Salmon Valley Stewardship

January 18, 2024

RE: Agreement No. **22-CS-11041300-032**
Agreement Title: **Native Plant Restoration**
Performance Period: **06/19/2023 - 12/31/2023**

Annual Performance Report

During this performance period the following activities were completed:

Timeline	Activities
June 2023	• Program coordinator started June 19, 2023, and met with SVS and SCNF staff for project initiation.
Summer 2023	• FS Trainings and Onboarding completed. • Acquired the use of a FS vehicle, Wex card, and phone. • Developed an ArcGIS Field maps mapping system. • Mapped and monitored potential sites for the collection of native seed on BLM and FS land within the Salmon Cobalt, North Fork, Leadore and Lost River Ranger District. • Taught plant ID lessons to the Salmon Teen Center. • Visited NRCS Plant Materials Center and learned about collecting, processing, cleaning, and storing seed. • Secured seed storage in partnership with the BLM. • Materials for Seed collection and storage purchased. • With the help of SVS interns, FS staff and other volunteers, began collecting native seed and voucher specimens.
Fall 2023	• Completed seed collection efforts. • Began working with local farms/greenhouses to initiate seed increase efforts. • Identified species for seed increase and sent seed to the FS Coeur d'Alene nursery as per our agreement. • Submitted a 3 yr. funding request via the Bipartisan Infrastructure Law (BIL) and secured year 1 budget for Native Plant Restoration Projects.

	• Materials for seed cleaning and seedball production purchased or acquired through project partnerships. • Worked with seed distributors to purchase seed that had not been field collected and selected species appropriate to the project parameters. • Cleaned, weighed, counted and measured seed from each species collected. • Selected locations for seedball applications and designed seed mixes specifically for each site. • Seed balls made! • Seed balls applied to designated treatment areas along new or existing monitoring transects and within treatment polygons.
Winter 2023	• Reviewed work accomplished, designed future workflow patterns and assessed project performance. • Created seedball treatment and seed collection polygons. • Entered data and work into FACTS.

Population and Phenology Monitoring Summary

Phenology monitoring requires repeated site visits in order to determine the ideal timing for seed collection. Plant phenology is dependent on precipitation, temperature, elevation, aspect, soil, and seasonality making it difficult to accurately predict and can vary from year to year. Often, this means you may be able to collect seed from a species at Site B, long after that species has entirely senesced or dried up at Site A, if their individual conditions are different enough.

The initial list of target species selected for potential collection is lengthy and plants were considered on a variety of criteria intended to contribute to species biodiversity, support pollinators throughout the season, bolster wildlife habitat, and increase ecosystem resiliency to biological invasions and wildfire. The list includes primarily rangeland and high desert species, early seral species, nitrogen fixers, annuals, perennials, and biennials. This list does not include grasses as it was deemed they were more commercially available and could be purchased at a later date. It was updated as the season progressed with new species of interest.

Initial List of Potential Target Species:

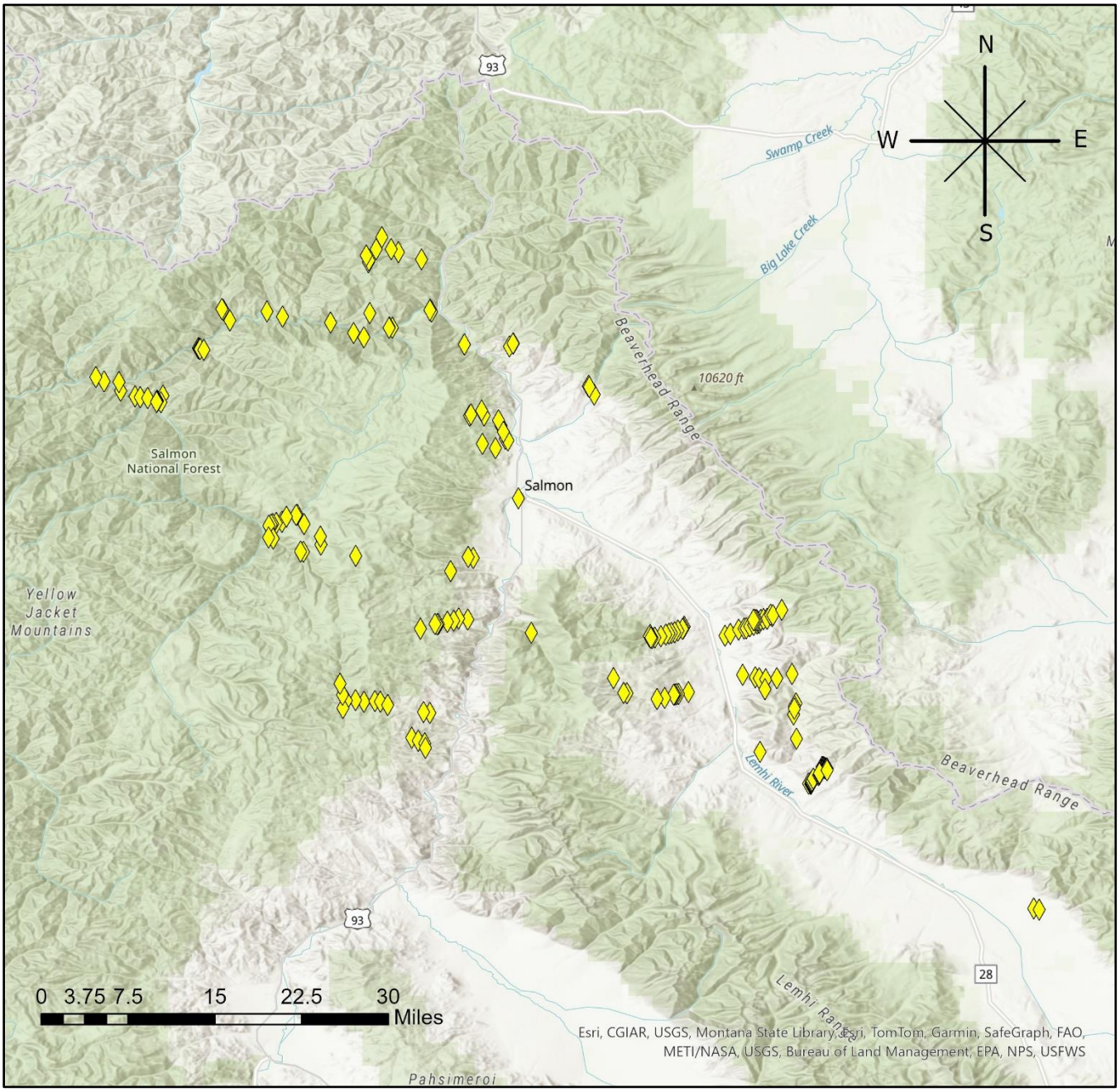
Scientific Name	Common Name	Scientific Name	Common Name
Achillea millefolium	Western Yarrow	*Frasera albicaulis*	White Stemmed Frasera
Allium sp.	Wild Onion species	*Fritillaria pudica*	Yellow Bells
Agoseris glauca	Pale Agoseris	*Geum triflorum*	Prairie Smoke
Antennaria sp.	Pussy Toes	*Grindelia squarrosa*	Curlycup Gumweed
Arnica cordifolia	Heart Leaf Arnica	*Gutierrezia sarothrae*	Broomrape Snakeweed
Arnica sororia	Twin Arnica	*Helianthus annuus*	Annual Sunflower
Artemisia arbuscula	Low Sagebrush	*Heterotheca villosa*	Hairy Goldenaster
Artemisia dracunculus	Common Tarragon	*Ionactis alpina*	Lava Aster
Artemisia tridentata	Big Mountain Sagebrush	*Ipomopsis aggregata*	Scarlet Gilia
Artemisia tripartita	Three Tip Sagebrush	*Lewisia rediviva*	Bitterroot
Astragalus atropubescens	Kelsey's Milkvetch	*Lithospermum ruderale*	Western Stoneseed
Astragalus purshii	Wooly Milkvetch	*Lupinus sp.*	Lupine species
Astragalus scaphoides	Bitterroot Milkvetch	*Machaeranthera canescens*	Hoary Tansyaster
Balsamorhiza sagittata	Arrowleaf Balsamroot	*Mentzelia dispersa*	Bushy Blazing Star
Calochortus eurycarpus	Mariposa Lily	*Mentzelia laevicaulis*	Smooth Stem Blazing Star
Calochortus nitidus	Broadfruit Mariposa Lily	*Penstemon aridus*	Stiffleaf Penstemon
Chaenactis douglasii	Douglas' Dusty Maiden	*Penstemon deustus*	Hotrock Penstemon
Chrysothamnus viscidiflorus	Yellow Rabbitbrush	*Penstemon sp.*	Penstemon species
Cirsium cymosum	Peregrine Thistle	*Phacelia hastata*	Silverleaf Phacelia
Cleomella serrulata	Rocky Mountain Bee Plant	*Phacelia heterophylla*	Varileaf Phacelia
Collomia linearis	Pink Tiny Trumpets	*Phacelia linearis*	Linearleaf Phacelia
Collinsia parviflora	Maiden Blue-Eyed Mary	*Phlox longifolia*	Longleaf Phlox
Crepis acuminata	Tapertip Hawksbeard	*Plantago patagonica*	Woolly Plantain
Cryptantha sp.	Cryptantha species	*Polanisia dodecandra*	Red Whisker Clammyweed
Eremogone sp.	Sandwort species	*Polygonum douglasii*	Douglas' Knotweed
Ericameria nauseosa	Rubber Rabbitbrush	*Sedum lanceolatum*	Lanceleaf Stonecrop
Erigeron pumilus	Shaggy Fleabane	*Senecio integerrimus*	Western Groundsel
Eriogonum microtheca	Slender Wild Buckwheat	*Sphaeralcea coccinea*	Scarlet Globemallow
Eriogonum ovalifolium	Cushion Buckwheat	*Stenotus acaulis*	Goldenweed
Eriogonum strictum	Blue Mountain Buckwheat	*Tetradymia canescens*	Spineless Horsebrush
Eriogonum umbellatum	Sulfur Buckwheat	*Townsendia sp.*	Townsendia species

Native Plants Field Maps

With the assistance of Andy Klimek, an ArcGIS Field Maps layer titled, "Native Plants," was developed to map and collect data on target populations identified during the phenology monitoring phase of this project. The Native Plants layer's data collection fields include entries for the name, phenology, and population size of a primary, secondary, and tertiary species seen at a sight allowing us to track multiple populations with the same data point. Other data including collection dates, weed presence, threats, and land ownership were also recorded. This map layer is located within, "R04 SCNF NZ BIP," ArcGIS group.

