Royal Botanic Garden Edinburgh

Expedition to China September 2019

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Acknowledgements

I would like to thank the Royal Botanic Garden Edinburgh (RBGE) for giving me permission to go on my first botanical expedition. I am very grateful to all the funding providers for the opportunity to gain valuable expertise overseas and in particular to help renovate The Chinese Hillside at RBGE. Thank you also to The Merlin Trust, Hardy Plant Society, RBGE Expedition Fund, William Steel Trust and The Finnis Scott Foundation for funding and supporting the expedition to China 2019. Thanks also to Richard for planning and leading the expedition and our Kunming Institute of Botany (KIB) colleagues.

Break down of costs

Merlin Trust - Accommodation, vaccinations and visa.

Hardy Plant Society - Expedition equipment

Finnis Scott Foundation - Expedition camera

William Steel Trust - Accommodation and equipment

RBGE Expedition Fund - Flights, accommodation, KIB guides, food, driver and fuel.

Introduction

The Royal Botanic Garden Edinburgh's mission is to explain the world of plants for a better future through its work in conservation, education and research. I am the Herbaceous Supervisor and my team are responsible for The Chinese Hillside which is undergoing renovation so there was a need to collect seed. Richard Brown, who accompanied me, is the Senior Horticulturist in the Woodland and Rock Garden at RBGE and has made several expeditions to China already. Material collected from this expedition will complement the existing collections in these areas of the garden.

Aim of Expedition

The aim of this fieldwork was to collect seed for RBGE and learn the skills and techniques involved in the collection of wild material. This will boost RBGE's wild collection percentage. It provided an opportunity for Richard and myself to see the plants we work with on a day-to-day basis, growing in their natural environment, and allow us to photograph and document them. The seeds of 198 species of plants were collected from this expedition. Over the next few years these will be grown on and planted at RBGE, as well as in the other three regional gardens in Scotland.

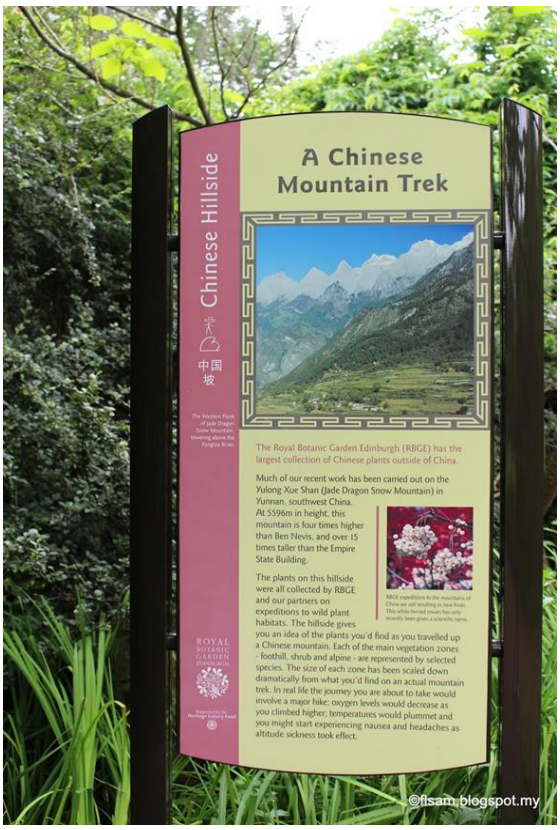

Figure 1.1 The Chinese Hillside at RBGE

Expedition places visited:

Beijing Botanic Garden

Beijing Horticultural Expo

Shika Snow Mountain

Baima Snow Mountain

Napahai Lake near Shang ri-la

Tianchi Lake

Zhiben Mountain (near Myanmar border).

Pianma Gaoligong Shan (near Myanmar border).

Biluo Xueshan Lanping (near Myanmar border).

Cangshan Mountains

Kunming Institute of Botany

Duration in total (1 Month)

China - a Plantsman's Paradise

China has a rich flora, one that is unrivalled in other temperate latitudes of the world. The country is roughly the same size as the United States of America, but China is estimated to contain 12 per cent of the world's plant biodiversity, about 30,000 species of higher plants distributed in c.353 families and 3,184 genera. In comparison North America (USA & Canda) has about 17,000 species of higher plants. The rich species diversity within the country reflects the wide range of habitats and altitudes. It is found that no other country in the world has such a diversity of habitat from tropical and subtropical regions to the boreal forests and extensive alpine areas well above the treeline in the west. The climate in the country is hugely varied with a summer monsoon with very high rainfall, whereas in some areas it can be dry and desert like. In winter months regions can experience deep snow whereas other areas experience dry yet deeply cold conditions. It is estimated that China has c. 220 endemic genera, and at species level, 56 per cent of species (c. 16,800) are endemic.

