April 01, 2026

RE: Agreement No. **22-CS-11041300-032**

Agreement Title: **Native Plant Restoration**

Performance Period: **01/01/2025 - 12/31/2025**

Annual Performance Report

Executive Summary – 2025 In Review

The following report details the work performed by the Salmon Valley Native Plants and Restoration Program ("Program") during Jan 1 – Dec 31, 2025 under coast-share agreement 22-CS-11041300-032 ("Agreement"). The Program showed some exciting growth in 2025, with the addition of new staff and development of seed increase contracts, while also continuing to maintain momentum in key areas such as diverse and productive site-specific seed collection, cleaning, and dispersal. Highlights and key figures from 2025 work detailed in the following report include:

- Doubled Program staff by hiring a full-time, permanent Program Coordinator with extensive prior experience in high desert plant ecology, restoration research and advocacy to assist in all aspects of planning and performing Program work.
- Established two innovative "low risk, first-time grower" seed production contracts with local growers to establish seed increase fields – following best practices for maintaining genetic diversity – from which native seed of priority forb species can be harvested for future projects. Each grower will produce the same two species: hoary tansyaster (*Dieteria canescens*) and Douglas dustymaiden (*Chaenactis douglasii*).
- Conducted most extensive post-seeding monitoring for the Program to date, generating enough data to make some broad but valuable estimates of restoration success and challenges from 2024 seeding projects.
- Scouted and collected seed from over 65,000 individual plants in over 300 populations across more than 1,400 acres at 110 sites, all within 50 miles of Salmon, following responsible and evidence-based collection and bulking protocols.
- Collected seed from 70 native species – most at high volumes for restoration projects, and some at smaller volumes for education, research or propagation – totaling approximately 20 million seeds and 45 bulk pounds after cleaning.
- Established a seed library for education, research, and partnership development
- Acquired additional seed cleaning equipment to allow for more precise and efficient seed cleaning, further developing our fully-integrated collection-to-storage workshop facility as a major Program asset and a foundation for building future partnerships.

- Designed 7 diverse seed mixes catered to specific restoration site types to be used in seedballs as well as in bare-seed restoration strategies (Fig. 1).
- Produced over 315,000 seedballs with modified recipes and stricter control on seed rates and seedball size than prior years, aiming for fewer seeds per ball (target: 10), smaller balls (target: 2.2 g) to reduce seedling competition and prevent trapping small seeds, and a softer structure to improve dissolvability in droughty sites.
- Seeded over 1,400 restoration islands across over 1,000 acres at 8 main sites.
- Continued to leverage affiliate status of SVS employees with USDA SCNF to reduce the burden on SCNF employees for accurately and correctly reporting program activities and data to relevant internal tracking systems such as FACTS.
- Coordinated or contributed to several volunteer and youth education events focused on native plants and pollinators, ranging from pre-school to tribal youth to landowners.

These and other accomplishments in 2025 left the Program in a strong position to continue to achieve the key goals of this Agreement, including making diverse and genetically appropriate seed available for restoration, conducting targeted native restoration focused on improving plant community diversity and pollinator resources, identifying effective regional restoration methods, and contributing in diverse ways to the development of regional restoration capacity. The Program is on track to complete the terms of this Agreement by the end of FY 2027, and looks forward to working with staff of the USDA and the SCNF to identify continued value in, and support for, this work.

Figure 1. A diverse mix of native forb seed prepared for 2025 restoration activities.

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Please note that plants are variously referred to in this report using common names, Latin names, and USDA plant codes. See the Appendix Table 5 for a full reference list of names.

Summary of activities completed during the performance period

Timeline	Activities
Late-Winter 2025	•Compiled and distributed 2024 annual report. •Finished workshop setup and installed electrical appliances. •Planned and coordinated Pivot Corner for Pollinators event. •Created native plant handout materials for public school "Agriculture Week". •Conducted project planning and updated data to relevant databases. •Conducted outreach activities with East-Central Idaho Native Plant Communities Working Group and other potential partner organizations from the federal, state, non-profit, and education sectors. •Attended the National Native Seed Conference. •Continued developing seed zones and selected sites for future seedball dispersion. •Developed seedball monitoring protocol. •Initiated hiring process for Program Coordinator
Spring 2024	•Assessed equipment inventory and acquired new materials for seed collection, seedballs, and seed cleaning. •Worked with partners to assess project accomplishments, strengths, and weaknesses. Developed plan to increase project capacity. •Completed hiring process and onboarding for Program Coordinator • Conducted 2024 seedball monitoring. •Attended Noxious Weed training organized by members of the Working Group •Program Manager attended Wilderness First Responder Training. •Updated restoration sites and target species for Fall/Winter 2025. •Began phenology monitoring and population scouting and mapping. •Trained and onboarded three seasonal SVS technicians in several aspects of native plant ID, phenology, and seed collection
Summer 2024	•Continued phenology monitoring and population mapping. •Revisited 2024 seedball monitoring points for summer survival data. •Conducted seed collection efforts and hosted one volunteer seed collection event. •Began cleaning seed as soon as each species collection was complete. •Acquired additional seed cleaning equipment to improve efficiency and precision. •Drafted and finalized low-risk seed grower contracts, publicly solicited for interested growers, and executed two 2-year contracts for producing seed for two native forbs. •Developed propagation protocols and guidance for genetic maintenance in native plant propagation, to accompany seed increase contract. •Hired and onboarded new seasonal crew to replace departed crewmembers.
Fall 2024	•Continued seed collection and population monitoring. •Continued cleaning seed and measuring vital seed lot specifications. •Travelled to USDA Plant Material Center in Aberdeen ID to consult with their staff on seed cleaning tasks and to clean seed that was impractical for cleaning in workshop. •Worked with FS staff to finalize restoration site targets and species mixes. •Designed and mixed 7 seed mixes for seedballs and bare seed dispersal. •Produced tens of thousands of seedballs for each mix; 315,000 in total •Coordinated several days of seed dispersal with volunteers. •Purchased supplies and developed Program Seed Library •Dispersed seedballs and bare seed mixes on the landscape, employing Program staff and SVS seasonals •Sent seed for increase contracts away for lab testing. •Local seed growers received seed for seed accessions and began process of site preparation, germinating seed, and potting plants. •Conducted seed moisture tests for remaining seed to prepare for winter storage •Acquired milkweed seedlings, coordinated volunteer landowners, and assisted with planting and seeding of milkweed.
Winter 2024	•Compiled field data from the 2025 field season for Annual Report. •Uploaded relevant data to the appropriate USDA FS databases (FACTS). •Initiated inventory, seed moisture testing and sealing for storage of leftover seed. •Communicated with local growers about status of germination and contract reporting. •Began preparing presentations for various conferences and symposia in early 2026 (Idaho Noxious Weed Conf, National Native Seed Conference). •Began planning for Program Manager departure and hire of Botany and Restoration Specialist.

Monitoring of 2024-deployed seed

Monitoring context and limitations

Monitoring the success of prior restoration efforts is an essential component of learning from and improving restoration strategies, especially in a region like Slamon where the need for effective restoration is growing. However, extensive and high-quality monitoring is time-consuming and comes at the expense of other activities, especially in programs like ours with very limited staff. Given this tradeoff, 2024 seeding efforts mainly prioritized seeding efficiency (covering the most ground) and microsite selection (getting seedballs into the sites most likely to succeed), with less priority on ease of follow-up monitoring. This focus was in line with the goals of this Agreement and facilitated maximized seeding output but created some limitations that constrained the kinds of monitoring that were possible.

The most significant barrier to monitoring was an inability to reliably relocate seedballs within 2024 restoration island points in spring 2025. Relocating seedballs was difficult and inconsistent because each point had a unique and unrecorded arrangement of seedballs, and the surface of steep slopes had sluffed and eroded over the winter with high ungulate wintering pressure at most sites. Additionally, the quantities of each seed mix combined and seeded prior to seeding each point varied and was only estimated at the time of seeding. This means only rough estimates are possible for the number of seeds that were likely sown at each point or island, allowing only rough estimates of the percent of seed sown that emerged. Finally, no seeds were sown without being incorporated into seedballs first, so the evaluation of seedball efficacy against other seeding methods was not possible. This prevents us from knowing whether seedballs were effective at improving success of any species at any site, compared to other possible dispersal methods.

These limitations allow for only basic descriptive results. The below sections are summarized from a more detailed monitoring report, which is available from SVS by request.

Monitoring Protocol

Nine sites were selected for monitoring for their accessibility by foot: Buster Gulch, Deadwater Gulch, Telephone Pole Flat, Uranium Gulch, Community Flat, Indian Creek Roadside north, Indian Creek Roadside south, Newlands Flat, and Uranium Pullout. The first four are upland slope sites, the last two are dry floodplain sites, and the remaining three are roadside sites.

Spring monitoring in early May involved revisiting 222 restoration island seeding points, including 210 on upland slope sites, 7 in dry floodplain sites, and 5 in roadside points (Fig. 2). Floodplain and roadside seeding points often had larger arrays of larger seedballs than upland slope points. We revisited in late June, but only for 7 of the larger roadside and floodplain seeding points. At both monitoring events, for each monitoring point, we relocated as many seedballs as possible, searching for at least five minutes but often longer, before proceeding to the next point. All relocated seedballs were inspected for seedlings, with each seedling identified to species. We recorded the number of seedballs found and average number of seedlings per seedball, identified the three most abundant species among those seedlings, and noted any other species growing in seedballs.

Figure 2. Spring monitoring of 2024-dispersed seedballs along the Salmon River Road (left) and above Buster Gulch (right).

Some seeding points made relocation too difficult to attempt, including sites that received sling-shotted seedballs and roadside sites seeded from a moving vehicle. These were not monitored for success in 2025. These sites were mostly limited to the milkweed mix or the roadside mix. Please refer to the 2024 Annual Report for details regarding seed mixes and seed dispersal.

In the process of monitoring, we produced a much-needed seedling ID photo guide which aided observers in identifying very small seedlings to species. We took macro photos of each species, and will continue to build this valuable resource in future years of monitoring. This will allow for personnel not already familiar with small seedling ID to be effective at monitoring, and can even be a resource to growers or agency staff.

Summarized Monitoring Findings

How many seedballs were relocated, and what happened to the rest?

In early May, we relocated one or more seedball at only 77 of the 222 seeding points visited, finding none at the remaining 145 points. This equates to only finding ~15% of the seedballs thought to be sown at the seeding points we visited. We relocated a higher percent of seedballs in the roadside and floodplain sites (20% -100%) than the upland slope sites (0.3% to 11%), owing to the larger size and steeper slopes of the upland slope sites. Failure to find the remaining 85% of seedballs could be due to GPS inaccuracy, over-burial of seedballs by slope erosion, destruction of seedballs by various disturbances, or direct consumption of seedballs by animals. Whether the seedballs we did not find had higher or lower levels of success than those we found is unknowable. Therefore, the following results, all drawn from the 15% we did find, offer only a rough (and likely inflated) estimate of the actual success across all seedballs sown in 2024.

How many plants emerged from seedballs?

Only 39% of the seedballs found had living seedlings in early May, with higher percents in roadsides (57%) than floodplains and upland slopes (33-35%). Two sites with only milkweed mixes had zero seedlings, while other sites such as Buster Gulch and Community flat had seedlings in over 83% of found seedballs.

Different sites had different numbers of seeds per seedball, so it can be misleading to compare the number of seedlings per seedball across sites. We instead use "emergence rate" – the number of seedlings that resulted from every 100 seeds estimated to have been in seedballs that we found – to compare across sites. The estimated emergence rate across all monitored seeding points was ~4% and ranged from 0 to 6% at individual sites. Dry floodplain sites had the lowest emergence rate (<1%), with variable but slightly higher emergence rates across the other site types.

Which species were most often observed?

In early May across all monitored seeding points, the most common species found growing from seedballs were HEAN3, GRSQ, CHDO, and PLPA2, roughly in that order. Other species that were often encountered were *Phacelias* (PHHA, PHHE2, PHLI), CLSE, VUOC, and ACMI. Species that were observed emerging from seedballs only rarely or at lower densities than others (in alphabetical order) were ASAT2, BASA3 (once), ELEL5, ERNA10, ERPU2, IOAL (twice), OEVI (once), PEDE4, and THLA. Seeded species that we did not observe as seedlings in any seedball were ACHY, ARDR4, ASSC4, ASSP, COLI2, SPCR, STAC, and VEBR. One *Penstemon* seedling was identified only to genus which tells us we did not detect at least 3 of the 5 *Penstemon* species sown.

The available data are too coarse to identify any patterns in species abundance across site types. Also, it is unknown if the species not observed as seedlings in any seedballs had germinated and failed to emerge, had not yet germinated and remained dormant for future seasons, or had some other fate (predation, fungus, damage, etc.). Finally, an important variable not taken into account in these results is differences in the number of seed of each species in the mixes, which prevents assessing and comparing species-specific emergence rates.

How did levels of spring emergence persist or fade by summer?

We compared early May and late June outcomes at only 7 seeding points (see above). Three of these points were dry floodplains sites, all at the Uranium Flat site, and the other four points were at roadside sites across three different locations. Early May monitoring relocated 68% of the seedballs sown, and 59% had seedlings, with an emergence rate of ~2.8% of estimated seed sown. Late June monitoring relocated 43% of the seedballs sown, and 21% had seedlings, with a summer emergence rate of ~0.4% of estimated seed sown. This summer emergence rate can be thought of as a survival rate, because it likely represents the seedlings that survived the period between monitoring events. These results suggest that roughly 1 out of 8 seedlings detected in early May was still alive in late June. Growing conditions in May and June 2025 were on the poorer side of average, with precipitation at ~53% of the 30-year average, and temperatures 3.7 °F warmer than average. This level of seedling attrition and overall low success is unfortunately in line with other dryland restoration research (Shackelford et al. 2021), especially for a drier and warmer than average year.

We also observed a reduced set of species surviving in late June compared to May, with no species alive in late June that weren't already present in early May. GRSQ, PLPA2, and CHDO were the most abundant in May and June, CLSE and ACMI decreased abundance through the season, and HEAN3, OEVI, and an unknown *Penstemon* were only present in early May.

Were any seedlings on track to successfully establish at seeded sites?

In late June, almost all surviving seedlings, especially perennials, were quite small and still in danger of succumbing to drought, though almost all individuals of two annual species (PLPA2, VUOC) were already setting some seed. These were the only two species that appeared to be on a trajectory toward completing reproduction in the first growing season. We observed anecdotally that even these reproducing individuals were making less seed than what wild (non-seeded) plants of these species were producing on nearby sites in 2025, suggesting something about the timing of seeding or seedball and microsite environment had delayed or stunted their growth. Our monitoring was too course to investigate the causes of this possible pattern, but we can speculate it may have had something to do with seedball structure or competition. Some seedballs had still not fully dissolved by spring, and this durable structure could have restricted young seedling growth, as has been reported for other similar seed technology (Baughman et al. 2023). Some microsites, especially those in roadside and floodplain sites, were weedy and highly colonized by other plants and this competition with established plants could also have stunted seedling growth from seedballs.

A wetter-than-average August-October in 2025 occurred after completion of monitoring and could have allowed surviving seedlings of annuls or perennials to thrive. Spring 2026 monitoring may revisit the most successful 2024 seeding points to check for this.

What did we learn about seedball size and seed rate?

The 2024 seedballs varied in size, even within individual batches, due to the production method. Also, different seed mixes had different amounts of seed per batch (seed rate). We estimate upland slopes seedballs had approximately 60 seeds per average-sized seedball, but roadside and dry floodplain seedballs higher seed rates (up to 200 or more per ball). Roadside sites (community flat, Indian Creek South) had among the highest emergence rates (5.5 – 5.8%), and because they also had higher seed rates, those sites resulted in high seedling densities (average of 11-12 seedlings per seedball) in early May. Compare that to the most successful upland slope site (uranium gulch; 5% emergence rate) which had lower seed rates and therefore resulted in lower mean densities of 3 seedlings per ball.

The smaller seedballs with ~60 seeds per ball resulted in less interactions between seedlings growing out of the same ball (they averaged 0.8 seedlings per seedball), though we can only speculate if those interactions were positive (facilitation; e.g. Longland & Dimitri, 2016), negative (competition or priority effects; e.g. Johnstone et al. 2026) or inconsequential for each of the species involved. If competition was the most important interaction, larger seedballs with higher seed rates with an average of 11 seedlings per seedball likely reduced chances of success for those seedling due to overcrowding in the dry spring of 2025, whereas the smaller seedballs resulting in 3 or less seedlings per ball had reduced competition in each seedball (Fig. 3). If facilitation was an important interaction in seedballs, then perhaps seedball size and seed rate was appropriate for many of the balls sown in 2024.

Figure 3. Example of a seedball with high rates of germination and emergence, but likely too-crowed for optimal seedling survival as the seedlings of at least 6 species try to survive the dry down of summer. All plants in this photo came out of the seedball.

