

NCRPIS 2007 *Fraxinus* Germplasm Collection Trip

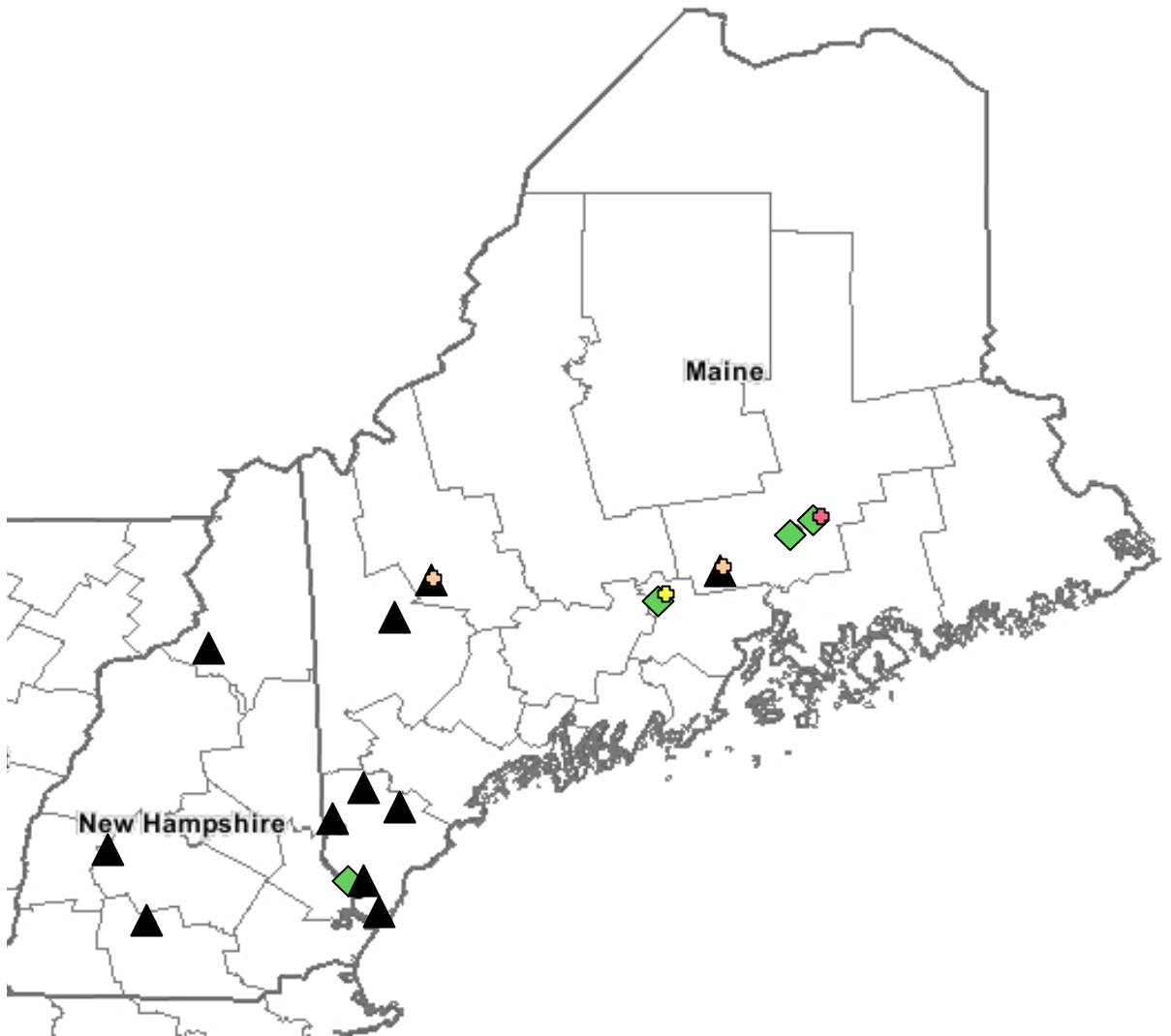
September 25 – 28, 2007



United States Department of Agriculture

Plant Introduction Station

Germplasm Collections and Sites of Future Interest



Sites of Future Interest

⊕ - *Fraxinus nigra* (2)

Germplasm Collection Sites

▲ - *Fraxinus americana* (11)

◆ - *Fraxinus pennsylvanica* (4)

⊕ - *Cornus amomum* subsp. *obliqua* (1)

⊕ - *Spiraea alba* (1)

Map showing the locations where germplasm was collected/identified

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Introduction

The USDA-ARS Plant Introduction Station (Ames, IA) completed reconnaissance and collection trips to Maine and New Hampshire in 2007. Participants included:

- **Dr. Candice A. C. Gardner**, Research Leader/Supervisory Plant Biologist, USDA-ARS Plant Introduction Station, Ames, IA
- **Dr. Mark P. Widrechner**, Horticulturist, USDA-ARS Plant Introduction Station, Ames, IA
- **Jeffrey D. Carstens**, Agricultural Science Research Technician, USDA-ARS Plant Introduction Station, Ames, IA



The objectives were to:

