

Population Structure of Broad-based Collections of Basalt Milvetch and Release of NBR-1 Germplasm

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Need for Native Legume Species

Important for:

- Increased biodiversity
- Nitrogen fixation
- Forage for wildlife, livestock, and birds



Study Objective

Make seed collections, evaluate in common gardens, assess genetic diversity structure, and release germplasm of basalt milkvetch



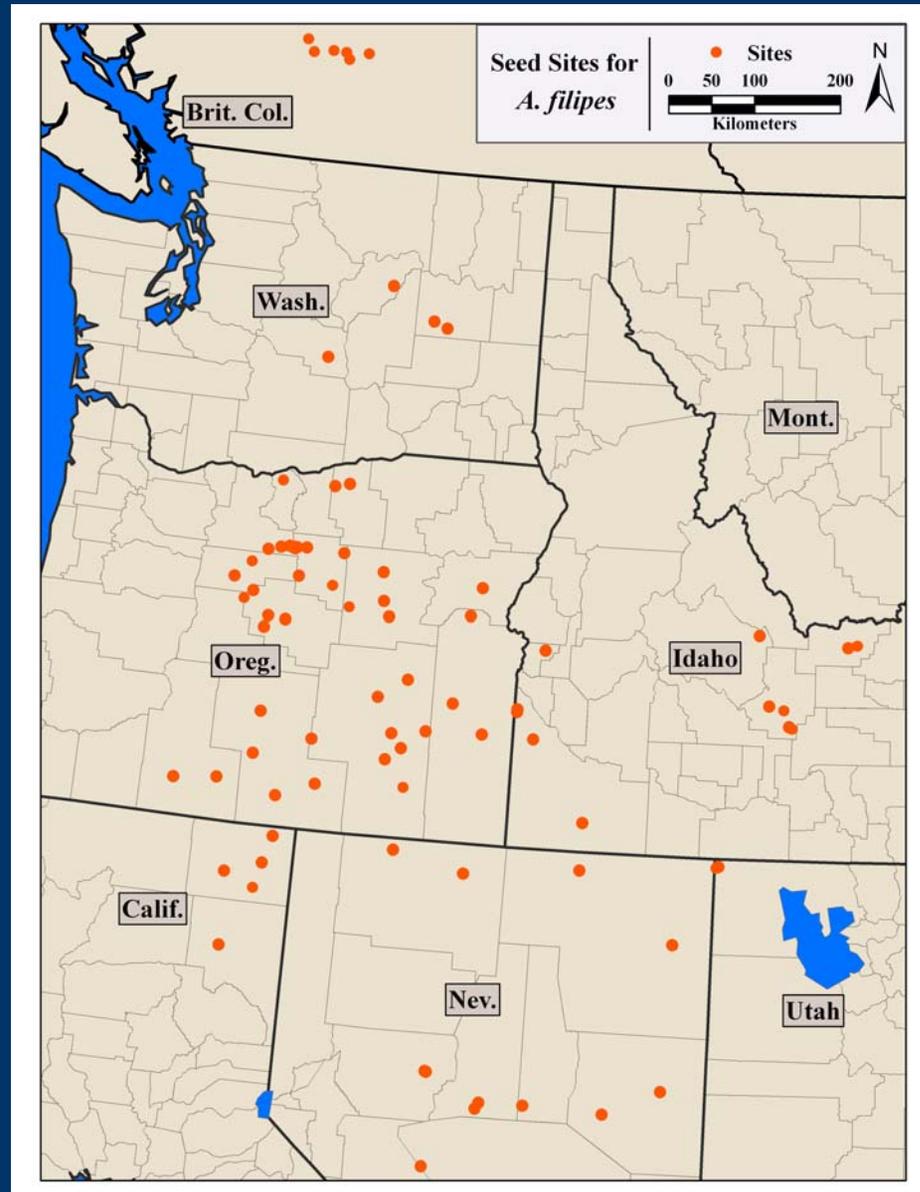
Basalt Milkvetch - *Astragalus filipes*



- * Wide spread
- * Upright habit

- * Good seed production
- * No toxicity

Basalt Milkvetch Collections



Common Garden Study

Locations: Evans Farm, Millville in northern Utah

2005, 2006

- * **Seed yield**
- * **Plant biomass**
- * **Regrowth after clipping**
- * **Plant height**
- * **Number of stems**
- * **Number of flowers**
- * **Plant vigor score (0-9)**
- * **Forage quality**