Fig: 1.2 Swertia

The extraordinary richness of the Chinese flora, particularly the temperate element was realised by plant hunters in the late nineteenth and early part of the twentieth centuries. Collectors from Russia, Britain, France and North America travelled the country in search of new plants for the scientific collections and their use in cultivation. The rich flora and species diversity gave the plant hunters plentiful scope for our gardens. Today our gardens, parks and botanical institutes are full of plants from a Chinese origin. These plants have certainly enriched our greenspaces and our gardens would be much poorer today without these Chinese introductions.

Chinese botany took a great step forward in the twentieth century with botanists working in many parts of the country. Today, each province in China has its own botanical institute and numerous Chinese botanists working on the flora to better understand and protect it.

Fig: 1.3 Gentiana trichotoma

Following in the footsteps of RBGE's plant collectors

One of the first major horticultural plant collecting expeditions to China was conducted in 1899 by Ernest 'Chinese' Wilson, a horticulturist at the Royal Botanic Garden Kew. Wilson travelled for three years in Yunnan province in search of hardy ornamentals and returned for further expeditions to Sichuan and Hubei. You will find plants from Wilson's original collections growing at RBGE today.

At RBGE, the then Regius Keeper, Isaac Bayley Balfour, recommended a member of his staff, George Forrest, to go on an expedition to China to collect hardy plants for British gardens. Forrest left the UK for China in 1904 and returned in 1907 with several thousand herbarium specimens and seed. Forrest later ventured to China for a further six lengthy expeditions from which he introduced many new plants including important garden species such as Primula, Gentiana, and Clematis. His Chinese collections would influence the botanic garden's scientific and horticultural activities for the next 100 years and transform the face of horticulture in the UK. At the same time the Chinese collections at RBGE were further enriched by other global explorers including Francis Kingdom Ward, who first collected in Yunnan in 1911 and Joseph Rock who actually took up residence in Lijiang and Dali in 1922 and learned the language and history of the local people.

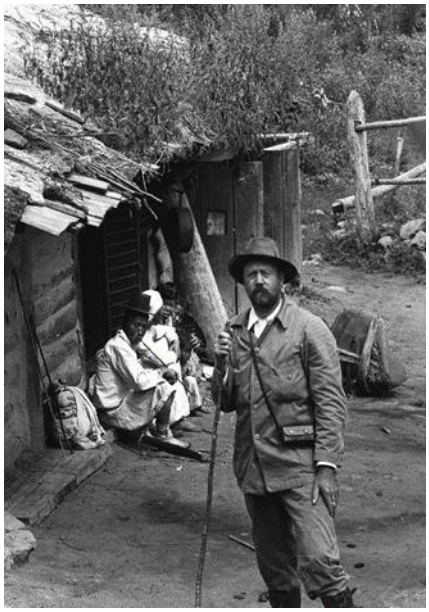

Fig: 1.4 Plant Hunters Left: Ernest Wilson and Right: George Forrest

Since these famous collectors RBGE staff have participated on regular expeditions to China collecting and recording alongside our Chinese partners. Plant exploration today is as important to RBGE as it was in the days of Forrest, but today the purpose is very much that of conservation. Conserving plants where they are found, in their native habitats and biological communities (in-situ) can be tricky. Ideal scenarios in conservation are few and far between. Rarely do we have all the resources, expertise and conditions required to implement effective in-situ conservation programmes in the world's biodiversity hotspots. In many situations, although never ideal, ex-situ conservation can help safeguard against the loss of plant diversity.

In 1991, the Royal Botanic Garden Edinburgh and the Kunming Institute of Botany signed a Twinning Agreement to promote collaboration in science and horticulture between the two organisations. For RBGE this was an important step in building long-term relationships with botanical institutes in China. Since the collaboration the establishment of the Lijiang Alpine Botanic Garden and the Jade Dragon Field Station were built.

