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

for

SEEDS OF SUCCESS

(Updated October 18, 2018)

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1. Introduction

This protocol outlines the procedures for making seed collections for *Seeds of Success*, part of the national Native Plant Materials Development Program. The purpose of the *Seeds of Success* program in the United States is to establish a national, high quality, accurately identified and well documented native plant species seed collection. All seed collections made following this protocol can be used to support development of geographically appropriate native plant materials for restoration emergency fire rehabilitation. Each seed collection should comprise of 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 multiplication in the native plant materials development program.

1a. Program History

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 collection teams in the United States for *Seeds of Success*. 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; and the Zoological Society of San Diego. Today there are more than 65 collection teams; this group plus the cleaning, storage and funding organizations is collectively referred to as the SOS Partners.

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 making one seed collection for each of the species on the Kew list, SOS shifted its collection strategy to making multiple collections of restoration and rehabilitation species to have genetically representative seed from across their range.

In June of 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).

1b. Program Goals

The goal of SOS is to provide wild collected seeds to researchers for common garden studies and other native plant materials development projects within the national Native Plant Materials Development Program. The goal of the Native Plant Materials Development Program, 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." The Seeds of Success collection program is the first step in this process of developing native plant materials.

During Phase 1 of the Millennium Seed Bank Project (2001-2010), there was a goal of collecting 10% of the world's flora. With SOS as the U.S. partner, MSB was able to reach this goal.

Estimates have shown that between 10 and 20 collections of a single 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. Training, Communication, and Annual Reporting

2a. 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 training course, "Seed Collection for Restoration and Conservation" has been developed to provide comprehensive training for SOS seed collection partners.

Before starting an SOS team, or making SOS collections, it is highly recommended that at least one lead botanist (all team members are welcome) participate in the training course. If you are founding a SOS team and need to train a collection team, contact the National Coordinating Office for more information.

2b. Communication

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

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

List: SOS has an email list for discussing the Seeds of Success program. You must be subscribed to the list in order 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, 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 in order 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 SOS Partners. This is a forum for discussion to raise issues and questions with other collectors and the National Coordinating Office. The conference call number cannot be posted on the website; contact the National Coordinating Office for details and to submit agenda items. Reminders, cancellations, and agendas will be posted to the SOS email list.

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

2c. Annual Reporting

When each collecting team has finished for the season, they must complete an annual report. A template and example 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. This report is to be submitted to the SOS National Coordinating Office. Additional comments may be submitted to the National Coordinating Office at any time throughout the year.

3. Target Species

Initially, collections sent to the Millennium Seed Bank (MSB) at Royal Botanic Gardens, Kew included only one collection per species. These species were on the "Kew list." Today, the collection focus of the SOS program is on species needed for restoration and rehabilitation projects, also called the "restoration list." Species from both lists may be collected as long as they contribute to SOS programmatic goals. Teams may make multiple collections of species on their restoration target list as long as they are capturing unique populations in each collection.

Collecting teams are encouraged to work with local federal land managers to develop and execute priority target lists. Projects using SOS seed may include emergency fire rehabilitation and restoration, waterway stabilization, landfill and corporate land recovery, wildlife habitat, threatened and endangered species habitat, and roadside revegetation. Thus we collect primarily common native workhorse species appropriate for restoration and stabilization.

In addition, BLM is continually identifying species of priority restoration value needed for native plant materials development. Teams collecting for BLM should work with their BLM colleagues to ensure that collections are being made of these high priority species.

Today with a goal of making 20 collections across the range of a species, researchers need to develop seed transfer zones for restoration species. Each team should be working from a regional restoration target list. Regional restoration target lists should be compiled by federal land managers, native plant materials development and conservation researchers, and any other native plant stakeholders.

Target species lists should be developed at the ecoregional level by SOS partners and the National Coordination Office. SOS currently uses Omernik Level III Ecoregions for seed collections' ecoregional distinction.

