ASIAN BOTANY AT HARVARD UNIVERSITY: 1800–PRESENT

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Abstract. A brief history of Harvard University's Asian specimen holdings is given based on a talk that was presented at the Chenshan Botanical Garden, Shanghai, in 2017. Although Harvard University was founded in 1636, it was not until 1842, 206 years later, that a collection of botanical specimens became available at the university through the private herbarium of Asa Gray. Following Gray's arrival, the collections grew rapidly through botanical explorations in the American West and the exchange of duplicate specimens with Gray's contacts in the rest of the world. Gray's contacts exchanged specimens from throughout the colonial empires, but especially specimens from the Asian subcontinent**,** The founding of the Arnold Arboretum in 1872 and the appointment of Charles Sargent, a strong advocate of the herbarium and library, as the first director, resulted in increased interest in temperate Asia. The directors who followed Sargent, particularly Elmer Merrill, expanded the Asian collecting efforts to tropical Southeast Asia through support for expeditions and the outright purchase of specimens. Although the exact number of specimens in the Harvard University Herbaria is unknown, the holdings of Asian specimens have grown to be the best in the Americas and among the most comprehensive of all the world's herbaria.

The early years: 1636–1842

Harvard University was founded in 1636, just 16 years after a permanent English colony was established in Plymouth, Massachusetts. The university, established to teach young men to lead a moral life, was named for John Harvard, who died as a young man and left his personal library and half his estate to the new university.

Despite its early founding, it was not until 1805 that William Dandridge Peck (1763–1822), who had graduated from Harvard in 1782, was hired to teach natural history. Peck was America's first entomologist. He worked as an accountant in Boston for 20 years while studying natural history as a hobby. He became proficient enough to be made Professor of Natural History at Harvard in 1805. In the course of his duties, he visited scientific institutions in Europe where he collected many books and obtained specimens (but not herbarium specimens).

Although not a botanist, he founded the Harvard Botanical Garden in 1810. His only botanical contributions appear to be *A Method of taking Impressions of Vegetable Leaves by Means of Smoke* (Peck, 1794) and a *Catalogue of American and Foreign Plants* (Peck, 1818). The majority of his publications relate to entomology, although he also published an account of a sea serpent in Cape Ann, Massachusetts (Peck, 1819).

Although Peck was immobilized by a series of strokes and died in 1822, his position at Harvard was not filled until the English ornithologist and botanist Thomas Nuttall was hired as Lecturer in Natural History and curator of the Harvard Botanical Garden, roles he filled from 1822 to 1834.

Nuttall arrived in Philadelphia, then the seat of science in America, from England in 1808 at the age of 22. After meeting with the leading botanists of the time, he was eager to explore North America. He traveled in the southeastern and eastern United States, in the Great Lakes region and throughout New England to the Rocky Mountains, hoping to reach the Pacific Ocean, but returned to England when the War of 1812 broke out (Graustein, 1967). He returned to the United States in 1815, but he had put his time in England to good use by studying the American and other plants in the major herbaria of the day. The fruit of his earlier field work in America and the study of herbarium specimens in both Europe and the United States was The *Genera of North American Plants, and a Catalogue of the Species, to the year 1817*, in two volumes (Nuttall, 1818).

As the title indicates, the two-volume work described all genera known from North America to the year 1817. It also provided a list of all known species in each genus and discussed the distribution and relationships of all genera. It was actually among the first to describe the world's biogeographical patterns, noting among others that *Mahonia* was a genus of both North America and India. Nuttall was also the first person to mention that unusual plants in North America might later be found in Asia or Europe. *Chimaphila*, a genus in which he recognized two species, *C. umbellata* (Linnaeus) W. P. C. Barton and *C. maculata* (Linnaeus) Pursh, was especially insightful: "Indigenous also to the North West Coast of America. – Menzies (now known as *Chimaphila menziesii* [R. Brown] Sprengel). Probably both species of the genus will be found also in East Asia and Europe" (Boufford and Spongberg, 1983). *Chimaphila japonica* Miq. is now known to be widespread in temperate eastern Asia and *C. monticola* Andres is in temperate China (subsp. *monticola* in Sichuan and subsp. *taiwaniana* [Masam.] Hid.Takah. in Taiwan).

In 1818, upon completion of the *Genera*, Nuttall set off on an exploration to Arkansas (Menefee, 2025), an account of which he wrote in detail in his journal (Nuttall, 1821) and which was summarized by Nelson (2015). Nelson's

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summary is worth quoting here:

> "Nuttall's books brought him to the attention of Harvard, which hired him in 1822 as a natural history lecturer and curator of its botanical garden. Without formal academic training, Nuttall was never made a professor, but over time, Harvard doubled his salary, allowed him to take botanizing leaves of absence, and awarded him an honorary Master of Arts degree. In 1830 he was also elected the first president of the Boston Society for Natural History. Nuttall was a popular teacher, guiding students on rambles through nearby woodlands, though his reputation for oddity persisted. Donald Culross Peattie described him as "a shy, eccentric bachelor, shabbily dressed and parsimonious from necessity. . . . During his curatorship of the botanical garden at Harvard it was his fancy to cut in his house all sorts of secret doors, which had for their purpose only his privacy; as a result, a man might enter Nuttall's study and find there nothing but innumerable cages of birds, with which this elvish little man continually experimented." (Peattie, 1935)

After 11 years at Harvard, Nuttall yearned for another attempt to travel to the Pacific Ocean. He gave up his position at Harvard to pursue this goal and successfully reached it. The Harvard University Herbaria contains no herbarium specimens from Nuttall's time there, but a large set of Nuttall's specimens is now in the Harvard Herbaria through a presentation by Elias Durand in 1866.

