The Great Basin Native Plant Project

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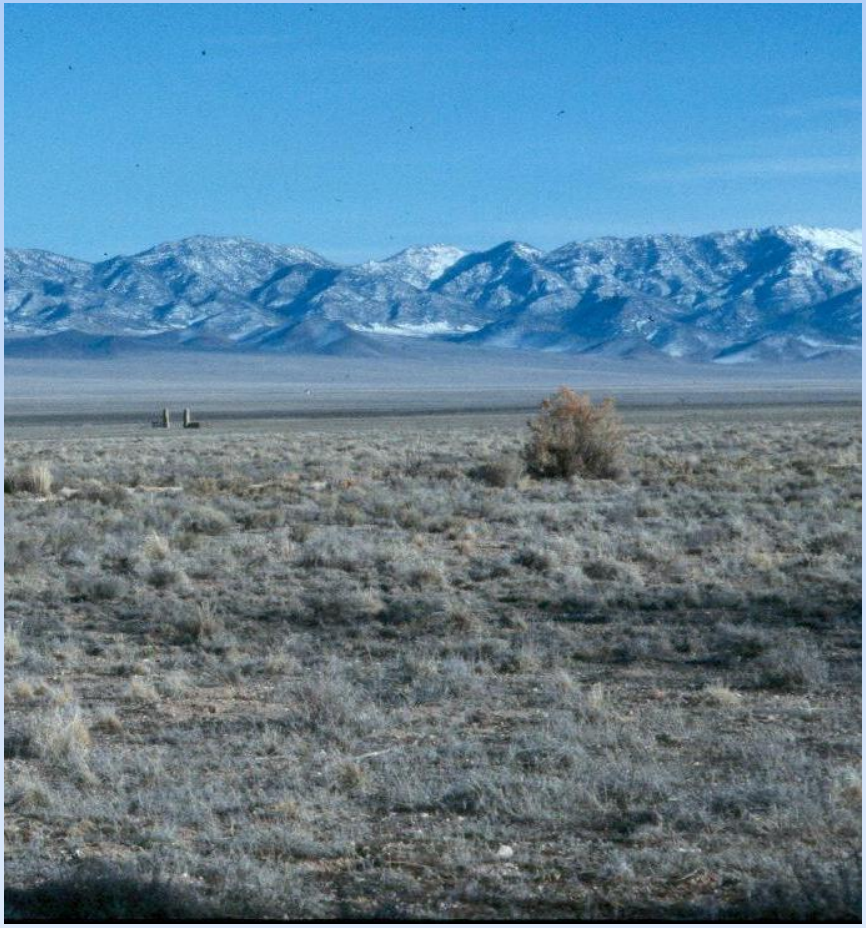
USFS-RMRS-GSD, Francis Kilkenny

The Great Basin

The Great Basin

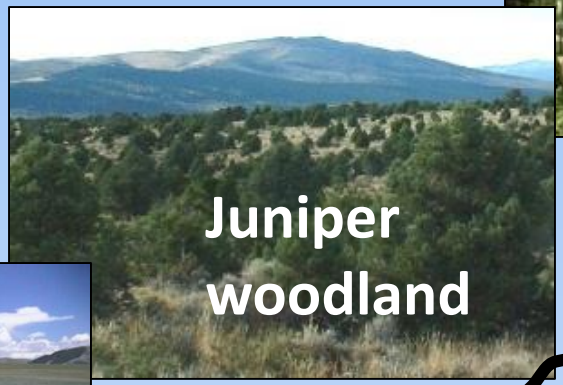
Total Area: 550,000 km^2

Public Lands: 410,000 km^2




DRY!!!

Great Basin Ecosystems



50 mm — Annual Precipitation — 600 mm

750 m — Elevation — 4000 m

Ecology of the sagebrush steppe

Remarkable diversity of the sagebrush steppe

- More than 5,000 plant taxa (Baldwin et al. 2012; Cronquist et al. 1972-2012; Hitchcock et al. 1987)
- Centers of diversity for many species-rich genera
- Many taxa are narrow or regional endemics



Photos by Kas Dumroese

- New taxa, such as *Lomatium ochocense* from central Oregon, still being discovered (Helliwell 2010)

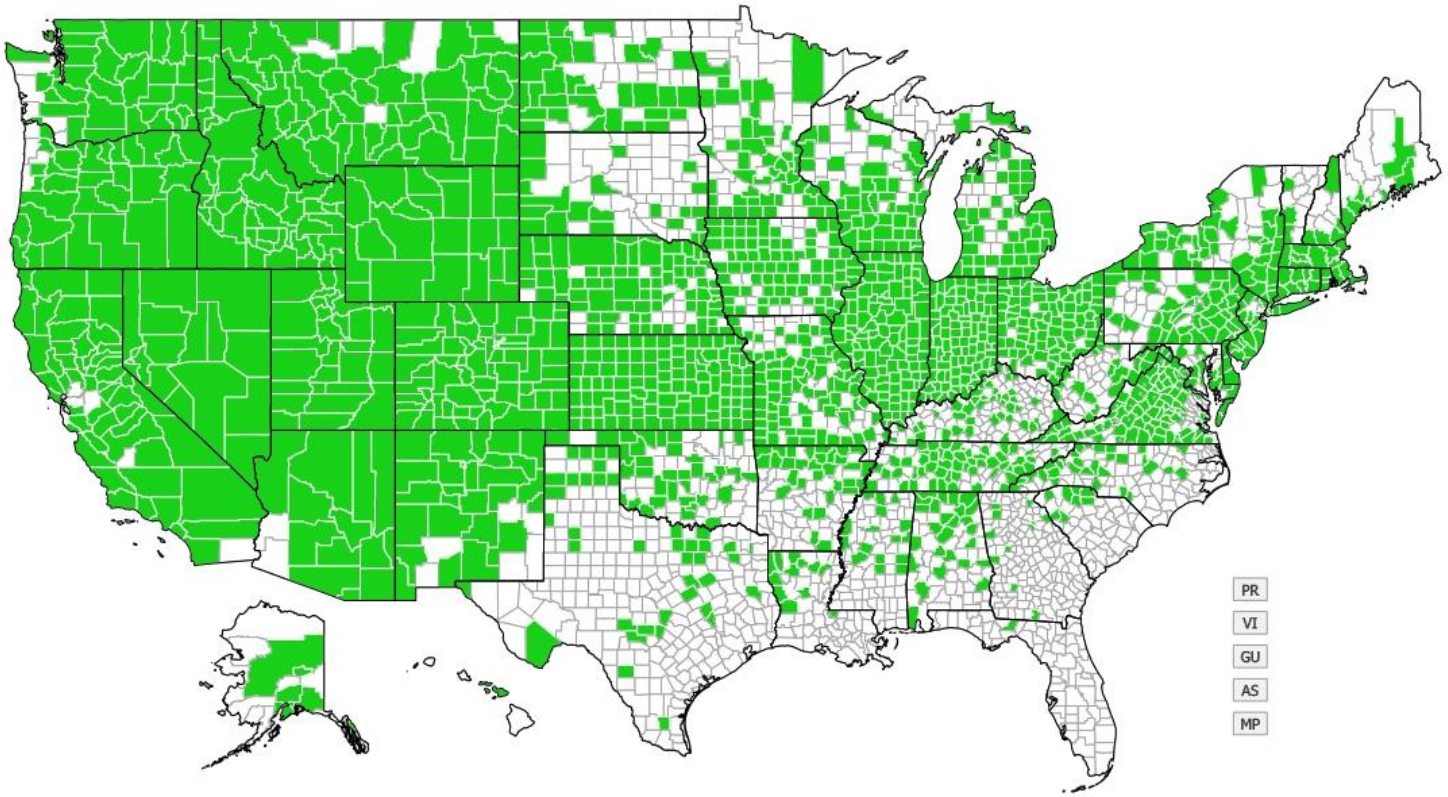
Remarkable diversity of the sagebrush steppe

2100 insect species

Kas Dumroese

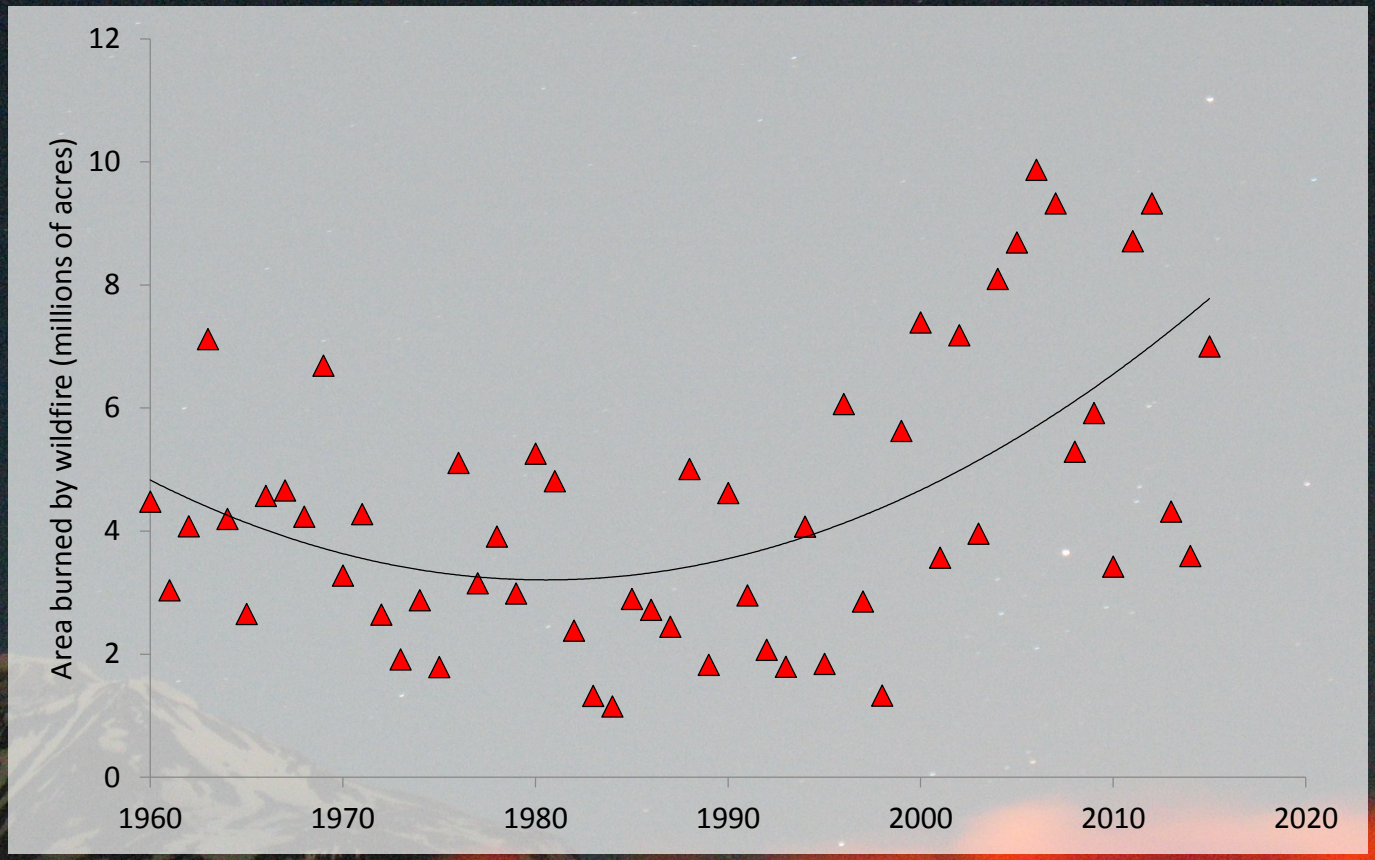
Tom Koerner, US Fish & Wildlife Service

Wildlife species of conservation concern



Invasive and non-native species
Cheatgrass!

Photo by: Famartin



Fire!

BLM/photo by Darlisa Black

Soda Fire

Homedale
Huston
Nampa
Garden City
Meridian
Boise
Marsing
Lake Lowell
Canyon
Owyhee
Kuna
Melba
Oregon
Idaho

Over 283,000 acres burned
5.5 times the area of Boise


Idaho Press


Boise Weekly


Stephen Lam/Getty Images

Partnerships

Great Basin Native Plant Project




NATIONAL SYSTEM OF PUBLIC LANDS
U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

GREAT BASIN
Native Plant
PROJECT

FOREST SERVICE
US
DEPARTMENT OF AGRICULTURE

U.S.
FISH & WILDLIFE
SERVICE

COOPERATORS

USDA Forest Service, Rocky Mountain Research Station
Grassland, Shrubland and Desert Ecosystem Research Program, Boise, ID, Provo, UT, and Albuquerque, NM
USDI Bureau of Land Management, Plant Conservation Program, Washington, DC
Boise State University, Boise, ID
Brigham Young University, Provo, UT
College of Western Idaho, Nampa, ID
Eastern Oregon Stewardship Services, Prineville, OR
Oregon State University Malheur Experiment Station, Ontario, OR
Private Seed Industry
Texas Tech University, Lubbock, TX
Truax Company, Inc., New Hope, MN
University of Idaho, Moscow, ID
University of Idaho Parma Research and Extension Center, Parma, ID
University of Nevada, Reno, NV
University of Nevada Cooperative Extension, Elko and Reno, NV
Utah State University, Logan, UT
USDA Agricultural Research Service, Bee Biology and Systematics Laboratory, Logan, UT
USDA Agricultural Research Service, Eastern Oregon Agriculture Research Center, Burns, OR
USDA Agricultural Research Service, Forage and Range Research Laboratory, Logan, UT
USDA Agricultural Research Service, Great Basin Rangelands Research Unit, Reno, NV
USDA Agricultural Research Service, Western Regional Plant Introductions Station, Pullman, WA
USDA Forest Service, National Seed Laboratory, Dry Branch, GA
USDA Forest Service, Pacific Northwest Research Station, Corvallis, OR
USDA Natural Resources Conservation Service, Aberdeen Plant Materials Center, Aberdeen, ID
USDI Bureau of Land Management, Morley Nelson Birds of Prey National Conservation Area, Boise, ID
US Geological Survey Forest and Rangeland Ecosystem Science Center, Boise, ID
Utah Division of Wildlife Resources, Great Basin Research Center, Ephraim, UT
Utah Crop Improvement Association, Logan, UT

