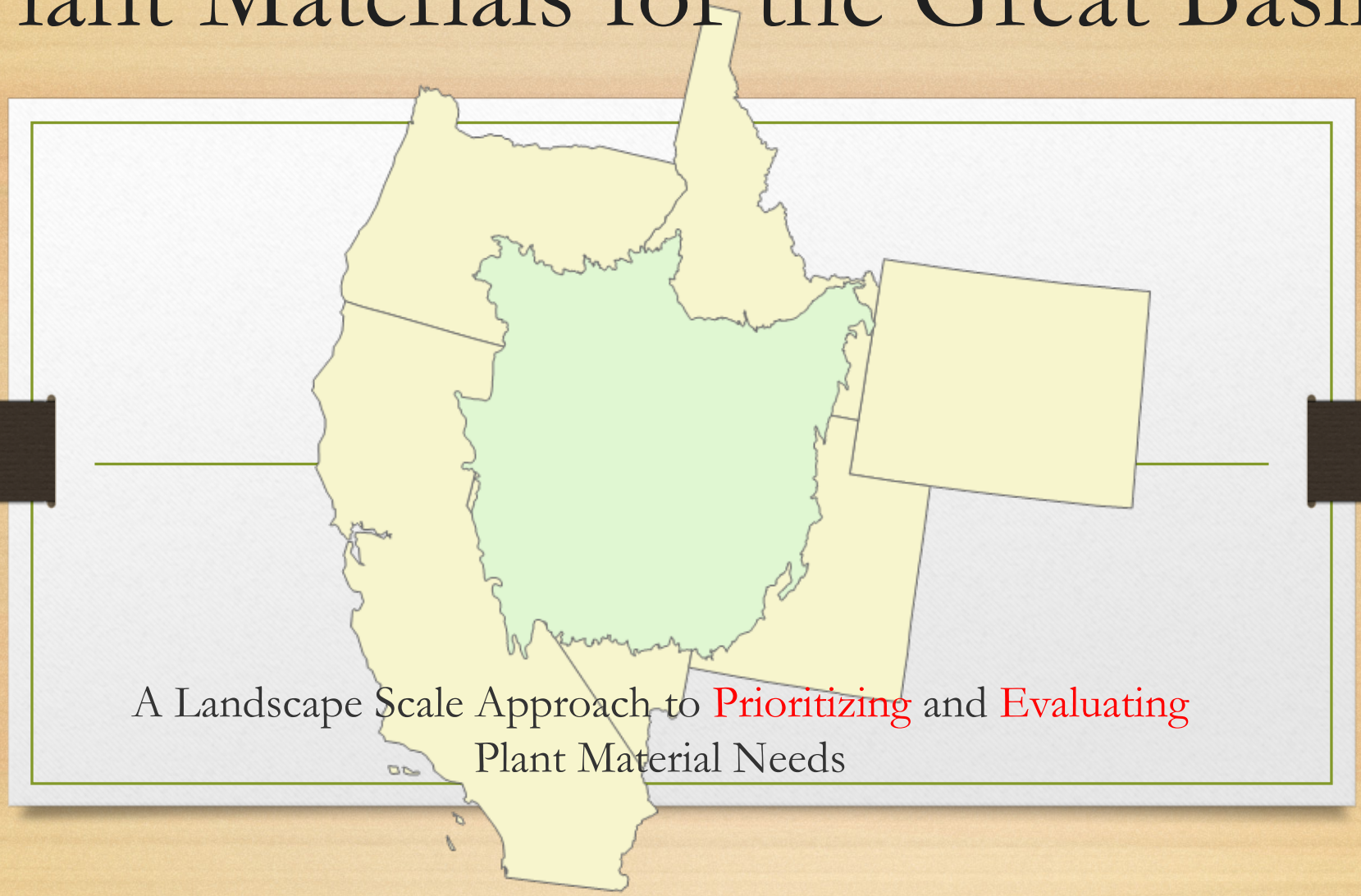
Plant Materials for the Great Basin



A Landscape Scale Approach to Prioritizing and Evaluating Plant Material Needs

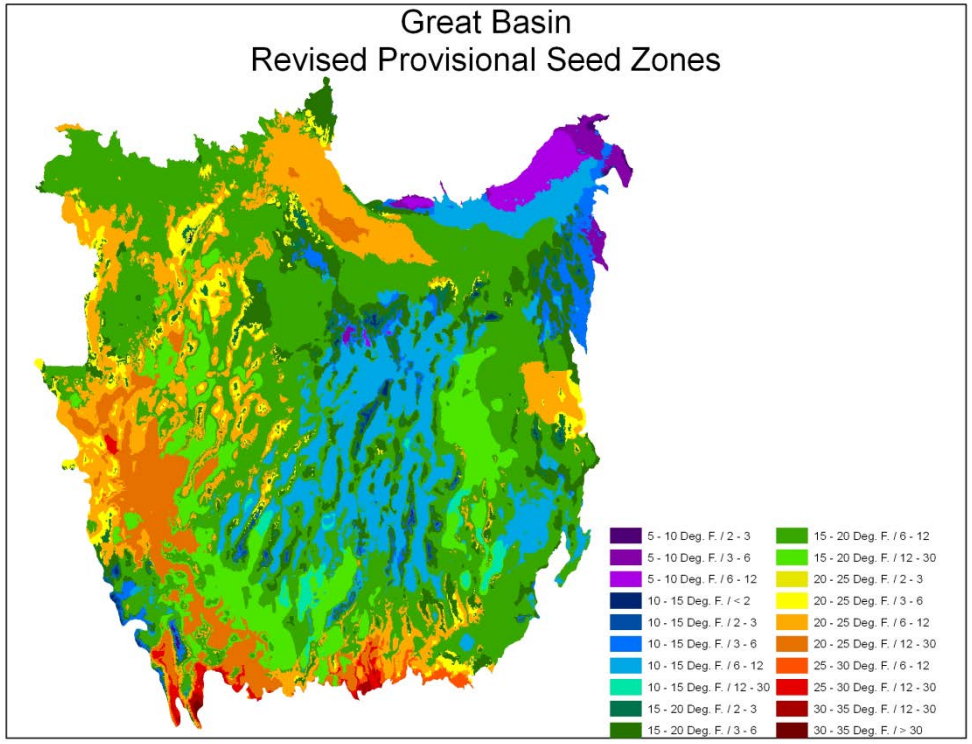
Scott Jensen, USDA FS RMRS, Provo, UT.

Guiding Structure

- Select a Plant Material Development Model
- Understand Regional Restoration Demand and Prioritize Restoration Needs
- Select and Prioritize Species

