The Return to China, Mother of Gardens

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In 1929, Ernest Henry Wilson’s book China, Mother of Gardens was published, which documented the importance of Chinese plant species to western gardens. Wilson collected plants widely in China between 1899 and 1910. Many of his introductions have become important components of the cultivated flora of our gardens and our cities, and have been used widely in plant hybridization and selection. Wilson’s China collections greatly expanded our understanding of the Chinese flora as the richest and most diverse flora in the temperate world and identified the usefulness of many species for cultivation.

However, until recently, many of the most important and useful Chinese species in America were the result of limited seed collections, representing only a narrow slice of the genetic diversity and potential of each species. In some cases, all the plants in this country derived from a single plant or a few seedlings. After multiple generations of propagation from seed, symptoms of inbreeding were being observed.

Since the 1930s, wars and the political situation in China made it difficult, if not impossible, for western scientists and plant explorers to travel.
particular parts of their range. By doing so, we could potentially maximize adaptability characteristics such as winter hardiness, heat and drought tolerance, and adaptability to specific soil characteristics.

**Collaboration Breeds Success**

Earlier expeditions in South Korea, beginning in the 1960s and 1970s, had clearly demonstrated the diversity of plant species still relatively unknown to western horticulture and the importance of studying intra-specific variation and its potential usefulness to landscape crops. Up until this point, collections had been largely one-time efforts and not part of a comprehensive plan to collect over a large geographic range. In the early 1980s, Barry yinger, at that time employed by the United States National Arboretum, proposed a series of Korean collecting trips that would facilitate the collection of specific target taxa over separate geographic and climatic ranges. The resulting trips occurred between 1984 and 1989. They were facilitated by the United States National Arboretum in close collaboration with American and Korean botanical institutions and were highly successful. This collaborative approach based on a multi-year master plan became the model on which we began to build a proposal for a longrange plan for plant exploration in China.

Key to the success of the Korean expeditions was the principle of collaboration among institutions as they plan, execute, and follow upon a plant collecting expedition. Most institutions today do not have the financial or human resources to do this work alone. Collaboration allows for the division of responsibilities and of the significant financial commitment needed. It also broadens the range of expertise present in the field. The field work itself is labor-intensive.

*Facing page:* While on a plant collecting trip for the Arnold Arboretum, E. H. Wilson captured this image of an alpine village (elevation 7,500 feet [2,286 meters]) in the mountains of western Sichuan, China, in August 1908. From the Archives of the Arnold Arboretum.
(Left to right) Kris Bachtell, Chris Carley, and Li Jianjun collect ash seeds (Fraxinus paxiana NACPEC08-016) on a road in Hong He Gu Forest Park, Shaanxi.

Intensive and it is important to have multiple hands to physically collect the seeds, make and record the field observations, and complete the evening tasks of cleaning seed and processing herbarium specimens. Most important, collaboration provides multiple sites for propagating, growing, and eventually evaluating the collections. Multiple institutions give a variety of testing locales and some level of insurance against seed loss or crop failure. And even if all are successful, it allows for a greater genetic reservoir to be tested and preserved through per manent living collections.

Widening the Pool

Several notable collection successes from the Korean expeditions encouraged us to continue in China. In 1984, there were two expeditions to islands off the northwest coast of South Korea. The key target species was Camellia japonica. It was believed that populations on these islands would represent the most cold hardy forms of the species. Seedlings grown in multiple institutions could be selected for hardiness as well as landscape attributes, and ultimately be used in breeding projects, with the ultimate goal being clones well-adapted and reliably cold hardy in USDA Zone 6 (average annual minimum temperature 0 to -10°F [-17.8 to -23.3°C]). Indeed, seedlings grown have demonstrated superior winter hardiness and, after years of testing, a number of named cultivars have been introduced. Similarly, kousa dogwood (Cornus kousa) was a tried and proven landscape plant but most, if not all, kousa dogwoods in the United States at that time (pre-1980) were descended from a narrow genetic pool. Additional collections made in Korea in the 1980s further demonstrated the great variation within that species. By 1990 we were seeing the promise of greater winter hardiness and...
hardiness, increased vigor, and interesting variation in flower bract shape and size from these collections. As we reviewed Chinese floras we discovered that Chinese botanists had observed and documented wide variation within this species in China, so much so that they divided what we know as *Cornus kousa* into multiple species. The successes of our Korean collections along with the promise of a richness of intraspecific variation encouraged us to pursue additional collections of these and other species in China. Another specific plant that motivated us was Chinese hemlock (*Tsuga chinensis*). During the 1980s and 1990s, hemlock woolly adelgid (*Adelges tsugae*) was becoming widespread in the northeastern United States, causing our native eastern hemlock (*Tsuga canadensis*) to decline and often die. At both the Morris Arboretum and the Arnold Arboretum, it was noted that a Chinese hemlock growing near an infested eastern hemlock was resisting infestation. A few other Chinese hemlocks growing in other arboreta were visited and also were showing resistance. This led to a comprehensive plan to re-collect Chinese hemlock from a number of different locales across its natural range in
China to further study its adelgid resistance and explore horticultural variation and adaptability within this species.

