A methodology recently used to perform a seed collection contract involving Provisional Seed Zones in the Eldorado National Forest

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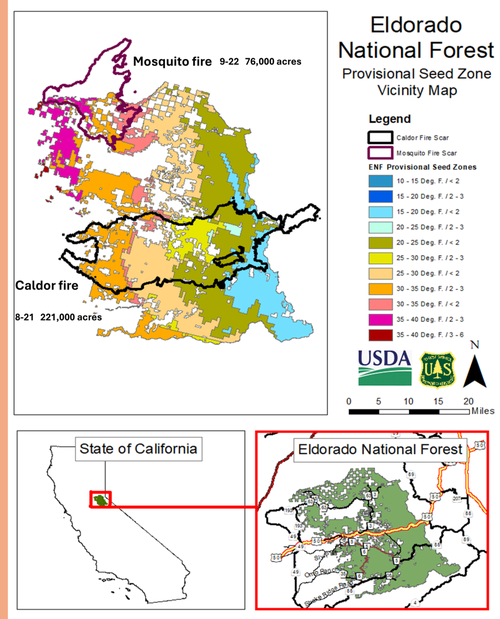
THE EVOLUTION OF PUBLIC/PRIVATE SECTOR PARTNERSHIPS FOR BUILDING LOCALLY SOURCED SEED INDUSTRIES

Comstock Seed has been collecting native seed for 40 years. In the early decades, we sold individual seed lots over broad geographic regions from the shortgrass prairie to the Sierra crest, regardless of ecotypic variation. Most sales were dominated with generic non-native species such as Crested wheatgrass or drier pasture varieties. By the 1990's, we were beginning to see contract clauses requesting more localized seed sources and a few of our larger jobs included utility corridors that traveled through multiple ecotypes. Seed blends were requested that reflected this variety. Provisional seed zones (PSZ's) were now being used in specifications for seed sources and by the early 2000's, advances in genomic tracking further delineated genetic variety within larger geographic areas that allowed us to define Seed transfer Zones. (STZ's) The use of these STZ's has entered the seed markets, largely by the BLM regional seed buys that favored Source Identified (SI) certification. This poster features the most progressive (and complicated) seed contract that our company has been awarded using PSZ's. We have added a methodology to reflect the contract requirements; this helped us to organize and perform the acquisitions. Hopefully, this poster will provide useful insights for others. The demand for local genetic varieties is currently overwhelming the seed industry and we need to aggressively increase seed collections that support private and public sector increase programs.

1 The contract shows the Mosquito and Caldor Fire footprints and the Provisional Seed Zones (PSZ's)



The Eldorado National Forest issued a solicitation for a two-year seed collection contract in the spring of 2024 Comstock Seed was awarded the contract

The 11 PSZ parameters include minimum winter temperatures and aridity and follow elevational gradients between the foothills and the Sierra crest between 2500' and 8000'

The contract also requires 2 pressed specimens per collection

Species	Seed Block	PSZ 35-40/3-6	PSZ 35-40/2-3	PSZ 30-35/<2	30-35/2-3	25-30/<2	Pounds
Acmispon parviflorus	Early			3.00	3.00		6.00
Dendromecon rigida		1.00	3.00		3.00		7.00
Hosackia stipularis			3.00				3.00
Lupinus stiversii				3.00			3.00
Turritis glabra						1	1.00
Asclepias cordifolia	Mid	2.00		5.00	4.50	2	13.50
Calystegia occidentalis		2.00					2.00
Cirsium occidentale		2.00	3.50			1	6.50
Eriodictyon californicum			3.00				3.00
Monardella odoratissima				4.50	4.50		9.00
Monardella villosa subsp. villosa		1.00					1.00
Calycadenia truncata	Late			3.00			3.00
Cirsium andersonii					4.50	3	7.50
Ericameria arborescens			4.00	4.00	4.00		12.00
Grindelia camporum						2	2.00
Solidago elongata						1	1.00
Solidago velutina subsp. californica			3.50				3.50
Trichostema lanceolatum		1.00					1.00
	Pounds/PSZ	9.00	20.00	22.50	23.50	10	85.00

Species	Seed Block	PSZ 35-40/3-6	PSZ 35-40/2-3	30-35/<2	30-35/2-3	25-30/<2	Pounds
Aquilegia formosa	Early				2.00		1.00
Scrophularia californica			2.00				2.00
Lupinus latifolius			3.00	3.00			6.00
Lupinus polyphyllus					3.00		3.00
Epilobium ciliatum	Mid		1.00	1.00	1.00		3.00
Rhododendron occidentale			2.00		2.00		4.00
	Pounds/PSZ	0	8.00	4.00	8.00	0	20.00

