



Royal
Botanic Garden
Edinburgh

Our achievements



Our history

The Royal Botanic Garden Edinburgh was founded near Holyrood Abbey in 1670. Now, with gardens at four sites in Scotland, RBGE is an internationally renowned centre of excellence in botany, horticulture and education, a world-class visitor attraction and home to globally important living and preserved plant collections and an outstanding botanical library and archive.



Hortus Medicus Edinburgensis, a catalogue of the Garden's plants, published

1683



The Edinburgh Garden moves to its second site, Leith Walk

1763



Tropical Palm House built

1834



RBGE establishes its first regional garden, at Benmore. Logan follows in 1969 and Dawyck in 1979

1929



RBGE starts work on Lijiang Botanic Garden, in partnership with Chinese government

2001



Digital imaging of 300,000 specimens means 10 per cent of Herbarium collection can be viewed online

2015

1697

Cape myrtle (*Myrsine africana*), the earliest specimen in the Garden's collection, brought back from the Cape of Good Hope



1820

Garden moves to current site at Inverleith



1904

George Forrest arrives in China for his first pioneering plant collecting expedition



1964

Opening of new Herbarium and Library building brings together the two preserved collections



2002

Completion of 25-year project to document plant diversity of Bhutan



Foreword

This publication celebrates the recent accomplishments of our internationally renowned Royal Botanic Garden Edinburgh. As we strive to combat the loss of biodiversity and to achieve a greater understanding of plants, fungi and environmental sustainability, our impact is both local and global. Given mankind's dependence on plants for its health, wealth and wellbeing, and the fact that 20 per cent of the world's plants are now classed as being threatened with extinction, the need for our innovative and high-quality botanical research, conservation and education programmes has never been greater.

We now have more than 13,000 species of plants in four magnificent gardens – collectively one of the richest collections of wild plant species in the world. Our herbarium contains 3 million preserved plant specimens and is associated with a highly acclaimed library and archives. Enriching these collections to maintain a resource for future research needs is a vital part of our remit, as is ensuring that our visitors (currently more than 900,000 per year) have an enjoyable and inspirational time in our gardens – plants and the natural world are also to be enjoyed!

Our research focuses on understanding and conserving the world's plant diversity; our DNA sequencing is providing valuable insights into plant evolution and ecology; and our focus on accelerating species discovery is underpinning a wide range of conservation projects from the Cairngorms to Nepal and from Oman to Peru.

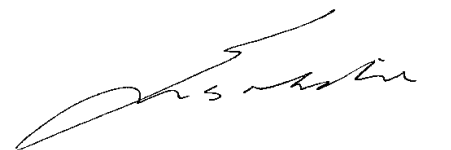
Our research into wild relatives of crops such as tomatoes, potatoes and aubergines in Peru is helping to guide the conservation of crop diversity, and our work on the environmental impact of rubber plantations will help producers manage economic risk and reduce ecological impact.

In Scotland we are successfully reintroducing and reinforcing populations of threatened plant species, including the woolly willow. We have established a long-term monitoring programme for specialist mosses that survive on mountain tops and are highly effective indicators of climate change.

Plant conservation and research are collaborative activities and our relationships with governments, institutions and colleagues in 35 countries ensure that expertise and resources are well targeted. Our work on the family Gesneriaceae, for example, is being used by the Chinese Government to launch a new category of protected areas.

Training the horticulturists and botanists of the future is a high priority. The current MSc course – Biodiversity and Taxonomy of Plants – was fully subscribed and boasts students from nine countries. Over the last five years almost 60,000 schoolchildren have joined in our schools programmes and the Edible Garden Project is going from strength to strength, enabling communities to grow, harvest and eat their own fruit and vegetables.

An enormous thank you goes to the staff, volunteers, donors, Patrons, Friends and our national and international partners, without whom none of these achievements would be possible.



Simon Milne, Regius Keeper

5 January 2016

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The challenge

Plant life is fundamental to the survival of biological diversity, human existence and the regulation of global cycles in energy, carbon and water. There is a pressing challenge to secure sufficient knowledge of the world's botanical resources to manage healthy ecosystems and support societal needs at a time of global environmental change.



Gentiana verna in the French Alps

Plant and fungal diversity

250,000 –
400,000

Estimated number of
species of land plants

70,000

Estimated number of
species of land plants
awaiting description

20%

Percentage of the
world's plants classed as
threatened with extinction

To conserve and use plants sustainably, we need to know what species exist, how to tell them apart, where they grow and what they are useful for. To guide interventions, there is an urgent need to understand how habitat destruction, climate change and other pressures will affect key species and ecosystems.

To engage people with plants and nature, there is a need for specialist training to develop national and international capacity in biodiversity science and conservation, and outreach activities to embed an appreciation of the natural world and sustainable living into the day-to-day lives of people and communities.



Who we are and what we do

Vision

A world that increasingly values, protects and benefits from plants

Mission

To **explore, conserve** and **explain** the world of plants for a better future



We deliver world-leading plant science and conservation programmes

to reduce the loss of global biodiversity and to achieve a greater understanding of plants, fungi and environmental sustainability.

We maintain and develop our internationally important collections

in order to maximise their value as a research, education, conservation and heritage resource.

We provide learning and training in horticulture, plant science and biodiversity conservation

to stimulate people to appreciate, understand and contribute to the conservation of plants and our natural environment.

We offer first-class visitor attractions

to enable more communities, families and individuals to enjoy and be inspired by our Gardens and their facilities, and become more environmentally responsible.

At the international level we are a global resource, providing expertise, training and information to help people to conserve ecosystems and protect natural capital. We work in many countries, with a particular focus in South America, South East Asia (work in Thailand pictured below right), Nepal and the Sino-Himalaya, and the Middle East.

At the national level, as Scotland's botanical institute, we play a significant role in delivering the Scottish Biodiversity Strategy. As a Non Departmental Public Body we give the Scottish Government access to scientific excellence and support the delivery of the Programme for Government. As a charity and an information hub, working with many partners, we inspire a wide audience to engage with the natural world that underpins our health, wealth and wellbeing, and encourage people to discuss and get involved with environmental issues. Pictured are the Temperate Palm House, left, and *Amorphophallus titanum*, below left, at the Edinburgh Garden.

International policies that steer our work:

- United Nations Sustainable Development Goals
- United Nations Convention on Biological Diversity (CBD)
- United Nations Global Strategy for Plant Conservation (GSPC)
- United Nations Millennium Development Goals (MDGs)

National policies that steer our work:

- Scottish Government Outcomes (Healthier lives; Sustainable places; Strong resilient communities; Valued natural environment; Reduced environmental impact; Education, research and innovation)
- Scottish Biodiversity Strategy (SBS)
- Scottish Government's Rural and Environment Science and Analytical Services Division's (RESAS) Research Strategy
- UK and Scottish Plant Health Strategies





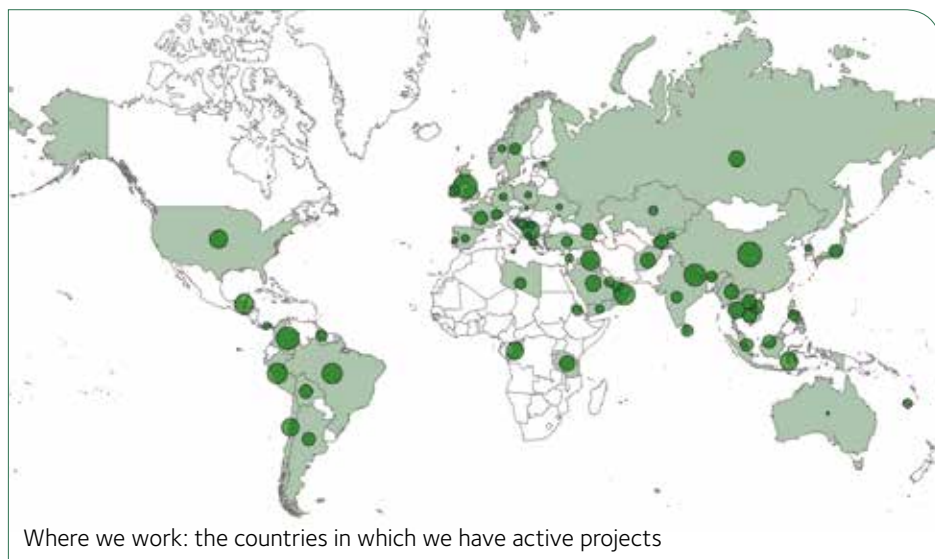
Our achievements

Explore | Conserve | Explain

Improving the understanding of plant and fungal diversity

Human welfare is dependent on plants and fungi. Recent estimates indicate that 20 per cent of all flowering plant species have yet to be discovered and described and the fungal kingdom remains largely unexplored. In addition, knowledge gaps for species already described often impede their conservation and sustainable use.

Our focus is on accelerating species discovery and the production of identification and knowledge resources: characterising species at imminent risk of extinction, species of importance to humankind and diversity in the most poorly known and threatened areas of the world.



Taxonomy and biodiversity inventory

Our taxonomic research organises biodiversity into a manageable framework to underpin ecological and biological research, resource management and sustainable use.

The twin tasks of taxonomy:

- **Species discovery and delimitation:** establishing which species exist and where they occur
- **Species identification:** developing tools to tell species apart

Our Living Collection, Herbarium and Library, established and maintained over hundreds of years, provide the basic tools that underpin this research.

Plant groups

We are advancing knowledge of herbaceous plants in the tropics that are poorly understood but play a critical role in tropical ecosystems and are of great importance as environmental indicator species, to the horticultural industry and as a source of food, products and medicines.



Zingiberaceae

The ginger family (Zingiberaceae) is an important source of spices and medicines. Our research on two genera (*Amomum* and *Cautleya*) led to a 30 per cent increase in the number of recognised species.