A Plant Material Development Framework

A reasonable compromise

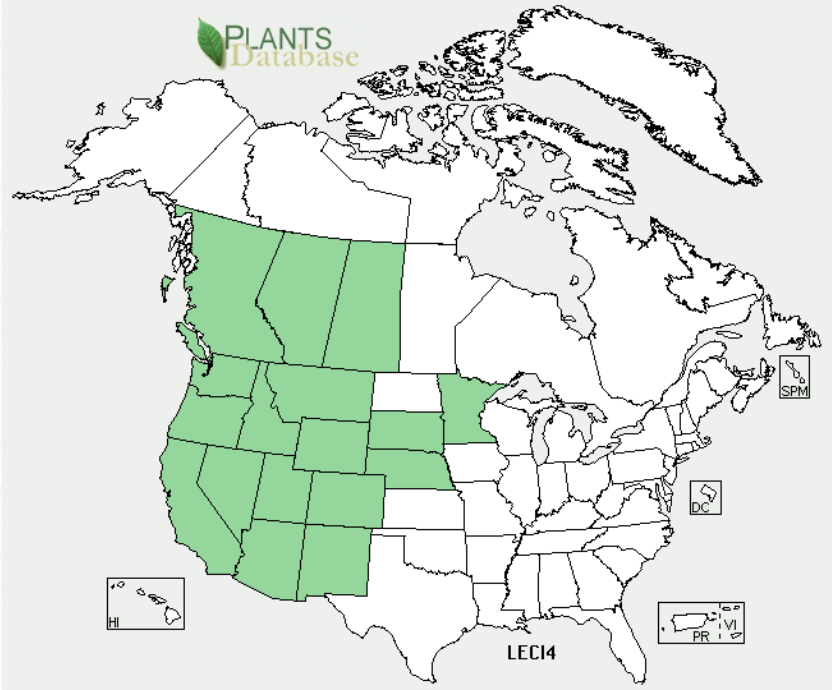


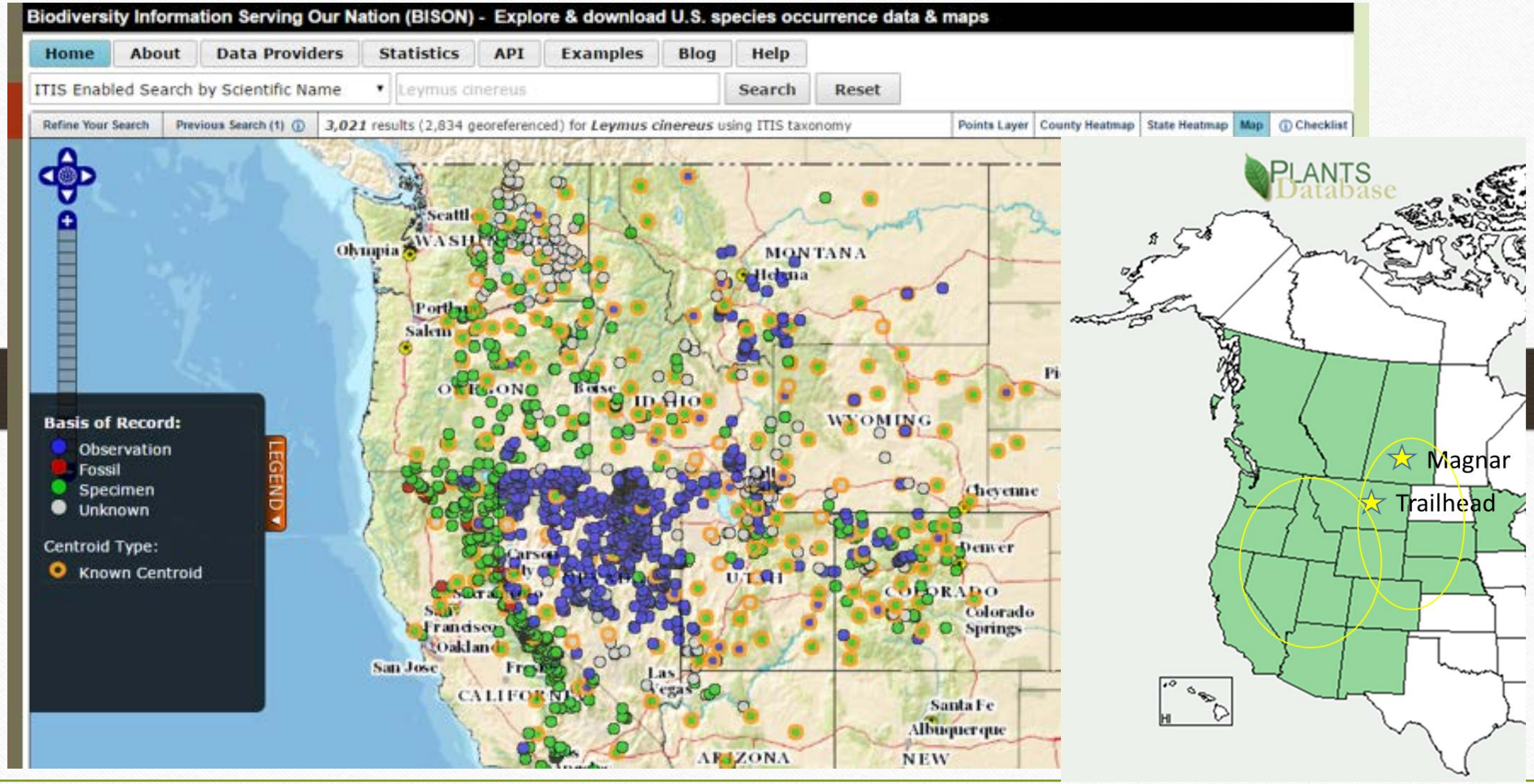
Generalized Provisional Seed Zones for the Great Basin

Bower, A., St. Clair J.B., and V.J. Erickson. 2014. Provisional seed zones for native plants.

Parameters:
Minimum winter temperature
Aridity index-
Annual heat: Annual Moisture

Basin wildrye

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County Heatmap
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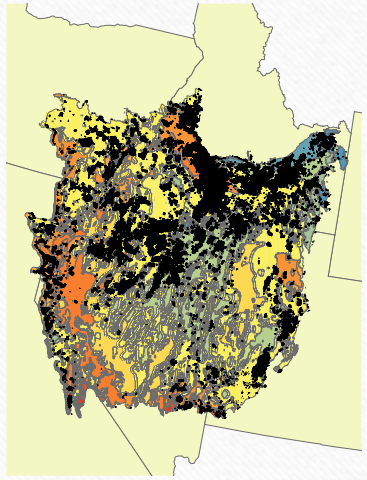
Map
Checklist
Basis of Record:
Observation
Fossil
Specimen
Unknown
Centroid Type:
Known Centroid
LEGEND
Seattle
Olympia
Portland
Salem
Boise
MONTANA
Helena
IDAHO
WYOMING
Cheyenne
Denver
UTAH
COLORADO
Colorado Springs
San Francisco
Oakland
San Jose
Las Vegas
CALIFORNIA
Santa Fe
Albuquerque
ARIZONA
NEW
PLANTS Database
Magnar
Trailhead
HI

