BUREAU OF LAND MANAGEMENT
TECHNICAL PROTOCOL
FOR THE COLLECTION, STUDY, AND CONSERVATION OF SEEDS FROM NATIVE PLANT SPECIES

for

SEEDS OF SUCCESS

(Updated March 2023)

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1. Introduction

This protocol outlines the procedures for making seed collections for Seeds of Success (SOS), the national native seed collection program, led by the Bureau of Land Management (BLM) in partnership with the U.S. Fish and Wildlife Service (USFWS), USDA Agricultural Research Service (USDA-ARS), National Park Service (NPS), Tribal Nations, and many non-federal partners. The purpose of the Seeds of Success program is to establish a national, high quality, accurately identified, and well documented native plant species seed collection. All seed collections made following this protocol are used to support development of geographically appropriate native plant materials for research, development, germplasm conservation, and ecosystem restoration. Each seed collection should comprise a significant representation of the genetic variation within the sampled population. The national collection acts as the basis for off-site (*ex situ*) conservation and, where and when appropriate, can be used for study and increase in the native plant materials development process.

1a. Program History and Partnerships

The Bureau of Land Management and Royal Botanic Gardens, Kew's Millennium Seed Bank originally participated in the Seeds of Success (SOS) program under the terms of a cooperative agreement signed by both parties in May 2000, with a renewed agreement signed in November 2005. In the first year of the program there were 23 different SOS collection teams in the United States. Since the original signing of the agreement, SOS has grown to include Chicago Botanic Garden, Lady Bird Johnson Wildflower Center, New England Wild Flower Society, New York Department of Parks and Recreation, Greenbelt Native Plant Center, North Carolina Botanic Garden, Center for Plant Conservation, and the Zoological Society of San Diego. To date over 2,500 people have been trained in the SOS protocol; this group plus the cleaning, storage, and funding organizations are collectively referred to as the SOS Partners.

In June 2008, a Memorandum of Understanding (MOU) was signed by the Bureau of Land Management, Chicago Botanic Garden, Lady Bird Johnson Wildflower Center, New England Wild Flower Society, New York City Department of Parks and Recreation, North Carolina Botanical Garden, and the Zoological Society of San Diego. The MOU ratifies Seeds of Success as a national native seed collection program in the United States coordinated by BLM. The MOU is available on the SOS website (http://www.blm.gov/sos).

Phase 1 of the Millennium Seed Bank (MSB) Project was completed in 2010, 10 years after it began. At that point, the nature of the Seeds of Success program changed as funding from Kew was no longer distributed to U.S. partners. Instead of sending seed collections to Kew, SOS continued its collection strategy of making multiple collections of restoration species to compile genetically representative seed from across the species range. **Making between 10 and 20 collections per species, per ecoregion or seed transfer zone, continues to be the focus of SOS today.**

1b. Membership

The SOS program is led by the BLM in close partnership with the USFWS, the NPS, and a variety of other federal agencies, Tribal Nations, and non-federal organizations who help with seed collection, seed cleaning and testing, seed storage, data management, processing voucher specimens, and more. SOS Partners are part of a network of experienced seed collectors, restoration practitioners, botanists, and researchers. If you wish to learn more about becoming a partner, and you are part of a federal agency, Tribal Nation, state or municipal government, botanical garden, or non-profit, please reach out to the SOS National Curator (see contact information in **Appendix 1**). Working with organizations, rather than individuals, ensures that partnerships are sustainable, and that network support is in place to produce high-quality collections.

1c. Program Goals

As the first step in the native plant materials development process (NPMDP; Figure 1), the goal of SOS is to increase the quality and quantity of native plant materials available for restoring and supporting resilient ecosystems. SOS makes this possible by collecting wildland native seed for research, development, germplasm conservation, seed production, and ecosystem restoration. The goal of the native plant materials development process, led by the Bureau of Land Management, is to ensure a stable and economical supply of native plant materials for restoration and rehabilitation efforts on public lands.

Figure 1. The Native Plant Materials Development Process

Estimates have shown that between 10 and 20 collections of a single species (depends on species), across its range, are needed to develop genetically appropriate ecotypes; thus, this is a collection goal for each species collected by SOS. Processing and storage partnerships have been formed to achieve the program's goal of native plant materials development so that SOS collectors can make collections throughout the range of targeted species.

2. Getting Started

2a. Communication

Regular communication between all parties involved in SOS collections is an essential part of the SOS program. The BLM hosts the National Coordinating Office, which manages overall program data, infrastructure, training, and policies. Each agency manages their own SOS teams and have a designated coordinator who (Figure 2). Any questions, collection logistics, training inquiries, or other needs should be communicated to a team's agency coordinator. Agency coordinators (Appendix I) will be in communication with each other throughout the season to make sure everyone has the information and support they need to be successful.

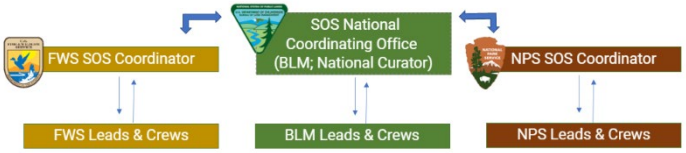

Figure 2. Interagency Coordination

SOS has three primary means of communication between the National Coordinating Office, Agency Coordinators, collectors, and other partners. These include the SOS website, SOS listserv, and monthly Collectors' Call.

Web: The website may be viewed at https://www.blm.gov/sos and includes information about collection guidance, training materials, and contact information.

List: SOS has an email listserv for discussing the Seeds of Success program. You must be subscribed to the list to post or send a message out to all the subscribers. Anyone is allowed to subscribe to the group, so if you know of someone who is interested, feel free to tell them about the list.

***To subscribe to the list*,** visit the website: http://lists.plantconservation.org/mailman/listinfo and select SOS, Seeds of Success List, or send an e-mail to **sos-request@lists.plantconservation.org** with the following information in the body of the message (not the subject):

SUBSCRIBE

You will then receive an e-mail that you will need to reply to confirm your subscription. After you confirm your subscription, another e-mail will be sent with instructions on how to use the list.

Call: On the first Tuesday of every month, collectors are invited to participate in the Collectors' Call, a conference call for all active SOS partners. At least one representative from every active collecting team is required to attend the meeting. This is a forum for discussion to raise issues and questions with other collectors, the National Coordinating Office, and Agency Coordinators. These calls take place on Microsoft Teams, however there is always a dial-in option; contact your Agency Coordinator for a meeting invitation or to submit agenda items. Reminders, cancellations, and agendas will be posted to the SOS listserv, but teams need to contact their Agency Coordinator specifically be invited to the Collector's Call.

Collectors' Call Time: 12 noon – Eastern, 11 am – Central, 10 am – Mountain, 9 am – Pacific, 8am – Alaska

2b. Training

It is extremely important that groups and individuals collecting seed for SOS are well trained so that plant populations are not harmed during the collection process and the protocol is followed to ensure data integrity.

The BLM National Training Center offers "Seed Collection for Restoration and Conservation" course to ensure comprehensive training for SOS seed collection partners and teams. Additional in-person and/or virtual trainings are available on an annual basis. Virtual trainings are free and open to all BLM, USFWS, NPS staff and seed collection contractors. Contractors hired by the BLM, USFWS, or NPS are responsible for ensuring their teams receive the proper training, including any additional training required under the contract that is outside the scope of the standard SOS Technical Protocol.

Before starting an SOS team, or making SOS collections, it is required that at least one lead botanist or crew member participate in the training course (although all team members are welcome). If you are starting an SOS team and need to train a collection team, contact your Agency Coordinator for more information. The name and contact information for the current SOS National Curator and Agency Coordinators are kept up to date on the website: www.blm.gov/sos.

2c. Workflow

Although seed collecting timing varies depending on phenology, all SOS collecting teams follow the same general workflow (Figure 3).

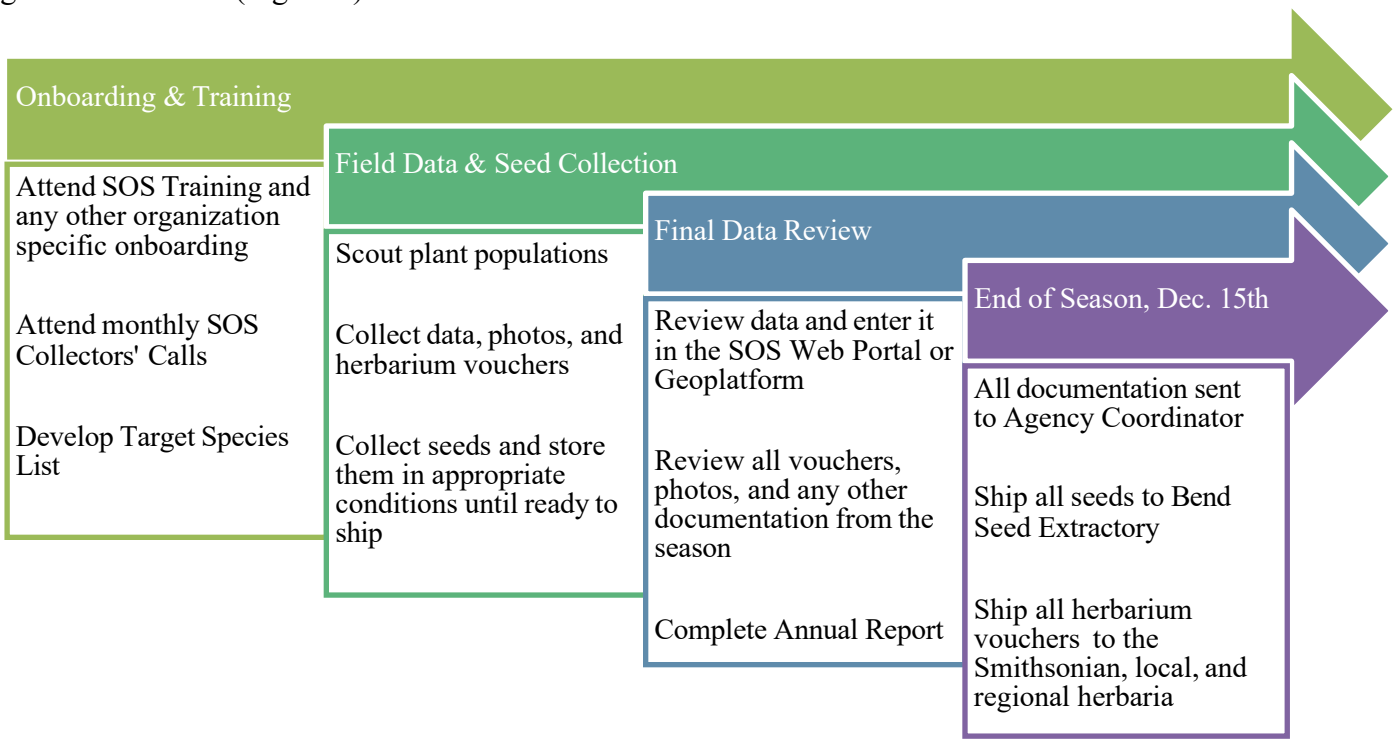

Figure 3. SOS Workflow

2d. Annual Reporting

When each collecting team has finished for the season, they must complete an annual report in addition to sending all photos, data forms, and permits to their Agency Coordinator who then sends all end of year data to the National Coordinating Office. A template is available on the SOS website and will be circulated at the end of each collecting season. The annual report is intended to summarize the collecting season (collections, difficulties, and highlights), as well as improvements to be made for the upcoming year. Additional comments may be submitted to your Agency Coordinator any time throughout the year.

3. Target Species

The focus of the SOS program is on species needed for restoration and rehabilitation projects.

Target species lists are developed by collecting teams and partners depending on the restoration needs of the geographic area. Projects using SOS seed may include emergency fire rehabilitation and restoration, wildlife habitat, pollinator habitat, threatened and endangered species habitat, and roadside revegetation and waterway stabilization. Thus, we collect primarily common native workhorse species appropriate for restoration and stabilization. Additionally, SOS collections focus on areas that may be vulnerable to climate change and extreme weather events, such as hurricanes, floods, drought, and wildfire.

Agencies are continually identifying species of priority restoration value needed for native plant materials development. Teams collecting for each agency should coordinate with agency

colleagues, such as State and Ecoregional Botanists or other Field Office staff to develop regional restoration target lists.