Native plant material restoration cycle

Native Seed Collection

Evaluation and Development

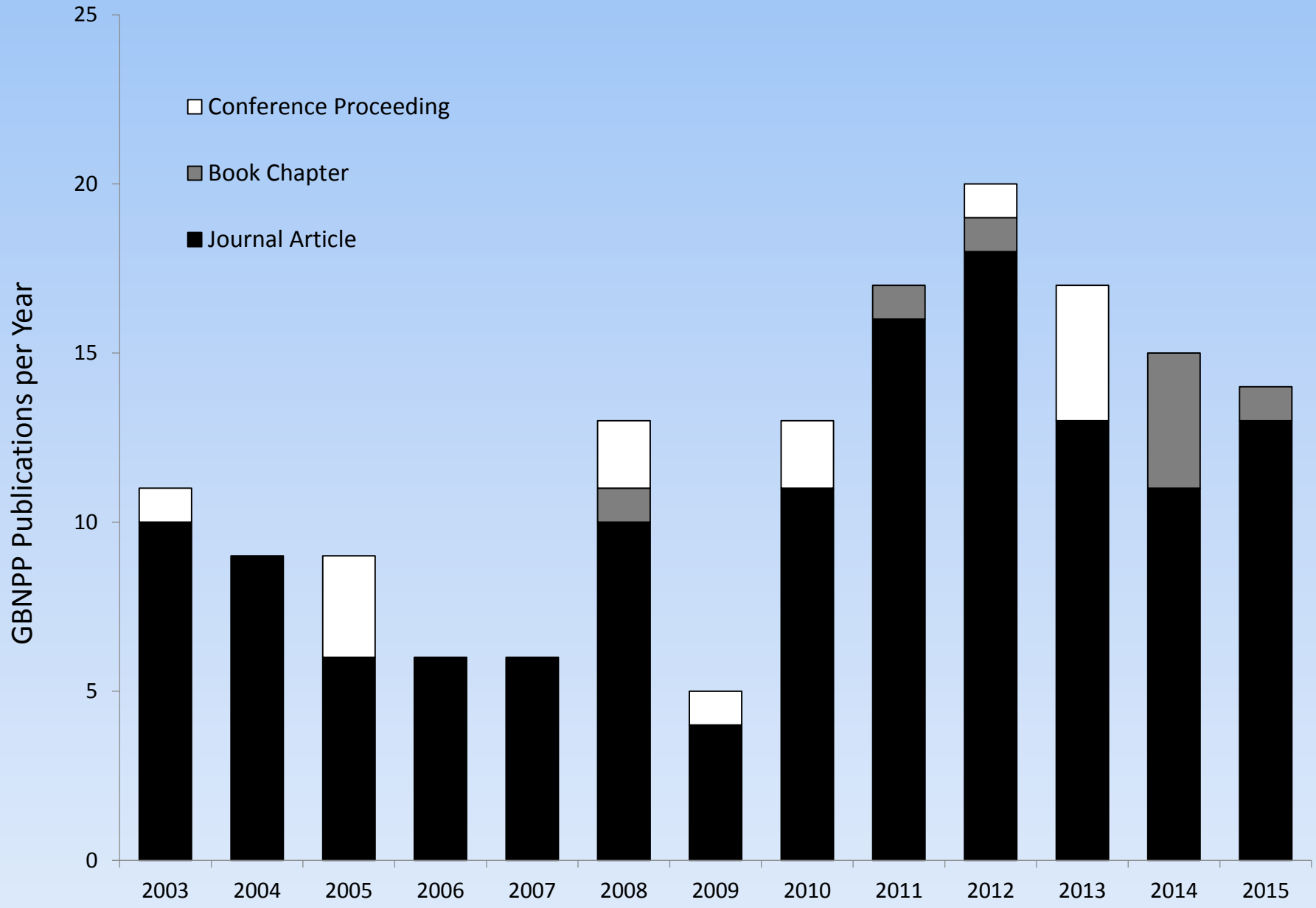
Initial Seed Increase

Seed Production

Seed Storage

Restore Native Plant Communities

Great Basin Native Plant Project Publications



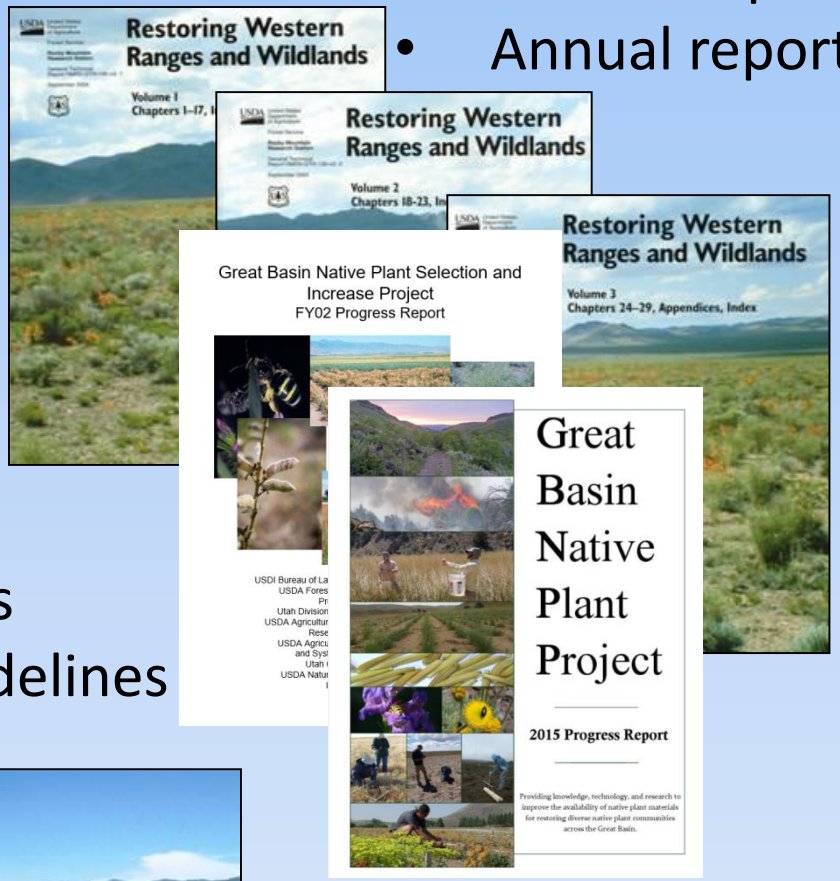
Genus	Taxa	Type	Genus	Taxa	Type
Achillea L. Asteraceae	2	F	*Heterotheca* Cass. Asteraceae	1	F
Achnatherum P. Beauv. Poaceae	4	G	*Iliamna* Greene Malvaceae	1	F
Agastache Clayton ex Gronov. Lamiaceae	1	F	*Ipomopsis* Michx. Polemoniaceae	2	F
Agoseris Raf. Asteraceae	4	F	*Koeleria* Pers. Poaceae	1	G
Allium L. Liliaceae	1	F	*Krascheninnikovia* Guldenstaedt Chenopodiaceae	1	S
***Amsinckia* Lehm. Boraginaceae**	3	F	***Lappula* Moench Boraginaceae**	1	F
Aquilegia L. Ranunculaceae	1	F	*Lathyrus* L. Fabaceae	1	F
Arenaria L. Caryophyllaceae	1	F	*Lepidium* L. Brassicaceae	1	F
***Argemone* L. Papaveraceae**	1	F	*Leymus* Hochst. Poaceae	3	G
Aristida L. Poaceae	1	G	*Ligusticum* L. Apiaceae	2	F
Artemisia L. Asteraceae	13	S	*Linum* L. Linaceae	5	F
Astragalus L. Fabaceae	5	F	*Lomatium* Raf. Apiaceae	12	F
Atriplex L. Chenopodiaceae	3	S	*Lotus* L. Fabaceae	1	F
Balsamorhiza Nutt. Asteraceae	3	F	***Lupinus* L. Fabaceae**	8	F
***Blepharipappus* Hook. Asteraceae**	1	F	*Machaeranthera* Nees Asteraceae	1	F
Bromus L. Poaceae	2	G	***Mentzelia* L. Loasaceae**	3	F
Castilleja Mutis ex L.f. Scrophulariaceae	1	F	***Microsteris gracilis* (Hook) Greene Polemoniaceae**	1	F
Chaenactis D.C. Asteraceae	3	F	*Muhlenbergia* Schreb. Poaceae	1	G
Chamerion Raf. ex Holub Onagraceae	1	F	***Nemophila* Nutt. Hydrophyllaceae**	1	F
Chenopodium L. Chenopodiaceae	1	F	***Nicotiana* L. Solanaceae**	1	F
Chrysothamnus Nutt. Asteraceae	3	S	*Oenothera* L. Onagraceae	1	F
***Clarkia* Pursh Onagraceae**	1	F	*Packera* Á. Löve & D. Löve Asteraceae	1	F
Cleome L. Capparaceae	2	F	*Pascopyrum* Á. Löve Poaceae	1	G
***Collinsia* Nutt. Scrophulariaceae**	2	F	*Penstemon* Schmidel Scrophulariaceae[2]	26	F
Crepis L. Asteraceae	3	F	*Perideridia* Rchb. Apiaceae	1	F
***Cryptantha* Lehm. ex G. Don Boraginaceae**	2	F	***Phacelia* Juss. Hydrophyllaceae**	7	F
Cymopterus Raf. Apiaceae	2	F	*Phlox* L. Polemoniaceae	1	F
Dalea L. Fabaceae	3	F	***Plagiobothrys* Fisch. & C.A. Mey. Boraginaceae**	1	F
Delphinium L. Ranunculaceae	2	F	*Poa* L. Poaceae	2	G
Descurainia Webb & Bethel. Brassicaceae	1	F	*Potentilla* L. Rosaceae	2	F
Elymus L. Poaceae	8	G	*Pseudoroegneria* (Nevski) Á. Löve Poaceae	1	G
Enceliopsis (A. Gray) A. Nelson Asteraceae	1	F	*Psoralidium* Rydb. Fabaceae	1	F
Epilobium L. Onagraceae	1	F	*Purshia* DC. ex Poir. Rosaceae	4	S
***Eriastrum* Wooton & Standl. Polemoniaceae**	1	F	*Rudbeckia* L. Asteraceae	1	F
Ericameria Nutt. Asteraceae	1	F	*Scrophularia* L. Scrophulariaceae[2]	1	F
Erigeron L. Asteraceae	3	F	*Shepherdia* Nutt. Elaeagnaceae	2	S
***Eriogonum* Michx. Polygonaceae**	9	F	*Sphaeralcea* A. St.-Hil. Malvaceae	5	F
***Eriophyllum* Lag. Asteraceae**	1	F	*Sporobolus* R. Br. Poaceae	1	G
Festuca L. Poaceae	1	G	*Stanleya* Nutt. Brassicaceae	2	F
Frasera Walter Gentianaceae	1	F	*Stenotus* Nutt. Asteraceae	1	F
Gaillardia Foug. Asteraceae	1	F	*Thelypodium* Endl. Brassicaceae	1	F
***Gilia* Ruiz & Pav. Polemoniaceae**	2	F	***Townsendia* Hook. Asteraceae**	1	F
Grayia Hook. & Arn. Chenopodiaceae	1	F	*Veratrum* L. Liliaceae	1	F
Hedysarum L. Fabaceae	2	F	*Vicia* L. Fabaceae	1	F
Helianthella Nutt. Asteraceae	3	F	*Vulpia* C.C. Gmel. Poaceae	1	G
Hesperostipa (Elias) Barkworth Poaceae	1	G	*Wyethia* Nutt. Asteraceae	1	F

2001-2014, the **Great Basin Native Plant Project** evaluated:

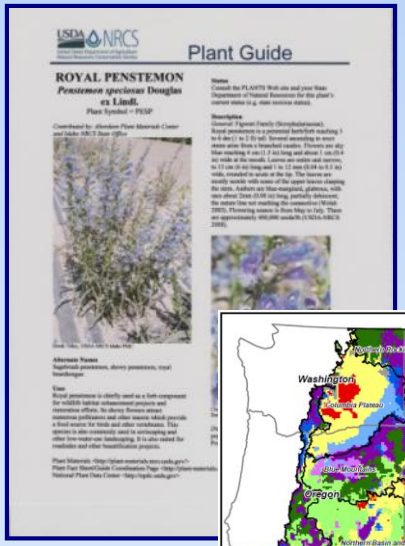
- 92 genera of native plant
- 225 taxa
- 80% are forbs
- 30+ varieties in production

Science delivery

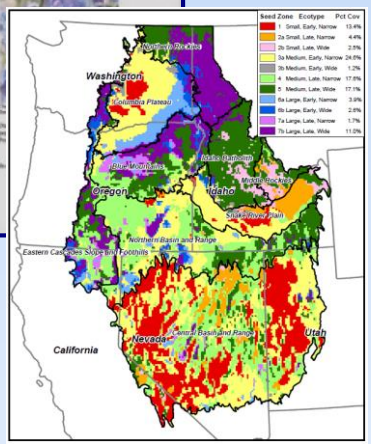
- Website
- Technical notes
- Webinars



- Manuals
- Manuscripts
- Annual report



- Plant guides
- Planting protocols
- Seed transfer guidelines



- Workshops
- Symposia
- Field tours

Organization

Native plant material restoration cycle

Native Seed Collection

Evaluation and Development

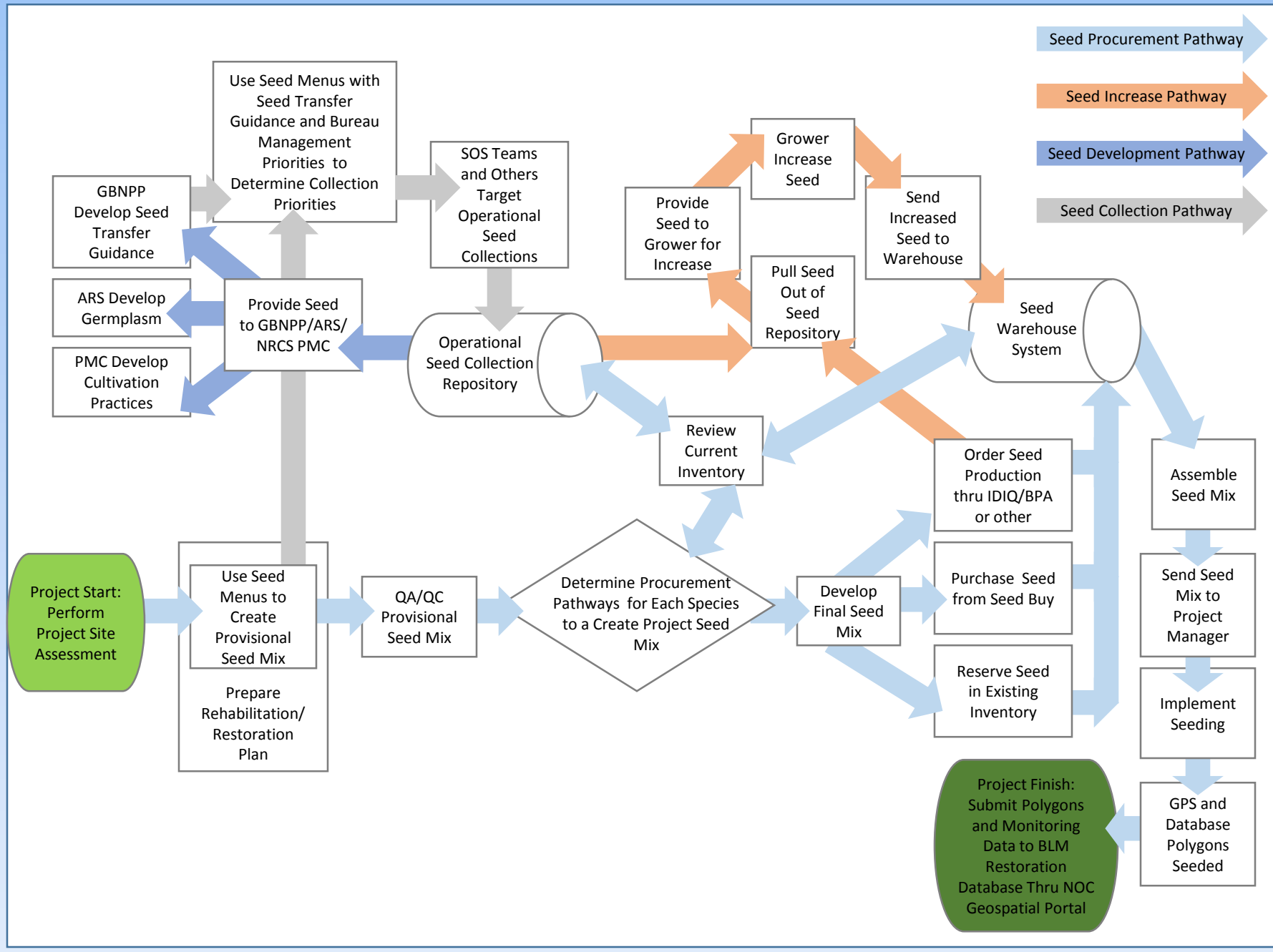
Initial Seed Increase

Seed Production

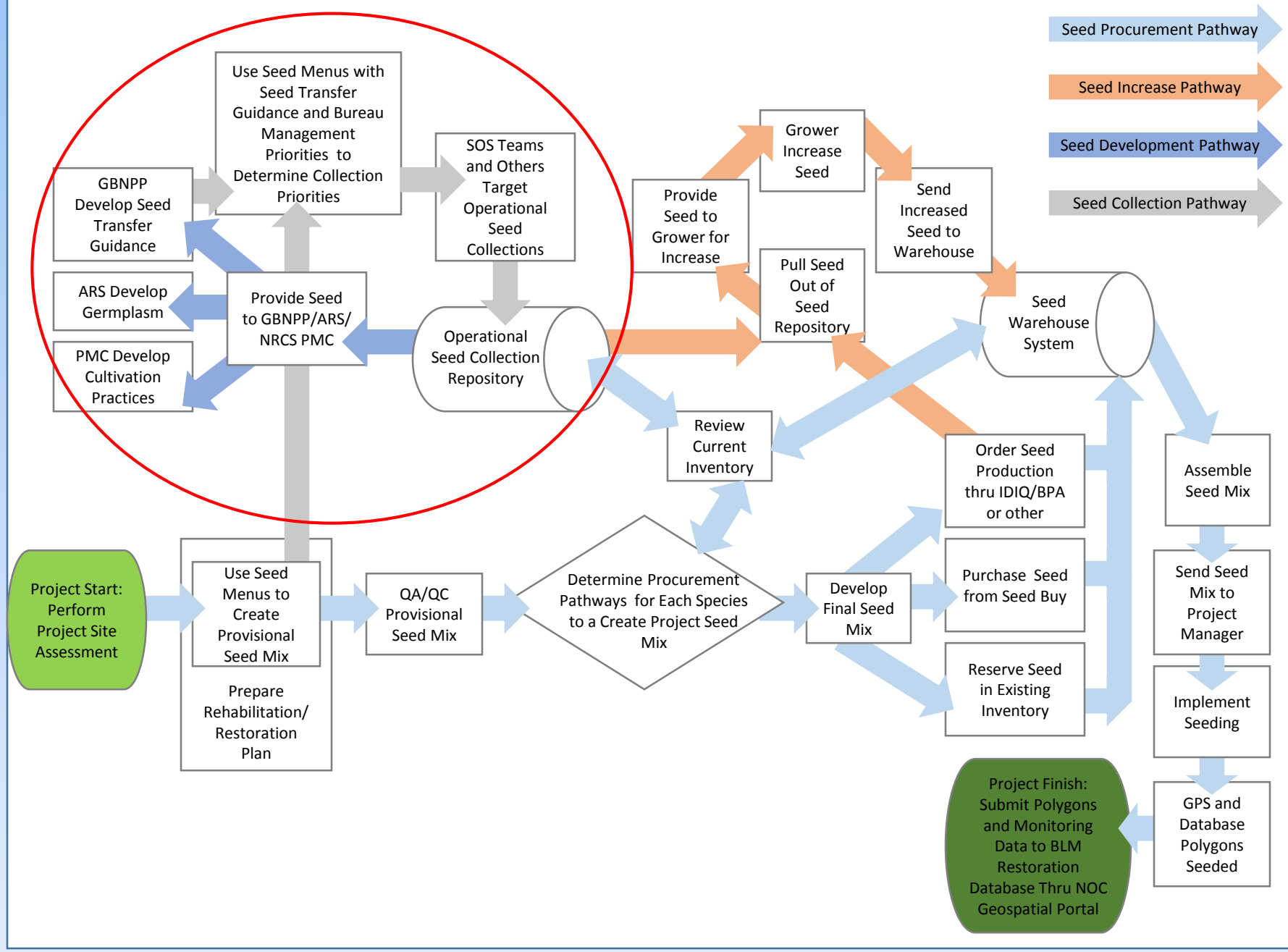
Seed Storage

Restore Native Plant Communities

Flow Chart of Seed Procurement, Increase, Development, and Collection Pathways



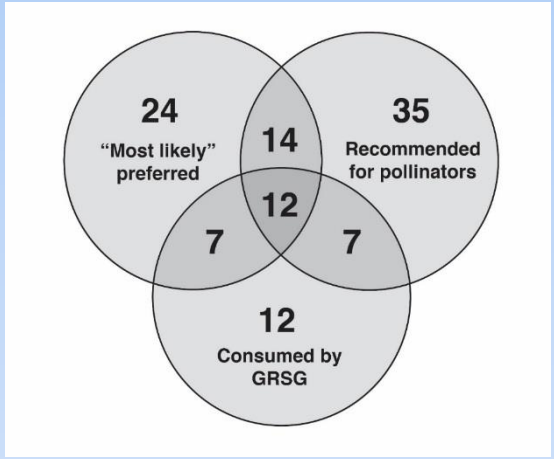
Flow Chart of Seed Procurement, Increase, Development, and Collection Pathways



