How To Measure the Success of Native Plant Selection and Increase

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GREAT BASIN NATIVE PLANT SELECTION & INCREASE PROJECT

2012 Progress Report

Improving the availability of native plant materials and providing the knowledge and technology required for their use in restoring diverse native plant communities across the Great Basin.
Great Basin
Native Plant Project

Join us for our Annual Meeting
March 17-18, 2014 in Boise, ID
GBNPSIP vs. GBNPP

- Project priorities 2002
  - Increase native plant materials available for restoration
    - Management or re-establishment of seed sources and development of technology to improve the diversity of introduced species monocultures
    - Technology transfer
    - Genetic research

- Project priorities 2014
  - Improve the availability of native plant materials and provide the knowledge and technology required for their use in restoring diverse native plant communities across the Great Basin.
    - Increase the availability of native plant materials, particularly forbs, for restoring disturbed Great Basin rangelands.
    - Provide an understanding of species variability and potential response to climate change; develop seed transfer guidelines.
    - Develop seed technology and cultural practices for producing native seed in agricultural settings.
    - Collaborate with seed regulatory agencies and the private seed industry to improve native seed supplies.
    - Examine interactions of native restoration species and exotic invasives to aid in formulating seeding prescriptions.
    - Develop application strategies and technologies to improve the establishment of native seedings.
    - Develop demonstration areas, manuals, popular publications and websites to facilitate application of research results
<table>
<thead>
<tr>
<th>Owner</th>
<th>Acres</th>
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<tr>
<td>BLM</td>
<td>73 million</td>
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<tr>
<td>Private</td>
<td>29 million</td>
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<tr>
<td>FS</td>
<td>19 million</td>
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<tr>
<td>State</td>
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<tr>
<td>D.Def.</td>
<td>3 million</td>
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<tr>
<td>Tribes</td>
<td>2 million</td>
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<tr>
<td>Other</td>
<td>5 million</td>
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<td>Total</td>
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BLM National Plant Materials Development Protocol
Native Plant SELECTION

1. Native Seed Collection

Seed collection for long-term archiving

Seed collection for evaluation and development

Common gardens

Agricultural Practices

Seed transfer zones

Genetic relationships
How are native germplasms selected?

- Determine desirable species
  - Indigenous to area
  - Site stabilization
  - Provide wildlife habitat and food (sage grouse)
  - Ecosystem diversity

- Determine source parameters (collection methods)
  - Random accessions from one population
  - Single selection from population --just darn cute
○ Increase their incidence in the population/gene pool
○ Take them out of general population pool for propagation (ornamentals)
How are native germplasms selected?

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- Determine source parameters (collection methods)
  - Random accessions from one population
  - Single selection from population -- just darn cute
  - Population selected from among several distinct populations of same species in common garden studies
  - Pooled Accessions from pre-determined ecoregions, seed transfer zones, or floristic regions
Native Plant INCREASE

Stock seed production

UCIA (Buy-Back from private growers)

PMC (Assigned certain germplasms)

Seed from GBNPP cooperator plots

Seed Marketplace

Niche, specialty, and workhorse species

Supply and demand—IDIQ contracts?

Has GBNPP increased availability of native plant seed?
Germplasms Developed Under The GBNPSIP Umbrella, And Sent To Growers For Seed Production, To Date (2012):

- Number: 41
- Different Species: 29
- Source Identified Germplasm: 30
- Selected Germplasm: 11
- Pooled: 22; Single Source: 17
- Official release: 9
GBNPSIP Germplasms To Date (Cont.):

- NBR: 13; SRP: 10; CBR: 9
- NBR/SRP: 4; NBR/CBR: 1; Other: 4
- Seed being Marketed (total lb over life of project):
  - (10,000-100,000+): 6
  - (1000-10,000): 3
  - (100-1,000): 2
  - (1-100): 11
  - (0): 19
GBNPSIP umbrella germplasms that have made an impact in the seed industry and reclamation projects:

