

# Status Report on *Fraxinus* Genetic Preservation Seed Collections by ARS and FS

July 2013



**Cover Photo: Large green ash tree in northwestern Ohio (Latitude: 41.0639444, Longitude: -83.674, Elevation: 239 meters) from which 10,821 seeds were collected on October 30, 2008 and are now safely in long term freezer storage as seed lot FSNS 1479.**

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## INTRODUCTION

In response to extensive tree mortality by the Emerald Ash Borer, ash seeds are being collected for long term storage to preserve genetic resources of the ash species. This has been a combined effort of the Agricultural Research Service and the Forest Service along with NRCS, BLM, and over 50 cooperators. The overall goal, of the collections, was to obtain 50 trees per Omernik ecoregion level III where a particular species occurred. (see attached plan). An ecoregion is a region of like environmental conditions and would represent trees adapted to those ecological conditions. Collections are to be evenly spaced across an ecoregion. The 50 trees could be all individual, in local populations of 5 or more trees, or a combination of local populations and individuals (table 1). A local population would be a group of trees where the greatest distance between any two individual trees would be no more than approximately 1 mile. Amounts collected per tree generally range from 2 to 10 quarts (2,000 to 10,000 CC) or 2,500 to 12,500 seeds. Some collections are smaller and some are much larger to accommodate certain experimental needs. Typically a genetics project can be conducted with a few hundred seeds but some requests for somatic embryo genesis studies have required 1500 seeds per tree. This report summarizes the accessions as they occur in the GRIN data base to assess the status of the effort and indicate what is needed to complete the germplasm collections.

Table 1. Possible combinations of individual tree and local populations to comprise 50-tree collections to be made per Omernik ecoregion III.

| Combination       | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 |
|-------------------|----|----|----|----|----|----|----|----|----|----|----|
| Single trees      | 50 | 45 | 40 | 35 | 30 | 25 | 20 | 15 | 10 | 5  | 0  |
| Local populations | 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 |

Table 2 gives a summary of all accessions, listed in the GRIN data base ([http://www.ars-grin.gov/npgs/acc/acc\\_queries.html](http://www.ars-grin.gov/npgs/acc/acc_queries.html)) by collection type (single tree or local population) and species. (Local population is described in the introduction above.) Both single tree and population accessions are

held in storage as individual trees as this is more useful for research and breeding. ARS accessions predominately are local populations and FS accessions are predominately single tree. Agency practice determined which type of accessions were posted to the GRIN data base. The working collections (samples made available to researchers and breeders) are held at the FS National Seed Laboratory Dry Branch, GA or the ARS North Central Plant Introduction Station Ames, Iowa. Security backup samples are also placed at the National Center for Genetic Resource Preservation, Fort Collins, CO.

NRCS had been collecting seeds from 2005 through 2010 when they chose to discontinue their own direct program while continuing to support the effort in other ways such as helping to publicize the work and recruit cooperative seed collectors. Those collections are represented in this report as part of the Forest Service collections.

Table 2. Number of ash accessions made from 2005 through 2012. These numbers are summarized from data posted to the GRIN data base by either ARS or FS, but are not observable to the public. Spreadsheets can be supplied that give more detailed data.

| Species | Collection type |                  |       | Individuals in local populations | Total individual trees |
|---------|-----------------|------------------|-------|----------------------------------|------------------------|
|         | Single tree     | Local population | Total |                                  |                        |
| White   | 740             | 39               | 779   | 419                              | 1159                   |
| Green   | 779             | 48               | 827   | 587                              | 1366                   |
| Black   | 394             | 13               | 407   | 174                              | 568                    |
| Blue    | 12              | 15               | 27    | 131                              | 143                    |
| Pumpkin | 13              | 0                | 13    | 0                                | 13                     |
| Total   | 1938            | 115              | 2053  | 1311                             | 3249                   |

### STATUS OF COLLECTIONS BY SPECIES

Proposed collection locations are marked on GIS maps for all species with extensive ranges (white, green, and black). Collectors can now go approximately to these locations and make collections. Accomplished collections are compared against the proposed sites to judge the evenness of collections and the number of trees yet to be collected. Proposed sites are very useful also for blue and pumpkin ash but must be used somewhat differently because of the more restricted occurrence of sites where these two species grow. Outlying populations will need to be addressed separately from ecoregions. Some ecoregions such as ecoregion 50 are quite large and probably should be represented by 75 to 100 individuals.

