Expedition to northern Vietnam 2019

Will Ritchie

Report for the Merlin Trust

Introduction

On 6 October 2019, an expedition to Vietnam departed from the United Kingdom. The team was composed of horticulturists and botanists from botanic gardens (see *Table 1*) aiming to utilise their expertise and skills to assist plant conservation efforts in the Lào Cai and Hà Giang provinces. Working collaboratively with local partners, the expedition focussed on four botanically diverse study areas and provided support for floristic surveys, conservation assessments and the development of *ex situ* conservation collections. The collection of seed, spores and propagules concentrated on specimens which were likely to be suitable for cultivation in the UK, required further taxonomic and/or ecological study and could be sourced sustainably from viable populations.

The establishment of *ex situ* collections in the UK was designed to support an integrated approach to plant conservation in the region. Climate models highlighted the suitability of UK botanic gardens for the long-term cultivation of such specimens as a resource for study and future repatriation. The expedition was part of a developing relationship and commitment, which also included capacity building and knowledge exchange.

Table 1. A summary of the expedition

Expedition summary	
Collection name:	2019 UK botanical expedition to northern Vietnam
Collection code:	LWCWEI (2019)
Region(s):	Láo Cai and Há Giang provinces, Vietnam
Participants:	Nguyễn, Văn Dư; Nguyễn, Mạnh Hùng; Lé, Toan Chí; Trịnh, Xuân Thānh; Baines, Richard; Luke, Andrew; Cano, Ángela; France, Hazel & Ritchie, Will
Institutions:	Institute of Ecological and Biological Resources; Royal Botanic Garden Edinburgh; English Heritage; Cambridge University Botanic Garden & National Botanic Garden of Wales
Associated collections:	HLKGC (2016)

Location profile

Located in Southeast Asia, the Socialist Republic of Vietnam is a country rich in tradition, culture and biodiversity. Since reunification in 1976, the peninsular nation has experienced considerable change. With one of the fastest growing populations and economies in the world, Vietnam has seen industry, agriculture and cities change the landscape considerably since the war period (1955 – 1975).

Occupying a latitudinal range from 18°30 to 23 north, the natural history of Vietnam is highly diverse. Within 127,500 mi^2, the landscape encompasses tropical, temperate, maritime and montane ecological regions. The varied range of niches available provides habitat for 16% of the world's species. 19,357 plants species alone have been documented thus far. Biodiversity loss is however prevalent in the country. The aforementioned development of industry, agriculture and cities are examples of pressures exerted on the nation's fauna and flora. 448 taxa of plants have been classified by the International Union for Conservation of Nature (IUCN) as threatened by extinction, but it is surmised that the data is insufficient to accurately characterise the true extent of the threat.

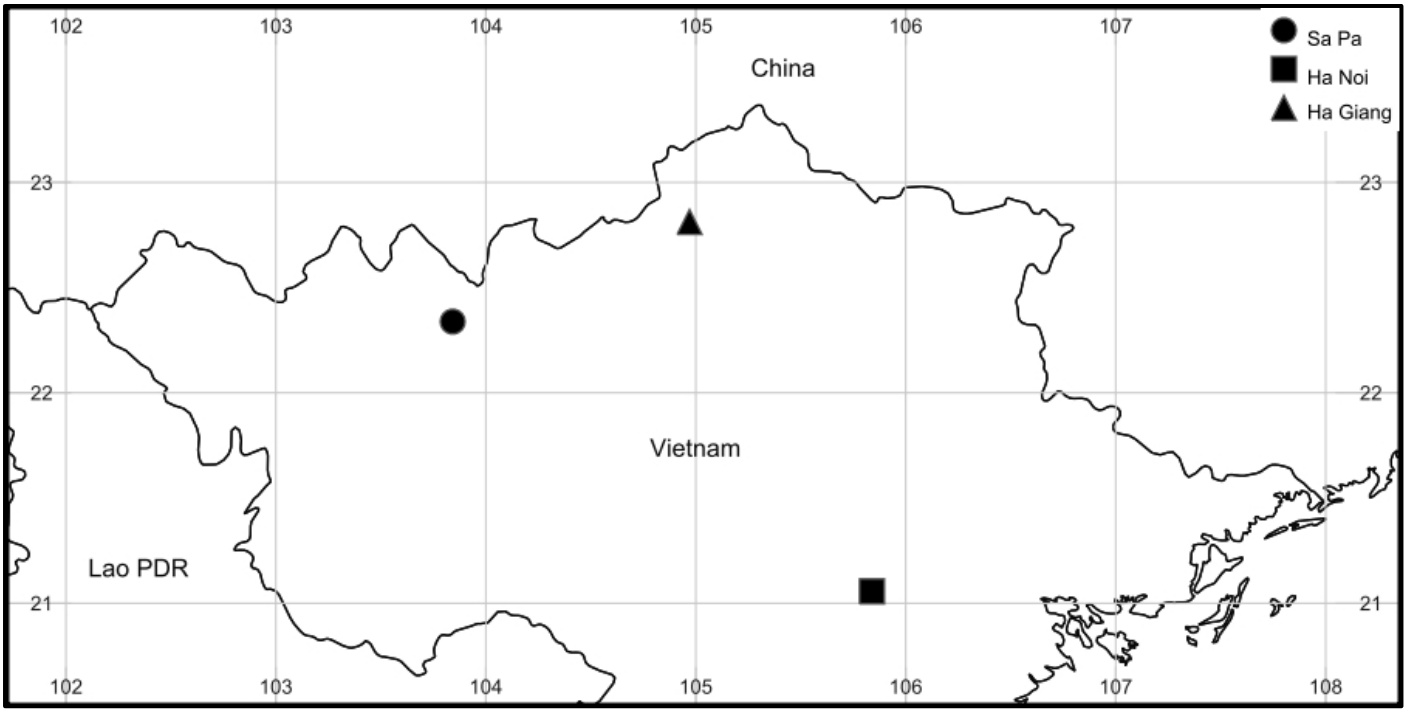

Figure 1. A map of northern Vietnam including cities as points of reference

The study areas were located in two of the northernmost provinces, Lào Cai and Hà Giang. Both provinces share a border with China in a mountainous frontier between the two sovereign states. The geology of both provinces varies considerably. Segregated by the Indochina and South China tectonic plates, the age, composition and prominence of differing rock formations have shaped contrasting landscapes. In Lào Cai, the Phan Xi Păng Massif dominates the scenery, composed of granite and schist rock types. While in Hà Giang, drumlins formed of karst limestone sit proudly in glacial plains. The floras of the two regions are similarly diverse. Unique migration patterns, isolation events and hybridisation have helped to create complex plant communities, influenced by both tropical and temperate floras. Recent botanical surveys have revealed many new species but fieldwork has been limited, relative to the size of both the provinces and the hypothesised diversity of plants.

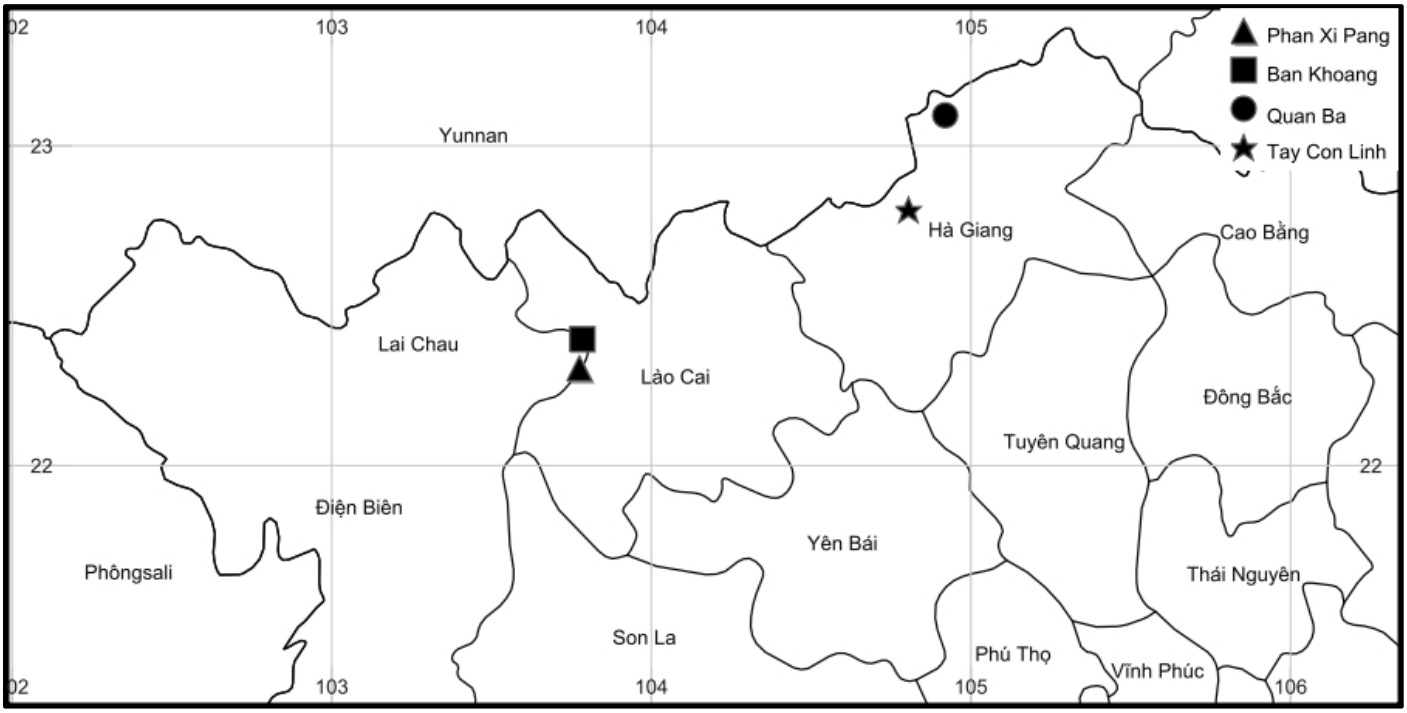

Figure 2. A map of the northern provinces of Vietnam including references to the four study areas

Local partners

The Royal Botanic Garden Edinburgh (RBGE) and the Institute of Ecological and Biological Resources (IEBR) established a partnership in 2014 and have continued to work collaboratively. In 2019 a memorandum of understanding was agreed between both parties to further cooperation in conservation and research, focussed on the temperate flora of Vietnam. IEBR are the premier institute for botanical research in Vietnam and the custodians of the national herbarium collections, located at the Vietnam National Museum of Nature (Index Herbariorum: VNMN). Herbarium specimens prepared during the expedition were submitted to the national herbarium collections. Duplicates, if available, where then dispersed to other herbaria in Vietnam and the UK.

Prior informed consent for collecting was authorised by the relevant national park authorities for each site. In Lào Cai, The Hoàng Liên National Park Authority issued permits and reviewed collections prior to export. Similarly, the Đồng Văn Karst Plateau Geopark issued and observed permits for collecting. The expedition was conducted in the letter and spirit of the Convention on Biological Diversity (1992), the Nagoya Protocol (2010) and in compliance with national guidelines and legislation. Export of seeds, propagules and herbarium specimens was subject to phytosanitary inspections in Vietnam and the UK. All permits and documentation which demonstrate compliance are available upon request.

