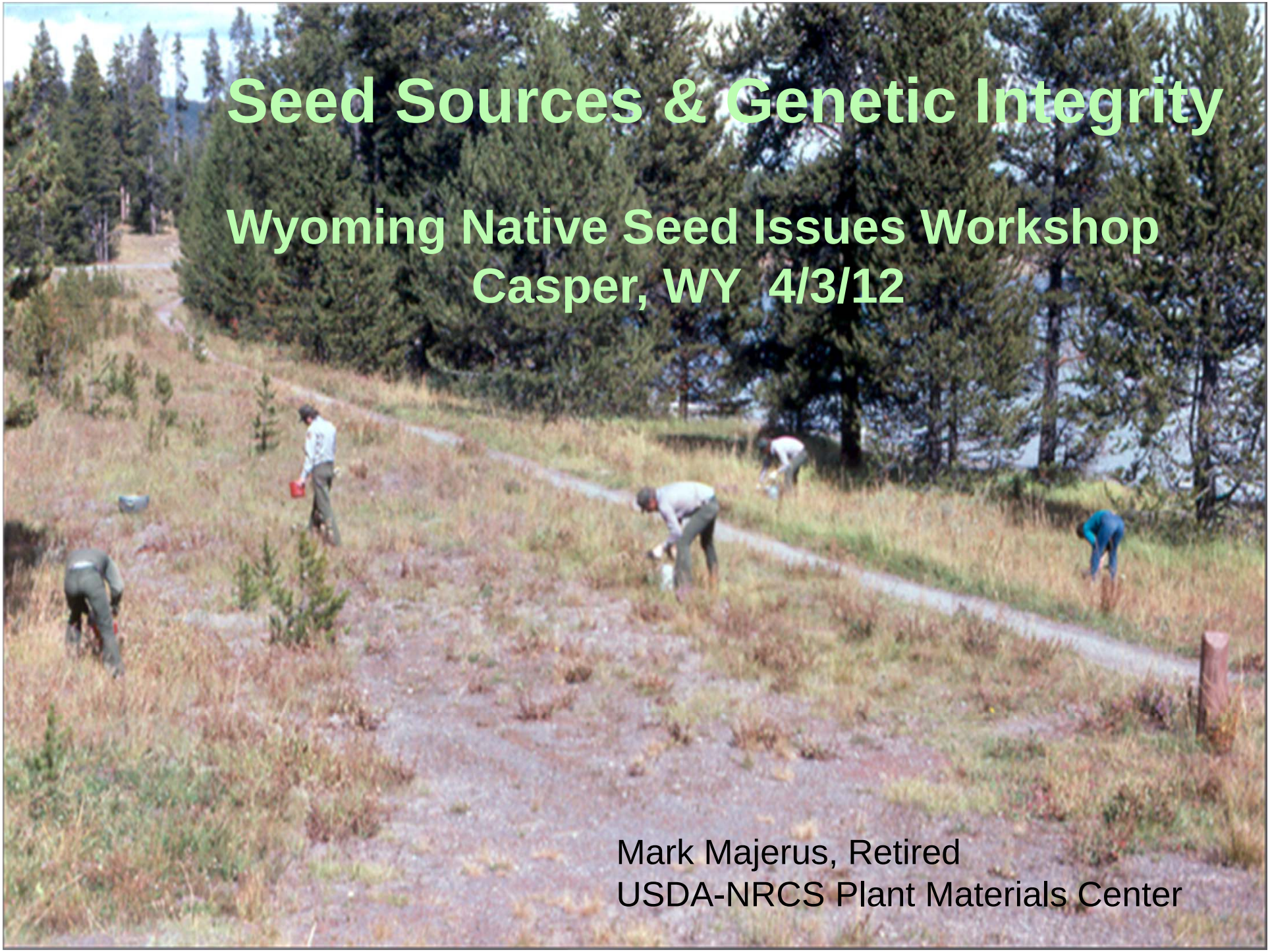
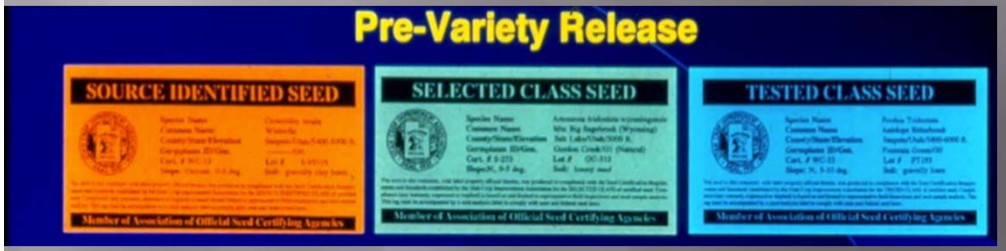


Seed Sources & Genetic Integrity

Wyoming Native Seed Issues Workshop
Casper, WY 4/3/12

Mark Majerus, Retired
USDA-NRCS Plant Materials Center

Native Seed Sources



Seed availability and Cost

- inherent productivity
- uniformity of ripening
- tendency to shatter
- ease of harvest
- ease of conditioning
- stand longevity
- abundance- wild & commercial fields