Native Plants Monitoring Points

As of 12/31/23, 169 locations were mapped and revisited at regular intervals in order to track the phenology of the target species located there. Sites can be found on the following map and are located on both BLM and FS lands.



Sites Visited

Sites were named with an arbitrary naming convention associated with a geographical landmark in close proximity and include the following locations: Agency Creek (AGC), Bobcat Gulch (BOG), Buster Gulch (BUG), Cabin Creek (CAC), Cow Creek (COC), Deep Creek (DEC), Diamond Creek (DIC), Hawley Creek (HAW), Haynes Creek (HAC), Hot Springs Creek (HSC), Hull Creek (HUC), Iron Creek (IRC), Kriley Gulch (KRG), Lewis & Clark Highway (LCH), McDevitt Creek (MCC), Moccasin Creek (MOC), Moose Creek (MOO), Napias Creek (NAC), Panther Creek (PAC), Perreau Creek (PEC), Pine Creek (PIC), Ramsey Mountain (RAM), Reese Creek (REC), Salmon River (SAR), Spring Creek (SPC), Twelvemile Creek (TWC), William's Creek (WIC), and William's Lake (WIL).

Other Concerns

It is important to note that not all sites monitored were visited later for collections. This may be due to several factors such as no longer targeting the species located at that site, having found better populations/collection sites elsewhere, or simply not having enough time and resources to prioritize it. However, the data collected at these sites is still immensely valuable. It provides insight into where and how certain plant species grow and gives us context that allows us to extrapolate where that plant may be found elsewhere.

Additionally, the exact timeline for when monitoring ended and collecting seed began is difficult to nail down as the transition between the two is rather organic. Many of our target species become ready for seed collection at different times so much so that through much of this process, monitoring and collecting often occurred congruently.

Wildflower Photos

***Lewisia rediviva* – Bitterroot**
Growing near Warm Springs Creek

***Phacelia hastata* – Silver Leaf Phacelia**
Spotted on a bench above the Salmon River

Mentzelia laevicaulis – **Blazing Star**
Found overlooking Iron Creek

Frasera albicaulis – **White Stemmed Frasera**
Growing near William's Lake Campground

Seed Collection Summary

Protocol

The Forest Service does not have an established protocol for seed collection and as such, this program had limited guidelines for how to operate during this phase. The regional botanists, Tova Spector and Jenny Carson were contacted about this issue and gave assurance that a protocol is in development for future seasons. In the meantime, we were instructed to adapt the BLM's Seeds of Success (SOS) protocol to suit the program's needs.

The SOS's seed collection protocol has been widely established and accepted for over ten years and follows these primary rules:

- Seeds may only be collected from wild populations.
- Each collection must sample at least 50 individual plants.
- No more than 20% of ripe seed should be collected from a population.
- At least 3 populations must be sampled per species.
- Populations should be at least 1km apart.
- Ideal collections are at least 10,000 seeds.

These guidelines prevent damaging the plant populations being sampled and promote genetic diversity within the seed collection.

Seed Collection Strategies

Different plant species produce seed in a remarkably diverse number of ways which translates to a diverse range of seed collection strategies. Even closely related species may require very different collection tactics. Some of our strategies may be found in the following list:

- Aster species like *Erigeron pumilus*, *Chaenactis douglasii*, and *Ionactis alpina* produce seed in a fluffy, dandelion like head from which seeds are easily stripped off by hand.
- Pea family species like *Astragalus purshii* or *Lupinus sp.* produce seeds in pods that can either be pulled from the plant by hand or clipped off.

- Penstemon seeds grow in small pods and can be easily shaken out and into a bag. However, the seeds are so small and so numerous that we found it easier to clip entire stems to avoid losing wayward seed.
- Plants like *Collomia linearis* or *Plantago patagonica* are either so sticky or hold on to their seeds so tightly, that the entire plant must be collected to allow time to dry before harvesting their seed.
- Borages like Cryptanthas or waterleaf species like *Phacelia linearis* and *Phacelia hastata* produce fresh flowers along the stem while old ones are actively fruiting, making it difficult to know when to collect. Out of concern, we sampled a few plants and allowed them time to dry out. To our surprise, this allowed a majority of the seed pods along the stem to mature. We continued to time our collections with species like this so that we could acquire a maximum number of seed.
- Shrubs like Ericameria nauseosa produce so much seed that placing a large bucket downwind and whacking the plant with a racket works excellently.

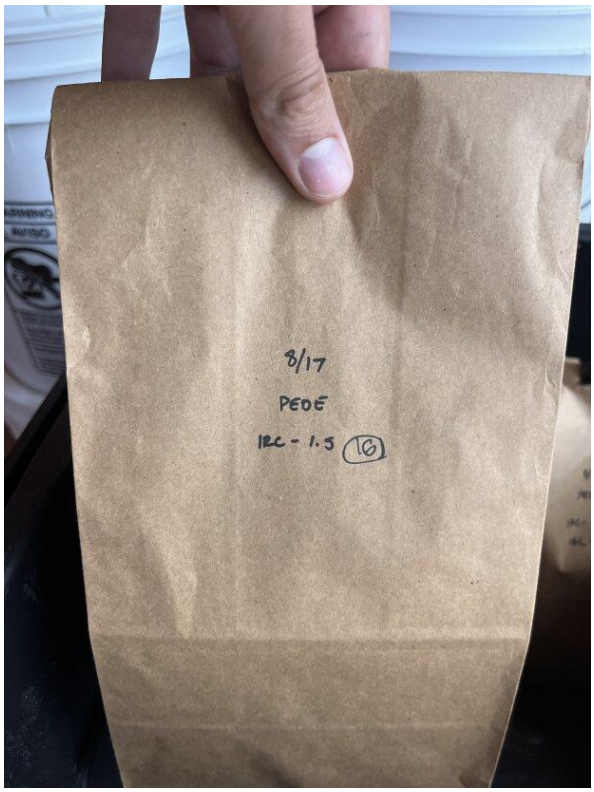
Seed Collection Photos

***Astragalus scaphoides* seed pods.**

***Townsendia sp.* displaying pappus seed heads.**

***Phacelia hastata* stems flowering and fruiting simultaneously.**

***Phacelia hastata* and *Phacelia linearis* stems drying under lights in seed storage shed. This process allows seeds to mature.**



Collection bags record the date, species collected, site name, and the # of individuals sampled.

***Ericameria nauseosa* seed collected in large quantities by whacking the shrub with a racket.**

Seed Collection Results

As of 12/31/23, the program collected seed from 37 different plant species and sampled a total of 25,445 individual plants. Collections occurred between 6/20/23 and 11/15/23 illustrating the range of fruiting habits our numerous target species exhibit. Despite this extended effort, many species still went uncollected due to a lack of capacity. The following table provides data on seed collections including the first and last date the species was collected, to show when certain species were prioritized. More seed collection data/records are available upon request.

Scientific Name	Common Name	Type	Annual or Perennial	First Collection	Last Collection	Plants Sampled
Phacelia linearis	Linear Leaf Phacelia	Forb	Annual	6/20/23	7/26/23	2491
Phacelia hastata	Silver Leaf Phacelia	Forb	Perennial	6/20/23	8/9/23	710
Astragalus purshii	Woolly Milkvetch	Forb	Perennial	6/20/23	10/24/23	182
Erigeron pumilus	Shaggy Fleabane	Forb	Perennial	6/27/23	8/2/23	2567
Collomia linearis	Pink Tiny Trumpets	Forb	Annual	7/11/23	7/17/23	1156
Senecio integerrimus	Western Groundsel	Forb	Perennial	7/11/23	7/13/23	749
Ionactis alpina	Lava Aster	Forb	Perennial	7/12/23	7/19/23	1945
Lewisia rediviva	Bitterroot	Forb	Perennial	7/12/23	7/19/23	247
Crepis acuminata	Tapertip Hawksbeard	Forb	Perennial	7/18/23	7/26/23	2023
Chaenactis douglasii	Douglas' Dusty Maiden	Forb	Perennial	7/24/23	8/17/23	88
Penstemon deustus	Hotrock Penstemon	Forb	Perennial	7/25/23	8/17/23	626
Arnica sororia	Twin Arnica	Forb	Perennial	7/27/23	8/9/23	2669
Arnica cordifolia	Heart Leaf Arnica	Forb	Perennial	7/27/23	--	3670
Penstemon sp.	Penstemon species	Forb	Perennial	8/2/23	8/15/23	471
Astragalus atropubescens	Kelsey's Milkvetch	Forb	Perennial	8/2/23	8/7/23	298
Mentzelia laevicaulis	Smooth stem Blazing Star	Forb	Biennial	8/2/23	10/25/23	57
Penstemon aridus	Stiff Leaf Penstemon	Forb	Perennial	8/2/23	8/10/23	111
Calochortus eurycarpus	Mariposa Lily	Forb	Perennial	8/2/23	8/9/23	781
Lupinus sp.	Lupine species	Forb	Perennial	8/2/23	--	8
Astragalus scaphoides	Bitterroot Milkvetch	Forb	Perennial	8/7/23	--	104
Eriogonum umbellatum	Sulfur Buckwheat	Forb	Perennial	8/10/23	8/31/23	1275
Eremogone sp.	Sandwort species	Forb	Perennial	8/16/23	--	231
Helianthus annuus	Annual Sunflower	Forb	Annual	8/29/23	--	145
Plantago patagonica	Woolly Plantain	Forb	Annual	8/30/23	--	1275
Tetradymia canescens	Spineless Horsebrush	Shrub	Perennial	8/31/23	9/12/23	87
Ericameria nauseosa	Rubber Rabbitbrush	Shrub	Perennial	8/31/23	9/14/23	225
Machaeranthera canescens	Hoary Tansyaster	Forb	Perennial	9/7/23	10/25/23	109
Grindelia squarrosa	Curlycup Gumweed	Forb	Biennial	9/12/23	9/27/23	905
Cleomella serrulata	Rocky Mountain Bee Plant	Forb	Annual	9/20/23	10/15/23	61
Achnatherum hymenoides	Indian Ricegrass	Grass	Perennial	10/23/23	--	3
Mentzelia dispersa	Bushy Blazing Star	Forb	Annual	10/23/23	--	2

