

THE NPGS ASH CONSERVATION PROJECT



Collecting Ash Seed: What Populations to Collect

The most critical areas to sample are those closest to EAB infestations. The trees in those areas will be totally or largely lost if immediate efforts are not made to preserve them. A distribution map showing all identified Emerald Ash Borer infestations and quarantine areas is shown in our Maps area and is regularly updated on the Internet at:

http://emeraldashborer.info/files/MultiState_EABpos.pdf.

We would like to focus seed collections on states with infested counties and surrounding areas. Our initial focus will center on the five most widespread *Fraxinus* species in eastern North America:

- *F. americana* L. (white ash)
- *F. nigra* Marshall (black ash)
- *F. pennsylvanica* Marshall (green and red ash)
- *F. profunda* (Bush) Bush (pumpkin ash)
- *F. quadrangulata* Michx. (blue ash)



Collecting seed from low-hanging branches

Range maps of these are shown in our [Maps](#) area.

Ideally, the full ecogeographic ranges of these species will be sampled in a stratified fashion. In part, this can be accomplished by acquiring samples from as many Omernik Level III ecoregions as possible from throughout the native ranges. A copy of the Omernik Level III ecoregion map for North America can be obtained from:

ftp://ftp.epa.gov/wed/ecoregions/cec_na/NA_LEVEL_III.pdf. (Note: This takes some time to download)

In the future, we will also work to obtain representative samples of *F. caroliniana* (Carolina ash) in the southeastern US and of western ash species.

Guidelines for collecting seed

Fraxinus species are widespread throughout the eastern and central United States, with other North American taxa found in isolated parts of the southwestern and western United States. Trying to identify suitable native populations of *Fraxinus* that are worthy of collecting comes with experience and can initially be difficult. However, a few simple guidelines can be followed in order to ensure high-quality samples are collected:

- **Target population size.** In a project of this type, there is an obvious trade-off between sampling many mother trees within a population and sampling fewer trees but more populations. A "lower-end" sampling target would be to collect from 5 productive mother trees within a stand. An "upper-end" sampling target would be to represent a population by harvesting from 25 to 30 mother trees, ideally within about 300 yards of each other in a dense ash stand. 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 captured by sampling from 30 individuals throughout a population for an outbreeding sexual species. In cases where mature trees are scattered through a continuous forest or along a corridor, the 300-yard distance is not a fixed limit. **Please note** that while the 25-tree sample may be appropriate for a thorough sampling of within-population variation, we realize that this isn't always feasible and can even hinder the sampling of a sufficient number of diverse populations within a region (see Sample Widely below). We do not want to reject populations just because they only have 5 to 15 mother trees with good seed production, and many of the population samples that we have been accessioning are based on less than 25 mother trees.
- **Natural areas.** Collections should be made in natural areas (e.g. state parks well away from campgrounds and other planted areas, preserves, national forests, conservation areas, etc.) from naturally growing trees of wild origin, not planted or cultivated. This ensures that locally-adapted populations are properly represented.
- **Isolation.** Observations should be made to determine if non-local ash trees have been planted in the area (e.g. reforestation, building plantings, urban landscapes, etc.). Please note that seeds should not be collected from trees even if they are believed to be of local origin when there are mature, planted ash trees (generally staminate clones) of unknown origin close enough to cross-pollinate. It is difficult, if not impossible, to determine which staminate trees have contributed to the seed trees being collected, without careful genetic testing, so we want to err on the side of caution. Targeting those areas most distant from urban and/or planted areas is preferred.
- **Request landowner permission.** Ownership of potential collection sites must be verified (either during pre-trip planning or initial field reconnaissance) so proper permission can be obtained from landowners and/or site managers. Such permission should be noted in the documentation provided with each collection in the [Data Collection Forms](#).
- **Sample widely.** Due to the limited time and resources that can be devoted to these efforts, population diversity should be maximized by selecting target populations that are expected to differ significantly from others already collected, based on either geographic distance or habitat/soil-type variation. Within a given [Omernik Level III ecoregion](#), it is best to sample widely rather than to select too many populations from a concentrated area. We try to separate collection sites within a Level III ecoregion by at least 15 miles in areas that have uniform soils and forest types. Within a population, it is also worthwhile to sample widely, selecting diverse mother trees that display variation in age, phenology, and morphological and color traits.

