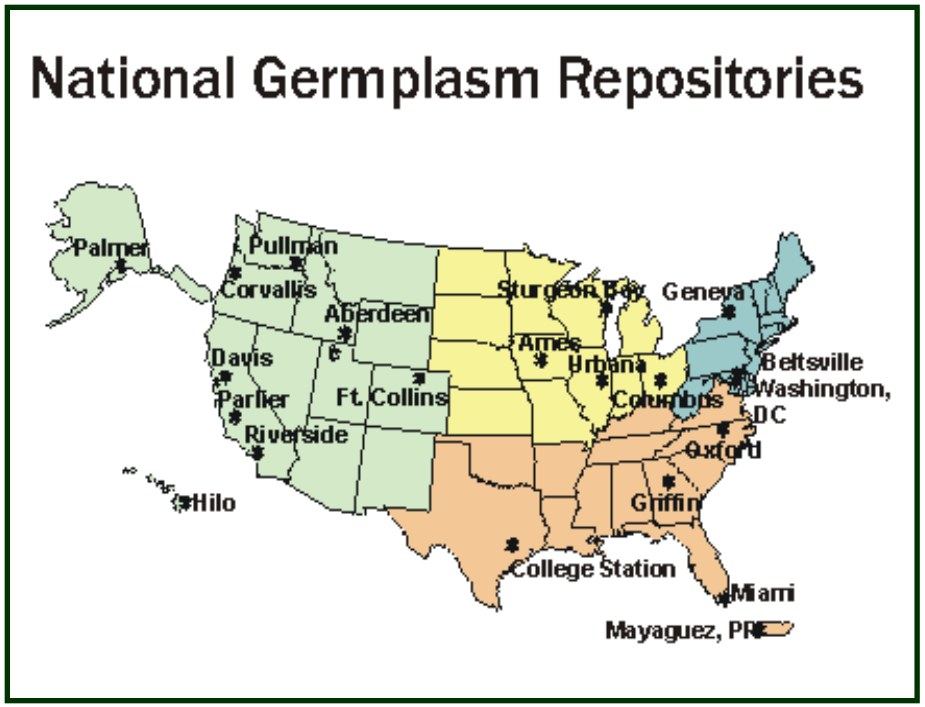
- GeoBrowser
- Google Earth GeoBrowser
- Google Earth KML
- MXD (Arc Map)


Alan Ager, Andy Bower, Vicky Erickson

# ARS National Plant Germplasm System

## Ex situ Conservation of Plant Genetic Resources

(RMRS > 500 collections)






# Initial Seed Increase

Private Growers

USDA
Lucky Peak
Nursery

USDA
NRCS, ARS, FS
Facilities

# Commercial Production

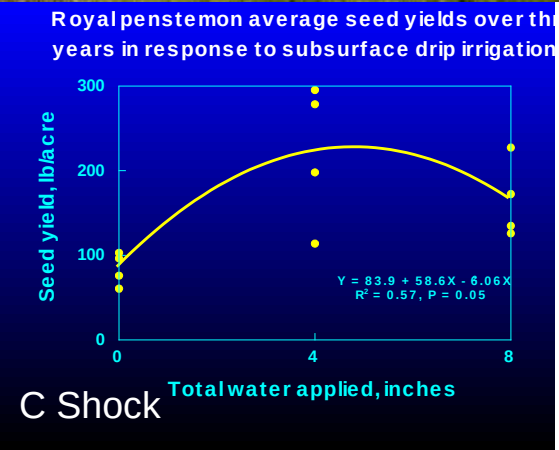
# Cultural Practices for Agricultural Seed Production

## Seed Biology & Technology

- Seed maturation, collection cleaning, storage, testing certification

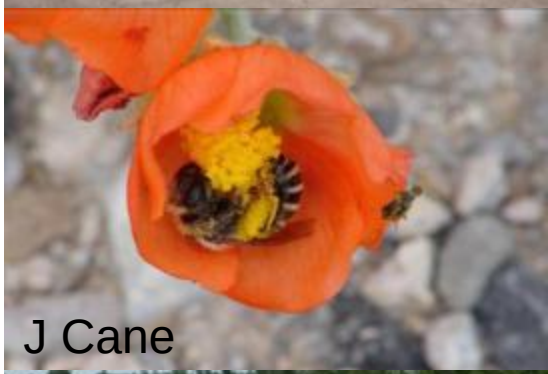
## Stand Establishment

- Soil requirements
- Seeding equipment , dates, rates
- Seedling propagation




## Stand Maintenance

- Weed control, irrigation
- Seed predators, diseases
- Pollinators
- Harvesting




# Germination Protocols

Bob Karrfalt, FS National Seed Laboratory

- **Purpose:**
  - What is best germination temperature? – AOSA rule
  - What is the range of germination temperatures?

