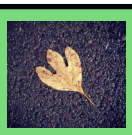
LIMELEDGE
BOTANICAL GARDEN AND ARBORETUM

Volume 1, Issue 1



Newsletter of the Limeledge Botanical Garden and Arboretum

Editor's Note: Welcome to the inaugural issue of *The Raccoon Den*! This newsletter is named after one of the many unique features of the old Simmons Farm: A limestone outcrop containing many ridges and cavities serving as excellent habitat for a number of animal species… and many interesting plants as well. As activities at Limeledge get started, this newsletter is intended to be a semiannual publication distributed to local organizations, professionals, and benefactors.

Articles

Planting Begins! **1**

Mission and Objectives of Limeledge **2**

An LLC Partnership to Maximize Opportunities **3**

The Cook Lot: Design Philosophy **5**

Food for Bees: A Pollinator Garden **6**

Florida Torreya: Ethics of Assisted Migration **7**

Species Spotlight: Mexican Hickory **9**

Planting Begins!

On May 1, 2022, the transition of the old Simmons Farm on State Route 321 in Elbridge to Limeledge Botanical Garden and Arboretum began.

Purchased in 1964 by Eugene Simmons, the property had been previously known as the Wright Farm, after one of the first families to permanently reside in Elbridge. The Wrights owned and operated the property beginning in the 1800s.

Initially, the arboretum proper will be installed in the "Cook Lot". Named for a previous owner and veteran of the American Revolution, this location is blessed with a variety of soil types and exposures, and is adjacent to a sheltered cove-like topographical feature that will allow Limeledge to experiment with a number of plants that may not be typically cold-hardy in Central New York. It is also seasonally home to a set of beehives. Elements of a pollinator garden, including an indigo collection, will be some of the first installations.

While the arboretum will grow to be the central attraction of the property, an important aspect of Limeledge is retaining the features of a functional farm and connecting the CNY community with its agricultural traditions. At present, about 110 acres of the farm is currently in field crops, with plans for an orchard and permaculture demonstration areas in the works.

Figure 1. View of the eastern side of the Cook Lot, bounded by Scotch pines to the SE.

Mission and Objectives of Limeledge

The mission of Limeledge Botanical Garden and Arboretum is to assist in the conservation of plants by providing an accessible, community-oriented and educational reference collection. With an emphasis on rare and endangered species, native taxa, difficult species complexes, and their ecosystem services, visitors will be introduced to the importance of biodiversity and the rich tapestry of terrestrial ecosystems. The acquisition of documented, wild-collected material as well as the preservation of genotypes currently within cultivation, will serve as a reservoir for maintaining valuable and noteworthy germplasm for future generations.

Limeledge will fulfill this mission by making its collections open to the public and collaborating with local schools and organizations on educational programming. Assembling the collections themselves is a labor of love conducted by Dr. Crim and others utilizing a large global network of private collectors and nurseries. Once the chartering process with the state department of education is complete, Limeledge will join organizations such as Botanic Gardens Conservation International (BGCI), American Public Gardens Association (APGA), ArbNet, and others. Membership in these organizations will allow Limeledge to further expand its holdings and exchange material with arboreta and botanical institutions worldwide.

Figure 2. The main access road to the Cook Lot will utilize in situ trees as living trellises for a reference collection of woody vines such as native grapes (*Vitis*), honeysuckles (*Lonicera*), and lesser known taxa such as *Aristolochia*.

The extensive trail system throughout a variety of landscapes on the property is also conducive to health and wellness and will eventually be open to the public for running and hiking. Retaining the agricultural character of the farm will be an important aspect of Limeledge's educational programming, and plans to renovate the barns on the property to use as event spaces will further reinforce these connections. In order to achieve these objectives, the next three years could look like this:

- **2022**: Plant the Cook Lot as an arboretum; prep the former house area for installation of orchard and permaculture/production areas; install pollinator garden near the beehives
- **2023**: Install orchard; install informational kiosks; open trail system to the public; begin barn work
- **2024**: Host events at the barns; educational tours and workshops on the land

In summary, Limeledge will serve a variety of needs unlike any other institution.

