Restoring Genetically Diverse Plant Communities

Sage Grouse Habitat

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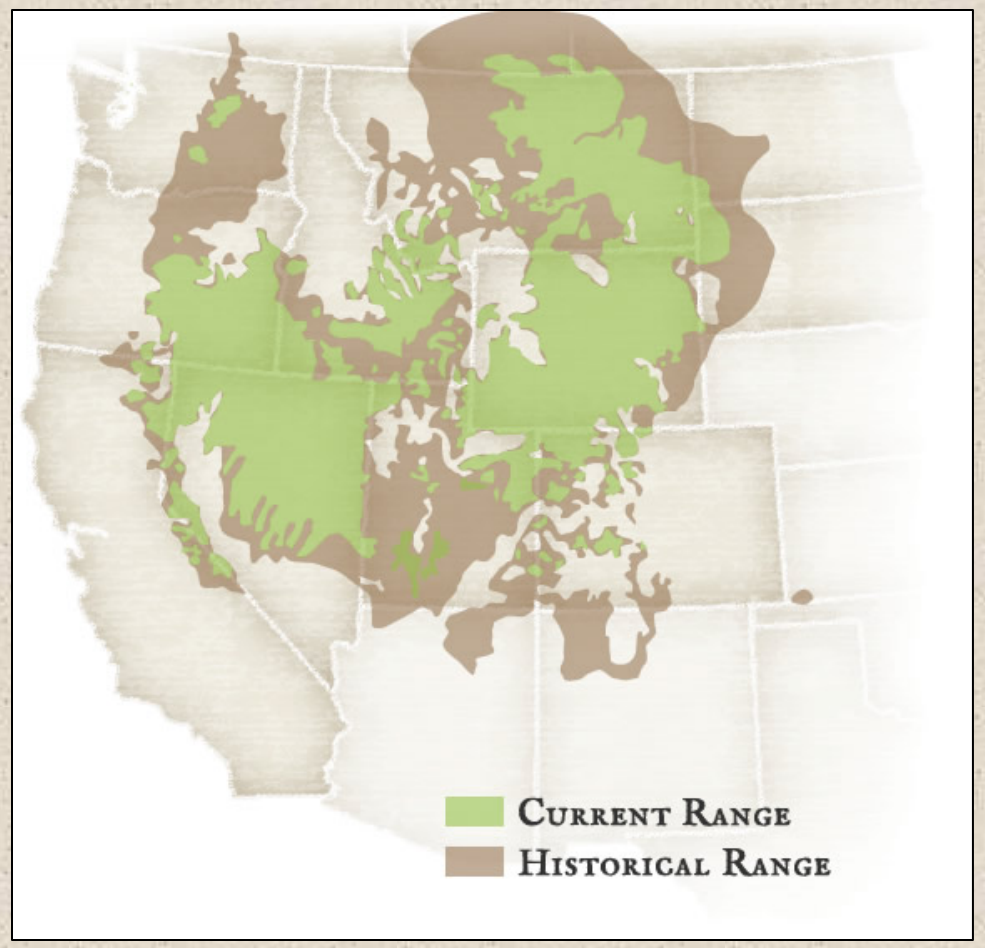
Sage Grouse

- Decline due to habitat loss and landscape fragmentation
- Habitat restoration
  - Active restoration via reseeding of native plants
  - Native plant community diversity is key



Sage Grouse Initiative

Winter

Spring

Sagebrush

70% or greater

Fall

Summer

Plants - Diet

Fall and Winter

- Sagebrush

Spring and Summer

- Forbs
- Insects

Chicks

- Sagebrush

Mountain Big Sagebrush

Wyoming Big Sagebrush

Plants - Nesting

- Medium height shrub cover (30 – 80 cm) and canopy cover of 15-30%
- Tall residual grass cover (> 40 cm) and minimum 15% grass & forbs

Aldridge

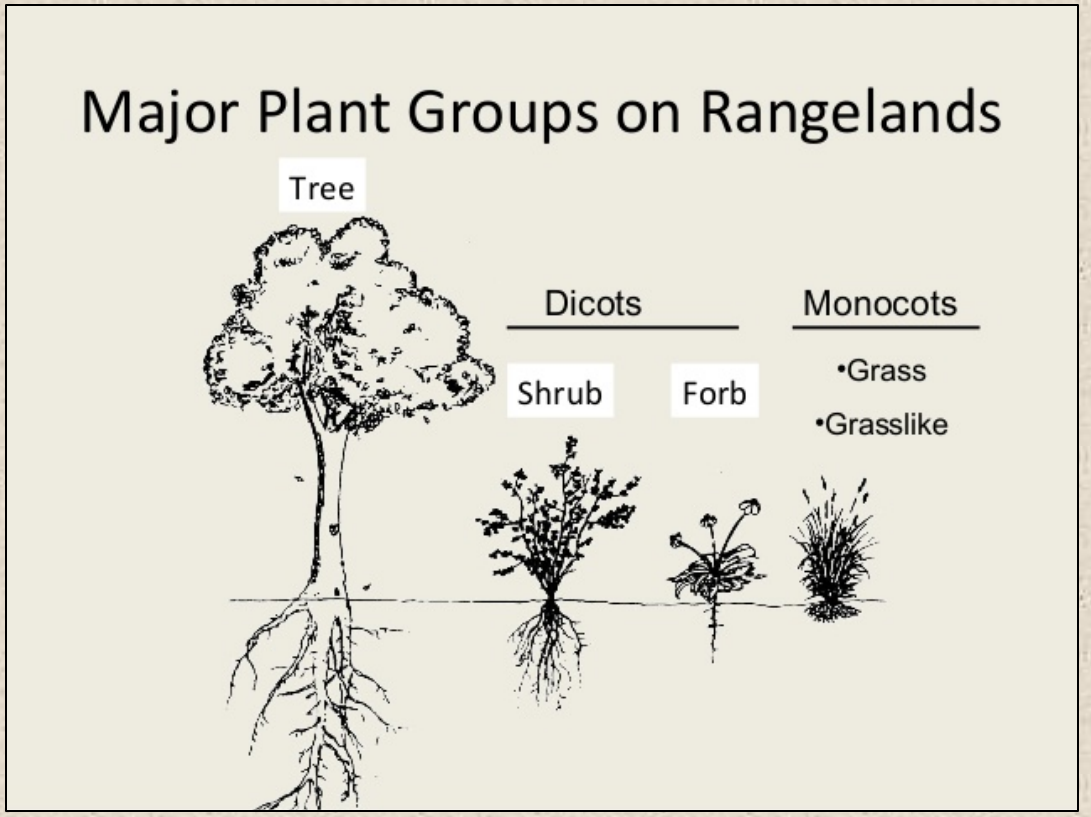
1. Gregg et al. 1994 J. Wildlife Management
2. Braun, Connelly and Schroeder 2005 USDA Forest Service Proceedings RMRS-P-38

Current Reclamation Practice

- Emphasis on native grasses and sagebrush (*Artemisia* spp.)
- Result?
  - Reduced plant community diversity
  - Limited # of functional groups
  - Competition from weeds

Functional Groups

- Grasses (e.g., cool- vs. warm-season)
- Shrubs
- Forbs



Texas A&M

Plant Community Restoration

Requires:

- Species Richness
- Functional diversity
- Habitat requirements of sage-grouse
  - Cover/nesting
  - Diet (direct and indirect)

Species Richness

How to?

- Seed mix

  Minimum 8 species (Piper et al. 2007)

- Site heterogeneity

  Variable niches (or sites) (Grubb 1977)

Species Richness

How to?

- Corridors

  Greater native plant diversity when patches are connected (Damschen et al. 2006)

- Managing competition

  Dominant species and genetic diversity

Cultivation

- Common for native grass species
- Results in selected germplasm or “cultivars”
  - Greater vigor
  - Rapid germination and seed production
- Altered competitive advantage?

Cultivars include 'Barton' and 'Arriba'

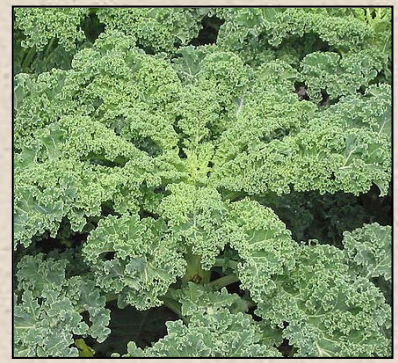
Are cultivars different?