The Asa Gray years: 1842–1888

For 206 years, from its founding in 1636, Harvard was without an herbarium. That changed when, following Nuttall's departure, the natural history position at Harvard, which remained vacant until 1842, was filled by Asa Gray, who was hired as Fisher Professor of Natural History. Gray remained at Harvard for the rest of his life. During his career he trained many students, developed the botany program at Harvard, and built what was to become the world's largest university herbarium.

Even before his arrival at Harvard, Gray showed a particular interest in the flora of Asia, publishing a review of Siebold and Zuccarini's *Flora Japonica* (Gray, 1840) in which he pointed out a number of genera shared between Japan and the eastern United States. He had also traveled to Europe to visit the large herbaria, where he made lifelong friendships with the leading botanists of the time. Upon settling in his new position, Gray began to develop his own herbarium and library while at the same time continuing the work with John Torrey at Columbia University on a *Flora of North America*. That was also the time of major explorations in the American West. As the leading botanist in North America, Gray was flooded with a continuous supply of new specimens coming to him for identification. The duplicates from those collections provided exchange material for his contacts in Europe. In return, Gray received specimens from the Hookers at Kew from throughout the British Empire, but especially from India, Nepal, Bhutan and Burma [Myanmar] and even some from China collected by Robert Fortune (1812–1880), who was active in the first half of the 1800s. Chinese, Japanese and Korean specimens collected by French missionaries arrived through Gray's connections in Paris.

The Asian collections were further enhanced after the opening of Japan in 1853. The collections by James Morrow (1820–1865) and Samuel Wells Williams (1824–1884), and later by Charles Wright (1811–1885) (Gray, 1859), were to prove particularly valuable for Gray's later comparisons of the flora of Japan with other parts of the world (Graham, 1972a; Gray, 1856, 1857, 1859). After the opening of Japan, additional Japanese and Far East Russian specimens arrived *via* Carl Johann (Ivanovich) Maximowicz (1827–1891) in St. Petersburgh.

Since Gray's arrival at Harvard in 1842, his herbarium and library had been outgrowing the space in his home. In 1864, he offered to donate both to Harvard on the condition that the university construct safer accommodations to house them. The Gray Herbarium (GH) officially became part of Harvard in 1866.

The Arnold Arboretum years: 1872–1950

Overlapping with Gray was Charles Sargent (1841–1927). Sargent was the first director of the Arnold Arboretum from its founding in 1872, remaining in that position until his death in 1927. Sargent was a strong supporter of collecting expeditions and field studies in North America and eastern Asia, and he was a strong advocate of both the herbarium and library (Sargent, 1913). The mandate of the Arboretum, located in the Jamaica Plain section of Boston and about 10 km from the main Harvard campus in Cambridge, was to grow all plants that were hardy in the Boston climate. This was later modified to include only woody plants. The Arboretum developed its own herbarium, first primarily of trees and shrubs of temperate North America, but within a few years expanding to include trees and shrubs from temperate areas worldwide. Sargent soon realized that Japan and China were the richest sources of new material for the Arboretum. In 1892, he traveled to Japan with his nephew to collect seeds and herbarium specimens. While in Hokkaido he met the British nurseryman, James Veitch, who was to later be instrumental in recommending the collector, Ernest Henry Wilson (1876–1930), to pursue the Arboretum's interests in China. Sargent's own trip resulted in a collection of around 1,225 herbarium specimens and the publication, *Forest Flora of Japan* (Sargent, 1894).

Although Wilson was the first collector employed by the Arboretum to carry out field work in China, the herbarium had earlier received specimens collected by Augustine Henry (1857–1930) in the late 1800s in Hubei and Yunnan provinces. Many of Henry's collections were also sent to the Gray Herbarium. Now that the Arboretum and Gray