An LLC Partnership to Maximize Opportunities

Following a vote by family trustees to approve the transition of the Simmons Farm into a botanical garden and arboretum, Simmons Farm at Limeledge, LLC was founded in November 2021. The primary purpose of this LLC is to support the establishment of Limeledge and to assist in raising it to a level of fiscal sustainability. As the process for establishing Limeledge as a 501c(3) nonprofit educational organization chartered by the New York State Department of Education proceeds, having an allied LLC provides flexibility for interfacing with contractors and consultants as the nascent organization establishes itself.

Simmons Farm
At Limeledge

LIMELEDGE
BOTANICAL GARDEN AND ARBORETUM

Simmons Farm at Limeledge will support the establishment of Limeledge Botanical Garden and Arboretum by providing access to capital for farm improvements that may not be possible for Limeledge itself in the early years. In addition, Simmons Farm can help manage the business aspects of retaining the agricultural features of the farm itself, which is an important component of the Limeledge mission. As sole proprietor of the LLC, Dr. Crim will direct it to synergize with and support the Limeledge mission through access to capital and generating novel revenue streams.

Figure 3. On January 4, tragedy struck the Simmons family when a mysterious fire destroyed much of the farmhouse, underscoring the urgent need for maintenance and rehabilitation of remaining farm infrastructure. Following removal of the debris and remaining structure, the area around the former house footprint will be utilized as orchard and permaculture demonstration areas.

Figure 4. The larger of the two barns holds potential as an event space for community lectures, professional training, and demonstration areas. A substantial renovation and extensive cleanup of the grounds will be necessary first, however.

Figure 5. The western boundary of the property overlooks Carpenter's Brook Fish Hatchery, an Onondaga County Park. The soils in this vacant lot south and west of the former house footprint are far sandier and more acidic than typical locally, and the site also benefits from local topography giving it a bit of extra shelter from the elements. This rare combination of traits makes it perfect for growing fruits such as blueberries, peaches, apricots, and pawpaws that may typically struggle in many parts of CNY. Since the Hatchery border will essentially be one of the main interfaces of Limeledge with the public, cleaning it up and preparing the site for installation of the orchard are top priorities.

Figure 6. View north towards the barns and former house. While the areas around the farm structures require extensive cleanup and maintenance, it is incredibly scenic, easy to access, and has incredible mixed-use potential.

The Cook Lot: Design Philosophy

Plantings in the Cook Lot are designed to support the mission of Limeledge in a variety of different ways. Taking inspiration from the late Dr. John Abbuhl, founder of Pine Hollow Arboretum outside of Albany, NY the Cook Lot will pay homage to his principle of *"Trees in a natural environment"*. In other words, letting the land itself dictate what is planted, and where. This allows for an organic, free-form approach to species assemblages that allows related and/or similar species to be united across the varied conditions present in the Cook Lot. Some examples of two diverse groups showcased at Limeledge:

- Maples (*Acer*) will primarily inhabit the southwestern corner, with some smaller Japanese and snakebark-type species ranging into the treeline for woodland-esque plantings similar to their native habitats, while other species will range out into the field to mingle with larger trees from other groups.
- Oaks (*Quercus*) are even more cosmopolitan than maples, and will have a dedicated trail meandering through the entire length of the Cook Lot. The ***Oak Path*** will take advantage of the site's soil variation to unite calciphiles like CNY's native Chinkapin oak (*Q. muehlenbergii*) with acid soil species, shrubby species, riparian species, ridge and valley species, and even some broadleaf evergreen species on the slopes of the cove. Thus, oaks will be scattered across the varied landscape, but united along a common trail.