- Identify and voucher *Fraxinus* populations within Maine state parks and the White Mountain National Forest during the summer of 2007
- Collect *Fraxinus* germplasm which is not represented in the *Fraxinus* collection located at the USDA-ARS Plant Introduction Station in Ames, Iowa during the fall of 2007
- Store and backup collections at the USDA-ARS Plant Introduction Station and the National Center for Genetic Resources Preservation in Fort Collins, Colorado, respectively
- Ultimately conserve and preserve genetic diversity of North American *Fraxinus* germplasm in response to the threat of loss these species from their native range to the emerald ash borer, *Agilus planipennis* Fairmaire

Importance of *Fraxinus* Conservation

The emerald ash borer (EAB) was accidentally introduced to North America from Asia. North American *Fraxinus* species evidently have no resistance to this pest. Since its introduction in the vicinity of Detroit, it has devastated native *Fraxinus* populations in Michigan, Indiana, Ohio, and Ontario, and it continues to spread. The loss of these 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. Natural ash populations have adapted to their environments. Preserving a significant number of these populations is required for successful reintroduction of these species, once adequate environmental control measures for EAB are developed or trees resistant to the insect are bred and introduced. 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 well-conserved ex situ germplasm collections will be able to provide this needed material. The easiest way to assemble such collections is to collect seeds from representative native stands following a systematic plan. The seeds will not transmit EAB to non-infested areas. Studies have shown no loss in viability over 7 years for green and European ash seeds stored at 5°C (Barton 1945). Seed regenerations at the Plant Introduction Station (Ames, Iowa) reported successful germination of 9-year old green ash seeds stored at -18°C (personal communication Dr. Mark Widrechner). Therefore, when properly handled, seeds survive well under medium and long-term storage conditions. Seeds can be easily distributed to scientists and growers to produce seedlings for EAB research, breeding, other scientific study, and future ecological restoration work. This report describes one component of a comprehensive plan to organize these seed collections.

A GIS map, the Emerald Ash Borer Viewer, is posted on the Internet at: <http://eabviewer.rsgis.msu.edu/viewer.htm>, showing all identified regional EAB infestations and quarantine areas.

Reconnaissance Trip Plan

Tuesday, 31 July 2007

Explore Vaughan Woods Memorial State Park near South Berwick, ME

Wednesday, 1 August 2007

Explore Bradbury Mountain State Park near Pownal, ME; meet with Charles Penney, Soil Conservation Technician, USDA-NRCS Augusta, ME to cover private property near Unity, ME; investigate areas around the University of Maine near Orono

Thursday, 2 August 2007

Meet Matt Hodgdon, Assistant Park Ranger, Grafton Notch State Park near Newry, ME; explore Moose Brook State Park and White Mountain National Forest near Gorham, NH

Reconnaissance Trip Summary

Tuesday, 31 July 2007

Exploration at Vaughan Woods Memorial State Park resulted in finding only two plants each of *Fraxinus americana* (Voucher MPW#584) and *F. pennsylvanica* (Voucher MPW#585/Ames 29220). Specimens were located in the state park and on private property just north of the state park. Permission was granted to make seed collections in the fall on the private property. Noted good seed production on all plants. Surrounding vegetation predominately consisted of *Tsuga canadensis*, *Quercus rubra*, *Pinus strobus*, and *Acer rubrum*. Good numbers of white ash trees with seeds were noticed throughout South Berwick with some specimens likely ~100 years old.

Wednesday, 1 August 2007

Investigation at Bradbury Mountain State Park resulted in finding numerous individual trees and scattered populations of white ash. Unfortunately, seed production was void on all specimens likely the result of a late spring frost or other environmental factors. A very large white ash was located near Tryon Mountain (43°54.90N 70°11.85W – GPS WGS84) that could potentially be a champion specimen.

During the afternoon, exploration with Charles Penney, resulted in finding numerous *F. pennsylvanica* around Twentyfive Mile Stream with good seed production. A voucher specimen of this population (Voucher MPW#586/Ames 29221) was taken.



Later that afternoon, we briefly explored area around the University of Maine Rogers Research Farm near Orono, ME and along the Penobscot and Stillwater Rivers. There were a few *F. pennsylvanica* trees with seeds growing along the east edge of the farm above the Stillwater River from which a voucher sample (Voucher MPW#587) was taken.

Additional ash trees with seeds were found along the Penobscot River stretching from Old Town to Costigan, ME.

Reconnaissance Trip Summary (cont'd)

Thursday, 2 August 2007

Along U.S. highway 2 southwest of Rumford Center, ME, a nice mature population of white ash growing on the north bank of the Androscoggin River was observed with good seed production. A voucher (Voucher MPW#588/Ames 29210) at this location was taken.

Next, we met with Matt Hodgdon, Assistant Park Ranger, Grafton Notch State Park, near Newry, ME. We found numerous white ash trees in the general vicinity of the park office and also farther west in the park along the Bear River. Unfortunately, there was insufficient seed production.

Exploration at Moose Brook State Park and White Mountain National Forest near Gorham, NH also resulted in finding insufficient seed production from local white ash populations.