Artemisia drancunculus	Common Tarragon	Forb	Perennial	10/23/23	--	55
Heterotheca villosa	Hairy Goldenaster	Forb	Perennial	10/24/23	--	5
Sporobolus cryptandrus	Sand Dropseed	Grass	Perennial	10/24/23	--	96
Eriogonum strictum	Blue Mountain Buckwheat	Forb	Perennial	10/24/23	--	8
Cirsium cymosum	Peregrine Thistle	Forb	Biennial	10/25/23	--	2
Artemisia tripartita	Three Tip Sagebrush	Shrub	Perennial	11/15/23	--	8

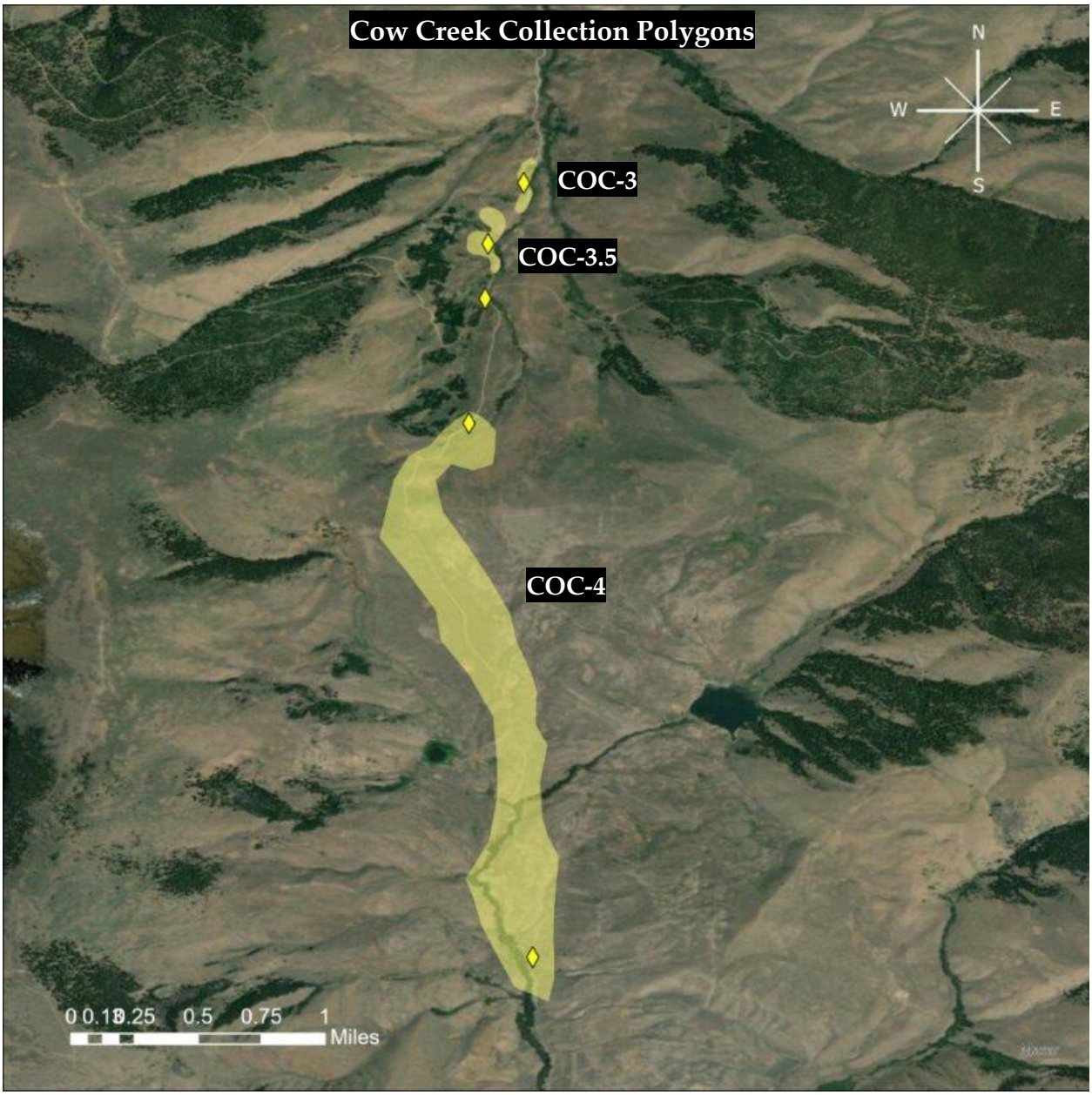
Collection Notes

- Genera in the above table lacking a specified species were unable to be identified to species due to a lack of the necessary flower parts required to do so at the time of collection. The "Mystery" *Penstemon* collections likely contain a combination of *Penstemon lemhiensis*, *Penstemon aridus*, *Penstemon wilcoxii*, and a fourth unknown species. At this time, we are unsure what species of *Eremogone* and *Lupinus* were collected. However, all genera in question only contain species that are native to Lemhi County, and all are potentially desirable.
- Many collections were opportunistic in nature meaning we had not intended to find or collect from that plant that day, but ended up finding it in amounts we deemed appropriate to collect from. This is primarily shown by the records in the table above lacking a "Last Collection" date, as they were only collected over the course of a single day.
- While gathering seed, we are unable to be certain that collections of *Phacelia hastata* are not *Phacelia heterophylla*. The two species are incredibly similar morphologically and there is very little information about how to differentiate them. However, they have distinct seeds, and we were able to determine that the seed stock is approximately 70% *hastata* and 30% *heterophylla*. Both are desirable species.
- Similarly, in regard to *Eriogonum umbellatum*, we believe there may be some contamination of the seed stock with *Eriogonum heracleoides*. The latter has only recently been given a species designation and resided previously as a subspecies of the former. Again, they are extremely similar morphologically and are both desirable species.
- *Cleomella serrulata* was only collected from a single field site. Much of the seed stock was donated by individuals with the plant in their gardens or on their land. We did not deem this to be inappropriate because wild populations are extremely limited.
- Some species collected were not intended to be used for restoration purposes in 2023. This is more apparent with the collections made later into the season where very few individuals were sampled.

Collection Maps

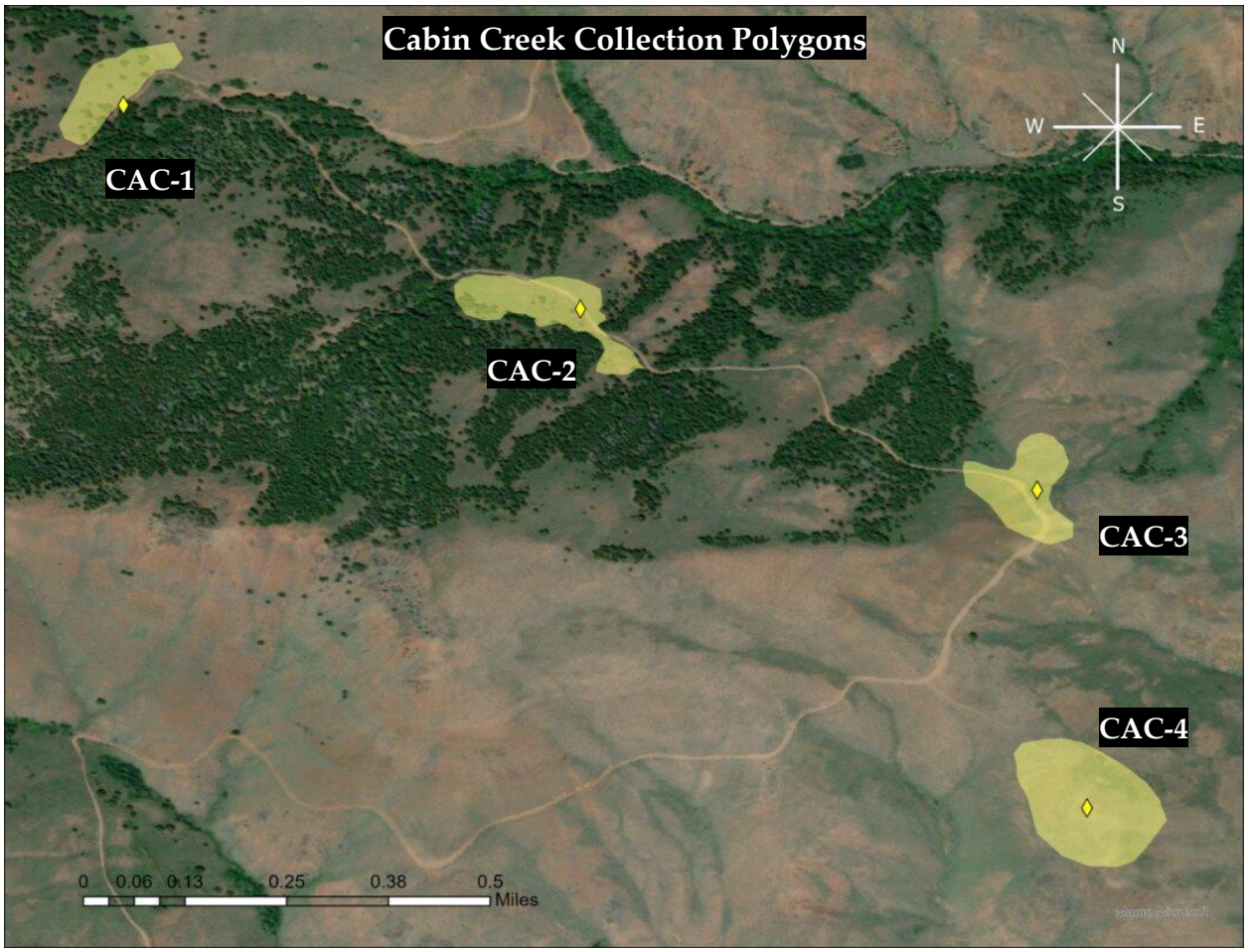
Collection polygons were generated in ArcMap and were intended to be used to calculate the cost per acre of collecting seed and for uploading spatial data to FACTS. The

polygons are much more extensive than the three maps shown below. More maps can be made available upon request. In total, collection polygons add up to just over 600 acres.