Target species lists should be sent to your Agency Coordinator early in the collecting season. These lists help track which SOS collecting groups are making collections for different species, as well as gauge seed cleaning needs. You may also contact your Agency Coordinator to request historic collection data relevant to your area, which can aid in compiling a unique target list and building on existing collections. These data are also required to follow the proper SOS recollection protocols (see ***Section 7b***). Additionally, a spatial gap analysis of BLM priority taxa was recently completed in the summer of 2021. The 2021 gap analysis shows that, despite 20 years of collecting, more collections are needed for every target species to meet the SOS goal of 10 to 20 collections across the species' range.

4. Species Excluded from this Program

The species excluded from Seeds of Success include:

- Any native plant species listed as Threatened or Endangered, under the *Endangered Species Act*.
- Any Candidate or any species Proposed for listing under the *Endangered Species Act*.
- Any species listed as G1 or G2 by a State Heritage Program.
- Any species listed as S1 or S2 by a State Heritage Program will not be collected in the state listing it as S1 or S2.
- Any species designated as a BLM State Director Sensitive Species that have been ranked G3 or S3 by a State Heritage Program and is included in the Center for Plant Conservation (CPC) network collection. (See ***Appendix 8***) BLM Field Office Botanists should carefully coordinate with the CPC Garden that collects in their region to make sure that G3 and S3 species are not overlooked in the collection by both groups and are not inadvertently collected by both groups.
- Any species included in Appendix I of the *Convention in the Trade of Endangered Species* (CITES).
- Any species not native to the U.S.
- Any agricultural or food crop species.
- All species in the genus *Quercus*.
- All known recalcitrant seeds (seeds that do not store well in dry, frozen conditions. See https://saveplants.org/best-practices/difference-between-orthodox-intermediate-and-recalcitrant-seed).
- All known intermediate/sub-orthodox seeds, such as species in the genus *Salix*, *Populus*, or *Ulmus*.
- All cultivars or populations from a known vegetation treatment site.

In the U.S., the Center for Plant Conservation (saveplants.org) collects and stores the seeds of rare, threatened, and endangered plant species, and the National Laboratory for Genetic Resources Preservation in Fort Collins, Colorado, stores many accessions of crop relatives. Both organizations are cooperating with the Seeds of Success program.

5. Storage and Distribution

Collections are cleaned, tested, and processed at several different facilities. Since 2003, BLM collecting teams have their seed cleaned by the U.S. Department of Agriculture Forest Service (USDA-FS) Bend Seed Extractory, while some non-federal partners clean their own seed. After cleaning and processing, SOS collections are divided into two portions – a long-term and a short-term storage portion. The PLS (pure live seed) allotted to each of these portions is determined by the type of collection (See Table 3. SOS Collection Definitions). Short-term storage needs are met by Bend Seed Extractory, while long-term and working collection storage needs are being met by the USDA Agricultural Research Service (USDA-ARS).

Table 1. Seeds of Success storage definitions

Long-term Storage Portion	The first 3,000 seeds from any Standard, Operational, or Recollection are stored in long-term storage conditions for conservation purposes with USDA-ARS.	3,000 PLS
Short-term Storage Portion	When an SOS collection team collects more than 3,000 there will be seed left over for use in native plant materials development projects. These seeds are kept in short-term storage conditions by the Bend Seed Extractory until requested. The original collecting team has first right to the seed they collected. If they decline this right, seed can be made available for other SOS partners.	PLS is dependent on size of collection (either Standard, Operational, or Recollection)

The National Laboratory for Genetic Resources Preservation (NLGRP) in Fort Collins, Colorado, is managing long-term collections, and the Plant Germplasm Introduction Testing and Research Unit (PGITRU) in Pullman, Washington, is maintaining both long-term and working collections for distribution to researchers working on projects related to native plant materials development through GRIN-Global.

PGITRU serves as the processing center for Seeds of Success accessions entering the National Plant Germplasm System (NPGS). PGITRU has partnered with the BLM, Kew Millennium Seed Bank, and other Plant Conservation Alliance members for collection and conservation of native plant species in the United States. PGITRU receives a portion of seeds from each SOS collection cleaned at the USDA-FS Bend Seed Extractory. From 2005 to 2021, PGITRU received 10,000 seeds for long-term storage. In 2022, the number of seeds for long-term storage changed to 3,000 seeds for standard and operational SOS collections, and 1,000 seeds for recollections (See Table 3. SOS Collection Definitions). In 2023, all collections regardless of collection type will have 3,000 seeds set aside for long term storage.

Accessions are sub-divided for 4°C back-up storage at the PGITRU in Pullman and -20°C storage at the NLGRP in Fort Collins (Table 2. Seeds of Success germplasm proportioning for long-term storage).

Table 2. Seeds of Success germplasm proportioning for long-term storage

SOS long-term storage portion (Standard and Operational Collections)	Ratio to long-term storage at NLGRP (Fort Collins) -20ºC	Ratio to working collection for PGITRU & GRIN-Global (Pullman) 4ºC
< 3,000 seeds	1/3	2/3
> 3,000 seeds	The first 3,000 seeds will be partitioned as in the row above. The remaining balance is then available for native plant materials development projects (short-term storage portion).	

The first 3,000 seeds of a collection constitute the long-term storage portion that is stored at PGITRU and NLGRP. The remainder of the SOS collection is made available for native plant materials development projects and is known as the short-term storage portion, which remains at Bend Seed Extractory. More about requesting seed for projects can be found in ***Section 14e. Requesting Return of Seed from Bend.***

6. Permission to Collect

Permission is required for all seed collected for the Seeds of Success program. Careful planning will ensure collections are taking place in the appropriate area, and that you (the collector) do not unintentionally wander onto land where you do not have permission to be.

6a. Collecting on BLM Lands

Collecting seeds for Seeds of Success on public land managed by the Bureau of Land Management is categorically excluded (CX) in the National Environmental Policy Act (NEPA). Department of the Interior (DOI) 516 Manual is the official guidance for determining the level of NEPA required. BLM's CX list is incorporated into the DOI NEPA manual at 516 DM 11, Section 11.9 (effective 12/10/2020). In the Forestry program section of the BLM Categorical Exclusion list there are five categorical exclusions. The fifth exclusion applies to seed collection as follows: *(5) Disposal of small amounts of miscellaneous vegetation products outside established harvest areas, such as Christmas trees, wildings, floral products (ferns, boughs, etc.), cones,* ***seeds****, and personal use firewood*. Thus, SOS collectors do not need to fill out additional paperwork when collecting on BLM managed lands. Additionally, non-commercial seed collecting, such as SOS, is allowed in Wilderness areas.

BLM may give permission to other volunteer groups to collect for the Seeds of Success program on BLM managed lands. To comply with DOI privacy standards, individuals acting in a personal capacity may not be listed as a collector on the data form. Team leads should be listed when no other collector names are available.

Additionally, speak to your local BLM Field Office or BLM contact to ensure you are following any specific local guidance when on BLM lands.

6b. Collecting on Non-BLM Lands

Collection may take place on private lands or lands managed by another federal agency (e.g., Fish and Wildlife Service, USDA Forest Service, Department of Defense) or state, county, or municipal agencies, if landowner permission is provided. Document landowner permission on the field data form associated with the seed collection. Keep written documentation of permission to collect in your office's files when collections are made on lands other than those managed by BLM.

If the landowner does not provide a collecting permit, a template for an Authorization Letter for SOS Collecting is available on the SOS Website.

All permissions and permits for collecting on non-BLM lands must be sent to your Agency Coordinator along with the rest of the end-of-season data.

7. Assessing Populations for Collection

It is essential that a knowledgeable botanist leads the collection team and is involved in identifying the most suitable population(s) for sampling. Choosing target populations will be up to the lead botanists and plant ecologists working at the BLM field office or other partner institutions. **An ideal collection will be from more than 100 individuals and will contain more than 10,000 viable seeds.** Collections larger than 20,000 viable seeds are preferred; collections this large maximize the flexibility of the collection and allow for a portion of the collection to be held at a second seed bank. Maximizing the use of the collection means that:

- Sufficient seed is available for germination and viability testing;
- Samples are available for distribution to users for restoration, education, or scientific purposes; and
- A substantial number of seed can be conserved as a long-term safeguard against loss of the wild population.

There are three different types of SOS collections, as outlined in the table below:

Table 3. Seeds of Success collection definitions

Collection	Definition	Estimated PLS
Standard SOS Collection	A seed collection made following the SOS Protocol that is under 80,000 estimated PLS (pure live seed). The first 3,000 PLS are conserved in long-term storage. Anything over 3,000 PLS is kept in short-term storage and is available for use in restoration and research.	3,000 - 80,000 PLS (3,000minimum, but ideally 10,000)
Operational SOS Collection	A seed collection made following the SOS Protocol that is over 80,000 estimated PLS (weight can vary). The purpose of these collections is for restoration, particularly for increasing through the seed production IDIQ or other grow-out. Anything over 3,000 PLS will be kept in short-term storage and is available for use in restoration and research.	80,000 + PLS
SOS Recollection	A seed collection made from a population that has previously been collected from following the SOS Protocol. The first 3,000 PLS of these collections will be sent to long-term storage. Anything over 3,000 PLS will be kept in short-term storage and is available for use in restoration and research.	3,000+ PLS

7a. Preliminary Site Visits

Preliminary site visits are often necessary to assess the populations, confirm the species identification with the collection of herbarium voucher specimens (see ***Section 10***), and estimate the likely harvesting date and potential seed production. Historic SOS collection data can be used to help estimate when a species may be ready for collection in a certain region. Where populations are suitable and the quality and quantity of seed is adequate, it may be possible to make collections of several different species from the same site. If you notice a non-target species population at the same site, speak to your local botanist about making an opportunistic collection.

The following points should be considered before harvesting takes place:

- Ensure that the population is of wild origin, not planted or cultivated. For example, do not collect seeds of native species that were included in a seed mix as part of post-fire management in areas that were burned and seeded. Native species that were not seeded in those areas could be collected.
- Small populations (less than 50 individuals) or those that will yield less than 10,000 viable seeds should not be collected.
- Seed development can vary within and among populations of the same species. Monitor seed maturation and assess insect damage and empty seeds throughout the population before making the seed collection.
- It is strongly encouraged that seed collectors return to a population throughout the seed dispersal period to maximize the genetic diversity of samples. Collections taken from the exact same population may be combined into one accession (SOS Collection Reference Number) during a single collecting season. Collectors must ensure that no more than twenty percent of the viable seeds are collected on any given day, and that all combined material is from the same population and uses the same seed collection reference number or accession number. Please note on the SOS field data form that the material was collected on multiple dates.

7b. Recollecting from Previous Populations

SOS recommends identifying new populations from which to collect each field season. However, revisiting previous collection sites is occasionally necessary to meet restoration goals, such as bulking seed for commercial increase. It is essential that a knowledgeable botanist leads the collection team and is involved in deciding when to recollect, and if the population is still suitable (e.g., has the population been under drought conditions in the previous years and possibly experienced a decline?).

Recollecting is only acceptable when adhering to all aspects of the SOS protocol detailed throughout this document, including:

- Training, Communication, Workflow, and Annual Reporting (***Section 2***)
- Permission to Collect (***Section 6***)
- Assessing Populations for Collection (***Section 7***)
- Sampling Strategy (only collecting 20% of available seed) (***Section 8***)
- Identification and Herbarium Specimens (***Section 10***)
- Field Documentation (***Section 11***)
- Photos (***Section 12***)
- Post-Collection Seed Care (***Section 13***)

Recollecting must also adhere to the following guidelines and adjustments to the original SOS protocol:

- Populations may not be recollected more than 2 years in a row, preferably allowing 3 years in between collections.
    - Ideally, if you make a collection in 2021 you will not collect again until 2025.
    - If you make a collection in 2021, you may collect again in 2022 but not a third time in 2023.
    - If you collect in both 2021 and 2022 you must wait 3 full years until 2026 to collect again.
- Seed Collection Reference Number Format
    - The collection shall be assigned a new SOS Collection Reference Number, following the traditional format and numbering (see 11a)
    - The collection shall be linked to the original SOS collection by selecting **YES** in the "Re-collection" field on the data sheet. Teams will also record the original Seed Collection Reference Number in the "Original Seed Reference #" field. For example, if a team is recollecting NM930-86 they will assign it a new number, following the sequential format, e.g., NM930-555 (new collection number), and include NM930-86 in the "Original Collection Number" field.
- Field Notes Section
    - Teams should begin the "Field Notes Section" of both the SOS data sheet and SOS data portal with "RECOLLECTION"
- Annual Report
    - Any recollection should be identified as such with both the original SOS Collection Reference Number and the new SOS Collection Reference Number listed on the annual report (e.g., NM930-86/NM930-555).
- Shipping
    - Communication between collecting teams, USDA-FS Bend Seed Extractory, and the SOS National Office is especially important for recollections to ensure data is recorded accurately and seed is divided and distributed in an appropriate manner. Teams should write "RECOLLECTION" on the outside of all bags containing recollection seed, as well as on the top of all the data forms, for all Bend shipments.