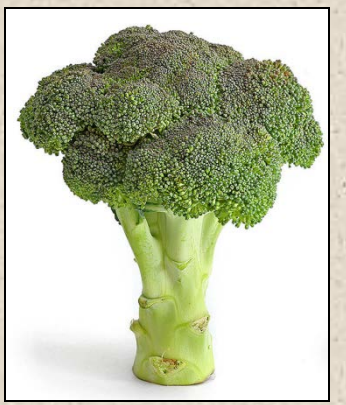
New Mexico

Wyoming

Winterfat

Brassica oleracea





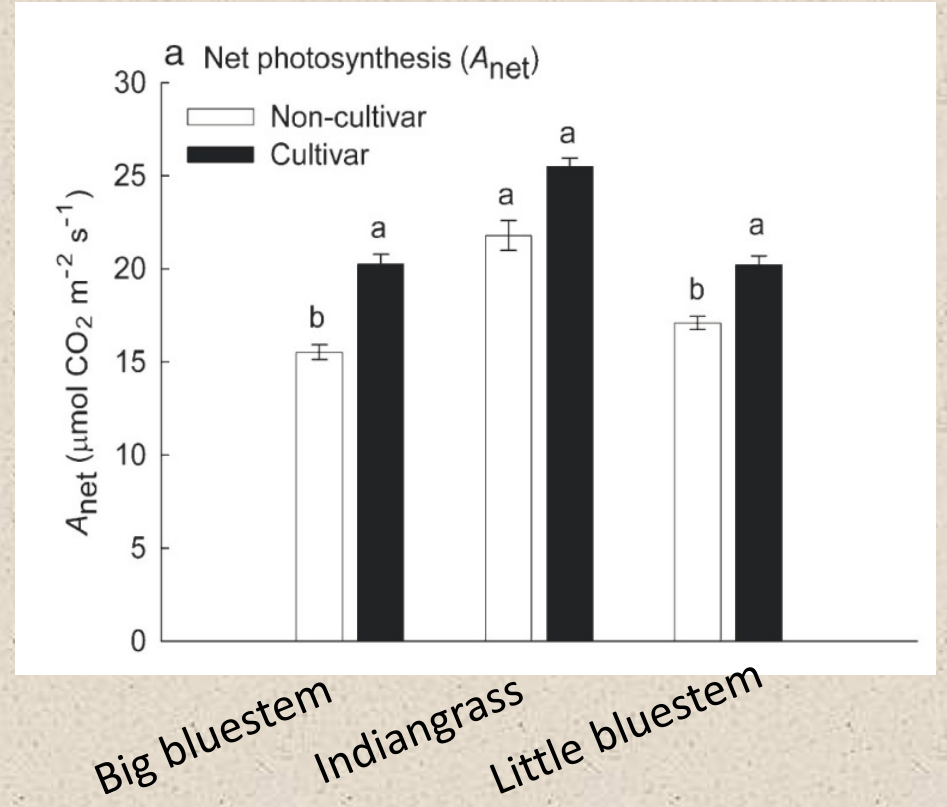
http://en.wikipedia.org/wiki/Brassica_oleracea

Restoring a Diverse Community

- Within-species diversity?
  - Adapted seeds
  - Competitive ability
  - Long-term establishment
- What is the evidence?

Examples

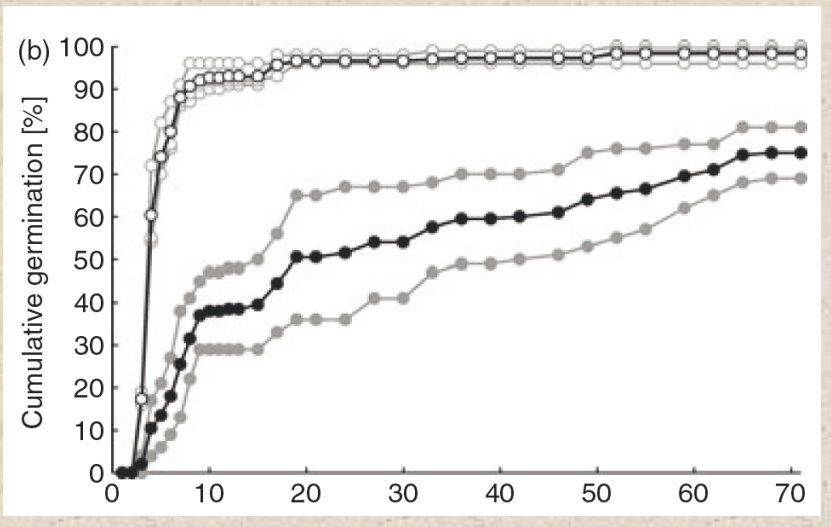
- Greater physiological performance among cultivars of tallgrass prairie species
- Seed source for restoration *can* impact plant performance
- Will the higher performing cultivars limit overall species diversity at a site?

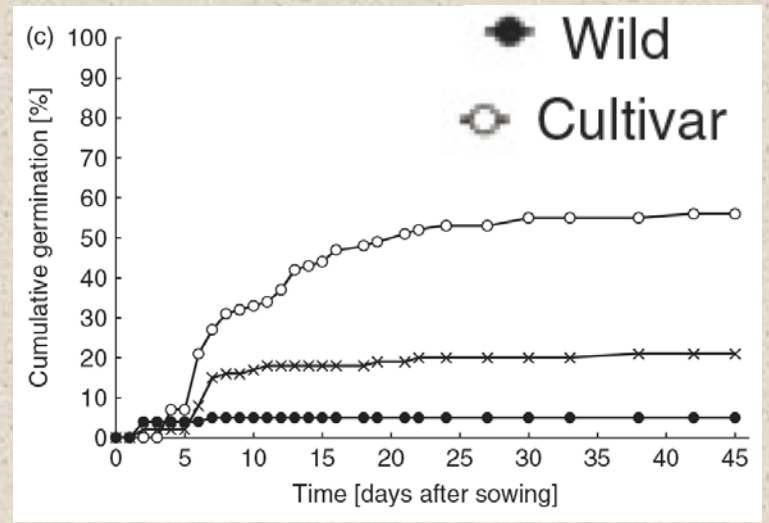


Lambert et al. 2011 Restoration Ecology 19: 43-52

Examples

- Rapid and greater germination in cultivars relative to uncultivated populations
- Altered seed dormancy characteristics
- Will loss of seed dormancy impact species-level associations?

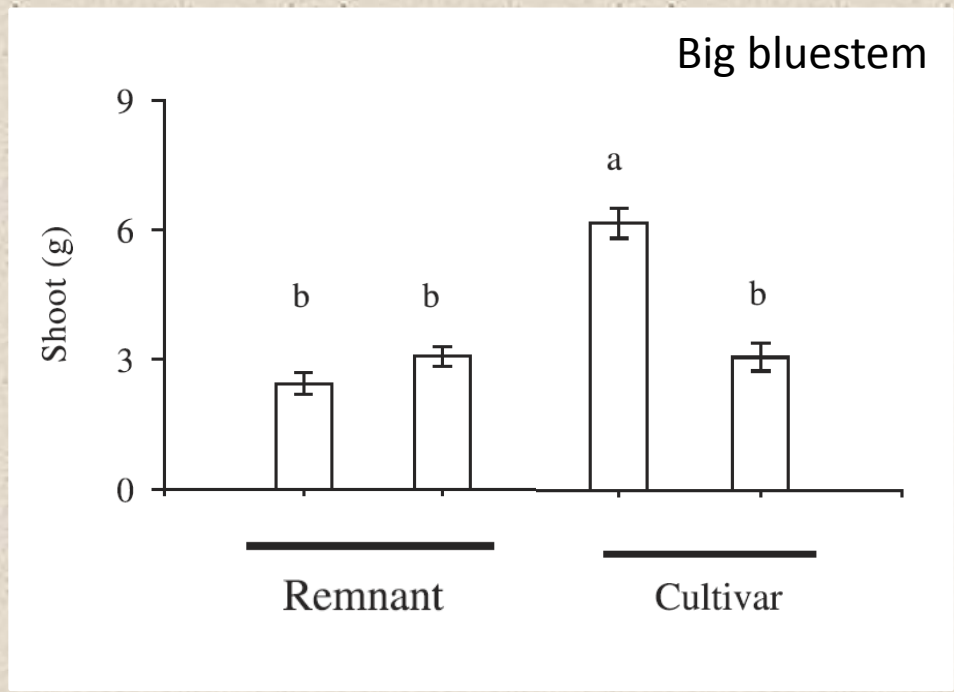




Schröder and Prasse. 2013. Restoration Ecology 21: 793-800

Examples

- Cultivars consistently larger than non-cultivars
- Local adaptation apparent but trumped by cultivars
- Elevated competitive ability of dominant grass species
- More evidence that non-local and cultivated seeds will limit community diversity?