Gesneriaceae

The Gesneriaceae (African violets) is a family of some 3,200 species of tropical herbs widely cultivated as ornamental plants. Our recent research has established a stable new classification and led to the discovery of 4 new genera and 43 new species.



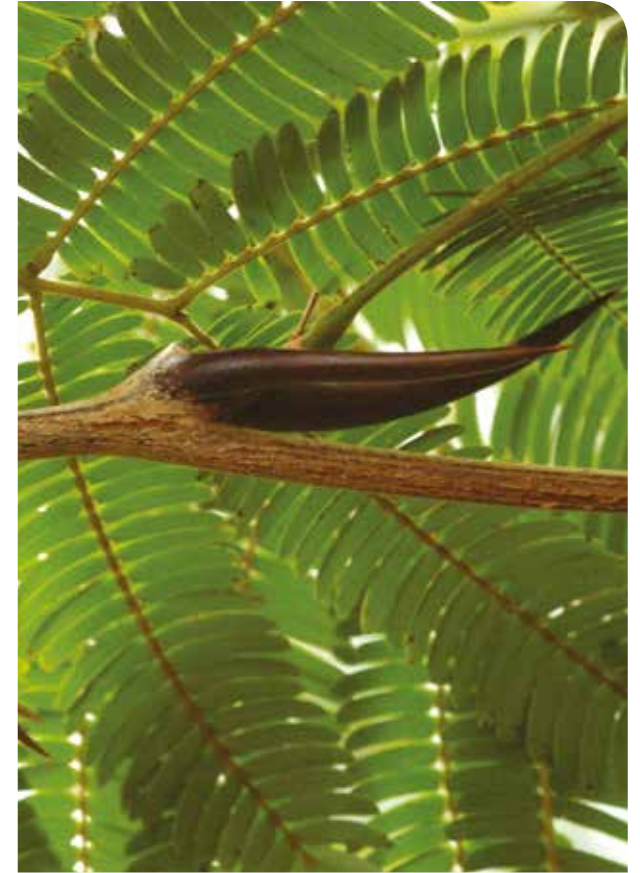
Begonia

Begonia is one of the largest of all plant genera, typifying the acute challenge of understanding the diversity and distributions of species-rich groups. We produced a global *Begonia* database with 27,720 specimen records online and since 2009 have discovered 56 new species.



Solanum

Our work on *Solanum*, which includes the cultivated tomato, potato and aubergine, led to an authoritative summary of 276 species in Peru, a geographic centre of diversity for these plants. Our research has also revealed evolutionary relationships within the Solanaceae, providing a classification framework for research around the world.



Globally there are about 100,000 species of trees. Tree species provide fuel, shelter and many other resources that benefit humanity. Our research underpins their conservation and sustainable use.

Conifers

Conifer species are ecologically, economically and culturally important, yet new species still await discovery. We discovered new species in groups as diverse as yew trees in China, *Podocarpus* from the Caribbean and monkey puzzle relatives in New Caledonia. This work provides a framework for conservation planning and sustainable use.

Sapotaceae

The Sapotaceae family contains approximately 1,200 species and is an important source of timber and products like shea butter, gutta-percha latex and edible fruits such as the miracle berry. Our Sapotaceae Resource Centre provides a key research tool based on over 54,000 records with advanced mapping and image-viewing functions.

Leguminosae

The legume family contains more than 20,000 species and is one of the most ecologically and economically important groups of flowering plants. We are at the centre of global efforts to produce a new evolutionary classification for legumes, and have produced a taxonomic monograph of *Berlinia*, an ecologically important group of African rain forest trees.



Klebsormidium sp. (green alga)



Coscinodiscus sp. (diatom)



Polytrichum sp. (moss)



Marchantia polymorpha (liverwort)



Clitocybe nebulosa (mushroom-forming fungus)



Hypogymnia physodes and *Usnea subfloridana* (lichens)

Cryptogams (algae, diatoms, mosses, liverworts, fungi and lichens) represent a major component of the planet's species diversity, yet remain poorly known. We study their diversity, evolution and ecology to address fundamental knowledge gaps in this important group of organisms.

■ Our research has produced detailed taxonomic treatments for 3,866 cryptogam species worldwide, including the description of 41 new species.

Our use of DNA data to unravel species relationships provides fascinating insights into the evolution and ecology of plants.

Places



Scotland has an outstanding diversity of cryptogamic plants and fungi, and has the best remaining European examples of globally rare temperate rainforest, characterised by lichen and bryophyte epiphytes. However, taxonomic tools and guides are needed as many of these species are difficult to tell apart and our understanding of the diversity of the Scottish cryptogamic flora remains incomplete.

Scotland

- We provided taxonomic aids for the identification of 2,939 Scottish species, including the description of 6 new species for Scotland and the discovery of new populations for 3 species previously thought extinct.
- In collaboration with Scottish Natural Heritage we established a long-term monitoring programme of specialist bryophyte species that can only survive on Scotland's highest mountains where snow persists well into the summer. Their sensitivity makes them highly effective indicators of climate change in our montane flora.
- We were lead authors and/or taxonomic authorities for the 2nd edition of *The Lichens of Great Britain and Ireland*, and for *Mosses and Liverworts of Britain and Ireland*. We support and ensure accuracy in the wider recording of Scottish and UK biodiversity through quality control on checklists, taxon dictionaries and synonym lists.



The forests of South East Asia are a global biodiversity hotspot with higher population density than other tropical regions, but rapid land conversion is resulting in severe deforestation and a high likelihood that species will go extinct before they are ever discovered.

South East Asia

- Laos has one of the least developed biodiversity research infrastructures in the world. We produced a list of the 4,850 vascular plant species known from Laos as a baseline for conservation action. Research on wild cardamom, the most economically valuable non-timber forest product in Laos, has led to a 30 per cent increase in the number of recognised species.
- Our work has led to a greatly enhanced understanding of the biodiversity of Sulawesi. For example, a new revision of the ginger genus *Etlingera* found 44 species not previously recorded on Sulawesi, of which 36 were new to science.
- Research and editing led to revisions of 3 plant families published in the *Flora of Cambodia, Laos and Vietnam* allowing accurate recognition and naming of 51 genera and 210 species.



China and the adjacent Himalayan region possess extremely high levels of plant diversity, which supports local communities and livelihoods, but which is also threatened by population growth and rapid environmental change.

China and the Himalayan region

- We lead production of the first comprehensive guide to the plants of Nepal, above. The first of 10 volumes, covering 600 species, was published in 2013, and we provide free online access to data, images, distribution maps and more than 20,000 specimens of over 9,000 species.
- We were an Editorial Centre for the recently completed *Flora of China*, the first English-language treatment of the 32,000 Chinese plant species. This flagship 25-year international collaboration resulted in the development of extensive research networks, flourishing partnerships and the establishment of the Lijiang Field Station with the Chinese Academy of Science's Kunming Institute of Botany.



The politically fragile region of the Middle East and South West Asia contains around 13,500 plant species. It is an important centre of origin for many economically important crop plants but there is a regional deficiency of biodiversity data and a lack of in-country capacity to generate it.

Middle East

- In the Arabian Peninsula and Soqatra we have produced or edited 600 species accounts in approximately 30 families to establish baseline knowledge of the flora.
- In Oman, above, we have contributed to an interdisciplinary atlas of the northern mountains as a tool for sustainable planning by the Omani Government. This included the first botanical surveys of 15 mountains where we recorded over a third of Oman's flora, including 14 endemic species.



Latin America holds more plant species than any other continent but even the trees that dominate Amazonia and regulate global cycles of carbon and energy are far from completely known.

South America

- Our floristic inventory in South America has demonstrated that up to 40 per cent of the species found in highly threatened dry forests in Andean valleys in Peru, above, grow nowhere else.
- We coordinated an international research network that compiled a dataset of more than 2,000 dry forest floristic inventories across Latin America and the Caribbean to identify key areas of diversity and endemism.
- Data from 367 floristic surveys carried out by our researchers over 5 decades in the world's most species-rich savannas in Brazil has been made freely available along with maps and plant images via a website which, to date, has been viewed more than 175,000 times.

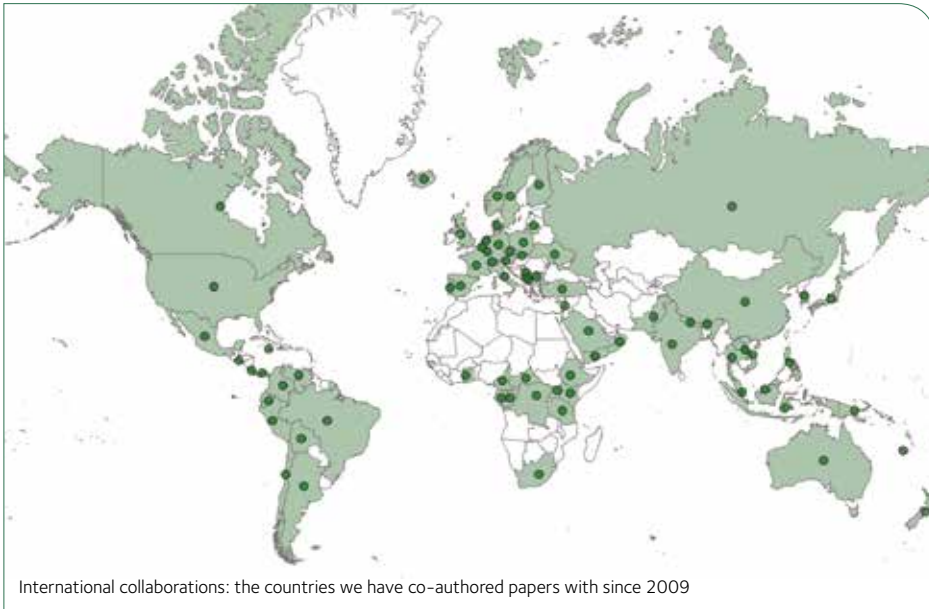
Ambassadors for Scotland



Through our international research programmes we have established high-level links with national governments and in-country representatives of the British Government. This strong support from senior diplomats and government officials not only facilitates our work but also further promotes Scotland and the UK on the international stage.