Guiding Structure

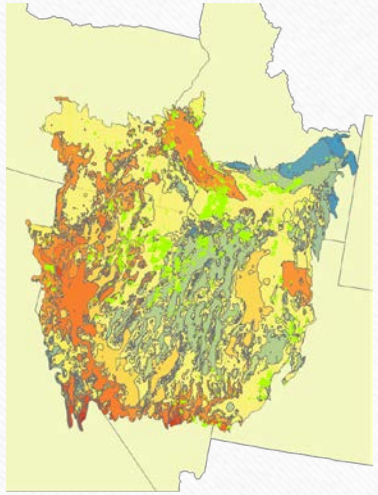
- Select a Plant Material Development Model
- Understand Regional Restoration Demand and Prioritize Restoration Needs
- Select and Prioritize Species

Understand Regional Restoration Demand

The Western Fire Map



LTDL Seedings Overlay



Prioritize Restoration Needs

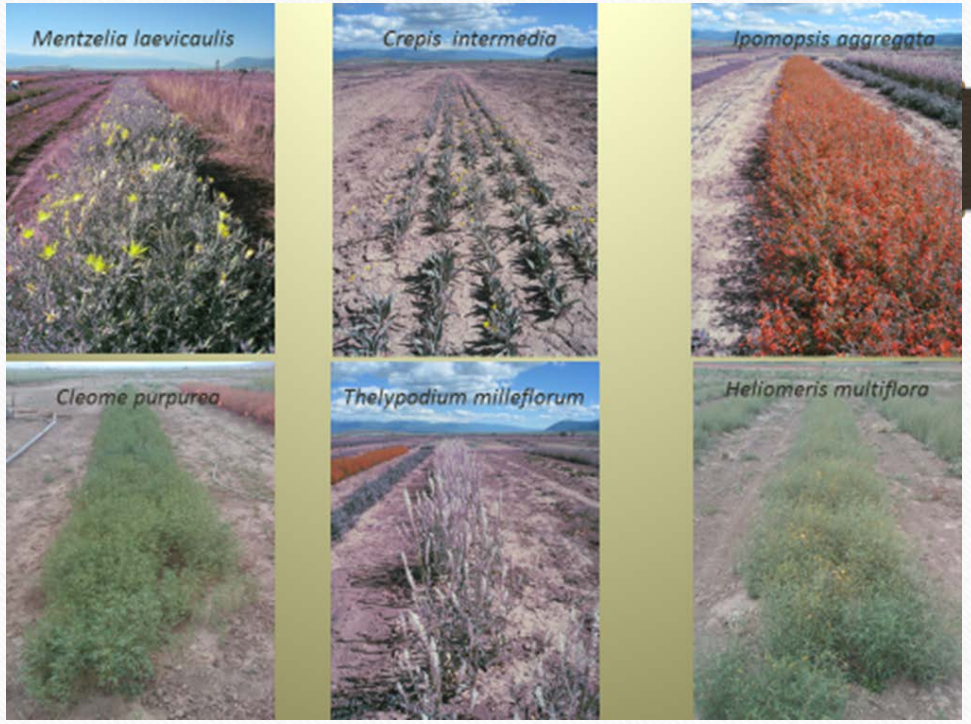
Calculated Native Forb Seed Demand					
Provisional Seed Zone	1993-1995	1996-1998	1999-2001	2002-2004	2005-2007
5 - 10 Deg. F. / 2 - 3	0	0	733	0	0
5 - 10 Deg. F. / 3 - 6	4818	3190	6275	1271	1839
5 - 10 Deg. F. / 6 - 12	25598	56824	98446	4588	16814
10 - 15 Deg. F. / < 2	0	1362	1	0	74
10 - 15 Deg. F. / 2 - 3	0	329	3856	0	5225
10 - 15 Deg. F. / 3 - 6	16324	17839	114634	8299	71110
10 - 15 Deg. F. / 6 - 12	48188	326642	591788	20247	635423
10 - 15 Deg. F. / 12 - 30	3510	0	1030	0	0
15 - 20 Deg. F. / 2 - 3	1501	4979	12871	1576	12894
15 - 20 Deg. F. / 3 - 6	65146	219185	499515	59405	415649
15 - 20 Deg. F. / 6 - 12	241500	581926	1813918	92817	1668405
15 - 20 Deg. F. / 12 - 30	454	7625	76521	884	33767
20 - 25 Deg. F. / 2 - 3	32	194	8809	1452	2979
20 - 25 Deg. F. / 3 - 6	12005	92592	270641	26343	91988
20 - 25 Deg. F. / 6 - 12	121932	296718	881549	101841	290206
20 - 25 Deg. F. / 12 - 30	2157	32405	48208	1151	23210
25 - 30 Deg. F. / 6 - 12	1644	7527	11974	1187	116841
25 - 30 Deg. F. / 12 - 30	667	1348	1691	13	17206
30 - 35 Deg. F. / 12 - 30	0	217	671	0	4581