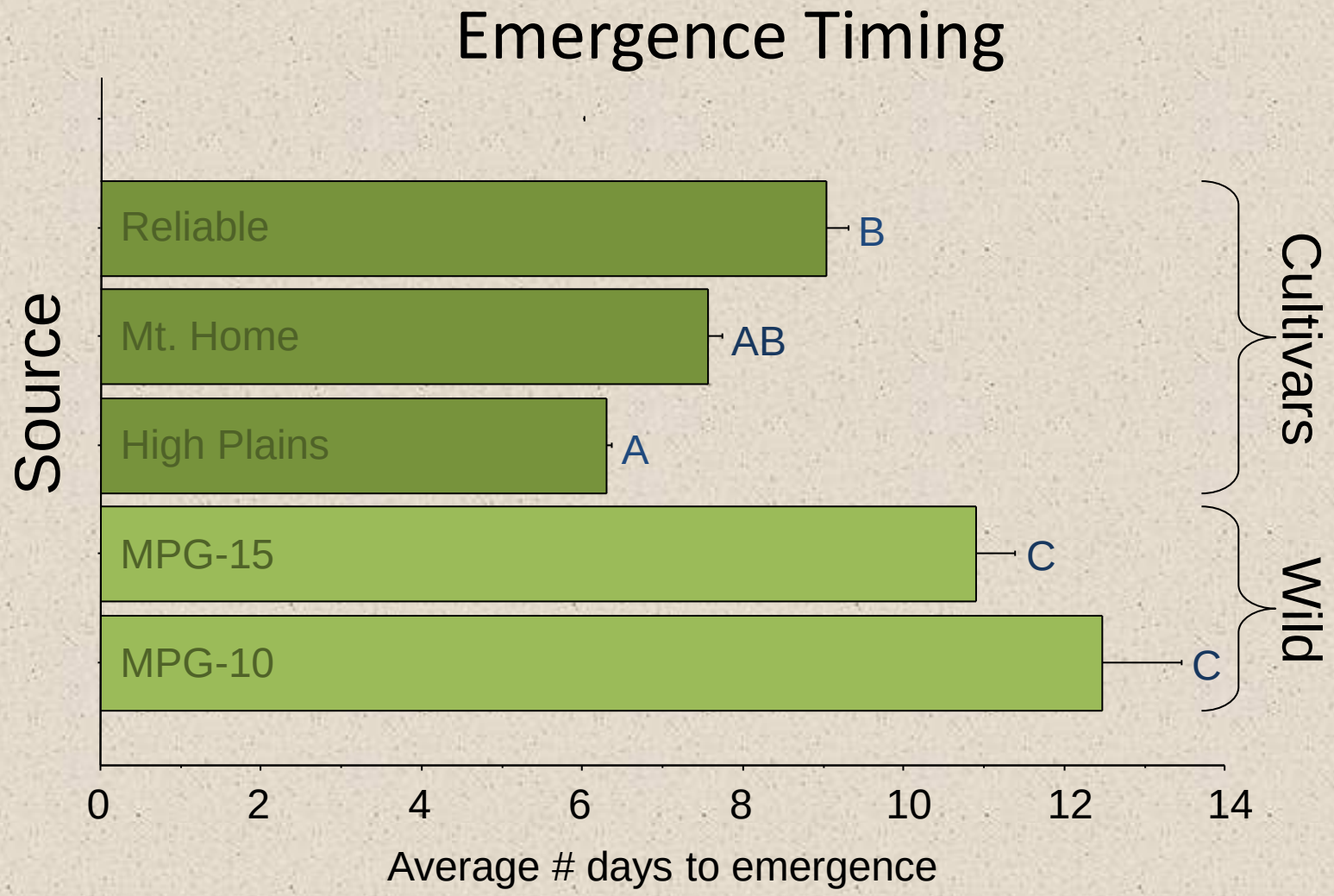
Gustafson et al. 2004. Functional Ecology 18: 451-457

Examples

- Are cultivars different from wild sources?
- If cultivars more vigorous, can we use that to our advantage in the presence of cheatgrass?

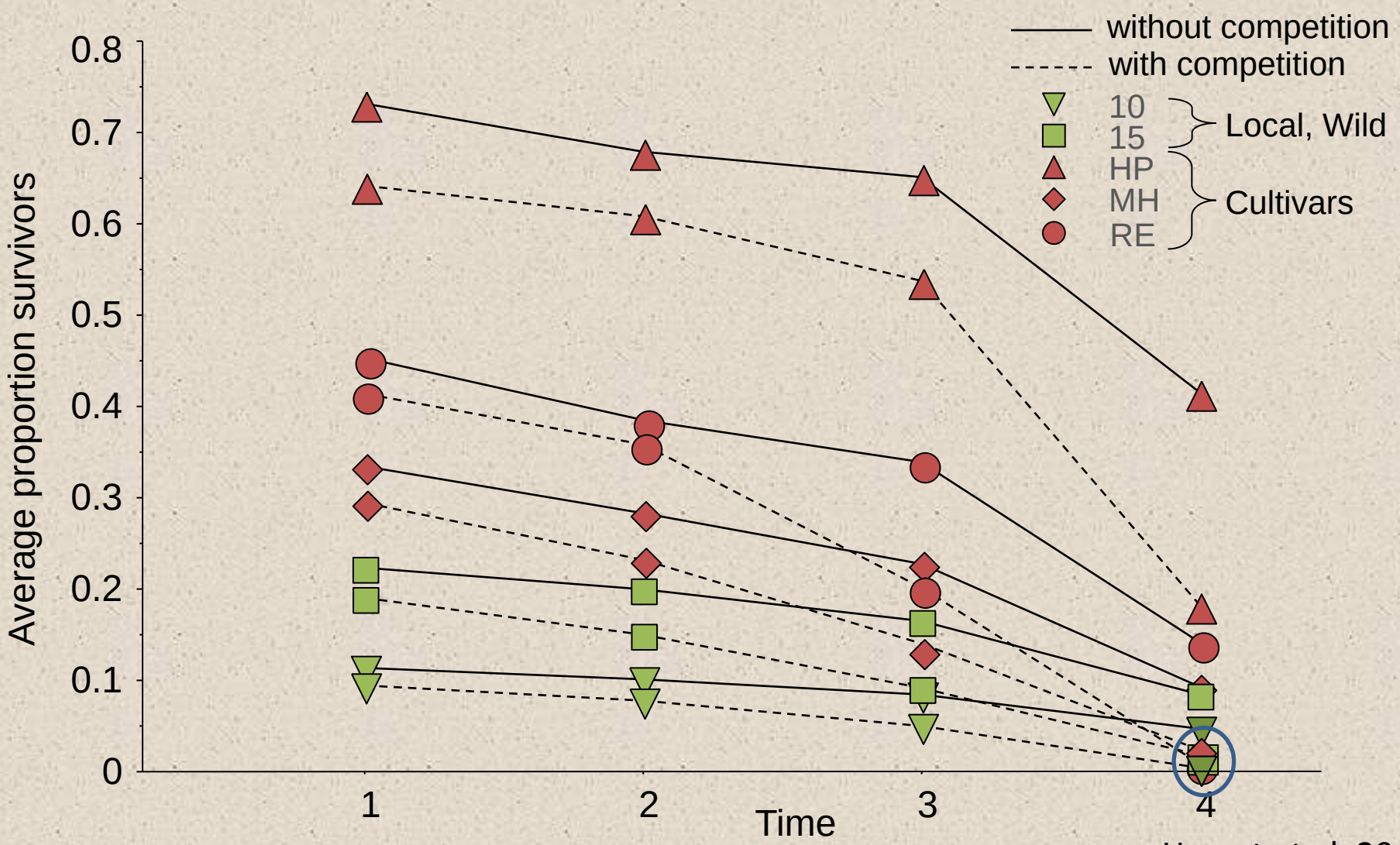
Herget et al. 2015 Plos ONE 10.1371/journal.pone.0119889

Do seed sources (wild vs. cultivated) differ?



Herget et al. 2015

Are cultivars of native species more competitive?



Herget et al. 2015

Summary

- Native plant species richness is a function of seed source as well as other factors
- If cultivars have a competitive advantage over other species, consider alternative sources or planting methods
- Different seed sources may have different uses depending on the site in question

Wyoming Reclamation and Restoration Center

http://www.uwyo.edu/wrrc/bulletins.html

B-1256 June 2014

SUCCESSFUL RESTORATION OF SEVERELY DISTURBED LANDS: NATIVE PLANTS AND ADAPTED SEEDS FOR RECLAMATION

This bulletin provides general information appropriate for all Wyoming ecological sites.

Part of a series by the University of Wyoming Extension Reclamation Issue Team and the Wyoming Reclamation and Restoration Center that describes strategies for restoring ecological functions to disturbed Wyoming lands. For this series, reclamation means restoration of components that support desired ecological functions, such as

Summary

This bulletin addresses the use of native plants and adapted seed sources in reclamation of severely disturbed lands. Native plants represent key resources for restoration of ecosystem functions and wildland health. Selection of adapted seed sources may improve the short-term establishment of plants as well as the long-term sustainability of plant and animal communities at reclamation sites. Background information and practical guidelines are outlined to assist restoration practitioners

Wyoming Reclamation and Restoration Center

B-1204 April 2010

SUCCESSFUL RESTORATION OF SEVERELY DISTURBED LANDS:
Seeding essentials for reclaiming disturbed lands

This bulletin provides general information appropriate for all Wyoming ecological sites.

Part of a series by the University of Wyoming Cooperative Extension Service Reclamation Issue Team and the Wyoming Reclamation and Restoration Center that describes strategies for restoring ecological functions to disturbed Wyoming lands.

Reclamation and restoration: For this series, **reclamation** means **restoration** of components that support desired ecological functions, such as livestock grazing, wildlife forage and cover, water supply, water quality protection, and aesthetic values.

