

ROOTS

BOTANIC GARDENS
CONSERVATION
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EDUCATIONAL REVIEW

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**REDUCING WASTE
(FOOD, ENERGY
AND WATER)**



**BOTANIC
GARDENS**
CONSERVATION
INTERNATIONAL

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FIRST WORD

REDUCING WASTE (FOOD, ENERGY AND WATER)

Paul Smith
Secretary General
BGCI



Welcome to this edition of *Roots*, which focuses on the reduction of waste – and what we in botanic gardens can do to contribute to this effort.

BGCI's Food Waste Challenge (page 4) presents a challenge in more ways than one. The Challenge itself required participants to systematically record their food waste over a 30 day period, and to come up with innovative recipes and solutions to reduce that waste. However, persuading people to participate in the Challenge was a challenge in itself. Most people were too busy to participate, and some even felt that they should receive a reward for participating. Most also thought that they wouldn't learn anything new or worthwhile from the Challenge. Some of these constraints may well have resulted from the design of the Challenge being too onerous but the main issues were the difficulties in bringing about behavioural change in people's busy lives. The incentives for change are not strong enough currently for people to change the way they live, meaning that education is often not enough on its own. Culture (habits) and economics (cost) are far more powerful drivers of change, or reasons to maintain the status quo, than education alone. This creates challenges for botanic gardens, and it may be that our role is more about supporting the necessity of change through the sharing of ideas rather than precipitating that change ourselves. As the cost of living continues to rise, including food prices, people may become more receptive to learning about ways to reduce food waste, and we should be ready to respond to that need.

In the case of energy, the direct link of reducing energy use to saving money is much more apparent right now than it is with food – particularly at this time when global energy prices have doubled over recent months. On page 18, Meise Botanic Garden explains how it has used a combination of building replacement and renovation to hugely save on energy bills, with a predicted 65% in energy usage and cost over the next two decades. Similarly, the example of Phipps Conservatory, Monterey Bay Aquarium and other Climate Toolkit members in reducing single use plastic (page 14) applies a holistic and participatory approach to waste reduction. In particular, the use of a hackathon – an event that allows employees to create solutions to problems – generated 42 ideas for reducing plastic use and waste. This not only applies collective brainpower to problem-solving, it also helps to ensure buy-in from employees who want to see their own ideas put into action.

Additional, innovative ways to incorporate sustainability into people's activities and lives are explored in the articles from: Reykjavik Botanic Garden who use art to engage people (page 8); South China Botanical Garden, who use an edible mushroom (page 11) and St Andrews Botanic Garden, who invoke a sense of place by focusing on local habitats and their ecological importance (page 22). I hope you enjoy this edition of *Roots*, which is probably an accurate representation of where society is in transitioning to a more sustainable future.



A pop-up banner promoting the BGCI food waste challenge at RHS Wisley. (BGCI)



(Pixabay)



FOOD FOR THOUGHT: AN OVERVIEW OF THE BGCI FOOD WASTE CHALLENGE

BGCI launched a 30-day food waste challenge, which encouraged individuals to reduce their food waste. Despite a mass recruitment drive, uptake was low, however data demonstrated a change in the participants' attitudes towards food waste. Exploring why people didn't take part in the food challenge highlighted possible issues gardens face as they grow their online education presence and how there is a need to strengthen the link between online and onsite engagement in the gardens.

The BGCI Food Waste Challenge (<https://www.bgcifoodwaste.org/>) was a one-year pilot project that aimed to persuade visitors to English botanic gardens to take-on a 30-day challenge to reduce their fruit and vegetable food waste. We wanted to encourage people to explore the world of fruit and vegetables, appreciate the diversity and versatility that these food types offer in our diets, and showcase the simple ways that we can reduce our food waste, whilst enjoying more fruit and vegetables in our diet.

BGCI developed the project using a website which allowed individuals across England to track their food waste with a particular focus on plant-based foods. Users could track their progress, gain access to resources (recipes and food initiatives) and compete against others in how much (or little) waste they produced. We recruited individuals utilising our network of BGCI members to promote the challenge and ran ten recruitment events in English botanic gardens to discuss the challenge and encourage people to sign up. The challenge was open to everyone, but we wanted to particularly focus on families, a target group for botanic gardens.

Above: Food being thrown in the bin taken by feedback. (WRAP)



Lemon with Mould on (Pixabay)



By challenging households and providing a range of support materials, we expected to see a reduction in fruit and vegetable food waste during the challenge period. By embedding the challenge over 30 days we hoped this would lead to an increased interest in adopting other environmental behaviours and cause long term change.

BGCI performed some in-depth analysis on whether the challenge had an impact on people's food waste and evaluated whether this sort of engagement was suited to the audience's members.

Results

A total of 64 people signed up on the website in order to participate in the 30 days food waste challenge. On Day 1 of the challenge, participants completed a questionnaire prior to starting their challenge. The majority of people who signed up to the food waste challenge website considered themselves to be well aware of the food waste issue and good at reducing food waste.

The table below shows the factors participants face in reducing their food waste

What are the biggest obstacles or challenges for your household in preventing food waste?'	
Factor	Frequency
Time	29
Convenience	23
Cooking skills	11
Children	10
Money	8
Other	1

BGCI at RHS Wisley recruiting people for the BGCI food waste challenge. (BGCI)



(unsplash)

Attitudes to food waste prior to the Food Waste Challenge

We spoke to over 8,000 people about the food waste challenge and the majority of participants mentioned that they had a strong awareness of the food waste problem. They were also conscious about the need to do something about it and that they had adopted, with various levels of success, certain food habits that would pre challenge prevent their households from wasting food. Themes showed,

- Lists reduce buying extra food and deciding meals
- Buying long lasting fruit and vegetables and longer expiry dates
- Buying loose rather than in pre-prepared packs, as supermarkets are catering for large families rather than individuals
- It is fine to waste food if you compost it*
- Older demographics mentioned they do not waste food and blamed other demographics including young couples and families with children.

* There is a public misunderstanding that the energy return from compost food is the same or greater compared to growing it.

Impact of the project on attitudes towards food waste after taking part in the programme

Although initially stating that their overall attitude towards food waste didn't really change as a result of participating in the challenge, partly we think because of their pre-existing awareness of the problem, most participants mentioned things that can be considered as a positive impact to their food waste and what could be achieved when recording food waste. Positive impact included eating skins of vegetables, cooking in bulk, feeding your pet on waste.

When asked who would continue the challenge, all participants said no. Factors include: too time consuming, no instant positive reward/gratification and the feeling of it not making much impact. However many said it highlighted the need for improvement on their food waste.