- Steve Monsen initiated, GBNPSIP/UCIA/PMC stock seed
  - Anatone Germplasm bluebunch wheatgrass (PMC)
    - 19% of all native plant seed in BLM bids—too successful?
  - Mountain Home Germplasm Sandberg bluegrass (UCIA)
  - Eagle Germplasm western yarrow (UCIA)

- Tom Jones initiated, GBNPSIP/UCIA stock seed
  - Fish Creek Germplasm squirreltail
  - Toe Jam Creek Germplasm squirreltail

- RMRS Provo Shrub Lab initiated, GBNPSIP/PMC stock seed
  - Maple Grove Germplasm Lewis flax

- UDWR-GBNPSIP initiated, GBNPSIP/UCIA stock seed
  - UDWR Tetra basin wildrye
Basin Wildrye

- UDWR Tetra Germplasm
- (S, CBR/NBR) (1,000-10,000lb)
Basin wildrye (Leymus cinereus) pooled tetraploid accessions for U.S. Intermountain West rangeland reclamation

Basin wildrye (Leymus cinereus [Scribn. & Merr.] Á. Löve) is an important native grass component of rangeland plant communities of western United States and Canada. Domestic livestock and wildlife, including birds and mammals, utilize the grass year round for food and protection due to its large stature.

Historical overgrazing has been a contributor to establishment of invasive species leading to more frequent and intense wildfires. This has caused diminished densities of basin wildrye throughout much of its original range.

Efforts are being undertaken to bolster the populations of basin wildrye, particularly in the Great Basin area of the U.S. Intermountain West. However, the only commercial seed available has been tetraploid (2n=28) and octoploid (2n=56) varieties developed from sources distant to this area, and establishment and survival have been inconsistent.

In order to provide a source of basin wildrye indigenous and locally adapted to the Great Basin area, the Utah Division of Wildlife Resources (UDWR) collected 59 accessions of basin wildrye from natural stands. In 2003 these were planted in an evaluation orchard in central Utah. Subsequent DNA analysis determined that thirty-one of these accessions were tetraploid and the balance octoploid; the specific geographic distribution and interaction of these coexisting populations remains to be defined.

Basin wildrye is an outcrossing species, but the immediate product of octoploid vs. tetraploid hybridization includes unstable hexaploids and sterility. Therefore, a decision was made to increase only the 31 UDWR tetraploids for more efficient seed production and reclamation site establishment.

The octoploids were initially cut down before heading in the evaluation orchard and subsequently removed from the field, preventing cross-pollination with the tetraploids. Seed is being harvested from the intercrossed tetraploid accessions and then pooled as certified (Selected Germplasm) Generation 1 (G1) stock seed. When officially released, the germplasm identification will be “UDWR Tetra”.

Commercial seed increase fields were established in 2009, and G2 (and later) generation certified seed is commercially available. Maintenance of genetic identity in development, production, and marketing of this pooled basin wildrye germplasm entity has been verified by member agencies of the Association of Official Seed Certifying Agencies (AOSCA). A bulletin detailing the Pre-Variety Germplasm program, “The AOSCA Native Plant Connection”, is available at AOSCA.org.

Original collections and subsequent evaluation and seed increase of UDWR Tetra was supported in part by the Great Basin Native Plant Selection and Increase Project (GBNPSIP) funded by USDI BLM and administered by USFS. GBNPSIP scientists established a research study on a rangeland site at Saylor Creek (southwest Idaho, precipitation 200-250 mm) in 2011 which included replicated seed plots of the varieties Magnar (octoploid) Trailhead (tetraploid), and UDWR Tetra. The plots burned in a natural fire in late summer, 2012.

Survival of plants and the seed head development in July, 2013 demonstrates that basin wildrye is tolerant to low intensity fires once established, and even benefits through reduced competition from invasive annual weeds such as cheatgrass. Visual inspection and preliminary data indicate that UDWR Tetra is competitive in stand establishment and appears more robust than the two varieties. Though these results are promising, several years of observation and additional study locations and reclamation planting evaluations will be required to determine long-term survival and productivity.