Introduction

This bulletin provides information most relevant to revegetating disturbed grassland and shrubland plant communities in Wyoming. The information applies to sites drastically disturbed by mining or construction activities where topsoil has been stripped, stockpiled, and replaced.

Determine reclamation objectives

The goal for any reclamation project is to restore important pre-disturbance ecological functions of a site disturbed by construction or mining operations. Important functions include wildlife habitat, forage for livestock and wildlife, watershed and water quality protection, and others. A thorough pre-disturbance inventory provides the basis for describing important functions and setting reclamation objectives.

Summary of components of successful reclamation seeding. See text for more information.

Activity	Critical components
Design a	• Determine reclamation objectives. • Assess site-specific pre-disturbance vegetation characteristics (e.g., canopy cover of herbaceous species, shrub density). • Utilize site-specific Natural Resources Conservation Service (NRCS) Ecological Site Descriptions (ESDs) for lists of appropriate species. • Calculate seeding rates in mixes using the NRCS worksheet available on the Wyoming Reclamation and Restoration Center Web site (http://uwyo.edu/WRRC) under Reclamation Information (see also Table 2).

Seed Issues and Seed Sourcing

- Active Restoration = Seeding native species
- Consider forbs as well as shrubs and grasses
- Meet goals for Sage Grouse habitat

Funding:

Examples

- *Achillea millefolium* – common yarrow
- *Antennaria spp.* – pussytoes
- *Astragalus spp.* – milkvetch
- *Crepis spp.* – hawksbeard
- *Linum lewisii* – blue flax
- *Lomatium spp.* – desert parsley
- *Machaeranthera spp.* – tansyaster
- *Sphaeralcea coccinea* – scarlet globemallow

Availability?

- *Achillea millefolium* – common yarrow
- *Antennaria spp.* – pussytoes
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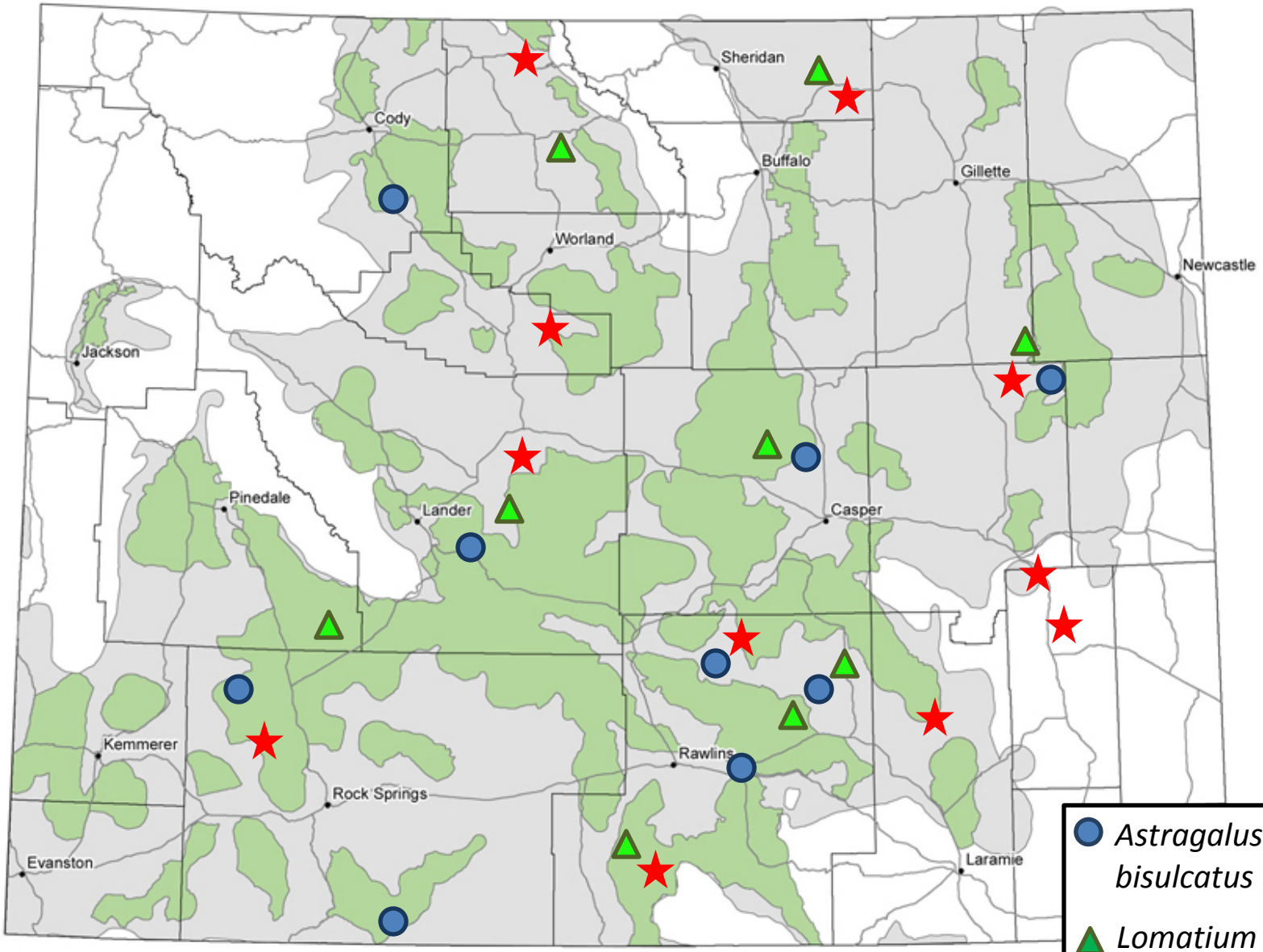
Limited

Forbs for sage grouse habitat restoration

Patricia McIlvenna, UW Grad Student

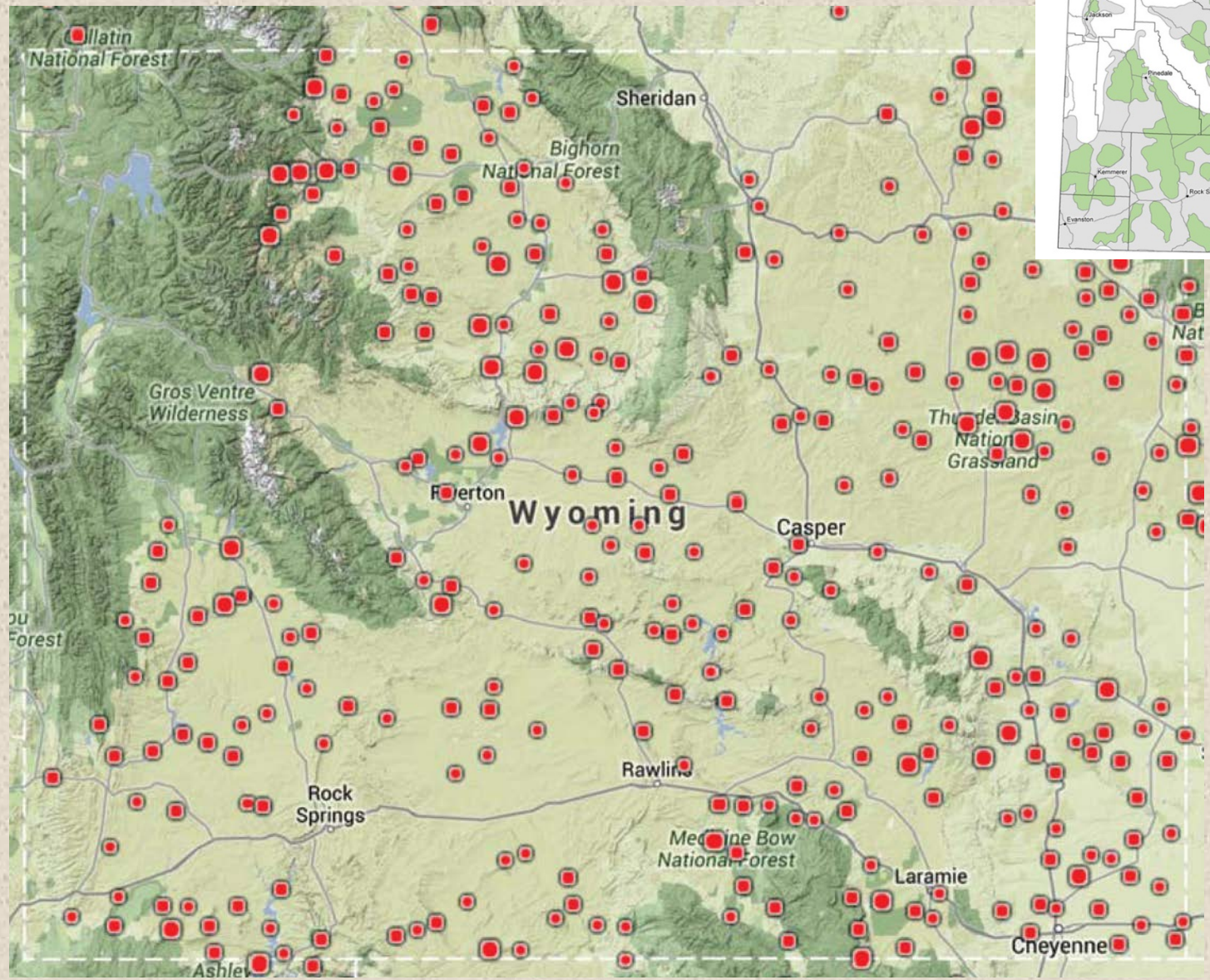
Sage-Grouse Core Management Areas Version 3

