The 1984 Sino–American Botanical Expedition to Yunnan, China

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A recent expedition to China yielded sixteen hundred flowering plants and ferns from a botanically rich part of that vast country

The 1984 Sino–American Expedition to Yunnan province, the People's Republic of China, was only the second time that American and Chinese botanists were able to undertake extensive fieldwork together in China since Liberation in 1949. Botanical exchanges between the United States and China had begun in 1978, when a delegation of American botanists, including past Director of the Arnold Arboretum, Dr. Richard A. Howard, visited China to initiate discussions on how best to carry out cooperative projects between botanists of the two countries (Thorhaug, 1978). The following year, 1979, saw a reciprocal visit to the United States by a delegation of Chinese botanists. The delegation visited botanical gardens, arboreta, and other research facilities throughout the country and, in a series of meetings with their American counterparts at the University of California in Berkeley at the end of their tour, decided that a joint field expedition in China would be an ideal means of continuing botanical exchange.

The First Joint Chinese and American Expedition: Metasequoia in the Wild

The first joint expedition took place between 15 August and 15 November 1980 and involved botanists from the Arnold Arboretum; the University of California, Berkeley; the Carnegie Museum of Natural History, Pittsburgh; the U.S. National Arboretum; and the New York Botanical Garden (Bartholomew et al., 1983a). This group, which included both authors of this article, was accompanied in the field by Chinese botanists from the Institute of Botany, Beijing; the Jiangsu Institute of Botany, Nanjing; the Wuhan Institute of Botany; and the Kunming Institute of Botany. One of the two regions visited by that expedition was especially significant because it included the valley in Lichuan Xian (county) where the dawn redwood, *Metasequoia glyptostroboides* Hu & Cheng, grows (Bartholomew et al., 1983b). The Metasequoia valley had been the site of the last American collecting expedition in China before the country was closed to the West more than thirty-one years previously.

Seeing the largest assemblage of wild plants of the dawn redwood (about six thousand individuals in this valley) was truly exciting, but our group was disappointed to find that the ecological conditions in the area had changed drastically since the previous expeditions had visited there. The thickets reported by Chu and Cooper (1950), in which seedlings and young plants of *Metasequoia* were found, had been completely cleared from the base of each *Metasequoia* tree. Most of the other trees on the surrounding hillsides, seen in pictures taken by Gressitt in 1948 (Gressitt, 1953), had been cut for fuel or construction purposes. The existing trees are now surrounded by rice paddies and fields of corn instead of natural vegetation, and the
human population in the isolated valley has increased dramatically! Even though the remaining trees have been given full protection, once they die they are unlikely to be replaced naturally under present conditions; the wild populations of Metasequoia will slowly pass out of existence, even though the widespread cultivation of the dawn redwood will ensure the survival of the species.

One interesting observation our group made during the visit to the Metasequoia region was that only the tree from which the type specimens of Metasequoia glyptostroboides were collected has a broad, somewhat buttressed base. All of the other trees in the Metasequoia valley, about one hundred kilometers from the "type tree" at Modaoqi (Modaochi), have smooth, straight trunks from ground level to the lowest branches. The oldest trees in cultivation in the United States are now large enough to show their mature growth habit, and all of them exhibit a swollen, slightly buttressed base. It seems very likely that the large number of seeds gathered in the late 1940s and widely distributed by E. D. Merrill, then Director of the Arnold Arboretum, were from the type tree and not from a tree in the main valley. Anyone fortunate enough to have trees derived from those first-distributed seeds should be aware of their probably direct descent from one of botany's most famous and historic plants.

Despite the severe habitat destruction, members of the Expedition were able to find several plants in the dawn redwood valley that had not been reported previously by either Gressitt (1953) or Hu (1980). In a summary of our impressions and suggestions for conservation in the Metasequoia valley, the American and Chinese botanists were unanimous in recommending that several hillsides supporting remnants of the original forest be set aside and allowed to regenerate naturally. With time, something approaching the original vegetation, which supposedly existed before the settling of the valley about three hundred years ago, might return.

Approximately four days were spent in the Metasequoia region, but getting there and back by boat, minibus, and jeep took about two weeks, and most of the fieldwork during the 1980 expedition was conducted in the Shennongjia Forest District, a mountainous region in northwestern Hubei province. This area had been visited previously by Western botanists, notably by Augustine Henry and E. H. Wilson, but the interior of the area was so rugged and difficult to reach that they spent little time there. In the early 1970s the Chinese government declared the region a "Forest District," a designation roughly equivalent to xian (county), and began constructing roads for the harvesting of timber. Roads now connect nearly all parts of the district, which allowed our group to reach remote and once isolated areas.