In Nepal we have had audiences with the President of Nepal and the Nepalese Prime Minister. We have close working relationships with the UK Foreign and Commonwealth Office, the Nepalese Embassy in London and the British Embassy in Kathmandu. We are playing a leading role in preparing the Britain-Nepal Bicentenary in 2016, a celebration backed by both governments. Picture, left, shows the Nepalese Ambassador at RBGE.

In South West Asia we work with national governments and international organisations, such as the United Nations Environment Programme, and link with UK embassies and the Scottish Government – which places a strategic emphasis on the Gulf States, particularly Qatar and the United Arab Emirates. We have welcomed Her Royal Highness Princess Basma bint Ali of Jordan and the Adviser to His Majesty the Sultan of Oman on official visits seeking advice and to develop closer collaboration.



The Malaysian Minister for Tourism and High Commissioner of Malaysia visited RBGE – see picture below – to see the role botanic gardens play in the UK tourism industry.

Recent Memoranda of Understanding (MoU) have been signed with Brazil, Chile, China, Colombia, Indonesia, Norway, Russia, Spain, Taiwan, Tajikistan, Thailand and Turkey. In total we have MoUs with 19 countries.



Building the biodiversity toolkit

We develop effective methodologies to accelerate and enhance characterisation of the planet's biodiversity.

DNA barcoding

A challenge for taxonomy in the 21st century is to speed up species identification and discovery in the face of unprecedented loss of species and habitats. To address this issue we have taken a leading role in DNA barcoding as part of a global collaborative effort to build a DNA sequence-based identification resource for life on earth.

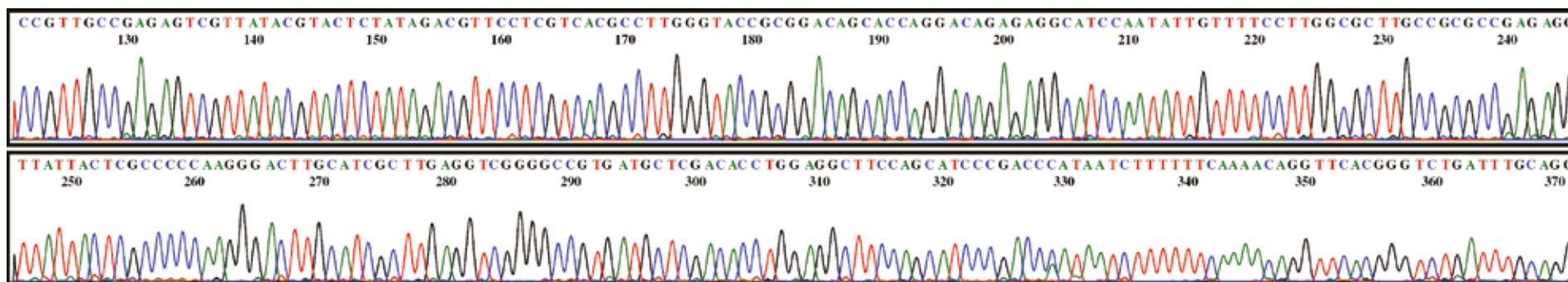
We led the 51-author publication that defined the international standards for DNA barcoding of plants, now cited more than 900 times. We have also provided general scientific leadership on plant barcoding in study design, laboratory protocols, data analyses and practical applications. We chaired the Scientific Steering Committee of the International Barcode of Life Project, a project involving thousands of researchers from around the world.

We applied DNA barcoding to the entire British angiosperm flora to create an identification resource and a phylogenetic framework for comparative biology. We also applied DNA barcoding to the diverse, but difficult to distinguish, British liverwort flora and selected lichen species – see picture, right. This has led to the discovery of previously unknown rare and threatened species in Scotland, and the taxonomic clarification of conservation priority species.

We coupled our DNA barcoding expertise with studies of speciation and species differentiation in diatoms to develop a DNA barcoding system for monitoring freshwaters for the Water Framework Directive in collaboration with the UK Environment Agency.

Linking DNA barcoding with genomic sciences, we have recently utilised next-generation sequencing technologies to further develop DNA methods for telling species apart, including approaches for closely related species complexes, and/or samples with degraded DNAs, such as herbarium specimens. Below: a DNA sequence electropherogram.

“RBGE’s leadership role has had a major impact in shaping the field of plant DNA barcoding around the world.” Dan Janzen, Tropical Ecologist



We develop biodiversity informatics infrastructure to capture, manage and publish biodiversity data to ensure it gets to the places it is needed, in the format that is most useful.

- We have streamlined the publication of taxonomic data, developed the concept of 'born digital' Floras and derived products such as mobile apps. This involved the development of database structures to allow flexibility in choice of outputs, ultimately enabling user-specified plant identification products.
- We have developed the concept of institutes being the 'primary source' for the digital data that they curate, promoting accreditation and minimising versioning problems caused by electronic duplication.
- We are a founding member of the World Flora Online consortium, an ambitious project aiming to produce a central global internet resource of knowledge of the world's flora by 2020. Working group members are pictured below in the Edinburgh Garden.



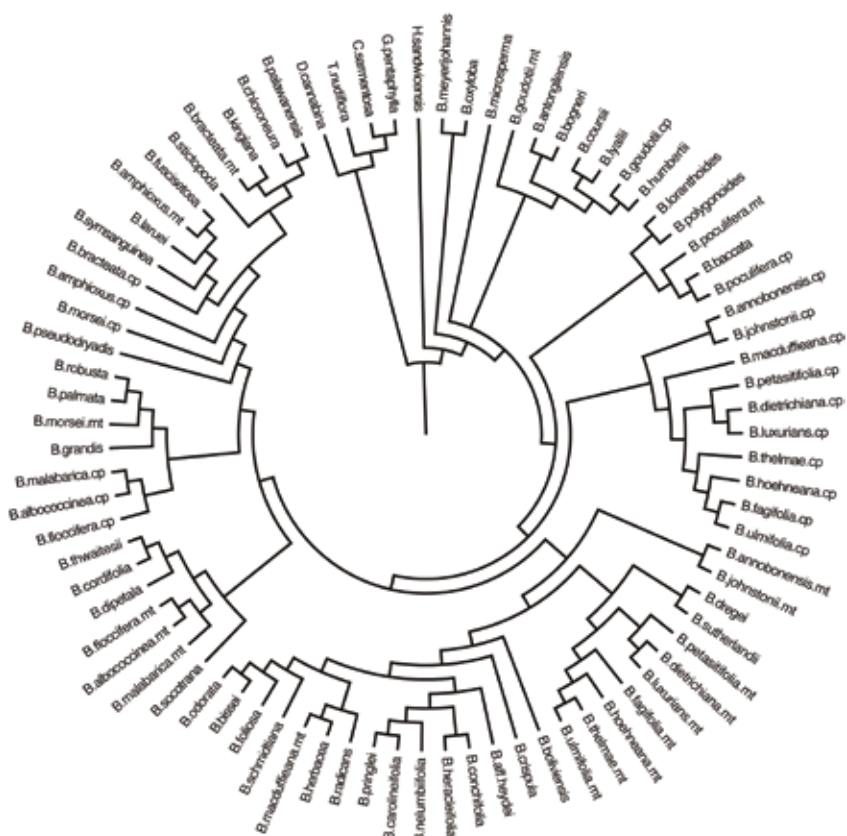
We develop and assess field data collection protocols and techniques in order to speed up and increase the rigour of biodiversity surveys, the gathering of research materials and the production of user-friendly identification guides.

- We pioneered the 'plant profiling approach' optimising the digital capture of field data, closely integrating the capture of digital images with distributional data.
- We researched collection methodologies to improve the quality and recoverability of DNA from field-collected plant samples. Above: packing specimens in Nepal.
- We have assessed the effects of differing levels of funding and taxonomic expertise on estimates of plant diversity and distribution during field surveys. This helps improve the design of field programmes and the interpretation of survey data.

Plant evolution and ecology

Our use of DNA data to unravel species relationships provides fascinating insights into the evolution and ecology of plants.

- We have shown that some dry forest areas are evolutionary museums containing ancient lineages, with single species that are 10 million years old or more, whereas in the Amazon rain forest and tropical savannas, diversification in some groups can produce hundreds of species in a few million years. Pictured below right: searching for new species in New Caledonia.
- Our scientists have demonstrated that the speciation rate in high-altitude Páramo vegetation in the Andes is faster than anywhere else on earth. Understanding that Páramo is a living laboratory of extraordinarily fast evolution adds another strand to the compelling arguments for its conservation in the face of climate change, mining and agricultural expansion.
- We have studied the genetic changes underlying difference in plant form with a focus on the genes responsible for differences in leaf shape, meristem development and pollination syndrome. As part of this work we produced the first genetic map for the hyper-diverse genus *Begonia*, below left, as a framework for understanding the evolution of leaf form.
- We have published two landmark papers exploring for the first time the evolution and diversity of flowering plant pollen, in the context of robust DNA-based phylogenies. Our studies provide an important baseline for the science of palynology and a methodology for morphological character exploration that can be repeated across the plant kingdom.





Our achievements

Explore | **Conserve** | Explain

Translating science into well-targeted and high-impact conservation programmes

Large-scale global change and direct human pressures on the natural environment are leading to extensive biodiversity loss and major societal impacts. There are pressing challenges in minimising extinction and promoting the maintenance and restoration of biodiverse and resilient ecosystems.