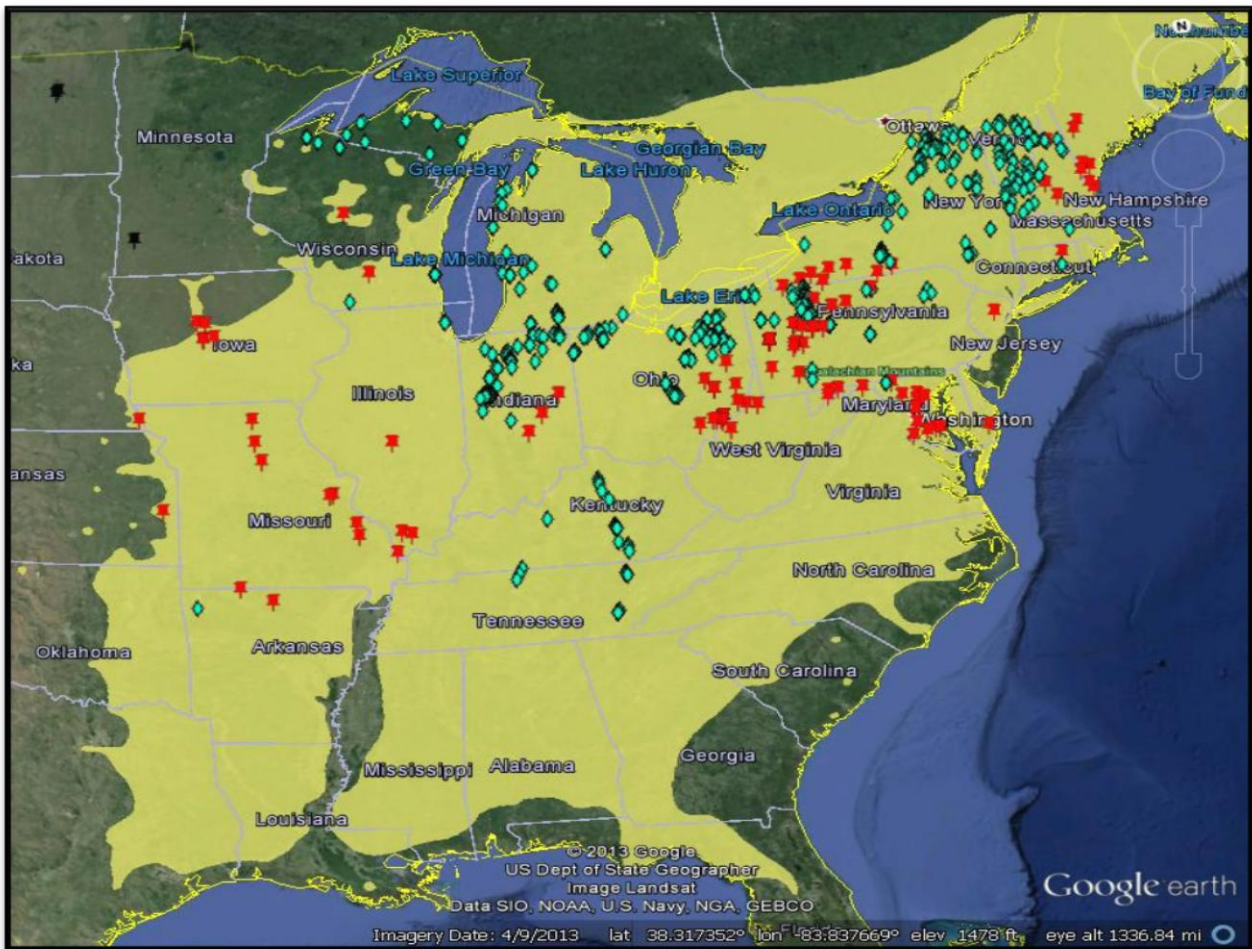
#### White Ash

White ash occurs in 38 ecoregions and has been collected in 29 ecoregions. The target of 50 individual trees per ecoregion has been reached in 7 regions but none of these are complete because the collections are not evenly spread across the region (table 3). The number of additional collections

needed to complete these regions ranges from 25 to 45 with an average of 34. Map 1 gives a general overview of accomplished collections for white ash.