8. Sampling Strategy

It is important to maximize the number of alleles (variants of a gene) present within a collected sample by capturing the greatest proportion of alleles represented in the field population. According to Brown and Marshall (1995), at least one copy of 95% of the alleles occurring in the population at frequencies of greater than 0.05 can be achieved by sampling from:

1. 30 randomly chosen individuals in a fully outbreeding sexual species, or
2. 59 randomly chosen individuals in a self-fertilizing species.

The reproductive biology of most native plant target species has not been studied, and the capture of rarer alleles would require a markedly increased sample size. Therefore, for each target species, collectors are advised to sample from a single population with more than 50 individuals, and to look for populations with larger numbers of plants. Without genetic testing, in the field it can be difficult to say precisely where one plant population ends, and another begins. Thus, collectors should use their best judgment, as well as guidance provided by local botanists and ecologists when determining the point at which one collection becomes two. Geographic features such as roads, ridges, and rivers inhibit gene flow between populations, and thus are useful indicators of separate populations. For long, continuous stands of a species, such as in a prairie, separation of at least one kilometer is necessary before being considered a separate population. For clonal or rhizomatous species collections should be made by collecting at widely spaced intervals to increase

the chance of sampling from genetically distinct individuals within the population. This can be accomplished by collecting all seeds from every fifth plant, instead of twenty percent from every plant to meet the collection goal of collecting no more than twenty percent of seeds from a population.

As previously mentioned, developing genetically appropriate ecotypes requires between 10 and 20 collections across a species' range. For SOS, each of those collections must be a unique population and contain more than 10,000 seeds.

9. Seed Collection Techniques

All seed collections that are a part of SOS should follow the protocol below. If your team is also making non-SOS seed collections, take care to ensure you are following the proper protocol for those collections as laid out by your contract or institution**. Only SOS collections should be entered in the SOS web portal or SOS data forms.**

Table 4. Seeds Collection Techniques

	Method	Rationale
1.	Assess the target population and confirm that enough individual plants (> 50) have seeds at natural dispersal stage.	To ensure that adequate genetic diversity can be sampled from the population, and that the seeds are likely to be at maximum possible viability and longevity.
2.	Carefully examine a small, representative sample of seeds using a cut test and for smaller seeds a hand lens.	Estimate the frequency of empty or damaged seeds and confirm that most seeds are mature and fully formed.
3.	Collect mature, dry seeds in either cloth or brown paper bags. Large collections can be made using plastic buckets and then transferred into bags. Tape the corners or seams of bags if collecting extremely small seed to prevent losing material.	Ensure the highest possible viability at collection and maximize the potential storage life.
4.	Detailed cleaning, such as removing petals, chaff, and leaves, should be left to the processing staff at the Bend Seed Extractory. However, please remove large stems or any woody material.	Maximize the use of available field time and clean and prepare seeds in controlled laboratory conditions. However, balance this with the knowledge that excess material can reduce the longevity of the seed.
5.	Fleshy fruits should be collected directly into plastic bags. Specific advice on ripening and cleaning fleshy fruits is in ***Section 13*** or contact Bend staff if specific guidance is needed.	Fleshy fruits decompose rapidly, and poor storage can lead to mold-infested seed collections.
6.	Sample equally and randomly across the extent of the population, maintaining a record of the number of individuals sampled.	Capture the widest possible genetic diversity from the plant population sampled. Where the population exhibits a pattern of local variation, use a stratified random sampling method to ensure sampling from each microsite.

	Method	Rationale
7.	Collect no more than 20% of the viable seed available on the day of collection.	Ensure that the sampled population is not over collected and is maintainable.
8.	Collect seeds from a population throughout its dispersal season. Seeds from a population collected in the same year can be combined as one collection, using the same seed collection reference number. Note the multiple dates of collections on the SOS field data form.	Maximize genetic diversity in the collection, capturing early, mid, and late bloomers.
9.	Collect more than 10,000 viable seeds if possible. However, collections of all sizes are welcome. The smaller the collection, the less utility it has. Regardless of size, the entirety of the seed should be submitted to ensure the associated data reflect what is put in storage.	Enable maximum use and study of the collection. 3,000 viable seeds are allocated to long-term storage in the SOS National Collection. Anything over 3,000 can be requested back by the collector or shipped to a partner organization for research and development.
10.	Send collections to USDA-FS Bend Seed Extractory for cleaning. Collections in excess of 3,000 seeds can be sent back to collectors if they are needed for native plant materials development research or a restoration project. See ***Section 14*** for details on requesting material from Bend.	Cleaning prolongs the life of the seed and ensures the purity of the collection. Seed cleaned at Bend is then sent to the NLGRP in Fort Collins, Colorado for long-term storage and the PGITRU in Pullman, Washington for long-term storage and working collections.
11.	For each collection, estimate the viable seed production per fruit, per individual and per population, and note these on the field data form. The equation used to calculate this is: (# of viable seeds per fruit) * (# fruits per plant) * (# of plants in the population) * 0.2 = **> 10,000 seeds**	Document species seed biology, better assess the influence of collecting on the population, and gather information to better document if we are meeting *Standards for Rangeland Health* for native plant communities. Prevent collection from unhealthy, small, inbred, or unripe populations.
12.	Clearly label all bags (inside and out) with the appropriate collection number. No other data needs to be included on the label. Do **not** write on cotton seed bags with permanent marker; the bags will be reused.	To ensure that this unique identifier is attached to each sample of a collection. All other data will be recorded on the field data form.

10. Identification and Herbarium Specimens

It is critical to the value of the seed collections that the species is accurately identified. Identification to the species level is required, though identification to subspecies or variety is preferred. Collections cannot be submitted to the program if identification is to genus only. Voucher material is essential to enable the accurate identification of seed collections. Vegetative material and close-up photographs can occasionally help with identification, but the most useful voucher material for this program is a set of quality herbarium specimens (pressed, dried plant specimens) for each collection. Therefore, collectors are **required** to collect

at least three herbarium voucher specimens for all Seeds of Success seed collections and to enter comprehensive identification notes on the field data form including where each specimen was sent and any additional identification notes. **Do not mount the voucher materials on an herbarium sheet.**

Below is a short description of some of the issues plant collectors should be aware of when collecting specimens for the Seeds of Success program.

Herbarium specimens are valuable outputs from the collecting program, and collectors should take three to four representative herbarium specimens for each seed collection made. These specimens can be held at the most appropriate local, regional, or national herbaria where they will be available for study or classification by visiting taxonomists. Close-up photographs, especially of flowers or organs that may be damaged by pressing and drying, are welcome and should be sent to the herbarium coordinators with the collection number clearly written on the reverse or, in the event of digital files, cited in the file name.

Collectors wishing to learn the correct technique for herbarium specimen preparation should accompany an experienced botanist taking specimens in the field. SOS program collectors should also attend an SOS training session (see ***Section 2***). Literature available to consult includes Radford et al. (1974), Ross (1994), and Bridson and Forman (2010) (see **Appendix 9**).

For those species that will not be in bloom during seed collecting time, it is suggested that an herbarium voucher specimen be taken during a preliminary trip to the population or from the same population the following year. Herbarium specimens must be taken from the exact population earlier in the season for the purposes of identification and population monitoring. If a preliminary trip is not made and material for a herbarium voucher specimen is inadequate at seed collection time, collectors should record a representative individual of the population with GPS so that herbarium specimens can be taken from those individuals in the following season when vegetative and reproductive (e.g., flowers, fruits, seeds) material would be available.

Collection: The standard Smithsonian herbarium sheet is 11 ¾ inches wide by 16 ½ inches long. If your specimen is larger, please consider dividing or folding the specimen so it will fit comfortably on a sheet. If you are using newspaper in your field press, cutting it to the size of an herbarium sheet will ensure your specimen will fit later. An ideal specimen displays all parts of a plants – vegetative, reproductive, and roots. However, take care to remove as much soil as possible from any forb or grass collections. A specimen that requires more than one sheet is acceptable if the label data indicates there are multiple pieces to be mounted on separate sheets. Please be aware though that these separated pieces still belong to a singular collection. Additionally, remember to leave space for a label when arranging your specimen on the sheet for pressing. **Do not mount the voucher materials on an herbarium sheet.**

Pressing: For the majority of vascular plants species no special consideration is made when pressing specimens in the field except to attempt to display the specimen in such a way that all taxonomic features of the specimen can be examined easily. There are a few exceptions of which to be aware, and they include ferns, large bulky fruits, grasses, seeds, and large leaves.

> ***Ferns:*** If only a few leaves are collected it is important that one or a few of the leaves are reflexed so that when mounted upon a sheet a researcher will be able to examine both the top and bottom surface of the leaf. This is most important because key taxonomic characteristics (spore producing structures) are typically located on the lower surface and if the leaf is not reflexed before pressing than an attempt should be made to collect multiple leaves so upon mounting all surfaces can be observed.
>
> ***Large Bulky Fruits and Cones (e.g., pinecones):*** Inevitably, fruits and the point of fruit attachment are some of the most fragile parts of a herbarium specimen and almost always break away from the specimen either during preparation or during examination. Please indicate on the label, presence of

bulky fruits and contain them in a paper or plastic envelope labeled accordingly, while shipping to the herbarium. This is a great way to assure that they do not become separated and lost during processing. This consideration would also apply to cactus specimens which typically become very brittle during the drying process. In this case the entire specimen could be placed in a plastic bag during shipping to both contain any separated pieces and to protect the processing technician that could unknowingly become injured from the spines of these specimens.

Grasses: Because of the tuft-like growing nature of grasses it is sometimes necessary to harvest a large specimen for pressing. In this case it is important to remember the dimensions of a herbarium sheet and arrange accordingly, first by folding, and then by cutting if too large. Once dried, it is virtually impossible to arrange the specimen to fit on a sheet and the specimen may have to be cut into pieces to fit on a sheet which can compromise the scientific and physical integrity of the specimen.

Seeds: The primary objective of the Seeds of Success program is to maintain a seed bank for the conservation and development of native plant materials for restoration and rehabilitation of U.S. lands. As such, it is preferable that some seeds stay with the voucher collection. After pressing and drying, a collection may begin to shed seed. If this occurs the seed may become separated from the specimen during shipment and processing. Once separated, unless witnessed directly by the processing technician, this seed will not be placed back with the specimen because it cannot be assumed that this is the specimen to whom the seed belongs. To prevent this, place the loose seed in a paper or plastic envelope labeled with the collection information so that it can be included with the mounted collection.

Large Leaves: Some of the same concerns regarding grass collections apply here. Remember that a herbarium sheet has a finite size and plan accordingly when collecting such plants by taking into consideration the dimensions of your herbarium pages.

Labeling: Labels play a huge role in the utility of an herbarium specimen. Without a label or with poor/inaccurate label information a specimen is useless as a scientific or historical artifact. A future researcher should be able to use a specimen label to connect the specimen to the place and time of its collection along with the original collector.

A typical label is approximately a 4 x 4 inch square (the ideal, but not set in stone) and is printed on acid free paper. The label should, at minimum, contain the identification (family, genus, and species), collection location (country, state, county, name of area, and GPS coordinates), the date of collection, the name of the collector(s), and the collection number. Although the data sheets are a valuable resource, a traditional specimen label is the convention. **Do not ship SOS data forms with herbarium specimens.** Place labels with the corresponding specimen when shipping. **You may find specific labeling instructions and an example template on the SOS website. The original font size on the template is what is preferred by the Smithsonian.**

Shipping: Please keep in mind that it is a long way to the Smithsonian and the U.S. Postal Service is not known for delicate handling of parcels. Specimens should be interleaved between newsprint (cheap and widely available), the stack of specimen-newsprint layers sandwiched between two pieces of cardboard tied at each end with string, and the whole bundle wrapped like a present in newsprint or craft paper (this prevents loose pieces from ending up in the bottom of the box). The Smithsonian is a great supporter of recycling, but when reusing boxes try to find ones that will hold the bundle(s) as snugly as possible (less movement = less damage) or add extra newspaper for padding. This is a cheap, easy, and effective method for shipping specimens over great distances.

