Cambridge University Botanic Garden

Annual Report & Accounts

2019–20

Cambridge University Botanic Garden

UNIVERSITY OF CAMBRIDGE

"I am delighted to note that the Cambridge Botanic Garden, which has offered some solace throughout the lockdown with its weekly virtual walks, is once again opening its gates... The Botanic Garden's team has been working very hard during lockdown to make sure that the Garden is at its best for visitors upon reopening, and I cannot thank them enough."

Professor Stephen Toope, ***Vice-Chancellor***
11 June 2020

Cambridge University Botanic Garden
Annual Report 2019-2020

Contents

Cambridge University Botanic Garden (CUBG) supports University teaching and research while also being a place of enjoyment and inspiration to visitors of all ages. The Botanic Garden is one of the largest University-owned botanic gardens in the world. Opened to the public in 1846, the 40-acre Garden has an unparalleled living collection of over 8,000 species, including nine National Collections, with glasshouses, experimental plots, lake, herbarium and botanical library.

CUBG also collaborates with national and international researchers from a wide range of partner organisations, including universities, conservation bodies and botanic gardens worldwide, to promote the conservation and scientific understanding of global plant biodiversity.

The Garden offers year-round inspiration for gardeners as well as an exciting introduction to the natural world for families through a programme of family, school and adults' activities and events.

Cover image © Paul Grover
Design: Paul Oldman (www.smithltd.co.uk)

Director's Report

Professor Beverley Glover
Director CUBG

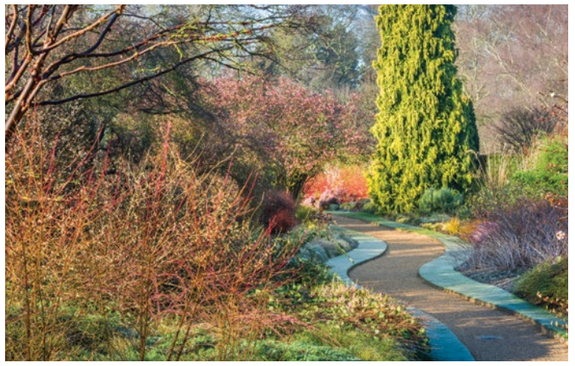
This year has presented a unique set of challenges to Cambridge University Botanic Garden, as we tried to focus on our core goals of supporting a globally excellent network of research and teaching around plants while providing stimulating opportunities for educational groups and visitors to engage with our living collection. The effects of the Covid-19 pandemic on all of our activities can be felt throughout this report.

Our intention this year had been to focus on the launch of our Living Collections Strategy in November 2019 and on our contribution to studying and responding to the Climate Emergency. The year began well, with the Living Collections Strategy launched to great fanfare in November 2019. Botanic Gardens Conservation International (BGCI), the umbrella group that supports all botanic gardens worldwide, chose the same opportunity to award us a Certificate of Accreditation, in recognition of our work to ensure that our collection is well managed and accessible. Paul Smith, the Secretary General of BGCI, joined the Curator, Sam Brockington, and I in the Sainsbury Laboratory auditorium to formally launch the Collections Strategy and hand over the Accreditation Certificate. An audience of stakeholders and friends from within the University and beyond, including our colleagues from other botanic gardens across the country, helped us to celebrate these twin achievements. With the last glass of Curator's Gin lifted in celebration, we settled down to implement the Strategy, with a twin focus this year on new collecting expeditions and on better management of the collections we have. At the same time, we continued to explore the sustainability of our own operations, improving our performance sufficiently to win our first Silver Award from the University's Green Impact scheme, and also developed and launched our first Climate Change trail in collaboration with Cambridge Zero.

However, the gathering storm of Covid-19 made its presence felt early in the new year, and our focus shifted sharply to responding to the immediate crisis. We established a small Emergency Action Gold team of myself, Sam Brockington, Carl Tatterton (Head of Estate and Operations) and Wendy Godfrey (Administrator). Together we agreed that our top priorities in all responses would be (1) the safety of our staff and visitors, (2) the maintenance of our collection and its use in research, (3) remaining open to allow people to connect with plants and nature. Following this approach, we made continuous adjustments to working practices during March, but it was with great sadness that we had to close the Garden to the public on 21 March. Our office-based staff were supported in the transition to working from home, our Visitor Services team were placed on furlough, and our horticulture team moved onto a new rota in which a minimal staff of 3 attended site every day to carry out essential watering in the glasshouses.

For the next few months we remained closed to the public, and worked out how to focus on our goals from this new position. For some staff, working from home provided the opportunity to work on projects that were easily sidelined by the everyday demands of life in the office. The Curation team, for example, caught up with a backlog of mounting herbarium sheets, and at the same time put extra effort into bringing forward our Collections Portal - bringing the Garden's collection to a worldwide audience digitally. For other staff, the lockdown presented a different challenge - that of bringing activities that normally take place face-to-face to a digital audience. The Learning team and the Comms team were particularly active here, developing a regular pattern of activities with something new released every day.

'The most challenging task was to create a new ticketing model to allow entry only with pre-booked, online tickets, and to align this ticketing system with the Garden's administrative operation.'



These included our enormously popular (and still ongoing) "Wellness Wanders" (a weekly filmed walk through the Garden focusing on the changing seasons), the online Gardening Club, and regular downloadable activities for children. Perhaps the highlight of the lockdown for these teams was their joint work on our first Virtual Festival of Plants, a 3-day celebration through talks, tours, films and interactive events.

As time went on, we were able to gradually increase the number of staff on site, and the horticulture staff worked hard in new team structures to bring the Garden back to our usual high standards. We were helped by a dry spring, which kept weed growth to a minimum, but it was a massive task to restore 40 acres to its normal glory after weeks of relative neglect. While the Garden was being brought back to its proper state, we planned and prepared for reopening to visitors, benefiting from the secondment of Nicci Steele-Williams, Head of Visitor Services, to the Emergency Action Gold team. There were many new systems to be put in place - visitor and staff safety, ticketing, queueing systems, how the Café and Shop would work, ensuring supplies of gloves and face coverings and hand sanitiser, and even spraying leaves onto the floor to delineate safe social distances for our visitors around the gates and Café area.

The most challenging task was to create a new online ticketing model to allow entry with pre-booked tickets, only, and to align this ticketing system with the Garden's administrative operation.

We were able to open our gates again on June 9th. The three month closure cost us an estimated £390,000 of lost income, and the capped visitor numbers ever since have continued to have a significant negative impact on our income streams. We have worked hards to mitigate this with savings across the organisation, and by developing new income generation schemes, but the legacy of lost income will take us some time to recover from. We were able to remain open for the rest of the academic year, with varying caps on numbers depending on local and national restrictions at any one time.

We were so pleased to be able to welcome our Friends and the general public in, bringing the Garden back to its usual busy, cheerful life. Many of our early visitors shared their stories of lockdown with us, and all were delighted to be back. It has been wonderful to see people enjoying the Garden through the various difficulties of this summer and autumn, and to hear how important it is to people that we offer them a beautiful and tranquil outdoor space in this most difficult of times.

Beverley Glover
Director, CUBG

Ups and downs

Thankyou to everyone who visited the Garden this year. We appreciate your moral support as well as financial support in what was a very challenging year.

Visitors*
187,450
down 45%

Admission takings
£406K
down 35%

Web page hits
1m

Instagram followers
72% up

Twilight attendees
2,006

1st
Living Collections Strategy document published

Facebook followers
33% increase

* includes friends, groups and paying visitors.

The year in pictures

2019

October

Apple Day

3,873

Apple Day visitors

November

Living Collections Strategy launch and BGCI Accreditation
Beverley Glover accepts BGCI Accreditation from Paul Smith of the BGCI.

Rare orchid
Flowering of the rare orchid *Bulbophyllum phalaenopsis.*

December

2020

Work starts on the eastern boundary fence and gate replacement.

January

February

Twilight at the Museums
Highest ever visitor numbers.

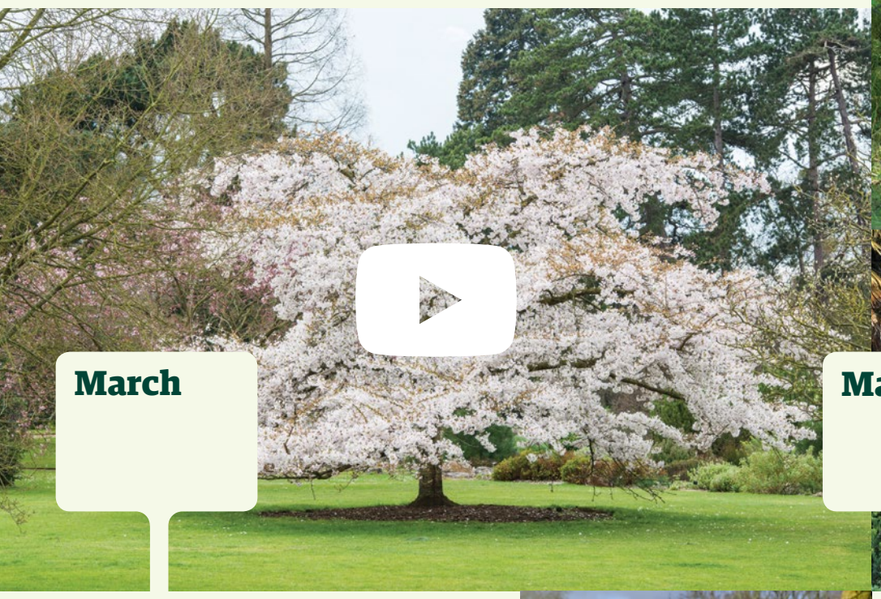
2,006

'Twilight' attendees

A year in pictures

Garden closes

Garden closes
to the public on 21 March.

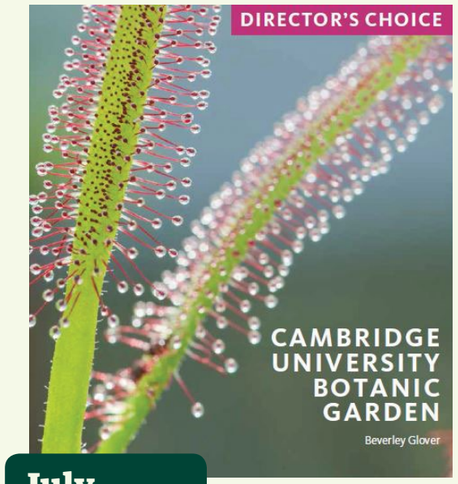


March

June

May

Guidebook
Director's Choice
Garden Guidebook
published.



July

Garden re-opens

The garden re-opened
to the public on 16 June
and we were delighted to
welcome visitors back.

September

PlaMatSu exhibition opens.

Virtual Visiting
The first Wellness Wanders
allow people to see online
what's happening in the
Garden during spring while
the gates are closed.

April

CUBG featured in BBC1 Heavenly Gardens programme on Good Friday
Image: Heavenly Gardens
presenters, Alexander Armstrong
and Arit Anderson.

Festival of Plants
Beverley Glover presenting
a Facebook Live to an
international audience during
the online Festival of Plants.

August

Agave seedlings shared
with the public after
rare plant flowering.

Research

The diversity of roles the Garden plays in Research, both across the University and more widely, always amazes our visitors and Friends. Pages 36–40 of this Annual Report provide a summary of Research conducted in 2019–2020. As well as our primary role in providing access to plant collections and offering horticultural support for botanical projects, the Garden also provides underpinning facilities supporting research in Archaeology, Architecture, Biochemistry, Chemistry, Earth Sciences, Engineering, Geography, Physics and Zoology.

Professor Beverley Glover
Director

Dr Samuel Brockington
Curator

Understanding early land plant evolution

Each year in this annual report we select a subset of our supported research to discuss in more detail. This year we have chosen to focus on a number of projects that aim to understand the adaptations shown by the earliest land plants as they made the transition from water to land, and on the ways in which our collection of modern plants can support that work. One component of our recent Living Collections Strategy was a renewed focus on collecting the early diverging lineages of land plants including mosses, liverworts, hornworts and the lycophytes (commonly known as the club mosses). Traditionally, these have been poorly represented in the formal documented collections of botanic gardens. Yet these same lineages offer unique opportunities to gain insight into the early history of the land plants. In building the strength of our collections in these early land plant lineages, we hope to drive research into early land plant evolution, both locally and internationally. In this context it is satisfying to report that our nascent early land plant collection is already being used to sustain a variety of research initiatives, as described here.

Evolution of a waterproof coating

The plant cuticle, which is a thin waxy coating that covers the above-ground surfaces of all land plants, is regarded as a key innovation in the colonisation of land by plants. This thin waxy coating is important is preventing water loss in dry terrestrial environments. The lab groups of the Director and Curator recently collaborated to characterise the first transcription factor to be identified in controlling the development of the cuticle in early land plants, specifically the liverwort *Marchantia polymorpha*. A transcription factor is a protein that turns on the expression or activity of other genes, something like a switch that controls a developmental programme. Genes encoding transcription factors are often important evolutionary targets in the emergence of novel plant traits. The transcription factor we studied is known as MIXTA and has previously been the subject of intense study by Beverley Glover's research group, due to its role in affecting flower-pollinator interactions. The gene that encodes this transcription factor appears to have arisen just prior to the origin of the first land plants, suggesting that it may be a key link in the ability of the early land plants to make cuticle and to colonise the land. Understanding this important transition will help us to understand how all plants cope with dry environments, a potentially key thread in our ability to support plant growth in changing habitats.