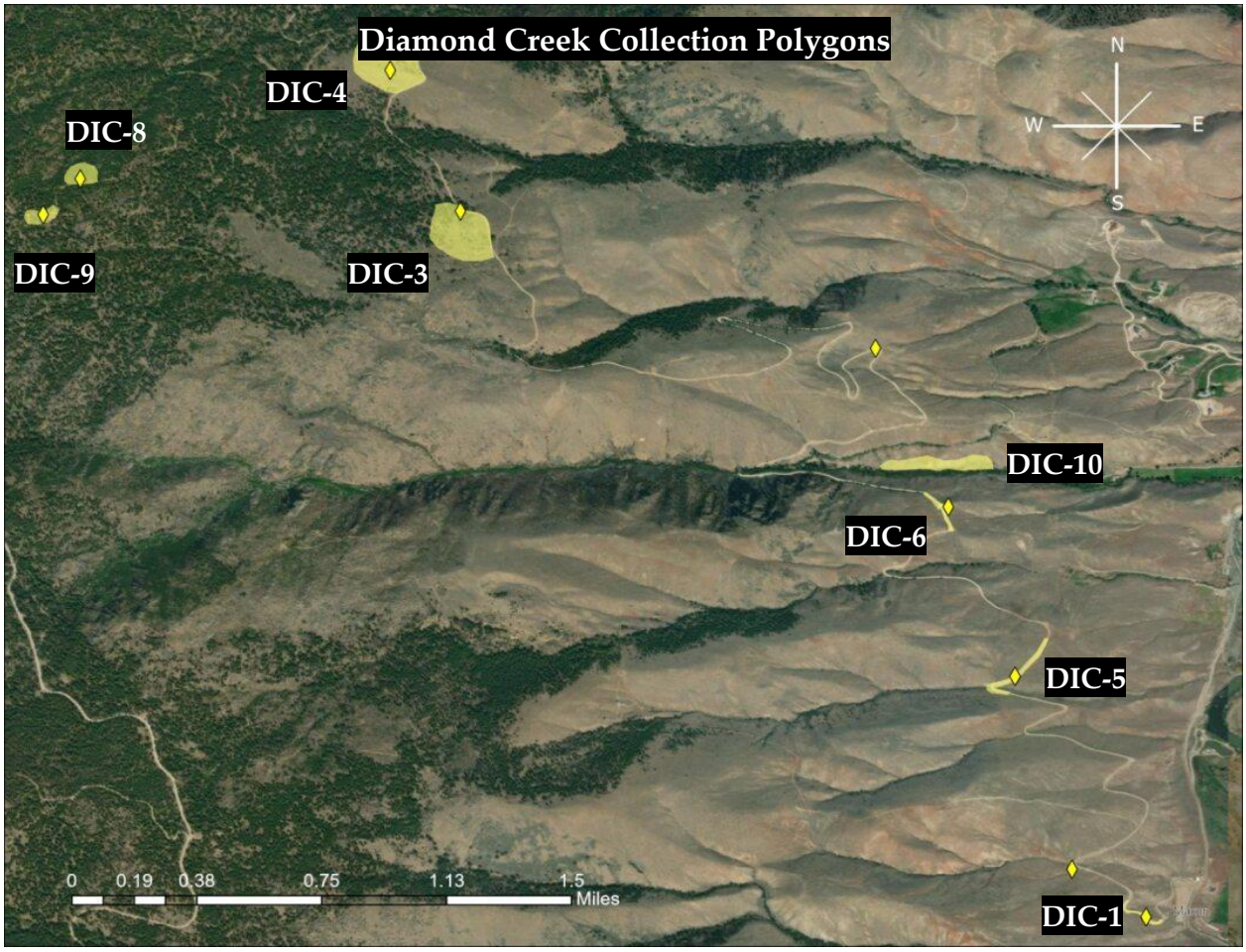
Collections occurred here between 8/31/23 and 9/14/23.

- **COC-3**: 89 *Grindelia squarrosa* sampled, 4 *Tetradymia canescens* plants sampled, and 49 *Ericameria nauseosa* plants sampled.
- **COC-3.5**: 323 *Grindelia squarrosa* plants sampled and 48 *Ericameria nauseosa* plants sampled.
- **COC-4:** 2 *Tetradymia canescens* plants sampled and 45 *Ericameria* nauseosa plants sampled.



Collections occurred here between 8/9/23 and 8/10/23.

- **CAC-1**: 27 *Phacelia hastata* plants sampled and 220 *Arinca sororia* plants sampled.
- **CAC-2**: 676 *Calochortus eurycarpus* plants sampled and 160 *Eriogonum umbellatum* plants sampled.
- **CAC-3**: 297 *Eriogonum umbellatum* plants sampled.
- **CAC-4**: 126 unidentified *Penstemon* plants sampled.



Collections occurred here between 7/27/23 and 10/23/23.

- **DIC-1**: 167 *Grindelia squarrosa* plants sampled.
- **DIC-3**: 1,047 *Arnica sororia* plants sampled.
- **DIC-4**: 1,402 *Arnica sororia* plants sampled.
- **DIC-5**: 119 *Grindelia squarrosa* plants sampled.
- **DIC-6**: 207 *Grindelia squarrosa* plants sampled.
- **DIC-8**: 2,946 *Arnica cordifolia* plants sampled.
- **DIC-9**: 724 *Arnica cordifolia* plants sampled.
- **DIC-10**: 3 *Achnatherum hymenoides* plants sampled, 2 *Mentzelia dispersa* plants sampled, and 55 *Artemisia dracunculus* plants sampled.

Volunteer Help

Our accomplishments are due in large part to the cooperation of the SCNF's North Zone BIP members, SVS, and other volunteers. SCNF's Wildlife Resources Department loaned out their technicians and volunteered 22 hours of help. SVS's interns in total, contributed another 129 hours, bringing the total help from volunteers to 151 hours. In future years, we hope to increase the number of people helping on project work by hiring technicians, interns, and increasing public outreach attempts.

SVS Intern, Mercy, collecting *Ionactis alpina* seed near Reese Creek.

Having additional help on a seed collection day can massively increase productivity. Even a single person's assistance essentially doubles the amount of work that can be accomplished. Much of the pilot year's field work was done solely by Ari, but the most productive days by far were those in which interns and volunteers were assisting.

Restoration Project Coordinator, Ari, teaching plant ID skills to SVS intern, Kainoa.

Voucher Collection

The Seeds of Success protocol requires field crews to collect pressed samples of species that seed was collected from so that the taxonomy may be verified. We chose to be laxer on this protocol, as SOS crews typically do not have the field botany training our program possesses. Some vouchers were gathered, especially in cases where we wanted to verify the identification. Compiled data on the vouchers we gathered is not available at this time as they have yet to be processed.

Budget Spending

A total of $489.89 was spent throughout the season on equipment and tools necessary for seed collection. The list of equipment includes packs of different sized paper bags, work gloves, pruners, plant ID materials and tools for keeping in the rig such as saws and axes. $418.65 of this total was spent on items we consider startup costs, meaning these items will not need to be purchased again in the following years. This total does not include gas expenses for our vehicle. Over 3,500 miles were driven in the pursuit of seed collection during the field season.

Seed Increase Summary

Coeur d'Alene Nursery

As per the National Seed Strategy, the region requested our program contribute to the region-wide push towards developing a native plant materials seed stock that can be grown in nurseries for restoration and revegetation purposes. We selected four species we thought would be ideal: *Ericameria nauseosa*, *Phacelia hastata*, *Grindelia squarrosa*, and *Machaeranthera canescens*. All are species we would like to see used more for restoration in the coming years, are well suited for our forest, and were already planned to be collected for our own purposes.

As the season progressed, we gradually weeded some selected species out due to various factors. Though we still intend to choose *Machaeranthera canescens* in the future, it flowers far too late in the season to have the seed collected and sent off in time to meet this year's deadlines. Additionally, we were informed by Nathan Robertson, seed horticulturist at the Coeur d'Alene nursery, that *Phacelia hastata* was a very difficult species to grow for increase due to its extremely high rates of seed dormancy. For these reasons, only *Ericameria nauseosa* and *Grindelia squarrosa* were chosen for seed increase this year.

Three large 5.5 gal bags filled with uncleaned Curlycup Gumweed seed and four bags of uncleaned Rubber Rabbitbrush seed were sent off and received by the nursery. At this time, no more information can be provided as the shipments are still being processed through their systems.

Local Farms

We have initiated talks with local farms and greenhouses in an attempt to begin our own seed increase efforts. Jessica McAleese at Swift River Farms and Amy Thornson Cramer from Red Birch have both expressed interest in partnering with us. Talks are still ongoing; plans are very preliminary and contingent upon future funding sources.

Seed Storage Summary

Cold Shed

A huge thank you to Hannah Alverson from the BLM for graciously donating the use of their cold storage shed located in the SO fire yard. At that time, we were extremely unsure as to how we would store our collected seed and where we could find workspace for our program's needs. Seed must be stored in cold conditions if it is expected to remain viable for extended periods, so this shed was exactly what the program required. The region will be providing funds to establish a larger cold storage facility in the future for the use of the forest and partners, but for now the shed is sufficient for our needs.

Collection Treatments

Once seed is collected, there are a few recommended strategies for preparing collections for storage. Insects and other microbes that may eat seed are typically present when the seed is

collected and must be removed to preserve the seed stock. This can be done via freezing the collections or administering pesticide. Since we lack access to a suitable freezer, we opted to go in the pesticide direction. Hot shot no-pest strips were purchased and were kept in airtight storage containers with the collections for at least 48 hours to ensure all insects were killed. The use of pesticides is also why we needed a storage area that experienced limited traffic in order to avoid harmful exposures.