Thanks to our history of glaciation in CNY, the Cook Lot is blessed with a wide variation in soil pH, texture, and hydric status within a relatively small area. The opportunity to have a healthy chinkapin oak (a calciphile) growing in close proximity to a healthy chestnut oak (*Q. montana*; a calcifuge) provides an opportunity that few collections can match. This will allow Limeledge to host reference collections for training specialists that are unmatched in their ability to provide professionals with field-based training on difficult groups of native species such as oaks, pines, willows, hawthorns, roses, gooseberries and currants, brambles, and many others. The lot itself can be broken down by some of these features, and some of the evolving planting goals therein:

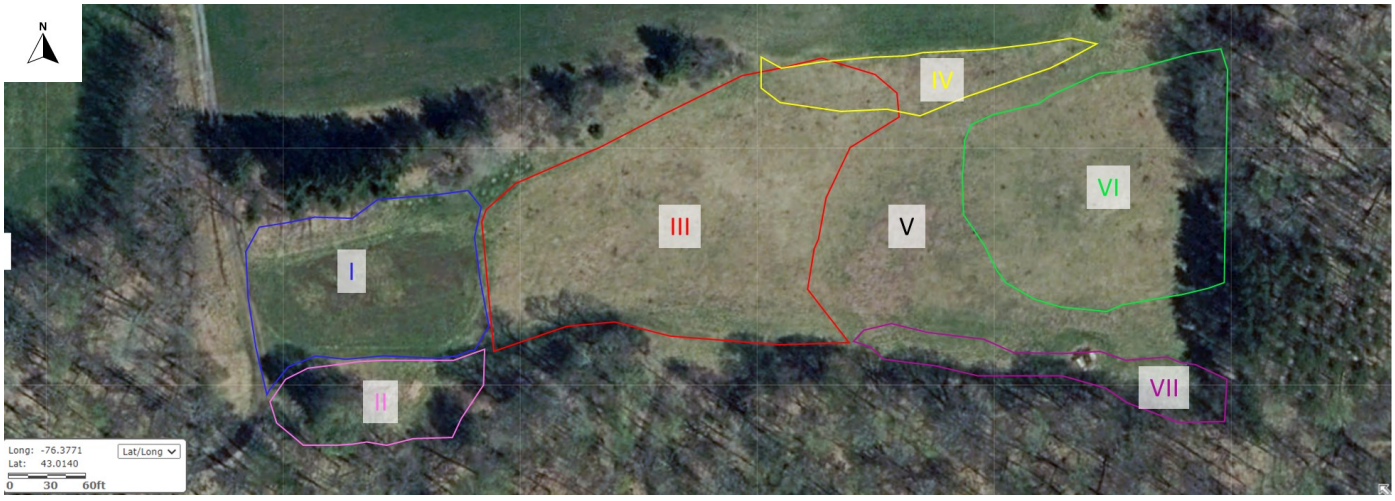


Figure 7. Approximate breakdown of Cook Lot planting zones. I. Front Gardens: Native species; small with scattered large and medium specimens; pollinator garden around beehives. II. Maple Collection: Woodland species at edge; larger taxa blending into zones I and III. III. Heartland: Scattered larger specimens and collections of species-poor genera. IV. North Flats: Overlapping with III and V; average to well-drained; smaller species so not to obstruct view to the north. V. Seasonal Stream and Drainway: riparian/alluvial area for moist to wet soil species. VI. East Knoll: Well-drained but rich and fertile; good for pines, birches. VII. SE Corner and Woodland: For shade tolerant, woodland, and possibly some variegated-foliage plants requiring shelter. The northwest hedgerow will also be utilized.

Food For Bees: A Pollinator Garden

Throughout the history of the property, honeybees have been placed in various locations across the farm by beekeepers. For at least the past decade or so, the bees have been located near the northwest corner of the Cook Lot along the spruce hedgerow.

The decline of pollinators has received a great deal of media attention in recent years. While it appears that many factors play a role, a remedy for one in particular may be right in Limeledge's wheelhouse. By having a large number of plant species blooming throughout the growing season, rather than all at once, we can help ensure that pollinators have a consistent supply of calories to support themselves, their progeny, and for some species, their colonies. Therefore, plant biodiversity can be very important for helping to stabilize population dynamics of pollinators. The plant collections at Limeledge will create a multitude of feeding opportunities for pollinators throughout the growing season.

Figure 8. Thanks to the presence of the beehives, honeybees often congregate around puddles in the access road and trails on the farm. This photo was after a night of rainfall in Summer 2021 on the access road next to the Cook Lot. Making honey and supporting the colony is thirsty work!