The UDWR and other Federal and State agencies conduct extensive fire and range rehabilitation annually in the Great Basin area of the Intermountain West. Utah reclamation projects have included UDWR Tetra since 2011, and evaluation is ongoing. Utilizing the indigenous UDWR Tetra as a seed component in these projects allows a conservative approach to germplasm management. It can avoid lack of fitness or potential outbreeding depression engendered by seeding varieties sourced from other geographic regions.
GBNPSIP umbrella germplasms that have made little impact in the seed industry as yet:

- Balsamroot (arrowleaf, Hooker’s)
- Basalt milkvetch
- Buckwheat (Wyeth, sulfur)
- Dusty maiden (Douglas)
- Globemallow (scarlet, Munro, gooseberryleaf)
- Hawksbeard (tapertip, limestone)
- Hoary tansyaster
- Lomatium (fernleaf, Gray’s, nineleaf, bare stem)
- Prairie clover (Western, Searle's)
- Penstemon (thickleaf, sharpleaf, blue, royal, etc.)
Giant Lomatium (Fernleaf Biscuitroot)

- LODI-NBR-P01-RMRS Germplasm
- (SI, NBR <4500ft) (1-100lb)
Reclamation seed mixes and pricing realities

- **Niche species** = up to ¼ plls lb/a; $40-$100+/lb
  - Most native forbs

- **Specialty species** = up to 1 plls lb/a; $20-$40/lb
  - Some native and non-native forbs and shrubs; some native grasses

- **Workhorse species** = balance of 10-15 plls lb/a; <$20/lb
  - Some native grasses, many non-native forbs and grasses

Figure 6. Three seed market categories based on annual volume sales, along with examples of where common restoration species fit.
DOLLARS: FUNDING GERMPLASM DEVELOPMENT AND INCREASE (I.E., SEED ON THE GROUND)

- Contracts
- Supply and Demand Market
- 1,000lb 10,000lb 100,000lb

For a healthy Great Basin seed market (availability and reasonable prices), plant 1,000,000 acres of shovel-ready projects per year (funding to come from re-directed fire budgets when no fires).
Chances of this happening with current wildfire reactive emergency stabilization and reclamation funding?

- Probably less than zero
  - GBNPP selection and increase funding is directed to research of ecological relationships, collection, development, and stock seed maintenance, **NOT** direct seed purchases
  - BLM consolidated buys dictated by BLM District personnel constrained by uncertainty about where the next fire will hit, seed costs, unfamiliarity with native plant options
  - Congressional purse strings are not likely to be influenced by public agency input, even if all agencies were humming the same tune

- Resolution/proposal promoted by grass roots non-public agency supporters of Western rangelands may shake things up.
A Grass Roots RESOLUTION

For Real Reclamation of Public Rangelands:

PROPOSAL FOR PROACTIVE PROJECTS

- Note: This resolution and proposal, along with grass roots individual and organizational signatures, will be submitted to Rep. Rob Bishop (UT), Chairman of the House Natural Resources Public Lands and Environmental Regulation Subcommittee; Rep. Mike Simpson (ID), Chair of House Appropriations for BLM; Senate Majority Leader Harry Reid (NV); and other members of Congress with interest and influence in public lands management.
The Proposal:
That Federal Funds At the Rate of $100 per Acre Be Earmarked to Plan, Prepare, and Seed At Least One Million Acres of Proactive Reclamation Projects per Year on Public Rangelands in the Western U. S.

- Executive Summary
  - Emergency, reactive wildfire response has engendered higher overall seed prices and shortages of critical plant materials. Funding for proactive reclamation projects will reduce wildfire severity, stabilize the reclamation seed market, and improve vegetative diversity and ecosystem health.