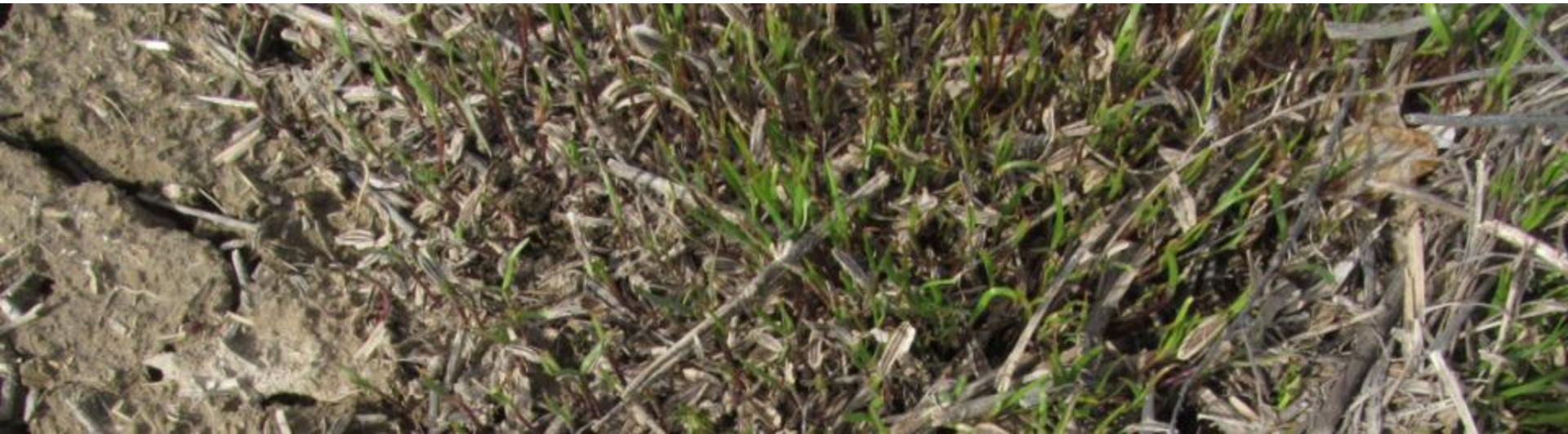
    -Determine sowing dates (cool = early sow, warm = l later sow)

    -How might this species respond to warmer climate?
  - Is there dormancy, how treat it: moist chill, how long, scarify
  - Preliminary protocols for 37 GB species

    -Preliminary because we need more seed lots to be sure

# Stand Establishment Treatments 2010, 2011, Clint Shock et al., OSU Malheur Experiment Station

| Species | Row Cover | Sand | Sawdust | Seed Treatment |
|---|---|---|---|---|
| *Achnatherum thurberianum* | + + | | + | - + |
| *Dalea ornata* | + + | | | - + |
| *Penstemon acuminatus* | + + | + + | | - + |
| *Penstemon deustus* | + + | | | - + |
| *Heliomeris multiflora* | + + | | + | - + |
| *Crepis intermedia* | + + | + + | | - + |
| *Balsamorhiza sagittata* | + + | | + | - |



Stand Maintenance

# Insect pests in Seed Production

Bob Hammon,
Colorado State University Extension

Preparing six tech notes:

Insect pests of:

- Fourwing saltbush
- Utah sweetvetch
- Mountain mahogany
- Globemallow
- Penstemon

