Cambridge University
Botanic Garden

Annual Report & Accounts 2023–2024

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Director's Report

Professor Beverley Glover
Director

The 2023-2024 academic year was an exciting one for the Botanic Garden. We have made significant advances towards two of our key goals this year. First, to ensure we continue to support a globally excellent network of research and teaching around plants, we undertook three collecting expeditions, one of which was associated with a first partnering activity with the Stellenbosch University Botanical Garden in South Africa. And second, to stimulate new visitor engagement with our Collection and to encourage new audiences to visit the site, we put on our first ever Winter Lights event.

The academic year has been a busy one, with exciting activity on many fronts. We were delighted to receive a significant uplift in our Research England Higher Education Museums and Galleries (HEMG) funding, which will enable us to expand our collection management and learning activities. Our Community Programme has been an enormous success this year, with 70 community groups now regularly visiting the Garden for tailored activities to suit their particular needs. Our ability to fund coach travel for state schools visiting the Garden, thanks to a grant from the Gatsby Charitable Foundation, has enhanced the range of schools visiting us and the feedback has been wonderful. Horticulturally it has been a wet year, which has meant time usually spent on irrigation has been devoted to other activities – particularly this year repairing badger damage to the Bog Garden, significant remedial tree work and extensive bed redevelopment in the Systematic Beds.

With travel now much easier than it has been for some years, we were able to send three collecting expeditions out, in support of our Living Collections Strategy. Teams composed of members of the horticultural staff and the collections management staff visited Kyrgyzstan, Croatia and South Africa. All three countries represent regions of the world with substantial amounts of biodiversity and with climates which are a reasonable match for predicted weather in the east of England. We have visited Kyrgyzstan several times previously, and have benefitted enormously from our links with the Bishkek Botanic Garden, who have supported our team in collecting a range of material. In turn, we have worked with the local team on describing, identifying and assessing risk to the many native tulip species. Working in partnership like this is a key element of botanical collecting expeditions, so we were delighted this year to begin to invest in our relationship with the Stellenbosch University Botanical Garden, in South Africa. Our Glasshouse Team Leader, Luigi Leoni, and our Collections Manager, Margeaux Apple, visited Stellenbosch for a month in early 2024. Luigi spent his time training members of the horticulture staff in Stellenbosch on the best ways to care for their glasshouse specimens, and he helped them to conduct a full cut back of their glasshouse material, giving everything a new lease of life. Margeaux in turn worked with the team in Stellenbosch to enhance their collections management and seed banking procedures, training staff in databasing, auditing and records management. In exchange, the Stellenbosch team shared some of their plant material with Luigi and Margeaux for our collection, and also took them on expeditions to help conserve locally endangered plant species. We hope that this work will be the first of a regular series of exchanges, and we look forward to growing the number of botanic gardens with which we partner in this way.

'With travel now much easier than it has been for some years, we were able to send three collecting expeditions out, in support of our Living Collections Strategy.'

November 2023 saw the launch of our first ever Winter Lights event. These events have become popular at many sites in recent years, and we decided that the time had come for us to experiment too. Our aim with this project was to reach new audiences who would not normally visit the Garden, inspiring them to visit again in daylight. We also hoped that, if successful, we could grow the event in future years and use it as an income generation mechanism to support our core work. The feature article in this year's Annual Report will show you how the displays looked and describe the work in detail. I will just say here that it was a very large amount of work, but a great success, with visitors really amazed by the beauty of our living collection displayed in this new way. We will be running a similar event this year, and have added an extra night and some additional capacity to each night, in the hope of attracting more visitors and also generating more income. It has been very exciting to work with the creative team on this project to explore ways to use lighting to enhance the unique sense of place and spirit that Cambridge University Botanic Garden has.

The Year in Pictures

October

Making ink from Newton's apple tree

November

Recording Gardeners' Question Time

December

Cambridge Botanic Lights

January

Sowing seeds from Kyrgyzstan

February

Moonflower(s)

March

Spoon carving course

April

Relaying turf in the Systematic Beds

May

Crane work on the Glasshouse Range

June

Festival of Plants

July

Plant collecting in Kyrgyzstan

Sounds Green

August

Community craft for blind and partially sighted people

Summer of Botany

September

Fungi Field Day

Research

Professor Beverley Glover
Director

As usual, we have supported an extraordinary range of research requests this year, and provide full details on pages 40-48. In this feature article I focus on some of my own research, supported not by the Botanic Garden's living collection but by its research facilities. This feature focuses on enhancing food security, both locally and globally, and demonstrates the extent to which the Garden supports important scientific research beyond the living collections themselves.

I was lucky enough to be granted a Sabbatical for the 6 months from October 2023 to March 2024, and one of the first things I did with this time was to visit colleagues in Kenyatta University, Nairobi. Dr Rebecca Karanja and I have been collaborating for some time on the idea of encouraging the growth of *Vicia faba* (broad bean, or faba bean) as a polycultural crop in Kenyan drylands. This visit was the first time I have been able to see the farms on which the trials are happening and talk to the farmers about their experiences. Faba bean is not a commonly grown crop in Kenya, so much so that most people there have never tasted a broad bean. Other legumes, including common beans (*Phaseolus* species), cow peas/black-eyed beans (*Vigna unguiculata*) and mung beans/green grams (*Vigna radiata*) are common, and are vitally important sources of protein in the diets of poorer people in rural areas. We hypothesised that faba beans would thrive in the Kenyan climate and provide an alternative source of protein and calories, but we did not know whether suitable pollinators would be available, as in European agriculture bumblebees are the main pollinators and there are no native bumblebee species in Africa. The farms on which the trials were taking place are typical small Kenyan farms. In this setup the landowner specifies a cash crop, such as banana or citrus, and installs a farmer who maintains the cash crop but is allowed to grow food for himself and his family between the main crop plants. To ensure adequate nutrition and to protect against crop disease, farmers grow multiple species in these strips, including legumes, maize and vegetables. It was wonderful to see how different the faba beans looked in the Kenyan climate. The plants grew and flowered quickly, producing smaller flowers which were readily pollinated by honeybees and smaller native insects, and generating three harvests per year (compared to the single annual crop in the UK). Those farms with access to irrigation water produced greater yields than those without, but even in totally dry habitats two crops per year were growing successfully, as long as seed was planted at the start of the two annual rainy seasons.

This work in Kenya is an extension of the work I have been conducting on faba bean pollination and yield here in the east of England for several years. Using the faba bean germplasm stocks provided by the National Institute of Agricultural Botany here in Cambridge, my research team have been exploring how variation in faba bean flowers influences pollinator attraction and crop yield. To do this work we have grown over 30 varieties of faba bean in the experimental glasshouses at the Botanic Garden and in the outdoor experimental plots. The work involves characterising various floral features, including colour, size, shape, visible patterns, scent, pollen content and nectar content. We then test how bumblebees respond to the

‘This demonstrates the extent to which the Garden supports important scientific research beyond the living collections.’

Vicia faba **and other legumes growing between bananas on a farm outside Nairobi**

Research

‘These projects have the potential for great impact in people’s lives and in the way agricultural crops support and are supported by wild pollinator populations.’

extremes of this variation in our lab facilities, and develop hypotheses as to which varieties should be most attractive to and beneficial for wild pollinators. The final step is outdoor field trials to test these hypotheses, enabling us to provide advice through PGRO (the Processors and Growers Research Organisation, which supports legume farmers across the UK) to both farmers and breeders. Some of this work has been published in the last academic year (Bailes *et al.,* 2023).

The Botanic Garden has also supported a similar approach to understanding strawberry pollination and the consequences for yield. Pollination is particularly important for strawberry growers, because inadequate pollination results in mis-shapen berries that are not commercially attractive. We have taken the same approach to understanding strawberry floral variation, working with local strawberry farmers in Norfolk who grow a wide range of varieties. Again, the experimental plots and glasshouses here at the Botanic Garden have been essential for this work, and the Garden made space for a polytunnel on the experimental plots to protect our outdoor plants and enable a longer season for the experimental work. Symington and Glover (2024) was published this year, describing the results of the work here at the Garden.

Next steps for these projects involve narrowing down the most important traits for farmers and breeders to focus on, and confirming our lab and glasshouse based studies with larger scale field trials at the PGRO trial site in Lincolnshire. Meanwhile in Kenya, we will be expanding the range of habitats we test faba bean growth in, and introducing a social scientist to our project to design strategies to encourage the use of faba beans in domestic cooking and household menus. These projects are not the most scientifically glamorous part of the research the Botanic Garden supports, and they rely not on our brilliant living collection but on our experimental facilities – but they have the potential for great impact in people’s lives and in the way agricultural crops support and are supported by wild pollinator populations.

Images clockwise from top:
Bumblebees visiting Vicia faba *flowers.*
BJ Glover, H Symington 2024 Strawberry varieties differ in pollinator-relevant floral traits. Ecology and Evolution 14 (2), e10914.

Eric Muthama Muia with the pan traps used to catch insects for identification on the Kenyan farms.
Artificial flowers used to explore how pollinators respond to large versus small petal spots on bean flowers.

Horticulture

Sally Petitt
Head of Horticulture

Propagation in the Garden

Throughout the year, staff in the Nursery and Experimental Section are involved in the production of plants for all areas of the Garden. Material can range from alpines, through to herbaceous, tropical and woody material, and can include seed and vegetative material from expeditions and botanical institutions, such as Kew's Millenium Seed Bank, or material collected directly from our own collections. The propagation skills and methods required to produce this wide range of material are varied, and require a diverse range of skills and in-depth knowledge from staff in the Nursery and Experimental Section.

In 2023-2024, the Nursery and Experimental Section dealt with approximately 1,000 individual propagation taxa, with between three and 20 individual plants required of each accession. In order to successfully produce this diverse range of material, staff need to have good knowledge of the individual requirements of these species (or at least their close relatives) and possess a range of specialist skills. The propagation process involves numerous stages, and staff also record each step on our database for future reference. This provides us with details of various stages including propagation date, technique, environment, germination date, date of pricking out or potting on, and finally date on which material is planted out in the Garden.

Each year a number of annuals are routinely propagated from existing Garden stock, including annuals like *Nicotiana sylvestris* for the Systematic Beds, and tender perennials such as *Pelargonium tomentosum* for the Scented Garden. In addition new taxa from a variety of sources require propagation, and this year new accessions included Australian endemics from Kings Park Botanic Garden, Perth, Australia, and 369 accessions of wild origin material from our own collecting trips to Kyrgyzstan and Croatia. The propagation requirements for these accessions vary, and a range of horticultural techniques are required to maximise the chance of successful germination. For example, recalcitrant seed cannot be stored and requires immediate sowing; some seed requires exposure to high or low temperatures or chipping of the hard seed coat, and some needs to be exposed to smoke to break dormancy.

Australian seed from Kings Park was exposed to smoke before sowing to simulate the effects of smoke in breaking seed dormancy in fire-prone floras. We have had successful germination of several notable species: *Callitris arenaria* (sandplain cypress) is a member of the Cupressaceae, and is endemic to southwest Australia, and *Isopogon divergens* (spreading coneflower), a shrub belonging to the Protea family (Proteaceae), which is recorded as vulnerable by the International Union for the Conservation of Nature (IUCN). Both of these will be grown in the Continents Apart House once large enough for planting.

Material from collecting trips to Croatia and Kyrgyzstan has also been successfully propagated, with some material germinating quickly, such as *Achillea filipendulina* from Kyrgyzstan, which has already been planted out in the Scented Garden. Others will be slower to reach planting size, but we have germinated *Malus niedwtzkyana*, a drought tolerant, endangered ancestor of the domestic apple used in the breeding of cultivated apples, and *Pyrus regelii* a drought tolerant pear with variable leaves. The propagation process can be challenging, and

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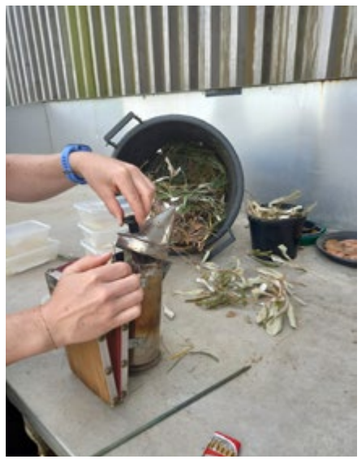


Images clockwise from above:
Propagation House – Spring 2024; Preparation for smoke application to break seed dormancy; Malus niedwetzkyana

Horticulture

‘In Autumn 2023, following extensive planning and research, the Western Display Section began work on the redevelopment of the central section of the Beds.’

staff have enjoyed success with more difficult species, such as *Acantholimon alberti*, an alpine member of the Plumbaginaceae family, which, once large enough, will be included in our alpine collection.

The successful germination of any species is dependent on a number of factors, including the quality of the propagation material, germination technique applied and sowing conditions. The skills and knowledge of our staff are also integral to successful propagation, and we are looking forward to introducing species collected and propagated by Garden staff into our plantings in the future.

Tree Management

Our tree collection requires constant management to ensure that it is maintained in a healthy and safe manner. Work can be both proactive and reactive, and involves a variety of actions including pruning, thinning, deadwooding, bracing and occasional removal of trees. This year we have introduced some new methods of tree management. The first of these is the creation of tree monoliths. This involves the removal of the top and/or limbs of damaged or decaying specimens, to leave a standing dead (or declining) tree, in which habitat cuts are made to resemble natural breaks. This approach allows us to retain certain trees while removing the risk of failure. Several trees have been treated in this way including *Tilia europea* in the Tilia boundary, and *Betula pendula* ssp. *mandshurica*, which will also serve to support biodiversity and provide valuable habitats for insects, birds and fungi.

Quercus x *warburgii*, or the Cambridge oak, in the Gilbert Carter Woodland has been encircled by an oak fence to deter access beneath the canopy, and this has allowed us to leave this specimen to decline gradually, rather than carrying out significant crown reduction, or removal of the tree. Following recommendations in our 2023 tree survey, this year we terravented (aerated) the root zone of the Cambridge oak. This process involves injecting high pressure air into the soil and backfilling the holes with biochar. The process breaks up compacted, nutrient-poor soils to open up cavities and improve drainage, air flow and nutrient accessibility, and ultimately encourages root growth to aid tree health. The same process was carried out on the bricked-up pear *Pyrus communis* on the South Walk. We may not see the benefits of terraventing immediately, but if this process and the creation of monoliths enables us to retain some of our trees, and encourage native biodiversity, these methods will be adopted more widely in the management of our tree collection.