- Background
  - How things got the way they are (whipsaw seed pricing and critical shortages)

- Implementation and Expected Outcomes
  - 1. UWRI Template; 2. Restoration and revegetation-- both improve ecosystem health; 3. Breaking the wildfire cycle; 4. Seed mix realities; 5. Local and widely adapted plant materials; 6. Importance of wildland collection for direct reclamation use; 7. Proactive project framework allows efficient seed field planning, 8. Use of certified and source identified seed ensures genetic identity and purity of plant materials.
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○ Signatures: The people indicating their support for this Resolution/Proposal represent a grass-roots cross section of individuals and/or private and public organizations that have interest and standing in one or more facets of rangeland reclamation

○ Signatures followed by “self” indicate a person signing as an unaffiliated individual, or as a member, employee, or associate of a public or private organization but without authorization to represent the vetted position of the organization.

○ Signatures followed by “org” indicate a person that has the authorization to represent the vetted position of the organization.

○ Resolution/proposal document will be located online; signatures to be gathered by online petition site
How To Measure the Success Of Native Plant Selection and Increase

Questions?
Comments?

Note: Questions or comments regarding the initiation or contents of this Resolution/Proposal should be directed to Dr. Stanford A. Young, Research Professor, Department of Plants, Soils, and Climate, Utah State University, Logan, UT, 843422-4855; 435-797-2082; stanford.young@usu.edu
AOSCA Germplasm Development Categories

- Accession / Germplasm Evaluated at Multiple Sites / Years
- Accession / Germplasm Progeny Tested
- Accessions Compared (N-T) or Selection within an Accession (M-T)
  - Collection Site of Accession Known
  - Accession / Germplasm Promises Distinctive Traits
  - Distinctive Traits Proven Heritable
- Proven Traits Broadly Adapted Favorable Market Projections

Germplasm Status
- Proven
- Unproven

Geographic Adaptation and Market Potential
- Narrow
- Broad

N-T = Natural Track  M-T = Manipulated Track
SI = Source Identified  S = Selected Germplasm  T = Tested Germplasm  V = Variety
PLANT GERMLASM HANDLING PROTOCOLS:
Provenance, Collection, Evaluation, Development, Release, Distribution, and Production

GBNPSIP Plant Germplasm Provenance and Distribution Qualification Committee (PDQ)
BLM National Plant Materials Development Protocol
BLM National Plant Materials Development Protocol
Bottle Brush Squirreltail

- Toe Jam Creek Germplasm (S, Rel., NBR) (10,000-100,000 lb)
- Fish Creek Germplasm (S, Rel. NBR/SRP) (10,000-100,000 lb)
- Central Utah Germplasm (SI, CBR) (10,000-100,000)
  Wildland Collected
  - Little Sahara Germplasm (SI, CBR) (1000-10,000 lb)
Mountain Home Germplasm (S, Rel., SRP) (10,000-100,000 lb)
Western Yarrow

- Eagle Germplasm
  (S, Rel., SRP)
  (10,000-100,000)
Lewis Flax

- Maple Grove Germplasm
  (S, Rel., CBR)
  (10,000-100,000 lb)
Globemallows

- Gooseberryleaf (SI, CBR) (100-1,000 lbs)
- Scarlet (SI, CBR) (o)
- Munro (SI, SRP; SI, NBR) (o)
- Globemallow, Misc. (SI, CBR) (10,000-100,000)
  Wildland Collected
Each Specific Germplasm Marketplace Evaluation

- AOC--Area of Collection (Level 3 Ecoregions/Provisional Seed Zones)
- PR--Population Representation (Single, Pooled)
- GDS--Germplasm Development Status (SI, S, T, or V)
- WCP vs. WCA--Wildland Collection Potential (1-10) vs. Actual (1-10)
- FPP vs. FPA--Field Production Potential (1-10) vs. Actual (1-10)
- APA--Applicable Planting Area (Level 3 Ecoregions/Provisional Seed Zones)
- MDP vs. MDA--Market Demand Potential (1-10) vs. Actual (1-10)
- MSP vs. MSA--Market Supply Potential (1-10) vs. Actual (1-10)