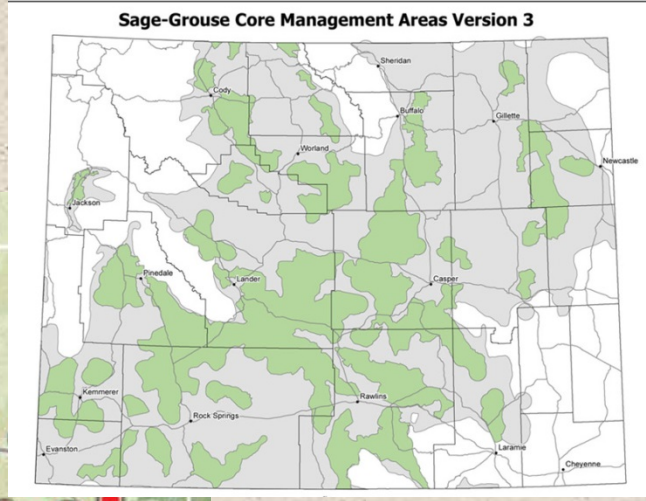


Nyssa Whitford
Sage-Grouse GIS Analyst
Lander Regional Office

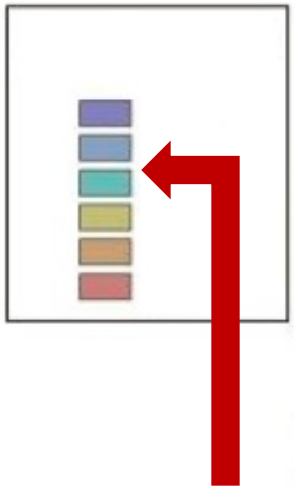
Core Areas shown were updated from the version two core areas. The version three core areas were updated under the direction of the Governor by the Sage-Grouse Local Working Groups and the

Sphaeralcea coccinea

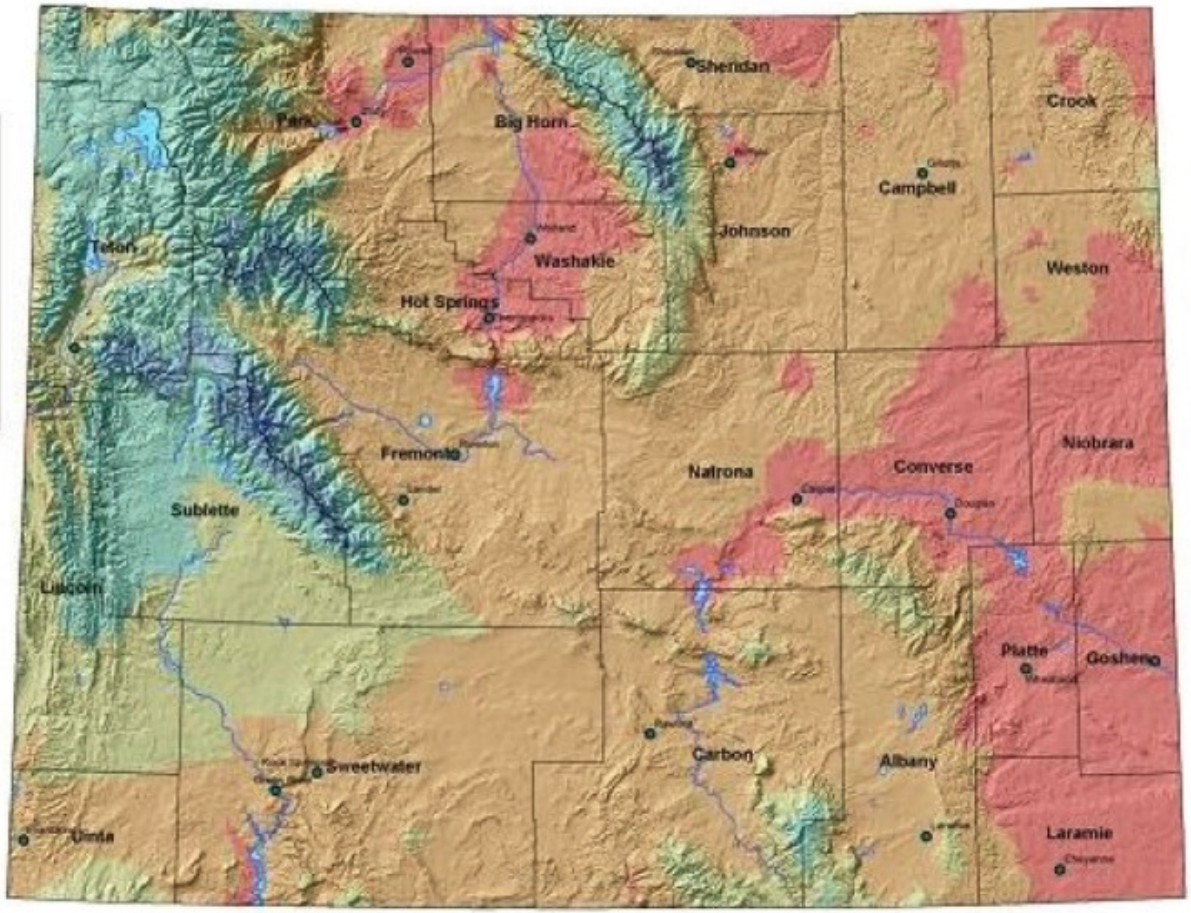




Wyoming Mean Annual Temperature



Difference in 25 ◦F



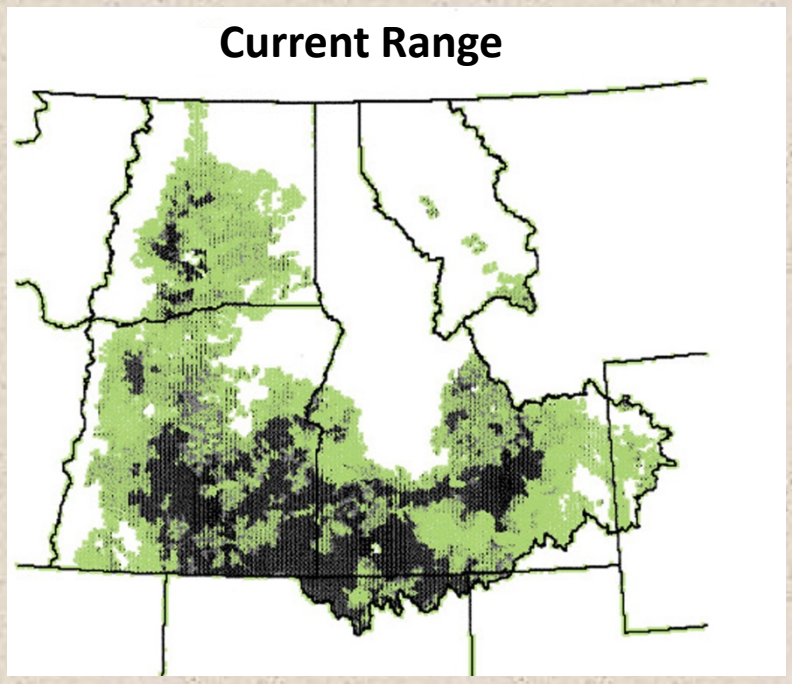
0 12.5 25 50 75 100

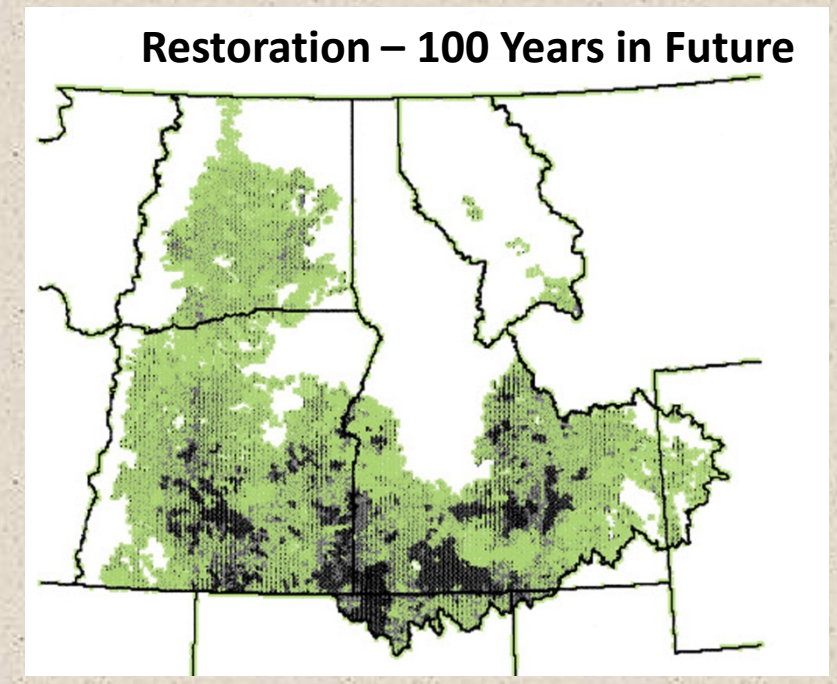
Lambert Conformal Conic Projection
Central Meridian: -107.5
1st Standard Parallel: 33
2nd Standard Parallel: 45
Latitude of Origin: 41

Wyoming State Climate Office
http://www.wrds.uwyo.edu/wrds/wsco/wsc.html

Can it work?