Approved for Release in 2007

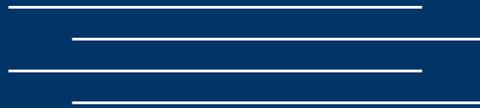
NBR-1 Germplasm Basalt Milkvetch

- * Accessions with highest seed yield from Northern Basin and Range (NBR) Ecoregion (Level III, Omernik, 1987)**
- * Only accessions with no detectable levels of selenium, nitrotoxin, and swainsonine**
- * 12 accessions from OR, ID, NV, CA, and UT**
- * Increase seed (Logan, UT and Silverton, OR)**

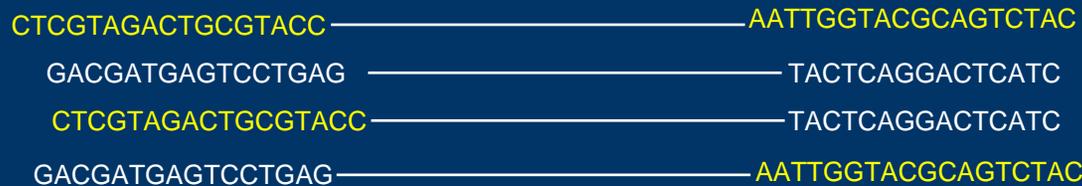
Amplified Fragment Length Polymorphisms



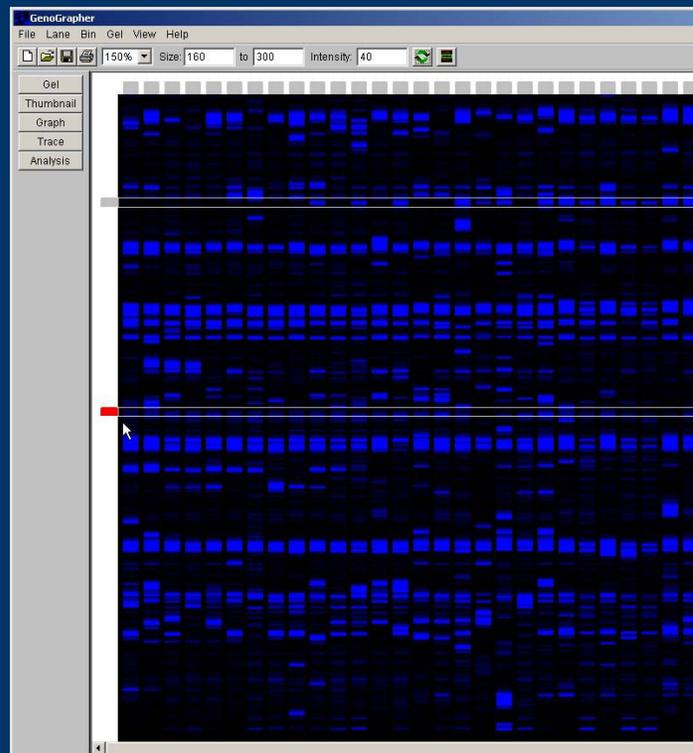
Restriction enzymes digest
DNA into fragments.



Sequence “adaptors” are
attached to the fragment ends.



Primers are designed to bind to the adaptors, and they have extra nucleotides on their terminal ends to reduce the number of bands that are amplified.