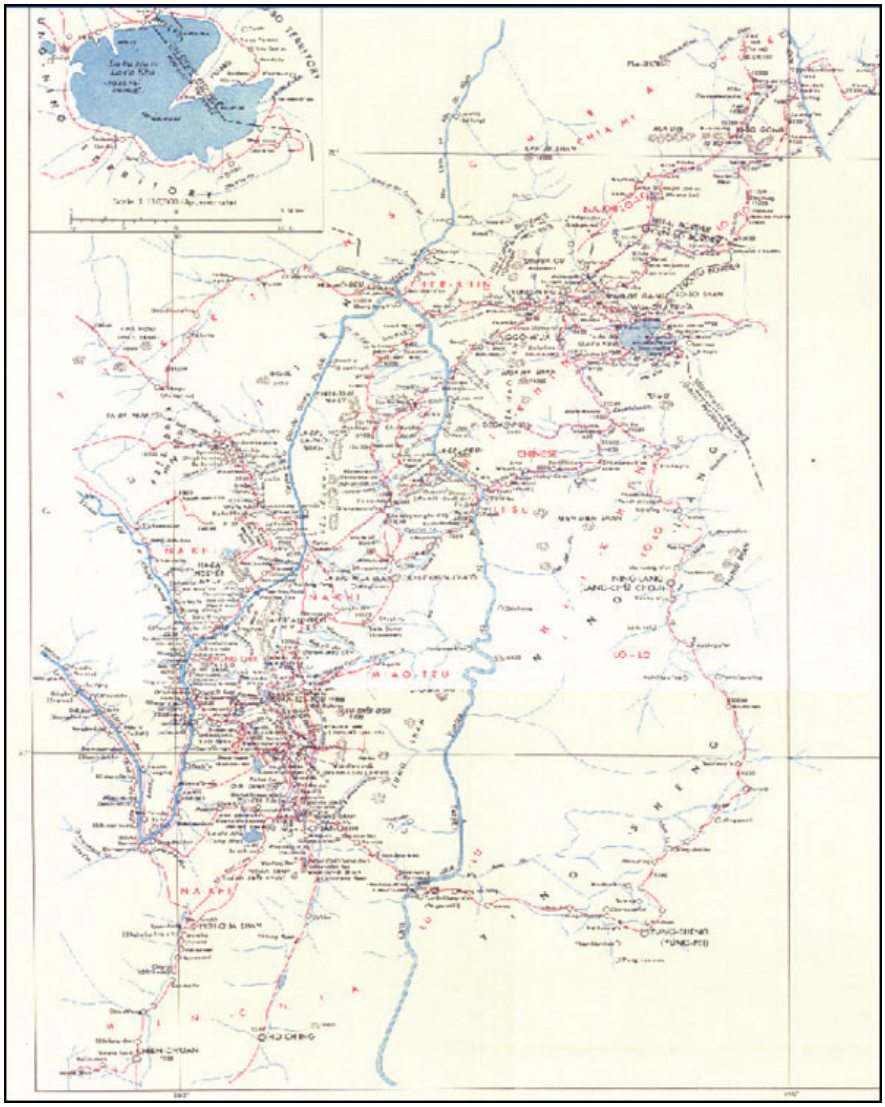

FIGURE 1: One of a series of maps of Lijiang region, northwest Yunnan Province, China, drawn by Joseph Rock.

Herbarium are combined, Henry's specimens in the Harvard Herbaria are among the most comprehensive collections of his material anywhere in the world.

Following Wilson, Sargent provided support for several other collectors—Frank Meyer (1875–1918; USDA), William Purdom (1880–1921; Kew, Arnold, Chinese Dept. of Forestry); Camillo Schneider (1876–1951; Vienna, briefly Arnold), Floyd A. McClure (1897–1970; Lingnan University, Smithsonian)–-but perhaps the most prolific collector of herbarium specimens for the Arboretum was Joseph Rock (1884–1962), who collected herbarium specimens in China from 1920 until 1948. Besides support from the Arnold Arboretum, Rock also obtained funding from the U.S. Department of Agriculture, the National Geographic Society, the Smithsonian Institution and the Harvard-Yenching Library. Rock's collections are particularly significant for the details on his labels. Rock recorded the local names and elevations on his labels for the locations where his collections were made. An excellent cartographer, he also drew maps of all of the places he visited as well as those in intervening areas (Figs. 1, 2). When compared with satellite maps of the same places shown on Rock's maps, the locations are remarkably accurate. If someone wished to investigate changes in vegetation in the places where Rock collected 100 or so years ago, the collection details associated with his specimens in conjunction with his maps are among the very few with the accuracy needed to do so.

Another collector, George Forrest (1873–1932), who also has specimens at Harvard, but whose main set is at the Royal Botanical Gardens, Edinburgh (E), may be another source of sufficiently accurate collecting localities to revisit to determine changes over the past 100-plus years. Forrest's main collecting area was in the divide (Fig. 5) between the Nu Jiang (upper Salween) and Lancang Jiang (upper Mekong). The two rivers run parallel from north to south in western Yunnan and are separated by a high ridge that is

mostly over 4,000 meters and exceeds 6,000 meters in some places. Forrest often recorded the latitude, but not always the longitude, where he made his collections, but the narrow divide makes it possible to infer on which side of the ridge the collections were made. The Nu Jiang (west) side of the ridge receives abundant moisture, while the Lancang Jiang (east) side of the ridge is in a rain shadow. Lush vegetation (tree-form rhododendrons, broadleaved deciduous and evergreen trees, and a rich herbaceous understory with numerous pteridophytes) is on the west side. The east side comprises spiny and aromatic microphyllous shrubs, xerophytic herbs, and other plants adapted to sparse rainfall. By utilizing the latitude, elevation, and composition of the flora, it might be possible to determine fairly accurately the location of Forrest's collecting sites.

Chinese botanists began collecting specimens at the same time Rock was active. Those supported by the Arnold Arboretum, either through funds for expeditions or for purchase of specimens, included Chun Wen-Young (1890–1971), Hu Hsen-Hsu (1894–1968), Wang Chi-Wu (1913–1987), Wang Chi (dates unknown), Tsoong Pu-Chiu (1906–1981), Tsiang Ying (1898–1982), Yu Te-Tsun (1908–1986), Ching Ren-Chang (1898–1986), Fang Wen-P'ei (1899–1983), Feng Kuo-Mei (1917–2007), Cheo Shuh-Yuen (1901–2000), How Foon-Chew (1908–1959), Chu Kuei Ling (1905–1990), Lau Sin-Ki (the Cantonese transliteration of his name, Liu Xin-Qi in pinyin) (dates unknown), also in the South China Institute of Botany (IBSC), from Hainan, and numerous others. They added thousands of specimens from throughout China, many of which were the basis of new species, either at the time of their identification or later in monographs and revisions and during the preparation of *Flora Reipublicae Popularis Sinicae* (Ma and Clements, 2006).