Our focus is the translation of policy-relevant science into conservation practice. We evaluate and then prioritise the species, ecosystems and regions that are most under threat, develop management solutions, and implement recovery and restoration programmes.



Identification of important areas for conservation

We provide major input into local, national and regional conservation planning in some of the most threatened and least explored ecosystems on earth.

- In the Arabian Peninsula, we led the identification of Important Plant Areas. We undertook a review of the Iraqi Ministry of Environment's ten-year National Key Biodiversity Areas programme and we developed a roadmap for the Saudi Arabian National Biodiversity Assessment. Our work was critical in the designation of the Yemeni island of Soqatra – see picture left – as a World Heritage Site and the planning of protected areas in the region.
- The dry forests of Latin America are rapidly disappearing due to conversion to agriculture. Our work has quantified the high levels of endemism and evolutionary uniqueness of these forests, and has been fundamental in identifying conservation sites.
- New Caledonia is a biodiversity hotspot, but faces massive environmental destruction due to nickel mining and fire – see below. Analysis of distributional data of nearly 3,000 plant species led to the production of a 'rarity hotspot map' to target conservation action.
- Our data collected over a 20-year period was used to secure UNESCO World Heritage Site status for the Sangha Trinational area in Congo.
- Our work on Gesneriaceae has been used by the Chinese Government to launch a new category of protected areas for plants with extremely small populations.

Evaluating threats to species

Our species conservation status assessments help reduce plant extinctions and target scarce resources effectively.

- We chair the International Union for Conservation of Nature Species Survival Commission (IUCN SSC) Conifer Specialist Group, and played a major role in the completion of the Red List and first global reassessment for conifers. This critical update showed that 34 per cent of the world's conifers are now threatened with extinction. We serve online detailed information, distribution maps and images for all of the 211 threatened conifers.
- We contributed several hundred assessments to the IUCN SSC Arabian Plant Specialist Group, the IUCN SSC Global Tree Specialist Group and the IUCN SSC Freshwater Plant Specialist Group, and since 2009 we have undertaken 5,952 IUCN species threat assessments.



Conservation science

Our conservation science enables objective assessment of threats and effective conservation management interventions.

- In Scotland we developed a web-based scenarios toolkit to explore options for woodland biodiversity management, offsetting the risks of climate change and tree disease. This is now being trialled by Scottish Natural Heritage at its flagship Glen Creran National Nature Reserve, to help conserve Scotland's internationally important temperate rain forest.
- We developed biological indicators for Scotland's Climate Change Adaptation Programme and the UK's Climate Change Adaptation Sub-Committee.
- We led the alignment of the national list of priority cryptogamic plant and fungal species with management actions in the Scottish Rural Development Programme to support the practical delivery of Scotland's Biodiversity Strategy.
- We produced the first major review on the implications of global change for rust pathogens. This informs how these important pathogens are likely to respond to climate change.
- Tanzania's forests, below left, are threatened by a rapidly rising demand for wood for construction, fuel and unregulated raw timber exports. We modelled the spread of logging, below right, and quantified associated losses of biodiversity, carbon and revenue. This study has facilitated more strategic forest conservation and triggered several national policy changes.



Lichen archaeology

The long history of human impacts on the natural environment hampers efforts to establish effective baselines for conservation. To provide an historical perspective on biodiversity change, we sampled environmental indicators (lichen species growing on trees) from timbers preserved in pre-industrial buildings from the 1400s to the 1600s – see pictures – and compared levels of biodiversity before and after the British Industrial Revolution.



This revealed up to 80 per cent loss from regions impacted by pollution and the decline of traditional woodland management. This scale of biodiversity loss has been 'hidden' across much of temperate Europe, because conservation baselines were established during the 1960s and 1970s, and hence are only relevant to the most recent post-industrial landscape changes.

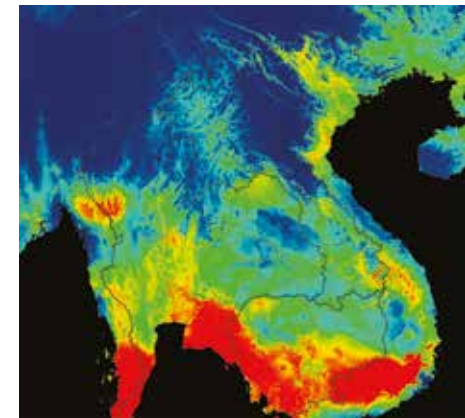
This finding has implications for the setting of internationally equitable conservation goals. Targets for European industrialised nations should be more ambitious to include the restoration of biodiversity to reflect pre-industrial baselines if they are to be consistent with the expectation placed on many developing nations of halting biodiversity loss.



Managing risk and reducing the environmental impact of rubber plantations

Hevea brasiliensis is the world's major source of natural rubber for the annual production of more than 1 billion tyres and represents a socioeconomically important natural resource. Our work aims to manage economic risks and reduce environmental impacts by identifying situations where rubber planting may be economically unsustainable and lead to loss of natural capital and ecosystem services.

Demand for tyres is resulting in rubber plantations in new environments, including those of high biodiversity value. Our computer modelling study revealed that 57 per cent of rubber plantations are now in areas susceptible to drought, erosion, frost or wind damage, which may make long-term rubber production unsustainable. In 2013 typhoons destroyed plantations worth over US\$250 million in Vietnam alone, and future climate change is likely to exacerbate these environmental stresses. There is potential for loss-loss scenarios: clearing of high-biodiversity-value land for economically unsustainable plantations that are poorly adapted to conditions and that alter landscape functions (e.g. hydrology, erosion), compromising livelihoods. Picture shows rubber tapping from *Hevea brasiliensis* and map shows suitable habitat for plantations in red.



Preserving and restoring biodiversity

Our *ex-situ* collections and plant reintroductions safeguard highly threatened species and their genetic resources.

- In Scotland we successfully reintroduced and reinforced populations of *Polygonatum verticillatum*, *Salix lanata* (pictured below right) and *Woodsia ilvensis*.
- Target 8 of the Global Strategy for Plant Conservation stipulates that signatories grow 75 per cent of threatened plants in *ex-situ* conservation collections, with 20 per cent available for possible reintroduction. We have 156 of 181 (83 per cent) Scottish Target 8 species in our conservation collections.
- The International Conifer Conservation Programme has established 245 safe sites spanning the British Isles and containing 12,500 plants, including 50 per cent of the world's critically endangered conifer species. This is one of the most comprehensive *ex-situ* conservation networks in the world for threatened woody plants. Pictured below left: *Araucaria subulata*.





Guidelines for restoring nature

We play a leading role in developing international and national guidelines for conservation translocations – the human movement of plants, animals and fungi for conservation purposes.

Conservation translocations include moving organisms to bolster dwindling populations, to replace those that have been lost or to create populations in new areas where threats are lower. But moving species is not without risk. Resources can be squandered if translocations fail. Translocations can spread pests and diseases, and in some cases a successful translocation can create problems for other species or other users of the land.



To promote best practice, maximising benefits and minimising harm, RBGE scientists co-authored the 2013 *International Union for the Conservation of Nature's (IUCN) Guidelines for Reintroductions and Other Conservation Translocations*. These guidelines have become the international standard, and were used as the basis for the Council of Europe's *Conservation Translocations under Changing Climatic Conditions* recommendations, that are now formal policy for the 50 signatory governments to the Bern Convention.

We then led the authorship of *The Scottish Code for Conservation Translocations*, a world-first national implementation of the new IUCN guidelines. Paul Wheelhouse, Scottish Minister for the Environment and Climate Change, is pictured above launching *The Scottish Code* in 2014.

Response to *The Scottish Code*:

"A remarkable contribution not only for Scotland, but as a precedent for other countries"

Axel Moehrensclager, Chair, IUCN SSC Reintroduction Specialist Group

"A fantastic piece of work ... It would be very nice to think other countries will emulate this"

Mark R Stanley Price, Chair, IUCN SSC Sub-Committee for Species Conservation Planning



Our achievements

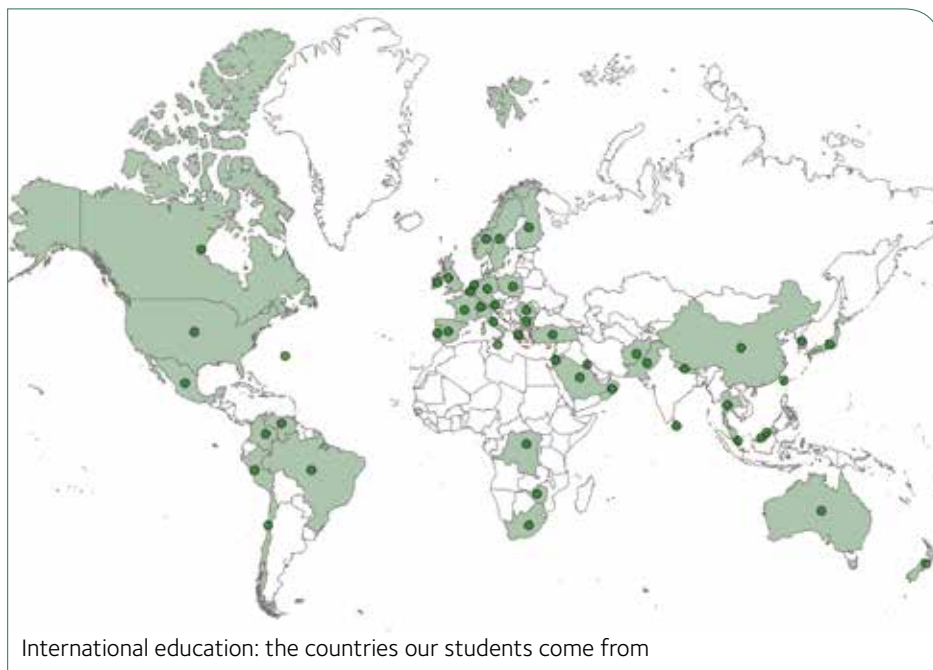
Explore | Conserve | **Explain**

Training, empowering and engaging more individuals and communities with plant conservation and sustainable use

Sustainable management of the planet's natural capital requires well-informed decision makers, effectively trained practitioners and a wider public understanding of environmental challenges and solutions.

