



Survey of Climate Adaptation Actions from Botanic Gardens and Arboreta: Results from 2022 and 2024

Compiled by Dionne Bunsha and Zahra Chan-Khan

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Introduction

Surveys in 2022 and 2024 aimed to collect case studies and knowledge about adaptation action from botanic gardens around the world. The results were compiled by the Climate Change Alliance of Botanic Gardens and UBC Botanical Garden to create the [Menu of Adaptation Actions for Botanic Gardens & Arboreta](#), a toolkit that offers strategies, approaches, and tactics to inspire adaptation work. This document highlights Adaptation Actions, Key Learnings, and Resources collected from the 32 responses in 2022 and the 42 responses in 2024. Learn more about stories from botanic gardens and arboreta in the [The Menu of Adaptation Actions for Botanic Gardens and Arboreta: Case Studies](#) report.



1
Build
Capacity and
Knowledge



2
Resilient
Plant
Collections



3
Integrated
Plant
Conservation



4
Landscape
Adaptation &
Sustainable
Management



5
Community
Learning and
Engagement

New Zealand	2	Uganda	1
Hungary	1	Switzerland	1
Italy	1	Mexico	2
France	3	India	1
Ukraine	2	Ethiopia	1
Spain	5	Zimbabwe	1
Brazil	1	Argentina	1
Belgium	1	Greece	1
United States	6	Canada	1
Russia	1	Israel	1
United Kingdom	1	Finland	1
Ecuador	1	Romania	1
Australia	4		

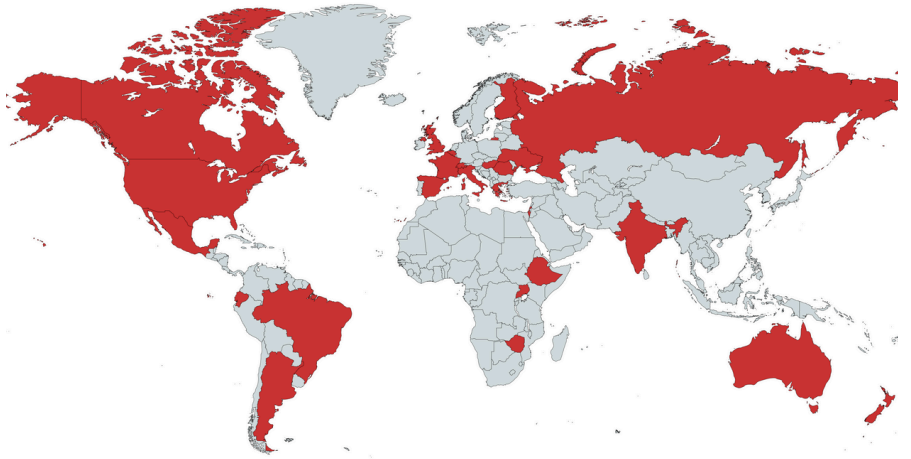


Figure 1. Table and map showing origin of 42 responses across 25 countries (2022 survey).

New Zealand	2
Australia	3
Poland	1
United States	13
Uganda	1
Italy	8
India	1
Korea	1
United Kingdom	1
Argentina	1



Figure 2. Table and map showing origin of 32 responses across 10 countries (2024 survey).

2022 Adaptation Actions

Below are examples of actions various botanic gardens are taking to adapt to climate change in 3 areas: Landscape Management and Practices, Research, and Education + Engagement.

Landscape Management and Practices

Organization	Action
Montreal Botanical Garden (CA)	Developing an action plan to determine the riskiest climatic consequences for the Montreal region. Review horticultural and arboricultural practices to improve resilience. Introduce more resilient genotypes.
Real Jardín Botánico (ES)	Monitoring changes in tree phenology and calculating carbon storage.
Shashemene Botanical Garden (ET)	Joining the Reducing Emissions from Deforestation and Forest Degradation plus (REDD+) technical committee.
O.V. Fomin Kyiv Botanical Garden (UA)	Studying adaptation of plants to stress factors (including acute hyperthermia) at the anatomical, morphological, biochemical and physiological levels to help predict and guide the introduction of rare plants for further conservation.
Jardín Etnobiológico de las Selvas del Soconusco (ECOSUR) (MX)	Creating a demonstration plot for ecological succession and restoration.
Jardín Botánico Dr. Alfredo Barrera Marín (ECOSUR) (MX)	Working on a coastal dune nursery project for ecosystem restoration in Puerto Morelos, Quintana Roo, Mexico. Implementing rainwater catchment for irrigation.
Betty Ford Alpine Gardens (US)	Publishing the North American Botanic Garden Strategy for Alpine Plant Conservation .
SCCV Château Pérouse (FR)	Annual assessment of plant adaptations and microclimates.