The acquisition of Asian specimens expanded to include Southeast Asian countries during the directorship of the Arnold Arboretum by Elmer Drew Merrill (1876–1956). Merrill, who was made administrator of the botanical collections of Harvard University in 1935 and director of the Arnold Arboretum in 1937, not only continued to provide support for collections from China but also supported expeditions outside of China. An article in *Nature* upon Merrill's retirement states "Under him the inflow of material, living and dried, into the Garden and Herbarium from eastern Asia, Malaysia and the Pacific has been tremendous…" (Anonymous, 1948). The Arboretum was also a major recipient of thousands of botanical specimens collected by Leonard J. Brass, an Australian botanist associated with the Arnold Arboretum, from the Archbold expeditions to Papua New Guinea. Many specimens collected by Mary Strong Clemens (1873–1968) from various Southeast Asian countries, including Papua New

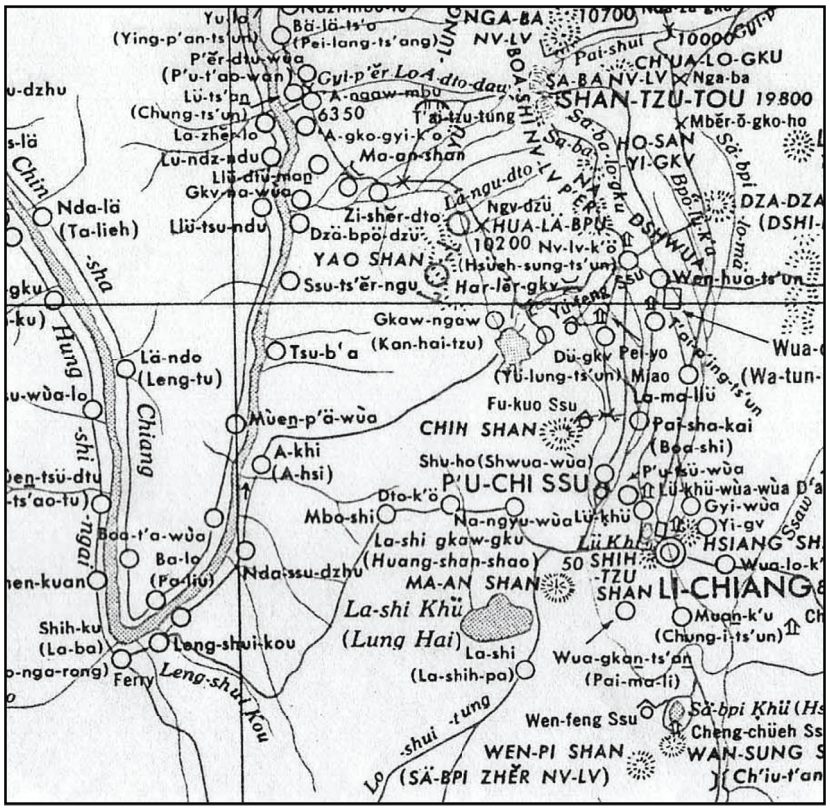

FIGURE 2: Close-up details of map in Fig. 1 drawn by Joseph Rock showing Shih-ku, lower left, where Rock collected *Paeonia lutea* Delavay ex Franch. (Fig. 3).

FIGURE 3: Specimen of *Paeonia lutea* Delavay ex Franch. (Paeoniaceae; A 01247709), collected by Rock in China, Yunnan Province, Mount Lauchünshan, southwest of the Yangtze bend at Shiku. Shiku is in lower left of Rock's map, at the bend of the river, in Fig. 2. The place of collection and elevation make it possible to return fairly close to the original

Guinea, are also in the Harvard Herbaria.

Before Merrill arrived at the Arboretum, he had sent specimens to Harvard during the time he served as botanist and then director in the Bureau of Science in Manila. The specimens were not only from the Philippines, but from neighboring countries, such as Indonesia, Malaysia, Indochina, and China, and were gathered by the collectors he supported from throughout the region. Leonardo Co (1953–2010; pers. comm.), a Philippine botanist who made several months-long trips to study specimens at the Harvard University Herbaria in the 1990s, considered the number of Philippine specimens at Harvard to be a close second to the Smithsonian's, which received a larger set because of Merrill's employment with the U.S. Department of Agriculture.

The lean years: 1950–1978

Asian specimens continued to arrive at Harvard after the departure of Merrill, but fewer purchases were made, the last being from James F. Maxwell (1945–2015), who collected extensively in Thailand and later in Laos. Instead, the Arboretum worked out exchanges whereby Arboretum publications, such as the *Journal of the Arnold Arboretum*, would be sent to herbaria in Southeast Asia in exchange for a set number of specimens each year.

Merrill's last student at Harvard (actually Radcliffe College at the time) in 1947, was Shiu Ying Hu (1908–2012), who had been a student at Lingnan University in Guangzhou, China, under the supervision of Frank A. McClure, who recommended her to Merrill. During China's war with Japan, Hu was based in Chengdu, where a number of China's universities were relocated during the war years. While there, she explored on her own and made numerous collections in western Sichuan, many of which she carried to Harvard. Due to the deteriorating political situation between the US and China, her collections, a few from Chinese botanists made in 1948, and voucher specimens collected on an expedition to the *Metasequoia region* of western Hubei led by J. Linsley Gressitt (1914–1982; Gressitt, 1953) in 1949 were the last specimens from China to be received by the Harvard Herbaria until after President Richard Nixon's trip to China in 1972, when the exchange of specimens between the Institute of Botany in Beijing and the Arnold Arboretum was resumed.

