

Exploring the Woodland Plant
Communities of North Carolina

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Eve Kennedy

26th April until 2nd May 2026



The view from Wolf Mountain Overlook



Joyce Kilmer Memorial Forest

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I would like to especially thank John Nix, Research Specialist at the Mountain Crop Improvement Laboratory of North Carolina State University. John was an integral part of our trip, offering to be our main point of contact, advising us on our itinerary, leading several all-day field trips to locations of botanical interest in North Carolina, and facilitating a visit and tour of the Mountain Crop Improvement Lab, NC State University. Without John's knowledge and expertise, we would not have been able to see such a wide range of flora and locations of botanical interest.

Lastly, I would like to thank Adam Black, Director of Horticulture, Botanical Research and Conservation at Bartlett Tree Research Laboratories for generously hosting us and taking time to show us the resources, work and research that is being done at the Bartlett Tree Experts as well as their extensive collections of tree species and rare wild collected species.



L-R John, Claudia, Katherine and I atop McRae Peak on Grandfather Mountain.

Aims and Objectives

- Observe a wide range of woodland plants native to the North Carolina Appalachian Mountain Range in a variety of different habitats
- Observe key native genera widely cultivated in the UK in a range of natural habitats and native woodland plant communities to inform cultivation
- Gain insight into current research, conservation, and breeding for hardy plants happening in Southeast America



DATE	ACTIVITY	FURTHER DETAILS
Sunday 26th April	Fly Philadelphia to Asheville.	Arrive 7pm. Transfer to accommodation in Ashville.
Monday 27th April	Botanising day trip led by John Nix at the following locations: 1. Pisgah National Forest 2. Blue Ridge Parkway	1. Pisgah National Forest: A bespoke trail taking in key highlights. A broad range of environments, from high peaks and cascading waterfalls to heavily forested slopes and rare mountain bogs featuring the endangered <i>Helonias bullata</i>. April is prime for spring woodland ephemerals (for example, <i>Uvularia</i>, <i>Sanguinaria canadensis</i>, <i>Trillium spp.</i>, <i>Arisaema triphyllum</i>). 2. Blue Ridge Parkway: known for its botanical diversity, featuring over 1,400 plant species. Stops on the route will include the environs of Ferrin Knob tunnel, Fork Mountain tunnel (a good site for seeing <i>Trillium erectum</i>), Wolf Mountain Outlook (a rare vertical bog) and Black Balsam Knob (a grassy bald peak).
Tuesday 28th April	A.M.: Visit Mountain Crop Improvement Lab to look at breeding programme of woody plants and hear about Rhododendron conservation research undertaken by John Nix. P.M.: Looking Glass Rock	Mountain Crop Improvement Lab, NC State University: a nursery and specialty crop lab at NC State University. The lab is actively working in over 50 genera and has over 80 patented plant varieties. Work at the lab involves traditional plant breeding, polyploid breeding and trialling using germplasm. They are also developing and trialling non-invasive plants. (mcilab.cals.ncsu.edu) Looking Glass Rock (an afternoon hike): Looking Glass Rock is a granite monolith with shallow soil. Particular points of interest include <i>Iris cristata</i>, <i>Cypripedium spp.</i>, <i>Kalmia</i> and <i>Rhododendron</i>.
Wednesday 29th April	Botanising day trip at Joyce Kilmer Memorial Forest.	Joyce Kilmer Memorial Forest: virgin forest famous for some of the largest <i>Liriodendron tulipifera</i> . April is a key time for <i>Asarum</i> , <i>Uvularia</i> , <i>Tiarella</i> , <i>Trillium spp.</i> and <i>Viola canadensis</i> . Other plants of note: <i>Halesia carolina</i> , <i>Cornus florida</i> , <i>Cercis</i> and <i>Tilia americana</i> .

Thursday 30th April	Botanising day trip led by John Nix. Location: Grandfather Mountain Nature Park	Grandfather Mountain Nature Park: a bespoke trail taking in key highlights. Famed for its incredible biodiversity, this is part of the United Nations' Southern Appalachian Biosphere Reserve. Acidic cove forests feature the vulnerable <i>Rhododendron vaseyi</i>. Another highlight will be the endangered <i>Carex fraseriana</i>.
Friday 1st May	A.M.: Botanising day trip led by John Nix. Location: Shortoff Mountain P.M.: Travel to Charlotte	Shortoff Mountain: a bespoke trail to explore the extremely xeric environment of part of the mountain caused by past forest fires and rocky terrain. This will provide excellent insights into plant resilience and adaptations to dry environments. Plants of note include <i>Rhododendron carolinianum</i>, <i>Fothergilla major</i>, <i>Eubotrys racemosa</i> (in flower) and <i>Iris verna var. smalliana</i> (near Linville Gorge).
Saturday 2nd May	A.M.: Bartlett Tree Research Laboratories and Arboretum. P.M.: Drop off hire car at airport. Fly from Charlotte to Philadelphia.	Guided tour of the Bartlett Tree Research Laboratories and Arboretum at Charlotte, NC with Adam Black, Director of Horticulture, Botanical Research and Conservation.

Exploring the Woodland Plant Communities of North Carolina

The main purpose of the trip for me, having been working as a horticultural intern at Longwood Gardens in Pennsylvania for the previous 8 months, was to be able to explore a different ecoregion in the USA, and to observe, with the help of local botanist John Nix, a wide range of woodland plants (trees, shrubs, herbaceous plants, and spring ephemerals) native to the North Carolina Appalachian mountain in a range of natural habitats, and to gain a deeper understanding of the conditions under which they thrive. I hoped that the trip would benefit me and the wider horticultural community by allowing me to see first-hand how certain species grow in their native habitat, which in turn will inform me on how to best cultivate similar plants in garden settings.