The overall small size of seedlings found at both monitoring events (especially in seedballs with many seedlings) when compared to adjacent wild seedlings leads us to believe that competition had a strong impact on seedling growth, but we can only speculate given the current data. If the growing season had been more conducive (wetter and more mild temperatures) and produced higher emergence and survival rates, both sizes/rates of seedballs used in 2024 would have likely resulted in more competition than desired. Others have found that overseeding can hedge against complete failure in dry years but can lead to reduced success in good years due to competition (Shackelford et al. 2021). Restoration efforts with limited seed resources but flexibility to repeat restoration efforts in multiple years (like our efforts), would be wise to avoid overseeding.

The above findings from monitoring of 2024 efforts were valuable in guiding adjustments and changes to the 2025 efforts detailed later in this report. For example, in 2025 we tried for smaller seedballs with fewer seeds and less binders, added bare seed "control" seedings alongside seedballs, and established a new monitoring strategy with standardized and designated monitoring points.

Seed increase contracts

Overview

Two contracts were established in 2025 with two local businesses to grow out populations of native species for seed production. The goals of the contracts were to produce seed that is valuable for restoration, and to grow the local restoration economy through engaging willing local growers who aren't already growing these species. These contracts were between the grower and SVS, using Agreement funding specifically dedicated for seed production contracts. The contract period is September 17, 2025 to September 30, 2027, and involved the transfer of 10,000 seeds of each of two species to each grower. A sample, draft version of contract is included in Appendix 1.

Species selection

SVS and SCNF staff consulted about which species were most suitable for seed production. Hoary tansyaster (*Dieteria canescens*) and Douglas dusytmaiden (*Chaenactis douglasii*) were chosen. Both species are widespread locally and identified west-wide as relevant for restoration (Gucker & Shaw 2026). Both are already grown commercially for seed to some degree but no available sources are regionally appropriate for East-Central Idaho. However, both live for only a few years and therefore their wild stands are variable in seed production, meaning we collect less than we could use in most years. All of these factors make them strong candidates for seed increase.

Contract process and design

Once species were selected, SVS published a 14-day request for bids in the local newspaper, the Recorder Herald, to solicit interested growers in the area. Only two local growers submitted bids, and both were selected. Prioritizing local growers is in line with SVS's mission and the terms of the Agreement supporting this work. Both growers had some experience propagating native plants and/or growing for seed production, but neither had grown these species for seed production before. While some experience is important to ensuring contractual funds produce the desired product (seed), engaging with growers to grow valuable species for the first time reflects SVS's and the Agreement's intent to grow and develop the local restoration economy. Getting local growers to produce these species will benefit local restoration efforts due to the widespread occurrence of the species and current lack of appropriate seed sources, and will benefit the first-time growers by building their experience with these species, improving their ability to secure future contracts for producing native seed.

We consulted with SVS and SCNF staff along with professionals involved in other Native Plant Programs across the West (Nevada, Wyoming, Oregon), and developed a custom contract designed for first-time growers that avoids some common pitfalls and encourages collaborative completion of the contract. Grower financial risk from failure of tricky-to-grow species is one of the largest barriers to entry for new growers entering the native seed market (Harrison et al. 2023), especially for native forbs. This contract removes much of the grower risk by staggering payments based on key effort milestones and regular reporting rather than paying only for seed produced. In exchange for this risk reduction, the growers agree to allow SVS to summarize and publicly share any valuable information produced through that reporting. The contracts also encourage growers to work with SVS to solve unforeseen problems as they occur, which we hope will foster shared responsibility and reduce conflicts that could discourage growers from pursuing additional contracts.

Some features of the contract are that it requests growers to follow a list of best practices we developed for ensuring maintenance of genetic diversity in the resulting seed (included in Appendix 1), including using low-rate direct sowing and backfilling stand gaps with seedlings germinated using low-rate seeding in containers. Additionally, we consolidated current best propagation practices for both species as an additional resource included with signed contracts (included in Appendix 1). Five reports are requested after major milestones of effort (after germination, after field planting any gaps, 6 months post-planting (first fall), 12 months post-planting (second fall), and after seed harvest(s). Single-page reports involve specific details and methods used in each period, and/or challenges encountered. Payments are staggered in three parts: upfront good-faith payment upon contract signing (30%), upon successful stand establishment in first spring (30%), and upon delivery of seed harvest (40%), with the option to divide the final payment into multiple years if the plants produce more than one harvest during the contract period. A shortfall liability section specifies that stand or seed production failures at any time can still result in securing the next payment so long as adequate reporting details the causes and possible future solutions to the failure. The contract requires all seed produced during the contract period to be provided to SVS regardless of how little or much it is, but any seed produced after the end of the contract belongs to the grower and can be sold to anyone, though it's encouraged to sell it to SVS for use in restoration projects if SVS can pay a fair market value for it.

For additional details, refer to the generic contract and propagation guidelines and protocols in the Appendix.

2025 Seed collection & phenology monitoring

Seed library

Starting in 2025, we began maintaining a seed library, which involves cataloging approximately 2-5 ml of cleaned seed for as many local species as we can (Fig. 4). These seeds are stored in glass vials and used for education and internal and external reference. For every new species we collect, a new vial is filled and labeled. Even species we are not focused on collecting for restoration are included, as Program staff are encouraged to collect this small quantity of seed from any species (excluding rare or threatened taxa) they encounter throughout the season. The seed library mostly includes native species, but seeds of important exotic or invasive plants are also included to enhance the educational and reference value of the library.

Figure 4. Our seed library, which will serve as an internal reference as well as a tool for education and external audiences.

Species target list for collections

If this Program has learned anything about seed collection in three years of operation, it is how variable each species can be from year to year. Small variations in weather can result in wildly different aboveground plant community composition and seed production on a yearly basis, especially for annuals or short-lived biennials. The result is that some species are abundant one or two years in a row, then relatively absent in the next. The complex needs of each species, from germination and establishment to flowering and seed production, and how those needs intersect with the equally complex pattern of weather each year makes it nearly impossible to predict which species will thrive each year. Close monitoring of each species through its lifecycle could help predictions, but this is impractical for our Program given the number of species we work with.

Instead of intensive monitoring and prediction on a species-by-species basis, we maintain a rough list of target species based on the restoration sites we plan to seed in the next year or two. Then, we regularly scout similar sites each spring to make note of which species are having a good year, then check it against those target lists. Large quantities of seed are only collected if that species is suitable for known or expected restoration sites. If not suitable, only smaller quantities (for research and development opportunities) will be collected, if any collections occur at all. This allows us to focus our efforts during the monitoring and collection season on species with the most value to current restoration needs, while also continuing to build our population and phenology database, and seed library, for future possibilities and learning about our regional flora.

Some species that appear on target lists are difficult to collect from or don't appear to have banner years, and we will put in higher effort to collect them in some years until we learn more about their suitability for collection. This difficulty may be due to a consistent lack of abundance, seedhead structures that disperse seed early or in ways that are difficult to collect by hand, irregular or narrow timing of ripening, or overall low rates of seed production or viability. All these factors play a role in determining a species' suitability to seed collection for restoration projects. If reasonable quantities of seed can not be obtained despite higher effort, this may lead us to remove it as a candidate for restoration collections, and we may collect just enough for the needs of our seed library. Some of the species that fit this category have been *Phlox* species, *Collinsia* species *Eremogone kingii, Eremogone congesta, Astragalus miser, Penstemon aridus*, and several *Lupinus* species.

The 2025 target species list (Table 1) mostly includes species that have been on prior years list, with the addition of a number of smaller statured and often "weedy" early-seral native species that we believed would make good additions to restoration efforts where such species are lacking and unwanted early-seral exotics are a serious threat. This included species like *Lappula occidentalis*, *Hackelia cinerea*, and *Sisymbrium linifolium*. However, because of the unpredictability of seed availability and high diversity of this area, we also collected a number of species that were not on our initial target list, so the 2025 target list is not a comprehensive list of 2025 collections. The comprehensive list of collected species is found in the Seed Collection Records section below.

Table 1. 2025 Target Species List. Shading indicates plant habit: forb (white), grass (green shade), shrub (brown shade). Stars (★) indicates highest priority species for 2025 collection that received more effort due to their importance to our planned site and/or their high abundance in 2025.

Scientific Name	Common Name	Scientific Name	Common Name
Achillea millefolium	Western Yarrow	*Helianthella uniflora*	False Sunflower
Achnatherum hymenoides	Indian Ricegrass	*Helianthus annuus*	Annual Sunflower
Arnica cordifolia	Heart Leaf Arnica	*Ionactis alpina*	Lava Aster
Arnica sororia	Twin Arnica	*Lappula occidentalis* ★	Stickseed
Artemisia dracunculus	Wild Tarragon	*Lewisia rediviva* ★	Bitterroot
Artemisia tridentata v. Wyo ★	Wyoming Big Sagebrush	*Lithospermum ruderale*	Western Stoneseed
Artemisia tridentata v. vas	Mountain Big Sagebrush	*Lomatium dissectum*	Fernleaf Biscuitroot
Artemisia tridentata v. tri ★	Basin Big Sagebrush	*Lomatium foeniculaceum* ★	Desert Biscuitroot
Artemisia tripartita ★	Three-Tip Sagebrush	*Lomatium grayi*	Gray's Biscuitroot
Asclepias speciosa	Showy Milkweed	*Lomatium triternatum*	Nineleaf Biscuitroot
Astragalus atropubescens	Kelsey's Milkvetch	*Dieteria canescens* ★	Hoary Tansyaster
Astragalus beckwithii	Beckwith's Milkvetch	*Mentzelia albicaulis* ★	Whitestem Blazing Star
Astragalus purshii	Wooly Milkvetch	*Mentzelia laevicaulis*	Common Blazing Star
Astragalus scaphoides	Bitterroot Milkvetch	*Mentzelia dispersa* ★	Bushy Blazing Star
Balsamorhiza sagittata ★	Arrowleaf Balsamroot	*Nothocalais troximoides* ★	False Dandelion
Boechera sp. ★	Rockcress species	*Oenothera caespitosa* ★	Evening Primrose
Calochortus eurycarpus	Mariposa Lily	*Oenothera villosa*	Hairy Primrose
Camassia quamash	Camas Lily	*Oreocarya humilis*	Low Cryptantha
Castilleja flava	Yellow Paintbrush	*Oreocarya sobolifera* ★	Western Lakes Cryptantha
Chaenactis douglasii ★	Douglas's Dusty Maiden	*Oreocarya spiculifera*	Snake River Cryptantha
Chrysothamnus viscidiflorus	Yellow Rabbitbrush	*Panicum capillare*	Witch Grass
Cleome serrulata	Rocky Mountain Bee Plant	*Penstemon aridus*	Stiffleaf Penstemon
Collomia linearis	Pink Tiny Trumpets	*Penstemon deustus*	Hotrock Penstemon
Crepis acuminata	Tapertip Hawksbeard	*Penstemon eriantherus* ★	Fuzzy Tongue Penstemon
Elymus elymoides	Bottlebrush Squirreltail	*Phacelia hastata*	Silverleaf Phacelia
Ericameria nauseosa	Rubber Rabbitbrush	*Phacelia heterophylla*	Varileaf Phacelia
Erigeron pumilus	Shaggy Fleabane	*Phacelia linearis*	Linearleaf Phacelia
Erigeron compositus	Cutleaf Fleabane	*Plantago patagonica*	Woolly Plantain
Eriogonum microtheca	Slender Wild Buckwheat	*Pseudoroegneria spicata*	Bluebunch Wheatgrass
Eriogonum ovalifolium	Cushion Buckwheat	*Senecio integerrimus*	Western Groundsel
Eriogonum strictum var. pro ★	Blue Mountain Buckwheat	*Sisymbrium linifolium* ★	Lava Cress
Eriogonum umbellatum	Sulfur Buckwheat	*Sporobolus cryptandrus* ★	Sand Dropseed
Frasera albicaulis ★	White Stemmed Frasera	*Stenotus acaulis* ★	Mock Goldenweed
Grindelia squarrosa ★	Curly Cup Gumweed	*Thelypodium laciniatum*	Lanceleaf Thelypody
Gutierrezia sarothrae	Snake Weed	*Verbena bracteata*	Big Bract Verbena
Hackelia cinerea ★	Gray Stickseed	*Vulpia octoflora*	Six Weeks Fescue

Collected population locations

We mapped and monitored a total of 304 plant populations in 2025 (Fig. 5). Sites were revisited at regular intervals to track the phenology of the target species located there and to discover additional populations of other species nearby. Sites occurred across BLM, FS, State, and private lands (private sites always accessed with landowner permission). This year's populations were in general more tightly clustered in lower-elevation habitats that hosted species appropriate for our main restoration sites along the Salmon River Breaks. However, the addition of the Haynes Creek Pipeline restoration site to our list led us to scout and collect from some mid-elevation sites along the Beaverhead and Lemhi mountains.

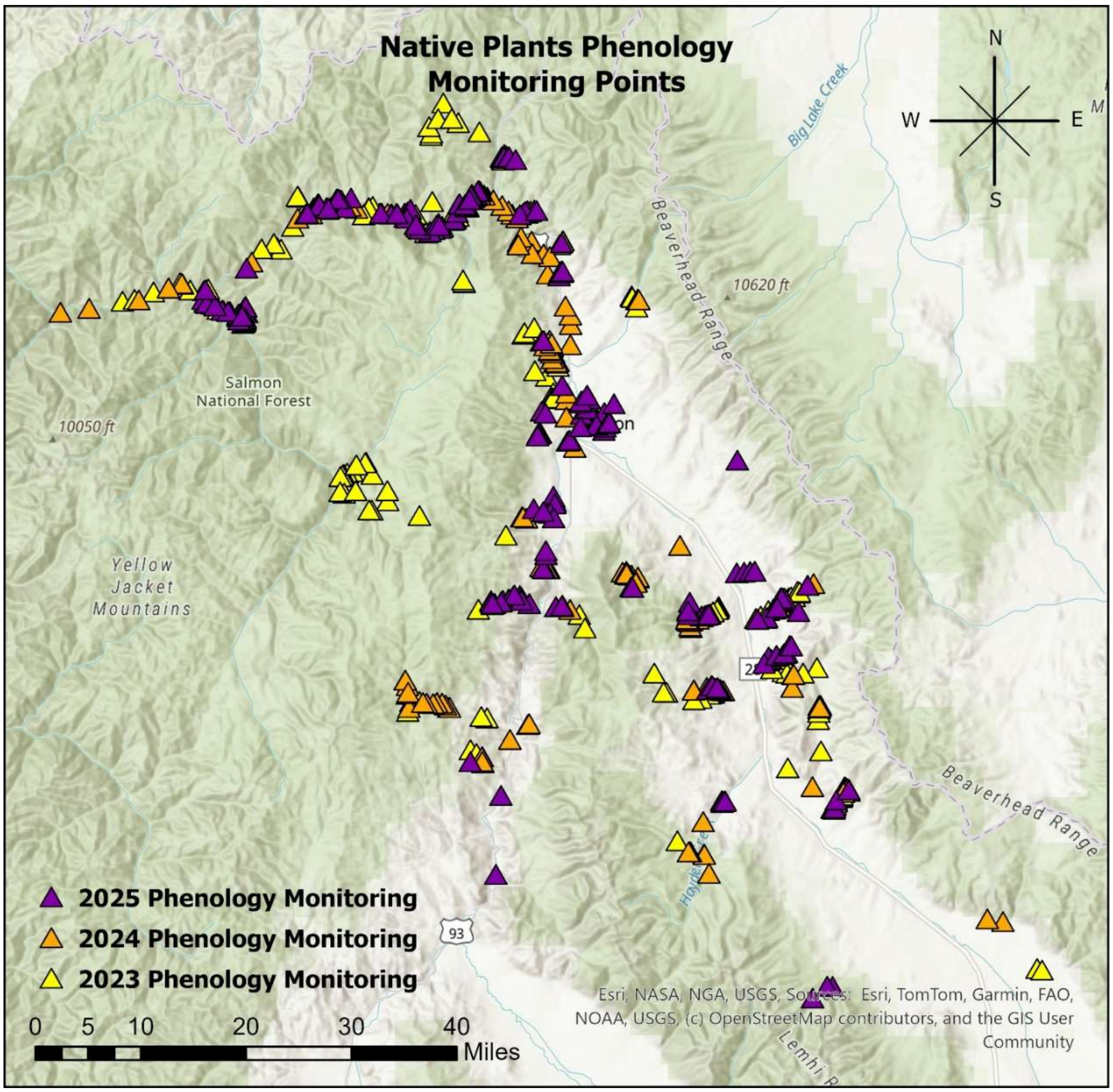

Figure 5. Populations monitored for seed collection from 2023 – 2025, with a total of 604 populations. In 2025, 304 populations were monitored. The different geographical clustering of points from year to year highlight how the priorities of the Program shift over time to meet different years and different restoration needs.