Guiding Structure

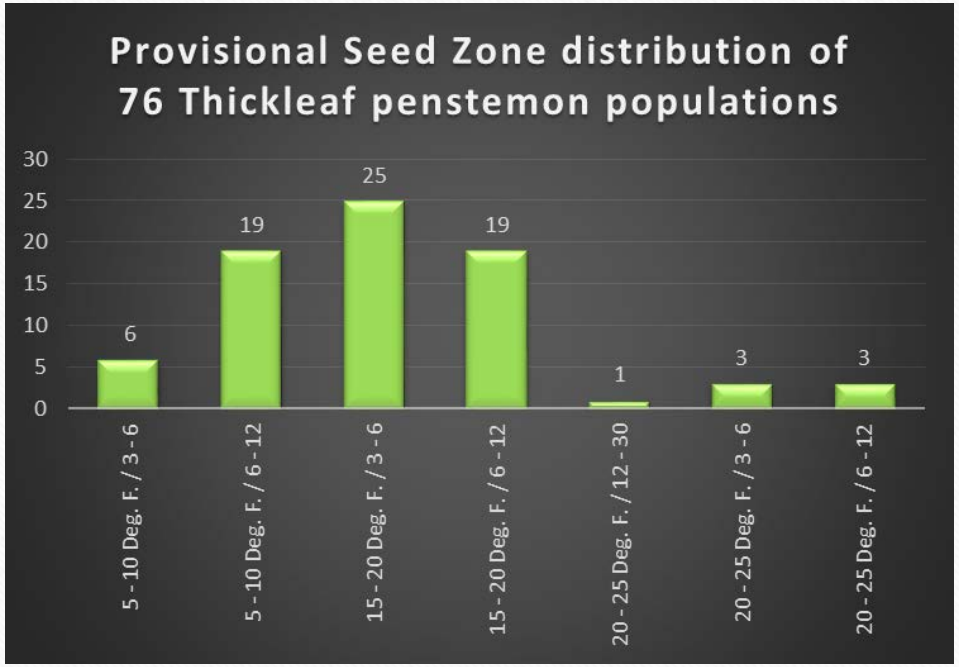
- Select a Plant Material Development Model
- Understand Regional Restoration Demand and Prioritize Restoration Needs
- Select and Prioritize Species

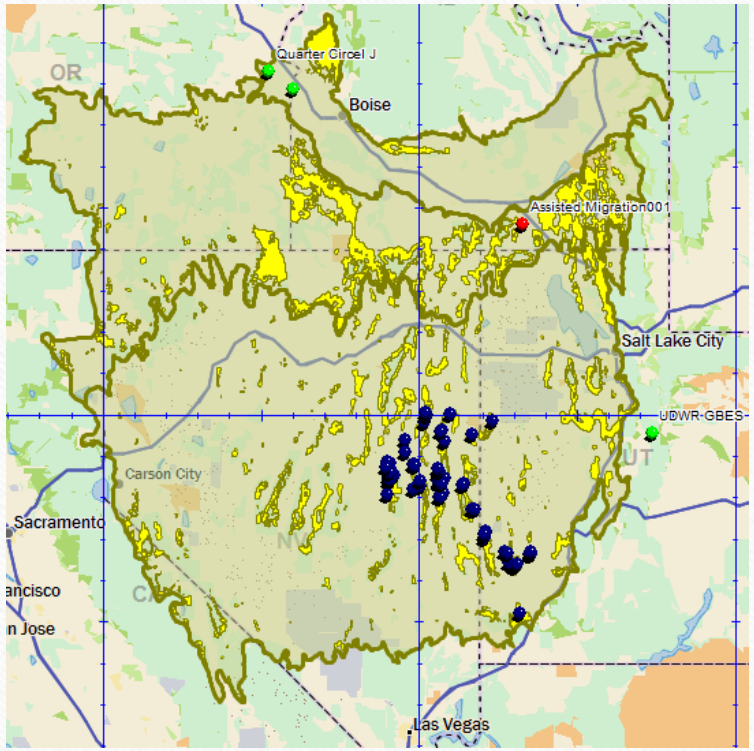
Species Selection

- Agency Interests
- BLM Seed Buy
- Farm Screening – Agronomic Potential
- Low Hanging Fruit – Annuals



Distribution of Thickleaf penstemon





Seed Source Recommendations

Conserve the range of *genetic variation*

- Pool seed from
  - the same ecosystem
  - more than 50 parents
  - at least 5 locations

- If environmental uncertainty is anticipated
  - Include material from other ecosystems similar to anticipated future environment (composite provenances)

