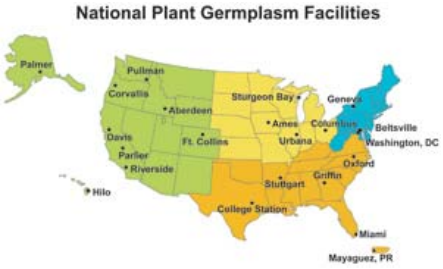
THE NPGS ASH CONSERVATION PROJECT

The National Plant Germplasm System (NPGS)

The NPGS is a cooperative network, coordinated by the U.S. Department of Agriculture-Agricultural Research Service (USDA-ARS), that is dedicated to preserving the genetic diversity of plants. Scientists must have access to genetic diversity to help bring forth new varieties that can resist pests, diseases, and environmental stresses. The NPGS aids scientists and their needs for genetic diversity by acquiring, preserving, evaluating, documenting and distributing germplasm and associated information. Increasing holdings within the NPGS and ensuring access to this germplasm are achieved through the process of germplasm acquisition and collection. The Germplasm Resources Information Network (GRIN) website describes the germplasm held by the NPGS and how to order from these collections for research and educational purposes. Click here to link to GRIN. You may also link to the GRIN site from anywhere in the NPGS Ash Conservation Project website by expanding the References Links (at left).



NPGS Facilities Map

The Need to Collect Ash

There are an estimated 8 billion ash (*Fraxinus*) trees in North America. These species are of great value in managed landscapes (street and park trees and windbreaks), for their wood products (lumber, tool handles, baseball bats, baskets, etc.), and in natural forest ecosystems. An introduced pest from northeastern Asia, the Emerald Ash Borer (EAB), *Agrilus planipennis* Fairmaire, is killing all native *Fraxinus* in Michigan, Indiana, and Ohio, and now spreading into surrounding states and Canadian provinces. So far, tens of millions of trees have died at great economic and ecological cost. Based on ongoing evaluations, no native North American populations are yet known to be resistant to EAB. The loss of these ash species has cultural, ecological, and economic implications that warrant preserving the genetic resources before too much is lost to the insect.

Trees, as do all plants, must be adapted to their environment to thrive. Over the centuries, natural ash populations have adapted to their environments, and preserving a significant number of these populations is required for successful reintroduction of ash once adequate control measures for EAB are developed or ash trees resistant to the insect are developed. Breeding resistant ash trees for reintroduction will ultimately require an array of adapted parental populations. Given the projected degree of EAB destruction to native stands, only adequate *ex situ* germplasm collections protected from EAB will be able to provide this needed material. When seed quantities and quality are sufficient, ash accessions curated in the NPGS active collection at the North Central Regional Plant Introduction Station in Ames, Iowa are freely available to support the scientific research and educational efforts that will be needed to overcome EAB.

In northeastern Asia, EAB has coevolved with a different set of *Fraxinus* species than are native to North America. In order to give access to potential sources of EAB tolerance or resistance to researchers, it is also important to assemble, conserve, and evaluate Asian ash germplasm.

A Cooperative Effort

Through a collaborative process involving USDA-ARS, the Forest Service[1] (USDA-FS), the Natural Resources Conservation Services[2] (USDA-NRCS), the Seeds of Success[3] program, Canadian Forest Service[4] (CFS), tribal governments, state agencies, and many other partners, a systematic plan[†] is being organized to conserve the range of genetically diverse ecotypes of North American *Fraxinus* currently represented in nature. We recognize that these efforts will require the involvement of many parties, including land-management agencies to be effective and are working to that end. Efforts are also underway in collaboration with the Morton Arboretum and the Beijing Botanic Garden to sample and obtain diverse populations of *Fraxinus* in China.

A list of collectors and their contact information, organized by state, is provided at the Contacts page.

It is our goal to create a comprehensive collection of *Fraxinus* populations within the US National Plant Germplasm System and to ensure that these collections are representative, well-documented, properly conserved, and made available to support research on *Fraxinus*, EAB and other pests and pathogens, to keep options open for the development of resistant ash trees and eventual restoration of ash to American forests and managed landscapes.

[†]Dr. Mark Widrlechner, who heads up this project from the NCRPIS, and his assistant, Jeff Carstens, presented this plan at the 20th USDA Interagency Research Forum on Invasive Species in Annapolis, MD, January 15, 2009. This presentation is entitled, Developing a Coordinated Plan for Ash (*Fraxinus*) Seed Collection in North America and is available here in PDF format

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[1]Forest Service http://www.nsl.fs.fed.us/GeneticConservation_Ash.html
[2]Natural Resources Conservation Service http://www.mi.nrcs.usda.gov/programs/pmc.html
[3]Seeds of Success http://www.nps.gov/plants/sos/
[4]Canadian Forest Service http://cfs.nrcan.gc.ca/subsite/seedcentre/ashconservation

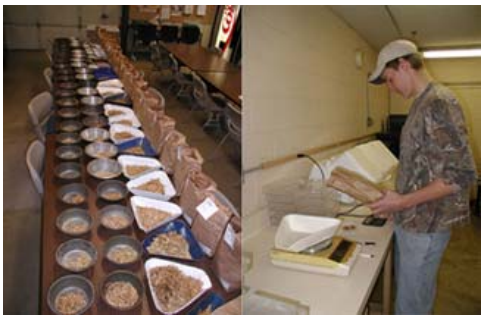
What has been accomplished so far

The ash collection at the North Central Regional Plant Introduction Station in Ames, Iowa, currently consists of 263 accessions from 21 countries. For more details about the North American collections, please consult our maps. From within the United States, there are 176 accessions collected from 24 states. Accessions collected in the United States in recent years (134 accessions) have received special processing. The seeds in each accession are collected from several trees. Aliquots are taken from each tree — the sample size of the aliquots are determined by the tree sample with the least amount of seeds. The aliquots are combined from each tree and represent a 'balanced sample.' This balanced sample is what is used for distribution to cooperators and for back up at the National Center for Genetic Resources Preservation (NCGRP) in Fort Collins, Colorado. After balanced bulks are created, seeds from individual mother trees are retained as separate seed lots, which are useful for genetic studies requiring half-sib family structure.