Systematic Beds

In 2015 the Garden received a grant from the Monument Trust to interpret the Systematic Beds, and the culmination of this grant was the development of the Rising Path. As part of this grant we redeveloped the Monochlamydae, Thalamiflorae and Corolliflorae sections, reviewing the family representation, bed layout and plant content of each of these. In autumn 2023, following extensive planning and research, the Western Display Section began work on the redevelopment of the central section of the Beds, the monocotyledons i.e. those plants which germinate with one seed leaf, including families such as Poaceae (grass family), Arecaceae (palm family) and Iridaceae (iris family). In the run up to autumn, Horticultural and Curatorial staff verified existing plantings; developed new plant lists; sourced new plant material with higher collection value e.g. wild origin, education or conservation value; started propagation of new accessions; and designed a new layout for the revised family content. Work on the ground started in autumn 2023, with the decanting of requisite accessions for replanting, and the removal of plants no longer required. During winter and spring, the area was levelled and turfed under the supervision of the Landscape and Machinery Section and with input from staff and trainees from all Garden teams in preparation for the cutting out of the new beds in autumn 2024. Bed preparation and planting will follow in 2025, by which time we will be rolling out the same process for the Calyciflorae (northern) section of the Beds. While responsibility for the Systematic Beds falls under the jurisdiction of the Western Display Section, this has been a good example of teams from across the Garden pulling together to deliver this project, which we will progress during the coming year.

Images clockwise from above: *Aeration and biochar treatment of Quercus* x *warburgii, or Cambridge oak; Tree monolith – Betula pendula* ssp. *mandshurica; Laying turf on the monocot section of the Systematic Beds*

Learning

Holly Clothier
Head of Learning

Schools in the Garden

Our Schools Programme remains a cornerstone of the Garden's educational offerings, engaging students from early years to sixth form. Over this reporting period, we hosted 288 school visits, with a total of 8,259 students. An additional 400 students visited from home education groups. We were particularly pleased to welcome 32 schools coming to the Garden for the very first time. The largest portion of visiting students were from primary schools, with a total of 5,750 students. This was followed by 1,293 from secondary schools, 628 from sixth forms and 588 from early years and reception. 408 of our sixth form visitors attended our 'Plant Responses' event, held over three days in collaboration with Hills Road Sixth Form College and the Sainsbury Laboratory.

Of all the school visits, 70 groups engaged in taught workshops with our dedicated Schools Learning Officers. It has been a pleasure to see an increase in the diversity of schools attending these workshops thanks to the Gatsby Schools Visit Grant which was launched in October 2023. The grant is funding bursaries to increase state school access to the Garden, covering travel and workshop costs for qualifying schools from Cambridge's neighbouring counties. 1,608 pupils from 37 schools benefited from the bursaries in Year One of the grant (January to July 2024). 1,238 of these pupils were from schools with an above-average pupil premium percentage. In the school year preceding the launch of the Gatsby Grant, 15.8% of our taught workshop visits were from schools with above-average pupil premium; in Year One of the Gatsby Grant, this figure increased to 66.7%.

Our initiative to provide free access passes to local sixth form students has continued successfully this year. We granted 861 passes to sixth form students from five colleges looking to dive deeper into relevant science and art subjects. We issued a further 99 passes to students from Anglia Ruskin University pursuing scientific disciplines.

Higher and Further Education

The Higher and Further Education programmes have gained fresh momentum as Dr Raphaella Hull took on the dedicated position of Higher Education & Interpretation Coordinator in May 2024. Over this reporting period, we hosted 1,008 students from universities and colleges across 55 educational visits, including 14 taught visits. We also continue to contribute to the Garden's own Horticultural Traineeship, providing the trainees with professional skills-building workshops and ongoing support.

To promote further HE/FE engagement, we are piloting a new series of workshops, including the successful 'Introduction to Botany' session attended by students from the University of Cambridge Crop Science Centre in July. The workshop was followed by a focus group discussion which proved fruitful; many of the ideas are being developed into further workshops in autumn and winter 2024.

Images, left to right:
Sixth form students participating in a plant evolution workshop; dancing into Nature community workshop in collaboration with the UCM and the Independent Living Service.

'We are proud to see the growth of our Community Programme, having hosted 2,220 individual community visitors in the Garden'

'It has been a pleasure to see an increase in the diversity of schools attending these workshops thanks to the Gatsby Schools Visit Grant which was launched in October 2023.'

Communities

We are proud to see the growth of our Community Programme, having hosted 2,220 individual community visitors in the Garden over the reporting period. At the core of our programme is the Community Membership scheme which now supports 70 local community-based organisations, granting them free visits to the Garden. Of the total community visitors, 574 of them participated in a workshop or guided walk tailored to the needs and interests of specific groups. Highlights from this year include:

- Dancing into Nature: two joyful workshops delivered in July in collaboration with the University of Cambridge Museums (UCM), with 23 participants from the council-run 'Independent Living Service'.

- Plant Evolution Mixed-Media Project: a series of six skill-sharing workshops with local mental health charity 'Make, Do and Mend' and artist Annabel Lee.

- Curious Adventures in Nature Smartphone Photography: a smartphone photography workshop led by Graham Fudger with 'BACA Charity', an organisation that supports young asylum seekers.

- Community Gardening Pilot Scheme: a series of eight gardening sessions with seven enthusiastic participants from the Independent Living Service.

Families

This year, we hosted a series of successful family trails, workshops and seasonal activities, aimed at engaging children in the wonders of plants and the natural world from an early age. Over the course of the year, we offered five themed family trails, which were enjoyed by thousands of visitors. These included three new trails: 'Autumn Art Adventure', 'The Lost Eggs' Easter trail (kindly sponsored by Mills & Reeve) and 'The Order of the Golden Lily' summer trail. Our Family Saturdays continue to be very popular, with hands-on workshops such as 'Wildlife Masks' and 'Herb Planting' engaging children (and their accompanying adults!) in creative, nature-themed activities. In total, 12 Family Saturdays were held and all 60 booked slots for children were consistently filled.

8,259 Student visitors

288 School groups hosted

1,293 Secondary students

32 New Schools visited

Seasonal family events included Apple Day Crafts in October (380 children), Cambridge Festival Carnivorous Plants in March (123 attendees), Easter Garden Craft in April (53 children), Festival of Plants Nature Wands in May (133 children) and Summer of Botany (198 children). A particular highlight was our February half-term Twilight at the Museums programme, which featured the captivating puppet show 'Seedheart' by Indigo Moon Theatre, attracting 400 attendees over three magical nights. These events sparked meaningful conversations about the environment and the impact of human activity on nature.

Adult Learning and Lifelong Learning

In this reporting period, the Garden offered 68 adult courses, attended by 765 participants; this included 12 online courses which attracted an international audience. The adult course topics ranged widely from 'Understanding Colour in Plants' and an 'Introduction to Garden Design' to 'The History of Saffron' and 'Printmaking with Daylight'.

The Science on Sundays talks continue to draw strong interest, regularly filling the classroom with a keen and engaged audience. We delivered seven Science on Sundays in this reporting period on a range of topics, from the ecology of drylands to the uses of the Cambridge University Herbarium. Audience feedback from these talks has been overwhelmingly positive, with one attendee noting, "Fabulous – clear, concise, deep understanding of a complex subject beautifully presented for the expert and amateur alike."

In an expansion of our seasonal learning events, we hosted the inaugural 'Fungi Field Day' in collaboration with the Crop Science Centre, which attracted over 1,000 participants. This day-long event featured talks, guided walks, and interactive activities centred around the world of fungi. We also participated in the city-wide Cambridge Nature Festival, organised by the Cambridge Nature Network. We hosted public talks and walks around the festival's theme of water and rivers, including a standout talk on the folklore and flora of the Fens.

'The Science on Sundays talks continue to draw strong interest, regularly filling the classroom with a keen and engaged audience'

'Our Adult Trails have continued to be popular. In this reporting period, we gave out 11,055 trail booklets across our 11 adult trails. This included the launch of a new adult trail, 'Dyes from Plants', developed in collaboration with Artist-in-Residence Nabil Ali, exploring plants used to create inks and dyes.'

Interpretation

With the recruitment of Holly Clothier as Head of Learning and Dr Raphaella Hull as Interpretation Coordinator, we have begun a comprehensive review of interpretation in the Garden. First, we audited

Image above right:
Community gardeners from the Independent Living Service and CUBG staff pick pumpkins in the Schools Garden

all Adult Trails to bring them up to date and then created a map that plots all interpretation elements within the Garden, assessing their status. This will inform new interpretation projects in the next reporting period.

Our Adult Trails have continued to be popular; we gave out 11,055 trail booklets across our 11 adult trails. This included the launch of a new adult trail, 'Dyes from Plants', developed in collaboration with Artist-in-Residence Nabil Ali, exploring plants used to create inks and dyes.

Staff & Volunteers

The achievements of the Learning Team would not have been possible without the work of our incredible team of 27 volunteers who have generously given their time, energy and passion across our Family, Community and Schools Programmes. We are also grateful to the contributions of Bee Carter who leaves us as a full-time member of staff at the end of this reporting period as we welcome back Bronwen Richards from maternity leave.

Curation

Samuel Brockington
Curator

The Curation team has been actively engaged in preparing for, and conducting, overseas trips and expeditions. As is becoming the norm, several of these trips targeted remote regions with the goal of acquiring unique plant specimens for our collections. This time, however, the team also ventured to Singapore—not to explore the wilderness of Southeast Asia, but to participate in the 8th Global Botanic Gardens Congress. The event brought together around 1,000 participants from across the globe. Our delegation included five members of the curation team: Angela Cano, Jake Powell, Margeaux Apple, Mar Millan and Sam Brockington.

Participating in this congress was a pivotal moment for the team, marking the official launch of BGsmartR, a project designed to empower managers of living collections. Now in its fourth year, BGsmartR is a software tool that provides a comprehensive view of the dynamics within living plant collections—capturing data in snapshots, over time, and in a global context. The program takes an export from a database and performs a series of analyses focused on quality and management. It enhances the extracted reports by integrating up-to-date information on taxonomic nomenclature, geographic distribution, conservation status and more. The outputs include visually appealing graphics and detailed management spreadsheets, offering curators valuable insights to inform their practices and communicate effectively with stakeholders. This tool enables users to iteratively track the impact of policies and strategies on their entire collections or on specific horticultural sections.

The launch of BGsmartR took place during a two-hour workshop, where Sam and Angela presented the project and demonstrated the tool. The 80 workshop participants, supported by the entire curation team, had the chance to explore the program's outputs through a workbook specifically designed for the event, which prompted reflection on key questions. To further showcase BGsmartR's capabilities, live demonstrations were conducted using data from two major living plant collections: our own and that of the Missouri Botanical Garden. In addition to the workshop, Angela presented a poster outlining the software and Sam delivered a talk on the global botanic garden network and its data ecosystem challenges. Our delegation made a notable impact through these various contributions to the congress. We also took full advantage of the opportunity to forge new connections and strengthen our network, which has already led to promising avenues for collaboration.

'These expeditions are vital to CUBG's mission, helping us maintain and expand our diverse living collections, foster collaboration with international colleagues, and contribute to the ex-situ conservation of global plant diversity'

This year's collecting expeditions spanned four continents! Members of the Horticulture and Curation teams embarked on journeys to Africa, Asia, Europe, and North America. From 5 April to 4 May, Margeaux Apple (Curation) and Luigi Leoni (Horticulture) were hosted by Stellenbosch University Botanical Garden (SUBG) in South Africa, rekindling a collaboration that began in 2018 following our expedition to the Richtersveld. The partnership, formalised with an MoU signed in 2022 by Sam Brockington and Donovan Kirkwood, Curator at SUBG, aims to share expertise, conduct joint fieldwork, support undergraduate education, promote scientific research, and facilitate in-situ and ex-situ conservation, including the exchange of living plant material.

In July, CUBG conducted two simultaneous expeditions. From 2 July to 1 August, Margeaux Apple, Nadiia Rositska (Curation), and Simon Wallis (Horticulture) led a collecting expedition to Kyrgyzstan. Joined by colleagues from the Kyrgyz National Academy of Sciences, Gareev Botanic Garden, Missouri Botanical Garden and Royal Botanic Gardens, Kew, the team made 209 collections representing 173 taxa. During the same period, from 1 to 14 July, Horticulture team members Andrea Topalovic Arthan, Paul Aston and Barbara Griffith joined partners from the University of Zagreb on an expedition to Croatia, where they made 96 collections of 95 taxa. This represented the first expedition under our newly signed MoU with the University of Zagreb Botanical Garden.

These expeditions are vital to CUBG's mission, helping us maintain and expand our diverse living collections, foster collaboration with international colleagues and contribute to the ex-situ conservation of global plant diversity. All in all, we collected some 391 accessions, 338 species (196 of which are not currently represented in Living Collection), 196 genera (of which 33 are not currently represented in Living Collection), 62 families, approximately 70 kg of herbarium material. A dedicated team of 21 volunteers led by Pete Atkinson, Margeaux and Nadiia from Curation spent a combined 424 hours of cleaning, removing chaff and debris, from approximately 522,000 individual seed from the July expeditions alone! We look forward to these collections enriching our landscapes, displays, science and learning in years to come. A huge thanks to Angela Cano, Margeaux Apple and Andrea Topalovic Arthan for leading on the organisation of their respective trips, and to all the participants for their sterling efforts.

Images clockwise from above:
Fynbos habitat overlooking a dam South Africa; Plant collecting at the Zavratnica inlet at the foot of the Velebit Mountains; CUBG Team in Kyrgyzstan

Friends

Anna Patterson Lee
Head of Development & Communications

This year saw a changing of the guard as Sacha Watson left the Garden after 10 years as Friends Administrator. We wish Sacha all the best in her new role and thank her for all her work supporting the Friends and growing the programme over the past few years.

We were delighted to welcome our new Friends Administrator in April. Helen Llewelyn has settled into the role brilliantly and has enjoyed getting to know the Friends and the programme. At the same time, the Friends have now shifted to join the Development and Communications team, in which they are most welcome.