Seed collection protocol and strategies

As mentioned in our previous reports, we roughly follow the Bureau of Land Management's Seeds of Success (SOS) collection protocols (BLM, 2024). The SOS project is well established, and we adhere to the following principles of that protocol:

- 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 three populations must be sampled per species.
- Separate populations should be at least one kilometer apart.
- At least 10,000 seeds per collection to capture appropriate genetic diversity

These guidelines exist to prevent oversampling plant populations while ensuring that adequate genetic diversity and high seed ripeness are present in collections. All volunteers and technicians working with the Program are trained to follow these rules. In addition to SOS guidelines, we follow a few additional guidelines suggested for using a Regional Admixture Provenance Approach (Bucharova et al. 2019), including targeting at least three populations per species, mixing populations only if they are from a similar region, and getting at least 500 plants per total collection. These additional guidelines are highly relevant for collections whose purpose is to be used directly in restoration or seed increase, rather than simply for genomic conservation. The only time we break from the guidance described above is to make small, opportunistic collections for the seed library to be used for reference or education, not restoration or seed production.

Plant species have evolved to produce seed in a remarkably diverse range of ways which translates into a diverse range of seed collection strategies. Even closely related species may require very different tactics. Some basic strategies are explained below, and more detailed techniques for certain species are available in prior reports or by request. Many species have seed appendages or structures that can be hazardous or uncomfortable to collectors, such as glass-like hairs, airborne particles, sticky resins, or sharp and hard structures. A variety of personal protective equipment, from respirators to gloves and glasses, are maintained in our collection kits and mandated for collection staff to avoid safety issues.

- Aster family species like *Erigeron pumilus* (shaggy fleabane), *Ionactis alpina* (lava aster), or *Dieteria canescens* (hoary tansyaster) produce seed with a fluffy pappus, creating a dandelion-like head from which ripe seeds can be easily stripped off by hand. They can also pulled from the plant using a handheld vacuum.

- Aster family in the sunflower tribe like *Balsamorhiza sagittata* (arrowleaf balsamroot), *Helianthus annuus* (annual sunflower), and *Grindelia squarrosa* (curlycup gumweed) produce heavier seeds without a pappus (Fig. 6). Clipping whole ripe seedheads or shaking them into a bag is an efficient method.
- Pea family species like *Astragalus purshii* (wooly milkvetch) or *Astragalus scaphoides* (bitterroot milkvetch) produce seeds in pods that can either be picked up off the ground, pulled from stems (if seed are ripe before pods are fully open) or shaken from the stems (if pods begin to open as seeds are ripe).
- Mustard species like *Thelypodium laciniatum* (cutleaf thelypody) or *Sisymbrium linifolium* (lava cress) produce seed in long, thin pods called siliques (Fig. 7). Rubbing these between your fingers opens them easily, but collection timing is critical because these pods open on their own soon after seeds are ripe.
- Borages or waterleaf species like *Phacelia sp.* continue to develop new flowers as the tips of their stems unfurl even while seed is ripening near the base of the stem, making timing tricky. In order to avoid harvesting unripe seed, lightly stripping the stem from the base is the easiest solution. For these species, care is taken to collect early-ripening and late-ripening plants to maximize genetic diversity.
- Seed of *Asclepias speciosa* (showy milkweed) and *Chamerion angustifolium* (fireweed) have large fluffy seed appendages and are incredibly unruly if collected when seed is already dispersing by wind. These are best collected when pods are just splitting open and seeds have detached from the pod's internal structures.

Figure 6. Example of the state of seed from wild population to cleaned seed (top; balsamroot), and ripe seed from several different species that can each pose their own challenges (bottom).

Figure 7. Various scenes from seed collection activities in 2025, including drying separate lots of sagebrush in November (top left), ripe seedpods from a tricky new species we collected this year (tufted evening primrose, OECA10; top right), a productive collection day with many species ripe at the same time near lower Panther Creek (bottom left), and a one-handed collection of three species near town in June (bottom right).

Seed collection equipment acquisition

The Program acquired two handheld, battery-powered vacuums to assist with the collection of various small seeds, such as those with fluffy appendages for wind dispersal (shaggy fleabane, fireweed), or those with delicate pods that spill seed when collected by hand (some Penstemons and mustards). These vacuums useful in 2025 for collection of some of these species and will become increasing useful as we experiment with other species that may not have been viable to collect otherwise. These powerful and portable vacuums were also handy for dealing with accidents of spilled or torn seed bags in the vehicle or shop.

Seed collection records

Between May 28th and November 18th, 2025, the Program collected seed from 70 different species (Table 2). We made 233 individual collections sampling over 65,500 individual plants across a total of 110 different sites, totaling 1,489 acres. This included over a dozen species that had not been sampled in 2023-2024, bringing the total number of taxa collected by the Program since 2023 to exactly 100 different taxa (including subspecies and varieties). This includes several species collected solely for the seed library and not yet intended for restoration or propagation.

In prior reports, we have included dates for first and last collection of species, and we continue to collect and organize this kind of phenological data for the species we work with. This phenology database is an increasingly important asset for the Program to help predict and inform where and when different populations of these species sprout, flower, and set seed. This database is getting large and is difficult to display in any simple way that has meaningful value to a reader. Several requests from outside organizations were made to us for various forms of this data for certain species in 2025. We fulfilled these requests individually, but this slightly clumsy process highlighted the need for this Program to better organize these data for use by others interested in conserving these species. Late in 2025, we began reorganizing this data to make it a more synthetic and useful body of knowledge. Please see the end of this report for information about our future goals to make these data more organized and accessible in 2026.

Table 2. Full collection list for 2025, by USDS species code, including plant habit and life history (A = annual, P = perennial), collection type (for restoration, seed library, or seed increase contract), and estimated number of plants sampled for 2025. Some collections were made on taxa that have yet to be identified to species (codes in italic).

USDA Code	Life Cylce	Intended purpose	# Plants Sampled	USDA Code	Life Cycle	Intended purpose	# Plants Sampled
ACMI2	Forb - P	Restoration	149	**HECY2**	Forb - P	Library only	60
ARDR4	Forb - P	Restoration	310	**HEUNU**	Forb - P	Restoration	280
ARTR2	Shrub	Restoration	340	**IOAL**	Forb - P	Restoration	365
ARTR4	Shrub	Restoration	2085	**IPAG**	Forb - B	Library only	30
ASAT2	Forb - P	Restoration	414	**LAOCO**	Forb - A	Restoration	1265
ASMI9	Forb - P	Library only	226	**LERE7**	Forb - P	Restoration	4784
ASPU9	Forb - P	Restoration	1490	**LILE10**	Forb - P	Restoration	133
ASSC4	Forb - P	Restoration	1016	**LIRU4**	Forb - P	Library only	126
ASSP	Forb - P	Restoration	1128	**LODI**	Forb - P	Restoration	299
BASA3	Forb - P	Restoration	8325	**LOFO**	Forb - P	Restoration	411
BOECH	Forb - P	Library only	164	**LOTR2**	Forb - P	Restoration	230
CAEU	Forb - P	Restoration	725	***LOMAT***	Forb - P	Restoration	1000
CAFL7	Forb - P	Restoration	800	**MACA2**	Forb - P	Restoration, Increase	901
CHAN80	Forb - P	Restoration	674	**MEAL6**	Forb - A	Restoration	325
CHDO	Forb - B	Restoration, Increase	2186	**MEDI**	Forb - A	Restoration	3311
CLLI2	Forb - P	Library only	20	**MELA2**	Forb - B	Restoration	168
CLSE	Forb - A	Restoration	135	**NOTR2**	Forb - P	Restoration	3072
CORA5	Forb - A	Library only	72	**OECA10**	Forb - P	Restoration	214
CRAC2	Forb - P	Restoration	70	**OEVI**	Forb - B	Restoration	133
DRYMO	Forb - P	Restoration	40	***OREO 1***	Forb - P	Restoration	985
ELEL5	Grass - P	Restoration	140	***OREO 2***	Forb - P	Restoration	167
ERCO24	Forb - P	Restoration	303	**PEAR2**	Forb - P	Restoration	572
ERHE2	Forb - P	Library only	20	**PEDE4**	Forb - P	Restoration	121
ERMI4	Forb - P	Restoration	447	**PEER**	Forb - P	Restoration	568
EROV	Forb - P	Restoration	870	**PELE8**	Forb - P	Library only	17
ERSTP3	Forb - P	Restoration	2283	**PEPR2**	Forb - P	Library only	4
ERUM	Forb - P	Restoration	390	**PEVE2**	Forb - P	Library only	5
ERNA10	Shrub	Restoration	89	**PHHA**	Forb - P	Restoration	813
ERPU2	Forb - P	Restoration	1553	**PODO4**	Forb - A	Library only	80
EUXA	Forb - A	Restoration	40	**SCLI**	Forb - P	Restoration	315
FRAL2	Forb - P	Restoration	1818	**SPCR**	Grass - P	Restoration	2075
FRPU2	Forb - P	Library only	123	**STAC**	Forb - P	Restoration	3377
GRSQ	Forb - B	Restoration	2438	**VUOC**	Grass - A	Restoration	5500
HACI2	Forb - P	Library only	286	**ZIVE**	Forb - P	Restoration	780
HEAN3	Forb - A	Restoration	1894				

Seed collection map examples

To show how collection species and areas shift over time, we highlight two small collection areas below, listing the species collected for the last three years and maps of where those collections took place. Additional maps and collection records can be made available upon request, and all collection locations, by species and for each HUC-12 area, have been entered into the USDA FACTS database.

Lower Panther Creek (Fig. 8)

In 2023, we collected seed from *Phacelia linearis, Phacelia hastata, Astragalus purshii, Helianthus annuus, Heterotheca villosa, Sporobolus cryptandrus, Eriogonum strictum* var. *proliferum, Dieteria canescens, Mentzelia laevicaulis,* and *Cirsium inamoenum*. In 2024, we collected seed from *Achillea millefolium, Penstemon eriantherus, Helianthus annuus,* and *Verbena bracteata*. In 2025, we collected seed from *Lomatium dissectum, Balsamorhiza sagittata, Hackelia cinerea, Astragalus scaphoides, Zigadenus venenosum, Astragalus atropubescens, Lomatium triternatum, Ipomopsis aggregata, Oreocarya sp., Astragalus purshii, Chaenactis douglasii, Phacelia hastata, Mentzelia dispersa, Achillea millefolium, Frasera albicaulis, Nothocalais troximoides, Penstemon eriantherus, Machaeranthera canescens, Polygonum douglasii, Penstemon lemhiensis, Penstemon procerus* and S*porobolus cryptandrus*.

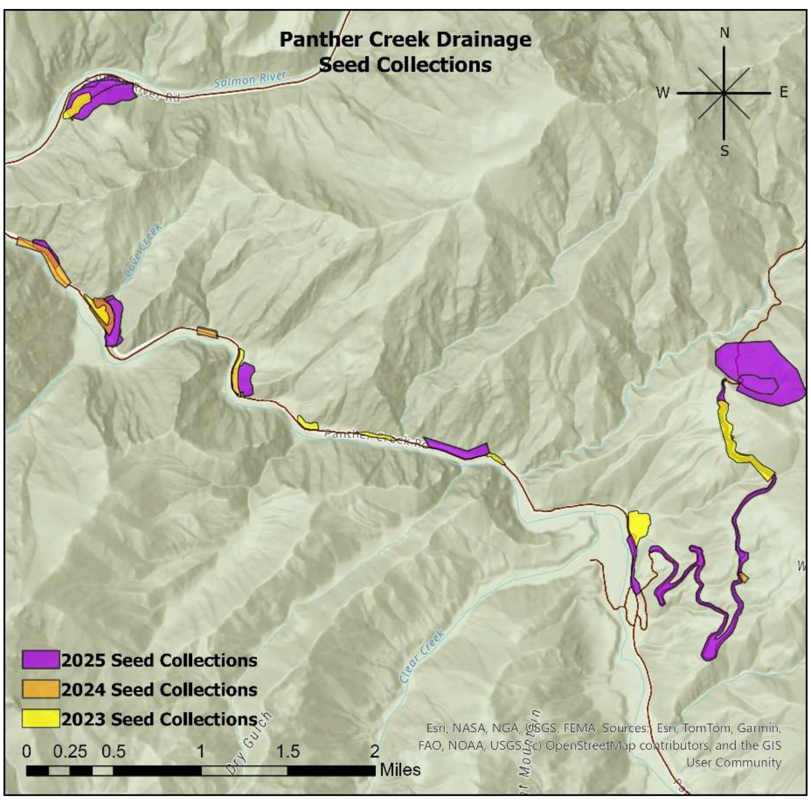

Figure 8. Seed collection areas for 2023-2025 for Lower Panther Creek area.

Warm Springs Creek (Fig. 9)

In 2023, we collected seed from *Lewisia rediviva, Erigeron pumilus, Ionactis alpina, Phacelia linearis, Collomia linearis, Senecio integerrimus, Chaenactis douglasii, Mentzelia laevicaulis, Astragalus atropubescens, Astragalus purshii, Penstemon aridus, Calochortus eurycarpus,* and *Lupinus* sp.. In 2024, we collected seed from *Stenotus acaulis, Ionactis alpina, Townsendia parviflora, Penstemon aridus, Astragalus purshii, Erigeron linearis,* and *Astragalus atropubescens*. In 2025, we collected seed from *Astragalus atropubescens, Castilleja flava, Cordylanthus ramosus, Heuchera cylindrica, Balsamorhiza sagittata, Oenothera caespitosa, Mentzelia albicaulis, Chaenactis douglasii, Penstemon aridus, Penstemon venustus, Linum lewisii,* and *Helianthus annuus*.

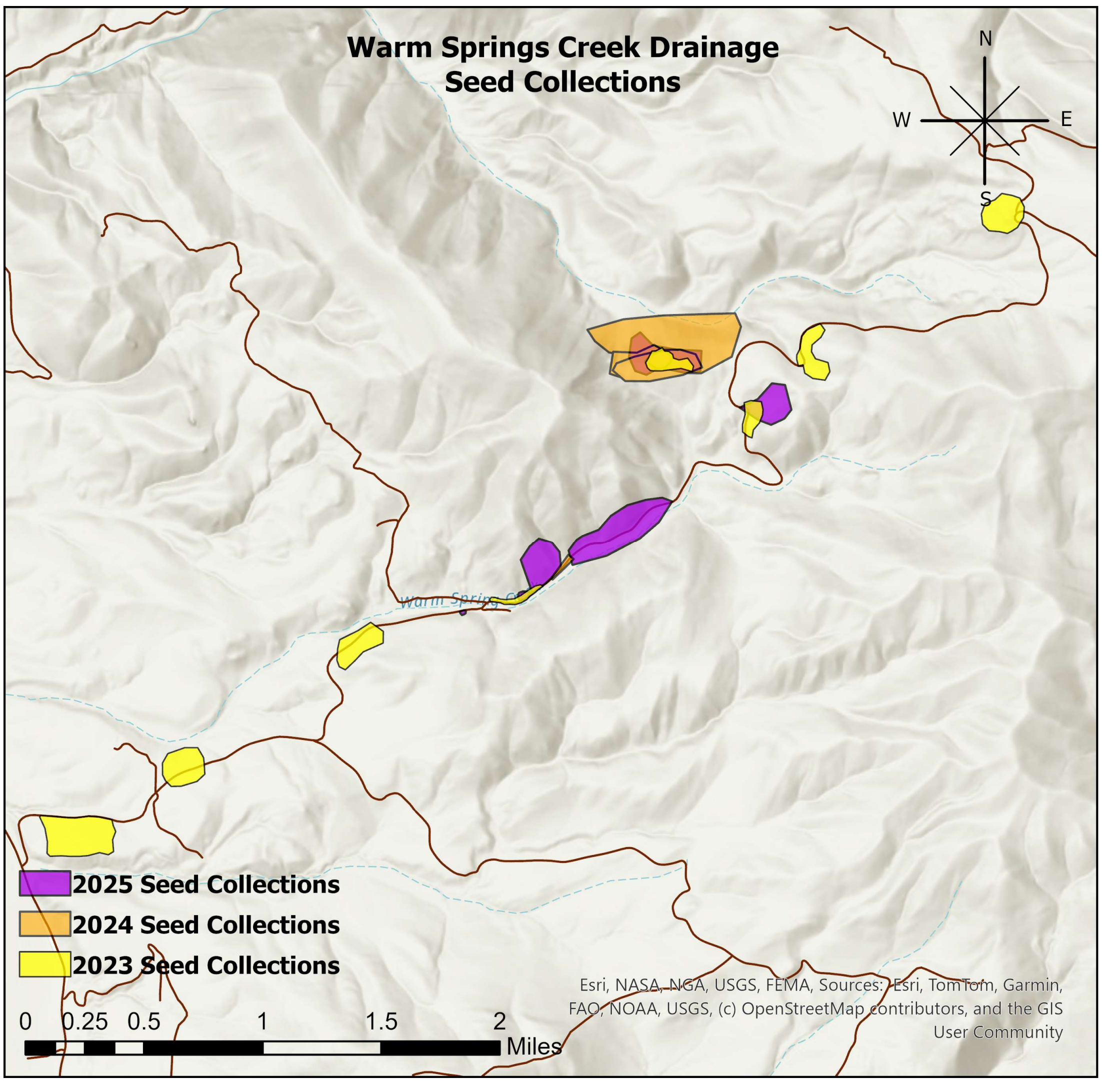

Figure 9. Seed collection areas for 2023-2025 for Warm Springs Creek area.