Seed menus and species selection

Ecological considerations for restoration seed-mix menus

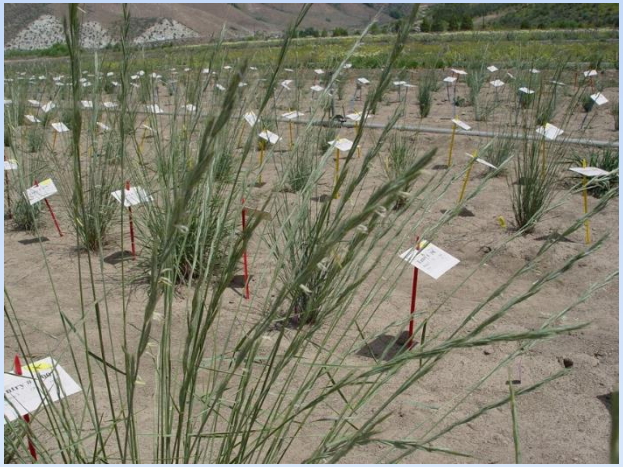
- Biotic interactions: competition, food-webs



Dumroese et al. 2016

Ecological considerations for restoration seed-mix menus

- Biotic interactions: competition, food-webs
- Structure and plant habit: grasses, shrubs, forbs



Ecological considerations for restoration seed-mix menus

- Biotic interactions: competition, food-webs
- Structure and plant habit: grasses, shrubs, forbs
- Seasonality and timing

Ecological considerations for restoration seed-mix menus

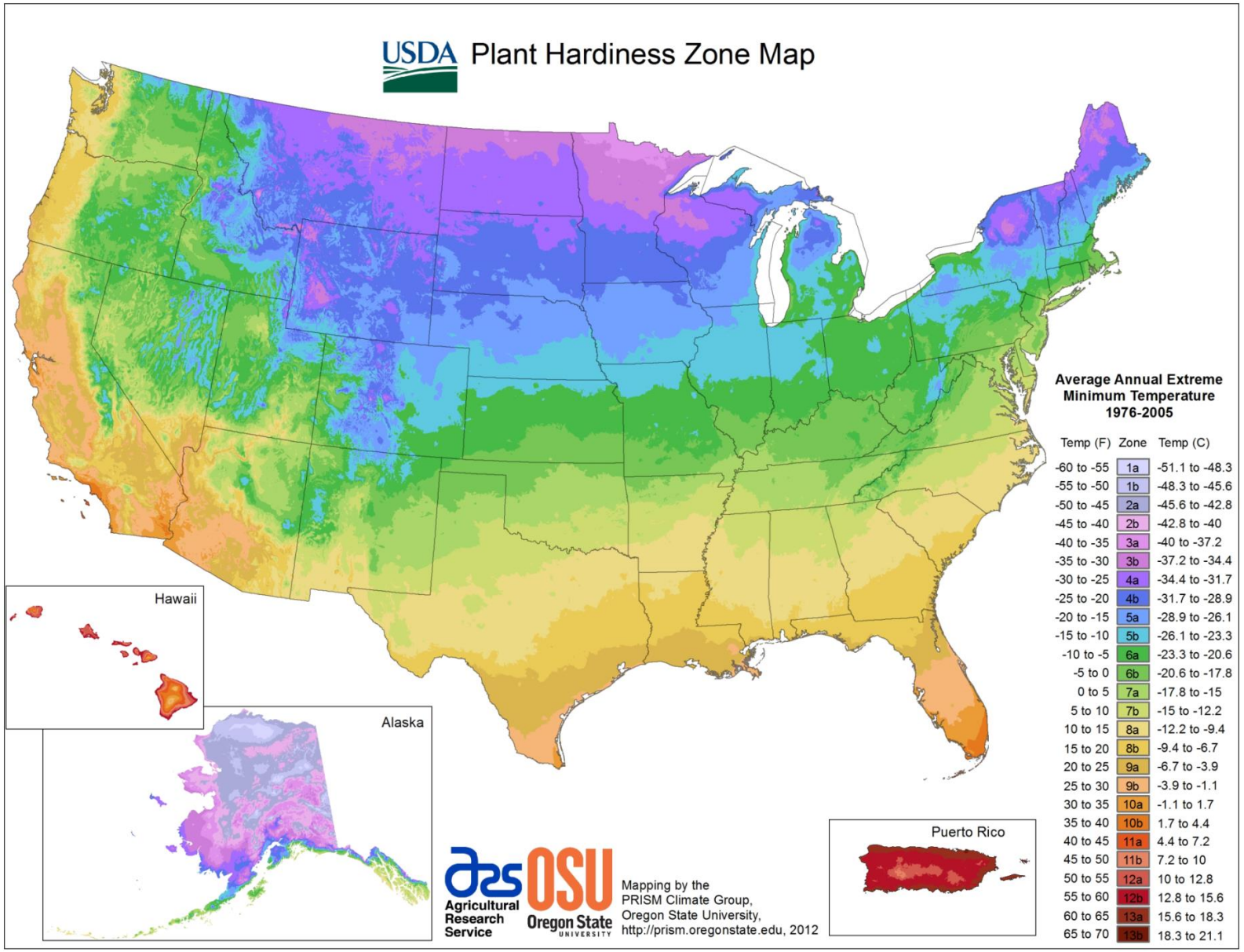
- Biotic interactions: competition, food-webs
- Structure and plant habit: grasses, shrubs, forbs
- Seasonality and timing
- Pollinator specific: flower color

Example seed menu for Wyoming big sagebrush shrubland with species list by bloom time, flower color, and plant habit

Species	Common Name		Bloom time, Flower color, & Plant habit							
			March	April	May	June	July	August	September	October
Achnatherum hymenoides	Indian ricegrass	ACHY			Perennial Grass					
Artemisia tridentata ssp. wyomingensis	Wyoming big sagebrush	ARTR						Shrub		
Cleome lutea	yellow beeplant	CLLU		Annual forb						
Elymus elymoides	squirreltail	ELEL		Perennial Grass						
Ericameria nauseosa	rubber rabbitbrush	ERNA					Shrub			
Eriogonum umbellatum	sulphur-flower buckwheat	ERUM			Perennial forb					
Hesperostipa comata	needle and thread grass	HECO			Perennial grass					
Poa secunda	Sandberg bluegrass	POSE	Perennial Grass							
Sphaeralcea ambigua	desert globemallow	SPAM		Perennial forb						

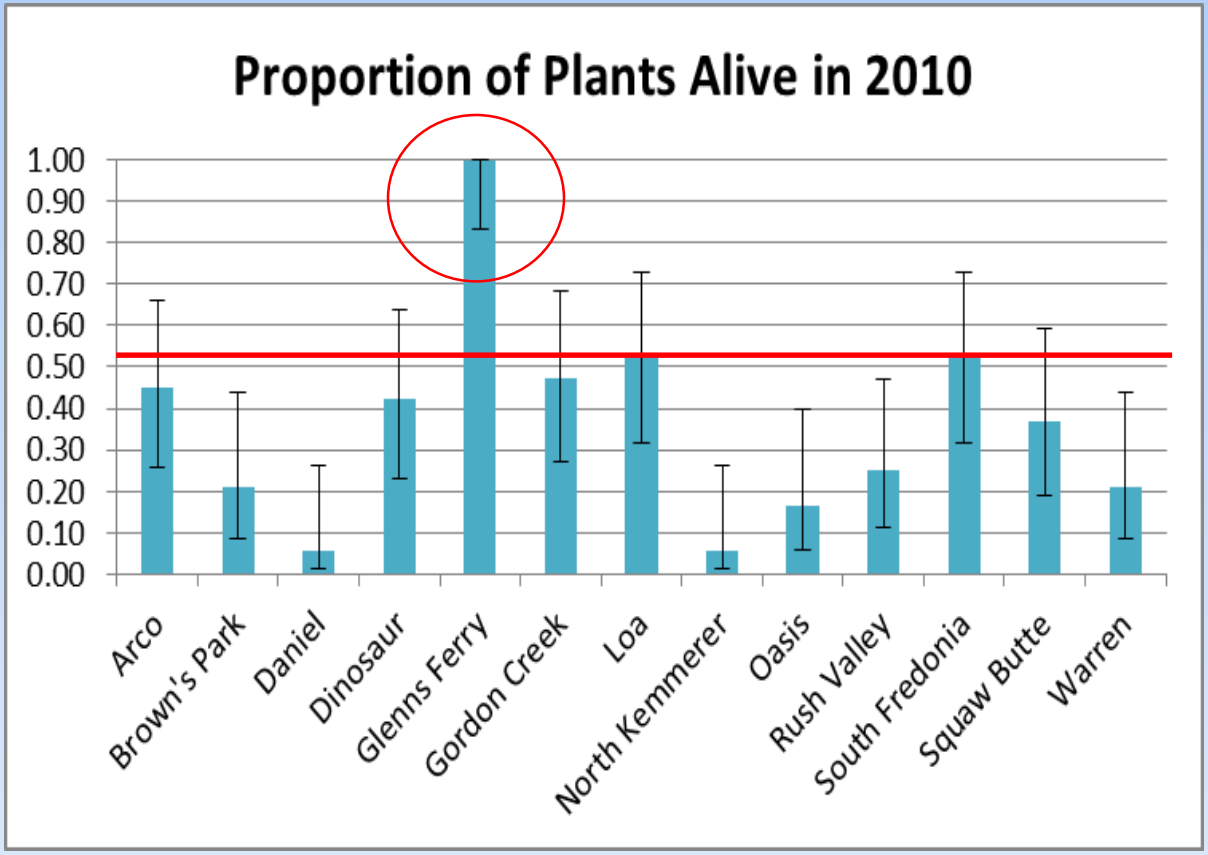
Seed transfer guidelines (seed zones)

USDA Plant Hardiness Zones - 2012



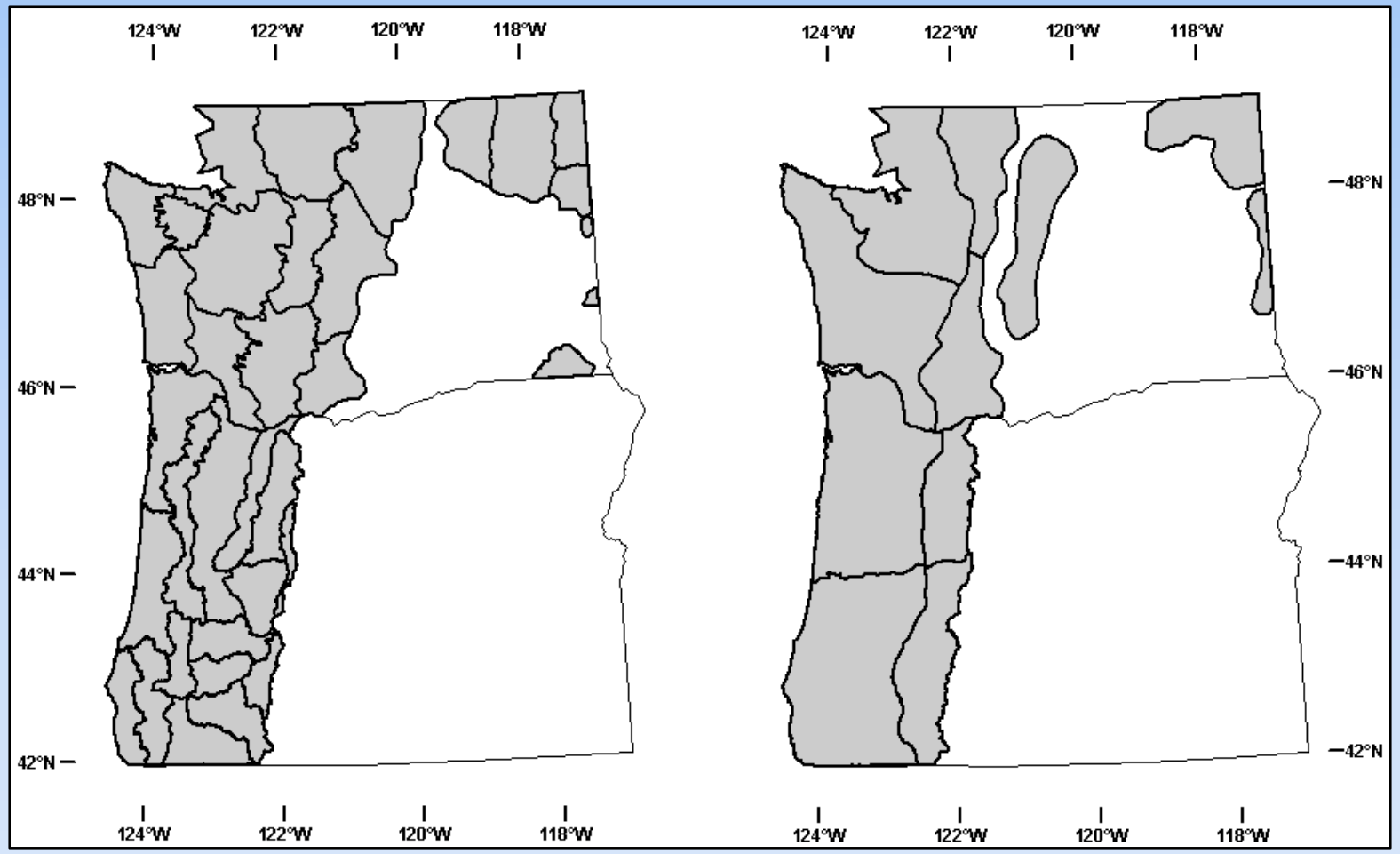
Local seed sources matter!

Wyoming Big Sagebrush
Common Garden
Glenns Ferry, Idaho (1987 Planting)



Sands and Welch unpubl.