Our focus is on specialist training and public engagement linking plants to individuals and communities in Scotland and around the world. We achieve this through building capacity to support conservation programmes, empowering people to understand, cultivate and benefit from plants, and providing accessible environmental education to embed sustainable living into wider society.

Education and training



International education: the countries our students come from

We are building a global network of trained personnel to enable the conservation and sustainable use of plants and, more widely, to improve societal environmental literacy.

School programmes

- In the last 5 years 59,696 children have participated in our schools programme at Edinburgh, Benmore and Logan. All of our programmes map to the Curriculum for Excellence and deliver experience-based and exploratory learning that encourages smarter, healthier and more environmentally aware lifestyles in Scotland's children and their families.
- Our partnership with the Scottish Schools Education Research Centre and programmes for teacher Continuing Professional Development has enabled us to reach more than 1,891 teachers across Scotland, providing them with the knowledge, resources and confidence to teach environmentally responsible behaviours to their pupils.

Schools gardening project

RBGE has been gardening with children for nearly 20 years.

Our project has provided children with their own 'one square foot' plot to plant up and tend through the growing season as well as communal areas that they all help to maintain. At the end of the season, they have taken their vegetables home to share with their families or used them for cooking at school.

Sessions, such as the one pictured below, were designed to be fun, educational and social, providing a real outdoor classroom experience. At the end of the year, we aimed for each child to go away with a love of soil (we never use gloves) and an appreciation of how the rich biodiversity in our gardens is interconnected, including the fact that they are also part of this web. The project has also provided an opportunity for the children to connect with their classmates, both by sharing the work in the garden and through ethical debates such as whether or not to kill snails or what the results might be of using chemicals.

Feedback from teachers has included many comments on the positive impacts that taking part in and excelling at the practical gardening tasks has had on children's self-confidence, eating habits and behaviour.



Lifelong learning

- We have delivered almost 100 workshops and short (10-week) courses per year with 3,500 individuals participating in approximately 70,000 learner contact hours in the last 5 years. Our diverse programme has included botanical illustration, photography, plant science, horticulture, herbology, Pilates and garden history, improving the knowledge, skills, and physical and mental wellbeing of the participants.
- Our short courses have often been used by adult learners as a first step back into education before going on to further training, ultimately entering the workplace or enhancing their existing jobs.
- A total of 580 people have attended RBGE certificate courses covering practical skills in disciplines ranging from botanical illustration to medical ethnobotany and horticulture. Courses have been run in Scotland, England, Chile, China, Mexico, Oman, Thailand and Turkey.
- Our Certificate in Practical Horticulture has been delivered at seven centres across the UK including the botanic gardens at Glasgow and St Andrews, Dingwall Academy, the Eden Project and community projects in Bute, Edinburgh and South Lanarkshire.
- We are the UK's largest single centre for the examination and delivery of the Royal Horticultural Society (RHS) Level 2 certificate in Horticulture, the industry's standard entry-level qualification. Our 750 students have included those starting their own businesses, trainees from existing businesses, those returning to work and school-leavers, as well as amateurs and retirees.
- Our botanical illustration students and tutors have won five gold and eight silver-gilt awards at prestigious RHS and Botanical Images Scotia (BISCOT) art shows.
- Our virtual learning environment PropaGate Learning was launched in 2012 and has reached 647 students from 45 countries on distance and blended courses covering topics as varied as botanical illustration, garden design and biodiversity research.



Capacity building: the countries in which we train people

Specialist training

- We have delivered practical training courses in field botany, survey techniques and conservation assessments. A total of 1,467 people attended workshops on plant identification and field skills, and training in conservation assessments was delivered to 448 people, increasing the capacity in biodiversity research and conservation at home and overseas.
- We have used PropaGate Learning to deliver specialist online and blended training courses in plant systematics and conservation to students in Scotland and across the world. This has included some of the most troubled regions of the planet, including over 130 students in Iraq and Afghanistan.
- We delivered a 2-week training course in basic molecular biology to 109 people and trained a further 100 in practical techniques in micro-propagation, cytology and microscopy.

Modern apprentices at RBGE

The two-year Modern Apprenticeship scheme was launched at RBGE in 2011 offering 16–19 year olds a full-time programme of on-the-job learning, along with the chance to obtain professional qualifications.

The scheme has provided apprentices, such as those below, with an opportunity to gain practical horticultural experience working in the different areas of the Garden: arboriculture, alpine, display and research glasshouses, herbaceous plants, turf and nursery. The apprentices have benefited from mentoring by RBGE staff and studied for the SVQ Level 2 in Amenity Horticulture on a day-release basis at Oatridge College.

To date, six apprentices have successfully completed the programme with one going on to gain a full-time post on the RBGE staff.



Further and higher education

- A total of 180 students have graduated from our HND/BSc programme in Horticulture with Plantsmanship, delivered jointly with Scotland's Rural College – see picture, above. More than 90 per cent of our graduates have gone on to careers or further study in horticulture, botany or allied fields.
- Since 2009, 89 students from 34 countries have participated in our world-renowned MSc in Biodiversity and Taxonomy of Plants, delivered jointly with the University of Edinburgh. Over 90 per cent of our MSc students have gone on to employment or further training in the biodiversity sector.
- Between 2009 and 2015, we supervised 51 PhD students from 19 countries, providing highly specialised training in biodiversity science. Topics covered ranged from understanding the diversity of the seed bank in degraded habitats in Kuwait to the taxonomy of Gesneriaceae species, and included the first lichen taxonomic PhD in the UK in more than 30 years.



Knowledge products – connecting plants to people

We provide access to authoritative, science-based information to empower people to make effective choices for conservation and the sustainable use of plants.

- We worked with the Department for International Development to develop user-friendly multilingual plant guides to put authenticated botanical information at the fingertips of local communities in Nepal – see picture, left. This is supporting sustainable development and promoting the expansion of ecotourism.
- Through Darwin Initiative funded work in Iraq we addressed a lack of accessible and useable tools for field identification using image-based mobile and web identification apps to strengthen the Iraqi capacity to monitor and conserve its newly designated KBA network.
- We produced a multilingual animated film *The Tropical Dry Forest* – see above – to raise awareness in Latin America of the importance of conserving the unique but neglected dry forest ecosystem.

Maximising impact through outreach

Our outreach programmes aim to strengthen the appreciation and understanding of plants throughout our society.

- At our Edinburgh Garden some 200,000 people attended science communication events including Science Festival, 'Lates' (aimed at young adults), science cafés and regular weekend drop-in sessions.
- Our Talking Science programme engaged hard-to-reach audiences at more than 60 events across Scotland, bringing science and scientists to over 30,000 people.
- Our Edible Gardening Project, pictured below, has enabled communities to take responsibility for their own dietary health and grow their own fruit and vegetables. To date the project has worked with over 20,000 people from all sectors of society.
- Our Science on a Plate project highlighted the science behind the food we eat to an audience of over 150,000 participants across Scotland. Likewise, our Really Wild Veg project engaged the public in exploring the value and diversity of native crop wild relatives in collaboration with the Rowett Institute of Nutrition and Health and seven community gardens across Scotland.



- We developed an exhibition called *From Another Kingdom*, pictured above, and an associated book to communicate the diversity and importance of fungi in health, medicine, food, drink and ecological services.
- We worked with the World Wildlife Fund to raise awareness among Scottish consumers of the effects of the soya food chain in driving habitat destruction in Brazil. Meat, eggs and milk sold in Scottish supermarkets are all produced using animals fed with soya, much of which originates from plantations which threatened the highly diverse cerrado ecosystem.
- Scotland has one of the highest per capita rates of cocaine consumption; we provided support for programmes that demonstrate to Scottish children the environmental and social consequences of drug misuse in source countries with a strong focus on Colombia. We also undertook outreach activities at public events, including Rockness, the Wickerman Festival and the Edinburgh Festival Fringe.
- The recent outbreak of ash dieback propelled plant diseases into the public view. To ensure clarity of message to the public in Scotland about the disease, and steps that can be taken to reduce its spread and impacts, we led the production of the *Moving Forward from Ash Dieback* exhibition, which reached over 100,000 people at venues across Scotland.
- To bring Scotland's habitats and wild plants to the city, we established three Scottish native plants areas, complete with interpretation, explaining the pressures faced by different habitats and what can be done to conserve them.



Four gardens providing an environment for tourism, leisure and wellbeing

We provide first-class visitor attractions to enable more communities, families and individuals to enjoy and be inspired by our four Gardens and to benefit from cultural enrichment and relaxation in a tranquil and beautiful environment.

- Since 2009 we have welcomed nearly 5 million visitors to RBGE Gardens. In 2014/2015 visitor figures rose by 20 per cent to 948,264.
- We are committed to participation in VisitScotland's Accessible Tourism Steering Group, and the Edinburgh Garden was voted one of the top 20 most accessible visitor attractions in the UK.
- In 2015, two of our Gardens (Dawyck and Logan) were rated as 5-star by VisitScotland, and we are committed to attaining and sustaining 5-star quality tourism standards at all our Gardens.
- We developed a new event, *Botanic Lights: Night in the Garden*, pictured right, which attracted more than 23,000 paying visitors to the Edinburgh Garden and was recognised with a Museum and Heritage award.
- We are a founder member of the new national group, Discover Scottish Gardens, which is a key partner in VisitScotland's themed years and aims to encourage tourism in Scotland.
- In the lead-up to the 2014 Glasgow Commonwealth Games, we hosted the *No Strangers* photographic exhibition and brought aboriginal artists from Australia, New Zealand and Canada to help visitors explore the wonder of culture and the plight of indigenous peoples around the world.
- Tourism Malaysia sponsored a Malaysian Plants and Food event and the development of a Malaysian Plants Trail in the Glasshouses to promote ecotourism in South East Asia.
- We hosted 20 new exhibitions at Inverleith House, providing a mix of international contemporary art, Scottish artists and material from our Archive and Herbarium to an audience of 100,000 people. Pictured left: sculpture by John Chamberlain.