Management of Lygus bugs

# Native Plant Materials for Great Basin Restoration

## USDA Natural Resource Conservation Service Plant Guides & Fact Sheets

### Grasses






### Forbs



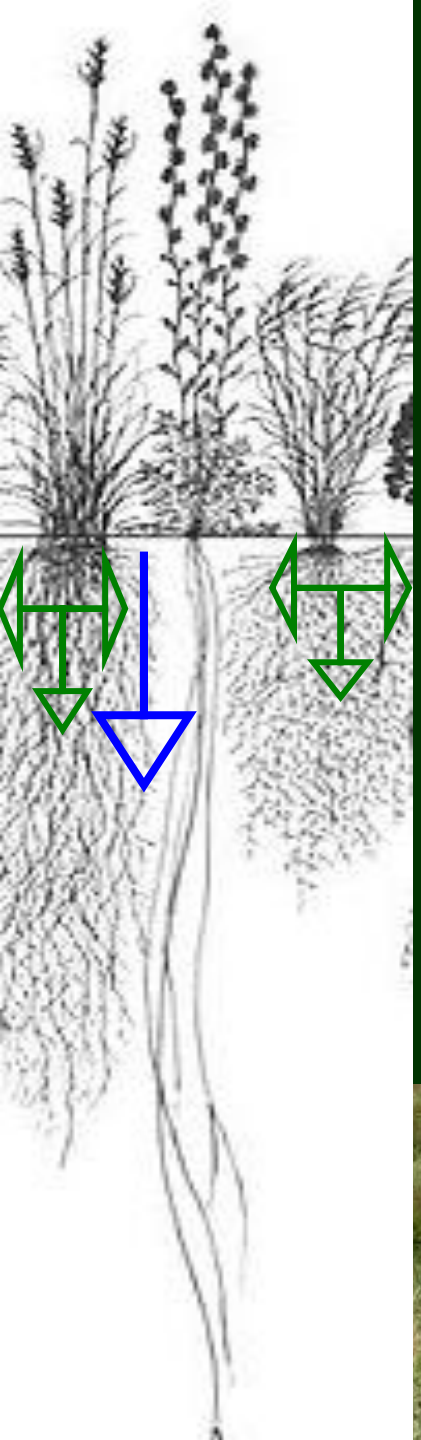






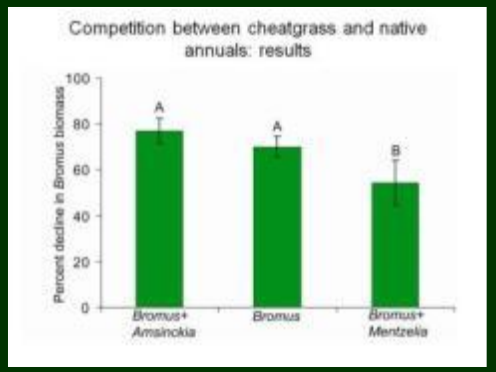

## OSU Malheur Experiment Station Plant Fact Sheets





# Wildland Seedings

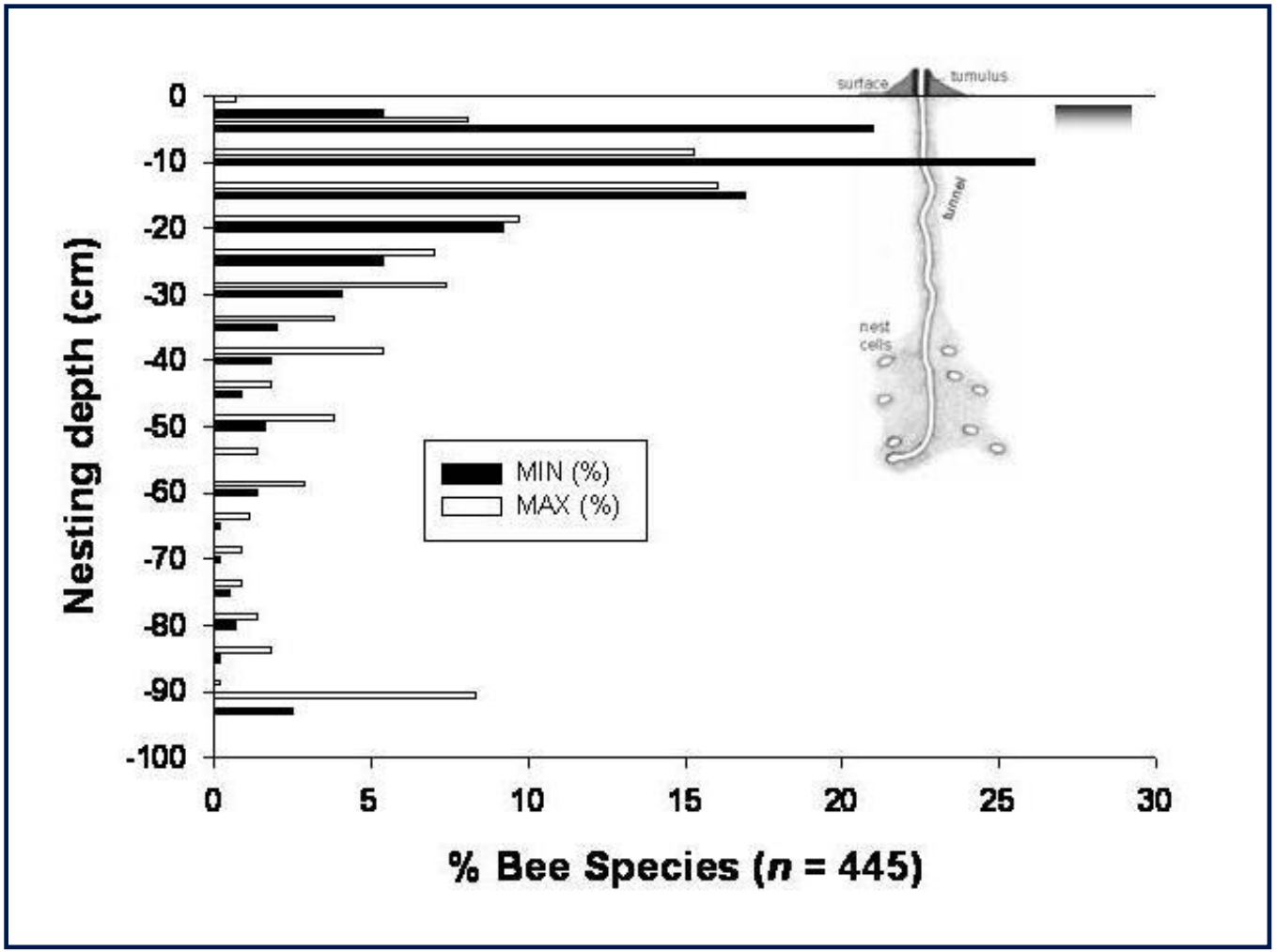
- Autecology, functional traits
- Successional status
- Interaction with invasive
- Root growth rates
- Rapid evolution
- Interactions among seeded species
  - Compatibility
  - Addition of annuals
- Resistant communities