Review of the BGCI food waste challenge

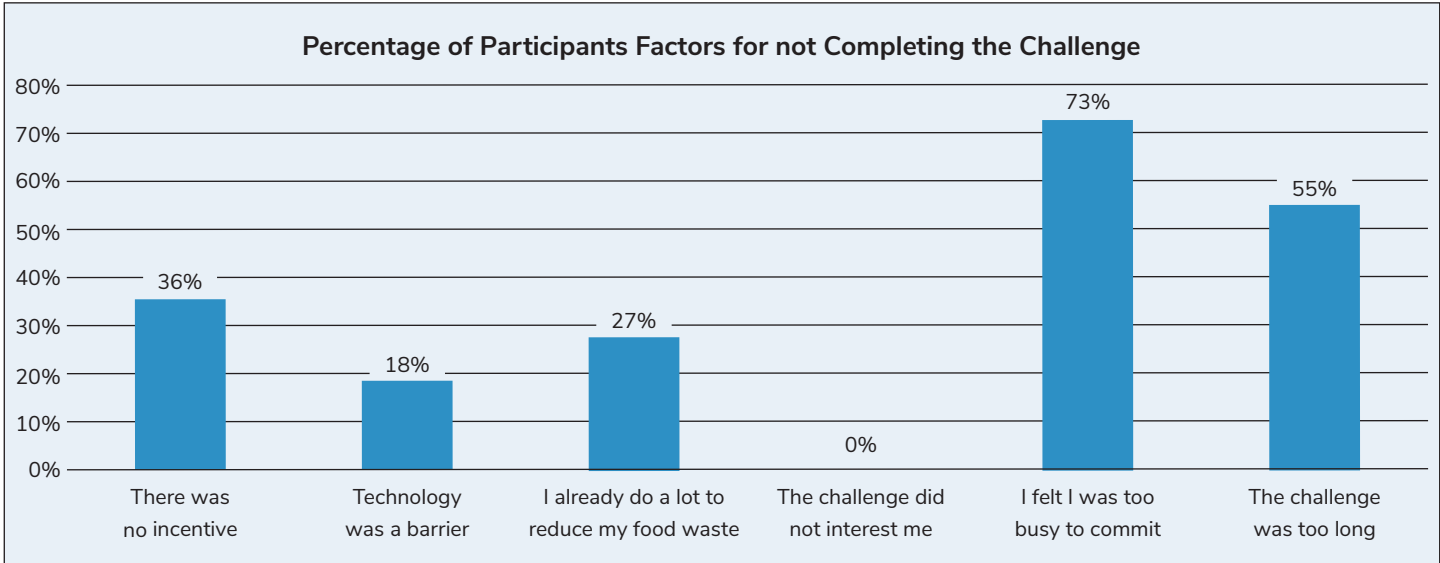
During recruitment we engaged with over 1 million people online through social media and 8,000 people though recruitment events. Take up was low, so we asked through public surveys the reasons for not taking part in the challenge.



A screenshot of the home page of the BGCI food waste challenge. (BGCI)

The majority of people who signed up to the food waste challenge website considered themselves to be well aware of the food waste issue

Graph to evaluate different forms of engagement. (BGCI)



- **100%: The subject is important and everyone should do more to reduce their food waste**
- **73%: They are too busy to take part in the challenge:** The challenge did not fit in with their lifestyle and post COVID 19 there is a rush to get back into normal life - giving less time to new initiatives. Users did not think it was worth finding time for this cause. Users feedback want something quick/easy and built into their everyday lives. 92% of those surveyed said they would only do 0-1 of these challenges a year, while only 8% of people said they would do something like this every 6 months. Comments from this question include: "I will only provide feedback if I am guaranteed a prize"; "we are bombarded by challenges/surveys constantly so unless there is a real benefit I won't do anything".
- **55%: The challenge was too long:** We had the biggest drop out rate after week 2 and while people were cooking they didn't see the link between logging food and cooking. One mentioned social media works because you get reminded to go on it daily. When asked 'if we were in a lockdown' would you still have done this, 70% of users still said no.
- **18%: Complexity:** The challenge was too complex for people; potential barriers such as not understanding the food waste issues or what goes in the food bin and how to log in, was all too complex.
- **27%: Felt the challenge didn't apply to them:** People have mentioned they are already doing their part for the environment, this is an extra thing and perhaps 'one too many' and with 54% mentioning they could not see the link between an online food challenge and botanic gardens.
- **36%: mentioned there was no incentive:** they learn they are wasting money however there is no physical reward/feel good factor. 100% of people felt the current incentives of saving food, recipes and fun facts wasn't enough. 72% of people said the incentive was the most important factor and they were looking for a guaranteed prize with instant gratification and something physical (money).
- **63%: felt that this challenge wouldn't make them waste less food.** With 54% feeling this wouldn't have made a positive impact on the world.

Public engagement

The low take-up of the challenge also raised some issues around public engagement activities and online engagement by botanic gardens. Only 18% of people saw online engagement as a barrier but there was a disconnect between conversation with the public .in the garden and following up with action at home, an area we should explore if we want to improve long term engagement with our audiences. BGCI is researching these areas as a possible expansion to the project and they highlight some key learnings.

- Do visitors to gardens not expect to be engaged with environmental issues?
- How do gardens as a venue strengthen the link between gardens and activities at home, resulting in longer term impact?
- How much can we realistically ask the public to do in engagement activities?
- Is online the way to go? We get great outreach but does this translate into action?
- What other ways can we engage with people on environmental issues (such as reducing waste at home?)

To learn more about the challenge and to sign up and take part, visit: <https://www.bgci.org/our-work/projects-and-case-studies/fruit-and-veg-food-waste-challenge/>

The challenge was open to everyone, but we wanted to particularly focus on families, a target group for botanic gardens

We wanted to encourage people to explore the world of fruit and vegetables



(Pixabay)

Each household wastes about a month's worth of food a year!

Over a quarter of the global supply of fresh water is used to grow food that never gets eaten

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PLASTIC WASTE PUT TO USE! MYCELIUM ART COURSES AT THE REYKJAVÍK BOTANIC GARDEN



Examples that were shown of fungi growing in trees. (Björk Þorleifsdóttir)

A mycelium art course for kindergarten and elementary school teachers at the Reykjavik Botanic Garden was developed and offered as a result of collaboration between The Reykjavik Botanic Garden, the Iceland University of the Arts and LÁN: Learning Artistically about Nature, a multidisciplinary initiative from the City of Reykjavík. The use of waste materials in combination with experiments and learning about mycelium growth on local plants, used cardboard and industrial Hemp. This was the basis for creative work that participants could develop with their pupils in schools in Reykjavík.

The Reykjavík Botanic Garden is an open-air museum where civil science is encouraged. The garden's grounds are ideal outdoor classrooms with around 5,000 registered plant species and varieties. Furthermore, the garden's display greenhouse is a wonderful option when the Icelandic weather gods are not in our favour. Wild nature seeps into the garden with birds, fish, rodents, insects, weeds, lichen, and mosses calling the museum grounds home.

Every year open seminars and free courses on various types of composting and turning your rubbish into “garden gold” are held at the Reykjavik Botanic Garden.



Various plastic packaging, leftover stationery, and other waste materials.
(Vala Sigbrúðar Jónsdóttir)

Iceland, just like every other country in the world, is facing problems in terms of waste management and at the Reykjavik Botanic Garden, strict rules are followed regarding the treatment of all waste. The garden is owned by the City of Reykjavik, and the municipality's "green steps" guidelines are followed to a tee as well as the international ISO 14001 standard for environmental management. Leftover lunches and coffee grounds at the garden are fed to either traditional compost heaps, indoor worm farm compost bins, or fermented in a Bokashi bucket – all will in due course become fantastic nourishment for the plants across the garden's eight collections.

Every year open seminars and free courses on various types of composting and turning your rubbish into "garden gold" are held at the Reykjavik Botanic Garden. In many cases, educators attend the seminars to learn how to bring more nature-friendly methods and awareness into their classrooms and neighbourhoods. Seminars bringing art and nature conservation together are a common theme at the garden but this year is the first time a course on art with mycelium and household waste has been offered through a collaboration between The Reykjavik Botanic Garden, the Iceland University of the Arts and LÁN: Learning Artistically about Nature, a multidisciplinary initiative from the City of Reykjavik.