757 plants, 738 After missing ones removed

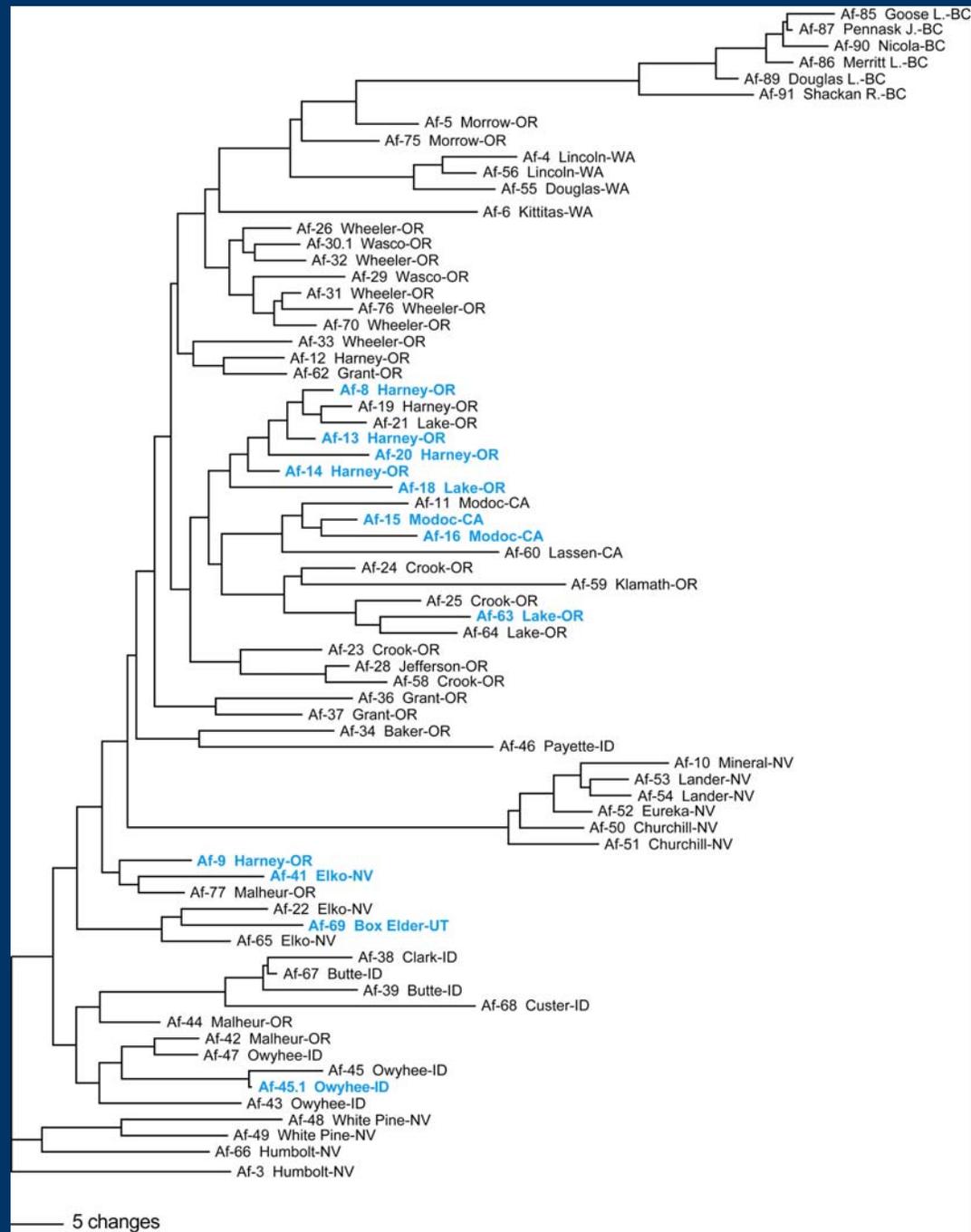
5 Markers	EaccMcac	EactMcac	EaggMcaa	EaggMcag	EaggMctc	Totals
genotyped markers	363	370	330	328	289	1680
after 1% tails removed	223	272	268	254	206	1223
error markers removed	8	1	6	11	3	29
final marker set	215	271	262	243	203	1194
error rate ^(before removing)	1.60%	2.00%	2.20%	3.00%	1.80%	*2.12%
missing plants	10	4	7	1	6	**19

