



What Seed Should I Grow?

Fred Edwards, Bureau of Land Management

Nevada Native Seed Forum

Sparks, Nevada

March 14, 2019



Outline

- Background on Nevada Native Seed Partnership
- Why we need better seed for Nevada
- What the Nevada Native Seed Partnership is doing to help you
- Where we heading in Nevada
- Considerations for positioning yourself for success
- Some resources to help



Who Are We?

Nevada Native Seed Partnership

- Restore ecosystem function species diversity and services
- Lower the cost of native seed
- Improve native seed market
- More species and genetically appropriate sources
- Build a Nevada industry and economy



Why don't we have better seed: Plant Blindness

We have an unconscious bias against plants

- Plant awareness is not hard wired into our physiology and sensory systems the same way that it is for wildlife.
- Plants are generally a non-threatening part of the environment
- People typically know less about plants than animals
- Plant awareness requires a mentor, especially in urban areas.



Animal Bias: Many folks think about plants like wildlife, but...

Plants function differently in space and time than animals :

- Plants are stationary and exposed, with relatively high genetic selection pressure
- Plants have below ground structures and dynamics – seed banks, corms, tubers and mutualisms (mycorrhizae and rhizobia)
- Plants have different dispersal and migration characteristics
- Plants have a variety of specialized reproductive systems



More differences...

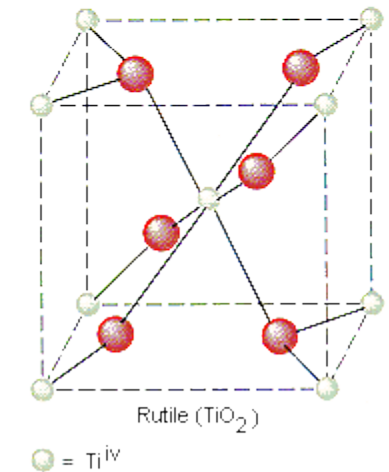
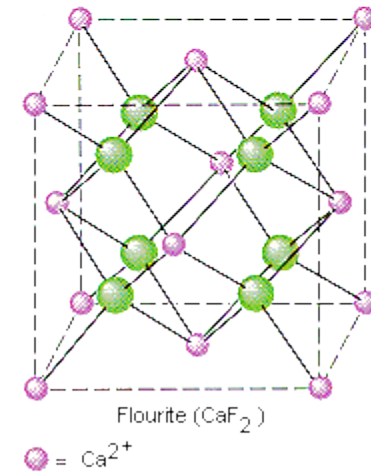
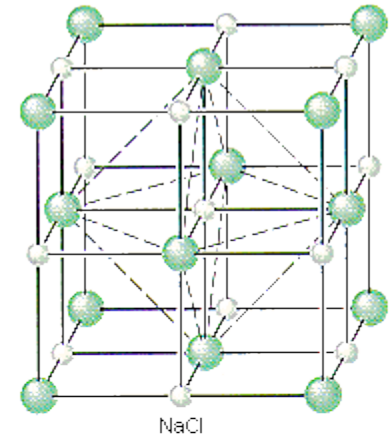
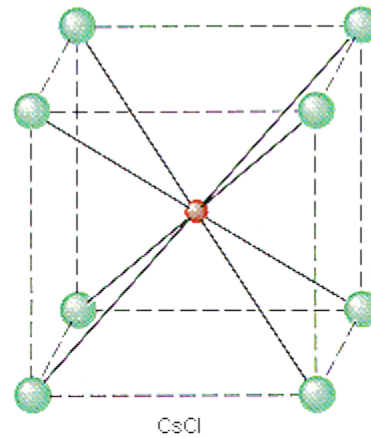
- Plant populations are often smaller, with greater genetic variation between populations
- Plant populations are more vulnerable to local threats
- Plants have more complicated life histories and more symbioses and mutualisms with other species
- Plants often respond with genetically fixed adaptations to changes in their environment



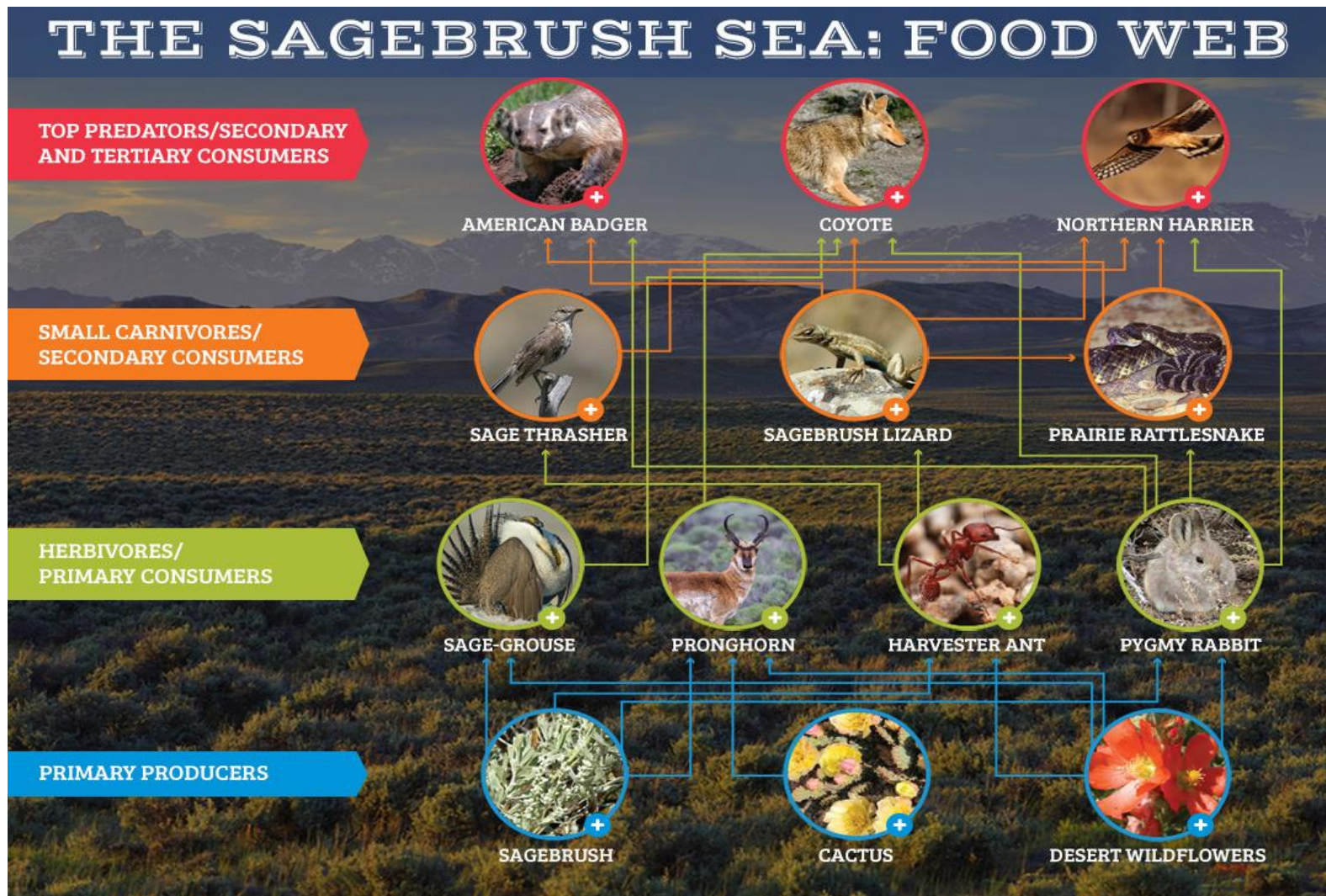
Ecosystem Structure and Function built by species diversity