2025 Seed cleaning and mixing

Seed cleaning methods

As in previous years, we continued to learn more about the most efficient ways to clean seed given the equipment available to us. We regularly record what methods and equipment were used to clean each species/lot, and we also often look back at prior years' records as a starting point, or when instructing seasonal staff to assist in cleaning. Examples of detailed cleaning methods are available in the 2024 report, but are omitted here because we plan to shift toward making this information more publicly available. Please see the end of this report for details about our 2026 plans for this topic. Detailed methods are available upon request.

Detailed descriptions of our existing seed cleaning equipment can be found in prior annual reports. We continue to rely heavily on our custom-built barrel dewinger, barrel chain thrasher, and air separator, as well as our many purchased sieves.

Seed cleaning equipment acquisition

In 2025, we purchased an adjustable hand-crank grain mill designed for grinding corn and other durable grains in an effort to find a new solution to breaking open durable pods of *Astragalus* and several other species. In particular, the pods of *Astragalus purshii* (wooly milkvetch) are durable and covered in a velvety fuzz that protects the pod from crumbling or crushing (Fig. 10). When adjusted to maintain a large clearance between grinding parts, this tool worked very well for breaking open pods without breaking many (if any) seeds. This immediately saved many hours of labor and improved seed yield for just one species, and we experimented with this grinder for other species as well.

We also purchased an additional set of fine screen sieves in sizes that filled in gaps in our existing sets (Fig. 11). Even the smallest change in screen size can be the difference between getting fine chaff out of seed, or separating a weedy contaminant from the target seed. Similarly, sieves with square openings (mesh) perform very differently and can be used to achieve different goals compared to sieves with round openings (perforated), and having a complete set of both gives maximum precision. We use all our sieves heavily in both the early, middle, and final stages of cleaning, depending upon the species. It is also worth noting that we occasionally have many staff cleaning seed at the same time (Fig. 12), when collections days are postponed due to weather or labor becomes available, and having many sieves, trays, and bins makes these busy workshop days incredibly productive.

Figure 10. The acquisition of a $40 grain mill allowed for efficient and more complete extraction of wooly milkvetch seeds from their durable, sharp, velvety pods. By adjusting the gap of the grinding plates to the correct width (yellow arrows), the whole pods (bottom left) were easily broken open enough for seed to readily be sifted out (bottom right). This process saved hours over prior methods of processing in small batches in the barrel chain thrasher, followed by hand-peeling of pods that refused to open. We used our air separator on the extracted seed to assess seed damage, and confirmed it was very low.

Figure 11. The current set of sieves used by the Program, including various sizes of three different styles: fine wire mesh (top left), coarse wire mesh (top right), and perforated metal pans (bottom).

Figure 12. The workshop has become a well-equipped and functional space for seed cleaning, measurement, and storage. Five people were working comfortably at the same time on this rainy late-summer day when seed collection efforts were stymied.

Seed measurement calculations

As in prior years, we collect certain measurements about the seedlots we collect that aids in using it judiciously (Appendix, Table 3)). After cleaning seed and combining multiple populations (when appropriate), each finished seedlot is sampled inhouse for purity, seed weight, and approximate seed volume. These measurements help us know how many whole seeds are in each unit of weight or volume, allowing us to estimate how many seeds we have, measure out more precise quantities of seed, and to observe differences across years or regions in seed size or quantity obtained.

Seed purity is obtained by taking a small quantity of material from the well-mixed seedlot, manually separating all seeds from non-seed material while counting seeds until reaching 300 seeds, then weighing each of those fractions on a high-precision, sub-gram scale. Purity is the weight of the pure seed divided by the entire weight of the sample. A 90% purity means 10% of the seedlot is inert material.

Two different seed weights are then calculated for each lot: average weight per whole seed, and whole seeds per bulk gram. Using the fractions separated above, the 300 pure seed weight (without chaff) is divided by 300 for average weight per whole seed. A groups of 300 is used because most seeds are so small that they would require scales that cost tens of thousands of dollars to weigh individually. Next, the total 300-seed sample weight (including chaff) is multiplied by its inverse and then by 300 to calculate the number of bulk seed per gram. Seed per bulk gram is the measurement we will then use to know how many seeds are in a given sample (by weight) of our seed lot, accounting for the inert material present in that seed lot.

Seed volume-to-weight ratios were also developed to aid in knowing approximately how many seeds were in specific, common volume measurements like teaspoons, tablespoons, or cups. These volume measurements, though crude, are helpful if quality scales are not available for measuring seed by weight, but are only used as a last resort because differences in compaction from sample to sample can lead to more error than weighing with a quality scale.

All of these measurements (Appendix 1) are calculated for each seed lot prior to storage or use in restoration sed mixes, with the exception of several fall-seeding species like *Artemisia* species in 2025, whose seed was collected, cleaned, and then dispersed into restoration sites within a narrow window of a few days due to challenging weather conditions and a lack of seasonal labor. Those seedlots had measurements calculated post-seeding, allowing for back-calculations of seeding rates if needed.

Seed mix design

A total of 75 species were included in 7 mixes prepared for 2025 seeding (Appendix, Table 4). Ten of these species were only added into mixes used for bare-seed dispersal due to low quantities or because seed was not yet cleaned or collected at time of seedball production (these ten were not included in bare seed mixes used for paired monitoring points; see below). We prepared seven base mixes that were targeted to specific sites we planned to seed. These base mixes were Benches, Diamond Bulldozer Line, Dry Slopes, Haynes Pipeline, Roadside, Steep Rocky, and Stoddard Flat, and contained 11 – 28 species each. Seed mix design started with assuming we wanted equal numbers of seeds of each species in the mix, then we adjusted those seed rates for a few species up or down for several reasons. We had insufficient supplies of seed for some species to include the desired amount, so those represented a smaller portion of the mix. Other species were included at higher rates because they are known to have low or delayed germination, or were species we wanted more establishment from. These base mixes were then mixed according to those target rates, then the whole mix was then split, half for seedballs and half for bare seed treatments.

Mixes bound for seedballs were measured out into single-batch samples and used to produce seedballs following methods described in prior reports. Species that were appropriate for inclusion in more than three of these base mixes (species with broad applicability in our region) were not initially included in the base mixes but were made into seedballs as single-species “solo” batches and added to bare seed mixes (along with the ten species not included in seedballs) after the base mix had been split. This was done to reduce the number of species competing in individual balls, and to make it possible for us to be precise (on a site-by-site basis) with how much of our most important and general species (those used for solo batches) we put into restoration islands. Single-species seedballs, once made, were mixed as appropriate with seedballs containing each of the base mixes prior to seeding. Note that the samples of seed from mixes and single species used to establish paired monitoring plots (explained below) were extracted prior to final mixing to ensure the same rates of the same species were in each pair of monitoring samples (seedball vs bare seed).

Seedball production

A total of 63 batches of seedballs were made in 2025, totaling approximately 900 pounds after drying, resulting in ~315,000 seedballs. Based on findings from spring monitoring, 2025 seedball recipes and production were modified in a few ways. Powdered bentonite clay was used instead of pelleted clay because it improved seedball formation and size consistency, and it also reduced batch duration. Powdered agar was omitted because it appeared to hold seedballs together too long even after repeated precipitation events. Average seedball size for most batches was reduced to a target average seedball size of ~2.2g per ball, and seed additions were measured by weight to produce an average seed rate of 10 whole seeds per average ball. For some batches (some of the single-species batches of CHDO, SPCR, ELEL5, ERPU2, GRSQ, HEAN3, and LAOCO), seedball size was reduced even further to a target of 1.1g or 0.7g per average-size ball, both still with a target of 10 whole seeds per average size ball (Fig 13).

Matching seed additions to target seedball sizes and seed rates was done by calculating total batch dry weight, dividing it by the target average seedball weight to estimate the average number of seedballs per batch, multiplying by our target rate (10 seeds per ball) to give the total number of whole seeds to add to each batch, then dividing by the seeds per gram of the specific seed or seed mix for that batch to determine the grams of seed to add. Despite efforts to have consistency, seedball size was still variable due to the crude (but cost-effective) production method, with some larger and some smaller than the target, but each batch was hand-sorted to break up the larger balls into target-size balls before drying, resulting in a majority of each batch being reasonably close to the target size.

Future seedball production should increasingly be informed by monitoring results regarding decisions like which species are included (some may perform poorly in seedballs, while some may benefit), which recipes are used (to produce seedballs with high dissolvability), and whether seedballs or other methods are most appropriate for specific sites or seed mixes. If seedballs show promise over other methods such as bare seed, some improvements in efficiency could also be made by using finer compost to encourage more even seedball formation, premixing dry ingredients long before production to reduce batch time, and reducing seedball drying time by constructing heated forced-air driers used for the first 30 minutes of drying to remove the majority of the moisture. Alternatively, other methods of bulking up seed with presumably beneficial ingredients could be achieved using protocols similar to rotary coating or pan coating (Pedrini et al. 2017), which could lead to single or multi-seed units that are more consistent in size but likely smaller than typical seedballs.

Figure 13. Drying six different mixes of seedballs, 2-3 batches per mix (above), and close-up of an experimental "micro-ball" version of seedballs (below) that were made extra small with higher quantities of seed per batch (but similar average seeds per ball as larger balls) for small-seeded species such as Lappula occidentalis.

2025 Seed dispersal

Restoration sites overview

As in previous years, the Program relies on partners and land managers to identify sites suitable for restoration.

Salmon River Breaks: The primary focus for the Program's efforts over the last three years have been within the boundaries of the Salmon River Breaks project area which spans 11,000 acres bordering the Scenic Salmon River Corridor (Fig. 14). The area has received a lot of management attention a variety of different vegetation treatments over the last decade. Due to a long history of sheep grazing, frequent burning, and winter big game use, the south-facing slopes of the corridor are depauperate in forbs and shrubs. Additionally, the region has received aerial herbicide treatments to reduce the presence of weeds. The Program’s goals at this site are to increase plant diversity (especially forbs and shrubs, bringing back floral resources to support pollinators and various wildlife species, and to bolster ecosystem resilience to wildfires and biological invasions. Three different seed mixes were made for this area, each targeting different components of the landscape: dry slopes, steep rocky slopes, and benches.

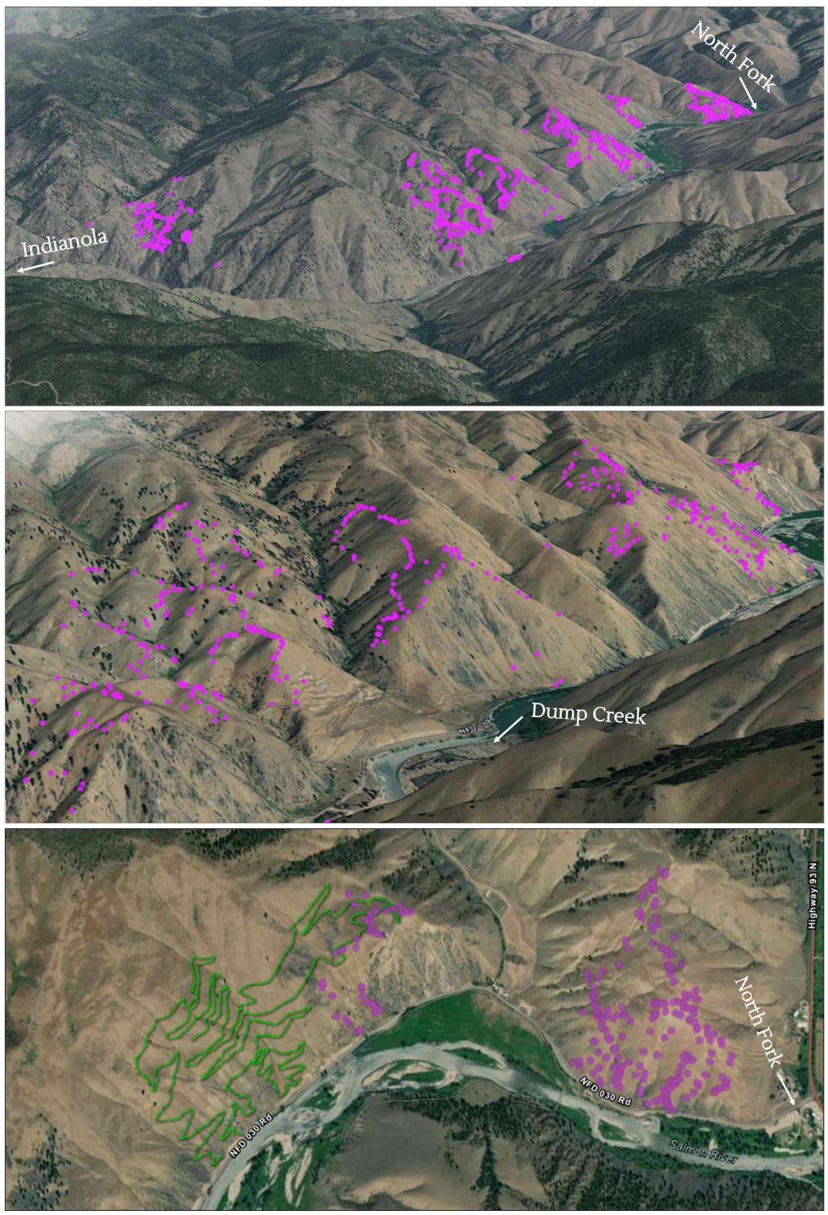

Figure 14. Some Salmon River Breaks seeding islands (pink dots) and seeding paths (green).

Diamond/Moose Dozer Lines: The 2022 Moose Fire was one of the largest wildfires in the Salmon region over the last decade. The scars from this fire can still be seen across the landscape in both natural and anthropogenic forms. In the foothills north of Salmon, firefighters implemented the use of bulldozers to make quick firebreaks ahead of the active fire line, leaving approximately 20 miles of disturbed dozer lines throughout the area. Even three years later, these lines are still sparsely vegetated but are increasing in weedy exotics. Following herbicidal weed treatments in 2024, we were tasked with revegetating as many of these lines as was needed or possible (Fig. 15)

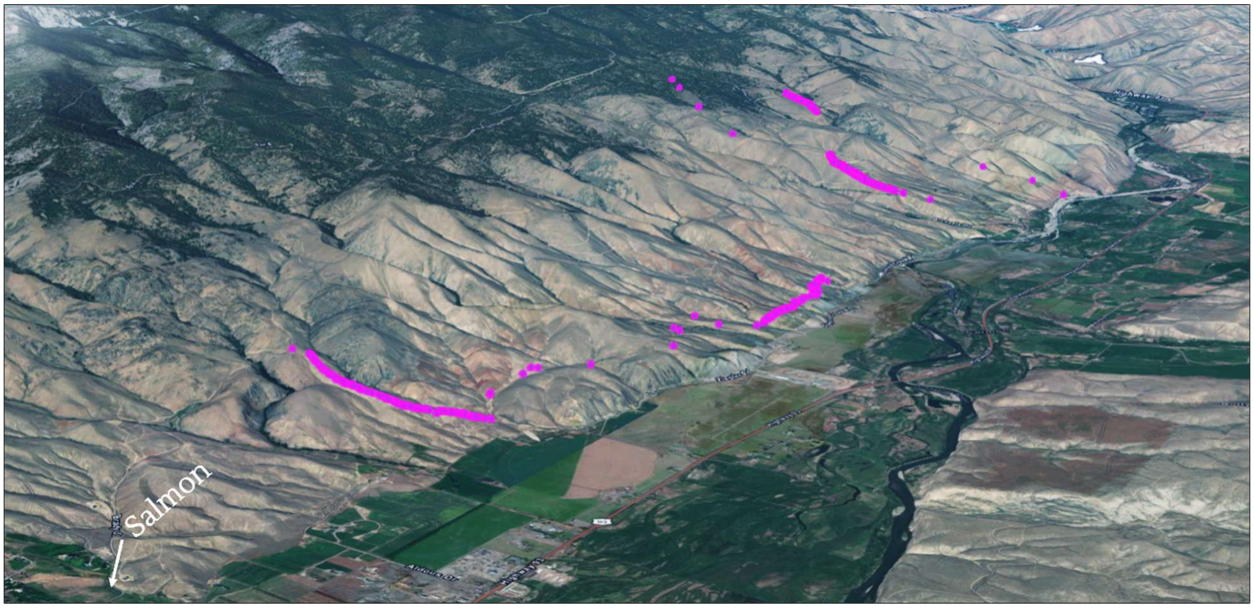

Figure 165. Seeding islands (pink dots) along several dozer lines in the Salmon Valley associated with the 2022 Moose Fire.