Phenotype—different physical manifestation

Genotype—different inheritable information

Ecotype

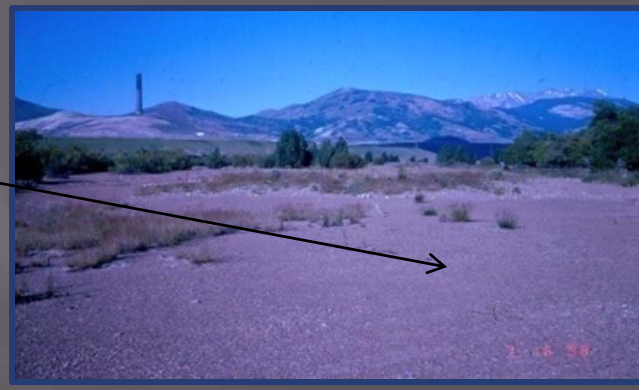
genetically distinct population adapted to specific environmental conditions

Roadblocks to Restoration:
Beyond the threshold of irreversibility

permanent damage to soil structure & viability

salinization

contamination with heavy metals and/or acidification



loss of topsoil or radical mixing w/ subsoil

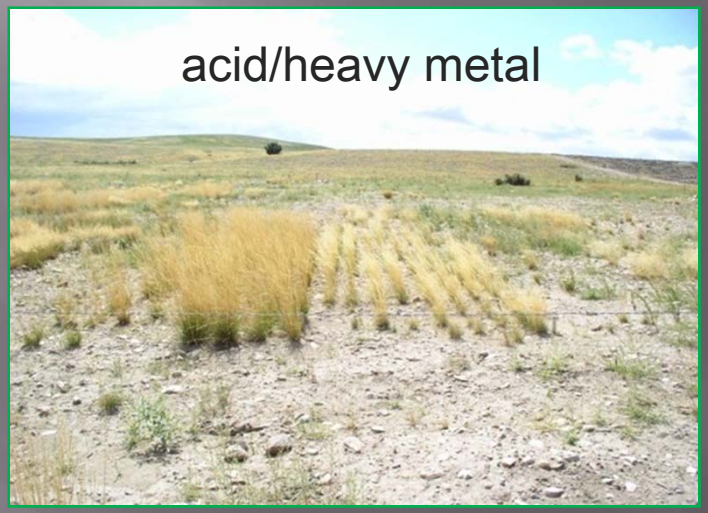
Damaged soil = alternate target vegetation

western wheatgrass
green needlegrass

bluebunch wheatgrass
Idaho & rough fescue

bluebunch wheatgrass
Indian ricegrass
prairie junegrass

Nuttal alkaligrass
alkali sacaton
alkali bluegrass
alkali cordgrass
slender wheatgrass
Inland saltgrass



basin wildrye
slender wheatgrass
Nevada bluegrass
Indian ricegrass
thickspike wheatgrass

bottlebrush squirreltail
Gardner saltbush
slender wheatgrass
thickspike wheatgrass