By the late 1980s, travel to China was becoming more practical and a group of horticulturists who had worked in Korea began to envision a wide-ranging, long-term plan to collaborate with Chinese colleagues. We had already identified a broad geographic area across northern China that represented areas with a climate parallel to the northeastern United States. We looked at reported mean temperature in both January and July and gave priority to areas with both hot summers and cold winters. Also, we continued to target species already known and grown in the United States that might benefit from new collections and the introduction of greater genetic diversity. We also began the slow process (in the days before email) of establishing contacts with Chinese colleagues and exploring the possibility of meeting with them in China to map a collaborative plan and agreement.

Out of this effort, a loose consortium of institutions came together in 1991 to form The North America–China Plant Exploration Consortium (NACPEC). Founding members included Lawrence Lee of the United States and...
NACPEC, the Early Years

Our overtures were enthusiastically received and in the autumn of 1991 the founding American members traveled to China to visit a number of botanical and forestry institutions in six cities, and to explore the feasibility of future plant exploration trips. Host Chinese institutions included the Research Institute of Forestry and Beijing Botanical Garden, the Heilongjiang Academy of Forestry in Harbin, the Chang Chun Forest Botanic Garden, Xian Botanic Garden, and Nanjing Botanic Garden. We visited their herbaria and discussed target species and potential areas for collection as well as the nuts and bolts of planning future trips and getting official permissions. With the advice and encouragement of our Chinese colleagues, we laid tentative expedition schedules for the next 5 years.

As part of the exchange, NACPEC would assist our Chinese partners by supporting Kousa dogwood (*Cornus kousa*) has a broad native range and much variation within the species. Hemlock wooly adelgids (seen as cottony white dots along the branchlets in this photo) attack native eastern hemlock (*Tsuga canadensis*) but Chinese hemlock (*T. chinensis*) appears to be resistant.
research projects, facilitating and supporting student and professional exchanges, and by procuring wild-collected and cultivated North American germplasm for evaluation by Chinese institutions.

Funding for these expeditions was primarily dependent on the participating NACPEC members' institutions with additional support from the National Plant Germplasm System, a part of the Agriculture Research Service of the United States Department of Agriculture (USDA). The USDA recognizes that the production of landscape plants represents a significant and growing part of American agricultural production and that, in the past, landscape plants were not well represented in the germplasm repository system.

Interest in NACPEC grew following the success of these planning efforts. In 1992, long wood Gardens (Kennett Square, Pennsylvania) and the Morton Arboretum (Lisle, Illinois) based on their expressed interest and experience were invited to join NACPEC. Later, the Arnold Arboretum (Boston, Massachusetts) and the University of British Columbia Botanical Garden (Vancouver, British Columbia) joined the collaboration.
From right, facing came In the far north of Heilongjiang, beautiful remnant ra) Peter Bristol, Law re s of the great Manchurian forest remain. The tallest nce Lee, and He Lin exact trees are Pinus koraiensis, Picea jezoensis, and A mine herbarium specimen biesnephe ropepis. Common deciduous species include s in the Nanjing Botan i ce Betula costata, Betula platyphylla var. mandshuri al Garden Herbarium on t he 1991 planning trip. Research in the herbarium was helpful ex amining herbarium specimen in the Nanjing Botanic Garden Herbarium on the 1991 planning trip. Research in the herbarium was helpful in pinpointing potential sites for future exploration.

