NYBG

SCIENCE STRATEGY (2025–2030)

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SUMMARY

The New York Botanical Garden (NYBG) Science Strategy outlines a bold and forward-thinking vision for advancing botanical research, conservation, and innovation through world-class science and cross-disciplinary collaboration. Built on a legacy of scientific excellence, this strategy aligns with global biodiversity frameworks and NYBG's Institutional Strategic Plan (2025–2030), ensuring its leadership in addressing pressing environmental and societal challenges.

A key feature of this strategy is the introduction of three Cross-Cutting Initiatives that position NYBG as a pioneer in integrative research. These initiatives—*Plants for Climate Resilience*, *Food Plants: A Global Conservation Priority*, and *Artificial Intelligence: Unlocking the Power of Plants and Fungi*—transcend traditional research boundaries and engage multiple disciplines to maximize impact. By embracing nature-based solutions, food security, and AI-driven research, NYBG is leading transformative efforts that contribute to conservation, sustainability, and scientific discovery on a global scale.

The *Plants for Climate Resilience* initiative leverages botanical expertise to develop solutions for climate adaptation, urban conservation, and ecological restoration. NYBG's leadership in the Global Conservation Consortium for Food Plants (GCCFP) reinforces its role in securing the future of critical food plants through global partnerships and scientific research. Additionally, the integration of Artificial Intelligence (AI) in plant science is accelerating species identification, biodiversity monitoring, and ecological forecasting, revolutionizing how we study and protect the natural world.

At the core of NYBG's scientific mission are three interconnected pillars: Exploring Biodiversity, Conserving Nature and Knowledge, and Engaging Audiences. NYBG scientists conduct extensive fieldwork and cutting-edge research, from molecular analyses to ecosystem studies, to document plant and fungal diversity, reconstruct evolutionary histories, and develop innovative scientific tools. Through science-based conservation and land management, we work to protect endangered species, restore ecosystems, and preserve traditional ecological knowledge, ensuring a sustainable future. Additionally, by fostering partnerships, engaging local and global communities, and promoting scientific literacy, NYBG empowers individuals and institutions to become advocates for biodiversity and environmental sustainability.

By bridging scientific disciplines, fostering international collaborations, and applying cutting-edge technologies, NYBG's Science Strategy strengthens its role as a global leader in botanical research and conservation. These initiatives guide NYBG's research agenda through 2030, ensuring scientific excellence, environmental stewardship, and meaningful contributions to biodiversity knowledge and sustainability.

What is "botanical diversity"?

While the 'botanical' term brings to mind plants, historically the botanical sciences have included several different groups:

Plants: Multicellular organisms that perform photosynthesis, utilizing sunlight to convert carbon dioxide and water into organic compounds. Plants play crucial roles in ecosystems as primary producers, providing the basis of the planet's food webs.

Fungi: A diverse group of organisms belonging to their own kingdom, fungi are characterized by their ability to absorb nutrients from organic matter in their environment, and often take forms such as mushrooms, molds, or yeasts.

Algae: Several groups of photosynthetic organisms that range from single-celled microalgae to large multicellular seaweeds, found in various aquatic environments. Algae play vital roles in aquatic ecosystems and global carbon cycling.

Lichens: Symbiotic associations between fungi and algae or cyanobacteria that form unique composite organisms with diverse ecological roles in a wide range of habitats, from rocky surfaces to tree bark.

INSTITUTIONAL CONTEXT

The New York Botanical Garden (NYBG) has been a connective hub among people, plants, and the planet since 1891. We are rooted in the cultural fabric of New York City, in the heart of the Bronx—the greenest borough. For more than 130 years, we've invited tens of millions of visitors to make the Garden a part of their lives, exploring the joy, beauty, and respite of nature. NYBG's 250 acres are home to renowned exhibitions, immersive botanical experiences, rich living collections, art, and events with some of the most influential figures in plant and fungal science, horticulture, and the humanities. We are also stewards of globally significant research collections, from the LuEsther T. Mertz Library to the specimens in the William and Lynda Steere Herbarium, the largest such collection in the Western Hemisphere.

NYBG's rich history of scientific exploration and discovery dates to the founding of the institution in 1891. Spearheaded by Nathaniel Lord Britton, the Garden's founding director, NYBG quickly became a hub for botanical research, conservation, and education. Through subsequent decades, NYBG's scientists have made important contributions to our understanding of plant diversity, ecology, and evolution. Our expert scientists work across the city, the nation, and the globe to document the plants and fungi of our world and find actionable, nature-based solutions to our planet's dual climate and biodiversity crises. Rooted in the Garden's state-of-the-art resources and robust collections, NYBG Science includes the William and Lynda Steere Herbarium; the LuEsther T. Mertz Library; the Laboratory for Integrative Biodiversity Research; the Center for Biodiversity and Evolution; the Center for Plants, People and Culture; the Center for Conservation and Restoration Ecology; and the Commodore Matthew Perry Graduate Studies Program.