Seed zones originate in forestry

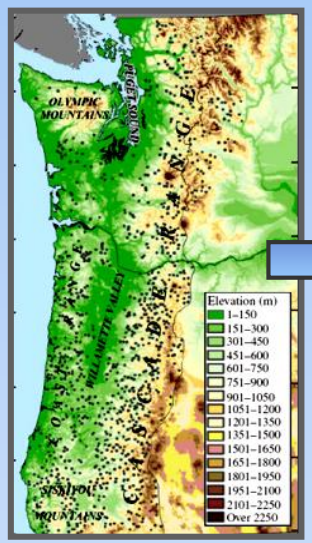


Douglas-fir; *Specialist*

Western redcedar; *Generalist*

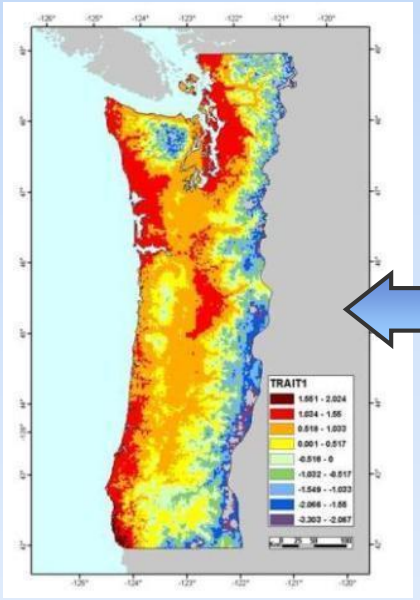
Adaptive seed zones are constructed using data from common garden studies

Collect seed from many sources

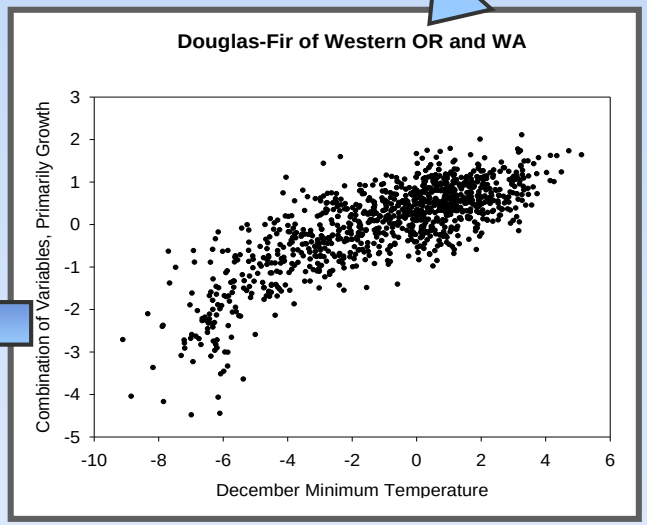


Grow families in a common environment

Measure many adaptive traits

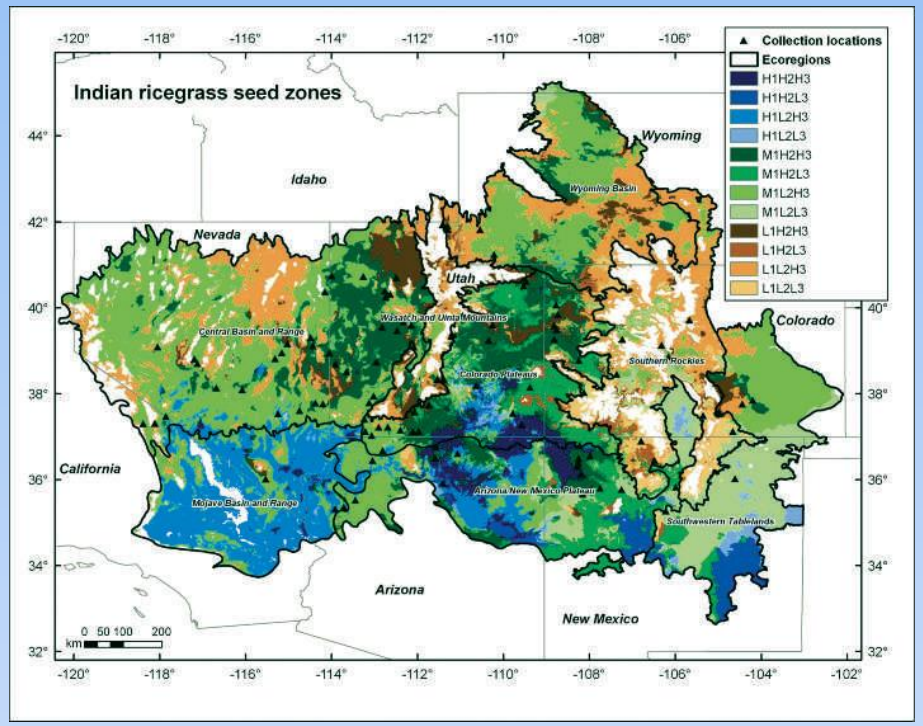


GIS



Traits vs source environment

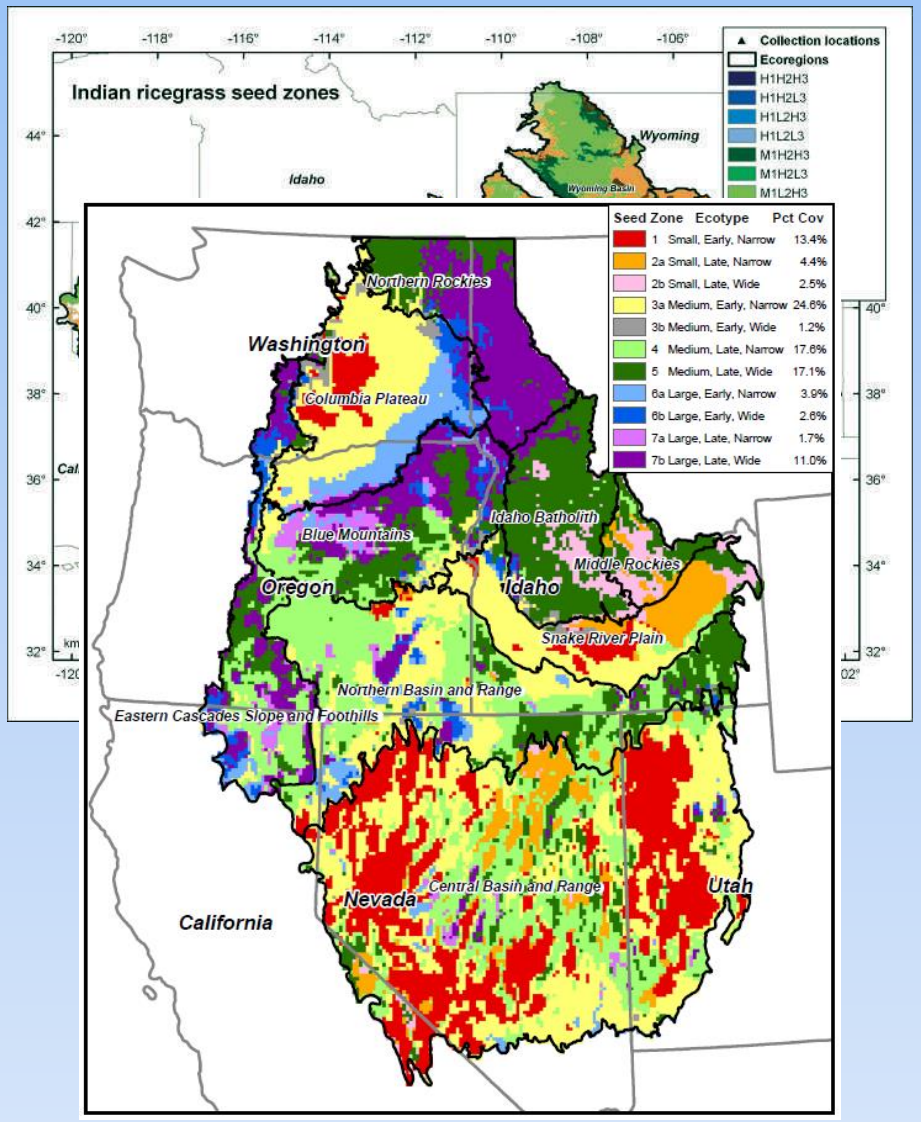
St. Clair et al. 2005 Annals of Botany



Johnson et al. 2011 REM

Recent Great Basin+ seed transfer guidelines:

- Indian ricegrass (*Achnatherum hymenoides*) – 2011



St. Clair et al. 2013 Evol. Appl.

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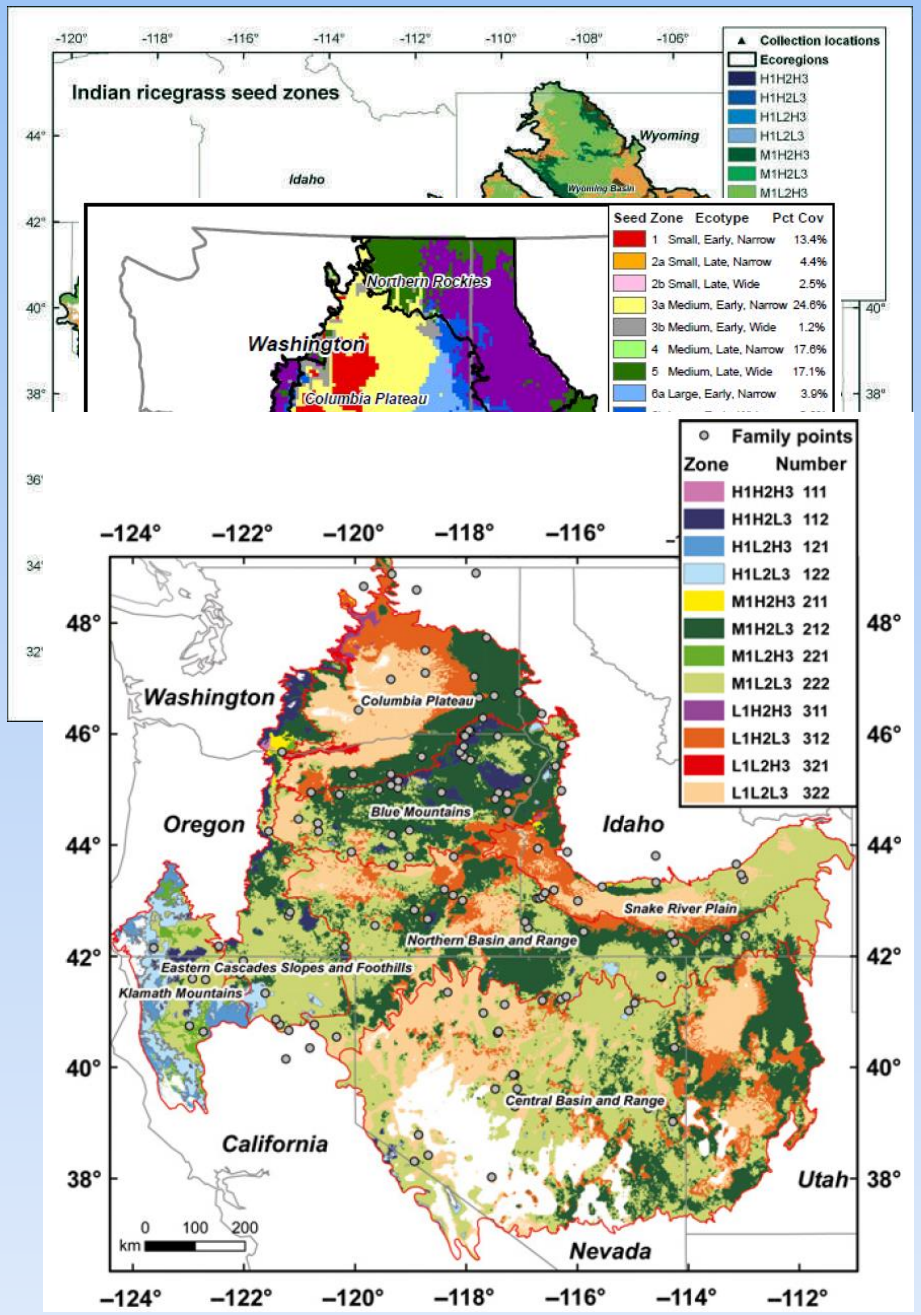
- Bluebunch wheatgrass (*Pseudoroegneria spicata)* – 2013



Johnson et al. 2015 Evol. Appl.

Recent Great Basin+ seed transfer guidelines:

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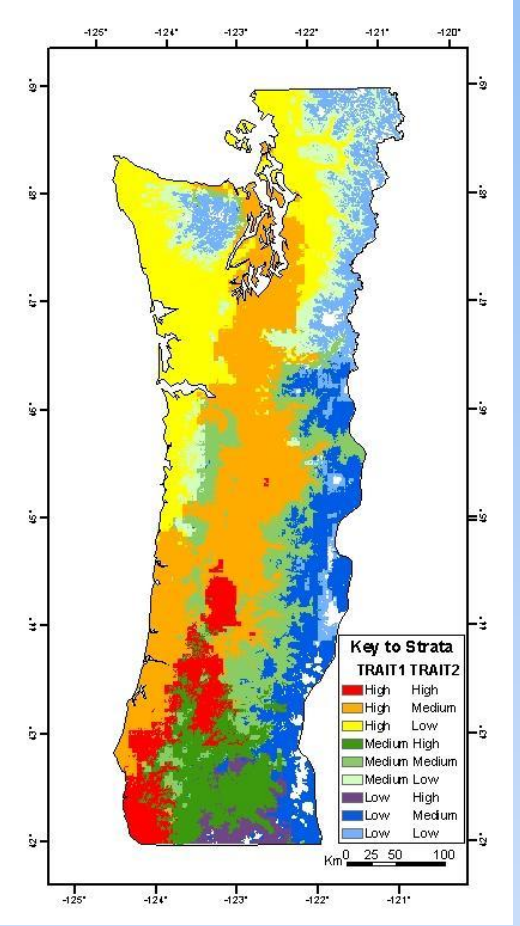
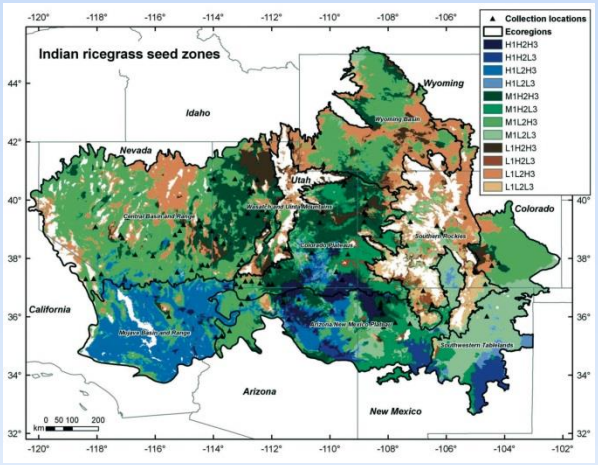
- Bluebunch wheatgrass (*Pseudoroegneria spicata)* – 2013
- Sandberg bluegrass (*Poa secunda*) – 2015