Research

Organization	Action
Real Jardín Botánico (ES)	<p>Starting to evaluate the level of changes related to increase in temperature, variability of rainfall, relative humidity, phenology and carbon sequestration.</p> <p>Developing a two-year long experiment to investigate the effect of increasing temperature on ornamental grasslands.</p>
Royal Botanic Garden Edinburgh (GB)	<p>Researching species behaviour, cultivation, and habitat restoration.</p> <p>Creating a Science and Biodiversity Strategy 2021-2030.</p>
O.V. Fomin Kyiv Botanical Garden (UA)	<p>“Prospects of using unmanned aerial vehicle for assessing climate-making properties of park tree species using Kiev A.V. Fomin Botanical as an example” (2018)</p> <p>“Estimation of the Prospects of Using Model Species of Wood Plants for the Overcoming the "City Heat Island" by Parameters of the Functional State of Photosynthetic Apparatus” (2018)</p> <p>“Various antioxidant responses to hyperthermia in anatomically different species of the genus Rosa.” (2019)</p>
Jardín Botánico de Castilla - La Mancha (ES)	<p>Evaluating the impacts of climate change and urban management on the biodiversity and ecosystem services of urban green areas through the URBANFUN Experiment.</p>
Montreal Botanical Garden (CA)	<p>Documenting causes of tree mortality over the years and connecting them with climatic events.</p>
Betty Ford Alpine Gardens (US)	<p>Mapping the alpine ecosystem, documenting Indigenous Protected and Conserved Areas (IPAs), cataloging, expanding field sites, and seed collecting/banking.</p>
UC Davis Botanic Garden and Arboretum (US)	<p>Testing the drought and heat tolerance of 40 new and underutilized tree species from west and central Texas in our Sacramento Valley climate in the Texas Tree Trials project. Staff and students have propagated over 1,000 trees and are currently planting and monitoring trees at the first field trial site.</p>
San Diego Botanic Garden (US)	<p>Exchanging seeds with Royal Botanic Gardens Victoria - Melbourne Gardens, focusing on seed collected from plants natively grown in environments similar to projected future climates.</p>

Research

Organization	Action
Sochi Dendrarium (RU)	Assessing climate risk for the Sochi arboretum collection.
Jardín Botánico - Histórico La Concepción (ES)	Phenological monitoring for over 20 years to understand the influence of climate change on plants.
Nature Palace Botanic Garden (UG)	Investigating the use of biochar in rehabilitating degraded farmlands.

Education and Engagement

Organization	Action
Shashemene Botanical Garden (ET)	Engaging school and community members in programs such as water-shade development and restoration planting.
Royal Botanic Garden Edinburgh (GB)	Creating a free online course for the public to learn about climate change and biodiversity.
Nature Palace Botanic Garden (UG)	<p>Training the community in waste recycling, resource recovery, energy saving, and alternative cooking energy technologies.</p> <p>Training farmers in climate-resilient agriculture.</p>
Betty Ford Alpine Gardens (US)	Creating the "Plants are the Answer" exhibit inspired by Project Drawdown, which highlighted the role of plants in carbon sequestration and promoted plant-based diets.
UC Davis Botanic Garden and Arboretum (US)	<p>Hosting Learning by Leading, an internship program for students to gain sustainability leadership experience.</p> <p>Focusing plant sales on drought/heat-adapted species and sharing strategies for local home gardeners to build more biodiverse, resilient landscapes.</p> <p>Installing educational tags on trees across campus that highlight the role of trees in ecosystem services, climate change mitigation, and climate-ready plant communities.</p>
Jardín Botánico - Histórico La Concepción (ES)	Hosting "Café con ciencia" (Coffee with Science), where climate change researchers share their research with high school students.

