

The Future of Hemlocks

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Stumbling upon mature Eastern hemlocks (*Tsuga canadensis*) in the wilds of Western North Carolina can be a profound experience. Often nestled in deep coves along pristine streams and among massive boulders, these venerable trees evoke a sense of grandeur, grace and reverence. In landscapes, hemlocks can be shapeshifters, appearing as towering specimens, hedges, screens and unique dwarf cultivars. At one end of the spectrum, the U.S. national champion Eastern hemlock, located in Highlands, NC, exceeds 175 feet in height. At the other extreme, *T. canadensis* ‘Sargentii’ is considered by many to be the “GOAT” of dwarf conifers, forming a “vernal fountain of perpetual joy” (Jenkins, 1946 — see Del Tredici, 2020, for a fascinating history of this cultivar).

Despite their magnificence, all is not well with our hemlocks. A pest known as hemlock woolly adelgid (HWA), *Adelges tsugae*, was first reported in the eastern U.S. in 1951 and eventually made its way to North Carolina. Although nearly microscopic, HWA is largely responsible for the precipitous decline of Eastern hemlocks.

Considerable work has been done on understanding the biology of HWA, as well as host plant resistance and chemical and biological controls (Frank et al., 2019; Jackson, 2021). Dr. Steve Frank (professor, entomology and plant pathology, NC State) and Ben Smith (research scholar, NC State) continue to do research on chemical control of HWA and another pest, elongate hemlock scale, and to look for sources of resistance within Eastern hemlocks and other interspecific hybrids. The Hemlock Restoration Initiative, a WNC Communities program sponsored by the North Carolina Department of Agriculture & Consumer Services and the U.S. Department of Agriculture (USDA) Forest Service Forest Health Protection Program, is helping to coordinate numerous efforts to conserve our native hemlocks, serving as a great source of information (<https://savehemlocksncc.org/>). The U.S. National Arboretum has recently released two hybrids of Chinese hemlock (*T. chinensis*) × Carolina hemlock (*T. caroliniana*) (Bentz et al., 2023). ‘Traveler’ (USPP 32,784) has pendulous branches and a pyramidal habit, reaching 30 feet high and 18 feet wide in 15 years. ‘Crossroad’ (not patented) also has a pyramidal habit, with ascending branches reaching 36 feet high and 19 feet wide in 17 years. Both are resistant to HWA. For information on the availability of licenses or cuttings, contact Dr. Margaret Pooler (research leader, U.S. National Arboretum, Margaret.Pooler@usda.gov).

As HWA became more of a problem in Western North Carolina, Dr. Anthony LeBude (associate professor and nursery extension specialist, NC State) and I set out to collect and evaluate different clones and species of hemlocks that might have resistance to HWA, as well as suitable forms for landscape plantings. With the cooperation of many individuals and public gardens (see acknowledgments, below), in a replicated experiment in 2008 we propagated and planted 40 selections, including Carolina hemlock, Eastern hemlock, Himalayan hemlock (*T. dumosa*), Japanese hemlock (*T. sieboldii*), Chinese hemlock and Northern Japanese hemlock (*T. diversifolia*). We have collaborated with colleagues at the University of Tennessee to study plant/pest interactions and document variation in host plant resistance among these species (Dove et al., 2020; LeBude and Ranney, 2009; Rogers et al., 2018). We found both Chinese and Himalayan hemlocks were highly resistant to HWA (Leppanen, et al., 2019). After 16 years of evaluation, we have selected and named two clones that were chosen for desirable forms, resistance to HWA and good rootability from cuttings.



Figure 1. Ernest Henry Wilson, 1920, provided by the Arnold Arboretum.
 Photographer unknown.