The systems approach utilized by permaculture recognizes the importance of pollinators. The woody plant collections at Limeledge will contain a number of potential pollinator species that have many benefits but may be poorly known or tested in this region. Taxa belonging to genera such as *Amorpha* and *Indigofera* (indigo) fix nitrogen and can tolerate poor soils while also providing ample sustenance to pollinators. Other unique specialties include plants utilized for herbs and/or tea, such as the attractive but uncommon *Elsholtzia stauntonii* Benth. (mint-shrub), or even to attract specific organisms, such as butterflies (*Aristolochia*).

Limeledge will feature a pollinator garden of woody shrubs eventually underplanted with high-quality herbaceous pollinators in the open spaces adjacent to the beehives. Since a large proportion of the arboretum will consist of angiosperms, pollinators will have a diverse array of food sources to select throughout the season. Some woody genera that will be added to the pollinator garden in 2022 include:

Amelanchier	*Colutea*	*Hydrangea*	*Ptelea*	*Salvia*
Amorpha	*Cotinus*	*Indigofera*	*Rhus*	*Spiraea*
Aristolochia	*Eleutherococcus*	*Lindera*	*Ribes*	*Styrax*
Bignonia	*Elsholtzia*	*Lonicera*	*Robinia*	*Syringa*
Buddleia	*Hamamelis*	*Philadelphus*	*Rosa*	*Viburnum*
Clematis	*Hibiscus*	*Prunus*	*Rubus*	*Vitex*

Florida Torreya: Ethics of Assisted Migration

Florida torreya (*Torreya taxifolia* Arn.) is an endangered conifer in the Yew Family (Taxaceae) native to a small area in northern Florida and adjacent Georgia on the banks of the Apalachicola River. Sadly, this species is currently at risk of extinction due to being negatively impacted by several factors, perhaps most severely by a fungal pathogen. Despite its very limited native range, the species was locally abundant in the past, and the high-quality wood was once collected for some limited uses. The relatively small size of the tree, with larger specimens only reaching a maximum size around 60-feet in height, precluded it from any large-scale harvesting, however.

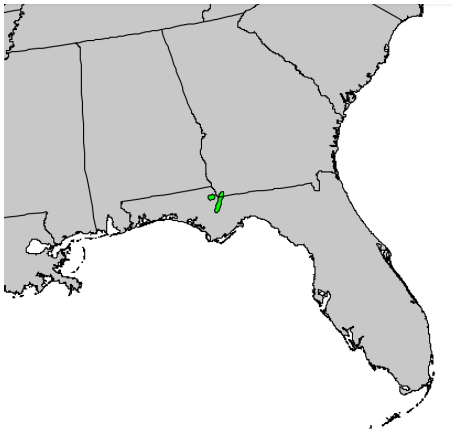


Figure 9. The limited native range of Florida torreya. Source: USFS

Although signs of disease in this species were noticed as early as the 1930s, a 1952 survey by Florida State University faculty Herman Kurz and Robert K. Godfrey detected limited signs of population decline; by 1962, however, they reported that Florida torreya populations were in such steep decline that extinction may be imminent [1]. Timber harvesting, hydrologic changes along the Apalachicola, and heavy pressure from deer browse within the torreya's tiny habitat areas were initially believed to be responsible, but it was soon apparent that an additional stressor was expediting the decline. An abundance of leaf spots and stem cankers on ailing trees indicated that at least one pathogen was attacking the species, and destruction of individual plants was so rapid and efficient that mature trees were no longer known in the wild by the 1960s [2]. In 2011, Dr. Jason Smith's group at the University of Florida demonstrated that a novel fungal pathogen played a major role in the decline of afflicted trees [3]. In 2013, the fungus was formally described and named *Fusarium torreyae* [4].