What is the Role of Botanic Gardens in the Climate Crisis?

Landscape Management and Practices

- Prioritizing rare, endemic, and culturally significant species.
- Participating in metacollections to maximize conservation of genetic diversity.
- Representing native plant communities in the collection.
- Acclimatizing wild plants and distributing plants adapted for gardening.
- Including climate models in plant selection and decision-making.
- Demonstrating climate-ready horticulture practices.
- Managing landscapes to create habitat for local biodiversity.

Research

- Studying plant and ecosystem responses to climate change and making projections for the future.
- Collaborating with other gardens on long-term phenological studies.
- Trialing species that are adapted to projected future climates.
- Testing innovating horticulture practices for emerging conditions, including extreme events.
- Protecting seed and gene diversity through banks and ex-situ conservation.

Education and Engagement

- Interpreting climate research and publications.
- Raising awareness about local climate impacts and how to take action.
- Providing relevant training for organizations to prepare for future conditions.
- Sharing knowledge with youth, schools, local planners, and community members.
- Supporting species selection for city parks and street trees.
- Mobilizing volunteers, lobbying, and partnering with other institutions and private industry.
- Partnering with local organizations for ecosystem restoration.

2022 Tools and Resources

Model for Collections Diversity and Habitat

Suitability (Preliminary)

From UC Davis Botanic Garden and Arboretum in collaboration with the Morton Arboretum
Model to maximize ecological diversity in collections according to current and future habitat suitability.

Eco-Variety Fruit Trees and Shrubs Project

From the Balkan Botanic Garden of Kroussia (GR)
Tool that maps traditional varieties of fruit trees and shrubs that have been collected during field research in 8 mountainous areas in Greece.

Climate Data Comparison Application

From Jardín Botánico de la Ciudad de Buenos Aires
"Carlos Thays"

Digital app where users can access extreme climate indices using data collected from weather station in the Garden.

Château Pérouse Online Database

From SCCV Château Pérouse (FR)
Database containing characteristics of over 20,000 taxa to support suitable plant selection.

2024 Adaptation Actions

Below are examples of actions various botanic gardens are taking to adapt to climate change in 6 areas: Plant Collections Policy, Landscape Management, Efficient Resource Use, Research, and Education and Engagement.

Plant Collections Policy

Organization	Action
University of Arizona Campus Arboretum (USA)	Amending plant collections policy to specify climate-ready tree species.
UC Botanical Garden at Berkeley (USA)	Curating drought-adapted collections.
Inala Jurassic Garden (Australia)	Growing ex-situ specimens of Tasmanian paleoendemic plant species which are at risk of climate-related increased fire regimes and temperatures.
Nature Palace Botanic Garden (Uganda)	Designing the home-herbal gardens program to promote cultivation of herbal medicinal plants that are crucial for primary care in the community but are becoming rare due to climate change impacts and other factors.
Betty Ford Alpine Gardens (USA)	Utilizing waterwise perennials.
Universita degli Studi di Genova (Italy)	Implementing new xerophytic collections
UC Davis Arboretum and Public Garden (USA)	Analyzing the suitability of tree collections for future climates with the BGCI Climate Matching Tool.