We are now running Friends 'pop-up' tents at Garden events – both as a way to recruit new Friends and to engage with existing members. It has been a steep learning curve, but with a lot of help from the Finance team, we are now fully set up, mobile and ready to get out there and enjoying running the stall at events.

This year, the Friends have had, as ever, a full programme of events:

- Herbarium Tours
- Annual Lecture
- Behind the Scenes Tour
- Wreath Making Workshop
- Sainsburys Lab Tour
- Behind the Scenes Tour
- A Guide to Birdsong
- Fullers Mill and Bressingham
- Churchill College Garden Tour
- Early Bird Tour and Breakfast
- Mediterranean Beds Tour
- Friends Evening Highlights Tour
- Brogdale Collections and Doddington Place Gardens
- Oxburgh Estate and Elsing Hall Gardens

Melbourne Hall

- The Dower House and Melbourne Hall Gardens
- RHS Wisley
- Kings College Gardens

This year's holiday was a trip to the South West, with Friends visiting the great gardens of Dorset and Somerset. Destinations included Minterne, Kingston Lacy, Mapperton House and Gardens, Forde Abbey, Lytes Cary Manor, Abbey Farm (a private garden), Tintinhull Gardens and Hinton Ampner. Our thanks to our wonderful volunteers Margaret (18 years' tenure) and Barbara for their help and support in making this event such a success.

Visitors & Events

Nicci Steele-Williams
Head of Visitor Services

Total visitors for the period: 367,812

We welcomed 344,852 visitors to the Garden this year during normal opening hours, including all our usual popular annual events. This year, we also had the excitement of the inaugural Botanic Lights event in December 2023, bringing us another 22,960 visitors on winter evenings and making a record-breaking total for the period of 367,812.

The year has been beset by what has felt like fairly constant rainy conditions, which have undoubtedly affected our visitor numbers a little, but not the enjoyment and experience of the visitors.

Apple Day – 4,239 visitors

In October half term 2023, our annual Apple Day was a lovely, vibrant day enjoyed by all. Numbers were back to pre-pandemic levels, with 4,239 visitors – an increase on 2,552 visitors in 2022. There were specialist and highlights tours by staff and volunteer Garden Guides, and apple identification by the East of England Apples & Orchards project. The apple tasting tent was as busy as ever, enthusiasm for tasting 20+ unusual varieties never dimming. The drop-in family craft sessions proved extremely popular and the Main Lawn hummed with music and visitors.

As usual, all teams are involved in preparing and running Apple Day, both staff and volunteers, resulting in a Garden collaboration enjoyed by so many visitors and Garden colleagues alike. We are particularly grateful to the many volunteers who help make Apple Day a special day.

Visitors in the Garden

Apple Day

Talking Plants topics were as diverse as ‘What did the first flower look like?’ to ‘How could cat whiskers contribute to food security in Africa?’

Botanic Lights – 22,960 visitors

After many years of planning, interrupted by the pandemic, 2023 finally brought the excitement of launching our Botanic Lights event. Held over 13 nights for the public, the Garden was on show as it had never been seen before. The stewarding was managed entirely by staff from the Garden with members of the Plant Sciences Department, the Cory Library and the University Herbarium. Everyone enjoyed working together and sharing the beautiful, illuminated Garden with all our visitors on those evenings, many of whom were new to us.

The trail led round the Garden taking in the kaleidoscope-lit tree collection and highlighting Garden features that became sculptural and striking in the multi-hued glow.

The weather was generally kind to us through the event run, though nothing would have dampened the mood – it proved a huge success, and we are already looking forward to the next one!

Botanic Lights

Festival of Plants

Festival of Plants – 2,771 visitors

At the Festival of Plants on Saturday 8 June, after a cool, drizzly start the sun shone and a thoroughly enjoyable day was had by all. It was, as ever, a fascinating day, with plants and fun, part fete/part science festival celebrating the wonder of plants. The Plant Science tent was full of scientists from across the University; guided tours took in the seasonal sights; our Horticultural team were challenged by visitor conundrums in the Ask the Gardener tent; and the Talking Plants tent, with its 10-15 minute drop-in bite-size talks throughout the day from Garden and Department colleagues, engaged visitors with some of the latest plant science research: topics were as diverse as ‘What did the first flower look like?’ to ‘How could cat whiskers contribute to food security in Africa?’. Family activities proved very popular in the Schools’ Garden and there was music, plus plant and food stalls, on the Main Lawn.

Festival of Plants

Sounds Green – 10,221 visitors

Our summer concert series, Sounds Green, continued many years of evening open-air music from the Cambridge Summer Music Festival. This year there were five Wednesdays in July, over which 10,221 visitors enjoyed the live music. This season’s performers were new-to-us acts Hannah Horton and Cores Do Samba, alongside returners Prime Bass, Arun Ghosh Quintet and Mighty Like the Blues. Once more, the weather this year was not as sunny as we’d have liked, with patchy rain on most of the evenings. As ever, this certainly did not stop everyone from enjoying themselves and we saw more dancing than ever on the Main Lawn by both adults and children.

This year’s series was, again, kindly sponsored by Birketts LLP.

Science on Sundays

Visitors enjoyed Science on Sundays drop in talks once a month between March and July. This programme of free, informal, monthly science talks brings our visitors the latest discoveries in plant science, as well as research linked to the plant collection at the Garden, in a 30-minute nutshell. This year’s programme included a wide range of subjects – from the world beneath a wildflower meadow to building tools to study an economically important crop disease, and from the extraordinary ecology of drylands, and the role of wetlands in climate change, to an immense archive of plant diversity: the many uses of the Cambridge University Herbarium.

‘The year has been beset by what has felt like fairly constant rainy conditions, which have undoubtedly affected our visitor numbers a little, but not the enjoyment and experience of the visitors.’

‘Apple Day numbers were back to pre-pandemic levels, with 4,239 visitors – an increase on 2,552 visitors in 2022.’

‘Our fantastic team of volunteer Guides continued to deliver fascinating, high-quality tours to visitors, both free regular Sunday tours and ad hoc charged tours. We added a second free tour on Sundays during the period, which has proven popular.’

Exhibitions

In spring, we welcomed back the International Garden Photographer of the Year (IGPOTY) exhibition, featuring a wonderful selection of highly placed photographs from the competition’s main categories, from vast landscapes to microscopic fungi. For the third year, the exhibition included winners of a photo competition open to our visitors for images of the Garden itself. Over 300 photographs of the Garden were entered and judged by a small panel comprised of IGPOTY and CUBG staff, including our Director.

Guided Tours and Trails

Our fantastic team of volunteer Guides continued to deliver fascinating, high-quality tours to visitors, both free regular Sunday tours and ad hoc charged tours. We added a second free tour on Sundays during the period, which has proven popular.

The new adult trails introduced by the Learning team during the last reporting period have been enthusiastically used by visitors: both Rhythms in Plants and Amazing People, Enquiring Minds, the latter publicising the work of researchers across the University with related interpretation boards throughout the Garden. These adult trails have become an important part of the Garden experience for many of our visitors.

Images above and right:
Sounds Green; Guided Tours

22,960 Botanic Garden Lights visitors

Cambridge Botanic Lights

Anna Patterson Lee
Head of Development & Communications

After years of thinking and planning, we were thrilled to hold our first ever winter lights trail in December 2023. Cambridge Botanic Lights ran for 13 days and saw just under 23,000 visitors explore the Garden after dark with stunning displays and artistic interventions to enchant and enthral them.

The lights highlighted some of the Garden's most beloved features (such as the Fountain, Lake and Glasshouse Range) and created beautiful experiences around the rest of the Garden, transforming the landscapes into a magical wonderland and offering a delightful experience for people of all ages.

The trail was bespoke and aimed to be a combination of the fantastic and fun, while also highlighting the work of the Garden – illustrating some of our plant science research, collection and heritage. In many ways, this combination reflected what we do here at the Garden throughout the year – we showcase and support plant science research and engage visitors with the amazing ways that plants evolve, grow and survive, but we also offer a place of beauty and space where people can escape the everyday – though usually without glitterballs and Kylie to make it more exciting!

As CUBG Director, Professor Beverley Glover, said in advance of the trail opening:

"This exciting new experience will be a wonderful way for all the family to explore the Garden after dark, a fun night out with friends and a beautiful, new romantic experience in the city centre."

And we hope that is what we delivered.

Winter lights have been talked about for a long time at the Garden – it was getting closer to reality before the pandemic hit, which (of course) put a pause on all plans. However, with the world regaining most of its

'The lights highlighted some of the Garden's most beloved features (such as the Fountain, Lake and Glasshouse Range) and created beautiful experiences around the rest of the Garden, transforming the landscapes into a magical wonderland'

equilibrium, we decided that we needed to take the plunge and go ahead! Teaming up with local lighting specialists, Pearce Hire and Splendid Events, we were able to create something really special for our visitors.

Teams across the Garden collaborated to bring this special event to life, with input from Horticulture, Visitor Services, Administration, Learning, Finance, Development, Marketing and Communications, as well as our partners in the Café and Shop. Project

13 Event days

23,000 Just under 23,000 visitors

planning began in the summer, devising concepts unique to the Garden including a large projection of some of our most well-known plants (the Moonflower and Titan arum) onto a building and the Garden's logo onto pathways; and a unique tree ballad was created about the importance of our tree collection.

Marketing kicked off in September with large-scale posters at key city locations, roads and transport routes, including the railway station and on the sides of buses. A ticket competition and photography contest were organised and a preview event for stakeholders, press, sponsors Mills & Reeve and all staff took place the night before opening to the public. Collaborations with hotels and social media influencers also enhanced the publicity.

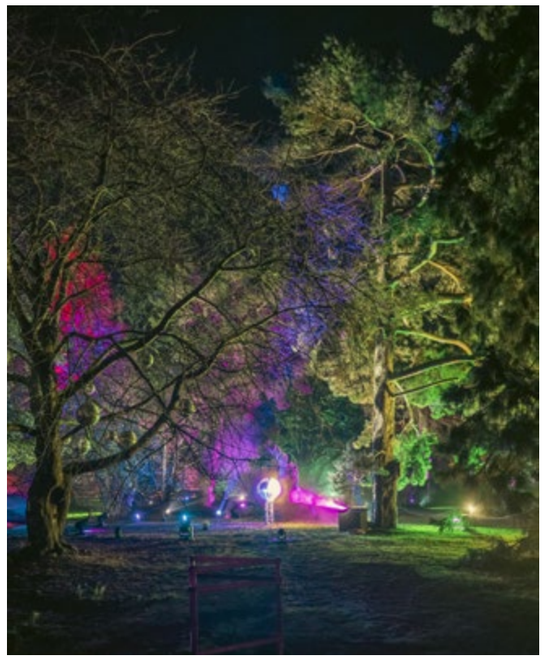
A huge team of Garden staff stewarded the events every night, making sure that all the visitors were welcomed, looked after and enjoyed their time at

‘A wonderful way for all the family to explore the Garden after dark, a fun night out with friends and a beautiful, new romantic experience in the city centre.’

the event. All this work, along with the meticulous installation and thorough checks throughout November, ensured a very successful run.

One of the event nights had to be cancelled due to high winds that necessitated the Garden’s closure. There were some issues with communicating to visitors about the closure, however this was resolved and has helped inform a more robust visitor communications plan for the future. Our plan for the 2024 lights includes a wealth of learnings from the 2023 event and we look forward to many more future lights events that will build on the successes, and learning points, of this first event series.

We hope that it was a truly magical celebration that left a lasting impression on all who came.



Some Botanic Lights stats:

1 marriage proposal

17,209m of cables around the Garden

9,969 light sources (that’s counting individual fairy lights)

The pea tunnel alone had 1,680m of fairy lights!

Botanic Lights images: Martin Bond

Cambridge Botanic Lights

Development & Communications

Anna Patterson Lee
Head of Development & Communications

As always, it has been a busy and varied year in the Development and Communications team: from promoting the Garden's first ever winter lights event to talking about plant expeditions around the world, welcoming a new Friends Administrator into the team and working on television programmes about the Garden's history and links to Darwin. We have been publicising research and grants news, the Garden's Artist in Residence and also, as ever, letting everyone know about the latest Garden news and events – including another moonflower flowering and some particularly smelly orchids.

On social media we have a full schedule of varied posts going out every week across all our channels. We also continue to experiment with, and grow, our social media channels – this year we have been particularly looking at what works best to attract the most views from followers and non-followers on Instagram, and then what creates the most click-throughs, and also growing our LinkedIn profile. Our most popular posts were done in partnership with the University Office of External Communications, generating thousands more likes and bringing new followers to the Garden's pages. This included a co-created 'ASMR' film, featuring the sights and sounds of the Garden as part of Mental Health Awareness Week. This generated over 55,000 views on Instagram – which was amazing, but was itself half the number of views our joint post about Cambridge Botanic Lights generated.

This year we started a new 'What's On' enewsletter which goes out seasonally to anyone who signs up to receive information about the Garden

Images clockwise from top:
Recording Susan Calman's Great British Cities; moth trapping recording for Radio 4; interview for BBC Radio Cambridgeshire

185.5% Instagram reach increase

1,276,093 CUBG website views

This year we started a new 'What's On' enewsletter which goes out seasonally to anyone who signs up to receive information about the Garden – this was jump-started by the thousands of Cambridge Botanic Lights visitors who signed up to hear more from the Garden.

We have also re-designed the back of the Garden map that is given out to Garden visitors – creating a new space to talk about what is in season, upcoming events, what is available to enhance their visit and the opportunity to join the Friends and support the Garden.

Some statistics:

Website

421,000 users (up 10.7% from last year) from 215 countries
1,276,093 page views on the website total – 6.4% increase

Instagram

20,658 total followers, 13.2% increase
23,228 profile visits, 38.3% increase

Facebook

22,938 total followers, 12.7% increase
19,373 page likes, 5.8% increase
64,876 profile visits, 115.5% increase
Reach of organic content: 1,717,065 185.5% increase
Reach including paid content: 1,839,013 205.8% increase

‘On social media we have a full schedule of varied posts going out every week across all our channels. We also continue to experiment with, and grow, our social media channels.’