Establishing plants on saline sites

US Fish & Wildlife-Hailstone Basin

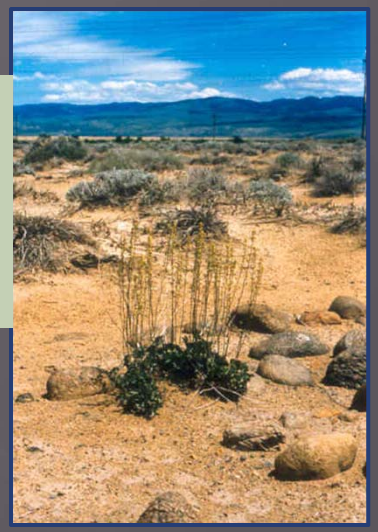
Collected 110 lbs. seed in 3 hours

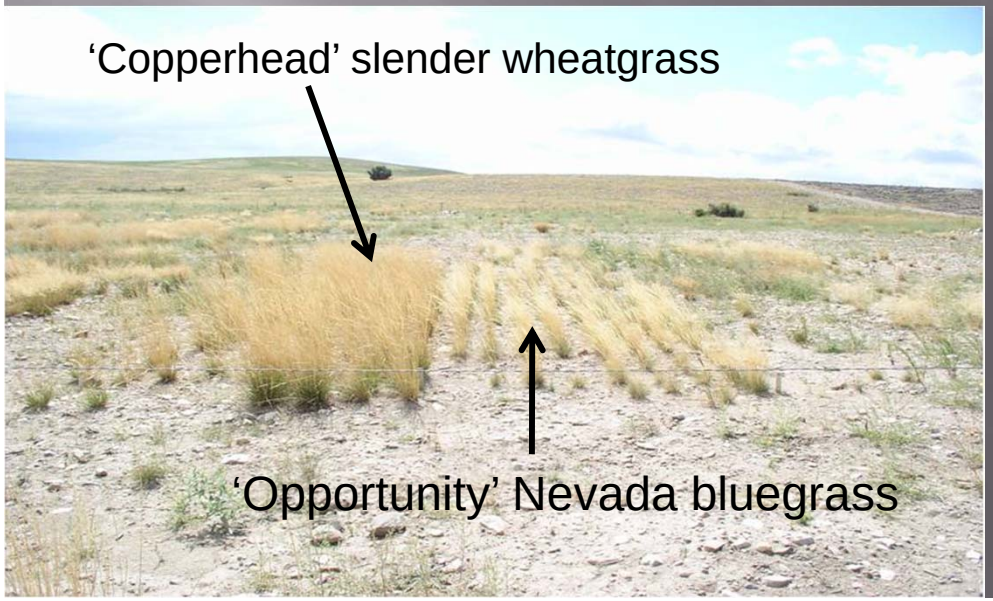
Utilized for research plots 2011

Establishing vegetation on acid/heavy metal impacted sites

Add lime and organic matter to increase pH

Utilize species that have an evolved tolerance of local edaphic conditions (Antonovics 1968)





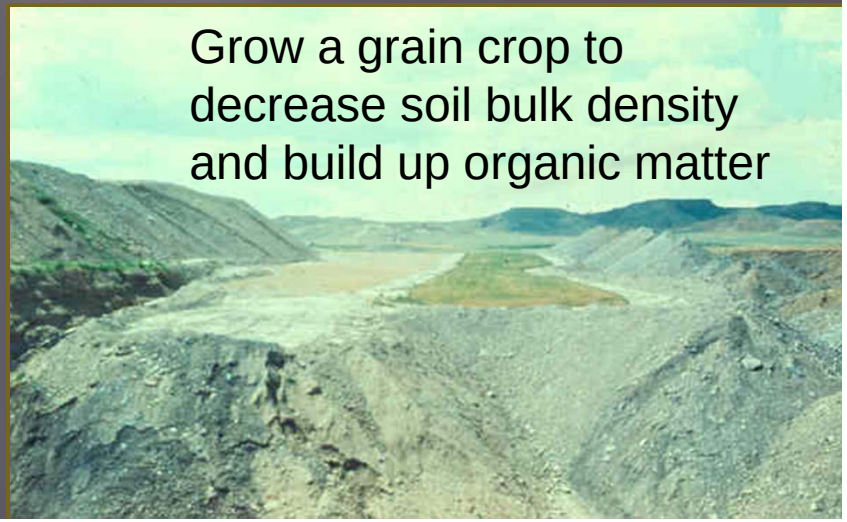
Establishing vegetation on subsoil

Add organic mater to improve infiltration and moisture retention.

- wood chips
- straw
- manure
- compost
- sugar beet pulp
- native hay
- pre-plant cover crop
  - -annual legume
  - -grain

Mulch to reduce evapotranspiration


Incorporation of wood chips to create infiltration pathways in bentonite soils


Grow a grain crop to decrease soil bulk density and build up organic matter

Maintain Genetic Integrity & Diversity

Self-pollinated-pioneer-colonizers

-little variation within populations
-distinct variation among populations
-need to utilize best adapted ecotypes

Cross-pollinated-late seral dominants

-exhibit significant variation among individuals
-less variation among populations
-each ecotype adapted to broader range

Site specific germplasm/cultivars

Foothills & Mountains
“San Luis” / “Highlander”

Saline-alkaline sites
“Pryor” / “Adanac”

mid & shortgrass prairie
“Revenue”

Acid/Heavy Metal Impacted
“Copperhead”

Key Factors in Utilizing Locally Adapted Material

Opportunities to narrow gene base

- Initial collection of seed
- cleaning of original seed
- establishment of production field (offsite)
- seed harvest
- seed cleaning
- seedling establishment

Inherent seed production & seed viability when collected

Seed Production Capabilities

Seedling Vigor

Seedling Vigor

Strong
slender wheatgrass
Canada wildrye
thickspike wheatgrass
western wheatgrass
bottlebrush squirreltail

Moderate
green needlegrass
needle & thread
blue grama
bluebunch wheatgrass
little bluestem
Indian ricegrass

Weak
prairie junegrass
Sandberg bluegrass
Idaho fescue

Competition within Seed Mixtures

Sowing → Germination → Emergence → Establishment → Juvenile → Mature

Varying competitiveness at different stages of development

Sources of Local Adapted Material

-Be sure of what you are collecting
-Collect from remote areas

Collect from the harshest sites each species is found

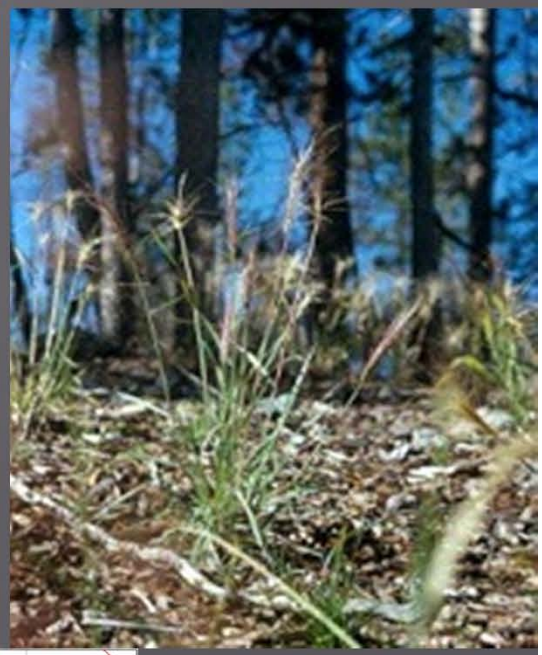
Collect from numerous plants & large area

