

Environment, Climate Change and Land Reform Committee

Draft Budget 2020-21

Written submission from Royal Botanic Garden Edinburgh (RBGE)

Update on Current Work Linking Preventative Spending within the ECCLR Portfolio to Economic and Health Benefits

Economic Benefits

All Scottish Government (SG) investment in the Royal Botanic Garden Edinburgh (RBGE) can be considered preventative spending in the broadest sense, i.e., generating an economic return on investment (ERol) available for other uses. The SG's current contribution to the RBGE via grant-in-aid (£8.5M in 2018-19) produces a **six-fold ERol for the Scottish economy** (net annual value to the Scottish economy (2017 figures) ca. **£52M**).

In detail, according to independent analysts Arcadis in 2016, the RBGE's ERol to SG over the next 25 years is estimated at:

- Globally £34.18 per £1;
- Scottish economy £11.07 per £1.

Even when the least certain impacts of our scientific research in the longer term are excluded:

- Globally £5.58 per £1;
- Scottish economy £5.35 per £1.

Job Provision

The RBGE provides **over 300 jobs and apprenticeships in Scotland**, including in areas of 'economic hardship;' jobs which would otherwise need to be found elsewhere.

Tourism

In addition to providing the **sixth most-visited free attraction** in Scotland and hosting **over a million visits per year** across our four gardens, our conservation work across Scotland's wild and threatened habitats contributes to the **country's offer** as a whole as a place of natural beauty, wildlife experiences and outdoor activities, bringing considerable economic income.

Maintaining the National Collections

We curate, protect, maintain and expand one of Scotland's most valuable and priceless assets, a **living collection of 13,500 species, over three million herbarium specimens** and an extensive botanical **library and archives**, all collated over centuries, with **unquantifiable replacement cost**. This unique and priceless national and global resource directly **underpins research and conservation**

programmes both in-house and around the world, estimated by Arcadis to generate **ca. £12M per annum**.

Discovery Science

Our descriptive taxonomic work delivers:

- Identification and threat assessment of **species of potential human and economic benefit** such as foods, products, and medicines;
- Evidence supporting **low-impact development planning** with tangible benefits in terms of maintaining natural capital and ecosystem services, such as in Oman where our designation of Important Plant Areas has been incorporated in the country's twenty-year National Spatial Strategy;
- Accurate identification of **indicator species for monitoring environmental change**, delivering an early-warning system for the impacts of pressures such as pollution and climate change, enabling action to be taken early, when it is likely most cost effective. Scotland's epiphytic lichens are a key focus of this work, with which we are conducting climate change experiments across the country, and for which we have developed management toolkits already in use by Scottish Natural Heritage and others;
- Vital information on **crop wild relatives**, supporting the development of new and alternative varieties, such as of cacao and potatoes, tolerant of environmental pressures including drought, salinity, pests and pathogens, helping to maintain **food security** and reduce food costs;
- Species of importance to the **global horticultural industry**, with income-generating and aesthetic benefits to the population.

Conservation

Working in partnership with governments, institutes and local people around the world, we help **sustain natural capital and its provision for human health and wellbeing**.

- Our work helps monitor and **protect threatened economically-important plants** including conifers, gingers, legumes, Solanaceae (the potato/tomato family) and tropical Sapotaceae trees;
- Our work with landowners and other stakeholders in Scotland helps to prevent ecosystem degradation and/or restore habitats, **minimising losses of both carbon and biodiversity**, thereby **maintaining or restoring natural capital and ecosystem services** such as nutrient cycling and water supplies, which would be hugely expensive to replicate. For instance, our Edinburgh Shoreline project is helping develop plant-based ways of protecting the coast from erosion as sea levels rise;