After having been in America for the past 8 months, I had seen the championing by the horticulturists and growers here of native plants. I have come to understand the importance and value of American native plants in garden settings in the Northeastern U.S. for their ability to withstand harsh environmental conditions (extreme cold or drought), their ecosystem restoration qualities, and provision of essential habitat to native species. Also, I believed that observing the beauty of the plant communities in the woodlands of North Carolina would provide me with an aesthetic source of inspiration for planting design and combinations

I hoped that my visits to the Mountain Crop Improvement Lab and Bartlett Tree Research Laboratories, hearing about the research and breeding work that goes on would give me insight into the challenges faced when it comes to woody plant breeding and cultivation from factors such as climate change, pests and diseases, invasive species, and learn how a research and trial led approach is helping to mitigate these challenges and create better options for the future.

North Carolina Climate

Where we were for this week, specifically in the west mountainous region of North Carolina, the climate and temperatures can vary by elevation. The lower to moderate elevations experience a humid and temperate climate with warm summers and mild winters, whereas higher elevations can experience cooler summers and much colder winters with snowfall. The area is generally high in moisture and humidity, and even at the time of visiting during a drought, many of the slopes and mountain coves remained moist from the air and low cloud.



Day 1- Pisgah National Forest and the Blue Ridge Parkway

Pisgah National forest spans over 500,000 acres and is considered to be the birthplace of modern forestry in America. The Blue Ridge Parkway, which cuts directly through parts of Pisgah, is a 469-mile-long scenic road that connects Shenandoah National Park in Virginia to the Great Smoky Mountains National Park in North Carolina, running mostly along the crest of the Blue Ridge Mountain range of the Appalachian Mountains.

Ferrin Knob Tunnel No.2

Our first stop, as we began our ascent in John's car up the Blue Ridge Parkway from Asheville, was to a mountain cove just before Ferrin Knob No.2, which is one of 25 tunnels along the North Carolina section of the Parkway. Located on the northeastern, lower side of the mountain, it is a moist cove with a steep gradient and shallow soil, often formed from organic matter on top of rocks, where water drains freely down the mountain. Felled trees, some of which may have been caused by the devastating hurricane of September 2024, cause changes in ground cover as it becomes colonized by a range of spring ephemerals, herbaceous woodland perennials, and a variety of ferns including *Adiantum pedatum* the native hardy maiden hair fern (pictured here in fig.2), *Onoclea sensibilis*, and *Woodwaria areolata*.



Fig. 1 Ferrin Knob Tunnel No.2



Fig. 2 Late spring herbaceous layer

Here, John helped us to track down a colony of the Large Yellow Lady's Slipper Orchids (Fig.3), as well as a colony of the smaller variety (Fig.4 and 5). These *Cypripedium* can tolerate shallow soil and enjoy the moist environment of this mountain cove. They are exceptionally long-lived perennials and can live for up to 60 years. They are pollinated by Sweat Bees, and their seeds are wind dispersed.



Fig. 3 *Cypripedium parviflorum* var. *pubescens*



Fig. 4 *Cypripedium parviflorum* var. *parviflorum*



Fig. 5 *Cypripedium parviflorum* var. *Parviflorum* close up

Other plants we observed in this community that John pointed out to us in this cove were *Prosartes maculata* (Fig.6), a herbaceous woodland perennial in the lily family and a mountain stonecrop *Seedum tournatum*. There were still some spring ephemerals out, with us being able to observe fading *Trillium grandiflorum*, that turn pink as they finish flowering, and *Podophyllum peltatum* still in bloom.



Fig. 6 *Prosartes maculata*



Fig. 7 *Seedum tournatum*



Fig.7 *Podophyllum peltatum*

Fork Mountain Tunnel

Our next stop along the Parkway was near the Fork Mountain Tunnel. Slightly higher in elevation, another area where the low-lying clouds are trapped in the valley creating a moist cove. Here we observed the *Aristolochia macrophylla* (Fig.8) vine twining through the tree canopy. John informed us that this plant has a symbiotic relationship with the Pipevine Swallowtail Butterfly as its primary native host plant. We saw *Diphyllaea cymosa* (pictured on the left corner of Fig.9) which is a close relative of *Podophyllum* (Fig. 7). Both have large umbrella-like leaves, but where *Podophyllum* produces a singular nodding white flower which is often hidden by the leaves, *Diphyllaea* has clusters of white flowers held up on long stalks. *Diphyllaea* needs moist soil conditions, and John tells us that these plants are often an indicator of ground water.



Fig. 8 *Aristolochia macrophylla*



Fig. 9 *Diphyllaea cymosa*



Fig. 10 *Trillium erectum*

We then got back in the car, and after another 1,200ft climb up the Parkway, we broke through the cloud layer and came across an astounding glade of *Trillium grandiflorum* (Fig.11) thriving in this sheltered, moist yet well drained location in dappled shade. We explored the surrounding areas to see what else we could find in this sunnier and drier location. We came across *Conopholis americana*

(Fig.12), a herbaceous parasitic plant which resembles pinecones. It parasitizes the roots of *Quercus* spp., and it is apparently foraged by bears and deers hence the common name Bear Corn.