# Fire Susceptibility of Ground-nesting Bees

Jim Cane and Byron Love, ARS

## Distribution of Soil Nesting Depths



# Can annual forbs suppress cheatgrass?

E. Goergen, B. Leger, & T. Forbis; *in review*

*Amsinckia tessellata*
AMTE

*Descurinia pinnata*
DEPI

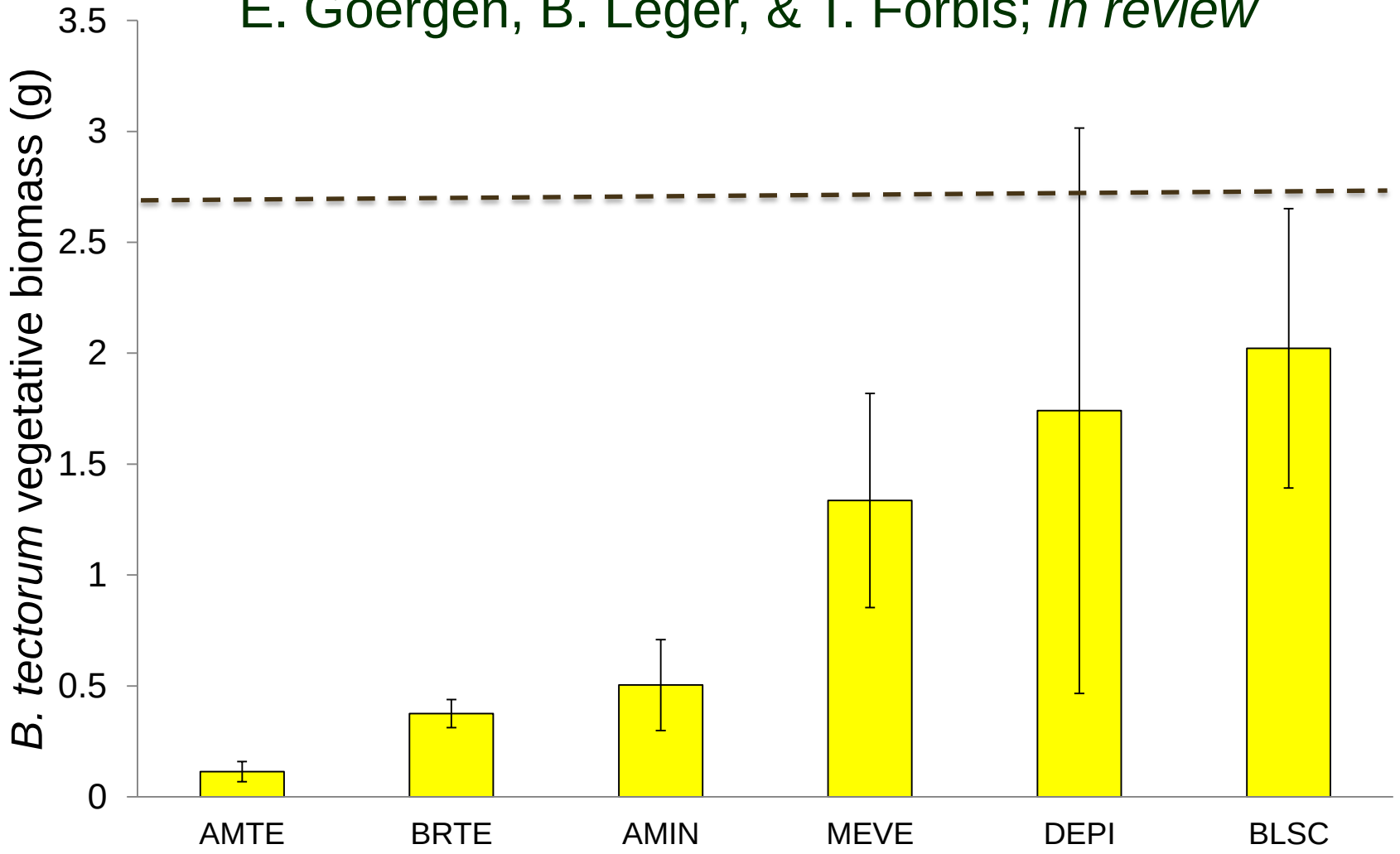
*Amsinckia intermedia*
AMIN

*Mentzelia veatchiana*
MEVE

*Blepharipappus scaber*
BLSC

# Annual forbs suppress cheatgrass

E. Goergen, B. Leger, & T. Forbis; *in review*



# Equipment and Strategies for Post-fire Seedings in Wyoming Big Sagebrush Communities

## Objectives:

- Drill comparison
  - > Reduce surface disturbance
  - > Conserve residual natives and biological soil crusts
- Improve establishment of small-seeded species - big sagebrush and many forbs
- Test big sagebrush seeding strategies
- Monitoring protocols
- Evaluate grazing impacts, etc.