- Further afield, we support **sustainable management of tropical forests** and other ecosystems, protecting a crucial carbon sink and helping maintain the richly diverse biosphere that the Intergovernmental Panel on Climate Change, in their 2019 report, agrees is vital to mitigating the climate emergency. For example, our Centre for Middle Eastern Plants works with local partners to tackle a range of challenges related to biodiversity, water conservation, and climate change. In China and elsewhere we **quantify large-scale land-use change** to support the management of economic and environmental risks and benefits and targeting of interventions by identifying situations where land conversion may be both economically unsustainable and cause dangerous losses of biodiversity and ecosystem services, or where reforestation may be most successful. In China, our map identifying unsuitable environments for conversion to rubber plantations is being used by the State Department of Commerce in their 'Green Rubber Strategy'. We are partner in two UKRI GCRF Interdisciplinary Hubs targeted unsustainable trade, its impacts on biodiversity and livelihoods, and global nitrogen pollution. It is important to note that **environmental issues are global issues and although, at first glance, there may not appear to be great economic benefits to Scotland, the degradation of the world's biodiversity and the climate emergency are global issues which will come back to haunt us if we do not act collaboratively now.**

The Climate Emergency

The climate emergency is one of the biggest economic and public health threats Scotland faces, and the **RBGE is a global leader in climate change adaptation and mitigation**, through protecting and restoring biodiversity, maintaining ecosystem services including carbon sequestration, and facilitating low-impact economic development.

- We develop **accurate bio-indicators** (such as population numbers of snow-bed species) to Scotland's Climate Change Adaptation Programme. In Scotland we enhance biodiversity through rescue and translocation of rare species such as the alpine-blue sowthistle (whose populations we doubled in three years), reinforcing populations in terms of numbers and genetic diversity, to improve **resilience to future climate change**. We carry out vital work to protect the **globally-important ecosystems** of Scotland, including Europe's best examples of internationally-rare temperate rainforest, delivering on the **2020 Route Map of the Scottish Biodiversity Strategy**. We pioneer activities such as rain-gardening and de-paving in our **urban environments**, which will ultimately save funds on emergency responses to extreme flooding events. We demonstrate "**green infrastructure**" ideas contributing to Adaptation Scotland and the 'Edinburgh Adapts' action plan;
- Our **overseas work to help keep global warming to 1.5°C or below** will have significant economic impacts for Scotland in the long-term. In Afghanistan our work with efficient stove technologies led to a more than 30% decrease in woody plant extraction, simultaneously **reducing both biodiversity losses and carbon emissions**. Our work on savannas and grasslands has initiated a **policy dialogue** on optimal tree-planting to prevent ecosystem degradation and loss of carbon.

Plant Health

Plant health is an emerging global issue, and the RBGE – as **sector lead in Scotland's Centre of Expertise in Plant Health** for Horticulture and Environment – is at the forefront of international collaborations to maintain biosecurity, database emerging pathogens, and explore disease resistance, providing an early warning for potentially catastrophic invasive non-native pests and pathogens which may impact upon the wider **natural environment, agricultural sector, and food security** in Scotland, with associated economic risks.

Education and Training

Our education programmes are a key part of our contribution to the Scottish economy through **upskilling a total of more than 12,000 learners per annum**. This includes:

- **Graduate and postgraduate** training: we are the UK's largest single centre for the RHS Certificate 2 in Horticulture, while our MSc programme provides high-level scientific training to ca. 15-20 exceptional students from around the world each year, many of whom go on to work in science, horticulture and conservation;
- **Schools** programmes covering the range from early years to Highers plus continuing professional development courses for teachers;
- **Apprenticeships, internships and work experience** programmes across our four gardens enabling people to gain skills, experience and qualifications, and provide a **stepping-stone into the workforce**;
- A **volunteer** programme catering for around 300 people, with roles ranging from research to garden guiding, horticulture, community engagement and curation of the library and archives. The programme is mutually beneficial, with positive impacts for volunteers including improved mental and physical health, reduced loneliness, inclusion, personal development, and helping people return to or enter the workplace;
- **Upskilling private sector workforces** (e.g., Wheatley Group grounds maintenance staff from areas of multiple deprivation, for whom a RBGE programme increased future employability, confidence and knowledge);
- Our PropaGate virtual learning space, the RBGE's fastest growing education programme, provides **accessible online professional training**, currently accessed in over 50 countries around the world.