Along the northwest side of Twin Mountain, NH, located along state highway 115, a large population of white ash with considerable seed production was noted. These trees were growing along the edge of the road (ROW). A voucher specimen (Voucher MPW#589/Ames 29212) was taken.

Listing of Vouchers Collected

Collection Number: MPW#584
Scientific Name: *Fraxinus americana* L.
Date: 31 July 2007
County, State: YORK COUNTY, MAINE
Elevation: 70'
Latitude: 43°12'44"N
Longitude: 70°48'43"W (WGS84).
Locality: Vaughan Woods Memorial State Park – South Berwick, Maine
Herbarium Specimen: yes
Plant Associates: *Quercus rubra*, *Pinus strobus*, *Lythrum salicaria*, *Cornus amomum*, *Rhamnus cathartica*, *Celastrus orbiculatus*, *Acer rubrum*, *Fraxinus americana*, *Carya* sp., *Juglans nigra*, and *Prunus virginiana*.
Biomass Type (seed, plant, cutting, herbarium specimen): HS
Collectors: Jeffrey D. Carstens and Mark P. Widrechner

Collection Number: MPW#585/Ames 29220
Scientific Name: *Fraxinus pennsylvanica* Marshall
Date: 31 July 2007
County, State: YORK COUNTY, MAINE
Elevation: 70'
Latitude: 43°12'44"N
Longitude: 70°48'43"W (WGS84).
Locality: Vaughan Woods Memorial State Park – South Berwick, Maine
Herbarium Specimen: yes
Plant Associates: *Quercus rubra*, *Pinus strobus*, *Lythrum salicaria*, *Cornus amomum*, *Rhamnus cathartica*, *Celastrus orbiculatus*, *Acer rubrum*, *Fraxinus americana*, *Carya* sp., *Juglans nigra*, and *Prunus virginiana*.
Biomass Type (seed, plant, cutting, herbarium specimen): HS
Collectors: Jeffrey D. Carstens and Mark P. Widrechner

Collection Number: MPW#586/Ames 29221
Scientific Name: *Fraxinus pennsylvanica* Marshall
Date: 01 August 2007
County, State: WALDO COUNTY, MAINE
Elevation: 165'
Latitude: 44°37'34"N
Longitude: 69°21'35"W (WGS84).
Locality: Twentyfive Mile Stream/UnityPond – Unity, Maine
Herbarium Specimen: yes
Plant Associates: *Quercus macrocarpa*, *Alnus* sp., *Pinus strobus*, *Fraxinus nigra*, *Acer saccharinum*, and *Cornus amomum*.
Biomass Type (seed, plant, cutting, herbarium specimen): HS
Collectors: Jeffrey D. Carstens and Mark P. Widrechner

Collection Number: MPW#587
Scientific Name: *Fraxinus pennsylvanica* Marshall
Date: 01 August 2007
County, State: PENOBSCOT COUNTY, MAINE
Elevation: 100'
Latitude: 44°55'49"N
Longitude: 68°41'32"W (WGS84).
Locality: University of Maine – Rogers Research Farm – Orono, Maine
Herbarium Specimen: yes
Plant Associates: *Quercus rubra*, *Acer rubrum*, *Populus tremuloides*, *Pinus strobus*, and *Prunus* sp.
Biomass Type (seed, plant, cutting, herbarium specimen): HS
Collectors: Jeffrey D. Carstens and Mark P. Widrechner

Listing of Vouchers Collected

Collection Number: MPW#588/Ames 29210
Scientific Name: *Fraxinus americana* L.
Date: 02 August 2007
County, State: OXFORD COUNTY, MAINE
Elevation: 620'
Latitude: 43°30'04"N
Longitude: 70°38'05"W (WGS84).
Locality: Androscoggin River – Rumford Center, Maine
Herbarium Specimen: yes
Plant Associates: *Pinus strobus*, *Rhus typhina*, *Ulmus* sp., *Alnus* sp., *Acer rubrum*, and *Quercus rubra*.
Biomass Type (seed, plant, cutting, herbarium specimen): HS
Collectors: Jeffrey D. Carstens and Mark P. Widrechner

Collection Number: MPW#589/Ames 29211
Scientific Name: *Fraxinus pennsylvanica* Marshall
Date: 02 August 2007
County, State: COOS COUNTY, NEW HAMPSHIRE
Elevation: 1398'
Latitude: 44°21'16"N
Longitude: 71°30'30"W (WGS84).
Locality: Meadows, New Hampshire
Herbarium Specimen: yes
Plant Associates: *Acer rubrum*, *Viburnum trilobum*, *Crataegus* sp., and *Rubus* sp.
Biomass Type (seed, plant, cutting, herbarium specimen): HS
Collectors: Jeffrey D. Carstens and Mark P. Widrechner

Alphabetical Listing of Vouchers Collected

MPW#584	<i>Fraxinus americana</i> L.
MPW#588	<i>Fraxinus americana</i> L. (Ames 29210)
MPW#585	<i>Fraxinus pennsylvanica</i> Marshall (Ames 29221)
MPW#586	<i>Fraxinus pennsylvanica</i> Marshall (Ames 29222)
MPW#587	<i>Fraxinus pennsylvanica</i> Marshall
MPW#589	<i>Fraxinus pennsylvanica</i> Marshall (Ames 29211)

Collection Trip Plan

Monday, 24 September 2007

Flight out of Des Moines leaves at 7:00a.m. Arrive in Portland at 12:30p.m. Pick up rental car and drive to hotel in Waterville. Pick up pole saw from hotel desk (shipped via mail) and arrange collecting supplies in rental vehicle.