Bottlebrush Squirreltail

Ranges from intermountain desert to mountains/foothills

5 subspecies

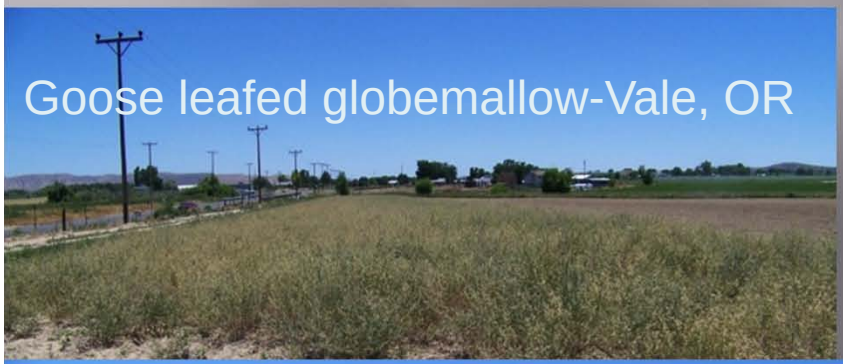
Wyoming ecotypes short, moderate seed production, but very drought tolerant



Sand Hollow-W. Idaho
Toe Jam Cr.-N. Nevada
Pleasant Valley- NC Oregon
Antelope Cr.-NW Oregon
Fish Creek-SC Idaho
Rattlesnake-SW Idaho
2 Colorado
2 New Mexico

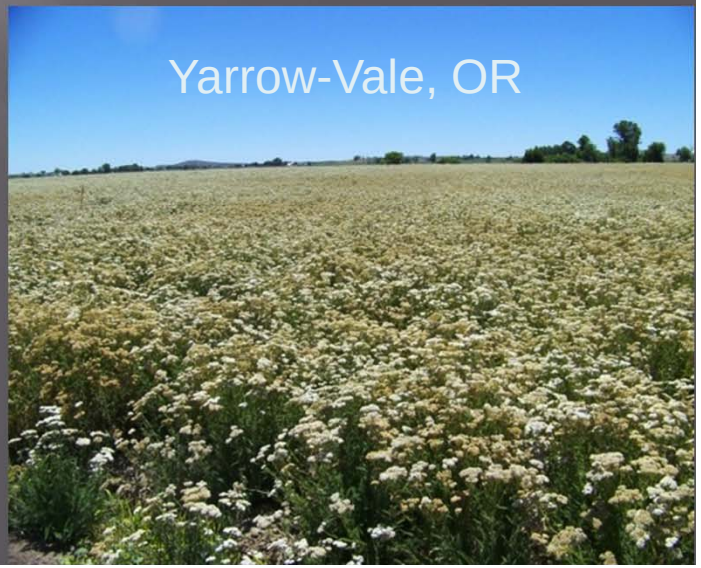
Contract Production of Local Ecotypes

pre-plant cleaning & germ-test
seed Increase
trials to test emergence & survival
contract agreement
crop isolation


Goose leafed globemallow-Vale, OR


Yarrow-Moses Lake, WA

Great Basin Restoration Initiative
Seed Production Trials-Malheur Exp. Sta


Yarrow-Vale, OR

Mulching with seed-laden native hay

Mid-July

needle and thread
green needlegrass
Indian ricegrass
Sandberg bluegrass
biscuit root
prairie smoke
scurfpea

Early August

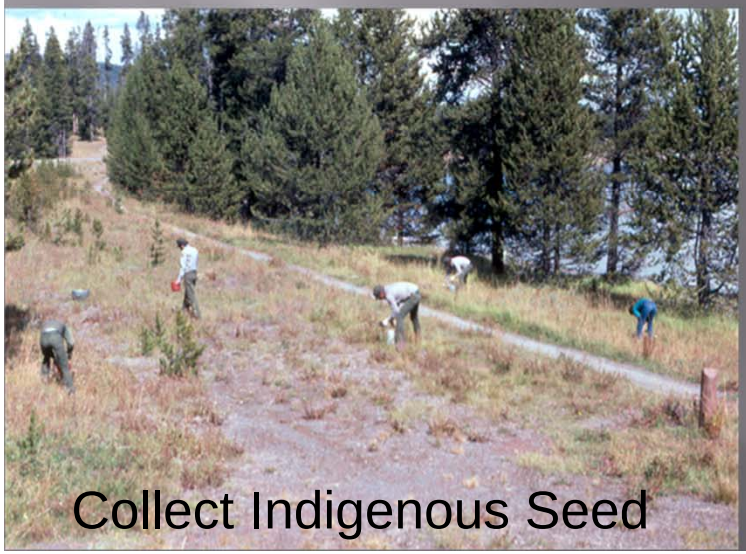
bluebunch wheatgrass
prairie junegrass
blue grama
western wheatgrass
side oats grama
lupine
prairie coneflower
yarrow
prairie clover