Origins of plant disease

Our liverwort collections have also been the focus of interest from an international team of scientists led by Ignacio Rubios at the Centre for Research in Agricultural Genomics in Barcelona, Spain. Unusually, the team needed access to diseased liverwort individuals from our collections, which is not something we normally admit to having! But in examining these diseased individuals of the early land plant lineages, they were seeking to understand the early mechanisms of disease resistance in the first land plants, and how these mechanisms have evolved over time. The results will provide fascinating insight into the long running arms race between plants and their pathogens over the last 450 million years, providing crucial information that will support efforts to enhance the ability of crop plants to resist disease. Hopefully these outcomes will compensate for our shame in admitting to growing sick plants!

Understanding the biodiversity of the UK

Last year we reported that we were particularly thrilled to be part of the Wellcome Trust-funded Darwin Tree of Life Project. Led from the Wellcome Sanger Institute on the outskirts of Cambridge, this ambitious project aims to sequence the complete genomes of all eukaryotic species native to the UK. Our liverwort collections have been among the first plants submitted for sequencing as part of this project, and the sequences of their genomes will soon be available to feed back into the other research projects described here. It is wonderful to see how our focus on early land plant collections has already begun to drive research in unexpected directions.

Liverworts

Mosses

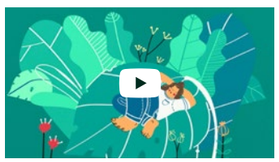
PlaMatsu exhibition in the Garden as designed by PhD students.

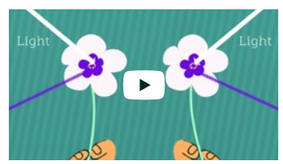
We welcome requests for material and resources from colleagues from all academic and research organisations and are delighted to be able to support such a diversity of projects.

Avoiding high light levels

When plants made the transition from water to land they were exposed to higher levels of light than ever before. This would have facilitated better growth, and taller growth habits, but was also potentially a source of stress - high light, in particular ultraviolet light, can damage cells and mutate DNA. In this context the Director's research group, in collaboration with Professor Nico Bruns at the University of Strathclyde, has been exploring how some of the early vascular plants, such as *Selaginella wildenowii*, use layered systems in the cuticle covering their primitive leaf-like structures to reflect away light. The effect of this is a blue sheen, particularly to the young leaves, which is also of interest in various ways to engineering and manufacturing industries. This collaborative research is supported by a European Union grant called an Innovative Training Network (ITN), which supports 9 PhD students in universities across Europe to explore how materials and surfaces can be developed for novel engineering applications by drawing inspiration from plants. The project is called PlaMatSu (Plant inspired Materials and Surfaces), and this year the students collaborated with the Garden's Learning team to showcase their research in a multimedia exhibition in a new summerhouse in the Garden. The exhibition opened in September and has received considerable public and media attention, as it contains both unusual plants (such as *Selaginella wildenowii*) and hands-on exhibits which explain how biological inspiration is translated into design and innovation.

We are always particularly proud to see our collections supporting research which is also translated into immediate public outreach. The PlaMatSu project is a great example of the Cambridge University Botanic Garden at its best - training PhD researchers, supporting a diverse range of research across multiple project partners in different countries, and developing innovative and engaging displays to share the research with our visitors and through our digital channels.





A film about the exhibition can be viewed at:
www.youtube.com/watch?v=eDbAZWedIc0&vl=it

Horticulture

Throughout the year the horticultural team have continued to maintain and develop plantings, collections and landscape, despite the considerable difficulties arising from Covid-19.

Sally Petitt
Head of Horticulture

A difficult gardening year

This year, Covid-19 impacted severely on our ability to maintain the Garden to our usual high standards, with only essential duties of indoor watering being carried out in the initial stages of lockdown in March and April. We were fortunately able to increase our input and staffing levels to include weeding and mowing as summer progressed, and in July to see the return of all the horticultural staff to the Garden full time. We were, however, unable to grow our normal diverse selection of annuals to bolster summer displays. Progress during the summer months was also hampered by an especially dry spring and summer, and although this suppressed growth of lawns and weeds, much of our time was spent watering glasshouse collections, and ensuring that key plantings, especially of areas planted in autumn and winter, were sufficiently irrigated. Despite these challenges we were pleased to be able to maintain the Garden so that when we re-opened it was tidy and presentable.

A new annual meadow

One area in which we did have success with annuals was an area between the Plant Growth Facility and the Experimental Plots, dissected by the North Walk. Previous plantings here consisted of collections of *Lavandula*, (lavenders) and *Rosmarinus* (rosemary), but these had been propagated and relocated to other areas of the Garden. Following earlier successes with annual seed mixes in the Garden we decided to implement a similar planting here, which would bring high summer colour and interest to this area, which is seeing an ever-increasing footfall. During late winter the Trees and Shrubs team and the Landscape and Machinery team prepared the site, levelling and stone burying, and in early spring a seed mix was sown across the site, just in advance of the March lockdown. This proved to be a very successful display, being low maintenance at a time when staff numbers were reduced, and flowering to coincide with the re-opening of the Garden on 9 June. Visitors were able to delight in an uplifting throng of waves of fresh, vibrant blooms of *Papaver rhoeas* (common poppy), *Glebionis segetum* (corn marigold) and *Centaurea cyanus* (cornflower), which were interspersed with *Phacelia tancetifolia* (fiddleneck), which emerged as a remnant from a previous annual sowing. Though in its prime for a limited spell, this really served to bring a smile to the faces of our returning visitors as lockdown eased.

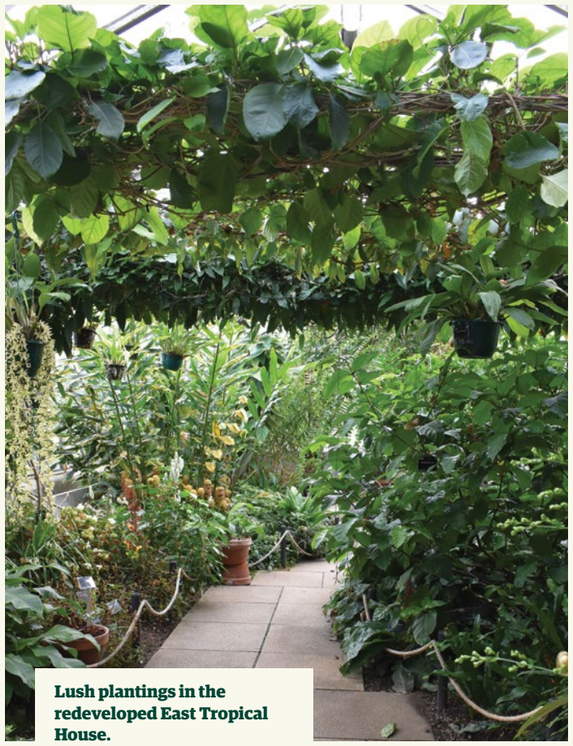
A concerted effort on the Systematics Beds during lockdown.

Winter Garden

In 2019 we celebrated the 40th anniversary of the Winter Garden. This remains amongst our most popular features, regarded by many as the primary example of winter season planting, regularly featuring in horticultural magazines and being a regular fixture for horticultural colleges. The success of the Winter Garden is down not only to the vision of Peter Orriss and Norman Villis, but also to the continued maintenance and development of this planting, which ensures it remains fresh and relevant even today. This development is on-going, with changes being made to the display each year, and resulting in the removal of specimens either past their prime, or outdated, and replaced with new plants, and often new species to ensure the Winter Garden remains as fresh and inspiring today as it did at its conception.

New plantings in the Winter Garden.

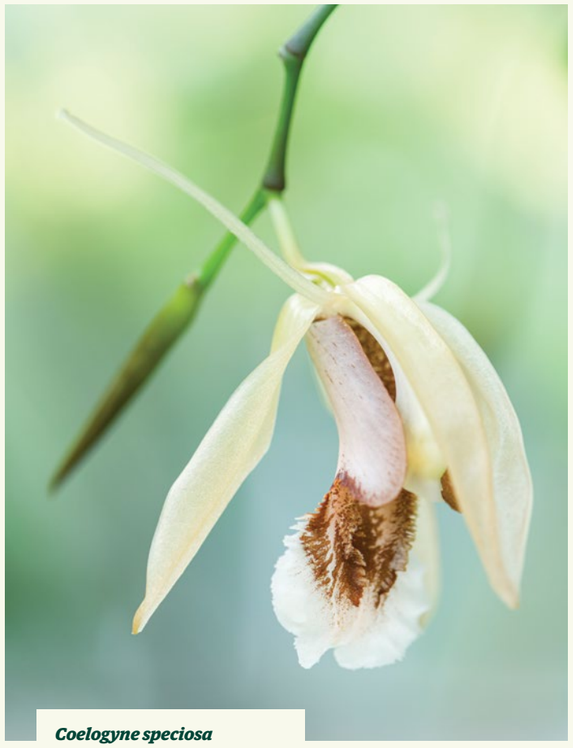
Annual mix - flowering on cue to welcome our first visitors.



Lush plantings in the redeveloped East Tropical House.

Heliconia stricta

Coryanthes macrantha



Coelogyne speciosa

‘The result is a more diverse and aesthetically pleasing planting’

During autumn 2019 work began on the latest phase of renovation work here. Plantings in the north eastern corner of the Winter Garden had become congested and misshapen and were causing die back in the adjacent evergreen *Taxus baccata* (yew) hedge. Mature specimens of evergreen *Viburnum tinus* (laurustinus) and *Cotoneaster lacteus* were removed along with a poor specimen of *Sorbus aucuparia* ‘Beissneri’ (mountain ash). A new and diverse range of species was selected to replace these, including the shrubby *Garrya issaquahensis* and *Sycopsis sinensis* (Chinese sycopsis). A single specimen of *Betula ermanii* ‘Grayswood Hill’ (Erman’s birch), has been positioned to stand as a focal point at the head of the ‘valley’ running from the main path to this corner of the Winter Garden. Beneath these shrubs are groupings of *Iris lazica* (Lazisatn iris) and *Bergenia* ‘Spring Fling’ (elephant’s ears), both of which are new to the Winter Garden. These are interspersed with existing accessions of *Sarcococca confusa* (sweet box), *Helleborus lividus* ssp. *corsicus*, *Ophiopogon planiscapus* ‘Nigrescens’ (black mondo) and *Phormium tenax* ‘Yellow Wave’ (New Zealand flax). These will mature and combine to form a dense under planting in contrast to the newly introduced woody specimens. As this new planting develops it will mature to provide horticultural inspiration, while also retaining the hall marks of the original concept of providing welcome winter colour, form and texture.

The East Tropics Glasshouse

The plantings in the tropical houses of the Glasshouse Range have seen little significant change since the renovation of the Palm House in 1987, and this was most apparent in the East Tropical House. During the intervening years the original compost had slumped to produce hollows in the beds, shrubby species had matured and melded into one, and the understorey had become dominated by a few individual species. Many of the vertical paving slabs which served as a buffer between the heating pipes and the plantings had been either broken or removed, creating issues with scorch on adjacent plants. In addition, the original rock work which lined the paths dominated the landscape and occupied valuable planting space. This year we embarked on work to address these issues and to develop a more enticing planting for our visitors to enjoy.

To begin, we carried out the heavy job of removing the edging boulders, which immediately increased access along the path, and planting space in the beds. A number of mature climbers, including *Cola heterophylla* and *Thunbergia mysorensis* (Indian clock vine) had romped their way across the roof of the house over the years, and these were re-trained on tramline supports to create a tidier and more effective archway spanning the roof of the house. Our attention then turned to thinning the dense ground cover of a limited palate of herbaceous species, and this allowed ease of access to the backs of the borders, where we were able to reinstate the buffer between the heating system and plantings.

With the borders now cleared we re-soiled the beds with a mix of loam, sand and grit which improved the soil texture and mineral content, but which will also reduce soil slump in the future. Some of the rocks were returned to the borders, and placed to provide interest to the landscape, but also to provide planting pockets for species requiring enhanced drainage, including a collection of Gesneriads, such as *Sinningia bullata* and *Smithiantha multiflora*. Having retained many of the existing shrubby specimens such as *Posoqueria latifolia* (needle flower) and *Zingiber spectabile* (beehive ginger) our attention turned to planting out of the herbaceous elements. Some of this material, like *Davallia pentaphylla*, *Hemigraphis alternata* (red-flame ivy), *Pilea involucrata* (friendship plant) and *Chloranthus oldhamii* (Oldham’s chloranthus), was reinstated from existing accessions.

Recently acquired new introductions to the collection have also been added to the display, including *Crossandra pungens* (firecracker plant), *Heliconia stricta*, *Chlorophytum macrophyllum* and *Episcia cupreata* (flame violet). We have also taken the opportunity to utilise the free roof space by displaying two genera of orchids here, *Coelogyne* and *Coryanthes*, both of which are grown in hanging baskets which are suspended from the framework of the glasshouse. The result is a more diverse and aesthetically pleasing planting, where species intermingle to great effect.

Learning

The major focus of the Learning team has been on how to shift our education programmes online, so we can continue to deliver high quality learning experiences despite COVID-19. It has been a learning experience for us too, but as you will read, a wonderful opportunity that has engaged our creativity, and allowed us to reach whole new audiences.

Dr Hayley McCulloch
Head of Learning

Educational visits

We welcomed 3,629 students via 131 educational visits to the Garden over the past year. The majority of these came from primary schools, 1,631 students. 1,240 students visited from secondary schools and 758 from tertiary establishments. This is a significant decrease from the 9,515 students that visited in the previous reporting period, reflecting the restrictions that Covid-19 imposed on visits during the spring and summer, which is usually our busiest time. Our free student pass scheme has seen another expansion with a total of 913 passes being issued. Of these 748 were issued to students from three local sixth forms and 165 were issued to undergraduate students from Anglia Ruskin University.