Tuesday, 25 September 2007

Collect green ash seeds near Unity with Chuck Penney. Travel to Orono to collect as seeds along Penobscot River near Old Town. Drive to Skowhegan to spend the night.

Wednesday, 26 September 2007

Drive to Mount Blue State Park to collect potential ash seeds. Exact locations of ash trees were not previously identified during reconnaissance trip. Drive to Rumford to collect white ash seeds along the Androscoggin River along U.S. highway 2. Drive to white ash population along state highway 115 near Meadows, NH. Drive to Bethlehem, NH to spend the night.

Thursday, 27 September 2007

Drive to South Berwick, ME to collect at Vaughan Woods Memorial State Park and throughout South Berwick. Meet Glen Dochtermann at Fort McClary State Park in Kittery Point. Drive to Sanford, ME to spend the night.

Friday, 28 September 2007

Finish any collecting from day prior if necessary. If time remains, identify and travel to additional locations for exploration/collecting. Box up seed samples and ship via FedEx. Drive to airport to return rental vehicle. Take shuttle to nearby hotel.

Saturday, 29 September 2007

Flight out of Portland at 6:40a.m. Arrive in Des Moines at 11:00a.m. Drive back to Ames.

Collection Trip Summary

Monday, 24 September 2007

Jeff Carstens and Candice Gardner arrived in Portland as expected around 12:30p.m. After picking up the rental vehicle, we ate in Portland before heading to Waterville. Upon arrival at the hotel, Jeff was happy to see the pole saw at the front desk waiting to be claimed. Jeff and Candy arranged and divided all of the collecting gear. Jeff would handle the harvesting of seed clusters and any climbing involved. Candy would be in charge of individually packaging seeds from each tree, as well as proper labeling. Labeling included date, location summary, lat/long coordinates, county/city, and tree number, and any other pertinent data if necessary. Jeff would also take any habitat notes if not already documented during reconnaissance.

Tuesday, 25 September 2007

Chuck Penney met Candy and Jeff first thing in the morning. Unfortunately, Chuck was not able to help us collect due to work-related deadlines, but was able to get us started by dropping us off at our first collection site near Unity. At an elevation of only 165', this site was a very flat floodplain along Twentyfive Mile Stream and bordered a open hay field. Unity Pond is only $\frac{3}{4}$ mile east. Numerous *Fraxinus pennsylvanica* were located through the area, with good seed production limited to the forest edge. Permission was granted by the owner, Buddy Hauss (Albion, ME). Surprisingly, green ash seeds were shattering readily, which drastically reduced the number of seeds that could be collected.



Unity, Maine Collection Site

Collection Trip Summary

Tuesday, 25 September 2007 (cont'd)

Our first collection was made from nine *Fraxinus pennsylvanica* (Ames 29221) trees along Twentyfive Mile Stream. Due to the small number of available seeds, Candy and Jeff discussed picking up seeds from the forest floor, but realized that this would be too time consuming, wouldn't allow them to differentiate between current and last years' seeds, and would increase the risk of collecting pathogens from the ground. If future collections are required, harvesting seeds from this population approximately 10-12 days earlier would be recommended. Other woody plants growing in this area included: *Quercus macrocarpa*, *Alnus* sp., *Pinus strobus*, *Viburnum lentago*, *Fraxinus nigra*, and *Acer saccharinum*. Unfortunately no seed production on *Fraxinus nigra* was found. Due to the high quality of fruits and leaves on the *C. amomum* subsp. *obliqua* (Ames 29208), a collection was made from five plants. The porcelain blue colored fruits were abundant and very showy. Overall, drought stress was noted on numerous plants throughout the area indicated by browning edges and curling of leaves.

While enroute to Old Town, ME, we stopped to admire a *Hydrangea paniculata* in full bloom growing in a cemetery. This specimen was estimated at 80 years in age. After taking a look around the cemetery, a few white ash were noted around the property lines. Further evaluation estimated a mature white ash population of approximately 100+ plants. However, only one tree was bearing seeds. We decided to collect seeds from the single tree (Ames 29212), which was located along Miles Road (Penobscot Co., Newburgh, ME).



Collection Trip Summary

Tuesday, 25 September 2007 (cont'd)

Our afternoon collections were focused around the Penobscot River between Old Town and Costigan, ME. Approximately three miles west of Old Town along Maine highway 43 following the Pushaw Stream, we collected seeds from a population of approximately 50+ *Fraxinus pennsylvanica* (Ames 29222), ranging from 10-20 years in age. Unfortunately seeds were shattering readily, and we were only able to collect seeds from four specimens. Also growing in this floodplain were *Acer rubrum*, *Pinus strobus*, *Cornus* sp., *Alnus* sp., and *Abies* sp. Permission to collect was granted by the land owners, George and Susan Ash.