Fig: 1.5 The RBGE and KIB Jade Dragon Field Station

On 11th September 2019 we set off for Beijing from Edinburgh Airport via Amsterdam for a month. The following sections highlight the key activities and places visited on the expedition.

Beijing Botanical Garden

Beijing Botanical Garden is located between the Fragrant Hills Park (also called Xiangshan Park) and Jade Spring Hill in Haidian District. It is 15 miles from downtown. In 1956, the project with a planned coverage of 4,000,000 square meters or nearly 1,000 acres was begun. Now Beijing Botanical Garden has an open area of 500 acres. It consists of the Plant Exhibition Area, the Scenic Spot and the Historical Resorts, the Scientific Research Area and the Nature Reserve. 10,000 categories of plants with a population of 1.5 million plants are cultivated here, and this one has been regarded as the biggest in north China so far.

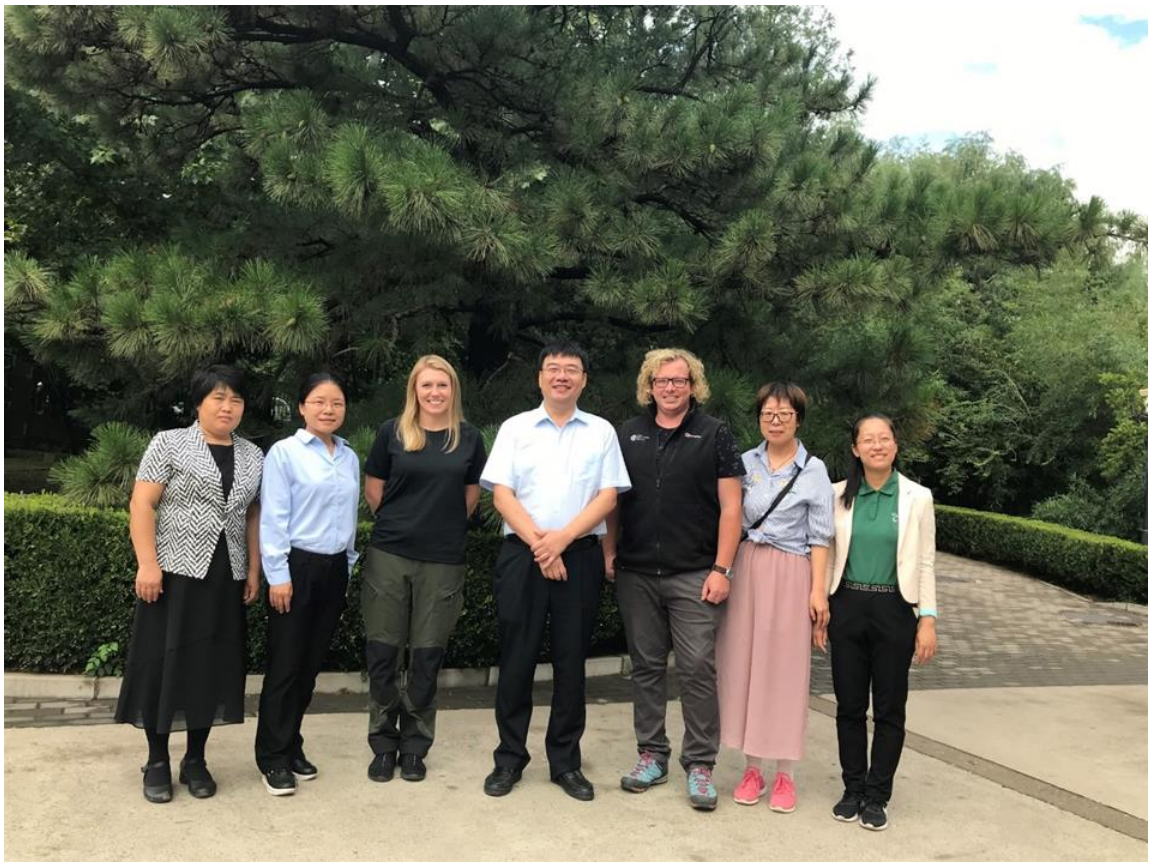

Fig: 1.6 Meeting staff from Beijing Botanics

The Plant Exhibition Area has four clear divisions. The Theme Gardens have 11 sub-divisions including Lilac Garden, Chinese Rose Garden, Flowering Peach Garden, Peony garden, and so on. The Arboretum Garden has Ginkgo, Conifers, Acers, Magnolia, Berberis and Paulownia growing.