X (Twitter)
17,075 followers, 0.6% increase
503,303 total impressions, 29.7% decrease

YouTube
57,900 views, 7% decrease
2,722 subscribers, 4.8% increase

LinkedIn
We have started actively posting on LinkedIn, followers have gone from 490 to 1,186 (142% increase)

Press and Publicity
TV = 9 appearances: 7 local and 2 national (SCTV and Channel 5)
Radio = 18 appearances: 15 local, 1 regional and 2 national (both Radio 4 – Gardeners’ Question Time & Open Country)

Newspaper = 15 appearances: 11 local + 4 national (inc. Guardian for Darwin specimens and Cambridge Botanic Lights)

Magazines = 25 appearances: 11 local, 6 regional and 8 national magazines (including Country Living, RHS Gardening, The English Garden, Museums Journal, Homes & Antiques)

Online = 176 appearances: 55 local, 45 regional, 37 national and 39 international

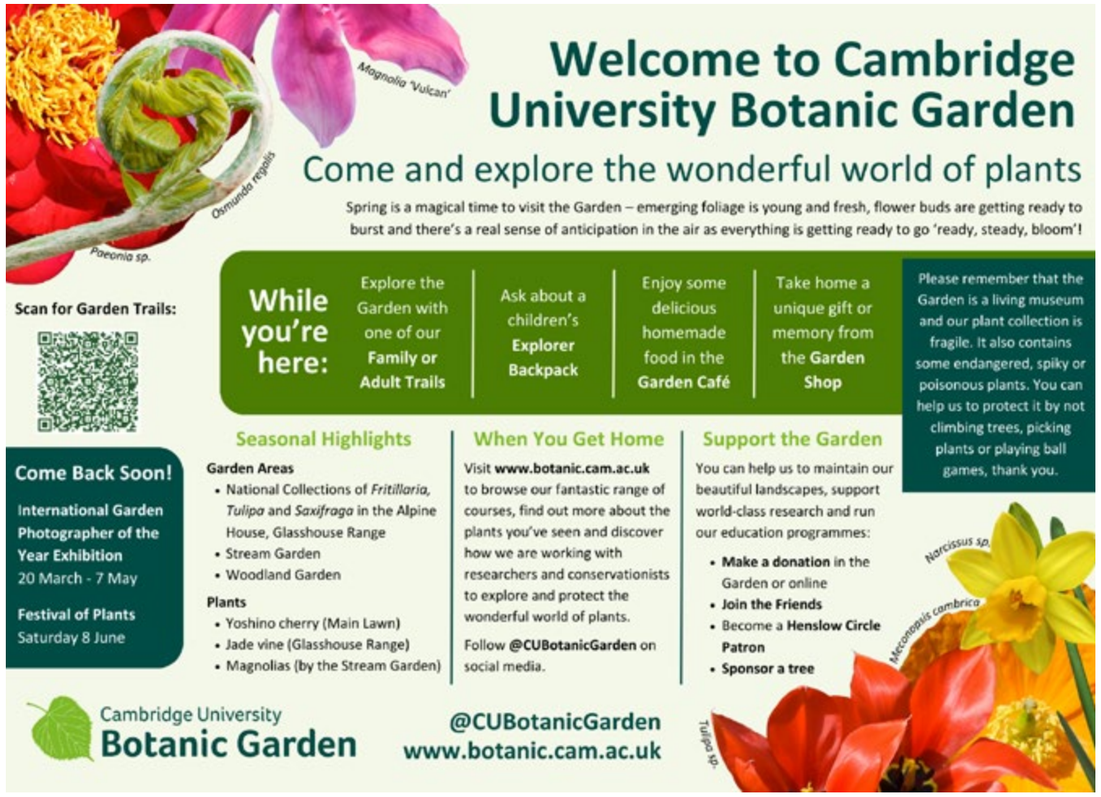
Plus a podcast and a short film on CUBG and water in Cambridge – ‘Pure Clean Water!’

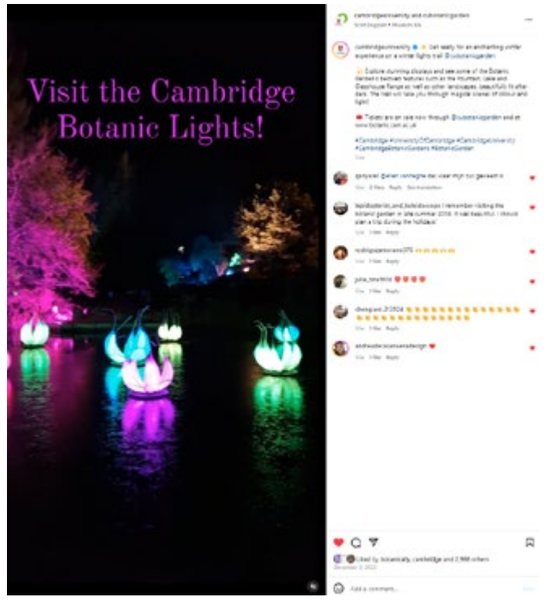
This year the Henslow Circle Patrons Group has continued their fantastic support of the Garden and we are delighted to have welcomed some new members to the group too. Members have enjoyed talks from CUBG staff about their expeditions to Kyrgyzstan, a talk and tour about the Phenology Programme and a series of Henslow Circle Late Night Openings which started off with fairly poor weather but ended on a high with a stunning September evening.

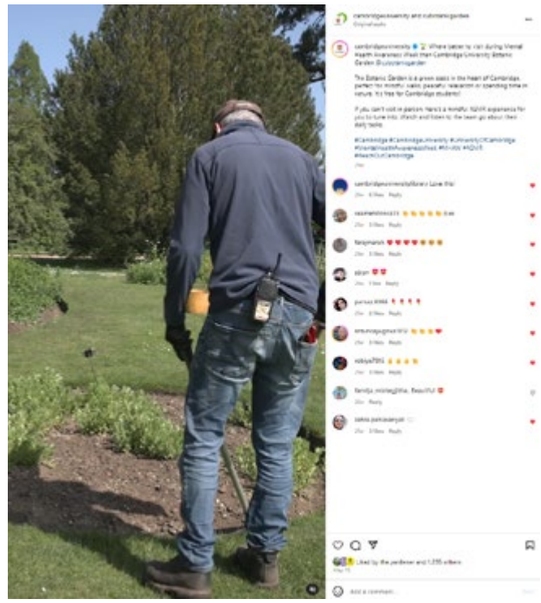
We would like to thank the sponsors of both Cambridge Botanic Lights and the Easter Trail, Mills & Reeve and the sponsors of the Sounds Green concert series, Birketts. We are also most grateful to the individual donors who support a range of projects around the Garden.
A big thank you is also due to our volunteers who have done invaluable work this year – Kat and Jim.

Images above right:
Spring Back of Garden Map;
Instagram posts

Development & Communications







Research Facilitated

Curation Team

Research Facilitated
Total fulfilled requests: 72

Cambridge University Botanic Garden

Professor Beverley Glover, Director
Research programme focussed on the evolution and development of flowers, plant/pollinator interactions, and plant surface properties, funded by the BBSRC, NERC, HFSP, EU Marie Curie Actions, Leverhulme Trust, Isaac Newton Trust and the Cambridge University Botanic Garden Research Fund. Material maintained at CUBG, analysed in the experimental plots, or accessed from living collections, for projects including:
• The relationship of floral morphology to pollination success in *Vicia faba*, with Dr Tom Wood (National Institute of Agricultural Botany), Roger Vickers (PGRO) and Charlotte Apsey (PhD student).

• Molecular evolution of key developmental pathways in plants, with Dr Samuel Brockington (Curator, CUBG), Thea Kongsted (PhD student) and Dr Eva Herrero (post-doc).

• Development and evolution of insect-mimicking petal spots in *Gorteria diffusa*, with Dr Paula Rudall (RBG Kew), Dr Allan Ellis (Stellenbosch University), Dr Udhaya Ponraj and Dr Roman Kellenberger (postdocs), and Farahnoz Kohjayori (PhD student).

• Development, function and evolution of iridescence in plants, with Dr Paula Rudall (RBG Kew), Professor Richard Bateman (RBG Kew), Professor Ulli Steiner (Adolphe Merkele Institute, Switzerland), Professor Silvia Vignolini (Department of Chemistry, University of Cambridge), Dr Edwige Moyroud (Sainsbury Laboratory Cambridge University), and Dr Bhavani Natarajan and Dr Humberto Herrera-Ubaldo (postdocs).

• Evolution and development of nectar spurs in *Linaria*, with Ben Fisk (PhD student).

• The relationship of floral morphology to pollination success in strawberry, with Hamish Symington (post-doc).

Professor Samuel Brockington, Curator
• Research programme funded by NERC, the NSF and DEFRA, using material grown in the experimental glasshouses and across the living collections, primarily focussed on three main areas: Caryophyllales and betalain synthesis, the genus *Tulipa* and the genus *Eriospermum*.

• Sequencing transcriptomes in Caryophyllales in collaboration with Stephen Smith (University of Michigan) and Ya Yang (University of Minnesota).

• Metabolomic survey of Caryophyllales, focussing on tyrosine derived metabolites (with Hiroshi Maeda, University of Wisconsin)

• Studying the phylogeny, evolution and diversity of tulip species with Brett Wilson (PhD student) and Flora and Fauna International (FFI).

• Sampling material for genomic sequencing projects

‘Research programme focussed on the evolution and development of flowers, plant/pollinator interactions, and plant surface properties.’

in Caryophyllales e.g. to generate highly contiguous assemblies for *Macarthuria*, *Stegnosperma*, and *Achatocarpus*, with Nathanael Walker-Hale (PhD student).

• Studying the evolution of transcriptional regulation in betalain pigmentation with Jasmina Dzurlic (PhD student).

• Studying morphological patterns in betalain pigment distribution across separate origins of Caryophyllales, with George Garnett (PhD student).

• Studying the evolution and function of catecholamines – animal-type neurotransmitters in plants, with Saswata Dey (PhD student).

University of Cambridge

Department of Plant Sciences

Prof. David Baulcombe, FRS (RNA Silencing and Disease Resistance)
Targeted grafts as a tool to enhance tomato preservation. Use of the Experimental Glasshouses to grow *Solanum lycopersicum*. The aim of this project is to characterize molecular components involved in RNA dependent gene silencing in hybridisation in *Solanum lycopersicum.*

Studying RNA cascade and disease resistance in tomato.
The aim of this project is to characterize molecular components involved in RNA dependent gene silencing as one of the mechanisms for disease resistance.

Prof. John Carr (Virology and Molecular Plant Pathology)
Certain dicistroviruses reside in plants without causing disease but will infect and kill insects, such as aphids, a major crop pest, when they feed. It has been hypothesised that plant-resident discistroviruses have a mutualistic relationship with plants by providing protection against aphids. Thus, it is conceivable that in addition to providing pollination services, bees might render plants an additional benefit by spreading aphid-pathogenic viruses. This idea will be investigated by sampling bees and aphids under field conditions, extracting RNA, and carrying out RT-PCRand Sanger sequencing for insect viruses. Plant samples will also be taken to assess prevalence of dicistrovirus residency in plants. The researchers were provided permits to access CUBG and sample bees, aphids, and plant samples.

Prof. Howard Griffiths (Physiological Ecology)
ATAC-seq of *Kalanchoe fedtschenkoi*. Use of the Experimental Glasshouses to grow *Kalanchoe fedtschenkoi*. This research aims to perform ATAC-sequencing on *K. fedtschenkoi* leaf samples to capture chromatin accessibility status of key CAM genes.

Prof. Ian Henderson (Genetic and Epigenetic Inheritance in Plants)
The researchers performed chromatin immunoprecipitation and sequencing using antibodies against conserved kinetochore proteins. To do so, the researcher collected leaf samples of *Ballota nigra, Filipendula ulmaria, Geum urbanum*, and *Quercus robur* from CUBG.

Prof. Julian Hibberd (Molecular Physiology)
Studying the production of collagen in lettuce and tobacco plants. Use of the Experimental Glasshouses to grow and harvest *Lactuca sativa* and *Nicotiana tabacum* plants. Grafting palm and banana for long term growth impact. Use of the Experimental Glasshouses to grow *Musa* sp. (banana), *Elaeis* sp. (oil palm), *Phoenix* sp. (date palm). The work involves grafting palm and banana and growing this alongside non-grafted controls to see the effect of growth over time. The primary hypothesis is to assess whether grafting has a negative impact on the plant. C4 Rice project. Use of the Experimental Glasshouses to grow *Oryza sativa*.

Prof. Johannes Kromdjik (Environmental Plant Physiology)
Acquiring knowledge to accelerate yield gain in Akaya. Use of the Experimental Glasshouses to grow *Gynandropsis gynandra*. Comparisons between C3 and C4 species in non-steady conditions. Use of the Experimental Glasshouses to grow *Alloteropsis semialata* subspecies *semialata* and *Alloteropsis semialata* subspecies *eckloniana*. This research aims to compare dynamic light responses and photoprotection mechanisms in C3 and C4 Alloteropsis species as part of a wider C3 and C4 phylogenetic pair comparison.

Barbara Neto-Bradley (Forest Ecology and Conservation)
As part of a project which aims to understand how research interest for plant species changes after they are assessed via the IUCN red list, the researcher will compile records from various botanic garden databases, using plant accession dates, to understand whether species representation in garden collections increases in the time after they are assessed via the IUCN red list. CUBG provided the researcher with data from the plant records database.

Prof. Alison Smith (Plant Metabolism)
The Botanic Garden has provided space for the Algal Innovation Centre glasshouse facility, to allow different algal species to be grown to establish what role algae can play in the development of a low carbon economy.

Dr Edmund Tanner (Tropical Ecology)
Peat vs. Peat-Free Compost. Use of the Experimental Glasshouses to grow various commercial tomato species. The aim of this project is to compare the growth rates of individual species in different compost mediums.

Yi Zhao (Evolution and Diversity)
Many members of Caryophyllineae have independently re-differentiated their perianth. The researcher is studying the types of organs from which the perianth of Caryophyllineae members is derived. Members of Caryophyllaceae, Nyctaginaceae, Aizoaceae, Montiaceae, Portulacaceae, and Cactaceae are of special interest to the researcher. CUBG provided flowering material from taxa of interest.

Other Departments, University of Cambridge

Dr Eyal Maori
Department of Biochemistry
Studying RNA Communication Between Honeybees. Previous work by this group has demonstrated that honeybees share RNA messages between members of the hive through worker – and royal jellies ingestion. The research work at the Botanic Garden aims to identify which RNA molecules are being shared within the hive population and whether these transmissible RNA molecules can promote immunity, brood development, and adaptation to environmental changes.