Species	Seed Block	PSZ 35-40/3-6	PSZ 35-40/2-3	PSZ 30-35/<2	30-35/2-3	25-30/<2	Pounds
Bromus sitchensis var. carinatus	Early	1.00	10.00	12.00	5.00	1.00	29.00
Poa secunda			9.00		5.00	1.00	15.00
Bromus laevipes	Mid	1.00	9.00		5.00		15.00
Elymus elymoides		1.00	9.00	12.00	5.00	1.00	28.00
Elymus glaucus		1.00	9.00	12.00	5.00	1.00	28.00
Melica aristata		1.00			5.00	1.00	7.00
Stipa lemmonii		1.00	9.00		5.00		15.00
Stipa occidentalis		1.00		11.50	5.00	1.00	18.50
Agrostis scabra	Late				5.00		5.00
Panicum capillare		1.00		7.50	5.00	1.00	14.50
	Pounds/PSZ	7.00	45.00	55.00	50.00	7	175.00

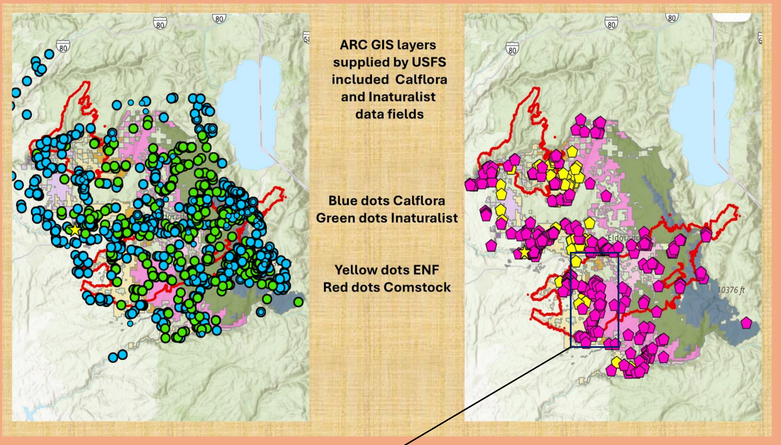
The Mosquito fire species list in the northern Eldorado NF includes
34 species within 5 PSZ's
75 collections
225 collection sites identified
280 lbs requested

2 Contract details list upland and riparian broadleaf herbs, shrubs, and grasses

Species	Seed Block	30-35/<2	30-35/2-3	25-30/<2	25-30/2-3	20-25/<2	20-25/2-3	15-20/<2	lbs/Species
Bromus sitchensis var. carinatus	Early	2.00	4.50	2.00	1.00	2.00	1.50	1.00	14.00
Poa secunda			4.50		0.50		1.50	1.00	7.50
Festuca rubra				2.00		2.00			4.00
Elymus elymoides	Mid	2.00	4.50		1.00				7.50
Elymus glaucus				2.00	1.00		1.50		4.50
Melica aristata			4.50	2.00					6.50
Stipa lemmonii						2.00		1.00	3.00
Stipa occidentalis		2.00					1.50		3.50
Phleum alpinum						2.00		1.00	3.00
Agrostis scabra	Late		4.50		0.50	2.00		1.00	8.00
Panicum capillare		2.00	4.50	2.00					8.50
	Pounds/PSZ	8.00	27.00	10.00	4.00	10.00	6.00	5.00	70.00

The Caldor Fire species list in the southern Eldorado NF includes
11 species within 7 PSZ's
33 collections
99 collection sites identified
70 lbs requested