Table 3. Progress, in number of ecoregions, towards goal of 50 trees per Omernik ecoregion level III.

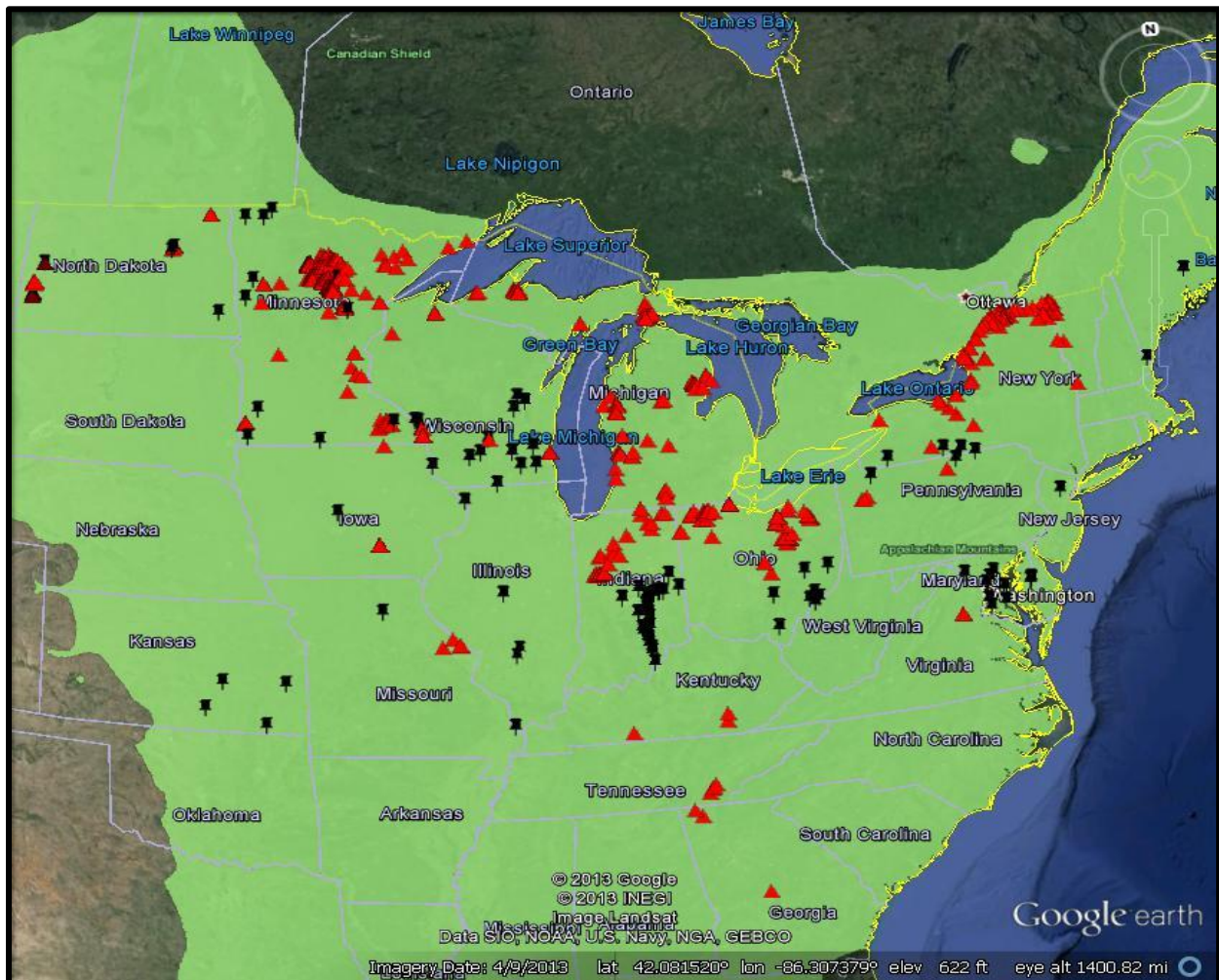
| Species   | Pumpkin | Blue | Black | Green | White |
|---|---------|------|-------|-------|-------|
| Number of ecoregions where the species occurs         | 14      | 13   | 22    | 48    | 38    |
| Number of ecoregions where collections have been made | 5       | 8    | 16    | 33    | 29    |
| Number of ecoregions with 50+ trees collected         | 0       | 0    | 1     | 6     | 7     |
| Number of ecoregions where collection is complete     | 0       | 0    | 0     | 0     | 0     |