In total, we spent six weeks in the Shennongjia Forest District. Our base camp in the village of Jiuhuping, at about fifteen hundred meters, was in an area with a climate very similar to New England's, except that central China receives far more rain throughout the year. The stream along the road in front of our base camp would rise dramatically after several days of torrential rains, then, because of severe deforestation on many slopes, would fall abruptly as the rains were followed by several clear, sunny days. But even without going outside we could guess at the level of the river from the brightness of the electric lights. Nearly all villages in mountainous regions of China are now supplied with elec-
tricity through the widespread use of small hydroelectric plants. Each village has a small generating station fed with water channeled from the main bed of the river somewhere upstream to a point high above the plant. The water then plunges through a nearly vertical pipe (or pipes) to run the generator. When the river was high our lights would burn brightly, but as the level of the water in the streambed dropped, the lights would dim, and after several rainless days the electrical supply became somewhat uncertain.

Noteworthy Plants of Central China

The trees around the village belonged to such familiar genera as Acer L. (maple), Fagus L. (beech), Quercus L. (oak), Betula L. (birch), Sorbus L. (mountain ash), Salix L. (willow), Populus L. (aspen), and Tilia L. (basswood). Associated with them, however, were a number of plants including Cercidiphyllum Sieb. & Zucc. [katsura], Eupeleva Sieb. & Zucc., and Pterocarya Kunth [wing-nut], endemic to eastern Asia, and Tetracentron Oliver, Decaisnea Hooker & Thomson, Davidia Baillon, Cyclocarya Iljinskaja [one of the wing-nuts, but with the wing completely circling the fruit], Sinowilsonia Hemsley, Sinofranchetia [Diels] Hemsley, and a number of others, mostly or completely restricted to China.

Many of these genera now known only from China are important in hypotheses...
regarding evolution and past geographic distributions of plants, particularly of plants in the north-temperate regions. One particular plant, Saruma Oliver (its name being an anagram of Asarum L.), a member of the Aristolochiaceae, resembles our wild ginger in leaf shape and overall appearance, but it has an erect, leafy stem with a flower in each leaf axil. The flowers are unusual in that they bear both sepals and petals. In wild ginger, the stems are creeping and the flowers have only sepals (the petaloid structures sometimes produced in Asarum canadense L. are actually modified stamens). Saruma suggests the kind of plants one would guess to be the ancestor of Asarum. It is very unlikely, however, that Asarum arose directly from Saruma, but the similarities and differences in the two genera clearly provide tantalizing clues as to what the ancestor of Asarum might have looked like.

Other noteworthy plants in central China include a number of herbaceous species that have their closest relatives in the Appalachian region of the eastern United States. One of these, Diphylleia sinensis H. L. Li, has a scattered distribution in central China. Its closest relative, Diphylleia cymosa Michaux (umbrella leaf), is restricted in the United States to the narrow area along the North Carolina–Tennessee state line and a few localities in adjacent Georgia, South Carolina, and Virginia. The third species in the genus, Diphylleia grayi F. Schmidt, named for Harvard botanist Asa Gray, is restricted to Japan and the Soviet island of Sakhalin. It is interesting that, even though they are more widely separated geographically from each other than they are from Diphylleia grayi, the Chinese and American plants are more similar to each other than either is to the Japanese plant.

One particularly interesting aspect of the 1980 expedition was being able to see many of the commonly cultivated plants of the eastern United States growing in their natural environment. Plants that had seemed to be restricted to university campuses, botanical gardens, and arboreta were much more splendid when seen growing from a crevice in a sheer rock cliff, or intermixed with other trees to form a particular kind of vegetation. At times, when seeing such plants as Viburnum rhytidophyllum Hemsely, Buddleja davidii Franchet (butterfly-bush), Pachysandra terminalis Sieb. & Zucc. (pachysandra), or some of the rhododendrons, it was hard to understand why they had not become more widespread in parts of North America, where the climate seemed so much like that of central China.

In total, the Chinese and American bota-
nists collected over twenty thousand sheets of herbarium specimens and about five hundred collections of living plants and seeds during the 1980 expedition. The opportunity to collect these specimens and to see the plants growing naturally made a strong impression on all of us. When examining herbarium specimens from China, we now can recall the kinds of situations under which the plants may have grown in the field, and can consider the various species that might have grown with it. The observations that are only available through fieldwork are most important in providing a clearer understanding of many aspects of biology, plant geography, taxonomy, and evolution that would otherwise either be speculative, or remain completely unknown.

Père Delavay and the Flora of Yunnan

The 1984 expedition to southwestern China was in a completely different vegetational and floristic region. While the provinces of central China have a flora with strong affinities to those of Japan and parts of North America, the flora in Yunnan is more like that of the Himalayan region and of northern Thailand and Burma. The area where we conducted the greatest portion of our fieldwork in 1984 was in the Dali (Tali) region of Yunnan province. The first botanical collections in this area were made by French missionaries in the late 1800s, and since then the area has been noted for the richness of its flora. Père Jean Marie Delavay, in particular, made most of the early collections in the Diencang Shan (Cang Shan [Tsang Shan] for short) mountain range west of the walled city of Dali.