3 The Eldorado NF supplied ARCgis data for known sites of many contract species

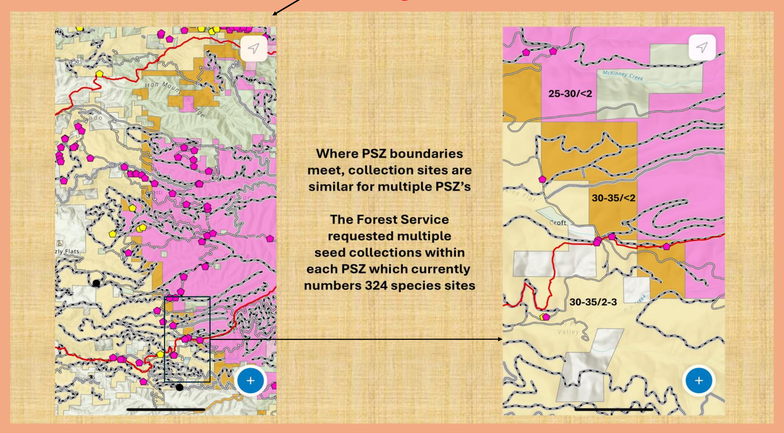


ARC GIS layers supplied by USFS included Calflora and Inaturalist data fields

Blue dots Calflora
Green dots Inaturalist

Yellow dots ENF
Red dots Comstock

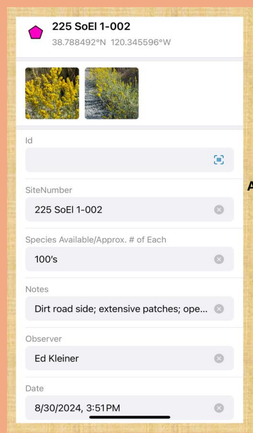
4 The progression between these photos reveals ARC details for seed collection sites along PSZ boundaries



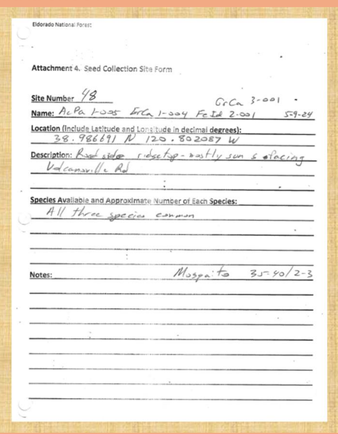
Where PSZ boundaries meet, collection sites are similar for multiple PSZ's

The Forest Service requested multiple seed collections within each PSZ which currently numbers 324 species sites

5 Each seed collection site has an ARC detail page with photos and a scanned field data sheet



ARC site example



Seed collection site form

6 We maintained a chronological site form log which shows multiple seed collections at many of the sites

1 ELGL 1-001
2 ELGL 2-001
3 ELGL 2-002
4 BRCA 1-001
4A BRCA 1-002 FERU 1-001
5 ACOC 1-001
6 ERAR 1-001
7 ACOC 1-002
8 ACOC 4-002 MEAR 5-001 ELGL
9 STLE 3-004
10 EPCI 1-001
10A ERAR 1-002
10B BRCA 1-003
11 BRLA 1-001 STLE 1-001 BRCA 2-003
12 STLE 1-002
13 ACPA 1-001
14 ERCA 1-001

226 site forms were defined that established 324 species collection sites.

Species that do not have a PSZ numerical code were not collected in 2024

8 We are completing five collection status sheets that show the comprehensive summary of all seed lot collections, including PSZ's, clean lbs requested, source sites for each seed lot collected, field lbs collected, and final clean lbs. Note that many lots contain seed from multiple sites within the same PSZ. Our goal is to provide seed lots with the maximum genetic diversity within the PSZ. The Clean Seed (C.S.) column lists the seed that is available to the USFS. Black font species are the contract species and red font species were collected as well, available to the Forest Service or other entities interested in local genetic sources.

