# arnoldia

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Nancy Rose, *Editor*
Andy Winther, *Designer*



The ARNOLD ARBORETUM of HARVARD UNIVERSITY

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*Front cover:* Japanese cornel (*Cornus officinalis*) blooms in early spring, typically March at the Arnold Arboretum. Photo by Nancy Rose.

*Inside front cover:* Trilliums (*Trillium* spp.) are part of the disjunct flora of eastern Asia and eastern North America. *Trillium erectum,* seen here, is a woodland native in much of eastern North America. Photo courtesy of Tom Barnes, University of Kentucky.

*Inside back cover:* At first glance the fruit of *Schisandra chinensis* appears to be a raceme of berries, but in fact each fruit consists of numerous fruitlets, each developed from an individual carpel within an elongate floral receptacle. In this photo, some carpels have matured into fruitlets (large, red) while others have not (small, greenish). Photo courtesy of Peter K. Endress.

*Back cover:* Harvested fruit from yellow-fruited spicebush (*Lindera benzoin* forma *xanthocarpum*), an unusual variant of the typical red-fruited form of spicebush (*Lindera benzoin* var. *benzoin*). Photo by Richard Lynch.

# Picking Up the Pawpaws: The Rare Woody Plants of Ontario Program at the University of Guelph Arboretum

*Sean Fox*

It might surprise you to learn that, in Canada, species such as *Magnolia acuminata* (cucumbertree), *Betula lenta* (sweet birch), and *Morus rubra* (red mulberry) are among those that are listed as endangered in the wild (see Table 1). You may be thinking, "Really, *Betula lenta*? It grows all over the place in the eastern United States!" It's true that the majority of woody plant species at risk in Canada are quite secure in the United States, so why the concern? Is there really a need for conservation?

Conserving an organism at the species level is generally regarded as the most immediate and crucial objective of many conservation programs. In the case of a species that is critically endangered on a global scale, simply ensuring the survival of a few individuals is often a significant challenge. But even many globally common plant species have conservation needs. Often these species do not have a very high representation of diverse genetic material archived in ex-situ collections simply because they are not considered to be a high priority for conservation. To compound this, the limited germplasm that is archived is often accessed from similar populations from the core of a species geographic range. By collecting from more provenances, including those at the extremes of a species' range, we can come closer to fully conserving and representing the genetic diversity of the species.

After the Laurentide Ice Sheet began receding nearly 12,500 years ago, the forests of eastern North America began their march northward. Species migration is a dynamic and ongoing process, and while many species have already pushed into the tundra region in the far north of Canada, most other species have only extended into southern Canada far more recently. These regional populations, on the forefront of a long migration into northern latitudes, must adapt to an array of environmental conditions that are often very different from those found at the core of the geographic range. Adapted gene complexes enable a plant to adjust to the timing of the local annual growth cycle, including bud break, root growth, shoot and leaf elongation, bud development, diameter growth, and cold acclimation. The genetic variation present in


NANCY ROSE

**Notable for its bright yellow fall foliage, sweet birch (*Betula lenta*) is a rare find in Canada.**

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**Flowering dogwood (*Cornus florida*) blooming in Ontario.**

these range extensions is very significant from a conservation standpoint since these particular genotypes may provide crucial genetic material to allow a species to migrate and fill various regional niches.

The Ontario populations of woody species, at the northern extent of their natural range, represent adaptations to our northern conditions. *Liriodendron tulipifera* from Ontario are more likely to be suitable for forestry planting in that province than seedling stock from a Virginia source. *Cornus florida* from Ontario-based provenances have proven, in cold hardiness trials, to be more winter hardy in Canada than nursery stock sourced from farther south. As migration pressures increase due to a rapidly changing climate, it may become even more critical to conserve these northern genotypes. Unfortunately, the pace of abiotic change in the environment is likely to be far ahead of biotic survival for many species. The continued exploitation and segregation of suitable habitat adds another dynamic to an already challenging scenario for in-situ conservation.

## UNDERSTANDING SPECIES AT RISK IN CANADA

Taking the time to thoroughly understand the legislative conditions regulating species at risk in Canada, as in many other parts of the world, can be an exercise in patience. The federal government of Canada's National Strategy for the Protection of Species at Risk is composed of the National Accord for the Protection of Species at Risk (NAPSR), established in 1996; the Habitat Stewardship Program (HSP), established in 2000; and the Species at Risk Act (SARA) established in 2003.

The National General Status Working Group (NGSWG) was formed in 1996 to support the mandate of the NAPSR, and is charged with establishing status rankings for all species in

## Table 1. At-risk woody taxa listed federally in Canada (2011)

| Taxon | Canadian Range | COSEWIC Status | SARA Status |
|---|---|---|---|
| *Betula lenta* | Ontario | Endangered | Endangered |
| *Castanea dentata* | Ontario | Endangered | Endangered |
| *Celtis tenuifolia* | Ontario | Threatened | Threatened |
| *Cornus florida* | Ontario | Endangered | Endangered |
| *Fraxinus quadrangulata* | Ontario | Special Concern | Special Concern |
| *Gymnocladus dioicus* | Ontario | Threatened | Threatened |
| *Hibiscus moscheutos* | Ontario | Special Concern | Special Concern |
| *Juglans cinerea* | Ontario, Quebec, New Brunswick | Endangered | Endangered |
| *Magnolia acuminata* | Ontario | Endangered | Endangered |
| *Morus rubra* | Ontario | Endangered | Endangered |
| *Pinus albicaulis* | Alberta, British Columbia | Endangered | No Status |
| *Ptelea trifoliata* | Ontario | Threatened | Threatened |
| *Quercus shumardii* | Ontario | Special Concern | Special Concern |
| *Rosa setigera* | Ontario | Special Concern | Special Concern |
| *Salix brachycarpa* var. *psammophila* | Saskatchewan | Special Concern | Special Concern |
| *Salix chlorolepis* | Quebec | Threatened | Threatened |
| *Salix jejuna* | Newfoundland and Labrador | Endangered | Endangered |
| *Salix silicicola* | Nunavut, Saskatchewan | Special Concern | Special Concern |
| *Salix turnorii* | Saskatchewan | Special Concern | Special Concern |
| *Smilax rotundifolia* | Ontario, Nova Scotia | Threatened (Great Lakes Population) | Threatened (Great Lakes Population) |
| *Vaccinium stamineum* | Ontario | Threatened | Threatened |

***Rosa setigera***

Canada. The species that are assessed as potentially at risk are suggested as candidates for further review to the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). COSEWIC was officially established in 1977, but was legally implemented as the authority for species at risk assessments under SARA in 2003. COSEWIC maintains a list of wildlife species in need of conservation initiatives and also a candidate list of species in need of further evaluation. The role of COSEWIC is advisory and the ultimate decision to place an organism on the Species at Risk List falls upon SARA and the federal government. SARA pro-

## Cucumbertree (*Magnolia acuminata*): Canada's First Endangered Tree

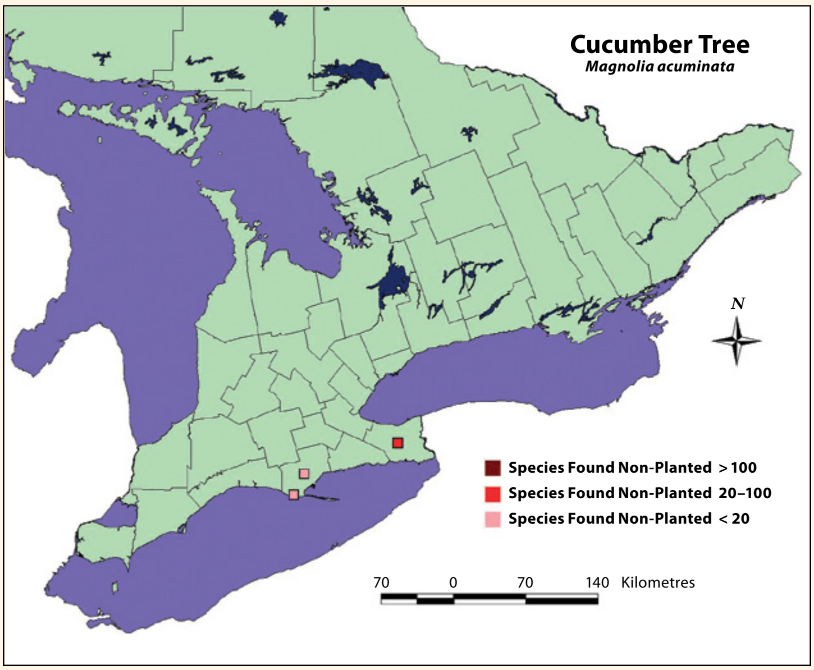
*Magnolia acuminata* was the first tree in Canada to be listed as endangered by COSEWIC in 1984. In 2003, this species was re-evaluated as endangered under the SARA and plans for a recovery strategy were developed.

Cucumbertree has always had a very limited distribution in Canada and is currently only known to occur in two areas of southwestern Ontario. In total, only 283 naturally occurring individuals are known to survive in 12 small, extant populations. These individuals represent an extreme northern extension for a species that forms its most abundant core population in the central Appalachian range of the United States.

The cucumbertrees remaining in Ontario are generally in good health; however, the habitat that supports them is highly fragmented. This segregation has not only reduced the reproductive fitness of the remaining populations (perhaps due in part to a reduction in pollinator-supporting habitat), but it has also eliminated suitable conditions for seedling regeneration. The range of cucumbertree also happens to lie within the most heavily populated area of human settlement in Canada and one of the most rapidly-developing regions in North America.

In-situ conservation efforts to identify and protect individual trees in isolated woodlots have had some success. However, further steps are required to ecologically connect these remaining sites in order to allow this magnificent species to continue its natural migration within Ontario.