Sofia Dartnell
Department of Zoology
The researcher will capture wild *Bombus terrestris* queens and rear colonies in the Zoology department for use in PhD studies. The researchers were provided permits to access CUBG and sample queen bees.

Ina Bi
Department of Geography
The researcher will measure C3 and C4 species for photosynthetic activity and stomata opening. This involves non-invasive A-Ci curves and light curves with a Targas gas exchange measurement device on a selection of plants at CUBG. The researcher was provided permits to access CUBG and perform analysis on a selection of plants.

Research Facilitated

Dr Raymond Wightman
Sainsbury Lab
Multiple projects:
Corylus avellana 'Contorta' exhibits twisted growth in its stems. The researcher will use Cryo-Scanning Electron Microscopy and Digital Microscopy to examine cell and cell wall organisation to determine the origin of the twisting. The aim of the study is to understand the mechanisms underlying this twisted growth at the level of the cell and subcellular features such as the cell wall and cytoskeleton. The researcher was provided with twig samples from the taxon of interest.

The researchers also used cryo-SEM microscope to observe the tepal, pollen and cladode surfaces of the moonflower (*Strophocactus wittii*). CUBG provided researchers with fresh plant material.

CUBG provided researchers samples of *Paulownia fargesii* following feedback on publication in which they examined secondary wall ultrastructure in fully hydrated woody tissue of diverse tree species. This is part of a collaboration between Sainsbury Laboratory and Jagiellonian University, Poland. Twig samples were harvested with support from CUBG staff and examined using cryo electron microscopy platform. Precise measurements of secondary cell wall thickness, cellulose microfibril diameter and orientation in individual wood layers were taken by researchers.

Working with a materials science and fashion postgraduate student at Central St. Martins, focusing on sustainable textiles. and is interested in working with Dionysia tapetodes as well as the "Himalayan Snowball Plant." CUBG provided fibres for microscopy analysis.

Victoria Avery
Fitzwilliam Museum
The Fitzwilliam Museum is putting on a second Legacies-themed show, currently called Resistance, Revolution & Reform, which will be held from 21 February until 1 June 2025, in which historic items will be juxtaposed with contemporary works of art. One of the contemporary artists, Jacqueline Bishop, whose work deals with botanical histories and black women's labour, is making a new work for the exhibition. Called 'Nana', it celebrates the market woman as herbalist, healer and midwife. At the centre of this multi-component work is a chemise made from lace bark with real (dried and pressed) botanical specimens, each associated with Caribbean healing and medicine, emerging from the bottom, including flowering and vegetative material of *Thymus vulgaris, Mentha pulegium* and *Urtica dioica*. CUBG staff members harvested and dried requested materials and provided to the researcher.

Paolo Bombelli
Department of Biochemistry
This project involves the use of algal devices to power environmental sensors. Researchers worked with CUBG staff to trial devices onsite.

Rebekka Katajisto
Hamilton Kerr Institute
The researcher requested CUBG expertise to identify flowers depicted in 16th-century paintings. CUBG staff members gave suggested identifications based on photos shared by the researcher.

Dr Matt Wilkinson
Department of Zoology
In this research project, three moth light traps will be set up in the Botanic Garden the evening before the collection visits, and the lights left on overnight. Moths will be identified, collected and later placed in a – 25°C freezer in the Dept of Zoology. The moth specimens will form the basis of a practical in the 1B Evolution and Animal Diversity course (within the Natural Sciences Tripos). The aim of the practical is to assess the extent to which moths co-evolve with their Wolbachia parasites. DNA will be extracted from tissue samples taken from the collected moths, and the COI and wsp genes (from moths and Wolbachia, respectively) will be sequenced. These sequences will be used to reconstruct moth and Wolbachia phylogenies, which will be tested for congruence.

External Researchers – UK

24 Research projects supported within the UK, excluding those at Cambridge University

Garden Moth Scheme UK
The Garden Moth Scheme (GMS) monitors the numbers of common moths in gardens across the

United Kingdom. At CUBG, volunteers count and identify moths found in trap every Friday morning. CUBG staff members put out trap on Main Lawn every Thursday evening.

Jonathan Shanklin
Cambridge Natural History Society
Leading a "fungal foray" at CUBG to identify and record fungal diversity.

Lucy Kirk
Anglia Ruskin University, Department of Zoology
The researcher set up three separate moth traps using LED light bulbs of different frequencies to record how these frequencies affect the species and abundance of moths attracted to each trap. CUBG provided permits for access to grounds and storage of moth traps during the research period.

Mariam Gamal El-Din
Norwich Research Park, Food Innovation and Health, Quadram Institute
The researcher aims to investigate the chemical profiles for selected plant species and correlate the biological activities of their extracts to their phytoconstituents. They study the influence of climatic conditions and geographical origin on the quality and quantity of the bioactive secondary metabolites and accordingly the associated biological activities using different chemometric techniques. CUBG provided dried plant material to the researcher.

Andrew Hudson
University of Edinburgh, Institute of Molecular Plant Science
The researcher is interested in the genetic basis for lower stinging hair density in the fen nettle (*Urtica dioic*a ssp. *galeopsifolia*). This subspecies has two sets of chromosomes (diploid, 2n), in contrast to the much more common stinging nettle's 4n. Therefore one possibility is that the density of stinging hairs is determined by the number of chromosome sets. CUBG collected seed from plants in our collection and supplied to the researcher.

Rachael Collings
RHS Wisley
This project is intent on quantifying the number of woody Araliaceae taxa grown outside in the temperate northern hemisphere. This research will assist the International Dendrology Society to quantify, research and plan funding for their articles on 'Trees and Shrubs Online'. CUBG provided information on the taxa of this family grown outside or under protection in the Living Collection.

Dr. Julia Mackenzie
Anglia Ruskin University, Faculty of Science and Engineering
This research focuses on urban birds, specifically the breeding behaviour of blue tits and great tits, and the impact of urban living on their breeding success. Data collection primarily involves monitoring approximately 40 nest boxes at the Cambridge University Botanic Gardens, as well as mist netting and colour ringing the adult birds. Behavioural studies may also be conducted. The nest boxes have been monitored and the birds studied in the garden since 2003.

Sam Ebon
Wellcome Sanger Institute, Tree of Life Project
The researchers are generating whole-genome reference sequences for globular springtails to investigate their evolution. The intent is to sample non-native springtails from populations that are likely present due to being imported on botanical materials. Researchers came on site to sample in the CUBG Glasshouses.

Aditya Korde
Anglia Ruskin University
This project looks at how urbanisation and anthropogenic influences such as traffic noise levels affect sexual communication in European robins, which are a type of oscine that will change and adjust the frequency of their songs (vocalisations) according to the amount of anthropogenic noise, and other forms of disturbance. The researcher used bioacoustic recorders to record the vocalisations of the robins, then analysed this data using the application known as Raven Lite to determine the song length and mean frequency. The researcher used CUBG as an urban study site in addition to the rural sits of the Cherry Hinton Chalk Park and Grantchester Meadows.

Research Facilitated

Francis Wamonje
NIAB, Pest & Pathology Ecology
Brown marmorated stink bug (BMSB, *Halyomorpha halys*) is an invasive pest established in many European countries, causing significant crop damage and urban nuisance impacts. The insect is originally from Asia, but its global range has expanded considerably within the last three decades. Reports of UK interceptions at ports date back to 2010, but since 2018 adults have been observed free in the environment within England. Climate-based niche models indicate that conditions in some regions of the UK are suited to establishment, with areas of Greater London likely to support at least one generation per year based on historic climate data. However, with predicted climate change, more extensive areas of South East and Eastern England may become colonised by 2050. Based on the increased numbers of BMSB sightings in 2021, we will continue with this surveillance targeting sites where previous records of BMSB pheromone trap catches have been confirmed and other sites where the CLIMAX model predicts establishment – e.g. Norfolk. Researchers set up a trap at CUBG which they monitor on a bi-weekly basis.

Rox Middleton
University of Bristol, Biological Sciences
The researcher is analysing the waxy blooms on the sepals of *Cerinthe major* as part of research that investigates the nanostructures that interact with light to produce colour and other optical effects in plant parts. CUBG provided fresh leaf and flower material to the researcher.

Olivia Grace Murrell
Manchester Metropolitan University, Department of Natural Sciences
In partnership with the Chester Zoo and the IUCN's Carnivorous Plant Specialist Group (see attached), we are working to determine the status of *Nepenthes* in ex situ collections worldwide. The overall research goal is to assess the genetic diversity of *Nepenthes* collections ex-situ compared to the genetic diversity that remains in wild populations. In the first stage of research, the project will determine which species are being held in collections and collect preliminary pedigree data. CUBG provided data as to which species we hold in our collection and provided leaf samples of a subset of taxa requested by the researcher.

Victor Gillett
University of Nottingham
The student is creating a book for the final project of a master's in Biological Imaging and Photography. One section will focus on the history and importance of botanic gardens, exploring why they were created and their mission. CUBG granted the student permit access to the grounds to capture general photographs of the Garden.

Richard Sewell
National Bat Monitoring Programme
The National Bat Monitoring Programme is an annual survey of bat populations in the UK. The researcher was given after hours access to CUBG on two occasions to monitor populations in the area.

Phoebe Stephenson
University of Manchester
As part of an intern project responsible for curating a Sino-Himalayan Garden at the Firs Botanical Grounds, the researcher requested historical records on *Metasequoia glyptostroboides* in CUBG's collection. Specifically the researcher was interested in historical records we might hold regarding exchanges of seed between CUBG and University of Manchester and/or Firs Botanical Grounds.

Nadine Mitschunas
UK Centre for Ecology and Hydrology
The researchers are running a peatland restoration project at Pymoor in the fenlands, which involves re-wetting a former arable field on peat soil. They are in the early stages of setting up a trial area on the re-wetted field which involves re-establishing natural high quality fenland vegetation. For this purpose they have selected 27 species of interest. The researcher requested seed of *Lathyrus palustris* for their project, which they did not have other means of sourcing. CUBG provided seed of this taxon to the researchers.

Melany Henot
University of Edinburgh
This project is on the unusual sex determination in black winged fungus gnats (Family: Sciaridae), and as part of this project the researcher requested collecting live fungus gnats to build a comprehensive phylogeny, as well as to collect mating system information. The researcher was granted permit

access to the glasshouses to collect specimens for their research.

Anna Dorling
University of Oxford
The Oxford Bee Lab is collaborating with Phil Stevenson's group at Royal Botanic Gardens Kew on a project which investigates whether certain plants synthesise psychoactive drugs in their nectar in order to make it more attractive to bees. The majority of this work is behavioural but one of the grant's aims is to screen the nectar of target plant species for the presence of some drugs of interest (cholinergic agonists and antagonists). This knowledge of the concentrations will then inform more behavioural work. We are presently focusing on sampling nectar from *Areca catechu* in microcapillary tubes. This will be stored on methanol and then analysed at Kew for the presence of arecoline using LC-MS. CUBG provided flower material to researchers.

Toni Martin
RHS Wisley, Herbarium
The Science and Collections Team are now embarking on the Plants for Purpose project, which aims to deliver climate resilience and sustainability through an ecosystem service specification tool. The project's key objective is empowering 28 million gardeners, industry and schools to make better plant choices from the estimated '400,000' different UK garden plant types. As part of this, the RHS Herbarium is undertaking a dedicated collection programme aiming to collect a representative specimen of each of these '400,000' cultivars. CUBG provided material for herbarium specimens to the researcher.

Richard Milne
University of Edinburgh
The researcher is working on a project to photograph the entire flora of the UK, aiming to create background-free images that will support a beginner's plant identification tool they are developing. Their "to-get" list has now narrowed down to the rarest and hardest-to-find species. CUBG provided access to our collection for supporting this project as well as seed of two species of *Ranunculus*.

Duncan McKay
Wildlife Trust for Beds, Cambs & Northants
This project aims to reintroduce Chichester Elm (*Ulmus x hollandica* 'Vegeta') to Lower Wood as a part of their restoration efforts. CUBG dug up root suckers from a tree in our collection, potted eighteen individuals in the nursery and provided to researchers to support their efforts.

Tim Pankhurst
Plantlife, East of England
Seed from fen orchid (*Liparis loeselii*) in CUBG's collection was provided to the researcher for distribution on Old Fen, Thelnetham. This is part of an ongoing project to reintroduce fen orchids in the UK and understand reproduction in situ. Licence number 2023-66098-SCI-SCI.

Joseph Russell
BBC, Natural History Unit
'ASIA' is the latest in landmark, blue-chip wildlife series created by the BBC team. This 7 x 1 hour series will, similarly to Blue Planet II and Planet Earth III, aim to capture new and spectacular wildlife behaviour across all of the continent's many habitats, as well as include stories on plant life, conservation and human impact. CUBG provided plant material to the team to film in-studio shots with native species to attain the high-end look otherwise impossible to replicate in the field at a macro scale.

Tina Bone
Association of Botanical Artists (ABA), Wildlife and Botanical Artist
This project aims to produce a botanical painting of *Juniperus communis* for a special worldwide botanical art exhibition in May 2025, called Botanical Art Worldwide 2025 – an international juried exhibition open to all botanical artists. The theme of the exhibition is crop diversity celebrating and focussing on biodiversity in the crops that have been closely associated with the human species over thousands of years. The artist requested living material to accurately portray the plant in the exhibition. CUBG provided onsite permit access to the artist to make field notes, drawing and take photographs.

Research Facilitated

External Researchers – International

9 Researchers supported internationally

Seanna Walsh
National Tropical Botanical Garden, Kalāheo, HI, USA
In partnership with the Chicago Botanic Garden, the researchers are working to determine the status of *Hibiscus clayi* in ex situ collections worldwide. One of the research goals is to assess the genetic diversity of collections ex situ compared to the genetic diversity that remains in wild populations, create pedigrees, and use all of that data to inform which additional founders need to be brought into collections to support reintroduction efforts over the long-term. CUBG provided dried leaf material of the plant in our collection for genetic research.