Seeds of Success manages target species information on a website hosted by the Bureau of Land Management at http://www.blm.gov/sos. Ecoregional lists of species using Omernik Level III Ecoregions are accessible on the web to assist collectors in choosing target species. Information on target species that were assigned to collecting groups for the MSB project are also available on the web. These targeting lists track which SOS collecting groups are making restoration collections for the different species.

All collectors should coordinate with the SOS National Coordinating Office to develop regional restoration target lists. This is best done via e-mail to the National Coordinating Office. You may also contact the National Coordinating Office to request a subset of data, which can aid in compiling a unique target list and building on existing collections.

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 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, or 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 species in the genus *Vitis*.
- All known recalcitrant seeds.

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

5. Storage and Distribution

Collections are cleaned, tested, and processed at a number of different facilities. Since 2003, BLM collecting teams have their seed cleaned by the U.S. Department of Agriculture, Forest Service Bend Seed Extractory while most non-federal partners clean their own seed.

Long-term and working collection needs are being met by the U.S. Department of Agriculture, Agricultural Research Service. The National Center for Genetic Resources Preservation (NCGRP) in Fort Collins, Colorado is managing long-term collections, and the Western Regional Plant Introduction Station (WRPIS) in Pullman, WA is maintaining both long-term and working collections for distribution to researchers working on native plant materials development related topics.

WRPIS serves as the processing center for Seeds of Success collections entering the National Plant Germplasm System (NPGS). WRPIS has partnered with the Bureau of Land Management, Kew Millennium Seed Bank, and other Plant Conservation Alliance members for collection and conservation of native plant species in the United States. Although MSB Phase 1 has been completed, germplasm collection continues under the SOS program. WRPIS receives a portion, typically 10,000 seed, from each SOS collection cleaned at the USDA Forest Service Bend Seed Extractory.

Accessions are sub-divided for -20°C back-up storage at the WRPIS in Pullman and the NCGRP in Fort Collins (Table 1). If seed quantity is sufficient, a distribution component is included in the 4°C working collection as outlined below.

Table 1. Seeds of Success (SOS) germplasm proportioning for long-term back-up and working collection samples.

SOS accession seed quantity	Ratio to long-term storage at NCGRP - 20°C	Ratio to long-term storage at WRPIS - 20°C	Ratio to working collection 4°C
<6,000	½	½	0
6,000 - 7,500	2/5	2/5	1/5
7,500 – 10,000	1/3	1/3	1/3
> 10,000	The first 10,000 seeds will be partitioned as in the row above. The remaining balance is then available for native plant materials development projects.		

6. Permission to Collect

Permission is required for all seed collected for the Seeds of Success program.

6a. Collecting on BLM Lands

Collecting seeds on public land managed by the Bureau of Land Management is categorically excluded 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 6, Appendix 5, Section 5.4 (effective 5/19/92). 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*.

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.

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, and Department of Defense) or state, county or municipal agencies, as long as 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.

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 a large number of individuals (100+) 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 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
- A substantial amount of seed can be conserved as a long-term safeguard against loss of the wild population

7a. Preliminary Site Visits

Preliminary site visits are often necessary to assess the populations, confirm the identification with the collection of herbarium voucher specimens (see ***Section 10***), and estimate the likely harvesting date and potential seed production. Where populations are suitable and the quality and quantity of seed is adequate, it may be possible to make collections of a number of different species from the same site.

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 with the expectation of seed being transferred to an in-house native plant materials development project, or returned to the collector. Instead, collections of less than 10,000 viable seeds shall be directly transferred to the SOS National Collection.
- Seed development can vary within and between 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 dispersal period to maximize the genetic diversity of samples. Collections taken from the exact same population may be combined into one accession (seed collection reference number) during a single collecting season. Collectors must ensure that no more than 20% 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 that the material was collected on multiple dates on the SOS field data form.

8. Sampling Strategy

It is important to maximize the number of alleles 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 target species has not been studied, and the capture of rarer alleles would require a markedly increased sample size. Therefore, collectors are advised to sample from a single population with individuals of the target species in excess of 50 individuals, and to look for populations with

larger numbers of plants.