Landscape Management

Organization	Action
Royal Botanic Gardens Kew (United Kingdom)	<p>Developing a Landscape Succession Plan (2024).</p> <p>Undertaking collecting trips in new areas that match London's 100 year climate outlook.</p>
Royal Botanic Gardens Victoria (Australia)	<p>Developing a Landscape Succession Strategy (2016-2026).</p>
UC Davis Arboretum and Public Garden (USA)	<p>Planning and strategizing with the Living Landscape Adaptation Plan.</p> <p>Building the collection of heat and drought tolerant species and testing new introductions for broader experimental use.</p> <p>Increasing staffing focused on tree care.</p> <p>Building organizational capacity to respond to big storm events.</p> <p>Developing new experimental gardens with low or no irrigation.</p> <p>Incorporating more green stormwater infrastructure, including a major flood protection and waterway habitat enhancement project.</p>
Arnold Arboretum (USA)	<p>Launching a multi-phase master plan to bring water infrastructure and automated irrigation to the entire landscape.</p> <p>Developing emergency irrigation systems for drought preparedness.</p>
Bok Tower Gardens (USA)	<p>Creating rain catchment areas to optimize water use rather than relying solely on wells.</p> <p>Reducing water usage and energy used to pump well water.</p> <p>Switching to more organic-based fertilizer and reducing fertilizer use by improving overall soil health.</p> <p>Reducing lawn coverage and refraining from spraying for weeds.</p>

Landscape Management

Organization	Action
Betty Ford Alpine Gardens (USA)	<p>Prioritizing waterwise and native plants when building new gardens.</p> <p>Showcasing high altitude, low water species for gardeners in the community.</p> <p>Relocating collections to better suit their needs and longevity.</p> <p>Excluding annuals from all collections.</p> <p>Collecting in-situ and ex-situ alpine seeds.</p> <p>Hosting educational programming on sustainable garden care and habits.</p> <p>Leading the North American Botanic Garden Strategy for Alpine Plant Conservation.</p>
Rogerson Clematis Garden (USA)	<p>Designing Backyard Habitat certified plant collections with mixed native and non-native plants collections that support wildlife and four seasons of interest.</p> <p>Following only organic practices.</p>
Inala Jurassic Garden (Australia)	<p>Creating a large waterhole that gravity-feeds the garden and four 22,500 L rainwater collection tanks to increase water collection capacity, especially for dry weather.</p> <p>Mulching to prevent excessive water loss through evaporation.</p>
Orto Botanico di Firenze (Italy)	<p>Decreasing lawnmowing and abstaining from lawn irrigation.</p> <p>Installing rainwater harvesting cisterns.</p>
University of Arizona Campus Arboretum (USA)	<p>Converting turf to arid adapted, longer living woody species.</p> <p>Implementing drip irrigation, water harvesting, and/or rain gardens in all new projects.</p>

Efficient Resource Use

Organization	Action
Nature Palace Botanic Garden (Uganda)	Promoting a waste-to-energy program that aims to reduce deforestation for cooking fuel by providing alternatives such as biomass briquettes and ethanol fuels. It has been estimated that a ton of briquettes can save up to 80 trees.
The Tasmanian Arboretum Inc. (Australia)	Harnessing solar power, planting trees, and offsetting carbon emissions.
University of Washington Botanic Gardens (USA)	Switching to electric powered vehicles and tools. Using renewable energy generated by campus and the city.
Phipps Conservatory and Botanical Gardens (USA)	Constructing the Center for Sustainable Landscapes and retrofitting the Exhibit Staging Center into two of the greenest buildings in the world. Activating Phipps' lower campus as a centralized hub for sustainable development and education in Pittsburgh.
Royal Botanic Gardens Victoria (Australia)	Decarbonizing operations by shifting toward solar generation and electric vehicles/equipment.

Research

Organization	Action
Inala Jurassic Garden (Australia)	Tropical Mountaintop Plant Science Project (TroMPS): Supporting ex-situ genetic conservation of plants and seeds in tropical montane forests.
Municipal Botanic Garden (Poland)	Wool on a Heap: Partnering with University of Silesia and University of Bielsko-Biala to research using sheep's wool and wool products in soil to retain moisture and slow-release water during times of scarcity. This can be used to reduce erosion on slopes and help plants colonize degraded soils, which has potential in post-industrial and other infertile areas.

Research

Organization	Action
Manaaki Whenua Landcare Research (New Zealand)	<u>Water Sensitive Design</u> and <u>Sustainable Water Trail</u> : Restoring on-site ponds, expanding green infrastructure, innovating stormwater management, and removing/preventing contaminants in water.
University of Washington Botanic Gardens (USA)	Gardens as study sites: collaborating with the university and researchers to study the collections, landscape, garden records, and new taxa.