Our Plant Conservation Biology Masterclass for A-Level and undergraduate students was moved online this year, along with so much of our programming. Three sessions were delivered using Zoom in April and May with 21 students attending at least one of the three. These students came from Comberton Village College, Hills Road Sixth Form College, Long Road Sixth Form College, Saffron Walden County High School, the University of Hertfordshire and Anglia Ruskin University. The sessions were facilitated with the help of two speakers, Anastasiya Timoshyna (Senior Programme Coordinator on Sustainable Trade at TRAFFIC) and Alicky Davey (of Flora and Fauna International), as well as five tutors who were all PhD students or post-doctoral researchers from the University of Cambridge. The presen--tations from both speakers were recorded and are accessible to the public on our website. Pleasingly, that page of the website has been viewed 805 times (623 unique page views).

As with all areas of our programme we have embraced the opportunity to explore new ways to engage with our audiences in the face of Covid-19 restrictions. In addition to moving our Conservation Masterclass online, in September we launched a series of over 20 free downloadable classroom resources and have begun to offer outreach sessions to schools who are unable to visit the Garden.

Families at the Garden

Children and families were able to create apple puppets, take part in a mini apple tasting and play with apple play dough as part of the activities provided in the Schools' Garden during Apple Day in October. Between October 2019 and March 2020 several new family events took place in the Garden. As well as our usual monthly Family Saturday events we also delivered a Pollinator Printmaking workshop for children aged 11+. This was a collaboration with PhD student Jake Moscrop and artist Kaitlin Ferguson to produce large scale prints inspired by the research of Beverley Glover's lab. We also ran two new GPS activities in the Garden for children aged 6+ at Halloween and Christmas, with both proving very popular. Since the Garden reopened in June we have been keen to arrange opportunities for families to participate in activities in a safe and enjoyable way. As such, we have run several outdoor family activities, including two Bat Patrol events, allowing families access to the Garden after closing to enjoy a guided walk with bat detectors to explore and learn more about bats.

We were pleased to be able run "There's a Tiger in the Garden" family activity in August with Creative Movements company. This was a fun morning of drama, movement, dancing and exploring for 2-5 year olds. This was the first time we had delivered one of these events outside, and it was adapted to ensure social distancing. The feedback was very positive and we are exploring how we can continue running these events outside in the future.

January's Family Saturday - weaving with plant fibres.

Downloadable family activities

We continued to reach out to families when the Garden was closed, and a total of 20 downloadable family activities have been added to the website this year including:

- Colouring fun
- Mini flower press
- Windowsill gardening
- Paint like a petal
- Leaf foil art
- Fantastic flowers
- Make a bee rainbow
- Seed share
- Petal power
- Mini garden designer
- Orchid adventure cards
- Super shiny flowers
- Make a paper orchid
- Painting with plants
- Chatterbox
- Wildflower bingo
- Minty munch pots
- Wild weaving
- Nature memory game
- Wildflower wander

www.botanic.cam.ac.uk/education-learning/families/athome/

44
Adult courses

616
Participants

287
New course attendees

Lifelong Learning

Our adult programme delivered 44 courses in the reporting period, of these 28 were delivered in the Garden and 16 as part of our new online offering. The online programme was set up as face-to-face courses were unable to run because of Covid-19 restrictions. In total we had to cancel 36 courses in the spring and summer. During the reporting period, a total of 616 participants took part in courses with us, 311 in the Garden between October and March and 305 online between July and September. We were pleased to welcome 287 new participants who had never attended one of our courses before. Our online courses also reached a much wider audience with participants joining us from all over the UK and a few internationally. The Science on Sundays programme also continued this year, with the majority of talks recorded and delivered online via the Garden website. We also introduced a virtual Gardening Club this year, a weekly video with advice and guidance on how to grow vegetables and make the most of your own garden space. This was well received and very popular, gaining positive feedback on social media. We plan to continue this project next year and build on its success.

Community Gardening at Hanover Court.

Community outreach

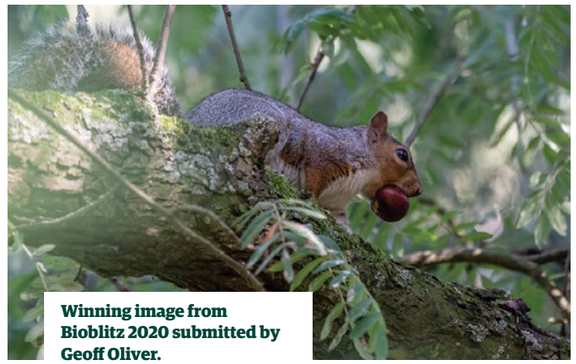
Community gardening kicked off with an early start in January which meant that we were able to run seven sessions before halting activities due to lockdown. Sessions included seed sowing, pruning and taking cuttings. This year, the Garden's horticultural trainees also worked on rotation to attend and support community gardening. Our Horticultural Learning Coordinator provided materials and advice to help support members of the community garden continue gardening during lockdown. Our work with community gardening also involved delivering a learn to garden course for volunteers new to community gardening, with 10 people attending. We also delivered a therapeutic gardening session in February with Springbank ward at Fulbourn Hospital and later supported residents of the ward to develop a ward garden.

St Paul's Thursday group continued to visit the Garden to enjoy a monthly walk, except for during the period of closure.

Working with University of Cambridge Museums (UCM)

We have continued to collaborate with other UCM organisations on several different projects during the reporting period. These include the annual Twilight at Museums event which this year saw the highest number of visitors ever with a total of 2,006 attendees (1,309 adults and 697 children). The theme this year was *Freaky Flowers (and other weird plants)*. Visitors were challenged to find these special plants within the spectacularly lit Glasshouse Range and were able to learn more about each plant from volunteers stationed at each one.

Bioblitz in the Garden in collaboration with the Museum of Zoology was held on the 19 and 20 September in fantastic weather. Small socially distanced nature walks were led by various experts from Cambridge University, Anglia Ruskin University and local Natural History Groups. Surveys were also undertaken by various experts to audit the species on site. 20 volunteers helped to ensure that the event ran



Winning image from Bioblitz 2020 submitted by Geoff Oliver.

354
BioBlitz submissions

20
BioBlitz volunteers

126.5
Volunteer hours to educational activites

smoothly. Members of the public were encouraged to enter a photography competition by submitting their wildlife sightings during their visit to the Garden to an activity on iRecord for the first time. (www.brc.ac.uk/irecord/join/cambridge-bioblitz-2020). Over 354 records were submitted to this platform, successfully trialling an approach to be implemented across the University's estate for collecting biodiversity data to inform the soon to be launched Cambridge University Biodiversity Action Plan (BAP).

We joined in with the Summer with the Museums programme of family activities (normally called Summer at the Museums), contributing several activities for their printed and online programme including a video, Make a Paper Orchid.

We have also collaborated on several smaller events and projects. These have included providing pine cones from the Garden for an early years session at the Fitzwilliam Museum in October and facilitating a visit to the Garden from Soham Village College students in November with the Fitzwilliam Museum and UCM widening participation team. We also delivered a session for young people at The Darwin Centre and The Phoenix Centre, Fulbourn Hospital, creating herbarium specimens as part of the UCM Children and Young People programme. Jointly with Rosalyn Wade, Museum of Zoology, we presented at the UCM forum in November to report on Science Detectives (UCM project from previous reporting period).

Exhibitions and Festivals

The team contributed to the Garden's Virtual Festival of Plants in May. This included a series of online family activities themed for each day of the festival which covered plant science, horticulture and conservation. In addition, we supported with content for the conservation themed day of the Festival by providing Conservation Stories of Hope: short films of plants in our collection that are on the IUCN Red List but for which there is hope. We also developed a list of ways people can get involved in plant conservation including a wide range of citizen science initiatives.

We supported nine PhD students from three universities across Europe to produce the PlaMatSu (Plant Inspired Materials and Surfaces) exhibition. This installation in the Garden showcased the amazing surface properties of plants and the novel materials which they can inspire. The project was funded by the European Commission. In October 2019, jointly with the Sainsbury Laboratory, Cambridge we attended the Big Biology Day at Hills Road Sixth Form College. We delivered a series of activities about pollination and the diversity of seeds and fruits produced by plants to members of the public.

Staff and Conferences

We welcomed Dr Hayley McCulloch as the new Head of Learning in January 2020. Hayley joins us with a background in education and plant science research. The team bid a sad farewell to Emma Daintrey who retired in March after nearly 10 years as Learning Administrator. We welcome Lucy Watts who has filled this role. We were joined from October 2019 to January 2020 by Hamish Symington, working as an intern as part of his BBSRC-funded Doctoral Training Programme. Hamish worked with the Learning team to develop new interpretation boards for the Garden and to produce a template for adult trails.

The Learning team would not be able to deliver our extensive and varied programme without the support of dedicated volunteers. It was great to welcome new volunteers this year and we are grateful for the 126.5 hours that volunteers have contributed to educational activities at the Garden.

We attended the annual BGEN conference in November which took place at the Royal Botanic Gardens Kew. The conference theme Securing Our Future was based around the framework of the United Nations Sustainable Development Goals. We were fortunate to also visit Wakehurst and the Millenium Seed Bank as part of the conference.

Curation

As with all the different Garden teams, the Curation team's year has been strongly coloured by the Covid-19 lockdown. Nonetheless it has also been a year full of achievement, sometimes unexpected progress, and new opportunity. I am especially proud of what the team has achieved this year and our collective resilience in the face of unusually challenging circumstances.

Dr Samuel Brockington
Curator

Living Collections Strategy

The academic year started with great fanfare with the launch of our new Living Collections Strategy 2020-2030. As described in depth on pages 28-31, this is the first time that the Garden has produced a comprehensive strategy for the Living Collections, and it was the result of many years' work by the Curation team. We are now excited to implement the many ideas and commitments we have outlined in this document, over the coming decade. With the successful implementation of the strategy, the Garden should have Living Collections that are of more value to our many stakeholders, better managed, and better-integrated with the core missions of the University.

Living Collections Portal

We were very pleased that our Living Collections Portal was launched at the start of October 2020. The portal, which feeds from CUBG's own database, enables users to search by species name, by a variety of higher taxonomic ranks, by global conservation status, by provenance, and by accession number. You can also filter to remove cultivar and hybrid species, and so constrain your search to biological species only. Official representatives of botanic gardens, universities and scientific institutions can now use the portal to order dried plant materials from which they can extract DNA, fresh frozen material and seeds, as well as photos and further information. Over the past five years the curatorial team has been working hard to get samples and information into the hands of international researchers as quickly as possible. We have already quadrupled the number of material requests that we process, and the portal should accelerate that progress.

Improving our databasing

We have also been working on a number of back-end projects to improve our databasing. In collaboration with Dr Lauren Gardiner, Dr Ángela Cano (our assistant Curator), and a host of volunteers and staff, we have databased the names table for the University Herbarium, so that we have a good idea of how many genera and families are contained within the 1 million specimens it holds. Angie and Pete Atkinson (Plant Records Officer) have been working on improving how we record the geographical origin of our plants, which should lead to more standardised labelling in the future. Together with the horticulture staff, we have been enriching the database for more unusual information such as plant life form and endemism which should be of benefit for the Education and Visitor teams.

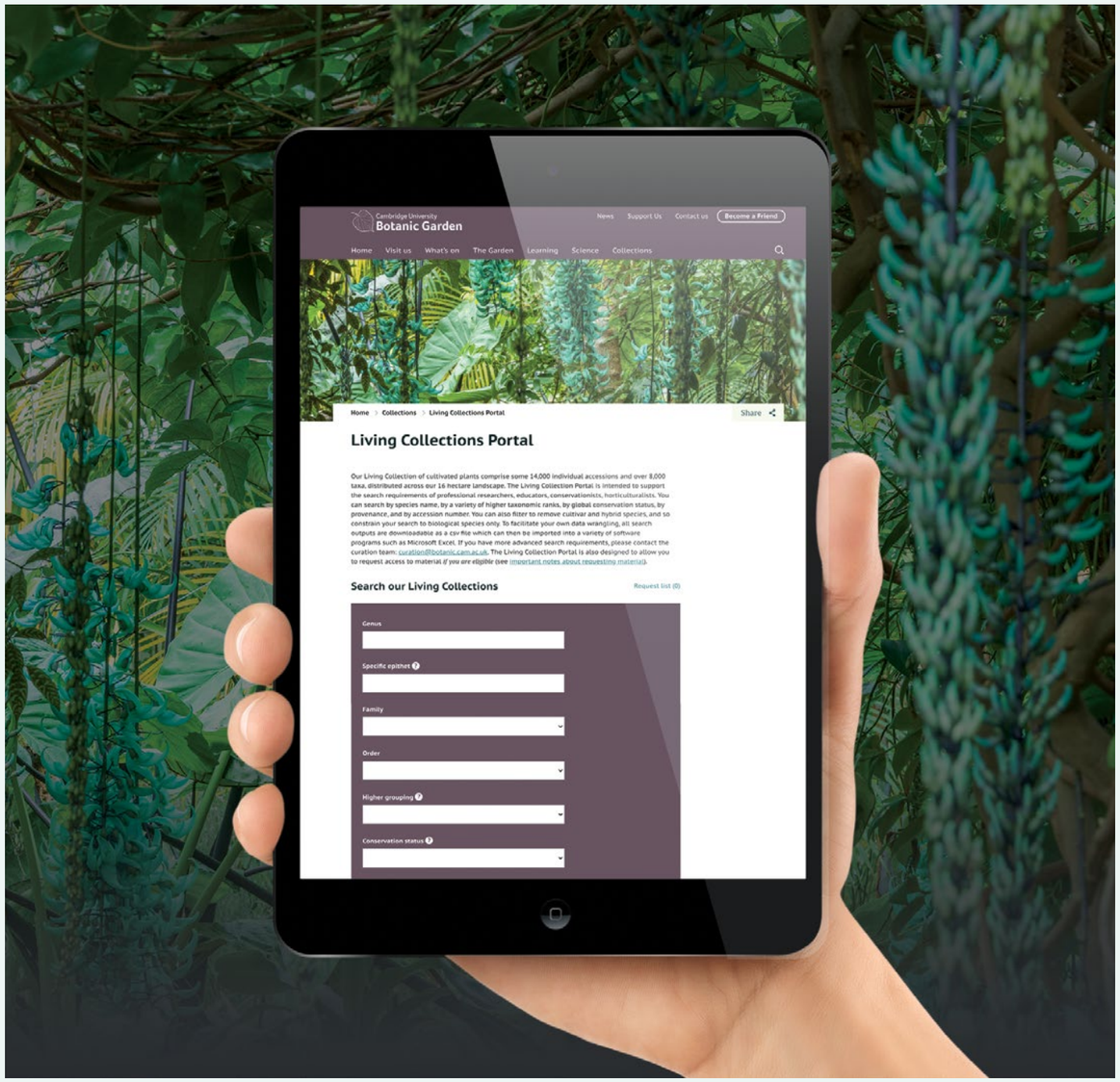
So all in all 2020 is a year that will live on in infamy, but we are justifiably proud of what we have achieved this year, and have learnt new processes, techniques and ways of communicating that have made us a stronger team and will serve us well in the future.