Before you collect

With so many organizations and individuals involved in the seed-collection process, it is crucial that we do not duplicate efforts or overlook opportunities. If you are interested in making ash seed collections in your region and you have not collected ash seeds for the National Plant Germplasm System before, please check the [maps](#) that display existing collections to ensure that the area that you can work in hasn't already been heavily collected. Then carefully read the sections on "[Guidelines for collecting seeds](#)" and "[How to collect.](#)" If you are still interested in helping, please contact Mark Widrechner in Ames, IA via email mark.widrechner@ars.usda.gov or phone (515-294-3511) to discuss the specifics before proceeding further.

An initial summer reconnaissance to identify ash populations that meet the key points noted in "Guidelines for collecting seeds" is often extremely helpful. Summer visits are good times to locate the best areas of seed production, confirm site ownership and access, and [make herbarium vouchers.](#)

If you are planning to collect in (or you live in) an area that is within a Federal or State ash quarantine zone (see http://www.emeraldashborer.info/files/MultiState_EABpos.pdf for current map of quarantined and regulated zones), it is important that these quarantines not be violated. Ash seed samples and herbarium vouchers may be considered regulated articles and should not be transported out of quarantine zones without appropriate permits. A PPQ 540 or other permits may be required. Please contact your APHIS State Plant Health Director for more details. A contact list is available at http://www.aphis.usda.gov/services/report_pest_disease/report_pest_disease.shtml



Mature *Fraxinus pennsylvanica* seed
(Green ash seed)

How to collect

After suitable populations with good seed production have been identified and "[georeferenced](#)" (with a GPS unit or fine-scale maps) during reconnaissance, seeds can be collected. Harvesting time generally occurs in the fall (depending on location timing will vary), though blue ash can mature its seeds earlier in the summer and some green ash populations can retain seeds well into winter. During late summer and autumn, seeds start to ripen by displaying a gradual change in coloration from green to yellow and then to tan or brown. The first seeds to fall from the trees are typically of poor condition.

Initially, time should be taken to estimate seed quality for each parent tree. Carefully examine a small, representative sample of seeds by simply cutting them in half. Visual observations should reveal a whitish endosperm that completely fills the seed pericarp. A photograph of an empty/non-viable seed and a viable seed is displayed at right (top). Seed quality can also be reduced by ash seed weevils (*Lignydodes sp.* — right, bottom), which destroy the endosperm.

At each collection site, a minimum of 1,000 seeds should be collected from each mother tree, but a larger amount (3,000-5,000 sd) is recommended to increase the likelihood of long-term success. The table below lists the average 100-seed weights, average 3,000-seed weights, and the average volume (in liters; 1 liter = 1.06 quarts). The ranges of weights and volumes are fairly large (range of volumes shown in parentheses), so keep this in mind when estimating the actual weight or volume needed for your collections.

Taxon	Avg 100-sd wts (gm)	Avg 3000-sd wts (gm)	Avg 3000 sd by volume (liters)
<i>F. americana</i>	4.02	120	1-1/2 (7/8 to 2-1/4)
<i>F. nigra</i>	5.39	160	2 (1-5/8 to 2-1/4)
<i>F. pennsylvanica</i>	3.39	102	1-1/2 (1-1/4 to 2)
<i>F. quadrangulata</i>	11.12	333	2-1/2 (2-3/8 to 2-5/8)



Samples of cut ash seed.
Empty/non-viable seed on left; viable on right.



Ash seed weevil. *Lignydodes* spp. Dejean;
Host: green ash *Fraxinus pennsylvanica* Marsh.
Image source: James Solomon, USDA Forest Service, Bugwood.org

The rough percentage of good seeds determined during collection by inspection will help you decide if collection is warranted or how much additional seed should be collected in order to reach the targeted quantity of live seed. Sample equally (relatively the same number of good seeds per mother tree) throughout the extent of the population. It is very important that seeds from each mother tree be kept separate.