Finally, when shipping to the Smithsonian, remember to put a notice of transmittal in the packaging that indicates who (which institution or agency) is sending the specimens and the number of specimens in the shipment. The document should also clearly state the intention of the sending institution. If from a Bureau of Land Management office or affiliate, the transaction is considered a 'transfer' of material. If the collecting institution is a private entity (botanic garden or university) the transaction is considered a 'gift' to the Smithsonian. Scanned and emailed communication indicating the same is also welcome; this is cheaper, faster, and better for the environment. Please remember though that we require a signature from the depositing agent on any documentation received. **You may find a notice of transmittal template on the SOS website. Shipping contacts and addresses can be found under 14d.**

You can find a perfect example of an herbarium specimen at: https://collections.nmnh.si.edu/search/botany/
Select: Keyword Search
Genus: *Achnatherum*
Species: *wallowaensis*
Click on the image to enlarge.

10a. Verification by a Local Taxonomist

If you have colleagues at local or regional herbaria that are willing to verify your specimens, please indicate on the field data form that you intend to pass a duplicate set of herbarium specimens to a local taxonomist (together with a copy of the field data form) for verification. Do not assume that all herbaria are willing to provide this service. However, if the specimens are of good quality, and it is explained that the transferred set of specimens can be incorporated into the herbarium, many taxonomists are willing to help by confirming or updating the collector's identification. If the taxonomist verifies the specimens, it is the collector's responsibility to share the verification results (collection number and complete scientific name together with the month verified and the name of the verifying taxonomist and herbarium) with the SOS National Coordinating Office for dissemination to all other parties holding that Seeds of Success collection.

10b. Nomenclature

USDA PLANTS Database is the taxonomic standard used by Seeds of Success and can be accessed on the web at https://plants.usda.gov/home. Identify collections to the subspecies and/or variety level. One goal of the program is to identify the varieties of widespread species that are found in each ecoregion. If you cannot find your taxa on the USDA PLANTS Database, contact the SOS National Curator (**Appendix 1**).

11. Field Documentation

Detailed documentation is an essential element of a good SOS seed collection. Use a copy of the ***Field Data Form*** (**Appendix 3**) for each seed collection and fill out all the data fields. Keep one copy of the completed form for your records. Send one copy whenever you ship seed related to the collection and submit another digital (scanned) copy to your Agency Coordinator via email. SOS collectors may also use the digital data collection tools via tablets with Survey123/Field Maps. To access digital data collection tools and the SOS Geoplatform group, contact your Agency Coordinator. It is the collector's responsibility to enter these data into the SOS web portal or review data collected digitally by the end of the season (December 15th at the latest).

Do not enter non-SOS collections into the SOS Field Data Form or the SOS web portal.

11a. Seed Collection Reference Number Format and Collector Codes

One of the most important parts of SOS collections is assigning a unique identifier to each collection. The Seed

Collection Reference Number will include two parts: the SOS collector code (office mail stop or organization acronym; see **Appendices 2 and 7**) and collection number; for example, **OR020-26** for the BLM Burns District Office's 26th collection and **CBG-25** for the Chicago Botanic Garden's 25th collection.

Seed collection reference numbers should be unique and sequential from year to year and should never be repeated. If the last collection of the previous year was 34, the next year's collection numbering should start with 35. Please do not add leading zeros (e.g., 035).

For BLM teams associated with a Field Office:
Collector codes are determined by the BLM field office where the team is based. Regardless of who is funding the team or where the team is collecting, the code will be based on the geographic location of the Field Office. For example, if there is a team collecting in the Mojave ecoregion and they are based out of the Ridgecrest field office, they will use CA650 as their SOS collector code. There may be instances where a team is working out of multiple field offices. If this is the case, teams will alternate codes depending on within which field office boundaries they are collecting. Please consult with the SOS National Curator about the appropriate field office codes.

BLM teams not associated with a Field Office:
If a team is not based in or associated with a BLM field office, then a collector code will be determined by the SOS National Coordinating office using the acronym of the organization. For example, if the team is based out of a botanical garden or university, the acronym for the organization will be used for that team (ex. Chicago Botanic Garden = CBG, Southern Utah University = SUU).

For teams associated with the USFWS:
Teams will be assigned a unique number associated with the USFWS region the team is collecting in. For example, a team based in Region 2 would have the code FWS0201. A second, separate team in that region would have the next sequential number, FWS0202.

For teams associated with the NPS:
Teams will be assigned a unique number associated with the state they are collecting in. For example a team collecting a national park in California could have the code NPSCA00, while a different team also in California would be NPSCA01.

For continuity, all current collecting teams will use their historic codes even if they do not match the above guidelines. See **Appendix 2** for collector codes and **Appendix 7** for a list of all BLM Field Offices and mail stop codes. Please contact your Agency Coordinator if you are a new team and need a code, or if you are continuing collections and need to know on which number to start.

12. Photos

Digital photos of the species being collected should always be taken while in the field. At least three photos should be taken for each collection:

1. Landscape Level/Population
2. Individual Plant
3. Material Collected (seed)

The following naming convention should be used for all SOS photos and each photo should be given a unique letter (A, B, C, etc):

PLANTS Code_Collection Number_Unique Letter

For example, Chicago Botanic Garden's collection of *Symphyotrichum lanceolatum* would have photos named the following:

SYLA6_CBG-419_A.jpg
SYLA6_CBG-419_B.jpg, etc.

Send images to your Agency Coordinatorelectronically via a Google Drive folder or zipped folders in an email. If possible, remove GPS coordinate information before sending photos. The document "Taking Quality Photos for Seeds of Success" is also available on the Seeds of Success website (blm.gov/sos) for reference.

13. Post-Collection Seed Care

In general, **keep the seed collections in a cloth or paper bag in a cool, dry place** prior to sending to the USDA-FS Bend Seed Extractory. **Do not freeze seed.** Do not allow collections to overheat, and do not leave them in a vehicle in full sun. Exposure to sustained high temperatures can badly damage the seed collections. Always maintain ventilation around the collections and try to park the collecting vehicle in the shade, or at the very least, try to shade the windshield. Damp collections should be spread out on newspaper to dry naturally, either outside in the shade or in a well-ventilated room, as soon as possible, before shipping the material.

13a.Treatment with No-Pest Strips

It is required that all SOS seed lots sent to the Bend Seed Extractory are treated with No-Pest Strips to minimize insect predation on seed and protect staff and contractors that may be handling seed post-collection. We ask that all seed collections are treated for 48 hours or until the presence of insects is gone from seed. Even collections that exhibit no presence of insects may include larva stage pests that could damage seed, so all collections should be treated. Closets or other small, enclosed areas (plastic tote bin, etc.) are appropriate for treating multiple seed lots at a time. Please do not ship pest strips with seed to the Bend Seed Extractory. Follow all manufacturer warnings on the packaging, and wash hands after use.

13b. Fleshy Fruits

Fleshy fruits may require careful handling and partial cleaning. Notify cleaning staff that fleshy material is coming, and ship immediately and never on a Friday.

Fleshy fruit shipping options:

a. Pack the whole fruits in strong plastic bags. The bags should then be packed in a rigid container. Shipping cold and wet ensures the fruits are not squashed and do not get too hot and ferment too much during their journey. This method is preferred.

b. Remove as much flesh from the fruits as possible before transit. This can be done under cool running water using a sieve. The seeds should then be left to air dry *for a little while* before shipping. Dry seeds carefully on material that will not stick to the seeds (do not use newspaper). They should then be packed as dry seeds (i.e., in cloth or paper bags).

If you have any specific questions such as, what "*a little while"* means for the species that you have collected, please contact the Bend Seed Extractory (see ***Section 14b*** for contact information for the Bend Seed Extractory).

14. Packaging and Shipping

All collections made for Seeds of Success shall follow the protocol section below for packaging and shipping. Please note there are different instructions for BLM and non-BLM collection teams. If you are a non-BLM team, please double-check your institution's protocol with your manager.

When shipping seed, data sheets, and herbarium specimens, please remember the following:

- **Senders are responsible for all shipping costs related to seed and voucher transport.**
- **Data sheets shall accompany all seed (but not herbarium shipments), as well as being sent to the Agency Coordinator.**
- **BLM offices shall send seed to the Bend Seed Extractory for cleaning unless told otherwise by the SOS National Curator.**
- **Most non-federal partners are responsible for cleaning their own seed.**
- **If your team is also making non-SOS collections as part of your contract, please label these collections as "NON-SOS." Bend Seed Extractory also has a separate data form for these collections, and the cleaning and processing costs for these collections are *not* covered by the National Coordinating Office.**

14a. Packaging of Seed

In general, **it is critical to the successful conservation of the seed that it is sent to the Bend Seed Extractory within a few days of collection**, together with the completed field data forms.

Ship each seed collection in one bag whenever possible. Make sure that the seed bags are clearly labeled with the unique collection number. Additionally, if a collection needs to be shipped in more than one bag, clearly label whether the bag is bag "1 of 3", "2 of 3", etc. As an additional precaution, place a second label on top of the seed inside the bag.

The labeled bags should be securely packaged for shipping. The following packaging is recommended, either:

- Sturdy cardboard box into which cotton, or paper seed bags have been placed
- Woven PVC or nylon air freight sack

Do not use the following for shipping seeds:

- Any non-breathable bags or containers
- Any bags made from plastic or from PVC backed fabric (although you may be instructed to ship fleshy fruits in PVC bags as part of a shipment, see ***Section 13***.

14b. Shipping Seeds for Cleaning (for BLM and federal agencies)

Materials collected for Seeds of Success by BLM employees and contractors hosted by BLM offices can be sent to the following address for cleaning:

USDA USFS - Bend Seed Extractory
63095 Deschutes Market Road

Bend, OR 97701

Contact: Sarah Garvin
sarah.garvin@usda.gov
(541) 383-5646
(541) 383-5498 Fax

Please notify the Bend Seed Extractory by email of seed shipments and **always send the seeds overnight via U.S. Post or FedEx**. Include a copy of **the completed field data forms** documenting the collection with all shipments of seed; material will not be cleaned without this documentation. If shipping multiple boxes, field data forms should be in the box with the corresponding collections. Additionally, if collecting seed over multiple days for one collection, do not ship material to the Bend Seed Extractory until the collection is complete. All seed is due to Bend by December 15th.

14d. Shipping Herbarium Vouchers to the National Herbarium and Elsewhere

Unmounted, labelled herbarium vouchers should be sent to the following locations, along with a notice of transmittal to Smithsonian included in the box or sent via email. More comprehensive vouchering information can be found in ***Section 10*** of the Protocol and on the SOS website.

Voucher 1. Smithsonian Institution
NMNH Department of Botany, MRC 166
P.O. Box 37012
Washington, DC 20013-7012

Contact: Erika Gardner
gardnere@si.edu

If shipping with **FedEx**, please us the Smithsonian's non-PO Box address:

Smithsonian Institution
NMNH Department of Botany, MRC 166
10th and Constitution Ave., NW
Washington, DC 20560

Voucher 2. Regional Herbarium (see ***Appendix 6***)
Voucher 3. Collecting Team's Herbarium

Send all voucher material marked with the seed collection number, along with the herbarium label. Templates for the notice of transmittal may be found on the SOS website.

14e. Requesting Return of Seed from Bend

The first 3,000 seeds of each collection are taken from each collection and sent to the Plant Germplasm Introduction and Testing Research Unit (PGITRU) in Pullman, Washington, for incorporation into the working and long-term Seeds of Success National Collection. Collectors can request the return of any extra material (above the 3,000 seeds) to be returned to them or a cooperating agency or organization. The SOS Clearance form is the mechanism to have the seed from the most recent collecting season be returned. This form can also be used to request seed test result data ASAP. If shipping is in planning stages, but not certain until after data are received, omit the shipping information, and complete a second clearance form to the SOS National Coordinating Office when shipping information is determined.

Complete the SOS Clearance Form (**Appendix 4**) and e-mail it to the SOS National Curator by **January 30th**. The SOS National Coordinating Office will review the request, assign clearance number(s) if approved, and send the approved clearance form to the Bend Seed Extractory. A limit of 25 seed lots will be shipped or tested each month; please plan requests accordingly or work with the SOS National Coordinating Office for more urgent requests.

Following the process outlined above will ensure that Bend will return material to the requested location. If this process is not followed, and a Clearance Form is not filed with the SOS National Coordinating Office, your seed will remain at Bend. Starting in the spring, Bend moves all the previous season's collections into their long-term storage freezer. For this reason, any lots from previous collecting seasons require use of the Seed Order Form, and there is a $30 charge associated with every lot requested.