The course was open to all elementary and kindergarten teachers in Reykjavik and was an introduction to growing mycelium. It involved mixing oyster mushroom grain-spawn with plants that grow near schools in Reykjavik with used cardboard and industrial hemp. Instead of using store-bought cling film or new plastic moulds we offered the participants the opportunity to assemble moulds with plastic waste to create an anaerobic environment for the mycelium, and give it shape. Examples of plastic waste reused were: old vegetable packaging, plastic plates and glasses, and deadstock products from a stationary manufacturer nearby. In visual art the practice of using 'found' materials or objects is well known and adds a layer to works of art where unexpected things can happen or that a work of art can take a shape that is not so much controlled by the artist but rather by the materials found.

Participants in the course could view multiple examples of mycelium growing in old tree trunks, a bokashi bucket, and the root systems of young grey alder trees, alongside experiments and artworks using mycelium as the material and subject of sculptures from the Iceland Academy of the Arts. After a brief demonstration the participants all made their mycelial sculptures to bring home or to the classroom to observe their growth for the next weeks.



Achillea millefolium used in the course.
(Vala Sigbrúðar Jónsdóttir)

Mycelium could be cultivated inside plastic waste that accumulates in school kitchens, feeding on used coffee grounds from the teacher lounge, used cardboard from the office and library, and plants from the neighbourhood.



Vala Sigbrúðar Jónsdóttir, master student of arts education at the Iceland University of the Arts, running the course with help from Svavar Skúli Jónsson, horticulturist at the Reykjavik Botanic Garden. (Gunndís Ýr Finnboadóttir)



One of the growing artwork. (Björk Þorleifsdóttir)

We emphasised connecting the course to possible ways of working with mycelium in the school system. Mycelium could be cultivated inside plastic waste that accumulates in school kitchens, feeding on used coffee grounds from the teacher lounge used cardboard from the office and library, and plants from the neighbourhood.

Using mycelium as bioplastic is being practiced by various product designers. Mycelium has been grown in Icelandic schools as a means of growing and harvesting the delicious oyster mushrooms, but our course connected mycelium with art. Approaching the material from a contemporary artistic standpoint where there are no right or wrong outcomes, and unexpected patterns of growth, shape, and texture can be regarded as opportunities instead of failures, as well as a way to learn with the organism feeding off and growing inside products that otherwise would have been wasted.

During the Children's Culture Festival in Reykjavík in April, the first experimental work and art pieces were shown at The Reykjavík Botanic Garden. Participants worked on this with their pupils. One of the participants, a teacher of fifth-grade students, created sculptures and drawings with her students after observing the growth of the experiments she made in our course and learning about the wonders and importance of mycelium for nature's ecosystems.

The idea to work with the growth of mycelium and plastic waste materials brings experimentation and wonder to the core of the work, allowing the materials and living organisms to shape a piece of art with you. This can create conditions for pupils in elementary schools or kindergartens for real experimental work that crosses subjects and fosters the unexpected in the classrooms. Just as important, the use of materials that normally have a short time of usage, such as single-use plastics, can bring up questions about how we treat materials around us.



Examples of shapes that were shown to the participants. (Vala Sigbrúðar Jónsdóttir)

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Hemp and straw used in the course.
(Vala Sigbrúðar Jónsdóttir)

SCIENTIFIC RESEARCH AND POPULAR SCIENCE EDUCATION COURSE: A UNIQUE MUSHROOM



A mushroom science popularisation course in South China Botanical Garden, the Chinese Academy of Sciences, has become popular among the public recently. The course tells a scientific research story about *Stropharia rugosoannulata* 'Zhongke1', and not only popularises the achievements of scientific research, but also promotes sustainable development. The course is an excellent case of popularization of scientific research.

Left and below: Students picking up mushrooms. (South China Botanical Garden, CAS)



The mushroom course tells the public basic knowledge about the mushroom, and the scientific research story about *Stropharia rugosoannulata* 'Zhongke1'. It lets the public observe its growth and development in an open field, and shows the process of resource utilization of agricultural waste. Participants enjoy picking the mushrooms, the immersive experience and realize the significance of green circular agriculture.



As we all know, the comprehensive utilisation of agricultural waste has gained more attention [1]. However, in practical operation, taking straw as an example: the fuel value has power generation which is too low, the nutrition as animal husbandry is not enough, and the degradation is slow. Although mushroom planting could produce the benefits, the common artificial large-scale commercial cultivated edible fungi, such as *Lentinus edodes*, *Pleurotus ostreatus*, *Pleurotus eryngii*, and *Ganoderma lucidum*, are only suitable for planting in facilities with high technical requirements and an investment threshold. Therefore, although it is prohibited by law, in many places farmers still burn straw directly in their fields, causing air pollution, fires, and the inability of planes to take off and land.

Then, if we can breed the edible fungus varieties that can be directly planted in the open field, and study the supporting simple planting technology, it will greatly adjust the farmers' enthusiasm to plant, so as to avoid the burning of straw. In this case, *Stropharia rugosoannulata* caught the attention of the scientists.

Stropharia rugosoannulata is nutritious and can be grown in the open field directly. It is one of the edible fungi recommended to be cultivated by the United Nations Food and Agriculture Organization (FAO), and it is also one of the ten outstanding mushrooms in the international mushroom trading market [2]. The optimum temperature for *Stropharia rugosoannulata* is 15 to 25 degrees, so in China, it is rarely cultivated in winter.

The students actively asking and answering questions. (South China Botanical Garden, CAS)

*The mushroom course tells the public the basic knowledge about the mushroom, and the scientific research story about *Stropharia rugosoannulata* 'Zhongke1'*



Professor Duan Jun giving a lecture. (South China Botanical Garden, CAS)

The course not only popularises the achievements of scientific research, but also promotes sustainable development.

Professor Duan Jun giving a lecture. (South China Botanical Garden, CAS)



Using the germplasm of *Stropharia rugosoannulata* as the material, Professor Duan Jun breeds a series of new excellent lines through the selective breeding method combined with tissue culture technology. One of the lines is named (*italics*) *Stropharia rugosoannulata* "zhongke 1", which is suitable for planting in the open air in winter in Guangdong. It also has the advantage of being resistant to stress and producing high yields.

Stropharia rugosoannulata 'Zhongke1' can be cultivated using a mixed substrate made from crop straw, peanut shell, and wood chips etc. After cultivating mushrooms, the substrate can be completely rotten, and become a good organic fertilizer for soil. The suitable cultivating time is from October to December every year in Guangdong, China. The mature mushrooms appear from about 45 days after cultivating to the end of March the next year. After cultivation of *Stropharia rugosoannulata* 'Zhongke1', rice can be planted in the same field. This is a good model of circular agriculture.

Stropharia rugosoannulata 'Zhongke1' has entered the field of vision of many rural revitalization teams, becoming a good resource fit for rural revitalization. This course is an excellent case of scientific research popularization, which is highly praised.

Stropharia rugosoannulata.
(South China Botanical Garden, CAS)

NOTES

¹ Ding Anqiang, Tang Qiangrong. The Main Patterns and Benefit Analysis of Cultivating *Stropharia Rugoso-annulata* with Rice Straw as Raw Material. *Agricultural Technology & Equipment*. 2021(11):60-61.

² <https://www.nongyie.com/zhongzhisyy/2015/36531.html>

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Students happily showing their harvest.
(South China Botanical Garden, CAS)





ADDRESSING SINGLE-USE PLASTICS: A VITAL STEP TO TACKLE CLIMATE CHANGE

In a world where plastic is so ubiquitous that it's easy to ignore in day-to-day operations, finding a place to start to reduce your consumption can be difficult, but it is absolutely vital. Greenhouse gas emissions are produced at every stage of the lifecycle of plastics, from the fossil-fuel drilling that provides the materials of plastics production, to the landfills and incinerators where much discarded plastic ends up. This article describes approaches and tools for reducing plastic, including examples from participants of the Climate Toolkit such as waste audits, staff engagement, hackathons, and communications.