* Overall average error percentage

** Number of plants removed from the study in the end

Analysis of Molecular Variance

Source of Variation	d.f.	Sums of squares	Variance components	Percentage of variation
Among populations	70	21406.224	25.54861 Va	26.8
Within populations	585	40831.125	69.79679 Vb	73.2
Total	655	62237.349	95.34541	
Fixation Index	phi-ST	:	0.268	

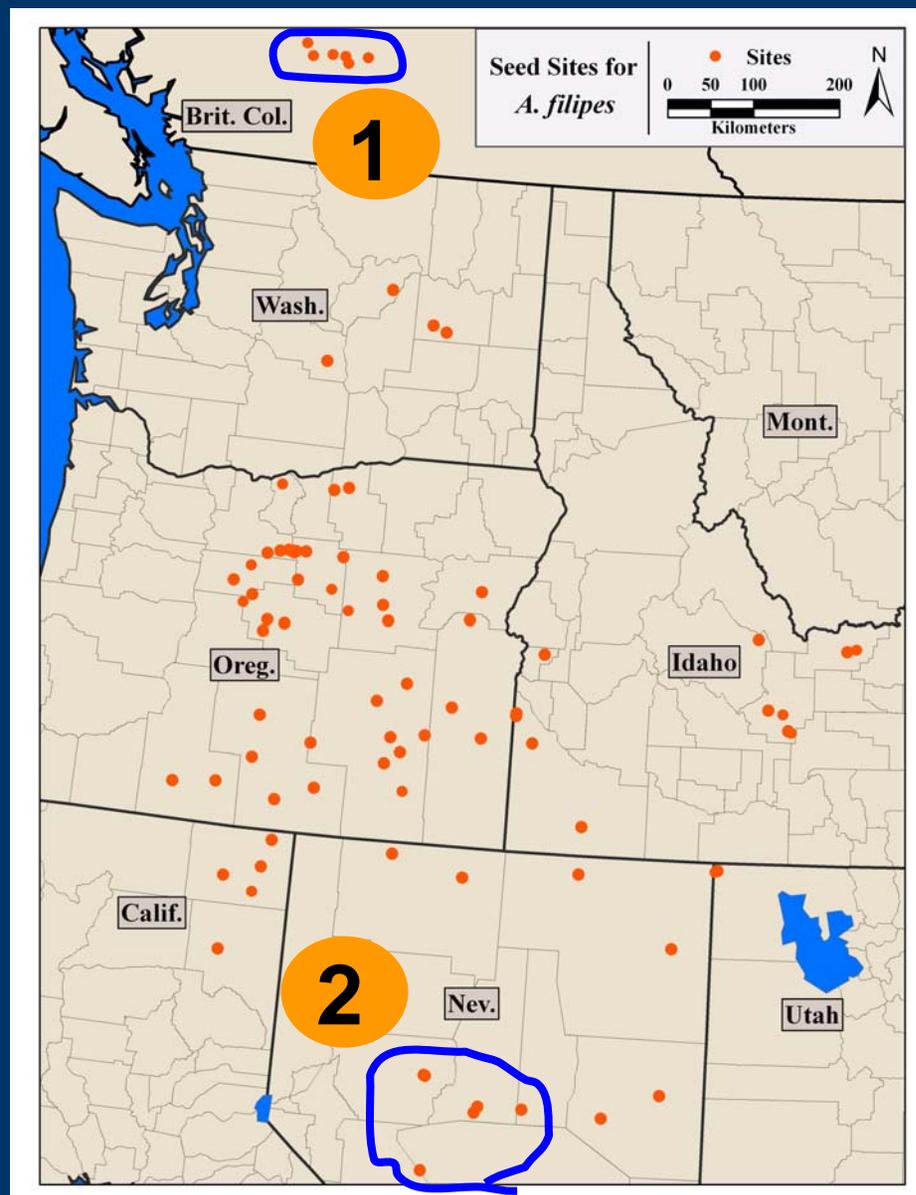


Accession	County*	State / Province	No. Plants	Mean S*
Af-86	n/a	BC	8	79%
Af-90	n/a	BC	8	79%
Af-85	n/a	BC	8	78%
Af-10	Nye/Mineral	NV	7	76%
Af-87	n/a	BC	8	75%
Af-53	Lander	NV	10	75%
Af-89	n/a	BC	7	74%
Af-54	Lander	NV	10	74%
Af-91	n/a	BC	7	74%
Af-50	Churchill	NV	5	73%
Af-52	Eureka	NV	8	73%
Af-68	Custer	ID	10	73%
Af-48	White Pine	NV	7	73%
Af-38	Clark	ID	10	72%
Af-46	Payette	ID	10	72%
Af-39	Butte	ID	10	72%
Af-51	Churchill	NV	10	71%
Af-59	Klamath	OR	10	71%
Af-60	Lassen	CA	9	71%
Af-6	Kittitas	WA	8	71%
Af-4	Lincoln	WA	8	70%
Af-3	Humboldt	NV	9	69%
Af-22	Elko	NV	10	69%
Af-16	Modoc	CA	10	69%
Af-11	Modoc	CA	10	68%
Af-49	White Pine	NV	10	68%
Af-55	Douglas	WA	10	68%