As we wandered through a denser woodland area, we observed *Convallaria majuscula* (Fig.13) which is a variety of Lily-of-The-Valley though to be native to the southern Appalachians. The European Lily-of-the-Valley is considered to be invasive in many parts of the U.S. The native *C.majuscula* can tolerate dry shade, and the flowers are smaller and do not come above the foliage. We also observed Ramps (*Allium triocum*) which are edible with a garlicky taste similar to wild garlic in the UK. Though, they are best not to be confused with the similarly looking Lily-of-the-Valley leaves which are toxic.



Fig.11 *Trillium grandiflorum*



Fig. 12 *Conopholis americana*

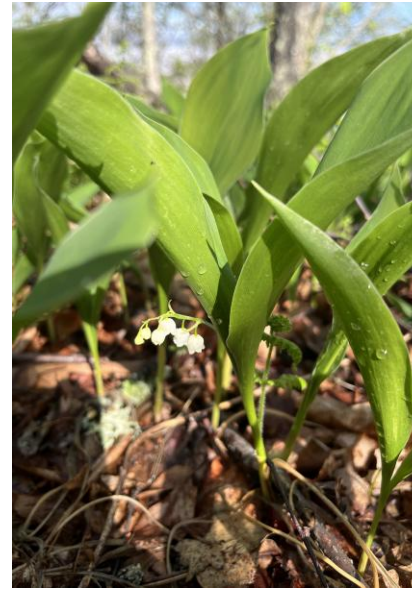


Fig.13 *Convallaria majuscula*

We saw the beautiful golden papery bark of *Betula alleghaniensis* (Fig.14) which was just starting to leaf out, and in the shrub layer, we observed the evergreen *Rhododendron minus* (Fig. 15) in flower. We observed the strappy leaves of *Amianthium muscitoxicum* (Fig.16), which is also known as Fly Poison, so called because the plant is poisonous and can be used as a fly killer. All parts of the plant, but especially the bulb, are poisonous to humans and animals.

Fig. 14 *Betula alleghaniensis*Fig. 15 *Rhododendron minus*Fig.16 *Amianthium muscitoxicum*

Black Balsam Knob

We continued to climb, in John's Car, up the Blue Ridge Parkway to our next destination, which was the Black Balsam Knob trail. We stopped off on the roadside on our way to the trail head, at an elevation of over 5,000 feet. Here, we were elevated well above the low-lying clouds, and the views across the Pisgah National Forest opened up (Fig 17). At this elevation, trees are shorter and lower branched, a growth response to tolerate the exposed and windy conditions at higher elevations. *Acer pennsylvanicum* is one of the first of the deciduous wooded understory to leaf out here. The understory is also comprised of *Magnolia fraseri*, *Amelanchier laevis*, and *Sorbus*. In the shrub layer there's *Rhododendron vaseyi*, *R. catawbiense*, *Viburnum lantanoides* and *Pieris floribunda*. As displayed in Fig.18, the soil profile is very shallow, and there is a lot of water run-off, therefore many of these plants have adapted to have shallow, spreading roots. The conifers seen dotted throughout Fig.17 are the Red Spruce, *Picea rubens*. John informs us that at another 1,000 feet in elevation from this point, we would be in a spruce and fir forest.

A little further up in elevation and just before we reached the Black Balsam Trail Head, we stopped to see a wonderful colony of Trout Lily, *Erythronium americanum* (Fig. 19).



Fig.17



Fig.18

Fig 19. *Erythronium americanum*

We reached the trail head and set off along the Black Balsam trail. We passed through a wooded area of Red Spruce (Fig.20), which opened out onto an exposed landscape of rock balds, grassland, and meadow, with incredible views into the distance (Fig.21). The small shrubs are mostly blueberry, which John tells us makes this trail incredibly popular in the fruiting season. This is where, later in the season also, the endemic Balsam Mountain Gentian, *Gentiana latidens*, tends to be found flowering. At the time of our visit, forming starry blue matts, in rock crevices, and lining the trail was the lovely little *Houstonia caerulea*(Fig. 22), which I had just seen recently used beautifully in many of the public gardens around Philadelphia.



Fig.20



Fig.21

Fig. 22 *Houstonia caerulea*

Wolf Mountain Overlook

Our next stop off point was Wolf Mountain Overlook at an elevation of 5,500 ft, to a rare and amazing vertical bog (Fig. 23). Here the water trickles down the rock face creating a moist and bog like environment where in the crevices, mosses form along with tiny saxifrage *Micranthes petiolaris*, *Parnassia asarifolia*, and more *Houstonia* (Fig.24). There were also small Appalachian St. John's Wort *Hypericum buckleyi* not yet in flower (Fig.25), and the tiny carnivorous round-leaved sundew, *Drosera rotundifolia* (Fig.26).

It was here that we could also see, dotted throughout the shrub layer, the iconic plant that lines the edges of Blue Ridge Parkway, the pink shell azalea which is the deciduous *Rhododendron vaseyi* (Fig.27 and Fig.28). The colour of the flower can vary from very light pink nearly white to a deep almost magenta pink (Fig.28). *Acer spicatum* is prevalent at this higher elevation. We noted that there was no opportunity for a herbaceous layer underneath the Rhododendrons.



Fig. 23 Vertical Bog



Fig.24



Fig.25 *Hypericum buckleyi*

Fig.26 *Drosera rotundifolia*

Fig.27

Fig.28 *Rhododendron vaseyi*

Cove Creek

We descended from Wolf Mountain Overlook to the Cove Creek location near the Davidson River. On the way down we saw *Magnolia acuminata* with its beautiful yellow flowers and more *Magnolia fraseri* in and amongst the tree canopies. In the Cove Creek area, I saw my first flash of the bright orange of the flame azalea, *Rhododendron calendulaceum* (Fig.29), and at ground level *Iris cristata* (Fig.30). It was in this location, that we were treated to being able to see a large colony of the Pink Lady Slipper Orchid *Cypripedium acaule* (Fig.31) which thrives in the partial shade and the acidic, very well drained soil of this location.