As previously mentioned, between 10 and 20 collections across a species range are needed to establish seed zone guidelines and ecotype for a species. Each of those collections shall 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.

	Method	Rationale
1.	Assess the target population and confirm that a sufficient number of 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 the majority of 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.	Ensure the highest possible viability at collection and maximize the potential storage life.
4.	Cleaning should be left to the processing staff at the Bend Seed Extractory for federal partners.	Maximize the use of available field time and clean and prepare seeds in controlled laboratory conditions.
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.
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.

	Method	Rationale
9.	Collect 10,000 to 20,000+ viable seeds. However, collections of all sizes are welcome. The smaller the collection, the less useful it will be.	Enable maximum use and study of the collection. The first 10,000 viable seeds are transferred directly to the SOS National Collection.
10.	The first 10,000 seeds of each collection sent to Bend becomes part of the SOS National Collection. Collections sent to Bend can be cleaned and sent back to collectors if they are needed for native plant materials development research or a re-seeding project. See ***Section 14*** for details on requesting material from Bend.	Seed from Bend is then sent to the NCGRP, Ft. Collins, CO for long-term storage and the WRPIS for long-term storage and working collections. Anything over 10,000 can be requested back by the collector or shipped to a partner organization for research and development.
11.	For each collection, estimate the viable seed production per fruit, per individual and per population, and note these on the field data form.	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.
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 be used, 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 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 a 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 additional outputs from the collecting program in their own right, and collectors should take three to four representative herbarium specimens for each seed collection made. These specimens can be held at the most appropriate regional, national and international herbaria where they will be available for study or for 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 attend an SOS training session (see ***Section 2***). Literature available to consult includes: Bridson and Forman (1992); Radford, Dickison, Massey and Bell (1974); and Ross (1994).

For those species that will not be in bloom during seed collecting time, it is suggested that a 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 (e.g. 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 fertile material would be available.

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.

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. A specimen that requires more than one sheet is acceptable as long as 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.

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 to be aware of 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.
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> ***Large Bulky Fruits (i.e. pine cones):*** Inevitably these parts of a specimen and the point of 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. It is encouraged to indicate on the label, presence of bulky fruits and to 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 also 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 prepare accordingly. 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.

Labeling: Labels play a huge role in the significance of a 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 collector and possible determiner of the plant species.

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 determination (family, genus, and species), collection location (as specific as possible), 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. **You may find specific labeling instructions and an example template on the SOS website.**

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) and 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). 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 (institution) 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.**

You can find a perfect example of 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 http://www.plants.usda.gov. 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.

11. Field Documentation

Use a copy of the ***Field Data Form*** (***Appendix 3***) for each seed collection made 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 copy to the SOS National Coordinating Office.

11a. Seed Collection Reference Number Format

Seeds of Success collecting teams use the following format to identify their collections. The Seed Collection Reference Number will include two parts: the SOS team code (office mail stop or organization acronym) and collection number; for example, **OR020-26** for the 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. See ***Appendix 2*** for collector codes and ***Appendix 7*** for a list of all BLM Field Offices and mail stop codes.

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 picture number (A, B, C, etc):

PLANTS Code_Collection Number_Picture Number

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 the SOS National Coordinating Office on CD or DVD via FedEx (see ***Appendix 1*** for the FedEx address) or electronically via GoogleDrive folder, Dropbox, etc.

13. Post-Collection Seed Care

In general, **keep the seed collections in a cool, dry place** prior to sending to the 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. Maintain ventilation around the collections at all times 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.

All teams have specific cleaning and processing arrangements; follow your institution's cleaning agreements and take advantage of the cleaning facilities' expertise and knowledge in cleaning seeds.

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. Collections that exhibit no presence of insects may include larva stage pests that could damage seed thus 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 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, ship immediately and never on a Friday.