An **ecosystem** is the biota (plants, animals, and microorganisms) within a given area, the environment it sustains, and their interaction

Native seeds are the key to creating diversity within an ecosystem



Another way to think about ecosystems ...

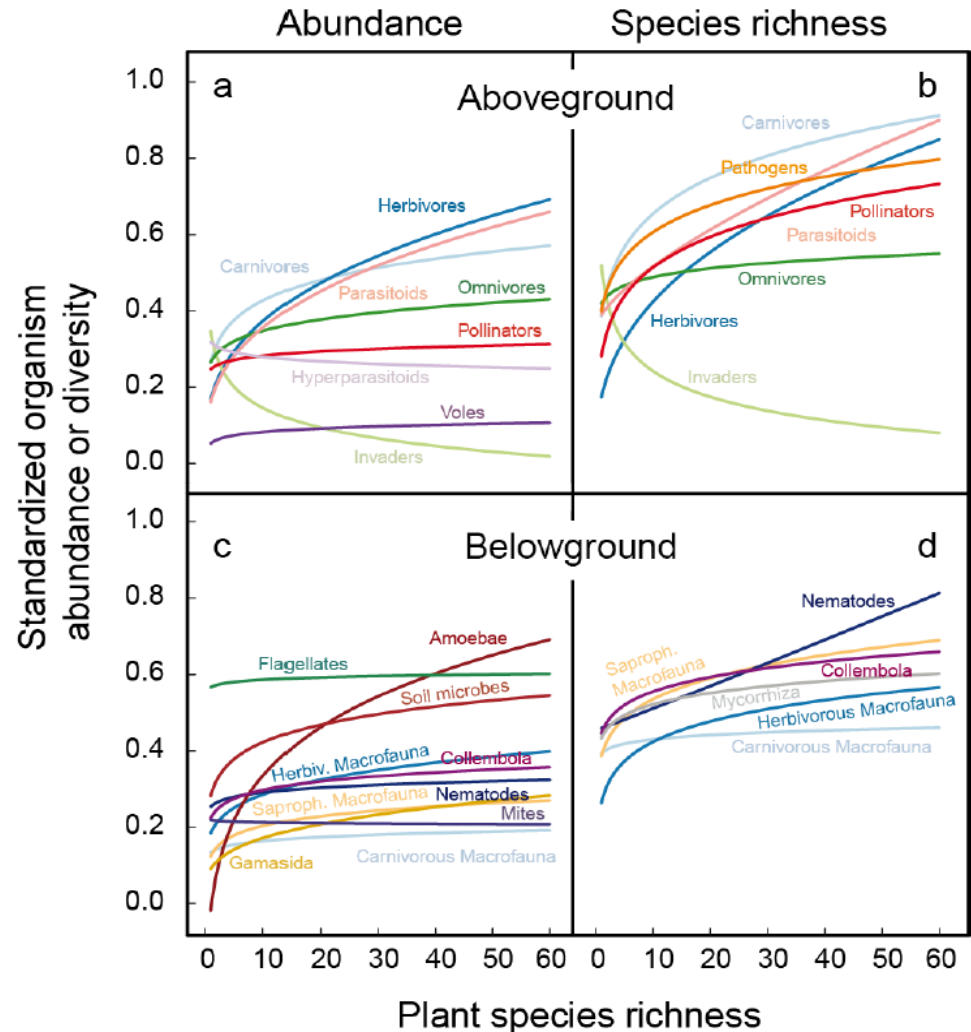


How do you measure ecosystem health?

Plant species richness and abundance is the best indicator of healthy ecosystems

Seeding is the fastest way to get species back into ecosystems

More species = more interactions = more/better services



Different Ecosystems: why crested wheatgrass works, yet does not quite work

Why it Works	Why it Doesn't Work
Non native adapted to highly competitive and high disturbance ecosystems in Asia	Does not share have functional connections with native species
Germinates and Establishes Quickly	Can create monocultures that are harder to remove than cheatgrass
Competes with cheat grass, but then so do some natives	Outcompetes native species and inhibits/delays natural succession



Ecosystems are not static, they change and adapt

Evolutionary ecology: considers how interactions shape species and the consequences of the resulting evolutionary change.