Objectives

The expedition was devised by Richard Baines and Dr Nguyễn Văn Dư, based on prior expeditions in 2014 and 2016. The purpose of the expedition was to further the understanding of the floristic diversity in four study areas. The following mutually beneficial principles and objectives were agreed:

Table 2. The mutually agreed principles and objectives of the expedition

1.)	The UK expedition team members would provide additional support for survey and documentation of the study areas
2.)	The participating botanic gardens would establish *ex situ* collections from the expedition, to serve as conservation resources
3.)	Taxonomic expertise at the Royal Botanic Garden Edinburgh and Kew would be utilised to study and classify specimens collected
4.)	Publication of scientific research based on the expedition and collections will be done so collaboratively and made available via open access journals to researchers based in Vietnam
5.)	The expedition will help develop personal relationships which will support future professional development opportunities and capacity building exercises

To achieve the objectives, a coalition between botanic gardens in the UK was agreed to provide expedition participants, *ex situ* conservation sites and additional expertise. The botanic gardens selected for *ex situ* collections, represent climatic variation within the UK and provide a wide range of cultivation opportunities.

Table 3. The botanic gardens (BGs) which were selected to host ex situ collections resulting from the expedition

Botanic gardens	**Locations**	**Av. temp. range**	**An. rainfall**
Logan BG (satellite of RBGE)	Stranraer, Scotland	3.1 to 13.4°C	1087 mm
RBGE	Edinburgh, Scotland	2.9 to 14.8°C	706 mm
Cambridge University BG	Cambridge, England	3.1 to 16.6°C	553 mm
NBG Wales	Llanarthne, Wales	4.6 to 16.1°C	1039 mm

Study area one: Phan Xi Păng

09 – 12 October 2019

The following text was submitted as a blog and featured on botanicgarden.wales (21 October 2019). The blog is an account of the first trip on the expedition to Phan Xi Păng but also summarises the purpose of the expedition and the role of ex situ conservation for the Garden's members and visitors.

My journey to Vietnam started on a train bound for Paddington Station from Port Talbot. After observing my bag containing wet weather clothing and secateurs in a side pocket, the gentleman sitting next to me asked where I was heading. After learning that I was representing the National Botanic Garden of Wales in a collaborative project between botanic gardens en route to Vietnam, his questions continued. Upon reaching the topic of conserving plants in botanic gardens, he asked perhaps the most common question about botanical expeditions, "why?".

The reasons why we take plants from the wild to grow them in collections elsewhere for the purpose of conservation (*ex situ*) can be confusing and seem counter-intuitive.

Few would argue that conserving plants where they are found, in their native habitats and biological communities (*in situ*) is not the best form of conservation. But such ideal scenarios 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 scenarios, although never ideal, *ex situ* conservation can help safeguard against the loss of plant diversity. I explained to my fellow passenger that, in Vietnam, there are many of these imperfect scenarios that prevent *in situ* from being the sole focus of plant conservation practitioners. The examples I used are as follows.

Rate of biodiversity loss. Vietnam is one of the fastest-growing countries in the world. Natural resources are therefore being consumed at an increasing, and arguably unsustainable, rate with few systems in place to protect biodiversity. Agricultural production and construction are also disturbing previously stable plant communities, creating opportunities for invasive or dominant species to colonise at an alarming rate.

Insufficient data and documentation. A sizeable proportion of the plant diversity in Vietnam is yet to be documented; many species remain unnamed and biological data is limited. Without sufficient data and information to guide conservation efforts, it is difficult to create effective strategies and prioritise practical conservation efforts.

Limited resources for in situ conservation. Government and non-government organisations focused on *in situ* conservation are restricted to few projects. There are great examples of work being carried out by the likes of IEBR and Flora and Fauna International for example but Vietnam is a large and diverse country which requires substantial resources to study, manage and conserve their flora.

Unfortunately, much of the world's capacity for conservation, research and management is rarely located in the world's biodiversity hotspots.

After reaching our destination and finishing the discussion about conservation and the work of botanic gardens, we parted ways and I headed for the Heathrow Express.

Those of us that were flying directly to Hà Nội met at Heathrow shortly before departure on our 12-hour flight. Andrew Luke, a veteran of two previous expeditions to Vietnam and Head Gardener at Wrest Park, found me at the check-in desk. Andy has a great knowledge of the flora and plants collected on previous expeditions as he personally grew much of the seed from previous trips at the Royal Botanic Gardens, Kew. His knowledge of woody plants and propagation has been invaluable in developing the *ex situ* collections that already exist. We latterly met Dr Ángela Cano, who is the Assistant Curator at Cambridge University Botanic Garden, in the departure lounge. Ángela has considerable experience in fieldwork with recent expeditions to South Africa, Colombia and Switzerland. This was, however, her first experience of fieldwork in Asia and she was looking forward to exploring a new flora.

We arrived in Hà Nội shortly after 04.30 local time. The RBGE contingent was due to arrive much later so we headed to the hotel. Taxi journeys in Vietnam can be eventful as cars and mopeds weave effortlessly across the roads with no clear indication of traffic rules or compliance. We however had full faith in our driver as he seemed to understand the rules and was typically calm. Despite being tired from the long journey, the driving and Hà Nội streets kept our eyes fixed to the windows.

The sight of mature bonsai on the roadsides and exotic plants such as *Allamanda*, *Bougainvillea* and large Bird's Nest Ferns (*Asplenium nidus*) adorning the walls and lamp-posts gave us horticultural clues to the culture and climate. After

a short sleep, the three of us took the opportunity to explore Hà Nội. We were able to discuss the expedition in person for the first time, drink Vietnamese coffee and walk the streets of the French influenced Old Quarter, enjoying the warmth, sights and sounds of the city.

Later that evening, the two members of the team representing RBGE landed. Expedition leader, Richard Baines, arrived with the heaviest bags after carrying much of the essential kit and documentation that we needed. Richard has, like Andy, visited Vietnam twice previously. His expertise and passion for the rhododendrons of the northern region will be vitally important throughout the trip. Hazel France is a Senior Horticulturist and joined the project for the first time. Hazel was no stranger to the region however having previously visited the botanic garden in Laos and assisted field studies in Cambodia.

With our colleagues from the Institute of Ecological and Biological Resources, we travelled by minibus to Sa Pa, a town located at the foot of the Hoàng Liên Sơn mountain range. On the way we needed to collect further permits for our fieldwork from the National Park authorities in Lào Cai. While the paperwork was getting finalised, the rest of the group went to a local cafe. From our position we could look across the Red River to China. The border was easily identifiable due to the use of Chinese and Vietnamese-Latin script on each side. During the expedition the border with China was never be far away and visible from all peaks. Once the permits were received, we continued north towards the mountains and the town of Sa Pa.

Sa Pa was familiar ground for some of us but the epic climb was still awe inspiring. Terrace hillsides made way for sheer mountain slopes as the minibus driver resorted to using his lowest gears. The roadsides were littered with novelty and interesting sights. A boy selling a recently caught cobra was only bettered by the colourful displays of White Ginger Lily (*Hedychium coronarium*) and exotic tree ferns (*Cyathea* spp.). We arrived at our destination six hours after leaving steamy and subtropical Hà Nội to find temperate and cool conditions at our base, the Mountaineer Hotel.

After an early morning bowl of noodle soup (Phở), we were on our way again to the base of the Phan Xi Păng mountain. As you may suspect there are many ways to reach the 'Rooftop of Indochina' at 3143 m. This time we started at a new trailhead, Cat Cat Station. The Lào Cai province is populated by a diverse range of ethnic groups and a Hmong community live in Cat Cat. Some are easily identifiable with their brightly-coloured clothing, worn as traditional dress and for the purpose of engaging tourists who may be interested in buying snacks for their hike or spending a night at one of their home stays.

Our group quickly got away from the crowds and headed for the forest, beyond the rice paddies, buffalos and tannoy system. A stone path led us downhill towards a stream. This was a pleasant start prior to the steep climb which followed. With spirits and temperatures high, our expedition started at pace but slowed as the gradient increased. With each step the views across the foothills became more and more impressive.

The colourful fruits helped distinguish potential collections from the vegetation. Many of the plants were identifiable due to their similarity to garden favourites. Early collections such as beautyberry (*Callicarpa* spp.), coralberry (*Ardisia* spp.) and whitebeam (*Sorbus* spp.) would be known to many gardeners but each had unique features unlike anything seen in cultivation.

The highlight of day one for me was at the very end when Andy found a series of large acorn-like seeds out of a stream. Without seeing the inflorescence, it was impossible to tell whether it was an oak (*Quercus* spp.) or its close relative stone oak (*Lithocarpus* spp.). The only way to find out is to grow it and see!

The night before we had created a campsite at 1800 m with impressive views toward the mountains beyond. This was to be our base for a further night. We started climbing again early on the second morning, climbing steeply into the forest once more. What was striking about the forest around us on the climb was that it was never dark. The canopy consisted only of aged trees with little understory to replace it. In many valleys, large areas once comprised of complex and stable plant communities, were now the reserve of monocultures of cardamom, many planted for the purpose of harvesting their seeds. The mountain was being used as a resource, for timber and agriculture. As a consequence, we were required to look high into the canopy and at our feet simultaneously as we ascended the slippery and varied path. Luckily, we were finding some great things on the forest floor. Species of *Arisaema*, *Begonia* and from Gesneriaceae were plentiful.

Despite aims to reach a marked population of Rhododendrons at 2500 m, our climb peaked at 2100 m. This peak however was also of botanical interest. The rocky outcrop was punctuated by woody plants, all rooted precariously into gaps between rocks and in thin montane soils. A hop and several jumps towards the peak revealed a series of new finds. An oak (*Quercus* sp.) and a chinquapin (*Castanopsis* sp.) were located growing near a potential new species of rhododendron (aff. *R. irroratum*). Himalayan Hemlock (*Tsuga dumosa*) stood prostrate overlooking them all. Despite temptations to go further, the situation was reviewed objectively. There was little time for further exploration so we retreated down the mountain contented by our new discoveries.

On day three, we packed up our camp to return to Sa Pa to process our specimens, data and bags full of laundry.

An alternative route was used for our descent. This allowed for further collections on the way. The path was less developed and more difficult in sections. The steep path was composed mostly of rocks, roots and clay. The rain fell intermittently, making the surface increasingly slippery. It became a running joke that only Ángela and the Vietnamese could make their way down the mountain with any skill or poise. The rest of us were covered in mud as we used a less graceful technique. The plants observed on the way down were as varied as the landscape. We came across a grove of *Magnolia* spp. with at least two different species were present, a small aff. *Primula nghialoensis* happily residing in the middle of the path and a specimen of *Exbucklandia tonkinensis* in flower. On the final section, after a long three days, we were quickly consoled by the sight of our minibus at Cat Cat Station and the promise of a warm shower and coffee.

Our first foray revealed a staggering and beautiful diversity of plants on Phan Xi Păng. It is a truly incredible place and an important part of Vietnam's natural history. We however also could see a great deal of biodiversity loss, limited regeneration of trees and cardamom plantations replacing the rich tapestry of plant life on the forest floor. Hopefully *in situ* conservation and good land management will restrict the degradation. The scale of the challenge however suggests that further *ex situ* resources may also be needed and play an important role in preserving the flora of Phan Xi Păng.

Figure 3. A collection being made of Callicarpa sp., including photography and labelling

Figure 4. A team photo with members displaying the flag of the National Botanic Garden of Wales

Figure 5. A view of a southern valley of Phan Xi Păng leading back to the city of Sa Pa

Figure 6. The frond shape of Dipteris chinensis being examined prior to photography and pressing for an herbarium sample

Study area two: Bản Khoang

14 October 2019

In the shadow of Phan Xi Păng lies many minor mountains, hills and valleys, creating a patchwork of rugged and wild terrain, agriculture and communities. The Bản Khoang district includes all three. The route to the highest peaks of the region started in small villages engaged in agricultural production. Various forms of curcurbits were being grown both in the field and in large polytunnels at our starting point. The heavy, yet rich, clay soil covered every person, tool and building and the practice of growing cucurbits on large trellises was unfamiliar, but it was a pleasure to see and of interest to the group. Within an hour of walking, the landscape changed considerably as the elevation increased, cultivation and evidence of human activity began to disappear. Paths became narrower and the vegetation became denser, varied and worthy of investigation.