The Plant Exhibition Area centres on a greenhouse which was opened to the public in the year 2000. With floor space of nearly 2.5 acres, it enjoys the reputation of 'the biggest display greenhouse in Asia'. The Greenhouse Exhibition Area is divided into 4 parts: the Tropical Rain Forests Area, the Desert Plants Area, the Garden of Seasons and the Theme Exhibition Rooms. Plants of 3,100 varieties with a population of 60,000 thrive in the greenhouse, including Lithops, and Cymbidium orchids. It makes the greenhouse an important base for scientific education and research. This greenhouse display reminded me of Singapore Gardens by the Bay and Longwood Gardens, USA. It was certainly impressive to be given a guided tour of this marvellous botanic garden. We also had the delight of trying moon cake with our Chinese colleagues as it was the celebration of the Moon Festival while we visited.

Fig: 1.7 Bamboo Garden at Beijing Botanics

Beijing Horticultural Expo 2019

The International Horticultural Exhibition 2019 is accredited as an A1 Exhibition for international horticulture. The event is organized by the Beijing Municipal Government and hosted by the Chinese Government. This year's theme was 'Live Green, Live Better'. The global media reported the participation of 110 countries and international organizations across the world.

We visited the UK garden and pavilion which highlighted the important role that nature plays in our everyday lives in a 2,000-square-metre space. It included a woodland, a wildflower meadow and a biodiversity garden. It was great to see the UK Garden and many other gardens designed from China and around the globe.

Fig 1.8 Beijing Horticultural Expo: Botanic Garden Exhibit

The Jade Dragon Field Station

The field station is situated just below the Jade Dragon Snow Mountain and sits at an altitude of 3,200m altitude. The field station allows botanists and horticulturists to study the mountain's flora by carrying out their work onsite. The field station was the first joint scientific laboratory with the UK in China. The project continues to grow with our Chinese partners visiting RBGE. The vision for the field station is be a world leading biological research station enabling effective research programmes aimed at helping preserve the biodiversity of the mountain and provide a safe haven for both plants and people.

The towering peaks of the Yulong Xue Shan (Jade Dragon Snow Mountain) must be one of the richest in botanical terms. The area has an estimated 3,000 species of plants growing on its slopes. Many original explorers found the number of plants growing here astonishing, as many of them were new to science. Today botanists and horticulturists are still making interesting and new discoveries within the region. Despite this the wealth of plant life is now much under threat from rapid developments in the area, such as the over harvesting of medicinal plants, receding glaciers as a result of climate change, and the increased pressures from tourism in the area.

Fig 1.9 Jade Dragon Snow Mountain – Gentiana and Persicaria in flower

On our expedition, Richard and I spent three nights at the field station where we observed many plant species and carried out our fieldwork. It took a while for our bodies to adjust to the altitude but I kept myself hydrated as advised by my colleagues at RBGE. It was magnificent to witness Gentiana and Persicaria growing in the wild at the bottom of the South Peak. I also observed my first Meconopsis pseudointegrifolia growing at the base of some scree on the mountain. These were spectacular to witness and document – we even encountered our first yaks and snakes! I was also shocked by the amount of plastic waste left on the mountain including oxygen canisters which many of the tourists are sold to cope with the altitude when going up the mountain. They appear to just drop them with little care for the environment. It seemed like the Blue Planet effect had not reached China yet.

Fig: 1.10 Horticulturists at the field station

Fig: 1.11 Codonopsis pinifolia

Fig: 1.12 Allium sp.

Shika Snow Mountain

Shika in Tibetan refers to a mountain abounding in red deer, one of the auspicious animals in Tibetan Buddhism symbolising longevity and justice. For this reason, the Shika Snow Mountain is regarded as a holy mountain for the local Tibetans.

The Shika Snow Mountain presents different landscapes according to the seasons. In spring, the foot of the mountain is covered with green grass while the top is still snow-capped. The blue sky, floating clouds, white peaks, green grassland, cattle, sheep, shepherd boys, Tibetan houses, and wisps of smoke are quite harmonious with one another. I was amazed by this marvellous creation of nature. In summer, Mount Shika becomes a sea of flowers. The brightly-colored azalea flowers are intoxicating. In autumn, the grassland at the foot of the mountain is dyed red by the Chinese Stellera in full bloom, while the mountain slopes are covered with Chinese larches, poplars, and birches, all of which are very fascinating! In winter, the mountain is coated with snow.