New introductions of HWA-resistant hemlocks

Tsuga chinensis ‘Ernest H. Wilson’

Chinese hemlock is native to central and western China. These trees are typically found in mixed mesic forests at elevations from 2,000-10,000 feet and can exceed 100 feet in height. The history behind this cultivar is rather fascinating. In fall 2023, John Nix (research specialist, NC State) and I surveyed all the trees in our then-15-year-old hemlock plot and flagged what we thought were the most desirable forms with good horticultural characteristics. 94-096*R consistently looked great in all the replicates and was highly resistant to HWA. With expert detective

help from Dr. Michael Dosmann (keeper of the living collections, Arnold Arboretum), Lisa Person (head of the library and archives, Arnold Arboretum), Pamela Anne Morris Olshefski (plant records and living collections manager, Morris Arboretum), and Tony Aiello (associate director of collections, Longwood Gardens), we were able to trace back the origin of this tree. We received cuttings of this clone from the Morris Arboretum in about 2006. Their records indicated that it was a cutting from 1948-883*A, also at the Morris. Records there further documented that 1948-883* was a “Plant rec’d from Mr. Charles Jenkins, Germantown, PA, 9/1948. Original scion from W.H. Judd of the Arnold Arboretum,

grafted by Edward Sauerbrey of Towson Nurseries, 2/32.” Charles F. Jenkins had a particular fondness for hemlocks (Jenkins, 1946), to the extent that he founded The Hemlock Arboretum at Far Country, in the Germantown (now Mt. Airy) neighborhood of Philadelphia and published *The Hemlock Arboretum Bulletin*. Digging back through old issues, Pam found a report from Charles (*The Hemlock Arboretum Bulletin* No. 1, July 1, 1932) in which he reported “... through the courtesy of the Arnold Arboretum specimens of *Tsuga chinensis* are being grown for me from scions supplied by them.” In Bulletin No. 2, Jan. 2, 1933, he states his *Tsuga chinensis* was “From the specimen in the Arnold Arboretum. Planted August, 1932.” Going back to distribution records from the Arnold Arboretum, it is documented that W.H. Judd, who was the propagator at the Arnold Arboretum from 1916-1946, provided scions of AA# 17569 to Towson Nurseries. So where did AA# 17569 come from? It turns out that one seedling was grown from seeds collected by none other than the famous E.H. Wilson (Fig. 1) on Sept. 15, 1910, from the Hubei Province, Fang Xian, 7,500-9,800 feet elevation, with the Wilson collection number of 4453. It’s pretty amazing that this plant has garnered attention, including repeated selection and propagation, by a series of notable horticulturalists/institutions, starting with E.H. Wilson, over a period of 114 years.

Tsuga chinensis ‘Ernest H. Wilson’ has dense branching and a broad pyramidal habit with ascending branches (Fig. 2). Mature trees were 17-18 feet tall and 11 feet wide after 16 years. Needles vary from 1/4-3/4 inches in length and

1/16-2/16 inches in width. The upper, adaxial needle surface is olive green (RHS 137B) and somewhat glossy. The abaxial surface generally lacks visible, white stomatal bands, or they are very faint. Cones are typically 5/8 inches long and 7/16 inches wide. This cultivar has demonstrated a high level of resistance to HWA compared to Eastern hemlock, and is hardy from USDA Zone 6a (maybe colder) to USDA Zone 8 (maybe warmer). Hardwood cuttings treated with 7,500 ppm liquid auxin (33% KNAA and 66% KIBA) for 5 seconds rooted 85-100% over different years. This cultivar is named in honor of Ernest H. Wilson to recognize his vast contributions to horticulture, as well as his role and the role of public institutions in collecting, sharing and conserving plants throughout the globe.

Tsuga aff. dumosa (yunnanensis) 'Clifford R. Parks'

Himalayan hemlock has a native range spanning India, northern Burma (now Myanmar), Vietnam, Tibet and China. Mature trees can exceed 120 feet in height with a cedar-like habit. Plants from some provenances can be tender. Often found in association with rhododendron and fir species above 5,000 feet in elevation.

Tsuga aff. dumosa 'Clifford R. Parks' has dense branching and a broad pyramidal habit with ascending branches (Fig. 3). Mature trees were 22-23 feet tall and 15 feet wide after 16 years. Needles vary from 1/4-3/4 inches in length and 1/16-2/16 inches in width. The upper, adaxial needle surface is emerald green (RHS 139B) and glossy, while the abaxial surface has two, sometimes faint, white stomatal bands. No cones have been observed. This tree was originally received from Dr. Clifford Parks, who was a professor of botany at the University of North Carolina at Chapel Hill. The exact origin of this tree is unknown. We originally received this tree as *Tsuga yunnanensis*, which is no longer an accepted specific epithet but suggests it may be of Chinese origin. Since we have not seen cones on our trees, we have been unable to definitively confirm the species designation of this tree and are currently including the "aff." designation to indicate its affinity to *T. dumosa*. This cultivar is highly resistant to HWA compared to Eastern hemlock and is hardy from USDA Zone 6b (maybe