**Canada's largest cucumbertree (*Magnolia acuminata*) is about 18 meters (59 feet) tall and has a trunk dbh (diameter at breast height) of 143 centimeters (56 inches).**




ROB GUTHRIE

**The very limited natural Canadian range of cucumbertree (*Magnolia acuminata*) in the southwestern Ontario.**

vides federal legislation aimed at preventing wildlife species from becoming extinct and to aid in their recovery.

COSEWIC only suggests species for listing after a detailed report is written, so only a limited number of rare species have been formally assessed. Therefore, a reduction in natural populations remains a strong concern, even with SARA in place. To add even more confusion, SARA does not apply to plant species on public land under provincial jurisdiction, so as signatories to the NAPSR, all provinces and territories are mandated to oversee their own programs to protect species at risk. In Ontario, the Endangered Species Act (ESA) was officially implemented in 2007.

The unusual flower and ripening fruit of pawpaw (*Asimina triloba*).

## THE RARE WOODY PLANTS OF ONTARIO PROGRAM

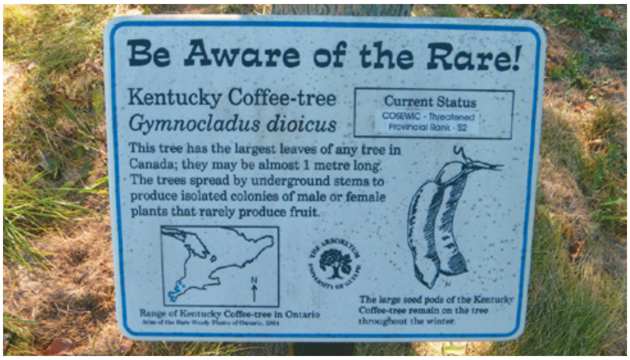
Back in 1978, well before terms such as climate change and global warming were used with any regularity, Dr. John Ambrose, curator of the University of Guelph Arboretum, embarked on a mission to begin evaluating and protecting rare woody flora in Ontario. His goal was not simply to cultivate an ex-situ accession of each species from an Ontario provenance, but to actually capture as much representation of the wild populations in Ontario as possible. With this target in mind, the Rare Woody Plants of Ontario Program was born.

The first phase of the program was lovingly dubbed "Picking up the Pawpaws" in reference to one of Ontario's most unique and seemingly out-of-place native plant species, *Asimina triloba,* which looks more suited to the tropics. The aim was to conduct extensive surveys of all of southern Ontario's rare woody species to better understand their distribution and relative abundance. This also doubled as an outreach program to educate the general public about some of Ontario's unique plant species that they had never even heard of before, let alone knew existed in Canada. Many property owners were excited to learn that the inconspicuous green shrubs in their back forty were actually rare and significant species. As a sense of pride and stewardship began to develop, some of these citizens moved forward in the following decades to become active members in non-governmental conservation and naturalist organizations. Some of these groups continue to play a prominent role in spreading the initial message of the program: the importance of in-situ conservation.

Much of the information gathered during the initial surveys also continues to prove invaluable in the ongoing development of legislatively-important COSEWIC assessments. Even after his retirement from the botanical garden world, Dr. Ambrose continues to play a leading role in protecting rare species in Ontario, including surveying and writing COSEWIC reports for at-risk species.

## AN EXCELLENT SITUATION FOR EX-SITU CONSERVATION

The second phase of the Rare Woody Plants of Ontario program revolved around developing a strong ex-situ conservation program at the University of Guelph Arboretum, which spans 165 hectares (408 acres) with over 1,700




**A series of interpretive plaques were created for Ontario's rare woody plants with support from BGCI Canada's *Investing in Nature: A Partnership for Plants* program. Here, Kentucky coffeetree (*Gymnocladus dioicus*) is highlighted in the University of Guelph Arboretum's World of Trees collection.**


PEGGY HURST

**John Ambrose (right), with botanists Lindsay Roger and Gerry Waldron, upon their discovery of a new species to Canada, swamp cottonwood (*Populus heterophylla*), in 2002.**

## The Eastern Redbud (*Cercis canadensis*): O Canada—Its Home and Native Land?

A specific epithet like *"canadensis"* might lead one to believe that eastern redbud floods the understory of the great northern forests. But, despite its seeming patriotism to Canada, this beautiful species is not quite as common in the north as one might think.

In Gerry Waldron's wonderful book, *Trees of the Carolinian Forest* (2003), he quotes the great Canadian botanist, John Macoun, as he recounts his first and only sighting of eastern redbud on Canadian soil in 1892:

> *… I was informed that a remarkable tree grew on the south end of the island, that many years ago produced an abundance of lovely red flowers in early spring before the leaves came out … the next day I examined the south point and found the tree. It had been undermined by the waves and fallen inland, and more than half its limbs were dead, but it still bore leaves and what remained was quite healthy. It will soon disappear, but the record of its existence will remain.*

**These flower buds of eastern redbud (*Cercis canadensis*) show the species' interesting trait of cauliflory (flower and fruit production from woody stems). This accession (1988-0284.002) in the World of Trees collection at the University of Guelph Arboretum is from a cold-hardy provenance in Wayne County, Michigan.**

This tree that Macoun happened across remains the only naturally-occurring individual ever discovered in Canada. This plant grew at Fish Point, Pelee Island, in Lake Erie—the most southerly point in all of Canada, and, as he predicted, was eventually swallowed by the lake as the shoreline eroded away. While there are naturalized populations established in parts of southwestern Ontario, as escapees from cultivated stock, eastern redbud is now officially ranked as extirpated in Canada.

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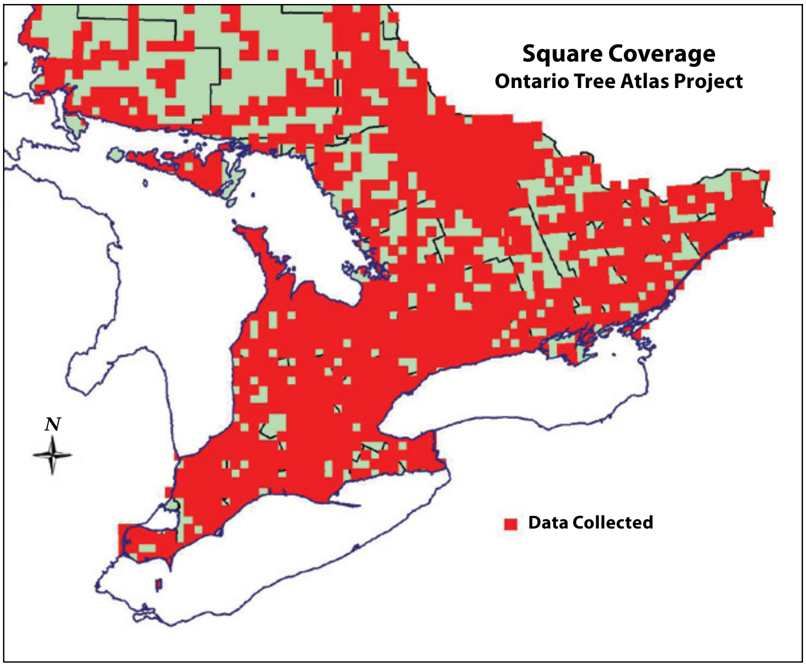



**Locations surveyed by the University of Guelph Arboretum for the presence of naturally-occurring, at-risk species are displayed in this map of southwestern Ontario.**

taxa of woody flora represented in its collections. The major emphasis is on the woody flora of eastern North America, with special attention being given to the rare woody flora of Ontario.

After initial surveys were completed, provenance-based germplasm collections were made in order to capture as great a representation of a species' provincial population as possible. Vegetative propagules were gathered for the establishment of a germplasm repository at the University of Guelph Arboretum, in the form of living gene banks. The gene banks at the Arboretum are arranged as seed orchards and serve two main purposes:

**(1)** To provide ex-situ back up for failure at in-situ conservation

**This pumpkin ash (*Fraxinus profunda*) accession (1994-0010.001) in the World of Trees collection at the University of Guelph Arboretum was cultivated from seed collected in Essex County, Ontario, very shortly after the discovery of the species in Canada in 1992.**

**Here, the blue ash (*Fraxinus quadrangulata*) gene bank at the University of Guelph Arboretum provides a secure site for a faculty research project.**

## Table 2. Accessions of known, wild, Ontario-based provenance for selected rare woody taxa under cultivation at the University of Guelph Arboretum.

| Taxon | Risk Ranking* | Total Number of Accessions | Total Number of Individuals |
|---|---|---|---|
| *Aesculus glabra* | G5, S1 | 5 | 20 |
| *Asimina triloba* | G5, S3 | 8 | 12 |
| *Betula lenta* | G5, S1 | 9 | 44 |
| *Campsis radicans* | G5, S2 | 3 | 4 |
| *Carya laciniosa* | G5, S3 | 6 | 25 |
| *Carya glabra* | G5, S3 | 3 | 7 |
| *Castanea dentata* | G4, S3 | 2 | 3 |
| *Celtis tenuifolia* | G5, S2 | 5 | 13 |
| *Cornus drummondii* | G5, S4 | 5 | 26 |
| *Cornus florida* | G5, S2 | 8 | 17 |
| *Euonymus atropurpurea* | G5, S3 | 6 | 16 |
| *Fraxinus profunda* | G4, S2 | 1 | 3 |
| *Fraxinus quadrangulata* | G5, S3 | 20 | 26 |
| *Gleditsia triacanthos* | G5, S2 | 7 | 38 |
| *Gymnocladus dioicus* | G5, S2 | 26 | 87 |
| *Hibiscus moscheutos* | G5, S3 | 1 | 2 |
| *Juglans cinerea* | G4, S3 | 12 | 32 |
| *Liriodendron tulipifera* | G5, S4 | 11 | 15 |
| *Magnolia acuminata* | G5, S2 | 16 | 37 |
| *Morus rubra* | G5, S2 | 5 | 21 |
| *Morella pensylvanica* | G5, S1 | 3 | 3 |
| *Pinus rigida* | G5, S2 | 4 | 5 |
| *Platanus occidentalis* | G5, S4 | 10 | 18 |
| *Ptelea trifoliata* | G5, S3 | 22 | 43 |
| *Quercus ellipsoidalis* | G5, S3 | 2 | 2 |
| *Quercus muehlenbergii* | G5, S4 | 16 | 64 |
| *Quercus prinoides* | G5, S2 | 2 | 9 |
| *Quercus shumardii* | G5, S3 | 4 | 9 |
| *Rosa setigera* | G5, S3 | 6 | 8 |

*** G-global, S-provincial**
**G1-extremely rare, G2-very rare, G3-rare to uncommon, G4-common, G5-very common**
**S1-critically imperiled, S2-imperiled, S3-vulnerable, S4-apparently secure, S5-secure**

efforts related to habitat loss and natural calamities. This is especially critical for many hardwood species that possess recalcitrant seeds that are difficult to store under conventional seed banking practices.