Fig: 1.13 Cable Cars on Shika Snow

Two cable ways are available on the mountain. Ascending by cable car, you can enjoy the beautiful mountain from high above. Richard and I spent a day exploring this mountain and we took the somewhat rickety cable car up to the mountain peak. The cable car takes about 20 minutes up to 4,400m and at the top there is a view of the Jade Dragon Snow Mountain, the Meili Snow Mountain and the Biluo Snow Mountain. Sadly the day we went up it was overcast at the top meaning the view was not visible. We did a full day of fieldwork and botanising at the top of the mountain in the alpine zones and at the middle cable car level. It was wonderful to see Rhododendrons, Abies and Pinus growing in harmony and it really opened my eyes to see how Rhododendrons grow in the wild. The mountain was full of lichens hanging from the trees and it was a delight to be on a mountain that was so wild.

Fig: 1.14 Bright red Podophyllum seed pod

Baima Snow Mountain Nature Reserve

The Baima Snow Mountain Nature Reserve, in Southwest China's Yunnan Province, is situated on the central part of the Hengduan Mountains, on the slope of the section between the Baima Snow Mountain, the major peak in the north of the Yunling Ranges, and Renzhi Snow Mountain. It is located in Deqen County of the Diqing Tibetan.

The Yunling Ranges are the source of the Lancang and Jinsha rivers. Above 4,000 metres, the mountains are covered in snow all year round. A great number of well-preserved primitive forests can also be found here. Highland oak birch, Yunnan pine, Rhododendron and Sophora are the main plants in the reserve. There are 47 species of animals found in the reserve with the most famous being the snub-nosed monkey or the Yunnan golden monkey, which lives in the sub-high mountain dark pine tree forests.

Fig: 1.15 Baima Snow Mountain

The Baima Snow Mountain Nature Reserve, covering an area of 190,000 hectares was established in 1983 on the slopes of the Baima Snow Mountain and Renzhi Snow Mountain along the Jinshajiang River in Deqin County. Within the Reserve, there are 20 peaks of more than 5,000 meters above sea level. Among which the highest is the Baima (White Horse) Snow Mountain towering 5,430 meters above sea level.

With varying ranges in altitude the Reserve features exothermic river valley and high frigid mountains. With a variety of biotic species, the Reserve is an ideal habitat for the Guizhou golden monkey. There are 47 species of usual mammals, 45 species of birds, and some animals peculiar to the Hengduan Mountains. These include the lesser panda and green-tailed monal. As well as other rare wild animals at higher altitudes, such as snow leopard, white - eared pheasant and horse musk deer.

With vast virgin forests, a complete natural ecosystem and ideal habitats for wild animals, the Reserve has an important scientific value in multidisciplinary researches of natural ecology, forestry, zoology, botany, geology, hydrology, pedology and meteorology.

Richard, myself and our KIB colleagues spent a day doing field work on this unique Snow Mountain Reserve. To our amusement, it was actually snowing at the top of the mountain so we didn’t hang around there for too long. It was fascinating to see the vegetation layers change as we drove up the winding road to the top. It was also worthwhile to see Primulas and Iris growing in the wild whilst exploring this mountain. It was also interesting to view the Chinese way of life on the route to this mountain – where local villagers would be cutting up a cow in the middle of the village. This made me think how detached we, in the western world, are from where our food comes from.

Napahai Natural Lake Reserve

Napahai Natural Lake Reserve is 3,270m above sea level and covers 660 square kilometers. It is about 8km northwest of Shangri-La town in Yunnan Province. It is both an ideal grassland for herdsmen and a paradise for plants and animals. This is, in the true sense, a seasonal lake. When summer comes, snow on the adjacent mountains melts and flows down into about ten rivers forming a vast lake. In the dry season, Napahai becomes a boundless green grassland - the best time for herding sheep, cattle and horses on the grassland. In September each lake again turns into a temporary habitat for migratory birds, such as bar-headed geese, wild ducks and black-necked cranes which are one of the 12 rarest bird species in the world. During this period, the lake becomes an ideal place for many ornithologists from around the world. Napahai was listed as a provincial-level nature reserve by the Yunnan province people's government in 1982.