If there are 5 to 15 (ideally 25) mother trees bearing a sufficient quantity of high-quality seeds within your collection site, then proceed to harvest seeds from

each mother tree separately, either by hand from low branches or by cutting down seed-bearing branches. Pruning small branches (< 1/2 inch in diameter; i.e. < 12 mm dia.) with a pole saw can result in quickly obtaining a large amount of seed. Please note that seeds may disperse readily if a branch falls to the ground abruptly. Alternatively, depending on the seed-shattering characteristics of the parent tree, tarps can also be spread on the ground in order to catch seeds released from the tree by shaking the limbs or striking them with a pole. Large quantities of relatively clean seed can be gathered quickly in this manner. Do not collect seeds that have already fallen to the ground.

Fruiting trees may also be spotted more easily and from greater distances following leaf fall, but the ability to harvest large quantities of seeds at such a late stage can potentially decrease drastically. In addition, leaf samples may not be available for species identification during collection, but twig and seed characteristics along with bark patterns should facilitate identification.

Summary:

1. Review "Before you collect" and contact Mark Widrechner.
2. Find area with good seed production on 5 to 25 trees. Obtain landowner's permission.
3. Georeference location.
4. Harvest mature seed with good seed fill, little or no insect infestation.
5. Harvest seed from trees, do not harvest seed already on ground. 1,000 seeds/tree min, ≥ 3,000 seeds/tree preferred, with a target population of up to 25 mother trees.
6. Keep samples from each tree separate.
7. Put seeds in brown paper bags to allow them to dry.
8. Dry at 65-70 °F with good ventilation. While collecting, park vehicle under shade.
9. Do not freeze or treat seed.
10. Label bags with black, permanent marker (outside) and tag (inside bag).
11. Fill in data collection form and arrange for shipment to Ames.

The US Forest Service recently published a guide for ash seed collection with many useful hints to increase your overall success. See [Methods for Collecting Ash Seeds](#) to order a printed copy or download a PDF file.

Samples should be collected and stored in brown paper bags where they can dry upon collection. If seeds are wet, they should be air dried for at least 24 hours. Keep the seed collections in a cool (65-70 °F, 18-21 °C), dry (RH < 60%) place during the collection trip and prior to shipping. Do not freeze seeds. Do not allow collections to overheat, and do not leave them in a vehicle in full sun. 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. Exposure to such sustained high temperatures can badly damage the seeds.

Clearly label all seed bags with a permanent black marker on the outside of the bag, along with a label containing the same information inside the bag. Seeds should be separated by mother tree and identified by marking each seed bag with an [unambiguous numbering system](#), along with the proposed name of the species collected, the collection site name, and the collection date. If additional bags are needed to contain a large number of seeds taken from the same tree, simply indicate it is bag 1 of 2 or 3 of 4, etc. Seed bags should be folded and stapled.

[Data collection forms](#) should be completed for all seed collections. If an herbarium voucher was taken prior to collection, please include the voucher collection number that is associated with the sample being collected, along with associated information about any materials collected from these trees for DNA sampling.

Georeferencing

When georeferencing ash populations, we prefer that you use a GPS unit and record your data in decimal degrees to at least 4 decimal places. Also, please set your unit to use the NAD83 datum. If you determined the coordinates retroactively, by using USGS topographic maps or online sources, please make sure that you note your source.