**(2)** To produce enough seed, through open or controlled pollination, to take the seed collecting pressure off of natural populations in Ontario. Seed produced will provide a valuable and readily accessible resource for restoration efforts, in addition to supplying material with promising horticultural attributes with respect to cold hardiness.

Today, a number of species that are at risk in Ontario have their germplasm archived within the Arboretum's gene banks and plant collections (see table 2). Much of the research conducted to develop germination and cultivation requirements for these rare species was published in 2008 in the book *Growing Trees from Seed* by Henry Kock, late University of Guelph Arboretum horticulturist. The accessions established at the Arboretum represent a significant portion of the genetic diversity for these very rare species at the northern extreme of their geographic range. Several of these accessions are from provenances that have already been lost in the wild.

In addition, many of the early provenance-based seed collections were distributed internationally to botanical organizations for more broad-based ex-situ archiving. A look through the plant inventories of many botanical gardens and arboreta will display cultivated material of species from these Ontario provenances.

**The first crop, in 2006, from the shellbark hickory (*Carya laciniosa*) gene bank at the University of Guelph Arboretum.**

**Pawpaw (*Asimina triloba*) seedlings growing in the nursery at the University of Guelph Arboretum.**

## PLANTING SEEDS FOR THE FUTURE

The Rare Woody Plants of Ontario Program was first initiated at the University of Guelph Arboretum over 30 years ago, and conservation efforts focusing on Ontario's native woody flora continue to this day. In addition to the endeavors already discussed, the Arboretum is currently engaged in several activities to build upon our conservation programs.

In 2006, after the early passing of our beloved horticulturist, Henry Kock, an endowment was established to help provide long-term, sustainable funding for our conservation programs. Henry's mission—to archive naturally-occurring Dutch elm disease-tolerant Ameri-

## Kentucky Coffeetree (*Gymnocladus dioicus*): Distribution within the University of Guelph Arboretum

A view from within the Kentucky coffeetree (*Gymnocladus dioicus*) gene bank at the University of Guelph Arboretum.

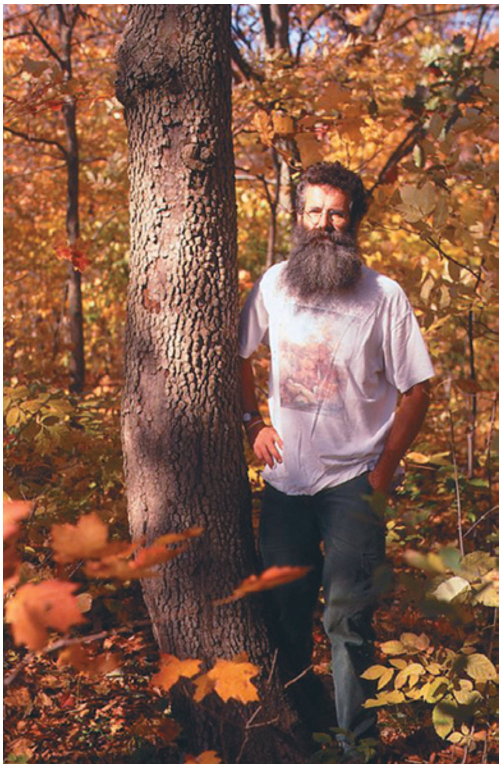
WHILE gene banking various accessions within seed orchards makes archiving and maintaining plant material simpler, a strong effort has also been made to establish accessions in suitable botanical and horticultural collections throughout the Arboretum. Distributing our conservation collections in this fashion serves several purposes:

- Accessions throughout our 165 hectare (408 acre) site provide insurance measures against localized disturbances (e.g., weather events, vandalism).
- The incorporation of rare native flora into various formal collections increases the value of our interpretive programs and provides visitors with the opportunity to see important species that are unlikely to be spotted in the wild.
- At-risk species planted throughout the site provide strategic long-term protection for the Arboretum property itself against any potential outside development activities in the future.

A well-established Kentucky coffeetree seed orchard is now starting to bear fruit, but you can also find accessions of known, wild provenance in other locations within the Arboretum.

**Table 3. Accessions of *Gymnocladus dioicus* under cultivation at the University of Guelph Arboretum of known, wild, Ontario-based provenance.**

| Collection or Area | Number of Represented Accessions | Number of Represented Individuals |
|---|---|---|
| Gene Bank Seed Orchard | 26 | 65 |
| World of Trees Collection | 1 | 7 |
| Leguminosae Family Collection | 6 | 6 |
| Native Trees of Ontario Collection | 1 | 5 |
| Gosling Wildlife Gardens: Native Plant Garden | 1 | 1 |
| RJ Hilton Center Accent Planting | 1 | 1 |
| Arboretum Nursery Archival Plantings | 2 | 2 |



ANNE HANSEN

**Late University of Guelph Arboretum horticulturist Henry Kock standing next to Canada's largest eastern flowering dogwood (*Cornus florida*).**

HENRY KOCK

**The accessioned plants in the cucumbertree (*Magnolia acuminata*) gene bank at the University of Guelph Arboretum bear mature fruit on an annual basis.**

**Over the past ten years, several bumper crops have been produced in the sweet birch (*Betula lenta*) gene bank at the University of Guelph Arboretum.**

can elm (*Ulmus americana*) germplasm at the Arboretum—provided the incentive to refer to this as the Henry Kock Tree Recovery Endowment. This endowment provides the opportunity to work with not only elm, but also with any other woody species in Ontario that are in need of recovery efforts in the future.

Ontario's Elm Recovery Project is currently operated out of the University of Guelph Arboretum with an archival germplasm repository in the beginning stages of development. The provincial Butternut Recovery Program was initiated several years ago by the Forest Gene Conservation Association (FGCA) with the Arboretum serving as one of their archival planting sites. The Royal Botanical Gardens (RBG Ontario) is currently undertaking a program to breed pure, non-hybridized red mulberry (*Morus rubra*), a species endangered in Ontario because of white mulberry (*Morus alba*) invasion. The University of Guelph Arboretum serves as a partner and site for a future ex-situ conservation collection.

Provincial field studies and seed collection trips are ongoing for species at risk in Ontario, with a particular emphasis on recently discovered species such as *Quercus ellipsoidalis* (1978), *Fraxinus profunda* (1992), *Quercus ilicifolia* (1994) and *Populus heterophylla* (2002). These are important species that we hope to further incorporate into our ex-situ collections at the Arboretum.

As our existing seed orchards continue to produce increasingly sound crops, we are now in the position to better distribute this seed to nurseries and local conservation authorities to aid in their restoration activities. Large crops of seed will also be archived at the National Tree Seed Center in Fredericton, New Brunswick, and the Ontario Tree Seed Plant in Angus, Ontario. Seed will continue to be available to other botanical institutions for conservation and research purposes.

In this modern era, and with an unstable economy, most botanical gardens and arboreta are facing tough challenges with budget and staff cuts. As the years have progressed at the University of Guelph Arboretum, we've also had to make difficult decisions regarding the activities that we have the capacity to engage in successfully. While we've had to scale back several of our display-based horticultural collections, we've found that our conservation programs have helped to provide a niche that further defines the mission of our organization.

It must always be remembered that ex-situ conservation programs, as valid and critical as they are, don't hold a candle to ecosystem conservation, expansion, and linkage. These in-situ conservation activities must be represented in our highest aspirations as citizens and nations. However, the important role that botanical gardens and arboreta can play must not be underestimated either. Whether it is the education, outreach, research, stewardship, or conservation hat that is being worn, public gardens are in a unique position to be meaningfully engaged in rare flora programs both locally and globally.

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Sean Fox is the Assistant Arboretum Manager and Head Horticulturist at the University of Guelph Arboretum in Ontario, Canada.

# Land Bridge Travelers of the Tertiary: The Eastern Asian–Eastern North American Floristic Disjunction

*David Yih*

The eastern Asian–eastern North American floristic disjunction is a curious phenomenon that has fascinated botanists for over 200 years: the existence of an entire catalog of species and genera shared by two vastly separated regions and found nowhere else. It has inspired generations of researchers and given impetus to such fields as biogeography and paleobotany. Scientists now recognize many different disjunct patterns around the world, but the eastern Asian–eastern North American was the first to be discovered, and remains the classic disjunction. It continues to stimulate new scientific papers, with each successive generation applying new research tools to its mysteries.