Johnson et.al. 2010

Seed Increase Project with UDWR

Species	PSZ	# Sources	1st crop
Thickleaf penstemon	15 - 20 Deg. F. / 3 – 6	18	2016
Nevada showy goldeneye	15 - 20 Deg. F. / 6 - 12	5	2015
Lewis flax	15 - 20 Deg. F. / 6 - 12	9	2015
Skyrocket gilia	15 - 20 Deg. F. / 3 – 6	7	2017
Rocky Mountain beeplant	10 - 15 Deg. F. / 6 - 12	6	2017
barestem biscuitroot	15 - 20 Deg. F. / 6 – 12	3	2019
Palmer's penstemon	15 - 20 Deg. F. / 6 – 12	11	2018
firecracker penstemon	15 - 20 Deg. F. / 3 – 6	6	2018
gooseberryleaf globemallow	15 - 20 Deg. F. / 6 – 12	8	2018
Annual sunflower	15 - 20 Deg. F. / 6 - 12	5	2017

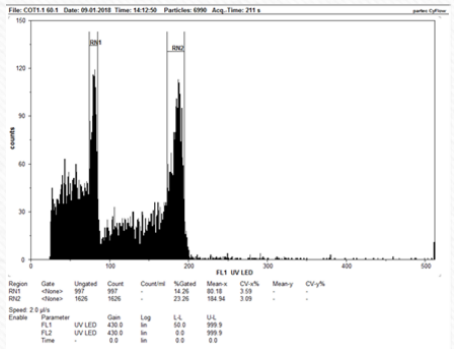
UDWR Native Seed Increase

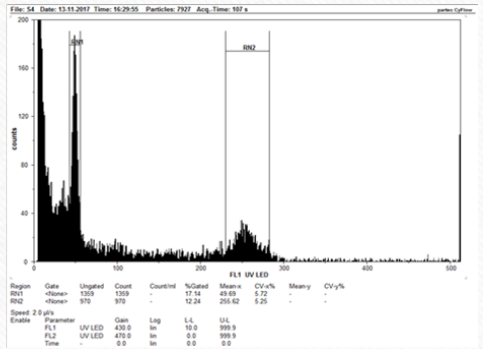
- Seed in Production or Sown 2021
  - 24 species with 80 accessions
- Harvested 2020
  - 15 species with 94 accessions

Species	Number of Accessions	Production (kg)
Cleome serrulata	9	5.8
Eriogonum racemosum	3	0.6
Heliomeris multiflora nevadensis	4	6.4
Ipomopsis agreggata	2	3.5
Iposmopsis congesta	1	0.05
Linum lewisii	4	3.6
Machaeranthera asteroides var asteroides	1	1.6
Mentzelia laevicaulis	2	3.6
Pachera sp.	1	0.05
Penstemon eatonii	4	0.5
Penstemon pachyphyllus	7	1.7
Penstemon palmeri	18	11.5
Phacelia crenulata corrugata	1	0.008
Sphaeralcea grossulariifolia	8	1.9

Source Selection

- Incorrect Cytotypes
- Seed Ripening Phenology Doesn't Match
- Poor Seed Producers
- Sources with Persistent Disease
- Species with Poor Agricultural Performance
- Species < 100 lbs. ac





Cedar City Utah, BLM

Hamblin Valley WRI Project

Unit:			
Program:		Project Name:	
Ship Date:		Job type:	
Mix Lot #:	sr-df-hv-17		
Acres:	3550		
KIND OF SEED	LOT NUMBER	POUNDS IN MIX	Seeds per sq.ft.
Bluebunch Wheatgrass 'Anatone	H4-15-84261	8800	7.13
Western Wheatgrass 'Arriba'	1485-1	3550	2.23
Thickspike Wheatgrass 'Bannock'	450-126-486X1	3550	3.15
Indian Ricegrass 'Nezpar'	NBS-RR3-NEZ-2	8800	7.62
Alfalfa 'Ladak'	SA-2190	2000	2.70
Lewis Flax 'Maple Grove'	S13-283-12	1100	1.67
Scarlet Globemallow--Iron, UT	28Y	59	0.02
Palmer Penstemon-White Pine NV	SIS5136	1900	6.48
Showy Goldeneye--White Pine NV	16-GE	500	2.76
Western Yarrow-Lincoln WA	099-568-402A	350	6.79
Arrowleaf Balsamroot--Sevier, UT	BASA-P-UTSV	400	0.10
Thickleaf Penstemon - Whitepine NV	16-TL	1100	2.09
Munro Globemallow--Iron UT	V-88681	200	0.57
Gooseberryleaf Globemallow--Beaver UT	21H	500	1.41
Yellow Beeplant--Nye NV	SIS5179	50	0.03
Firecracker Penstemon 'Richfield'	2011.0592	400	0.62
Sandberg Bluegrass--Mountain Home	NBS-CF3-MTH-1	500	2.62
BULK POUNDS PER ACRE:	9.51	33759	
PLS POUNDS PER ACRE:	8.59		