Père Delavay first went to China in 1867 where, in addition to his missionary work, he was an avid botanical collector. On returning to France in 1881, Delavay met the French botanist Adrien Franchet, with whom he made an agreement to send all future collections to him at the Muséum d'Histoire Naturelle in Paris. On returning to China in 1882, Delavay was stationed at a mission near the northeast corner of Erhai Lake, not far from Dali. Over the next ten years Delavay sent Franchet an enormous number of specimens, many of which were new to science. Plants such as Rhododendron arboreum W. W. Smith subsp. delavayi (Franchet) Chamberlain, Vaccinium delavayi Franchet, Paeonia delavayi Franchet, Clethra delavayi Franchet, Viola delavayi Franchet, Thalictrum delavayi Franchet, to mention only a
few, commemorate this prodigious early collector.

The flora around Dali is now quite well known, since the region has been visited by many Western and Chinese botanists over the past hundred years. It is interesting to note that some of the taxa named by Franchet have subsequently been shown to be synonymous with Himalayan plants described earlier by British botanists working in the western extension of the Sino-Himalayan floristic region. The Dali area was, however, the farthest west in Yunnan province that foreigners were allowed to visit in 1984, and it was for this mountain range that permission was granted for the second Sino–American Botanical Expedition.

**To Kunming by Way of Hong Kong**

The 1984 trip began in Hong Kong, where the four American participants met before entering China. Bruce Bartholomew of the California Academy of Sciences, who had been in Hong Kong for several days after returning from several weeks of fieldwork in Bhutan, met the three of us (Dr. Dan H. Nicolson, Department of Botany, Smithsonian Institution; Dr. Paul L. Redfearn, Southwest Missouri State University and Missouri Botanical Garden; and Dr. David E. Boufford, Arnold Arboretum) at the airport and took us to our hotel. At about six o'clock the next morning we all met in the hotel lobby for a brief before-breakfast excursion to the misty summit of Victoria Peak, which overlooks the city. The forests on this steep-sided mountain are now preserved, and those of us who had never been to Hong Kong before were quite surprised at the extent and richness of the forest in this tiny, overpopulated British colony. We returned to the city for a Cantonese *dimsum* breakfast at about nine o'clock, then checked out of the hotel and went to the airport to wait for the flight to Kunming.

The flight took us across the extensive delta of the Pearl River and over some of the most impressive karst formations in the world, in Guangxi (Kwangsi) province. Once over Yunnan we could see the red earth so characteristic of central Yunnan.

Kunming is in a large basin surrounded by hills, most of which had long since been denuded of their forests and eroded to bedrock. The city is at an elevation of about two thousand meters (a little over six thousand feet), and, at about twenty-five degrees north latitude, is located at roughly the same latitude as the southern tip of Florida, near Miami. After the intense heat and humidity of Hong Kong, the climate of Kunming, which is more like May in New England all year 'round, was perfect.

At the airport in Kunming we were met by several old and new friends. Professor Zhang Ao-luo, who had visited the Arnold Arboretum in 1982 as Vice-Director of the Kunming Institute of Botany, was now the Director of the Kunming Branch of the Chinese Academy of Sciences, and had played a leading role in arranging for the 1984 expedition. Also at the airport were Professor Ying Tsun-shen, who had spent one year as a Mercer Fellow at the Arboretum in 1981–1982 and who had also been a member of the 1980 expedition to Hubei; Professor Li Hsi-wen, who had visited the Arboretum for about four days in 1981; and Ms. Wang Siyu, who was a visitor the Arboretum from November 1984 to August 1985. All of these people have been instrumental in furthering cooperation between botanists in the United States and China.

On the evening of our arrival we were hosted at a magnificent banquet by Professor Wang Xianpu, the Vice-Director of the Institute of Botany, Beijing, and Professor Zhou Jun, the Director of the Kunming Institute of Botany. Among some of the more exotic dishes were fried larval bees, freshwater shrimp and crabs from Kunming Lake, and whole, deep-fried frogs, which are now raised
in China but which had come originally from Cuba. The banquet provided an opportunity for everyone to express his best wishes and to toast further cooperation between Chinese and American scientists.

The next two days were spent sorting out the ton and a half of supplies that had been shipped from the United States, loading everything on a large truck and making general plans for how we would proceed in the field. This short period gave us an opportunity to meet some of the Chinese botanists with whom we would work for the next several weeks and to renew friendships with those who had been with us before. There was also time to inspect the new herbarium building at the Kunming Institute of Botany and to become familiar with the Institute’s botanical garden.

On to Xiaguan over the Burma Road

On the morning of June twelfth we were ready to go. The vehicles met us at the Kunming Hotel, where we were staying, and the caravan of two trucks and a minibus, loaded with collecting equipment and six weeks’s supply of soft drinks, beer, preserved eggs, rice, Yunnan sausages, and other staples, headed off toward the Western Hills at the far edge of the city. There we reached the terminus of the Burma Road, the highway we were to follow, for the next ten hours and four hundred kilometers, to the city of Xiaguan, which was to be the site of our base camp for the next seven weeks. The day was bright and clear with only a few large, puffy, white clouds in the sky. Little did we know that this was to be the only completely
sunny day out of thirty! The Americans were fascinated by the passing landscapes and spent most of their time looking out of the windows of the minibus. As we drove to the west we traversed progressively higher hills and low mountain ranges separating broad basins. Even after many hours along the Burma Road we were still impressed—and disturbed—by the complete absence of forests or even small plots of trees, but we knew that once we neared our destination, far from the city of Kunming, we would begin seeing more and more extensive forests and other types of natural vegetation. After all, we had read of the rich botanical treasures that had come from the region of Dali and had seen the specimens in herbaria. Nevertheless, it was more than a little upsetting to see one mountain range after another, completely stripped of trees, pass by in the distance. It was also upsetting to see that as we proceeded farther and farther from Kunming, the villages were not becoming smaller and smaller! We were later told by one official that the Dali Autonomous Region was home to about one and three-quarter million persons. Finding towns in China with names completely unknown in the West, but with populations exceeding one million, or even two million, is not uncommon.