At NYBG, we're purposeful plant people—dedicated horticulturists, enthusiastic educators, and scientific innovators—committed to helping nature thrive so that humanity can thrive. We believe in our ability to make things better, teaching tens of thousands of children and families each year about the importance of safeguarding our environment and eating healthfully. We ensure a greener future for all by training the next generation of botanists, gardeners, landscape designers, and environmental stewards.

Botany and Plant Science:

Botany is the fundamental field of study focused on the classification, structure, physiology, ecology, evolution, and diversity of plants. It is a branch of biology with historical roots in taxonomy and morphology.

Plant science is a broader, more applied discipline that includes botany but also incorporates agriculture, horticulture, biotechnology, and plant pathology. While botany tends to be more foundational, plant science emphasizes practical applications, such as crop improvement, ecosystem management, and climate resilience. Both fields contribute to understanding and conserving plant life, but they differ in scope and focus. Historically, NYBG's greatest strength is botany, with recent expansion into important areas of plant science when these complement our traditional strengths.

NYBG SCIENCE

NYBG's Science Strategy for 2025–2030 is a visionary roadmap aligned with international biodiversity frameworks, aiming to advance botanical research and conservation. Anchored in NYBG's mission to advocate for the plant world, the strategy focuses on three endeavors:

Explore Biodiversity

We conduct extensive field-work locally, regionally, and worldwide, carry out scientific research from molecules to eco-systems, and synthesize results to uncover new knowledge about botanical diversity. This includes understanding evolu-tionary histories and ecological roles and documenting contri-butions to global processes and human society. We also develop novel resources and tools to advance scientific research.

Conserve Nature and Knowledge

We implement science-based sustainable land management practices to protect endangered species and ecosystems, inform efforts to halt and reverse biodiversity loss, and preserve traditional ecological knowledge. By restoring degraded ecosystems and fostering stewardship, we help safeguard biodiversity, promote resilience, and ensure the long-term sustainability of natural resources. Our extensive collections preserve primary knowledge in the form of physical specimens and library materials, and their digitized counterparts.

Engage Audiences

We foster strong partnerships with local communities, academic institutions, conservation organizations, and global alliances to amplify the impact of our botanical research and conservation efforts. Through educational programs, public engagement, and inspiring initiatives, we aim to cultivate a shared passion for plants and nature, promote scientific literacy, transform our lifestyle to protect our environment, and empower individuals to become advocates for biodiversity conservation.

To accomplish our objectives, we will continue to collect and share scientific evidence, further activate our collections, broaden our training offerings, amplify the integration of biodiversity science in discussions across disciplines, and optimize beneficial outcomes through our collaborations with communities, governments, corporations, land stewards, and other professionals.

We aim to leverage and further cultivate our primary strengths—our collections and expertise—to pursue three Cross-Cutting Initiatives that draw from and integrate across our six core Scientific Themes: Biological Diversity and Evolution; Integrative Biodiversity Research; Plants, People and Culture; Conservation and Restoration Ecology; Science and Humanities Collections; and Training Future Botanists. Our vision is ambitious, and achieving it will depend on leveraging our existing experience and resources alongside renewed investment in our scientific endeavors.

To support all Cross-Cutting Initiatives and Scientific Themes, we will enhance both our living and preserved collections, expanding the breadth of resources and data available to advance our work. NYBG's collections are vital for facilitating research, and our collection efforts will be informed by an assessment of geographic and taxonomic gaps, ensuring their alignment with our Themes.

115+

New publications every year

70+

Research projects

60+

Countries where we are carrying out fieldwork with local partners

We will expand collaboration between our horticultural and scientific programs to serve both scientific research and conservation and restoration. Our collections, both physical and digital, will be curated to the highest standards to uphold the scientific integrity of our biodiversity data. Additionally, we will improve and expand our infrastructure to provide cutting-edge physical and digital assets that are essential for supporting our endeavors.

Human capital is a cornerstone of our efforts. Leveraging activities and expertise across the six Scientific Themes, we will elevate our commitment to nurturing the next generation of botanists through training initiatives. Fostering a culture of scientific excellence is central to our mission, achieved through competitive recruitment practices, rigorous performance evaluations of scientific personnel, ongoing skill development opportunities for staff and students, and adherence to ethical best practices in our research and collaborations. We will actively address barriers to recruitment and advancement, ensuring a diverse and inclusive workforce. This collective effort will bolster our capacity to devise and implement sustainable nature-based solutions to contemporary challenges.