Fig.29 *Rhododendron calendulaceum*Fig.30 *Iris cristata*Fig. 31 *Cypripedium acaule*

We explored further along the Davidson River and observed the arching stems of *Leucothoe fontanesiana* (Fig.32) dripping with delicate bell-shaped white flowers near the riverbank. On the ground, we saw *Galax urceolata* and my first sighting of the wonderful and weird *Asarum shuttleworthii* flower.



Fig.32 *Leucothoe fontanesiana*



Fig.33 *Galax urceolata*



Fig. 34 *Asarum shuttleworthii*

Pink Beds

Our final location after a long day of botanizing was to the Pink Beds, so named because of the number of pink flowering plants in this area. We were seeking out a mountain bog where we were hoping to see *Helonias*. En route to the bog, we saw some beautiful painted Trillium along the trail edge, as well as the strikingly marked basal leaf rosettes of *Goodyera pubescens*, which are in the Orchid family. The trail took us through dense *Rhododendron* and *Kalmia* thickets. Pines form part of the upper canopy here.

Fig.35 *Trillium undulatum*Fig.36 *Goodyera pubescens*Fig. 37 *Rhododendron* thickets

We found the mountain bog area and a colony of *Helonias bullata* (Fig.38) which is a wetland plant requiring moist soil conditions. It has a basal rosette of leaves and long stalks with bright pink flower clusters. Many of the *Helonias* had already finished flowering, we think due to the drought and warmer temperature which the region had been experiencing that spring.

To finish the day, John had a tip off that there was a colony of the large whorled pogonia orchids off a trail nearby the Pink Beds. After giving up looking, we spotted them by the side of the trail on the way back to John's car (Fig.39)! They like disturbance, so it made sense for them to grow on the trail edge.

Fig. 38 *Helonias bullata*Fig 39. *Isotria verticillata*

Day 2 – Mountain Crop Improvement Lab and Looking Glass Rock

On day two, in the morning, we visited John at the Mountain Crop Improvement Lab, where he works as a research specialist, for a tour of the facility, and in the afternoon, we took a self-guided trail up to Looking Glass Rock in Pisgah National Forest.

Mountain Crop Improvement Lab, NC State University

The Mountain Crop Improvement (MCI) Lab is an extension of North Carolina State University and is located at the University's Mountain Horticultural Crops Research and Extension Center. It is situated amongst the mountains just outside of Asheville in Mills River, NC. The whole site covers around 350-370 acres and is organized into growing fields, greenhouses, polytunnels, offices, and laboratories. . The MCI Lab has released over 85 patented varieties of nursery crops and other public releases like x *Gordlinia grandiflora* 'Sweet Tea'

The MCI Lab works on research for a number of different crops to seek opportunities for improvements in, for example, pest and disease resistance, drought and climate tolerance, and invasive species management. They work to provide specialty crops and solutions for local growers as well as conducting research, creating patents, and providing workshops and training.

They are currently a team of five research specialists led by one principal investigator, and each specialist manages breeding programs organized by genera. Some of their current research and breeding programs focus on woody plants, grasses, perennials, and specialty crops like teas and pawpaws.

Breeding Work

The lab works on thousands of crosses each year, and around two thirds of these are hand crosses. To help with this, the lab employs techniques such as fridges for seed stratification and freezing

pollen, light coolers for evergreens - to slow down growth and synchronize flowering between species to allow for cross pollination, and fly cages for fly pollination.

When looking at ornamental plants, breeding is done for a number of different reasons. At the MCI Lab they are looking at trying to enhance and improve certain characteristics or traits in a plant such as:

- Flowering - time and size
- Foliage quality
- New growth
- Rootability
- Pest and Disease resistance
- Cold hardiness
- Seasonal interest
- Colour and growth habit
- Drought and heat tolerance

Through breeding work, plants can also be made sterile, which can help with invasive species. Along with hand crosses, the lab also uses tissue culture and does some transgenic work, mainly to target disease. For example, they are currently working on developing plants which have a resistance to rose rosette virus which is prevalent in the US.

Looking Glass Rock

In the afternoon, we went on a hike up to Looking Glass Rock. Looking Glass Rock is a huge granite monolith which was formed millions of years ago by volcanic activity but has been shaped by weathering and erosion over time. It is an iconic landmark in the area and offers vast panoramic views of Pisgah National Forest from the summit.

As we begin the trail, we start walking through a mixed hardwood forest with *Fagus grandifolia* in the understory. In the shrub layer, we see the cute little green flowers of *Euonymus americanus* (Fig.42) which have impressive bright pink fruits which open to reveal bright orange seeds later in the season. We also spot the deep Merlot flower of *Calycanthus floridus* (Fig. 44) in bloom. At ground level, in the herbaceous layer, there is the striped, hooded spathes of *Arisaema triphyllum* (Fig.43).



Fig. 42 *Euonymus americanus*



Fig. 43 *Arisaema triphyllum*



Fig.44 *Calycanthus floridus*

As we ascend up the trail on the 'switchbacks' (zig-zagged paths), it takes us through *Rhododendron* and *Kalmia latifolia* thickets (Fig.45) which have formed into tunnels around the trail. It was beautiful to see the *Kalmia* flowering so abundantly (Fig.46). At the peak of Looking Glass Rock, we were treated to panoramic views of the dense tree covered mountains (Fig.47).