Our collections

Our collections underpin our national and international research, education and conservation programmes, and are of enormous cultural value. They make up one of Scotland's national collections and rank amongst the best of their kind in the world.



Herbarium

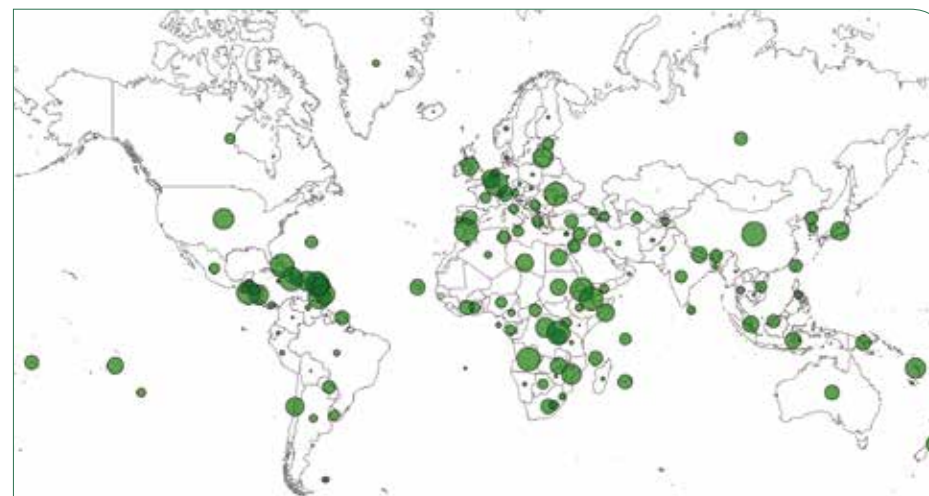
An exceptional resource of 3 million preserved plant and fungal specimens dating from 1697 to the present. These specimens provide a working reference collection for the identification of plants, the naming of species and the study of plant distributions, conservation, ecology and evolution.



Our Herbarium Collection: countries where our specimens were collected

Library and Archive

We curate one of the world's finest collections of botanical and horticultural literature and art. This collection is of enormous scientific, cultural and historical significance and contains some 70,000 books and 150,000 volumes of periodicals.



Our Living Collection: countries where our plants were collected

Living Collection

RBGE's four Gardens hold one of the world's richest collections of wild plant species, containing over 13,000 species from 157 countries, including some that are extinct in the wild and others that are new to science. They are a 'safe house' for threatened species, provide a resource for research and training, and offer a stage for engagement, interpretation and recreation.



Accessibility and use of the collections

We promote effective physical and digital access to our collections to maximise their use and development.



- We hosted over 500 international research visitors who have studied the collections in our Herbarium.
- There were 127,155 unique visits to our online Herbarium database and 603,954 specimen records and 343,500 images were downloaded by users in 82 countries.
- We sent 18,057 herbarium specimens on loan to 39 countries.
- We sent out more than 5,000 samples of DNA from herbarium specimens, leading to exciting new collaborations with other researchers.
- We added 109 type specimens to our herbaria in our recently collected material, a vital part of the process of species discovery and description.
- Seasonal changes in our Living Collection were monitored through phenological recording to provide insights into how plants are responding to climate change.
- We were recognised by the Global Biodiversity Information Facility as being a 'colossal dataset', with up to 13 million of our records being downloaded each month.
- We have digitised 45,000 type specimens and in total have over 250,000 specimens available online as high-resolution images.
- We developed the concept of stable Uniform Resource Identifiers, creating a robust framework for citing and linking digital herbarium specimens. This approach has been followed by other institutions and international projects such as the World Flora Online.
- We evaluated and developed methods for using Optical Character Recognition to speed up the process of extracting information from digitised herbarium specimen labels.
- We participated in the EU-funded Biodiversity Heritage Library for Europe project to digitise key historically important institutional publications.
- Catalogue records for selected collections from our Archive were added to the Archives Hub (archiveshub.ac.uk/), opening up the collections to a much wider audience.
- We have published books about our collections to bring them to a wider audience, including *The Catalogue of Plants*, *How the Garden Grew* and *Botanical Treasures: Objects from the Herbarium and Library of the Royal Botanic Garden Edinburgh*, which was recognised with an Association of Cultural Enterprises Award for Best New Publications.



RBGE at the heart of Europe's natural history collections

RBGE has played a key role in an ongoing 4-year, €5 million European Union-funded project involving 20 natural history institutions and botanic gardens across Europe.

The SYNTHESYS project was designed to develop and support the infrastructure of natural history collections within Europe, with the aim of facilitating access to the almost 400 million biological specimens housed by partner institutes.

As part of this project we have been leading the development of best practice for the integration of digital and physical collections. This has included the use of automatic metadata-capture technologies and crowdsourcing methodologies. It has also involved coordinating the development of European strategic priorities for DNA barcoding, helping develop an online self-assessment tool for the care and management of collections and supporting the development of policies and procedures to cover new kinds of natural history collections.

A core element of SYNTHESYS has been to provide researchers with funded visits to European collections and, to date, over 50 experts from 20 countries have been funded to visit RBGE as part of the project. One such visit is pictured above.



Cultural research

Our work is closely linked to the cultures of the regions where we work. This is reflected in our botanical and ethnographic collections and extends our influence beyond purely scientific research.

We house an internationally important Archive of manuscripts, drawings, photographs and artefacts, which is closely linked to our Herbarium, Library and Living Collections. Research on the history of natural history reveals forgotten links, adding value to often dispersed materials and opening them up to scientists, humanities researchers and the public. Our work on Indian botanical art, and the development of botanical research and conservation in India, has resulted in a series of books, exhibitions and lectures, and a film documentary.

Plant taxonomic research requires the understanding of past publications, collections and archives. Our digitisation programmes in the Herbarium and Library have facilitated wider access and discovery of these valuable resources, and our expert commentaries have enabled non-specialists to understand them. We have led in the digitisation and understanding of the Wallich Catalogue, pictured right: a rare, early-19th-century, handwritten, lithographed inventory of the East India Company Herbarium, which is now dispersed in more than 100 herbaria and is the basis of many hundreds of new plant names. The Catalogue is now readily accessible through a dedicated website, the information can be correctly understood and entries are linked to digitised herbarium specimens.

Our involvement in modern cultures has ranged from staging international art exhibitions at Inverleith House, to Scottish Talking Trees Storytelling events, to the film *Embera* exploring the links between cultural diversity and biodiversity in Colombia. Presenting biological and cultural diversity intertwined has enhanced our engagement with a wide audience and demonstrated relevance to people's everyday lives.





Conservation of the collections

We invest in the care and curation of collections to enhance their value and longevity.

- We developed and implemented the global standard approach for the arrangement and organisation of species in herbaria using a stable molecular evolutionary classification. This system has been adopted by other herbaria such as Royal Botanic Gardens Kew and the Natural History Museums in London and Paris.
- We created a Rare Book Room providing dedicated, secure storage for the treasures of the Library Collection. Approximately 4,000 books were rehoused in the new space along with collections of original illustrations, teaching diagrams and historical architectural plans.
- We carried out conservation work on Redouté's Roses with the support of funding from the Dulverton Trust, and began work on the conservation of the William Roxburgh collection of 585 drawings of Indian plants.



Enriching the collections

New additions enrich our collections and create a resource for current and future research needs. Our new collections are typically 'gold standard' (for example, our new herbarium specimens have associated digital field photographs, high-resolution spatial co-ordinates and tissue samples suitable for genomic science).

- We acquired 105,900 new herbarium specimens from fieldwork by RBGE staff and gifts from herbaria around the world, as well as several donations of entire herbaria.
- We developed institutional policies and facilities for long-term storage and curation of silica-dried tissue samples for DNA research.
- More than 2,500 books were added to the Library via purchases, exchanges and donations.
- We enriched the collection-level listing of the Archive with digital versions, summaries and transcriptions.
- We added 10,303 wild-collected accessions to the Living Collection from 497 collections, with a focus on endangered plants such as conifers from Japan and Gesneriaceae from Tanzania. Other collections have included temperate plants from the mountains of northern Vietnam and bulbous monocots from the steppe of Russian Altai, Kyrgyzstan and Tajikistan.
- We opened a new Alpine House, pictured right, with excellent ventilation and an internal tufa cliff, pictured below, providing an ideal growing environment for many genera difficult to grow in cultivation (e.g. *Dionysia*).



Collections-based research discoveries old and new

Our living and preserved collections are essential for species discovery. Seven new genera and 199 new species have been described at RBGE in the past 5 years based on the combination of our Living Collection, Herbarium and Library.

The new genus *Somrانيا* from the Gesneriaceae family, pictured below, first arrived in Edinburgh from Thailand as a seed collection and its novelty only came to light after the plants flowered in the research glasshouses, enabling them to be compared to our existing herbarium specimens and literature.



Our estate



Embedded in our world-class Gardens are buildings and structures of significant architectural importance.

We continue to add to our estate and enhance the quality of our existing assets, to support our work in an environmentally sustainable fashion.