NYBG Mission

The New York Botanical Garden is an advocate for the plant world. The Garden pursues its mission through its role as a museum of living plant collections arranged in gardens and landscapes across its National Historic Landmark site; through its comprehensive education programs in horticulture and plant science; and through the wide-ranging research programs of NYBG Science.

NYBG Science Goal

The goal of NYBG Science is to lead world-class research in plant and fungal sciences, integrating traditional and emerging technologies to enhance our understanding of biodiversity for the benefit of people and nature.

CROSS-CUTTING INITIATIVES: PIONEERING INNOVATION IN BOTANICAL SCIENCE

The New York Botanical Garden (NYBG) is expanding the frontiers of botanical science with three groundbreaking Cross-Cutting Initiatives that position us as a global leader in conservation, sustainability, and technological innovation:

1.
Plants for Climate Resilience

2.
Food Plants: A Global Conservation Priority

3.
Artificial Intelligence: Unlocking the Power of Plants and Fungi

These initiatives address some of the most pressing environmental and societal challenges of our time. Unlike traditional research themes that are primarily within the purview of a single department, these initiatives transcend disciplinary boundaries, integrating expertise from across NYBG Science's research, training, and outreach efforts, and integrating across our core Scientific Themes. The interdisciplinary nature of these initiatives ensures that they not only contribute to cutting-edge research but also have real-world impact.

NYBG's commitment to *Plants for Climate Resilience* reflects a bold approach to tackling climate change through nature-based solutions, restoration ecology, and sustainable land management. By leveraging plant science to enhance ecological resilience, this initiative supports urban conservation efforts, habitat restoration, and community-driven sustainability programs. Similarly, *Food Plants: A Global Conservation Priority* takes a pioneering step toward safeguarding global food security by leading the Global Conservation Consortium for Food Plants (GCCFP), reinforcing NYBG's role as a central hub for the conservation, documentation, and sustainable use of critical food plant species.

In parallel, NYBG is harnessing the power of artificial intelligence to revolutionize plant science and conservation. AI-driven approaches—ranging from computer vision for species identification to AI-enhanced biodiversity monitoring and remote sensing—are unlocking new possibilities in plant research, climate adaptation, and land-use planning. By adopting and developing AI tools, NYBG is accelerating the digitization of plant collections, enhancing species discovery, and enabling more precise ecological predictions.

These Cross-Cutting Initiatives exemplify NYBG's role as a pioneer in integrative, forward-thinking research. They reflect the institution's dedication to bridging disciplines, fostering global partnerships, and applying the latest scientific advancements to biodiversity conservation and sustainability. As NYBG moves forward with these transformative efforts, we reaffirm our commitment to leadership in shaping a greener, more resilient future for people and the planet.

1.
PLANTS FOR CLIMATE RESILIENCE

As climate change accelerates, ecosystems and human communities face increasing challenges, from extreme weather events to biodiversity loss. Plants play a central role in climate adaptation and mitigation, offering nature-based solutions that enhance resilience at multiple scales. NYBG is committed to advancing research and applications in urban conservation, restoration ecology, land use, and resource management to address climate challenges while promoting sustainable interactions between people and nature.

Nature-Based Solutions

Nature-based solutions (NbS) harness the power of plants and ecosystems to provide a means for climate adaptation and mitigation. These include habitat restoration, sustainable land management practices, and urban greening efforts that enhance carbon sequestration, reduce flood risks, and support native biodiversity. NYBG's research integrates botanical expertise with innovative land management approaches, ensuring that plant-based strategies remain at the forefront of climate resilience efforts.

Through projects like **Nurturing Nature: Plant-Based Solutions for Long-Term Climate Resilience**, NYBG collaborates with other botanical gardens, academic institutions, decision makers and grassroots organizations, to develop science-backed strategies that address climate change while benefiting both ecosystems and communities. This initiative aligns with international biodiversity frameworks, contributing to goals for carbon neutrality, ecosystem restoration, and community-driven conservation efforts.

Urban Conservation and Resilience

Urban areas, where the majority of the global population resides, are particularly vulnerable to climate-related challenges such as heatwaves, air pollution, and flooding. NYBG's work in urban conservation focuses on increasing green infrastructure, enhancing tree canopy cover, and promoting native plantings that improve air quality, reduce urban heat islands, and support pollinators and other wildlife. The Thain Family Forest, NYBG's old-growth forest, serves as a living laboratory for studying the ecological functions of urban forests and their role in climate resilience.