Monterey Bay Aquarium and Phipps Conservatory and Botanical Gardens, both members of the Climate Toolkit, recently presented a talk with resources to describe where to make effective single-use plastic reductions. This article describes their different approaches and tools for reducing plastic including both top-down and bottom-up approaches, waste audits, and staff engagement via a plastics “hackathon.”

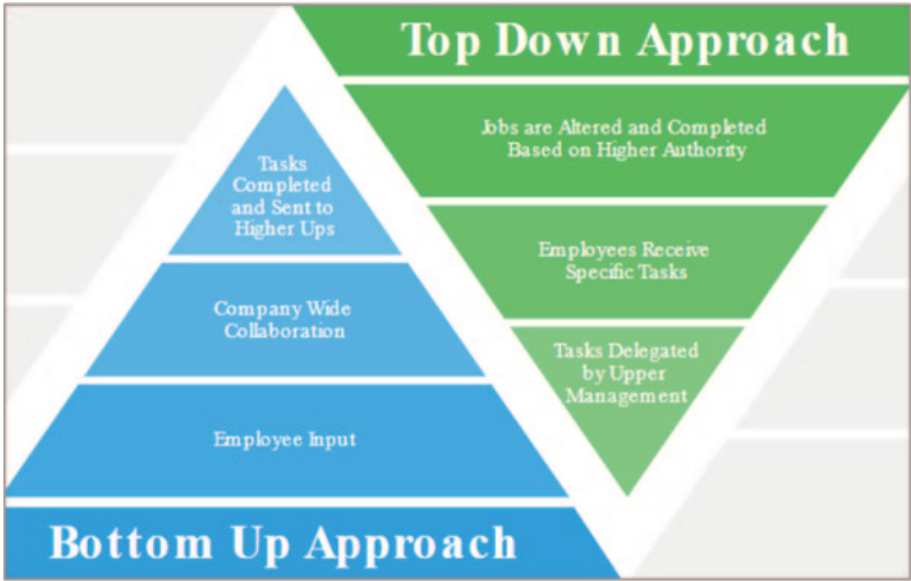
Above: Monterey Bay Aquarium
Completing a waste audit to evaluate
and reduce their plastic consumption.



Plastic is pervasive in the retail and service industries, from bags and utensils to containers and packaging. Not only does plastic pollute our ecosystem, but it also produces a significant carbon footprint to create, destroy, and/or recycle. Plastic production contributes 232 million tons of CO2 emissions per year. Plastic is also subject to a poor chain of custody in which much plastic that is thought to be recycled is actually thrown into a landfill. Sadly, less than 9% of all plastic is recycled or reused. The average amount of plastic waste that is discarded into landfills each year is 300 million tons. Even when we do recycle, the process involves emitting immense amounts of carbon; recycling (or incineration) produces about fifteen million tons of greenhouse gases. No matter how you use plastics, carbon emissions are being released. You can find this information and more details on the contributions of plastics to climate change in the report [The New Coal: Plastics and Climate Change](#), a resource from Beyond Plastics.

Where to Start

Finding a place to start to reduce your consumption can be difficult. One of the best ways to start a project is to think about **your approach** to reduction. A **top-down approach** is where managers and executives make decisions that trickle down throughout the system. A **bottom-up approach** is where employees create ideas or projects that can trickle upward. These methods complement one another, allowing an organization to both make immediate, effective change when possible and help ensure commitment and enthusiasm throughout the workforce to catch details that fall outside the purview of high-level planning.



Phipps Conservatory and Monterey Bay Aquarium.



Icon set, part of the communications used by Climate Toolkit to help address climate change.

“Audits are helpful tracking tools to establish a baseline of your institution’s waste consumption, how you are sorting, and to see if you need another trash avenue.”
Claudia Pineda Tibbs

Top-Down and Bottom-Up Approaches.

Phipps Conservatory: Top-Level Solutions and Staff Engagement

Phipps Conservatory used both top-down and bottom-up approaches to reduce their plastic usage. From the top-down perspective, Phipps leadership worked directly with management of its café to mandate a holistic approach to plastics reduction. Through this collaboration, Phipps was able to eliminate all plastic utensils, cups, water bottles, lids and plates with compostable or reusable alternatives. One of the biggest components was the elimination of soda and plastic water bottles and the installation of water refilling stations throughout the conservatory.

To complement a bottom-up approach, Phipps embraced the hackathon event format to create an opportunity for employees to brainstorm solutions to plastic reduction. A **Hackathon** is an event that allows employees to create solutions to problems. Hackathons began as an opportunity for technology professionals to collaborate and solve technical problems.

Thirty-one employees from across all Phipps departments voluntarily signed up to participate. Employees were split up into groups focusing on subjects including compostable alternatives, plastic consumption and redistribution, plastic waste in horticulture, plastic usage by guests, plastic used for distributing flowers, and plastic signage and packaging materials. The event generated **forty-two innovative ideas** about how to reduce plastics within all departments. The list of ideas is attached below. Some of these thoughts are small and some larger, but hackathons support all ideas.

The event resulted in the formation of a **Plastic Reduction Team** to continue honing these reduction efforts. Phipps employees have successfully implemented nine of their concepts so far into the horticulture, marketing, events, and education departments, with more to come.



Phipps Conservatory's Hackathon to Reduce Single Use Plastics.

“Greenhouse gas emissions are produced at every stage of the lifecycle of plastics, so Phipps made them a principal focus when rethinking our daily operations.”
Richard Piacentini

The Hackathon generated forty-two innovative ideas about how to reduce single plastic usage across campus.

1. Digital receipts
2. Kiosk check-in
3. Scanable membership cards
4. New shirt for admissions (e.g. Recover brand, Thread)
5. Personal pledge to set a goal and report back after a designated period of time (within departments, across members/guests)
6. Incentivized family workshop on plastics to brainstorm for plastic reduction at home and provide some guidance on confusing recycling questions
7. Produce videos within the same helpful info above
8. MOD day in exchange for community clean-up
9. Papier mache flower pots using the plastic pots as the mold to demonstrate creativity and positivity around generating solutions to plastics and provides a good chance for discussion about why we aren't sending home plastic pots
10. Create a green gift guide: list on the website, include greek baked goods, etc., and share tips for green wrapping
11. Clay pots
12. Design seasonal shows to prioritize plastic reduction and plant reuse, thereby making shows more 'plastic efficient', includes plant 'Red List'
13. Mixing soil on site
14. Buy soil in huge quantities
15. Plant pot take back (e.g., distributors, Lowe's, possibly other vendors)
16. Use only plants we can produce and no more
17. Consolidate shipping
18. Challenge ourselves to use alternatives to plastic
19. Reuse packaging for show decor
20. Cocktail stirrers
21. Use milk cartons for flower pots

22. Explore buying milk in plastic jugs versus large plastic bags versus smaller scale (e.g., quarts)
23. No lids on to-go cups
24. Provide glass cups, not compostable
25. Keep waste goals through all shows, including gift shop sales; uphold 80% or more of items sold during Winter Show are American made
26. Prototype alternative substrates for signage (e.g., falcon board)
27. Speak with vendors about alternative packaging; request waste reduction in packaging across departments
28. Sell or donate used pots (e.g., May Market, bulb sales, nurseries, Bidwell)
29. Increase departmental budgets to reduce imported single-use waste
30. Connect with Gateway to initiate new waste stream; Terracycle
31. Paper packaging goes into Agrecycle bins versus recycling bins
32. Winter show holiday lights donation versus throw away
33. Community/staff composting
34. Increase paper shredding/composting for horticulture to reduce plastic bags required for trash
35. Use soil bags as trash bags in conservatory
36. Buy coffee in larger bags
37. Replace zip ties in the broderie with a combo lock or reusable velcro tab
38. On-site granulation
39. Centralized office supply purchasing options available
40. Ability to purchase stainless steel straws in café, with paper emptied in the trash and compost bins always have green liners
41. Garbage bags in the office are large and typically have very little trash in them but are thrown away every day
- 42.