September/October

big bluestem
little bluestem
prairie sandreed
dotted gayfeather
penstemon

National Park Restoration

Top priority--Maintain genetic integrity



Mixture diversity & composition


South-facing slope

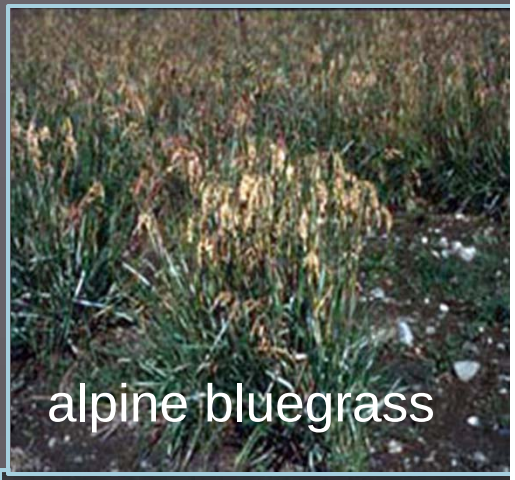

North-facing slope

Western needlegrass in YNP

thrives on obsidian sands
poor seed producer
variable viability
hairy awns difficult to condition
difficult to establish seed
production field

Alpine Restoration

Collections from high elevations are not readily grown for seed at lower elevations that have a much longer growing seasons.

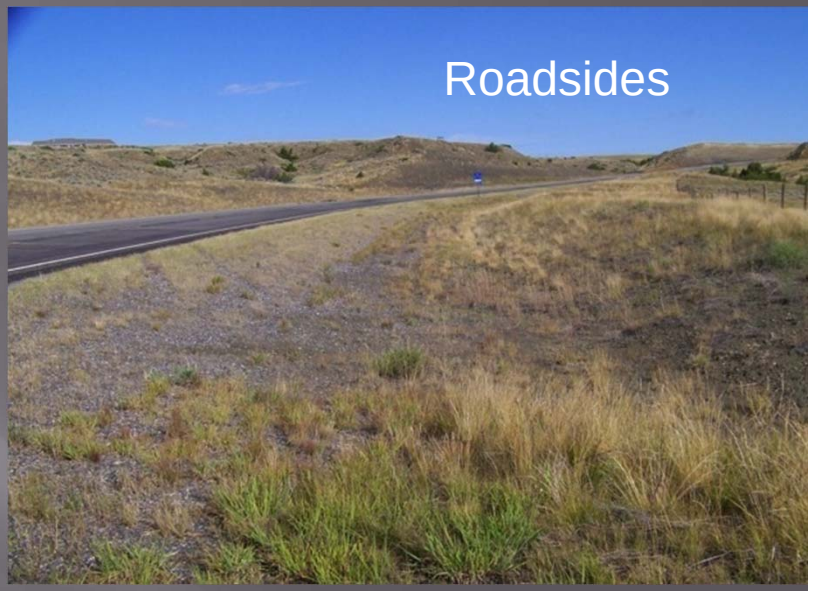

alpine bluegrass


Scribner's wheatgrass


alpine timothy


tufted hairgrass

Large Scale Reclamation Cultivars best Option?