Continuing four miles north from Old Town along the Penobscot River and US highway 2, a second population of *F. pennsylvanica* (Ames 29223) was collected. Again, probably 50+ green ash were found in this area ranging from 8 to 20 years in age. Large amounts of seeds were collected from each of the nine specimens that were sampled. Seeds from this population were much greener than the very brown ripe seeds of the previous population. This could potentially be the result of later flowering phenology and/or better moisture availability allowing seeds to fully mature. Soil conditions were very moist due to their close proximity to the banks of the Penobscot River. Associated with this collection were *Acer rubrum*, *Rosa* sp., *Spiraea alba*, *Salix* sp., and *Betula* sp.. The *Rosa* sp. were aesthetically pleasing due to their deep purplish-red fall colors and associated fruits. In addition, the *Spiraea alba* were abundant (100+) and located on both sides of the road. Due to the impressive inflorescences (about 6" long and 6" wide), a seed collection (Ames 29228) was made by sampling 25 plants. Plants ranged from 4' to 5' tall. *Spiraea* seed capsules varied considerably in their degree of maturity. After putting seeds from the final specimen in the vehicle, it was getting dark and time to make the drive to Skowhegan, ME to spend the night.

Collection Trip Summary

Wednesday, 26 September 2007

Most of the morning was spent exploring Mount Blue State Park near Weld, ME. We spent a couple hours searching on the southwest side of Little Blue Mountain. Surprisingly, a large population (est. 500+) of *Fraxinus nigra* was discovered throughout this area. Specimens were growing in mucky, high organic soil conditions. Plants were very narrow and tall, with trunks approximately 2-5" in diameter for 30-35' tall specimens. Again, no seed production on this species was found. Seed production for this species may likely be due to limited sun exposure and competition for plant resources. Since we only found this species commonly in the interior portions of the forest, this may suggest that this species is shade tolerant or perhaps it is outcompeted by other hardwood species in higher light exposure environments. A herbarium voucher of this species was prepared and submitted to the U.S. National Arboretum Herbarium, Washington, DC.

A herbarium of *Viburnum lantanoides*, which was found growing in association with black ash was also submitted the N.A. This species was quite striking due to its fall color and surprisingly large leaves. Plants growing under dense shade were approximately 3-4' in height. No fruits were available. Next years' inflorescences had already formed throughout the very open branching growth habit.



Through limited observations, this species was noted throughout the southeastern quarter of the White Mountain National Forest in New Hampshire. However, it may be that this species is quite common throughout, wherever it can escape animal browsing.

After spending a couple hours on Little Blue Mountain, we ventured to the southwestern portion of the state park. As we entered through the main gate towards the camping area and Webb Lake, a large white ash was overhanging the road just loaded with seeds.

Collection Trip Summary

Wednesday, 26 September 2007 (cont'd)

This collection of white ash (Ames 29213) at Mount Blue State Park consisted of only two trees. Only 15 white ash were recorded in the vicinity. Associated with this collection were *Acer rubrum*, *Acer pensylvanicum*, *Fraxinus nigra*, *Viburnum lantanoides*, and *Cornus alternifolia*. The alternate leaved dogwood was a very nice mature (10-15 years) specimen. Surprisingly, no additional *C. alternifolia* trees were noted.

Our final two collections for the afternoon were of very nice mature specimens of white ash. The first population (Ames 29210) was located along US highway 2 adjacent to the Androscoggin River approximately 2 miles southwest of Rumford Center, ME. We were able to collect seeds from six plants among a population of 50+ plants. Associated flora included *Rhus typhina*, *Ulmus* sp., *Alnus* sp., *Acer rubrum*, *Spiraea alba*, *Quercus rubra*, and *Pinus strobus*. Majority of the specimens were approximately 60' tall, which required a fair amount of climbing. Without climbing gear and a pole pruners, the total number of collections and seed amounts would have been drastically reduced.

The last collection of the afternoon featured another white ash population (Ames 29211) collected in Coos Co., NH along state highway 115. This population was collected at an elevation of 1398', compared to all other *Fraxinus* collections collected between 20' - 1270' with average elevation around 426'. Other species noted included *Viburnum trilobum*, *Crataegus* sp., and *Rubus* sp. We sampled a total of 11 trees. A short drive to Bethlehem led us to the Wayside Inn hotel, which featured a wonderful Swedish meal at the Riverview Restaurant.



Collection Trip Summary

Thursday, 27 September 2007

Early morning travel from Bethlehem, NH found us battling a rather fierce rainstorm, which ended as we arrived at Vaughan Woods Memorial State Park near South Berwick, ME. We were able to collect seeds from two plants of *Fraxinus americana* (voucher MPW#584) and two plants of *Fraxinus pennsylvanica* (Ames 29220). Unfortunately, after sorting through the seeds, we realized that all the seeds from the white ash collection were either empty or infested with weevil larvae. The weevil that commonly attacks ash seeds is called the ash seed weevil, *Lignyodes* spp. Photos below were taken by James Solomon, USDA Forest Service.