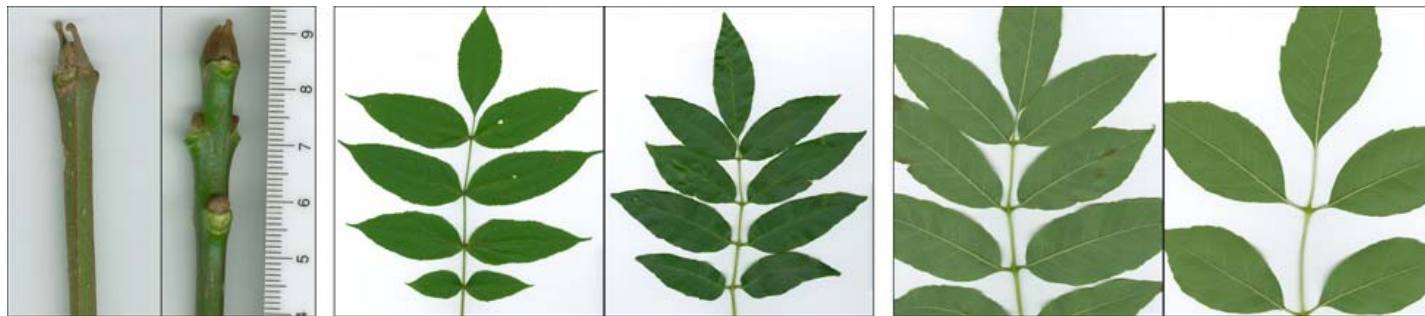
Ideally, a single point should be marked approximately in the middle of the population being sampled. If this is impossible because of access issues, please explain the relationship of the coordinates that you have recorded to the trees being sampled in "Other Notes" under the main heading of "Site Description" in the [data entry form](#). It is not necessary to record coordinates for each individual tree, assuming that all trees are being collected from a single, contiguous stand. If a collection is being taken along a transect, trail, or road, you can include the coordinates of the starting and ending points in the "Other Notes" section.

How to identify Eastern North American *Fraxinus* species

In our primary target region, there are six, widely recognized native *Fraxinus* species. Here is a quick key to help distinguish among them during the growing season:

- | | |
|--|--|
| 1. Young branches 4-angled, often winged | <i>F. quadrangrandulata</i> (Blue Ash) |
| 1. Young branches more-or-less circular in cross-section | |
| 2. Lateral leaflets without stalks | <i>F. nigra</i> (Black Ash) |
| 2. Lateral leaflets with stalks | |
| 3. Leaflets strongly whitened beneath | <i>F. americana</i> (White Ash) |
| 3. Leaflets green or rusty beneath | |
| 4. Lateral leaflets gradually narrowed at base into a narrow wing that runs down the upper part of the leaflet stalk | <i>F. pennsylvanica</i> (Green Ash) |
| 4. Lateral leaflets acute at base; leaflet stalk without wings | |
| 5. Leaflets with long, tapered tips; fruits very large (4 to 7.5 cm long) and narrowly oblong | <i>F. profunda</i> (Pumpkin Ash) |
| 5. Leaflets with short acute or blunt tips; fruits smaller (2.5 to 5.5 cm long), widest above the middle, winged to the base | <i>F. caroliniana</i> (Carolina Ash) |

Ash Key illustrations:



1. Young branches 4-angled, winged (l)
vs circular (r).

2. Lateral leaflets without stalks (l)
vs with stalks (r).

3. Leaflets strongly whitened beneath (l)
vs green or rusty (r).

Other traits and habitat preferences that can help distinguish among these six species are described below. We have included some images of mature fruits (seeds), stems and buds that may be helpful for distinguishing among these species at other times of the year.

F. americana

F. americana typically grows in moist, upland forests, where it often associates with sugar maple, northern red oak, basswood, and yellow birch. Its leaflets are often entire or with very shallow teeth. The bud scars are U-shaped.



Fraxinus americana (white ash).

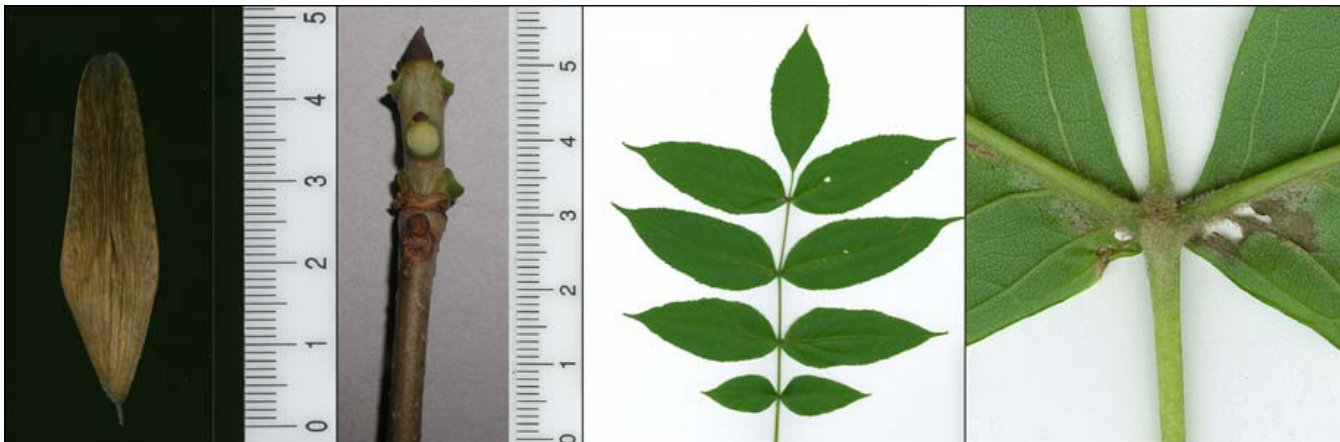
Shown left to right: seed, twig, leaf (upper side), leaf (under side).