A few hours after leaving Kunming, as we neared the city of Lufeng, we dropped down into a large basin with landforms reminiscent of the Painted Desert in Arizona and very unlike anything we had seen in eastern Asia. The basin was totally devoid of trees [except for the ever-present single row of introduced Eucalyptus trees planted along the road], and the dry, layered rock outcrops were completely barren and in sharp contrast to the irrigated depressions filled with rice that separated them. We were told that this region was noted for the “dragon bones” [dinosaur fossils] that had been found there. We later stopped in this desolate region on our return to Kunming six weeks later and found only three species of noncultivated vascular plants: one grass, a species of Arundinella Raddi [Gramineae]; one herb, a Euphorbia L. [Euphorbiaceae]; and one shrub, Dodonaea viscosa [L.] Jacquin [Sapindaceae, or sometimes Dodonaeaceae].

Around noon we stopped for lunch in the city of Chuxiong, about halfway between Kunming and Dali. According to present custom in hotels throughout China, the Americans and Chinese were seated in separate dining rooms. The only times we could eat together were when we were hosting banquets for our colleagues, when they were giving a banquet for us, or when we were in the field under less formal conditions.

After lunch we continued on our journey, but since it was still relatively early and we had only about five more hours of travelling to do, we decided to make a few brief stops along the way to stretch our legs and to look at the plants. The first stop was along a narrow ravine where all of the trees had been cut, and all that remained were some straggly shrubs of Gaultheria forrestii Diels, Camellia saluenensis Stapf ex Bean, Viburnum foetidum Wallich var. ceanothoides (C. H. Wright) Hand.-Maz., a few other shrubs, and some overgrazed herbaceous plants. Despite the disturbance we were glad to get an idea of the kinds of plants we would be seeing later. The next and last stop was at the top of a high pass in the last mountain range we had to cross before reaching the wide plain to the east of Dali and the Cang Shan mountain range. Again there were no trees, and this time there were even fewer shrubs. The few herbaceous plants other than grasses grew only next to the road, and the mountain slopes were completely grass covered. We later learned the reason for the absence of trees and shrubs. Since the valley floors are used strictly for agriculture, the people must drive their animals to these higher elevations to graze, and to provide more grazing land the slopes are periodically burned to remove
the woody growth. In some places the extensive burning has so altered the growing conditions and depleted the soil that only bracken (*Pteridium aquilinum* [L.] Kuhn var. *wightianum* [Aghard] Tryon) is able to grow. The view to the east was spectacular as the sun, now starting to drop in the west, highlighted the jagged peaks and narrow ravines of the mountains ringing the heavily populated basin below. About two hours after this stop we got our first glimpse of Erhai Lake and the cloud-covered Cang Shan mountain range, where we would finally be able to begin our fieldwork.

**Setting Up Our Main Base in the Erhai Lake Hotel**

A necessary ingredient for anyone conducting fieldwork in China, as has been said many times, is a good measure of patience. Our first day was spent organizing facilities for drying specimens in a large room at the Erhai Lake Hotel, our main base of operations. We asked to have built two large wooden boxes with open bottoms and tops in which we would put kerosene heaters to dry our plant specimens. The work was contracted out to a local carpenter who took full advantage of artistic license and the relaxing regulations on free enterprise by charging us the equivalent of two hundred American dollars for two rather crude boxes, built mostly of scrap boards, that did not quite conform to our specifications. Nevertheless, we were able to arrange strips of wood over the tops of the boxes in such a way that the plant presses could be arranged side by side and end to end over the heat sources. The construction of the boxes took the better part of a day, and we then spent the remainder of the afternoon visiting Erhai Park, at the south end of Erhai Lake.

From the hills above the park we got our first glimpse of the walled city of Dali and its famous pagodas, far off in the distance, on the west side of the lake. The following day was spent at a meeting with officials from the Dali Autonomous Region and Yangbi Xian, and with several people from the scientific bureaus of Dali and Yangbi. Everyone was cordial and most generous in offering assistance, and we knew we could count on these people in the event of problems.