An inventory of the balance of the remaining short-term storage portions of seed that have not requested for return by the collector, will be circulated annually to national native plant materials development process partners. This annual inventory release will be managed by the SOS National Office. For distribution requests to be filled, an explanation of material usage needs to accompany every request and submitted via the Seed Order Form available on the website.

Bend will not accept forms that are sent with seed collections or emailed to them from anyone other than the SOS National Office. The SOS National Office also keeps all SOS Clearance Forms and Seed Order Forms on file to track seed use.

Appendix 1. Program Contacts:

BLM	FWS	NPS
Peggy Olwell Plant Conservation and Restoration Program Lead Bureau of Land Management 1387 S. Vinnell Way Boise, ID 83709 208-373-4090 polwell@blm.gov **Sarah Hill, *BLM SOS Coordinator*** SOS National Curator / National Coordinating Office Bureau of Land Management 1387 S. Vinnell Way Boise, ID 83709 sehill@blm.gov	**Patricia S. De Angelis** Botanist US Fish & Wildlife Service-Division of Scientific Authority 5275 Leesburg Pike, MS: IA Falls Church, VA 22041 703-358-1708 x 1753 **Kelly Thomas, *FWS SOS Coordinator*** Native Seed Coordinator U.S. Fish & Wildlife Service - Division of Scientific Authority 5275 Leesburg Pike, MS:IA Falls Church, VA 22041 703/358 1708 x 2635 kelly_thomas@fws.gov	**Lori Makarick** Branch Chief, Landscape Restoration and Adaptation Biological Resources Division National Parks Service 1201 Oakridge Drive Fort Collins, CO 80525 970-817-0025 Lori_Makarick@nps.gov **Katie Vinzant, *NPS SOS Coordinator*** Restoration Ecologist National Parks Service 1201 Oakridge Drive Fort Collins, CO 80525 720-701-0737 Katharine_Vinzant@nps.gov

Appendix 2. Program Contacts: Seeds of Success Collecting Teams and Partners

Coll. Code	BLM Offices	Team Contact	Email	Phone
AK930	Alaska State Office AK Natural Heritage	Ann Erickson Justin Fulkerson	aerickson@blm.gov jrfulkerson@alaska.edu	907-271-1985 907-786-6387
AZ040	Safford Field Office	Jeff Conn	jconn@blm.gov	520-348-4470
AZ010	Arizona Strip District Office	Jenna Moore	jnmoore@blm.gov	435-688-3278
AZ030	Kingman Field Office	Joelle Acton	jacton@blm.gov	928-718-3727
AZ930	Arizona State Office	Vacant		
AZ932	The Arboretum at Flagstaff	Sheila Murray	Sheila.Murray@thearb.org	928-774-1442 ext 112
CA160	Bakersfield Field Office	Denis Kearns	dkearns@blm.gov	661-391-6115
CA170	Bishop Field Office	Martin Oliver	mpoliver@blm.gov	760-872-5035
CA180	Mother Lode Field Office (formerly Folsom)	Graciela Hinshaw	ghinshaw@blm.gov	916-941-3134
CA190A	Central Coast Field Office (formerly Hollister)	Ryan O'Dell	rodell@blm.gov	831-582-2224
CA190B	Central Coast Field Office (formerly Hollister)	Bruce Delgado	bdelgado@blm.gov	831-582-2247
CA190C	Central Coast Field Office (formerly Hollister)	Mike Powers	mpowers@blm.gov	831-582-2223
CA320/370	Applegate Field Office	Jennifer Mueller	jmueller@blm.gov	530-279-2722
CA330	Arcata Field Office	Crystal Welch	cwelch@blm.gov	707-825-2335
CA350	Eagle Lake Field Office	Valda Lockie	vlockie@blm.gov	530-252-5325
CA360	Redding Field Office	Brooke Thompson	bthompson@blm.gov	530-224-2112
CA610	California Desert District	Kim Marsden	kmarsden@blm.gov	951-697-5223
CA650	Ridgecrest Field Office	Carrie Woods	cwoods@blm.gov	760-384-5448
CA660	Palm Springs Field Office	Chelsea Collins	Cncollins@blm.gov	760-833-7145
CA690	Needles Field Office	Vacant		
CA930	California State Office	Christina Lund	clund@blm.gov	916-978-4638
CA930A	California Botanical Garden (formerly Rancho Santa Ana Botanical Garden)	Naomi Fraga	nfraga@calbg.org	626-674-6746
CA930B	Lockeford Plant Materials Center	Annie Young-Matthews	anna.young-mathews@ca.usda.gov	209-727-5319 ext 10
CA930C	Zoological Society of San Diego (see also ZSSD)	Stacy Anderson	sanderson@sandiegozoo.org	760-747-8702 ext 5728
CA930D	Santa Barbara Botanic Garden (see also SBBG)	Heather Schneider	hschneider@sbbg.org	
CO810	Dolores Public Lands Office	Vacant		
CO932	Colorado State Office	Carol Dawson	cdawson@blm.gov	303-239-3725
CO932A	Betty Ford Alpine Gardens	Nicola Ripley	nicola@bettyfordalpinegardens.org	970-476-0103 ext. 6
ES030, ES933	Eastern States Office	Rebecca Theodorakos	rtheodorakos@blm.gov	202-912-7211
ID400	Coeur d'Alene Field Office	LeAnn Abell	labell@blm.gov	208-769-5036
ID130	Owyhee Field Office	Jessa Davis	jcdavis@blm.gov	208-896-5923
ID230	Shoshone Field Office	Danelle Nance	dnance@blm.gov	208-732-7220
ID340	Salmon Field Office	Hannah Alverson	halverson@blm.gov	208-756-5402
ID930	Idaho State Office	Anne Halford	ahalford@blm.gov	208-373-3824
MT050	Dillon Field Office	Kelly Savage	ksavage@blm.gov	406-683-8048
MT060	Lewistown Field Office	Vinita Shea	vshea@blm.gov	406-538-1919
MT100	Missoula Field Office	Jen McNew	jmcnew@blm.gov	406-329-3914
MT923	Montana/Dakotas State Office	Wendy Velman	wvelman@blm.gov	406-896-5032
NM018	Taos Field Office	Lillis Urban	lurban@blm.gov	575-751-4712
NM030	Las Cruces Field Office	Patrick Alexander	palexander@blm.gov	575-525-4314
NM080	Carlsbad Field Office	Katie Sandbom	ksandbom@blm.gov	575-234-5972
NM930	New Mexico State Office/Southern NM	Zoe Davidson	zdavidson@blm.gov	505-954-2045

NM930N	Farmington District Office/Northern NM	Vacant		
NV020	Winnemucca Field Office	Robert Burton	rburton@blm.gov	775-623-1707
NV030	Carson City Field Office	Dean Tonenna	dtonenna@blm.gov	775-885-6189
NV040	Ely Field Office	Erica Husse	ehusse@blm.gov	775-289-1828
NV052	Las Vegas Field Office	Lara Kobelt	lkobelt@blm.gov	702-515-5022
NV930	Nevada State Office	Vacant		
NV930A	Elko Field Office	Jess Kindred	jkindred@thegreatbasininstitute.org	
OR010	Lakeview District Office	John Owens	jowens@blm.gov	541-947-6133
OR014	Klamath Falls Resource Area	Kerry Johnston	kjohnston@blm.gov	541-885-4136
OR020	Burns District Office	Caryn Burri	cburri@blm.gov	541-573-4517
OR030	Vale District Office	Susan Fritts	sfritts@blm.gov	541-473-6274
OR050	Prineville District Office	Kristin Williams	kwilliams@blm.gov	541-416-6798
OR080	Salem District Office	John Klock	jklock@blm.gov	458-209-1771
OR090	Eugene District Office	John Klock	jklock@blm.gov	541-683-6181
OR090A	City of Eugene	Diane Steek	diane.m.steeck@ci.eugene.or.us	541-682-4927
OR090B	Institute of Applied Ecology	Sophie Linden	sophielinden@appliedeco.org	
OR090C	TNC-Coburg Hills	Vacant		
OR100	Roseburg District Office	Vacant		
OR110	Medford District Office	Sasha Joachims	sjoachim@blm.gov	541-618-2497
OR120	Coos Bay District Office	Tim Rodenkirk	trodenki@blm.gov	541-751-4252
OR130	Spokane District Office	Molly Boyter	mboyter@blm.gov	509-665-2137
OR134	Wenatchee Resource Area	Molly Boyter	mboyter@blm.gov	509-665-2137
OR135	Border Field Office	Kim Frymire	kfrymire@blm.gov	509-536-1279
OR930	Oregon State Office	Sarah Canham (detail)	scanham@blm.gov	541-416-6785
OR931	Rae Selling Seed Bank (formerly Berry Botanic Garden)	Vacant		
UT030	Grand Staircase-Escalante National Monument	Raymond Brinkerhoff	rbrinker@blm.gov	435-644-1228
UT060	Moab Field Office	Pam Riddle	priddle@blm.gov	435-259-2138
UT080	Vernal Field Office	Sandra Robins	srobins@blm.gov	435-781-4448
UT933	Utah State Office Richfield Field Office	Aaron Roe	aroe@blm.gov	801-539-4065
UT931	Red Butte Bot. Garden (see also CP2)	Bruce Pavlik	bruce.pavlik@redbutte.utah.edu	801-585-5853
WY010	Worland Field Office	Cari Forsgren	cforsgren@blm.gov	307-347-5106
WY020	Cody Field Office	Destin Harrell	dharrell@blm.gov	307-578-5933
WY030	Rawlins Field Office	Frank Blomquist	fblomqui@blm.gov	307-328-4207
WY040	Rock Springs Field Office	Vacant		
WY050	Lander Field Office	Emma Freeland	efreeland@blm.gov	307-347-5100
WY060	Casper Field Office	George Soehn	gsoehn@blm.gov	307-261-7531
WY070	Buffalo Field Office	Charlotte Darling	cdarling@blm.gov	307-684-1045
WY080	Newcastle Field Office	Johnathan Sheeler	jsheeler@blm.gov	307-746-6614
WY090	Kemmerer Field Office	Kelsey Smith	kdsmith@blm.gov	307-367-5341
WY100	Pinedale Field Office	Josh Hemenway	jhemenway@blm.gov	307-367-5322
WY930	Wyoming State Office	Kimberly Wahl	kwahl@blm.gov	307-775-6099
WY932A	University of Wyoming: Hufford Lab	Kristina Hufford	khufford@uwyo.edu	307-766-5587
WY932B	University of Wyoming: Mealor Lab	Brian Mealor	bmealor@uwyo.edu	307-766-3113
WY932C	University of Wyoming: King Lab	Vacant		
Coll. Code	**SOS MOU Signatories**	**Team Contact**	**Email**	**Phone**
CBG	Chicago Botanic Garden	Chris Woolridge Dave Sollenberger	cwoolridge@chicagobotanic.org dsollenberger@chicagobotanic.org	847-835-6957