Collaborating with city agencies, community organizations, and global partners, NYBG is expanding efforts to integrate urban biodiversity conservation with climate adaptation policies. By leveraging tools such as remote sensing, GIS mapping, and ecological monitoring, NYBG provides data-driven insights to support sustainable urban planning and land management.

Restoration Ecology

Ecosystem degradation due to deforestation, land-use change, and invasive species threatens biodiversity and climate stability. NYBG scientists work to restore degraded landscapes, enhance ecosystem services, and develop best practices for habitat regeneration. Research efforts focus on native plant restoration and species interactions to improve restoration outcomes.

Additionally, NYBG's conservation research informs policies for sustainable land management, ensuring that restoration projects align with both ecological and social needs. By integrating traditional ecological knowledge (TEK) with modern restoration science, NYBG fosters community-led conservation that enhances ecosystem resilience while respecting cultural and historical land stewardship practices.

Land Use and Resource Management

Sustainable land use practices are essential for mitigating climate change impacts while maintaining biodiversity and ecosystem function. NYBG collaborates with agricultural, forestry, and conservation sectors to develop plant-based strategies for soil health, water retention, and sustainable harvesting. These efforts contribute to food security, climate-smart agriculture, and responsible resource management, ensuring that ecosystems remain productive and resilient in the face of environmental change.

NYBG's Vision for the Future

NYBG's integrated approach to Plants for Climate Resilience reinforces the Garden's commitment to research, education, and action. By harnessing plant science, engaging local and global communities, and supporting the development of evidence-based policies, NYBG serves as an incubator for developing, testing, and implementing innovative ideas, to ensure that nature-based solutions are not just theoretical but actively implemented to combat climate change and secure a sustainable future for all.

2.
FOOD PLANTS: A GLOBAL CONSERVATION PRIORITY

Food plants form the foundation of human nutrition, culture, and agricultural sustainability. Yet, many of these vital species face threats from habitat loss, climate change, and genetic erosion. As a leader in botanical science and conservation, NYBG is committed to safeguarding food plant diversity through research, education, and collaborative global initiatives.

This commitment is exemplified by NYBG's role as the host institution for the Secretariat of the Global Conservation Consortium for Food Plants (GCCFP)—a major international effort to enhance the documentation, conservation, and accessibility of food plant diversity worldwide.

Global Conservation Consortium for Food Plants (GCCFP)

The GCCFP is a strategic initiative under Botanic Gardens Conservation International (BGCI) that is designed to strengthen collaboration between botanical gardens, genetic resource repositories (gene banks), the agriculture sector, and research institutions. By promoting complementary conservation strategies, the consortium supports the preservation and sustainable use of food plants, their genetic resources, and their associated knowledge for future generations.

NYBG's selection as the host institution for the GCCFP Secretariat reflects our scientific leadership and long-standing commitment to food security and plant-based sustainability. The Garden's expertise in food plant research, ethnobotany, and conservation genetics—coupled with robust community programs such as Bronx Green-Up and the Edible Academy—makes it an ideal hub for advancing this global mission.

Goals and Impact

The GCCFP is dedicated to achieving six key objectives:

1. **Improving Documentation:** Enhancing global data on food plant diversity by integrating information from botanical gardens, genebanks, and research organizations.
2. **Strengthening Conservation:** Ensuring efficient and complementary conservation efforts across institutions, reducing redundancy and maximizing resource use.
3. **Increasing Access and Use:** Promoting the sharing and sustainable use of conserved food plant material to support agriculture, breeding, and research.
4. **Enhancing Knowledge:** Advancing scientific understanding of food plant taxonomy, systematics, and conservation needs.
5. **Building Capacity:** Providing training, technical support, and knowledge exchange among stakeholders worldwide.
6. **Influencing Policy:** Advocating for the recognition of botanical gardens and genebanks in global food security frameworks.

By leading these efforts, NYBG plays a pivotal role in global food security and climate resilience. The GCCFP aligns with international initiatives such as the UN Food and Agriculture Organization (FAO), the Global Biodiversity Framework, and the International Plant Treaty, ensuring that conservation actions support broader sustainability goals.

A Collaborative and Inclusive Approach

To maximize impact, the GCCFP operates through a multi-tiered governance structure, including:

- A **Global Steering Committee** comprising BGCI, the Crop Trust, key botanical gardens, and genebank representatives.
- A **Global Lead Institution**, with NYBG serving as the host for the first five-year term, overseeing coordination, communication, and resource mobilization.
- **Regional Sub-Groups** in Northern America, Europe, Asia/Pacific, Africa, and Latin America, ensuring that conservation efforts are regionally relevant and inclusive

NYBG's Vision for the Future

By hosting the GCCFP Secretariat, NYBG reinforces its position as a global leader in plant conservation, sustainability, and food security. The Garden will drive scientific research, foster international cooperation, and advocate for policies that protect the rich diversity of food plants. This initiative is a transformative step toward a more resilient, biodiverse, and food-secure future.