Fleshy fruit shipping options:

a. Pack the whole fruits in strong plastic bags with as much air as possible. The bags should then be packed in some kind of rigid plastic container. Shipping cold and wet ensures the fruits are not squashed and also 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 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 bags.

If you have any specific questions such as, what "*a little while"* means for the species that you have collected, and to notify seed extractory staff that fleshy fruits are in transit, please contact the 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 National Coordinating Office.**
- **Most BLM offices shall send seed to the Bend Seed Extractory for cleaning.**
- **Most non-federal partners are responsible for cleaning their own seed.**
- **All Seeds of Success seed shall end up with a portion in long-term storage and another portion available for research and development for native plant materials.**

14a. Packaging of Seed

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

As often as possible, ship each seed collection in one bag. Make sure that the seed bags are clearly labeled with the unique collection number. The preferred labels are those that can be neatly tied to the neck of the bag with string. This should allow for the bag to be opened and checked while in transit to the seed bank. 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 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 interns 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
(541) 383-5481
(541) 383-5498 Fax

Contact: Kayla Herriman
kherriman@fs.fed.us

Please notify the Bend Seed Extractory that seeds will be shipped and **always send the seeds overnight mail or with 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.

14c. Shipping Seeds for Storage (for non-federal partners that have cleaned seed)

For those collection teams that have the ability to clean their own seed, you may send your seed directly to the Western Regional Plant Introduction Station (WRPIS) in Pullman, WA. Please contact the National Coordinating Office for more information.

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

Herbarium vouchers should be sent to the following locations, along with a notice of transmittal and a copy of the field data sheet. These should be unmounted, labelled and should include the completed field collection data forms. 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

Voucher 2. Regional Herbarium (see ***Appendix 6***)

Voucher 3. Collecting Team's Herbarium

Send all voucher material marked with the seed collection number and a copy of the correlating field data forms. Templates for the notice of transmittal may be found on the SOS website.

14e. Requesting Return of Seed from Bend

The first 10,000 seeds of each collection are taken from each collection and sent to the Western Regional Plant Introduction Station (WRPIS) in Pullman, WA for incorporation into the working and long-term Seeds of Success National Collection. Collectors can request the return of any extra material, above the 10,000 seeds, to be returned to them or a cooperating agency/organization. The SOS Clearance form is the mechanism to have the seed returned.

The SOS Clearance Form (***Appendix 4***) should be filled out completely. The Clearance Form, along with the associated SOS field data forms, should be emailed to the SOS National Coordinating Office who will review the request, and if approved, assign a clearance number and send it to the Bend Seed Extractory.

Following the process outlined above will ensure that Bend will return material to a requested location. If this process is not followed, and a Clearance Form is not filed with the National Coordinating Office, your seed will remain at Bend.

An inventory of the balance of collections greater than 10,000 stored at Bend, that have not requested for return by the collector, will be circulated to national Native Plant Materials Development Program partners.

This annual distribution will be managed by the SOS National Coordinating Office. In order for distribution requests to be filled, an explanation of material usage needs to accompany every distribution request.

Appendix 1. Program Contacts: National Coordinating Office

Below are program contacts in the National Coordinating Office of Seeds of Success, located in Washington, DC.

Native Plant Materials Development Program

Bureau of Land Management Plant Conservation Program Lead
Peggy Olwell

(For US Postal Service mail)
Bureau of Land Management
1849 C Street NW, Rm 2134LM
Attention: Peggy Olwell
Washington, DC 20240
Tel: 202-912-7273
Email: polwell@blm.gov

(For FedEx or UPS or DHL)
Bureau of Land Management
20 M Street SE, Rm 2134LM
Attention: Peggy Olwell, 5249
Washington, DC 20003

Seeds of Success National Curator
Leah Prescott

(For US Postal Service mail)
Bureau of Land Management
1849 C Street NW, Rm 2134LM
Attention: Leah Prescott, 5250
Washington, DC 20240
Tel: 202-912-7232
Email: lprescott@blm.gov