With the lack of disturbance, the typical primary colonisers and widely observed annuals disappeared. New plant communities were beginning to be seen that were stable, well developed and diverse. The first specimen we collected was identified as *Brassaiopsis* sp., a plant which was familiar to most of the team. To me this was easily identifiable and looked incredibly similar to a specimen collected on the 2016 expedition, now growing in the Temperate House at Kew. Although familiar to the group, few documented records of it growing in this particular location were known. Even less was known of the population ecology or distribution. It was decided that a collection would therefore be made and a full set of samples was prepared.

The elevation continued to increase as our hike progressed. The vegetation had noticeably changed at several intervals, from 1970 m onwards the canopy started to recede, leaving only mature trees of considerable age. One such tree attracted our attention due to the leaf shape and visible acorns, with the help of binoculars. Identified as a *Quercus* sp., preparations were made for a collection. Too little is known about the diversity of Fagaceae in Southeast Asia for a sufficient understanding of the taxon's evolution or conservation requirements. Collections were therefore made from specimens which resembled known *Quercus, Lithocarpus* and *Castanopsis* for further study and documentation. Collecting seeds from mature trees was however technically challenging, not due to the available seed resources but to the height of the trees and their position. We were fortunate therefore that Thānh was adept at both climbing and

the use of pole pruners, brought specifically for such challenges. With careful coordination, clipped infrutescences and leaf samples dropped into our hands from above.

The climb became more difficult as paths were no longer present and the team had to navigated their way past large rock outcrops and climb steep embankments with little more than slippy clay soil underfoot. The temptation to cling on to branches to pull yourself up was high, but not good practice as many species had spiny bark or creatures, such as snakes or poisonous insects could be present. Sight of the peaks was encouraging as was the change in vegetation. Mature trees were still present but more squat in form, obviously shaped and stunted by exposure to the elements. It was noticeably cooler, which was a relief to much of the team, particularly those from the UK. From 2100 m a number of collections were made including from a specimen of *Magnolia* sp. Unfortunately, few identifying features were present, the leaves were non-descript, entire with no prominent venation. The branching pattern and cylindrical fruit suggested that the tree may be classified in subgenus *Yulania*, but cultivation or further observation will be required to reveal a full set of characters.

After our descent we had time to revisit a site only twenty minutes' drive away from where the bus had parked. Richard and Andy had visited this site previously and found it be floristically diverse, but particularly interesting for rhododendrons. The site was located on the edge of the Hoàng Liên National Park but we were informed that there was now commercial activity close by due to the relaxing of the regulations enforced for the National Park. The new 'buffer zone' was earmarked for economic development, to bring much needed jobs and investment to local communities. As conservationists, this sounded concerning but understandable. While we fully appreciated the need for economic development, new jobs and prosperity in the area we speculated on what this would entail and whether it would have an impact on the biodiversity locally. I remained personally optimistic as the area remained in a national park and thus thought it will still be protected. I was wrong.

As our minibus pulled onto a new road, recently finished, we passed a series of contractors and tradesmen working on the roadsides. Signs of a large infrastructure project were abundant with cables, pipework and plant equipment everywhere. Richard seemed somewhat confused sitting in the front seat, unable to recognise the location from his previous visit. The trees and shrubs were gone, occasionally stumps remained. The bus continued past workers, fires and large piles of rubbish. The piles got larger and more spread-out as we continued. When we arrived, our destination was a rubbish tip, a large one at that. Many of the items observed where in scripts and languages other than

Vietnamese, mostly Mandarin, but Spanish and English were also common. This was imported rubbish. Where rare species of rhododendrons once stood, no vegetation remained. We continued to walk to the top of the hill, which was too steep to be utilised. This area remained green, vegetated but once more many large trees and shrubs had been removed. We did manage to make collections, specimens with an affinity to *Dichroa* sp., *Celastrum* sp., among others but there was little of interest to see. We finished our day walking back through the rubbish tip, in the dark and dejected, on to the bus and back to the hotel.

For me the experience at the rubbish tip reminded me how fragile plant conservation infrastructures can be. Although within the boundary of a national park, the biodiversity of the area was lost due to need for economic development. I also reflected on our role as international citizens. We in the UK wouldn't tolerate such activities at one of our national parks but on our behalf, rubbish is being exported to areas of high biodiversity, resulting in the removal of endangered trees. It was hard to know how best to help. It reminded me of the importance of *ex situ* collections, hopefully some of the specimens currently grown at Logan Botanic Garden from the expedition in 2014 can be repatriated one day. In many ways, the decision was political and little could be done to prevent it. It put livelihoods before conservation, which is difficult criticise. Hopefully in the future, as Vietnam develops, there will be more options and resources to support biodiversity.

Figure 7. Curcurbits being grown on trellises at a farm in the village of Bản Khoang

Figure 8. A typical field lunch comprising of luncheon meat, cheese and cucumber served in a baguette

Figure 9. A new road and rubbish disposal facility at a previously diverse field site (i)

Figure 10. A new road and rubbish disposal facility at a previously diverse field site (ii)

Study area three: Tây Côn Lĩnh

16 – 19 October 2019

The team set off from Sa Pa early in the morning on the long and winding road to Tây Côn Lĩnh. The bus headed east, driving parallel to the Chinese border. The new roads that linked Sa Pa and Lào Cai were indicative of the investment in the region. New routes were being developed between urban centres as the economy and populations of the northern cities were growing quickly. They were fast, modern and easy to navigate. As we continued east after lunch in Lào Cai city, the quality of the roads deteriorated. Smaller, winding routes along mountain sides guided us through the uplands. As a province, Lào Cai is relatively poor compared to its neighbours and road maintenance was limited. Pot holes, subsidence and occasional cattle slowed our journey. At a narrow pass we were halted by a large Yusen Logistics cargo lorry was stuck, perilously positioned on the mountainside. As it was blocking travel in both directions, a large crowd had gathered, but only a few were assisting. Despite our attempts and enquiries, we could do little to help. We turned our vehicle around and tried a few other routes to no avail. We were stuck. It took a few hours for the route to clear but eventually we were on our way again, completing our journey in 11 hours. We made best use of our time at the side of the road. Two further collections were added. Despite being at an elevation of only 600 m, seeds from a *Camellia* sp. and *Quercus* sp. were collected due to their tolerance of the difficult terrain and conditions observed. The resilience of both were noteworthy and were acquire for further study.

Our base in Hà Giang province was its capital and namesake, Hà Giang city. The city had a population of only 70,000 people, equivalent to Wrexham in north Wales or Corby in Northamptonshire, so it felt quiet and small after Hà Nội especially. The province is however developing into a tourism destination thanks to the beautiful surrounding landscapes. Situated within the boundaries of the Đồng Văn Karst Plateau Geopark, large drumlins and mountains composed of karst limestone rock formations tower over the towns and villages. A truly spectacular place. The scenery and new landscapes created a sense of anticipation in the team who were keen to explore more.

Our field sites in Tây Côn Lĩnh required further travel. In our minibus we headed deep into rural uplands, weaving in between rice plantations, across rivers and over hills. The last section of our journey couldn't be navigated by minibus so a fleet of motorcycles and riders were scheduled to take us further. After much discussion and confusion, it became

apparent that the motorcycles wouldn't be ready until the morning. We therefore spent a few hours exploring our immediate surroundings. Not our intended destination or altitude (816 m) but we wanted to make the best of the situation and could collect plant materials for glasshouse cultivation. One of our first notable collections was *Mussaenda frondosa*. The white leaf-like bracts and orange flowers caught our attention from afar, it had climbed high into a prominent position in the canopy. Once more the telescopic pole pruners were useful in the acquisition of samples and seeds. Rarely did we collect from a specimen which was flowering and fruiting simultaneously, providing all diagnostic characters required for identification. Only 200 metres away was another notable collection, *Lanonia dasyantha*. Ángela, who has specialised in palm research, noticed a small population that the rest of us would have walked straight past. Once observed, the palmate leaves were striking and weren't to be missed again. Records of the taxon in the region were rare so samples were taken with additional care in creating a suitable herbarium specimen.

The next morning at dawn, the motorcycles, mopeds and riders arrived. The riders were small, light and highly skilled at riding along mountain paths. The UK team members by comparison were large, had been eating rice daily and not used to such riding. The ride that followed was safe but uncomfortable. It was a memorable experience as the views were incredible and a unique opportunity to see Yao (local ethnic group) communities living and working in the mountains. After a couple of stops to regroup at cardamom drying stations, we were finally exploring again. The diversity of begonias growing in the region is something I had observed on my last expedition, as I was working at Glasgow Botanic Gardens and the custodian of a National Plant Collection at the time. I continued with my interest on this expedition too and was pleased to see so much diversity. Begonias are predictably located near water courses and many species seem to enjoy similar niches in such environments. At 1104 m I spotted a specimen with a large asymmetrical leaf with pronounced teeth along its margin. It looked very different to any species collected previously so samples were taken. It will be interesting to review the diversity of *Begonia* specimens collected on our expeditions one day. I would be keen to learn the limits of their range and hardiness as some have been collected at elevations above 1500 m.

Due to Richard's interest and specialism in rhododendrons, it has been the most widely collected taxon during our expeditions. In the vicinity of Phan Xi Păng, rhododendrons are numerous and diverse. The soil and climate are ideal for their growth and development. In Tây Côn Lĩnh, sightings of rhododendrons were less numerous. The environment was less favourable for them. The alkali soils only supported certain species and the isolation of the landscape would have limited successful migration from populations in the west and north. The rhododendrons that were discovered

in Tay Con Linh were highly prized and admired by Richard due to their rarity. A specimen with an affinity to *Rhododendron vialii* was located at 1650 m. The puberulent abaxial leaf surfaces were a key character for identification in the absence of any flowers. At 1860 m a further *Rhododendron* was found growing epiphytically. There were no characters to help Richard identify the section or species but seed was available for cultivation.

The accommodation for our stay in Tây Côn Lĩnh consisted of a cardamom drying station. Most of the team had the luxury of sleeping inside while others, like myself, slept outside under a tarpaulin. At first, I thought I was given a bad deal but later discovered that the roasting rack on which we slept stayed warm throughout the night and could enjoy the stars too. On days two and three further exploration was undertaken but progress was slow due to the lack of existing routes and the dense vegetation. A number of noteworthy collections were made by the team, who split into two groups. One focussed on a detailed assessment of the forest plant communities and the other made a speedy ascent to the top of the mountain to document the ecology of the highest elevations. In the forest, species more commonly associated with a tropical range were collected, such as *Commelina* sp., *Symplocos* sp. and *Cissus* sp. These taxa are hypothesised to have migrated to the region from the warmer climates of the south. At the top of the mountain, less than two miles away were many temperate species, found in greater abundance in China and likely to have migrated from the north. These collections included Aff. *Rhododendron* subsect. *Irrorata, Camellia furfuracea* and *Hydrangea* sp. In one day, we as a team were able to experience all of the drivers of speciation and diversification of the region's flora. The intersection between tropical and temperate migration patterns, isolating terrain, marked climatic and environmental variation all within two miles and 1,000 feet of elevation. Much more time was required to thoroughly document the area, likely many years, but by the time we had made our last collection of the day, the motorcycles were waiting to take us back to Hà Giang city for food and to sleep.