Exist as a dynamic equilibrium

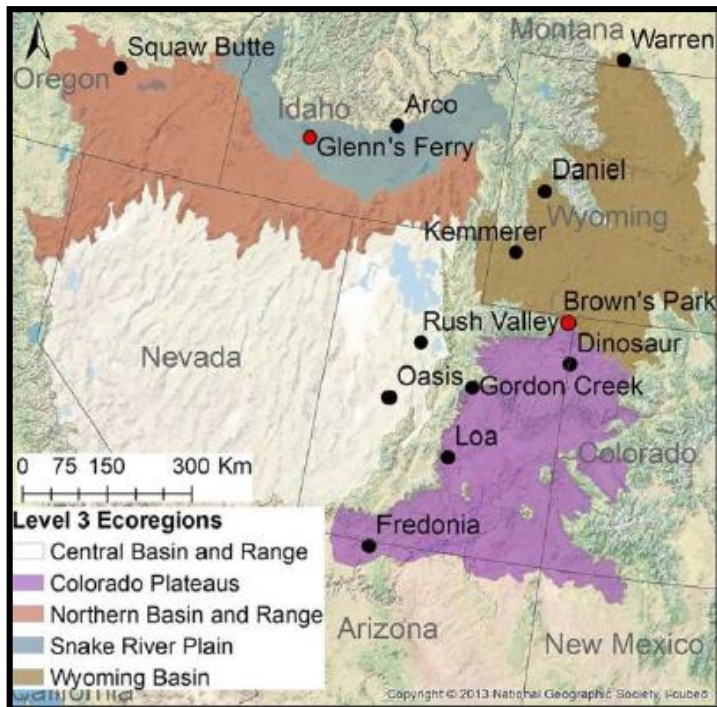
big changes = new ecosystem

little changes = local adaptation

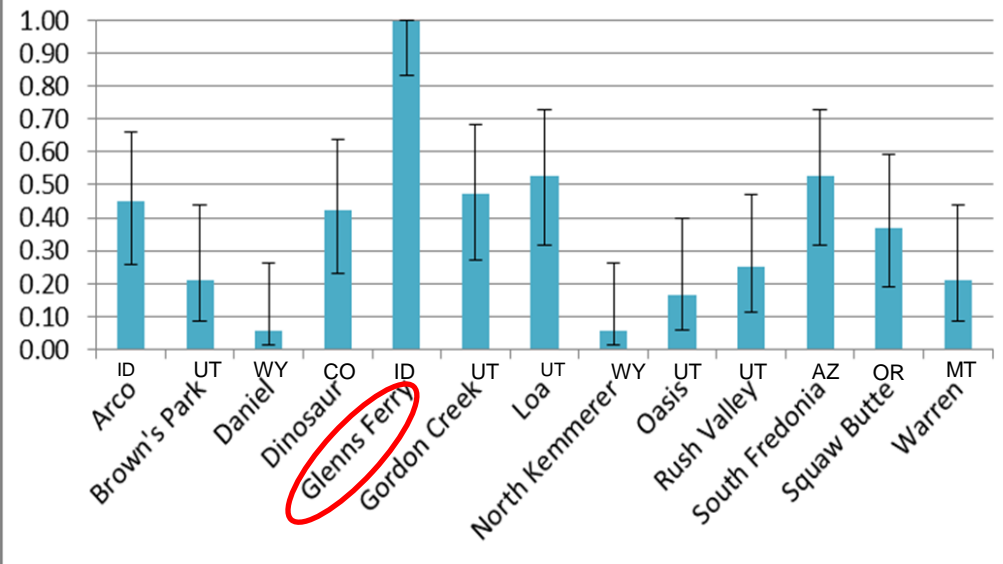
Local Adaptation is Real

Wyoming Big Sagebrush Survival
from 13 Locations Planted in Glenns
Ferry, ID in 1987

Sands and Moser 2013
Germino et al. 2018



Proportion of Plants Alive in 2010



Black symbols source populations; **red**
symbols common garden locations

Local Adaptation is Real

Macranthera canescens



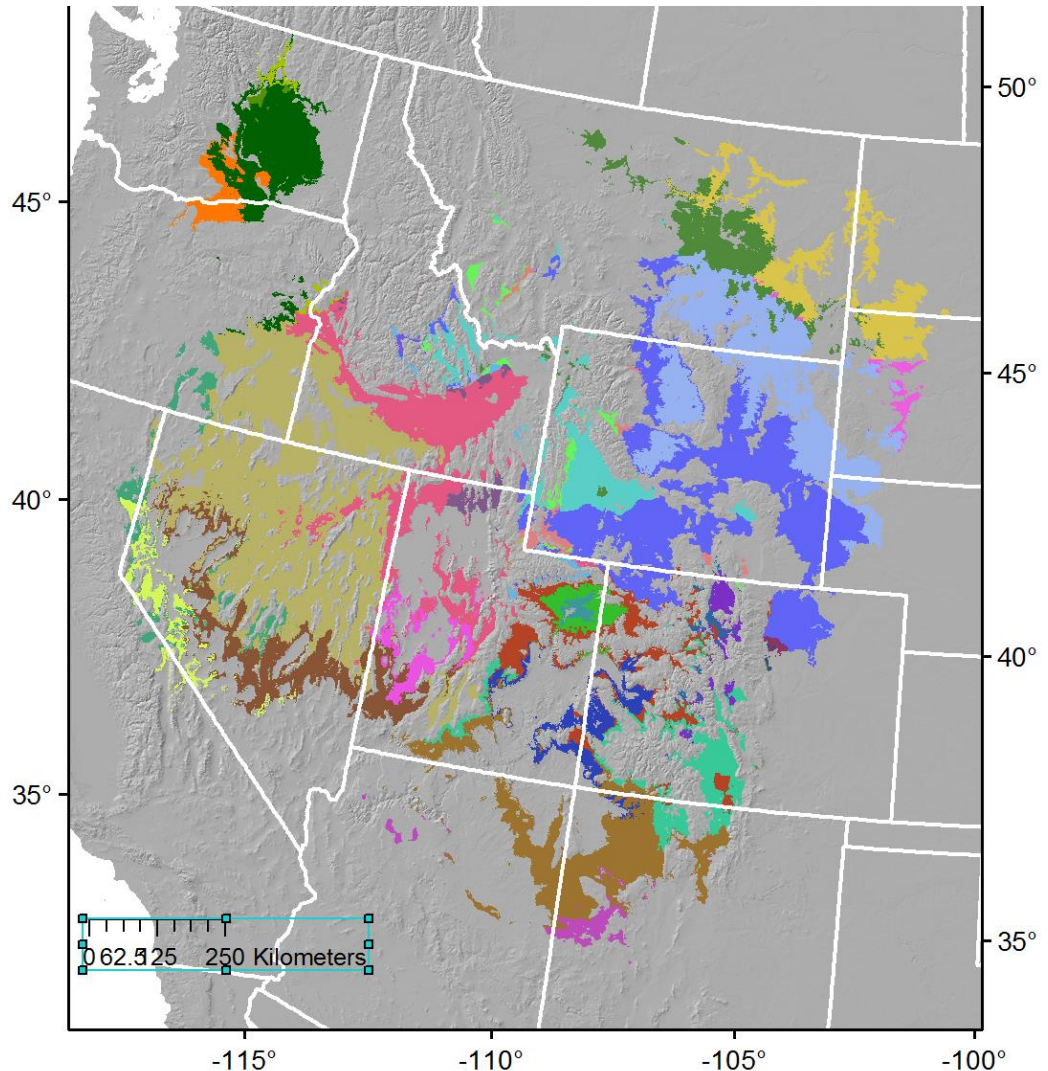
Wyoming Sagebrush Empiric Seed Transfer Map