- We developed a new hydro-electric scheme at Dawyck to produce an efficient and effective facility to generate electricity, making Dawyck the world's first carbon-neutral botanic garden.
- We refurbished the Fernery at Benmore to provide a fascinating and innovative visitor attraction through the resurrection of an historic building. **A**
- The Caledonian Hall was extended in order to provide a new bar and toilet facilities, greatly enhancing the appeal of this important venue for income-generating functions.
- We converted the former Regius Keeper's Cottage into much-needed accommodation for the Visitor Welcome Team and a new café facility with terrace. **B**
- We extended the glasshouse sales area at the John Hope Gateway to enable the Garden's Shop to exploit the revenue opportunity.
- Our Lecture Theatre was refurbished, creating a modern and vibrant space with state-of-the-art audiovisual technology and lighting to facilitate a wide range of uses. **C**
- We developed the nursery drainage and roads infrastructure to upgrade the facility in Edinburgh as a vital component and hub for the developing Living Collection.
- We reconstructed the Botanic Cottage, a unique project that will support the flourishing education programme and community gardening projects in the Demonstration Garden by providing facilities and acting as a hub for engagement within RBGE. **D**
- We opened a new Conservatory at Logan to house the renowned collection of South African plant species. The facility is powered entirely by renewable energy. **E**



Our people

RBGE employs around 230 staff and benefits greatly from the work of over 300 volunteers. Our youngest member of staff is an apprentice aged 19, and many of our retired staff in their 80s still regularly come to work and contribute to RBGE's outputs. Our on-site student population, more than 100 strong, further serves to enhance and enrich our working environment.

Awards to RBGE staff

Many RBGE staff have been recognised for their work; here are just some of the honours awarded.

In the last 5 years 20 members of staff across RBGE have been awarded Long Service Awards by the organisation in recognition of 25 years or more of dedicated service to the Garden. These include Gordon Murdoch **A** and Ian Potts **B** who have worked at Logan and Benmore respectively for 45 years each.

Martin Gardner **C** received an MBE for services to horticultural conservation.

Dr George Argent was awarded the David Fairchild Medal for plant exploration.

Dr Heather McHaffie **D** was awarded an MBE for services to the conservation of plants in Scotland.

Phil Lusby **E** was awarded an MBE for services to UK plant conservation and botanical and horticultural education.

Professor Stephen Blackmore was made Queen's Botanist in Scotland, awarded the Victoria Medal of Honour and made CBE.

Dr Mary Gibby **F** was awarded an OBE for services to botany.

Professor Peter Hollingsworth **G** was awarded a visiting professorship from the University of Edinburgh and was made an honorary professor by the Chinese Academy of Science's Kunming Institute of Botany.

Professor Toby Pennington was awarded a visiting professorship from the University of Edinburgh.

Professors Peter Hollingsworth, Toby Pennington and David Mann were awarded Individual Merit Promotion for Research Excellence by the Natural Environment Research Council.

Dr Mark Watson was awarded the Dr Patrick Neill medal by the Royal Caledonia Horticultural Society, and a Certificate of Appreciation from the Government of Nepal.





Volunteering at RBGE



More than 300 people volunteer at RBGE each year, supporting a huge range of activities including work in the Herbarium, Library and Archive, Education, Public Engagement, Publications, Horticulture, and Marketing and Communications departments. Dedicated teams of Volunteers have worked on phenology, organising events and running our Friends activities. Volunteers have also provided critical support at each of our Regional Gardens.

The work of our Volunteers has enabled us to be much more effective in achieving our mission. This has been recognised officially with the first Long Service Awards for Volunteers, some of whom have been in continual service for 20 years. When asked why they volunteer they all stress the importance of being part of a team and frequently mention the rewards of learning new skills and knowledge while working alongside dedicated professional staff.

As well as our long-term Volunteers we have also benefited from a higher turnover group of Volunteers working on exhibitions and events, including invigilation of art in Inverleith House. These mostly younger Volunteers have gained very valuable work experience that has broadened their outlook and increased their employment opportunities.

"I joined RBGE as a Volunteer when I retired because I wanted to help the organisation and for the company of younger people. I feel part of the community here and look forward to my day at the Garden every week."

Joan Wilcox, RBGE Membership Volunteer for 10 years

Our funders

Our primary source of income is the Scottish Government Rural and Environment Science and Analytical Services Division (RESAS).

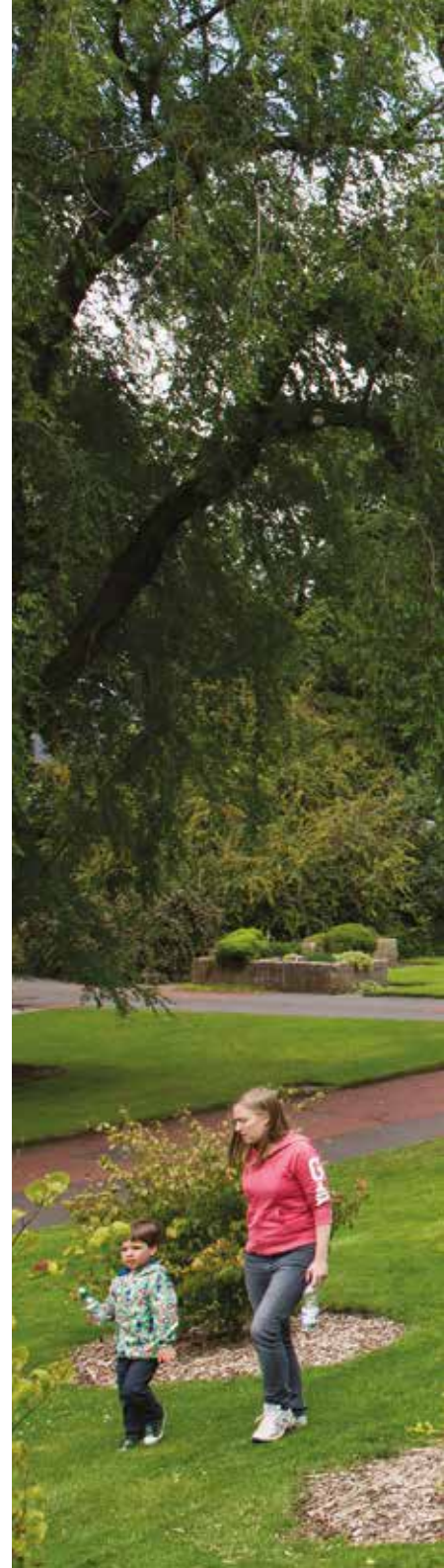
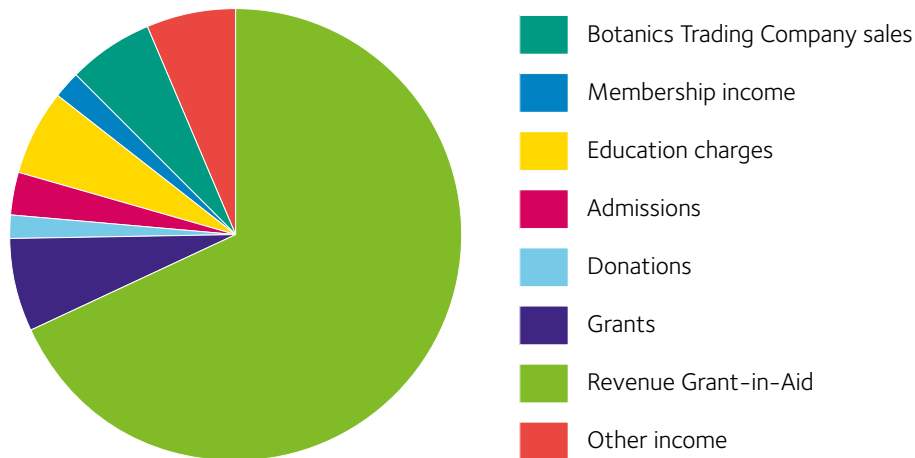
We also raise income across a variety of sources, including commercial activities, consultancy, grant funding and individual donations and membership.