LBJWC	Lady Bird Johnson Wildflower Center	Minnette Marr	mmarr@wildflower.org	512-232-0240
MARSB	Mid-Atlantic Regional Seed Bank	Ed Toth	etoth@marsb.org	
NEWFS	Native Plant Trust (formerly New England Wild Flower Society)	Michael Piantedosi	mpiantedosi@nativeplanttrust.org	
NYCDPR-BBG	NYC Dept. of Parks & Rec. w/ Brooklyn Botanic Garden	Heather Liljengren	Heather.Liljengren@parks.nyc.gov	718-370-9044
NCBG	North Carolina Botanical Garden	Johnny Randall	jrandall@email.unc.edu	919-962-0522
SBBG	Santa Barbara Botanic Garden (see CA930D)	Heather Schneider	hschneider@sbbg.org	
ZSSD	Zoological Society of San Diego (see CA930C)	Stacy Anderson	sanderson@sandiegozoo.org	760-747-8702 ext. 5728
Coll. Code	**Other SOS Partners**	**Team Contact**	**Email**	**Phone**
CP	Colorado Plateau Native Plant Program	Adrienne Pilmanis	apilmani@blm.gov	801-539-4076
CP1	Landsward Institute, Northern Arizona University	Vacant		
CP2	Red Butte Bot. Garden (see also UT931)	Bruce Pavlik	bruce.pavlik@redbutte.utah.edu	801-585-5853
CP3	Southern Utah University	Jackie Grant	jacqualinegrant@suu.edu	435-865-8549
CP4	Canyon Country Discovery Center	Ben Muhlenstein	benm@ccdiscovery.org	435-587-2156 x1002
CP5	Friends of Verde River	Tracy Stephens	tracys@verderiver.org	307-690-8084
GBNPP	Great Basin Native Plant Project			
FWS0800	USFWS Region 8	Sarah Kulpa	sarah_kulpa@fws.gov	775-861-6340
FS0417	USFS Humboldt-Toiyabe NF	Dirk Netz	dnetz@fs.fed.us	775-355-5340
FS0422	USFS Rocky Mtn Research St.			
GBPMC	Great Basin Plant Materials Center	Eric Eldredge	eric.eldredge@nv.usda.gov	775-423-7957
LLPMC	Los Lunas Native Plant Materials Center	Bernadette Cooney	bernadette.cooney@nm.usda.gov	505-865-7340
PSSL	USDA Forest Service Provo Shrub Sciences Lab	Scott Jensen	sljensen@fs.fed.us	801-356-5128
RMRS	Rocky Mountain Research Station	Francis Kilkenny	ffkilkenny@fs.fed.us	208-373-4376
UAH	University of AZ Herbarium	Shelly McMahon	mcmahonm@email.arizona.edu	530-220-3011
USBG	U.S. Botanic Garden	Ray Mims	rmims@aoc.gov	202-226-4067
	Bend Seed Extractory	Kayla Herriman Sarah Garvin	kayla.herriman@usda.gov sarah.garvin@usda.gov	541-383-5481 541-383-5646
	Smithsonian Institution, US National Herbarium	Erika Gardner	gardnere@si.edu	202-633-0936

Appendix 3. BLM Seeds of Success Field Data Form

Seed Collection Ref. Number:		**Collector Code:**	
Date(s) Collected (MM/DD/YY)**:**		**Collector Name(s):**	
		Collection Number:	
		Alt. Collection Number:	
	Recollection: Y N	**If yes Recollection, Original Seed Reference #:**	

COLLECTION DATA

Family:		**No. of Plants Sampled** (min. 50)**:**	
Genus:		**No. of Plants Found** (approx.)**:**	
Species:		**Area Sampled** (acres)**:**	
Subspecies/Variety:		**Seeds Collected From:**	*Plants Ground Both Unknown*
Plant Habit:	*Tree Shrub Forb Succulent Grass/Grasslike*	**Avg Plant Height** (feet)**:**	
Field Notes to assist in identification of pressed specimen (e.g. flower color)**:**			
Common Name(s) of Plants:		**NRCS PLANTS Code:**	

LOCATION DATA

Ecoregion (Omernik Level III)**:**		**State:**		**County:**	
Subunit (BLM area, park name, etc.):		**Area within Subunit** (trail name, etc.):			
Land Owner:		**Non-BLM Permission Filed:**	Y N		
Location Details:					
Coordinate Source Used:	*GPS Map None*	**Accuracy:**	*Exact Within 5km 6-20km More than 20km*		
GPS Datum:	*NAD83 NAD27 WGS84 Other:*				
Latitude (dg/min/sec) (ex: 40˚ 34’ 19.5” N)**:**	N			**Elevation:**	
Longitude (dg/min/sec) (ex: 107˚ 36’ 51.54” W)**:**	W			**Unit** (ft or m)**:**	

HABITAT DATA

Associated Species, at least 5 (Scientific Name)**:**	
Ecological Site Description, Habitat Type and/or National Vegetation Classification :	
Modifying Factors:	*Mowed Burned Grazed Flooded Seeded Trampled Other:*

Land Form:		**Slope** (degrees)**:**	
Land Use:		**Aspect:**	*N NE E SE S SW W NW*
Geology:			
Soil Texture:	*Clay Silt Sand Other:*	**Soil Color:**	

HERBARIUM VOUCHERS

Number of pressed specimens:		**Date Voucher Taken:**	
Herbaria Names (Smithsonian, Regional, Local):			

SPECIALIST IDENTIFICATION

Identified by (name and organizational affiliation):			
Material Identified:	*In Field From Pressed Specimen on Day of Collection* *From Pressed Specimen on Another Date From Photograph*	**Date Identified** (MM/DD/YY):	

PRE-COLLECTION CHECKLIST

This section is for your reference only and not required as part of the data collected by the SOS National Coordinating Office. The conditions indicated in **boldface** *describe ideal population size and seed dispersal stage for seed collecting.*

Assess Population & Seed Dispersal Stage
Approximate area of population: x (feet, yards, miles……)
Approximate total number of individual plants present and accessible: *0-50 50-500 500-5000 > 5000*
Evidence of disturbance or damage: *Resown Burnt Sprayed* **No damage**
Readiness of population for collecting: give percentages or circle the most frequently occurring: *Vegetative In flower Immature seeds* **Around natural dispersal** *Post dispersal*
Estimate the number of individual plants at natural dispersal stage: *<50* **>50**
Is the population: ***A single population*** *A population with distinct sub-populations* (Can you sample separately or from the most suitable?)
Assess Seed Quality & Availability
On a typical individual, where on the plant/branch/fruit is the seed at natural dispersal stage: **Recognized**
Using a cut test on the seeds at this stage, give percentages or circle the most frequently occurring: **Healthy** *Insect-damaged Empty Moldy Malformed/other damage*
Estimate the number of healthy seeds per fruit:
Estimate the number of fruits per individual plant:
Should Seed Be Collected On This Trip?
Using the above information, if you only collect 20% of the healthy seeds available today, will this result in a collection of **>10,000** healthy seeds?

Appendix 4. Seeds of Success Return Request: Clearance Form

How to Request Seed Back to your Office with the Seeds of Success Clearance Form
*** A word version of this document is available on the SOS website (www.blm.gov/sos)

The U.S. Forest Service Bend Seed Extractory is the seed cleaning facility for SOS seed collected by the BLM. After cleaning, the first 3,000 seeds are taken off the top of the collection and sent to Pullman, WA and Ft. Collins, CO for incorporation into the Seeds of Success National Collection. With this form, BLM collectors can request the entire remaining balance (any seed over 3,000) be returned or shipped to a cooperator. To request only a portion of your remaining balance, or to send the remaining balance of a single collection to multiple partners, please contact the SOS National Coordinating Office. This form can also be used to request seed test result data. If both test results and shipping are requested, please fill out both the "shipping" column and "seed test results" column. If shipping is in planning stages, but not certain until after data is received, omit the shipping info, and complete a second form to the SOS National Coordinating Office when shipping information is determined.

Complete this form and e-mail it to the SOS National Coordinating Office with associated SOS Field Data Forms by **January 30th**. A monthly review of clearance forms will occur on the first Tuesday of the month, following the national coordinating call. The SOS National Coordinating Office will review the request, if approved, assign a clearance number(s), and send the approved clearance form to the Bend Seed Extractory. A limit of 25 seed lots will be shipped or tested each month, please plan requests accordingly or work with the SOS National Coordinating Office for more urgent requests.

Bend will not return material without SOS Field Data Forms and a clearance number assigned by the SOS National Coordinating Office. **Please allow at least 30 days from date of approval to the date you would like the seed or seed test results returned.**

Requester Contact Information

Name:
Email:
FedEx Account #:

SOS Collecting Team:
Phone Number:

Return Request type

	Shipping Request	Seed Test Results
Date Needed		
Name & Organization		
Recipient's physical address and email address		

Please return or test the following collection(s):

SOS Collection Reference Number	Species	Clearance Number (assigned by the National Office)

Native Plant Materials Development Project *(Please describe how the returned seed will be used, e.g., common garden study, restoration project, academic partnership, etc. This section must be filled out for your request to be processed.)*

Please submit the **completed** clearance form to SOS National Curator, Sarah Hill (sehill@blm.gov).

Appendix 5. Seeds of Success Annual Report

*** A stand-alone document of this template is available on the SOS website (www.blm.gov/sos)

Organization (Agency, Field office, organization name):	**Team Code:**
Location:	
Number of species collected:	**Number of SOS collections made:**
Collecting Season Summary (accomplishments and challenges):	
Partners *(Other agencies, NRCS, non-profit, etc.)* and in what capacity you worked together:	
Organizations that provided volunteers, and how many:	

Education and Outreach: ***(include any work with other groups to promote or highlight Seeds of Success, e.g., citation for a newsletter, web article, conference/meeting display, or presentation on SOS and/or the native plant materials development process, etc.)***

Format (talk, exhibit, publication)	Title	Name of Event or Publication	Location (Nearest City, State)	Date

Distributions: ***(include tracking information for collections that have been shipped out of your office to the Bend Seed Extractory or any other receiving institution)***

Species	**SOS Seed Coll. Ref. Num** (e.g., NV030-xx)	**Receiving Institution** (e.g., Bend Seed Extractory)	**What the SOS material will be used for** (e.g., restoration, research)

Internal Research using Non-SOS Collections: ***(include information for collections that are kept at your office for Native Plant Materials Development projects. This section is for non-SOS collections only.)***

Species	**Seed Coll. Ref. Num.** *(e.g., CBFO-23-2017)*	**What the non-SOS material will be used for**

Please submit the final annual report to your Agency Coordinator December 15th.

BLM: Sarah Hill, sehill@blm.gov.
USFWS: Kelly Thomas, kelly_thomas@fws.gov.
NPS: Katie Vinzant, Katharine_Vinzant@nps.gov.

Appendix 6. Offices and Herbaria Selected to Receive Herbarium Duplicates from the Seeds of Success Program

Office/ Team Code	Statewide or Regional Herbaria	Index Herb Code	Contact Info	Local Herbaria chosen	Contact Info
	US National Herbarium, Department of Botany MRC-166 Smithsonian Inst. 10th and Constitution Ave., NW Washington, DC 20560	US	Erika Gardner gardnere@si.edu		
AK930	Univ. of AK Anchorage Herbarium 3311 Providence Dr. Anchorage, AK 99508	UAAH	Justin Fulkerson 907-786-6287	BLM, ASO 930, Lands and Renewable Resources Anchorage, AK 99513	John Payne 907-271-3431
AK040	University of Alaska Museum Herbarium PO Box 756960 907 Yukon Dr. Fairbanks, AK 99775-6960	ALA	Jordan Metzgar 907-474-7109	BLM, Anchorage FO 6881 Abbott Loop Rd. Anchorage, AK 99507	
AK025	University of Alaska Museum Herbarium PO Box 756960 907 Yukon Dr. Fairbanks, AK 99775-6960	ALA	Jordan Metzgar 907-474-7109	BLM, NFO Kotzebue Field Station Kotzebue, AK	
AZ930	Arizona State Univ. Herbarium Dept. of Plant Biology PO Box 87101 Tempe, AZ 85287-1601	ASU	Elizabeth Makings 480-965-6162	Phoenix Field Office 21605 N. Seventh Ave. Phoenix, AZ 85027	John L. Anderson 623-580-5520
All AZ Field Offices	Arizona State Univ. Herbarium Dept. of Plant Biology PO Box 87101 Tempe, AZ 85287-1601	ASU	Elizabeth Makings 480-965-6162	Desert Botanical Garden 1201 N.Galvin parkway Phoenix AZ 85008	
AZ010, AZ100				Arizona Strip FO 345 E. Riverside Dr. St. George, UT 84790-9000	Jacqueline Roaque 435-688-3242
CA160	UC Jepson Jepson Herbarium University of California 1001 Valley Life Sciences Bldg. #2465 Berkeley, CA 94720-2465	JEPS	Bruce Baldwin 510-643-7008	Bakersfield FO	Denis Kearns 661-391-6115
CA169	UC Jepson	JEPS	Bruce Baldwin 510-643-7008	Goodwin Education Center	Kathy Sharum 661-391-6033
CA170	Herbarium Rancho Santa Ana Botanic Garden 1500 N. College Ave. Claremont, CA 91711-3101	RSA	Steve Boyd 909-625-8767	BLM Bishop Field Office 785 N. Main, Suite E Bishop, CA 93514	Martin Oliver 760-872-5035
CA180	UC/Jepson Herbarium	JEPS	Bruce Baldwin 510-643-7008	University of California Davis	Ellen Dean 530-752-1091