Rangeland drill

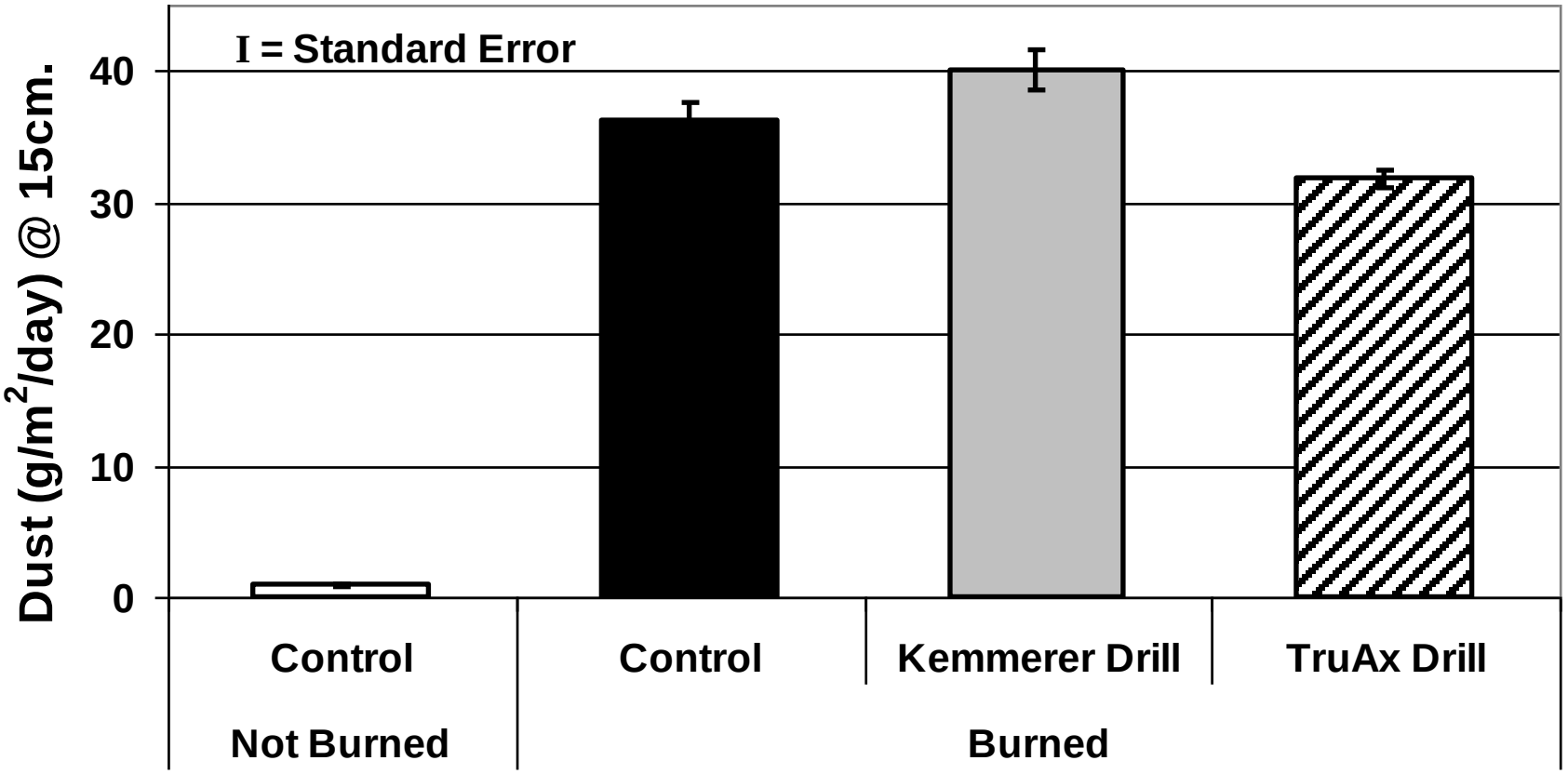
Minimum-till drill

N. Shaw, R. Cox, A. Hild

# Dust Emissions

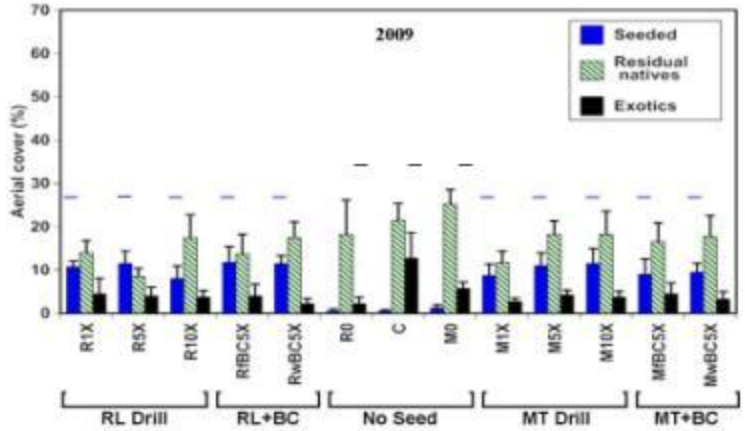
## November 2008-March 2009

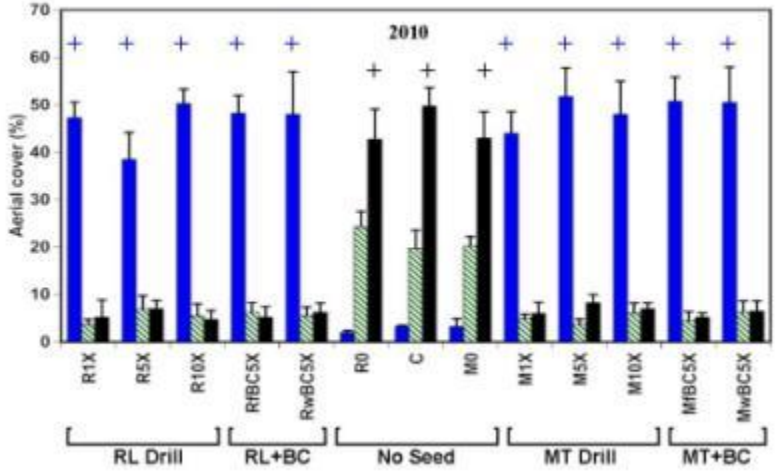
B. Newingham, U Idaho and A. Ganguli, N. Dakota State U



# Scooby
# Aerial Cover 2009 -2010

N. Shaw and R. Cox



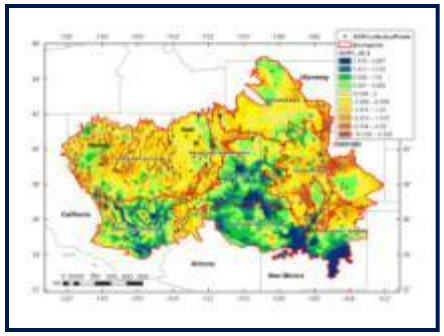




- Seeded species: Similar among treatments in 2009; increased 4.6X in seeded plots by 2010
- Residual natives: Declined from 2009 to 2010
- Exotics: Similar among seeded treatments both years; increased 6.9 times from 2009 to 2010 in unseeded treatments

# Science Delivery


- Manuals
- Manuscripts
- Plant guides

- Websites
- Technical notes
- Videos
- Equipment

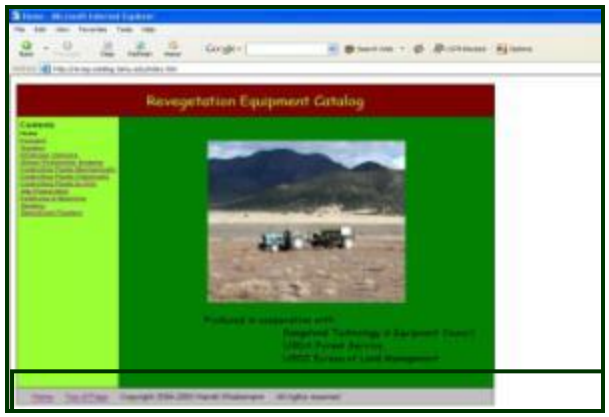


- Native seed
- Seed zones/seed transfer guidelines

- Workshops
- Symposia
- Field tours
- US and international contacts

# Websites

## Developed by GBNPSIP Cooperators:




- Revegetation Equipment Catalog
- Western Colorado Entomology Native Plant Seed Production
- Native Wildflower Seed Production
- Seed Zone Mapper