The pictures below show the collecting and sampling process, as well as the storage conditions at NCRPIS.

Jeff Carstens harvesting ash seed

Collecting ash seed is not always easy. This combined image shows Jeff Carstens scaling a tree and using a pole saw to reach areas unsafe to climb.



Processing ash seed

Lf: Seeds are cleaned, weighed, and 'balance-sampled' before storing. Rt: Matt Fouts weighing the seeds and determining the total number for the accession based on a 100-seed weight.

Mark Widrlechner with part of the ash seed collection

The distribution lots are stored at 5 °C and 30% relative humidity. Photo by Bob Elbert, Iowa State University.

Ash seed collection in the freezer

Long-term storage of seeds is accomplished by storing them in our walk-in freezer, which is kept at -18 °C. Backup samples are also stored at the NCGRP in Fort Collins, CO.

Upcoming Collections

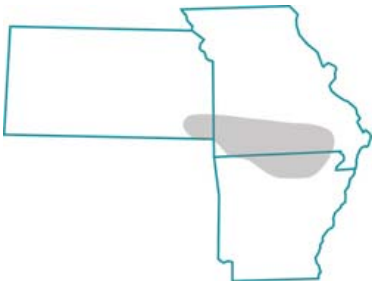
This part of the website is currently under construction. We plan to expand it as more details about upcoming collections become available. If you would like to share information about local collection plans for the coming field season, please email Mark Widrlechner.

The following trips are being planned for 2010:

Minnesota - Wisconsin
planned collection area shown in gray.

Minnesota-Wisconsin (Widrlechner & David)

A pair of reconnaissance and seed-collection trips to eastern Minnesota and southwestern and central Wisconsin, focusing on black, green and white ash for August and September 2010, organized by Mark Widrlechner and Andrew David.



Kansas - Missouri - Arkansas
planned collection area shown in gray.

Kansas-Missouri-Arkansas (Carstens & Griffin)

A seed-collection trip to southeastern Kansas, southern Missouri, and northern Arkansas, focusing on blue ash for September 2010, organized by Jeff Carstens and Jason Griffin.

The Emerald Ash Borer (EAB)

The emerald ash borer beetle *Agrilus planipennis* is an invasive insect from Asia. It was first discovered in North American in the Detroit, Michigan and Windsor, Ontario areas in 2002. It has since spread to 11 states in the US and in the surrounding areas of Ontario via transport of firewood and infested nursery stock.

The EAB beetle is about 10 mm long by 4 mm wide. The adults lay eggs in the crevices of ash tree bark in late May to mid-June. The eggs hatch and the larvae bore under the bark and consumes the cambium of the trees while going through several larval stages. Their random boring pattern cuts across the xylem and phloem of the cambium layer, thus cutting off the transport of water and nutrients which kills the trees. The larva overwinter and then pupate in the spring. Adults emerge from May to July from D-shaped exit holes, with peak emergence in mid-June. The life cycle of the EAB is usually one year, but can be two years in colder climates.

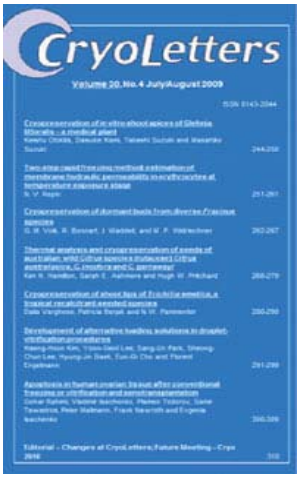
For more information, visit the emerald ash borer information website.

Emerald Ash Borer (adults) and tree damage from larvae.
Photo source: US Forest Service, David Cappaert, photographer.

Conserving Seeds, Plants and Dormant Buds

Three potential methods for conserving ash within the NPGS are to:

- **Perserve dried seed samples in cold storage.**
  This is the current method employed at NCRPIS. More information can be found on the Procedures webpage.
- **Cryogenically preserve dormant vegetative buds.**
  A protocol has been developed to store and recover plants from dormant vegetative buds. This method is very labor intensive and is most practical for the conservation of species clones, especially of male, seedless trees. A PDF copy of this work is available here. The article is entitled: Cryopreservation of Dormant Buds From Diverse *Fraxinus* Species. From: CryoLetters 30 (3), 262-267 (2009).
- **Protect living trees from EAB in long-term field plantings.**
  Presently, insecticidal treatments are being tested to protect individual specimen trees from EAB. The long-term effectiveness of this approach is not yet clear. For more information on this topic, including summaries of recent tests of new products and treatments, see "Insecticide Options for Protecting Ash Trees From Emerald Ash Borer" at http://www.entomology.wisc.edu/emeraldashborer/Multistate%20EAB%20Fact%20Sheet%202009.pdf



Cryopreservation of Dormant Buds From Diverse *Fraxinus* Species
CryoLetters 30 (3), 262-267 (2009)