F. caroliniana

F. caroliniana typically grows in very wet shrubby thickets along the coastal plain. It is more of a shrub than a tree, with trunks less than 15 cm (6") in diameter. (No images yet available.)

F. nigra

F. nigra typically grows in wet woods with spruce and larch, except in the southern part of its range where it can often be found in north-facing forested slopes. Its terminal buds are large and dark brown to black. The bud scars are more-or-less flat topped.



Fraxinus nigra (black ash).

Shown left to right: seed, twig, leaf (upper side), close-up view of leaflets without stalks (under side).

F. pennsylvanica

F. pennsylvanica has the widest habitat range of all native ash, ranging from elm-cottonwood-silver maple floodplain forests to being an old-field invader, even on upland sites. It can also be found with bald cypress and pumpkin ash in inundated swamps. It is extremely variable in twig and leaf pubescence. Its leaflets are usually toothed. Its winter buds are brown and the bud scars flat-topped, half circles.



Fraxinus pennsylvanica (green ash).
 Shown left to right: seed, twig, leaf (upper), close-up of toothed leaflet (top, right),
 close-up of leaflet gradually narrowing at base and running along upper portion of stalk (lower, right).

F. profunda

F. profunda typically grows in flooded open forests with bald cypress and water tupelo. It can be a very large tree, up to 120' tall, with very large leaflets (to 20 cm long) and the largest fruits of all native species. Its leaves are lustrous above and often covered with fine reddish hairs beneath. Young branches are typically covered with velvety hairs. (No images yet available.)

F. quadrangulata

F. quadrangulata typically grows on alkaline or calcareous soils (derived from limestone) with a wide range of lime-loving plants, including Kentucky coffeetree, bur oak, hackberry, and red cedar (on particularly dry sites). Its terminal buds are grayish yellow and the bud scars narrowly U-shaped.



Fraxinus quadrangulata (blue ash).
 Shown left to right: seed, twig, leaf (upper side), leaf (under side), seeds on branched inflorescence.

Seed comparison



F. quadrangulata (blue ash)

F. pennsylvanica (green ash)

F. americana (white ash)

F. nigra (black ash).

In addition, *Fraxinus excelsior* (European Ash) is sometimes cultivated as a landscape tree in the Eastern United States and Canada. It would key to *F. nigra* above. However, *F. nigra* has tufts of tan to reddish hairs at the base of each leaflet, but *F. excelsior* does not.

How to make herbarium vouchers

Initial reconnaissance efforts should occur in mid-summer in order to identify and document desirable, seed-producing ash populations. During reconnaissance, voucher specimens should be taken along with complete passport data. The purpose of voucher specimens is to document the populations from which seeds will be collected, as well as to verify that the species has been identified correctly. A minimum of two vouchers each of both vegetative and floral branches should be sampled per collection area and deposited in both national (U.S. National Arboretum Herbarium) and regional herbaria. If desirable, additional vouchers may be collected for the collecting team's own herbarium. The number of vouchers taken per collection should reflect the expertise of the collector, the degree of within-population phenotypic variation, and the possibility of two or more taxa occurring in the same location. A vegetative voucher specimen should comprise at least 12-14 inches long of annual growth, including at least two of the compound, pinnate leaves, both lateral and terminal buds. A "floral" voucher specimen should consist of a twig about 12-14 inches long, including at least two of the compound, pinnate leaves, both lateral and terminal buds, and one cluster of developing seeds. Having both vegetative and reproductive vouchers aids in identification, as morphological characteristics may be skewed due to the amount of annual growth that is sampled. Immediately after collection, the specimen should be pressed and labeled with the collection date, proposed taxonomic name, collection location name and/or description, and collection number. The collection number and date should be written in indelible ink on the outside of the newspaper holding the specimen. The pressed specimen should then be quickly dried at a moderate temperature to avoid molding and deterioration. Collection numbers should be assigned to each herbarium specimen following an [unambiguous numbering procedure](#).