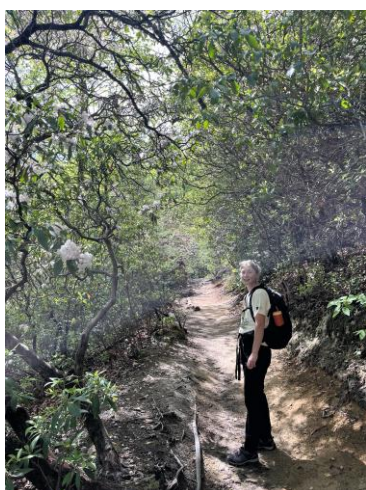


Fig. 45



Fig. 46 *Kalmia latifolia*



Fig.47 The view from Looking Glass Rock

Day 3 Joyce Kilmer Memorial Forest

On day 3 we took a trip, two hours drive west from Asheville to Joyce Kilmer Memorial Forest. This area of forest within the Nantahala National Forest, is one of the last great virgin hardwood forests in Eastern America which was 'spared from the saw' (USDA Forest Service) when back in the 1930s, amidst depression and bankruptcy, and after changing land ownership from timber harvesting companies several times, it was finally proposed that the huge trees were preserved by offering to sell the land. This was then bought by the Federal Government. In 1934, the Veterans of Foreign Wars petitioned the Federal Government to set aside a stand of trees as a living memorial to Joyce Kilmer who was a fallen war hero and poet. The Forest Service chose this forest as the best candidate and in 1936, 18 years after his death in service during the First World War in France, the 3,840-acre forest was dedicated to him. He is most remembered for his famous poem 'Trees'.



Fig.48 *Liriodendron tulipifera*



Fig. 49



Fig. 50 *Liriodendron* flower

Where much of the forests of North Carolina were once logged, this area has remained one of the largest remnants of virgin forest in the Eastern US and has some of the largest tulip poplars in the country, with some trees over 400 years in age and reaching 100 feet high or taller and over 20ft in circumference. These were the biggest *Liriodendrons* (Fig.48 & 49) I had ever come across comparatively

to what I already thought were exceedingly large trees in the forests around Longwood Gardens in Pennsylvania, and immeasurably larger than the trees which are grown as specimen trees in the UK.

We took the Joyce Kilmer memorial trail through the forest and were amazed by the pristine wilderness and the peace and tranquility of the place. It was great to see such practically untouched and complete plant communities with such a mature herbaceous layer. The lush-ness, density and incredible floor to ceiling green of this forest was quite astounding (Fig.51).

When trees fall, they are left in place with minimum intervention using crosscut saws to clear sections from the trail (Fig.52). The decaying trees on the forest floor get taken over by mosses and fungi and often become nurse logs by providing nutrients and a good growing environment for saplings (Fig.53). This is why trees can often be found growing in a straight line in nature.



Fig. 51



Fig.52



Fig.53 Nurse log

In the herbaceous layer, we spotted a couple of different *Trilliums*; *T.cuneatum* with its mottled leaves (Fig.54), and *T.vaseyi* (Fig.55) which is similar to *T.erectum* but with larger, often overlapping, burgundy petals. The forest floor was carpeted with the heart-shaped foliage and tiny white flowers of *Viola canadensis*, mixed with the white, fluffy, erect stems of *Tiarella cordifolia* (Fig.56), along with the foliage of many other herbaceous perennials such as *Iris cristata*, *Actaea*, *Maianthemum racemosum*,

Prosartes maculata, Mayapples, *Goodyera repens*, and delicate ferns such as *Adiantum pedatum* (Fig.57).



Fig. 54 *Trillium cuneatum*



Fig. 55 *Trillium vaseyi*



Fig.56 *Tiarella cordifolia*



Fig.57

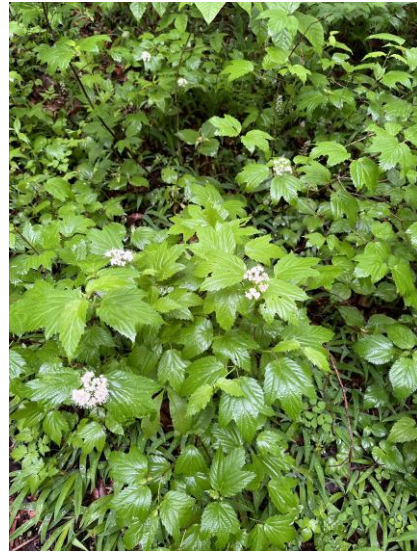


Fig.58 *Viburnum acerifolium*

In the shrub layer, we saw *Virburnum acerifolium* (Fig. 58) in flower and the foliage of *Rhododdendron maximum*.

Day 4 Grandfather Mountain and Linn Cove

On day four, we were reunited with John as he took us on a bespoke tour of Grandfather Mountain, which is near Linville, North Carolina. The mountain, which is 5,946 feet tall, is part of the Southern Appalachians Biosphere Reserve. It is estimated to be around 300 million years old, with some rock formations dating back to 1.1 billion years. Some believe that it is the age of the mountain that gives it its name 'Grandfather', whereas others believe it was called that by settlers because of the various rock profiles that resemble an old man's face. Now, Grandfather Mountain is a nature park and conservation site, offering visitors access to a wilderness reserve, hiking trails, an animal sanctuary, and numerous viewpoints where they can see amazing views of the Blue Ridge Parkway and Appalachian Mountains

As we ascended the mountain by car to the Top Shop and Black Rock parking lot just below the summit for the Grandfather Trail, we wound up the mountain, passing through **northern hardwood forests, acidic cove forests**, and large populations of the pink shell Azaleas *Rhododendron vaseyi* lining the roadside. When we reached the parking lot, at this elevation, we were in **Red Spruce-Fraser Fir Forest**. We had access to the Mile High Swinging Bridge, which is a 228-foot suspension bridge that is suspended at more than 1 mile above sea level and bridges an 80ft chasm between cliffs (Fig.60).