CALDOR Grasses - Species	Common name	Zone	Lbs	Sites				Plants Pressed	Col bk lbs	C.S. *
Bromus carinatus 8	Alaska brome	30-35/<2	2.00	104					4.00	1.92
Agrostis scabra 5	Ticklegrass	30-35/<2	0.00	154					0.80	
Poa secunda 4	Sandbreg bluegrass	30-35/<2	0.00	74				74	2.00	0.90
Elymus elymoides 3	Squirreltail	30-35/<2	2.00	124					8.50	
Stipa occidentalis 4	Western needlegrass	30-35/<2	2.00	8	124	181		181	19.40	
Melica aristata 5	Bearded melic	30-35/<2	0.00	74	81				2.50	1.20
Panucum capillare	Witchgrass	30-35/<2	2.00							
Bromus carinatus 1	Alaska brome	30-35/2-3	4.50	4.4a 10b	65 98 105	106 108 120		65	30.30	18.20
Bromus laevipes 3	Woodland brome	30-35/2-3								
Festuca rubra 1	Creeping red fescue	30-35/2-3								
Poa secunda 5	Pine bluegrass	30-35/2-3								
Elymus glauca 4	Blue wildrye	30-35/2-3								
Elymus elymoides 2	Squirreltail	30-35/2-3								
Melica aristata 3	Bearded melic	30-35/2-3								
Stipa lemmonii 3	Lemmon needlegrass	30-35/2-3								
Agrostis scabra 1	Ticklegrass	30-35/2-3								
Descgampsia caespitosa	Tufted hairgrass	30-35/2-3								
Panucum capillare 2	Witchgrass	30-35/2-3								
Stipa occidentalis 1	Western needlegrass	30-35 2-3								
Bromus carinatus 5	Alaska brome	25-30/<2								
Festuca rubra	Red fescue	25-30/<2								
Elymus glauca 5	Blue wildrye	25-30/<2								
Elymus elymoides 7	Squirreltail	25-30/<2								
Poa secunda 3	Sandbreg bluegrass	25-30/<2								
Agrostis scabra 3	Ticklegrass	25-30<2								
Stipa occidentalis	Western needlegrass	25-30/<2								
Melica aristata 4	Bearded melic	25-30/<2								
Panucum capillare	Witchgrass	25-30/<2								
Bromus carinatus 4	Alaska brome	25-30/2-3								
Poa secunda 6	Pine bluegrass	25-30/2-3								
Elymus elymoides 1	Squirreltail	25-30/2-3								
Elymus glauca 7	Blue wildrye	25-30/2-3								
Agrostis scabra 6	Ticklegrass	25-30/2-3								
Bromus carinatus 9	Alaska brome	20-25/<2								
Festuca rubra 6	Creeping red fescue	20-25/<2								
Stipa lemmonii	Lemmon's needlegrass	20-25/<2								
Stipa occidentalis 7	Western needlegrass	20-25/<2								
Phleum alpinum	Alpine timothy	20-25/<2								
Agrostis scabra 4	Ticklegrass	20-25/<2								
Poa secunda	Pine bluegrass	20-25/<2								
Bromus carinatus 11	Alaska brome	20-25/2-3								
Bromus laevipes 4	Woodland brome	20-25/2-3								
Poa secunda	Pine bluegrass	20-25/2-3								
Festuca rubra 4	Red fescue	20-25/2-3								
Elymus glauca 9	Blue wildrye	20-25/2-3								
Stipa occidentalis 6	Western needlegrass	20-25/2-3								
Bromus carinatus 10	Alaska brome	15-20/<2								
Poa secunda 8	Pine bluegrass	15-20/<2								
Stipa occidentalis 8	Western needlegrass	15-20/<2								
Stipa lemmonii	Lemmon's needlegrass	15-20/<2								
Elymus elymoides 10	Squirreltail	15-20/<2								
Festuca rubra 5	Red fescue	15-20/<2								
Phleum alpinum	Alpine timothy	15-20/<2								
Agrostis scabra	Ticklegrass	15-20/<2								

34 contract collections (black)
additional collections (in red)

* C.S. number are not totals

Collection status sheets

- 1 Mosquito Riparian locations, collections, and cleanouts
- 1 Mosquito Herbs and Shrubs locations, collections, and cleanouts
- 1 Mosquito Grasses locations, collections, and cleanouts
- 1 Caldor Herbs locations, collections, and cleanouts
- 1 Caldor Grasses locations, collections, and cleanouts

Caldor contract grass list

Species	Seed Block	30-35/<2	30-35/2-3	25-30/<2	25-30/2-3	20-25/<2	20-25/2-3	15-20/<2	lbs/Species
Bromus sitchensis var. carinatus	Early	2.00	4.50	2.00	1.00	2.00	1.50	1.00	14.00
Poa secunda			4.50		0.50		1.50	1.00	7.50
Festuca rubra				2.00		2.00			4.00
Elymus elymoides	Mid	2.00	4.50		1.00				7.50
Elymus glaucus				2.00	1.00		1.50		4.50
Melica aristata			4.50	2.00					6.50
Stipa lemmonii						2.00		1.00	3.00
Stipa occidentalis		2.00					1.50		3.50
Phleum alpinum						2.00		1.00	3.00
Agrostis scabra	Late		4.50		0.50	2.00		1.00	8.00
Panicum capillare		2.00	4.50	2.00					8.50
	Pounds/PSZ	8.00	27.00	10.00	4.00	10.00	6.00	5.00	70.00

7 We also use the Theodolite app for site reference data

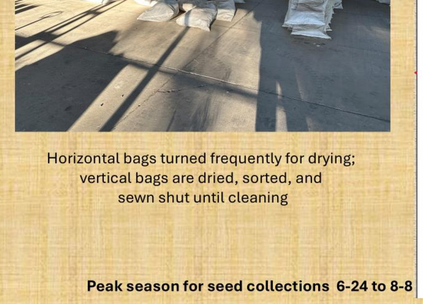
Most seed lots were hand screened to reduce volume prior to using machinery

The Seed collection log contains 290 seed collections from the 2024 season. The sacs were dried and combined for each PSZ. We are cleaning each seed lot using various combinations of equipment at Comstock Farm