201
Accessions supplied

1,053
Accessions received

522
of all accessions were direct or indirect wild origin material

'We have already quadrupled the number of material requests that we process, and the portal should accelerate that progress.'



Curation

Assistant Curator Dr Ángela Cano collecting in Picos de Europa.

Collecting Expeditions

Dr Ángela Cano, our assistant Curator, was locked down for part of the year in Northern Spain (poor Angie!). But we have turned that to our advantage, and Angie obtained collecting permits for many of the local mountainous national parks, which harbour a great number of unusual endemic plants of interest to many of our horticultural sections. She did a great job in tracking down many families and genera that are not yet represented in our collections, marking their GPS location, and then returning to these locations in September to collect seed. She has now returned to Cambridge with her precious cargo, and we look forward to growing up these new accessions over the coming years.

With the onset of the Covid-19 pandemic, of course, many of our plans had to be put on hold, including a collecting expedition to temperate South America, and well-advanced collecting expeditions to Central Asia were cancelled at the last minute. In some instances, our in-country collaborators were able to partially fulfil our original objectives, and we are eagerly awaiting wild-collected tulip bulbs from Tajikistan, to add to our National Tulip Collection. We received a vast amount of carefully chosen seed lots from the annual *index seminum* exchange, which we have had to put into storage until the horticulture staff are up to full strength in terms of both staff numbers and time.

Parnasia palustris

Gentianopsis ciliata

Stoberia

Updating the herbarium

Mar Millan, our Curation Technician, worked from home for a large part of the year, primarily mounting the herbarium specimens from our recent expeditions, particularly our specimens from last year's expedition to South Africa. Herbarium mounting is both Art and Science, and Mar has produced some gorgeous looking pressed plant specimens. In this she has been ably assisted by our volunteer Penny Coggill, also working from home.

Cotyledon

Stapelia

Friends

This year we are more grateful than ever for the constant support of the Friends of Cambridge University Botanic Garden.

Anna Patterson Lee
Head of Development & Communications

During a very difficult year, the support that we have continued to receive from our Friends has been fantastic. One of the ways in which we were able to show our gratitude for this support was by reopening to our Friends a week earlier than to the public when we were able to allow people back into the Garden in June. We were delighted that so many of our Friends chose to take up this opportunity and to share their experiences of lockdown with us.

Before the lockdown, we held some well-attended events over the winter: Sainsbury Laboratory Tours given by Elisabeth Burmeister on 14 October and 8 November, Autumn Interest Tour with Sally Petitt on 29 October, Friends' Annual Lecture with Dr Chris Thorogood on 14 November and Christmas Wreath-Making workshops on 2 December. The Behind-the-Scenes Tour with Paul Aston on 11 March was the last event to go ahead in the spring.

Unfortunately, we had to cancel many events this year. This included a Guide to Birdsong, Early Bird Tours, an Evening Bat Walk, Newnham College Garden Tour, an outing to Hidcote Manor Gardens and Kiftsgate Court Gardens, a trip to Gardens of the Lake District and Borderlands, an outing to Blickling Hall and East Ruston Old Vicarage, Kelmarsh Hall and Coton Manor, seeing Sussex Prairie Gardens and Sheffield Park and a Murray Edwards College Garden Tour.

The cancelled coach outings were organised once again by Jenny Egbe and Leslie Jakubowska. This was to be their final year as Friends tours organisers, and we would like to thank them for the huge amount of effort and work they have put into the tours over the years. We hope to run these coach outings once Covid-19 restrictions are lifted. Jenny and Leslie have handed over the organisation to Hilary Thomas who has kindly taken on this challenge.

At the end of September, we have 6,803 Friends, which is a little lower than last year. Some Friends chose to let their membership lapse during the lockdown but we are hopeful that the numbers will steadily rise back to pre-lockdown figures.

As an incentive for people to pay for their membership with Direct Debit, this year we have introduced a new offer whereby if Friends (new and existing) choose to pay by Direct Debit, they will receive two extra months' membership.

Corporate Memberships
At the end of the year, we have 64 Oak and 11 Redwood Corporate Friends. We lost a significant number of Corporate Friends in the spring when offices were closed, but we hope that as people start to come back to work, these numbers will start to go back up again.

6,803
Friends

75
Corporate Friends

Olive Courtyard at the Sainsbury Laboratory.

Howard Rice

Autumn interest tour with Sally Petitt.

Christmas wreath-making workshops.

Friends' Annual Lecture with Dr Chris Thorogood.

Living Collections Strategy

Central to our success is the recognition that our Living Collections support world-class education, learning and research, and in doing so, help to solve some of society's most pressing concerns. In support of these fundamental objectives, in November 2019 we launched and published the Garden's first ever Living Collections Strategy – a blueprint which will ensure stronger alignment of our Garden with Cambridge University's pursuit of education, learning and research at the highest levels of international excellence.

Dr Samuel Brockington
Curator

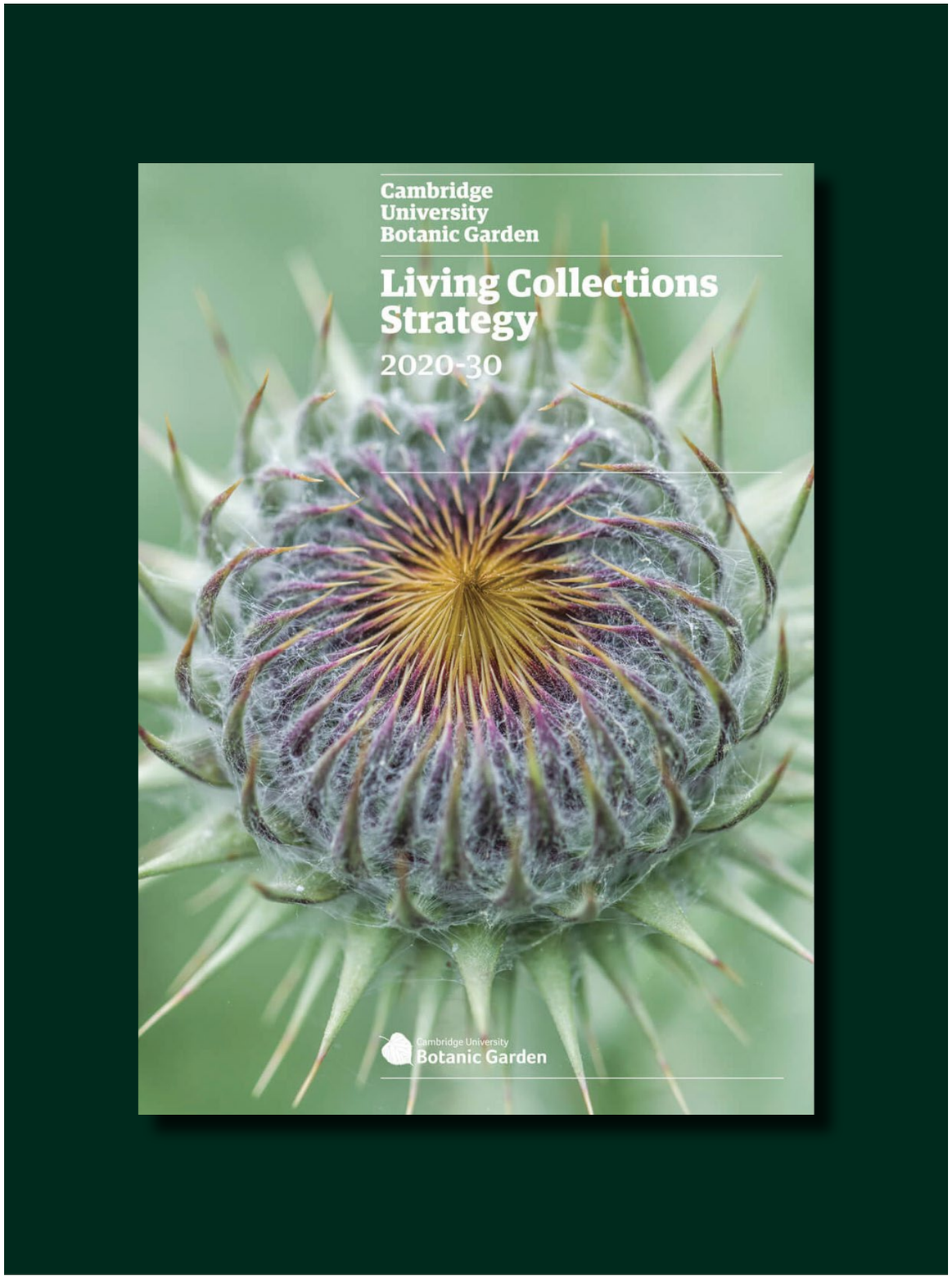
Our Living Collections have their origin in 1762 when the first University Botanic Garden was established in the centre of Cambridge, on about five acres of land, at what is today known as the New Museums Site. The Garden was conceived as a typical Renaissance physic garden and grew herbaceous plants used in the teaching of medical students at the University. As the discipline of botany grew at Cambridge under the watchful eye of Professor John Stevens Henslow, the argument was made for a larger Botanic Garden on its current forty-acre site. The newly designed Garden was laid down in 1834 in an innovative and scientific manner. The Garden and its landscapes subsequently went on to support seminal work in plant genetics, plant physiology and plant pathology through much of the 20th century. Now in the 21st century, Plant Science at Cambridge continues to grow in strength, through the combined work of the Department of Plant Sciences, the National Institute of Agricultural Botany, the Sainsbury Laboratory at Cambridge University, and the newly founded Crop Science Centre. Within this context, the collections, facilities and expertise at Cambridge University Botanic Garden continue to support a vast array of activities.

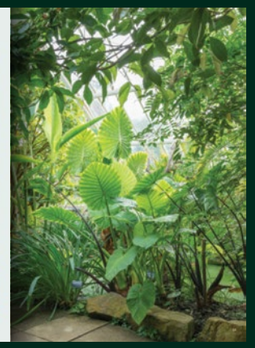
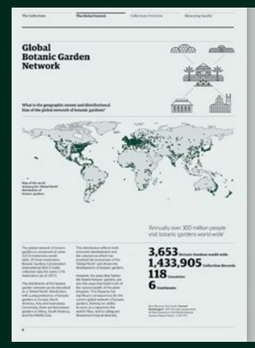
The CUBG has four overarching strategic goals:

- To be recognised internationally as a centre of excellence supporting research in all fields where access to a living collection of diverse plant species is necessary;
- To encourage students from a wide range of HE institutions to engage with plant science and plant diversity, and to train future leaders in the field;
- To support learning about the natural world, and enjoyment of plants, plant science, and horticulture, by welcoming large numbers of visitors and offering an externally facing lifelong education programme;
- To develop new opportunities that showcase the research and teaching of the University of Cambridge, and the global network of plant scientists, in a publicly accessible, horticulturally excellent, heritage landscape.

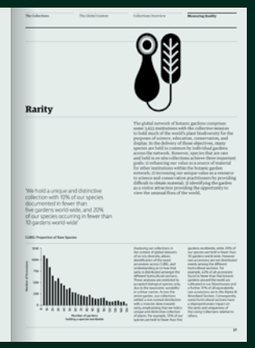
The goal of our new Living Collections Strategy is to develop a vision which advances the capabilities of the Botanic Garden; supports its core values and objectives; enhances the relationship between the Garden and its stakeholders; and enriches collaboration with its peer collection-based institutions. In pursuit of this goal we have sought to answer four key questions, with respect to our Living Collections: What Living Collections do we currently hold and what is their quality? What aspects of the Living Collections do we need to prioritise in support of our three core objectives: Research, Education and Conservation? How can we best increase the value of our Living Collections through the collection and acquisition of new material? How can we improve and develop our management and procedures to better serve the Living Collections and deliver our core objectives?

In answering these questions, we divided the strategy into two halves. We outlined the global context for our Living Collections by summarising our recent analyses of the global network of botanic gardens (Mounce, Smith & Brockington, 2017). With reference to these analyses we highlight some of the core strengths and weaknesses of this global network and emphasise future global challenges which bear on our own Living Collections Strategy, including the on-going and accelerating tsunami of plant extinction. We give an overview of our current collections as currently managed by six horticultural teams. We provide key numbers with respect to the distinctive collections managed by our different teams and provide a visual display of some of the diversity in these collections, and our landscapes. Finally, we define nine key metrics by which we measure the current quality of our Living Collections, and by which we can measure future improvement in their quality. These metrics relate to the key concepts of rarity, diversity, wild-origin, extinction risk, seed-banking, provenance, duplication, longevity and sustainability, and exceptional interest.