Figure 2. *Tsuga chinensis* 'Ernest H. Wilson' growing at the Morris Arboretum, Philadelphia, PA, 2024. Photo taken by Pamela Anne Morris Olshefski.

colder) to USDA Zone 8 (maybe warmer). Hardwood cuttings treated with 7,500 ppm liquid auxin (33% KNAA and 66% KIBA) for 5 seconds rooted 75-100% over different years. This cultivar is named in honor of Dr. Clifford R. Parks (Fig. 4) to recognize his contributions as an educator, scientist, plantsman, co-founder of Camellia Forest Nursery, and plant breeder who was generous in sharing plants, including this one.

Availability

Stock plants of both cultivars are available from the NC State Department of Horticultural Science at the Mountain Horticultural Crops Research and Extension Center in Mills River, NC. Contact Tom Ranney, tom_ranney@ncsu.edu, if interested.

So, what is the future of hemlocks in North Carolina? We know we have effective chemical controls for HWA

that can be used to protect important native hemlocks (NCACM, 2024) in both natural areas and managed landscapes. There are some indications that biological controls may be having an impact, and the Hemlock Restoration Initiative, the North Carolina Forest Service and others continue to release and study the effectiveness of these predators. The hope is that predators will eventually keep the HWA in check and be a long-term solution (savehemlocksn.org). The search is also on for sources of resistance in native species. In the meantime, we do want to chemically protect selected native trees to maintain broad genetic diversity going forward. We are also excited to share these newly named cultivars of two Asian hemlock species, *Tsuga chinensis* 'Ernest H. Wilson' and *Tsuga aff. dumosa* 'Clifford R. Parks', which are well adapted to North Carolina, are resistant to HWA, and have desirable habits and production traits.



Figure 3. *Tsuga aff. dumosa* 'Clifford R. Parks' growing at the Mountain Horticultural Crops Research and Extension Center, Mills River, NC, 2024. Photo taken by Thomas G. Ranney.

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Acknowledgments

Thanks to the following organizations for providing plant material for this study: Lorax Farms, Warrington, PA; The Holden Arboretum, Kirtland, OH; Camellia Forest Nursery, Chapel Hill, NC; JC Raulston Arboretum, Raleigh, NC; Morton Arboretum, Lisle, IL; Yew Dell Gardens, Crestwood, KY; Chicago Botanical Garden, Chicago, IL; U.S. National Arboretum, Washington, DC; Longwood Gardens, Kennett Square, PA; The Morris Arboretum, Philadelphia, PA; and the Washington Park Arboretum, Seattle, WA.

Thanks also to our team, including Dr. Anthony LeBude, Nathan Lynch, Tom Eaker, Andra Nus, Irene Palmer, John Nix, and the staff at the Mountain Horticultural Crops Research and Extension Center, for their help and support in acquiring, growing and maintaining these plants.

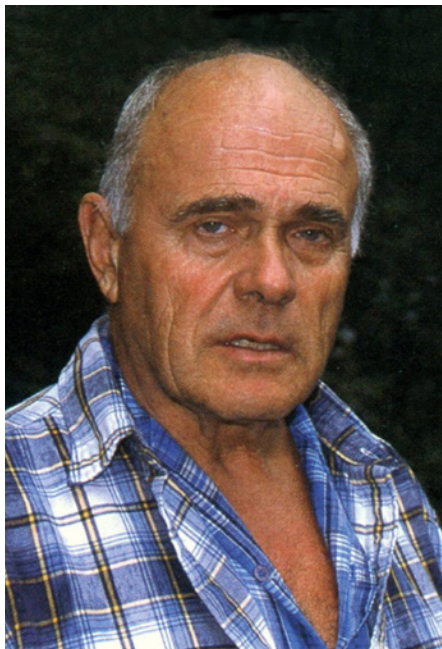


Figure 4. Dr. Clifford R. Parks. Photo provided by the North Carolina Botanical Garden.

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