After specimens are dried, a computer-generated label for each specimen should be laser-printed onto archival bond paper and paper clipped to each specimen until it can be mounted by herbarium staff. An example of a voucher specimen label is shown at right. Please note, herbarium vouchers should not be mounted by collectors.

We recommend that digital images of the tree and surrounding habitat be captured. If images are captured, a consistent naming protocol should be followed so images can easily be linked to the corresponding voucher specimens. The collection number along with the collection location should be cited in the image file name or provided on the reverse side of the photograph.

During the collection of the herbarium specimen, collectors should complete data collection forms for each population vouchered, documenting the site location/description, latitude and longitude coordinates, habitat, associated vegetation, etc. This ensures that the seed lots will be properly documented in the NPGS's GRIN database. A completed data collection form is only necessary on a population basis and is not intended for each individual specimen.

Literature that further explains proper technique in sampling and handling herbarium specimens includes:

- Bridson, D. and Forman, L., 2004. *The Herbarium Handbook*, 3rd edition. Digitally reprinted, Royal Botanic Gardens, Kew
- Radford, A.E., Dickison, W.C., Massey, J.R., and Bell, R., 1974. *Vascular Plants Systematics*. Harper and Row, New York.
- Saville, D.B.O. 1962. *Collections and care of botanical specimens*. Canadian Department of Agriculture, Publication No. 1113, Ottawa, Canada.
- Liesner, R. and MOBOT staff. Undated. A helpful resource is the website by the Missouri Botanical Garden: [Field Techniques Used by Missouri Botanical Garden](#).

PLANTS OF MISSOURI Herbarium of U.S. National Arboretum

Fraxinus americana L.

ADAIR COUNTY: T62N, R16W, NW 1/4 SW 1/4 Section 12, Novinger Quad, Elev. 920', 40.18812°N Lat., 92.64506°W Long. (NAD83).

Collected in Thousand Hills State Park. Growing along with *Quercus bicolor*, *Quercus alba*, *Hypericum prolificum*, *Carya* spp., *Ulmus* sp., *Quercus imbricaria*, *Rhus aromatica*, *Ruellia* sp., and *Quercus velutina*.

Voucher of Ames 29626 for the USDA-ARS North Central Regional Plant Introduction Station, Ames, IA and the U.S. National Plant Germplasm System.

Mark P. Widrechner and Jeffrey D. Carstens
MPW#591 28 July 2008

Example of unambiguous numbering system

If you already have an unambiguous numbering system for your collections, we encourage you to continue with that. In our system, we include the initials of the collector, a four digit number to indicate the year collected, a three digit sequential number assigned to the population collected, and a three digit sequential number assigned to the specimen sampled within that population. Thus, if John A. Doe collects a voucher of *Fraxinus* from his tenth collection for 2008, the collection number for the third tree from that population would be coded as JAD/2008/010/003. The year (2008) is followed by the collection site (010) which is followed by the tree that was sampled (003).

JAD / 2008 / 010 / 003

- JAD** = John A Doe
- 2008** = collected in 2008
- 010** = 10th collection site for year 2008
- 003** = 3rd tree from the 10th collection site

How to package and ship

As soon as samples have been adequately dried, collectors should ship the seeds to the North Central Regional Plant Introduction Station (NCRPIS) in Ames, Iowa and the vouchers to the National Arboretum and regional herbaria. Instructions on the shipment of vouchers follow below.