- Models -> a six-fold increase in areas under restoration will reduce risk of local extinction of Sage Grouse





Black areas occupied by Sage Grouse

Wisdom et al. 2002 Conservation Biology 16

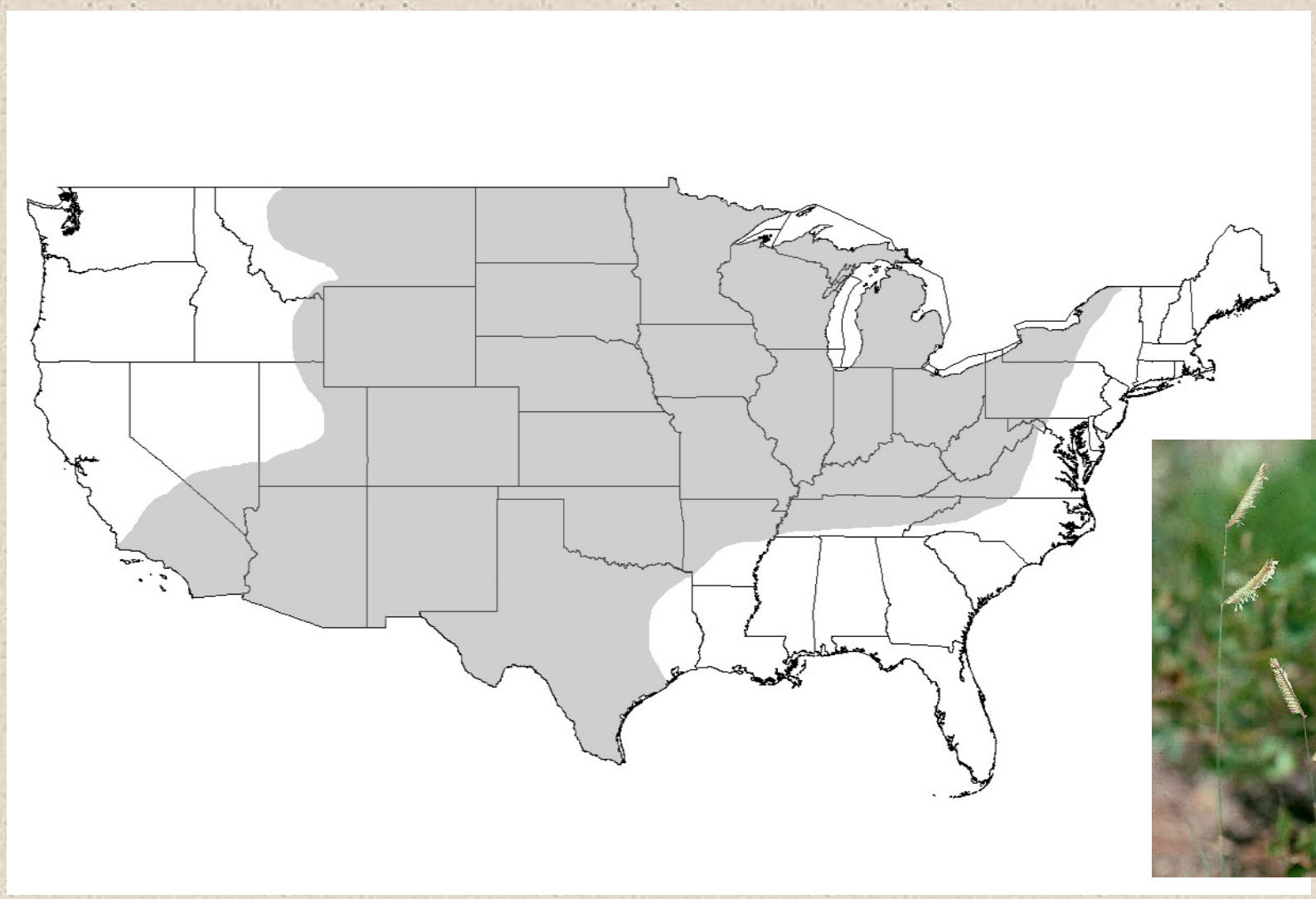

Long-term success in restoring a species to a given site is dependent upon obtaining **plants adapted** to the site.

Local Adaptation

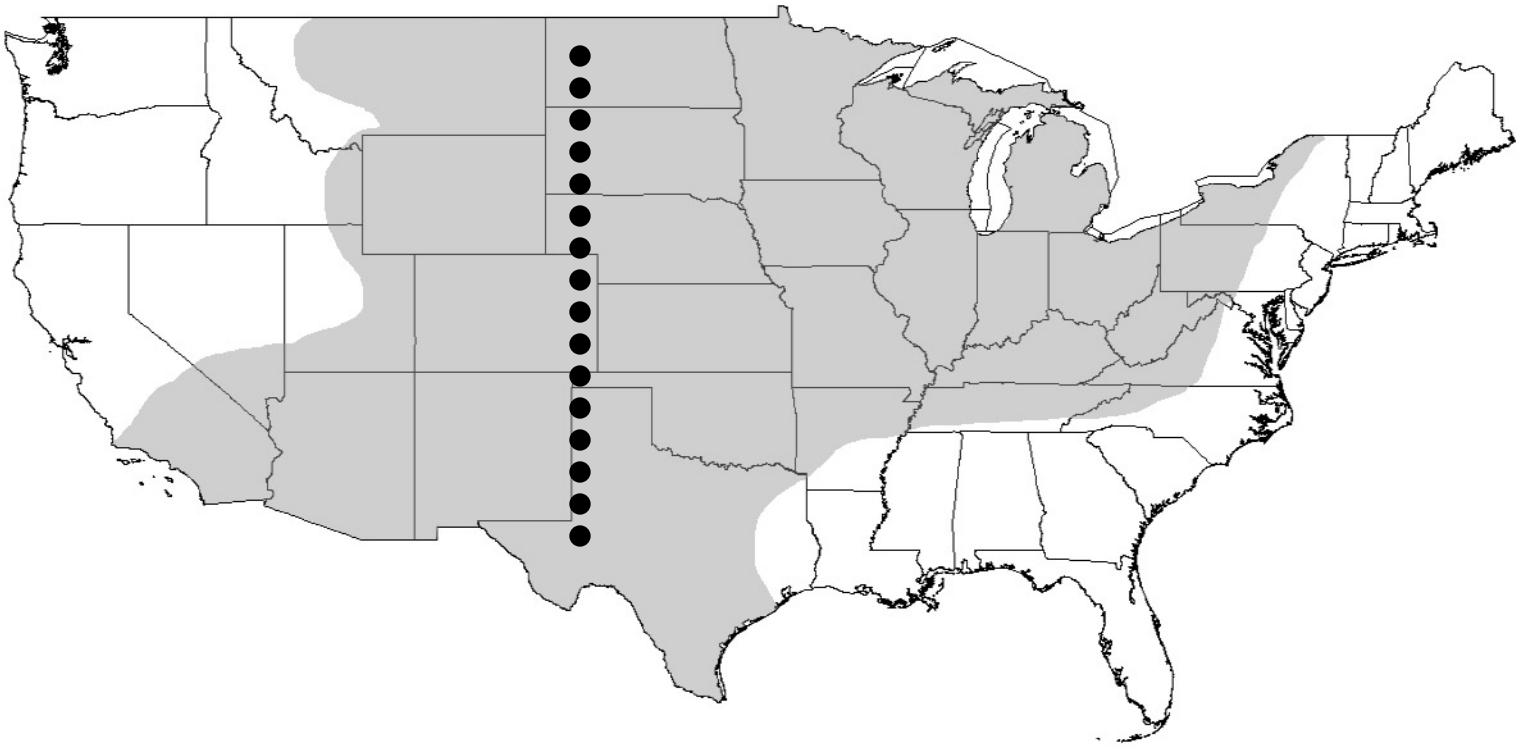
Plant Ecotypes: distinct genotypes (or populations) within a species, resulting from adaptation to local environmental conditions.