Map 1. White ash collections made as of July 2013, ARS (push pins) and Forest Service (diamonds) combined. Species range shown by yellow shading.

## Green Ash

Green ash occurs in 48 ecoregions and has been collected in 33 ecoregions. The target of 50 individual trees per ecoregion has been reached in 6 regions but none of these are complete because the collections are not evenly spread across the region (table 3). The number of additional collections needed to complete these regions ranges from 25 to 50 with an average of 30. Map 2 gives a general overview of accomplished collections for green ash.

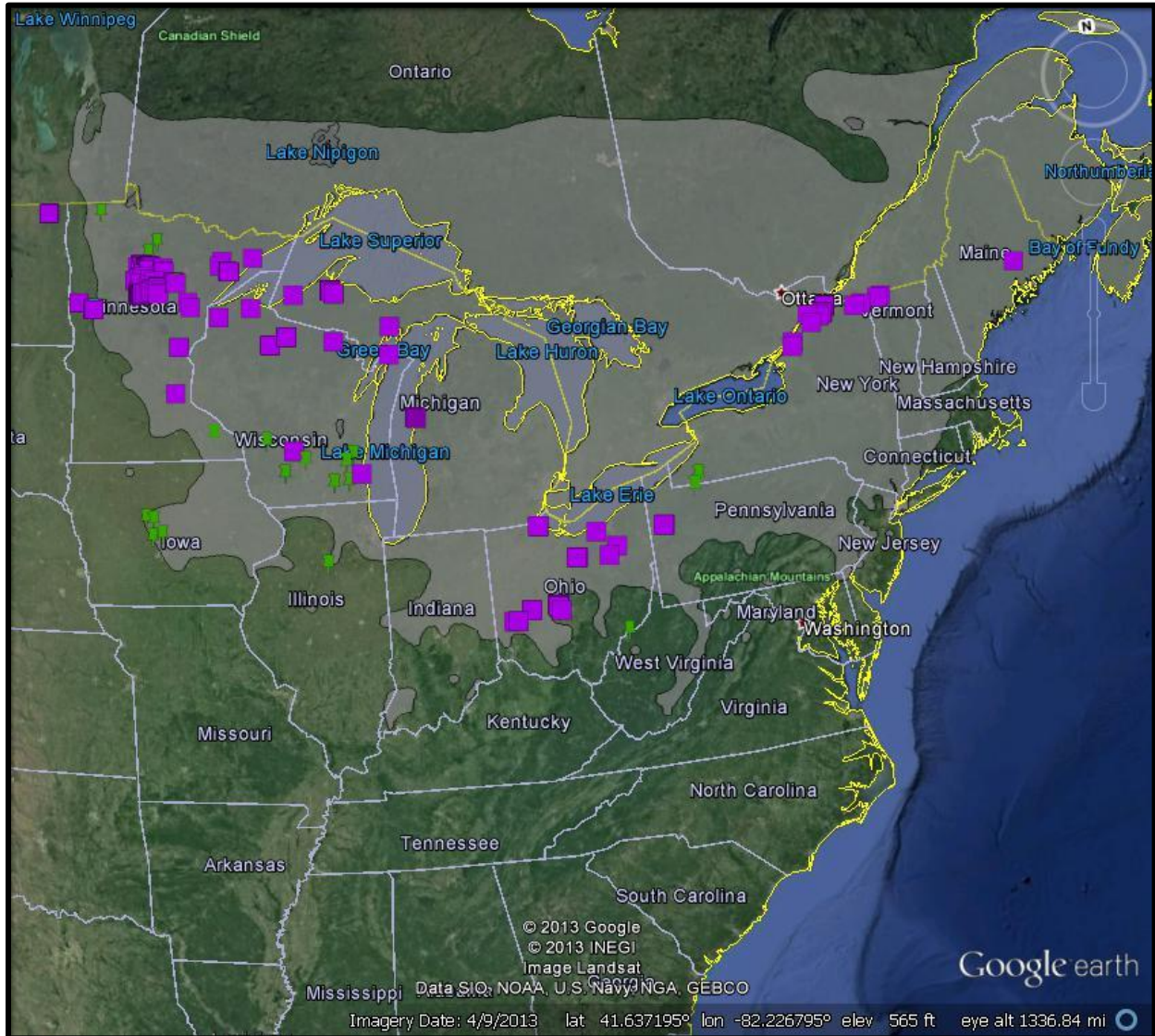


Map 2. Green ash collections made as of July 2013, ARS (push pins) and Forest Service (triangles) combined. Species range shown by green shading.

## Black Ash

Black Ash occurs in 22 ecoregions and has been collected in 16 ecoregions (table 3). Over half of these regions have less than 10 trees collected and the others generally less than 25. The number of additional collections needed to complete these regions ranges from 25 to 50 with an average of 30.

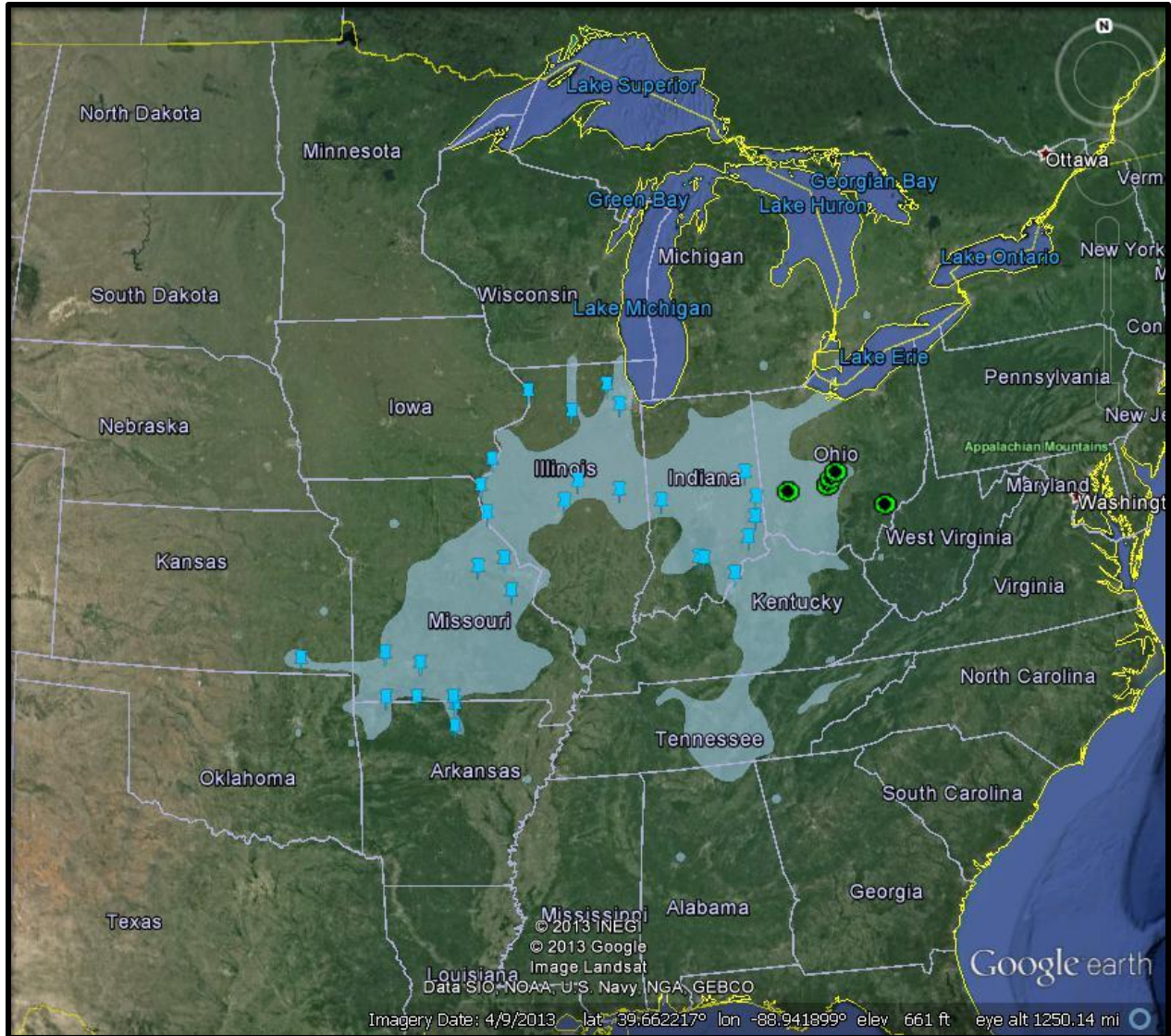
Map 3 gives a general overview of accomplished collections for black ash.