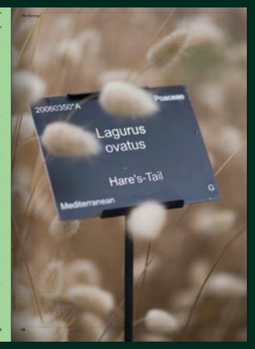








'Our Living Collections Strategy is an important document for the Garden. It analyses the 'now' and directs us into the future, mapping out how we intend to implement this strategy and best deliver on our aims of research, education and conservation.'

Beverley Glover, *Director*

The strategy answers 3 questions:

What aspects of the Living Collections do we need to prioritise in support of our three core objectives: Research, Education and Conservation?

How can we best increase the value of our Living Collections through the collection and acquisition of new material?

How can we improve and develop our management and procedures to better serve the Living Collections and deliver our core objectives?

The strategy comprises 3 sections:

1 **Collection Priorities**

Informed by our analyses, we outline the overarching collection priorities that are needed to fulfil the missions of Research, Education and Conservation.

2 **Collection Acquisition**

We outline eight concurrent material acquisition strategies that will be needed to shape the contents of our Living Collections in order to meet these collection priorities.

3 **Collection Management**

We define the major priorities in terms of management of the Living Collections to ensure the collections best support research, education and conservation activities.

In the second half, we examine how our Living Collections are currently used in support of our three main objectives: Research, Education and Conservation. Through quantitative analysis of patterns of use, and through illustrative case studies, we highlight what features and values of our Living Collections are most significant in terms of enhancing our ability to support these three objectives. In the context of our analyses of the global network of botanic gardens, and coupled with an assessment of the strengths and weaknesses of our own Living Collections, we outline eight acquisitions approaches to improve the content of our Living Collections. We propose to focus on collecting and accessioning early-diverging land plants, wild-origin taxa, plant families not currently in cultivation, species linked to our National Collections, plant species threatened with extinction, plant diversity from two Northern and two Southern temperate hotspots, plants of special relevance to humans and society, and last but not least, our own native Flora.

Finally, in the last section, we consider how best to improve the management of our Living Collections and identify seven key qualities of well-managed Living Collections. They should be Open, Accessible, Accurate, Informative, Legal, Secure and Integrated. In light of these, we define a series of actions which will enhance our Living Collections with respect to these qualities, over the next decade.

In summary, this strategy asks how we can best safeguard the world's plant diversity within the wider global botanic garden network. The strategy also seeks to drive excellence in research and teaching to help tackle some of our most urgent challenges: climate change, food security and the production of medicines. The Living Collections at Cambridge University Botanic Garden are at the heart of our identity, both as a botanic garden, and as a University. We look forward to implementing the aims of our strategy to ensure that we continue to safeguard plant diversity and drive the pursuit of excellence in all areas of research and teaching where access to plant diversity is essential.

'This Living Collections Strategy puts plant diversity and wild-collected plant material at the top of our agenda, as we believe this is crucial to supporting world-class research both in Cambridge and around the globe. It is this cutting-edge plant research that aims to solve today's global challenges, which are impacting on people and societies around the world'

Sam Brockington, *Curator*

Communications

The first half of the year was busy, with publicity for the Living Collections Strategy, Winter Garden, Snowdrop Trail and Twilight at the Museums, however the focus for this report must be the second half of the year as we had to quickly adapt our content and ways of communication within a short space of time.

Anna Patterson Lee
Head of Development & Communications

Website

The website has been vital. During this year we have accumulated over 1 million page views (over 800,000 unique page views), which is a record, and is due to the essential services that the site provided during lockdown/reopening - from selling tickets, to letting people know how and when we were reopening, to hosting the Wellness Wanders and Festival of Plants, and the regular updates to tell stories about plant science, interesting plants and the work going on behind-the-scenes.

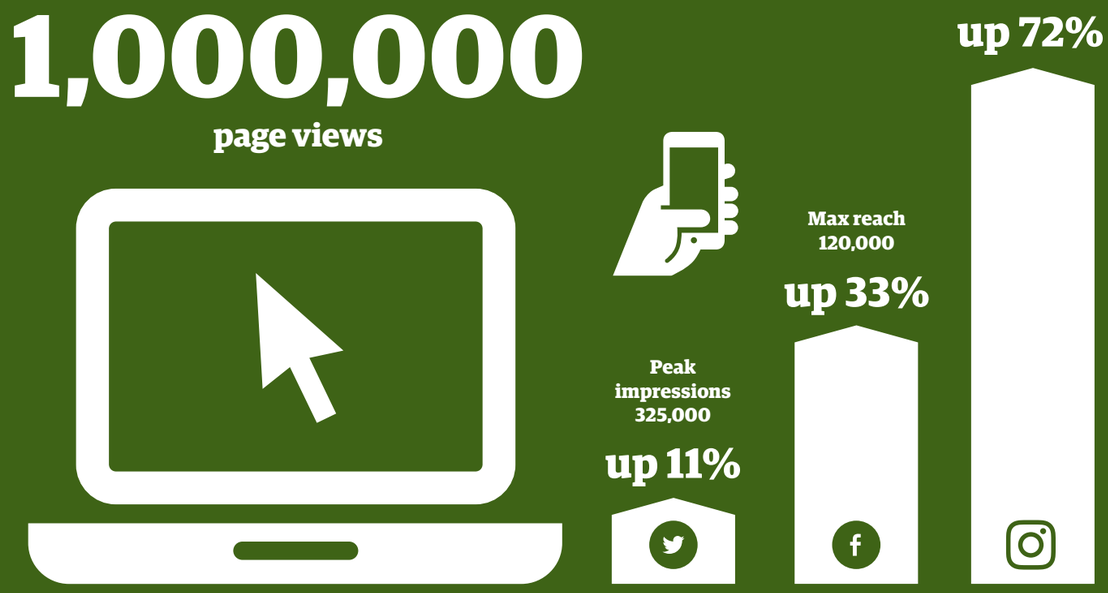
Social Media

Between 1 October 2019 - 30 September 2020 our Facebook followers rose from 9,871 to 13,174 (an increase of 33%) and our Twitter followers rose from 11,478 to 12,785 (an increase of 11%). Our Instagram following continues to build, increasing from 5,241 to 8,993 (a 72% increase).

Our average reach over a month (the number of people seeing our posts on Facebook) was 120,000 (up from 65,000 the prior year). Unsurprisingly, the most interest this year was when we temporarily opened the Garden for free as lockdown started, when our post reached 128,000 views.

On Twitter, our monthly impressions (interactions of any sort with a tweet - views, likes, replies etc.) are averaging 178,000 with a peak of 325,000 in March, again related to the temporary free opening and then closing of the Garden.

Our online Festival of Plants also proved popular with over 112,000 impressions over the three days.



Fundraising Campaign

Our planned capital fundraising campaign has been put on hold while we concentrated on bringing the Garden to as many people as possible digitally. However, we are very grateful to those who have continued their support of the Garden throughout this year - especially to members of the Henslow Circle.

TV

The Garden has had a good media profile over the year both locally and nationally, and we were delighted to secure the Garden's appearance on two high profile BBC programmes. Heavenly Gardens was broadcast on BBC1 on Good Friday; and a highlight during the summer was a 3-day visit from the BBC Green Planet crew who were filming the next series, due to go out in 2022.

Digital activities

When CUBG closed the gates in March, we were aware that many people would miss the beauty and tranquillity of the Garden during a very challenging time in the outside world. With that in mind, we developed a programme of digital activities to make CUBG as accessible as possible.

This included weekly Wellness Wanders, which have been incredibly popular with thousands of viewings across the world and lovely feedback, as well as short weekly Bitesize Botanics which gave a brief window into the Garden. We worked with the Learning team to produce the Gardening Club, which gave weekly tips and advice to those who caught the gardening bug while at home, Family Activities and a Daily Quiz. These were all phased out as lockdown lifted, though the Wellness Wanders still remain with a loyal following and hundreds of views each week.

In May, we brought the Festival of Plants online - over three days the worlds of Plant Science, Plant Conservation and Horticulture were explored through talks, films, activities and interactive sessions.

Virtual visiting

The challenges of the past year have made us think creatively about how the Garden can reach as many people as possible. We wanted to bring the peace and beauty of the Garden to people who couldn't visit, and to inspire people who were suddenly able to spend a lot more time in their own gardens.

13 January 2020

13 May 2020

3 June 2020

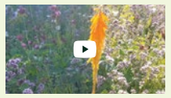
10 June 2020

1 July 2020

15 July 2020

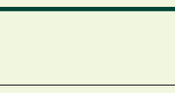
9 September 2020

28 October 2020

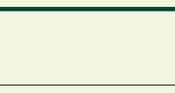


22 July 2020

12 August 2020



Planning Your Vegetable Garden
27 March 2020



Growing Tender Veg
24 April 2020

Gardening Club

We worked with the Learning team to produce the Gardening Club, which gave weekly tips and advice to those who caught the gardening bug while at home.

15 films

How to attract moths, butterflies & bats
1 May 2020

Intercropping & Successional Sowing
5 June 2020

Citizen Science
18 June 2020

Harvesting & Sorting
17 July 2020

1 April 2020

Wellness Wanders

Weekly Wellness Wanders have been incredibly popular and have a loyal following and hundreds of views each week.

21 films

Festival of Plants

In May, we brought the Festival of Plants online - over three days the worlds of Plant Science, Plant Conservation and Horticulture were explored through talks, films, activities and interactive sessions.

Day 1: Plant Science
Seeing a plant hormone in action

Day 2: Horticulture
Garden Highlights Tour

Day 3: Conservation
Stories of Hope

Day 2: Horticulture
Behind the Scenes

Blossoms & Blooms
30 March 2020

Systematic Beds
1 June 2020

Around the Fountain
8 June 2020

Sights & Sounds Around the Garden
4 May 2020

Spring Colour, Winter Garden
6 April 2020

Glasshouse Range
14 April 2020

Inside the Glasshouse Range
18 May 2020

11 films

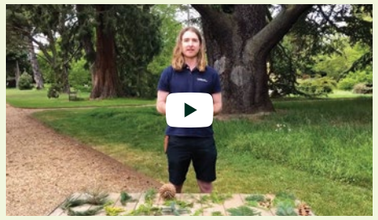
Bitesize Botanics

Short weekly Bitesize Botanics which gave a brief window into the Garden.

Mediterranean Beds
11 May 2020

As part of the Festival of Plants, we worked with Candide to produce films of the Garden's Trainee Technicians talking about their favourite Garden activity/plant or place.

Jon
Identifying Plants



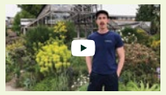
See more at:
www.botanic.cam.ac.uk/gardening club
www.botanic.cam.ac.uk/wellness-wander
www.botanic.cam.ac.uk/bitesize
www.botanic.cam.ac.uk/festival-of-plants-2020-programme/

Trainee Talks

Leah
Plant Stars of the Glasshouse Range

Emily
Victoria Cruziana

Bethan
Mowing & Machinery

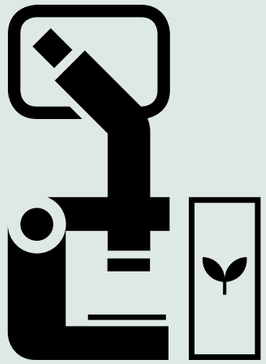


Colin
Meditarranean Beds

5 films

Research supported and facilitated

The Botanic Garden maintains and makes accessible the living plant collection of the University of Cambridge. Research and teaching is supported through the plant collections of over 8,000 species, the Experimental Section which provides supported glasshouse and open-ground research plots, and through use of the 40-acre landscape. In addition to home-grown research the Garden supports a wide range of projects throughout the University of Cambridge and collaborates with a great many external partners.



Cambridge University Botanic Garden

Professor Beverley Glover, *Director*

Research programme focused 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 the living collection, for projects including:

Stamen evolution in *Solanum* with Dr Sandy Knapp (The Natural History Museum) and Gwen Davis (PhD student).

The relationship of floral morphology to pollination success in *Vicia faba*, with Dr Jane Thomas (National Institute of Agricultural Botany), Roger Vickers (PGRO) and Jake Moscrop (PhD student).

Molecular evolution of key developmental pathways in plants, with Dr Sam Brockington (Curator, CUBG), Thea Kongsted (PhD student) and Dr Chiara Airoldi (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 Boris Delahaie and Dr Roman Kellenberger (postdocs) and Roisin Fattorini (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 Jeremy Baumberg (Department of Physics, University of Cambridge), Dr Silvia Vignolini (Department of Chemistry, University of Cambridge), Dr Edwige Moyroud (Sainsbury Laboratory Cambridge University), Dr Chiara Airoldi and Dr Carlos Lugo-Velaz (postdocs) and Jordan Ferria (PhD student).

The effect of plant viral infection on pollinator attraction, with Professor John Carr (Department of Plant Sciences, University of Cambridge), Dr Alex Murphy (postdoc) and Netsai Mhlanga (PhD student).

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

Conservation of *Potentilla porphyrantha* in Armenia with Lydian International, Dr Peter Carey, Dr Jo Treweek and Chris Davis (PhD student).

The relationship of floral morphology to pollination success in strawberry, with Hamish Symington (PhD student).

The role of pollination in ethylene production and fruit development in tomato, with Dr Saumya Sand (postdoc).