(For FedEx or UPS or DHL)
Bureau of Land Management
20 M Street SE, Rm 2134LM
Attention: Leah Prescott, 5250
Washington, DC 20003

Appendix 2. Program Contacts: Seeds of Success Collectors

Coll. Code	BLM Offices	Team Contact	Email	Phone
AK930	Alaska State Office AK Natural Heritage	Eric Geisler Justin Fulkerson	egeisler@blm.gov jrfulkerson@alaska.edu	907-271-3266 907-786-6387
AZ040	Safford Field Office	Jeff Conn	jconn@blm.gov	520-348-4470
AZ100	Arizona Strip District Office	Kathleen Harcksen	kharckse@blm.gov	435-688-3380
AZ310	Kingman Field Office	Ammon Wilhelm	awilhelm@blm.gov	928-718-3758
AZ930	Arizona State Office	Lisa Thornley	lthornley@blm.gov	602-417-9356
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 Harry McQuillen	ghinshaw@blm.gov hmcquill@blm.gov	916-941-3134 916-683-1701
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	Michael Dolan	mdolan@blm.gov	530-233-7923
CA330	Arcata Field Office	Jennifer Wheeler	jswheele@blm.gov	707-825-2316
CA350	Eagle Lake Field Office	Valda Lockie	vlockie@blm.gov	530-252-5325
CA360	Redding Field Office	Kendra Fallon	kfallon@blm.gov	530-224-2107
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	Joel Miner	jminer@blm.gov	760-833-7145
CA690	Needles Field Office	Vacant		
CA930	California State Office	Christina Lund	clund@blm.gov	916-978-4638
CA930A	Rancho Santa Ana Botanical Garden	Sarah De Groot	sdegroot@rsabg.org	909-625-8767 ext 225
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	Cara Gildar	cngildar@fs.fed.us	970-882-6854
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	Derek Strohl	dstrohl@blm.gov	414-297-4416
ID230	Shoshone Field Office	Danelle Nance	dnance@blm.gov	208-732-7220
ID330	Challis Field Office	Ace (Andrew) Hess	ahess@blm.gov	208-879-6242
ID340	Salmon Field Office	Kyra Povirk	kpovirk@blm.gov	208-879-6217
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
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		505-599-6345
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 Eastern Nevada Landscape Coalition	Erica Husse Greg Gust	ehusse@blm.gov ggust@envlc.org	775-289-1828 775-289-7974
NV052	Las Vegas Field Office	Lara Kobelt	lkobelt@blm.gov	702-515-5022
NV930	Nevada State Office	Fred Edwards Jess Kindred	fsedwards@blm.gov jkindred@thegreatbasininstitute.org	775-861-6491
NV930A	Elko Field Office	Fred Edwards Jess Kindred	fsedwards@blm.gov jkindred@thegreatbasininstitute.org	775-861-6491
OR010	Lakeview District Office	John Klock	jklock@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	Claire Hibler	chibler@blm.gov	503-375-5677
OR090	Eugene District Office	Patricia Johnston	p3johnso@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	Rob Fiegener	rob@appliedeco.org	541-753-3099 ext 201
OR090C	TNC-Coburg Hills	Vacant	Vacant	Vacant
OR100	Roseburg District Office	Susan Carter	scarter@blm.gov	541-464-3289
OR110	Medford District Office	Stacy Johnson	sjohnson@blm.gov	541-471-6584
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 Univ. of WA Bot. Gardens	Mark Mousseaux Vacant	mmoussea@blm.gov	541-618-2232
OR931	Rae Selling Seed Bank (formerly Berry Botanic Garden)	Vacant		
UT030	Grand Staircase-Escalante National Monument	Amber Hughes	ahughes@blm.gov	435-826-5602
UT060	Moab Field Office	Vacant		
UT080	Vernal Field Office	Jessi Brunson	jbrunson@blm.gov	435-781-4448
UT933	Utah State Office Richfield Field Office	Marcia Wineteer Dustin Rooks	mwinetee@blm.gov drooks@blm.gov	801-539-4065 435-896-1518
UT931	Red Butte Bot. Garden (see also CP2)	Bruce Pavlik	bruce.pavlik@redbutte.utah.edu	801-585-5853
WY010	Worland Field Office	Eve Warren	ewarren@blm.gov	307-347-5109
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	Jim Glennon	jglennon@blm.gov	307-352-0336
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	Marion Mahaffey	mmahaffey@blm.gov	307-828-4543