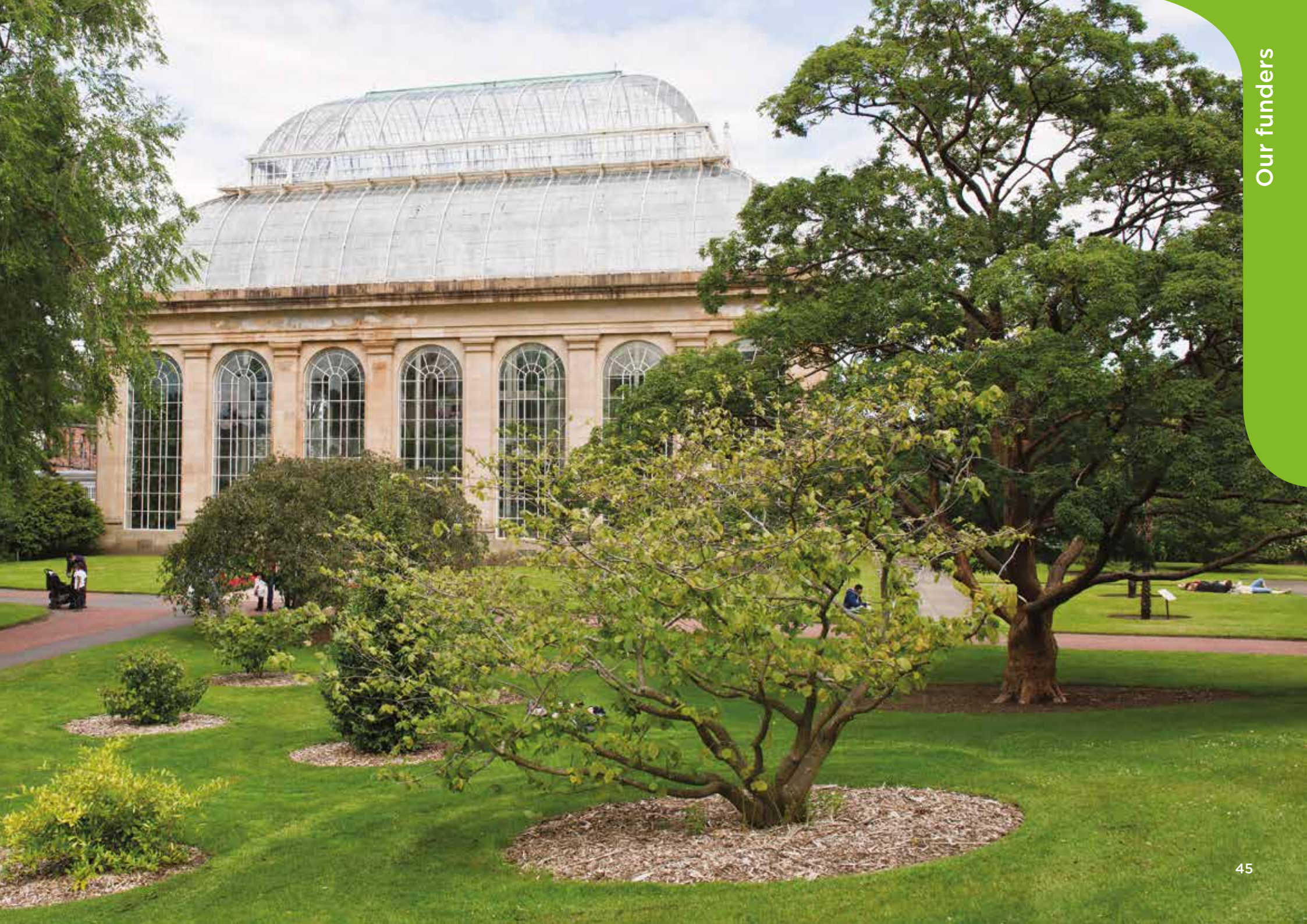
We are grateful to the many charities, trusts and sponsors of our work. We are particularly grateful for major donations from the Heritage Lottery Fund, the Monument Trust (a Sainsbury Family Foundation) and players of People's Postcode Lottery.

Since 2009, we have received grant income support for our biodiversity research and conservation from:

- Andrew W. Mellon Foundation
- Arts and Humanities Research Council
- Biotechnology and Biological Sciences Research Council
- British Embassy, Kathmandu
- Cairn Energy
- Centre national de la recherche scientifique
- Daphne Jackson Trust
- Darwin Initiative
- Department for Environment, Food & Rural Affairs
- Department for International Development
- Edinburgh Botanic Garden (Sibbald) Trust
- Environment Agency
- Esmee Fairbairn Foundation
- European Union
- Foreign & Commonwealth Office
- Friends of the Royal Botanic Garden Edinburgh
- Gordon and Betty Moore Foundation
- Leverhulme Trust
- Linnean Society of London
- National Geographic Society
- Natural Environment Research Council
- Royal Society
- Royal Society of Edinburgh
- Scottish Natural Heritage
- Swiss National Science Foundation
- University of Utah

Our income categories 2014/15





Our work in numbers

Values in this table relate to the period from 2009/2010 to 2014/2015 unless otherwise specified.

Volunteers	
Volunteers supporting RBGE	310 per year (on average)

Capacity Building	
PhD students	51 from 19 countries
Researchers trained in genetics and/or microscopy techniques in the RBGE laboratories	210
Researchers trained in plant identification	1,467
Researchers trained in conservation assessment techniques	448

Herbarium	
Specimens in the Herbarium	More than 3,000,000
Specimens received by the Herbarium	105,900
Loans of specimens	18,057 to 39 countries
Herbarium specimens databased	399,566
Herbarium specimens digitised	268,073
Visits to the search page of the Herbarium catalogue	127,155
Specimen records downloaded	603,954
Digital specimen images downloaded	343,500 to 82 countries

Library and Archive	
Items in the Library Collection (as of 31 March 2015)	142,008
Books added to the Library	2,554
Journal issues, reprints, etc. added to the Library	23,882
Books, journals, etc. reshelfed following use/loan	38,462
Metres of items cleaned by volunteers	1,100
Views of digitised books	21,865
Downloads of digitised books	9,479

Living Collection

New accessions to the Living Collection	15,476
Average number of families in the Living Collection	349
Average number of genera in the Living Collection	2,726
Average number of species in the Living Collection	13,487
Taxa/unique types of plants represented in the Living Collection	17,545
Average % of Living Collection of known wild origin	57.5%
Threatened taxa (i.e. taxa included on the IUCN Red List, 2015) in the Living Collection	298
IUCN threatened species that are only in cultivation at RBGE	32

Taxonomic and Research Outputs

New plant species named	199
Species covered by detailed taxonomic accounts (monographs/Floras)	1,902
Species covered in checklists	8,497
IUCN species threat assessments produced	5,952
Species listed in open-access electronic resources maintained and updated by RBGE staff	More than 155,000
Publications by RBGE staff, students and Research Associates	1,951
Peer-reviewed journal articles by RBGE staff, students and Research Associates	798 (average of 160 per year)
Articles by RBGE staff, students and Research Associates in journals with an Impact Factor ≥ 2	315
Articles published since 2009 cited more than 50 times	37

Education

Individuals attending a professional course	1,639 from 48 countries
MSc students	89
HND/BSc students	185
RHS Certificate	695
RBGE professional courses	672
Tutor-Student contact hours	401,478
Delivery of bespoke teaching and training modules on plant biodiversity	458 students at 7 universities
Adult leisure courses run each year	90-100
Individuals attending an adult leisure course	3,524

RBGE as a Visitor Attraction

Visitors	4,955,917
Events (sessions)	15,356
Attendance at events	195,137
Exhibitions	45
Visitors to exhibitions	600,000
Contemporary art exhibitions in Inverleith House	26

Environmental Statistics

Electricity generated by Dawyck hydro-power scheme	35,000 kWh/ 100 kWh per day
Carbon equivalent reduction saving to the environment as a result of the Dawyck hydro-power scheme	More than 20 tonnes
Green waste processed by the Edinburgh Garden	More than 760 tonnes
Compost produced and used at the Edinburgh Garden	More than 410 tonnes

The future...

Plants are a fundamental and critical part of the natural capital on which our health and wealth depend, and it is vital that plant research and conservation are increasingly tied into economic and environmental sustainability. Working with governments and industry, the Royal Botanic Garden Edinburgh and all botanical institutes have a central role in reducing biodiversity loss and ecosystem degradation, and therefore addressing some of the biggest global challenges. Sustaining such botanical centres of excellence must be an international and national priority.

Major issues for us include:

- **Conserving and enhancing our world-leading National Collections.** As custodians of world-leading living and preserved plant collections we have a continued and vital role to play in the conservation of 'plant capital' to underpin research and conservation programmes. Providing global access to these collections through the power of the internet and sustaining our botanical expedition programmes will provide a valuable legacy to botanical scientists of the future.
- **Connecting plants to people.** In an increasingly urbanised society the challenge of connecting people to their natural world is growing. It is our job to help people be inspired, informed and transformed as a result of their experience with our four Gardens and connecting with our collections, stories and expertise. Through social inclusion, outreach, broadening audiences, training and volunteering we will help to deliver the Scottish Government's Programme for Scotland and ensure that people feel better about themselves and the natural environment as a result of their time with us.

- **Addressing the challenges of plant health.** In this age of climate change, globalisation and changing land use we are facing new and serious threats to plant health from pests and diseases. Meeting these threats requires effective and targeted science and greater awareness of the need for improved plant biosecurity.
- **Providing specialised training.** The world needs plant scientists and horticulturists and we are committed to equipping the future experts from the UK and around the world with a very high standard of professional skills – offering one of the most comprehensive ranges of courses for anyone looking to develop their career in botany, horticulture, garden design or botanical illustration.
- **Achieving a greater understanding of plants, fungi and environmental sustainability.** Global biodiversity is still being lost at an alarming rate and it is important that we advance the understanding of species and their distribution. With such knowledge we can help to develop carefully targeted conservation programmes, we can help nations benefit from their biological diversity and we can assist decision making and policy development on sustainable use.
- **Providing infrastructure to safeguard our collections and deliver our work.** The Royal Botanic Garden Edinburgh is a custodian of world-class collections, and delivers world-class research, conservation and education. To protect our living collections major investment is needed to renovate our iconic heritage glasshouses, and to replace our research glasshouses, which are now beyond viable repair. Likewise, our research and education buildings need upgrading to provide purpose-built facilities to support our work and ensure that the Royal Botanic Garden Edinburgh remains a great place to work, learn and be inspired – for our staff, volunteers, students, programme associates and especially for our growing number of visitors and community partners.

Images courtesy of Brenda White (pp.24, 25, 26 and 27), Matt Laver (p. 29), Michael Wolchover (p. 30), Lloyd Smith (p. 31), Jackie Paddison (p.41).

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Royal
Botanic Garden
Edinburgh

Royal Botanic Garden Edinburgh

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The achievements of the Royal Botanic Garden Edinburgh are only possible thanks to the generosity of our donors and supporters.

Explore | Conserve | Explain

Donations and legacies from Members, Patrons and supporters are vital to discover and describe new species of plants, identifying those most at risk from extinction.

Explore | Conserve | Explain

Grants from trusts and foundations, and corporate sponsorship, make a crucial difference to protecting and restoring global plant biodiversity through conservation initiatives.

Explore | Conserve | Explain

Whatever level of support you are able to give, your donation today will help enhance four botanic gardens, deliver world-leading research programmes and grow educational work both at home and abroad.

There are many ways to support our work at the Royal Botanic Garden Edinburgh. Please contact our Fundraising team today to find out how your gift can protect the world's plant life and connect people to our natural world.

Call **0131 248 2855**

Email **fundraising@rbge.org.uk**

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