Explains:

Results observed by
Sands and Moser

Why BLM sagebrush
seedlings often fail

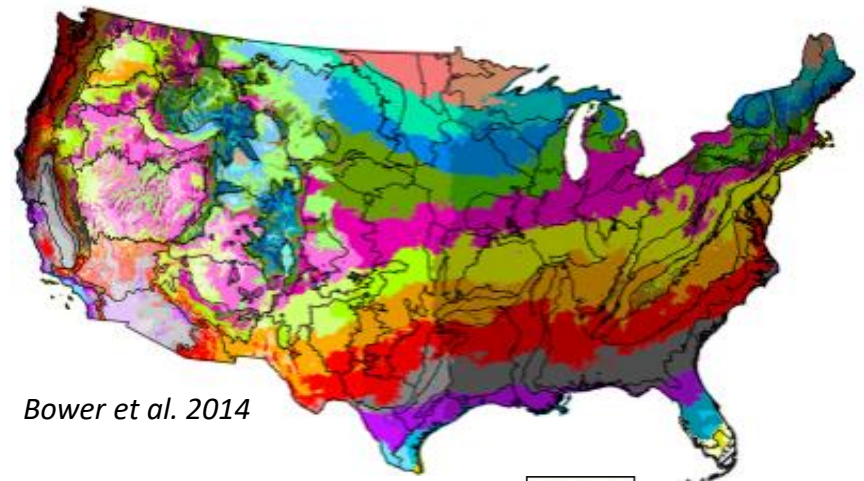
Improves cost
effectiveness of
treatments



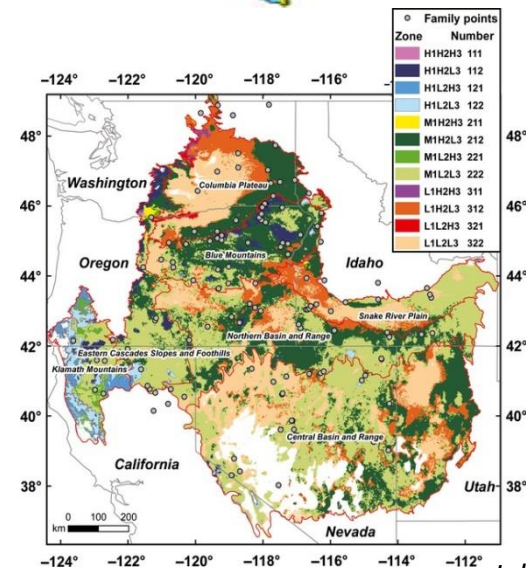
Seed Zones:

Best compromise for addressing local adaptation

- A mapped area with a fixed boundary which seeds or plant materials can be transferred for the best chance of success
- Developed in the 1920s
- USFS Policy in the 1960s
- Provisional: based on minimum winter temperature and aridity
- Empiric: provisional + a species' genetic variation