## Contributions from GBNPSIP Cooperators:

- Seed Testing Protocols
- AOSA Test Method for Species without Rules
- Native Plant Propagation Protocols
- Seeds of Success


***Links on GBNPSIP webpage and brochure***

# Outreach and Education





# Future Direction

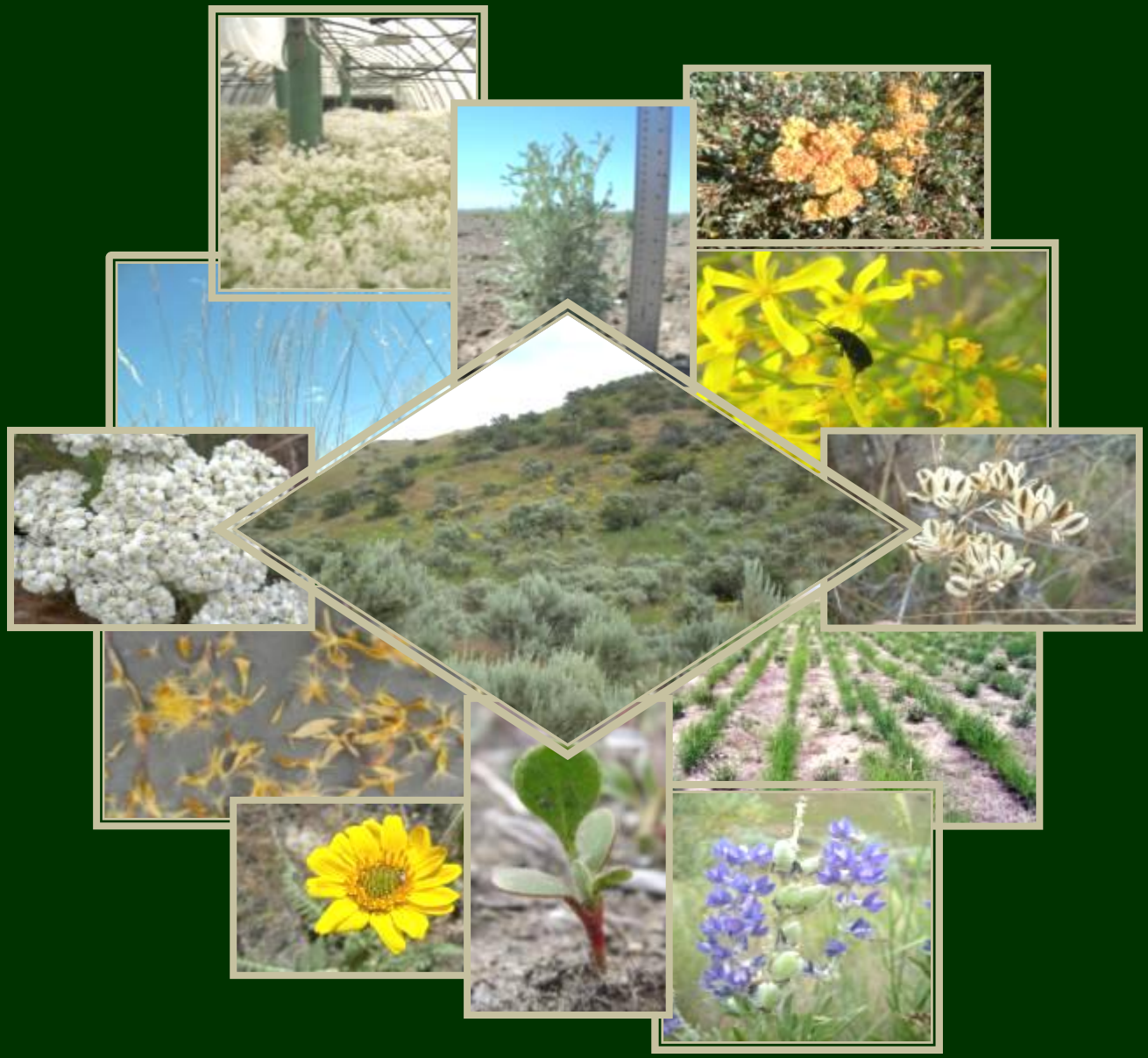
- Collaborate with users to provide genetically-diverse, regionally-adapted plant materials as specified by seed need assessments
- Develop cultural practices required for seed production
- Apply results to management and ecological restoration activities to increase knowledge of species and community dynamics and to provide diversity for future natural selection, especially with climate change
- Improve and accelerate science delivery to managers, restoration ecologists, the native seed industry and the general public

# Acknowledgments

USDI Bureau of Land Management,
Native Plant Materials
Development Program
and Great Basin Restoration Initiative