Figure 156. Haynes Pipeline site, showing areas that received broadcast and raked-in seed (polygon), and monitoring points (pink dots)

Haynes Creek Pipeline: A small and linear disturbance (approximately one acre) was created on a bench slope just north of Haynes Creek for maintaining a water pipeline for livestock purposes. (Fig. 16) The surrounding area had enough smooth brome, exotic mustard, and other weeds that seeding native species into the disturbance was deemed prudent by FS staff. This was our highest elevation site, in a mountain sage and Douglas fir ecotone site, and required collecting some different species than for our other sites. Because of its small area, exotic plants were manually removed with hand tools immediately prior to seeding, and nearly the entire disturbance received seeding in mid October.

Salmon River Roadsides: As in prior years, highly disturbed areas immediately adjacent to the Salmon River Road between North Fork and the Middle Fork were a restoration priority under the assumption that continued additions of appropriate native species are important to counter the high abundance of exotic species in these areas, especially when recent disturbances like fire, roadwork, or recreation improvement expose bare ground that has yet to be infilled with weeds. Many small sites along the Salmon River Road, and the road from the confluence of the Salmon River and Panther Creek upstream along Panther Creek to Garden Creek received the specific roadside seed mix, which was composed of species likely to grow and thrive in these kinds of sites.

Stoddard Pack Bridge: Staff from the FS informed us that restoration was a component of the reconstruction contract for rebuilding the Stoddard pack bridge just downriver of the Middle Fork. We prepared a custom mix for this site, to focus on the disturbed areas adjacent to the bridge foundation and piles. This mix was similar to our roadside sites, but included more grasses and some additional forb species suitable for a larger and more significant disturbance area with the possibility of some steeper areas. The completion of the bridge was eventually delayed so we did not restore the site, but all mixed seed is in cold storage for use after the future completion of the bridge work in 2026.

Telephone Pole Flat and Ridges: As in prior years, Telephone Pole flat along lower Panther Creek, along with some ridges above it, were targeted with a similar reasoning and approach to the Salmon Breaks sites above. This site received three different mixes similar to the Salmon River Breaks sites (Steep Rocky, Dry Slopes, and Benches)

Additional maps and seed dispersal records can be made available upon request, and all seeding locations, for each HUC-12 designation, including seed mix information, have been entered into the USDA FACTS database and are available to Forest Service staff as AGOL online layers.

2025-2026 Updated monitoring protocol

A new monitoring design was used during 2025 seeding to create a network of seeding points for restoration effectiveness monitoring. As detailed earlier in this report, it was difficult to consistently relocate seeding islands from 2024, and the exact mix and rate of seed used in each island was not known. Instead of taking more time while seeding each island to measure and record exact rates and locations, which would significantly reduce the amount of restoration seeding per hour of labor, we instead chose to establish a smaller subset of the total seeding points as specialized monitoring points. The goal of these monitoring points is to be easier to relocate, have consistent and known seeding rates, and to compare multiple seeding methods.

In fall 2025, we established 85 different 1x2 m paired-plot seeding points (Fig. 17). We left a large nail in the soil marked with a wire tag, took GPS points, and took plot and landscape photo points to improve our ability to relocate them in 2026. Half of each plot (1x1m) was seeded with seedballs and the other half was seeded with bare seed, with both halves receiving the same rate of the same seed or seed mix. To achieve these identical rates, samples were pre-weighed based on seed weight, purity data, and seedball recipe calculations so that each sample, whether bare seed or seedball, contained approximately 600 whole seeds. Of course, measuring by weight has a certain level of inaccuracy, but several random samples were hand-counted and were within 5% of this target. With sample sizes of 5-10 monitoring points per seed mix type, this design should provide enough accuracy to observe any meaningful patterns in success or failure across methods, mixes, and species.

Monitoring samples were sown into small pits or furrows similar to those used in our standard seeding island points, ensuring good seed-soil contact and minor burial. The 85 samples were primarily spread across 5 seed mixes (benches, pipeline, diamond dozer, dry slopes, and steep rocky) and 6 single-species mixes (LAOC, HEAN3, GRSQ, ERPU2, and CHDO), with 5-10 sample replicates per mix. The monitoring points were established at the same time and dispersed across the same sites as our standard seeding island points. There are two additional differences between the seed sown at monitoring points and standard seeding island points: 1) standard islands often received a base seed mix in addition to seed of additional species (from workhorse “solo” seedball batches) prior to sowing, whereas each monitoring point was always seeded with either a single base mix or a single species; 2) pits and furrows were often closer together in monitoring points (to fit into the 1x1 area) than those in standard seeding islands, resulting in more consistent soil disturbance and probably higher per-area seed rates. Despite these differences, we believe monitoring points are similar enough to standard seeding island points that monitoring outcomes can be used to roughly approximate the success of the larger seeding efforts, though their primary purpose is to determine which species and mixes perform better or worse with which methods at which sites (see below).

We plan to monitor all 85 points at least twice in 2026 (mid-spring, early summer). The resulting data will be used to address the following key questions, which will aid in designing future seeding efforts for maximum success:

- Are there differences in seedling establishment from seedballs vs bare seed?
- Do different species or seed mixes perform differently across seeding methods?
- Which species or mixes give the best or worst success for each seeding method?
- Which sites, species, and mixes have the most vs the least success?

Figure 17. Examples of 2x1m paired plot monitoring points for diamonds dozer (left) and dry slopes (right) sites.

List of public outreach activities

Program staff led or participated in several volunteer and outreach events in 2025. However, because much of the season was spent with two fulltime staff instead of one as in prior years, our ability to be productive and accomplish Program goals without the use of volunteer labor was greater, leading to a smaller need for volunteers from a practical viewpoint. Of course, engaging volunteers has much more value than just the completion of the work, so continuing to engage volunteers is still an ongoing priority to ramp up in 2026.

- Delivered interactive pollinator lessons to local preschool
- Co-presented “Pivots for Pollinators” public event encouraging native plant restoration on private lands adjacent to irrigation pivots alongside UI Extension, NRCS, USFS, and Mule Deer Foundation

- Presented in-person, hands-on restoration demonstration at 2025 University of Idaho Rangeland Fall Forum
- Hosted 1 volunteer seed collection evening
- Engaged volunteers and other partner staff for seed dispersal during Federal Shutdown on 4 different days
- Held multiple conversations and discussed possible future working relationships with tribal members, large local landowners, state, and federal agency staff

Other project activities

Milkweed monitoring

Using mostly non-FS funding sources dedicated for native plants and pollinator work, the NPP Coordinator and SVS seasonal staff contributed 174 hours to monitor 102 sites as part of Idaho fish and Game's Monarch and Milkweed Monitoring effort (Idaho Department of Fish and Game, 2025). This involved assisting in the delivery of trainings to volunteers, and adopting sites that were leftover after volunteers chose their preferred sites. Sites were visited three times between July 1st and Aug 15th. At each visit, we followed their protocols for surveying the size and health of milkweed patches and surveying for all forms of monarch presence or activity. State-wide, this IDFG program got over 900 sites monitored mostly by volunteers. In the Salmon Valley, SVS monitored 102 of the 166 total sites, and served as a backstop for monitoring sites that would have gone un-monitored. We regularly coordinated with IDFG staff to ensure our efforts were in line with their needs for data.

In the process of monitoring, SVS's efforts found eggs, larvae, and adults of Monarchs at multiple sites throughout the valley, providing better resolution of data for IDFG than if many of these sites had not been surveyed. We also identified over 20 new milkweed patches that were not already in the IDFG milkweed database during our surveys and also during our extensive scouting and seed collection.

Milkweed planting

We purchased 266 showy milkweed seedlings from a local nursery, which were initially intended for planting in coordination with FS staff on FS land along the Salmon River under this Agreement. When the Federal Shutdown postponed coordination for the planting season, the Program had to pivot, and leveraged SVS's broad social media reach to encourage community members to adopt these seedlings to plant on their own property in the Salmon and Lemhi Valleys. We also offered seed to those interested community members from our large 2025 seedlot. All 266 seedlings and ~80,000 seeds were handed out, and SVS assisted with planting and seeding on several properties at the request of the landowners. A total of 18 different community members participated. Planting locations ranged from Lemhi to Tower Creek, and included small private residences in town as well as larger open spaces such as the Sacajawea Interpretive Center and a mid-size ranch that had just participated in a river restoration project.

All planting locations were marked with GPS, and we plan to contact participants or directly revisit the sites in late spring 2026 to identify where seedlings have successfully established.

Agreement finances and efficiency

The Program invoiced a total of $150,885 to the Agreement in 2025, with 71% of this going toward personnel, 20% for fringe and indirect costs, 6% combined for supplies, equipment, and travel, and 3% for other expenses. This low ratio of supplies and equipment to personnel expenses reflects the fact that many of the larger equipment and supplies purchases needed for this Program to operate at the current scale were put in place in prior years, allowing for 2025 to be a productive year of collecting, seeding, and promoting the capabilities of the Program. Nearly all of the work performed by the Program is invoiced to this Agreement, though SVS has secured and uses other (much smaller) funding sources to support smaller components of the Program, but that work is not reported here.

Another way to measure the Program's growth and efficiency over the years of this Agreement is by comparing all annual expenses to total acres that received restoration activities each year. This estimate of the Program's total cost per acre of restoration activity includes sourcing and cleaning appropriate seed, restoration planning and hand-seeding, supplying and operating the entire Program, and all outreach and education efforts. That approximate Program cost for 2025 is $97 per acre, which is lower than the 2024 figure ($104 per acre) and magnitudes lower than the 2023 figure ($10,000 per acre). Although these figures are crude and are significantly higher than what it would cost per acre if the Program were to simply focus on nothing but seed sourcing and restoration, they demonstrate the maturation and streamlining of the Program's work, and compare favorably to other rough estimates of similar restoration land treatment costs per acre ($52 - $228) for the scale of work we are performing (Meldrum et al. 2025).

Salmon Valley Stewardship is committed to reaching the goal of 20% match of total funding from this Agreement in the form of both non-cash and in-kind contributions. That goal is $103,161.50 by September 2027, and as of December 31, 2025, it had met $93,358.59, or 91%, of its commitment. Match from SVS in support of the Program's 2025 work was $29,989.

Review of agreement objectives being met

The overall objectives and goals outlined in the original and modified Agreements continued to be met by the 2025 work detailed in this report. Those goals and the 2025 work toward them are as follows:

- *Develop local solutions for accelerating the pace and scale of native plant restoration:* Made progress via seed increase contracts, increased collection quantities and species diversity, diversified seeding techniques.
- *Source, collect, and/or increase locally-appropriate seeds*: Major progress via extensive wild collections, as well as first increase contracts. Did not put much effort into commercial sourcing this year due to presumed lack of regionally-appropriate material.
- *Identify and employ restoration practices that enhance success:* Made progress via intensive spring monitoring, replanning of monitoring protocol moving forward to include control treatments and precise replication, and diversifying seeding techniques.
- *Develop increased regional capacity in all stages of native plant restoration within organizations, institutions, agencies*: Some progress made by conducting several outreach events promoting native plant use, engaging with local growers for seed increase, and committing to several new site types (pipeline, dozer line, bridge construction disturbance).

In addition to the goals of the Agreement, the 2024 Annual report detailed several aspirational goals for growth and development in 2025. Those goals and details about 2025 progress toward them or reasons they were not met are as follows:

- *Initiation of contracts with private growers to produce seed*: Accomplished.
- *Bring on a new Program coordinator to expand capacity and balance day-to-day work with planning for growth*: Accomplished.
- *Initiate seed testing to monitor seed viability*: not initiated due to high cost or labor of testing for so many species, and because so much of our seed goes back out onto the landscape in the same year as collection. Our limited amount of testing has not indicated unexpected levels of viability loss, and we believe that our strict adherence to best practices in seed handling ensure high viability for our current purposes. As the Program grows, this will be reevaluated.
- *Start working with biological soil crusts*: Although we continue to source field soil from areas with intact plant communities and soil crusts (where present) to be sieved and used in seedballs as an effort to recognize the important of soil biomes in native plant restoration, no further efforts were made to enter the space of

biological soil crust restoration because of a difficulty to identify suitable techniques that could be practically adopted by our Program given its current resources, methods, and focus.

- *Begin using new technologies like activated carbon (AC) and gibberellic acid (GA) to improve germination and establishment*: Recent research on activated carbon for use as an ameliorant for herbicide in restoration settings, some of it performed by our new Coordinator, Owen Baughman, in his prior job as a scientist, has shown a limited ability for AC to adsorb meaningful amounts of herbicides unless applied at very high levels per seed (Baughman et al. 2023, Baughman et al 2024, Davies et al. 2024). Similar levels of herbicide avoidance may be achieveable by pitting or furrowing below the affected herbicide-soil layer (Terry et al. 2021, Baughman et al. cite). However, AC remains an ingredient in our seedballs for its value in contributing to a texture and structure that dissolves well over winter. Use of GA was not explored due to lack of time and resources, but we could still choose to investigate it if research was clear that breaking dormancy for genetically appropriate native species used in restoration is actually beneficial to success, given that complex variations of dormancy generally evolve due to the improved fitness that it imparts in the climates and soils of origin.

Expected 2026 changes and program development

Staff changes

In early 2026, Program Manager Ari Pepper is projected to depart his role at Salmon Valley Stewardship, and Program Coordinator Owen Baughman will assume the Manager role. Owen is expected to continue working at the current level (30-32 hours per week average). Salmon Valley Stewardship will hire a new role to help fill in needed skills and maintain Program momentum. This new role, a Botany and Restoration Specialist, will be a permanent position and will be filled with a candidate who possesses strong skills in local plant ID and botany, an appetite for conducting detailed field work to scout, map, and collect seed, and a functional knowledge of regional plant community threats and restoration theory. This new position is also expected to work 30-35 hours per week on this Agreement.

Plans to grow the Program

This Program has come a long way in three short years and has developed several incredible assets upon which to grow. The most effective restoration efforts get “the right seed in the right place at the right time”. Our Program has invested heavily in generating the “right seed”, and this component of the restoration puzzle is among the most often overlooked because most areas lack regionally-appropriate seed in quantities relevant to restoration. Conducting restoration "in the right place and at the right time" is more likely to fail without "the right seeds", and all the money in the world cannot buy something that does not exist. As our work over the last few years has shown, it takes time and expertise to build a pipeline of regionally-appropriate native seeds. But once that pipeline reaches a certain scale, new opportunities arise to improve restoration success, advance applied knowledge of these diverse species, and engage a more diverse set of partners and audiences. With this in mind, the Program is looking ahead toward a few aspirational areas of growth in 2026 and beyond.

Consolidated species phenology database

As previously mentioned, the complex and ever-growing database of plant population locations and phenology (flowering time, seeding time, etc.) for 100 species is becoming a valuable resource for the Program internally but could also be a valuable external resource if organized correctly and maintained. In 2026, this kind of organization and development will be a new priority for the Program in order to make the most public good of this important data that our Program has begun to acquire. This could result in either our own proprietary database for this region that it easily shared, or could come from us contributing data to existing phenological databases that are more sophisticated but lacking in data for our region. We will explore the tradeoffs of available options, discuss with FS staff, and make progress toward this goal in 2026.

Engage additional FS programs

Although the primary goal of the work performed under this Agreement will be to fulfil the existing Agreement goals, engaging additional programs within the SCNF to better coordinate and plan plant restoration on a larger variety of disturbed areas is an avenue for some growth. For example, aiding in recovery of burn pile scars associated with timber sales, being aware of areas of roadside disturbance from road work, and working where recreational developments (such as campgrounds, trail improvements, etc) disturb land that is in need of seed. Essentially, anywhere the SCNF uses seed or requires contractors to use seed could be a place where our Program could improve restoration efforts by supplying quality seed or providing consultation.

Publishing seed cleaning methods

In the coming year, we plan to combine multiple years of records into our best practices and then publish these to public databases for others to use. Many of the species we work with have no publicly available information about how to clean them, so this sharing of knowledge we have already developed and recorded will be a meaningful contribution to the larger restoration economy.