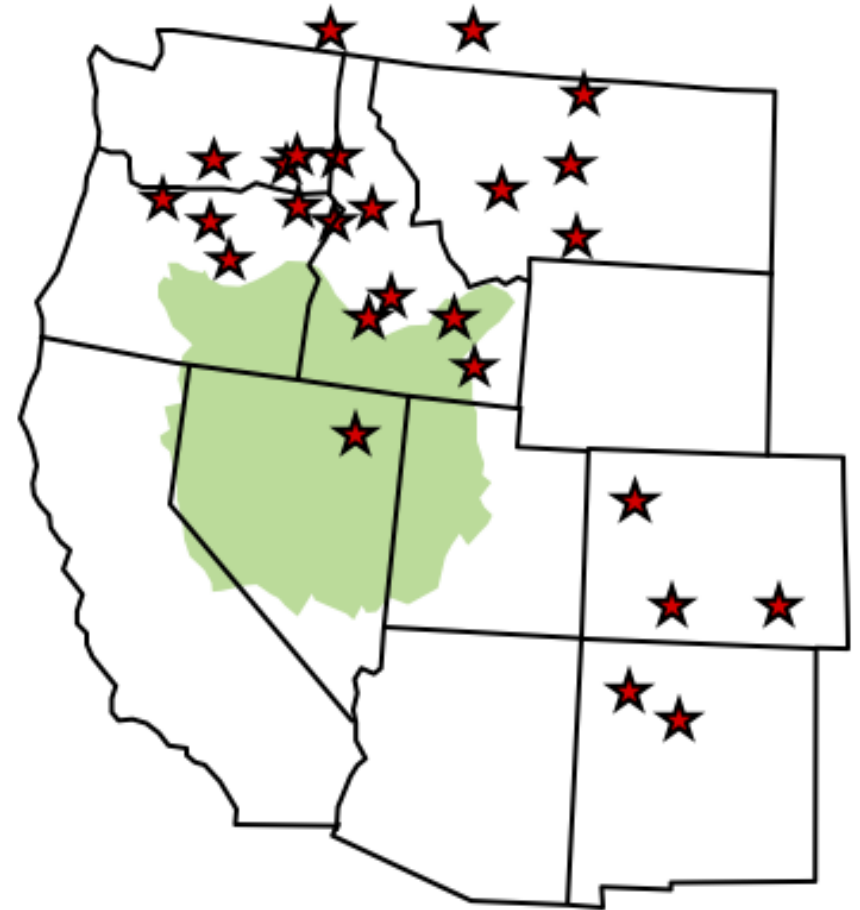
Bower et al. 2014



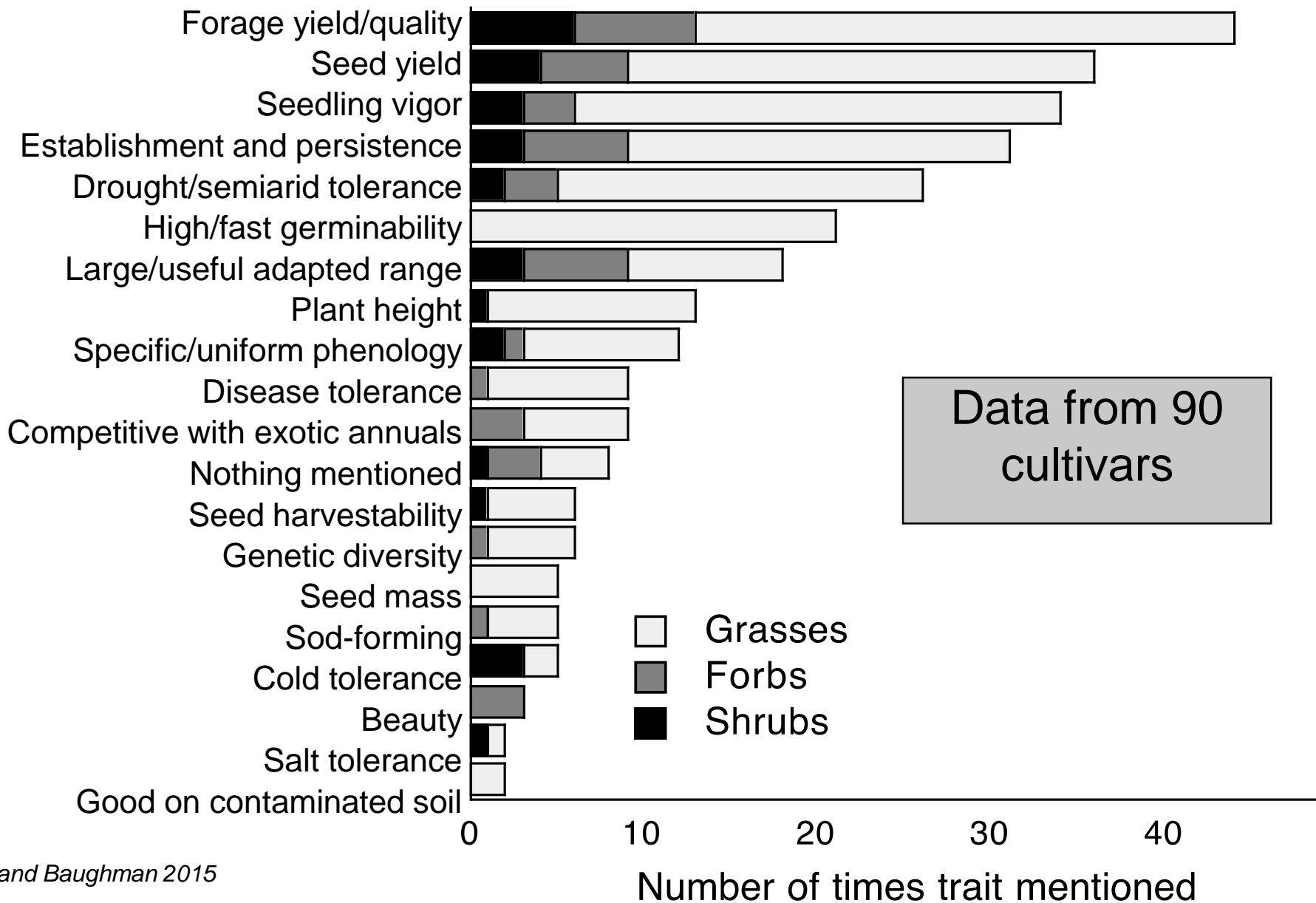
Johnson et al. 2015

Where does most seed come from in the Great Basin?