3.
ARTIFICIAL INTELLIGENCE: UNLOCKING THE POWER OF PLANTS AND FUNGI

Artificial intelligence is revolutionizing botanical research, offering unprecedented tools to explore, conserve, and utilize plant and fungal diversity. NYBG is actively integrating AI into its research infrastructure and scientific endeavors, enhancing and accelerating work on species identification, climate mitigation, biodiversity conservation, remote sensing, land-use planning, and collections-based discovery.

Accelerating Collections-Based Discovery

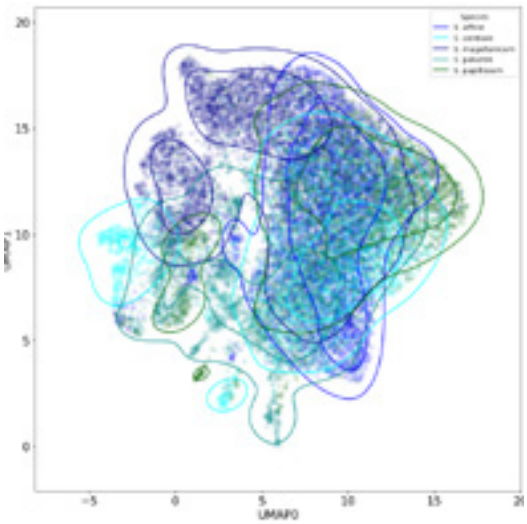
NYBG's Steere Herbarium is adopting machine learning tools to accelerate the transcription and databasing of specimen labels, addressing a significant bottleneck in digitizing collections. By implementing tools such as VoucherVision, we hope to double the rate of label transcription, unlocking data from thousands of specimens to support global research and conservation efforts. We are also exploring AI applications for measuring and analyzing plant traits, such as leaf morphology and flowering time, from herbarium specimens, to enhance understanding of plant ecology and evolution. These advances contribute to more efficient data processing and open new avenues for research and discovery.

AI in Climate Mitigation and Biodiversity Conservation

AI's capacity to analyze vast datasets is instrumental in addressing climate change and biodiversity loss. At NYBG, AI models predict how plant and fungal species respond to environmental change, informing conservation strategies and habitat restoration efforts. By identifying species resilient to climate fluctuations, AI aids in selecting candidates for reforestation and ecosystem rehabilitation projects, enhancing carbon sequestration and ecosystem stability. Image analysis algorithms developed to identify disease symptoms can assist in detecting and monitoring plant diseases, enabling early intervention that will reduce crop losses and support sustainable agriculture and food security.

Remote Sensing and Land-Use Planning

Integrating AI with remote sensing technologies, such as satellite imagery and drones, allows NYBG to monitor large-scale ecological patterns and land-use changes. AI algorithms process these data to detect deforestation, urban expansion, and habitat fragmentation, providing critical insights for conservation planning and policy development. This approach enables proactive measures to protect vital ecosystems and maintain biodiversity.



Advancements in Species Identification

Accurate species identification is fundamental to botanical science. NYBG is leveraging AI-powered computer vision to automate and refine this process. By training machine learning algorithms on extensive datasets of plant images, AI can swiftly and accurately identify species from photographs, facilitating rapid assessments of biodiversity and aiding in the discovery of new species.

NYBG's Vision for the Future

Embracing AI aligns with NYBG's mission to advance botanical science and environmental stewardship. By integrating AI into research and conservation practices, NYBG enhances its capacity to address global challenges, from climate change to food security. These technologies not only accelerate scientific discovery but also democratize data access, engaging a broader community in the collective effort to understand and protect plant and fungal diversity.

Above:
A specimen of *Sphagnum magellanicum*, a moss, from the Steere Herbarium, and the results of a clustering analysis using thousands of specimen images that shows the ability of AI tools developed by NYBG scientists to identify and group *Sphagnum* specimens by species.

Below:
A specimen of *Darlingtonia californica*, a carnivorous plant, from the Steere Herbarium, for which NYBG staff have used AI tools to identify and transcribe the various text components on the specimen.