Seed collections of urban trees are usually of uncertain genetic origin and therefore typically cannot be used to represent a given provenance. Since the trees located throughout South Berwick were very large (d.b.h >20") and seemed to likely represent local genotypes, seeds from eight *Fraxinus americana* (Ames 29209) were collected. A portion of this sample included seedlings growing along the Great Works River and by Leighs Mill Pond.

Before lunch, we called Glen Dochtermann to check on our meeting location in Kittery Point. We met up at Fort McClary State Park which borders the Portsmouth Harbor. There we found a small number of white ash seeds. Candy collected seeds from the ground, but upon careful inspection back in Ames, the seeds were not properly formed and the sample was discarded.



Collection Trip Summary

Thursday, 27 September 2007 (cont'd)

During our time at this popular, well-visited state park, numerous civilians stopped to inquire about the efforts taken to pick up seeds from the ground. Candy took advantage of this opportunity to explain the importance of our efforts to those that seemed interested. After leaving Fort McClary, we decided to stop at a nearby cemetery. Two white ash trees were found. One was approximately 120' tall bearing many seeds, completely out of reach. The other tree growing approximately 50 yards away was only 30' in height. Seeds were collected from the lone, smaller specimen (Ames 29216).

After trying to package all of the seed bags into the vehicle, we realized that a stop at FedEx would create additional working room. In order to get away from urban areas, we headed north on highway 5 in hopes of finding additional rural areas with suitable ash populations.

As a result, a collection was made from four white ash (Ames 29214) specimens growing in Highland Cemetery near Limerick, ME. Approximately 50 specimens (mostly male) growing throughout the cemetery were likely over 80 years in age. In addition, younger white ash seedlings were found in the adjacent wooded property. Fall colors in this population favored yellow tones.

As we circled clockwise from Limerick, we made one last collection for the day near Hollis Center, ME. This seed collection (Ames 29215) was made from one white ash sapling growing next to a specimen that was likely 75+ years old.

Collection Trip Summary

Friday, 28 September 2007

Our last day was scheduled fairly open to help wrap up any last minute collecting, sort through seed samples, and send seeds/supplies via FedEx. Due to the amount of time spent sorting and packaging seed samples at night in the hotels and having all scheduled collecting sites completely harvested, the whole day was available to explore new territory. It was agreed that areas in New Hampshire could be explored due the likelihood of collections being made along the rights of way. After traveling north on Maine highway 109, white ash was found in a forested area making up approximately 10% of composition. Collected seeds (Ames 29218) from nine specimens ranging from 20'-80' tall. Seed production was good. Other species in the area included *Quercus rubra*, *Populus* sp., *Pinus* sp., and *Betula* sp.

As we made it across the Maine-New Hampshire border, we made several stops throughout the White Mountain National Forest (WMNF). Surprisingly, ash trees were fairly hard to find. Any specimens that were found were void of seed production likely due to inclement spring weather or heavy competition.

Leaving the WMNF we ended up making two additional white ash collections. The first collection (Ames 29219) was a roadside collection in Merrimack County, NH. The second collection (Ames 29217) was also a roadside collection in Hillsborough County, NH.

We made a final stop at FedEx to ship the recent seed collections as well as the pole saw and miscellaneous climbing gear. This drastically reduced our luggage amounts and helped ensure that seeds would arrive back in Ames in a timely manner.

Listing of Germplasm Collected

Collection Number: Ames 29208
Scientific Name: *Cornus amomum* Mill. subsp. *obliqua* (Raf.) J.S. Wilson
Date: 25 September 2007
County, State: WALDO COUNTY, MAINE
Elevation: 165'
Latitude: 44°37'34"N
Longitude: 69°21'35"W (WGS84).
Locality: Twentyfive Mile Stream/UnityPond – Unity, Maine
Herbarium Specimen: yes
Plant Associates: *Quercus macrocarpa*, *Alnus* sp., *Pinus strobus*, *Fraxinus nigra*, *Acer saccharinum*, and *Fraxinus pennsylvanica*.
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Collection Number: Ames 29209
Scientific Name: *Fraxinus americana* L.
Date: 27 September 2007
County, State: YORK COUNTY, MAINE
Elevation: 100'
Latitude: 43°13'08"N
Longitude: 70°47'45"W (WGS84).
Locality: Great Works River/Leighs Mill Pond - South Berwick, Maine
Herbarium Specimen: yes
Plant Associates:
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Collection Number: Ames 29210
Scientific Name: *Fraxinus americana* L.
Date: 26 September 2007
County, State: OXFORD COUNTY, MAINE
Elevation: 620'
Latitude: 43°30'04"N
Longitude: 70°38'05"W (WGS84).
Locality: Androscoggin River – Rumford Center, Maine
Herbarium Specimen: yes
Plant Associates: *Pinus strobus*, *Rhus typhina*, *Ulmus* sp., *Alnus* sp., *Acer rubrum*, and *Quercus rubra*.
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Collection Number: Ames 29211
Scientific Name: *Fraxinus pennsylvanica* Marshall
Date: 26 September 2007
County, State: COOS COUNTY, NEW HAMPSHIRE
Elevation: 1398'
Latitude: 44°21'16"N
Longitude: 71°30'30"W (WGS84).
Locality: Meadows, New Hampshire
Herbarium Specimen: yes
Plant Associates: *Acer rubrum*, *Viburnum trilobum*, *Crataegus* sp., and *Rubus* sp.
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Listing of Germplasm Collected