We spent a day botanising with our KIB colleagues on a grassy slope next to the Lake. This open steep grassy bank was a herbaceous heaven where we came across Salvias, Iris, Primula, Asters Arisema and Dracocephalum forrestii. The water on the lake was very still and there was drizzle in the air so in some ways it felt like Scotland. It was so interesting to find such a species rich area full of herbaceous plants. We took many photographs and enjoyed the moment when we reached the top of the slope to look over the lake.

Fig: 1.16 Napahai Lake Nature Reserve

Fig: 1.17 Aster, Salvia and Dracocephalum forrestii

Tianchi Lake

Tianchi Lake, also called as the Shuchang Lake, is known as the national natural reserve – the name means 'lake in the sky.' Among the dense forest, there are various wild animals and plants. In particular the primitive Yunnan pine forest preserves a good ecological environment.

It has large virgin forests and we had hoped to hike to reach the species rich grasslands that surround the lake. However, our 4x4 car had been involved in a crash the day before (though thankfully no one was injured). As a result we had to get a new car and driver for the rest of the expedition. This new 4 x 4 was not equipped to cope with the deeply rutted dirt roads leading to Tianchi lake. As a result we had to just carry out fieldwork within the forests. We encountered wild boar for the first time here which our local guide told us to stay away from as they can be dangerous. We also got impressive views of snow-capped mountains which were truly breathtaking. Again I felt hugely privileged to be in virgin forest just bursting with life – once again, I thought of people back home and how some people have become so detached from nature.

Fig: 1.18 Tianchi Lake

Fig: 1.19 Dirt track roads

Fig: 1.20 Euphorbia jolkinii

Zhiben Mountain, Gaoligong Shan and Biluo Xueshan

We then drove south towards the Myanmar border (police checks in this area were common as it was so close to the border) visiting three valleys that are tropical in the bottom but then sweep high through *Rhododendrons* and Alpine zones at the top. It was impressive to see these vegetative zones change through the hairpin bending roads that led to the top of the mountain. We visited Zhiben Mountain where we were ecstatic to see *Rhododendron giganteum* growing in the wild and huge specimens of *Schefflera* covered in mosses and epiphytic ferns. Again the lichens were abundant here as well as the bright red seed pods of the *Arisema*. The next day we drove along the mountain road pass to Pianma which is on the Gaoligong Shan (Mountain Range). Here we observed Rhododendrons growing out of rock and views over the mountains to Myanmar. I was immersed in the sound of the forest in this region as it was so teeming with life it was almost deafening. This made me even more determined to conserve the natural world for future generations after what I witnessed that day.

Fig: 1.21 Rhododendron giganteum

The next day we drove with our Chinese colleagues up the Biluo Xueshan mountain. We reached a remote village with the most breathtaking views of the valley below. It made Scottish hills look tiny and it was spectacular to see whole hillsides just covered in virgin forest untouched by humans. We hiked for three hours with two local foresters who carried a machete. This was the most magical experience and despite the language barriers we managed to bond with the two locals and admire the vegetation. Again we found Rhododendrons growing as well as the striking red *Aeschynanthus bracteatus*. We had to be careful at one point as there were big rock falls from the upper part of the mountain. The local forester told an interesting story of an American pilot during WW2 crashing into the mountain hillside. He said his grandfather had recovered the body and he had a piece of the fighter plane in his house today. This area was again full of life with both plants and animals. However as we were sliding down the hillside, fatigued on our descent, we came across where the villagers had just dumped plastic waste down the hillside straight into virgin rainforest – this shocked me and I stopped to document it with my camera. This highlighted the urgent need to recycle plastic and educate the people in China of this environmental message.

Fig: 1.22 Litter dumped on the Biluo Xueshan

On the last day carrying out field work in this region we drove along the mountain pass of the Xuepan Shan Lanping where we found more Rhododendrons. The road in places was deeply rutted with big trucks also moving on these small roads which at times was a bit frightening. As we drove on we could see rice paddy fields on terraces and how people carved this dramatic landscape into the land for growing agricultural crops. It was a great contrast to see this aspect of rural China which was completely different to what we had observed in Beijing city.

Fig: 1.23 View toward the Myanmar border

Fig: 1.24 Seeing my first Cardiocrinum giganteum in the wild.