Figure 11. The canopy of Mussaenda frondosa exhibiting the petaloid bracts and flowers

Figure 12. Samples of Lanonia dasyantha being prepared for photography

Figure 13. The team stop for a break at a cardamom drying station

Figure 14. A local cardamom farmer roasts fresh fruits to process the fruit prior to sale

Study area four: Quản Bạ

20 – 21 October 2019

40 miles north of Hà Giang city was the district of Quản Bạ. This was to be the last area surveyed on our expedition. Documented records and herbarium samples from the district were few and most of the members of the team from IEBR had not travelled this far north and east. Quản Bạ was however a growing centre for tourism. We were afforded a taste of what attracted the tourists on our drives to field sites, the drumlins bulged from the valley floor, exposing white limestone outcrops dripping with vegetation. Our first site was in the village of Tam Sơn. We first walked through the village, encountering children playing in the paddy fields and somewhat confused by and curious about our presence. The elevation was low at only 800 m and much of the forests had been cleared but new plant communities became apparent. My personal highlight was collecting spores from *Cyathea contaminans.* I had seen tree ferns in Vietnam before but had never been able to collect viable spores for propagation. The hirsute stipes were easily visible from a distance confirming it's genus and other diagnostic characters were present upon closer inspection of the fronds with a hand lens. Our afternoon in Tam Sơn was short and resulted in few collections but it was good practice for what was to come. The rocks underfoot were brittle and occasionally unstable. The soils were very thin and provided little support for our feet. It reminded me of The Burren and the limestone uplands of County Clare in Ireland. But this was different, more challenging to climb and yet, in what seems like a harsh environment, many plant communities thrived.

At Tùng Vài, we entered lands managed by Fauna and Flora International with a clear mission. Although surveying the plant diversity was a priority, there was one species we were especially keen to see. *Magnolia grandis* is now an icon of Vietnam's plant conservation initiatives. Not only is it critically endangered (IUCN classification), it is a majestic tree with large primitive flowers. The distribution of *M. grandis* is now limited to this one reserve and even locating them can be difficult due to the technically challenging hike. We were prepared for our longest day in the field and needed to move at pace to reach our waypoints. Our elevation fluctuated by only 180 m as we entered the forest. The hike was difficult, perhaps gruelling, due to many obstacles and the hard surface of the limestone, scarred by fissures, grooves and hollows. The plant communities around us were once again different to all that we had seen before. The urge to stop, study and admire was strong but not possible due to the pace of the hike. A comprehensive survey of the area would lead to many need species and a greater understanding, I'm sure. With time against us, we only made stops for specimens that those who are botanically inclined physically couldn't walk

past. These included aff. *Amorphophallus tonkinenese*, *Diplazium megaphyllum* and *Streptocarpus* spp. We did eventually stop for longer to take refuge from the rain and eat some lunch. In this moment of tranquillity, I was able to truly admire where we were. A forest canopy comprised of magnolias cast shade over the lianas wrapped around their sizeable trunks. Herbs and ferns were growing out of every outcrop of limestone on the thinnest of soils or organic matter. The geology itself was incredible, a forest floor of irregular white limestone pavements eroded by the constant trickle of water towards visible streams or hidden sink holes. It was at this moment that I truly appreciated the expedition and how fortunate I was to be involved and experience such a place.

After lunch, our hike continued at pace. The team was renewed after some much-needed food and water. The hike continued to be difficult and finding the waypoints was challenging. Technology such as GPS units are great tools, but in situations like this, with interference from the canopy and limited accuracy, they offered little help. Morale was starting to sink as the day was slipping away. Staying in the forest after dark was not an option due to the difficult terrain. We continued searching, trying to get closer to the *M. grandis* at each turn. Suddenly, Dr Dư recognised a landmark, he now knew where he was and led us further into the forest. After scrambling over some moraine, we could see it, a giant of the forest, *Magnolia grandis*. After a brief celebration we continued to work quickly, assessing the population which comprised of only three specimens. We also assessed the seeds available so we could harvest sample sustainably without having a detrimental impact on its reproduction and the local population. Fortunately, the seed mast was plentiful with the branches littered with infructescences harbouring ripe fruit and seeds. A full set of samples were taken and additional care was taken to prepare DNA material, herbarium sheets and seeds due to their value for research and applied conservation efforts. After a series of obligatory ‘selfies’ and posed photographs the team quickly realised the time and theneed to head back, quickly. Buoyed by the discovery and prospect of end of the fieldwork the team moved at paced and spirits were high. The last sections of the hike were incredibly difficult so extra care and concentration were required. By dusk, the team emerged from the forest with one last *Begonia* sample in hand to get in the mini bus and head back to Hà Giang then Hà Nội.

Figure 15. The drumlins of Quản Bạ District and outlying villages of Hà Giang city

Figure 16. The abaxial leaf surface of Amentotaxus sp. with diagnostic stomatal bands

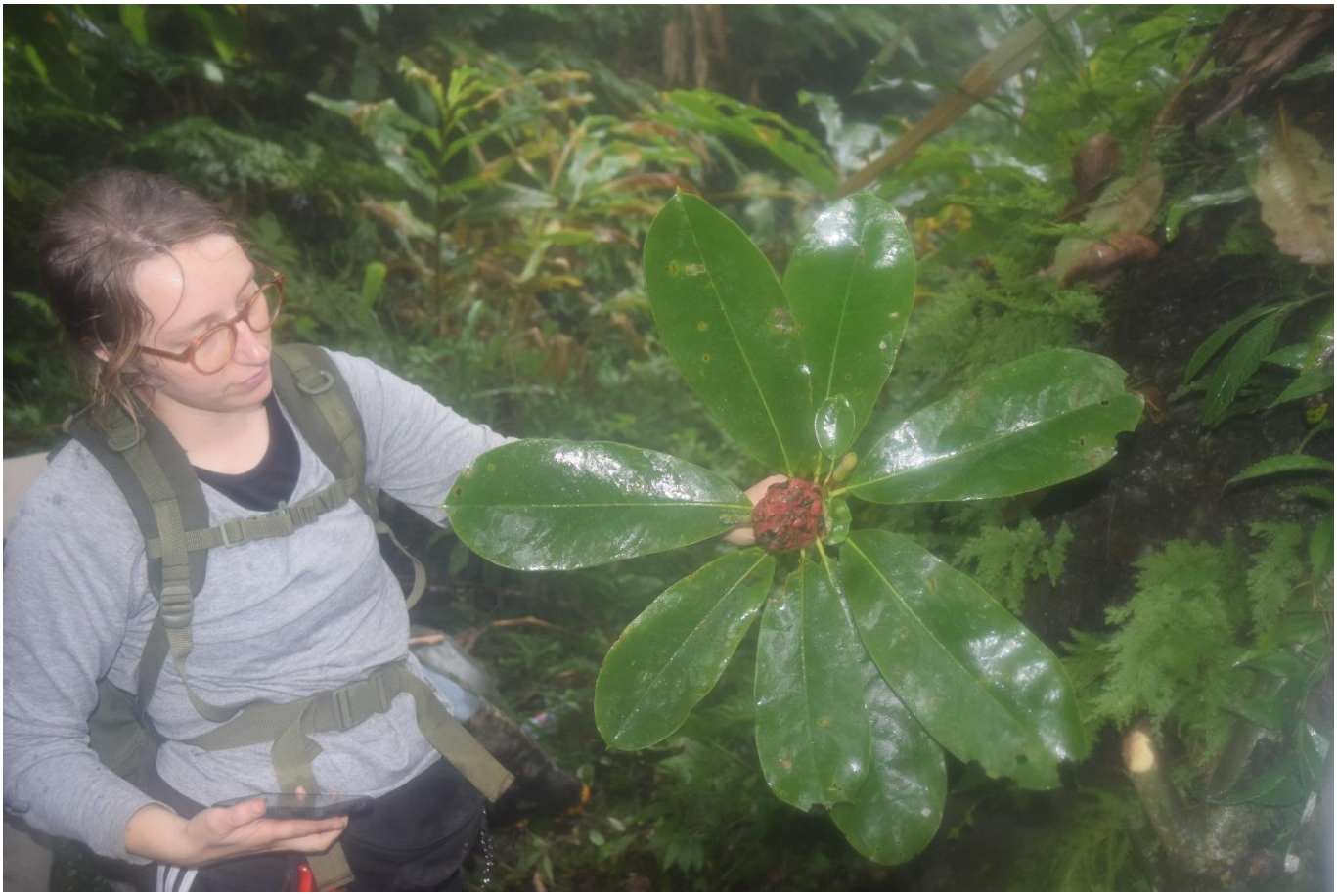

Figure 17. Hazel France with a specimen collected from Magonia grandis prior to processing

Figure 18. Team members document the discovery of Magnolia grandis

23 – 24 October 2019

The last part of our expedition was to attend a plant conservation workshop in Hà Nội, organised by Fauna and Flora International and Botanic Garden Conservation International. The event was hosted at the Pan Pacific Hotel. The luxury was jarring at first as we readjusted to the urban environs. The day before we had been in the remote wilderness with few luxuries to speak of. The workshop focussed on bringing conservation practitioners from across Vietnam together into one room to explore potential collaborations and identify target taxa. I enjoyed the day, and learned much about current projects and research. It also highlighted what I had suspected that plant conservation in Vietnam had considerable strengths and weaknesses. In the room was a wealth of expertise and passion for plant conservation, that much was evident. Some were using high technology to study plants and publishing scientific research in well regarded international journals. Other taxonomic groups however were barely studied. The herbaria were struggling to function and applied conservation programmes were few. Conservation practitioners in national parks seemed particularly frustrated with the resources and support available.

We each spoke about our expedition and the value of *ex situ* conservation which was well received by all in the room. The value of our expedition was understood and appreciated. After the meeting and by the time our trip finished thoughts had already turn to what next.

For me personally, I would like to see more capacity building support by international botanic gardens, to support the local communities, conservation practitioners and researchers who are working hard to secure the flora for future generations. The teaching and development of practices for conservation horticulture could be particularly valuable. Plant propagation and cultivation for conservation purposes was occasionally utilised but success was limited due to the lack of skills and knowledge. I also would like to see members of the IEBR team visit the UK and their fellow team member's gardens to see conservation horticulture projects and the *ex situ* collections developing. I think it would be a rewarding professional development opportunity. And finally, I think as many people as possible should be told the story of Vietnam's incredible landscapes and biodiversity. It is a unique and special place, with kind and welcoming people. I will endeavour to communicate this to visitors to the National Botanic Garden of Wales and celebrate the *ex situ* collections growing in our arboretum at every opportunity.

Acknowledgements

I would like to acknowledge my gratitude to the Merlin Trust, trustees and Valerie Finnis and her family's generosity for supporting my participation on the expedition. The £1000.00 award was used to subsidise the costs of the expedition and was invested in both my career and plant conservation. I would also like to thank the Royal Horticultural Society and the members of the National Botanic Garden of Wales who also contributed funds and support.

A special mention and sincere debt of gratitude is also owed to the local partners involved who supported the project. Expeditions are only possible due to partnerships with collaborators with local knowledge, botanical expertise and an understanding of the national regulations, permissions and local customs. I would like to acknowledge in particular the contribution of the porters and communities who helped us throughout the expedition. Their indigenous knowledge, field skills and patience were invaluable and much appreciated.