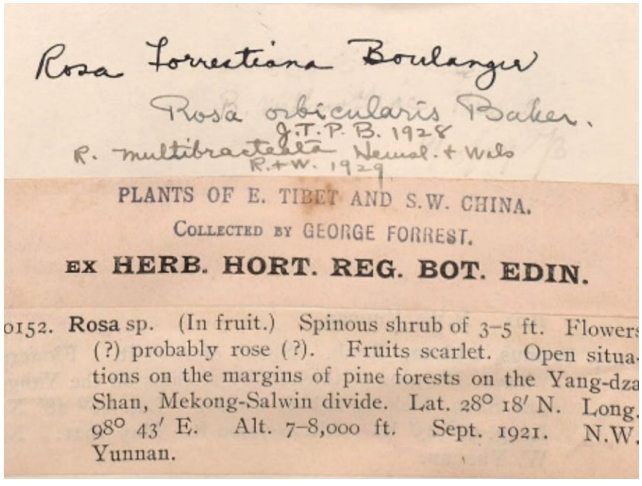
Rosa Forrestiana Boulanger
Rosa orbicularis Baker.
J.T.P.B. 1928
R. multibracteata Hemsl. & Wils
R.&W. 1929
PLANTS OF E. TIBET AND S.W. CHINA.
COLLECTED BY GEORGE FORREST.
EX HERB. HORT. REG. BOT. EDIN.
0152. Rosa sp. (In fruit.) Spinous shrub of 3–5 ft. Flowers (?) probably rose (?). Fruits scarlet. Open situations on the margins of pine forests on the Yang-dza Shan, Mekong-Salwin divide. Lat. 28° 18′ N. Long. 98° 43′ E. Alt. 7–8,000 ft. Sept. 1921. N.W. Yunnan.

Figure 4: George Forrest label for *Rosa forrestiana* Boulanger (Rosaceae) collected on the Mekong-Salwin divide, western Yunnan, China. The "spinous shrub" was likely collected on the Mekong (Lancang Jiang) side of the divide, which is roughly where it shows when plotted using Forrest's coordinates.

The modern era: 1978–present

In 1978, the Harvard Herbaria's collection was further enhanced by the arrival of Peter Shaw Ashton (1934–) as the Arnold Arboretum's sixth director (Powell, 2008; Reed, 2007). Ashton brought with him his extensive, lifelong collection of thousands of specimens of *Dipterocarpaceae*, one of the main components of forests in Southeast Asia, that had long been one of his main taxonomic interests. Ashton's students at Harvard also carried out systematic studies of Southeast Asian plants and brought back from their field trips specimens of other groups in addition to those of their main study groups.

Another infusion of Southeast Asian voucher specimens, primarily from Indonesia and the Philippines in the 1980s and 1990s, came through grants from the National Cancer Institute to John Burley (1950–; Anonymous, 2024), in collaboration with Djaja Djendoel Soejarto (1939–) of the University of Illinois Chicago, and their associates, to collect in bulk to screen for anti-cancer and anti-AIDS properties.

Further specimens from Papua New Guinea were collected by Wayne N. Takeuchi (1952–), an employee of the Arnold Arboretum, and his colleagues, and most recently by Harvard University Herbaria postdoctoral fellow, Zacky Ezedin (1995–).

Joint field trips in China were agreed upon eight years after President Richard M. Nixon's visit to China following President Jimmy Carter's resumption of full diplomatic relations with China in 1979, even though much of the country remained closed to foreigners. Sino-American collaboration began with a first field trip to western Hubei Province in central China in 1980 (Bartholomew et al., 1983a, 1983b). Peter Raven, director of the Missouri Botanical Garden and chair of the Botanical Society of America Committee for Scientific Liaison with the People's Republic of China at the time, had been instrumental in arranging visits by American botanists to botanical institutions in China in 1978 (Howard, 1978; Shen-Miller, 1979; Thorhaug, 1978), and reciprocal visits by botanists from the leading institutions in China to the major universities and botanical institutions in the United States the following year. At the University of California, at the conclusion of the Chinese visit, it was agreed among members of the delegation that the best means of reinstituting botanical collaboration was through

Country	Total vascular plant type specimens in Harvard Herbaria in 2017	No. of types for a particular country	Percent of total number of types	Est. no. of specimens
Cambodia	105692	234	0.221	8678
China	105692	10171	9.623	377209
India	105692	1176	1.113	43614
Indonesia	105692	2421	2.291	89787
Japan	105692	778	0.736	28853
Korea	105692	205	0.194	7603
Laos	105692	91	0.086	3375
Malaysia	105692	2691	2.546	99800
Mongolia	105692	21	0.020	779
Myanmar	105692	234	0.221	8678
Nepal	105692	183	0.173	6787
Papua New Guinea	105692	4000	3.785	148347
Philippines	105692	5012	4.742	185879
Russia	105692	348	0.329	12906
Thailand	105692	164	0.155	6082
Vietnam	105692	1166	1.103	43243
Total number of Asian specimens		28895		1071621

Table 1: Estimated number of vascular plant specimens for each Asian country based on the total number of vascular plants in the Harvard University Herbaria (ca. 5.2 million as of 2017) and the percentage of type specimens for that country.

a joint field trip in China in 1980 followed by a field trip to the southeastern United States by Chinese botanists in 1982.

My own involvement in China began with a telephone call from Bruce Bartholomew of the University of California Botanical Garden in the fall of 1979 asking if I would be interested in participating in a field trip to China during the following summer. Bruce had been a member of the two delegations to China in 1978 and was one of the arrangers of the return visit by the Chinese botanists in 1979. Bruce had long had a deep interest in China and had even visited China as a private citizen in the 1970s. At the time, it was difficult to find any Americans who had experience in Asia, but I had spent seven months in Japan along with a three-week visit to Taiwan for my PhD research in 1977, making me one of the few. Bruce explained that there would be an attempt to get National Science Foundation (NSF) funding but asked if I would be willing to cover my own expenses if we were not successful. Although I had been in a permanent position at the Carnegie Museum of Natural History in Pittsburgh, Pennsylvania, for less than a year, I eagerly agreed. Fortunately, the funding application to the National Science Foundation was successful; it was determined that scientific collaboration between the U.S and China was a high priority endeavor.