And if you have collected in (or you live in) an area within a Federal or State ash quarantine zone, your shipments of seeds and vouchers may require inspection and appropriate permits before shipment. Any permits that you received from APHIS or State regulatory officials must be included within your shipment container. Please contact your APHIS State Plant Health Director for more details. A contact list is available at http://www.aphis.usda.gov/services/report_pest_disease/report_pest_disease.shtml



Seeds

Seeds should be removed from their pedicels before shipment. Seed samples contained in brown paper bags should be clearly labeled on the outside with black permanent marker along with a label on the inside. Occasionally, large amounts of seeds are obtained during collection and require additional bags. In such cases, please indicate the number of bags for each mother tree (e.g. 1 of 2, etc.). Please ensure that all samples are secure as they may encounter rough handling en route. It is recommended to ship samples via ground transportation as conditions within an airplane may be unfavorable during transport on certain airlines. Some airlines consistently maintain safe temperature and air pressure in their cargo bays, while others do not guarantee safe conditions without prior arrangements. Samples should be securely folded and stapled shut. Shipment should include the collection data spreadsheet which is created using the form downloaded from the [Forms](#) page. In addition, please email the spreadsheet electronically to mark.widrechner@ars.usda.gov. Notification of an incoming shipment is greatly appreciated. Please avoid shipping near holidays.

If you are shipping via private carrier service, please ship seed samples to:

USDA-ARS North Central Regional Plant Introduction Station
Attn: Mark Widrechner
1305 State Avenue
Ames, IA 50014

If you are shipping via the US Postal Service, please ship seed samples to:

USDA-ARS North Central Regional Plant Introduction Station
Attn: Mark Widrechner
Iowa State University
G212 Agronomy Hall
Ames, IA 50011-1170

We can cover the cost of shipping seed samples and data collection forms to the NCRPIS only if FedEx is used as the carrier. A FedEx account number will be supplied by Mark P. Widrechner upon request.

Once at the NCRPIS facility, collection data are entered into the NPGS's GRIN database, seed drying is completed, and the seeds are cleaned, their quality evaluated, digital images captured of both the seeds and collection forms. The seeds are then prepared for proper storage. Balanced, bulk samples from each collection area will be assembled at the NCRPIS and back-up samples transferred to the National Center for Genetic Resources Preservation (NCGRP) in Fort Collins, CO for long-term conservation. After balanced bulks are created, the remaining seeds from individual mother trees will be kept as separate seed lots.

Vouchers

Once voucher labels have been created and attached to the dried specimens, they can immediately be shipped to the proper locations which would include the U.S. National Arboretum Herbarium and an active regional herbarium.

The U.S. National Arboretum Herbarium primary contact and mailing address:

Robert Webster	U.S. National Arboretum Herbarium
Email: robert.d.webster@ars.usda.gov	Attn: Robert Webster
Phone: 202-245-4542	3501 New York Avenue NE
	Washington, D.C. 20705-2350

The cost of shipping herbarium specimens to the National Arboretum Herbarium can be covered only if FedEx is used as the carrier. A FedEx account number will be supplied by Robert Webster upon request.

Appropriate regional herbaria can be determined by contacting:

Alan T. Whittemore
Email: alan.whittemore@ars.usda.gov

Phone: 202-245-4550

If available, additional herbarium specimens can be given to the collecting team's local herbarium, otherwise duplicate specimen(s) can also be sent to either the national or regional herbarium.

Due to the fragile nature of voucher specimens, they should be packed with special care to avoid damage during shipment. Specimens should be protected by intercalating them between sheets of corrugated cardboard, and then bundled and the cardboards securely tied. The bundles should be wrapped in paper which is then taped. The bundles should be packed in a strong box, sized only slightly larger than the bundles to reduce shifting in transit. Any extra space in the box should be filled with packing peanuts, bubble wrap or similar materials. When shipping herbarium voucher specimens, please include a paper copy of the data collection form for each specimen along with a list of all the specimens being shipped. For each specimen, the corresponding label and data collection form should be paper clipped to its corresponding sheets of newsprint. An electronic version of the packing list should also be transmitted by email to:

Robert Webster (robert.d.webster@ars.usda.gov),
Alan T. Whittemore (alan.whittemore@ars.usda.gov), and
Mark Widrechner (mark.widrechner@ars.usda.gov).

Notification of an incoming shipment is recommended. Avoid shipping near holidays.