Dr Sam Brockington, *Curator*

Research programme focused on the evolutionary genomics of the order Caryophyllales, funded by NERC, the NSF and the Isaac Newton Trust, and using material grown in the Experimental Glasshouses, and across the living collections:

Sequencing transcriptomes in Caryophyllales in collaboration with Professor Stephen Smith (University of Michigan) and Professor Michael Moore (Oberlin College, Ohio).

Reconstituting the betalain pathway in heterologous host systems with Alfonso Timoneda (PhD student) and Dr Hester Sheehan (postdoc).

Exploring the evolution and regulation of arogenate dehydrogenase (TyrA), the key enzyme for the production of the essential aromatic amino tyrosine (Tyr), in Caryophyllales.

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

Analysing the fog-capturing properties of South African curly-whirly plants in the genus Eriospermum with Dr Loubab Zedane (post-doc).

Sampling material for genomic sequencing projects in Caryophyllales.

Dr Ángela Cano, *Assistant Curator*

Research programme focused on the evolution of Neotropical rainforests using palms (*Arecaceae*) as models, funded by the International Palm Society and the Gothenburg Global Biodiversity Centre.

Next Generation Sequencing of palm species in collaboration with Dr Christine Bacon (University of Gothenburg) and Professor Alexandre Antonelli (RBG Kew).

Bioinformatic processing of palm genomic sequences in collaboration with Dr María F Torres Jiménez (University of Gothenburg).

Biogeography and diversification of Central American tropical rainforests using palms as models, with Dr Fred Stauffer, Dr Mathieu Perret (University of Geneva), Dr Christine Bacon, Tobias Andermann, Dr Alexander Zizka, Dr Mats Topel, Isabel M. Liberal (University of Gothenburg), Harri Lorenzi (Jardim Botanico Plantarum) and Professor Alexandre Antonelli (RBG Kew).

Biogeography and evolution of the subfamily Ceroxyloideae (Arecaceae), with Sebastián P Escobar, Dr Wolf Eiserhardt, Professor Henrik Balslev (Aarhus University), Dr.John Dransfield, Dr. Willian Baker and Professor Alexandre Antonelli (RBG Kew).

Evolution and diversification of the palms and their seed traits, with Dr Sidonie Bellot, and Dr William Baker (RBG Kew).

Molecular phylogeny of the Lepidocaryeae (Calamoideae: Arecaceae) and description of a new species of Mauritiella, with Dr María F. Torres Jiménez), Dr Christine Bacon, Dr Alexander Zizka (University of Gothenburg), and Dr William Baker, Professor Alexandre Antonelli (RBG Kew).

Phylogenomics of subfamily Coryphoideae (Arecaceae), with Dr Wolf Eiserhardt (Aarhus University).

Integrative species delimitation and evolution in the American palm genus *Brahea*, with Dr Craig Barrett (West Virginia University) and Dr Larry Noblick (Montgomery Botanical Center).

Dr Chantal Helm

Bat survey in collaboration with Kevin Hand (National Bat Monitoring Project).

Moth survey in collaboration with Dr Helen Leggett (Cambridge University, Department of Zoology).

Department of Plant Sciences, Cambridge

Professor Sir David Baulcombe, FRS
(RNA Silencing and Disease Resistance Group)
Use of the Experimental Glasshouses to propagate the progeny of *Solanum lycopersicum x S. pennellii* hybrids through to the F4 generation, to investigate segregation in hybrid plant populations. Transgressive segregation results in plants that have heritable properties that are outside the range of the parents, and this work aims to understand the molecular biology of this important trait so that it can be harnessed more efficiently for crop improvement.

Professor John Carr
(Plant Virology Group)
We have been using a bay of the glasshouses, and part of the outdoor Experimental Plots, to investigate the effects of virus infection of the interactions of tomato and bean (*Phaseolus vulgaris*) with bumblebees (*Bombus terrestris*). The work suggests that virus-infected plants are more attractive to pollinators than healthy or resistant plants and findings may be useful for improving pollinator service in gardens and for understanding how plants, pathogens and pollinators coevolve in the wild. We are expanding the work to include peppers.

Professor David Coomes
(Forest Ecology and Conservation Group)
Exploring the properties of organic fertilisers and their consequences for plant growth. Also using weather data collected at CUBG to inform studies of the impact of drought on UK woodland.

Professor Howard Griffiths
(Plant Physiological Ecology Group)
Maintaining collections of succulent plants for analysis of those with Crassulacean acid metabolism. The diversity and evolution of epiphytic bromeliads from the neotropics are being investigated. The compromise between water use and carbon gain is also being used to infer evolutionary origins and biomass production potential in succulents and grasses. In grasses, many savanna species have evolved the C4 pathway to enhance productivity, and the selection pressures leading to changes in leaf vein anatomy and metabolic partitioning are being investigated. These processes led to the development of highly productive crops such as sugar cane, sorghum and maize. *Agave tequilensis*, *Aechmea*, *Guzmania (Bromeliaceae)*; *Jatropha*, *Kalanchoe*, *Mesembryanthemum* and rice plants all are maintained at the Botanic Garden. Various moss species are also used from the collection in the Garden and cultured in shade for analysis of moss metabolism. Performing ATAC sequencing of *Kalanchoe* leaf samples.

Professor Jim Haseloff
and **Dr Jennifer Deegan**
(Synthetic Biology for Engineering Plant Growth Group)
Anatomical studies of fern gametophytes and of liverworts, requiring access to the living collection.

Professor Julian Hibberd
(Molecular Physiology Group)
Rice, millet and wheat are grown for anatomical analysis, RNA isolation and deep sequencing as part of a project to understand the genetic differences between the more common C3 photosynthesis and the more efficient C4 photosynthesis. Determining the extent to which diverse monocotyledons can be grafted. Attempting grafting within 6 orders of monocotyledons not previously grafted.

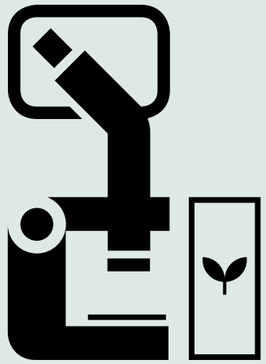
Professor Uta Paszkowski
(Cereal Symbiosis Group)
The mutually beneficial arbuscular mycorrhizal (AM) symbiosis is the most widespread plant-fungal association between roots of terrestrial plants and fungi of the Glomeromycota, in which the fungus receives photosynthates from the plant and enhances its mineral, particularly phosphate, nutrition. This research focuses on the identification and characterisation of molecular mechanisms underlying the development and functioning of AM symbioses in the crop plants maize and rice. Maize and rice lines are grown in the Botanic Garden's Research Glasshouses and Experimental Plots for genetic characterisation and seed amplification. Also exploring the presence of mycorrhizal associations in diverse grass species from the Garden's collection.

Professor Alison Smith and Dr Matt Davey
(Plant Metabolism Group)
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.

University of Cambridge

Dr Edwige Moyroud
(Sainsbury Laboratory)
The bullseye patterns in the centre of many flowers attract pollinating insects, but we do not know how plants control their formation. We are working with *Hibiscus trionum*, which creates a central bullseye of pigmented tissue in the middle of the flower, to understand the development of these patterns. In the Experimental Glasshouses we are screening a large population of mutagenised *H. trionum* plants to identify mutants with altered floral patterns.

Research supported and facilitated



Dr Sebastian Schornak
(Sainsbury Laboratory)
Plants engage with fungi to improve access to nutrients such as phosphate. We sample liverwort species from the Botanic Garden and stain them to detect fungal structures. Comparing early land plant symbiosis with the root symbiosis of higher plants will allow us to highlight evolutionary aspects of symbiosis establishment in different parts of plants.

Dr Raymond Wightman
(Sainsbury Laboratory)
Working with CUBG Alpine and Woodland Section to study hydathode development in *Saxifraga* using cryoSEM microscopy and to analyse their secretion products with Raman microscopy. Another project focuses on the control of phyllotactic patterning in *Saxifraga* species. I am also exploring surface patterning mechanisms and the development of wood using the living collection.

Professor Paul Dupree
(Department of Biochemistry)
Use of the greenhouses to grow thermotolerant plants for biochemical analysis. Provision of species with polysaccharide gums. Pilot investigation of the presence of polysacharides of interest. Eventually, the polymer could be used to study enzyme activity from microbes involved in digestion.

Professor Peter Leggo
(Department of Earth Sciences)
Experiments using digested food waste pelletised with finely ground zeolitic tuff and diatomite as soil improvers using *Nicotiana*. This work aims to find the mixture giving maximum plant nutrients.

Professor Nick Davies
(Department of Zoology)
Feeding behaviour of blue tits and great tits in the Botanic Garden, studied over many years.

Dr Walter Federle
(Department of Zoology)
Biomechnical measurements of *Nepenthes alata* to explore pitcher plant evolution and function. *Nepenthes* pitchers used for outreach activities.

Professor Ulf Buentgen
(Department of Geography)
Although highly valued as a culinary delicacy around the world, our understanding of the biological and ecological requirements of truffles (*Tuber spp*) is still limited, because of the species' hidden belowground lifecycle. Growing in symbiotic association with the fine roots of their plant partners, ectomycorrhizal truffles have never been successfully cultivated under laboratory conditions. In this interdisciplinary project, 'Lucy' – a trained truffle dog that started its scientific career about ten years ago in Switzerland – has for the first time detected Burgundy truffles (*Tuber aestivum*) in the Botanic Garden. With a wide range of differently sized fruit bodies growing at various sites with diverse plant communities throughout most of the year, the Botanic Garden offers unique 'living laboratory' conditions for illuminating the mysterious world of truffles. We will also compare the findings from Cambridge with data from similar observations in southern Germany and Switzerland where wild Burgundy truffles are growing under different climatic conditions.

Gerda van de Kerkhof
(Cambridge University, Department of Chemistry)
Using a range of chemical and microscopic techniques to determine the chemical composition of the surface ridges found on petals of *Eschscholzia californica* flowers and the flowers of related species.

External collaborations

Dr Tim Pankhurst (Plantlife)
The Fen Orchid, *Liparis loeselii*, is the principal focus of a collaboration between Plantlife and CUBG, also involving RBG Kew, Norfolk Wildlife Trust, Suffolk Wildlife Trust, Butterfly Conservation and Natural England. Over the last 10 years, we have been developing and applying a conservation strategy for this European protected species. The main part of this work is now reintroduction and we have been growing plants to supply stock for reintroduction. This stock also provides material for ex-situ study. We have also developed ex-situ stock of field wormwood *Artemisia campestris* (Sched 8, Critically Endangered) for study and introduction; eight reintroductions have been carried out in the last year as part of the strategy to rebuild the UK distribution and repopulate former sites, now returned to suitable condition.

Dr Peter Stroh
(Botanical Society of the British Isles)
I am Scientific Officer and England Officer for the BSBI, based at Cory Lodge. During the period 1 Oct 2019 – 30 Sep 2020 I co-authored 'Grassland plants of the British and Irish lowlands' (Stroh et al., 2019), focusing on 109 plant species currently considered to be of greatest conservation concern in Great Britain. The book includes a series of 'species accounts', presenting detailed information about identification and typical habitat, biogeography, ecology, threats and management requirements. Each account is illustrated with an up-to-date distribution map alongside a photo of the species and typical habitat. I was also lead author or co-author on nine peer-reviewed papers, and contributed to the 'State of the World's Plants and Fungi' report, led by RBG Kew. I'm currently working on the production of the third Plant Atlas for Britain and Ireland.

Aaron Ang
(John Innes Centre, Norwich, UK)
Auxin is an important phytohormone involved in almost all aspects of plant development. Canonically, auxin perception and signalling was thought to be mediated by de-repression of auxin response factors (ARFs) by a pathway called TIR1. Recently, we have identified a non-canonical auxin signalling mechanism mediated directly by ARF3/ETT. This project aims to identify the origin of this pathway by means of structural and biochemical comparisons of ETT proteins from diverse angiosperm lineages obtained from the Garden.

Ewout Van Oost
(Institute for Agriculture, Fisheries and Food Research, Melle, Belgium)
Development of bioassays to test frost tolerance and pathogen resistance of lavender species. In this project we are developing and optimizing bioassays to screen for frost tolerance and pathogen resistance in different lavender species and cultivars.

Matthew D DeMars
(Max Planck Institute for Chemical Ecology, Jena, Germany)
The research in our department focuses on understanding the biosynthesis of medicinally relevant monoterpene indole alkaloids (MIAs) from flowering plants. Recently, we have discovered that a key step in the biosynthesis of a number of these compounds requires the action of a carboxylesterase-like enzyme in the alpha/beta hydrolase superfamily. In order to understand the evolution of this enzyme, we aim to examine members of the family across a variety of different plant species. Published transcriptomic and genomic data have allowed us to compile a list of homologous alpha/beta hydrolases that we would like to express in *E. coli* . Following expression and purification of these candidates, we will test them on several potential small-molecule substrates to examine their reactivity properties. These data will provide crucial insight into the diversity and evolutionary history of this important superfamily of enzymes in the context of MIA biosynthesis. Accordingly, we are using tissue from key plant species housed in the CUBG for RNA extraction and gene amplification purposes.

Ignacio Rubio Somoza
(Centro de Recerca en Agroeconomia, Barcelona, Spain)
We are studying the liverwort *Marchantia polymorpha* growing in humid soil from different botanic gardens in Europe. We are using modern sequencing techniques to catalogue the viruses that can be found in liverworts from different countries and different habitats, to help us understand the evolution of plant resistance to disease.