WY100	Pinedale Field Office	Josh Hemenway	jhemenway@blm.gov	307-367-5322
WY930	Wyoming State Office	Paige Wolken	pwolken@blm.gov	307-775-6318
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	Lyle King	lking@tctwest.net	307-765-2526
Coll. Code	**SOS MOU Signatories**	**Team Contact**	**Email**	**Phone**
CBG	Chicago Botanic Garden	Emily Yates Dave Sollenberger	eyates@chicagobotanic.org dsollenberger@chicagobotanic.org	847-835-6861 847-835-6957
LBJWC	Lady Bird Johnson Wildflower Center	Minnette Marr	mmarr@wildflower.org	512-232-0240
MARSB	Mid-Atlantic Regional Seed Bank	Clara Holmes	Clara.Holmes@parks.nyc.gov	718-370-9044 ext. 300
NEWFS	New England Wild Flower Society	Bill Brumback	bbrumback@newfs.org	508-877-7630
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	Patty West	patty.west@nau.edu	928-523-0736
CP2	Red Butte Bot. Garden (see also UT931)	Bruce Pavlik	bruce.pavlik@redbutte.utah.edu	801-585-5853
CP3	Southern Utah University	Jackie Grant Matt Obgurn	jacqualinegrant@suu.edu mattogburn@suu.edu	435-865-8549 401-965-4492
CP4	Four Corners School of Outdoor Ed.	Mark Grover Jasmine Anenberg	mgrover@fourcornersschool.org, janenberg@fourcornersschool.org	435-587-215 ext. 1024, 1006
CP5	Friends of Verde River Greenway	Kate Watters	agavemariadesign@gmail.com	928-221-0045
GBNPP	Great Basin Native Plant Project	Fred Edwards	fsedwards@blm.gov	775-861-6491
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	kherriman@fs.fed.us sarahegarvin@fs.fed.us	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:	

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*	**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:					
Source Used:	*GPS Map None*	**Accuracy:**	*GPS 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 (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

The U.S. Forest Service Bend Seed Extractory is the seed cleaning facility for SOS seed collected by the BLM. After cleaning, the first 10,000 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 10,000) 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 National Coordinating Office.

Complete this form and e-mail it to the SOS National Coordinating Office with associated SOS Field Data Forms by **January 30th**. The SOS National Office will review the request, if approved assign a clearance number(s), and send the approved clearance form to the Bend Seed Extractory.

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 returned.**

Contact Information

Name: _____ SOS Collecting Team: _____
Email: _____ Phone Number: _____

FedEx Account Number: _____

Return Request

Please return the following collection(s) by (date) _____to:
Name and Title:
Organization and Office:
Shipping Address:

SOS Seed Collection Reference Number/ Collection Number	**Species Name**	**Clearance Number** (assigned by the National Office)

Native Plant Materials Development Project (Please describe how the returned seed will be used, i.e. common garden study, restoration project, academic partnership, etc.)

Please submit the **completed** clearance form to Leah Prescott (lprescott@blm.gov).