Celine Vanhee
Sciensano, Belgium
Dietary supplements (DS) promoting weight loss are gaining more and more popularity. One of the plant genera which is often present in these DS is *Hoodia*. However, plants belonging to this genus are listed in annex 2 list of the CITES list, thus stating that they may be present provided that they can demonstrate the proper certification papers. Unfortunately, this is not always the case and illicit trading has also become increasingly popular. Therefore, the researchers endeavour to develop and validate a combinatory approach of screening for a chemical marker and utilising a qPCR methodology to detect the presence of this genus in DS that are intercepted by Belgian regulatory agencies and sent to the governmental laboratory. CUBG provided researchers with plant material of *Hoodia* and closely related taxa to provide negative control for both the chemical screening as well as the qPCR.

John Beetham
Geelong Botanic Gardens, Victoria, Australia
This project is aimed at determining the status of *Prumnopitys a*ndina in cultivation around the world. CUBG provided accession level data for the plants of this taxon in our collection.

Thomas Abeli
Department of Science, University of Roma Tre, Rome, Italy
This project is aimed at reassessing the status of *Nymphaea thermarum* after its rediscovery in the wild in July 2023. CUBG answered a questionnaire provided by the researcher for the sake of estimating the ex situ population size and pedigree.

Connor Ryan
Holden Forests & Gardens, Kirtland, Ohio, USA
Holden Forests and Gardens, in partnership with Botanic Gardens Conservation International (BGCI) and the Global Conservation Consortium for Rhododendron (GCC-R), is conducting an ex-situ collections survey of Rhododendron species native to North America. CUBG provided the researcher with accession-level (provenance) information for target taxa represented in living plant, seed, and other germplasm collections.

Kim Yu Gyeom
Gachon University , Gachon, South Korea
This project is aimed at determining the phytogeographic origins, timing of divergence, and east-west pathways of monocotyledons with a disjunct distribution between East Asia and North America. The researchers endeavour to understand the mechanisms of speciation in monocots distributed in East Asia and North America and analyse species diversity and identify factors of adaptive evolution between East Asia and North America. CUBG provided dried leaf material of target taxa to researchers.

James Cohen
Weber State University, Odgen, Utah, USA
The aim of the project is to reconstruct the phylogeny of areas of the Boraginaceae phylogeny using plastid genomes to better understand patterns of evolution of these various groups. The research is focused on particular areas of the evolutionary tree (e.g., *Hackelia* [*Eritrichium* is a relative in the same tribe], *Mertensia*, and *Onosma*) that remain underexplored, particularly from a phylogenomic perspective. CUBG provided leaf material and seed to researchers of target taxa for this project.

Nelson Ari Wilhelm
Aarhus University, Aarhus, Denmark
With a backdrop in Anthropology, this research focuses mainly on historical and current junctions of the proliferation of *Hedychium gardnerianum* which is regarded as a heavily threatening invasive plant in the Azores Archipelago that has been putting immense pressure on the local endemic forest over the last decades. The research shows CUBG as an intermittent host of the ornamental plant that bridged one decisive stage of the trajectory from the Himalayas, where the plant originates from, to the Azores Archipelago. The researcher requested archival information about the plants historically in the collection, particularly documentation on its export to Jardim Botanico José do Canto in Sao Miguel, the Terra Nostra Park in Sao Miguel, or other institutions across the Azores islands as well as documentation on the import of the plant from the Himalayas to the Cambridge University Botanic Garden.

Sean Lahmeyer
Huntington Botanic Garden, California, USA
This project is aimed at determining the status of *Juglans californica* in cultivation around the world. CUBG provided accession level data for the plants of this taxon in our collection.

Total # accessions

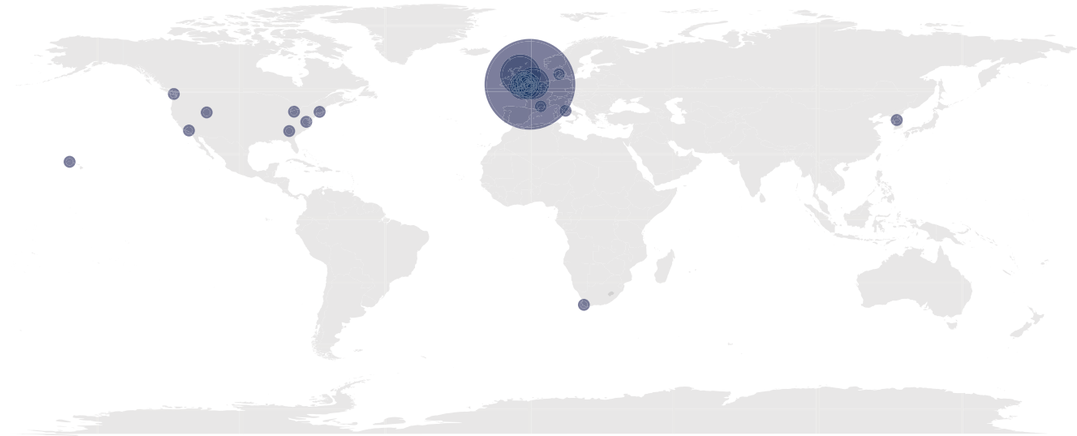
129 accessions supplied to 26 institutions.

Plant material supplied to other gardens

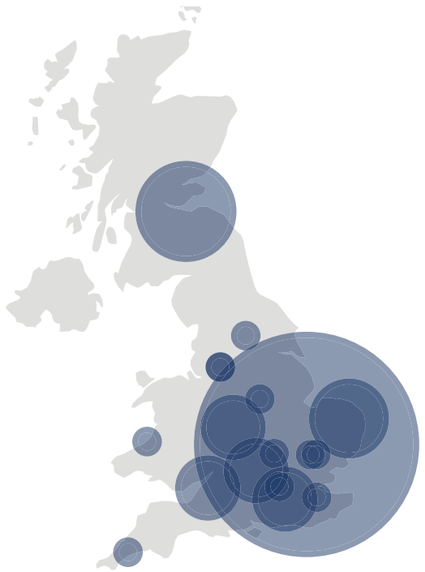
69 accessions of 68 taxa supplied to 11 other gardens.

Affiliation	Contact's Country
St. John's College, University of Cambridge	UK
RHS Harlow Carr	UK
Churchill College, University of Cambridge	UK
Birmingham Botanical Garden	UK
University of Oxford Botanic Garden	UK
Wolfson College, University of Cambridge	UK
Stellenbosch Botanical Garden	South Africa
Royal Botanic Garden, Edinburgh	UK
Royal Botanic Garden, Kew	UK
National Trust, Aberaeron	UK
Eden Project	UK

Cambridge University Botanic Garden exchanges 2023 – 2024



CUBG exchanges within the UK 2023 – 2024



Publications

E Bailes, J Moscrop, S Mitchell, M Dorling, T Wood, J Thomas, B Glover 2023 Bumblebee responses to variation in pollinator-attracting traits of *Vicia faba* flowers. *Ecology and Evolution, 13,e10617.*

R Fattorini, FN Khojayori, G Mellers, E Moyroud, E Herrero, RT Kellenberger, R Walker, Q Wang, L Hill, BJ Glover 2024 Complex petal spot formation in the Beetle Daisy *(Gorteria diffusa)* relies on spot-specific accumulation of malonylated anthocyanin regulated by paralogous GdMYBSG6 transcription factors. *New Phytologist* 243, 240-257.

GV Davis, BJ Glover 2024 Characterisation of the R2R3 Myb subgroup 9 family of transcription factors in tomato. *Plos one*, 19, 3 e0295445.

BJ Glover, H Symington 2024 Strawberry varieties differ in pollinator-relevant floral traits. *Ecology and Evolution* 14 (2), e10914.

J Ferria, SL Saladin, U Ponraj, R Wightman, C Giorio, CA Airoldi, BJ Glover 2024 HtDCR-like1 regulates the development of structurally coloured cuticle by modulating cuticle chemistry and mechanical properties in *Hibiscus trionum*. bioRxiv 2024.04.11.589056.

CA. Airoldi, C Chen, H Herrera-Ubaldo, H Fu, CA Lugo, AJ. Crosby, BJ Glover 2024 Characterisation of cuticle mechanical properties: analysing stiffness in layered living systems to understand surface buckling patterns. *bioR|xiv*, 2024.03. 27.587033.

E Bailes, J Moscrop, S Mitchell, M Dorling, T Wood, J Thomas, B Glover 2023 Bumblebee responses to variation in pollinator-attracting traits of Vicia faba flowers. *Ecology and Evolution* 13 (11), e10617.

J Pattrick, H Symington, W Federle, B Glover 2023 Bumblebees negotiate a trade-off between nectar quality and floral biomechanics. *Iscience 26* (11).

TE Kongsted, BJ Glover 2023 Phylogenetic analysis of bHLH classes III and IV in land plants and their algal relatives. *New Phytologist* 240, 1717-1721.

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G Centenaro, BJ Glover, A Piermattei, PW Thomas, T Čejka, U Büntgen 2023 The importance of botanic gardens for global change research – New insights into Cambridge's hidden truffle kingdom. *Plants, People, Planet* 5 (3), 329-334

RT Kellenberger, U Ponraj, B Delahaie, R Fattorini, J Balk, S Lopez-Gomollon, KH Müller, AG Ellis, BJ Glover 2023 Multiple gene co-options underlie the rapid evolution of sexually deceptive flowers in *Gorteria diffusa*. *Current Biology* 33 (8), 1502-1512.

A Murphy, S Jiang, J Elderfield, A Pate, C Halliwell, BJ Glover, N Cunniffe, J Carr 2023 Biased pollen transfer between virus-infected and non-infected plants by bumblebees favors the paternity of infected plants in cross-pollination. *IScience* 26(3).

E Cullen, Q Wang, BJ Glover 2023 How do you build a nectar spur? A transcriptomic comparison of nectar spur development in Linaria vulgaris and gibba development in *Antirrhinum majus*. *Frontiers in Plant Science* 14, 1190373.

K Feng, JF Walker, HE Marx, Y Yang, SF Brockington, MJ Moore, RK Rabeler, SA Smith 2024 The link between ancient whole-genome duplications and cold adaptations in the Caryophyllaceae. *American Journal of Botany* e16350.

B Pucker, N Walker-Hale, J Dzurlic, WC Yim, JC Cushman, A Crum, Y Yang, SF Brockington 2024 Multiple mechanisms explain loss of anthocyanins from betalain-pigmented Caryophyllales, including repeated wholesale loss of a key anthocyanidin synthesis enzyme. *New Phytologist* 241,1, 471-489.

T Feng, B Pucker, T Kuang, B Song, Y Yang, N Lin, H Zhang, MJ Moore, SF Brockington, Q Wang, T Deng, H Wang, H Sun 2023 The genome of the glasshouse plant noble rhubarb (*Rheum nobile)* provides a window into alpine adaptation. *Communications biology* 6 (1), 706.

M Alejandra Guerrero-Rubio, N Walker-Hale, R Guo, H Sheehan, A Timoneda, F Gandia-Herrero, SF Brockington 2023 Are seven amino acid substitutions sufficient to explain the evolution of high l-DOPA 4,5-dioxygenase activity leading to betalain pigmentation? Revisiting the gain-of-function mutants of Bean et al. (2018). *New Phytologist* 239, 2265-2276.

JE Householder, F Wittmann, J Schöngart, MT Fernandez Piedade, WJ Junk ... A Cano and other authors 2024 One sixth of Amazonian tree diversity is dependent on river floodplains. *Nature ecology & evolution* 8, 5, 901-911.

AR Zuntini, T Carruthers, O Maurin, PC Bailey, K Leempoel, ... A Cano and other authors 2024 Phylogenomics and the rise of the angiosperms. *Nature* 629, 843–850.

DLM Cooper, SL Lewis, MJP Sullivan, PI Prado, HT Steege ... A Cano and other authors 2024 Consistent patterns of common species across tropical tree communities. *Nature* 625, 728-734.

E Pos, L de Souza Coelho, D de Andrade Lima Filho, RP Salomão, ... A Cano and other authors 2023 Unraveling Amazon tree community assembly using Maximum Information Entropy: a quantitative analysis of tropical forest ecology. *Scientific reports* 13 (1), 2859.

DF Correa, PR Stevenson, MN Umaña, LS Coelho, DA Lima Filho, ... A Cano and other authors 2023 Geographic patterns of tree dispersal modes in Amazonia and their ecological correlates. *Global ecology and biogeography* 32 (1), 49-69.

V Peripato, C Levis, GA Moreira, D Gamerman, H ter Steege, ..., A Cano and other authors 2023 More than 10,000 pre-Columbian earthworks are still hidden throughout Amazonia. *Science* 382,103-109.

Research Facilitated

Weather

Katie Sarll
Nursery & Experimental Horticulturalist

October 2023 – September 2024

Summary of the year

The winter was mild and wet with some cold temperatures towards the end. This pattern continued into the spring season. The summer had some high temperatures and long dry spells. The total annual rainfall was above average at 835.7mm.

Month by month

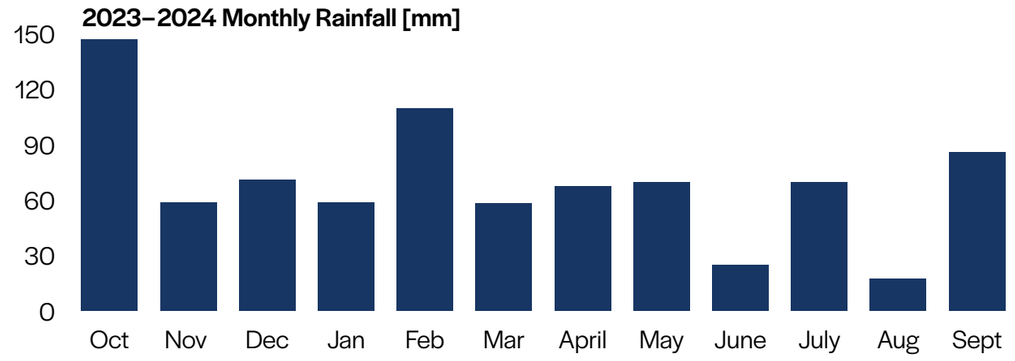
- October was mild and wet throughout with 35.7mm of rain on the 12th and a maximum temperature of 25.2°C on the 10th. October had the highest monthly rainfall total of the year, at 146.6mm.
- November was a damp month with the heaviest deluge on the 2nd at 13.0mm. Night temperatures dipped as low as – 4.2°C on the 30th.
- December was cold throughout the month, with a minimum temperature of – 2.7°C on the 3rd.
- January was a very cold month, with a low of – 7.1°C on the 18th. Several days of heavy rainfall culminated with 21.5mm on the 5th, then only small amounts of rain fell from the 6th onwards.
- February started to warm up from the second half, with 17.1°C on the 16th and no frosts. It was a wet month, with a total of 109.2mm rainfall for the month.
- March was mild and damp throughout, with a high temperature of 17.2°C on the 15th and 13.8mm of rain on the 1st.
- April had a cool and wet start to the month, with intermittent days of warmth. The highest temp was 20.7°C, recorded on the 13th, but a low of – 1.1°C was recorded on the 26th.