GBNPSIP Cooperators
for their research and PHOTOS

# Thank you!



Step 1: Seed collection

Step 2: Research and development

Step 3: Seed increase

Step 4: Commercial seed production

Step 5: Improved seeding technology

Step 6: Healthy native plant communities

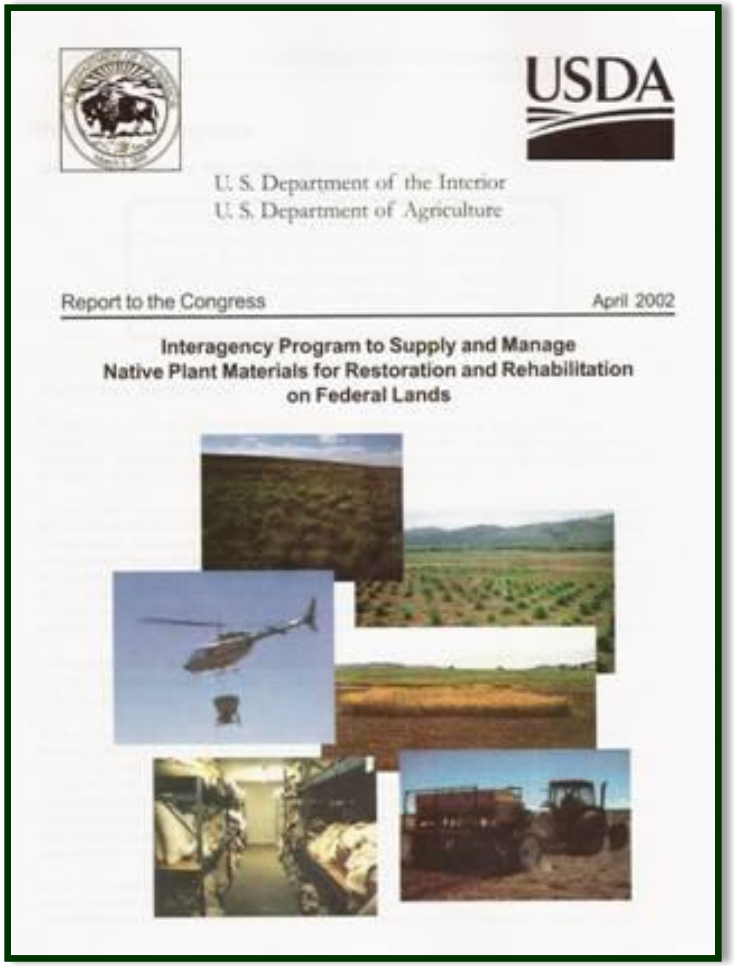
# Forbs with Growers

| Species | Common name | Zone/Ecoregion |
|---|---|---|
| *Achillea millefolium occidentalis* | Western yarrow | SRP |
| *Astragalus filipes* | Basalt milkvetch | NBR, SRP |
| *Balsamorhiza hookeri* | Hooker's balsamroot | CBR |
| *Balsamorhiza sagittata* | Arrowleaf balsamroot | CBR |
| *Chaenactis douglasii* | Dusty maiden | NBR, SRP |
| *Crepis acuminata* | Tapertip hawksbeard | CBR |
| *Crepis intermedia* | Limestone hawksbeard | CBR |
| *Dalea ornata* | Western prairie clover | NBR, SRP |
| *Dalea searlsiae* | Searl's prairie clover | CBR |
| *Eriogonum umbellatum* | Sulphur-flower buckwheat | NBR, SRP/IB |
| *Linum lewisii* | Lewis flax | CBR |
| *Lomatium dissectum* | Fernleaf biscuitroot | NBR, SRP |
| *Lomatium grayi* | Gray's biscuitroot | SRP |

# Continued……

| | **Germplasm/Release** | **Zone/Ecoregion** |
|---|---|---|
| *Lomatium nudicaule* | Barestem biscuitroot | NBR, SRP |
| Species | Nineleaf biscuitroot | NBR |
| *Machaeranthera canescens* | Hoary tansy aster | NBR, SRP |
| *Penstemon acuminatus* | Sharpleaf penstemon | NBR, SRP |
| *Penstemon cyaneus* | Blue penstemon | SRP |
| *Penstemon deustus* | Hotrock penstemon | IB |
| *Penstemon speciosus* | Royal penstemon | NBR, SRP |
| *Sphaeralcea coccinea* | Scarlet globemallow | CBR |
| *Sphaeralcea grossulariifolia* | Gooseberryleaf globemallow | CBR |
| *Sphaeralcea munroana* | Munro globemallow | NBR, SRP |