The role of a *Fusarium* pathogen complicates species recovery efforts in several ways. Unfortunately, many *Fusarium* species behave as generalist pathogens capable of infecting a range of hosts. As a result, recovery efforts need to consider potential impacts of the pathogen on other species. While this is less of a concern in the native range of Florida torreya where the pathogen is already abundant, it is problematic in the context of assisted migration, which runs the risk of introducing a potential pathogen to new ecosystems and novel hosts. To assess the host specificity of *Fusarium torreyae*, Trulock (2012) inoculated several conifer species found in the native range of Florida torreya, as well as some that are abundant in the southern Appalachian areas that have been suggested as sites for assisted migration [5]. Interestingly, the pine species native to the same area as Florida torreya were not susceptible to the pathogen; however, other pine species such as Eastern white pine (*P. strobus*) developed cankers when inoculated. Other genera that showed susceptibility included *Abies* (firs), *Picea* (spruces), *Tsuga* (hemlocks), and *Taxus* (yews). These data indicate that *Fusarium torreyae* may behave as a generalist capable of infecting species across conifer genera and families.

Figure 10. Cankers developing on a wild Florida torreya stem. Source: Jason Smith, University of Florida

While Trulock's data can't indicate whether *Fusarium torreyae* would have the same impacts on tree species in other regions as it has on Florida torreya, they do indicate that it's possible for the pathogen to have a negative impact on a wide range of other hosts. In an era of widespread

forest community structural change due to climate change, land use change, introduced pests and pathogens, and other anthropogenic impacts, recognizing potential pathogens as a challenge to re-wilding and assisted migration is necessary. Indeed, the biotic interactions of the Florida torreya itself in a new ecosystem must also be examined. The introduction of a new biological entity to any ecosystem has the potential to alter ecosystem function; the question is whether we define these inevitable changes as beneficial or deleterious to the ecosystem in question, especially if there are potential impacts on keystone species. A further, and potentially even more insidious complication could arise if the *Fusarium torreyae* is present in the tissues of the seeds themselves, meaning that ex situ conservation itself could be responsible for spreading a fungus that is potentially harmful to naïve ecosystems. That said, it is important to note that while this species shows signs of disease at ex situ plantings such as the Biltmore Estate (identified in 1980s without modern methods as a different *Fusarium* species), the infections generally fail to generate the girdling cankers that are so devastating to mature stems in its native range [6]. If these less damaging infections are indeed due to the same pathogen, it underscores the importance of understanding what environmental factors may be allowing the plants in their native environment to be so much more susceptible, as well as establishing the extent of the pathogen's distribution. If it is already widespread, the greatest concern regarding assisted migration of Florida torreya may be moot.

Figure 11. Florida torreya in cultivation. Source: Creative Commons image by Zoya Akulova.

In the context of climate change, it will likely be beneficial to retain or enhance biodiversity using assisted migration. Since ecosystems are in a constant state of flux, in some cases it can be argued that the primary change being introduced with a new species is that of an acceleration of the natural process of species entering new habitats. Since this is constantly being done unwittingly by humans cultivating exotic plants for ornament and agriculture, why not guide and expedite changes that may otherwise occur too slowly (i.e. plant range changes and species adaptation) to account for rapid climate change and to retain biodiversity? Since humans are doing this unintentionally for some species in ways that negatively impact biodiversity, why not do so intentionally within a framework for preserving it, especially with a species that has public groups with high levels of interest? It is important that professionals, academics, and the public work together to combine knowledge and expertise with the grassroots enthusiasm that can only be generated by interest in such a unique species.

Limeledge currently has about 100 Florida torreya seeds gifted from the Torreya Guardians, a group dedicated to saving the Florida torreya from extinction by utilizing assisted migration. Over the last two years, these seeds have been exposed to various temperature treatments to investigate the effects of temperature and stratification on germination. Utilizing a PCR method for detecting the pathogen on seeds, screening of germplasm can now be performed to reduce the chances of spreading Fusarium torreyae *[7]. If work by Dr. Crim and students at The College of Saint Rose indicates that these seeds and/or plants are likely pathogen-free, they will be planted in the* ***Torreya Ten****, a woodland area near the Cook Lot that is a good habitat fit for Florida torreya. Despite its native range, this species is surprisingly cold-hardy.*

Torreya is an ancient genus, with roots as far back as the Jurassic [8]. As a federally-listed endangered species with an IUCN designation of critically endangered, helping to safely preserve the Florida torreya is a perfect fit with the mission of Limeledge.