Af-67	Butte	ID	9	67%
Af-45	Owyhee	ID	10	67%
Af-5	Morrow	OR	9	67%
Af-66	Humboldt	NV	9	67%
Af-45.1	Owyhee	ID	10	67%
Af-36	Grant	OR	9	67%
Af-41	Elko	NV	10	67%
Af-69	Box Elder	UT	9	67%
Af-64	Lake	OR	10	67%

Accession	County*	State / Province	No. Plants	Mean S*
Af-34	Baker	OR	10	66%
Af-18	Lake	OR	10	66%
Af-15	Modoc	CA	8	66%
Af-25	Crook	OR	10	66%
Af-56	Lincoln	WA	10	66%
Af-43	Owyhee	ID	10	66%
Af-29	Wasco	OR	10	66%
Af-19	Harney	OR	10	66%
Af-65	Elko	NV	7	66%
Af-63	Lake	OR	10	66%
Af-75	Morrow	OR	8	66%
Af-76	Wheeler	OR	8	65%
Af-20	Harney	OR	8	65%
Af-30.1	Wheeler	OR	10	65%
Af-70	Wheeler	OR	10	65%
Af-47	Owyhee	ID	8	65%
Af-8	Harney	OR	10	65%
Af-42	Malheur	OR	10	65%
Af-9	Harney	OR	10	64%
Af-62	Grant	OR	10	64%
Af-37	Grant	OR	10	64%
Af-26	Wheeler	OR	9	64%
Af-44	Malheur	OR	10	64%
Af-33	Wheeler	OR	10	64%
Af-23	Crook	OR	10	64%
Af-77	Malheur	OR	10	64%
Af-58	Crook	OR	10	64%
Af-21	Lake	OR	9	64%
Af-13	Harney	OR	9	63%
Af-28	Jefferson	OR	10	63%
Af-32	Wheeler	OR	10	63%
Af-31	Wheeler	OR	10	63%
Af-24	Crook	OR	10	63%
Af-14	Harney	OR	10	62%
Af-61	Harney	OR	10	62%