Maria Fernanda Torres Jiménez
(University of Gothenburg, Department of Biological and Environmental Sciences, Gothenburg, Sweden)
Genomic screening of pooled populations of *Geonoma macrostachys* and *Geonoma acaulis* to detect outlier loci potentially associated to intra-specific leaf shape variation. As a complementary analysis, we will generate a long-read *Geonoma macrostachys* draft assembly.

Dr. Matthias Fladung
(Thuenen-Institute of Forest Genetics, Germany)
Evolution of dioecy in Salicaceae
The evolution of dioecy is still under active discussion. A prominent model suggests a transition from hermaphroditism via gynodioecy. Empirical data of some dioecious species seem to be consistent with this model. On the other hand, a pathway from monoecy might be more likely in other taxa such as the genera *Populus* and *Salix*. Since several details on the genetic and molecular mechanisms of dioecy in poplar have recently been revealed, it is now possible to directly test a putative evolutionary path via monoecy by studying the monoecious relative Poliothyrsis sinensis (italics). We are therefore examining gene expression and hormone concentrations in relation to flower development in *P. sinensis* in comparison to *Azara microphylla* using material from the Garden.

Dr Julia Mackenzie
(Department of Life Sciences, Anglia Ruskin University)
Blue tits and great tits breeding in the Cambridge University Botanic Garden have been studied for over 15 years. The project involves monitoring breeding birds and colour ringing of adults to identify breeding pairs.

Sandra Mesquita
(Instituto Superior de Agronomia, Universidade de Lisboa, Portugal)
Research on the cultivation of *Musschia aurea.*

Dr Nick Owens
(Independent Researcher)
Identification of bees and aculeate wasps present in the Botanic Garden as part of an ongoing study of the importance of the site for these insects. This entails field observations as well as the collection of specimens of some of the smaller species for microscopic identification. Trapping methods include spot netting and the use of water traps (yellow bowls containing water and a spot of detergent) – placed in unobtrusive parts of the garden. Nest sites and flowers visited are noted and photographs taken. This may lead to a publication of an introductory guide to the bees of CUBG.

Glen Powell
(NIAB EMR)
Surveying the presence of brown marmorated stink bugs in urban sites with tree diversity. Sentinel pheromone traps are set out for these invasive bugs in trees and checked every week for signs of shield bugs.

Plant material supplied to other gardens

CUBG supplied directly 201 accessions of plant material to 13 institutions and 46 accessions to 6 institutions through the Index Seminum scheme.

Botanical Garden University Fribourg, Switzerland (1 seed).
Atlanta Botanical Garden Atlanta, GA, USA (1 plant).
Birmingham Botanic Gardens, United Kingdom (1 cutting).
Chelsea Physic Garden, London, United Kingdom (4 seeds, 8 plants, 2 cuttings)
Conservatoire et Jardin botaniques de la Ville de Geneve, Chambesy-Geneve, Switzerland (3 seeds, 19 plants, 9 cuttings).
Botanical Garden Le Havre, France (1 seed).
Stockholm University Bergius Botanic Garden (2 plants, 1 cutting).
Madeira Botanical Garden, Funchal, Madeira, Portugal (8 plants, 6 cuttings).
National Botanic Garden of Wales, United Kingdom (1 cutting).
Oxford Botanic Garden, United Kingdom (27 seeds, 8 plants, 11 cuttings).
Royal Botanic Gardens, Kew, Richmond, United Kingdom (4 plants, 1 cutting).
Mount Stewart House Garden and Temple of the Winds, United Kingdom (1 plant).
Institute for Botany and Ecology, Centre for Ecological Research, Hungarian Academy of Sciences, Vacratot, Hungary (14 seeds).
Botanic Garden, University of Pecs, Hungary (9 seeds).
Jardin Botanique de l'Universite de Strasbourg, France (12 seeds).
Nantes Botanic Garden, France (1 seed).
Botanischer Garten Universitat Konstanz, Germany (3 seeds).
Maj Institute of Pharmacology, Polish Academy of Science, The Garden of Medicinal Plants, Krakow, Poland (7 seeds).

Plant material acquired

During the last year the Garden received 1,053 accessions. Of these 522 accessions were of direct or indirect wild origin material and 531 were from Garden origin (this includes seed collected in the Garden). The accession material was obtained from 82 different sources. 19 accessions were of bulbs, 60 were received as cuttings, 321 were received as plants and 653 were received as seed.

Of interest are 15 accessions of wild collected Tulips from Kazakhstan and 62 accessions of seed collected in Vietnam as part of the Logan, Wrest Park, Cambridge, Wales, Edinburgh Vietnam Expedition 2019.

Publications by Botanic Garden Staff

R Middleton, M Sinnott-Armstrong, Y Ogawa, G Jacucci, E Moyroud, PJ Rudall, C Prychid, BJ Glover, MJ Donoghue, S Vignolini (2020) *Viburnum tinus* Fruits Use Lipids to Produce Metallic Blue Structural Color. *Current Biology* 30 (19), 3804-3810.e2.

CA Airoldi, BJ Glover (2020) Evo–Devo: Tinkering with the Stem Cell Niche to Produce Thorns. *Current Biology* 30 (15), R873-R875.

R Fattorini, BJ Glover (2020) Molecular Mechanisms of Pollination Biology. *Annual Review of Plant Biology* 71, 487-515.

JG Pattrick, HA Symington, W Federle, BJ Glover (2020) The mechanics of nectar offloading in the bumblebee *Bombus terrestris* and implications for optimal concentrations during nectar foraging. *Journal of the Royal Society Interface* 17 (162), 20190632 1.

GT van de Kerkhof, L Schertel, R Poon, G Jacucci, BJ Glover, S Vignolini (2020) Disordered wax platelets on *Tradescantia pallida* leaves create golden shine. *Faraday Discussions* 223, 207.

HA Symington, BJ Glover (2019) SpotCard: an optical mark recognition tool to improve field data collection speed and accuracy. *Plant Methods* 15 (1), 1-6.

CA Airoldi, TJ Hearn, SF Brockington, AAR Webb, BJ Glover (2019) TTG1 proteins regulate circadian activity as well as epidermal cell fate and pigmentation. *Nature Plants* 5 (11), 1145-1153.

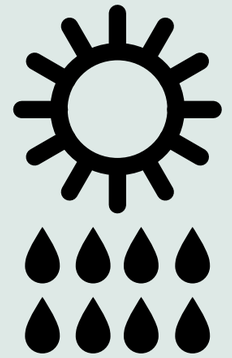
H Sheehan, T Feng, N Walker-Hale, S Lopez-Nieves, B Pucker, R Guo, SF Brockington (2020) Evolution of L-DOPA 4,5-dioxygenase activity allows for recurrent specialisation to betalain pigmentation in Caryophyllales. *New Phytologist* 227 (3), 914-929.

A Timoneda, T Feng, H Sheehan, N Walker-Hale, B Pucker, SF Brockington (2020) The evolution of betalain biosynthesis in Caryophyllales. *New Phytologist* 224 (1), 71-85.

G Yao, JJ Jin, HT Li, JB Yang, VS Mandala, M Croley, R Mostow, SF Brockington et al. (2019) Plastid phylogenomic insights into the evolution of Caryophyllales. *Molecular phylogenetics and evolution* 134, 74-86.

One Thousand Transciptomes Initiative (including Brockington SF) (2019) One thousand plant transcriptomes and the phylogenomics of green plants. *Nature* 574 (7780), 679.

Weather



Pete Michna
Experimental Supervisor

Overall this year the winter was very mild, the spring was warm and dry while the summer had some very high temperatures and long dry spells. Total rainfall for the year was slightly above average.

October was mild and showery with one notable shower of 24.3 mm on the 5th. Things brightened up later in the month with the first air frost of the winter, -0.8°C, on the night of the 27th. November and December continued mild and showery with a few night-time air frosts; the coldest night of the winter was on the 29th of November at only -3.2° C. December also saw the lowest day-time maximum of the winter with a relatively mild 4.6°C on the 9th.

In January and February, the mild, showery weather continued with a few frosty mornings. On two days gale-force winds closed the Garden. The only snow of the winter fell on the 27th of February, giving a short-lived light covering.

March stayed mild and was rather dry, especially in the second half, with another gale closing the Garden for a day. Despite the Covid-19 lockdown weather readings continued.

April saw some unseasonably warm temperatures, up to 24.4°C on the 11th, and only a few light rain showers, the heaviest being a paltry 2.9 mm on the 17th.

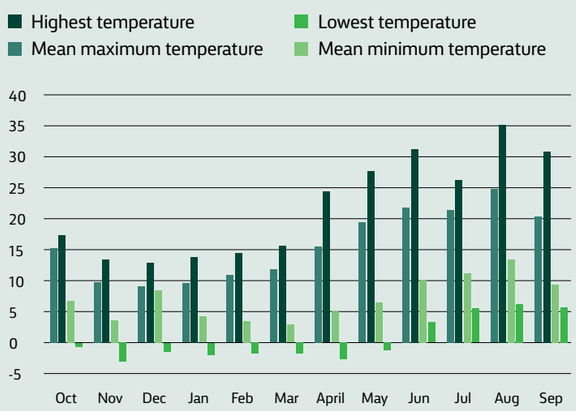
May was also warm, and even drier which really slowed down the growth of the grass and weeds, a boon to the small Horticulture teams who were returning to carry out essential maintenance.

June was more showery with a useful 18.9 mm of rain on the 17th, and with a hot spell towards the end of the month, with a maximum of 31.2°C on the 25th.

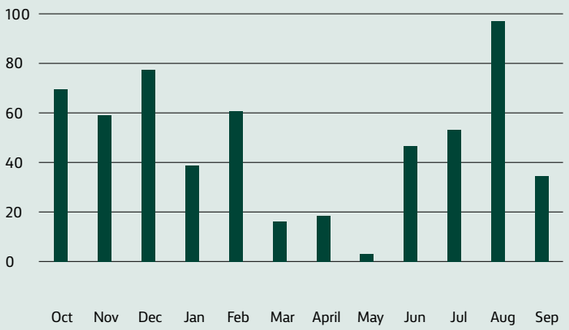
July was milder, with a reasonable amount of rain, but in August the hot weather returned for a few days and a maximum temperature for the year of 35.1°C on the 7th.

August was generally rather dry but there were some heavy storms, notably one giving 30.3 mm of rain on the 28th, which increased the total for the month. There were gales on the night of the 25th/26th. September saw another long, dry spell with the temperature reaching 30.9°C on the 15th, with cooler, wetter autumnal weather coming on cue in the last week.

Monthly temperature (°C)



Monthly rainfall (mm)



Funding

Income

Funding Source	*Details*	2019–20 £ k	2018–19 £ k
University Support	Pay and Non Pay	992.8	980.4
Trust Funds	The Cory Fund	663.2	636.2
	Other Trust Funds	20.3	19.4
Admissions Income	Gate takings (including tours, guidebooks etc)	406.0	628.1
Earmarked Funds	Friends (including income for events and activities)	259.3	286.9
	Other Specific Donations and Trade	355.0	445.2
Project Grants/ Funding – See breakdown below		64.1	37.4
Education Courses, Donations & Events		39.2	63.8
Donations – General		4.9	6.8
Other		30.0	0.0
Total Income		2,834.8	*3,104.1

Breakdown of Income (Project Grants/Funding)

	2019–20 £ k	2018–19 £ k
The Rising Path (The Monument Trust)	0.0	0.8
Funding towards Trainee Programme (Perennial)	22.7	22.5
Audience and Learning / Strategic Audience Engagement Grant (UCM)	14.0	14.0
PlaMatSu Exhibition and Workshops (Marie Curie Innovative Training Network)	27.4	0.0
Interpretation (HEIF5/Donation)	0.0	0.1
Total	64.1	37.4

Expenditure

Funding Source	2019–20 £ k	2018–19 £ k
University Support	996.7	981.1
Trust Funds	533.7	511.6
Admission and Tours	499.7	561.3
Earmarked Funds: Friends	250.1	237.7
Earmarked Funds: Other	194.2	315.2
Specific Project Grants/ Funding – see breakdown below	68.3	198.8
Education Courses, Donations and Events	44.5	62.0
Donations – General	1.2	2.4
Other	29.1	0.0
Total Expenditure	2,617.4	2,870.1
Total Income less Total Expenditure 217.4	234.0	
Less: Earmarked funds held for future planned expenditure	-213.6	-229.6
Funds reinvested by Cory and Trust Fund Managers	-0.7	-1.5
Funds reinvested in the Research Fund	-61.9	0.0
Funds remaining for discretionary use	-58.8	2.9

Breakdown of Expenditure (Specific Project Grants/Funding)

	2019–20 £ k	2018–19 £ k
The Rising Path (The Monument Trust)	0.0	160.7
Funding towards Trainee Programme (Perennial)	29.1	23.2
Audience and Learning / Strategic Audience Engagement Grant (UCM)	11.2	11.9
PlaMatSu Exhibition and Workshops (Marie Curie Innovative Training Network)	27.7	0.0
Interpretation (HEIF5/Donation)	0.0	3.0
Impact (BBSRC)	0.2	0.0
Total	*68.3	198.8

Notes:
* Calculations include minor rounding differences.
Income figures include interest where funding has been held on deposit.