We bravely crossed the Mile High Swinging and singing (the wind makes it sound like a harmonica) Bridge to see spectacular views from Linville Peak (Fig.59). As there is a weather station on the Swinging Bridge, it is known that the temperature is usually 10- 20 degrees (Fahrenheit) cooler than at ground level and that it is also one of the windiest locations in North Carolina. These winds have caused the red spruce here to become 'flagged', which is where the windward side of a tree has been stripped of its branches (Fig.61). An image of a flagged red spruce tree is the logo for Grandfather Mountain.

In this community, John points out to us *Kalmia buxifolia* (Fig.63), a small, low growing evergreen shrub with delicate white flowers and pink buds, which has formed these wonderful cushiony mounds covering the rock (Fig.62).



Fig.59

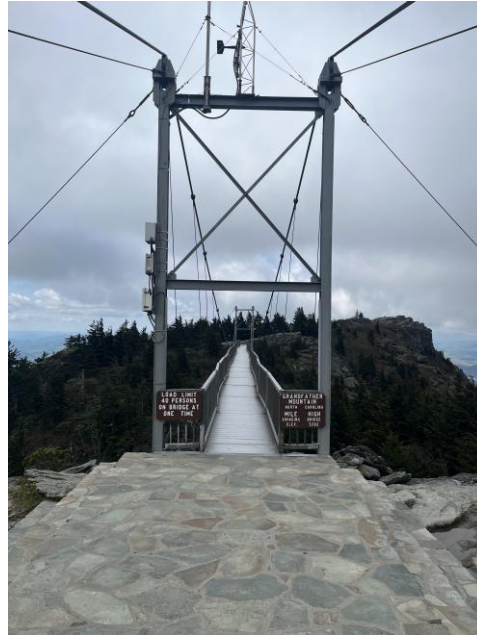


Fig.60 Mile High Swinging Bridge

Fig.61 *Picea rubens* flagging

Fig.62

Fig.63 *Kalmia buxifolia*

After venturing back over the Mile High Swinging Bridge, we took the Grandfather trail over to MacRae Peak, which involved the, at times a little hairy, use of ladders and cables to get through the steep climb sections of the trail (Fig.64 and Fig.65). Here we were again in the Red Spruce/Fraser Fir Forest (*Picea rubens*, *Abies fraseri*) which can be found in high mountains of this region. It was cool to see the shallow root systems of the Red Spruce twisting over and around the boulders, anchoring them to the mountain and protecting them against high winds. The views from MacRae peak at 5,844 ft were breathtaking (Fig.67).



Fig.64



Fig.65



Fig.66



Fig.67

Whilst on this trail, we saw *Virburnum lantanoides* (Fig.68) in flower. Its common name is the hobble bush, due to its lower branches taking root and allegedly tripping people up. We also saw the upright shoots of *Carex fraseriana* poking through (Fig.69), which we had hoped to see as it is endangered in its native range, and is an usual sedge with white bottlebrush-like flowers.

We saw the small emerging plants of *Solidago spithamea*, which is another endangered and endemic species to the North Carolinas. It grows in rock crevices at high elevation and is apparently a 'relict' species meaning that it was once more widespread when conditions were, in this case, colder, but now due to warming it only persists at higher elevation. John tells us that *Solidago* species are resistant to deer due to a scent they give off that repels them.



Fig.68 *Virburnum lantanoides*



Fig. 69 *Carex fraseriana*



Fig.70 *Solidago spithamea*

Linn Cove

We eventually made it off the grandfather trail and descended back down the mountain in John's car. In the afternoon, we explored a few more of the acidic forest coves and overlooks just past the iconic Linn Cove Viaduct section of the Blue Ridge Parkway, in an area that provided us views back to Grandfather Mountain.

Here in these coves, we observed the beautifully speckled white flowers of *Clintonia umbellulata* (Fig.71) flowering, along with nearby, the broadly, strappy leaves of *Veratrum viride* (Fig.72). We also saw the very sweet, fringed Phacelia dotted through the herbaceous layer, as well as *Uvularia grandiflora* (Fig.74), *Caulophyllum thalictroides* (Fig.75), and *Zizia aurea* (Fig. 76).



Fig. 71 *Clintonia umbellulata*



Fig.72 *Veratrum viride*



Fig.73 *Phacelia fimbriata*



Fig.74 *Uvularia grandiflora*



Fig.75 *Caulophyllum thalictroides*



Fig.76 *Zizia aurea*

In terms of woody plants and shrubs in this community, we saw *Magnolia fraseri* again (Fig.77) and *Aesculus flava* in flower (Fig.78).



Fig. 77 *Magnolia fraseri*



Fig.78 *Aesculus flava*

Day 5 Shortoff Mountain

On our final day in the mountains, John took us on a trail walk up Shortoff mountain, which is located on the southern rim of Linville Gorge, a large mountain gorge wilderness area. Due to previous wildfires on the mountain, a lot of it is very exposed and xeric. We were interested in exploring this environment to understand what plants have shown resilience and have undergone adaptation to grow here.