Species Spotlight: Mexican Hickory

Many tree species native to eastern North America have close relatives, or themselves can be found in, Mexico. These Mexican taxa are often poorly known, rarely cultivated, and data-deficient in terms of their conservation needs due to the security situation in many parts of that country. Environmental degradation, land use change, and high rates of endemism potentially put some species in incredible jeopardy.

Hickories (*Carya*) are no exception, and one species, *Carya palmeri* W.E.Manning, has been collected at least once in the wild by the former Yucca Do Nursery in northern Mexico. The Limeledge plants are derived from this collection. Yucca Do was a prolific mail-order nursery in Texas in the late 1980s to early 2000s specializing in a wide range of wild-collected material from the southwest and Mexico, and was responsible for introducing many new species to cultivation. Fortunately, a collector in Oregon had acquired this taxon from Yucca Do years ago and offered to share some of his material when he trimmed his tree.

Figure 12. Grafted Mexican hickory scion on bitternut hickory (*Carya cordiformis*) understock. Note the similarity of the sulfur-yellow buds to our familiar native bitternut.

Mexican hickory is listed as near threatened by the International Union of Conservation for Nature (IUCN) in The Red List of Mexican Cloud Forest Trees (2011). It has likely never been grown in upstate New York, or possibly anywhere in the northeast. The species is closely related to our bitternut hickory (*Carya cordiformis* (Wangenh.) K.Koch) and indeed, the scionwood looked very similar to bitternut, sharing the unusual trait of having distinctive sulfur-yellow buds. We utilized simple cleft grafts onto in-situ wild bitternut seedlings in late March. It is possible that our plants are part of the only lineage of this species in cultivation in the U.S., and while many species from northern Mexico are shockingly cold hardy, it's possible that they will not be able to survive in our climate. We'll only know the answer to this question if the native bitternuts used as understocks for the Mexican hickory scions prove to be compatible hosts. Stay tuned!

Figure 13. Cleft graft before wrapping and sealing with parafilm.

A place for every plant, and for every plant a place

Special thanks to Ben Simmons for assisting with art!

The Raccoon Den

Dr. Philip Crim, editor and founder

Temporary Website

For more information, please see:

https://plantecophys.weebly.com/limeledge-botanical-garden-and-arboretum.html

Florida Torreya: Ethics of Assisted Migration

References

[1] Godfrey, R.K.;, and Kurz, H. 1962. The Florida Torreya destined for extinction. *Science*. 136 (3519): 900–902.

[2] Alfieri, S.A., A.P. Martinez, and Wehlburg, C. 1967. Stem and needle blight of Florida torreya, *Torreya taxifolia* Arn. *Proceedings Florida State Horticultural Society* 80: 428–431.

[3] Smith, J.A., O'Donnell, K., Mount, L.L., Shin, K., Peacock, K., Trulock, A., Spector, T., Cruse-Sanders, J., and Determann, R. 2011. A novel *Fusarium* species causes a canker disease of the critically endangered conifer, Torreya taxifolia. *Plant Diseases*. 95: 633-639.

[4] Aoki, T., Smith, J. A., Mount, L. L., Geiser, D.M., and O'Donnell, K. 2013. *Fusarium torreyae* sp. nov., a pathogen causing canker disease of Florida torreya (*Torreya taxifolia*), a critically endangered conifer restricted to northern Florida and southwestern Georgia. *Mycologia* 105(2): 312–319.

[5] Trulock, A.J. 2012. Host range and biology of *Fusarium torreyae* (sp. nov.), causal agent of canker disease of Florida torreya (*Torreya taxifolia* Arn.). Master's Thesis: University of Florida.

[6] U.S. Fish and Wildlife Service. 1986. Florida torreya (*Torreya taxifolia*) recovery plan. U.S. Fish and Wildlife Service: Atlanta, GA.

[7] Dreaden, T.J., Quesada, T., and Smith, J.A. Detection method for *Fusarium torreyae* the canker pathogen of the critically endangered Florida torreya, *Torreya taxifolia*. *Forest Pathology* 50(3): e12597

[8] Florin, R. 1963. The distribution of conifer and taxad genera in time and space. *Acta horti Bergiani* 20(4): 122-312.

LIMELEDGE
BOTANICAL GARDEN AND ARBORETUM