Planning progressed for the first NACPEC full plant exploration trip to the province of Heilongjiang, located in the far northeastern corner of China. We were hosted by Professor Jin Tie shan, a renowned professor of forestry at the Heilongjiang Academy for Forestry. This first expedition to China was a great learning experience for the American visitors and our hosts alike. We mailed much of our equipment over in advance, including herb arium presses, papers and blot-
ters, pole pruners, packing bags, and sphagnum moss for packing and shipping seed. Once we arrived, we had to navigate the protocols of importation of supplies and later the exporting of seed. As with governments everywhere, these procedures are never fast or easy.
that first diplomatic trip in 1991, NACPEC has sponsored a total of 12 plant collecting trips to China.
A World of Opportunities

The outcome of this work is hard to fully measure as it has affected so many individuals and institutions in so many ways. Over the years, NACPEC plant explorers have had a chance to

and to look after our safety and human comforts. The modern world had not yet arrived in rural Heilongjiang in 1993 and we had a chance to experience the beauty of the traditional agrarian life in northeast China. In the far north of Heilongjiang, we got to see remnants of the once great Manchurian forest with Korean pines (Pinus koraiensis), yezo spruce (Picea jezoensis), and Manchurian fir (Abies nephrolepis) towering well over 100 feet (30.5 meters) tall.

Chinese and American institutions and lots to be grown and evaluated in our institutions. The herbarium specimens serve as an important part of the scientific documentation of each germplasm collection and as a permanent record of the occurrence of that species in the wild. This work is especially important today as China is being developed at an unprecedented pace. Mountainous areas that were largely pristine in the 1980s were being developed with tourist resorts and aerial tramways in the 1990s, putting increased pressure on the already limited natural areas in China. The success of this first expedition energized the team to continue planning for two separate expeditions in 1994 and others in later years. Since

By the end of this monthlong trip we had collected 112 accessions. Especially notable collections include Maackia amurensis, a potentially useful urban street tree; Pinus koraiensis, a beautiful and fast growing five-needled pine; and Abies holophylla, one of the first best adapted to areas with hot summers. Where possible, each accession included dried pressed specimens for herbaria of both
(Left to right) Sheng Ning, a local host, and Jeff Lynch collect seeds of *Acer trifurum*, a maple valued for its exfoliating bark and brilliant red-orange fall color. This Chinese man collected a bumper harvest of Korean pine (*Pinus koraiensis*) cones from the local forest in Jilin. After drying in the sun, the edible seeds (commonly called pine nuts) are extracted, cleaned, and packed. Korean pine is the most common source of pine nuts in world commerce because they are relatively large, plentiful, and inexpensive.
visit and study innumerable Chinese plants in their natural habitat and to learn from Chinese colleagues about the plants' economic and folk uses. By seeing a plant growing in its natural habitat, we can glean insights into the growing conditions to which it is best adapted. It has also given our collectors the opportunity to lecture to groups of professionals and amateurs about the importance of conserving our planet's plant resources. Additionally, NACPEC institutions have hosted many Chinese colleagues and students for study visits and extended internships in the United States over the past 20 years, as part of our broader academic exchanges.

Today we are well aware of the dangers of introducing a new invasive species. In many instances we are focused on re-collecting new genetic material of plants that have already proved themselves as well-behaved, handsome landscape plants. When in the field, many potentially invasive plants were left uncollected. Warning signs include an aggressive habit in their natural environment or the existence of related species which have already become unruly in the United States. Back at home, curators keep an eye on plants in the botanical gardens and those showing invasive tendencies are typically removed. With each trip, NACPEC has become increasingly focused on a limited number of target species that address specific emerging needs.
still unknown virulent disease or insect, or may contain a compound effective in the fight against cancer. No doubt the value of these collections will continue to emerge for decades and maybe even centuries to come in ways we cannot yet imagine. NACPEC is probably the most successful, broad-based, and long-lived collaboration of its sort anywhere in the world. And after nearly 20 years of active collecting in its countryside, modern China continues to indeed be the “Mother of Gardens.”

Bibliography

Facing page: This gateway building is part of the beautiful Taoist temple complex on the slopes of Wudang Mountain in Hubei. Taoist monks find tranquil spirituality in nature. Over the centuries they have helped protect this botanically rich forest, dubbed “horticultural heaven” by NACPEC expedition members. Photo by Paul Meyer.