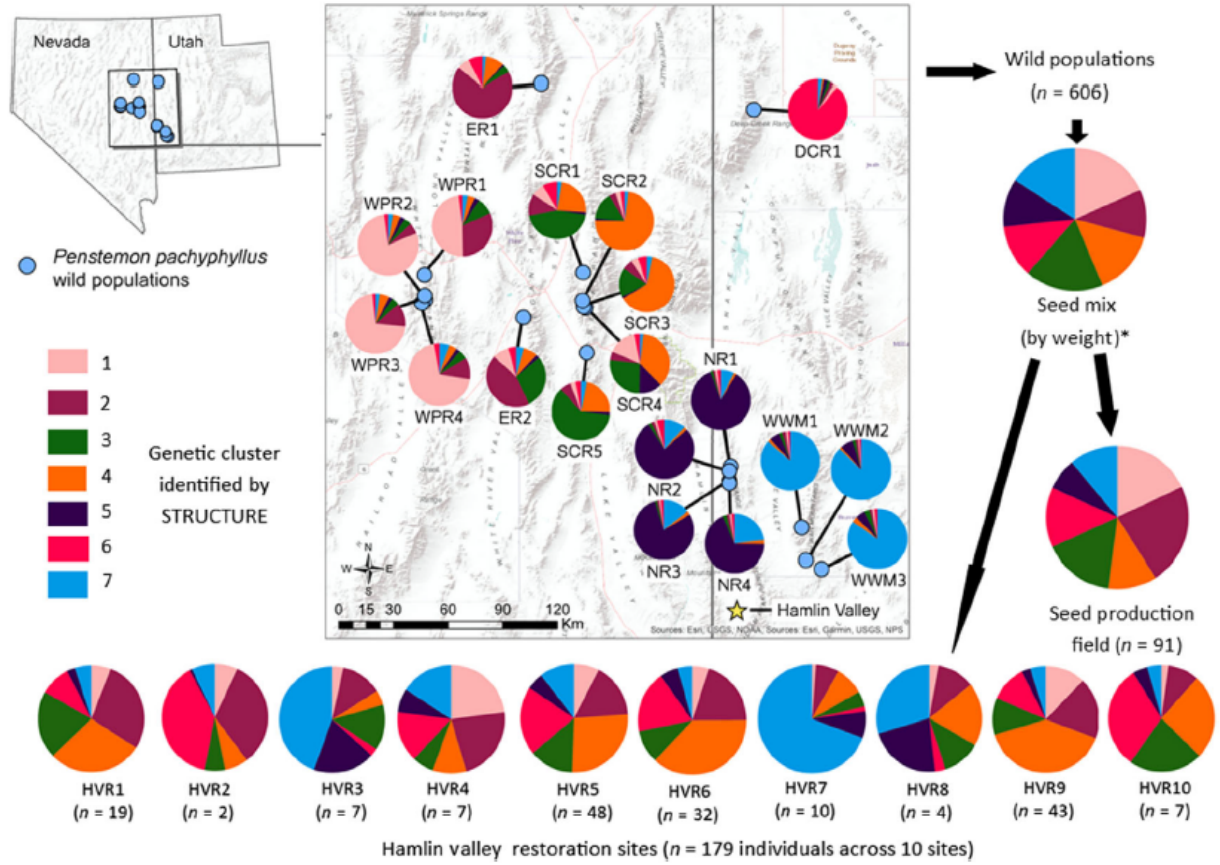


Figure 2. Map of 19 source populations, with proportion of each of seven genetic clusters identified by STRUCTURE shown for each population. Also shown is the proportion of each genetic cluster present in the seed production field (plants grown in Vale, Oregon, not shown on map) as well as the 10 restoration sites in Hamlin Valley (yellow star). More detail about admixture among clusters is available in Table 2 and full STRUCTURE results are presented in Figure S2. *Seed mix indicates the proportion of each assigned genetic cluster present in the seed mix used for the seed production field and restoration sites, based on seed weight and assignment of each population to each genetic cluster.

Implications for Practice

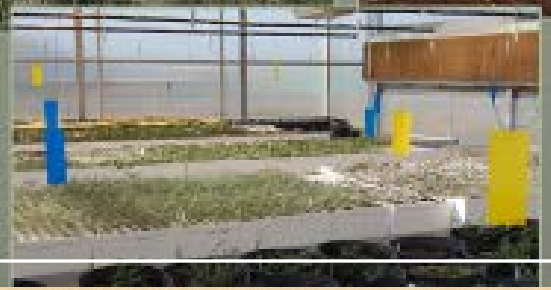
- When increasing seeds from a mixed-source seed lot in an irrigated production field, unexpected and unpredictable shifts in the representation of source populations may occur that may change the representation of source populations in seeds produced for restoration efforts.
- When a mixed-source seed lot is used at different restoration sites, the representation of source populations may shift even in the first generation, potentially in response to selection for the best-adapted genotypes for the site.
- If source populations have different seed germination requirements, these differences may influence which populations are able to establish at sites with varying climatic conditions.