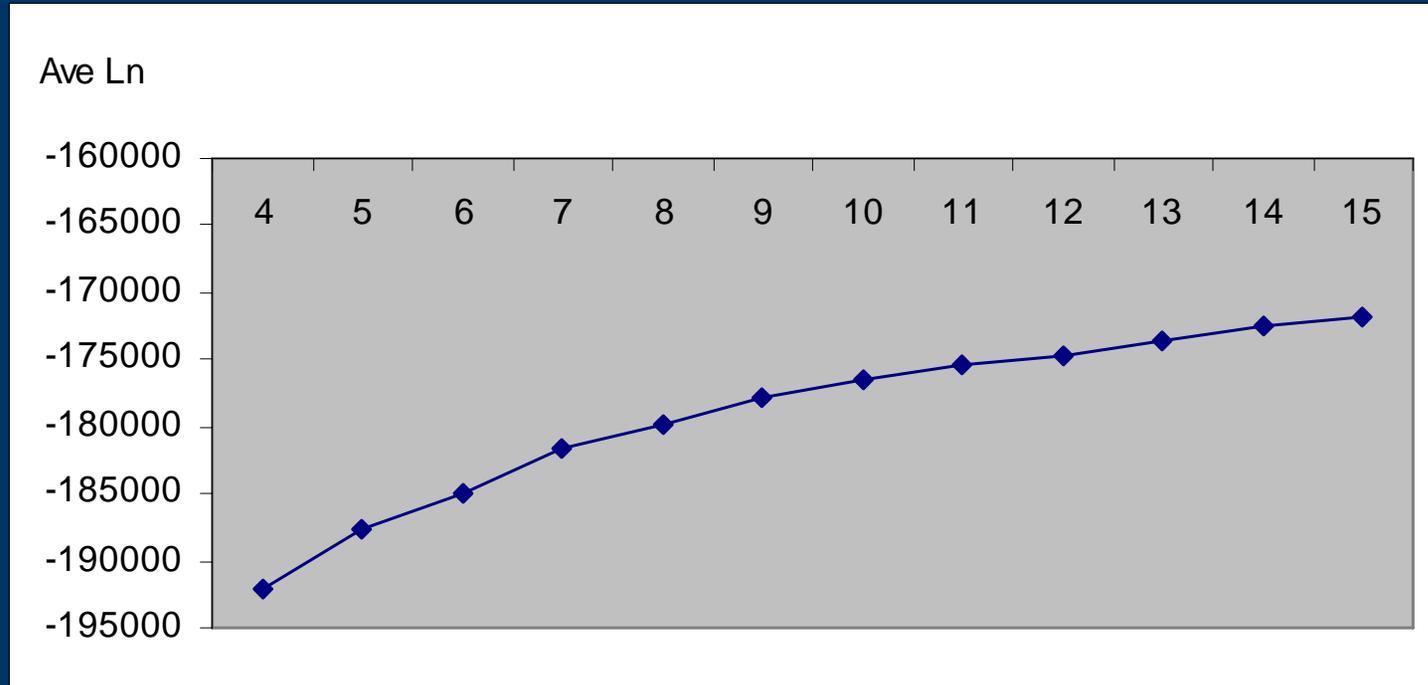
Preliminary Genetic Groupings (Basalt Milkvetch)

One Group for
Canada



One Group for
Central Nevada

Bayesian clustering using Structure 2.1.



How many populations (meta-populations) are there?

- Three?
- Seven level III ecoregions?
- Eleven?
- 71?

Western Prairie Clover

Dalea ornata



- * Northern GB
- * Upright habit

- * Good seed production
- * No toxicity

Searls' Prairie Clover

Dalea searlsiae



- * Southern GB
- * Upright habit



- * Good seed production
- * No toxicity

Conclusions

- Accessions with the highest level of seed production and no detectable levels of toxicity were identified and released as NBR-1 Germplasm Basalt Milkvetch.
- AFLP studies indicated differences in genetic diversity in basalt milkvetch, which were used to define the NBR-1 germplasm release.
- Field and genetic diversity evaluations of two *Dalea* species are also underway

Acknowledgements

Great Basin Native Plant Selection and Increase Project