**In the Field at Last**

Finally, on the third day after our arrival in Xiaguan, we set out for the field. Our first trip was to be a five-day excursion into the mountain directly east of Yangbi. Yangbi is
situated on the western side of the Cang Shan; although Dali and Xiaguan, on the opposite side of the mountain range, are now open to foreigners, Yangbi can be visited only with special permission. For this first trip we would be able to drive to our temporary base camp at twenty-eight hundred meters and then hike upward from there, but first we set out for the town of Yangbi, where we were to spend the night. For the first twenty to thirty kilometers out of Xiaguan the Burma Road descends as it follows the river draining Erhai Lake, the water of which eventually flows into the Mekong River just slightly to the northwest. This river cuts through the southern extension of the Cang Shan and has formed a spectacular gorge that is now marred by several hydroelectric stations and the complete pollution of the river by the effluent of a paper mill situated near the southern end of Erhai Lake.

The collections made on that first day out were from fifteen hundred meters, the lowest elevation we were to reach on the entire trip, and some of the plants collected were never seen again during our stay in China. We stopped twice to collect before reaching Yangbi, where we had lunch and pressed the collections we had made that morning. During the pressing, one of our Chinese colleagues nearly severed a finger with his clippers while trimming a woody specimen to fit in the press. The rich flow of blood was stopped with an abundant wrapping of Johnson & Johnson Band-Aids, and, surprisingly, after a few days the wound had healed quite nicely. The only other medical problem on the trip occurred when another of our Chinese colleagues, He Si, remained in bed one morning complaining of intense pains in his stomach. This problem proved to be rather serious. Mr. He was taken back to the city of Xiaguan, where it was found that he was bleeding internally. He was then hospitalized for several days. After leaving the hospital he was restricted to a diet of mostly rice soup and mild vegetables for the next several weeks, and even this rather serious problem eventually passed.

Once the morning’s collections had been processed we decided to walk down to the river at the edge of the city of Yangbi and to try climbing the slopes on the far side of the river, to see what vegetation remained. Our walk through the town revealed a construction boom taking place; lots of new buildings were going up, and many old buildings were getting facelifts. It was interesting to see that the old, ornately carved wooden fronts of the buildings were meticulously being replaced.
with exactly carved replicas. The afternoon’s collecting was not particularly noteworthy since much of the natural vegetation had been removed years before we arrived, but we did manage to collect our first specimens of the coniferous genus Keteleeria Carrière and a small, creeping plant in the morning glory family (Convolvulaceae), Dichondra repens Forster, that has a close relative, Dichondra caroliniensis Michaux, in the southeastern United States. With the afternoon’s collections safely between sheets of newspaper and bundled up to go back to the base in Xiaguan for drying, we took time to discuss the day’s work, what had gone wrong, how procedures could be made more efficient, and what we would have to do to maximize our time in the field. Once discussions were out of the way we prepared for the following day’s trip to high elevations and then turned in for the night.

Collecting in the Cang Shan

Our trip to high elevations was one of the easiest of the Expedition. A road had been built to about the twenty-eight-hundred-meter mark for the construction of a hydroelectric station, and we were able to drive the entire way. The valley in which Yangbi is situated is completely under cultivation. As we drove up the west side of the Cang Shan the wet terraces of paddy rice gave way to drier slopes with corn and small orchards of various, irregularly planted fruit trees, but very little native vegetation. On the mountainsides above Yangbi are planted many trees of English walnuts (Juglans regia L.), for which Yangbi is famous. It was not until we had nearly reached the hydroelectric facility that we began to see extensive areas of disturbed, but essentially native, vegetation.

The storage buildings used in the construction of the power station served as our base for the next three days, and a small complex of three additional buildings provided housing for the workers and a place to prepare our meals, which we ate outside when it was not raining too hard. From this camp we were able to go off in several directions, but all mostly upward, and it was near this first camp that we found some of the best-preserved forests of the entire trip. The fact that the forests occur in the watershed of the...
hydroelectric plant will probably result in their continued protection.

Directly behind the camp at an elevation of about thirty-one hundred meters was a magnificent forest of *Rhododendron sinogrande* Balfour f. & W. W. Smith. These rhododendrons, reaching heights of about thirty meters and having trunks some fifty centimeters in diameter, bore thick, leathery leaves that were often sixty to seventy centimeters long and thirty centimeters wide. The trees looked more like magnolias than rhododendrons, and—in the very wet, cloud-forest habitat on a plateau high above a spectacular, misty waterfall, with everything covered by mosses, liverworts, and epiphytic ferns—they looked particularly lush. We were too late to see this rhododendron in flower, but it is known to have large, white campanulate (bell-shaped) flowers, each with a bright purple spot in the center. Although much too tender to grow in the Boston area, this species does well in the cool coastal areas of northern California.

Because of the moisture, this was one of the few places where the local people had been unable to burn the forests, even though immediately adjacent areas showed signs of recent fires. One of the disadvantages brought on by the abundant moisture was the prevalence of terrestrial leeches, which were by far the worst in this area. These leeches are abundant throughout the Old World Tropics and Subtropics and are one of the occupational hazards of fieldwork in this part of the world. They are usually found on the undersurfaces of leaves and readily attach themselves to passing animals that brush against them. The leeches release a powerful anticoagulant into a bite, causing blood to flow copiously. Even after the leeches have been removed or have drunk their fill of blood, the wound continues to bleed, sometimes for several hours. Keeping pant legs tucked into the tops of boots and wearing special, tightly woven linen socks that reach up and tie around the leg just below the knee help to keep most leeches out, but a few always manage to find an opening somewhere.