Budget Spending

A total of $1,073.46 was spent on seed storage materials. The list of materials purchased includes storage containers, packs of plastic trays, storage racks, lighting, pesticide strips, and other various purchases for the shed. $895.63 of the total spent on storage materials is considered startup costs and will not need to be repurchased in future years.

Seed Cleaning Summary

Before collected seed can be used for any specific purchase, it must be cleaned of debris, chaff, pods, pappus, and other detritus that accumulates along with the seed during collections. Because each plant produces seeds in unique ways, a wide variety of cleaning methods and tools were used.

Seed cleaning can be incredibly time intensive, especially when lacking the necessary heavy equipment that most seed cleaning services provide. Because of this, we briefly considered outsourcing our seed cleaning needs to either a private business or a Forest Service nursery. Both ended up being more costly than we deemed appropriate and so we set out to do it ourselves.

Guidance and Help

The program utilized a wide variety of friendly sources for learning about how to clean seed and what equipment to get our hands on:

- Jessica McAleese from Swift River Farms taught us about removing pappus from aster seeds and showed us their home-made drum thresher which we modeled our own after. She also gave us tips on winnowing and other seed cleaning methods.
- The RNGR database has information available about how seeds for specific species can be cleaned and grown from various institutions. We referenced this source when we could, however, it lacks information on the diversity in species we collected.
- We visited the Derek Tilley at the NRCS Plant Materials Center in Aberdeen, Idaho and learned all about seed screening, using large-scale seed cleaning equipment, numerous seed cleaning techniques, seed increase strategies, and ways to test seed viability.
- Forest Service facilities employees at the Salmon-Cobalt office helped us construct numerous different seed cleaning devices.

Ari and Katie learning about seed cleaning from Derek Tilley and Mary Wolf in at the NRCS Plant Materials Center in Aberdeen, Idaho.

Jessica McAleese's DIY 50-gal drum thresher at Swift River Farms.

Derek Tilley demonstrating the Tilley Bubbler Method for testing seed viability.

Derek Tilley demonstrating the use of the LA-H Laboratory Brush Machine to Diane.

Derek Tilley demonstrating the use of hand screens to clean debris from seed.

Seed Cleaning Tools

After learning about seed cleaning, we put together a set of handheld equipment we could use to clean our collections:

- Diverse selection of seed screens purchased from Seedburo Equipment Company and Strictly Medicinal Seeds for filtering out different sized debris and chaff from seed.
- 5 Gallon drum thresher as per Swift River Farm's design. Constructed by Jordan Schaeffer in Facilities. For crushing pods and breaking up larger stems.
- Wood and sandpaper seed scraper for abrading off pappus and other debris. Constructed by Cal Mincey in Facilities as per Derek Tilley's design.
- Rubber welcome mat and trowel for rubbing off seed coverings and pappus.
- Rubber mallets for crushing seed pods.
- Box fans and bins for winnowing (air screening) viable seed from non-viable seed and other debris.

Seed Cleaning Results and Methods

As of 12/31/23, all species collected before 10/23/23 were cleaned except for *Tetradymia canescens* and *Arnica cordifolia* totaling 27 species cleaned. *Arnica cordifolia* was not cleaned because we did not decide it was suitable for any of our seed mixes. Furthermore, we could not determine how to clean seeds from *Tetradymia canescens* without destroying them. The remaining species were collected experimentally past our seed cleaning phase and were not intended for use in 2023's seed mixes.

The following list provides details on the species we cleaned and how it was done.

- ***Arnica sororia*** – Rub between rubber mat and in between hands to remove pappus. Do not use rubber trowel as it breaks the seed. Winnow until desired cleanliness is achieved.
- ***Astragalus atropubescens*** – Threshed pods and stems. Sieved with 12/64 then 1/12 to separate most seeds. Crushed and rubbed remaining pods in sandpaper box. Sieve again with 12/64 then 1/12. Pick out larger chaff pieces then winnow until desired cleanliness is achieved.
- ***Astragalus purshii*** – Used Aberdeen Brush Machine. Sieved with 12/64 then 1/12 to separate most seeds. Pick out larger chaff until desired cleanliness is achieved.
- ***Astragalus scaphoides*** – Sieved with 12/64 to separate most seeds. Crushed remaining pods and stems with rubber mallet the sieved again with 12/64. Winnow until desired cleanliness is achieved.
- ***Calochortus eurycarpus*** – Crushed pods by hand. Sieved with 12/64, 1/12, then 30x30. Winnowed gently until desired cleanliness is achieved.
- ***Chaenactis douglasii*** – Rub seed with rubber trowel and mat to remove pappus. Pappus seems to resist fully coming off. Winnow until desired cleanliness is achieved.
- ***Cleomella serrulata*** – Dry pods and stems. Open pods by hand into bin. Sieve thoroughly with 1/12 to separate seed from pods and chaff. Some pods will remain with

the seed. Sieve intermittently with 1/12 to separate remaining seeds. Thresh remaining pods and stems. Sieve intermittently with 1/12 to separate any remaining seed. Winnow until desired cleanliness is achieved.

- ***Collomia linearis*** – Dry plants. The majority of seed will fall out but thresh the dried plants to ensure no seed is lost. Sieve with 1/12 to remove chaff. Winnow until desired cleanliness is achieved.
- ***Crepis acuminata*** – Rub seed with rubber trowel and mat to remove pappus. Sieve through 12/64 to remove large chaff. Sieve intermittently with 12/64 to gradually remove more chaff. Winnow until desired cleanliness is achieved.
- ***Eremogone spp***. - Rub old pods with rubber trowel and mat to remove seed. Sieve through 2.5/64 to remove chaff and empty pods. Winnow in place until desired cleanliness is achieved.
- ***Ericameria nauseosa*** – Rub with hands and rubber mat to remove pappus. Using rubber trowel will break the seed. Pappus fluff clumps together very easily so winnow in place to remove pappus from seed and chaff. Winnow until desired cleanliness is achieved.
- ***Erigeron pumilus*** – Rub with rubber trowel and mat to remove pappus. Do not winnow, seed is too small to winnow safely. Rubbing is all that is needed in order to achieve desired cleanliness.
- ***Eriogonum umbellatum*** – Rub flower heads with rubber trowel and mat to dislodge remaining flowers from old umbel stems and to rub off dried petals, revealing seed. Sieve through 1/12. Winnow to remove additional small chaff. Repeat rubbing process. Sieve through 1/12. Repeat this process until desired cleanliness is achieved.
- ***Grindelia squarrosa*** – Clip heads and place in box. Shake old flower heads in box to dislodge seed stuck in place. Sieve through 1/12. Remove remaining heads and shake again in box x2. Sieve again through 1/12. Place all old heads in a box. Sieve those heads with 12/64 to collect bunched seeds. Rub bunched seeds with rubber trowel and mat to dislodge and break up. Sieve with 1/12 to remove chaff from rubbing. Place all seed and chaff in same box. Winnow to remove some of the chaff. Sieve intermittently with 8/64 to remove small amounts of floating chaff. Sieve through 30x30 to remove small thin chaff. Repeat sieving and winnowing process until desired cleanliness is achieved.
- ***Helianthus annuus*** – Sieve with 12/64 then 1/12. Winnow until desired cleanliness is achieved.
- ***Ionactis alpina*** – Rub with rubber trowel and mat to remove chaff. Winnowing will also remove good seed. Winnow gently in place until desired cleanliness is achieved.
- ***Lewisia rediviva*** – Remove seed from dried flowers by hand. Sieve through 1/12 to remove chaff. Winnow until desired cleanliness is achieved.
- ***Lupinus spp***. - Only a few pods were collected. Open with hands to remove seed. Pick them out by hand because there are very few.
- ***Machaeranthera canescens*** – Rub with rubber trowel and mat to remove pappus. Winnow carefully in place until desired cleanliness is achieved.

- ***Mentzelia laevicaulis*** – Crush pods with mallet. Sieve with 12/64 to remove seed. Winnow carefully until desired cleanliness is achieved.
- ***Penstemon deustus*** – Dry plants. Thresh plants until well broken up. Sieve out dust and seed from remaining stem parts and unbroken pods. Sieve with 30x30 mesh to remove chaff. Sieve with 40x40 mesh to remove dust. Put handfuls of remaining unbroken pods into plastic bag and crush with rubber mallet. Not all pods will open. Repeat process until all pods are broken. Sieve as listed above until desired cleanliness is achieved.
- ***Phacelia hastata*** – Dry plants. Thresh plants until stems are thoroughly broken. Sieve with 1/12 to separate broken stems and intact pods from dust, fluff, and seed. Sieve pods and broken stems with 12/64 to remove large chaff. Rub small amounts of intact pods with trowel and rubber mat to extract remaining seed. Sieve that stock with 12/64 to remove sticks x2. Sieve with 30x30 meth to remove dust. Combine all stock. Sieve with 1/12. Winnow until desired cleanliness is achieved.
- ***Phacelia linearis*** – Dry plants. Thresh until well broken. Sieve with 1/12 and 2.5/64 to remove chaff and stems. Sieve with 40x40 mesh to remove dust. Rub the remaining pods to break open and remove seed. Repeat sieving process listed above. Winnow until desired cleanliness is achieved.
- ***Plantago patagonica*** – Dry plants then thresh until well broken. Sieve with 1/12 to get most seeds. Rub the remaining debris with rubber trowel on mat until pods come off stems. Sieve with 1/12 then with 30x30. Winnow gently until desired cleanliness is achieved.
- ***Senecio integerrimus*** – Rub seed with rubber trowel and mat to remove pappus. Winnow until desired cleanliness is achieved.

Seed Cleaning Photos

SVS technician Jake, rubbing off pappus from *Ericameria* seeds with a rubber trowel and mat.

Katie Baumann using our 5-gal DIY drum thresher to break open *Astragalus* seed pods.