Western US empirical seed zones





Gymnosperms

Pinaceae

Abies grandis

Larix occidentalis

Picea glauca

Pinus contorta

Pinus monticola

Pinus ponderosa

Pseudotsuga menziesii

Angiosperms

Monocots: Poaceae

Achnatherum hymenoides

Bromus carinatus

Elymus elymoides

Elymus glaucus

Festuca idahoensis

Koeleria macrantha

Poa secunda

Pseudoroegneria spicata

Liliaceae

Allium acuminatum

Eudicots: Apiaceae

Lomatium dissectum

Asteraceae

Artemisia tridentata

Eriophyllum lanatum

Fabaceae

Lotus crassifolius

Lupinus latifolius

Lupinus polyphyllus

Polygonaceae

Eriogonum umbellatum

Ongraceae

Epilobium densiflorum

Saxifragaceae

Saxifraga oregana

Rosceae

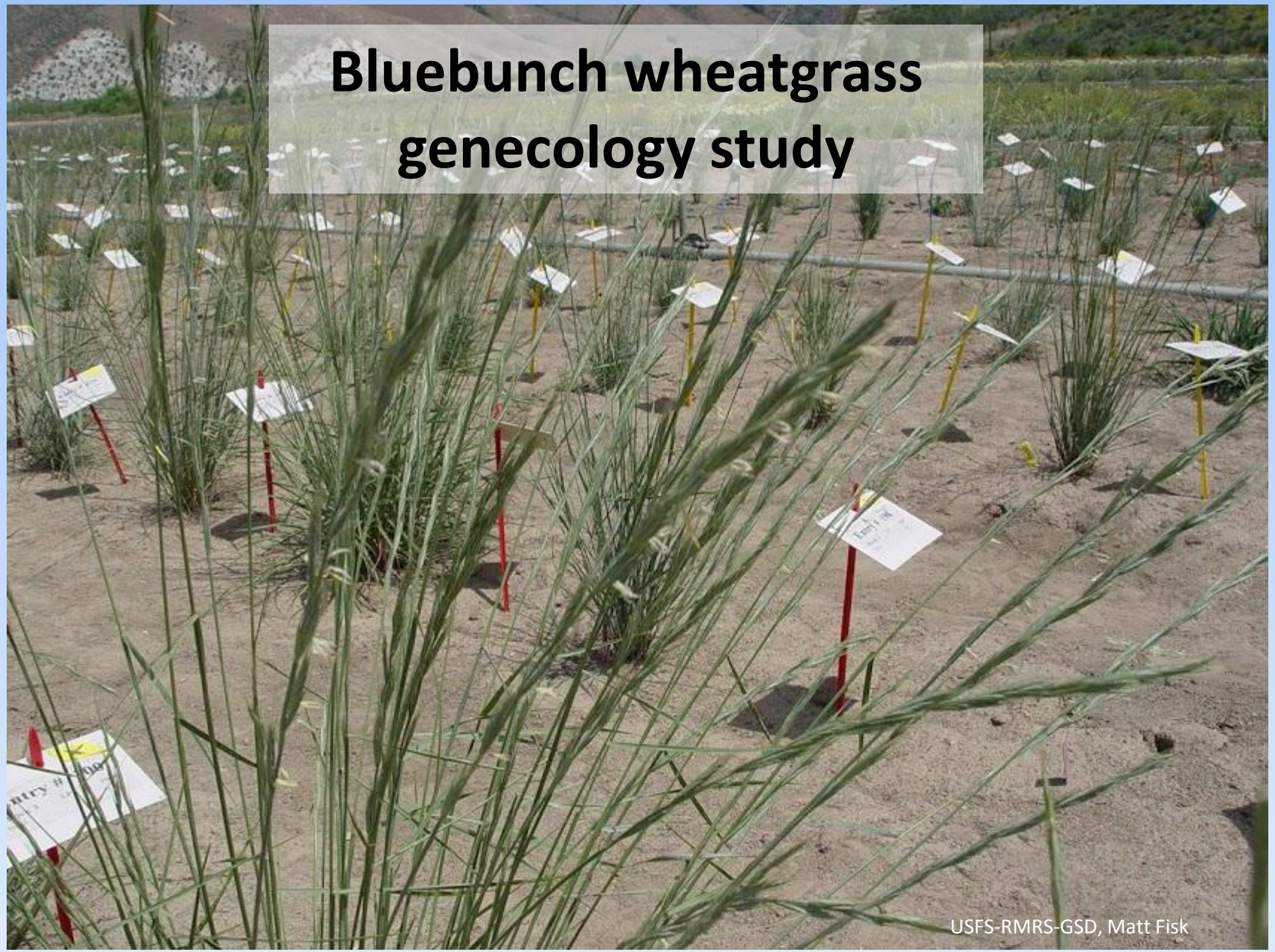
Coleogyne ramosissima

Holodiscus discolor

Potentilla gracilis

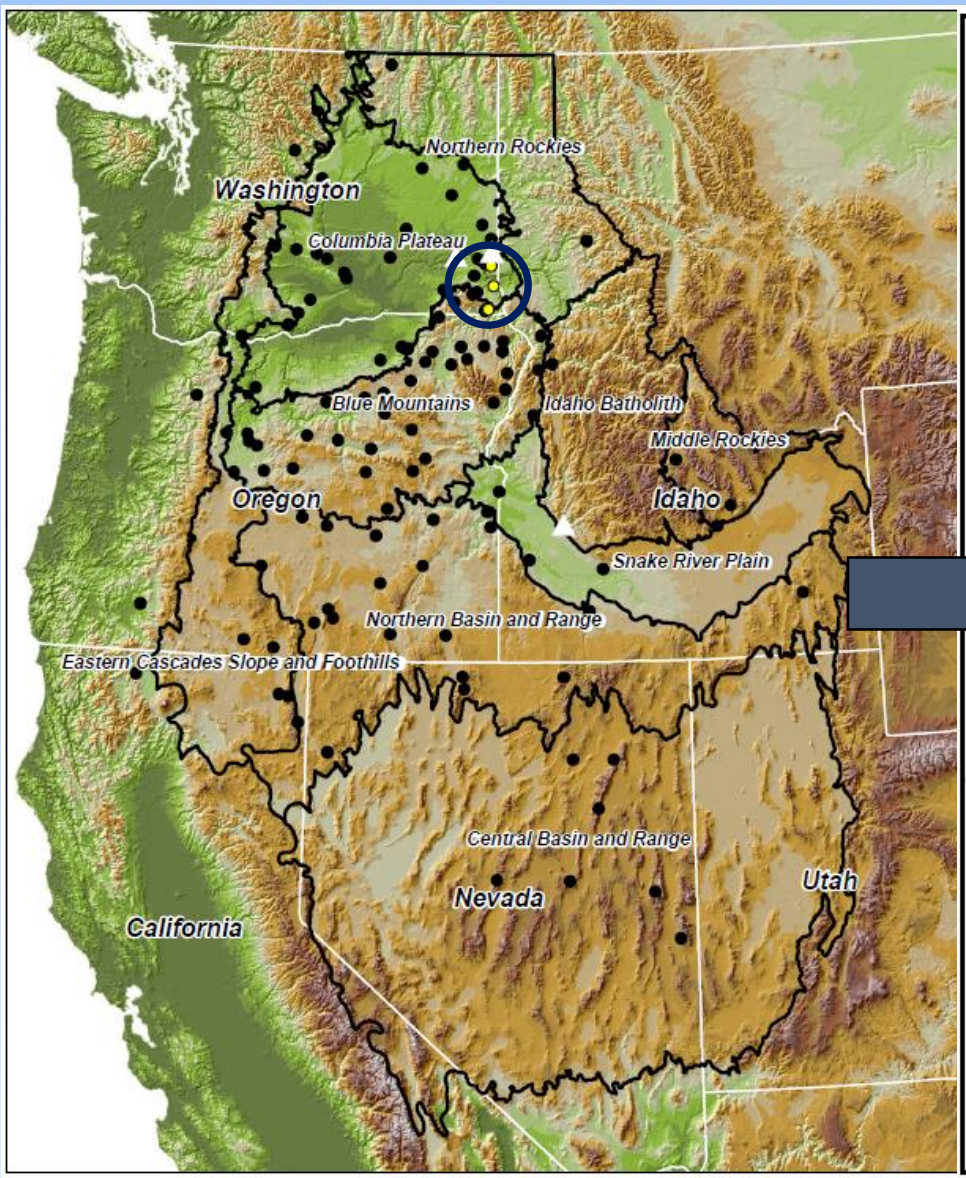
Purshia tridentata

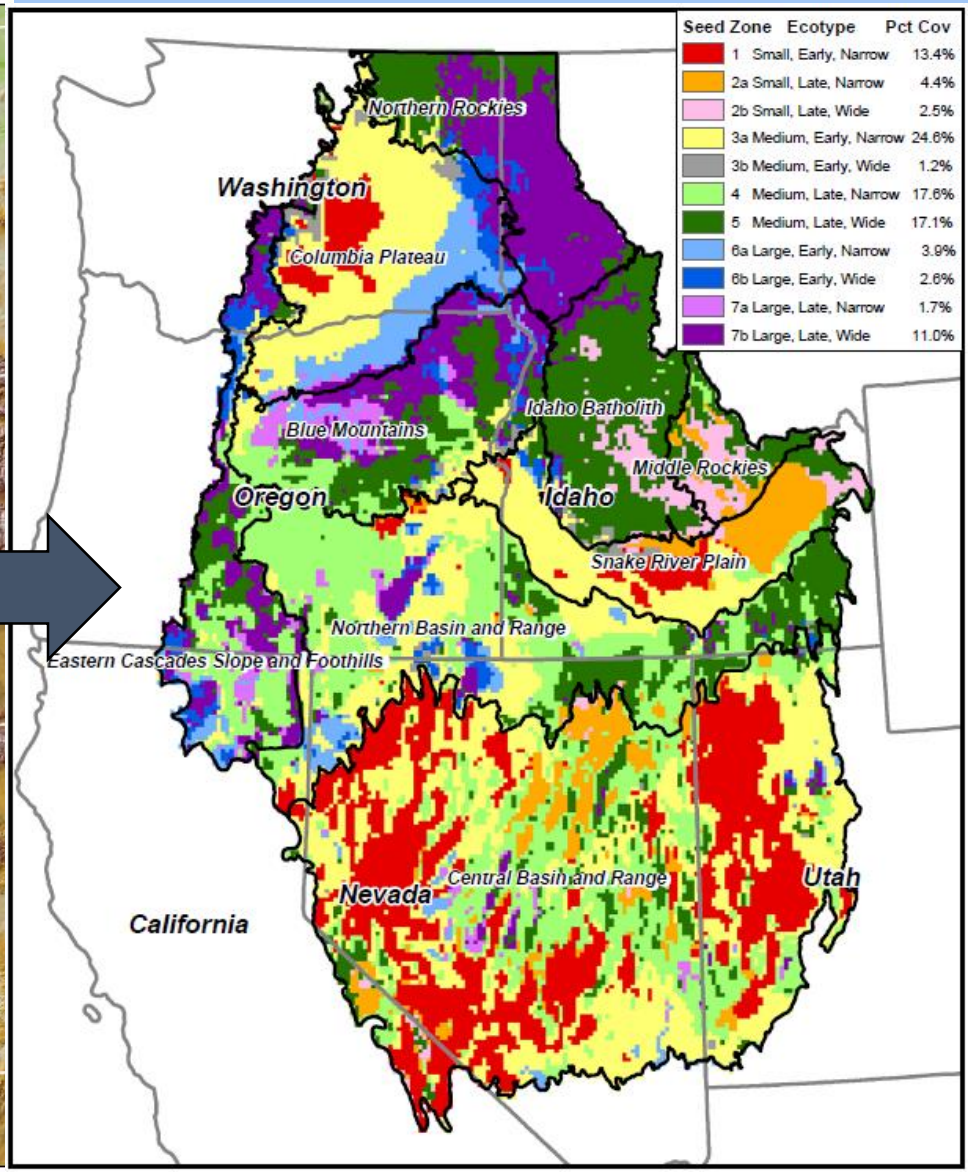
Bluebunch wheatgrass genecology study



USFS-RMRS-GSD, Matt Fisk

Bluebunch wheatgrass genecology study





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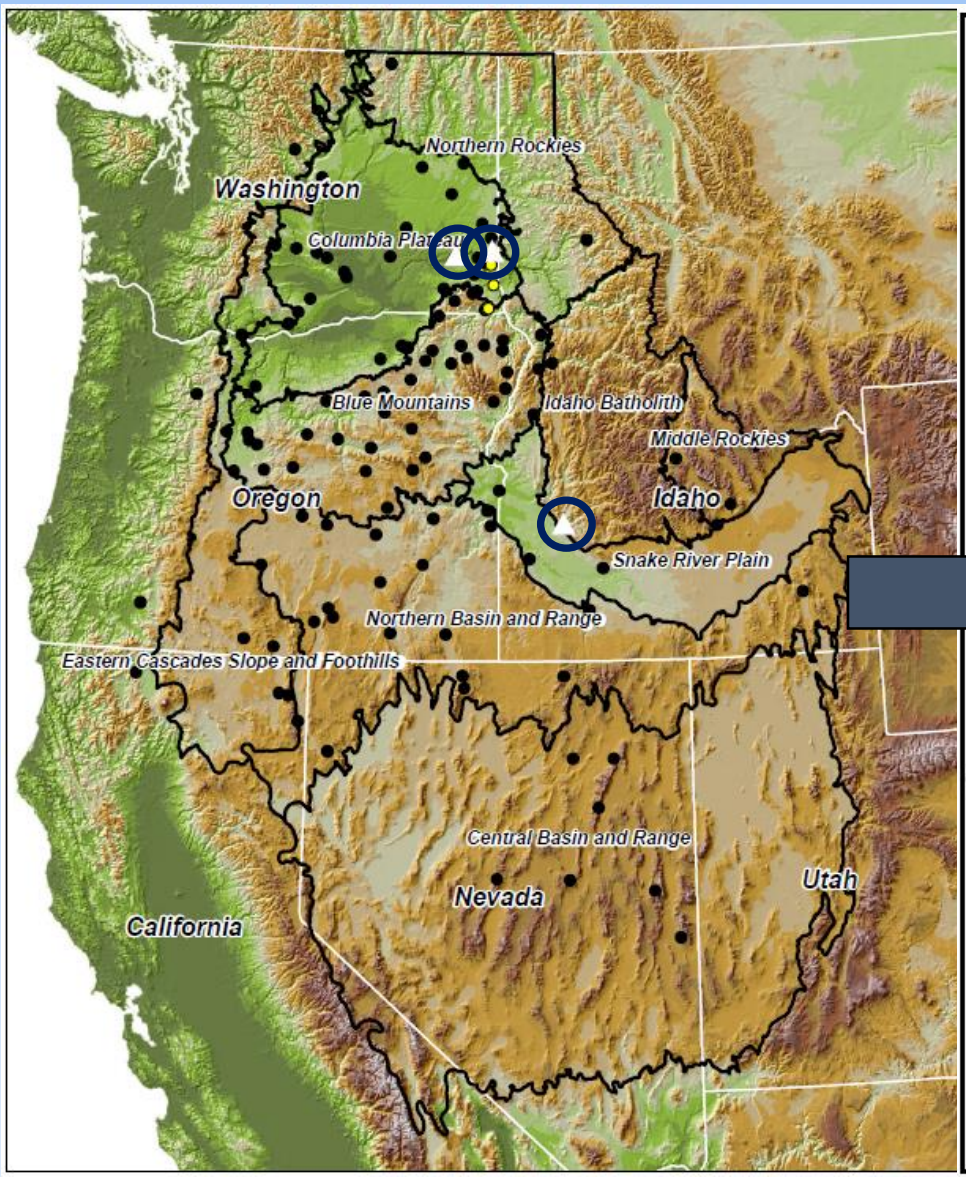
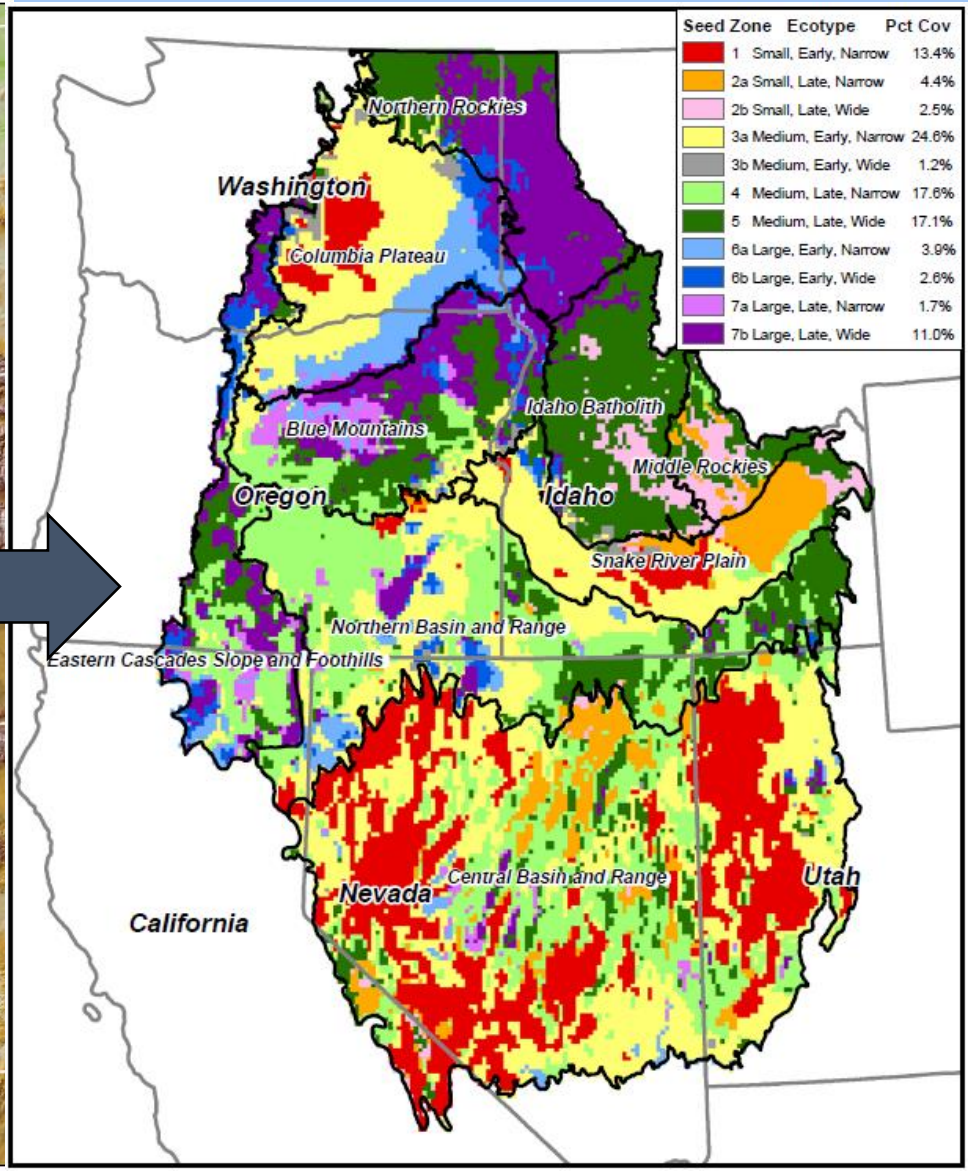
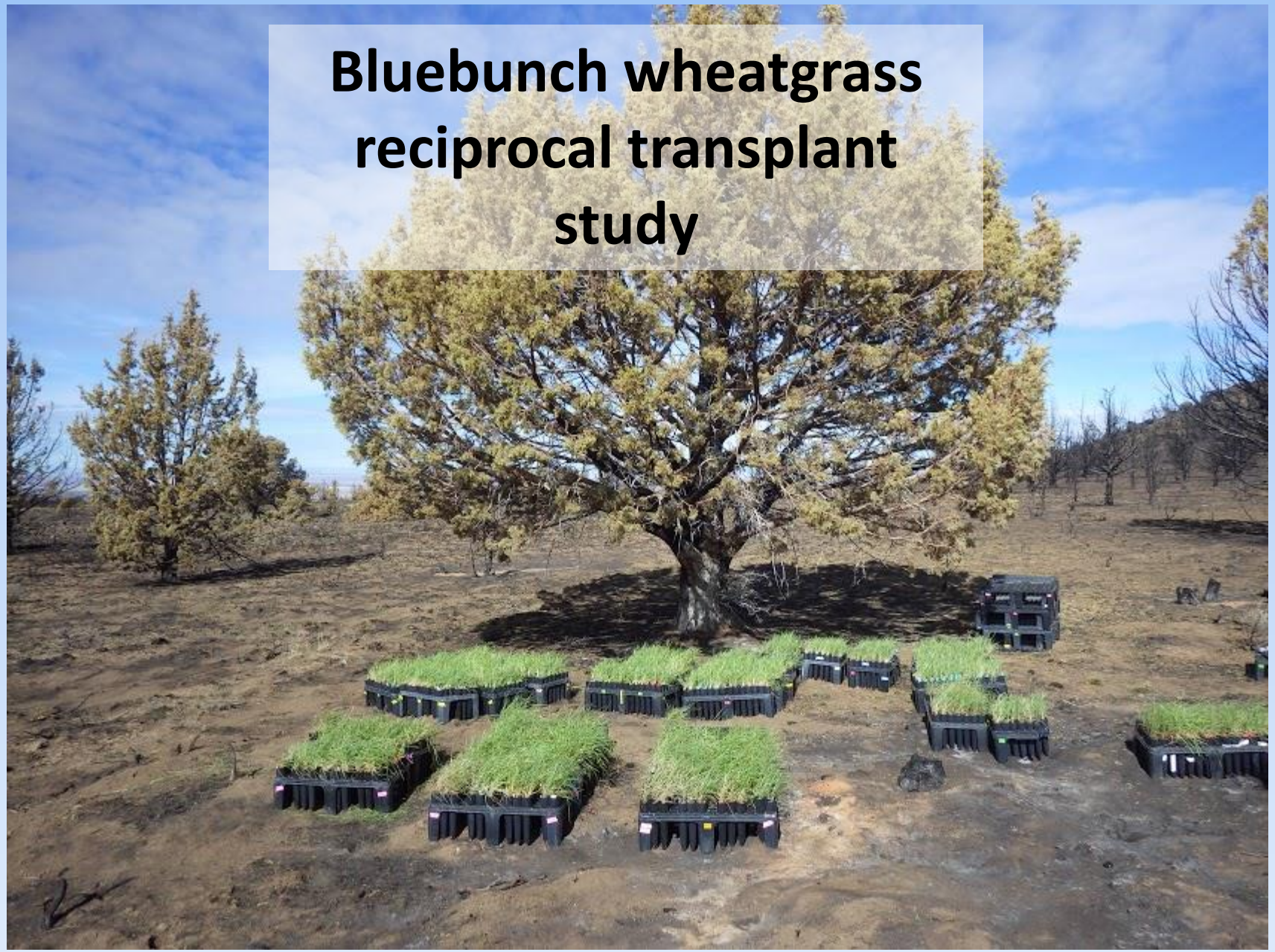
Bluebunch wheatgrass genecology study