THEME 1: BIOLOGICAL DIVERSITY & EVOLUTION

INTRODUCTION

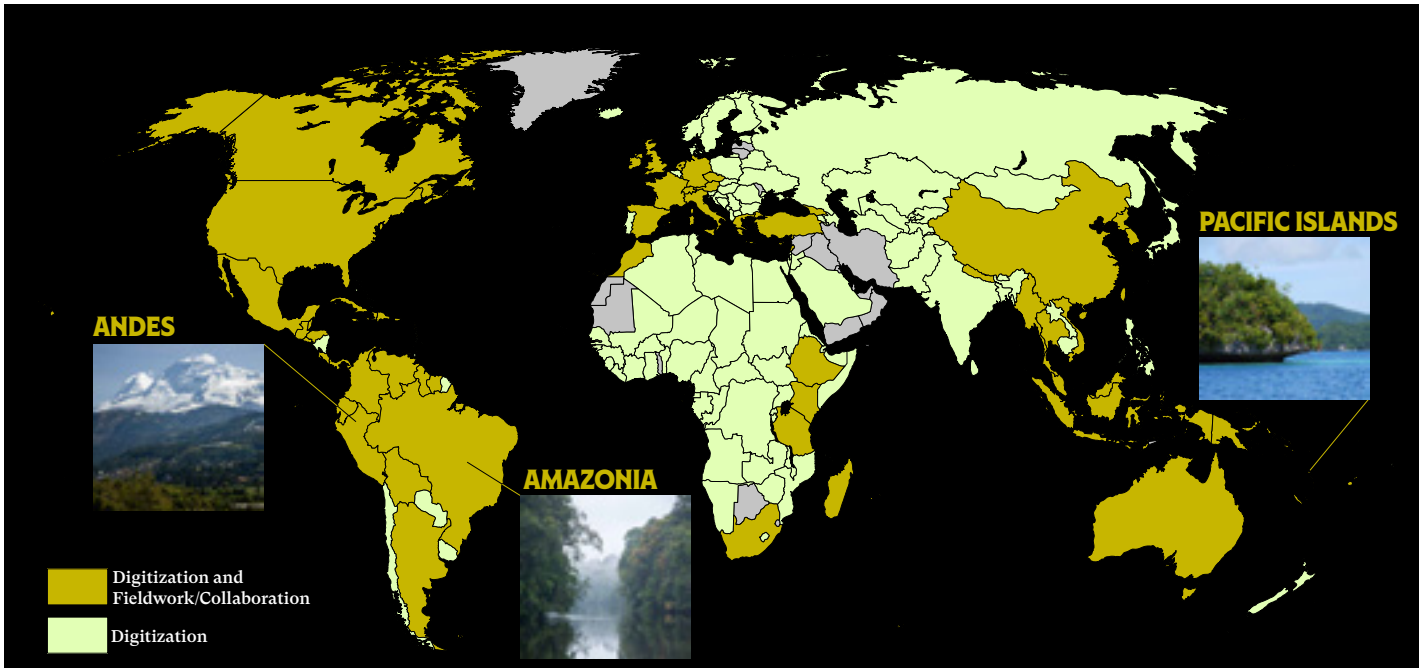
NYBG scientists use field and specimen-based research to discover, document, and illuminate the evolution of plant and fungal diversity. By leveraging our exceptional resources —including the Steere Herbarium, Mertz Library, and NYBG Living Collections—we are uniquely placed to generate, synthesize, and mobilize biodiversity knowledge. Our research generates the foundational data necessary to guide and support conservation management decisions, nature-based solutions, food security initiatives, and restoration ecology. Additionally, it informs our Cross-Cutting Initiatives: *Food Plants: A Global Conservation Priority* and *Plants for Climate Resilience*. We are focused on maintaining continual impact in our areas of current and emerging geographic strength, while also strategically expanding into new areas where we can have the greatest local and global impact. We combine traditional and innovative tools to maximize the understanding and preservation of biodiversity. Our work is anchored in local and global collaborations and capacity building, education, and outreach. In our ongoing commitment to advancing biodiversity research, conservation, and education, we strive to be at the forefront of innovation and collaboration, ensuring a sustainable future for our planet and its diverse ecosystems.

39

Species are described on average by NYBG scientists every year

985

Species were described by NYBG scientists between 2000 and 2025, equivalent to the flora of a small country