Office/ Team Code	Statewide or Regional Herbaria	Index Herb Code	Contact Info	Local Herbaria chosen	Contact Info
CA190	UC/Jepson Herbarium	JEPS	Bruce Baldwin 510-643-7008		
CA320	UC/Jepson Herbarium	JEPS	Bruce Baldwin 510-643-7008		
CA330	Herbarium, Biological Sciences Department Humboldt State Univ. Arcata, CA 95521-8299	HSC	Robin Bency 707-826-4801	Arcata Field Office Herbarium	Jennifer Wheeler 707-825-2316
CA340	UC/Jepson Herbarium	JEPS	Bruce Baldwin 510-643-7008	University of California Davis	Ellen Dean 530-752-1091
CA350	UC/Jepson Herbarium	JEPS	Bruce Baldwin 510-643-7008	Eagle Lake FO Herbarium 2950 Riverside Dr. Susanville, CA 96130	Valda Lockie 530-252-5325
CA360	Herbarium, Biological Sciences Department California State Univ. Chico, CA 95929-0515	CHSC	Lawrence Janeway 530-898-5381	Redding FO Herbarium 355 Hemsted Dr. Redding, CA 96002	Kendra Fallon 530-224-2107
CA370	UC/Jepson Herbarium	JEPS	Bruce Baldwin 510-643-7008		
CA650	Rancho Santa Ana Botanic Garden	RSA	Steve Boyd 909-625-8767		
CA690	*No reply*. Use UC/Jepson Herbarium	JEPS	Bruce Baldwin 510-643-7008		
CA930	*No reply.* Use UC/Jepson Herbarium	JEPS	Bruce Baldwin 510-643-7008		
CBG	Nancy Poole Rich Herbarium, Research Department Chicago Botanic Garden 1000 Lake Cook Rd. Glencoe, IL 60022	CHIC	Dr. Kayri Havens 847-835-8378		
All CO offices **1ST**	Univ. of Colorado Museum Herbarium Clare Small Bldg. Campus Box 350 Boulder, CO 80309-0350	COLO	Dr. Erin Tripp 303-492-3216		
All CO offices **2ND**	University of Wyoming Rocky Mt. Herbarium Dept. of Botany PO Box 3165 Laramie, WY 82071-3165	RM	Ron Hartman & Ernie Nelson 307-766-2236	Colorado College 14 E. Cache la Poudre Colorado Springs, CO 80903 **4TH**	Dr. Tass Kelso 719-389-6405
All CO offices **3RD**	CSU Herbarium Dept. of Biology Colorado State Univ. Fort Collins, CO 80523-1878	CS	Jennifer Ackerfield 970-491-0496	Adams State College 208 Edgemont Blvd. Alamosa, CO 81102 **5TH**	Kristy L. Duran 719-587-7767
All CO offices				Univ. of CO - Denver Dept. of Biology Campus Box 171 PO Box 173364 Denver, CO 80217-3364 **6TH**	Leo Bruederle 303-556-3419

Office/ Team Code	Statewide or Regional Herbaria	Index Herb Code	Contact Info	Local Herbaria chosen	Contact Info
ID070 and other Idaho without info.	Museum of Nat. History Ray D. Davis Herbarium Idaho State University Campus Box 8096 Pocatello, ID 83209	IDS	Dr. Lief Tapanila 208-202-3871		
ID080	Dept. of Biological Sciences Stillinger Herbarium Univ. of Idaho Moscow, ID 83844	ID	David Tank 208-885-7033		
ID090	Boise State University Herbarium Dept. of Biology 1910 University Dr. Boise, ID 83725	SRP	Dr. Jim Smith 208-426-3551	Lower Snake River District Herbarium 3948 Development Dr. Boise, ID 83705	Ann DeBolt 208-384-3465
LBJWC	Herbarium, Plant Resources Center Univ. of Texas at Austin 1 University Sta. F0404 Austin, TX 78712-0471	TEX	Dr. George Yatskievych 512-471-5904 512232-3402 f		
MT030	North Dakota State Univ.. Herbarium Hastings Hall Fargo, ND 58105	NDA	Edward DeKeyser 701-231-8180 edward.dekeyser @ndsu.edu	Dickinson Research Ext. Center 1089 State Ave. Dickinson, ND 58601	Dennis Whitted 701-231-5583
MT923	408 Lewis Hall Dept. of Plant Sciences Montana State Univ. Bozeman, MT 59717	MONT	Curator Matt Lavin 406-994-2032 w 406-994-1848 f mlavin@ montana.edu,		
MT923	Herbarium Univ. of Montana Missoula, MT 59812-1002	MONTU	Shannon Kimball 406-270-3702		
MT923	Charles A. Taylor Herbarium Agricultural Hall 320 Dept. of Biology & Microbiology SD State Univ.	SDC	Gary E. Larson, Curator 605-690-3435		
NV030 NV052 NV930	NRES, MS-186 Univ. of Nevada Reno 1664 N. Virginia St. Reno, NV 89557	RENO	Jerry Tiehm 775-784-1105	BLM Las Vegas FO 4701 N. Torrey Pines Dr. Las Vegas, NV 89130	Lara Kobelt 702-515-5022
OR010 OR014 OR020 OR030 OR050 OR080 OR090 OR100 OR110 OR120 OR134	OSU Herbarium Dept. of Botany and Plant Pathology 2082 Cordley Hall Corvallis, OR 97331-2902	OSC	Aaron Liston-Director Richard Halse-Curator 541-737-4106		

Office/ Team Code	Statewide or Regional Herbaria	Index Herb Code	Contact Info	Local Herbaria chosen	Contact Info
OR030				Albertson Coll. of Idaho 2112 Cleveland Blvd. Caldwell, ID 83605	Dr. Don Mansfield 208-459-5287
OR020				BLM Burns District Herbarium 28910 Hwy 20 West Hines, OR 97738	Skyler Hickey 541-573-4478
OR090B				Upper Willamette Field Office 3106 Pierce Parkway Suite E Springfield Oregon 97477	Jessica Celis 541-683-6794
OR110				Medford BLM Herbaria, 3040 Biddle Rd, Medford, OR 97504	Bryan Wender 541-471-6549
OR130 OR134	Herbarium Botany Dept. Univ. of Washington Box 355325 Seattle, WA 98195-5325	WTU	David Giblin 206-543-1682 206-685-1728 f	Spokane District Herbarium Wenatchee, WA	Molly Boyter 509-665-2137
UT931 (formerly known as RBG)	Stanley L Welsh Herbarium Brigham Young Univ. 378-MLBM Provo, UT 84602	BRY	Aaron Roe 801-539-4065	BLM Utah State Office P.O. Box 45155 Salt Lake City, UT 84145-0155	Aaron Roe 801-539-4065
UT030				Grand Staircase-Escalante NM 190 E. Center St. Kanab, UT 84741	Amber Hughes 435-826-5602
UT050	Stanley L. Welsh Herbarium Brigham Young Univ. 378 MLBM, BYU Provo, UT 84602	BRY	Robert Johnson 801-422-7094	Utah Valley State College - Herbarium Dept. of Biology Life Sciences 800 W. 1200 S. Orem, UT 84058-5999	James Harris 801-863-8623 Jason Alexander 801-863-6806
UT080	Intermountain Herbarium Utah State University 5305 Old Main Hill Logan, UT 84322	UTC	Dr. Michael Piep 435-797-0061	Uinta Basin Herbarium BLM 170 S. 500 East Vernal, UT 84078	Sandra Robins 435-781-4448
UT080	Rocky Mt. Herbarium University of Wyoming 3165 University Sta. Laramie, WY 82071	RM	Ron Hartman and Ernie Nelson 307-766-2236		
VA (vnps)	Massey Herbarium, Biology Dept. VA Polytechnic Inst. and State Univ. Blacksburg, VA 24061-0406	VPI	Thomas F. Wieboldt 540-231-5746 540-231-9307 f wieboldt@vt.edu	URV Herbarium, Biology Department University of Richmond Richmond, VA 23173	W. John Hayden 804-289-8232 804-289-8233 f jhayden@richmond.edu
WY930	Western Wyoming College				
WY930	Rocky Mt. Herbarium University of Wyoming	RM			

Appendix 7. BLM Offices and Mail Stop/Collector Codes

AK020 - Northern Field Office
AK025 - Central Yukon Field Office, Fairbanks District Office
AK040 - Anchorage Field Office
AK050 - Glenallen District Office
AK930 - Alaska State Office
AZ030 - Kingman Field Office
AZ010 - Arizona Strip Field Office
AZ020 - Phoenix Field Office
AZ040 - Safford Field Office
AZ050 - Yuma Field Office
AZ060 - Tucson Field Office
AZ061 - San Pedro Project Office
AZ070 - Lake Havasu Field Office
AZ930 - Arizona State Office
CA067 - El Centro Field Office
CA068 - Barstow Field Office
CA160 - Bakersfield Field Office
CA170 - Bishop Field Office
CA180 - Folsom Field Office
CA190 - Hollister Field Office
CA320 - Alturas Field Office
CA330 - Arcata Field Office
CA340 - Ukiah Field Office
CA350 - Eagle Lake Field Office
CA360 - Redding Field Office
CA370 - Surprise Field Office
CA610 - California Desert District
CA650 - Ridgecrest Field Office
CA660 - Palm Springs-South Coast Field Office
CA690 - Needles Field Office
CA930 - California State Office
CO100 - Little Snake Field Office
CO110 - White River Field Office
CO120 - Kremmling Field Office
CO130 - Grand Junction Field Office
CO140 - Glenwood Springs Field Office
CO150 - Uncompahgre Field Office
CO160 - Gunnison Field Office
CO172 - San Juan Field Office
CO200 - Royal Gorge Field Office
CO210 - La Jara Field Office
CO220 - Saguache Field Office
CO932 - Colorado State Office
ES930 - Eastern States Office
ID100 - Boise District Office
ID120 - Bruneau Field Office
ID110 - Four Rivers Field Office (was ID095)
ID130 - Owyhee Field Office (was ID096)
ID200 - Twin Falls District Office
ID210 - Jarbidge Field Office (was ID097)
ID220 - Burley Field Office (was ID078)
ID230 - Shoshone Field Office (was ID076)
ID300 - Idaho Falls District Office
ID310 - Upper Snake Field Office
ID320 - Pocatello Field Office (was ID075)
ID330 - Challis Field Office (was ID084)
ID340 - Salmon Field Office (was ID085)
ID400 - Coeur d'Alene District Office
ID410 - Coeur d'Alene Field Office (was ID086)
ID420 - Cottonwood Field Office (was ID087)
ID930 - Idaho State Office
MT010 - Billings Field Office
MT020 - Miles City Field Office
MT030 - North Dakota Field Office
MT040 - South Dakota Field Office
MT050 - Dillon Field Office
MT06? - Havre Field Office
MT060 - Lewistown Field Office
MT070 - Butte Field Office
MT090 - Malta Field Office
MT092 - Glasgow Field Station
MT100 - Missoula Field Office
MT923 - Montana/Dakotas State Office
NM010 - Albuquerque Field Office
NM011 - Cuba Field Office
NM012 - Grants Field Station
NM018 - Taos Field Office
NM030 - Las Cruces District Office
NM040 - Tulsa Field Office
NM050 - Socorro Field Office
NM060 - Roswell Field Office
NM070 - Farmington District Office
NM080 - Carlsbad Field Office
NM930 - New Mexico State Office
NV010 - Elko Field Office
NV020 - Winnemucca Field Office
NV030 - Carson City Field Office
NV040 - Ely Field Office
NV050 - Las Vegas Field Office
NV060 - Battle Mountain Field Office
NV065 - Caliente Field Station
NV065 - Tonopah Field Station
NV930 - Nevada State Office
OR010 - Lakeview District Office
OR014 - Klamath Falls Resource Area
OR020 - Burns District Office
OR030 - Vale District Office

OR035 - Baker Resource Area
OR050 - Prineville District Office
OR054 - Central Oregon Resource Area
OR056 - Deschutes Resource Area
OR080 - Salem District Office
OR086 - Tillamook Resource Area
OR090 - Eugene District Office
OR091 - West Eugene Wetlands
OR100 - Roseburg District Office
OR110 - Medford District Office
OR115 - Butte Falls Resource Area
OR116 - Ashland Resource Area
OR117 - Grants Pass Resource Area
OR118 - Glendale Resource Area
OR120 - Coos Bay District Office
OR130 - Spokane District Office
OR134 - Wenatchee Resource Area
OR930 - Oregon State Office
OR931 - Berry Botanic Garden
TC200 - National Training Center
UT010 - Fillmore Field Office
UT020 - Salt Lake Field Office
UT030 - Escalante Interagency Resource Center
UT030 - Grand Staircase-Escalante National Monument
UT040 - Cedar City Field Office
UT052 - Richfield Field Office
UT055 - Henry Mountains Field Station
UT060 - Moab Field Office
UT070 - Price Field Office
UT080 - Vernal Field Office
UT090 - Monticello Field Office
UT100 - St. George Field Office
UT110 - Kanab Field Office
UT930/3 - Utah State Office
UT931 - Red Butte Botanical Garden
WO230 - Fish, Wildlife, and Plant Conservation Division
WY010 - Worland Field Office
WY020 - Cody Field Office
WY030 - Rawlins Field Office
WY040 - Rock Springs Field Office
WY050 - Lander Field Office
WY060 - Casper Field Office
WY070 - Buffalo Field Office
WY080 - Newcastle Field Office
WY090 - Kemmerer Field Office
WY100 - Pinedale Field Office
WY930 - Wyoming State Office

Appendix 8. CPC National Collection of Endangered Plants

Seeds of Success does not collect seeds from threatened or endangered species. The SOS Technical Protocol is designed for the sustainable collection of common 'work-horse' species that can be used in restoration projects.