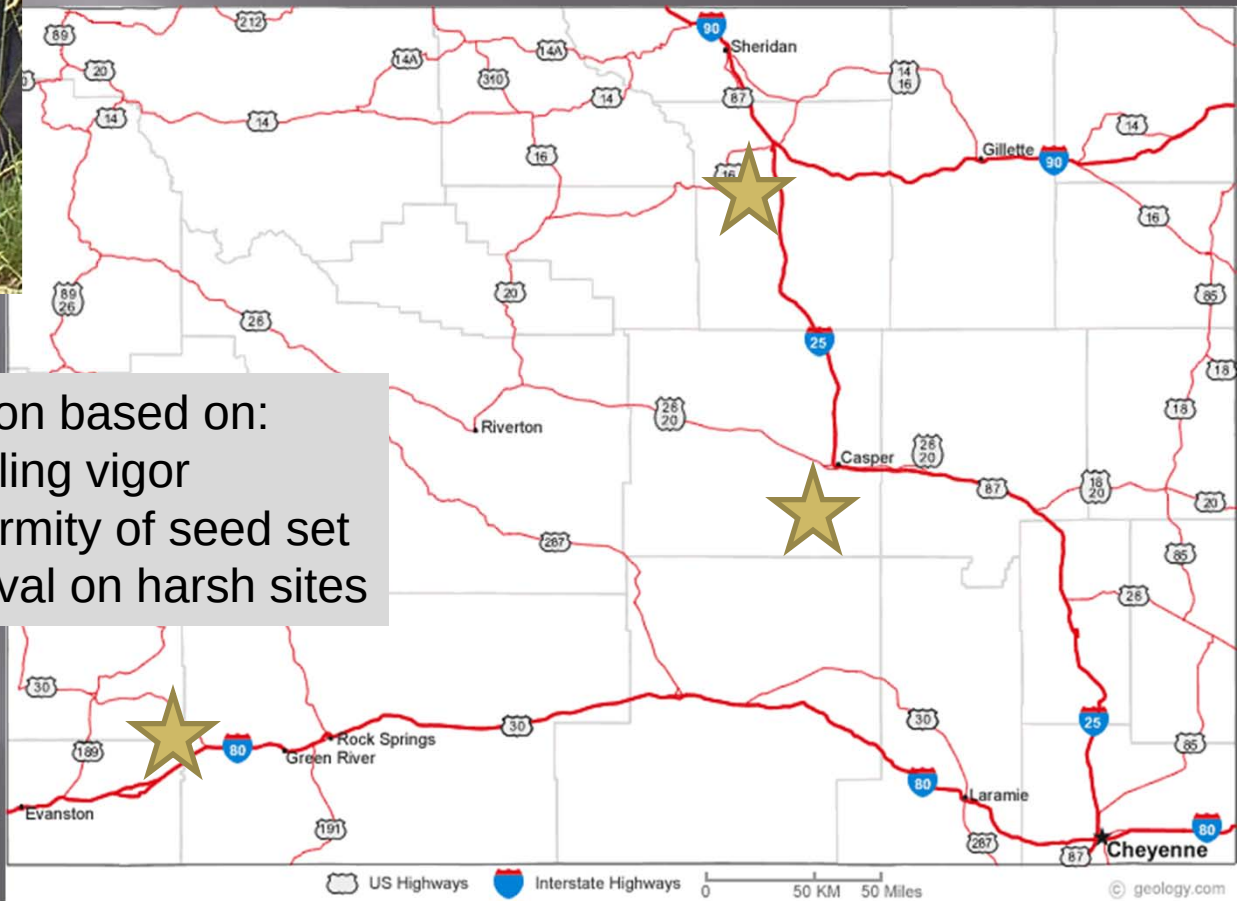
Cultivar & Germplasm Single Source

‘Rosana’ western wheatgrass- NW of Forsyth, MT
‘Critana’ thickspike wheatgrass- S of Havre, MT
‘Trailhead’ basin wildrye- S of Roundup, MT (tetraploid) (green)
‘Magnar’ basin wildrye- Saskatoon, Sask (octaploid) (blue-green)
‘Goshen’ prairie sandreed- Torrington, WY
‘Wytana’ 4-wing saltbush- N of Roundup, MT
‘Shoshone’ beardless wildrye- Powell and Riverton, WY
‘Pryor’ slender wheatgrass- between Frannie, WY & Bridger, MT
‘Rimrock’ Indian ricegrass- Billings, MT
‘Lodorm’ green needlegrass- N of Bismarck, ND
‘Antelope’ slender white prairieclover- W of Dickenson, ND
‘Stillwater’ prairie coneflower- 3 Stillwater-2 Carbon County, MT

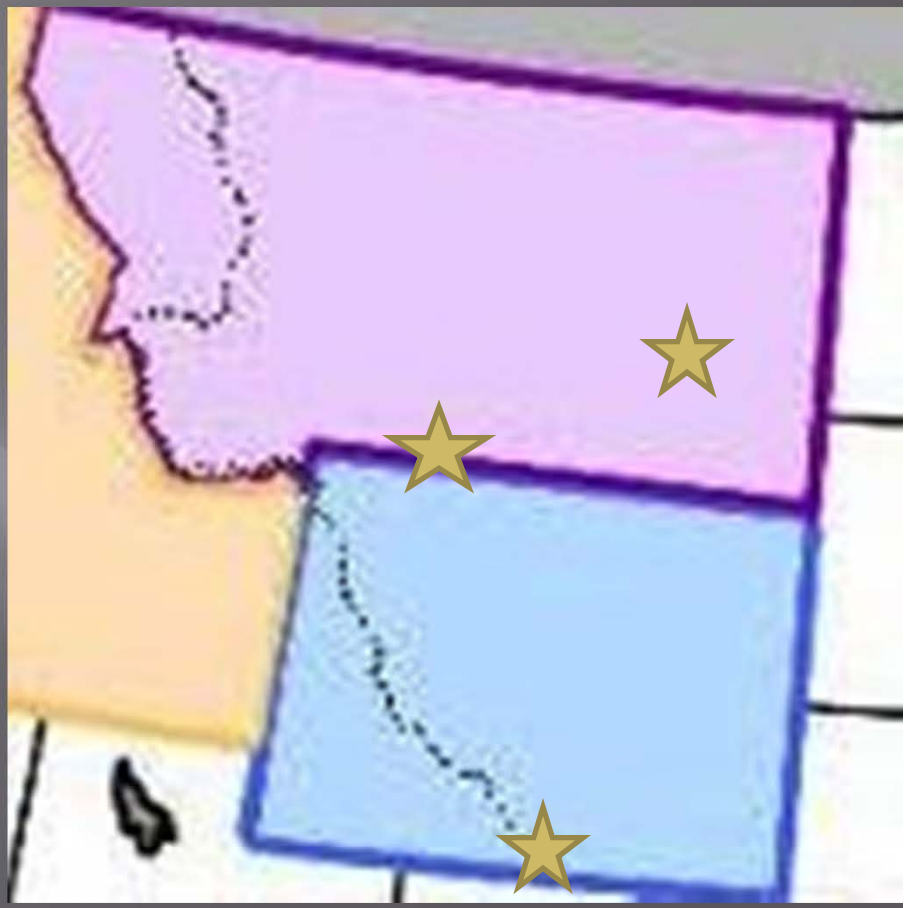
High Plains Sandberg bluegrass

35 accessions collected throughout MT and WY
Evaluated at 4 sites: Rock Springs & Greybull, WY
Bridger & Missoula, MT