Bruce explained that there would be five of us: Thomas Elias of the New York Botanical Garden, John Creech of the U.S. National Arboretum, and Stephen Spongberg of the Arnold Arboretum of Harvard University, in addition to the two of us. To work out details for the trip, a meeting of the five of us was scheduled to be held at the Cary Arboretum of the New York Botanical Garden in Millbrook, New York, in January 1980. Prior to the meeting, John Creech was replaced by Theodore Dudley, also of the National Arboretum. Shortly before the trip, Thomas Elias dislocated his shoulder in a jogging accident and was replaced by James Luteyn, also of the New York Botanical Garden.

For the expedition, all supplies and collecting equipment, including presses, corrugated cardboard, plain newsprint, tents, kerosene heaters as a heat source for drying specimens, and collecting tools had to be shipped from the United States to China. Being based in San Francisco, the burden for purchasing and packing the material to send to China fell on Bruce Bartholomew. It was my first experience working with Bruce, but he handled everything with the can-do attitude that he exhibited throughout our many years of collaboration. Bruce was the most reliable and steady person I ever worked with. He never complained and always quietly took on tasks that others would attempt to avoid. Our collaboration continued for the next 43 years, until his unfortunate death in 2023. At the time we were planning another field trip to China, to western Yunnan, for 2024.

After the 1980 trip, further field work in China was doubtful. It was rumored that the Chinese had spent upward of $300,000 for our three months in China, 15 August–15 November 1980, at a time when China was just emerging from the Cultural Revolution. It had been agreed that China would cover the expenses of Americans in China and the U.S. would cover the expenses of the Chinese botanists when they were in the US. Although we had insisted that we did not need or expect special accommodations, the institutes and villages where we stayed took advantage of the situation to purchase new vehicles, improve roads in the areas we visited, enhance their local environment, build shower facilities, and support an army of local and regional officials who accompanied us while we were in the field. Fortunately, it was eventually agreed that for future expeditions, we would cover our own expenses within China.

The situation in China gradually changed in the 1980s as China slowly opened additional areas to foreigners. In the 1980s trips were first to western Hubei (1980), Yunnan (1984; Dali and Yangbi regions), Guizhou (northeast, 1986), and western Sichuan (Dujianyan, 1988). In the 1990s, field trips became possible throughout China as more parts of the country were opened to foreigners. Since then, expeditions, primarily collaborations between botanists from the Harvard Herbaria and the California Academy of Sciences (CAS) with institutions within China, have resulted in tens of thousands of new herbarium specimens, many from regions of China not previously visited by botanists. The collections in the early 1990s by the two American institutions (A and CAS) were mostly in different areas and were not systematically targeting specific regions. Those by the Harvard Herbaria were in Nei Mongol (Inner Mongolia; 1993); Henan (1994); Qinghai (Nangqian and Yushu xian; 1995); and the mountains of northwestern Beijing (1996), which reach an elevation of over 2,000 meters, and in southwestern China (Appendix 1).

In 1997 two major projects were launched. The CAS received NSF grants for a Biological Surveys and Inventory project for collecting expeditions in the Gaoligong and Dulong Jiang regions of western Yunnan. The Harvard University Herbaria received two rounds of NSF funding under the same program: the first to Michael J. Donoghue (1952–) for three years of field work, and the second, with matching funds from the National Natural Science Foundation of China, to David Boufford (1941–) for five years of field work in the Hengduan region (Gansu, Qinghai, Sichuan, Xizang [Tibet] and Yunnan) just north of the Gaoligong Mountains. In addition to exchanging specimens, a database of the collections made by both the Harvard Herbaria and CAS is available on the Biodiversity of the Hengduan Mountains and adjacent areas of south-central China (https://www.hengduan-biodiversity.net/fieldnotes). Both projects collaborated with several institutes in China—the Institute of Botany, Beijing; the Chengdu Institute of Biology; the Institute of Mycology and Microbiology, Beijing—with the most extensive collaboration being with the Kunming Institute of Botany in Yunnan. Exchanges of specimens between the CAS and the Harvard Herbaria from those two projects enhanced the collections at both institutions, Harvard's by more than 40,000 specimens.

Duplicate specimens from the Harvard trips were also sent on exchange to other institutions with similar geographical interests, especially to the herbarium of the University of Tokyo (TI) and the herbarium of the Muséum national d'Histoire naturelle in Paris (P), which has a significant collection of plants from China, including duplicates from the early French missionaries, which have been sent to Harvard in return. The University of Tokyo has reciprocated with specimens from Nepal, Bhutan, and Japan.

When the NSF projects were concluded, additional collecting expeditions in the Hengduan region and in other parts of China were organized, usually for one field season at a time, with support from the National Geographic Society, institutions within China, and donations from private individuals.

There is no exact count of the number of specimens in the Harvard University Herbaria, nor of the number of specimens by country, but during the preparation of a grant proposal in 2017, a rough estimate of the number of specimens was calculated for each country recognized in the herbarium for Asia. The calculations were based on the total estimated number of specimens in the herbaria and the number of type specimens from each country. Although far from accurate, this method provided a very rough estimate of the number of specimens from each Asian country. The counts for Japan, Nepal, and Thailand are especially misleading, since these countries have a smaller proportion of types, but all counts are underestimates to a greater or lesser extent (Table. 1).

For further details (collectors, specimens) regarding the Asian collections in the Harvard University Herbaria, please visit the specimen database at https://kiki.huh.harvard.edu/databases/specimen_index.html. Select the name of the country from the pull-down list and generate a search. Further information about individual collectors and teams of collectors from that country can then be obtained by cutting and pasting the name of the collector(s) into the name field of the Index of Botanists at https://kiki.huh.harvard.edu/databases/botanist_index.html.

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Appendix

Harvard University Expeditions to Asia after 1980

1984, 14 June–22 August. China, western Yunnan, Dali and Yangbi xian; Kunming region. *Sino-Amer. Bot. Exped. to western Yunnan 1-2006*. (*Bruce Bartholomew, David E. Boufford, Hsi-Wen LI, Cheng-Gong MA, Dan H. Nicolson, Tsun-Shen YING & Shao-Wen YU*). Angiosperms: 1,557; gymnosperms: 10; pteridophytes and lycophytes: 186.