Starting in the foothills of the mountain, the community is like that of a coastal foothill plain. The season here is much shorter; plants bloom earlier and go to seed faster. The *Trilliums* travel north for more favorable conditions. We saw a lot of *Robinia hispida* (Fig.79) in flower, which seems to be very drought tolerant, though preferring partial shade. At ground level, we saw the very delicate *Chimaphila maculata*, not yet quite in flower (Fig.80). We also saw the orchid *Cleistesiosis bifaria* emerging. This orchid is often seen coming up around burn or construction sites as it likes disturbed ground.



Fig.79



Fig.80 *Robinia hispida*



Fig.81 *Chimaphila maculata*

As we continued up from the foothills, the trail became very open and exposed with little shade. We saw *Kalmia buxifolia* again, though in these conditions its habit is bushier and more sprawling (Fig.81 & 82) than the compact, cushion forming plants we saw on top of Grandfather mountain the previous day.



Fig.81 *Kalmia buxifolia*



Fig.82

We noticed that many of the trees and shrubs we saw had more red in the new growth and foliage (Fig 83 to Fig. 85). This is an impact of increased sun exposure; the plant produces red pigments (anthocyanins) in the new growth. It is a protective adaptation a bit like sunscreen for the plant.



Fig.83 *Magnolia fraseri*



Fig. 84 *Quercus rubra*



Fig. 85 *Hamamelis virginiana*

We saw, along with *Quercus rubra* (Fig.84), *Q. montana*, and *Q. marilandica* (Fig.86) which was thriving in this environment and is very well adapted to poor soil and harsh, dry conditions. The plants at these lower elevations have a higher heat tolerance.



Fig. 86 *Quercus marilandica*



Fig. 87 View of Lake James

As we continued up the trail, and as the elevation increased, it got slightly cooler, and we started to see pops of purplish pink in the shrub layer of *Rhododendron catawbiense*. We also spotted an *Exobasidium* gall on one of the *Rhododendrons*; these galls only affect ericaceous plants (Fig.89).



Fig.88 *Rhododendron catawbiense*



Fig.89 *Exobasidium* gall

On the way to the summit, we saw a drought-tolerant blueberry, *Vaccinium stamineum* flowering with small, white bell-shaped flowers (Fig.90). We also saw *Fothergilla major* (Fig.91) in flower.



Fig.90 *Vaccinium stamineum*



Fig.91 *Fothergilla major*

We stopped at several different rock outcroppings just below the summit. These had amazing views out to Linville gorge (Fig.92), but also a unique looking landscape and community of plants (Fig.93). The trees up here are shorter, like pictured in Fig.93, *Pinus ponderosa* and the Table Mountain Pine (*Pinus pungens*). The cones from *Pinus pungens* require heat possibly from fire for the cones to release seed.



Fig.92 Linville Gorge



Fig.93

It was on one of these rocky outcrops that we spotted the critically endangered, tiny *Hudsonia montana* (Fig.94) which is a member of the rock-rose family.



Fig.94 *Hudsonia montana*



Fig.95



Fig.96 *Populus grandidentata*

The summit of Shortoff is a flat plateau which takes you through a section of forest which survived the fires. It was quite disorientating to be in a flat, forested area of land at that elevation (Fig.95). Here we saw for the first time amongst the canopy *Populus grandidentata*, a fast growing, short-lived, pioneer species. We observed the downy, silvery-white fuzz on the new growth (Fig.96). We also saw the site of a natural pond on top of the summit of Shortoff, a rare site for these mountains, however it was completely dry due to the current spring drought conditions (Fig.97).



Fig.97

In this community, we saw the endemic *Tsuga caroliniana* (Fig.98) which is highly threatened by the Hemlock Woolly Adelgid, a non-native, sap sucking pest from Asia. We also saw the impressively large, compound leaves of *Aralia spinosa*, pictured here as a young sapling (Fig.99), and a lovely ground cover of *Gaultheria procumbens* (Fig.100) which releases a menthol smell when the leaves are crushed.



Fig.98 *Tsuga caroliniana*



Fig.99 *Aralia spinosa*



Fig. 100 *Gaultheria procumbens*

Finally, we saw the whorled leaves and stems of *Lilium michauxii* (Fig.101) which is the state wildflower of North Carolina, whereas Dogwood is the official state flower. We also saw *Thermopsis mollis* flowering (Fig.102), which is in the pea family and resembles a Lupin.



Fig. 101 *Lilium michauxii*



Fig. 102 *Thermopsis mollis*

Day 6 Bartlett Tree Research Laboratories and Arboretum

On our last day, after travelling to Charlotte, North Carolina the previous evening, we met with Adam Black, Director of Horticulture, Botanical Research and Conservation at Bartlett Tree Research Laboratories and Arboretum for a tour of the facility and arboretum.

Founded in 1907 by Francis A. Bartlett, it is now fourth generation owned. The original mission was to provide tree expertise and 'preventative care that would assure good health, longevity, beauty, and safety for his clients' trees' (Bartlett,2026). They are now the world's leading scientific tree and shrub care company with 125 offices globally, research and diagnostic laboratories, experimental field sites, and research collaborations with universities throughout the US.