Budget Spending

A total of $1,326.69 was spent on seed cleaning materials and equipment. The list of purchased items includes, mason jars, various seed screens, galvanized steel containers of various sizes, PPE, and other various materials used to clean seed or construct seed cleaning equipment. The entirety of our seed cleaning purchases are considered one-time purchases and will be available for use in future seasons.

Time Spent

Seed cleaning by hand is monumentally time intensive, especially considering the large variety of species the program collected. To accomplish what we did took well over 220 cumulative work hours including all help received on this effort. This is the reason the program intends to purchase seed cleaning equipment, as the time constraints required to hand clean ever-increasing quantities of collected seed is not sustainable.

Seed Mixes Summary

Significant work was put into designing our seed mixes. Each location selected for seedball application had a separate seed mix designed specifically to meet the needs of that site. Special effort was taken to ensure that species selected for a site's mix were capable of growing

there, whether it was appropriate to introduce potentially new species there, and how they would compete with other species both in the mix and those already present at the site.

Purchased Seed

As mentioned previously, some species were not prioritized for collection because they were more readily available through commercial seed distributors. The list of species and the amount purchased is available in the following table. Significant care was taken in the selection of seed distributors and seed stock to ensure a lack of contaminants and that the seed source was applicable to the Salmon area. BFI Native Seeds was deemed to be the best source both in the efficacy of seed stock and pricing. Seed was purchased mid-September.

Species	Qty. (lbs.)	Price per lbs.	Total
Achnatherum hymenoides – Indian Ricegrass	5	$18.00	$90.00
Elymus elymoides – Bottlebrush Squirreltail	6	$26.00	$156.00
Elymus lanceolatus – Thickspike Wheatgrass	5	$7.50	$37.50
Hesperostipa comata – Needle and Thread Grass	3	$95.00	$285.00
Poa secunda – Sandberg's Bluegrass	6	$12.00	$72.00
Pseudoroegneria spicata – Bluebunch Wheatgrass	5	$14.00	$70.00
Achillea millefolium – Western Yarrow	2	$40.00	$80.00
Balsamorhiza sagittata – Arrowleaf Balsamroot	1	$75.00	$75.00
			$868.50

Cleaned Seed Measurements

Seed cleaning resulted in just under 9lbs of cleaned seed. To calculate seeding rates, seed per lb. is typically necessary. However, because the seedball recipe is by parts/volume, we required volume measurements of our seed as well. This required seed counting and weighing to estimate actual amounts of seed in hand. This sort of information is often available for more common seed, but as our collections included more uncommon species, information on these measurements was not available. Measurements and calculations are shown in the table below.

Species	Collection Mass (lb)	Mass of 1 Seed (lb)	Seed/lb	# of Seed in Collection	Seed/ft @ lb/acre	Mass(g) / .5 tsp	# Seed / .5 tsp
Arnica sororia	0.31085	1.91491E-06	522,218	**162,332**	12	0.747	860
Astragalus atropubescens	0.09480	6.07993E-06	164,476	**15,592**	4	2.253	817
Astragalus purshii	0.03527	6.08576E-06	164,318	**5,796**	4	2.326	843
Astragalus scaphoides	0.21164	1.26915E-05	78,793	**16,676**	2	2.352	409
Calochortus eurycarpus	0.09039	2.84825E-06	351,093	**31,735**	8	1.02	790
Chaenactis douglasii	0.01984	2.36544E-06	422,754	**8,388**	10	0.34	317
Cleomella serrulata	1.90259	1.56818E-05	63,768	**121,325**	1	1.93	271
Collomia linearis	0.12125	2.46399E-06	405,846	**49,211**	9	1.819	1628

Species	Collection Mass (lb)	Mass of 1 Seed (lb)	Seed/lb	# of Seed in Collection	Seed/ft @ lb/acre	Mass(g) / .5 tsp	# Seed / .5 tsp
Crepis acuminata	0.20283	8.38478E-06	119,264	**24,190**	3	0.744	196
Eremogone sp.	0.01323	1.20501E-06	829,869	**10,977**	19	1.041	1905
Ericameria nauseosa	0.11464	2.49857E-06	400,229	**45,882**	9	0.605	534
Erigeron pumilus	0.18519	5.55554E-07	1,800,004	**333,339**	41	0.489	1941
Eriogonum umbellatum	0.28660	3.75114E-06	266,585	**76,404**	6	0.829	487
Grindelia squarrosa	2.08778	2.97183E-06	336,493	**702,522**	8	1.384	1027
Helianthus annuus	0.49604	1.62317E-05	61,608	**30,560**	1	1.589	216
Ionactis alpina	0.10141	1.98416E-06	503,992	**51,111**	12	0.372	413
Lewisia rediviva	0.01984	2.80885E-06	356,018	**7,064**	8	1.491	1170
Lupinus sp.	0.00028	2.79987E-05	35,716	**10**	1	--	--
Mentzelia laevicaulis	0.11023	2.81279E-06	355,519	**39,189**	8	0.702	550
Penstemon aridus	0.01543	7.49571E-07	1,334,097	**20,588**	31	1.169	3438
Penstemon deustus	0.49383	3.44827E-07	2,900,006	**1,432,124**	67	1.067	6822
Penstemon sp.	0.33069	1.28205E-06	780,002	**257,941**	18	1.304	2242
Phacelia hastata	0.16094	1.85188E-06	539,992	**86,905**	12	1.343	1599
Phacelia linearis	1.08467	6.28317E-07	1,591,554	**1,726,316**	37	1.024	3593
Plantago patagonica	0.04409	1.75431E-06	570,023	**25,134**	13	1.627	2045
Senecio integerrimus	0.07716	2.71338E-06	368,544	**28,438**	8	0.745	605
Elymus elymoides	6.00000	6.1068E-06	220,000	**982,512**	5	0.923	333
Hesperostipa comata	3.00000	1.24781E-05	115,000	**240,420**	3	1.205	213
Poa secunda	6.00000	1.05822E-06	1,000,000	**5,669,911**	23	0.768	1600
Pseudoroegneria spicata	5.00000	7.69412E-06	139,000	**649,847**	3	0.788	226
Balsamorhiza sagittata	1.00000	1.66417E-05	55,000	**60,090**	1	0.929	123
Achillea millefolium	2.00000	3.82134E-07	4,400,000	**5,233,764**	101	1.456	8400
Achnatherum hymenoides	5.00000	9.21531E-06	162,000	**542,575**	4	2.186	523

With this information in hand, we were able to accurately say how much seed we were adding to each mix. As an informal number, we attempted to include around 2,000 seeds into the mix for each species collected.

Seedball Sites

The selection criteria for seedball treatment locations were broad in nature. We wanted to test our seedballs in a variety of different soil types, steepness, elevations, and dominant vegetation types. We also selected sites that had a low weed presence or sites that had previously been treated for weeds. One site is located up Kriley Gulch, two are found uphill from the Salmon River Road, one is located in a flat off Panther Creek, and the last two are located near Carmen Creek on the McFarland Ranch.

Base Mix Design

In an attempt to standardize the seed mix process, we designed a base mix of species that would be appropriate for use at every treatment site and that could be amended with additional species to tailor the efficacy of the mix more closely to the site. The following species were selected for the base mix: *Elymus elymoides, Hesperostipa comata, Poa secunda, Pseudoroegneria spicata, Achillea millefolium, Balsamorhiza sagittata, Machaeranthera canescens, Astragalus atropubescens, Phacelia hastata, Phacelia linearis, and Plantago patagonica.*

Seed Mixes

As mentioned above, separate seed mixes were designed for each location made up of species we deemed would be the most successful and appropriate. The sites at Carmen Creek and near Panther Creek have two different mixes each, a more conservative mix for the transects, and a more experimental forb mix to be dispersed around the site. The seed mixes for each site are listed below:

Panther Creek (Telephone Pole Flat) Transect Mix: *Astragalus purshii, Chaenactis douglasii, Ericameria nauseosa, Erigeron pumilus, Helianthus annuus, Mentzelia laevicaulis, Penstemon deustus* + BASE MIX.

Panther Creek (Telephone Pole Flat) Forb Mix: *Achillea millefolium, Balsamorhiza sagittata, Collomia linearis, Crepis acuminata, Eremogone sp., Ericameria nauseosa, Erigeron pumilus, Eriogonum umbellatum, Helianthus annuus, Ionactis alpina, Lupin sp., Machaeranthera canescens, Mentzelia laevicaulis, Penstemon aridus, Penstemon deustus, Phacelia hastata, Phacelia linearis, and Plantago patagonica.*

Salmon River Breaks (Buster Gulch) Mix: *Astragalus purshii, Astragalus scaphoides, Chaenactis douglasii, Ericameria nauseosa, Erigeron pumilus, Helianthus annuus, Mentzelia laevicaulis, Penstemon deustus* + BASE MIX.

Salmon River Breaks (Newland) Mix: *Astragalus purshii, Chaenactis douglasii, Ericameria nauseosa, Erigeron pumilus, Helianthus annuus, Mentzelia laevicaulis, Penstemon deustus* + BASE MIX.

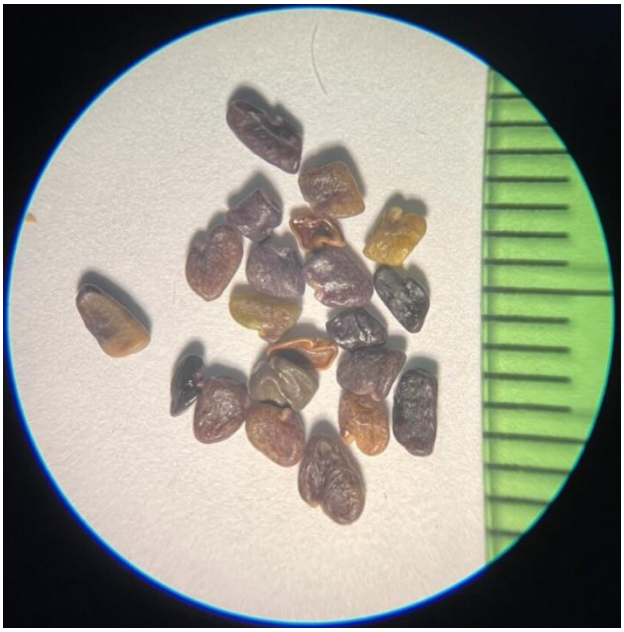
Kriley Gulch Mix: *Astragalus purshii, Chaenactis douglasii, Cleomella serrulata, Ericameria nauseosa, Erigeron pumilus, Grindelia squarrosa, Lewisia rediviva* + BASE MIX.