Monterey Bay: Leadership, Auditing and Outreach

Monterey Bay Aquarium is a leader of sustainability and climate-related education with a mission rooted in sustainability. Monterey's relationship to plastic reductions starts with the ocean; about 9 million tons of plastic pieces are estimated to be thrown into the ocean every year. Claudia Pineda Tibbs, sustainability manager of Monterey Bay Aquarium, describes how a waste audit was used to evaluate and reduce their plastic consumption, overall findings from the audit, and challenges and opportunities of their plastic consumption.

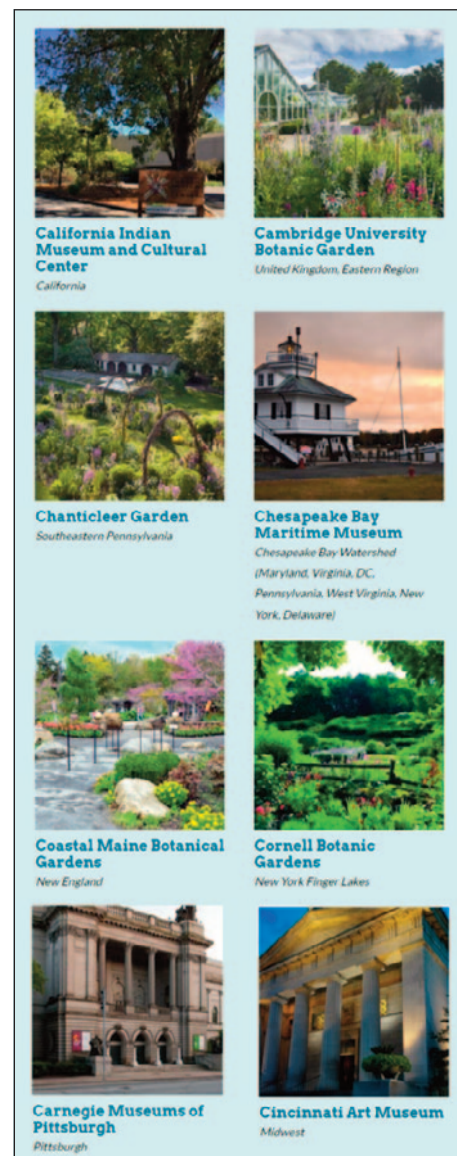
"The Monterey County recycling plant stopped receiving certain types of plastics, so our staff decided to complete a waste audit at the beginning of 2020 to evaluate our waste sorting. Waste was collected for 24 hours all over the campus including areas such as **visitor center, café, parking lots, and employee restricted areas**. Waste audits are an assessment of a facilities' waste program, usually to see if there are any misconnections about how to sort the trash or to gauge what your employees or guests are bringing to your site."

"Very insightful, fascinating, and disgusting" is how Tibbs describes the waste audit process. Composting efforts represented the highest amount of generation with the lowest amount of contamination. "About 40% of our trash is going to a landfill of which 80% could be diverted depending on the county. Education amongst our guests and our staff is extremely important to help encourage correct sorting. Our staff has worked diligently to sort café waste into their correct bins and reduce our waste. Retail and culinary partners have been helpful; some of our retail suppliers have stopped wrapping their products in plastic and instead use cardboard which is compostable." Monterey Bay Aquarium reached out to their culinary suppliers including Mission Creamery who now have changed the way they ship their product to reduce plastic consumption.

One of the most challenging issues that most institutions who serve guests face is reducing the waste that visitors bring onsite. Institutions can reduce the amount of plastic they produce but will still have to try to divert the waste that their guests bring onto their site. At Monterey Bay, student lunches were observed to contain a multitude of plastic wraps. Communication efforts continue to focus on encouraging guests to rethink their own approaches to plastic waste, a testament to the fact that to address climate change and related issues effectively requires every one of us.

The Climate Toolkit

To learn more about this and other ways to address climate change in your garden, join The Climate Toolkit (climatetoolkit.org), a collaboration between 55 gardens, zoos, and museums to help address climate change within their own operations as a model for visitors. The Toolkit embraces 32 goals in areas including energy, food service, transportation, waste, landscapes and horticulture, investments, visitors, internal and external engagement and research. The Climate Toolkit creates a network of sustainable change by hosting webinars, creating sustainable content, interviewing organizations who have created sustainable policies, and discussing how organizations can work together to achieve their sustainable goals.



A few of the Climate Toolkit participants.

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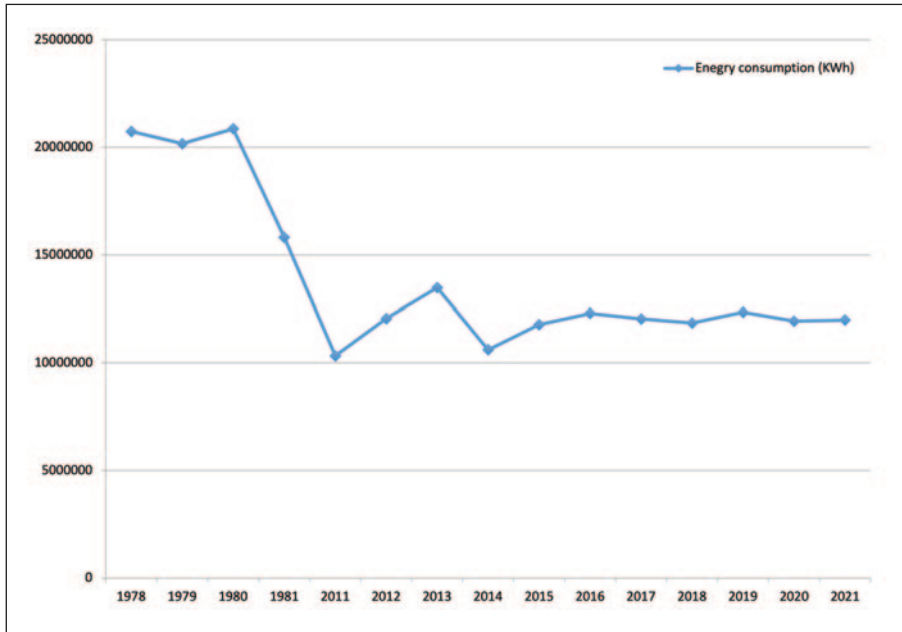
REDUCING CARBON FOOTPRINT THROUGH SUSTAINABLE RENOVATION AND INNOVATION

Several botanical gardens have historical buildings and glasshouses. The combination of these old buildings and glasshouses results in a high energy need and a large carbon footprint. The climate crisis urges a drastic change in how we heat our buildings to become climate neutral by 2050. Meise Botanic Garden is developing an energy master plan combining sustainable renovation with innovative heating technologies. It aims at lowering its carbon footprint by 65% in the next few years. In parallel Meise Botanic Garden promotes sustainability through its educational programmes and the WOODLab.

As part of the European Green Deal, the European Commission (2019) proposed a reduction in greenhouse gas emissions by 2030 to at least 55% compared to 1990 levels. This is only possible if all stakeholders, private and public, are committed, including botanical gardens. Achieving a 55% reduction is a serious challenge for many botanical gardens as they are often situated on historic building land and include old buildings such as mansions and castles. Additionally, glasshouses conserving and showcasing tropical and subtropical plant diversity are often present. This results in high energy needs to keep them alive. Reducing energy consumption does not necessarily require drastic measures such as the closing of the glasshouses. A detailed energy master plan might be good guidance to achieve the energy reduction goal step by step.