**SRP** = Snake River Plain, **NBR** = Northern Basin and Range, **CBR** = Central Basin and Range




# Federal Interagency Native Plant Materials Development Program

USDA and USDI strategy for addressing short and long-term native plant needs

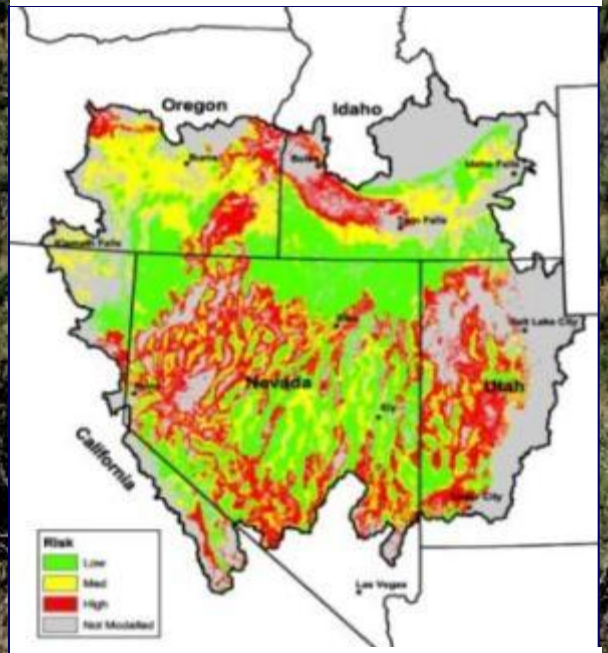
## Great Basin Restoration Initiative

Proactive, landscape-scale restoration program

## Great Basin Native Plant Selection and Increase Project

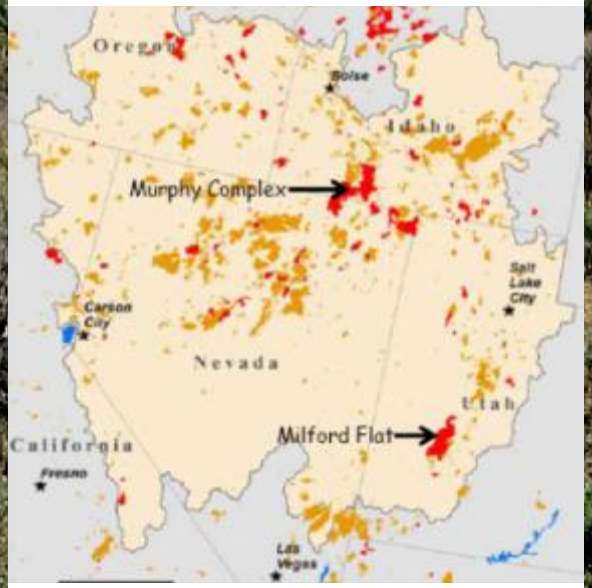
Collaborative public/private plant materials program

## Cheatgrass risk assessment




Wisdom et al. 2005

## Wildfires 1990 - 2007

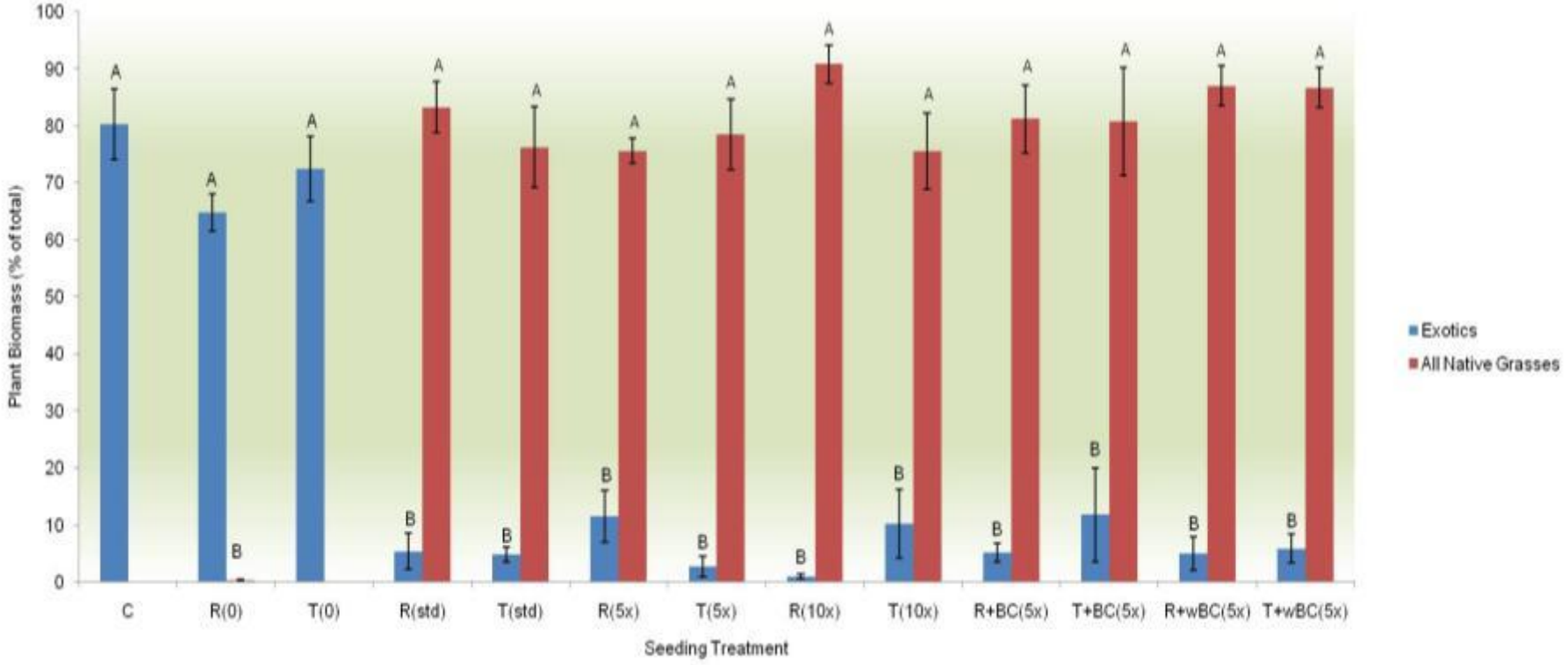



2007: 11,000km$^2$
1990-2007: 68,000 km$^2$

## Areas of sagebrush persistence across current and 7 future climate scenarios


Neilson et al. 2005

# Scooby Post-fire Seeding
# Seeded Grass and Invasive Biomass (second season)




Blue = Cheatgrass, halogeton, Russian thistle biomass

Red = Seeded native grass biomass (bluebunch, Indian ricegrass, Sandberg bluegrass, squirreltail)

# Major Findings:

- Clean seedbed critical
- Precipitation critical
- Residual perennials – many recover
- Drilled species – similar between drills or initial improvement with rangeland drill
- Small-seeded species – emergence generally improved with minimum-till drill with impacter units –
- Fall and winter hand broadcasting (aerial seeding) - erratic
- Sagebrush density increased with higher rates, generally better with minimum-till drill