Map 3. Black ash collections made as of July 2013, ARS (push pins) and Forest Service (squares) combined. Species range shown by dark shading.

### Blue Ash

Blue ash occurs in 13 ecoregions and has been collected in 8 ecoregions (table 3). 2 regions might need only about 25 more collections. Others will need 50 or close to 50 collections to be completed. This species tends to be dispersed in occurrence because of the sites it occurs on are more disjunct. Additionally the published range maps are not as complete as needed for this work. A recent report by McCullough (*Can. J. For. Res.* 42: 1542–1550 (2012)) finds blue ash survival after attack by EAB to be much higher than for other species. Therefore, a comprehensive collection of blue ash might become important as a domestic source of EAB resistance. Map 4 gives a general overview of accomplished collections for blue ash.

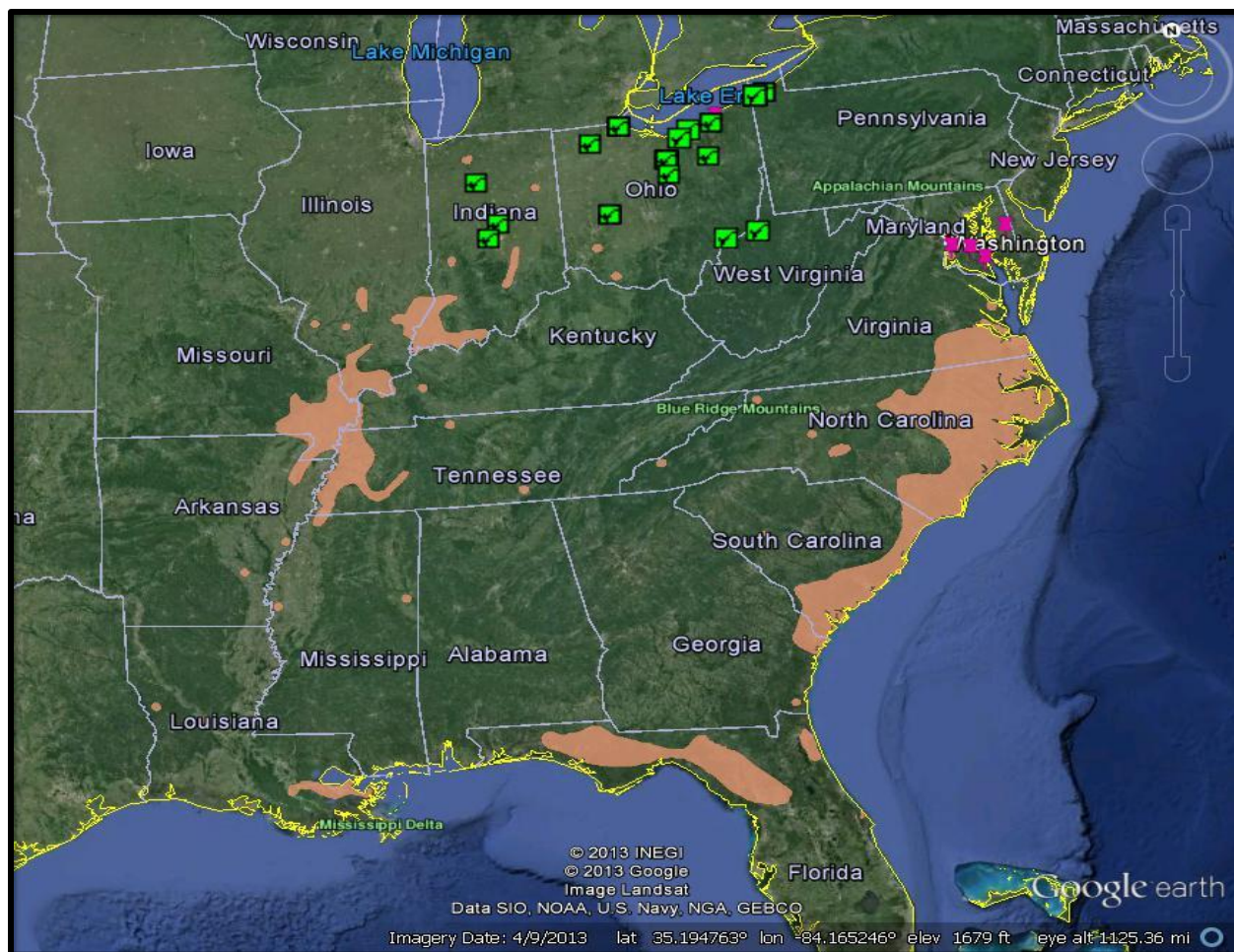


Map 4. Blue ash collections made as of July 2013, ARS (push pins) and Forest Service (dots) combined. Species range shown by blue shading.

### Pumpkin Ash

Pumpkin ash occurs in 14 ecoregions and has been collected in 5 ecoregions (table 3). With only 13 trees collected much needs to be done with pumpkin ash. Published range maps are also not as complete as needed for this work. This species is reported as being aquatic, but several individuals have been found growing with green ash on wetland sites but not aquatic. Map 5 gives a general overview of accomplished collections for pumpkin ash.





Map 5. Pumpkin ash collections made as of July 2013, ARS (push pins) and Forest Service (squares) combined. Species range shown by colored shading.