Public Engagement

As one of Scotland's **top visitor attractions** and a **trusted source** of accurate and impartial information, we **educate and engage** audiences across Scotland and the world with environmental issues, with potential **preventative results ranging from**

local and global climate change awareness to youth interest in STEM subjects, healthy eating and other wellbeing benefits. For example:

- Our lichen trails engage visitors to our gardens with some of the most overlooked members of Scotland's flora;
- Our volunteer phenology programme is an important vehicle for bringing climate change science to the wider public;
- Our regular 'Bioblitz' events engage children and adults alike with the beauty and novelty of our native wildlife;
- Our science is featured regularly in broadcast and print media, where SG is highlighted as our main funder;
- We make full use of events such as the flowering of our world-famous *Amorphophallus titanum*, with extended opening hours and an enhanced staff presence, to **maximise public engagement with the risks facing the world's plants.**

Health and Wellbeing

- The RBGE provides four essential **community greenspaces**, delivering significant **social, psychological, health, aesthetic and ecological functions** within urban and socially deprived areas of Scotland, and contributing to the National Outcome of *living in well-designed, sustainable places where we are able to access the amenities and services we need.* Here, we enhance human well-being through **livelihood provision, health improvements, stress reduction, rejuvenation and recreational activities**, as well as providing a sense of peace and tranquillity. The economic benefits of our contribution to health and wellbeing through preventative spend, reducing emergency costs to the NHS, are evident ('green prescriptions' are a recognised treatment by NHS Scotland) but hard to calculate;
- We also run specialist **community programmes** and promote **social inclusion** by actively reaching out to all socio-economic groups through community gardening, cooking and other initiatives. Last year these were accessed by **around 2,500 people** including hard-to-reach groups such as disadvantaged adults and families; the autistic community; people with dementia, Parkinson's disease and mental health issues; adults and teenagers with learning disabilities; ethnic minorities and refugees. Groups such as Garvald Edinburgh, Edinburgh and Lothians Regional Equality Council, and TEENS+ have gained practical, hands-on experience and skills, and built a sense of worth, inclusion and belonging. For example, young people with complex needs from Pilrig Park School taking part in our Edinburgh "Gardening for Life" project demonstrated improved resilience, independence, self-confidence, and more realistic attitudes to further education, work and leisure. Ultimately these programmes help people to lead **healthy and more fulfilled lives**, and to take up a place in society, meeting the National Outcome of *strong, resilient and supportive communities*;

- We promote **healthy lifestyles** via our Edible Gardening project, funded by the players of the People's Postcode Lottery, which last year provided **over 7,000 people** with the knowledge and skills to grow food, promoting the growing of healthy food in gardens, allotments and containers, alongside exercise and outdoor activity as a route to improved mental health;
- In the local community we provide continuity of offsite horticultural training to support **community groups to realise their biodiversity goals**, from the creation of species-rich greenspace at Victoria Quay, through an urban plant nursery and food production scheme at Granton Hub, to work with local schools on biodiversity enhancements along the Edinburgh Shoreline. With Edinburgh Living Landscapes we are building an integrated network for nature, crucial to the health, happiness and wellbeing of Edinburgh's people and wildlife.

Scotland's international reputation: With worldwide operations, highly-respected outcomes, involvement in global policymaking initiatives, and close (and often long-standing) connections with governments, frequently at the highest levels, the RBGE plays a crucial **economic and diplomatic role for Scotland**. We help to establish and enhance working relations between Scotland and other countries, forging alliances beyond traditional means, strengthening Scotland's profile and building respect for its contribution to global challenges. For example, recent one-to-one high level contacts include the Prime Minister of Nepal, many ambassadors, Christiana Figueres (Convenor of Mission 2020) and the President of the Russian Academy of Sciences. Many RBGE projects are highlighted in the UK Sixth National Report to the United Nations Convention on Biological Diversity.