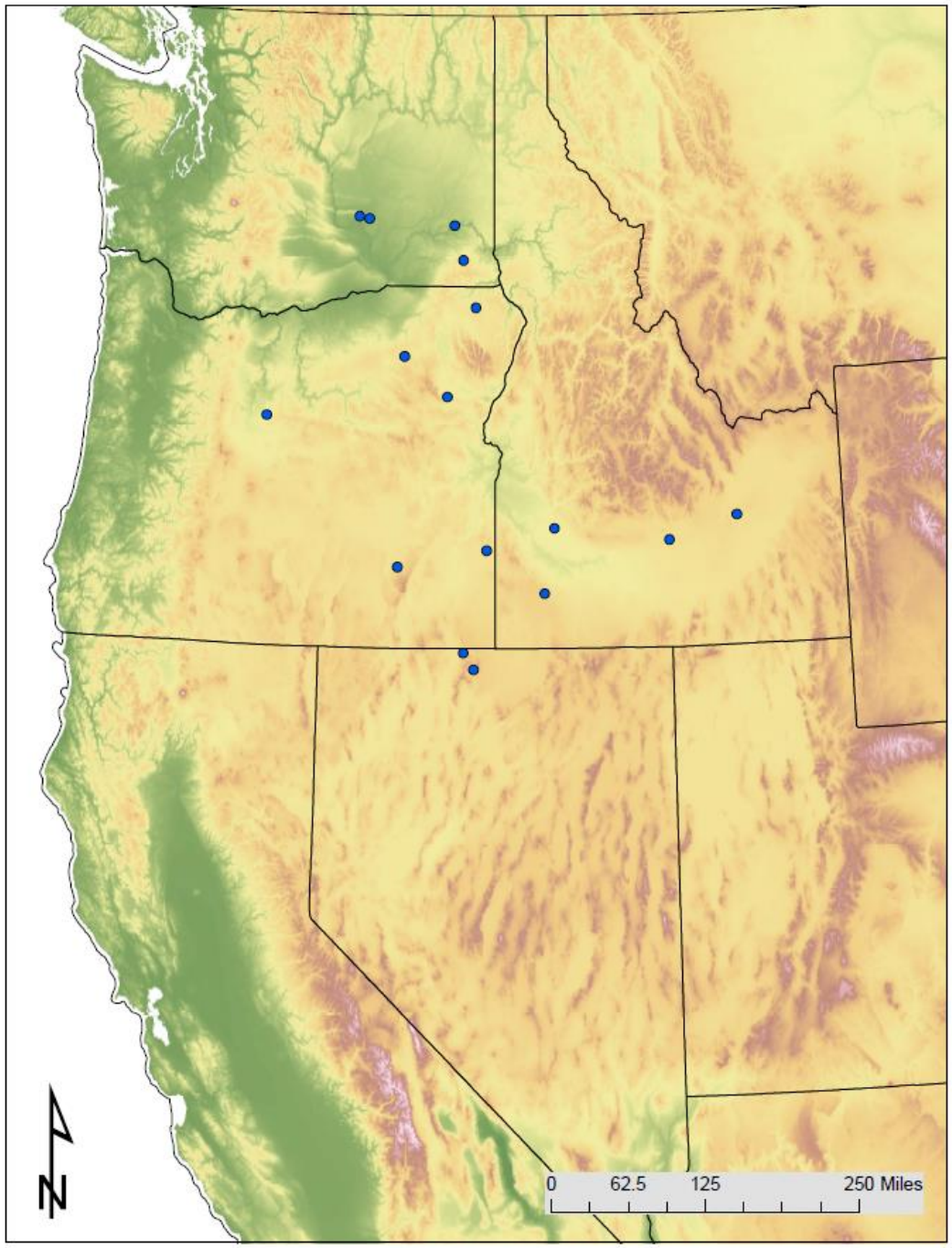


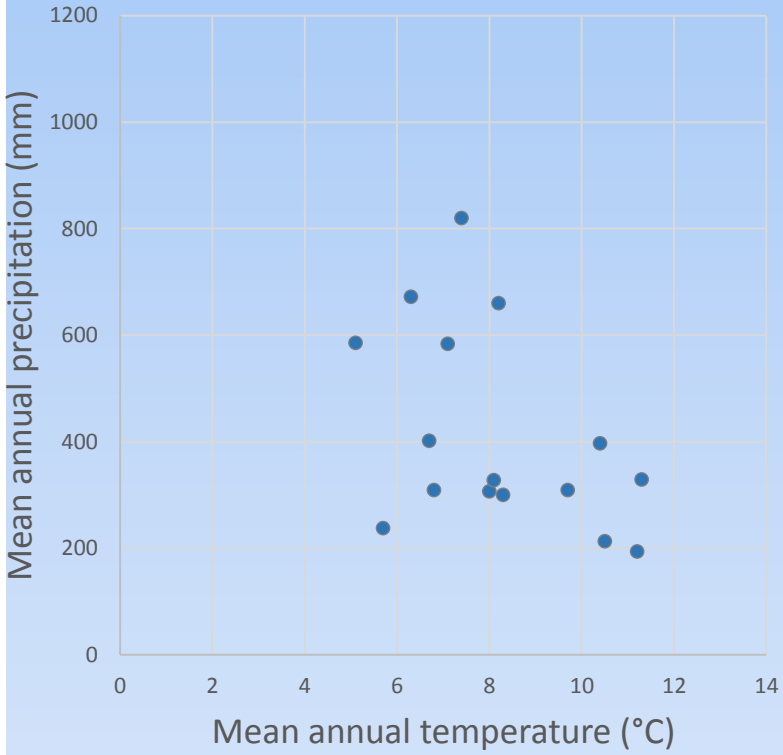


St. Clair et al. 2013 Evol. Appl.

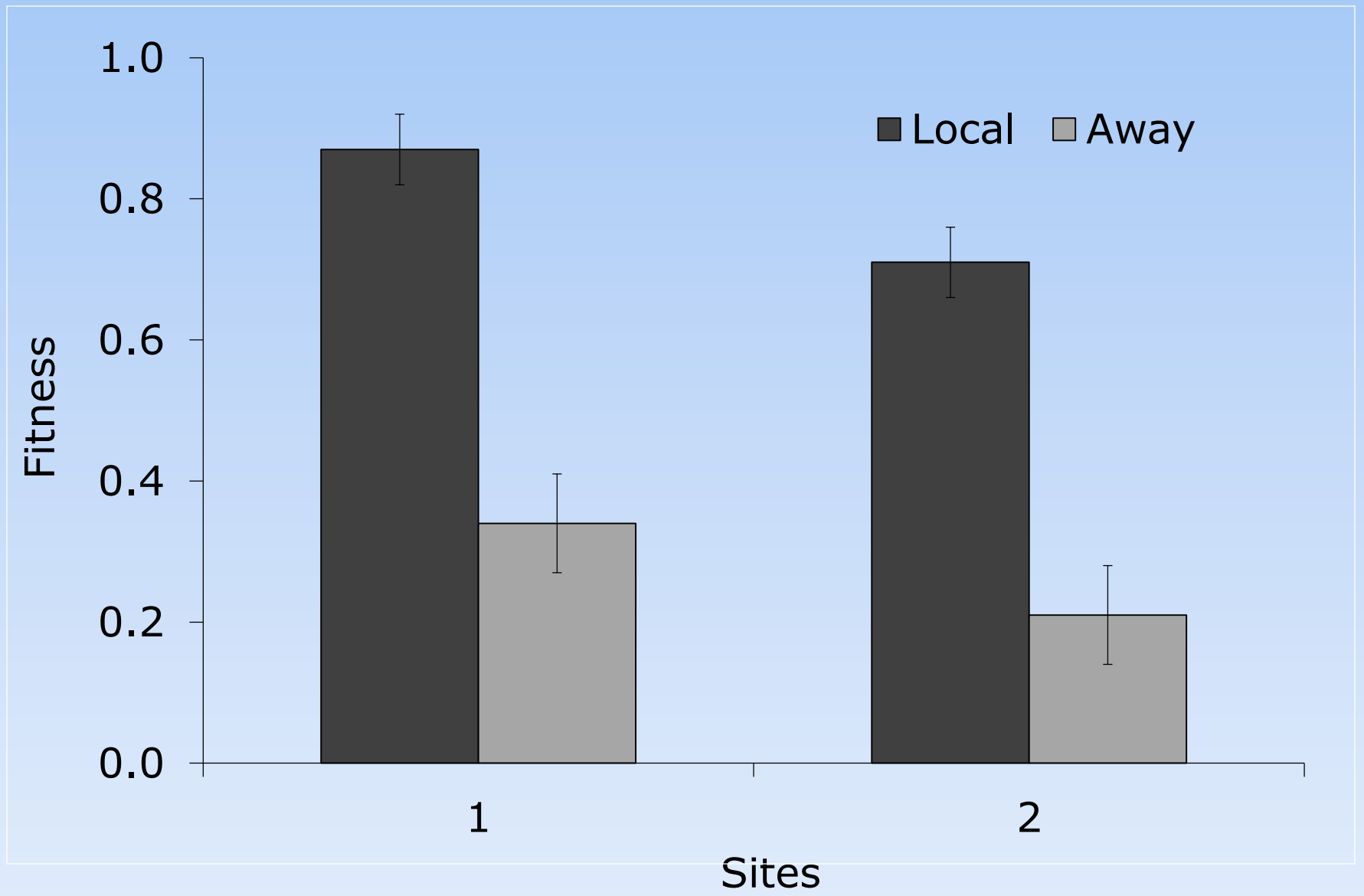

Bluebunch wheatgrass
reciprocal transplant
study

Bluebunch reciprocal transplant study sites



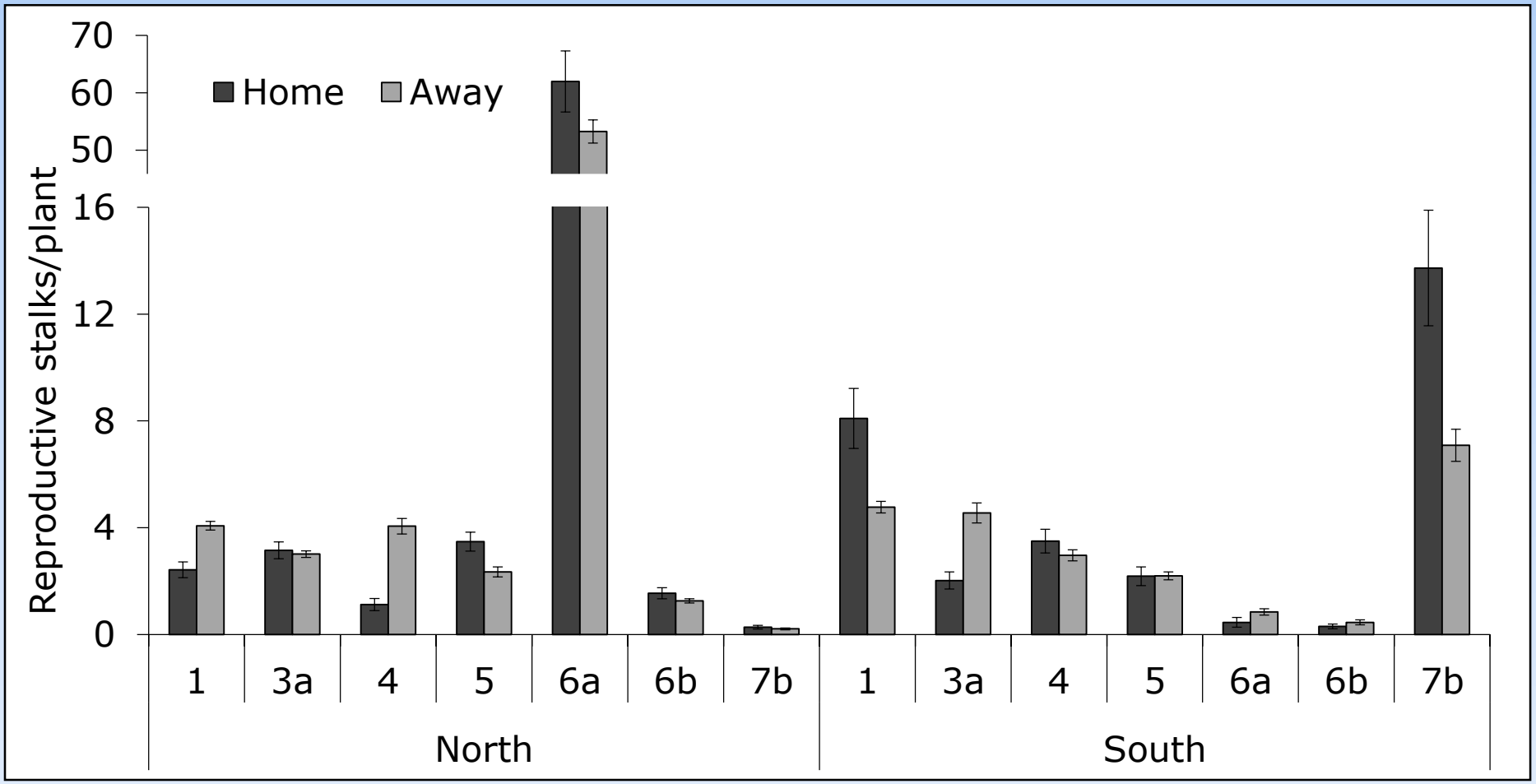


If local is best…



Local seed sources differ in reproductive effort

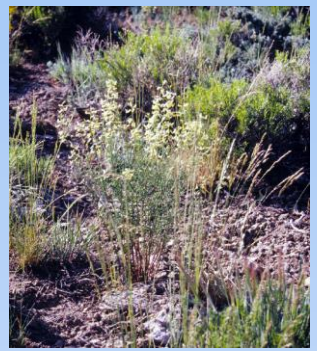
	North			South		
Site	$F_{6,214}$	=72.74	P<0.0001	$F_{6,209}$	=27.33	P<0.0001
Local	$F_{1,214}$	= 0.04	P=0.8336	$F_{1,209}$	= 0.00	P=0.9443
Site*Local	$F_{6,214}$	= 2.41	P=0.0282	$F_{6,209}$	= 2.29	P=0.0363