Appendix one: Personal profile

Table 4. personal profile of author

Name	Will Ritchie
Role	Curator
Organisation	National Botanic Garden of Wales
Merlin No:	779

In my current role at the National Botanic Garden of Wales, I'm focussed on developing plant collections of utility for conservation, research, education and display purposes. The Garden is a young institution, opened in 2000, but has the capacity, facilities and resource to be a leading botanic garden. To this end, we have prioritised establishing *ex situ* collections. The Garden has already developed valuable collections representing the flora of Wales but with ample space, horticultural and scientific resources, we are committed to international collaborations. My own passion for these projects is linked to my belief that botanic gardens are valuable resources and that there is a need for greater equity in plant conservation, matching expertise and resources to areas where biodiversity is high but capacity is limited.

I first started studying the flora of Vietnam while Curator at Glasgow Botanic Gardens. I was asked to participate in an expedition to northern Vietnam in 2016 by Richard Baines. Since then I have developed a greater understanding of, and affinity to, the region's flora, people and culture. I have become committed to supporting conservation efforts in Vietnam, by providing additional support for conservation horticulture and developing *ex situ* collections in parallel to *in situ* programmes. In the absence of an existing network of *ex situ* collections in the country, I think the support of international botanic garden can assist and provide tangible benefits.

Participation in expeditions have been incredibly valuable in my career and I'm grateful for all the opportunities in horticulture that have been afforded to me. Since 2012, I have been working in curatorial teams at botanic gardens, continuing to learn and gain experience to support my career and the future development of botanic gardens. The opportunity to partake in the 2019 expedition to Vietnam has further equipped me with the experiences, knowledge and skills to develop in my current role and aid the development of the National Botanic Garden of Wales. Thanks to the support of the Merlin Trust, I feel enriched by the experience and I'm at a stage of my career where I can make meaningful contribution to our horticulture, conservation and share my knowledge with early career horticulturists.

Figure 19. Profile picture in the Great Glasshouse at the National Botanic Garden of Wales

Appendix two: Expenditure

Table 5. A summary of the expenditure financed by the award from the Merlin Trust

Item	Date	Source	Cost (GBP)
Flights, LHR to HAN (return)	11 September	Travel Trolley	636.42
Vaccinations	12 September 2019	Boots	216.00
Train to London Paddington	30 September 2019	Trainline	50.60
Heathrow Express (return)	30 September 2019	Heathrow Express	37.00
Hotel (two nights), Hà Nội	07 October 2019	Riverside Hotel	71.31
Hotel (two nights), Hà Nội	24 October 2019	Riverside Hotel	70.43
Fieldwork support	24 October 2019	Institute of Biological and Ecological Resources	2,000.00
Train to Ffairfach	25 October 2019	Trainline	50.60
Total			3,132.36

Appendix three: Itinerary

Table 6. A summary of daily activities during the expedition

Date	Activity
6/10/19	Arrived Hà Nội
7/1019	Planning and Preparation, Hà Nội
08/10/19	Travel to and stay in Sa Pa
09/1019	Phan Xi Păng, study area one
10/10/19	Phan Xi Păng, study area one
11/10/19	Phan Xi Păng, study area one
12/10/19	Phan Xi Păng, study area one
13/10/19	Collection and data processing, Sa Pa
14/10/19	Bản Khoang, study area two
15/10/19	Travel to Hà Giang
16/10/19	Tây Côn Lĩnh, study area three
17/10/19	Tây Côn Lĩnh, study area three
18/10/19	Tây Côn Lĩnh, study area three
19/1019	Tây Côn Lĩnh, study area three
20/10/19	Quản Bạ, study area four
21/10/19	Quản Bạ, study area four
22/10/19	Travel to Hà Nội
23/10/19	Conference
24/10/19	Conference & flight

Appendix four: collections summary

Table 7. A summary of the specimens collected, including their locality and a field description

Coll#	Assigned name	Locality	Description
1	Hedychium	Phan Xi Pang, near San Sa Ho village	Perennial to 70 cm, 20 cm leaves, red calyx, white corolla, broad labellum. No scented
2	Callicarpa cf. rubicola	Phan Xi Pang, near San Sa Ho village	Shrub, 2 m tall, purple fruits
3	Clerodendrum	Phan Xi Pang, near San Sa Ho village	Small tree to 3 m tall, leaves scented, strong non pleasant, red calyx, black fruit, two seeds per fruit
4	Dryopteridaceae	Phan Xi Pang, near San Sa Ho village	Fern, ca. 50 cm tall, young leaves reddish, then dark green, inducium peltate
5	Aeschynanthus	Phan Xi Pang, near San Sa Ho village, near a ravine	Herb, 40 cm tall, red calyx and corolla, base of filaments pale red, apex red
6	Gesneriaceae	Phan Xi Pang, near San Sa Ho village, near a ravine	Herb, 70 cm tall, leaves pale green abaxially, light green to dark green adaxially. Calyx green to purple, corolla lilac with white vertical stripes inside
7	Polygonatum	Phan Xi Pang, near San Sa Ho village	Herb, about 70 cm tall, leaves dark green adaxially, pale green abaxially, fruits purple
8	Rhododendron	Phan Xi Pang, near San Sa Ho village	Epiphyte, 20 cm tall, leaves pale green below, dark green above, brown stipules
9	Rhododendron saxicolum	Phan Xi Pang, near San Sa Ho village	Shrub, 2 m tall, capsules 1.5 cm tall, brown
10	Rhododendron saxicolum	Phan Xi Pang, near San Sa Ho village	
11	Rhododendron saxicolum	Phan Xi Pang, near San Sa Ho village	Shrub, about 150 cm tall
12	Ardisia	Phan Xi Pang, near San Sa Ho village	Herb, 30 cm tall, pink fruits
13	Rhododendron irroratum	Phan Xi Pang, near San Sa Ho village	Tree, 8 m tall, most leaves green, some yellow. Fruits green with yellow tones
14	Sorbus	Phan Xi Pang, near San Sa Ho village, near a ravine	Tree, ca. 8 m tall, fruits pale green
15	Diospyros	Phan Xi Pang, near San Sa Ho village	Tree, leaves dark green, fruits green
16	Ardisia	Phan Xi Pang, near San Sa Ho village	Small shrub, 40 cm tall, red fruits
17	Lauraceae	Phan Xi Pang, near San Sa Ho village	Shrub, 2 m tall, leaves dark green, scented. Red fruits
18	Rhododendron maddenii	Phan Xi Pang, near San Sa Ho village	Epiphyte, about 2 m tall, leaves pale green or yellow, whitish abaxially
19	Fokienia hodginsii	Phan Xi Pang, near San Sa Ho village	Tree, ca 7 m tall

20	Rhododendron leptocladon	Phan Xi Pang, near San Sa Ho village	Epiphyte, 1 m tall, dark green leaves above, whiteish below
21	Rhododendron sp. nov.	Phan Xi Pang, near San Sa Ho village	Tree, 10 m tall, 70 cm diameter, dark green leaves adaxially, pale green abaxially, green fruits
22	Oreocharis	Phan Xi Pang, near San Sa Ho village	Epiphyte, 10 cm tall, dark green leaves adaxially, pale green leaves with dark veins
23	Rubiaceae	Phan Xi Pang, near San Sa Ho village	Shrub, ca 170 cm, leaves dark green adaxially, pale green abaxially, blue fruits
24	Rhododendron aff. irroratum	Phan Xi Pang, near San Sa Ho village	Tree, 5 m tall, leaves dark green adaxially, pale green abaxially, green fruits
25	Lithocarpus	Phan Xi Pang, near San Sa Ho village, near a ravine	Tree, ca 10 m tall, acorns collected from the ground
26	Begonia	Phan Xi Pang, near San Sa Ho village, near a ravine	Herb, leaves green adaxially, pale green abaxially, ink flowers
27	Rhododendron	Phan Xi Pang, near San Sa Ho village, near a ravine	Epiphyte, ca 20 cm tall, leaves dark green adaxially, pale green abaxially
28	Oreocharis	Phan Xi Pang, near San Sa Ho village	Epiphyte, about 10 cm tall, leaves green adaxially, pale green abaxially with reddish veins, yellow flowers
29	Viburnum cf cinnamomifolium	Phan Xi Pang, near San Sa Ho village	Tree, 4 m tall, most leaves green, some orange, red peduncle, purple fruits,
30	Dipteris	Phan Xi Pang, near San Sa Ho village	Herb, 2 m tall, petiole about 1 m long, brown sori
31	Myrsinaceae	Phan Xi Pang, near San Sa Ho village	Herb, 1 m long, leaves green adaxially, pale green abaxially, red spots on the margin of the leaflets, red fruits
32	Rhododendron aff. saxicolum	Phan Xi Pang, near San Sa Ho village	Shrub, 3 m tall, leaves same green both sides, buds pale green
33	Primula	Phan Xi Pang, near San Sa Ho village	Herb, 10 cm tall, leaves dark green adaxially, pale green abaxially, lilac corolla adaxially
34	Dichroa	Phan Xi Pang, near San Sa Ho village	Shrub, about 2 m tall, young leaves strongly purple abaxially, dark green adaxially, the purple disappearing when older, dark green calyx, blue filaments, yellow anthers
35	Malvaceae	Phan Xi Pang, near San Sa Ho village, near a ravine	Shrub, 1 m tall, green leaves, both faces same tone, yellow epicalyx, pale yellow capsules
36	Carex	Phan Xi Pang, near San Sa Ho village	Herb, about 70 cm tall, stem red at the base, red fruits
37	Asteraceae	Phan Xi Pang, near San Sa Ho village	Terrestrial herb, leaves dark green with yellow hairs, pale green leaves abaxially, brown peduncle
38	Magnolia	Phan Xi Pang, near San Sa Ho village	Cone, about 10 cm long, with white lenticels. Red seeds
39	Castanopsis	Phan Xi Pang, near San Sa Ho village	

40	Gesneriaceae	Phan Xi Pang, near San Sa Ho village	Terrestrial herb, 5 cm tall, 20 cm diameter, leaves dark green adaxially, pale green abaxially
41	Rhododendron irroratum	Phan Xi Pang, near San Sa Ho village	Epiphyte, ca 1 m long, prostrated, most leaves dark green, some red, pale green abaxially
42	Rhododendron	Phan Xi Pang, near San Sa Ho village	Tree to 8 m, leaves dark green adaxially, pale green abaxially, brownish fruits
43	Arisaema	Phan Xi Pang, near San Sa Ho village	Herb, white stem and petioles with purple vertical spots, leaves dark green adaxially, pale green abaxially, spate white at the base, tuning green towards the apex with purple vertical spots
44	Rhododendron aff. moulmainense	Phan Xi Pang, near San Sa Ho village	Tree, about 8 m tall, 60 cm diameter, leaves green, same tone at both sides, pale green buds, green capsules
45	Begonia	Phan Xi Pang, near San Sa Ho village	Herb, 10 cm tall, 30 cm diameter, leaves pale green adaxially, whitish abaxially, reddish petioles
46	Rhododendron	Phan Xi Pang, near San Sa Ho village	Epiphyte, about 1 m tall, leaves dark green adaxially, pale green abaxially
47	Magnolia	Phan Xi Pang, near San Sa Ho village	Cone 10 cm long, orange seeds
48	Quercus	Phan Xi Pang, near San Sa Ho village	Tree, about 10 m tall, 50 cm diameter, leaves dark green adaxially, pale green abaxially
49	Arisaema	Phan Xi Pang, near San Sa Ho village	Raceme about 10 cm long, red fruits
50	Magnolia	Phan Xi Pang, near San Sa Ho village	Cone about 10 cm, peduncle about 7 cm, red seeds
51	Magnolia	Phan Xi Pang, near San Sa Ho village	Orange fruits
52	Liriope	Phan Xi Pang, near San Sa Ho village	
53	Rhododendron	Phan Xi Pang, near San Sa Ho village	Epiphyte, about 80 cm tall, leaves dark green adaxially, pale green abaxially
54	Photinia	Phan Xi Pang, near San Sa Ho village	Leaves dark green adaxially, pale green abaxially, petioles reddish, mid vein yellow abaxially, yellow fruits
55	Quercus	Phan Xi Pang, near San Sa Ho village	
56	Rhododendron aff. maddenii	Phan Xi Pang, near San Sa Ho village	Shrub, 6 m tall, leaves olive green adaxially, white abaxially reddish twigs
57	Euonymus formosana	Phan Xi Pang, near San Sa Ho village	Shrub, about 2 m tall, leaves dark green adaxially, pale green abaxially, red peduncles, pink fleshy calyx, orange seeds
58	Viburnum	Phan Xi Pang, near San Sa Ho village	Shrub, about 2 m tall, dark green leaves same tone both sides, black fruits
59	Fagaceae	Phan Xi Pang, near San Sa Ho village	