- Mostly grasses
- Mostly cultivars
- Mostly from the northern, wetter edges of the Great Basin
- Selected for agronomic or forage qualities
- Shrubs and a few forbs are mostly wildland collected

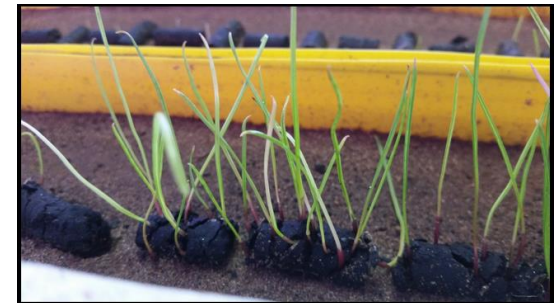
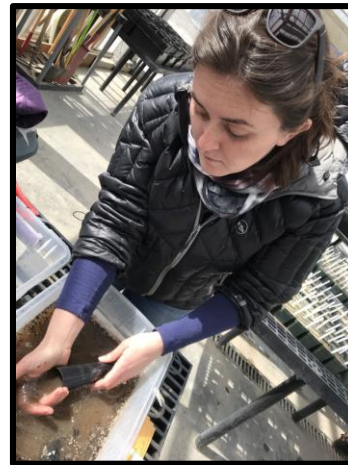
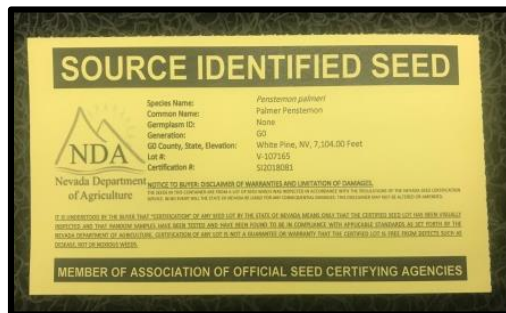


How Varieties are Developed



What is the Nevada Native Seed Partnership doing to help you?

- Seed collections- priority species
- Seed transfer zones analysis – priority analysis
- Seed certification
- Research and Development
- Nevada Seed Strategy (in progress)



Where are we Heading in Nevada?

Short term (5-10 years)

- Advance the use of best available science – seed zones, species compatibility, seeding techniques and technologies, etc.
- Have Nevada growers growing Nevada native seed
- Increase availability and variety of native seed sources
- Capture local adaptation from different seed zones using local seed collections
- Rely more on natural track and pre-varietal germplasms
- Coordinate public and private native seed needs
- Develop seed transfer guidance for forbs (wildflowers)

Where are we Heading in Nevada?

Long term (10-20 years)

- Development of ecologically based varieties
- Genetic management plans for workhorse species
- Rotating collection schedule for seed sources
- Stabilization of native seed demand

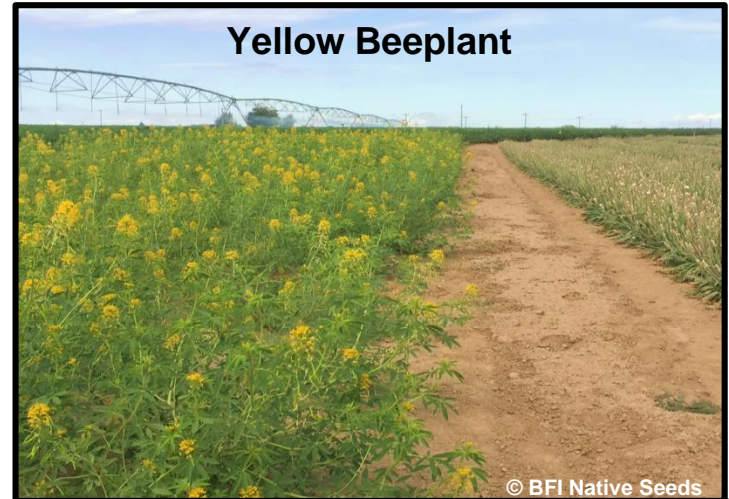


How to Position Yourself For Success: Considerations for Species Selection

- Deciding what native species to grow is one of the first steps
- Species Selection Considerations:
 - Have utility in reclamation, rehabilitation, and restoration
 - In demand by agencies
 - Produce seed well in agricultural settings
- Seed Source Selection Considerations:
 - Seed transfer guidelines
 - Source identified seed

How to Position Yourself For Success: Considerations for Field Establishment

- Field longevity
 - Different species will produce seed over different durations of time
- Manage weeds
 - There are weed content standards – Federal Seed Act
- Seed orchards on site may help increase seed available for increase in place of wildland collections



How to Position Yourself For Success

Considerations for Stabilizing the Demand

- Certify the increased seed
- Coordinate and develop relationships
 - Relationships between seed purchasers and producers on priority species will help to reduce volatility in demand, help stabilize market price, and reduce grower risk
- Sell to a seed broker or vend directly to seed purchasers



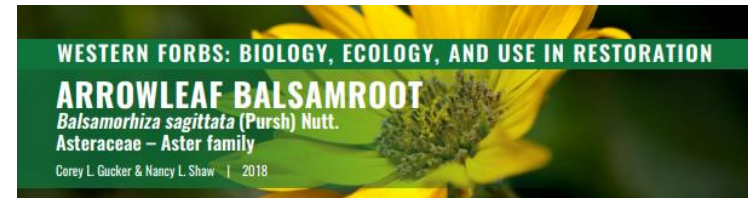
Resources to Help Growers

Synthesis of research produced by BLM and the GBNPP

Forb Manual expected end of 2019

Six fact sheets produced in FY18

Arrowleaf balsamroot
Douglas dustymaidens
Hoary tansyaster
Sagebrush false dandelion
Royal penstemon
Gooseberryleaf globemallow



ORGANIZATION

NOMENCLATURE 1

Names, subtaxa, chromosome number(s), hybridization.

DISTRIBUTION 2

Range, habitat, plant associations, elevation, soils.

DESCRIPTION 3

Life form, morphology, distinguishing characteristics, reproduction.

ECOLOGY 6

Growth rate, successional status, disturbance ecology, importance to animals/people.

REVEGETATION USE 12

Current or potential uses in restoration.

DEVELOPING A SEED SUPPLY 13

Seed sourcing, wildland seed collection, seed cleaning, storage, testing and marketing standards.

AGRICULTURAL SEED PRODUCTION 17

Recommendations/guidelines for producing seed.

NURSERY PRACTICES 19

Recommendations/guidelines for producing planting stock.

WILDLAND SEEDING AND PLANTING 20

Recommendations/guidelines, wildland restoration successes/failures.