Recognition of the disjunction began in the 1750s with botanists making lists of species found in both regions. By the mid-1800s botanists had collected enough materials to lead them to the astounding conclusion that the flora of eastern North America (ENA) had more in common with eastern Asia (EA) than it did with western North America. Most of

PETER DEL TREDICI

**ENA meets EA: A garden path separates the eastern North American species Allegheny spurge (*Pachysandra procumbens,* left) from the eastern Asian species Japanese spurge (*Pachysandra terminalis*).**

what were once thought to be identical species are now considered congeners (distinct species belonging to the same genus), so the disjunction is more about shared genera than shared species, and it is now clear that eastern North America has more in common with western North America than with eastern Asia. However, it is also clear that eastern Asia and eastern North America have more in common than eastern Asia and western North America and that a remarkable disjunction phenomenon exists. Today, the list of EA-ENA botanical "disjuncts" (shared taxa peculiar to the two regions) includes about 65 genera, a handful of closely related genera, and a few species (Wen 1999).

Most of the genera are temperate; only a few come from subtropical or tropical zones. And most disjuncts are woody plants. Many of the herbaceous ones are early-leafing species adapted to thrive on the forest floor. Some EA-ENA disjunct genera that have familiar representative species in the Northeast are listed in Table 1 (Li 1952), along with generalized common names for the species.

## DISJUNCT REGIONS

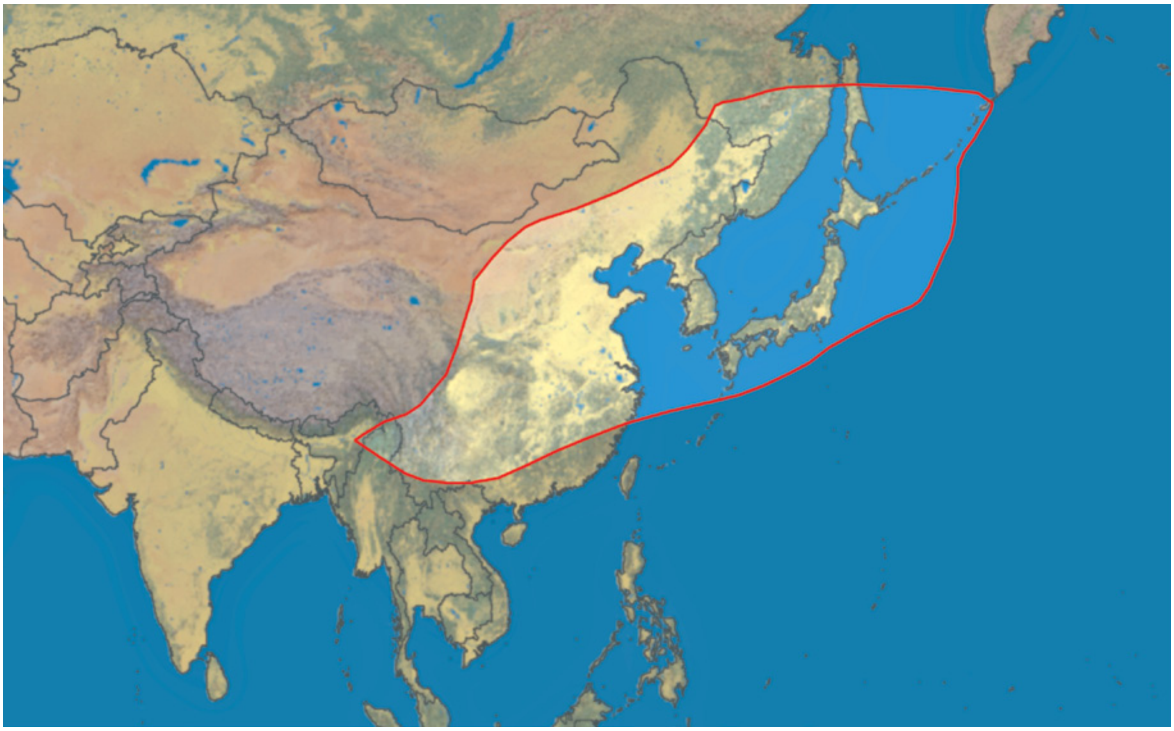
The majority of eastern Asian disjuncts grow in the Sino-Japanese Floristic Region, which extends from China's western Yunnan and Sichuan provinces through central, eastern, and most of southern China to Korea and Japan. The richest association of disjunct genera occurs in central China, along the longest river in Asia: the Yangtze (Li 1952). On the American side, the richest disjunct area is along the Appalachian Mountains. The two areas are the only instances globally of the mixed mesophytic forest, one of the most biodiverse temperate forest types in the world.

Western botanists have reported experiencing a sense of déjà vu in the forests of China. Add to the disjuncts the more wide-ranging species that also occur in both regions, and the level of similarity becomes quite high. A recent study found that 67% of the seed plant genera in Maine occur on Japan's Honshu Island (Qian 2002). The similarity was even greater in ages past. Several genera that are now endemic to eastern Asia occur in fossil form in North America, e.g., the familiar *Ginkgo* and *Metasequoia* (dawn redwood), while fossil remains of *Sequoia* (redwood) and *Taxodium* (baldcypress), genera now confined to North America, have been found in eastern Asia.

At present, the similarity is limited by pronounced differences in biodiversity. Disjunct genera tend to have more species in Asia than in America. The extreme example is *Lindera*, with 80 species in eastern Asia but only 2 in North America. Indeed, eastern Asia, with its 2,753 genera of seed plants, has a biodiversity far greater than that of eastern North America, which has only 1,230. According to one explanation, the Paleocene forests of both regions were equally rich in species until severe climatic fluctuations in North America resulted in many extinctions. Another possibility is that the complex topography of eastern Asia promoted a greater rate of speciation there due to

### Table 1

| WOODY | |
|---|---|
| *Campsis* | Trumpet vine |
| *Carya* | Hickory |
| *Catalpa* | Catalpa |
| *Cornus* | Dogwood |
| *Gleditsia* | Honey locust |
| *Hamamelis* | Witchhazel |
| *Liquidambar* | Sweetgum |
| *Liriodendron* | Tuliptree |
| *Lyonia* | Maleberry |
| *Mitchella* | Partridgeberry |
| *Nyssa* | Tupelo |
| *Pachysandra* | Pachysandra |
| *Parthenocissus* | Virginia creeper |
| *Sassafras* | Sassafras |
| **HERBACEOUS** | |
| *Panax* | Ginseng |
| *Phryma* | Lopseed |
| *Podophyllum* | Mayapple |
| *Saururus* | Lizard's tail |
| *Symplocarpus* | Skunk cabbage |



**The Sino-Japanese Floristic Region.**

PETER DEL TREDICI

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**Manchurian catalpa (*Catalpa bungei*), left, is native to China, while northern catalpa (*Catalpa speciosa*), right, is native to the central and eastern United States and southern Ontario.**

COURTESY OF DAVID CREECH

NANCY ROSE

**Showy flowers are a feature shared by Chinese trumpet creeper (*Campsis grandiflora*), left, and the familiar trumpet creeper (*Campsis radicans*) of North America, right.**

ROBERT MAYER

***Lindera obtusiloba* (seen here in fall color at the Arnold Arboretum) is one of the many *Lindera* species native to eastern Asia.**

the abundance of varied habitats and natural barriers that could allow different populations of a species to evolve separately (Sargent 1913; Qian and Ricklefs 2000). The EA–ENA disjunction is now recognized not only among plants, but among taxa of fungi, arachnids, millipedes, insects, and freshwater fish, as well (Wen 1999). But botanists can take credit for being the first to notice and document the phenomenon.

## A THEORY BLOOMS

The earliest hint came in the 1750 dissertation of Halenius, a student of Linnaeus. It mentions nine species found both on Siberia's Kamchatka peninsula and in North America, including members of genera familiar to New England botanists: *Asplenium, Lycopodium, Anemone, Heuchera,* and *Spirea.* Commercial exploitation of the phenomenon had already begun. Père Lafitau, a French Jesuit, had discovered American ginseng (*Panax quinquefolius*) growing near Montreal in 1716, and French Canadians were neglecting their farms in the rush to collect wild ginseng for export to China (Kingsford 1888). In 1784, C. P. Thunberg, a Swedish botanist, included in his *Flora Japonica* twenty species first described for North America (Boufford and Spongberg 1983). The following year, the Italian botanist Luigi Castiglioni began a two-year sojourn in the United States. Castiglioni's mission was to bring back useful seeds to Italy, and he is credited with introducing to continental Europe such trees as black locust (later to show invasive tendencies), catalpa, and arborvitae. In 1790 he published his *Viaggio negli Stati Uniti dell' America,* with elegant botanical drawings of such American sights as the franklintree, already rare in the wild and soon to be extinct outside of cultivation. It also contains the first explicit discussion of the floristic similarity of eastern North America to Japan, the only part of eastern Asia for which published floras were then available. Overlooked by nearly all who would later treat the disjunction, he received scant credit for his role in its discovery (Li 1955). Brief comments in the work of Pursh and then Nuttall reveal little beyond an incipient recognition of the disjunction, though Nuttall

MICHAEL DOSMANN

NANCY ROSE

**Though their flowers look similar, Chinese witchhazel (*Hamamelis mollis*), left, blooms in late winter or very early spring while common witchhazel (*Hamamelis virginiana*), right, blooms in late fall or early winter in eastern North America.**

PETER DEL TREDICI

PETER DEL TREDICI

**Cultivated Chinese ginseng (*Panax ginseng*), left, and a fruiting specimen of American ginseng (*Panax quinquefolius*), right.**

undertook to note the geographical distributions of North American genera. It remained for Asa Gray, the preeminent American botanist of the nineteenth century, to focus attention on the disjunction, bringing it to the notice of the wider scientific community in a series of articles beginning in 1840 and spanning nearly 40 years.