Selection based on:
- Seedling vigor
- Uniformity of seed set
- Survival on harsh sites

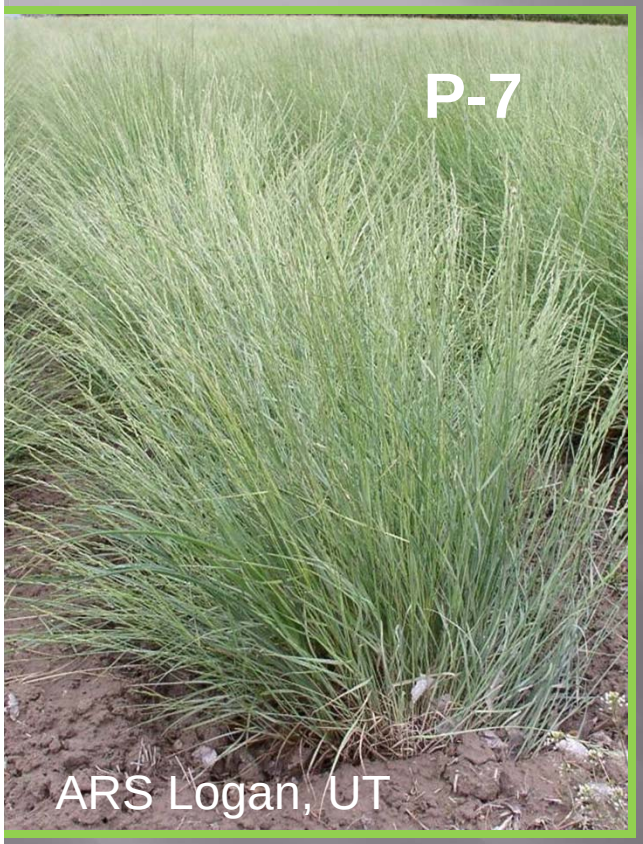


Open Range winterfat



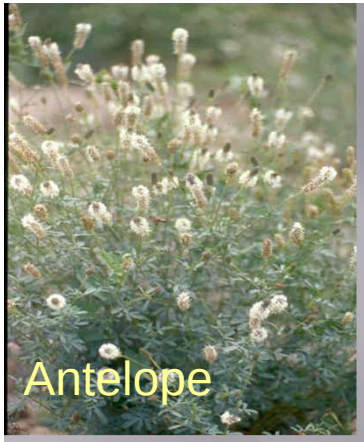
32 original collections
Evaluated at Rock Springs, Greybull and Bridger

Bluebunch Wheatgrass

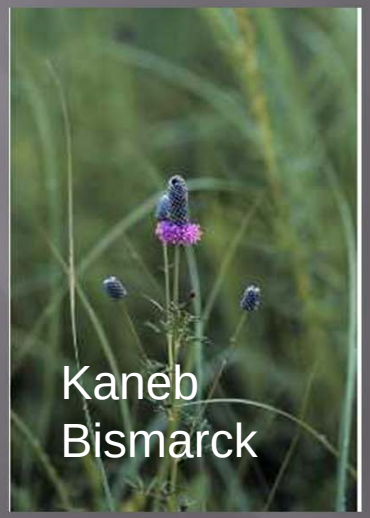


Multi-origin polycross
23 open-pollinated collections
2 cultivars (Whitmar-Goldar)
WA, OR, NV, UT, ID, MT, BC

Recurrent Phenotypic Selection
14 collections-East Slope RM
3 cycles (best 20%)



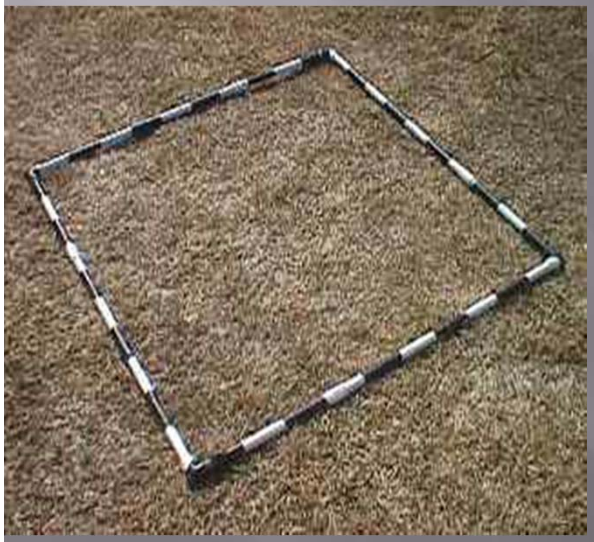
Dire need for commercial production of native wildflower – cultivar or ecotypes!