Great Basin Research Center and Seed Warehouse

- Plant Materials Development
  - Wildland and agricultural test facilities and common gardens
  - Primarily native forbs and grasses

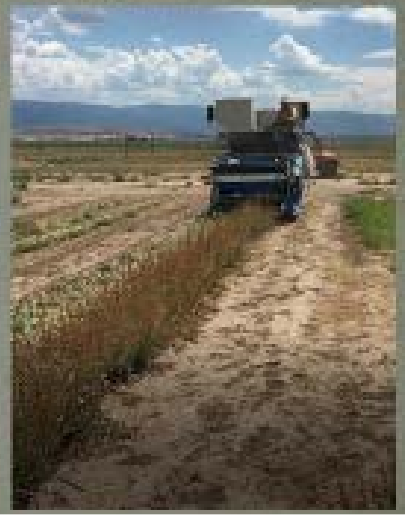





UDWR Native Seed Increase

- Germination and Propagation Facilities
  - Greenhouse, Drive-in Coolers, Incubators, and Shade House
- 2 Farms
  - Snow Field Station, Ephraim UT
    - 22 acres
  - Fountain Green, UT
    - 20 acres
- Specialized Equipment
  - Planting, Maintenance, Harvesting and Cleaning



Propagation

Greenhouse and Transplant
(limited seed quantities)

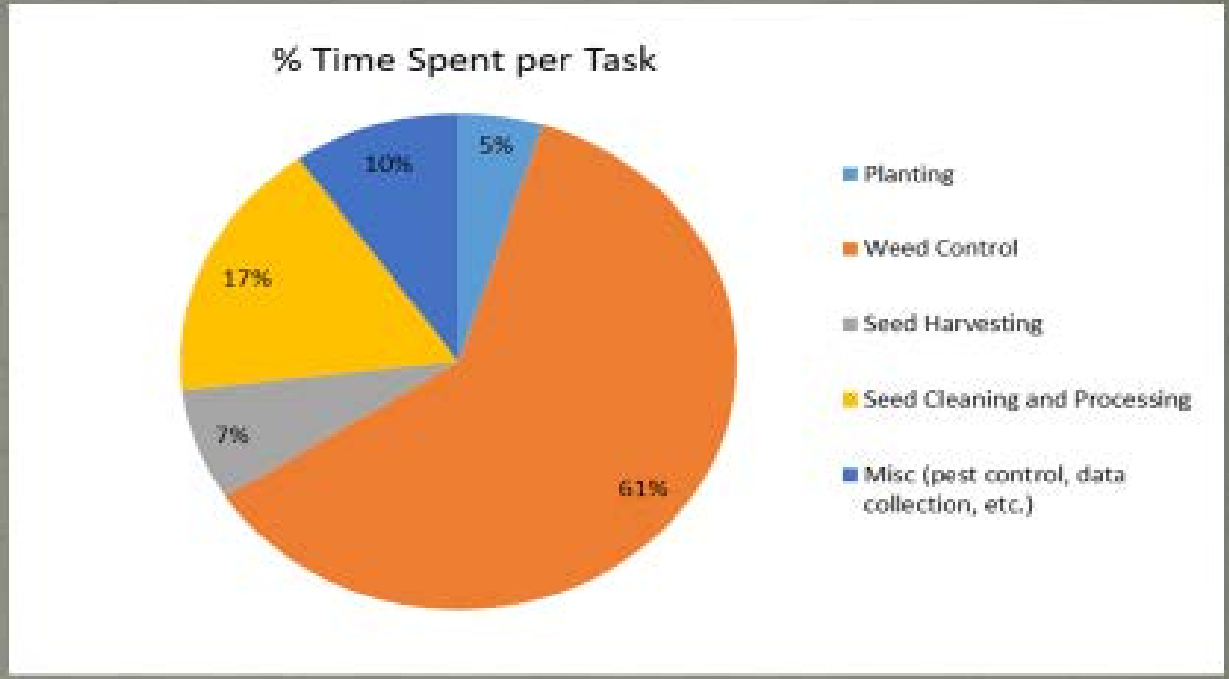
Direct Seed in Beds

Harvest Methods

Cleaning

Miscellaneous

- Beehive to ensure pollination/seed fill
- Pesticide/Insecticide/Fungicide (flea beetles, cutworms, etc.) that won't harm pollinators.
- Gopher control
- Source seed selection/collection (species, seed-zone, isolation distances, etc.)
- Fertilizer
- Ground preparation (tillers, harrows, etc.)



Partners:

Great Basin Native Plant Project

USDA Forest Service

USDI Bureau of Land Management

Utah Division of Wildlife Resources