Charles Darwin, who began an extensive correspondence with Gray in 1855, encouraged him to study the global distributions of the North American flora. In his second letter to Gray he wrote, "The ranges of plants, to the east and west, viz. whether most are found in Greenland and Western Europe, or in E. Asia appears to me a very interesting point as tending to show whether the migration has been eastward or westward" (Darwin 1855). In 1859, after studying new collections from Japan, Gray published his classic "Diagnostic Characters" paper that included a list of 134 species shared by eastern North America and Japan. On the list were such northeastern plants as blue cohosh (*Caulophyllum thalictroides*), fox grape (*Vitis labrusca*), ditch stonecrop (*Penthorum sedoides*), honewort (*Cryptotaenia canadensis*), hobblebush (*Viburnum lantanoides*), wild ginger (*Asarum canadense*), red trillium (*Trillium erectum*), large twayblade (*Liparis liliifolia*), and rose pogonia (*Pogonia ophioglossoides*). All were later shown to be distinct from their Asian counterparts—belonging to the same disjunct genus, but different species. The two ferns on Gray's list, sensitive fern (*Onoclea sensibilis*) and cinnamon fern (*Osmunda cinnamomea*), turned out to be too widespread globally to qualify as disjunct species (Li 1952). In addition to comparing the flora of Japan to various other regions, Gray's "Diagnostic Characters" contains an extended discussion of the EA-ENA disjunction. "It will be almost impossible to avoid the conclusion," he writes, "that there has been a peculiar intermingling of the eastern American and eastern Asian floras which demands explanation" (Gray 1859). It was the eve of the appearance of Darwin's *Origin of Species,* during a ferment of interest in the natural world, and there was no shortage of theories on such topics. "Schouw's hypothesis" held that there had been multiple geographic origins of many species. At a time when naturalists were struggling to reconcile scientific rigor with cherished beliefs, Gray was also conversant with such hybrid approaches as Maupertius's "principle of least action," according to which it was "inconsistent with our idea of Divine wisdom that the Creator should use more power than was necessary to accomplish a given end" (quoted in Gray 1859). By applying this principle, one could argue (without sacrificing piety) that once created, the far-flung species had migrated on their own, rather than requiring further divine intervention. With characteristic grace, Gray gave dispassionate consideration to all points of view. J. D. Hooker, the prominent British botanist and a close friend of Darwin, had recently proposed, in relation to southern-hemisphere taxa, "the hypothesis of all being members of a once more extensive flora, which has broken up by geological and climatic causes" (quoted in

COURTESY OF TOM BARNES, UNIVERSITY OF KENTUCKY

**Rose pogonia (*Pogonia ophioglossoides*), seen here, is native to bogs in much of eastern North America. *Pogonia japonica* (formerly listed as *P. ophioglossoides* var. *japonica*) is a very similar-looking species native to Japan and parts of China.**

Boufford and Spongberg 1983). In the end, Gray applied a similar hypothesis to the Asian and American floras. With various refinements, it remains in effect to this day.

## THE ONGOING PUZZLE

With the general adoption of cladistics in the latter part of the twentieth century and rapid advances in molecular genetics, new tools have emerged for studying the disjunction. Most scientific papers from the last twenty years use molecular data and focus on a single disjunct genus. There are several sorts of molecular-level data to choose from (the most popular has been ITS—short for sequences of internal transcribed spacer regions of nuclear ribosomal DNA). Though their relative merits are still being assessed, the information they yield pertains not only to phylogeny (how disjuncts are related in terms of evolutionary descent), but also to dating divergence times and inferring pathways and directions of migration.

Often the genetic analyses match nicely with the prior work of traditional taxonomists. The genus *Sassafras,* for example, is monophyletic. That is, its three species constitute a clade. The eastern North American *S. albidum* is "sister" to the smaller clade made up of its two eastern Asian counterparts. Molecular data subjected to statistical methods put their intercontinental divergence time at around 15 million years ago (Nie et al. 2007). *Sassafras* also illustrates several frequent patterns; diversification in one or both continents following the time of separation is common, and disjunct genera tend to have more eastern Asian than American representatives.

The upshot of all the investigations into geology, the fossil record, climate studies, taxonomy, and the molecular clocks and phylogenetic analysis of modern genetics is still a necessarily tentative picture of the disjunction's history. But there is agreement on the broad outlines. Most scientists do not consider

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**Asa Gray listed sensitive fern (*Onoclea sensibilis*) as a disjunct species, but it was later determined simply to be a very globally widespread species.**

**Native ranges of *Sassafras* species in eastern North America and eastern Asia.**

PETER DEL TREDICI

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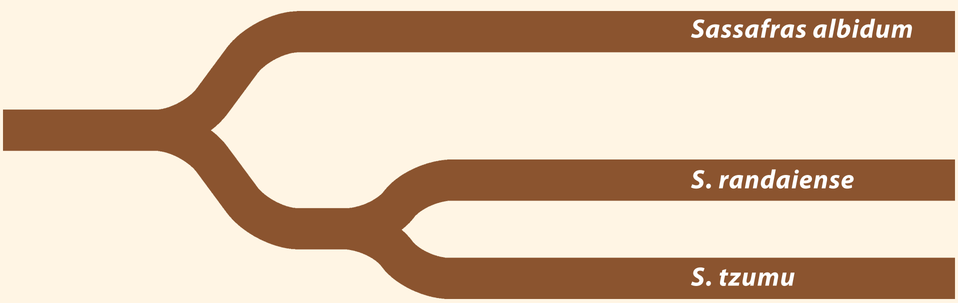
**Foliage of *Sassafras albidum* (left), a familiar native tree in much of the eastern United States, and of *S. tzumu* (right), native to China.**




**The entire genus *Sassafras,* which constitutes a clade. The eastern North American *S. albidum* is "sister" to the smaller clade made up of its two eastern Asian counterparts, *S. tzumu* and *S. randaiense.***

MICHAEL DOSMANN

CHRIS EVANS, RIVER TO RIVER CWMA, BUGWOOD.ORG

**Autumn foliage of kousa dogwood (*Cornus kousa*), top, from Asia, and flowering dogwood (*Cornus florida*), bottom, from North America.**

long-distance dispersal to have played much of a role. The prevailing view is that most disjuncts are remnants of genera that were once widely distributed in the northern temperate zone during the Tertiary period. These broad distributions in the northern hemisphere were made possible by recurring land bridges. Bering land bridges connecting Asia to North America were present at several times since the Mesozoic era. North Atlantic land bridges connected North America to Europe via Greenland beginning in the early Tertiary, and by the mid-Tertiary, Europe and Asia were connected by a land bridge along the Tethys Seaway. After the establishment of the northern Tertiary flora, the formation of the Rocky Mountains brought profound changes in climate and rainfall patterns, causing the genera to disappear from western North America during the late Tertiary and Quaternary. During the Quaternary glaciations, they were also extirpated from Western Europe.

Drawing on fossil, geologic, and climatic evidence, B. H. Tiffney proposed five different time periods during which migrations over the land bridges may have occurred between the two regions (pre-Tertiary, early Eocene, late Eocene-Oligocene, Miocene, and late Tertiary to Quaternary), with different types of plants featured in each migration (Tiffney 1985). A multiple-origins view is also supported by molecular evidence. Molecular clock data from *Cornus, Boykinia,* and *Calycanthus* suggest that the disjunction could have involved multiple events at different geological times in different genera (Xiang et al. 1998).

Ultimately, the EA-ENA disjunction is part of a broader picture that will occupy biogeographers for years to come. Studies of northern hemisphere intercontinental disjuncts point to complex biogeographical relationships among taxa in five major regions, including not only eastern Asia, eastern North America, and western North America, but western Asia and southeastern Europe as well. Darwin's desire to determine whether migration happened "eastward or westward" has grown into a multifaceted field of study.

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David Yih, Ph.D., is a musician, writer, and naturalist.

# A Rare Find: Yellow-Fruited Spicebush (*Lindera benzoin* forma *xanthocarpum*)

Richard Lynch

There are as many different harbingers of spring as there are fond memories in the minds of the people who look for them. For some, the last of the snow melting off a northern slope fits the bill. For others, the first chorusing of spring peepers (*Hyla crucifer*) in the still-cold ponds of late March provides hope for the warmer seasons to come. For those with a more botanical bent, and especially for lovers of the deep woods across the eastern United States, the opening of the tiny yellow flowers of spicebush (*Lindera benzoin*) clearly marks the tipping point from winter to spring. In many parts of the Northeast, spicebush is the first shrub to flower and is often timed with the arrival of mourning cloaks (*Nymphalis antiopa*) and spring azure butterflies (*Celastrina ladon*).