Charlotte Arboretum Site

- **Formerly agriculture-** it was former cotton and tobacco fields at time of purchasing
- Traditionally mowed areas reduced **prairie flora** where it would have been predominantly prairie. It is believed that nearly 100% of original prairie has been lost in the US.
- Early successional trees came when agriculture was abandoned but there are still some natural tree areas by the streams
- Charlotte was decided on as it can push the limits on southern and northern species and can indicate strong, tolerant cultivars
- **Staffing** consists of teams of arborist/ grounds staff, research staff, horticulturists, pathologists, entomologists, plant collection and records staff. They also have interns throughout the year that mainly focus on plant pathology.
- The site is **not open to the public**, but they still have people coming in, for example, it is a resource for local plant societies who they accommodate regularly.

- It currently spans over **360 acres** but is still growing
- The arboretum is **organized taxonomically** but they are now moving towards the collections being more geographically organized and looking at creating specialty habitats to accommodate for a lot of wild collected material e.g. vertical seepages, bogs, dunes, rockeries, and varying topography.
- The **Arboretum understory** is being worked on to introduce more perennials, ferns, grasses, and sedges.
- **Irrigation and Ponds** - the ponds and irrigation are fed by a natural spring. The land is well contoured, so any water runoff is fed back to the ponds. They also do not need to draw from the mains water and irrigation is only provided, when necessary, plants are grown not to expect it.



Fig. 103 *Magnolia seeboldii*



Fig.104

Collections

To name a few of the collections they have:

- **Magnolia**

They have the second largest collection of magnolias in the world, including species such as *M.seeboldii* (Fig.103) which is not often cultivated.

- **Rhododendron Hill**

The collection is on a north facing hill, though they do trial some things on the south side. Certain species can't normally be grown in the area. There is Phytophthora in the area, so some plants are lost to this. The canopy trees consist of *Quercus alba*, *Q.rubra*, *Liriodendron*, *Acer rubrum*, *Oxydendron arboreum*, and *Pinus virginiana*.

- **Texas/Mexico**

Adam was in Texas prior to moving to Charlotte and still has connections to and projects going on there. It is a wild collected, species only, collection of plants with a high conservation priority (Fig.104).

- **Conifers**

One of the larger collections. They have good species diversity, with the climate meaning they can support both subtropical and tropical species (with greenhouse protection). They have north facing slopes for conifers which helps to keep the roots cool.

- **Australian**

- **Southeastern natives**

They keep naturalistic planting and thin out aggressive woody plants using controlled burns.

- **Nut Tree Collection** They are using burn management through this collection to allow natural prairie to come back

- **Oak collection** - looking at for example West Texas species for climate resilience.
- **Elm**
- **Celtis**
- **Piedmont prairie** -they have plugged in Piedmont prairie plants to try and restore prairie
- **Maples**
- **Ilex**
- **Crataegus**



Fig. 105 Lower pond. Wetland and marginal species and prairie re-introduction.

Research

To name a few of their current/past research projects:

- **Emerald Ash borer**

A prevalent pest which has devastated northeastern Ash forests. They are looking at the remaining Ash trees to see if they have any resistance and try to preserve those genetics.

- **Urban tree Plaza**

They imitated a street tree environment (Fig.106) with different types of soil, volumes, and structures to see what worked best. The research for this is published.

- **Leyland Cypress**

They are studying how pathogens can be introduced by the pruning wound.

- **Willow Oaks**

A growth regulator study looking at how growth is affected by field vs. pot grown plants and different treatments to roots.

- **Crape Myrtle Scale**

Researchers are developing a potential bio control.



Fig. 106

Conclusion

Coming away from this trip, I feel incredibly lucky after four and a half full on days of botanizing in some of the most beautiful and pristine plant communities I have ever seen, along with visits to two of the leading experts in plant breeding and tree and shrub research and care. Of my 8 months in total spent in the US, the wildlands and vastness of the natural landscapes is something I will never forget.

I feel this trip has benefited me greatly, in that I have a much-improved plant knowledge of the plants of this region. I have gained a real understanding of the specific conditions required for the plants in these communities to grow, for example; the acidic coves, moist but well-drained, shallow soil, grassy balds, rocky outcrops, and bogs. I have an increased knowledge of the different natural plant communities within the area including northern hardwood forests, rich cove forests, oak/hickory forests, rock outcrops, and spruce-fir forests in the highest elevations. This increased knowledge can be translated into my day-to-day horticultural practices in the UK and will inform and inspire plant selection and care.

Although this year spring was accelerated in the region, mostly due to the drought they were experiencing, it was good to see how plants can be resilient and adapt, in for example, the migration and plant adaptation on Shortoff mountain. This has been an increasingly pressing and relevant topic since coming back to the southeast UK and going through an over 50-day drought with record high temperatures. I think, increasingly, drought and heat-resistant options are going to become more necessary, which is where looking at a landscape and community of plants such as on Shortoff mountain can be very useful, along with the important breeding, trialing, and research work which is happening at the MCI lab and Bartlett Tree Experts.

Appendix 1. Budget Breakdown

Element of Project	Actual Cost
Air Fare	£628.06
Accommodation	£269
Transport (Hire Car Costs, Fuel and taxis)	£145.30
Food	£216.97
Grandfather Mountain Admission Fee	£33.14
Guide Donation	£100
Total	£1,392.47

Grant awarding body	Amount	Percentage of Total
Hardy Plant Society	£1000	57%
Merlin Trust	£750	43%
Total Amount Awarded	£1750	100%

Personal Contribution	£200
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Total amount awarded £1,750 + personal contribution £200 – actual cost £1,392.47 = £557.53
to give back.

57% of £557.53 = £317.79 to HPS

43% of £557.53 = £239.74 back to MT

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