Carmen Creek Transect Mix: *Arnica sororia, Astragalus scaphoides, Calochortus eurycarpus, Collomia linearis, Ericameria nauseosa, Erigeron pumilus, Eriogonum umbellatum, Grindelia squarrosa, Ionactis alpina, Lewisia rediviva, Penstemon sp.,* + BASE MIX

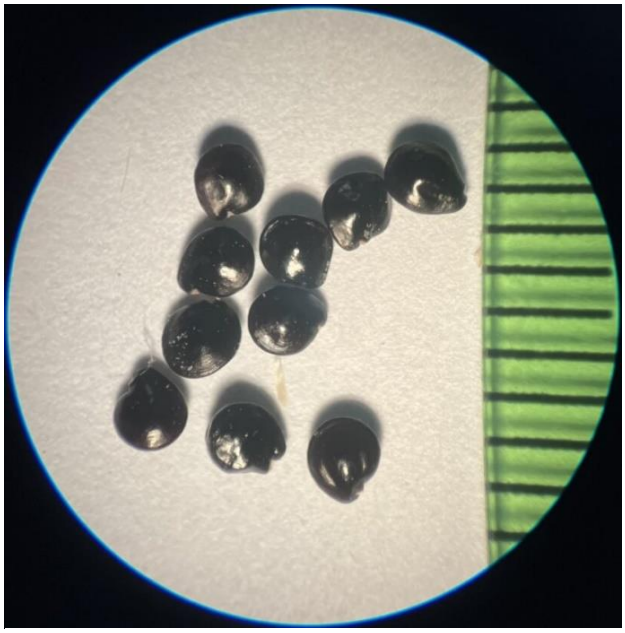
Carmen Creek Forb Mix: *Arnica sororia, Astragalus atropubescens, Astragalus scaphoides, Calochortus eurycarpus, Collomia linearis, Crepis acuminata, Eremogone sp., Erigeron pumilus, Eriogonum umbellatum, Ionactis alpina, Machaeranthera canescens, Penstemon sp., Phacelia hastata, Phacelia linearis, Poa secunda, Balsamorhiza sagittata, and Achillea millefolium.*

Hi-Res Seed Imagery

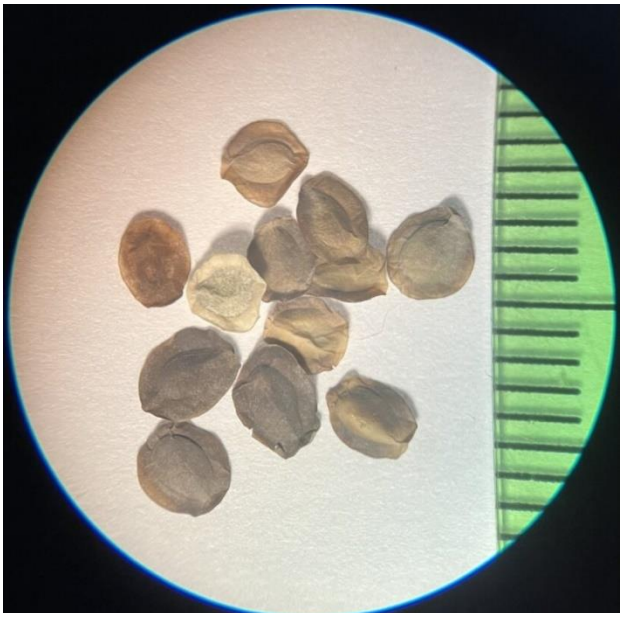
One of this program's goals is to contribute to public knowledge concerning the species we collected seed from. As mentioned above, very little information on things like growing habits, flowering/fruiting timing, the shape and size of seeds, how to collect and clean the seed, and how to properly store the seed is available. As such, we intend to submit the data we have collected and the things we have learned to various online databases so others working towards the same ends may also benefit from our work. Detailed seed imagery from various species can be found below and more imagery can be made available upon request:



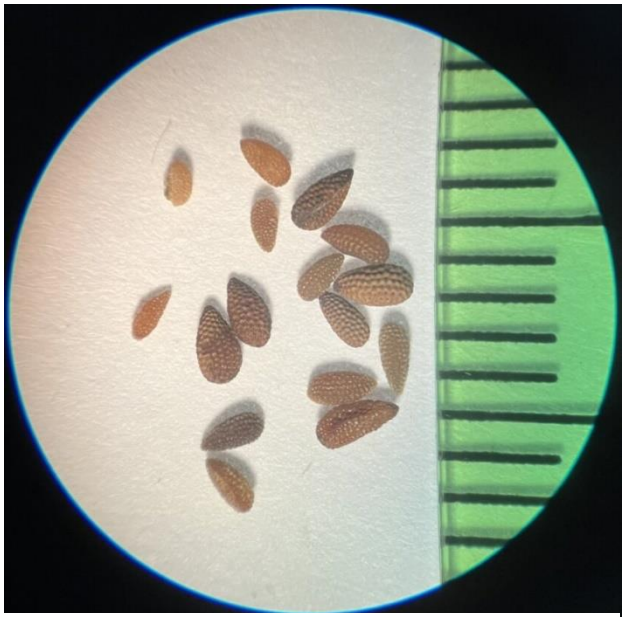
***Astragalus atropubescens* seed**



***Lewisia rediviva* seed**

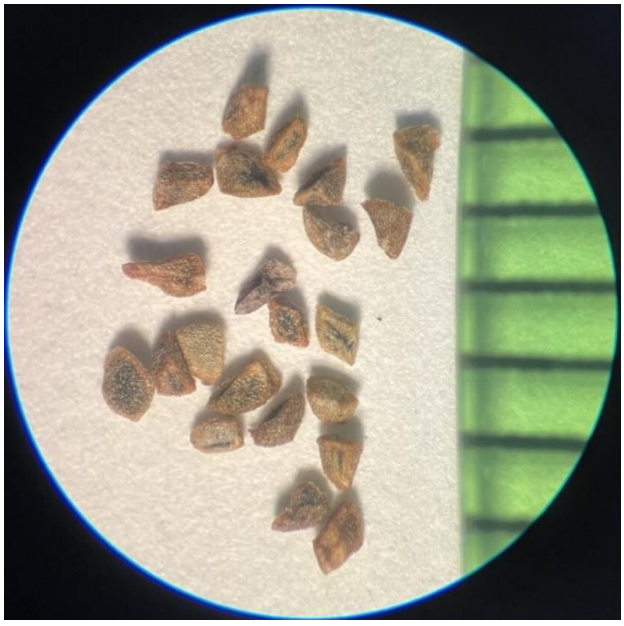


***Mentzelia laevicaulis* seed**



***Phacelia hastata* (small) seed & *Phacelia heterophylla* (large) seed**

***Eriogonum umbellatum* seed**



***Penstemon deustus* seed**

Seedball Summary

Seedball Technology, Methodology and Recipe

Seedballs are an ancient technology that has been adapted to ecological restoration in recent years. Seedballs are a conglomeration of clay, soil, compost, and seed. They are designed to time seed dispersion with a germination event and protect the seed from predation, while providing valuable nutrients to new seedlings. The Salmon-Challis National Forest and surrounding areas consists of extremely dry and steep country with a long history of disturbed ecosystems and shallow soil. Due to these difficult hurdles, seedball technology was selected over aerial/hand seeding methods in order to give our seed a better chance of survival.

With the help of Dr. Elise Gornish, a professor at the University of Arizona studying seedball technology in arid environments, we identified our strategy for seedball use. We follow Dr. Gornish's recipe consisting of 5 parts clay, 3 parts compost, and 1 part seed. We chose to modify this recipe slightly by adding health soil, soil dug from a post-wildfire location containing high levels of activated carbon and soil microorganisms. We also added cayenne pepper to the recipe as it is known to deter animals and insects while causing no harm to the soil or surrounding environment. After these additions, our recipe is as follows:

- 4 parts clay
- 1 part health soil
- 3 parts compost
- 1 part seed
- 1 tbsp cayenne pepper

Making Seed Balls

With all ingredients in hand, we began experimenting with making seedballs by hand. By equating one part to one cup, we combined all the ingredients in a tub. By slowly adding water, the mixture becomes sticky and can be easily rolled into small balls. We attempted to keep the seedballs between 0.25 and 0.5 inches in diameter and each batch was able to produce approximately 150-200 balls. Our first attempt contained seeds only from our base mix, and then we began rolling balls according to the other mixes we designed. In addition to rolling seedballs for each of the seed mixes mentioned previously, we made batches that only contained either *Grindelia squarrosa*, *Penstemon sp*. or *Cleomella serrulata*. The number of seedballs we made for each mix is as follows:

- Base Mix: 131
- Kriley Gulch Transect Mix: 139
- Carmen Creek Transect Mix: 143
- Carmen Creek Forb Mix: 250
- Newland Transect Mix: 133
- Buster Gulch Transect Mix: 138
- Panther Creek Transect Mix: 142
- Panther Creek Forb Mix: 170
- *Penstemon* species: 161
- *Grindelia squarrosa*: 334
- *Cleomella serrulata*: 341

In future years, we plan to mass produce seedballs using cement mixers, however hand rolling was suitable to meet our goals for this year's treatments. Seedballs were placed in plastic trays after rolling to let them dry out.

Seedballs laying out to dry.

Ari measuring out a seed mix.

Cup displaying part of a seed mix.

Budget Spending

A total of $1,362.29 was spent on seedball materials. These items included materials like the seed mentioned above, mini picks, compost, measuring cups, scales, and other various pieces of equipment. Most of these purchases are consumables items, however, very little of what was purchased was used this year and should extend its use through at least another field season.