Cangshan Mountain

Cangshan Mountain lies west of Dali Ancient City and Erhai Lake and includes 19 peaks and 18 streams. The highest peak is Malong Peak with a height of 4,122 metres. May and June are the perfect months to visit Cangshan Mountain since at that time it's carpeted with many kinds of flowers. We spent two days using the cable cars to access the protected mountain and observe the plants growing there. It is a popular destination for many tourists but thankfully, at the top it has been carefully designed so that a board walk protected the vegetation. The mountain range is noted for its rich, diverse flora, first scientifically documented by Pierre Jean Marie Delavay in 1882. The cable cars alone are a real feat of engineering and give impressive views back down to Dali Ancient Town.

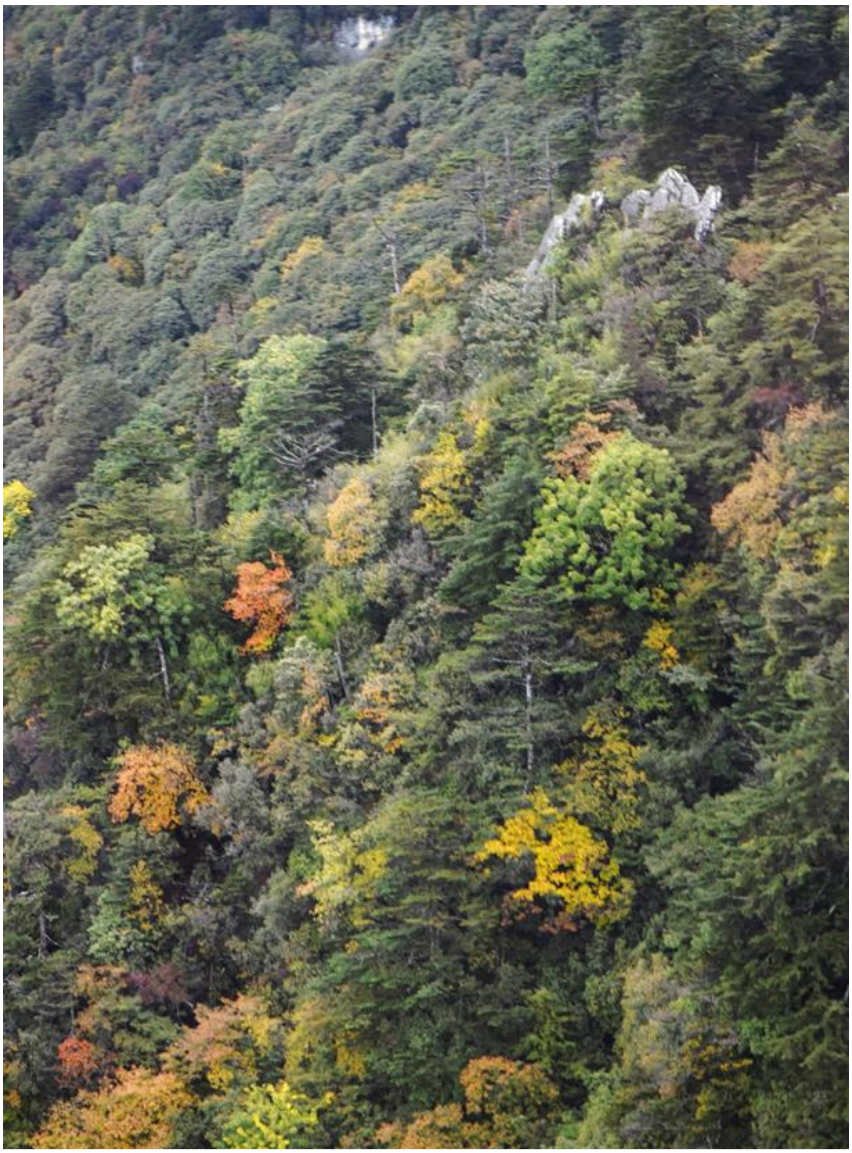

Fig: 1.25 Autumnal colour on the Cangshan Mountain, Yunnan

Kunming Institute of Botany

On the last few days of our expedition we met up with our Chinese colleagues at Kunming Institute of Botany and had a guided tour of the Botanical Gardens.

Kunming Institute of Botany (KIB) is an important research institute that is directly affiliated to the Chinese Academy of Sciences (CAS) and dedicated to research in the fields of Botany and Phytochemistry. It is committed to exploration of the world of plants, to generating knowledge about them and developing their sustainable use to benefit people.