Spicebush also plays a role in alerting nature lovers that the fall season approaches. By the middle of September, female plants begin to display some of the brightest red fruit found in nature. Plants growing in deep woods will be a bit sparse in fruit, but those growing along the forest edge or near wetlands can produce a great profusion of colorful fruit. There are a great number of resident and migrating bird species that take full advantage of the bounty, and often within a week or two the

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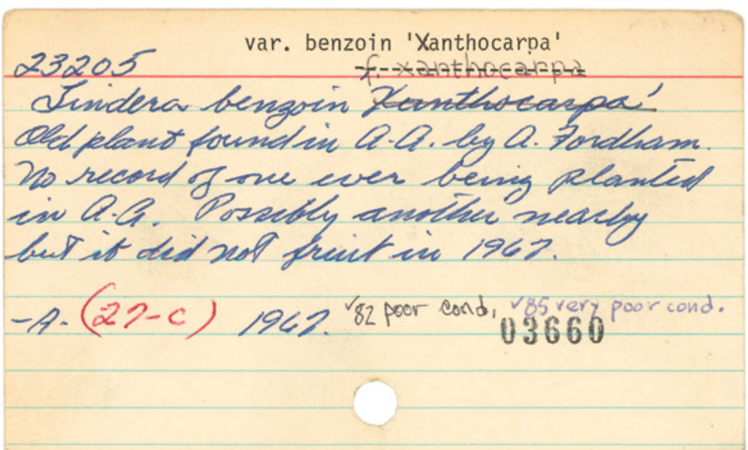
**The typical bright red fruit of spicebush (*Lindera benzoin*).**

ALL PHOTOS BY THE AUTHOR UNLESS OTHERWISE INDICATED

***Lindera benzoin* forma *xanthocarpum* bears golden-yellow fruit.**

**A view across the lowland sweetgum–red maple forest in the Staten Island Greenbelt.**



var. benzoin 'Xanthocarpa'
23205 ~~f. xanthocarpa~~
Lindera benzoin 'Xanthocarpa'
Old plant found in A.A. by A. Fordham.
No record of one ever being planted
in A.A. Possibly another nearby
but it did not fruit in 1967.
-A- (27-C) 1967. √82 poor cond, √85 very poor cond.
03660

**The old hand-written accession card for the yellow-fruited spicebush found at the Arnold Arboretum reads: "Old plant found in A.A. by A. Fordham. No record of one ever being planted in A.A. Possibly another nearby but it did not fruit in 1967." The plant's nomenclature had been changed several times over the years. The last note from 1985 indicated that the plant was in "very poor condition" and it presumably died sometime after that.**

fruit have been harvested and carried off by wildlife.

Though bright red is the typical fruit color, there is also a yellow-fruited spicebush (*Lindera benzoin* forma *xanthocarpum*). The story of this unusual variant begins in Shrewsbury, Massachusetts, in 1913, where it was discovered by Mrs. Frank E. Lowe. A description of the plant written by G. S. Torrey was published the following year in *Rhodora* (note that the species name was then *Benzoin aestivale* rather than the current *Lindera benzoin*):

> "On October 4, 1913, Mrs. Frank E. Lowe collected in Shrewsbury, Mass., specimens of the Spice Bush, *Benzoin aestivale* Nees., which differed from the common form in having the drupes orange-yellow, instead of bright red. Several bushes were found, some growing with the typical form in low, damp places; some alone, in drier ground in a rocky pasture. They all bore yellow fruit, which were ripe and falling. The material was sent by Mrs. Lowe to Mrs. E. L. Horr of the Worcester Natural History Museum, by whom it was referred to the Gray herbarium. The plant may be characterized as follows: BENZOIN AESTIVALE (L.) Nees., forma xanthocarpum, forma nova, fructus flavis."

There seems to be no record of the progress of the plant after its first find in Shrewsbury, at least until the discovery by propagator Alfred Fordham of a plant at the Arnold Arboretum in 1967. It was recorded as spontaneous

**Thousands of native plant seedlings growing in the propagation range at the Greenbelt Native Plant Center.**

(not purposely planted), but given how rare the plant seems to be in nature, one could conjecture whether the Arboretum plant might not have had its genesis from the seeds that were collected from the Shrewsbury population in 1913 or perhaps sometime later. Sadly, the plant that was known at the Arboretum went missing itself sometime after 1967.

The story of the yellow-fruited spicebush continues in New York City (of all places!) where, in 2007, seeds were collected in the Staten Island Greenbelt—an 1,800-acre nature reserve that is part of the New York City Department of Parks and Recreation. The Greenbelt Native Plant Center (begun in 1986) employs 22 full-time staff in the production of hundreds of thousands of native plants that supply native plant restoration projects throughout the region, and they had asked me about good sites for collecting spicebush seeds. I recommended an area in the Greenbelt that I knew contained many thousands of spicebushes and brought some of the staff (including nursery manager Tim Chambers and woody plant propagator Sam Pattison) on a collecting trip to the site. While having a conversation with Tim about the status of endangered native plants of the region (my favorite topic of conversation), Sam returned with a collecting bag full of bright red fruit. Scattered among the red fruit were a number of yellow ones. Before Sam had a chance to add his to a much larger container filled with many hundreds of fruit, I asked to see his yellow fruit and began to marvel at what he had discovered.

We retraced the steps he had taken in collecting the fruit and found a single small shrub growing in a thick lowland grove of red maples (*Acer*

**Spicebush grows in full sun in this successional meadow in the Staten Island Greenbelt.**

**Green milkweed (*Asclepias viridiflora*), left, and globose flatsedge (*Cyperus echinatus*), right, are two of the rare (in New York) plants found growing in a sunny meadow within the Staten Island Greenbelt.**

*rubrum*), where a few of the golden-yellow fruit still remained. After the discovery of the first specimen, we made a greater effort to look for the yellow-fruited plants in the vicinity of the first one, but found none. Further up the trail and into a sunny meadow, we discovered two more plants heavily laden with yellow fruit. The meadow is part of a successional grassland growing over serpentine-derived soils and contains other New York State rare plants such as green milkweed (*Asclepias viridiflora*), purple milkweed (*A. purpurea*), and globose flatsedge (*Cyperus echinatus*). We collected these additional yellow fruit and added the fruit from the first collection; these became a separate cohort of seed from which we could propagate.

It turns out that the yellow-fruited spicebush is a rarer taxon than first believed. According to Charles Sheviak, the state botanist for New York, the plant had not previously been recorded as growing in the state. In Massachusetts, state botanist Brian Connelly has no records for any extant populations in the state. Although it is likely that other populations for the plant do exist, there are no other confirmed populations known in these two states.

The question then arises as to what conservation efforts, if any, need to be taken to ensure the continued existence of the plant in the wild. In using the term "forma" in describing the plant, G. S. Torrey seems to convey the belief that the plant is a random mutation, not sustainable over time, occurring within a larger population. In general, the term "variety" would be used to describe a plant that is self-sustaining or represents a variant that covers a portion of the range of a larger species description.

Given that we don't know either the genetic differences that separate the yellow-fruited spicebush from the more common red-fruited plant, or the potential adaptive differences of the two plants in nature, there remains the outstanding question as to the true taxonomic status of the plant. The first yellow-fruited spicebush seedlings grown from the seeds we collected are reaching flowering size, so we may know within a year or two if the fruit color is inherited from one generation to another (though this might be complicated by the obligate out-crossing nature of spicebush in the wild, as the yellow-fruited plants grow within a colony of several thousand red-fruited plants). We may also consider undertaking experiments to determine if yellow-fruited plants are as attractive as red-fruited plants to wildlife that act as dispersers of the seeds in the wild (though, in general, it is believed that red-fruited plants are favored over other colored fruit by many migrating bird species). It may take some time to unravel the true nature of this elusive plant.

At the very least, we can feel fortunate that the rediscovery of the yellow-fruited spicebush allows a much broader horticultural audience to grow and appreciate the plant. Like the beloved Franklin tree (*Franklinia alatamaha*), the yellow-fruited spicebush might not be the best "fit" for Nature, but at least generations of nature-lovers can enjoy the plant in a more horticultural setting.

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Richard Lynch is a botanist and president of the Sweetbay Magnolia Conservancy, a not-for-profit organization dedicated to the study and preservation of rare plants in the vicinity of New York City.

**The author with a three-year-old seedling of yellow-fruited spicebush growing at the Greenbelt Native Plant Center on Staten Island.**