Seedball Application Strategies

We applied seedballs to our treatment sites in two primary ways: placing them directly on the ground or placing them in small divots dug by a mini pick. Research on micro-topography has revealed that small divots have lower temperatures, collect more litter, water, and nutrients so we wanted to utilize this strategy to see if it could give our seedlings a greater chance of survival. Additionally, at each site, we placed seedballs along monitoring transects every half meter using the small divot strategy to monitor for success in future years.

Seedball nestled in small divot.

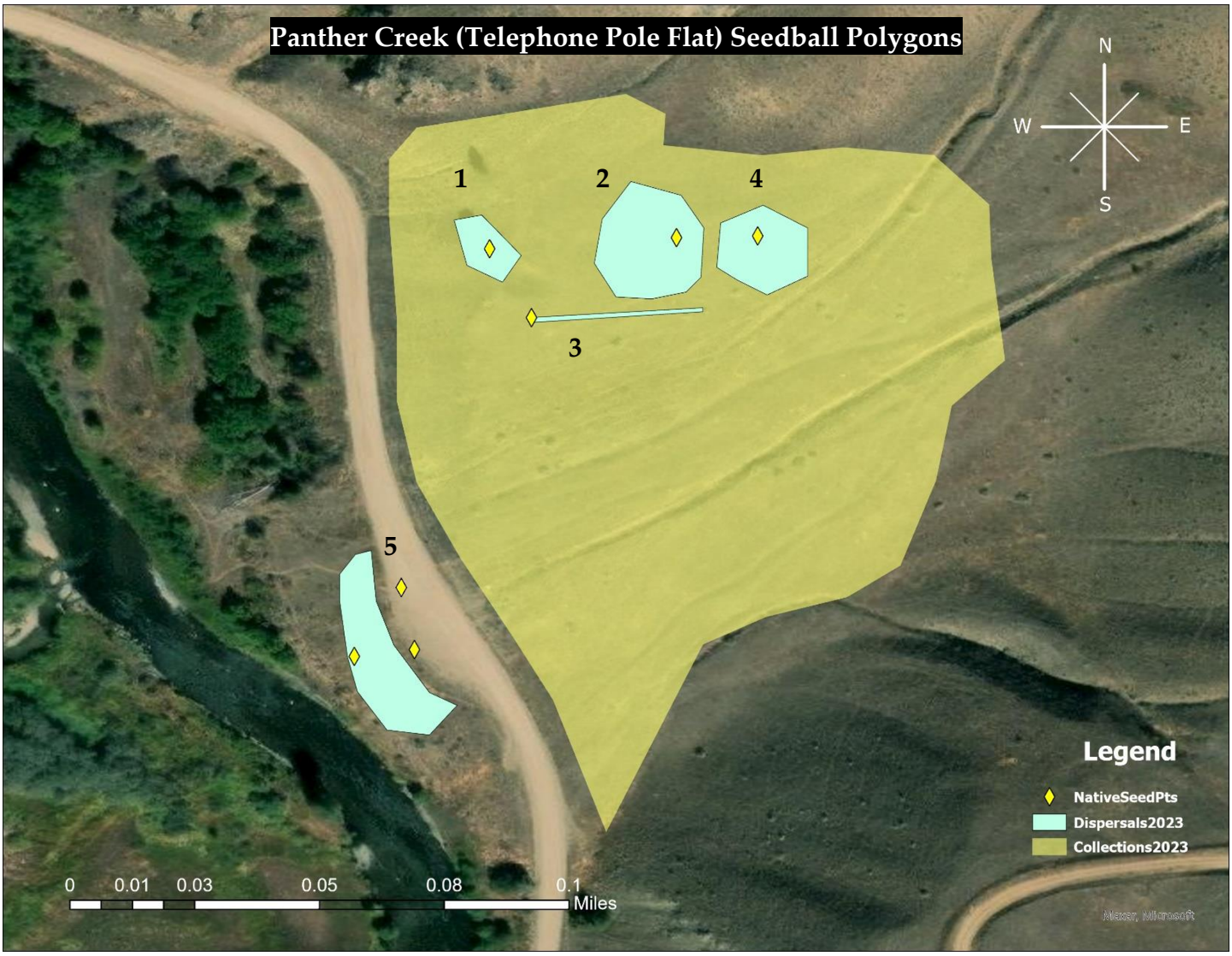
Katie and Diane reading a monitoring transect before applying seed balls.

Seedball nestled in a small divot.

Seedballs being put out along monitoring transect.

Seedball Treatment Polygons

More maps of polygons can be made available upon request. Seedball treatment polygons covered just over 4.1 acres in total.



Multiple treatments were performed at this site:

1. *Cleomella serrulata* seedballs dispersed on the soil surface.
2. Panther Creek Forb Mix seedballs dispersed in small soil divots.
3. Panther Creek Transect Mix seedballs placed in small soil divots along monitoring transect.
4. The remaining Panther Creek Transect Mix seedballs dispersed on the soil surface.
5. *Cleomella serrulata* and *Grindelia squarrosa* seedballs dispersed on the soil surface.

Multiple treatments were performed at this site.

1. Kriley Gulch Transect Mix seedballs placed in small soil divots along monitoring transect.
2. The remaining Kriley Gulch Transect Mix seedballs dispersed on the hillside.
3. The remaining Kriley Gulch Transect Mix seedballs placed in small soil divots on the hillside.
4. *Cleomella serrulata* seedballs dispersed on the soil surface.

Multiple treatments were performed at this site:

1. Carmen Creek Transect Mix seedballs placed in small soil divots along monitoring transect.
2. Carmen Creek Forb Mix, *Penstemon*, and *Grindelia squarrosa* seedballs dispersed in small soil divots.
3. Carmen Creek Forb Mix, *Penstemon*, and *Grindelia squarrosa* seedballs dispersed in small soil divots.
4. Carmen Creek Transect Mix seedballs placed in small soil divots along monitoring transect.
5. *Grindelia squarrosa* and *Cleomella serrulata* seedballs dispersed in small soil divots and on the soil surface.

Budget Summary

The following table provides an overview on the budget breakdown for the Native Plant Restoration Program's pilot year spending and funding sources. More information on specific line items can be provided upon request.

Category	USFS Funding	SVS Agreement	Total Spent
Seed Collection Materials	$339.18	$90.71	$489.89
Seed Storage Materials	$889.25	$174.21	$1,073.46
Seed Cleaning Materials	$662.50	$664.19	$1,326.69
Seedball Materials	$0.00	$1,362.69	$1,362.29
Office Supplies	$0.00	$38.70	$38.70
Lodging	$0.00	$120.00	$120.00
Shipping Costs	$72.80	$76.90	$149.70
	$2,033.73	**$2,527.00**	**$4,560.73**

Looking to the Future

Project Planning and New Workflow

I began working on this project on June 19th, 2023, directly in the middle of the field season and with little to no project planning done before hand. With these constraints, the season felt rushed and poorly planned out. Seeds were collected that were not used, surpluses of materials were purchased, and learning about the landscape and its diverse ecosystems had to be done on the fly. Even though we managed to meet our goals for the project's pilot year, we are immensely excited about having the time to plan and prepare before the coming field season. We have designed a new workflow that will minimize redundancies and streamline our process.

New Funding

We are immensely excited about a potential new funding source for the program. We submitted a three-year budget request via the Bipartisan Infrastructure Law (BIL) and have been granted our request for year one at a total of $275,000. Here's how we plan to utilize it:

- **New Equipment** – Seed cleaning was a time intensive endeavor, and as the quantity of seed we need to clean increases over time, it is going to become a greater and greater

constraint. To this end, we have plans to purchase large scale seed cleaning equipment that would dramatically reduce the time it takes to clean seed as well as raise the level to which we are able to clean it. Some collected seed was unable to be cleaned either because we didn't have the time, or because we did not have the necessary tools. We plan to purchase the LA-H Laboratory Brush Machine that we were lucky to try out while at the Plant Materials Center in Aberdeen, Idaho, and a large air screener.

- **New Technicians** – Through SVS we plan to hire new technicians/interns who will assist with on the ground project work. The SCNF Botany, Invasive species, and Pollinators program also hopes to bring on new technicians that could potentially assist with our work as well.

- **Seed Increases** – We plan to continue working with the Coeur d'Alene Nursery, contributing to the National Seed Strategy, and making new plant species more readily available for restoration efforts. Additionally, we hope to use a portion of the new funding to begin contracting local farms to conduct seed increases as well. The growing of native forbs collected from native populations provides a stable and sustainable source of viable seed that we absolutely want to capitalize on as much as possible.

- **New Technologies** – We are in preliminary talks with Avary Drones, to learn whether they would be appropriate for seedball dispersal. Drones would allow us to increase our treatment areas and reach sites that may be too time consuming to visit on the ground. Additionally, we are looking into new research such as soil microalgae, carbon coated seed treatments and crypto biotic soil crust slurries that we hope will give our seedballs an added edge of competition.

Monitoring for Success

Lastly, come springtime, our first task will be to revisit our seedball treatment sites to determine the success of the strategy. Not only are we excited to learn about which of our application strategies worked the best or which plants are outcompeting others, we need to know how well the seedball technology works on this forest as a whole. Though we are staying positive about what the results we hope to see, we need to be prepared to pivot to a new strategy should the need arise.

Contacts

A huge thank you to Amy Thornson Cramer, Jordan Schaeffer, Cal Mincey, Dr. Elise Gornish, Derek Tilley, Mary Wolf, Andy Klimek, Nathan Robertson, Michael Whitson, Tova Spector, Jennifer Carson, Hannah Alverson, Courtney Frost, Sarah Windsor, Janelle Brown, Becca Aceto, BIP Staff: Katherine Baumann and Chris Stenlund, SVS Staff: Jenny Gonyer, Maggie Seaberg, Jessica McAleese, Tiffany Shelton, Kate Yeater, Jake Waring, SVS Interns:

Kainoa, Henry, Mercy, and Romina, and everyone involved in our Native Plants Communities Restoration Working Group. We absolutely could not have accomplished what we did without the support and cooperation of everyone involved. Please feel free to reach out if you have any further questions and keep your ears to the ground for future volunteer/education opportunities this coming season.

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