The Center for Plant Conservation's (CPC) National Collection of Endangered Plants contains plant material for more than 2,000 of the country's most imperiled native plants. Seeds, cuttings, and other plant material are collected and carefully maintained by botanical institutions that participate in the CPC. Researchers and botanists at each participating institution collect plant material and seeds from the most imperiled plants in their regions. The institutions study and hold this material in protective custody. An important conservation resource, the CPC National Collection is a backup in case a species becomes extinct or no longer reproduces in the wild. The Collection is also an important resource for the scientific study of plant rarity, rare plant life cycles, and rare plant storage and germination requirements.

After studying and growing the plants, institutions provide plant material to federal and state agencies and private land managing organizations to assist their efforts to recover imperiled plants in the wild. CPC participating institutions are involved in restoring more than 60 of America's rarest plants in their natural habitat.

More information about the Center for Plant Conservation is available online at https://saveplants.org/

For more information contact:
Center for Plant Conservation, info@saveplants.org, (760) 796-5686.

Appendix 9. References

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Appendix 10. Glossary

**Denotes a required field on the SOS Field Data Form*

Accession Number – A number representing a unique germplasm or collection and associated with a Seed Collection Reference Code or field number. This number is consecutive and never to be reused. Collections made in different growing seasons from the same population are unique accessions or collections, assigned unique seed collection reference numbers. Example: CO932-5. See also ***Seed Collection Reference Number*** for the accession number format required for SOS.

Alt. Collection Number – Alternate collection numbers are secondary identification number representing a code assigned by another institution – they are *not* required for the SOS National Office. They may represent another organization or individual involved in the collection, a batch number or other numbering system previously employed by the current institution. E.g., MSB378585, CH-101, or 2014-16.

***Area Sampled** – In acres, the size of the area in which the collection was made. Since collections should ideally be made from the entire population, this number should be very close to the actual population size, in acres.

***Area within Subunit** - The geographic area where this collection was made. Geographic areas are physical or logical areas that transcend the geopolitical areas defined in the State, County, Subunit fields. These may include mountain ranges, river valleys, trail names, etc. e.g., Marigold Trail, Red Rocks Canyon, or Maroon Bells.

***Aspect** – The cardinal direction of the slope where the collection was made. Measure using a compass. E.g., NW.

***Associated Species** – List the scientific name for all plants found coexisting with the collected species, ideally at least five for SOS.

***Collector Code -** BLM field office or institutional code assigned to your collection team. These are assigned by the SOS National Coordinating Office. E.g., AK930, NCBG or CP2.

***Collector Name(s)** – All active participants participating in seed collection. Collectors' name should be entered as last name, first initial. Example: Dawson, C., Howard, M., Haidet, M.

***Collection Number** - The collection number is the sequential, unique, number assigned to a given collection. This number is the second part of the seed collection reference number.

***Common Name(s)** – The vernacular or trade name(s) of the collected species. Common names should be lower case, except for proper nouns within the name. E.g., blue grass, Iowa tall grass, and creeping Jenny.

***County** – The county the collection was made.

Cut Test – A test performed by splitting seeds in half to determine the viability of a potential collection. Immature seeds are usually green, and seeds ripe for collecting are usually brown with a notable live embryo. A cut test can be used to estimate the number of healthy seeds per fruit.

Date(s) Collected** – Enter up to two dates a collection was made from the same population. Use MM/DD/YY format. Collections made in different growing seasons from the same population are unique accessions or collections, assigned unique seed collection reference numbers (see ***Recollection). E.g., August 4, 2021 is recorded as 08/04/2021.

Date Range - If the collection dates span more than two dates, utilize this field in the web portal, which is a free text box. Enter the range of dates, or the individual dates. Use MM/DD/YY format and separate multiple dates with a comma. For example, if the collection took place

on August 4th, 5th, 7th, and 9th, 2021, then enter the first two dates in the first two fields, and then "08/07/2021, 08/09/2021" in the "Date range" field.

***Ecoregion** – Ecoregions denote areas within which ecosystems (and the type, quality, and quantity of environmental resources) are generally similar. The SOS standard is to use Omernik Level III Ecoregions (https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states).

***Elevation** – Distance above or below sea level. If necessary, indicate a range, e.g., 1200-1400 feet.

Estimate the number of healthy seeds per fruit – After performing a cut test, calculate the number of seeds ripe for collection per fruit.

Estimate the number of healthy fruits per plant – This number will yield an approximation of how many plants in the population need to be sampled to reach the ideal sample size of more than 20,000 healthy seeds.

Evidence of disturbance or damage – Any manipulations made to the collection site. Most collections should be made on sites falling under 'No Damage.'

***Family** – The family to which the collection belongs.

***Genus** – The genus to which the collection belongs.

***Geology** – The mineral structure of the collection site, either a formation type or specific rock which makes up the parent material. E.g., granite, limestone, or sandstone. If you are unable to recognize the parent material, reference the soil map for the location at https://websoilsurvey.sc.egov.usda.gov

***GPS Datum** – GPS device setting, when using GPS with a map, make sure both tools match. The SOS standard is NAD83.

***Habitat Type** – Description of the collection site as a plant community or ecosystem. Example: oak savanna, prairie, sagebrush steppe. Ecological site descriptions and national vegetation classifications are also accepted for this field on the SOS data form.

***Identified by –** The name and organization of the botanist or plant specialist who identified the taxa of the collection.

Infraspecific Rank – The term preceding the infraspecific epithet. E.g., ssp. (subspecies), var. (variety), or subvar. (subvariety).

Infraspecific Epithet – The taxonomic designation below the species level to which the collection belongs, part of the scientific name. Example: *multiflora* in *Brickellia longifolia* var. *multiflora*.

***Landform** – Description of local topography. E.g., mountain, hill, alluvial fan, flat, etc. A selection of landforms and their definitions is available on blm.gov/sos

***Landowner –** This should reflect the public agency or municipality that is responsible for the land on which the collection was made. Omit private individuals' names. You MUST keep written permission on file in your office if a collection was made on private land or land other than BLM. E.g., USFWS.

***Land Use** – How the land is used by humans. E.g., mining, recreation, grazing, conservation.

***Latitude** – Direction from the equator (N/S), degree, minute, and second.

***Location Details** – The locality of the collection site, including driving and hiking directions from some recognizable point to the collection site. Be detailed enough that someone can retrace the location details and find the population using cardinal directions, mileage, and permanent landmarks. E.g., Starting at the intersection of Fifth St and Cole Ave, head SW on Fifth St towards Albert St. and turn right onto Albert St. In 6 miles slight right east onto Coffee Pot Rd E. In 5.4 miles turn S (right) to Coffee Pot Recreation area and continue for 3 miles. The population primarily lines the road just after the cattle guard and is off to the right when facing the lake.

***Longitude** – Direction from the Prime Meridian (E/W), degree, minute, and second.

Long-term storage portion - The first 3,00 seeds from any SOS collections are stored in long-term storage conditions for conservation purposes with the USDA-ARS.

***NRCS PLANTS Code** – A code system for recording plant names in the United States is used in the USDA NRCS PLANTS Database. Plant species "symbols," as they're called, are comprised of the first two letters of the genus, followed by the first two letters of the species, the first single letter of the variety name (if present), and sometimes a tie-breaking number. See http://plants.usda.gov/ and query the scientific name to find the unique code.

***Modifying Factors** – Any event that has altered the collection site, such as burning, grazing, or seeding. If a modifying factor results in a cultivated population, the population can no longer be considered for collection. However, naturally occurring populations within a seeded area may be considered as suitable collection populations.

Native Plant Materials Development Process – The interagency process developed by the BLM which works to develop a reliable, stable crop of high-quality native seeds and seedlings from wild collected species for restoration, rehabilitation, and reclamation.

Natural Dispersal Stage – The point in the population's growing cycle where seeds would be distributed without human interference. The best stage at which to collect seed.

***Non-BLM Permission Filed** – Permission is needed to collect on all private and public lands. Written permission should be kept on file for all collections. Indicate "yes" that permission is filed.

***No. Plants Found** – Total number of plants living at the collection site; this number includes those plants whose seeds are not ripe for collection on the day of collection.

***No. Plants Sampled** – Number of plants seed was collected from. There should be a minimum of 50 plants sampled, and the number should be exact, *not* an average or range.

Operational Collection – A seed collection made following the SOS Protocol that is over 80,000 estimated PLS (weight can vary). The purpose of these collections is for restoration, particularly for increasing through the seed production IDIQ or grow-out.

Photograph Reference – Use the following naming convention to document each of the three digital images taken with for every collection: PLANTS Code_Collection Number_Letter. Example: Photos for Chicago Botanic Garden's collection of *Symphyotrichum lanceolatum* are named SYLA6_CBG-419_A.jpg, SYLA6_CBG-419_B.jpg, SYLA6_CBG-419_C.jpg.

Plant Habit – The way the collected species grows. E.g., tree, shrub, forb, succulent, or grass/grasslike.

***Plant Height** – Distance from the ground to the top of the plant in feet and inches**.** This number should be an average of the population.

PLS – Pure live seed. The number of viable seeds in a collection.

Population – A group of individuals living within the same collection site, continuous in range and generally uniform in appearance; one accession or collection. Geographic features such as roads, ridges, and rivers inhibit gene flow between populations, and thus are useful indicators of separate populations.

Readiness of Population – The ripeness of the population on collection day; collections should be made when the population is closest to natural dispersal stage.

Recollection – A seed collection made from a population that has previously been collected from following the SOS Protocol.

Seed Collection Reference Number** – Collector code, BLM field office or institutional code, followed by collection number, a consecutive and chronological number representing the unique collection or accession, never to be reused. See ***Accession Number. Example: CA170-42, OR110-347 or CBG-2481.

***Seed Collected From** – Choose from the following: plant, ground, both. The best collections are made from plants.

Short-term storage portion – The seed remaining in a collection after the long-term storage portion has been removed. These seeds are kept in short-term storage conditions by the Bend Seed Extractory or other facility until requested. The original collecting team has right of first use or can make seed available for other SOS partners for native plant materials development projects.

***Slope** – The degree of steepness at the collection site; record a number representing the degree of slope 0-90 measured with a clinometer. E.g., 30 degrees.

***Soil Color** – Refer to the Munsell Soil Color Chart and document color using the code and descriptive name. E.g., 7.5 YR 3/3 "dark brown".

***Soil Texture** – Describes the soil at the collection site with the following terms: clay, silt, and sand etc. Soil texture is best estimated by rolling a sample of soil between your finger and thumb.

***Source Used –** The source used to obtain the lat/long coordinates for the collection site. E.g., gps, map, other.

***Species** – The species to which the collection belongs.

Standard Collection – A seed collection made following the SOS Protocol that is under 80,000 PLS. All SOS collections are for restoration purposes.

***State** – The state in which the collection was made.

Sub-Populations – A cluster of individuals that are divided from the main population either physically or in appearance.

Subspecies** – See ***Infraspecific Rank.

***Subunit** – The descriptive name of the area given to it by the landowner or land manager. This may include the city, town, village, park, forest, or refuge in which the material was collected. E.g., Blue Mountains, Antelope Island State Park, Ridgecrest Field Office, Phoenix.

Variety** – See ***Infraspecific Rank.

Viability Equation – The equation used to determine whether only collecting 20% of the healthy seeds available on a given day will result in a collection greater than 10,000 seeds. *(# of viable seeds per fruit) * (# fruits per plant) * (# of plants in the population) * 0.2 = >10,000 seeds*

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