ACKNOWLEDGEMENTS 21

Primary funding sources, chapter reviewers.

LITERATURE CITED 21

Bibliography.

RESOURCES 27

Select tools, papers, and manuals cited.

NOMENCLATURE

Balsamorhiza sagittata (Pursh) Nutt., hereafter referred to as arrowleaf balsamroot, belongs to the *Arctothiza* subgenus (Sharp 1935), Heliantheae tribe, and Engelmanniinae subtribe of the Asteraceae or aster family (Cronquist et al. 1994; Moore and Bohs 2003; Weber 2006).

NRCS Plant Code. BASA3 (USDA NRCS 2017).

Synonyms. *Balsamorhiza helianthoides* (Nutt.) Nutt., *Espeletia helianthoides* Nutt., and *E. sagittata* (Pursh) Nutt. (Weber 2006).

Common Names. Arrowleaf balsamroot, breadroot, graydock, spring sunflower (USDA FS 1937; USDA NRCS 2017).

Subtaxa. No varieties or subspecies are currently recognized by the Flora of North America (Weber 2006).

Chromosome Numbers. Chromosome number is $2n = 38$ (Weber 2006).

Hybridization. Hybridization is common within the *Balsamorhiza* genus where distributions overlap, and the genus is described as "notorious for lack of genetic barriers to hybridization" (Welsh et al. 1987). Intermediate forms resulting from hybridization with Hooker's balsamroot (*B. hookeri*), Carey's balsamroot (*B. careyana*), hoary balsamroot (*B. incana*), and rosy balsamroot (*B. rosea*) have been reported (Owmbey and Weber 1943; Welsh et al. 1987; Taylor 1992; Weber 2006), but these may not represent all potential hybrids. Arrowleaf balsamroot does not hybridize with cutleaf balsamroot (*B. macrophylla*), which is a highly polyploid species (Weber 2006).

Although common, hybrids may be highly restricted geographically. Arrowleaf balsamroot × Hooker's balsamroot hybrids are restricted to the ecotones between parent habitats in sagebrush communities, which are deep soils for arrowleaf balsamroot and shallow soils lacking defined horizons for Hooker's balsamroot. A similar type of



Where can I find seed transfer guidance?

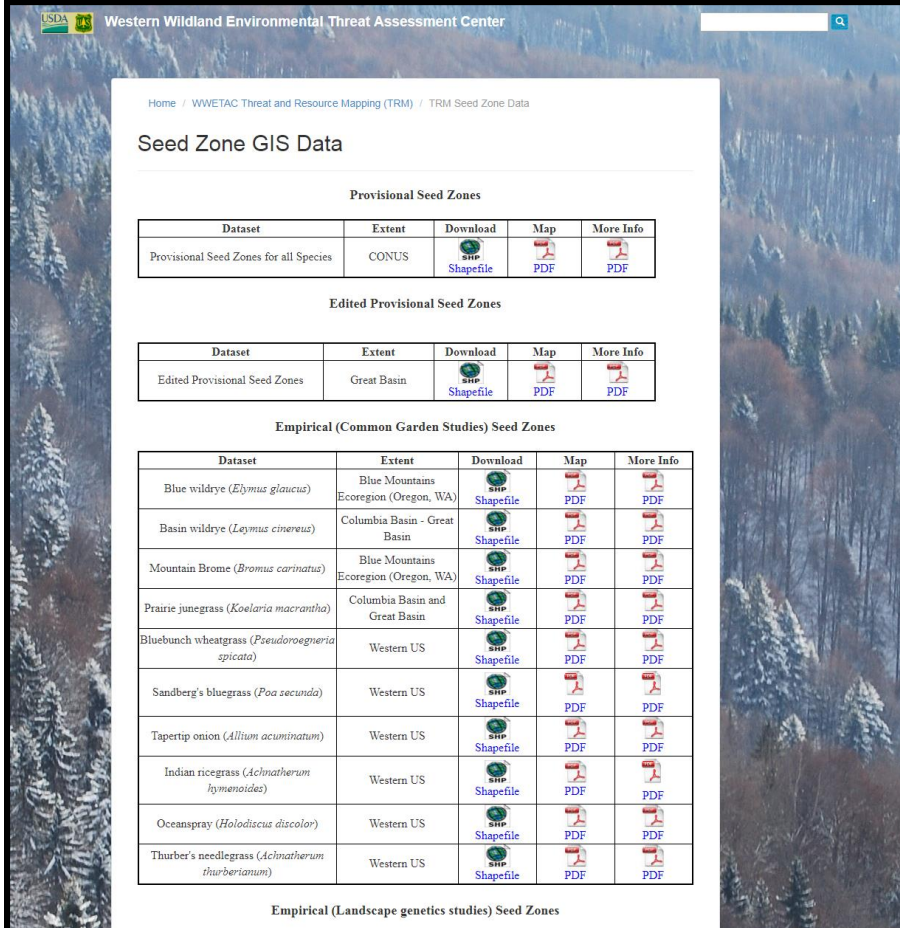
All Seed Zones uploaded to: Western Wildland Environmental Threat Assessment Center (WWETAC)

<https://www.fs.fed.us/wwetac/threat-map/TRMSeedZoneMapper.php>

Provisional Seed Zone Maps

Empirical Seed Zone Maps:

- Indian ricegrass
- Thurber's needlegrass
- Squirreltail
- Great Basin wildrye
- Sandberg's bluegrass
- Bluebunch wheatgrass
- Wyoming Sagebrush
- Basin Big Sagebrush
- Mountain Sagebrush (in a few months)






USDA Western Wildland Environmental Threat Assessment Center




Home / WWETAC Threat and Resource Mapping (TRM) / TRM Seed Zone Data

Seed Zone GIS Data































Provisional Seed Zones

Dataset	Extent	Download	Map	More Info
Provisional Seed Zones for all Species	CONUS	 Shapefile	 PDF	 PDF