60	Rhododendron arboreum	Phan Xi Pang, near San Sa Ho village	Tree, ca 7 m tall, leaves dark green adaxially, pale green abaxially with brown indumentum. Brown capsules
61	Viscum	Phan Xi Pang, near San Sa Ho village	Parasitic shrub, pale green leaves, yellow buds, green fruits
62	Magnolia	Phan Xi Pang, near San Sa Ho village	Tree, about 8 m tall, leaves green on both sides, orange seeds
63	Quercus	Phan Xi Pang, near San Sa Ho village	
64	Ilex	Phan Xi Pang, near San Sa Ho village	Shrub about 3 m tall, leaves dark green adaxially, pale green abaxially, red fruits
65	Rhododendron arboreum subsp. cinnamomeum	Phan Xi Pang, near San Sa Ho village	Tree, 5 m tall, leaves dark green adaxially, pale green abaxially, brown indumentum, bud covered with brown indumentum
66	Rhododendron	Phan Xi Pang, near San Sa Ho village	Shrub, about 1.5 m, leaves dark green adaxially, pale green abaxially, some yellow
67	Rhododendron valentinianum	Phan Xi Pang, near San Sa Ho village	
68	Rhododendron chunii subsp. vietnamense	Phan Xi Pang, near San Sa Ho village	Epiphyte, about 1 m tall, most leaves green, same tone on both sides, some red
69	Fagaceae	Phan Xi Pang, near San Sa Ho village	Shrub, 3 m tall, leaves green with mid vein yellow, brown indumentum abaxially. Seed covered by green spikes with brown indumentum at the base
70	Fagaceae	Phan Xi Pang, near San Sa Ho village	Tree, 2.2 m tall, green leaves, same tone on both sides, green acorns
71	Cotinia davidiana	Phan Xi Pang, near San Sa Ho village	Shrub, 50 cm tall, most leaves dark green adaxially, some with whitish veins, some red. Abaxially pale green. Red fruits
72	Tsuga	Phan Xi Pang, near San Sa Ho village	Tree, 6 m tall, 20 cm diameter, green needles adaxially, white abaxially
73	Sorbus	Phan Xi Pang, near San Sa Ho village	Tree, 4 m tall, leaves dark green adaxially, with red tones, pale green abaxially
74	Magnolia	Phan Xi Pang, near San Sa Ho village	
75	Magnolia	Phan Xi Pang, near San Sa Ho village	
76	Magnolia	Phan Xi Pang, near San Sa Ho village	Tree, 10 m tall, cone with closed follicles, pink with yellow lenticels
77	Magnolia	Phan Xi Pang, near San Sa Ho village	Tree, 12 m tall, 70 cm diameter, leaves dark green adaxially, pale green abaxially, follicles pink with lenticels, seeds red
78	Magnolia	Phan Xi Pang, near San Sa Ho village	Tree, about 7 m tall, orange seeds
79	Primula	Phan Xi Pang, near San Sa Ho village	Rosette, perennial herb, leaves very close to grownd level, shaded mossed

			bank, leaves dark green adaxially whiteish abaxially
80	Begonia	Phan Xi Pang, near San Sa Ho village	Herb perennial, 20 cm diameter, growing on mossy rocky outcrop, leaves iridescent blue adaxially, whiteish abaxially
81	Loxostigma grifithii	Phan Xi Pang, near San Sa Ho village	Herb, about 20 cm tall, leaves pale green adaxially, whiteish abaxially, purple peduncle, flowers white outside, corolla mouth yellow, corolla gorge with purple spots
82	Gesneriaceae	Phan Xi Pang, near San Sa Ho village	Herb, 30 cm tall, leaves bright green adaxially, whiteish abaxially, pedicels purple, fruits green with purple tones
83	Rhoiptelea tonkinensis	Phan Xi Pang, near San Sa Ho village	Tree, 7 m tall, 20 cm diameter, bark striated vertically, leaves dark green adaxially, pale green abaxially, green fruits
84	Acer laevigata	Phan Xi Pang, near San Sa Ho village	Tree, 5 m tall, 15 cm diameter, leaves dark green adaxially, white abaxially, reddish peduncles
85	Ardisia	Phan Xi Pang, near San Sa Ho village	Shrub, 1 m tall, leaves dark green adaxially, pale green abaxially, pink fruits
86	Rhododendron maddenii	Phan Xi Pang, near San Sa Ho village	Epiphyte, about 70 cm tall, leaves bright green adaxially, pale green abaxially, covered with brown indumentum
87	Rhododendron	Phan Xi Pang, near San Sa Ho village	Tree, 5 m tall, 7 cm diameter, reddish bark, leaves dark green adaxially, bright green abaxially
88	Rhododendron	Phan Xi Pang, near San Sa Ho village	Shrub, 3 m tall, leaves dark green adaxially, pale green abaxially with brown mid vein covered in brown indumentum, pale green buds
89	Dioscorea	Phan Xi Pang, near San Sa Ho village	Vine, 7 m long, hanging from a tree, leaves dark green adaxially, whiteish abaxially
90	Gesneriaceae	Phan Xi Pang, near San Sa Ho village	Epiphyte, long stems appressed to the trunk of the host, branches 10 cm long, leaves dark green adaxially, pale green abaxially, purplish capsules
91	Lysionotus serratus	Phan Xi Pang, near San Sa Ho village	EpiphyteX about 1 m tall, leaves dark green adaxially, pale green abaxially, corolla with white and red vertical stripes
92	Melodinus monogynus	Phan Xi Pang, near San Sa Ho village	Vine, 3 m long, 1 cm width, leaves dark green adaxially, pale green abaxially, fruit green turning yellow
93	Viburnum	Phan Xi Pang, near San Sa Ho village	Tree, 4 m tall, 8 cm diameter, smooth bark, leaves dark green adaxially, pale green green abaxially, red fruits
94	Exbucklandia formosana	Phan Xi Pang, near San Sa Ho village	Tree, 10 m tall, 40 cm diameter, leaves dark green adaxially, pale green abaxially, white flowers

95	Aeschinanthus	Phan Xi Pang, near San Sa Ho village	Epiphyte, red calyx, red corolla,
96	Rhododendron	Phan Xi Pang, near San Sa Ho village	
97	Dioscorea	Phan Xi Pang, near San Sa Ho village	Climber, severa meters long, tubers brown, capsules green, stigmas yellow
98	Rhododendron sinofalconeri	Phan Xi Pang, near summit	Shrub, about 2.5 m tall, numerous branches spreading horizontally, young shoots covered in pale brown indumentum, leaves dark green with bright green mid vein adaxially, covered with brown thick indumentum abaxially, bud apex red, base pale green
99	Rhododendron	Phan Xi Pang, near summit	Shrub, about 3 m tall, numerous branches spreading horizontally, most leaves green, some yellow, leaves dark green adaxially, pale green abaxially, pale green buds
100	Arisaema	Phan Xi Pang, near summit	Herb, 50 cm tall, stem and petioles with black and pink pixel-like vertical rectangles, leaf blade dark green with red margin adaxially, white abaxially, spathe pink with purple spots, spadix green with dark spots at the base, purple with dark spots towar
101	Indet	Phan Xi Pang, near summit	Shrub, about 3 m tall, leaves dark green adaxially, pale green abaxially, black ripe fruits
102	Rhododendron sinofalconeri	Phan Xi Pang, near summit	Tree, about 4 m tall, reddish bark, exfoliating, leaves dark green adaxially with pale green mid vein, covered in brown indumentum abaxially, buds pale green with brown indumentum
103	Rhododendron tepropeplum	Phan Xi Pang, near summit	Shrub, about 1 m tall, young twigs reddish, older with exfoliating bark, purple buds, most leaves green with white dots adaxially, pale green with brown dots abaxially, mid vein pale brown on both sides, some red leaves, brown capsules
104	Rhododendron cranulatum	Phan Xi Pang, near summit	Shrub, about 50 cm tall, smooth bark, buds pale green at the base, pink towards the apex, leaves dark green adaxially, pale green abaxially, some red. Brown capsules
105	Rhododendron tepropetaloides	Phan Xi Pang, near summit	Shrub, about 2 m tall, red exfoliating bark, past year twigs reddish, current year twigs brown with brown indumentum, buds green at the base, reddish towards each apex, leaves dark green with white dots adaxially,

			white with brown dots abaxially, mid vein
106	Euonymus	Phan Xi Pang, near summit	Shrub, about 1 m tall, young twigs reddish, leaves dark green adaxially with pale green veins, pale green abaxially, red margins, purple peduncle, pink capsule with orange seeds
107	Rhododendron	Phan Xi Pang, near summit	Shrub, about 2 m tall, smooth bark, young twigs pale green, buds same color, leaves dark green with pale green mid vein adaxially, pale green abaxially, some yellow leaves, green capsules
108	Enkianthus	Phan Xi Pang, near summit	Shrub, about 3 m tall, smooth bark, red petioles and leaf margins, leaves dark green adaxially, pale green with red mid vein abaxially, fruits black
109	Rhododendron falconeri	Phan Xi Pang, near summit, next to water reservoir	Shrub, about 3 m tall, leaves dark green adaxially, pale green abaxially covered on brown indumentum
110	Rhododendron sinofalconeri	Phan Xi Pang, near summit, next to water reservoir	Shrub, about 2.5 m tall, exfoliating reddish bark, bud green at the base, brown towards the apex, leaves dark green with pale green mid vein adaxially, covered in brown indumentum abaxially
111	Brassaiopsis	Ban Khoang	Herb, 1.8 m tall, stem green, thorny, terminal inflorescarence, leaves green both sides same color, white flowers, green immature fruits
112	Quercus	Ban Khoang	Tree, about 5 m tall, 22 cm diameter, bark smooth, leaves bright green with yellowish mid vein on both sides, green acorns
113	Scurrula	Ban Khoang	Parasite growing on Quercus (112), 70 cm tall, leaves dark green adaxially, brownish abaxially
114	Arisaema	Ban Khoang	20 cm long and 7 cm wide infructescence with bright red seeds about 1 cm long and 5 mm wide
115	Illicium	Ban Khoang	Tree, 5 m tall, petioles red adaxially, green abaxially, leaves dark green adaxially, bright green abaxially, red peduncle and fruit
116	Litsea cf. cubeba	Ban Khoang	Tree, 4 m tall, 10 cm diameter, bark smooth, young twigs yellowish, leaves dark green adaxially, whiteish abaxially, aromatic, green fruits
117	Celastraceae	Ban Khoang	Epiphyte, 2 m tall, leaves dark green adaxially, pale green abaxially, green capsules, black seeds partially covered with an orange aril
118	Oreocharis	Ban Khoang	Epiphyte, about 20 cm tall, 40 cm diameter, leaves dark green adaxially,