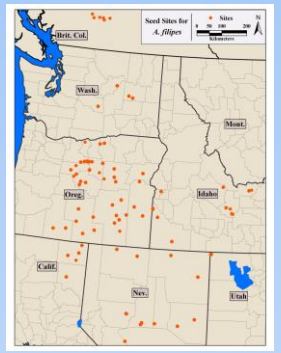


Germplasm development and cultivation practice

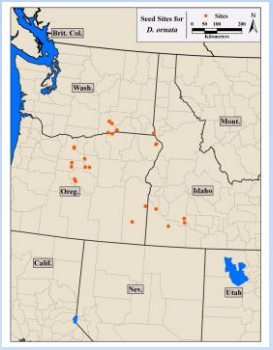
Partnership with ARS to develop native legume germplasm

Basalt milkvetch
(*Astragalus filipes*)





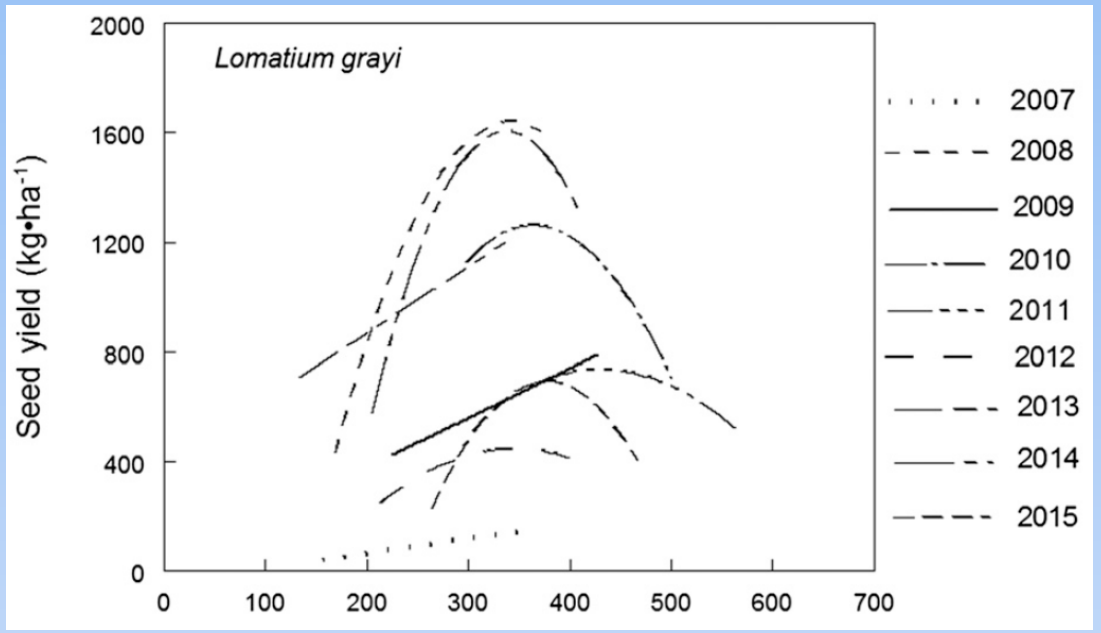
Western prairie clover
(*Dalea ornata*)

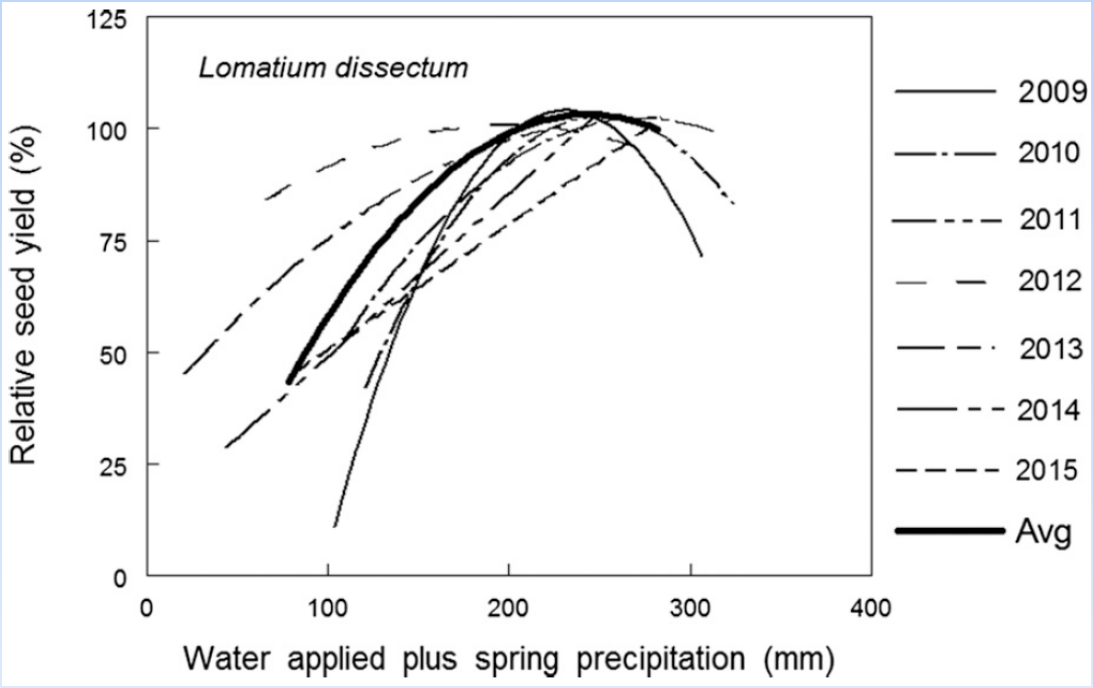


Searls' prairie clover
(*Dalea searlsiae*)