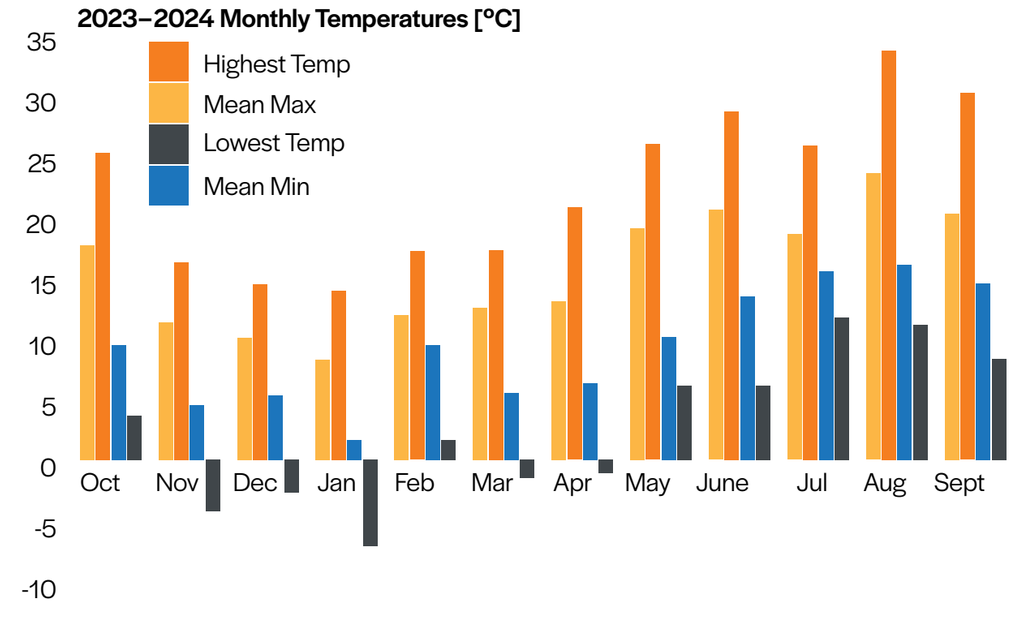
The winter was mild and wet with some cold temperatures towards the end. This pattern continued into the spring season. The summer had some high temperatures and long dry spells. The total annual rainfall was above average.

- In May there was sporadic rain throughout the month, with 30.2mm on the 22nd. Seasonal warm temperatures were recorded throughout the month with the highest of 25.9°C on the 13th.
- June was a very dry and consistently hot month, with 28.6°C on the 26th, getting wetter towards the end with 5.8mm of rain on the 14th.
- July was a mild month, with a maximum of 25.8°C on the 19th July. Moderate amounts of rain fell throughout the month, with 22.2mm on the 6th, contributing to an overall sense of a damp summer.
- August was consistently dry and warm with a maximum temperature of 33.6°C (the highest of the year) on the 13th and 7.5mm of rainfall on the 25th.
- September was consistently warm throughout, with a maximum temperature of 30.1°C on the 2nd and minimum of 8.3°C on the 28th. This month saw the third highest rainfall for the year at 85.6mm for the month, which contributed to the above average total annual rainfall.

835.7mm Rainfall this year

33.6°C Year's warmest temperature





Funding

Rachel Agnew
Finance Manager

In many ways, a bumper year for the Garden! Income was good, increasing considerably through trading activities, particularly with the introduction of our new Cambridge Botanic Lights winter event that was enjoyed enormously by visitors (and staff!).

We were delighted to receive an increased number of Legacies and In Memory donations, helping support the work of the Garden, to include funding initial development of the Garden's Masterplan – a key 10-20 year strategy document that will help guide and steer the Garden successfully into the future.

Expenditure increased, with continued planned investment in our collections, horticulture, learning and development. Additional funds were spent in support of trading activity, driving new revenue streams.

This year, funding was set aside for capital developments (Station Road Welcome Building, Masterplan and a new site-wide Irrigation project). Significant investment was also made in the 'Research Fund', an investment fund created to support and showcase science and research through a variety of means, aiding academic researchers and students, all firmly underpinned by the Garden's strategic goals.

University financial support for the Garden continues to be under review with funding cuts in place for 2024-25 and more significant reductions on the horizon, partially absorbed through existing mitigatory plans to diversify and extend revenue streams.

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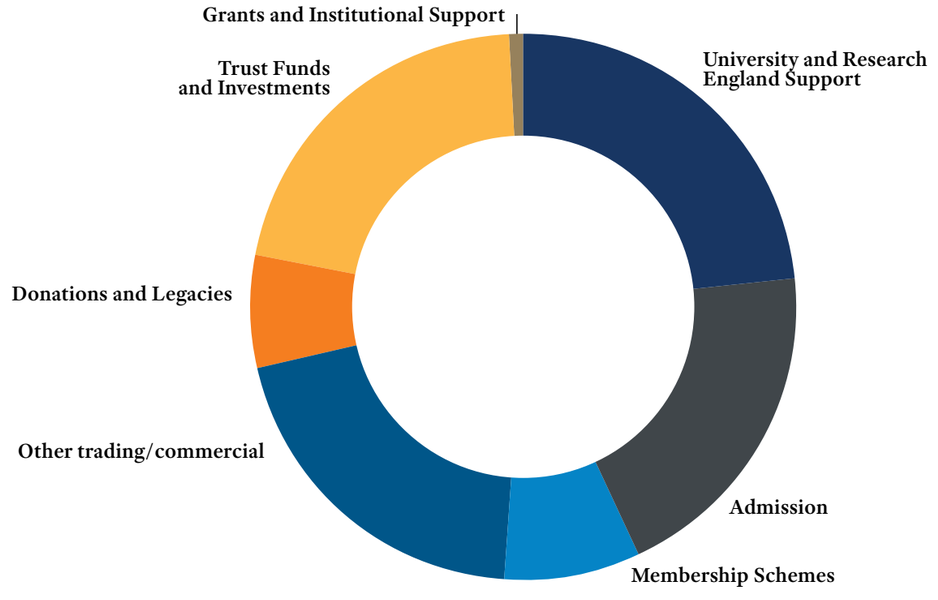
'Expenditure increased, with continued planned investment in our collections, horticulture, learning and development.'

Income	2023-24 £K	2022-23 £K
University and Research England Support	1,136.8	1,145.8
Admission	942.6	859.9
Membership Schemes	397.1	375.9
Other trading/commercial	978.5	402.1
Donations and Legacies	314.6	199.9
Trust Funds and Investments	1,026.9	925.8
Grants and Institutional Support	31.7	38.2
Total Income	**4,828.2**	**3,947.6**

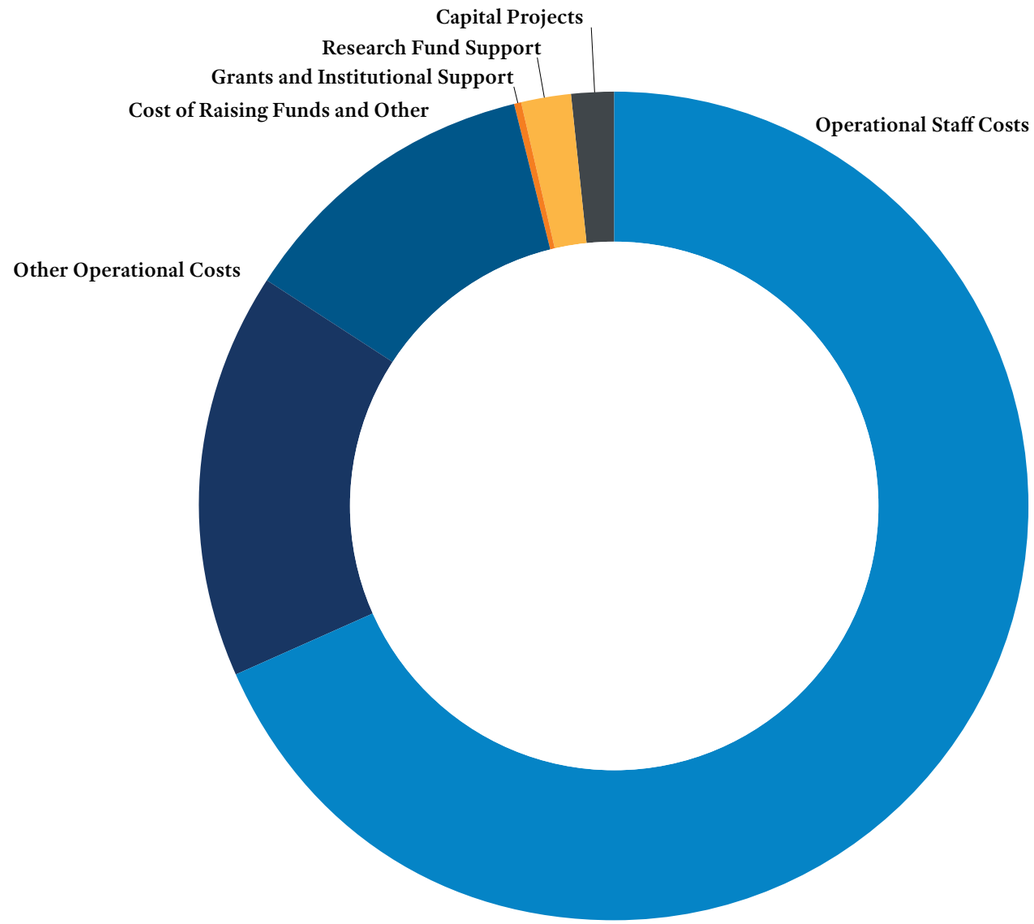


‘This year, funding was set aside for capital developments (Station Road Welcome Building, Masterplan and a new site-wide Irrigation project).’

Expenditure	**2023-24 £K**	**2022-23 £K**
Operational Staff Costs	2,689.2	2,514.5
Other Operational Costs		
Collections, Conservation and Horticulture	265.7	259.1
Learning and Outreach	23.0	14.4
Development and Communication	40.0	25.5
Estates and Maintenance	32.1	22.8
Administration and Systems	176.9	146.4
Other Operational	78.7	62.4
Cost of Raising Funds and Other	467.1	172.2
Research Fund Support	76.3	40.9
Grants and Institutional Support	17.2	34.1
Capital Projects	54.7	60.0
Total Expenditure	**3,920.8**	**3,352.3**
Total Income less Total Expenditure:	907.3	595.3
Plus: Adjustment for Strategic Research Initiative ‘Collections, Connections, Communities’	6.2	0.0 *
Less: Earmarked funds held for future planned expenditure	-888.0	-611.6 **
Funds remaining for discretionary use	**25.5**	**-16.3**

* Strategic research funding held for ‘Collections, Connections and Communities’ – Funding managed by CUBG on behalf of the initiative. For more information visit *https://www.ccc.cam.ac.uk/.*

**Includes specifically funded activity and comitment of funds towards the Garden’s Capital Projects *https://www.botanic.cam.ac.uk/the-garden/development-of-the-garden/current-projects/*



Funding

‘We are also hugely thankful for the numerous donations received at our ticket offices, online or in our donation boxes.’

Donations

Sponsor a Tree Scheme

Thank you to all those that have sponsored a tree, celebrating a special person or occasion.

A total of £6,000 was raised, supporting the valuable work of the Garden.

Individual Gifts and Donations

Grateful thanks to those individuals funding specific activity this year, supporting capital and other projects, along with the salary of a Horticultural Trainee.

We are also hugely thankful for the numerous donations received at our ticket offices, online or in our donation boxes, as well as all the time donated by our volunteers. Thank you, as always, for such generous support.

Legacies, Bequests and In Memory

Monica Beck £124,624
Rita Christie £11,872
Jane Shears £10,000
Many thanks also to those giving In Memory of a loved one.

Grants, Trusts and Societies

Gatsby Foundation, support towards School Travel Bursary scheme £25,000, Year 1 of 3.

Corporate and Other Support

Mills & Reeve sponsorship of the Winter Lights £10,000
Mills & Reeve sponsorship of the Easter Trail 2024 £6,000
Birketts sponsorship of Sounds Green Summer Music Series 2024 £7,000
Sainsbury Laboratory, 2024 Festival of Plants contribution £1,000
The Fitzwilliam Museum, support towards ‘our planet’ themed activities £3,730

Thanks also goes to the Henslow Circle, Friends and Corporate Friends for their generous and unwavering support, and to those who continue to make significant gifts over and above the annual renewal subscription.

...and lastly thanks to all our visitors and those who have chosen to Gift Aid admissions, subscriptions, and donations, helping to support the continuing work of the Garden.

The development of Cambridge University Botanic Garden has been made possible thanks to the generosity of generations of supporters.

If you would like to find out more about how you can support the work of the Garden, please visit our website: *https://www.botanic.cam.ac.uk/join-support/donate/*

Syndicate & Cory Managers

Four meetings of the Botanic Garden Syndicate were held during the year under the Chairmanship of Dame Fiona Reynolds.

Syndicate members

Professor David Coomes, Professor Jon Drori (external), Dr Laurie Friday, Dr Ian Furner, Dr Amy Gilmour (from November 2023), Mr Donald Hearn, Professor Christopher Howe, Professor Henrik Jönsson, Professor Rebecca Kilner, Professor Kamal Munir, Mr Bert Titley (student member for one year), Professor Julian Hibberd and Dr Rosy Thornton (to November 2023). The Secretary was the Garden’s Director, Professor Beverley Glover.

Cory Managers

The Cory Managers met four times during the year under the Chairmanship of Professor Julian Hibberd (Head of the Department of Plant Sciences).
Managers for the year were:
Mr Michael Allen (to July 2023), Professor David Cebon, Professor Howard Griffiths, Dr Kate Maxwell, with Mr David Sizer as the representative of the Director of Finance.