Appendix 5. Seeds of Success Annual Report

******* A stand-alone document of this template is available on the SOS website

Organization:	**Team Code:**
Location:	
Number of species collected:	**Number of collections made:**
Collecting Season Summary (accomplishments and challenges):	
Partners *(FWS, FS, 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; i.e. citation for a newsletter, web article, conference/meeting display, or presentation on SOS and/or the Native Plant Materials Development Program, etc.)***

Format (ex: talk, exhibit, publication)	**Title**	**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 *(ex: NV030-xx)*	Receiving Institution	What the SOS Material will be Used For

SOS Collections: ***(include information for current year collections that have been shipped out of your office to the Bend Seed Extractory. Include any other receiving institutions as outlined by clearance forms)***

Species	Seed Coll. Ref. Num. *(ex: CBFO-23-2017)*	Receiving Institution *(Field Office)*	What the Material will be Used For *(grow out)*

Please submit the final annual report template to Leah Prescott (lprescott@blm.gov) at the National Coordinating Office of Seeds of Success by the end of the calendar year.

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

Office/ Team Code	Statewide or Regional Herbaria	Index Herb Code	Contact Info	Local Herbaria chosen	Contact Info
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
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

Office/ Team Code	Statewide or Regional Herbaria	Index Herb Code	Contact Info	Local Herbaria chosen	Contact Info
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
ES	No response to memo. North Carolina Botanic Garden will be recommended				
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		

Office/ Team Code	Statewide or Regional Herbaria	Index Herb Code	Contact Info	Local Herbaria chosen	Contact Info
MT923	Charles A. Taylor Herbarium Agricultural Hall 320 Dept. of Biology & Microbiology SD State Univ.	SDC	Gary E. Larson, Curator 605-690-3435		
NV052	Nevada State Museum 600 N. Carson St. Carson City, NV 89701	NSMC	George Baumgardner 775-687-4810	Herbarium Dept. of Bio. Sci. Univ. of NV - Las Vegas 4505 Maryland Pkwy Box 454004 Las Vegas, NV 89154-4004	Kathryn Birgy 702-895-3098
NV052				BLM Las Vegas FO 4701 N. Torrey Pines Dr. Las Vegas, NV 89130	Gayle Marrs-Smith 702-515-5156
NV030	Herbarium, Environmental and Resource Sci. Dept. Univ. of Nevada 920 Valley Road Reno, NV 89512-0013	RENO	Jerry Tiehm 775-784-1105		
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 Also OR015 to be sent here, but unconfirmed.	OSC	Aaron Liston-Director Richard Halse-Curator 541-737-4106		
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
OR110				Medford BLM Herbaria, 3040 Biddle Rd, Medford, OR 97504	Bryan Wender 541-471-6549
OR130	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	Robert Johnson 801-422-7094	BLM Utah State Office P.O. Box 45155 Salt Lake City, UT 84145-0155	Ronald Bolander 801-539-4065

Office/ Team Code	Statewide or Regional Herbaria	Index Herb Code	Contact Info	Local Herbaria chosen	Contact Info
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	Christine Cimiluca 435-781-4454 ccimiluc@blm.gov
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
NM??? - Amarillo Field 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 National Collection of Endangered Plants contains plant material for more than 600 of the country's most imperiled native plants. An important conservation resource, the National Collection is a backup in case a species becomes extinct or no longer reproduces in the wild.

Seeds, cuttings and other plant material are collected and carefully maintained by botanical institutions that participate in the Center for Plant Conservation. 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 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 http://www.centerforplantconservation.org/

For more information contact: Center for Plant Conservation (760) 796-5686.

Appendix 9. References

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Bridson and Forman (1998). *The Herbarium Handbook*, Third Edition, edited by Diane Bridson and Leonard Forman, RBG Kew, UK.

Kartesz, JT (2006). *A Synonymized Checklist and Atlas with Biological Attributes for the Vascular Flora of the United States, Canada, and Greenland*. Second Edition. In: JT Kartesz and CA Meacham. *Synthesis of the North American Flora, Version 2.0-BLM*.

Massey, J.R. (1974). The Herbarium. In Vascular Plant Systematics by A.E. Radford, W.C. Dickison, J.R. Massey and C.R. Bell, Harper and Row Publishers,

Ross, Tim (1994). Basic Techniques for Field Documentation of Vascular Plants from Rancho Santa Ana Botanic Garden Workshop on Field Collecting. Held March, 1994.

Topic Index