### SUMMARY

Collections have been made over a wide area. Black, green, and white ash have been collected in about 75% of all ecoregions where they occur and blue ash in about 60% of ecoregions of occurrence. However, many gaps remain in all ecoregions. Focus needs to be placed on regions within the EAB infested area, and especially on those that are more complete as these are closer to the earlier infestations in Michigan, Ohio, and Indiana where opportunities to collect are becoming limited by heavy ash mortality. The largest problem in focusing collections is not having resources to dedicate to priority areas. More partnering and direct funding is needed to complete the collections.

### RECOMMENDED ACTIONS

Observations made up through the middle of June show that 2013 is a mast year over most of the range of the eastern ashes meaning that 2013 is an opportunity to complete collections in at least half of the ecoregions. At conus rate it costs \$547 to put a worker in the field for 5 days, or about \$1,100 for a

team of two workers. Adding vehicle costs brings the total to about \$1,500 per week. In total, collection costs for 2 to 3 weeks of peak collection season would be \$3,000 to \$4,500 for a 2-person team, excluding salary. **Action 1:** ARS and Forest Service should each fund a 2-person collection team or more if possible. **Action 2:** Continue cooperative collections to supplement the agencies' internal efforts by providing training, guidance, and recruitment of collectors. Through these relatively small investments, a large portion of the collections can be completed and a rapidly vanishing genetic resource will be secured.

**Additional Information:** Please contact any of the authors for additional information. For more detailed data tables and help understanding how the tables were constructed, please contact Becky Loth [bloth@fs.fed.us](mailto:bloth@fs.fed.us) 478-751-3552.