Edited Provisional Seed Zones

Dataset	Extent	Download	Map	More Info
Edited Provisional Seed Zones	Great Basin	 Shapefile	 PDF	 PDF

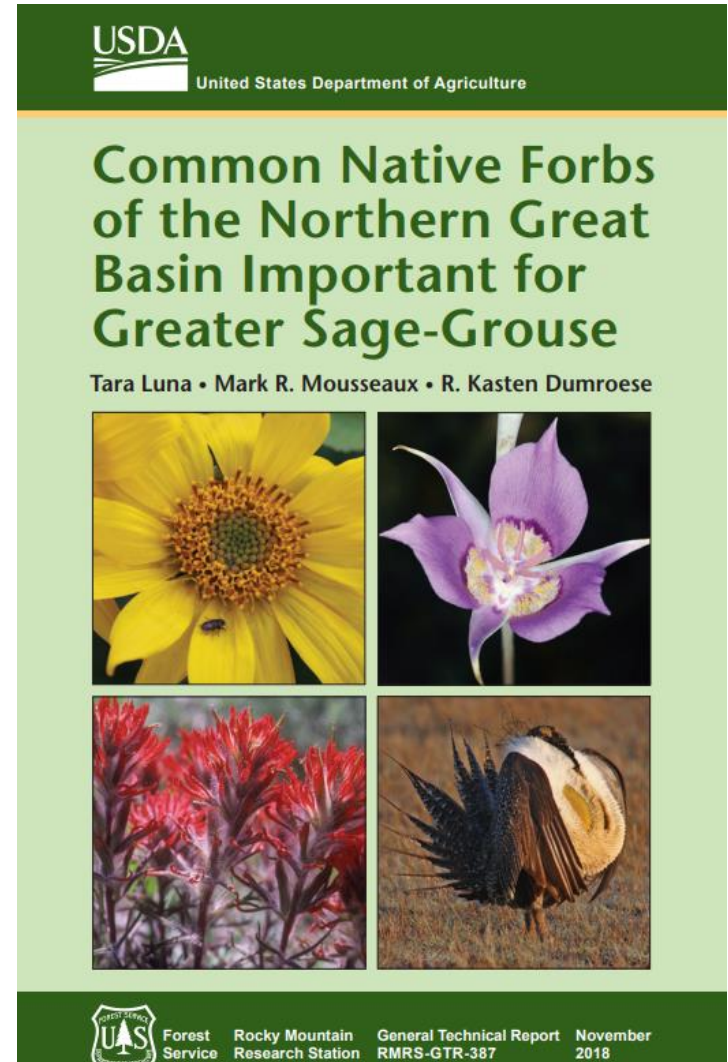
Empirical (Common Garden Studies) Seed Zones

Dataset	Extent	Download	Map	More Info
Blue wildrye (<i>Elymus glaucus</i>)	Blue Mountains Ecoregion (Oregon, WA)	 Shapefile	 PDF	 PDF
Basin wildrye (<i>Leymus cinereus</i>)	Columbia Basin - Great Basin	 Shapefile	 PDF	 PDF
Mountain Brome (<i>Bromus carinatus</i>)	Blue Mountains Ecoregion (Oregon, WA)	 Shapefile	 PDF	 PDF
Prairie junegrass (<i>Koeleria macrantha</i>)	Columbia Basin and Great Basin	 Shapefile	 PDF	 PDF
Bluebunch wheatgrass (<i>Pseudoroegneria spicata</i>)	Western US	 Shapefile	 PDF	 PDF
Sandberg's bluegrass (<i>Poa secunda</i>)	Western US	 Shapefile	 PDF	 PDF
Tapertip onion (<i>Allium acuminatum</i>)	Western US	 Shapefile	 PDF	 PDF
Indian ricegrass (<i>Achnatherum hymenoides</i>)	Western US	 Shapefile	 PDF	 PDF
Oceanspray (<i>Holodiscus discolor</i>)	Western US	 Shapefile	 PDF	 PDF
Thurber's needlegrass (<i>Achnatherum thurberianum</i>)	Western US	 Shapefile	 PDF	 PDF

Empirical (Landscape genetics studies) Seed Zones

What plants do sage grouse need: Sagebrush Forb Manual

- Produced by Rocky Mountain Research Station
- Supported by BLM
- Resource to help identify sage grouse species



Additional Resources

**NATIVE WILDFLOWERS
&
RESTORATION**

Corey L. Gucker¹, Nancy L. Shaw², Anne Halford³, Génie MontBlanc⁴, and Alexis Malcomb⁵
¹University of Nevada, Reno; ²USGS Rocky Mountain Research Station; ³Bureau of Land Management; ⁴Upper Grand River Flows Restoration

Western Forbs: Biology, Ecology, and Use in Restoration
is a developing online book containing information about the important ecological functions of forbs and guidelines to support their inclusion in revegetation and restoration.

BIOLOGY & ECOLOGY

Over the past 15 years, considerable research has gone into understanding the ecology of western forb species and establishing guidelines for their successful use in restoration. However, this information is scattered through the literature and has yet to be synthesized.

Gathering and synthesizing published data as well as unpublished protocols and knowledge gained through practical experience is necessary for seed collectors, growers, practitioners, and land managers to increase the supply and use of appropriate seed sources of native forbs for restoration of sagebrush steppe and other western ecosystems.

REVEGETATION & RESTORATION

Seed Sourcing Seed Collecting Seed Production Nursery Production Wildland Revegetation

GreatBasinFireScience.org

<https://www.blm.gov/programs/natural-resources/native-plant-communities/native-seed-and-plant-material-development>

NATIONAL SEED STRATEGY
**for Rehabilitation
and Restoration**

2015-2020

<https://www.blm.gov/programs/natural-resources/native-plant-communities/national-seed-strategy>

Thank you!

Nevada Native Seed Partnership



Fred Edwards



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Christopher Bernau



Beth Leger
Juan Solomon
Michael Taylor



Mitch Markey



Dash Hibbard



Kevin Badik
Liz Munn

Questions?