After three days of thoroughly collecting this site, we returned to our main base in Xiaguan to see how the specimens we had sent back each day had turned out. We were rather disappointed to find that the kerosene

![Osbeckia crinita Bentham ex C. B. Clarke (Melastomataceae), a small shrub found from the northwestern Himalaya to China. It is rare in Hubei province but can be common in open grassy places elsewhere in its range. Attaining 2 to 7 feet in height, Osbeckia crinita has opposite leaves and reddish, four-angled branchlets. Cultivated in England as early as 1820, it is easily grown in the greenhouse, where it forms a shrub about 2 feet in height. Plants flower in autumn, producing blossoms with four lilac–rose petals and yellow stamens. This plant was found at Chingbiqi, Yunnan, at 2,300 meters (7,600 feet) in elevation.](image)
space heaters that we shipped from the United States were not operating as expected. The most serious problem was that we could not keep the flame properly adjusted, but what appeared to be much worse was the thick, black smoke that poured out of the tops of the heaters. This soot-filled smoke clogged the perforations in the corrugates and hindered the flow of warm, drying air. After reading the directions that came with the heaters and finding that they produced smoke at elevations greater than two thousand feet (we were at three times that elevation) and then pondering the problem for most of a day, we decided to try the small kerosene cook stoves that the Chinese used for cooking. The disadvantage of using these was that there was no protective cover over the open flame they produced, but they did give dependable, smokeless heat. With visions of accidentally burning down the building that housed our driers, we decided to give the kerosene cook stoves a try. After some experimenting the flame was adjusted for adequate drying, and through the diligence of several technicians we avoided causing a major conflagration.

A Series of Efficiently Organized Marches

After the relative ease of travelling by minibus to nearly three thousand meters, the rest of the expedition was to prove more strenuous; we would have to hike to our temporary base camps, work there for several days, and then hike back to the nearest road before

The marble market in Dah, Yunnan  The Chinese word for marble, dah shi (the stone of Dali), comes from the name of this city on the eastern slope of the Cang mountain range.
driving on to the next site. These efficiently organized marches included about twenty pack animals to haul our tents, sleeping bags, food, a dry change of clothing, cooking utensils and other supplies needed to support a group of ten botanists, a cook, the procurer of supplies, several officers from the local scientific bureau, two or three guides, and several assistants. Each trek of about twenty kilometers started from an elevation of about fifteen hundred meters and coursed upward over well-worn, but primitive trails to around twenty-seven hundred to twenty-nine hundred meters and usually took eight to ten hours of continuous hiking, with a short break for lunch. Except for some of our Chinese colleagues and the local people who supplied the pack animals and were accustomed to such hikes, most of us were exhausted by the time we reached the sites where we would make camp. A short rest often revived us enough for us to be able to pitch the tents and dig ditches around them to drain off the inevitable torrents of water that would fall. A hot meal consisting of several dishes (rice, several kinds of vegetables and meats, bean curd, and other standard Chinese staples) provided the energy we would need for the following day’s collecting. When it was not raining, the short twilight between dinner and bedtime frequently afforded spectacular views of the surrounding mountains and valleys and the approaching and departing storm fronts.

During the day at several of these camps we shared what little level ground there was

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The Catholic Church at Dali
with small groups of four to eight young (five to twelve years old, rarely older) herders, who would drive their mixed assemblages of pigs, sheep, cattle, goats, and horses to these high-elevation pastures each day to graze. At about six o’clock in the afternoon, each young herder would cry out at periodic intervals in his own distinctive, melodic voice for his charges to return. Without fail the cries would produce a rush of animals from every direction, heading toward the source of the sound. To maintain these important grazing lands, the local people periodically burn the vegetation to remove all woody growth. Each year the fires burn more deeply into existing forests, leaving less and less of the original diversity and resulting in more and more extensive bracken-filled pastures. (The cut bracken did come in handy, though, for use as a thick, springy ground cover under the tents.)

From several of these high-elevation camps we were able to explore upward into the alpine zone at around four thousand meters, and in other directions into rich, wet ravines filled with ferns, mosses, and other moisture-loving plants. Every day produced some botanical surprises: an extensive colony of the deep-purple-flowered lady’s-slipper, Cypripedium tibeticum King ex Rolfe, at about thirty-five hundred meters; a bog at around twenty-four hundred meters with Burmannia disticha L. and Epilobium blinii H. Léveillé, an exceedingly rare willow-herb collected only once in the previous thirty-five years and known only from a few other collections; several spectacular and bizarre species of Arisaema Martius; the magnificent lily, Cardiocrinum giganteum (Wallich) Makino; an unusually common sundew, Drosera peltata W. W. Smith var. lunata (Buch.-Ham.) C. B. Clarke, on slopes under Rhododendron arboreum subsp. delavayi; many plants of Habenaria davidii Franchet in an overgrazed pasture; Osbeckia crinita Bentham ex C. B. Clarke; and many unusual species of Impatiens L., Rhododendron L., and Vaccinium L., including the Cang Shan endemic, Vaccinium delavayi, a small evergreen shrub about ten to twenty centimeters tall. Unfortunately, it was too early in the season to see most of the seventy or so species of Gentiana L. known from this mountain range.