G. Turesson 1922 The species and variety as ecological units.

Available Resources are Often Cultivars

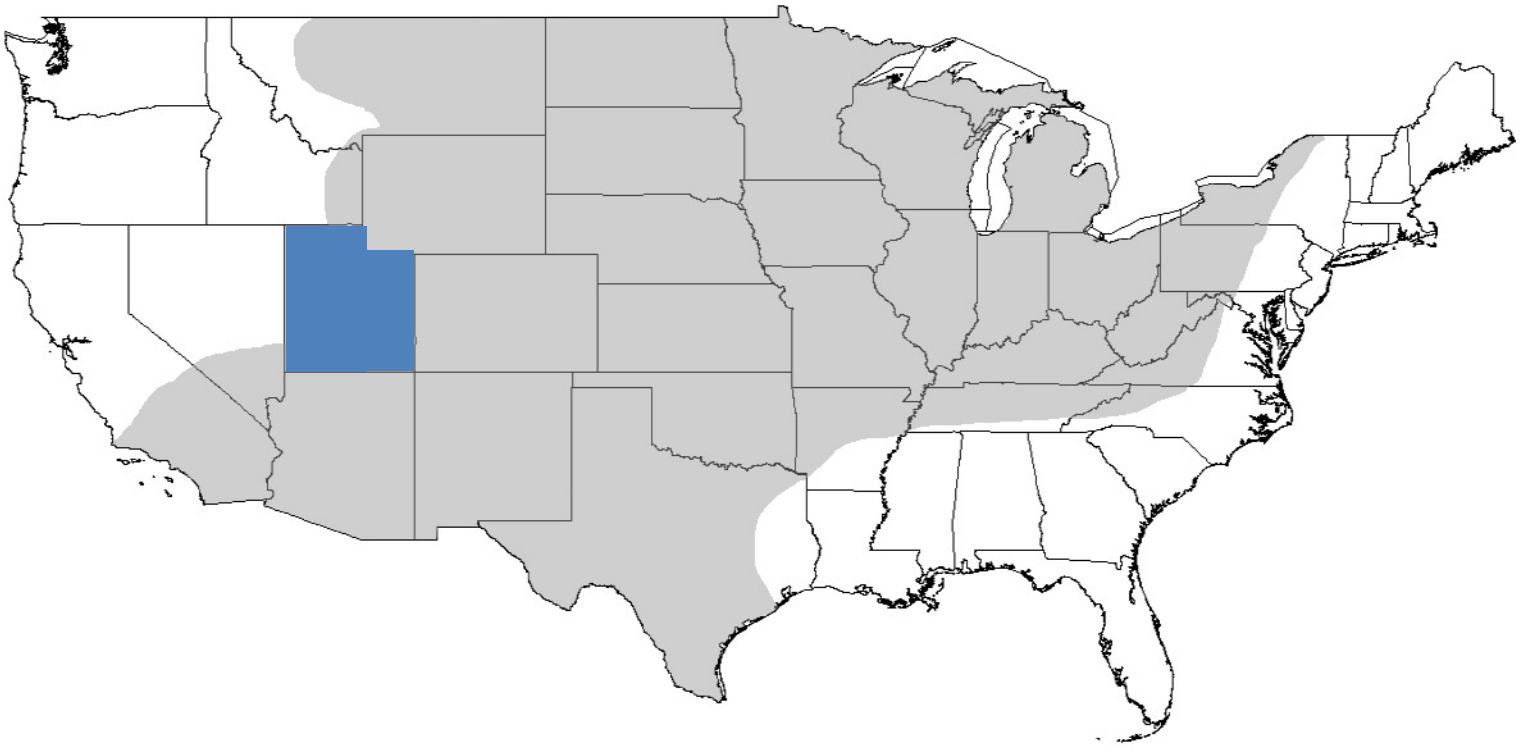


Latitudinal Variation: *Bouteloua gracilis*



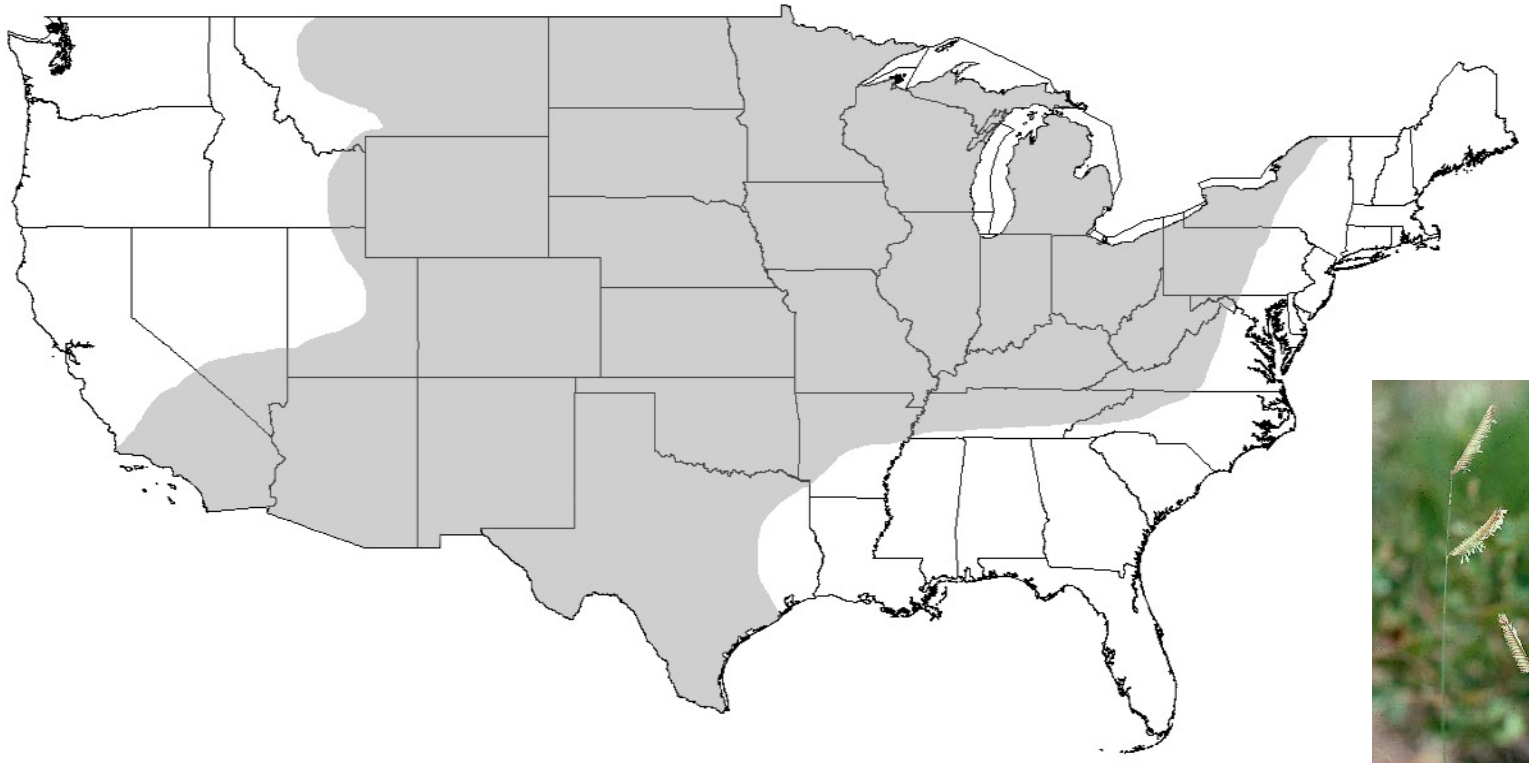
Growing Range

Latitudinal Variation: *Bouteloua gracilis*



Growing Range

Available Resources: Cultivars

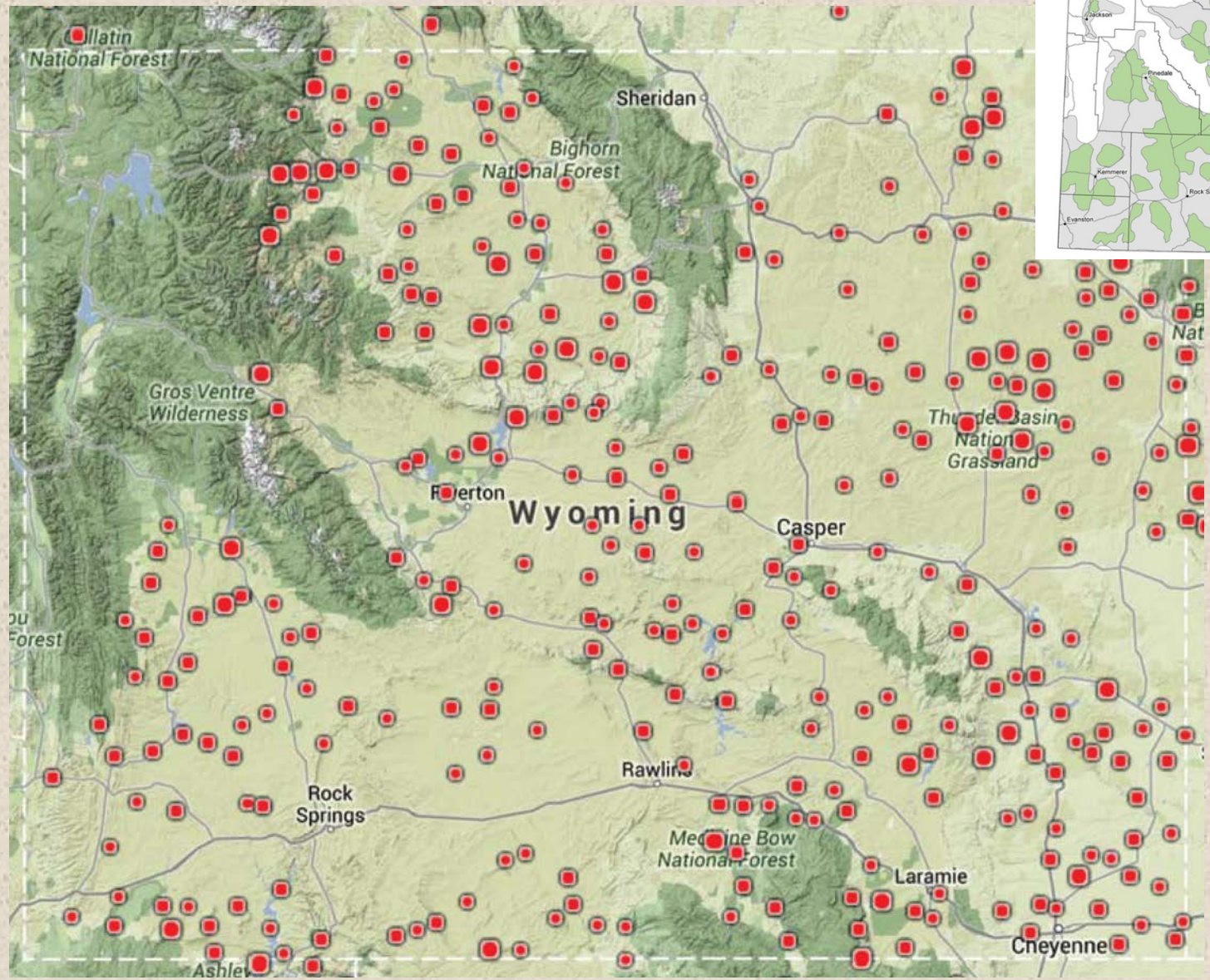


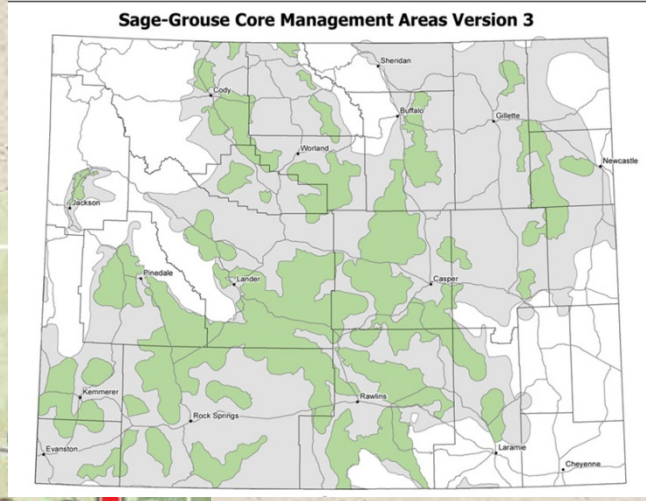
Species and Source Selection

Opportunities!

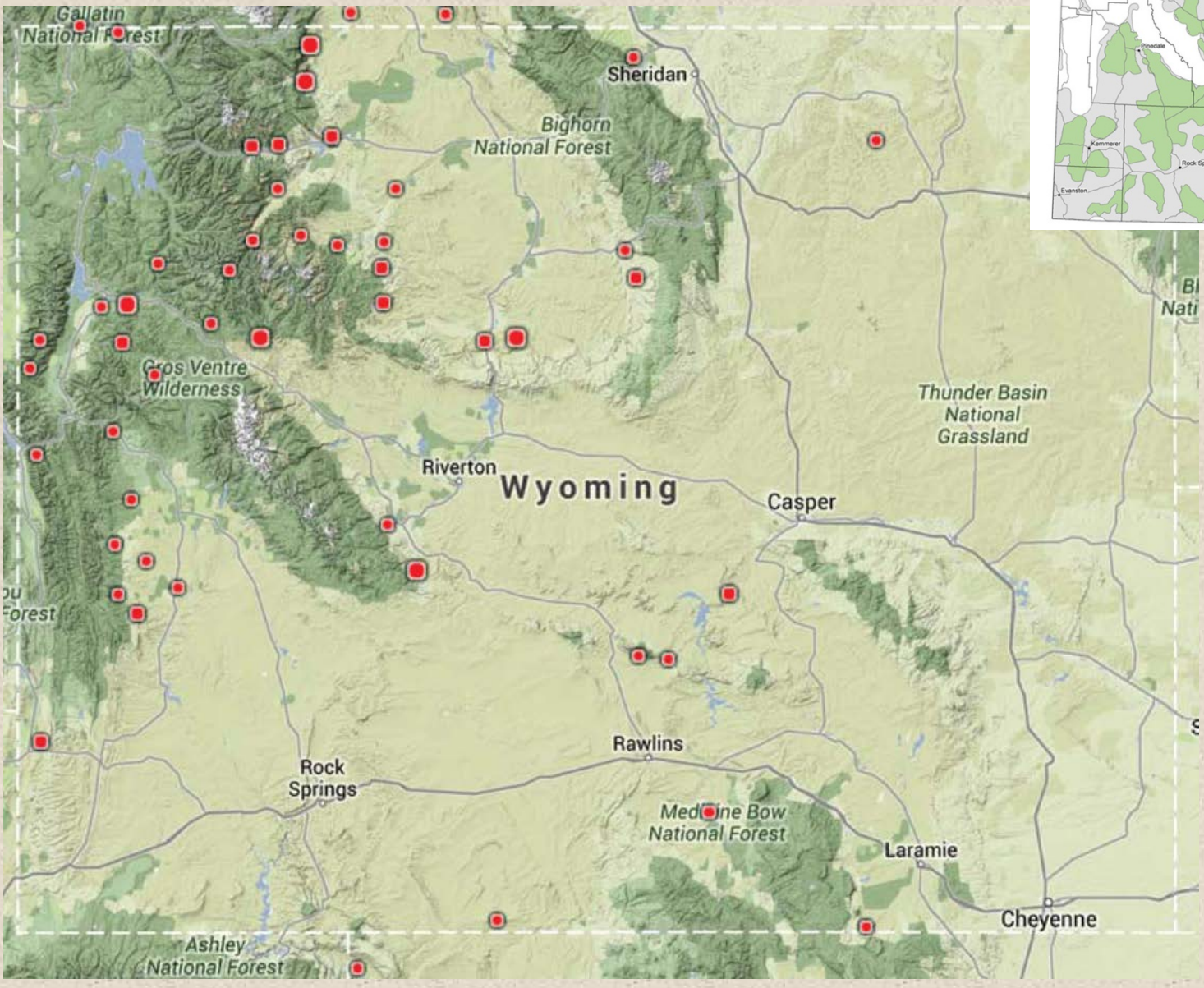