D. Johnson

Cultivation practice with OSU Malheur Experiment Station

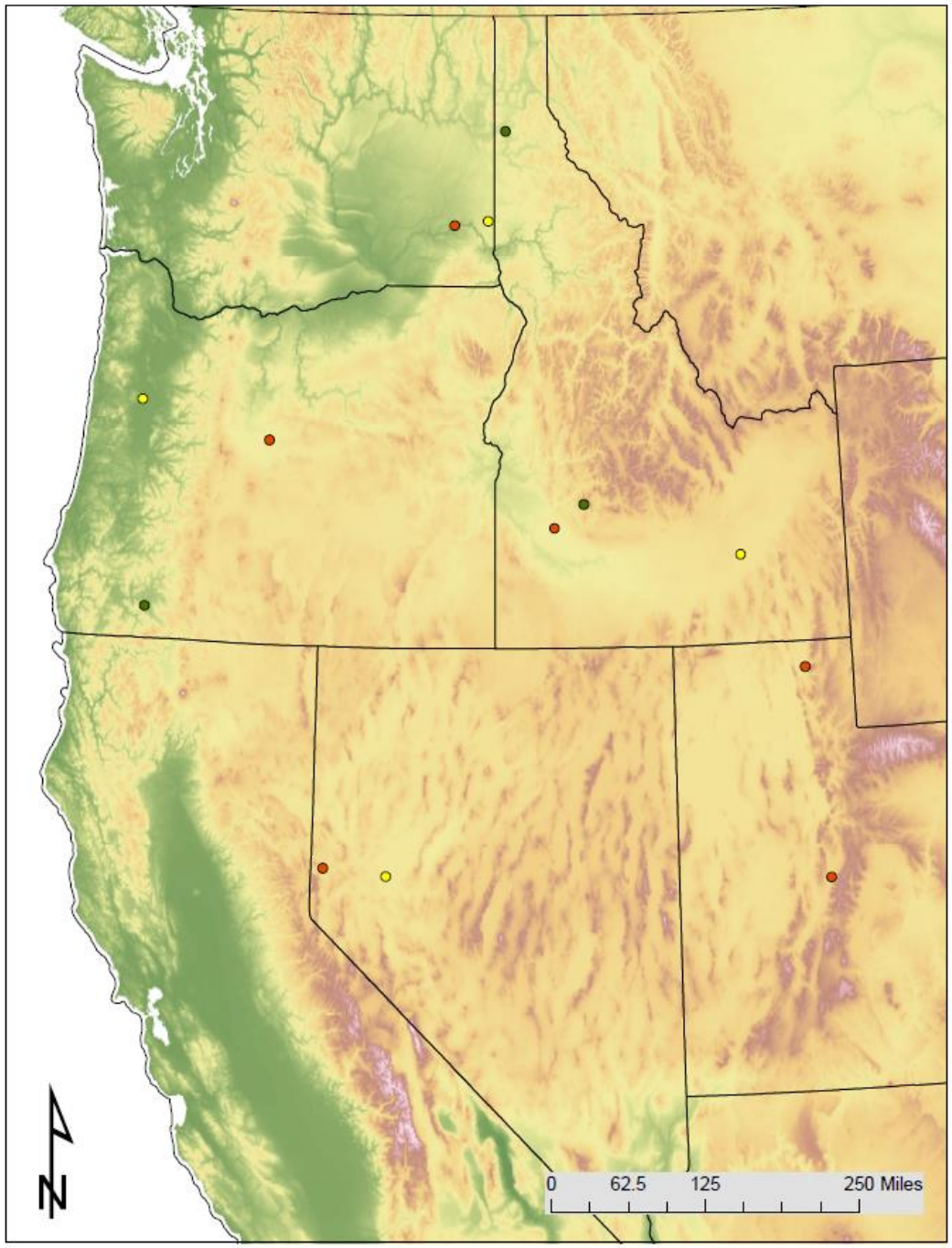


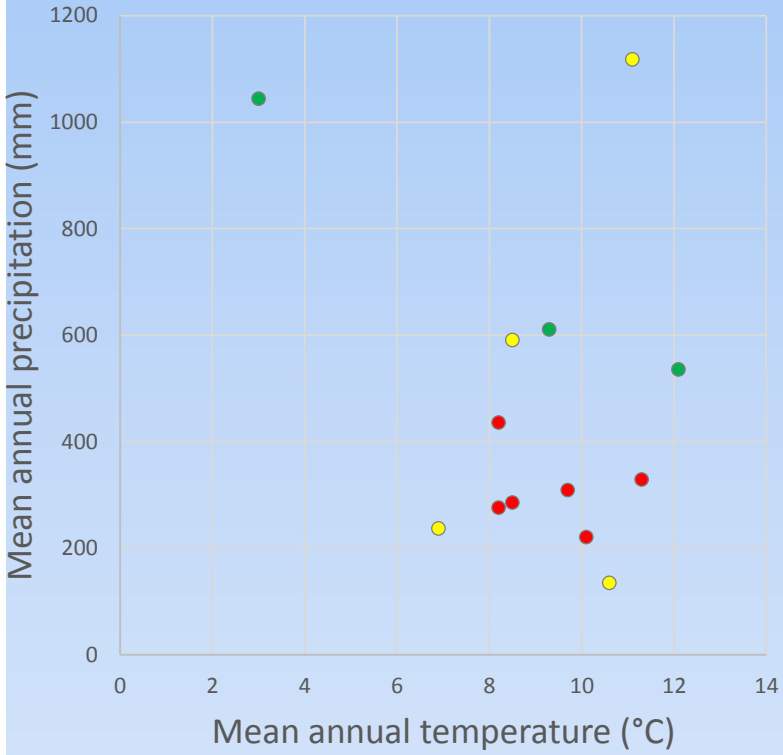


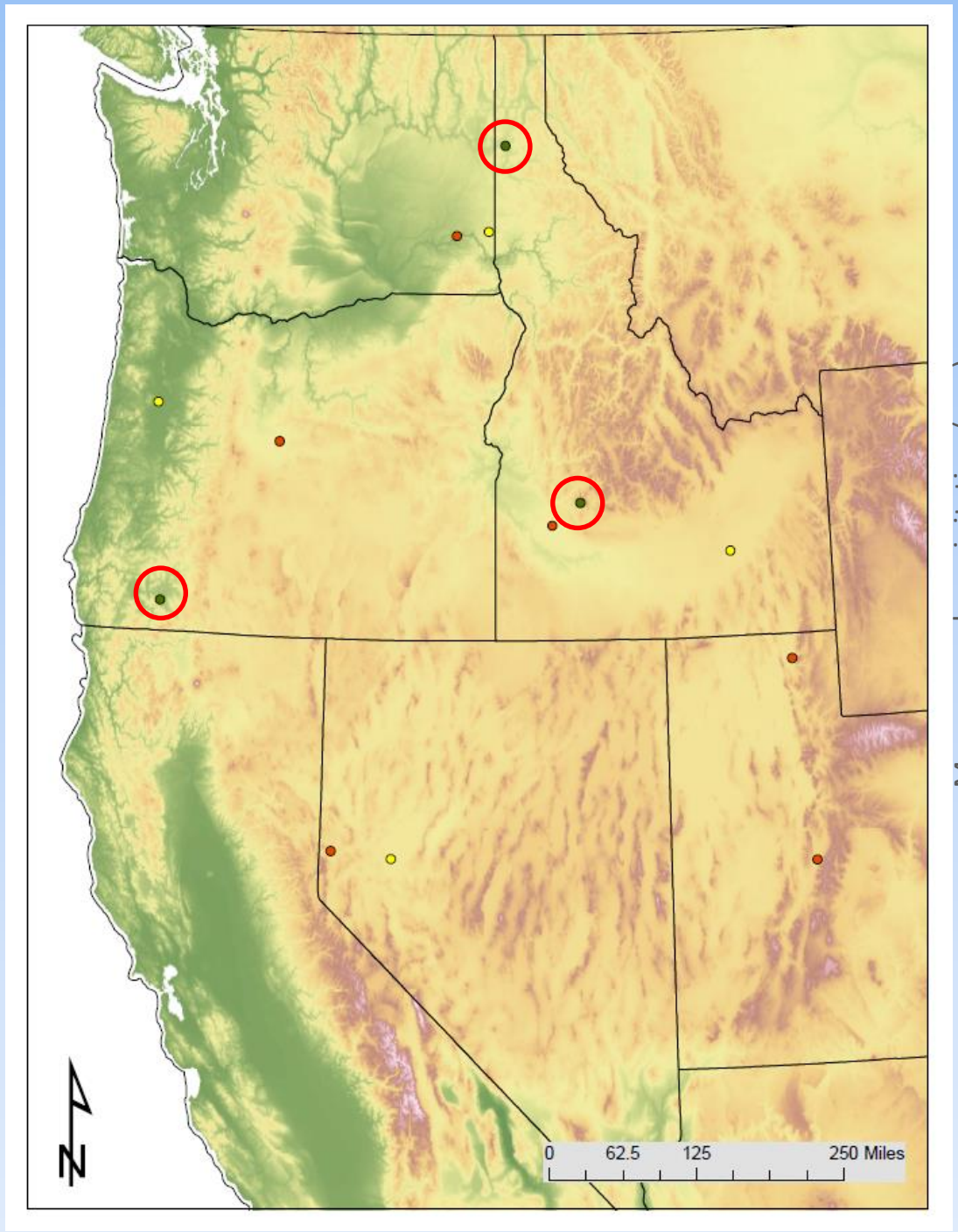
Shock et al. 2016, HortScience

Intermountain common garden network

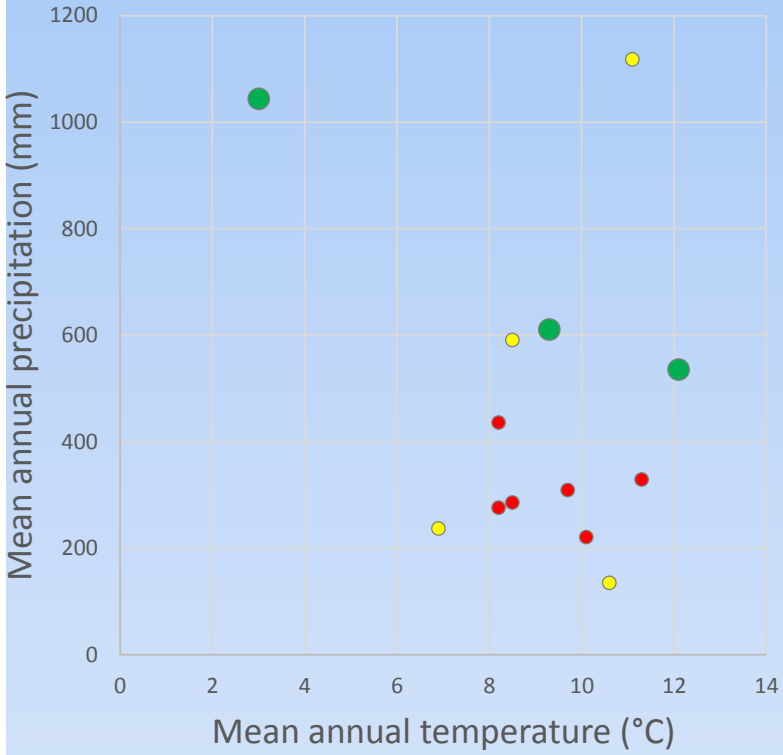
Sites with staff/personnel



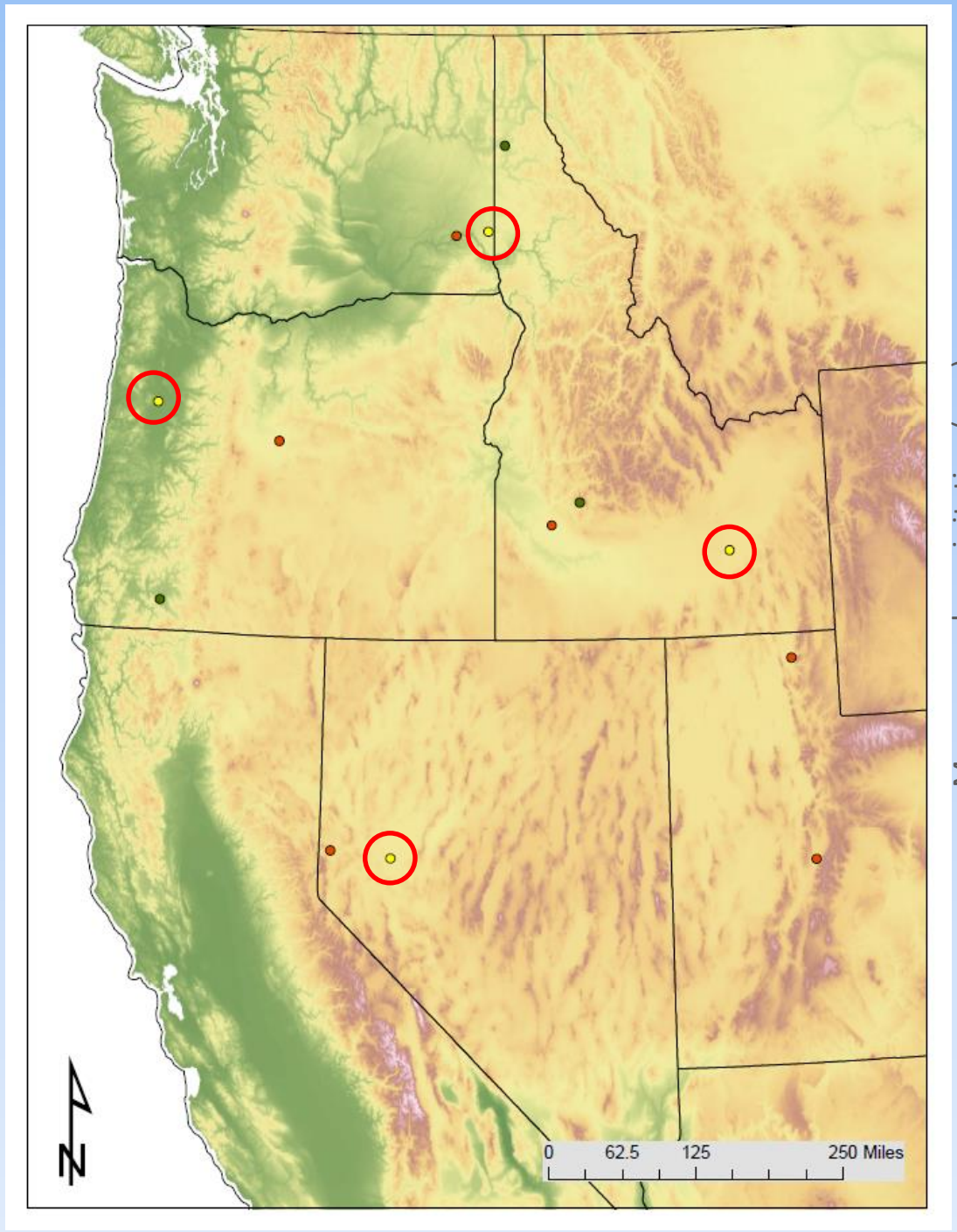


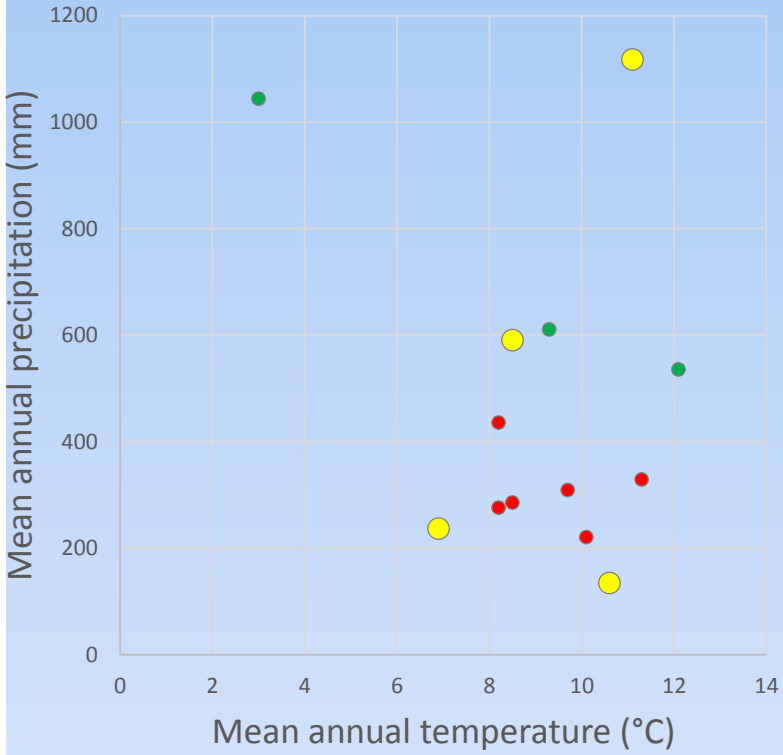


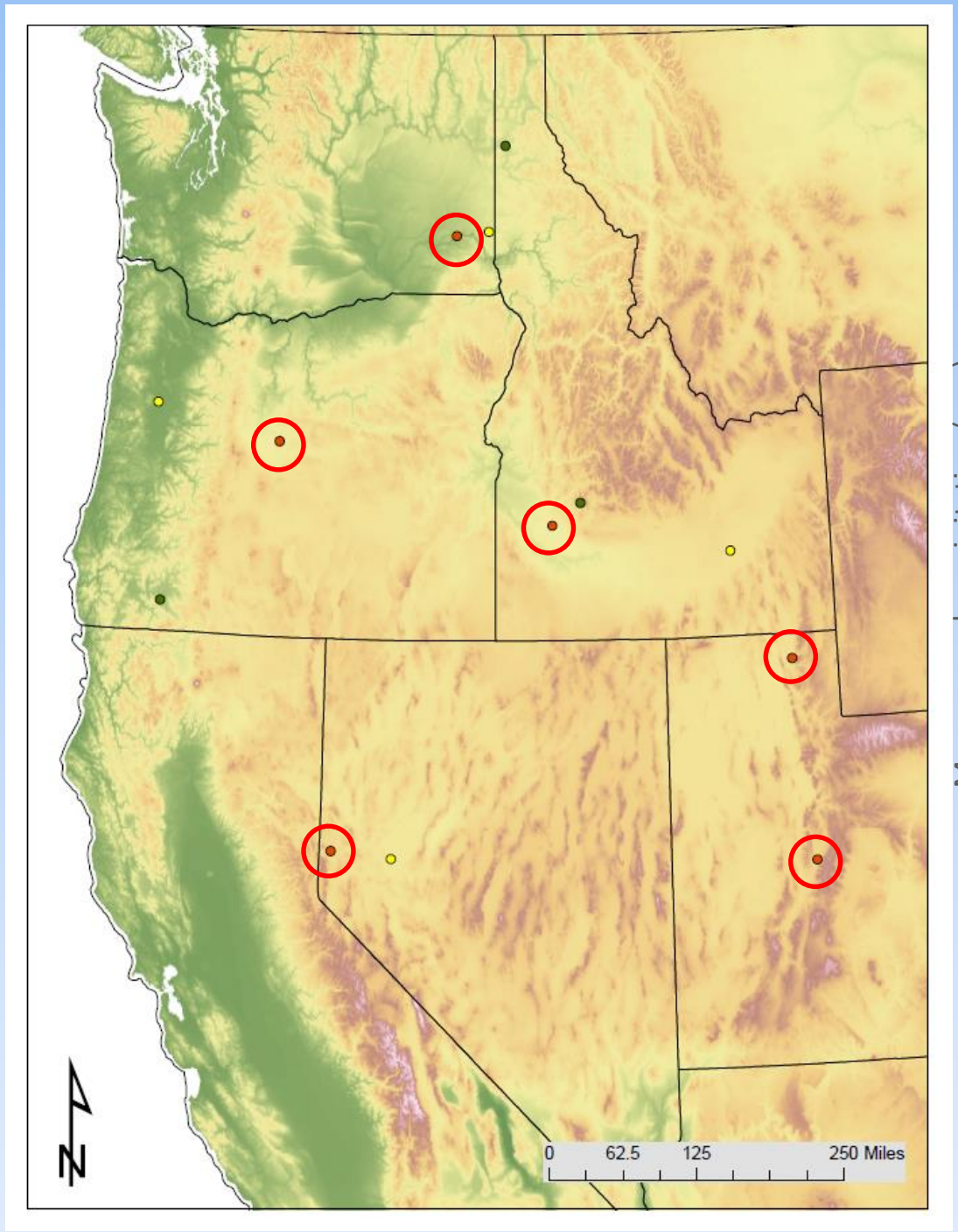
Forest Service nurseries



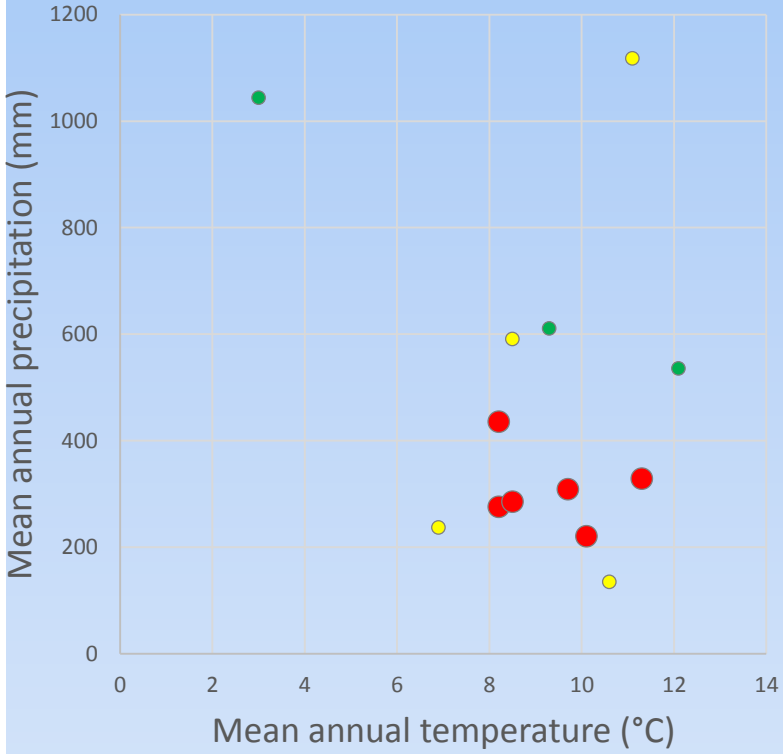
NRCS Plant Materials Centers



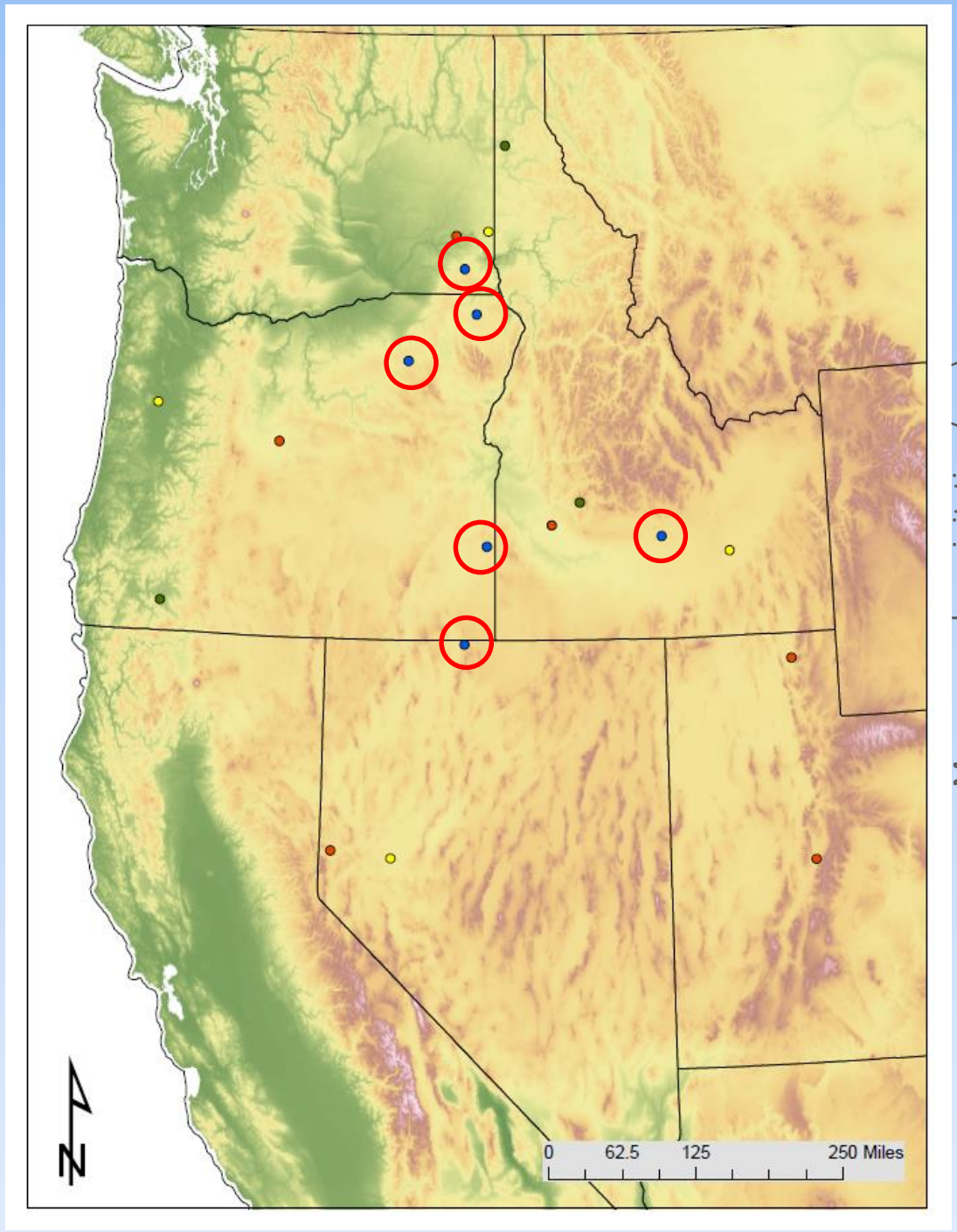


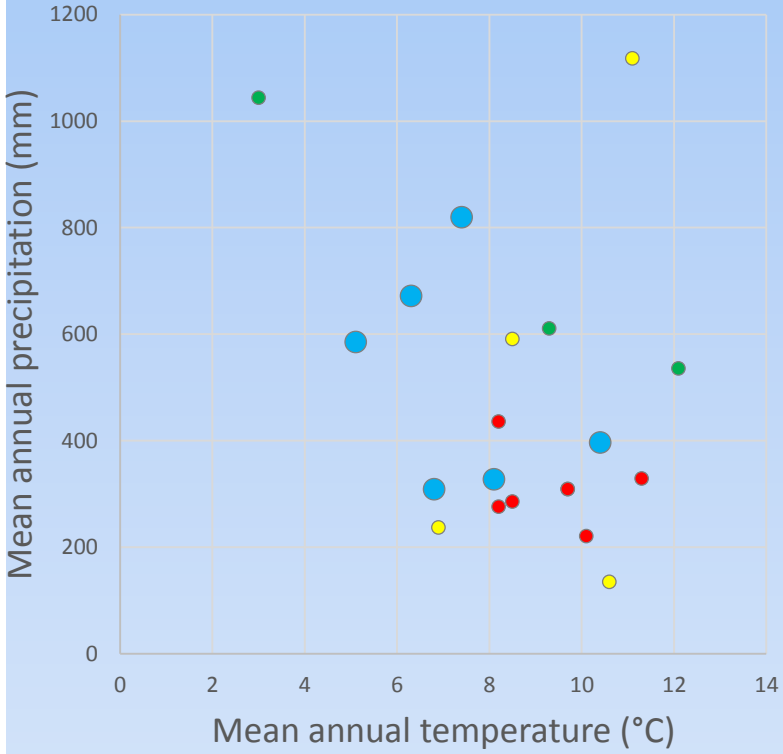


Various long-term research sites, universities and federal



Bluebunch reciprocal transplant sites with extra infrastructure (fences)





Showy goldeneye
(*Heliomeris multiflora*)

Thickleaf penstemon
(*Penstemon pachyphyllus*)

Douglas' dustymaiden
(*Chaenactis douglasii*)

Hoary tansyaster
(*M. canescens*)

Nettleleaf horsemint
(*A. urticifolia*)

Yellow beeplant
(*Cleome lutea*)

Globemallow
(*S. grossulariifolia*)


THANK YOU!