1986, 19 August–17 October. China, northeastern Guizhou. *Sino-Amer. Guizhou Bot. Exped. to northeastern Guizhou 1-2474*. (*Bruce Bartholomew, David E. Boufford, Qianhai CHEN, Sizhao FANG, Jin-Gen QI, Stephen A. Spongberg, Yan-Huo TSI, Yuling TU, Peishan WANG, Yinghai XIANG, Tsun-Shen YING)*. Vascular plants: 2,474.

1988, 21 August–16 September. China, Sichuan, Dujiangyan region. *David E. Boufford & Bruce Bartholomew, with Gang LI & Guanghua ZHU 23935-24929*. Angiosperms: 809; gymnosperms: 3; pteridophytes and lycophytes: 196.

1989, 21 September–3 October. China, Taiwan. *David E. Boufford, Bruce Bartholomew, Chen-Meng KUO, W. P. LEU, C. H. LIN & W. C. LIN, Ching-I PENG 24938-25281*. Angiosperms: 211; pteridophytes and lycophytes: 115.

1992, 21 July–10 August. South Korea. *David E. Boufford, T. J. Kim, H. W. LEE, Chong-Wook PARK & Byung-Yun SUN 25712-25842*. Angiosperms: 111; pteridophytes and lycophytes: 21.

1993, 5–9 August. China, Nei Mongol. *David E. Boufford, Emily W. Wood, Tsun-Shen YING & H. Y. ZHANG 25843-26052*. Angiosperms: 153; gymnosperms: 1; pteridophytes and lycophytes: 2.

1994, 19 May–8 June. China, Henan, Neixiang Xian. *David E. Boufford, Hong-Xiang CHENG, Bao-Dong LIU, C. Y. XI, Tsun-Shen YING, Cheng-Jun ZHANG & X. L. ZHU 26055-26542*. Angiosperms: 416; gymnosperms: 2; pteridophytes and lycophytes: 69.

1995, 19 June–7 July. China, Qinghai. *David E. Boufford, Michael J. Donoghue, Xue-Feng LU & Tsun-Shen YING 26545-27081* (Benito Tan, bryophytes). Angiosperms: 510; gymnosperms: 4; pteridophytes and lycophytes: 26.

1996, 16–18 July. China, Beijing Municipality: Mentougou District. *David E. Boufford, Mei-Duo SURI, Shao-Yong YANG & Xian-Chun ZHANG 27088-27145*. Angiosperms: 56; pteridophytes and lycophytes: 1.

1997, 13 August–8 September. China, western Sichuan (Daowu, Kangding, Li, Luding, Luhuo, Maerkang xian). *David E. Boufford, Michael J. Donoghue & Richard H. Ree 27156-28004*. Angiosperms: 752; gymnosperms: 5; pteridophytes and lycophytes: *Yu Jia*, 99 bryophytes: 772; *David Hibbett & Zheng WANG*, fungi and lichens: 530.

1998, 1–31 July. China, western Sichuan. *David E. Boufford, Bruce Bartholomew, Wenyun CHEN, Michael J. Donoghue, Richard H. Ree, Hang SUN & Sugong WU (S. K. WU) 28008-29343*. Angiosperms: 752; gymnosperms: 11; pteridophytes and lycophytes: 79; bryophytes: 2,017; Zhu-Liang YANG & Zheng WANG, fungi and lichens: 551.

2000, 5 July-18–18 August. China, western Sichuan, eastern Xizang (Tibet). *David E. Boufford, Susan L. Kelley, Richard H. Ree & Su-Gong WU* (*S. K. WU*) *29354-30182*. Angiosperms: 761; gymnosperms: 7. pteridophytes and lycophytes: 66; *Yu JIA & Hidetsugu MIWA*, bryophytes: 865; Brian Perry, fungi and lichens: 177.

2001, 4–10 September. Myanmar, Kachin State. *Bruce Bartholomew, David E. Boufford & Zhi-Lin DAO 8676-8806*. Angiosperms: 103; pteridophytes and lycophytes: 33. The trip was cut short due to death of organizer, Joe Slowinski (https://en.wikipedia.org/wiki/Joseph_Bruno_Slowinski).

2004, 6 July–25 August. China, western Sichuan, eastern Xizang (Tibet). David E. Boufford, *Jia-Hui CHEN, Susan L. Kelley, J. LI, Richard H. Ree, Hang SUN & Yong-Hong ZHANG 30405-32596*. Angiosperms: 2122; gymnosperms: 12. pteridophytes and lycophytes: 88; *Yu JIA*, bryophytes: 2088; *Zhu-Liang Yang & Zaiwei GE*; fungi and lichens: 689.

2005, 7 July–28 August. China, western and northwestern Sichuan, central Yunnan. *David E. Boufford, Jia-Hui CHEN, Kazumi FUJIKAWA, Susan L. Kelley, Richard H. Ree, Hang SUN, Ji-Pei YUE, Da-Cai ZHANG & Yong-Hong ZHANG 32600-34994*. Angiosperms: 2331; gymnosperms: 7. pteridophytes and lycophytes: 81; *Yu JIA*, bryophytes: 800; *Zhu-Liang Yang & Zaiwei GE*; fungi and lichens: 514.

2006, 20 July–28 August. China, western Sichuan, western Yunnan. *David E. Boufford, Bruce Bartholomew, Susan L. Kelley, Richard H. Ree, Hang SUN, Liang-Liang YUE, Da-Cai ZHANG & Yong-Hong ZHANG 34996-37410*. Angiosperms: 2353; gymnosperms: 13. pteridophytes and lycophytes: 81; *Zhu-Liang Yang & Zaiwei GE*; fungi and lichens: 537.