Above: The new glasshouse complex, the Green Arc, will soon replace the old energy consuming glasshouses. (Temporary association NU – ar-te)

The current energy need corresponds to the average energy consumption of 500 Belgian households



Left: Energy need (KWh) of Meise Botanic Garden for heating the buildings and glasshouses. (Meise Botanic Garden)

Meise Botanic Garden is developing an energy master plan in collaboration with the Flemish Energy Company (Vlaams Energie Bedrijf - VEB) with the scope to become climate neutral by 2050. The master plan outlines in detail, all measures that will be taken in the coming years to lower the energy needs and to switch to more sustainable heating solutions. With about 15000 m² of glasshouses and 50 buildings, Meise Botanic Garden always had a high energy consumption. Various measures have been taken in the past to moderate energy consumption. Especially during the previous energy crisis of the late seventies, a well isolated heat network was installed which halved the energy consumption. Since then, the energy consumption remained stable corresponding with the average energy need of 500 Belgian families.

The energy master plan includes more than 100 actions that will lower the energy needs and reduce the carbon emissions. They can be grouped in two main categories: actions focused on lowering the energy needs through re-construction and renovation and actions focused on electrification of the heating system.



A Combined Heat and Power system reduced the primary energy consumption. (Meise Botanic Garden)

Re-construction is often not an option for heritage buildings



Energetic renovating of a medieval castle is a challenge, but new technologies, such as vacuum isolated glazing, helps lowering the energy need. (Meise Botanic Garden)



Left: The old farmstead was renovated following the box-in-box principle and houses inter alia a multipurpose room. (Meise Botanic Garden)

Re-construction

Whether demolition and re-construction or deep renovation is the preferred solution depends on many factors (Wastiels et al., 2016). Mostly, the choice is obvious because of the bad condition of certain buildings (re-construction) or the heritage value (deep renovation).

Meise Botanic Garden cultivates about 20,000 plant taxa of which more than half are found in our glasshouses. The plants are grown for research, conservation, and educational purposes. The smaller glasshouses, used for the research and conservation collections, date back to the 1930s and 1940s and are in a very bad condition. They will be replaced by a modern glasshouse complex that was baptised the Green Ark. It is fully equipped with modern climate control techniques, with a focus on energy efficiency. It should result in a 25% energy reduction. The completed Green Ark will also contain a visitor centre where we will share stories about our plant biodiversity conservation activities and the Garden's role in a changing world.

A similar makeover is planned for the building containing the herbarium collections. The building will be carbon neutral. The herbarium rooms will be kept at a temperature of 16 degrees celsius which should keep the collections pest-free.

Renovation

The heritage value of the old farmstead, public glasshouses (the Plant Palace), or the Bouchout Castle meant re-construction was not possible, and renovation is the only solution. In the case of the old farmstead the box-in-box principle was successfully applied. The renovated building now houses four rooms for visiting scientists and trainees and a multipurpose hall. The heating is assured by a small geothermal heat pump.

For the public glasshouses, the possibilities for energetic renovation are more limited. The wooden window frames of the facades, made of durable teak, cannot be altered and the construction is too light to hold double glass. Nevertheless, the replacement of the glass by new safety glass makes the construction more windproof. In addition, the heating pipework and pumps are replaced to make the whole installation more efficient.

For the Bouchout Castle, all glass will be replaced with vacuum insulated glazing that has excellent isolation properties and remains thin enough to be used in existing wooden frames (McSporran, 2014).

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In the WOODlab, the public can discover the qualities of wood as climate friendly building material. (Meise Botanic Garden)



Electrification

If a garden decides to maintain its glasshouses, there will always remain a need for energy, but it can be lowered to a large extent (Gorjian et al., 2021). The installation of a Combined Heat and Power (CHP) system is a first step to deal in a more efficient manner with this energy need. Traditional methods of electricity generation produce a huge amount of residual heat, which is difficult to reuse in a central power plant and thus becomes waste heat. By generating electricity locally with a gas engine, this residual heat can be recovered locally for heating the glasshouses. This CHP is fully integrated into the Garden's existing heating system. It behaves like an extra boiler which happens to generate electricity as well. Where total energy efficiency of a traditional power plant barely reaches about 40%, it can rise to over 90% for a CHP.

This system will soon be complemented by a large geothermal heat pump of 1 MW. The system should cover about 50% of the heat demand and will also allow cooling in the summer. Solar panels on several existing buildings will complete the first phase of our energy transition.

By 2030 the carbon footprint is projected to be lowered by at least 65%, well within the ambitions of Europe's green deal.

Public outreach

The wave of renovations brings opportunities to act as a centre of knowledge towards partner institutions that are going through the same process of renovations and renewal. The energetic measures that will be taken will provide a unique opportunity to communicate about the energy transition to the wider public. In our WOODlab, already opened in 2019, we promote the use of wood as a sustainable climate-stabilising building material to the public. A school programme, specifically aimed at technical education, takes a closer look at wood as a sustainable construction material. The origin of the wood and the durability class to which each wood species belongs are discussed in this workshop. Additionally, the sustainability theme and the reference to climate change is incorporated into several school programmes. Food security for the future, the use of palm oil and the focus on crop wild relatives are just some of the themes that are closely linked to the research of Meise Botanic Garden and for which we raise public awareness through our school programmes.

Above: Several workshops for children focus on sustainability. (Meise Botanic Garden)

Promoting sustainable solutions is an important role for botanical gardens

Electrification of the heating is crucial to become CO2 neutral

Solar energy is an affordable option to produce green energy

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THE TANGLED BANK: ECOLOGICAL DRIVERS OF EVOLUTION IN A BOTANIC GARDEN

St Andrews Botanic Garden moved to its current 9 hectare site in the 1960s with a clear mission: to represent the widest possible collection of plant diversity so that university botany students could learn how different habitats give rise to variations in plant form and function. However, similar to many other botanic gardens, the ways that botany was taught changed in the following years and as a result, the past thirty years have seen an increasing shift of emphasis in the garden away from botanical teaching and towards horticultural amenity and leisure, matched by a decreasing use by students and an increase in visits by gardeners and tourists.

In 2020 we reviewed the options for the future of the botanic garden: managing a high quality botanic garden that provides the full range of features that were considered necessary for undergraduate education in the 1960s is a significant undertaking both financially and also environmentally and with limited resources, tough choices needed to be made. In this process, it was clear how deeply the climate crisis, habitat degradation, biosecurity risk and the changing social conversation were interconnected in a botanic garden. In response, we wanted to develop a locally-based vision that demonstrated accountability and action. However, it quickly became apparent that the challenge was two-fold: there were many possible paths to take, rather than a shortage of options (having heated glasshouses, irrigation systems and diverse soils meant that potentially any botanical research mission could be feasible), whilst at the same time long-standing features that are unique to botanic gardens (such as Order Beds) commit the garden team to intensive management practices that could rule out new or different ideas.

Above: Image 1 - The three habitats of the Tangled Bank in St Andrews Botanic Garden. (St Andrews Botanic Garden)

It was clear how deeply the climate crisis, habitat degradation, biosecurity risk and the changing social conversation were interconnected in a botanic garden



This process of review has touched every aspect of the botanic garden's operations and led to a refreshed mission that will guide successive business plan cycles, starting with the Tangled Bank project. The Tangled Bank is a long term ecological research experiment containing three types of grassland found around the coasts in Fife, investigating how these habitats are likely to change as a result of genetic adaptations and species invasions that could arise from the biodiversity crisis. Extending across a four acre site, it is the first space that visitors see on entering the garden and through which all garden users pass during their visit. This brings multiple opportunities: space to conduct experiments, space to engage and educate different audiences, spaces to explore or escape, and a radical change in how we demonstrate the evolutionary relationships between organisms.