Seed collection log

DATE	SPECIES	SITE #	M/C		PSZ	FIELD LBS
16-May	POSE	21	M	1-001	30-35/2-3	1.0
29-May	STLE	32	M	1-004	35-40/2-3	28.0
	POSE	35	M	1-003	30-35/2-3	1.0
	ACPA	19	M	2-002	30-35/2-3	4.0
	ACPA	33	M	1-003	35-40/2-3	11.0
31-May	ACPA	16	M	2-001	30-35/2-3	6.0
	ACPA	40	M	1-004	35-40/2-3	2.6
	POSE	41	M	2-003	35-40/2-3	2.2
	Lupine sp.	41	M		35-40/2-3	3.8
6-Jun	ELGL	56	M	3-003	35-40/2-3	7.0
	BRCA	55	M	2-002	35-40/2-3	2.0
	BRCA	11	M	2-003	35-40/2-3	9.0
	POSE	37	M	2-001	35-40/2-3	1.0
	STLE	12	M	1-002	35-40/2-3	2.0
	BRCA	50	M	3-001	30-35/2-3	5.0
	ACPA	13	M	1-001	35-40/2-3	1.0
	ACPA	48	M	1-005	35-40/2-3	2.0
7-Jun	ELGL	51	M	2-007	30-35/2-3	19.0
	BRCA	51	M	3-001	30-35/2-3	15.0
	STLE	51	M	2-002	30-35/2-3	12.0
10-Jun	DECA	94	C	1-001	30-35/2-3	8.0
	POSE	99	C	5-001	30-35/2-3	4.0
	BRCA	65	C	5-001	25-30/<2	1.0
	ACOC	100	C	1-004	25-30/2-3	3.0
	POSE	75	C	3-001	25-30/<2	1.0
	POSE	100	C	5-002	30-35/2-3	5.0
	ELGL	99	C	4-002	30-35/2-3	3.0
	STLE	65, 97	C	3-004	30-35/2-3	16.0
	EPCI?	93	C	1-001	30-35/2-3	1.0
13-Jun	BRCA	30,31,32	M	2-004,5,6	30-35/2-3	27.0

9 INVENTORY MANAGEMENT



Horizontal bags turned frequently for drying; vertical bags are dried, sorted, and sewn shut until cleaning

Peak season for seed collections 6-24 to 8-8

2024 collection summary
5-16 to 10-22

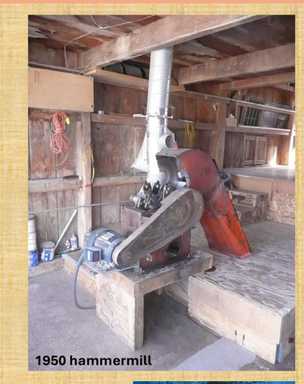
Collection date	# of sites visited
16-May	1
29-May	4
31-May	4
6-Jun	8
7-Jun	3
10-Jun	9
13-Jun	10
18-Jun	4
19-Jun	7
24-Jun	18
26-Jun	5
30-Jun	12
3-Jul	15
7-Jul	19
12-Jul	16
16-Jul	8
19-Jul	11
21-Jul	18
25-Jul	11
26-Jul	15
1-Aug	13
5-Aug	10
8-Aug	17
12-Aug	7
15-Aug	9
20-Aug	9
30-Aug	6
3-Sep	2
20-Sep	4
7-Oct	6
18-Oct	4
22-Oct	5

Small scale machinery for cleaning small seed lots

Cuisinart, mineral sieves, hair dryer

Berry macerator

Seed Tech aspirator



1950 hammermill

Field screening leaves residual organics in the field

Concluding comments

Due to advancements in genomics over the last twenty years, agencies and a multitude of private sector entities are requesting seed that has specific genetic certification and/or source certification that is similar to their project locations. Genetic analysis of species is ongoing, and Seed Transfer Zones (STZ's) are being defined for a growing list of species used in restoration. The time frame to use this data and bring significant amounts of seed to the restoration market can be 20 years.

Current restoration seed markets are already insufficient to supply a growing eclectic market. Wildfires restoration alone, has overwhelmed the market. Further, due to climate change and global warming, urban transformation to drier landscapes in the arid west has become an existential issue. Until our agricultural sector can catch up on cultivation and expansion of inventories, we must rely on other approaches, including native seed collections from the wild. Seed collection contracts like the one presented on this poster need to become more frequent, and we feel it is essential that increasing amounts of this seed be used for grow-out contracts. The seed and nursery industries must respond with appropriate species for our drying times.

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