# Book Review:

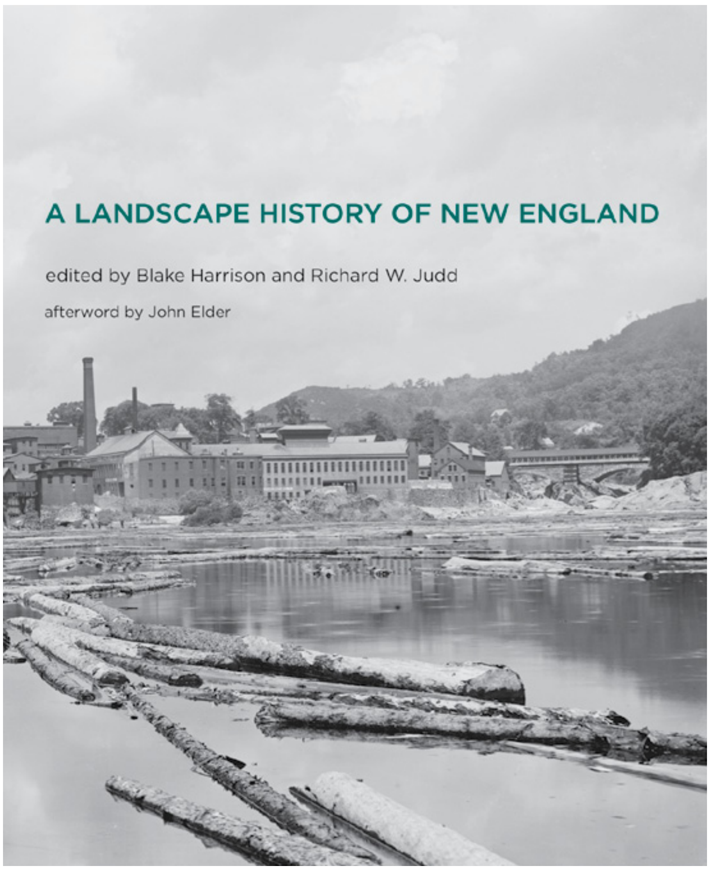
*Phyllis Andersen*

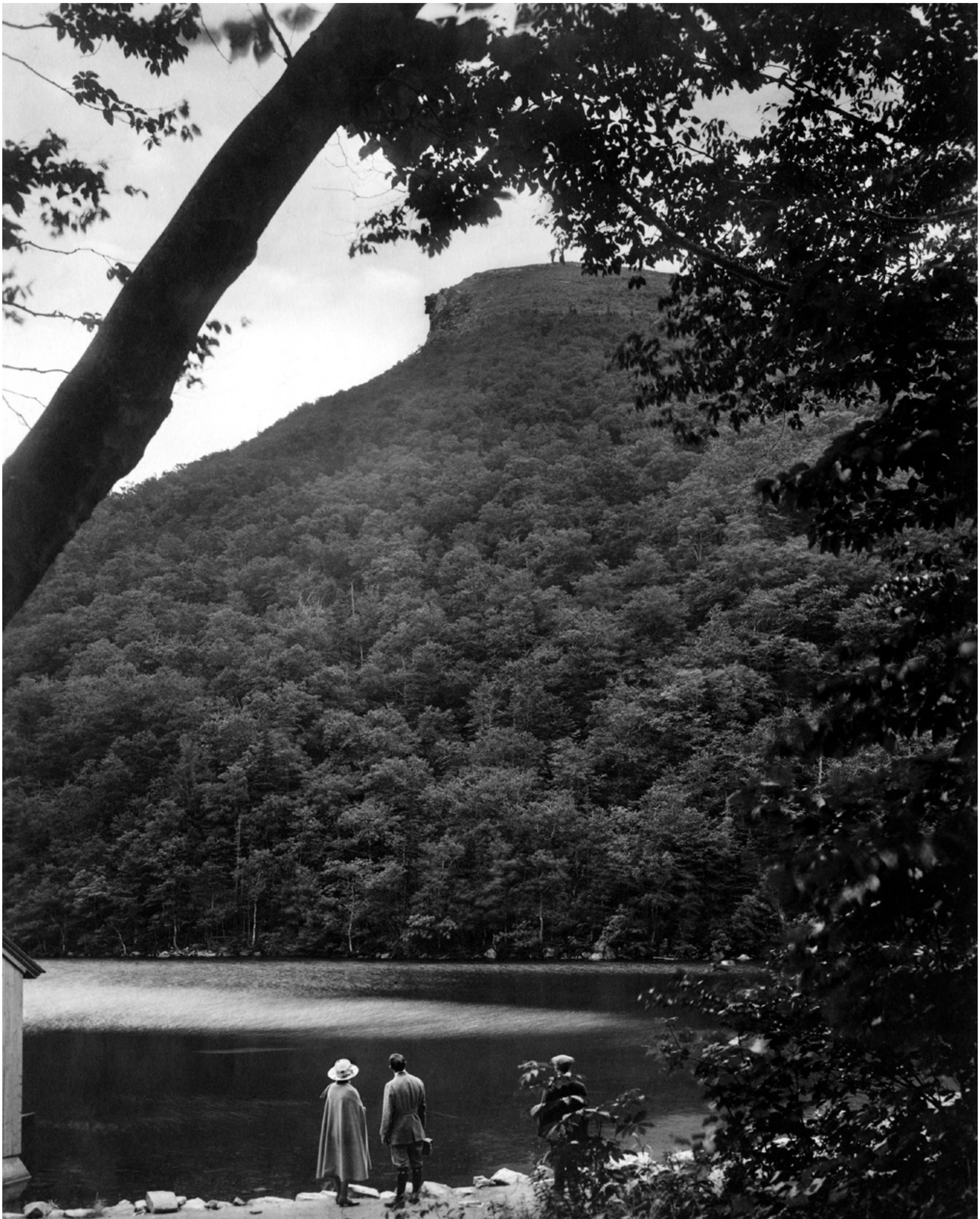
*A Landscape History of New England*
Edited by Blake Harrison and Richard W. Judd.
Cambridge: MIT Press, 2011. 413 pages.
ISBN 978-0-262-01640-7

Coeditors Blake Harrison and Richard W. Judd challenged a group of senior and young scholars to produce essays that capture myriad aspects of the New England landscape: the material landscape of forests, upland farms, stone walls, inland rivers, and rocky coast lines, and the symbolic landscape of picturesque villages, bucolic pastures, and the stock pieties of hard-working farmers with backs to the plow and eyes on the horizon. Methodologies deployed by the authors vary from the new disciplines of environmental and ecological history to literary narrative and to the politics of gender, ethnicity, and environmental change. The twenty essays are bookended by the editors' introduction and conclusion—dissimilar threads skillfully woven to form comprehensive case studies of landscape and cultural changes over three centuries. The essays engage both the essence of regional character and the theatrical promotion of magnetic scenery created for the seduction of tourists to visit New England and support local economies.

Old England was a refuge for New England's early settlers, so newly settled places were often named after mother-country places (the Berkshires, Portsmouth, Worcester, New London) and topographic terms (brook, pond, marsh, fens) coincidental to mother country terms. This offered familiarity amidst what some early settlers called the emptiness of the place and others called the howling wilderness. The fact that the "emptiness" contained areas of cultivation by Native Americans was ignored in the jeremiads of early Puritan ministers who needed a transformative narrative to motivate their flocks to both stay and spread out. As waves of settlers came to understand the intrinsic capacities of the landscape, the wilderness became a land of cultivation and harvesting: pastures, orchards, and gardens; forests for fuel and building material; rocky and sandy coastal waters offering access to a rich diversity of fish and crustaceans.

Joseph Conforti opens the roster of essays by setting a theme for the entire volume: regional identity as both historically grounded and culturally invented. Conforti projects New England identity as flowing from Native American




NEW HAMPSHIRE HISTORICAL SOCIETY


T. W. SMILLIE, NATIONAL ARCHIVES PHOTO 22-CD-451

**"Fishermen and weir, Passamaquoddy Bay region near Eastport, Maine, circa 1880. This photograph was part of broader study by the U.S. Fish Commission for the 1880 U.S. Census. It shows fishermen using a traditional brush weir to take herring for the burgeoning canning industry."**

tribes such as the Algonquians, with their seasonal settlements and cultivation of crops, to the formation of isolated towns and villages distributed across farmland and along the seacoast, a land-planning method still visible today.

The New England landscape was physically reconstituted in the nineteenth century with a surge of industry, especially shoe manufacturing, textile mills, and ship building. The current evolutionary stage of development includes a topology of leisure and recreation: heritage sites, boutique-lined waterfronts, ski slopes, athletic fields, and the indigenous clothier of fishers and hunters, L. L. Bean. Conforti quotes Dona Brown, a historian at the University of Vermont, to describe that tourist landscape as "a commodity peddled and consumed like the notions of an itinerant Yankee trader."

In his essay, Kent Ryden finds the well-worn argument of nature vs. culture a useless bit of rhetoric in understanding the New England landscape. Everything we see is the result of land use, he insists, recorded in the ways that human minds and hands worked in tandem with natural opportunities and constraints. He cites a little-known essay by Thoreau, "The Succession of Forest Trees," first delivered as a lecture in 1860. From years of observing

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**"Tourists in Franconia Notch, 1920s. Franconia Notch was one of the most popular sites in New Hampshire's White Mountains. Here, tourists by the shores of Profile Lake gaze upward at the Old Man of the Mountain." Source: From *Automobile Blue Book.***

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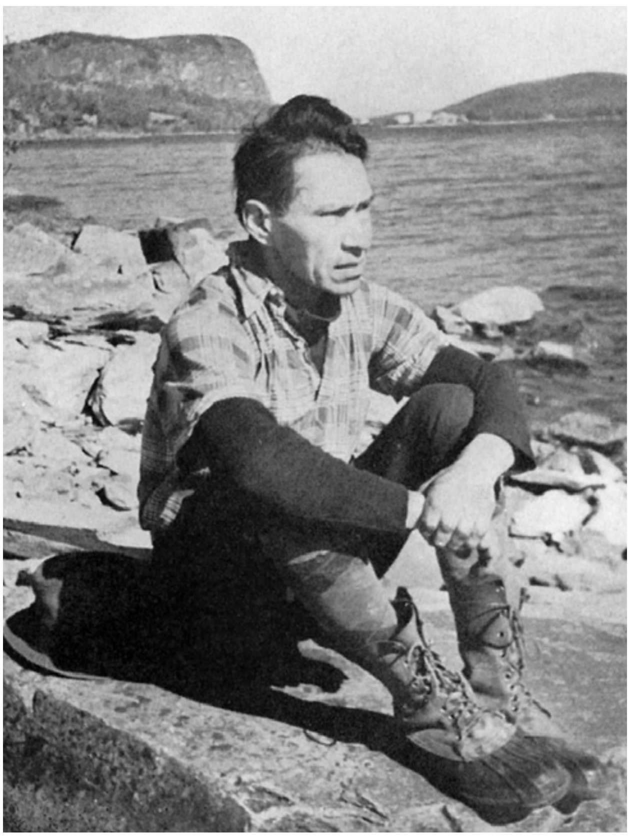
**"Robert Havell, 'View of the City of Boston from Dorchester Heights,' circa 1841. Views of Boston Harbor like this one provide an incomplete picture, because they show only the landscape visible to the human eye. Some of the harbor's most indispenable features, such as its ship channel and anchorage, were part of an underwater landscape that lay out of sight beneath the waves."**

the transformation of abandoned farm fields back to forests, Thoreau became aware that the species mix of the New England forest in the mid-nineteenth century was as much a result of human interventions as natural succession. Ryden adds to Thoreau's observation that New England's famous fall foliage is as much determined by human intervention as by natural process. His evidence is that when first-growth forests were cleared for timber and farmland by the middle of the nineteenth century, three-quarters of the region had been deforested and the fields derocked. With the diminishing of agricultural use, the forests returned as old fields were taken over by white pine (*Pinus strobus*), which thrives in sunlight and can survive in poor soils. As the pine forests matured, an understory of deciduous species, mainly oaks and maples, established themselves below the evergreen canopy. At the turn of the twentieth century, pines were cut for wood products and the young deciduous species could then dominate, producing colorful autumn foliage that was of little value to farmers but was essential to establishing the ritual of autumn visitors (leaf-peepers) to New England.