- Species selection
  - Common vs. rare
  - Characteristics for germination and growth
- Source selection for seed increase
  - Maintain natural variation
  - Region specific?

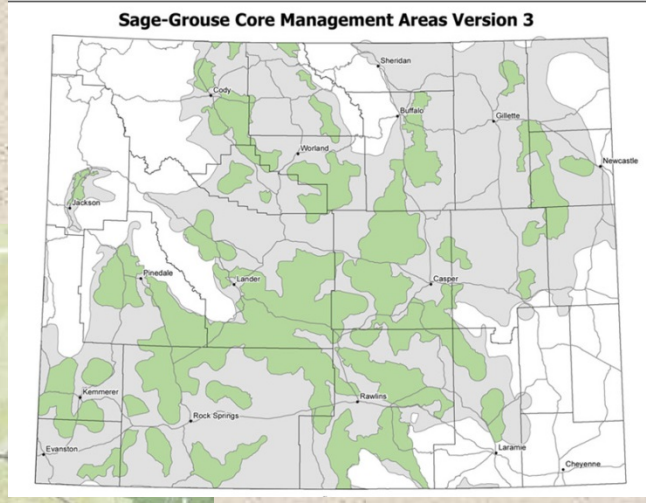
Sphaeralcea coccinea





Hedysarum boreale





Seed Issues and Seed Sourcing

- Active Restoration…
  - Seeding native species
- Consider forbs as well as shrubs and grasses
  - Opportunities to improve seed mix
  - Match seed source to site conditions
- Meet goals for Sage Grouse habitat