The Tangled Bank is a statement of intent: we want to communicate a sense of urgency, of business-as-usual not being an option, and hopefully the sense that positive opportunities are still open to us. To this end, the Tangled Bank project replaces the Order Beds (which were laid out according to the Cronquist system), the glasshouses (which included Xerophytic, Alpine and Tropical displays) and the Shrub Beds (with large collections of *Lonicera*, *Hydrangea*, *Viburnum*, *Cotoneaster* and *Syringa* species) with three habitats: wood meadow, sand dunes, and urban grasslands, which will be called the Biocene Garden (see image 1). These habitats are found around the Fife coast, most notably at Tentsmuir National Nature Reserve which has become a reference point for us, but also in many cases in places that we don't appreciate or even realise. Developing the Tangled Bank in relation to local habitats has allowed us to think clearly about the threats that these habitats face, such as urbanisation, fragmentation, changing patterns of rainfall and growing season temperatures. These threats are shared around the world but what is important to us is how these are manifested locally, and how these are unique: what emerges from these reflections are the processes of time and the pathways of movement and trade that inform the various risks of pests, diseases or plant species. The principle of 'doorstep botany' here is crucial, enabling us to focus on the unique qualities of the plants that we see around us and hopefully encourage our colleagues and visitors to think about them and their assemblages in a new light.

Above: Image 3 - Children running along the boardwalk between the wood meadow and the sand dunes.
(St Andrews Botanic Garden)

“It is interesting to contemplate a tangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about...”
Charles Darwin,
“On the Origin of Species”



The Tangled Bank at St Andrews Botanic Garden. (St Andrews Botanic Garden)



We are often asked why we are doing this, given that native habitats can be found locally, or if the Tangled Bank is a 'wilding' project. Although the project does share many of the features of the rewilding movement, we don't see it as such: rather, we are keen to emphasise our role as a botanic garden rather than a nature reserve and to this end, research and experimentation is the priority. To this end, the Tangled Bank will facilitate two types of research: baseline monitoring and recording of plant distributions and microclimates, with demographic and functional trait data gathered longitudinally on a subset of species, and hypothesis-driven research with specific research questions that address how environmental characteristics influence phenotype expression. We are at the earliest stages of this research to begin, we have carried out extensive biological modelling to identify the key climate variables that inform plant distributions in Fife and then identify where the same intersections of climates can be found around the world today and forecast where they might be found under different climate scenarios (image 2). Using this modelling, we will then be able describe the functional diversity of plants found in these habitats, characterise niches, and then select species from similar habitats around the world for introduction into the Tangled Bank and develop research questions that address questions of fitness, natural selection and adaptation under climate change.

The three habitats are laid out as distinct features in their own right but with gradients running between them, reflecting the transitions we find in Fife, with specific design interventions to make them part of the visitor experience. For example, a feature boardwalk runs between the wood meadows and sand dunes enabling all visitors to see plants right up close—the dunes of Tentsmuir NNR are some of the most biodiverse habitats in Fife with a stunning diversity of plants but these are largely inaccessible to people with mobility issues, and the wide, contemporary design of the boardwalk enables all visitors to not only see these plants. However these plants are largely to see them right up close as the boardwalk cuts through dunes and the plants are raised to their eye level. This spirit of 'similar but not the same' is a core principle of the design language, encouraging visitors to the garden to see the plants they are most familiar with in new ways. Throughout the Tangled Bank, quirky design elements can be found, such as the 300m² glasshouse which has been converted into a pergola and over time, this will enable us to develop a unique design aesthetic that responds directly to our part of Fife.

Native and non-native plants at Tentsmuir NNR, one of the inspirations for the Tangled Bank.
(St Andrews Botanic Garden)



Setting out the sand dune grasslands to take the place of the Order Beds.
(St Andrews Botanic Garden)



Wood meadow glades established, taking the place of dense exotic shrub collections.
(St Andrews Botanic Garden)

This combination of habitat development and research allow us to open up the education mission, with curriculum-aligned courses in schools and universities, taught postgraduate courses for university students, and a message of exploration and adventure for self-led visits. Being open to new ways of thinking about the role and content of education in a botanic garden has led to partnerships with students from biology, sustainable development and design courses, and we are hopeful that collaborations with similarly-minded organisations can grow as a consequence. Having been initiated as a 'rapid response' and on a low budget, we have started with the creation of the wood meadow and the sand dune habitats: a Meanwhile Garden is being created to take the place of the glasshouses and our next steps will be to identify partners who are interested in how urban habitats will respond to climate change and develop the final component of the Tangled Bank, the 'Biocene Garden'. We see this as being dominated by grassland species but with a role for urban forestry and wetlands too, in a designed landscape that is contemporary, inclusive and optimistic. The sense of hope is fundamental to addressing the biodiversity crisis and this, perhaps, is the core role of the Tangled Bank.

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The establishment of locally native grassland communities into which non-native plant introductions can be made to assess impacts of naturlisation. (St Andrews Botanic Garden)





SPOTLIGHT

NAME: PATTI DAVIE

**ROLE: CHAIR OF THE FRIENDS
OF THE UNIVERSITY OF
BRISTOL BOTANIC GARDEN**

Left: Nicolas Wray, Curator of Bristol Botanic Garden and Patti Davie, Chair of the Friends, at Buckingham Palace

How long have you been involved with the University of Bristol Botanic Garden?

I became a Friend of the garden in 1996 after enrolling for various courses being run by the Garden – for example, Garden History and Physic Gardens and later the RHS Diploma in Horticulture. I learnt about volunteering and started by helping with the plant sales and the open days.

What is your current role in the Garden?

Currently I am Chair of the Friends of the University of Bristol Botanic Garden. I was first elected Chair of the Friends in March 2005. I stood down after six years in office in March 2011. However, I remained on the Committee and was re-elected Chair in March 2015. My term of office should now be coming to an end but like many places succession planning is a problem so I will probably be continuing for the time being.

My contributions to the committee include being co-editor of the quarterly newsletter since Spring 2012 and organising the annual fund-raising jazz concert. Since 2010 I have been archiving the Friends' records (pre-Covid I spent every Tuesday at the Botanic Garden) and during the lockdowns have continued carrying out some scanning and compiling at home.

Why do you volunteer?

My family are all keen gardeners, especially my grandmother who gave me my love of plants and with whom I spent holidays and helped on my uncle's market garden. With a career dealing with wills and trusts, I had no formal horticultural training until I did the RHS diploma course in 1999.

As my knowledge of the work carried out at the Botanic Garden grew, the more I wanted to be involved in supporting and promoting the Garden. I realised the value of volunteers in helping in the development of the Garden and learnt about the DNA research projects and the specialist collections. In 2014 the Friends set up an Education and Training Fund to provide support for trainee horticulturalists, and in 2015, the Botanic Garden was recognised by the University of Bristol as a major benefactor in their Centenary Campaign celebrations. Since the Friends were set up, over £1m has been donated to the Garden.

Being involved with the garden, either as a Friend or a volunteer feels like being part of a big family. It is a pleasure to meet such a wide range of people – all of whom share a passion for the Garden.

What has been the biggest challenge to you during your time on the Friends' Committee?