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Plant Associates: *Quercus macrocarpa*, *Alnus* sp., *Pinus strobus*, *Fraxinus nigra*, *Acer saccharinum*, and *Fraxinus pennsylvanica*.
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Collectors: Jeffrey D. Carstens and Candice A. Gardner

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Latitude: 43°13'08"N
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Locality: Great Works River/Leighs Mill Pond - South Berwick, Maine
Herbarium Specimen: yes
Plant Associates:
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

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Longitude: 70°38'05"W (WGS84).
Locality: Androskoggin River – Rumford Center, Maine
Herbarium Specimen: yes
Plant Associates: *Pinus strobus*, *Rhus typhina*, *Ulmus* sp., *Alnus* sp., *Acer rubrum*, and *Quercus rubra*.
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Collection Number: Ames 29211
Scientific Name: *Fraxinus pennsylvanica* Marshall
Date: 26 September 2007
County, State: COOS COUNTY, NEW HAMPSHIRE
Elevation: 1398'
Latitude: 44°21'16"N
Longitude: 71°30'30"W (WGS84).
Locality: Meadows, New Hampshire
Herbarium Specimen: yes
Plant Associates: *Acer rubrum*, *Viburnum trilobum*, *Crataegus* sp., and *Rubus* sp.
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Listing of Germplasm Collected

Collection Number: Ames 29212
Scientific Name: *Fraxinus americana* L.
Date: 25 September 2007
County, State: PENOBSCOT COUNTY, MAINE
Elevation: 540'
Latitude: 44°43'03"N
Longitude: 69°05'02"W (WGS84).
Locality: Newburg, Maine
Herbarium Specimen: yes
Plant Associates: *Parthenocissus* sp., *Malus* sp., *Crataegus* sp., *Acer rubrum*, and *Cornus sericea*.
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Collection Number: Ames 29213
Scientific Name: *Fraxinus americana* L.
Date: 26 September 2007
County, State: FRANKLIN COUNTY, MAINE
Elevation: 715'
Latitude: 44°40'56"N
Longitude: 70°27'02"W (WGS84).
Locality: Mount Blue State Park – Weld, Maine
Herbarium Specimen: yes
Plant Associates: *Acer rubrum*, *Acer pensylvanicum*, *Viburnum lantanoides*, *Fraxinus nigra*, and *Cornus alternifolia*.
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Collection Number: Ames 29214
Scientific Name: *Fraxinus americana* L.
Date: 27 September 2007
County, State: YORK COUNTY, MAINE
Elevation: 715'
Latitude: 43°40'51"N
Longitude: 70°47'20"W (WGS84).
Locality: Highland Cemetery - Limmerick, Maine
Herbarium Specimen: yes
Plant Associates: *Pinus strobus*, *Betula* sp., *Rhus* sp., and *Acer rubrum*.
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Collection Number: Ames 29215
Scientific Name: *Fraxinus americana* L.
Date: 25 September 2007
County, State: YORK COUNTY, MAINE
Elevation: 200'
Latitude: 43°36'01"N
Longitude: 70°36'07"W (WGS84).
Locality: Hollis Center, Maine
Herbarium Specimen: yes
Plant Associates: not observed
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Listing of Germplasm Collected

Collection Number: Ames 29216
Scientific Name: *Fraxinus americana* L.
Date: 27 September 2007
County, State: YORK COUNTY, MAINE
Elevation: 20'
Latitude: 43°04'51"N
Longitude: 70°42'56"W (WGS84).
Locality: Pepperell Cemetery – Kittery Point, Maine
Herbarium Specimen: yes
Plant Associates: not observed
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Collection Number: Ames 29217
Scientific Name: *Fraxinus americana* L.
Date: 28 September 2007
County, State: HILLSBOROUGH COUNTY, NEW HAMPSHIRE
Elevation: 810'
Latitude: 43°03'57"N
Longitude: 71°48'18"W (WGS84).
Locality: East Deering, New Hampshire
Herbarium Specimen: yes
Plant Associates: not observed
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Collection Number: Ames 29218
Scientific Name: *Fraxinus americana* L.
Date: 28 September 2007
County, State: YORK COUNTY, MAINE
Elevation: 568'
Latitude: 43°31'42"N
Longitude: 70°53'44"W (WGS84).
Locality: Acton, Maine
Herbarium Specimen: yes
Plant Associates: *Pinus* sp., *Quercus rubra*, *Populus* sp., and *Betula* sp.
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Collection Number: Ames 29219
Scientific Name: *Fraxinus americana* L.
Date: 28 September 2007
County, State: MERRIMACK COUNTY, NEW HAMPSHIRE
Elevation: 1270'
Latitude: 43°23'31"N
Longitude: 72°00'15"W (WGS84).
Locality: New London, New Hampshire
Herbarium Specimen: yes
Plant Associates: *Populus tremuloides*, *Acer rubrum*, *Betula* sp., and *Pinus strobus*.
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Listing of Germplasm Collected