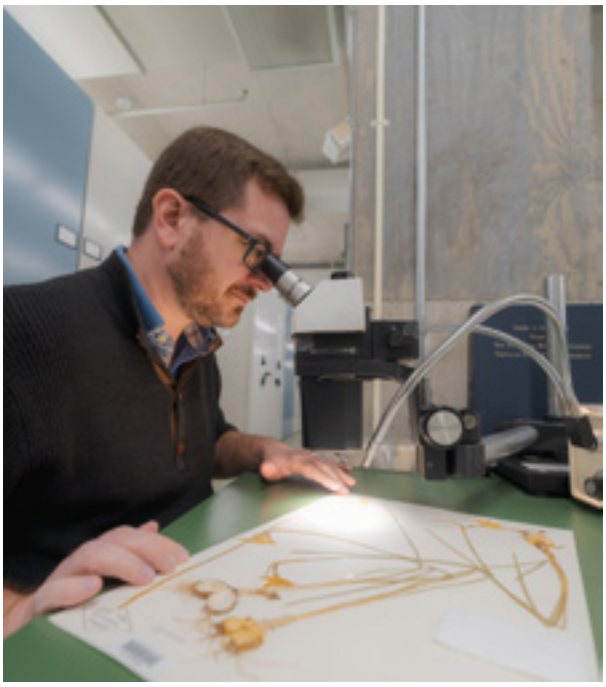
Geographic focus

NYBG s scientific work spans the globe. Our scientists work on nearly every continent, in diverse ecosystems including the Amazon, the Andes, South Pacific Islands, and close to home in New York City. During 30 years of digitization activity in the Steere Herbarium, we have digitized specimens from almost every country on Earth. Through fieldwork and research, we document biodiversity, uncover evolutionary histories, and develop conservation strategies. Our efforts support ecosystem resilience by preserving endangered species, restoring degraded habitats, and safeguarding traditional ecological knowledge. Collaborating with local communities, academic institutions, and conservation organizations, we translate science into action. By integrating botanical research with education and public engagement, we inspire stewardship and inform policies that protect biodiversity on both local and global scales.

AREAS OF FOCUS

1.1. Document and Describe the World's Plants and Fungi

In the field, herbarium, and laboratory, we explore some of Earth's most diverse and threatened ecosystems and describe species that are not yet known to science. Among other research products, we synthesize and share our knowledge of these organisms by taxonomic group and evolutionary history (e.g., monographs, phylogenomic analyses), by geography (e.g., floras), and by characteristics (e.g., studies of functional traits), focusing especially on those groups that are imperiled and understudied. We continue our emphasis on geographical areas in the Americas, particularly North America, the Amazon, the Andes, and the Caribbean, as well as programs in Southeast Asia and the Pacific Islands. Our expansion into new geographic areas is directed by identifying critically understudied regions where we can have the greatest impact.



Goal 1.1.1: Advance species documentation in understudied regions

Partnering with local stakeholders, we will produce authoritative accounts of plant and fungal biodiversity to document floras from understudied areas, providing the fundamental data needed to achieve impactful conservation priorities and protect human livelihoods, at scales ranging from local to global.

Goal 1.1.2: Synthesize botanical knowledge

In a world of rapid extinction, species are being lost before they are fully understood. To better comprehend the complexities of the world's plant and fungal diversity, we will continue our contemporary monographic work, building upon the historical data residing in our Library and Herbarium to reinterpret past studies, synthesizing these data using new tools, technologies, and approaches, and integrating them with the ongoing description of species that results from our field explorations.

Goal 1.1.3: Understand the evolution of key functional traits

Coping with Earth's rapidly changing climate will require a much better understanding of biologically and economically important plant functional traits—those features or characteristics that determine how a plant responds to its environment—and how these represent adaptations for handling stress and change. Through our studies in phylogenomics, which aim to estimate organismal relationships and evolutionary histories, we will continue to provide the fundamental comparative framework needed to understand the origin and evolution of species and their traits.

1.2. Decipher the Complex History of Plant and Fungal Evolution

Using material from our historical specimens and new field collections, we sequence genes and genomes to reconstruct the evolutionary history of life, allowing us to explore the origins of biodiversity, relationships among species, and evolutionary change over time. We interpret these relationships to understand how nature has solved problems in the past, which can be used to design effective solutions for the future. Studying evolution across temporal and spatial scales allows us to understand changes in species distributions and interpret the evolutionary processes driving genetic and geographic shifts in both threatened and invasive species. This critical work enables us to identify conservation priorities and develop solutions for resilience in a changing world.

Goal 1.2.1: Reconstruct evolutionary history using cutting-edge phylogenetic methods

We will continue to expand our knowledge of the evolutionary history of life, focusing on understudied groups and species-rich taxonomic lineages, especially those that comprise key components of complex ecosystems, have played outsized roles in the origin of the Earth's biodiversity, and that elucidate processes responsible for the generation of evolutionary innovations.