We pressed many of these plants in the field as we collected them, but because of bad weather or insufficient time, we placed some in large plastic bags and took them back to the campsites for pressing. After dinner we sorted, numbered, and bundled the

A shepherd in Malutang, Yunnan, at an elevation of 2,800 meters (9,200 feet).
collections for shipment the next day by mule and then by truck back to Xiaguan for drying. To assist the regular staff member from the Institute of Botany in Kunming, who stayed in Xiaguan to care for the specimens, a technician from Xiaguan was hired to help with the processing of specimens being sent back. She proved to be remarkably capable and, despite the language barrier, was extremely quick to grasp techniques and to pitch in with whatever had to be done. On Sundays she delighted everyone by bringing her daughter to stay with her during the half day that she worked.

**Collecting on the Eastern and Northern Slopes**

With the western, and wetter, slope of the Cang Shan thoroughly collected along most of its length, our party shifted operations to the eastern slope. The eastern side of the range has been inhabited for several thousand years, no doubt because of the abundance of fish, freshwater shrimp, and golf-ball-sized snails in Erhai Lake and the numerous, fertile alluvial fans and the broad plain its base. The effects of this long history of human habitation are clearly seen in the nearly total
absence of forests on the eastern slope of the Cang Shan and the total destruction of forests on more-accessible sites. The only forests remaining in the Cang Shan are small expanses of *Abies delavayi* Franchet forests that occur above thirty-two hundred meters. Some recent plantings of *Pinus armandii* Franchet and *Pinus yunnanensis* Franchet have been made at lower elevations, but many of these smaller trees are frequently cut by the local people for whatever needs arise, and the plantations appear to be relatively unproductive.

As important and famous as the walnuts are for Yangbi on the western side of the Cang Shan, they do not compete with the considerable fame and importance held for the marble quarried on the eastern slopes. So famous is the marble from this region that the word for marble is *dali shi* in Chinese and *dali seki* in Japanese: dali for the famous walled city at the foot of the mountain and shi, or seki, the word for stone. The quarrying of marble and the crafting of the stone into various ornamental and functional items is a considerable industry in the area, and many buildings and other large structures are totally or partially made of marble.

In many places the heavy rainfall in the Cang Shan has eroded the marble of the mountain into deep gorges. The top of the mountain is almost continuously in the clouds, except for periods in the winter and for briefer times at other seasons of the year, and the clouds generally bring a good supply of water from farther west that falls as rain or snow at the higher elevations. The rain, often torrential, has eroded away large boulders and carried them to the foot of the mountain, where they are now buried beneath tons of alluvial till on the plain adjacent to the lake. These huge boulders, some of marble and others of granite, are large enough to be of commercial value for building stones and are actively excavated from the outwash plains and chiseled into building blocks. This industry is so extensive at some sites that the ground appears as cratered as any place on the moon.

Our final long collecting journey in the Cang Shan was at the northern end of the range. After having hiked in to several previous areas, we inquired about the possibility of renting additional pack animals for riding. We were told that this would be possible, and relatively inexpensive—about two and a half American dollars per day—and we were all looking forward to an effortless, all-day journey on horseback. When our "horses" arrived we discovered, first, that they too were mules, and second, that the "saddles" were the usual pack saddles with only a blanket thrown over them. Nevertheless, we climbed aboard and were delighted at this new, effortless means of mountain climbing. It took only a few hours, however, to discover how uncomfortable a wooden pack frame can be, and for several days afterwards we were instantly reminded of our "horseback" ride each time we tried to sit.

This last site in the Cang Shan proved to be one of the most interesting, for it contained the greatest number of truly temperate elements that we saw on the entire trip. Whereas all of the other sites were vegetated with Himalayan, Thai, or Burmese elements, this area, primarily on north-facing slopes, supported such more typically central Chinese plants as *Malus Miller*, *Sorbus L.*, *Viburnum L.*, *Clintonia Rafinesque*, and *Enkianthus Loureiro* in an abundance that we had not seen before in this part of China. We could only guess that this flora represented an extension from the Lijiang Snow Range, which was just a short distance to our north.