Despite the difficulty of subsistence farming in New England, by the early twentieth century the farm complex of pasture, cultivated fields, orchards, and picturesque barns and outbuildings offered symbolic value to visiting urbanites fatigued by lives over which they had little control. Attracted to a life of self-sufficiency, writers in particular were drawn to the back country of New England where they documented their survival tactics in numerous publications. Dona Brown describes a little known back-to-the-land movement of the 1930s; she notes that an "imaginative reconfiguration" of New England was underway as the image of a region full of "dour puritans and antiquated blue laws" was refigured.

In a 1932 editorial in *Harper's Monthly*, the noted writer and historian Bernard DeVoto observed that the Great Depression was not as severe in New England because long years of trials and tribulations had given the people great moral strength: "By the granite they have lived for three centuries, tightening their belts and hanging on." Brown uses as an example the writer Elliott Merrick and his wife who gave up urban life for a back country farm in Vermont where Merrick wrote *From This Hill Look Down* (1934). He stressed self-reliance and hard work in taming nature as a way to revitalize the urbanized mind and body. The couple was followed by another pair of writers, Helen and Scott Nearing, who relocated first to rural Vermont and then Maine. Their book, *Living the Good Life* (1954), became a manual for disaffected youth of the 1960s and 1970s.



SPECIAL COLLECTIONS, RAYMOND H. FOGLER LIBRARY, UNIVERSITY OF MAINE

**"Henry Red Eagle on the shores of Moosehead Lake, circa 1940. Red Eagle often drew inspiration from the Moosehead Lake region, incorporating its recreational and its working spaces into his writing." Source: From Bangor & Aroostock Railroad, *In the Maine Woods* (1941).**

Elizabeth Pillsbury investigates Long Island Sound on New England's southerly shore, valued first for its oysters and later for boating recreation. The Sound became a waste depository and ended up as a dead ecosystem. Moving up the coast line, Robert Gee brings his reader to Maine's "drowned coast" created by the rising and then receding sea level revealing land features: dramatic inlets of eroded tide pools and island clusters accommodating a rich variety of sea and shorebird life. Gee tracks the development of Maine's fish canning and blueberry industries in tandem with its growing popularity for tourists and summer homes. Moving back down to Boston, Michael Rawson traces the concern for the environmental health of Boston Harbor today back into the nineteenth century, when extensive filling of brackish tidal flats dramatically altered the shore line.

The topic of alternative ways of writing about the New England landscape is covered by two essays on lesser known individuals, each dealing with the ambiguity between documentary and fantasy writings. Under the pen name Henry Red Eagle, the Native American writer and wilderness guide, Henry Perley, wrote numerous stories about Maine's north woods. Written for a popular audience, his tales of adventure and romance highlighted his Native culture. Perley also participated in tourist activities, and like many other Natives took roles in national performing troupes such as P. T. Barnum's, cooperating with displays of stereotypical Indian behavior demanded as entertainment by "white man" audiences. Similarly, the Maine travel writer George H. Haynes, who, in the words of contributing author David L. Richards, specialized in the two social dimensions of landscape in general: timeless antiquity and rushing modernity; he blended literary romanticism with journalistic realism that he referred to as "a bit of realistic fairy-land" writing. Haynes prodigious output included books, articles, historic treatment of scenic areas, and promotional brochures.

Across New England, tourism filled the gap when the utility of lumber and crop-producing landscapes moved on. The landscape that had made agriculture so difficult on rocky upland pastures changed in people's minds to a topography of gentle mountains and valleys cut through by rivers and streams—romantic scenery documented by artists, photographers, and souvenir postcards. Tourism also responded to picturesque scenes of villages with white painted houses, church spires, and town greens.

John Cumbler describes how the landscape of Cape Cod, described by Thoreau as the "bared and bended arm of Massachusetts," evolved from the productive but fragile landscape of fisheries, salt works, and grain fields to pleasure grounds for summer visitors. The sandy and nutrient- poor soil and overgrazing by sheep and cattle led to depopulation of the area by the turn of the century, while tourism grew from early guest houses and cottage communities to golf courses and seaside hotels on manicured lawns.

The editors admit that more work needs to be done on the urban landscape of New England. Two useful articles in this volume take up the urban story in the late nineteenth century. Phil Birge-Liberman reveals that the Boston park system was created as much by the values of the reigning Yankee upper class as it was to satisfy a genuine need for leisure spaces on behalf of the city's burgeoning population. The annexation of neighboring towns to the city of Boston and the growing number of immigrants compelled the Yankee leaders to do a bit of social engineering by developing a park system that could control behavior and ease social tensions. Birge also treats real estate speculation and its link to park development—an area that needs much more investigation not only in Boston but other American cities. James O'Connell examines the Boston metropolitan landscape in the twentieth century: the linkage of suburbs, highway development, and a regenerative way of life in expanded urban areas.

European academics use the idea of *terroir*, a French term based on *terre* (land as place), referring to an area where soil and microclimate conditions produce distinctive qualities in food products, especially wine. An expanded definition of terroir includes the customs and traditions of a people. A closer reading of the New England landscape that integrates the work of earth scientists is in the future of environmental history. It would serve to deepen and enrich the current discourse that continues to take much for granted. This book offers a distinctive base for this dialogue to continue.

### Additional Reading

***(books by some of the essay authors)***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Phyllis Andersen is a landscape historian and former director of the Institute for Cultural Landscape Studies of the Arnold Arboretum.

# Remember last winter?


MICHAEL DOSMANN

**This image of Meadow Road and the Fabaceae (legume family) collection was made on January 13, 2011, after yet another heavy snowfall. Read a summary of 2011 weather events at the Arboretum in the next issue of *Arnoldia.***

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# Plainly Unique: *Schisandra chinensis*

*Sam Schmerler*

The plants of the Arnold Arboretum display incredible floral diversity. *Magnolia macrophylla*'s huge waxy blooms open twice, partly closing in between for an overnight sex change. *Helwingia japonica* sprouts tiny green umbels in the center of otherwise unremarkable leaves. *Davidia involucrata* forgoes petals entirely, but shelters its reproductive organs with massive white bracts. Even wild *Viola sororia,* flagging down bees with its iconic violets, surreptitiously sends out discrete, self-pollinating flowers underground.

With all this bizarre and beautiful reproduction going on, most of us overlook the most evolutionarily distinctive flowering plant in the collection: *Schisandra chinensis.* An unassuming woody vine, it represents a unique and ancient lineage that parted ways with most other flowering plants at least as far back as the early Cretaceous, before even "living fossils" like *Magnolia.* This ancient group, the Austrobaileyales, is now recognized as the third-oldest remaining branch on the phylogenetic tree of flowering plants, diverging after only *Amborella* (a strange New Caledonian shrub) and the Nymphaeales (a group of herbaceous aquatics that includes water lilies). This means that all the other flowering plants in our collection—from creeping crowberries to towering tuliptrees—are more genetically similar to each other than any of them are to *Schisandra.*

We can't grow the other Austrobaileyales here, since they hail from warmer forests in North America, Asia, and Oceania, but *Schisandra chinensis,* from temperate northeastern Asia (China, Korea, northern Japan, eastern Russia), can reliably survive Boston winters. This dioecious vine doesn't *appear* particularly primitive. Visually, it doesn't stand out much at all. Our two specimens (343-97-B, a male plant from Changbaishan, China, and 409-97-B, a female from Chiaksan, South Korea) twine unobtrusively up his-and-hers trellises in the Levintritt Shrub and Vine Garden and tend to blend in with their neighbors. Their simple, medium-green leaves are perfectly innocuous, eventually turning a bland butter yellow. In late spring, small, white, sweet-smelling flowers droop on thin pedicels in a passable impersonation of nearby *Actinidia* (kiwi). The female's flowers develop into elongated fruits with numerous bright red, berrylike fruitlets. Winter will reveal exfoliating bark resembling that of climbing hydrangea.

Evolutionary biologists (including Arboretum director Ned Friedman) have discovered that *Schisandra* and the other Austrobaileyales can offer insight into many key events in the history of flowering plants. Aspects of *Schisandra*'s vascular system may represent an early step in the development of vessels, the structures that allow most flowering plants to rapidly transport water and ecologically dominate hot and dry habitats. *Schisandra* also retains a relatively simple anatomy during its haploid stage, with only four nuclei and one developmental module in each female gametophyte (almost all flowering plants have eight nuclei and two modules). The endosperm of *Schisandra* seeds consequently contains only one complement of genes from each of its parents, while most flowering plants acquire an additional copy of their moms' genes. *Schisandra* likely shares these characteristics with the extinct ancestors of all flowering plants, a living link to the distant past.

But while it retains many archaic anatomical features that are long lost in most flowering plants, *Schisandra* has evolved a unique and medically promising biochemistry. Traditional Chinese herbalism prescribes *S. chinensis* for a whole host of ailments and as a general tonic and adaptogen. Recent science has isolated several new types of lignans (a class of polyphenols) from the fruits; these have anti-oxidant and anti-inflammatory properties. *Schisandra* lignans have been shown to protect brain cells from glutamate and liver cells from a variety of toxins; they may also inhibit platelet aggregation, tumor proliferation, and possibly even HIV replication. As chemists in the food and medical industries increasingly explore these lignans, it's likely that demand for *S. chinensis* as a pharmaceutical precursor and "functional food" will increase.

Even though *Schisandra* may not dazzle, this vine's exciting chemistry and singular evolutionary history prove it truly stands alone. Next time you visit the Arboretum be sure to check out *Schisandra chinensis*—it tends to reward closer inspection.

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Sam Schmerler recently completed his appointment as a Curatorial Fellow at the Arnold Arboretum.