The institute covers an area of 67.8 hectares - the main research divisions are the State Key Laboratory of Photochemistry and Plant Resources in West China, the Key Laboratory for Plant Diversity and Biogeography of East Asia, the Key Laboratory of Economic Plants and Biotechnology, and the Germplasm Bank of Wild Species. In addition, KIB manages two botanical gardens: one in Kunming and the other in Lijiang. In 2005, Kunming Botanical Garden was designated a “national environmental education base” by the China Association for Science and Technology. KIB has also cooperated with the World Agroforestry Centre to establish a joint Centre for Mountain Ecosystem Studies, and closely worked with officials of Haiyan county, Zhejiang Province, to establish the “Haiyan Biotechnology Cooperation Centre”, Institute of Tibetan Plateau Research at Kunming, also located at KIB campus.

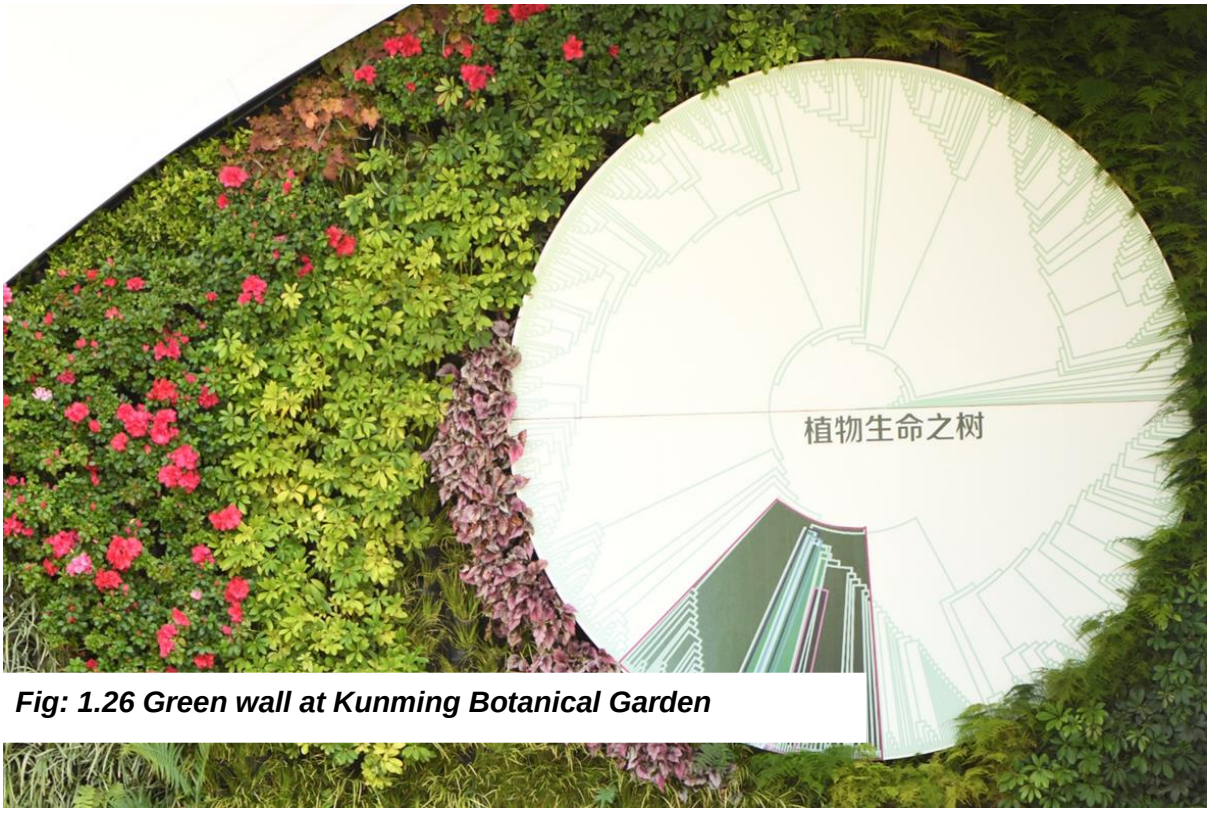

Fig: 1.26 Green wall at Kunming Botanical Garden

Overview

This expedition was highly valuable in helping me to conserve and better understand Chinese plant species. It is so beneficial to see them growing in their native habitat and the seed collected will be grown in ex-situ conservation at RBGE safeguarding the future of the plants in the wild if they were to die out.