Collection Number: Ames 29220
Scientific Name: *Fraxinus pennsylvanica* Marshall
Date: 27 September 2007
County, State: YORK COUNTY, MAINE
Elevation: 70'
Latitude: 43°12'44"N
Longitude: 70°48'43"W (WGS84).
Locality: Vaughan Woods Memorial Sate Park – South Berwick, Maine
Herbarium Specimen: yes
Plant Associates: *Quercus rubra*, *Pinus strobus*, *Lythrum salicaria*, *Cornus amomum*, *Rhamnus cathartica*, *Celastrus orbiculatus*, *Acer rubrum*, *Fraxinus americana*, *Carya* sp., *Juglans nigra*, and *Prunus virginiana*.
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Collection Number: Ames 29221
Scientific Name: *Fraxinus pennsylvanica* Marshall
Date: 25 September 2007
County, State: WALDO COUNTY, MAINE
Elevation: 165'
Latitude: 44°37'34"N
Longitude: 69°21'35"W (WGS84).
Locality: Twentyfive Mile Stream/UnityPond – Unity, Maine
Herbarium Specimen: yes
Plant Associates: *Quercus macrocarpa*, *Alnus* sp., *Pinus strobus*, *Fraxinus nigra*, *Acer saccharinum*, and *Cornus amomum*.
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Collection Number: Ames 29222
Scientific Name: *Fraxinus pennsylvanica* Marshall
Date: 25 September 2007
County, State: PENOBSOT COUNTY, MAINE
Elevation: 90'
Latitude: 44°57'14"N
Longitude: 68°42'04"W (WGS84).
Locality: Pushaw Stream – Old Town, Maine
Herbarium Specimen: yes
Plant Associates: *Acer rubrum*, *Pinus strobus*, *Alnus* sp., *Abies* sp., and *Cornus* sp.
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Collection Number: Ames 29223
Scientific Name: *Fraxinus pennsylvanica* Marshall
Date: 25 September 2007
County, State: PENOBSOT COUNTY, MAINE
Elevation: 100'
Latitude: 44°59'54"N
Longitude: 68°38'27"W (WGS84).
Locality: Penobscot River – Costigan, Maine
Herbarium Specimen: yes
Plant Associates: *Spiraea alba*, *Acer rubrum*, *Salix* sp., *Rosa* sp., and *Betula* sp.
Biomass Type (seed, plant, cutting, herbarium specimen): S, HS
Collectors: Jeffrey D. Carstens and Candice A. Gardner

Listing of Germplasm Collected

Collection Number: Ames 29228

Scientific Name: *Spiraea alba* Du Roi

Date: 25 September 2007

County, State: PENOBSCOT COUNTY, MAINE

Elevation: 100'

Latitude: 44°59'54"N

Longitude: 68°38'27"W (WGS84).

Locality: Penobscot River - Costigan, Maine

Herbarium Specimen: yes

Plant Associates: *Acer rubrum*, *Fraxinus pennsylvanica*, *Rubus* sp., *Salix* sp., *Betula* sp., and *Rosa* sp.

Biomass Type (seed, plant, cutting, herbarium specimen): S, HS

Collectors: Jeffrey D. Carstens and Candice A. Gardner

Alphabetical Listing of Germplasm Collected

Ames 29208	<i>Cornus amomum</i> Mill. subsp. <i>obliqua</i> (Raf.) J.S. Wilson
Ames 29209	<i>Fraxinus americana</i> L.
Ames 29210	<i>Fraxinus americana</i> L.
Ames 29211	<i>Fraxinus americana</i> L.
Ames 29212	<i>Fraxinus americana</i> L.
Ames 29213	<i>Fraxinus americana</i> L.
Ames 29214	<i>Fraxinus americana</i> L.
Ames 29215	<i>Fraxinus americana</i> L.
Ames 29216	<i>Fraxinus americana</i> L.
Ames 29217	<i>Fraxinus americana</i> L.
Ames 29218	<i>Fraxinus americana</i> L.
Ames 29219	<i>Fraxinus americana</i> L.
Ames 29220	<i>Fraxinus pennsylvanica</i> Marshall
Ames 29221	<i>Fraxinus pennsylvanica</i> Marshall
Ames 29222	<i>Fraxinus pennsylvanica</i> Marshall
Ames 29223	<i>Fraxinus pennsylvanica</i> Marshall
Ames 29228	<i>Spiraea alba</i> Du Roi

REFERENCES

Barton LV. 1945. Viability of seeds of *Fraxinus* after storage. Contributions of the Boyce Thompson Institute 13: 427B432.