2007, 6–22 May. China, southern Gansu. *David E. Boufford, Qing TIAN & Zhi-Yun ZHANG 37446-37850*, with *Yu JIA* (bryophytes). Angiosperms: 357; bryophytes: 9.

2007, 21 July–24 August. China, western and northwestern Sichuan. *David E. Boufford, Kazumi FUJIKAWA, Susan L. Kelley, Richard H. Ree, Hang SUN, Bo XU, Jian-Wen ZHANG, Ti-Cao ZHANG & Wei-Dong ZHU 37851-40492*. Angiosperms: 2560; gymnosperms: 13. pteridophytes and lycophytes: 84; bryophytes: 652; *Zhu-Liang Yang & Zaiwei GE*; fungi and lichens: 537.

2009, 16 July–8 August. China, western Sichuan, eastern Xizang (Tibet), northwestern Yunnan. *David E. Boufford, Bruce Bartholomew, Deren A. Eaton, Xin-Hui LI, Richard H. Ree, Hang Sun, Bo XU, Ji-Pei YUE, Jian-Wen ZHANG & Xin-Xin ZHU 40532-42035*. Angiosperms: 1473; gymnosperms: 8; pteridophytes and lycophytes:37; Zhu-Liang Yang & Zaiwei GE; fungi and lichens: 385.

2010, 19 July–14 August. China, western Sichuan, northwestern Yunnan. *David E. Boufford, Lin-Yang CHEN & Xin-Hui LI* 42052- 42895. Angiosperms: 825; gymnosperms: 8; pteridophytes and lycophytes:21.

2013, 19 August–18 September. China, eastern Sichuan northwestern and central Yunnan, *David E. Boufford, Yong-Sheng CHEN, Julian F. Harber, Xin-Hui LI & Qia WANG 43125-43581*. Angiosperms: 426; gymnosperms: 8; pteridophytes and lycophytes:30; fungi: 1.

2014, 6 May China, western and northwestern Sichuan. *David E. Boufford, Sharon Christoph, Chris Davidson, Yong-Dong GAO & Qiu-Yun XIANG 43585-43741*. Angiosperms: 151; gymnosperms: 2; pteridophytes and lycophytes: 5.

2014, 13 August–14 September. China, western Hubei. *David E. Boufford, Tao DENG, Michael J. Donoghue, Patrick W. Sweeney & Dai-Gui ZHANG 43768-43863*. Angiosperms: 83; pteridophytes and lycophytes: 1.

2015, 9–20 August. China, northwestern Yunnan. *David E. Boufford, Sharon Christoph, Chris Davidson, Xin-Hui LI & Tao YANG 43968-44082*. Angiosperms: 115; gymnosperms: 1; pteridophytes and lycophytes: 1.

2016, 3–5 August. Japan, Hokkaido, *David E. Boufford, Sharon Christoph, Chris Davidson & Hiroyuki SATO 43930-43941*. Angiosperms: 11. 2016, 8 August. Japan, Honshu. *David E. Boufford, Shinobu AKIYAMA, Sharon Christoph, Chris Davidson, Hideaki OHBA & Hiroshi TAKAHASHI 43942-43953*. Angiosperms: 11; pteridophytes and lycophytes: 1.

2017, 9–20 August. China, northwestern Yunnan. *Chris Davidson, David E. Boufford, Sharon Christoph, Xin-Hui LI & Tao YANG 13734-13800*. Angiosperms: 65; pteridophytes and lycophytes: 1.

2017, 9–20 August. China, northwestern Yunnan. *David E. Boufford, Sharon Christoph, Chris Davidson, Xin-Hui LI & Tao YANG 43968-44082*. Angiosperms: 115; gymnosperms: 1; pteridophytes and lycophytes: 1.

2018, 28 April–7 May. China, southern Yunnan. *David E. Boufford, Sharon Christoph, Chris Davidson, Xin-Han HUANG & Zhuo ZHOU 44087-44181*. Angiosperms: 94; gymnosperms: 1.

2018, 27 July–1 September. China, northwestern Sichuan, eastern Qinghai, northwestern Yunnan. *David E. Boufford, Bruce Bartholomew, Jian-Ling GUO, Li QIN, Julian F. Harber & Jipei YUE 44182-45073*. Angiosperms: 865; gymnosperms: 3; pteridophytes and lycophytes: 28.

2019, 15–18 March. China, Guangdong. David E. Boufford, Tao CHEN, Shunyu MIAO & Yan ZHENG 45075-45118. Angiosperms: 42; gymnosperms: 2.

2019, 11 August. China, central and western Yunnan. *David E. Boufford, Jian-Ling GUO, Zhan-Xiang LI, Lin SU, Xin YU & Yong-Hong ZHANG 45120-45658*. Angiosperms: 508; gymnosperms: 3; pteridophytes and lycophytes: 29.

2023, 17 June–8 July. Uzbekistan, Kyrgyzstan, Tajikistan. *David E. Boufford, Boburbek A. Karimov, Samantha J. Levine, Orozbai Mamatkulov, Richard H. Ree, Hikmatullo Suyunkulov, Ziyoviddin Yusupov 46050-46186*. Angiosperms: 135; gymnosperms: 1; pteridophytes and lycophytes: 3.

2024, 6–20 August. China, northwestern Yunnan. *David E. Boufford, Hui-Ge CHEN, Jun-Tong CHEN & Guo SHI 46319-46486*. Angiosperms: 154; gymnosperms: 1; pteridophytes and lycophytes: 12.