Seed library image database

Although started in 2024, a comprehensive and standardized series of high-resolution seed images to accompany our seed library is a goal for 2026. These will eventually be available to the public via our website or other venues. The value of these images will primarily be for education and outreach, as the odd and otherworldly shapes and textures of seeds are often hidden from the unaided eye, and are awe-inspiring for children and adults alike to explore or recreate via art. However, some of these images might end up being the first publicly available images online for some of the more uncommon or regional species we work with, which can serve as a good resource for other native plant programs, growers, or applied researchers.

Engaging additional partners and agencies

There is also room to grow the Program outside of this Agreement by attracting funding and support from additional partners and agencies to better bolster the value and durability of the Program. Although we expect the SCNF will continue to support this Program built entirely from the current Agreement, a diversification of support would result in a more robust and wide-reaching Program with goals and obligations that beyond the work invoiced to this Agreement. Our aspirational efforts to move in that direction meet some of the broader goals of this Agreement of developing any and all aspects of the regional restoration economy and pursuing all options for generating and using diverse, high-quality seed.

Acknowledgements and contacts

We would like to highlight the contributions of various people toward the successful 2025 year, and the ongoing success of this multi-year Program. Staff from SCNF and other local agencies that committed field time to scouting, collecting, cleaning and seeding include Katie Baumann, Arianne Pieszchala, Maggie Wertheimer, Hannah Alverson, and Emma Cole. Diane Schuldt and Gina Knudson were both heavily involved in the creation and modification of this Agreement and the Program, and we are grateful for their visionary dedication to land and ecosystem stewardship in this region over their careers and wish them well in retirement. We also thank other staff from the SCNF and SVS who contributed time and energy to the Program this year. Finally, we wish Ari Pepper well in his new endeavors, and appreciate his impressive and organized efforts to build this Program into what it is and setting it up for longer-term success.

To request additional information or for other inquiries:

- Owen Baughman – Restoration Program Manager – owenbaughman@salmonvalley.org https://www.salmonvalley.org/nativeplants

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Appendix

Agreement No. 22-CS-11041300-032

Agreement Title: **Native Plant Restoration**

Performance Period: **01/01/2025 - 12/31/2025**

Contents

Draft contract for plant nursery services (generic example)

****Draft for 2025 SVS Annual Report. For reference only. This is not a final version***

This contract ("The Contract") is made effective as of [date] by and between:

Client: Salmon Valley Stewardship **Address:** 107 S Center St.
Contact Information: aripepper@salmonvalley.org, 612-310-1177

Nursery: example **Address:** example **Contact Information:** example

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1. Purpose

Salmon Valley Stewardship ("SVS") wishes to engage [Nursery Name] ("Nursery") to provide services for the cultivation of native plant species on approximately 0.02644 acres of land owned or managed by the Nursery. The primary goal is to produce seed from these native species for use in local wildland restoration projects through the existing Native Plants Restoration Program established by the cost share agreement 22-CS-11041300 between The USDA Salmon-Challis National Forest and SVS. A secondary goal is to generate local expertise in propagating native plants important for restoration to benefit the future supply and demand for these species.

2. Background

Native plant communities throughout the Western U.S. have and continue to experience significant disturbances and degradation, resulting in an increasing need for restoration activities over many millions of acres. Even with the best possible seed, restoration in this region is often unsuccessful due to harsh growing conditions, meaning large quantities of seed are needed over long timeframes to result in meaningful restoration success. Wild-collected seed cannot meet the volume of this restoration need alone, so agricultural increase of native seeds is needed. This increase of native plant seed has been underway for decades, but mostly for grasses. Native forbs are a diverse component of healthy vegetation communities and are critical to ecological function via their complex interactions with other organisms from birds and mammals to insects and soil microbiota. However, most forbs are poorly understood, with very few grown for seed increase and little if any appropriate seed available for purchase by restoration practitioners for most species. One reason for this lack of forb seed increase and availability is that many of these species pose challenges to being appropriately propagated and managed in agricultural settings to produce large seed crops. Many natural adaptations that help promote success in the wild for these species - such as seed dormancy, indeterminate flowering, durable seed appendages, and variable size and phenology - are directly at odds with the kinds of traits that typical agricultural practices rely on for maximizing yield and minimizing harvest effort.

Despite the challenges of growing native forbs for seed increase, it can be accomplished properly and efficiently by specialty farmers who develop the appropriate skill and expertise with these species. Typically, acquiring such expertise is done proactively by farmers experimenting with their own resources and time prior to successfully selling the seed, but this requires significant upfront capital and consistent demand for the specialty product. Unfortunately, demand for native forbs in this region is unpredictable and often driven by federal agencies with large minimum needs, lowest-bidder purchasing policies, and short lead-times. Furthermore, there is increasing pressure to follow specific seed transfer guidance and genetic management for seedlots used in restoration in order to maximize restoration success, meaning farmers must produce the right variety at the right time in order to meet demand. Even the task of acquiring starting seed with high viability and the appropriate genetic diversity to begin increase can be time-consuming and complex for new growers. Large operations growing multiple varieties and species at the same time can be profitable in such a complex, volatile, and high-risk market, but the current situation is discouraging for small growers to enter and/or experiment with new species.

This contract recognizes these challenges and is specifically designed to reduce risk from small growers who want to work with "new-to-them" native forb species. The goal of this contract is to encourage the development of expertise with native forb seed production for small growers, so that they have more confidence and less risk in engaging larger and more traditional contracts for seed production in the future. This contract reduces risk by incrementally paying growers based upon reaching specific milestones of effort and learning (as recorded in reports; see below) rather than upon only final seed production quantity. The goal for this contract is to result in the co-production of 1) local farmer expertise in growing native forbs for seed, 2) new or useful propagation knowledge for specific forb species to share with the public, and 3) high-quality native seed for use in local restoration efforts.

3. Scope of Work

I. The Nursery agrees to use the Plot for the cultivation of native plant species, starting in the fall of 2025, by using seed collected by SVS from designated wildland sites.

II. The Nursery agrees to follow the Propagation Guidelines and Protocols included in Exhibit 1 to the best of their ability, and to communicate with SVS prior to deviating from those guidelines and protocols if unable to follow them.

III. Species selected for cultivation by The Nursery will be chosen prior to the signing of this contract and are as follows:

   A. Dieteria canescens - Hoary Tansyaster

   B. *Chaenactis douglasii* - Douglas's Dusty Maiden

IV. The Nursery will perform the following activities:

   A. **Preparation:** The Nursery will prepare the Plot for planting in the fall of 2025, including soil preparation, clearing, and other necessary activities.

   B. **Germination & Sowing:** The Nursery will germinate seeds via direct sowing and in a nursery setting following provided protocols during the fall/winter of 2025 and ensure that proper care is given to promote successful seedling growth. Nursery-grown seedlings will be used to fill any gaps in the field-sown plot.

   C. **Establishment & growth:** In the spring of 2026, the Nursery will transplant the nursery-grown seedlings and manage plant growth over the course of the growing season to promote high survival of plants.

   D. **Harvest & cleaning:** The Nursery will manage the plot through to seed harvest and ensure collection and cleaning follow the provided specifications. The Nursery agrees to deliver all harvested and cleaned seed to SVS for long term storage in good condition (dry, cool) within 2 weeks following harvest. Some SVS-managed equipment can be made temporarily available to assist with seed harvest and cleaning if needed (vacuums, dewingers, sieves, separators), but must be returned undamaged within 48 hours in good working order.

   E. **Reporting:** To confirm progress and capture useful lessons learned, The Nursery will submit all reports as listed below to SVS. Reports will be between 0.5 and 2 pages and can consist of bulleted notes or simple commentary. All reports must detail the most recent period of work, including success achieved, barriers encountered, corrective measures taken, and improved protocols discovered (if any). Additional information required in specific reports are detailed below. Reports must be sent via email to SVS at the above contact information within 14 days after the completion of the following milestones:

1. Completion of both direct-sowing and nursery germination
    a) Additional information required: nursery germination conditions, nursery percent germination achieved under each set of conditions, field-sown seeding rate and method, field seeding dept, field pre- or post-sowing seedbed treatments or activities, field irrigation information (if any), dates for both nursery and field germination/sowing activities
2. Upon time of field outplant planting
    a) Additional information required: nursery conditions and growing medium used, percent mortality in nursery between germination and outplanting, number of seedlings outplanted, percent establishment of field-sown seed (% of holes or row filled), details about thinning (if needed)
3. 6 months after field-planting
    a) Additional information required: percent mortality since date of outplanting, suspected reasons for any mortality, notes about variability in plant shape/size
4. 1 year after field-planting (if applicable)
    a) Additional information required: percent seedling mortality since date of outplanting
5. Upon delivery of each yearly seed harvest prior to the end date of this contract
    a) Additional information required: details about method and frequency of seed harvest, percent of total plants that produced harvested seed, estimated percent of seed that was unable to be harvested (lost to wind or rain), list of possible weed seed contaminants if any, basic seed cleaning details, total weight of cleaned seed delivered.

F. **Public sharing of knowledge**: SVS and The Nursery agree that propagation and plant maintenance information co-produced during the course of this contract and included in reports may be publicly shared (e.g. to other not-for-profit native seed collaboratives, online propagation databases, native seed conferences). Shared information will be in the form of summarized protocols or as tabular/graphical data. Reports from The Nursery will not be directly shared themselves, nor will identifiable or personal information about The Nursery, unless requested.

4. Land Use & Access

I. The Plot is [x] sq. ft. (y bed feet) and is located [location].

II. The Nursery will provide occasional, supervised access to the Plot to SVS Restoration Program Staff, if requested 48 hours ahead of time by SVS, to observe plants or troubleshoot problems.

5. Payment Structure

I. SVS will pay The Nursery per bed-foot in production, and this price is to include all work detailed in this contract, including the seeds produced prior to the contract end date

  A. **Payment Rate:** $[rate] per bed-foot, [y] total bed-feet.

  B. The total payment $[total payment] will be broken down into three installments as follows:

    1. **Initial Payment:** $[fill in] (30% of total payment) upon execution of this contract, with the expectations of The Nursery preparing seedbeds and conducting direct sowing, conducting pre-germination, germination, and establishment activities for nursery-grown seedlings, and completing and submitting Report 1.

    2. **Progress Payment:** $[fill in] (30% of total payment) upon completion of outdoor spring seedling planting to fill establishment gaps (or upon completing spring thinning if no gaps were present) with the expectations that The Nursery will conduct field maintenance, seed harvesting, seed cleaning, and the submission of reports 2-4.

    3. **Harvest Payment:** $[fill in] (40% of total payment) upon the delivery of all seed harvested before the end of the contract, and the submission of Report 5 with each year's harvest.

      a) If seed is produced in both 2026 and 2027, both harvests are included in this contract, and the Nursery can elect to receive half the harvest payment after the 2026 harvest.

C. If The Nursery borrowed or used SVS-managed equipment for seed cleaning and this equipment is damaged or not returned, SVS will deduct the value of the replacement or repair costs from the final payment.

6. Seed Production Shortfall & Liability

I. Despite the best efforts of The Nursery and SVS, seed production could be lower than desired or even nonexistent.

II. The Nursery will receive each payment installment only if:

  A. The stated expectations of the prior payment installment have been met and associated reports have been submitted

  B. The Nursery has:

    1. adhered to the agreed-upon protocols, methods, and timeline for propagation, and communicated with SVS staff as major issues arise and before deviating from protocols

    2. taken reasonable corrective measures to avoid reduced seed production, at no additional cost to SVS

    3. included specific details in the post-harvest report (#5) about the reasons that seed harvest was low, the corrective measures and their effects, and suggestions to avoid these issues in future efforts.

7. Ownership of Seeds

I. SVS will retain ownership of the starting seeds provided to the Nursery for propagation and all seed produced from these species by The Nursery prior to the end of this contract, with the exception that The Nursery can elect to keep enough seed (5,000 to 10,000 viable seeds) for the purposes of growing additional plots beyond the contract period.

II. Leftover seedlings not used to supplement gaps in direct-sown fields are property of SVS, unless there are more than 50, in which case SVS and The Nursery will come to an agreement about what to do with these excess plants that benefits both parties, resulting in an addendum to this contract.

III. SVS recognizes some species may produce additional seasons of seed harvests beyond the contract period. Those seeds are not covered under this contract and can be sold as decided by The Nursery. However, SVS or one of it's Native Plant Program Partners will still want this seed and will appreciate being informed of future harvests so that they can find other funds to purchase the seed at a fair market price, if possible.

8. Liability & Indemnification

I. The Nursery agrees to indemnify and hold SVS harmless from any claims, damages, or liabilities arising from The Nursery's activities on the Plot, including any accidents, property damage, or injury caused by The Nursery's staff or equipment.

II. SVS is not responsible for any damages or losses caused by the activities of The Nursery, unless directly caused by SVS staff's own actions or negligence.

III. Should it be necessary, conflict of interest documents must be signed by The Nursery and approved by the SVS board prior to the initiation of contract activities.

9. Term & Termination

I. This contract will begin on [date, 2025] and will terminate on September 30th, 2027, unless extended by mutual written agreement of both parties.

II. SVS retains the right to terminate this contract with 30 days written notice if The Nursery fails to fulfill their obligations under this contract.

10. Miscellaneous

I. **Dispute Resolution:** Any disputes arising out of or in connection with this contract shall be resolved through mediation and or arbitration, in Lemhi County.

II. **Governing Law:** This contract shall be governed by the laws of the state of Idaho.

III. **Amendments:** Any amendments to this contract must be made in writing and signed by both parties.

Signatures

[Signature section omitted in this draft]

Exhibit 1: Propagation Guidelines and Protocols for Native Seed Production

Purpose

The following general guidelines originate from published research recommendations aimed at maximizing how much of the genetic diversity within locally-collected wild seedlots is retained through the process of agricultural seed increase. This maintenance of genetic diversity improves the chance of short and long-term success of seed-based restoration. Additional species-specific protocols for germination and propagation are included to maximize the number of seed-bearing adult plants that are produced from the minimum amount if starting seed. Contractors must read and make all reasonable efforts to follow these guidelines and protocols.

Background

Agricultural production of native seeds is critical to help meet the increasingly large need for restoration or augmentations of degraded ecosystems, because use of wild harvested seed alone is bound to be inadequate or ecologically damaging itself (Kiehl et al. 2014, Pedrini et al. 2020, Leger et al. 2021). However, seeds that are bound for native plant restoration projects must meet several unique requirements to have the greatest chance of resulting in a self-sustaining and ecologically valuable population (Kettenring et al. 2014; Espeland et al. 2017). These desired qualities of a highly valuable native seedlot are different and sometimes opposite from those of typical seedlots used for production of food, fuel or fiber for human or livestock use (Leger et al. 2021). Seeds used in restoration ideally have the high levels of genetic diversity and trait variability needed to persist and adapt through countless future generations without further human input, whereas seeds used in agriculture ideally have stable and predictable traits and rely on continued human input and selection to maintain these valuable traits or develop new traits.

Native plants often have characteristics that make them complicated to germinate, propagate, and harvest seed from. Elimination or avoidance of these traits through intentional or unintentional selection likely has negative effects on the value of the resulting seed for restoration (Leger et al. 2021, Diaz-Martin et al. 2023). For example, a population may have individuals that mature at different times or flowers that mature at different times on the same plant, and harvest protocols must be catered to each of these challenges to maintain population diversity. Even careful production over multiple generations can result in notable, unintentional selection. For example, after 8 generations of production of *Clarkia pulchella,* Pizza et al. (2021) and Etterson et al. (2025) found clear and unintentional shifts in population genetics, including increased incidence of self-fertilization and decreased population-wide genetic diversity.

The importance of maintaining high genetic diversity combined with the logistical barriers that undomesticated species present to seed propagation make the business of careful seed production from wild collections difficult but important. Adherence to the guidelines and protocols below will reduce the negative consequences of agricultural propagation on these native plants.

<u>General Propagation Guidelines</u>

The guidelines that follow are sourced from the native seed production literature and together represent current best practices for maintaining genetic diversity. Please read these carefully and regularly, and follow as many of them as is possible and reasonable, recognizing that they are not "*all or nothing*" requirements, but rather "*the more, the better*" guidelines. A helpful mantra for working with the challenging traits of native species bound for restoration is "*innovate, don't eliminate*!".