			pale green abaxially with brown prominent veins, old yellow flowers, green capsules
119	Aeschinanthus	Ban Khoang	Epiphyte growing on trunk, 70 cm long, stem 5 mm wide, leaves dark green adaxially, pale green abaxially, dark red calyx, red corolla outside, with yellow tones inside, filaments red, anthers yellow
120	Agapetes	Ban Khoang	Epiphyte, 40 cm tall, leaves dark green adaxially, pale green abaxially, fucsia fruits when ripe (green when immature), pubescent
121	Rhododendron	Ban Khoang	Epiphyte, 15-20 cm, bark red, young twigs green, buds pink apically, green at the base, leaves dark green with pale green mid vein adaxially, brownish with brown spots abaxially
122	Aeschinanthus	Ban Khoang	Epiphyte, climbing a tree with some branches growing 20 cm tall, leaves dark green adaxially, pale green abaxially, yellow calyx, red corolla, the mouth with yellow tones and dark red spots, the gorge pale yellow, capsule peduncle purple, capsule green wi
123	Magnolia	Ban Khoang	Tree, about 4 m tall, smooth bark, leaves green, lighter abaxially than adaxially, yellow mid vein, old fruit remnants, seeds orange
124	Lysionotus serratus	Ban Khoang	Climber, with rosettes of dark green leaves adaxially and white leaves with purple veins abaxially, reddish capsule peduncle, reddish capsule
125	Schefflera	Ban Khoang	Herb, to 4 m, stem 6 cm diameter, bifurcating, brown petioles, leaflets dark green adaxially, whiteish with yellowish mid vein abaxially, inflorescence tachos and pedicels reddish adaxially, pale green abaxially, fruits green, turning black when ripe
127	Begonia	Ban Khoang	Herb, about 10 cm tall, 40 cm broad, leaves green with blue iridescence or bright green tones adaxially, white abaxially, brown petiole
128	Gesneriaceae	Ban Khoang	Epiphyte, about 10 cm tall, 30 cm broad, leaves dark green adaxially, pale green abaxially
129	Vaccinium	Ban Khoang	Shrub, 3 m tall, smooth bark, green young twigs, leaves green same tone both sides, dark fruits
130	Rhododendron	Phan Xi Pang, near summit, next to water reservoir	Large shrub to 3 m tall, bark coarse, young twigs green, fawn buds, very pointed, leaves shiny mid green

			adaxially, light green with plastard indumentum abaxially, capsules green, barril shaped
131	Rhododendron	Phan Xi Pang, near summit, next to water reservoir	Large shrub, to 4 m, bark coarse, young twigs green, buds green obvoid, leaves doll green mid vein light green adaxially, doll green with yellow mid vein abaxially, capsules green barril shaped with prominent lime green style
132	Rhododendron cf. huidongensis	Phan Xi Pang, near summit, next to water reservoir	Small tree to 4 m, bark coarse, young twigs green, buds ovoid, green, singular, leaves shiny rich green mid vein prominent yellowish adaxially, doll silvery green with prominent yellow midrib abaxially, capsules green, barril shaped
133	Rhododendron	Phan Xi Pang, near summit, next to water reservoir	Tree to 5 m, bark coarse, young twigs green, buds green, leaves doll green adaxially, mid green abaxially, capsules barril shaped, in clusters, green
134	Schefflera	Phan Xi Pang, near summit, next to water reservoir	Tree, 5 m tall, bark pale brown with deep vertical fisures, green petioles, 8 leaflets per leaf, leaflets doll green with grey mid vein adaxially, doll green abaxially
135	Rhododendron	Ban Khoang	Shrub, 2 m tall, not compact habit, bark coarse reddish, young twigs reddish, buds pointed ovoid red, leaves shiny mid green adaxially, doll silvery green abaxially, capsules green barril shaped
136	Vittaria	Ban Khoang	Epiphyte , 50 cm long, simple fronds, linear, 3 cm width 50 cm long, dark green adaxially, glaucous green abaxially, linear sporangia in the margin, orange-brown
137	Tripterospermum	Ban Khoang	Climbing, 50 cm long, elongated purple fruits, white inside with black seeds
138	Quercus	Ban Khoang	Tree, about 8 m tall, 20 cm diameter, leaves dark green adaxially, a bit lighter abaxially, green acorns
139	Begonia	Ban Khoang	Herb, 50 cm tall, red petioles, leaves bright green on both sides with red hairs in the veins, new leaves bright red
140	Henckelia	Ban Khoang	Herb, growing on the side of a rock, 10 cm tall, 10 cm diameter, leaves dark green with dark red areas adaxially, whiteish with purple areas and green veins abaxially, green calyx with purple spots, corolla tube white outside, lobes lilac, gorge yellow ab

141	Barringtonia	Ban Khoang, near rubbish tip	Tree, 5 m tall, 10 cm diameter, leaves dark green adaxially, pale green abaxially, fruits green to purple
142	Alpinia	Ban Khoang, near rubbish tip	Herb, about 70 m tall, red seeds
143	Celastrum	Ban Khoang, near rubbish tip	Shrub, about 4 m tall, smooth bark, leaves dark green adaxially, pale green abaxially, pale green mid vein, black fruits
144	Dichroa	Ban Khoang, near rubbish tip	Shrub, 150 cm tall, leaves dark green adaxially, pale green abaxially with dark green veins, pale green fruits
145	Myrtaceae	Ban Khoang, near rubbish tip	Tree, 7 m, 25 cm diameter, smooth bark, leaves dark green, fruit looks like a ponme granate, opens irregularly, yellow. Seed orange
146	Rhododendron maddenia subsp. glabrous	Ban Khoang	Epiphyte, glabrous leaves on both faces,
147	Camellia sinensis	On the way to Tay Con Linh	Tree, about 4 m tall, 10 cm diameter, smooth bark, young twigs reddish, leaves dark green adaxially, pale green abaxially, the mid vein more pale than the blade on both sides, green fruits
148	Quercus	On the way to Tay Con Linh	Tree, about 9 m tall, vertical striations with lenticels on bark, leaves dark green adaxially, pale green abaxially, green spiky bract involucre, green acorns
149	Ladianthus	Tay Con Linh	Shrub, 1 m tall, white flowers, blue fruits
150	Vittaria	Tay Con Linh	Epiphyte, growing on base of petioles of Livistona sinensis, 20 cm large, glaucous green
151	Schizophragma	Tay Con Linh	Climber, climbing to 5 m, white bracts, tubular flowers white outside, orange inside, fruits green
152		Tay Con Linh	Tree, to 4 m tall, 4 cm diameter, white bracts, orange flowers
153	Alpinia	Tay Con Linh	Herb to 3 m tall, leaves about 80 cm long, 15 cm wide, inflorescence about 50 cm long, fruits red
154	Gesneriaceae	Tay Con Linh	Epiphyte, 10 cm wide, leaves dark green adaxially, pale green-purple to white abaxially, inflorescence 10 cm tall
155	Gesneriaceae	Tay Con Linh	Epiphyte, herb, 10 cm wide, coriaceous leaves, dark green adaxially, pale green abaxially
156	Lanonia dasyantha	Tay Con Linh	Understory palm, about 2 m tall, no stem, 25 palmate leaves, divided in 12 segments, young leaves with clear and dark spots, these disappear in old leaves, petioles 1-1.5 m, spines in petiole until half of its length, blade 1 m diameter, inflorescences 40

157	Medinella	Tay Con Linh	Climber, about 1,5 m tall, leaves dark green adaxially, pale green abaxially, pink flowers
158	Aeschinanthus	Tay Con Linh	Epiphyte, shrub, about 50 cm tall, 1 m wide, leaves dark green adaxially, pale green abaxially, calyx, corolla and filaments dark red
159	Magnolia	Tay Con Linh	Tree, 12 m tall, 40 cm diameter, bark with horizontal lenticels of about 3 cm long, leaves about 40 cm long, 20 cm wide, pale green adaxially, brown-pale green abaxially
160	Aeschynanthus	Tay Con Linh	Climbing, stems 7 mm wide, reaching 4 m hight, with branches separating from the host tree 70 cm long, dark red calyx, capsules 10 cm long, green
161	Loxostigma grifithii	Tay Con Linh	Epiphyte, herb, about 1 m long, tubular flowers pale yellow outside, lower lips yellow inside, all corolla inside with purple spots
162	Begonia	Tay Con Linh	Herb, 150 cm tall, stems reddish, leaves dark green adaxially, pale green abaxially, pink bracts
163	Liliaceae	Tay Con Linh	Herb, long inflorescence of about 3 m tall, ramified to one order, with 16 branches 40 cm long, with dry capsules, banana like, 15 cm long 2 cm wide, hanging
164	Rhododendron vialii	Tay Con Linh	Epiphyte, 1 m long, branches 40 cm long
165	Arisaema	Tay Con Linh	
166	Begonia	Tay Con Linh	Herb, 50 cm tall, pink petioles, leaves green adaxially, whiteish abaxially brown fruits
167	Rhododendron	Tay Con Linh	Epiphyte, 1 m tall, green young twigs, leaves green adaxially, brownish abaxially, green capsules
168	Arisaema	Tay Con Linh	Spadix 15 cm tall, covered in red juicy fruits
169	Castaneopsis	Tay Con Linh	Acorns found in the floor
170	Castaneopsis	Tay Con Linh	Tree, 10 m tall, 50 cm diameter, leaves dark green adaxially, pale green abaxially
171	Begonia	Tay Con Linh	Herb, growing on a rock, 15 cm tall, 30 cm wide, petioles green with red hairs, leaves bright green with red area around veins adaxially, whiteish with red areas around veins abaxially
172	Annonaceae	Tay Con Linh	Fruit compound of fleshy units, these red or green on the sides
173	Tetrastigma	Tay Con Linh	Climber, herbaceous, about 3 m long, leaves dark green adaxially, pale green abaxially, green or black seeds
174	Polypodiaceae	Tay Con Linh	Epiphyte, 20 long, 7 cm tall, fronds dark green adaxially, whiteish

			abaxially, aporangia wothou inducium, circular
175	Rhododendron	Tay Con Linh	Shrub, bout 1 m tall, growing on rock, bark smooth, reddish, young twigs green, leaves green silvery adaxially, pale green abaxially, capsules grey
176	Aeschynanthus	Tay Con Linh	Epiphyte, branches 50 cm long, fruit a capsule of 5 cm long plus 2 cm style remnant
177	Aspidestra	Tay Con Linh	Mono or, epiphyte, leaves 80 cm long, 7 cm wide, green to black fruits
178	Rubiaceae	Tay Con Linh	Shrub, 60 cm tall, leaves dark green adaxially, pale green abaxially, red fruits
179	Aralia	Tay Con Linh	Shrub, 4 m tall, leaves 2 m long, bipinnate, black fruits
180	Magnolia	Tay Con Linh	Fruit about 10 cm long, follicles pale brown, seeds red
181	Arisaema	Tay Con Linh	Herb, 30 cm tall, green spathe, whiteish peduncle
182	Arisaema	Tay Con Linh	Spadix 10 cm long covered in orange fruits
183	Polygonatum	Tay Con Linh	Herb, about 70 cm tall, leaves dark green adaxially, pale green abaxially, fruits greennto blueish
184	Lythracae	Tay Con Linh	Tree, about 3.5 m tall, 7 cm diameter, bark whiteish, leaves dark green adaxially, a bit less dark a abaxially, capsules green to brown
185	Aralia	Tay Con Linh	Tree, 4.5 m tall, 8 cm diameter, young stems covered with spines, aromatic leaves, white flowers
186	Commelina	Tay Con Linh	Herb, crawling in the understory, leaves dark green adaxially, pale green abaxially, with purple petioles, green capsules
187	Verbenaceae	Tay Con Linh	Tree, 5 m tall, leaves dark green adaxially, pale green abaxially, red fruits
188	Celastraceae	Tay Con Linh	Climber with branches separating from the host tree, these about 2 m long. Leaves dark green adaxially, whiteish abaxially, capsules with pink soft spines
189	Polypodiaceae	Tay Con Linh	Epiphyte, growing on the trunk of a tree, sporangia pale brown
190	Gesneriaceae	Tay Con Linh	Herb, growing on rock, about 50 cm long, leaves bright green adaxially, pale green abaxially, peduncle, bracts and calyx maroon, tubular corolla pale pink at the base, lilac towards the apex outside, white with lilac vertical stripes inside, capsules maro
191	Commelina	Tay Con Linh	Climber, about 150 cm tall, leaves bright green adaxially, whiteish