The Return to Kunming

After several days of packing up supplies, readying specimens for transport, cleaning up the room we had used as a base camp, and
meeting with various officials to discuss the results of our trip, we began our journey back to Kunming. This time we decided to make it a two-day trip, with occasional stops for collecting on the way. The stops allowed us to add a few additional plants to our collections and to discover one small patch of relatively mature vegetation along the road that made for brief, but interesting, study. On our return to Kunming, as planned, we made several day trips out of the city to collect in various habitats. When our collecting options were finally exhausted, we divided the specimens into a Chinese set and an American set. As agreed beforehand, the first set of all collections was to remain in China and the second set was to go to the United States. The American participants further agreed that the first set of the American portion of the specimens should be deposited in the Arnold Arboretum Herbarium to supplement what is already one of the most extensive collections of Asian plants in the world. Once the specimens were divided, the American set was boxed for shipment, and the Chinese set was arranged in systematic order for identification. We had decided that identifying the collections in Kunming made the most sense; botanists at that institution have been actively working on a multi-volume *Flora of Yunnan* and would have the expertise to help with any problems that might arise, and the herbarium would contain representatives of most, if not all, of the plants we had collected. After three weeks of herbarium work everything was identified to

*Our memorable mule caravan trek from Dali (1,900 meters, or 6,200 feet, in elevation) to Huadianba (elevation 3,000 meters, or 9,800 feet).*
the best of our abilities, but a large number of sheets remained for examination by specialists at other institutions working on particular families for the multivolume Flora of China. These identifications were made after we left China and were forwarded to us by mail.

The Expedition's Results

In the United States, all of the data associated with the specimens were entered into a computer at the California Academy of Sciences in San Francisco. The data were brought up to date periodically as new identifications arrived from China and as spellings and author citations were checked. The computer was then used to generate labels for all of the collections, probably the first time a computer has been used for this purpose for plants collected in China. The data are still available in the computer and can be manipulated in various ways to generate reports on the expedition and for various kinds of studies on the flora of China.

In total, the expedition produced 1,653 collections of flowering plants and ferns, which, with duplicates, resulted in 19,015 herbarium specimens. The main sets of these specimens will be stored in the herbaria of the participating institutions, the Institute of Botany in Beijing, the Kunming Institute of Botany, the Arnold Arboretum, and the California Academy of Sciences, and duplicates will be sent to other major botanical research institutions throughout the world where studies of the Chinese flora are taking place. In addition to the vascular plants, we collected more than two thousand numbers of mosses. The first set of these will remain in China, but the second-most-complete set will be deposited in the herbarium of the Missouri Botanical Garden; duplicate specimens of the mosses will also be distributed to other botanical institutions throughout the world.

The Future: Botanical Research and the Need for Conservation

Although we were not permitted to collect living plants or seeds on the 1984 expedition, we fully expect that this situation will change in the near future. Between the time of the first Sino–American botanical expedition, which took place in 1980, when essentially no protection was given to natural areas or plants anywhere in China, and the second expedition in 1984, the Chinese government and the Chinese people have become greatly concerned about the environment and the protection of rare and endangered plants and animals. Many areas have now been set aside as preserves, and many others are regulated in various ways, sometimes without much study or consideration. Once these areas have been scientifically evaluated it is almost certain that new regulations will be formulated that will allow for scientific research and the judicious removal of living plants and seeds for study and for exchange with botanical institutions outside of China. Until a balance can be reached, which should happen within the next few years, we can only be patient and understanding of these restrictions. Chinese botanists are most sympathetic to this problem, which also directly affects them and their research efforts, and are doing all that they can to foster botanical research and cooperation between Chinese and American botanists. Their efforts have been extraordinary in many cases, and it has only been through their persistence and dedication that the joint expeditions and botanical exchanges have been, and will continue to be, so remarkably successful.

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Tripterygium forrestu Loesener, a member of the Celastraceae, which George Forrest first collected in 1906, on the eastern flank of the Dali range, during one of his early trips to Yunnan. He introduced it into cultivation. The species, which is a shrub 2 to 4 feet in height, is common in scrub and thickets at elevations of 1,500 to 3,000 meters (5,000 to 10,000 feet). Photographed at Yinglofeng, Yunnan province, in the Cang mountain range, at an elevation of 2,400 meters (about 7,000 feet).

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References


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Along with the steady rise of science and increasing development of industrial and agricultural production, mankind more and more assumes it is his right to conquer the earth and change its form or nature. In the process, intentionally or unintentionally, he has opposed the laws of the natural world, destroyed the dynamic equilibrium of many ecosystems, and often brought catastrophe upon himself and other creatures. Forest denudation, grassland degeneration, the constant spread of deserts, and the pollution of the atmosphere and water systems are now common phenomena in many areas of the world.

From the ecological viewpoint, the establishment of protected areas in different natural zones or biogeographical regions will be of great advantage to society. To maintain typical natural ecosystems for advanced study and to provide a scientific base for rational utilization and restoration of nature are of overwhelming importance.

China, as with many countries in the world, has high regard for this important cause. More and more people are giving attention to expanding and strengthening this work.

Two reports on current work in conservation follow. The first is an overview excerpted from an article (“Nature Conservation in China: The Present Situation”) by Professor Wang Xianpu, of the Institute of Botany, Academia Sinica, Beijing, that was originally published in *Parks*, Volume 5, Number 1, pages 1 to 10 (April/May 1980). (The above three paragraphs come from that article.) The second report (“Burretiodendron hsienu Chun & How: Its Ecology and Its Protection”), by Professor Wang and two of his associates, focusses on efforts to preserve a valuable but endangered species of tree native to China and Vietnam. It has not been published before.