Monitoring Restoration Success

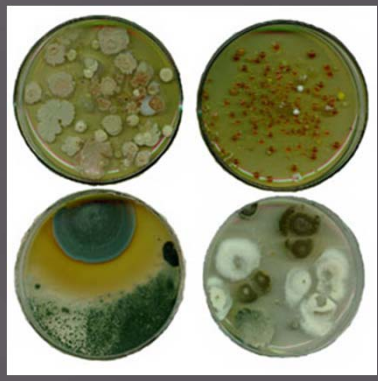
Direct Comparison vs. Attribute Analysis

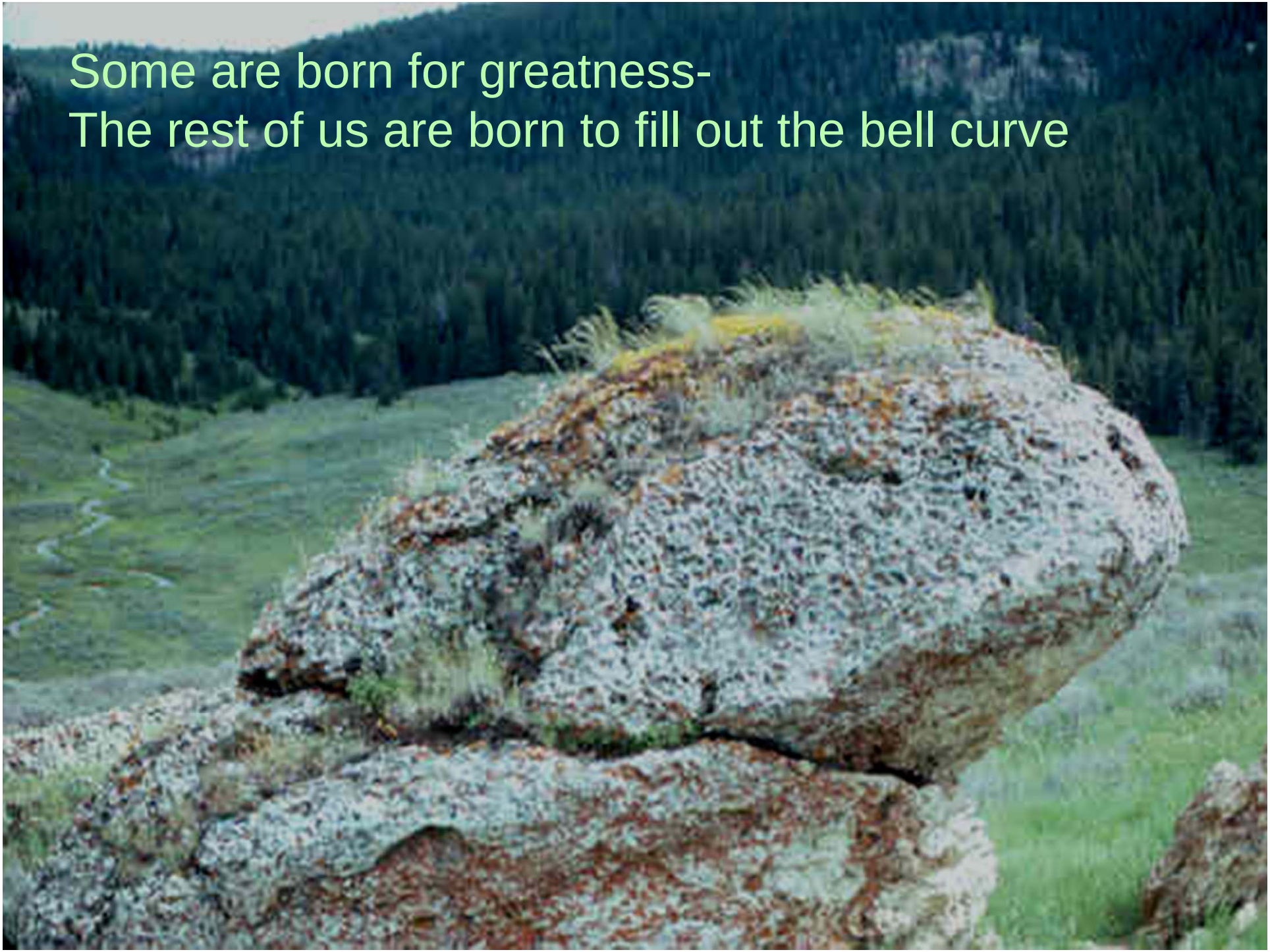
Species Diversity
- **Richness**
- **Evenness**
- **Spatial heterogeneity**
- **Less exotics/invasives**



Soil Health
- Soil Organic Matter (SOM)
- Soil Organic Carbon (SOC)
- Soil Nutrients

Soil Biota
- Soil Invertebrates
- Enzyme Analyses
  - Bacteria
  - Fungi
- Mycorrhiza




Some are born for greatness-
The rest of us are born to fill out the bell curve