Education and Engagement

Organization	Action
Cornell Botanic Gardens (USA)	<p>Establishing a <u>Climate Change Demonstration Garden</u> to inform visitors, including school groups, of the potential impacts of climate change on native, invasive, ornamental, and food plants.</p> <p><u>Climate Stories</u>: Partnering annually with a cohort of visiting mid-career scholars from around the world to host an online webinar during which each scholar discusses the impacts of the climate crisis in their country and what governments, NGOs, and others are doing to mitigate and adapt.</p> <p>Partnering with other Cornell scholars in working with local communities (e.g., in the Pamir Mountains of Central Asia) and with <u>Indigenous communities</u> (e.g., Lakota Sioux) on climate adaptation.</p> <p>Executive Director Christopher Dunn serving on the inaugural Steering Committee of IUCN's new <u>Climate Crisis Commission</u>, which brings together scientists, NGOs, Indigenous and Tribal leaders, and policy experts to raise the profile of the climate crisis. Dr. Dunn was involved in drafting an IUCN position paper on the role of botanic gardens, zoos, and aquaria in these efforts.</p>

Education and Engagement

Organization	Action
Rogerson Clematis Garden (USA)	<p>Demonstrating site-appropriate planting according to microclimates.</p> <p>Creating and distributing “care sheets” for planting choices.</p> <p>Reducing the number of sub-tropical clematis (which are not winter hardy) in the collections once seeds are saved in the seed bank.</p>
University of California Botanical Garden at Berkeley (USA)	Developing an interpretation of climate research from campus.
UC Davis Arboretum and Public Garden (USA)	Mentoring students to take on leadership roles in adapting and transitioning landscapes through the Learning by Leading program.
Manaaki Whenua Landcare Research (New Zealand)	<p>Sharing climate mitigation actions with a wide range of audiences from primary school programs to professional engineer training.</p> <p>Outreach and engagement with local governments for green infrastructure technical design and post-flood recovery.</p> <p>Creating on-site interpretive signage for Sustainable Stormwater Trail Walkers.</p>
Phipps Conservatory and Botanical Gardens (USA)	<p>Creating the <u>Homegrown</u> program, which helps build raised vegetable garden beds in underserved local communities in an effort to increase access to fresh healthy organic food and food sovereignty.</p> <p>Partnering with a renewable energy service provider to:</p> <ul style="list-style-type: none"> • Create an educational campaign displaying 16 oil barrels and signage to convey the annual fossil fuel consumption of the average residential family • Offer incentives for homeowners to switch to clean energy (e.g. a Garden membership)

Key Learnings: Testimonials from Around the World

“Accessible solar panels for cleaning and maintenance.”

- Phillip Eric Parsons, *The Tasmanian Arboretum Inc., Australia*

“Processes and funding (essentially mindset/culture) are the biggest hurdles to change.”

- Tanya M. Quist, *University of Arizona Campus Arboretum, USA*

“Botanic gardens, especially in Africa, must refocus their programs to address the peculiar problems faced by the people on the continent.”

- David K. Nkwanga, *Nature Palace Botanic Garden, Uganda*

“Master planning is key! Raising endowments for new infrastructure is very important.”

- Danny Schissler, *Arnold Arboretum of Harvard University, USA*

“Searching for appropriate natives, “nativars”, and non-natives that will survive not just the heat, but heavy winter rains and erratic winter cold events is far more important than simply using drought tolerance and xeric performance as criteria. The climate may be changing, but our soil profile isn't.”

- Linda Beutler, *Rogerson Clematis Garden, USA*

“Look at systems in totality. We looked at our pumps, but not at our whole irrigation system. We are now improving our clocks and zones to continue to increase water monitoring.”

- Brendan Huggins, *Bok Tower Gardens, United States*

“What we are doing is not enough. We are facing extreme heat waves in Florence and especially monumental trees are suffering.”

- Giulia Torta, *Orto botanico di Firenze, Italy*

“Implement and gain operational experience from colleagues and other botanical gardens before making decisions and implementing actions.”