Funding

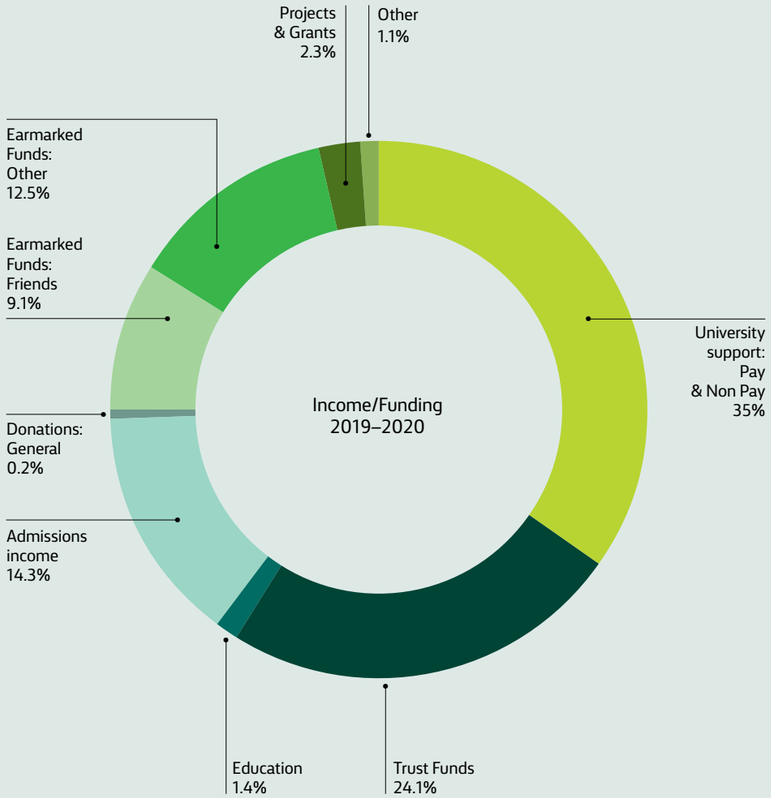
Rachel Agnew
Finance Manager

This has been a difficult year financially, when from a strong trading position in the six months to January, Covid-19 brought with it the need for 'lockdown', immediately and significantly stemming trading income previously forecast to support 41% of Operational Costs. Direct action was taken and costs cut drastically in an attempt to maintain a financial equilibrium.

Staffing resources mid-year were redirected to activities designed to 'virtually' engage our visitors and Friends such as the Wellness Wanders, Festival of Plants and a host of educational activities for family and adults alike. With the Garden closed, we took the opportunity to work on a range of long-running projects including the development and launch of our Collections Portal and the establishment of a remote adult learning programme. A budget was also allocated to aid staff working from home and then to enable the safe return of both staff and visitors, providing screens, sanitizing stations, additional and regular professional cleaning, personal protective equipment and signage.

With ongoing and unwavering support from our Friends, donations received throughout our 'closed' period to date, returning visitors from June and gift aid (thank you!) – we were able to manage the operational budget and end the financial year positively. This was a good temporary but unsustainable result, as financial demands going forward will undoubtedly escalate.

Future plans are muted with capital projects currently on hold.



Gifts, donations & support

Received in Annual Report period 1 October 2019 – 30 September 2020.

We would like to extend our sincere thanks to all who have chosen to support the Garden whether financially or through the gift of time by volunteering. Volunteer hours totalled 3,890 for the period. Your contributions are hugely appreciated and greatly valued.

In Memory Gifts

Donation from Mr Duncan Murray towards interpretation and the renaming of the Murray Walk in memory of Andrew Murray, first Curator, and, in consultation with Henslow, original planner of the Botanic Garden, £3,827.

Continued donations in memory of Ms Philippa Hill, £423.

Donation from Mrs Ruth Meyer, in memory of Dorothy Prichard, £250.

Donations in memory of Mr John Edward Last, £115.

Donation in memory of Mrs EG Surrey, donated anonymously, £625.

Donations in memory of Mr Michael Whyman, £682.

Donations received at the funeral of the late Mrs Julia Helena Brookfield, £86.

Individual Gifts and Donations

We are hugely grateful for the numerous donations received online or in our donation boxes during the Covid-19 lockdown and since. Thank you for helping us through this incredibly challenging period. We would also like to thank everyone who expressed their gratitude for the Wellness Wanders and made subsequent donations in support of them.

Thanks also to the Henslow Circle, Friends and Corporate Friends for their generous support particularly this year and to those who continue to make significant gifts over and above the annual renewal subscription. Special thanks to those who have chosen to Gift Aid admissions, subscriptions, and donations, helping to support the continuing work of the Garden.

Grants Trust and Societies

Perennial, the Gardeners' Royal Benevolent Society, for the employment of an additional horticultural trainee, £22,701.

Marie Skłodowska-Curie Innovative Training Network (via the University of Strathclyde) towards the PlaMatsu Exhibition and Workshop, £27,385.

Other support

Department of Plant Sciences for the Virtual Festival of Plants 2020, £1,000.

University of Cambridge Museums, Strategic Audience Engagement Grant, £4,000.

University of Cambridge Museums – The Botanic Garden Audience & Learning Strategic Partnership Grant (Year 3 of funding 1 April 2020 – 31 March 2021), £10,000.

Gatsby Plant Science Education Programme grant awarded for the support of Plant Science virtual Masterclass 2020, £150.

3,890
Volunteer hours

Syndicate & Cory Managers

Four meetings of the Botanic Garden Syndicate were held during the year under the Chairmanship of Dame Fiona Reynolds. Syndicate members were:
Professor Paul Brakefield,
Professor David Coomes,
Mr Jon Drori (external),
Dr Laurie Friday,
Dr Ian Furner,
Mr Donald Hearn,
Professor Nick Jardine (until end 2019),
Professor Henrik Jönsson (from July 2020),
Professor Rebecca Kilner,
Professor Ottoline Leyser (until July 2020),
Mr Charles Li (student member),
Professor Alison Smith,
Dr Rosy Thornton (from January 2020),
Professor Bhaskar Vira,
The Secretary was the Garden's Director, Professor Beverley Glover.

The Cory Managers met four times during the year under the Chairmanship of Professor Alison Smith (Head of the Department of Plant Sciences). Managers for the year were:
Mr Michael Allen,
Professor David Cebon,
Professor Howard Griffiths,
Dr Kate Maxwell,
with Mr Jonathan Appleton as the representative of the Director of Finance.

Botanic Garden staff

(Oct 2019–Sept 2020)

Director
Beverley Glover
PA to Director: Jane Adams

Administration
Administrator: Wendy Godfrey
Assistant Administrators:
Richenda Whitehead and Caty Cooke
Learning Administrator:
Emma Daintrey (to March 2020),
Lucy Watts (from March 2020)
Friends Administrator: Sacha Watson.

Curation
Curator: Sam Brockington
Assistant Curator: Ángela Cano
Plant Records Officer: Pete Atkinson
Plant Records Assistant: Mar Millan.

Development and Communications
Head of Development and Communications:
Anna Patterson Lee
Marketing and Communications Co-ordinator:
Helen Needham.

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

Finance
Finance Manager: Rachel Agnew
Finance Coordinator: Tracey Brock
(from December 2019)
Finance Administrators:
Elaine Dalton and Anouska Arthur

Horticulture
Head of Horticulture: Sally Petitt
Horticultural Learning Co-ordinator:
Sandie Cain
Alpine & Woodland Section:
Supervisor – Paul Aston;
Assistant – Simon Wallis
Demonstration & Display:
Supervisor – Pete Kerley;
Assistant - David Austrin
Experimental Area:
Supervisor – Pete Michna;
Assistant – Katie Martyr
Glasshouse Section:
Supervisor – Alex Summers;
Assistant – Barbara Griffith
Landscape & Machinery:
Supervisor – Adrian Holmes;
Assistant – Matthew Murawski
Systematics Section:
Supervisor – John Kapor;
Assistants – Julie Clos, Pete Wrapson
Trees & Shrubs Section:
Supervisor – Mark Crouch;
Assistant – Alistair Godfrey
Weekend Horticultural Assistant:
Alice Riches
Trainee Horticultural Technicians:
(from September 2019 to September 2020):
Patsy Bigley, Ella Buckley,
Bethan Collerton, Jonathan Strauss,
Leah Collins, Emily Passmore,
Colin Stewart.

Learning
Head of Learning: Hayley McCulloch
(from January 2020)
Learning Officer: Sally Lee
Schools Learning Officer: Bronwen Richards
HE and Research Impact Co-ordinator:
Chantal Helm.

Visitor Services
Head of Visitor Services:
Nicci Steele-Williams
Deputy Head of Visitor Services & Team Leader (Tuesday-Thursday): Laura Welford
Team Leader (Friday-Monday): David Evans
Visitor Services Assistants:
Andy Bryant (to March 2020),
Amanda Wilkins,
Lucinda Fudge,
Sue Baker,
James Oliver,
Anca Cojocaru (to October 2019),
Vikas Shinde,
Paul Johnson (to April 2020),
Laura Middleton,
Josephine Leng (to August 2020),
Alicia Lloyd (from March 2020),
Kristine Cimals (from May 2020),
Alexandra Pond (from May 2020),
Betsy Brown (from July 2020).
Visitor Services Receptionist: Heloise Toop

Botanic Garden staff activites

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

Professor Beverley Glover: fellow of Queens' College; trustee of the Royal Botanic Gardens Edinburgh; member of the Science Advisory Committee of the Royal Botanic Gardens Edinburgh; member of the Council of the European Society for Evolutionary Developmental Biology; member of the Council of Scientists of the Human Frontier Science Programme (vice-chair to July 2020, chair from August 2020); member of the Botanical Society of America; member of the British Society for Developmental Biology; Fellow of the Linnean Society; member of the Council 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, 'Plants, People, Planet'; member of the Editorial Board of Current Opinion in Plant Biology; member of the Natural Environment Research Committee's Peer Review College; serves on the Royal Society's 150K grants panel; gave an invited lecture at AIM High A-Level Biology Conference (London) and the opening plenary lecture at the Spanish Society for Evolutionary Biology meeting (Seville) – SESBE VII.

Dr Sam Brockington: is an active member of the High Value Biorenewables Network; fellow of the Linnean Society; trustee of the Bedfordshire, Cambridgeshire, and Northamptonshire Wildlife Trust.

Dan Jenkins: member of the UK Plant Sciences Federation committee; continued as a member of the Biology Education Research Group and the Education Policy Advisory Group of the Royal Society of Biology.

Alex Jenkin: member of the Outreach and Engagement Working Group of the Royal Society of Biology.

Stephanie Smith: member of the Careers Committee of the Royal Society of Biology.

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 continued on the RHS Qualifications Steering Group, and joined the RHS Education Committee.

Alex Summers is a Vice Chair of the RHS Tender Ornamental Plant Committee.

Simon Wallis continued as chair of the Saxifrage Society.

Chantal Helm joined Cambridge University's Ecological Advisory Panel; is the Chair of the Herts and Middlesex Bat Group; a Trustee of the Hertfordshire Natural History Society; external examiner in Environmental Science at Northampton University.

Gifts, Donations & Support

Corporate Friends

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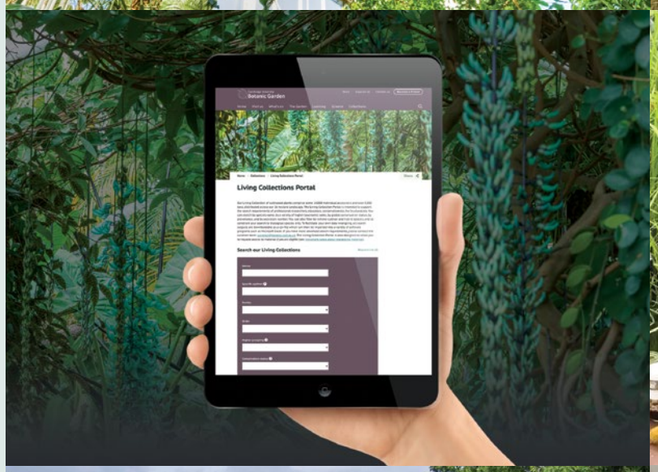
AKT II Ltd Amazon Arcadis Arcus Foundation Arts Council England ArtsMark (Arts Council England) Audience Engagement UK Ltd BDB Pitmans LLP BIOS Health Ltd Birketts LLP Bloomhall Ltd BNPPRE t/a Stutt & Parker Bromium UK Ltd Brookgate Ltd Cambridge Assessment Cambridge Econometrics Cambridge Education Group Cambridge Institute for Sustainability Leadership Cambridge Intelligence Ltd Cambridge Judge BusinessSchool Cambridge Research Office Cambridge University Information Services Cambridge University Press Cambustion Limited Carter Jonas Centrica Hive Limited Churchill College Clare Hall Costello Medical Deloitte Department of Chemistry Department of Engineering Department of Geography Department of Pathology Department of Pharmacology Department of Physics Department of Psychology Docker UK Ltd Eversheds-Sutherland LLP Faculty of Mathematics Geant Granta Design Gurdon Institute Hills Road Sixth Form College Historic England Hoare Lea Institute of Criminology Intrasonics Ltd Irwin Mitchell LLP Isaac Newton Institute John Lewis and Partners KPMG Lynfield Management Ltd Mander Portman Woodward (MPW) Cambridge Marks & Clerk LLP Mott MacDonald Ltd MRC Cognition and Brain Sciences Unit Nash Matthews Natural England nCipher Security Ltd NIAB PEM Pembroke College Penningtons Manches LLP Qualcomm Technologies International Ltd Ramboll Raspberry Pi Foundation Repositive Ltd RSM UK Management Ltd Samsung AI Center Cambridge Samsung Electronics UK Ltd Samsung Cambridge Solution Centre Saunders Boston Ltd Savills (UK) Ltd Select English Siemens Industry Software Ltd St Mary's School St. Faith's School Stephen Perse Foundation Stone King LLP Taylor Wessing LLP Thales The Cambridge Crystallographic Data Centre The Leys School Thomson Webb & Corfield Trustonic Undo University of Cambridge Institute of Continuing Education University of Cambridge School of Clinical Medicine VNC Automotive Limited WSP.



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