Because my professional life was in the financial sector, I was asked to be part of the project management team for an application to the Heritage Lottery Fund. This was put on hold when, in 2000, the University of Bristol announced a review with possible closure of the Garden. After over 2 years of consultation and a considerable campaign by many influential parties, including the then Chair of the Friends and Pro Vice Chancellor, and with the support of Friends and other botanic gardens, it was agreed that the Garden would be relocated. A number of sites were considered. Eventually in October 2003, work started to move some 100,000 plants to their new home and to complete the task of cataloguing all of them. This was accomplished by the small staff and many volunteers over the next 2+ years. The old garden closed in July 2005. The new garden in its current site was opened in March 2006 by Sir Peter Crane (then Director, Royal Botanic Gardens, Kew)

Moving the Garden was a major challenge. Another challenge was retaining existing members of the Friends and additionally, encouraging new members to join the Friends' scheme. To raise awareness of the move of the garden in May 2005, the Friends organised a sponsored walk from the old to the new garden (approximately one mile across the iconic Clifton Suspension Bridge). We raised £1500.

What special event stands out for you during your long association with the Garden?

It must be receiving the 2018 Queen's Award for Voluntary Service given to the University of Bristol Botanic Garden volunteers. In June 2018, Nick Wray (Curator of the Botanic Garden) and I were privileged and delighted to be invited to attend a Buckingham Palace garden party for volunteers. We then held our own garden party at the Botanic Garden in July 2018 for all volunteers -some 100 attended. Later in April 2019, the Award was formally presented to me on behalf of the volunteers by HRH the Duke of Kent. In attendance were the Lord Lieutenant of Bristol, the High Sheriff and the Lord Mayor; the Vice Chancellor, the Dean of Life Sciences, the Garden Director and the Curator from the University of Bristol and the President of the Friends, Mrs Jekka McVicar.

And finally, given your long association with the University of Bristol Botanic Garden, what advice would you give to people who want to be more active in supporting Botanic Gardens e.g. joining a Friends' group or committee.

Botanic gardens are very special places with the scientists and horticulturalists working together to ensure the survival of plants which are endangered, including those on the IUCN Red list as well as plants upon which we rely for our own survival. Sir David Attenborough emphasised the importance of plants to us all in his latest series 'Green Planet'.

It is important that we are able to help, albeit in a small way, to further the research and maintenance of these species by volunteering and supporting botanic gardens. At the same time we benefit by getting to know like-minded people providing us with companionship and a sense of purpose. The past two years have made obvious the benefits of gardens and gardening - which those of us volunteering in gardens already knew – and with such a variety of roles, it is for all ages and abilities, not just for those who are retired and have time to spare.

RESOURCES

FOOD

1. BGCI food waste challenge

Encourage visitors to take up the 30-day food waste challenge to see if households can reduce their fruit and vegetable waste. Visitors log in and record their food generating a number which they can aim to beat week after week.

Link: <https://www.bgci.org/our-work/projects-and-case-studies/fruit-and-veg-food-waste-challenge/>

2. Food fact for life

This group of resources from KS1-5 provides activities and certificates for schools and gardens to use. They highlight certain aspects of the food chain which could compliment many garden activities.

<https://www.foodafactoflife.org.uk/>

ENERGY

3. The Renewable Energy Centre

This website holds a bank of resources created by companies across the sustainable sector. Some ideas provide mini experiments for the public to do.

Link: <https://www.therenewableenergycentre.co.uk/educational-resources/>

4. Energy.gov

Energy.gov provides resources which may help to generate long term impact and engaging with certain demographics. These resources do not just explain about renewable energy but support in highlighting roles within the sector

Link: <https://www.energy.gov/diversity/student-educational-resources-stem>

WATER

5. The Water Project

An excellent resource to highlight water issues currently facing the planet. This website can support in providing ideas and materials which offers some great activities at your institute

<https://thewaterproject.org/community/student-resources/grades-3-4/>

CLIMATE

6. The Climate Toolkit

The Climate Toolkit is a collaborative opportunity for museums, gardens and zoos who want to learn how to aggressively address climate change within their own organizations and inspire the communities they serve to follow their lead.

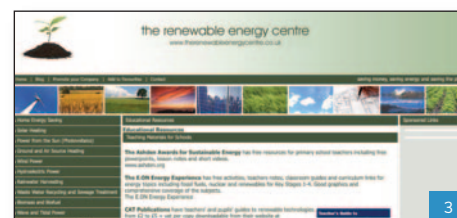
Link: <https://climatetoolkit.org/about/>



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CONTRIBUTE TO THE NEXT ISSUE OF ROOTS

The next issue of Roots is called **Education Highlights from the 7th Global Botanic Gardens and IXth European Botanic Garden Congress**. Gardens presenting at the congress on education will be providing a summary of their work for the readers of roots. BGCI plans to show a selection of published papers, workshop findings and posters to support gardens unable to attend.

BGCI will be in touch once abstracts are agreed



BGCI'S ONLINE TRAINING PLATFORM

BGCI has launched an online training platform to provide online and blended learning training courses to BGCI members and other interested individuals. The platform, which is Moodle based, allows the creation of a range of interactive content with resources designed to complement BGCI's existing face-to-face training courses, projects, and publications.

Find out more by visiting: <https://training.bgci.org/>

Modules include:

Defining a botanic garden

Masterplanning

Policy (linking to)

Introduction to interpretation

Introduction to evaluation

Scaling up biodiverse forests

Air layering -
added to existing veg prop module

Global Botanic Garden funds

Plant collection (coming soon)

BGCI'S DIRECTORY OF EXPERTISE

BGCI's new Directory of Expertise is designed to enable experts within botanic gardens to let other people know about their own skills and knowledge and, if possible, help them to solve a problem or challenge related to botanic gardens or plant conservation. As a membership benefit exclusively for BGCI Institutional Members, staff associated with these institutions can apply to be listed in the Directory.

The Directory currently includes 11 areas of expertise including Public Engagement. BGCI's purpose in creating this Directory is twofold: firstly, to share the knowledge and skills in the botanic garden community with broader society to solve problems or save plant species. Secondly to give staff of BGCI Institutional Members opportunities to broaden their experience and make a contribution that might not come their way in day to day work.

For more information or to be listed as an expert visit:

<https://www.bgci.org/resources/bgci-databases/directory-of-expertise/>





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CONSERVATION
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ROOTS

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INFLUENCE & ACTION

Botanic Gardens as Agents of Change

Join us for the 7th Global Botanic Gardens Congress (7GBGC) which will be held in Melbourne Australia from Sunday 25 – Thursday 29 September 2022.

Whilst our ability to meet has been limited recently, it is now time to bring our community together and experience real people, real connections and real gardens.

Influence and Action: Botanic Gardens as Agents of Change will explore how botanic gardens can play a greater role in shaping our future. With accelerated loss of biodiversity across the globe, increased urbanisation, population growth and climate change, our need to work together to find new solutions for the future has never been greater.

7th Global Botanic Gardens Congress

**25–29 September 2022
Melbourne Australia**

Join inspiring speakers, fascinating workshops, panel discussions, and symposia, in addition to a designated Education and Engagement Day, field visits and an evening program designed to showcase the vibrant contemporary creative and food scenes for which Melbourne is globally renowned.

Explore our most liveable city and Royal Botanic Gardens Victoria's stunning and contrasting landmark gardens at Melbourne and

Cranbourne. Immerse yourself in natural areas of coastal heathland or towering hardwood forest, visit regional botanic gardens and enjoy 'The Art of Botanical Illustration' Exhibition incorporating works from renowned artists from around the globe.

There is so much on offer. Visit the Congress website for more information on registration and call for abstracts to ensure you take advantage of this valuable opportunity.



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