- Marco D'Antracoli, *Botanic Garden and Museum of the University of Pisa, Italy*

“We found that the effectiveness of the BGCI tool could be improved by incorporating rainfall data. This has been an iterative process, with very applicable results. We will continue to monitor, feedback etc.”

- Richard Barley, *Royal Botanic Gardens Kew, United Kingdom*

Key Learnings: Testimonials from Around the World

"Climate change isn't a project or a management initiative and requires constant focus and learning from all staff. Implement a cross organisation working group made up of all areas and different levels of staff to champion the CCABG both internally and externally - it is a big ask when the major responsibility falls on a few dedicated staff."

"Sometimes, climate adaptation tactics involve considerable change in approaches, and other times you are already doing what you can."

- *Clare Hart, Royal Botanic Gardens Victoria, Australia*

"Engaging students in climate adaptation work has been tremendously meaningful and empowering for our students and our staff mentors. In addition, this work has generated a lot of positive attention for us in the press and among donors."

"Our LLAP [Living Landscape Adaptation Plan] has been an effective tool for helping us advocate for more university resources for our tree canopy."

We held an adaptation planning workshop in early 2020 right before COVID. We haven't had a chance since then to bring our whole team together to focus on this topic, but I think that is needed. The planning process daylighted differing mindsets and perspectives from our different work teams, and those will take more leadership work and clarity to redirect and align."

- *Emily Griswold, UC Davis Arboretum and Public Garden, USA*

"Museums, gardens, and zoos all have unique pathways towards climate sustainability within their own operations, surrounding communities, and specific bioregions. Utilizing surveys and direct 1:1 virtual and/or in-person meetings has been incredibly useful in gauging the interests and needs of our partner institutions."

"With the creation of Phipps' lower sustainability campus, it was all about embracing top-down regenerative thinking and long-horizon Objective Key Results (OKR) as opposed to traditional short-term return on investment (ROI). With the Green Mountain Energy campaign, we learned that sometimes our organizations must be willing to get uncomfortable and have difficult conversations with the visiting public in order to communicate the immediate need for action with this climate space. With the Homegrown program, we learned that it's incredibly important to engage and involve the communities we're attempting to serve at every step in the process."

- *Andrew Lampl, Phipps Conservatory and Botanical Gardens, USA*

Key Resources

[NIACS Adaptation Workbook for Land Management and Conservation](#)

Step-by-step, customizable climate change planning framework

[The Climate Explorer](#)

Database with historical and projected future conditions for cities in the United States

[2030 Palette](#)

Database of sustainable design, principles, strategies, and tools for zero-carbon, adaptable, and resilient built environments

[Greenhouse Gas Protocol](#)

Comprehensive global standardized frameworks to measure and manage greenhouse gas (GHG) emissions from private and public sector operations, value chains, and mitigation actions

[Climate Positive Design Toolkit](#)

Tools and learning for landscape designers to build projects that mitigate emissions and support biodiversity.

[The Climate Assessment Tool](#)

Online tool to assess the likely suitability of taxa to predicted future climate scenarios

[The Climate Toolkit](#)

Collaborative network of museums, zoos, and public gardens to share best practices and resources aligned with Project Drawdown's Table of Solutions and the UN's Sustainable Development Goals

[Climate Change Alliance of Botanic Gardens](#)

Network of botanic gardens taking action to protect and enable adaptation of botanic landscapes in a changing climate

[Drawdown Solutions Library](#)

Toolkit of practices and technologies that can help emissions decline by mid-century

[BGCI Technical Reviews](#)

Technical reviews of various sustainability-related topics with insight from botanic gardens around the world

[Landscape Succession Toolkit](#)

Framework for botanic gardens and arboreta to guide adaptation in the climate crisis, and transition living landscapes and plant collections to ones that can thrive in future climates

[Living Building Challenge](#)

Philosophy, certification, and advocacy tool for designers of the built environment to make projects regenerative

[APGA Disaster Readiness Initiative](#)

Regional workshop and an online course with practical information for disaster planning

[Public Gardens Sustainability Index](#)

Collection of resources, tools, and garden profiles to inspire advancement of sustainability programs and operations

Questions or Feedback? Please contact garden.programs@ubc.ca.



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