After a leaf collection trip in 2013, Kevin Conrad and Ron Miller returned in 2015 to revisit sites where *M. ashei* is endemic. The Arboretum's conservation of the species continues today. (Photo credit: USNA)

Claire Broderick & Dr. Todd Rounsaville

Conserving the genetic diversity of Ashe Magnolia

What would compel a scientist to trek through rough forest paths in Florida's panhandle during the sticky summer months of 2020? Seeds. The seeds of a particular threatened tree species, native and restricted in the wild to just 10 counties in northern Florida, the Ashe Magnolia (*Magnolia ashei*). The seeds of this species are part of a long-term project to preserve the genetic diversity of Ashe magnolia.

The U.S. National Arboretum's Germplasm Program has been collecting and studying *M. ashei* for nearly a decade to help conserve this rare native tree. Kevin Conrad, Dr. Margaret Pooler, Chris von Kohn, Martin Scanlan, and others at the National Arboretum have been integral to the project as explorers, coordinators, collectors, analysts, and researchers. The new lead for the Arboretum's Germplasm Program is Dr. Todd Rounsaville, who has described the Arboretum's project on *M. ashei* and the Arboretum's next steps.

THE ATTRACTION OF ASHE MAGNOLIA

The Garden Club of America named Ashe Magnolia as their 2017 Native Plant of the Year. They recognized that *M. ashei* is "valued for its large creamy white blossoms with pink and purple markings that bloom in late spring, its citrus-scented fragrance, and its cone-shaped pink-purple aggregates that add fall interest," in addition to which, "it is heat tolerant and disease resistant." It received high praise as "an ideal specimen tree for the small garden."

THE THREAT TO *M. ASHEI*

Although extremely rare, you can find *M. ashei* planted in some landscapes and commercially available at specialty nurseries, where their big leaves and fragrant flowers attract attention. So why go collecting from the native population? Most of the plants available for purchase in nurseries originate from limited sampling of only a few wild *M. ashei* populations and are genetically similar. This narrow sampling of

***In situ* conservation—take steps to protect the species growing in its native habitat.**

***Ex situ* conservation—grow and distribute a species in gardens at the Arboretum.**

Collection trips in Florida included preparing specimens for the Arboretum's herbarium. (Photo credit: USNA)

genetic diversity means that potentially important genes are not represented in *ex situ* collections. If a natural disaster like a hurricane destroys one of the *in situ* populations, then the genetic diversity that could help the species to resist attacks from new types of diseases and environmental changes would be lost forever. With a more complete sample of genetic material, the species as a whole can be better safeguarded from threats posed by disease or a changing climate. Such has been the case with boxwood blight that threatens boxwood in North America. Boxwood that are resistant to the blight are being bred with the vulnerable varieties to create strong hybrids that retain the appealing characteristics of the susceptible variety.

There is genetic diversity in the subpopulations of native trees growing in Florida, but that native habitat is declining in area and habitat quality. Calamitous storms in recent years have been detrimental to the wild populations. For instance, Hurricane Michael killed many *M. ashei* trees in 2018.

***Magnolia ashei* is an attractive plant, with its fragrant, creamy flowers and broad leaves. The Garden Club of America named Ashe Magnolia as their 2017 Native Plant of the Year.**

HOW WOULD THEY KNOW WHERE TO COLLECT SEEDS WITH THE MOST GENETIC DIVERSITY?

In 2013, a team from the National Arboretum initiated a project to sample *M. ashei* across its range in Florida and in cultivated populations. They traveled to Florida to take samples of *M. ashei* across the whole natural region so they could analyze the genetic diversity back in the laboratory. Dr. Rounsaville noted that this study would provide several useful insights that could be helpful for following up on both *in situ* and *ex situ* conservation efforts.

The study revealed the overall genetic diversity within and between populations and revealed the populations that were not already represented in the botanic garden community. Analysis of the samples found that the wild populations represented "two subpopulations for the species which were geographically partitioned into eastern and western groups." Yet between the two populations was "the Holmes Creek population occurring directly at the interface between the eastern and western subpopulations." This small middle group "was found to be the most distantly related to all other populations and had the greatest genetic diversity."

The eastern group was well represented in botanic gardens worldwide, and the western group was found in cultivated populations, while the small central population was not represented in any of the gardens surveyed. Therefore, "the Florida populations lacking *ex situ* representation were identified and prioritized for collecting efforts, with Holmes Creek being the most notable example." In the summer of 2020, a USDA colleague based in Florida trekked through the identified population to collect seeds.

NEXT STEPS FOR EX SITU PRESERVATION

The National Arboretum is pursuing a plan to conserve *M. ashei* outside its natural habitat through living collections. From the 2020 seed collection, there are now hundreds of young Ashe Magnolias growing in the Arboretum's polyhouses. A new *M. ashei* orchard will be established at the National Arboretum with 20 to 30 of the trees. This will be a long-term orchard

The Florida populations lacking ex situ *representation were identified and prioritized for collecting efforts, with Holmes Creek being the most notable example.*

Magnolia seeds collected in Florida in 2020 made their way to the National Arboretum's greenhouse to be planted. Some of the seedlings will be planted at the National Arboretum where the living orchard will be a source of rare genetic material available to future research and plant breeding efforts. (Photo credit: USNA)

for growing mature trees and capturing the genetic diversity of the Holmes Creek subpopulation. Partner arboretums in Virginia, Georgia, and North Carolina will also establish orchards from the seedlings, replicating the Arboretum's orchard as backups to decrease the risk of losing the genetic material if one orchard were to fail.

WHY NOT SIMPLY STORE THE COLLECTED SEEDS?

Although the National Arboretum has a seedbank, it could not be used for the *M. ashei* seeds. Magnolia seeds cannot be stored long-term like the seeds of most plants, because the embryos cannot survive the lowered moisture content required for cold storage. Instead, magnolias must be conserved as living plants. The *M. ashei* seeds were planted in polyhouses at the National Arboretum to grow and preserve the genes in the adult plants that are incorporated into botanical collections.

However, the Arboretum will work with a cryo-preservation USDA lab in Colorado to freeze shoot tips which can be prepared in such a way that they can be stored for a very long time. The shoot tips could later be grown into healthy plants using tissue culture. This long-term storage will complement the living orchards maintained by the Arboretum and its partners. The living orchard at the Arboretum will be a source of genetic material available to future research and plant breeding efforts, and shoot tips from the orchard will be cryo-preserved for long-term storage.

FROM FLORIDA FORESTS TO DC ORCHARD

From a small location in Florida, the wild-collected seeds have been taken to Washington, DC, and other states to grow in orchards, from which shoot tips will go to Colorado. One day you will be able to observe dozens of *M. ashei* at the Arboretum where the beautiful orchard will be on display, and it may be acting as one of the many coordinated strategies to protect the future of the species.

CLAIRE BRODERICK *is the Membership Program Manager at FONA. Seeing the magnolias bloom at the Arboretum is one of the highlights of spring for her.*
DR. TODD ROUNSAVILLE *is the new lead for the Arboretum's Germplasm Program. He conducts research on genetic diversity, seed biology, and germplasm management, and pursues plant conservation efforts both* in situ *and* ex situ.