Estimated Costs of Programmes, and Evidence of Cost Savings on Other Parts of the Budget

Expenditure

Total **expenditure £18.5M** (of which £8.5M from SG revenue grant-in-aid; note that self-generated income has since risen to more than 40% of all income, and now includes ca. £3M per year from tourist spend, ca. £2M from research and other grants, ca. £1M from education fees, plus major commercial events, consultancy, gifts and bequests); **99.4% of expenditure is within Scotland**, directly benefiting the Scottish economy.

Expenditure by outcome:

- Tourism and recreation offer: 416% (ca. £3.01M);
- Education and training: 9% (ca. £1.59M);
- National collections: 33% (ca. £6.14M);
- Science and conservation activities: 42% (ca. £7.76M).

Economic Benefits/Cost Savings to Scottish Government Budget (estimated by independent EIA, 2016)

Arcadis estimated the **total economic impact of the RBGE in 2016 at over £102M globally and ca. £52M within Scotland**. This equates to an ERoI of **£6.11 per £1 of grant-in-aid**, per annum, to the Scottish economy – rising to a predicted £11.07 per £1 after 25 years.

Breakdown of economic benefits

- **Education:** total net annual gross value added (GVA) from RBGE education and training activities: **£21M by year 10**, £29M by year 15, £41M by year 25 (Net Present Value [NPV] @3.5%); comprising:
 - Education fees paid by learners from outside Scotland, i.e., revenue to the Scottish economy;
 - Educated learners who remain in Scotland on completion of their course and enter the labour market. These contribute to a more proficient workforce enabling Scottish employers to increase productivity and hence GVA.
- **Science:** total net annual GVA to Scottish economy **£294M** (£783M to global economy) **by year 10**, £0.5bn (£1.5bn globally) by year 15, £1.2bn (£4.5bn globally) by year 25 (NPV@3.5%); comprising:
 - Benefits from external researchers accessing the collections in person, via herbarium loans, or download of images and/or data, including:
 - Visiting researcher spend in the Scottish economy;
 - Direct value of accessing the collection (shadow value calculated based on time spent multiplied by hourly GVA per researcher);
 - Downstream benefits of knowledge accessed from the collections e.g., enabling external research projects to achieve greater success and/or sooner.
 - Benefits from science research projects in which RBGE staff are currently engaged (33-50% of total benefits attributed to the RBGE depending on the partners involved). Estimate derived from scaling up a detailed review of three representative projects to the sum of all research projects currently engaged in. Calculated in terms of return on the SG investment via grant-in-aid, science projects generate, for Scotland £6.29 per £1 of grant by year 10, £9.64 by year 15, £22.94 by year 25 (globally £26.47 per £1 of grant by year 10, £42.44 by year 15, £109.68 by year 25).
- **Health and wellbeing** impacts are indirect and unquantifiable but nonetheless significant (see discussion in Section 1.0, above);
- **Climate emergency** impacts via biodiversity conservation, climate mitigation, adaptation, and public education reducing necessary

emergency spend from other budgets are also unquantifiable but discussed in Section 1.0.

How We Would Intend to Action the Results

In order to continue the RBGE's world-class work and **cost-saving** for other departments via **income generation, education provision, promotion of health and wellbeing, and reduction of threats from the biodiversity crisis and climate emergency**, we propose:

1. The SG **enhance the existing level of revenue grant-in-aid** to RBGE (currently £8.879M grant-in-aid) by 3.8% enabling us to continue to leverage funds from other sources and provide the SG with an outstanding ERol;
2. The SG approve and commit to **fund a significant proportion (£46.9M, 74% of total estimated cost) of the RBGE Edinburgh Biomes Masterplan Outline Business Case**, for which full planning permission has already been given, and to underwrite the project in order that the inherent challenges and risks associated with large scale capital fundraising are mitigated. This investment will sustain the RBGE's contribution to the delivery of the **National Outcomes** and **ensure statutory compliance** in the protection of the National Living Collection and listed buildings. The funding itself constitutes a preventative spend (Note that the NPV of the full Edinburgh Biomes Programme is estimated at £31.5M, vs. minimal repairs to the glasshouses: NPV £45.8m), essential to **mitigate the urgent, serious, quantitative and qualitative threats** to the existing infrastructure of the Edinburgh Garden, including:
 - Breach of statutory duty by failing to prevent collapse of our historic Grade A listed glasshouses and extensive research glasshouses;
 - Health and safety concerns for those working and visiting the decrepit and deteriorating glasshouses;
 - Threat of catastrophic loss of a large proportion of the national collection of living plants;
 - Risk of emerging pests and pathogens destroying components of the irreplaceable national collection, compounded by sub-optimal quarantine and screening facilities;
 - Inability to grow revenues from tourism, recreation and commercial activity in our glasshouses, leading to continued or increased dependency on SG funding;
 - Decline of our nationally and internationally important education programmes in plant science, horticulture and conservation, with inherent impacts upon the Scottish economy;

- Continued unacceptable carbon emissions and poor sustainability record from a high-profile element of the SG estate.

Future Preventative Spending Plans

To further the National Outcome, *we have a globally competitive, entrepreneurial, inclusive and sustainable economy*, the RBGE proposes to **maintain and develop our activities** in:

- Operating **major tourist sites**;
- **Discovery science** (taxonomy) underpinning biodiversity conservation in Scotland and worldwide, adaptation to the climate emergency, and improved food security through knowledge of crop wild relatives;
- Global **conservation action**, maintaining and restoring natural capital and ecosystem services, protecting a biodiversity-rich planet and mitigating global climate change;
- Enhanced and continued investment in **plant health**, an emerging risk and priority for maintaining Scotland's natural environment, agricultural sector and consequent food security;
- Pioneering **innovative plant science** including genetic and genomic techniques for biodiversity discovery, conservation and plant health;
- **Upskilling** the Scottish population via education, internship and apprenticeship programmes;
- **Engaging the public** with biodiversity science, natural history, wild spaces and the climate crisis;
- **Entrepreneurial and consultancy** activity;
- Attracting UK and **international research funding**;
- **Improving efficiency and reducing carbon losses.**

A crucial part of our short-, medium-, and long-term forward plan is a commitment to the **Edinburgh Biomes Programme**, which will, over the next six years:

- Secure the **RBGE's contribution to the Scottish economy** of £52 million per year, and maximise the ERol on grant-in-aid (currently more than £6 per £1 within Scotland alone);
- Generate **additional revenue streams**, reducing future dependency on SG support;
- Prevent the collapse of listed buildings and improve **statutory compliance** through the restoration of A-Listed heritage glasshouses;
- Maintain one of Scotland's most treasured and popular **tourist destinations**;

- Safeguard the globally-significant **Scottish National Collections** and allow vital research based around them to continue, underpinning the future success of the RBGE as a centre of **scientific and horticultural excellence**;
- Provide fully-accessible, fit-for-purpose **education facilities** for advancing knowledge and skills;
- Facilitate **public engagement** (for over 1M visitors per year, including high-level international policymakers and dignitaries) with the natural world, historic national collections, biodiversity crisis, climate emergency, and related biosecurity issues;
- **Cut carbon losses** from our Edinburgh glasshouses by 12%, with associated energy use cut by up to 50%, through sustainable energy generation, increased efficiencies and reduced heat losses;
- Underpin and support **Scotland's National Performance Framework** and delivery of the **UN Sustainable Development Goals**;
- Further Scotland's reputation as a **global leader** in cutting-edge plant science, conservation horticulture, environmental protection, and sustainable development towards a net-zero carbon economy.