Corporate Friends

Redwood Friends

Studio 24 Ltd Cambridge Design Partnership Abcam Limited GMSL Cambridge University Press & Assessment Microsoft MRC Toxicology Unit Nu Quantum Ltd Domino UK Limited Cantab Asset Management Costello Medical Mills & Reeve

Oak Friends

Cambridge Mechatronics Ltd Cogentia Healthcare Consulting Ltd Department of Pharmacology Hills Road Sixth Form College Mishcon de Reya LLP The Leys School Uncommon Development & Alumni Relations Marshall Sports and Social Club Select English Faculty of Law Gurdon Institute Judge Business School Kennedys Ansys UK Ltd Penningtons Manches Cooper LLP School of Clinical Medicine St Andrews Tutorial College Ltd Cambridge Econometrics Harrison Clark Rickerbys Ltd K J Tait lowRisc CIC Pembroke College Yusuf Hamied Department of Chemistry Churchill College Cam Medical Primary Care Network Entrust (NCIPHER) Siemens Industry Software Ltd CCDC Department of Physiology, Development & Neuroscience Faculty of Education Isaac Newton Institute for Mathematical Sciences University of Cambridge; Department of Biochemistry, Wellness, Equality and Diversity Committee AstraZeneca Cambridge Innovation Capital Ltd Cambridge Nutraceuticals Clare Hall Downing College Geant Association Stantec UK Ltd Uni. Of Cambridge, Department of Geography Arcus Foundation Cambridge Flow Solutions Ltd Hughes Hall, University of Cambridge Quantinuum Ltd Samsung Cambridge Solution Centre Social Club WeWork Dept of Pathology Cambridge University Birketts LLP Cambridge Bid Ltd Cambridge Water (South Staffs Water) Cambridgeshire Police Federation Department of Earth Sciences Department of Psychology Department of Veterinary

148 Corporate Friends

12 Redwood Friends

136 Oak Friends

Medicine DPMMS, University of Cambridge Fauna & Flora Genomics plc Gonville & Caius College HP UK Development Ltd Maison Clement Bakery & Patisserie Ltd Research Office St Faith's School The Tuesday Project Ltd Hoare Lea Department of Criminology Lucy Cavendish College RAND Europe Community Interest Company University of Cambridge, Architecture Cambridge City 4 PCN Ltd Cambridge Commonwealth, European & International Trust Cambridge Education Group Department of Genetics EMBL-EBI Staff Association Graphcore Ltd Intrasonics Ltd John Lewis Cambridge Lynfield Management Office of Intercollegiate Services Ltd Savills (UK) Ltd Staff Counselling Centre Stephen Perse Foundation Stephen Perse Foundation Thomson Webb & Corfield LLP University of Cambridge, Information Services WSP ARM Ltd Gilead Sciences Peters Elworthy & Moore Qualcomm Sports & Social Club Royal Albert Homes Department of History & Philosophy of Science Howes Percival Fitzwilliam Museum CGL Deloitte LLP Cambridge Consultants Ltd Cambridge Intelligence Ltd Engineering Department Evonetix Ltd FORA Marks & Clerk LLP Mediatex Nash Matthews LLP Natural England NIAB Raspberry Pi Foundation Sancton Wood School Taylor Wessing Vypercore Samsung AI Center Mantle Space Softwire Brookgate Development Management Ltd Emmanuel College Cambridge Homerton College Institute of Astronomy University of Cambridge King's College Cambridge MRC-Cognition and Brain Sciences Unit SLB Cambridge Research The Biodiversity Consultancy Ltd Vine FX Ltd Cambridge Institute for Sustainability Leadership Saunders Boston Limited St Catharine's College Five AI Cambridge Investment Management Ltd Carter Jonas Department of Archaeology Eversheds Sutherland LLP Healx Ltd Howard Ventures Ltd Mott MacDonald Ltd MPW Trinity College Stone King LLP

Botanic Garden Staff

Director
Beverley Glover
EA to Director: Jane Adams

Assistant Director (Audiences & Enterprise)
Paul Pomfret (to May)

Administration
Departmental Administrator: Wendy Godfrey
Assistant Administrators: Richenda Whitehead and Caty Cooke
Learning Administrator: Lucy Watts
Friends Administrator: Sacha Watson (to March), Helen Llewelyn (from April)

Curation
Curator: Sam Brockington
Assistant Curator: Ángela Cano
Plant Records Officer: Pete Atkinson
Collections Co-ordinator: Margeaux Apple
Curation Assistants: Mar Millan and Nadiia Rositska
Biodiversity Informatician: Jake Powell (to September)

Development
Head of Development and Communications: Anna Patterson Lee
Marketing and Communications Co-ordinator: Helen Needham
Marketing Assistant: Katy Lawrence

Estates
Head of Estates and Operations Manager: Carl Tatterton
Estates Manager: Phil Starling

Finance
Finance Manager: Rachel Agnew
Finance Coordinator: Mayur Joshi (to December), Danielle Martin (from March)
Finance Administrators: Elaine Dalton and Rebecca Chapman (to January), Mark Devlin (from March)

Horticulture
Head of Horticulture: Sally Petitt
Horticultural Displays: Team Leader – Paul Aston; Senior Horticulturist Western Display – Rut Gallmeier (to July), Jonathan Strauss (from September); Assistants – Pete Wrapson, Alice Riches, Jonathan Strauss (to September), Reshma Shah (from June, Maternity Cover); Senior Horticulturist Eastern Display – Andrea Topalovic Arthan, Assistant – John Kapor
Garden Landscapes: Team Leader – Tom Wheatcroft (from February); Senior Horticulturist Landscape and Machinery – Adrian Holmes, Assistant – Ross Gildea, Ralph Dolan (from May): Assistant Trees and Shrubs – Richard Denham and Lewis Dearn
Glasshouses: Team Leader Glasshouses and Nursery – Luigi Leoni; Senior Horticulturist Nursery & Experimental – Simon Wallis, Assistant – Katie Martyr, Lauren Fear (to September); Glasshouses Senior Horticulturist – Kathryn Bray, Assistant – Barbara Griffith
Weekend Horticultural Assistant: Stefania Martinico (from April)

Trainee Horticultural Technicians September 2023 – September 2024
Jacky Hall, Jerrod Macnaughton, David Mullen, Charlotte Seers, Rosamund Stafford, Hannah Fisher, Rebecca Gulliver.

Learning
Head of Learning: Holly Clothier (from May)
Learning Officers: Sally Lee, Raphaella Hull
Schools Learning Officer: Bronwen Richards, Hannah Elkington, Bridget Carter (Maternity cover)
Community Learning Co-ordinator: Louise Campbell

Visitor Services
Head of Visitor Services: Nicci Steele-Williams
Deputy Head of Visitor Services & Team Leader: Laura Welford
Team Leaders: David Evans and David Radley
Visitor Services Assistants: Amanda Wilkins, Lucinda Fudge, Sue Baker, Alicia Lloyd, Saphia Kaikati, Tom Austin, Martha Gough (from October), Kirsty Mather (from March), Hannah Sell (from March), Jess Wilson (from April), Hetty Lucas (to August), Eilidh Bodfish (to December), Chris McFarlane (to March), Charlotte Pearce (to January),
Visitor Services Receptionist: Heloise Toop, Bryony Toop (from March, Maternity cover)

Botanic Garden Staff Activities

The following members of staff have contributed to external organisations and groups in connection with their posts:

Professor Beverley Glover: fellow of Queens' College; member of the Science Advisory Committee of the Royal Botanic Garden Edinburgh; member of the Scientific Advisory Board of the Max Planck Institute for Plant Breeding Research; member of the Council of the European Society for Evolutionary Developmental Biology; Chair of the Council of Scientists of the Human Frontier Science Programme (until end 2023); member of the Botanical Society of America; member of the British Society for Developmental Biology; Fellow of the Linnean Society; patron of the Cambridgeshire Gardens Trust; vice president of the Cambridgeshire Beekeepers' Association; member of the Advisory Board of New Phytologist; Strategic Advisor to 'Plants, People, Planet'; member of the Editorial Board of Current Opinion in Plant Biology; member of the Natural Environment Research Council's Peer Review College; gave talks at the Royal Botanic Garden Kew, the Human Frontier Science Programme Awardees meeting in Cape Town, at Kenyatta University (Nairobi), at Hills Road Sixth Form College, at the Perse School, at the Gatsby Plant Science Summer School, at the University of Leeds and gave a plenary lecture at the International Botanical Congress in Madrid.

Botanic Garden Staff

Professor Samuel Brockington: Academic Lead for the Cambridge University Herbarium; co-Chair of the Collection-Connections-Communities Strategic Research Initiative, Trustee and council member for the Bedfordshire, Cambridgeshire, and Northamptonshire Wildlife Trust (BCN-WT); Chair of BCN-WT Conservation, Education and Communities Committee, member of the Great Fen Steering Group; Trustee for Thrive (Social and Therapeutic Horticulture); fellow of the Linnean Society; member of the High Value Biorenewables Network; member of the Botanical Society of America; member of the Darwin Tree of Life Plant Steering Group; gave talks at the International Botanical Congress in Madrid and the International Botanic Gardens Congress in Singapore, and a keynote talk at the International Workshop on Anthocyanins and Betalains in Leeds.

Carl Tatterton continued as a trustee of the Hobson's Conduit Trust.

Helen Needham continued as a member of the Great Days Out In & Around Cambridge committee.

Sally Petitt continued as chair of the Merlin Trust (which provides travel awards to young horticulturalists) and as a member of the Borde Hill Garden Council. She continues to serve on the Royal Horticultural Society (RHS) Education Committee and the RHS Joint Rock Garden Committee.

Luigi Leoni is a member of the RHS Orchid Committee.

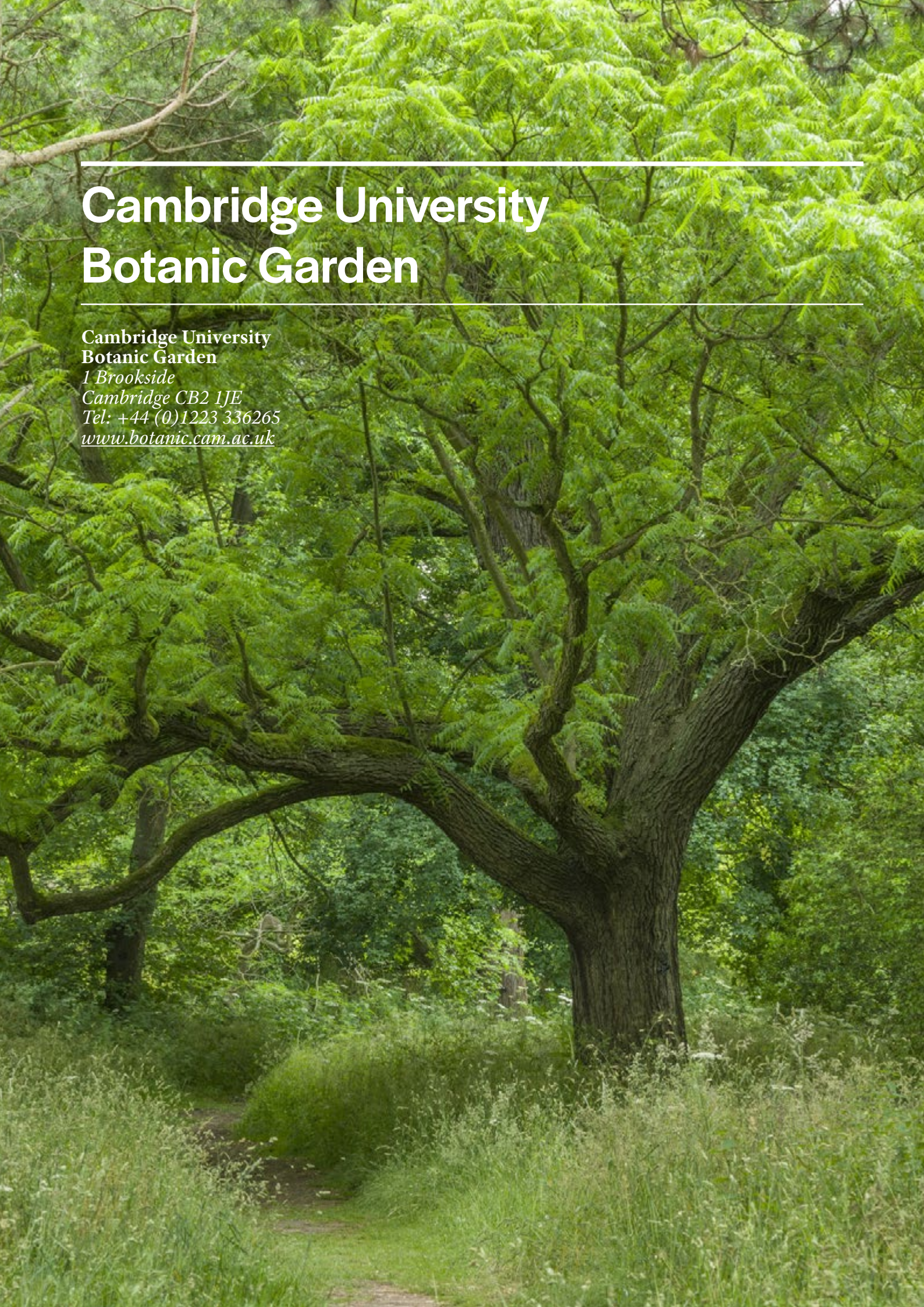
Dan Jenkins is a fellow of the Royal Society of Biology, continued as a member of the Curriculum Committee, Plant Science Group, Biology Education Research Group and the Education Policy Advisory Group at the Royal Society of Biology. Elected as a member of the Policy Group at the Association for Science Education.

Claire Pennycuick continued as a member of the Careers Committee of the Royal Society of Biology.

Alex Jenkin continued as a member of the Biology Education Research Group and Outreach and Engagement Working Group of the Royal Society of Biology.

Dr Chris Graham was elected to the Education Science and Policy committee of the Royal Society of Biology.

'Thank you to everyone who has supported the Garden this year – with an admission ticket, Friends membership, donation, gifts in wills, corporate sponsorship and more. It all makes a difference and is hugely appreciated.'



Cambridge University Botanic Garden

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