Source seed collection (already completed by SVS):

- Collect seed from multiple populations that are separate but in the same region (regional admixture provenancing); Espeland et al. 2017, Bucharova et al. 2019)
- Collect from individual populations multiple times (within or across growing seasons) (Espeland et al. 2017, Pedrini et al. 2020)
- Maximize the number of sampled individuals in each source population (minimum 50 parents per population, ideal 500+) (Espeland et al. 2017)
- Carefully handle and clean seed to minimize loss of viable seed from the collection prior to propagation (Pedrini et al. 2020, Conrady et al. 2023)

Germination and greenhouse establishment

- Maximizing the number of plants you get from the starting seed will maximize diversity
- Follow trusted pre-germination treatments and protocols (below), but if none are reliable, experiment with multiple conditions based on related species protocols. If germination is lower than 50% of the apparently viable seed, try again with different treatments
- Use the longest recommended stratification time if stratification is needed; do not err on the shorter side (Diaz-Martin et al. 2023)
- Consider stratifying seed in the soil medium in which it will grow, rather than in dishes or agar that require immediate post-germination transplanting that can damage seedlings and cause unwanted selection in root traits (Diaz-Martin et al. 2023)

- Avoid overseeding that will result in a need to thin plants. If thinning needs to happen in some cases, make efforts to conserve different sizes of plants (don't just thin small ones) and different phenology (don't just thin the late plants). Make every effort to ensure that the plants you choose to keep include individuals from all germination cohorts (early, mid, and later-germinating seeds) to avoid phenological selection (Diaz-Martin et al. 2023)
- Refer to published guidelines for species/genus-specific recommended planting medium and moisture/light/temperature requirements
- Consider keeping source populations separate through germination and outplanting to ensure plants with different needs can be more easily catered to (St. Clair et al. 2020)

Field establishment

- Follow provided guidelines for timing and spacing of outplanting, and maintain more than the minimum number of flowering plants in case of mortality events.
- Consider keeping source populations physically separate through the seed production process (e.g. different rows or sections of row) while still encouraging open-pollination across populations (St. Clair et al. 2020).
- Consider polyculture planting, with multiple species in each row or alternate rows, to avoid unintentional selection for intraspecific competitive ability and to encourage traits that promote interspecific coexistence (Espeland et al. 2017).
- Mimic the natural moisture, light, nutrient and disturbance levels (and their variation) found in the wild (Espeland et al. 2017). This could somewhat contradict typical farm instincts to ameliorate harsh conditions.
- Conduct a reasonable amount of weed control through hand-weeding, but complete removal of all weeds is not necessary unless specific weeds will cause issues in seed harvesting or cleaning.
- Ensure proper pollination is occurring, via promoting high diversity of on-farm pollinators, and exposure of plants to open pollination and/or wind. When increasing material from locally-collected populations (as is the case for SVS and The Nursery in this instance), it is likely beneficial if pollinators are actively pollinating nearby wild populations and propagation fields at the same time, further increasing geneflow (Espeland et al. 2017).
- Avoid any activities that impart selection:
    - Do not perform "rouging", or the process of removing non-standard individuals. In fact, do the opposite: take measures to keep all plants alive even if different

    - Avoid over or under-watering. Each of these could favor a different fraction of the population and result in unwanted selection.
    - Avoid over-reliance on fertilizers and/or herbivore control, each of which can select for vigorous but dependent plant traits and select against plants adapted to herbivory and/or nutrient-poor conditions (Conrady et al. 2023).

Seed Harvest and Cleaning

- Make all reasonable attempts to collect all seed from all flowers on all plants (Pedrini et al. 2020, Conrady et al. 2023). This will often require multiple harvests per plant, and careful harvest techniques that avoid damaging unripe seedheads.
    - Seeds will have different genetics for early vs late-ripening seed, even from the same plant, due to maternal effects and pollinator activity
    - Even determinate species with all seed ready at the same time on a single plant will have individuals with early and late traits that should be maintained
- Make all reasonable attempts to avoid contamination of seed with weed seeds, unless those weed seeds are easily separable from target seed during cleaning
- Make all reasonable attempts in seed cleaning to conserve all viable seed, even if there is a large range of seed size, weight, or shape (Holl et al. 2022). Diverse populations can have different seed dimensions, and losing certain seedlot fractions (e.g. the lightest or smallest seeds) imparts unwanted selection (Pedrini et al. 2020)

Seeding and Restoration Protocols (will be performed by SVS)

- Mix seed produced from multiple regionally proximal populations and/or production farms, if starting seed was initially from the same populations (St. Clair et al. 2020)

Propagation Protocol: *Dieteria canescens* - Hoary Tansyaster

Photos from https://westernforbs.org/species/dieteria-machaeranthera-canescens-hoary-tansyaster/

Overview of species:

This is a short-lived perennial forb that grows multiple stems up to 2-4 ft tall, each with dozens to hundreds of flowerheads that flower indeterminately in late summer through mid-fall. Seeds are ripe 4-5 weeks after flowering, and have hairy pappi that readily disperse seed via wind or jostling of stem. This species can produce seed crops for 2-4 years in production fields, starting with the first or second season after sowing.

Germination:

- Seed of this species is generally nondormant but some varieties or populations benefit from periods of cool+moist stratification ranging from a few days to over a month. The preference of seed from the Salmon region is yet unknown.
  - As a starting point for nursery germination, seed should be moist incubated in nursery cells on medium-coarse well drained medium and exposed to diurnal cycles of light/dark that also correspond with higher/lower temperatures, with 52-77*F highs and 33-50*F lows.
  - Germination may be staggered from 4 days to 40+ days

Nursery propagation:

- Some sources suggest direct-seeding into field plots in late fall into firm, weed-free seedbed will produce stands that produce the greatest number of harvests, but under- or over-seeding could result in row gaps (inefficient use of space) or a need for thinning (which imparts unwanted selection).
  - Spring seeding produces stands that do not produce much seed in the first year and have fewer harvest years.

- Others have successfully grown seedlings in nurseries and transplanted in fall. Seedlings can take up to 6 months for roots to fill 3x5 inch containers.
    - There are no published records evaluating the success of spring outplanting
- Plants are taprooted, which can require more care and good timing when transplanting, and do not take well to being germinated on blotters first.
- Suggested planting medium: Species is adapted to gravely soils with good drainage that have medium subsurface moisture availability, and do not do well in soils with prolonged saturation. Create a planting mix that mimics this, such as a 2:1:5 mix of fine volcanic sand (lava fines), perlite, and Sunshine Mix #4 or equivalent.

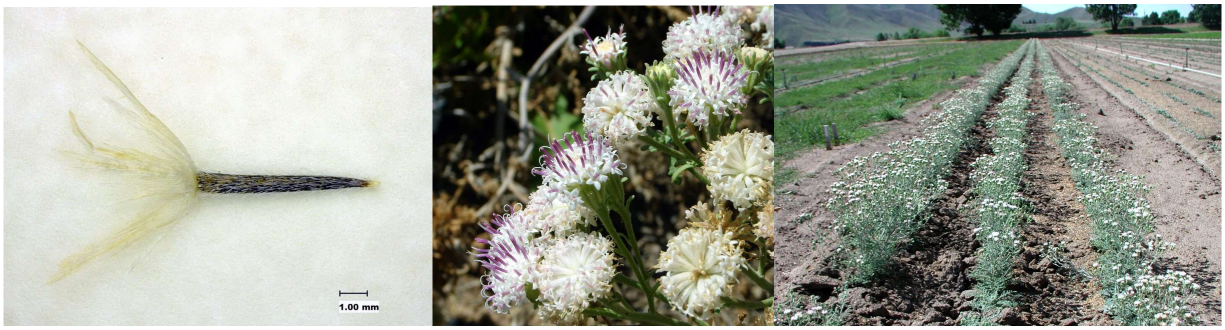
Field Propagation:

- Species is adapted to medium to coarse textured well drained soils with pH 6 - 8.4 and at least 10 inches of rooting depth
- Recommended to use weed barrier fabric with 3-6 inch diam holes spaced 9 - 18 inches apart (0.6 to 2.25 square feet per plant; or 89 to 170 plants per 100 square feet)
- Supplemental irrigation is unnecessary, especially with weed barrier fabric, and was not found to reliably increase seed production. It may be warranted under severe and lengthy spring or summer drought
- For direct sowing:
    - Seeding rates of up to 25 seeds per hole have been recommended to maximize establishment, but this likely results in the need to thin, and thinning can bottleneck genetic diversity. Consider a lower seeding rate (5-10 seeds per hole) to reduce thinning followed by spring outplanting of nursery stock to fill gaps.
    - If thinning becomes necessary, see general guidelines for thinning practices that minimize unwanted selection.
    - A light covering of sand or sawdust was found to promote stand establishment. Regardless of covering seeding depth is ⅛ to ¼ in.; lightly pack soil
    - Use of row cover from sowing until early April was found to improve stand production in Ontario OR. Mouse bait packs were placed inside the cover.
- For outplanting of seedlings from containers
    - Appropriately harden-off seedling prior to outplanting. This species is eventually frost-tolerant but very young seedlings are affected by hard freezes.

Maintenance and Harvest:

- Supplemental irrigation is likely unnecessary unless there is severe/prolonged drought
- Flowering is from late summer to late fall; seeds mature within 4-5 weeks of flowering
- Indeterminate seed ripening, so hand or vacuum harvesting recommended to allow for multiple harvest per plant without disturbing unripe seed.
- Seed readily disarticulates by light touch or wind from flower heads when ripe, and seed can be safely collected just before the pappus and seedhead have fully opened.
- Seed is small and hard to clean due to a hairy pappus that is not easily removed from seed. For many restoration applications (including for SVS) there is no need to remove this pappus if the seedlot is free of weed species contaminants. Therefore, take extra care to remove weeds prior to harvest that could result in contamination.
- Allow seed to dry in open and well-ventilated containers at ~50*F and >30% RH.
- Seed may contain granivorous insects and can be treated with an appropriate insecticide upon harvest or frozen for 48 hours soon after initial drying
- After seed shatter, plants go dormant and can be mowed no shorter than 6 inches for winter to reduce the chance of old stems uprooting dormant rootstocks.

Propagation Protocol: *Chaenactis douglasii* - Douglas's Dusty Maiden



Photos from https://westernforbs.org/species/douglas-dustymaiden-chaenactis-douglasii/

Overview of species:

This is a biennial forb that grows a prostrate rosette its first year, then a larger rosette that bolts into a single, many-branched stem 1-3 ft tall in its second year. Each healthy plant has hundreds of flowerheads that all mature within a few weeks of one another in mid-summer (late June through July). Seeds have scaly pappi that aid in wind dispersal and seeds readily detach themselves from the head when ripe. This species typically only produces seed in its second (final) year in the wild, but has been found to occasionally have large first-year seed production in some instances. Stands that produce large harvests in the first year may not produce large harvests the second year.

Germination:

- Seeds are considered deeply dormant and require cold moist conditions to stratify, but exact conditions vary by population and those from colder climates need longer cold stratification
- Direct sowing in Oct-Dec in the same climates as seed origin can result in proper stratification and reasonable amounts of germination and emergence in the first spring. Early-germinating seedlings can be susceptible to unseasonable hard freezes.
- For manual germination, 30-90 days of cold moist (+/- 37*F) stratification followed by warmer temperatures (60-70*F) often produces 30%+ germination, but higher rates of germination have not been reliably achieved. Several practices could improve above this ~30% mark:
    - Cold water soak prior to stratification could improve post-stratification germination
    - Cool (70*F) dry after-ripening could improve post-stratification germination

- Light scarification may boost germination (our seed may already have been)
- High rates of germination were found to occur after up to 6 months of continuous cold moist incubation at 37-41*F in one instance
- Seed may require light to germinate

Nursery propagation:

- To take advantage of natural stratification, consider sowing containers outside or in +/- ambient greenhouses in late fall and transferring seedlings to larger containers or directly into the ground at the secondary leaf stage.
- Weak fertilizers may be suitable to promote growth.
- Suggested planting medium: Species is adapted to gravely soils with good drainage that have medium subsurface moisture availability, and do not do well in soils with prolonged saturation. Create a planting mix that mimics this, such as a 3:1:5 mix of fine volcanic sand (lava fines), perlite, and Sunshine Mix #4 or equivalent.
- Time until seedling's roots fill a 2.5 x 5.5 in container is approximately 6 months, but could be grown in smaller pots and outplanted sooner if desired.

Field Propagation:

- Species is adapted to soils with a pH of 4.2 - 8.0
- Recommended to use weed barrier fabric with 3-6in diam holes spaced 9-18 in apart (0.6 to 2.25 sq ft per plant; or 88 to 170 plants per 100 sq ft))
- Supplemental irrigation is unnecessary, especially with weed barrier fabric, and was not found to reliably increase seed production. It may be warranted under severe and lengthy spring or summer drought
- For direct sowing:
    - Seeding rates of up to 25 seeds/hole have been used, but this results in the need to thin, which can bottleneck genetic diversity. Consider lower seeding rate (5-10 seeds/hole) and be prepared to fill gaps by outplanting nursery stock in spring
    - If thinning is necessary, see general guidelines for ideal thinning practices
    - A light covering of sand or sawdust was found to promote stand establishment. Regardless of covering seeding depth is ⅛ to ¼ in.; lightly pack soil
    - Use of row cover from sowing to early April was found to improve stand production in Ontario OR. Mouse bait packs were placed inside the cover.

    - If soil crusting issues, light irrigation can assist with germination and emergence
- For outplanting of seedings from containers
    - Appropriately harden-off seedling prior to outplanting. This species is eventually frost-tolerant but very young seedlings are affected by hard freezes.

Maintenance and Harvest:

- Supplemental irrigation is likely unnecessary unless there is severe/prolonged drought
- Maintain relatively weed-free fields. Eliminate all cheatgrass prior to seed harvest if possible because cheatgrass seeds are particularly difficult to efficiently clean from the seeds of this species.
- Most flowers ripen within a 1-3 week window of one another, but multiple harvests are likely necessary to avoid loss due to dispersal. Initial harvests need to be gentle enough to avoid disturbance of unripe heads.
- Ripening seed is at risk of dispersal from heavy rain, hail, or strong winds. Maintaining clean row spaces can allow for recovery of early-dispersed seed by vacuum/sweeping.
- The scaly pappus is not easily removed from seed. For many restoration applications (including for SVS) removal of pappus is not needed if the seedlot is weed-free.
- Allow seed to dry in open and well-ventilated containers at ~50*F and >30% RH.
- Seed may contain granivorous insects and can be treated with an appropriate insecticide upon harvest or frozen for 48 hours soon after initial drying

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    - https://npn.rngr.net/renderNPNProtocolDetails?selectedProtocolIds=asteraceae-machaeranthera-3727
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Seedlot measurement for seed collected in 2025

Table 3. A selection of the key seedlot measurements we calculated for the majority of species collected in 2025.

SPECIES	Total Collected in 2025 (g)	Sample bulk mass (g)	Sample pure seed mass (g)	% Purity	300-seed weight (g)	Weight per whole seed (h)	Whole seeds per gram	Approx seed per 1/4 tsp	Approx seed per cup
ACMI	7.553	0.043	0.035	81.40%	0.035	0.00012	6,977	3,237	621504
ASAT2	137.853	0.965	0.948	98.24%	0.948	0.00316	311	297	57024
ASMI9	0.604	0.638	0.634	99.37%	0.634	0.00211	470	n/a	n/a
ASPU9	260.889	1.114	1.107	99.37%	1.107	0.00369	269	298	57216
ASSC4	619.601	1.415	1.406	99.36%	1.406	0.00469	212	248	47616
ASSP	1994.9	1.772	1.772	100.00%	1.772	0.00591	169	58	11136
BASA3	3200.7	2.676	2.661	99.44%	2.661	0.00887	112	62	11904
BOECH	13.525	0.039	0.036	92.31%	0.036	0.00012	7,692	5,115	982080
CAEU	26.674	0.372	0.36	96.77%	0.360	0.00120	806	381	73152
CAFL7	49.951	0.034	0.032	94.12%	0.032	0.00011	8,824	3,018	579456
CHDO	852.9	0.32	0.29	90.63%	0.290	0.00097	938	195	37440
CLSE	396	1.974	1.974	99.99%	1.974	0.00658	152	119	22848
CORA5	2.268	0.088	0.081	92.05%	0.081	0.00027	3,409	1,647	316224
CRAC2	2.045	0.351	0.301	85.75%	0.301	0.00100	855	217	41664
DRYMO	17.727	0.027	0.025	92.59%	0.025	0.00008	11,111	6,467	1241664
ERCO24	1.931	0.158	0.145	91.77%	0.145	0.00048	1,899	1,149	220608
ERHE2	1.266	0.583	0.579	99.31%	0.579	0.00193	515	262	50304
ERMI4	3.127	0.118	0.105	88.98%	0.105	0.00035	2,542	1,947	373824
ERNA10	56.211	0.428	0.299	69.86%	0.299	0.00100	701	233	44736
EROV	121.613	0.221	0.219	99.10%	0.219	0.00073	1,357	1,076	206592
ERPU2	118.58	0.028	0.027	96.43%	0.027	0.00009	10,714	3,579	687168
ERSTP3	189.077	0.27	0.243	90.00%	0.243	0.00081	1,111	767	147264
ERUM	96.048	0.594	0.565	95.12%	0.565	0.00188	505	243	46656
FRAL2	190.228	0.853	0.67	78.55%	0.670	0.00223	352	181	34752
FRPU2	13.168	0.628	0.518	82.48%	0.518	0.00173	478	137	26304
GRSQ	1096.8	0.339	0.308	90.86%	0.308	0.00103	885	598	114816
HACI2	75.498	0.69	0.551	79.86%	0.551	0.00184	435	180	34560
HEAN3	1592.39	2.284	2.253	98.64%	2.253	0.00751	131	99	19008
HECY2	3.343	0.02	0.012	60.00%	0.012	0.00004	15,000	5,700	1094400