			abaxially, with purple petioles, white flowers, yellow hairy filaments
192	Cissus	Tay Con Linh	Climber, woody, pink fruits
193	Euphorbiaceae	Tay Con Linh	Green capsules with prominent veins, they belong to a tree about 20 m tall, 40 cm diameter, whiteish bark, hearted shaped leaves
194	Arisaema	Tay Con Linh	Herb, about 40 cm tall, petiole with lenticels
195	Fabaceae	Tay Con Linh	Tree, 8 m tall, 20 cm diameter, bipinnated leaves, legumes about 20 cm long
200	Rhododendron	Tay Con Linh	Shrub, evergreen, usually epiphytic to 1m, leaves green above, brown/silvery below, buds green ovoid, fruits, brown barrel shaped.
201	Gesneriaceae	Tay Con Linh	Herb, perennial >20cm, leaves shiny green above, silvery below, flowers yellow, upright.
202	Aucuba	Tay Con Linh	Shrub, evergreen >2m, leaves lanceolate, shiny green above, dull green below, fruits red>6mm spherical.
203	Symplocaceae	Tay Con Linh	Shrub, evergreen >3m, leaves lanceolate, acute, rich green, fruits green, barrel-shaped in clusters >0.5cm
204	Dichroa	Tay Con Linh	Shrub, multi stemmed to 1m, leaves opposite, green on both sides, fruits black spherical >0.3mm
205	Hydrangea	Tay Con Linh	Shrub, deciduous, 3m tall, leaves broadly lanceolate, acute, seed in disk florets.
206	Aucuba	Tay Con Linh	Shrub, evergreen >2m, leaves lanceolate, shiny green above.
207	Pieris	Tay Con Linh	Shrub to 2m, evergreen, leaves green, shiny, fruits upright, dry in upright clusters.
208	Rhododendron irrorata subsp vietnamensis	Tay Con Linh	Tree to 10m metres, evergreen, leaves shiny green lanceolate on upper surface, dull green below, buds green, ovoid.
209	Syzygium	Tay Con Linh	Tree small, leaves evergreen, opposite, fruits shiny, green.
210	Fagaceae	Tay Con Linh	Tree, evergreen, seed collected on ground.
211	Rhododendron aff lyi	Tay Con Linh	Shrub, evergreen, usually epiphytic to 1m, leaves green above, brown/silvery below, buds green ovoid, fruits, brown barrel shaped.
212	Camellia furfuracea	Tay Con Linh	Multi stemmed tree up to 4m, leaves evergreen, undulate, shiny on both surfaces, flowers >7cm across whote petals, yellow stamens, autumn flowering.

213	Viburnum	Tay Con Linh	Shrub to 1.5m, evergreen, leaves lanceoate/ovate, acute, fruits red >1cm spherical
214	Hydrangea	Tay Con Linh	Shrub, deciduous, 3m tall, leaves broadly lanceolate, acute, seed in disk florets.
219	Magnolia	Tay Con Linh	Tree, evergreen to 8m, collected seed on ground.
220	Rhododendron irrorata subsp vietnamensis	Tay Con Linh	Tree to 10m metres, evergreen, leaves shiny green lanceolate on upper surface, dull green below, buds green, ovoid.
221	Enkianthus	Tay Con Linh	Shrub, deciduous, up to 4m tall, leaves lanceolate, reddish colour, fruits in pendulous clusters
222	Euonymus	Tay Con Linh	Shrub, evergreen , to 1 m tall, leaves shiny green on both surfaces, fruits pink 1.5cm across,capsules x4 seeds.
223	Enkianthus	Tay Con Linh	Shrub, deciduous, up to 4m tall, leaves lanceolate, reddish colour, fruits in pendulous clusters
224	Fagaceae	Tay Con Linh	Tree, evergreen, acorns upto 3cm, singular, collected on ground.
225	Rosaceae	Tay Con Linh	Tree, deciduous, 4m tall, branches brown, fruits green spherical, multiseeded, pithy.
226	Fagaceae	Tay Con Linh	Tree, evergreen, acorns upto 3cm collected on ground.
227	Rehderodendron macrocarpum	Tay Con Linh	Fruit 7 cm long, brown
230	Myrtaceae	Tay Con Linh	Shrub, evergreen, leaves green, flowers white classic myrtaceae.
231	Camellia	Tay Con Linh	Shrub, evergreen 2m high,leaves lanceolate, acute, alternate. Flowers in clusters, yellow in bud.
232	Magnolia	Tay Con Linh	Tree, evergreen, seed in cones collected on ground 8cm long.
233	Indet beauty	Tay Con Linh	Shrub to 2m, leaves simple, green on both surfaces, pendulous pink flowers
234	Illicium	Tay Con Linh	Shrub, 3m tall, evergreen, leaves green, ovate.
240	Agapetes	Tay Con Linh	Sprawling woody scrambler, 2m long, epiphytic. Leaves green on both sides 5cm, fruits spherical 0.5cm diam
241	Celastraceae	Tay Con Linh, near the top of the mountain	Shrub, flowers dark red corolla, yellow stamens
242	Rhododendron	Tay Con Linh, near the top of the mountain	Tree, 12 m tall, 40 cm diameter, appealing brown bark, young twigs green, buds conical to rounded, vary green, leaves dark green with yellow mid vein adaxially, doll green with yellow mid vein abaxially, brown capsules from last year
243	Camellia	Tay Con Linh, near the top of the mountain	Shrub, 2 m tall, bark brown, green leaves on both sides, flower buds in clusters, flowers pale yellow

246	Lauraceae	Tay Con Linh, near the top of the mountain	Tree, 4 m, 20 cm diameter, leaves shiny green adaxially, doll green abaxially, elongated fruits green
247	Abroma angusta	Tay Con Linh, lowlands, by a river	Climber, about 3 m long, 1.5 cm thick, leaves dark green adaxially, pale green abaxially, petiole reddish, base of blade veins reddish, peduncle reddish, persistent calyx green with reddish tones capsules green, then developing into dry brow and opening d
248	Magnolia		Tree, evergreen, seed in cones collected on ground 8cm long.
249	Cestrum	Bottom of Fairy Bosom	Shrub, about 2.5 m tall, bark pale brown, leaves scented, pale green flowers, white fruits, black seeds
250	Jasmine	Bottom of Fairy Bosom	Shrub, multiple stems, 1.5 m tall, 1 cm wide, white flowers
251	Indet	Tam Son	Climber, woody, leaves green adaxially, pale green abaxially, fruits green turning orange and then red when ripe
252	Begonia	Tam Son	Herb, by steam, about 20 cm diameter, leaves dark green with dark red veins adaxially, mid green with red veins abaxially, pink flowers
253	Cyathia contaminans	Tam Son	Tree fern, about 3 m tall, fronds 2 m long, 1 m long, reddish rachis
254	Ardisia	Tam Son	Herb, 50 cm tall, 60 cm wide, leaves dark green towards the mid vein clear green towards the margins adaxially, pale green abaxially, red flowers and fruits
255	Vitex	Tam Son	Tree, about 2.5 m tall, 20 cm diameter, bark pale brown, leaves bright green adaxially, silvery abaxially, scented, purple flowers, fruits green turning black when ripe
256	Amorphophallus tonkinense	Tung Vai	Herb, 80 cm tall, petiole with blueish areas, leaf blade dark green adaxially, pale green abaxially
257	Strobilanthes	Tung Vai	Shrub, about 2.5 m tall, leaves dark green adaxially, pale green abaxially, inflorescence about 10 cm long, one flower developed at the time per inflorescence, this purple
258	Streptocarpus	Tung Vai	Small shrub, 1 m long, leaves dark green adaxially, pale brown abaxially, the young ones orange, fruits contorted
259	Diplazium megaphyllum	Tung Vai	Fern, stem about 80 cm tall, frond 2 m long
260	Indet	Tung Vai	Epiphyte, 2 m above the ground in a tree trunk, branches 1 m long, flower buds dark red with white

261	Indet	Tung Vai	Shrub 1.5 m tall, leaves dark green adaxially, yellow-green abaxially, orange at the base when young, capsules 10 cm long
262	Indet	Tung Vai	Epiphyte, branches about 1 m long, leaves dark green adaxially, pale green abaxially, bracts, peduncle and calyx dark red, the latter persistent when fruiting, capsules green
263	Magnolia	Tung Vai	Tree, about 20 m tall, 80 cm diameter, pale brown trunk, smooth bark, leaves about 20 cm long 10 cm wide, fruit 10 cm long
264	Ardisia	Tung Vai	
265	Illicium	Tung Vai	Fruit brown
266	Magnolia grandis	Tung Vai	Tree, about 20 m tall, 50 cm diameter, bark smooth, pale brown, trunk branching from 2.5 m upwards, petiole bright green, leaves dark green adaxially, pale green with yellow mid vein abaxially, fruits bulky, about 10 cm long and 8 cm width, pink when unri
267	Arisaema	Tung Vai	Orange seeds
268	Pyrrosia	Tung Vai	Frond about 1 m long
269	Podophyllum	Tung Vai	Herb, 40 cm, leaves dark green adaxially, pale green abaxially
270	Indet	Tung Vai	Herb, 60 cm tall, leaves dark green adaxially, pale green abaxially, pale green calyx, corolla pale pink outside and inside, with purple spots inside
271	Indet	Tung Vai	Climber, 5 cm diameter, yellow fruits
272	Begonia	Tung Vai	Herb, about 70 cm tall, deeply loved leaves, red petioles and abaxial leaf blade, dark green adaxial blade, pink flowers
273	Selaginella	Tung Vai	Herb, red rachis, dark green to blue iridescent leaves
274	Enicosanthellum petelotii	Tung Vai	Tree, 3 m tall, aromatic leaves, black carpels when ripe fruit
275	Amentotaxus	Tung Vai	Tree, about 7 m tall, leaves dark green adaxially, white abaxially
276	Indet	Tung Vai	Herb growing on exposed humid rock, about 10 cm tall, 20 cm wide, flowers lilac
277	Magnolia	Tung Vai	
278	Magnolia	Tung Vai	
279	Aeschynanthus	Tung Vai	
280	Begonia	Tung Vai	Herb about 70 cm tall, red petioles and abaxial leaf blade, adaxial leaf blade dark green with white spots, pink flowers. Possibly same species as 272
281	Begonia	Tung Vai	Herb, about 50 cm tall, leaf blade green on both sides, pink flowes

Appendix five: tables & figures

Tables

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Figure 10. A new road and rubbish disposal facility at a previously diverse field site (ii)

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Figure 18. Team members document the discovery of *Magnolia grandis*

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