SPECIES	Total Collected in 2025 (g)	Sample bulk mass (g)	Sample pure seed mass (g)	% Purity	300-seed weight (g)	Weight per whole seed (h)	Whole seeds per gram	Approx seed per 1/4 tsp	Approx seed per cup
HEUN	176.889	2.741	2.149	78.40%	2.149	0.00716	109	46	8832
IOAL	19.942	0.334	0.32	95.81%	0.320	0.00107	898	310	59520
IPAG	3.442	0.376	0.366	97.34%	0.366	0.00122	798	598	114816
LAOCO	547.834	0.34	0.338	99.41%	0.338	0.00113	882	384	73728
LERE7	205.509	0.355	0.355	99.99%	0.355	0.00118	845	651	124992
LILE10	17.375	0.488	0.429	87.91%	0.429	0.00143	615	408	78336
LIRU4	123.31	7.431	7.405	99.65%	7.405	0.02468	40	46	8832
LODI	338.657	3.782	3.747	99.07%	3.747	0.01249	79	19	3648
LOFO	98.893	1.488	1.471	98.86%	1.471	0.00490	202	46	8832
LOMAT-K	93.909	1.397	1.321	94.56%	1.321	0.00440	215	83	15936
LOMAT-W	274.7	1.451	1.398	96.35%	1.398	0.00466	207	66	12672
LOTR2	48.954	1.632	1.612	98.77%	1.612	0.00537	184	46	8832
MACA2	200.591	0.22	0.21	95.45%	0.210	0.00070	1,364	510	97920
MEDI	287.898	0.127	0.101	79.53%	0.101	0.00034	2,362	1,864	357888
NOTR2	149.363	0.525	0.506	96.38%	0.506	0.00169	571	66	12672
OECA10	121.786	0.928	0.76	81.90%	0.760	0.00253	323	192	36864
OEVI	96.7	0.141	0.135	95.74%	0.135	0.00045	2,128	1,068	205056
OREO sp.	275.607	0.523	0.517	98.85%	0.517	0.00172	574	357	68544
PEAR2	5.913	0.83	0.8	96.39%	0.800	0.00267	361	213	40896
PEDE4	80.427	0.024	0.014	58.33%	0.014	0.00005	12,500	8,188	1572096
PEER	95.647	0.287	0.263	91.64%	0.263	0.00088	1,045	903	173376
PELE8	1.696	0.384	0.377	98.18%	0.377	0.00126	781	348	66816
PEVE2	10.41	0.118	0.114	96.61%	0.114	0.00038	2,542	1,459	280128
PHHA	129.564	0.314	0.301	95.86%	0.301	0.00100	955	836	160512
PODO4	13.445	0.548	0.539	98.36%	0.539	0.00180	547	598	114816
SILI	25.588	0.034	0.032	94.12%	0.032	0.00011	8,824	7,279	1397568
SPCR	644.967	0.036	0.03	83.33%	0.030	0.00010	8,333	8,392	1611264
STAC	2922.9	0.383	0.369	96.34%	0.369	0.00123	783	168	32256
VUOC	44.082	0.115	0.078	67.83%	0.078	0.00026	2,609	770	147840
ZIVE	88.331	0.506	0.499	98.62%	0.499	0.00166	593	217	41664

List of seed mixes and their composition

Table 4. List of seed mixes (across the top) and the species they contained (marked by an X), with the final two columns indicating whether each species was only included in the bare seed version of the mix (not included in seedballs), or only included in seedball mixes as single-seeded "solo" seedballs. If a species has no X in either of the last two columns, it was included in both the regular seedball and bare seed versions of the mixes.

Code	Latin	Benches Mix	Diamond Mix	Dry Slopes Mix	Steep Rocky Mix	Roadside Mix	Pipeline Mix	Stoddard Mix	*Bare seed mixes only*	*Single-species seedballs*
ACHY	*Achaenatherum hymenoides*					x		x		x
ACMI	*Achillea millefolium*	x	x	x		x	x			
ARSO2	*Arnica sororia*	x	x				x			
ARDR4	*Artemisia dracunculus*			x	x				x	
ARTR2	*Artemisia tridentata*			x	x				x	
ARTR4	*Artemisia tripartita*			x	x				x	
ASSP	*Asclepias speciosa*	x							x	
ASAT2	*Astragalus atropubescens*		x	x			x			
ASPU9	*Astragalus purshii*	x	x	x						
ASSC4	*Astragalus scaphoides*			x			x			
BASA3	*Balsamorhiza sagittata*	x	x	x			x			
BOECH sp.	*Boechera spp.*	x	x	x						
CAEU	*Calochortus eurycarpus*	x	x				x			
CAFL7	*Castilleja flava*	x	x	x			x			
CHDO	*Chaenactis douglasii*		x	x	x	x		x		x
CHAN80	*Chamaenerion angustifolium*	x								
CLSE	*Cleomella serrulata*					x				
COLI2	*Collomia linearis*	x					x			
CORA5	*Cordylanthus ramosus*	x								
CRAC2	*Crepis acuminata*		x				x			
DRYMO sp.	*Drymocallis spp.*	x	x				x			
ELEL5	*Elymus elymoides*		x	x			x	x		x
ERNA10	*Ericameria nauseosa*	x	x	x			x	x		
ERPU2	*Erigeron pumilis*	x	x	x	x		x			x
ERCO4	*Eriogonum corymbosum*		x							
EROV	*Eriogonum ovalifolium*		x							
ERSTP3	*Eriogonum strictum proliferum*			x	x					
ERUM	*Eriogonum umbellatum*	x					x			

Code	Latin	Benches Mix	Diamond Mix	Dry Slopes Mix	Steep Rocky Mix	Roadside Mix	Pipeline Mix	Stoddard Mix	*Bare seed mixes only*	*Single-species seedballs*
FRAL2	*Frasera albicaulis*	*x*	*x*				*x*			
FRPU2	*Fritillaria pudica*	*x*	*x*				*x*		*x*	
GRSQ	*Grindelia squarrosa*	*x*	*x*	*x*		*x*		*x*		*x*
HACI2	*Hackelia cinerea*			*x*	*x*			*x*		
HEUN	*Helianthera uniflora*						*x*			
HEAN3	*Helianthus annuus*			*x*		*x*		*x*		*x*
HECY2	*Heuchera cylindrica*						*x*			
IOAL	*Ionactis alpina*		*x*	*x*						
LAOCO	*Lappula occidentalis*	*x*	*x*	*x*			*x*			*x*
LERE7	*Lewisia rediviva*	*x*	*x*							
LIRU4	*Lithospermum ruderale*	*x*	*x*				*x*			
LODI	*Lomatium dissectum*			*x*						
LOFO	*Lomatium foeniculaceum*		*x*	*x*						
LOGR	*Lomatium grayi*		*x*	*x*	*x*					
LOTR2	*Lomatium triternatum*	*x*	*x*	*x*						
MACA2	*Machaeanthera canescens*		*x*	*x*						
MEDI	*Mentzelia dispersa*		*x*	*x*	*x*					
MELA2	*Mentzelia laevicaulis*			*x*	*x*					
NOTR2	*Nothocalais troximoides*	*x*	*x*	*x*			*x*			
OECA10	*Oenothera caespitosa*			*x*	*x*					
OEVI	*Oenothera villosa*					*x*		*x*		
OREO sp. 1	*Oreocarya*	*x*	*x*	*x*	*x*					
PACA6	*Panicum capillare*					*x*		*x*		
PEAR2	*Penstemon aridus*		*x*							
PEDE4	*Penstemon deustus*			*x*	*x*					
PEER	*Penstemon eriantherus*			*x*	*x*					
PENST spp.	*Penstemon spp.*		*x*							
PHHA	*Phacelia hastata*			*x*	*x*					
PHHE2	*Phacelia heterophylla*	*x*		*x*	*x*					
PHLI	*Phacelia linearis*	*x*	*x*	*x*						
PLPA2	*Plantago patagonica*	*x*	*x*	*x*						
POSE	*Poa secunda*	*x*		*x*			*x*	*x*		*x*
PODO4	*Polygomun douglasii*	*x*								
SCLI	*Schoenocrambe linifolia*	*x*	*x*	*x*						

Code	Latin	Benches Mix	Diamond Mix	Dry Slopes Mix	Steep Rocky Mix	Roadside Mix	Pipeline Mix	Stoddard Mix	*Bare seed mixes only*	*Single-species seedballs*
SPCR	*Sporobolus cryptandrus*	x		x	x	x		x		x
STAC	*Stenotus acaulis*	x	x	x						
THLA	*Thelypodium laciniatum*	x		x	x					
VEBR	*Verbena bracteata*					x		x		
VUOC	*Vulpia octoflora*	x	x	x						
ZIVE	*Zigadenus venenosus*	x	x				x			

Reference List of Species Names

Table 5. Full list of species for reference, linking USDA codes with common and Latin names. Not all species on this list were collected or seeded in 2025.

USDA Code	Scientific Name	Common Name
ACHY	*Achnatherum hymenoides*	Indian ricegrass
ACMI	*Achillea millefolium*	Common yarrow
AGGL	*Agoseris glauca*	Pale agoseris
ANTEN spp.	*Antennaria spp.*	Pussytoes
ARAR8	*Artemisia arbuscula*	Low sagebrush
ARCO9	*Arnica cordifolia*	Heartleaf arnica
ARDR4	*Artemisia dracunculus*	Tarragon
ARSO2	*Arnica sororia*	Twin arnica
ARTR2	*Artemisia tridentata*	Big sagebrush
ARTR4	*Artemisia tripartita*	Threetip sagebrush
ASAQ2	*Astragalus aquilonius*	Northern milkvetch
ASAT2	*Astragalus atropubescens*	Hairy milkvetch
ASBE3	*Astragalus beckwithii*	Beckwith's milkvetch
ASMI9	*Astragalus miser*	Wretched milkvetch
ASPU9	*Astragalus purshii*	Pursh's milkvetch
ASSC4	*Astragalus scaphoides*	Bitterroot milkvetch
ASSP	*Asclepias speciosa*	Showy milkweed
BASA3	*Balsamorhiza sagittata*	Arrowleaf balsamroot
BOECH sp.	*Boechera spp.*	Rockcress
CAEL	*Calochortus elegans*	Elegant mariposa lily
CAEU	*Calochortus eurycarpus*	White mariposa lily
CAFL7	*Castilleja flava*	Yellow paintbrush

USDA Code	Scientific Name	Common Name
CANI	*Calochortus nitidus*	Broadfruit mariposa lily
CAQU2	*Camassia quamash*	Common camas
CHAN80	*Chamaenerion angustifolium*	Flreweed
CHDO	*Chaenactis douglasii*	Douglas' dustymaiden
CHVI8	*Chrysothamnus viscidiflorus*	Yellow rabbitbrush
CICY	*Cirsium cymosum*	Cluster thistle
CLSE	*Cleomella serrulata*	Rocky Mountain beeplant
COLI2	*Collomia linearis*	Narrowleaf collomia
COPA3	*Collinsia parviflora*	Maiden blue-eyed Mary
CORA5	*Cordylanthus ramosus*	Bristly bird's-beak
CRAC2	*Crepis acuminata*	Tapertip hawksbeard
CRYPT spp.	*Cryptantha spp.*	Cryptantha
DRYMO sp.	*Drymocallis spp.*	Sticky cinquefoil
ELEL5	*Elymus elymoides*	Bottlebrush squirreltail
ERCO24	*Eriogonum corymbosum var. orbiculatum*	Roundleaf buckwheat
ERCO4	*Eriogonum corymbosum*	Corymb buckwheat
EREMO sp.	*Eremogone spp.*	Sandwort
ERHE2	*Eriogonum heracleoides*	Parsnipflower buckwheat
ERHY	*Eriocoma hymenoides*	Indian ricegrass
ERKI2	*Eriogonum kingii*	King's buckwheat
ERLI	*Erigeron linearis*	Narrowleaf buckwheat
ERMI4	*Eriogonum microthecum*	Slender buckwheat
ERNA10	*Ericameria nauseosa*	Rubber rabbitbrush
EROV	*Eriogonum ovalifolium*	Ovalleaf buckwheat
ERPU2	*Erigeron pumilus*	Shaggy fleabane
ERSTP3	*Eriogonum strictum subsp. proliferum*	Proliferous buckwheat
ERUM	*Eriogonum umbellatum*	Sulphur buckwheat
FRAL2	*Frasera albicaulis*	White-stem frasera
FRPU2	*Fritillaria pudica*	Yellow fritillary
GRSQ	*Grindelia squarrosa*	Curlycup gumweed
GUSA2	*Gutierrezia sarothrae*	Broom snakeweed
HACI2	*Hackelia cinerea*	Gray stickseed
HEAN3	*Helianthus annuus*	Common sunflower
HECO	*Hesperostipa comata*	Needle and thread
HECY2	*Heuchera cylindrica*	Roundleaf alumroot
HEGR8	*Heuchera grossulariifolia*	Gooseberryleaf alumroot
HEUN	*Helianthella uniflora*	Oneflower helianthella
HEVI4	*Heterotheca villosa*	Hairy goldenaster
IOAL	*Ionactis alpina*	Lava aster
IPAG	*Ipomopsis aggregata*	Scarlet gilia

USDA Code	Scientific Name	Common Name
LAOCO	*Lappula occidentalis*	Western stickseed
LERE7	*Lewisia rediviva*	Bitterroot
LILE	*Linum lewisii*	Lewis FLax
LIRU4	*Lithospermum ruderale*	Western stoneseed
LOFO	*Lomatium foeniculaceum*	Desert biscuitroot
LOGR	*Lomatium grayi*	Gray's biscuitroot
LOMAT sp.	*Lomatium spp.*	Biscuitroot (various)
LOTR2	*Lomatium triternatum*	Nineleaf biscuitroot
LUPIN spp.	*Lupinus spp.*	Lupine
MACA2	*Machaeranthera canescens*	Hoary tansyaster
MEAL6	*Mentzelia albicaulis*	White-stem blazingstar
MEDI	*Mentzelia dispersa*	Bushy blazingstar
MELA2	*Mentzelia laevicaulis*	Giant blazingstar
NOTR2	*Nothocalais troximoides*	False dandelion
OECA10	*Oenothera caespitosa*	Tufted evening primrose
OEVI	*Oenothera villosa*	Hairy evening primrose
OREO sp.	*Oreocarya*	Perennial cat's-eye (various)
ORGL	*Oreocarya glomerata*	Cockscomb cat's-eye
CRSP4	*Oreocarya spiculifera (Cryptantha)*	
(CRSO)	*Oreocarya sobolifera (Cryptantha)*	
OXLA2	***Oxytropis lagopus***	Haresfoot locoweed
PACA6	*Panicum capillare*	Witchgrass
PEAR2	*Penstemon aridus*	Stiffleaf penstemon
PEDE4	*Penstemon deustus*	Hotrock penstemon
PEER	*Penstemon eriantherus*	Fuzzytongue penstemon
PENST spp.	*Penstemon spp.*	Penstemon
PEVE2	*Penstemon venustus*	Venus Penstemon
PHHA	*Phacelia hastata*	Silverleaf phacelia
PHHE2	*Phacelia heterophylla*	Varileaf phacelia
PHLI	*Phacelia linearis*	Linearleaf phacelia
PLPA2	*Plantago patagonica*	Woolly plantain
PODO4	*Polygonum douglasii*	Douglas Polygonum
PODOT	*Polanisia dodecandra subsp. trachysperma*	Redwhisker clammyweed
POSE	*Poa secunda*	Sandberg Bluegrass
PSSP	*Pseudoroegneria spicata*	Bluebunch wheatgrass
SILI	*Sisymbrium linifolium*	Flaxleaf plains-mustard
SEIN2	*Senecio integerrimus*	Lambstongue ragwort
SPCR	*Sporobolus cryptandrus*	Sand dropseed
STAC	*Stenotus acaulis*	Stemless mock goldenweed
TECA2	*Tetradymia canescens*	Spineless horsebrush

USDA Code	Scientific Name	Common Name
THLA	*Thelypodium laciniatum*	Cutleaf thelypody
TOPA2	*Toxicoscordion paniculatum (Zigadenus)*	Foothill deathcamas
VEBR	*Verbena bracteata*	Bigbract verbena
VUOC	*Vulpia octoflora*	Sixweeks fescue
ZIVE	*Zigadenus venenosus*	Meadow deathcamas