Goal 1.2.2: Understand biogeographic evolution and species distributions through time and space

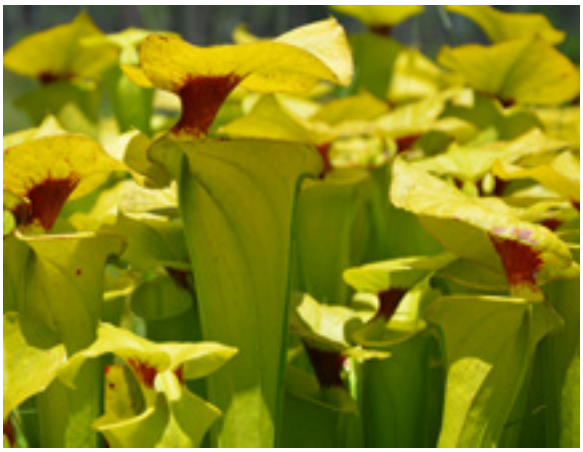
We will integrate time-calibrated phylogenies with geographic, climatic, and species distributional data from historic and contemporary herbarium collections to reconstruct the history of plants and fungi. This improved understanding of past distribution patterns can be used to predict current and future challenges associated with land use and ecosystem services that are being impacted by climate change. By compiling and integrating distributional data across multiple species, we can predict and document distributional shifts for entire floristic communities.

Goal 1.2.3: Assess population genetic and demographic processes

Exploring the raw material of genetic variation, which is the basis for evolution by natural selection, will enable us to identify local adaptations to diverse habitats and climates, track past speciation and migration events, and forecast the adaptability of particular species to environmental change. These results will further inform conservation strategies to help save threatened species and control invasives.

1.3. Develop and Disseminate New Tools and Resources for Biodiversity Discovery

At landscape scales, we are developing the next generation of tools to document biodiversity and monitor ecosystems, using new approaches such as remote sensing, artificial intelligence, and environmental DNA (eDNA). At the species level, we take the same approach, using the latest advances in biodiversity informatics and combining data from herbarium specimens, living collections, and genes and genomes to accelerate species identification and create accessible, born-digital monographic and floristic syntheses. Accessibility is a key component of resource development, to ensure we are supporting the communities where our research is most impactful.



Goal 1.3.1: Develop resources and tools for discovering and describing biodiversity

We cannot conserve what we do not know, yet we live in a time of massive extinction accompanied by a steady decline of highly trained experts holding specialist knowledge. To fill the gaps in our knowledge of biodiversity, we will create tools that facilitate and accelerate species discovery, description, and identification, thus providing the foundational information needed to make informed conservation management decisions and stem the tide of species loss. Novel tools will speed identification of the hundreds of millions of specimens in the world's herbaria, while others will increase automation of species description, including their morphologies and distributions, to more efficiently create born-digital taxonomic outputs such as identification aids, field guides, monographs, and technical floristic manuals.

Goal 1.3.2: Create tools to efficiently use molecular data

The DNA sequencing revolution has outpaced our ability to process and interpret molecular data, creating rich repositories of data available for mining and analysis. We will create tools that facilitate the analysis of large datasets to accelerate the study of biodiversity, identify gene functions, understand changes in functional traits due to evolutionary selection, and develop improved diagnostic assays for rapid species identification (i.e., DNA barcoding).

Goal 1.3.3: Invent tools for rapid assessment and monitoring of biodiversity

In an era of dwindling resources and massive environmental change, the challenges of documenting the planet's shifting ecosystems require novel tools to assess and manage biodiversity before it is lost. We will develop the tools needed for rapid and automated assessment and monitoring of biodiversity, habitat health, and ecosystem services, by taking advantage of technological advances in artificial intelligence and machine learning. Examples of these tools include remote sensing and sampling of environmental DNA (i.e., eDNA).

CASE STUDY: 30 YEARS OF FLORISTICS AND CONSERVATION IN THE AMAZON

The Amazon River is one of Earth's longest rivers, flowing 4,000 miles across South America from the Andes Mountains to the Atlantic Ocean. The immense area drained by the Amazon River and its tributaries is known as the Amazon Basin, a vital natural reservoir of plant and animal diversity. Altogether, the Amazon Basin is home to at least 30,000 plant species.

For over a century, NYBG's scientists have contributed to the exploration and discovery of the Amazon flora, working with international partners on the ground to describe and document the rich flora of the region. As a result of our longstanding history and continuing activities in the Amazon, the Steere Herbarium holds one of the largest and most comprehensive collections of plant and fungal specimens from Amazonia, with more than 150,000 specimens from the Brazilian Amazon alone. For the past 30 years, NYBG scientists have focused their efforts in traditionally understudied areas, such as the Brazilian States of Acre and Rondonia and the Tapajos River basin. This work has resulted in the production of local and regional checklists for Amazonian states and protected areas such as the First Catalog of the Flora of Acre, the Vascular Plants of the Tapajos Basin, and the Projeto Flora Amazônica. These resources provide the baseline data for conservation initiatives and resource management.

Our collaborative endeavors in the Amazon also established the foundation for systematic studies in the region. These investigations, centered on ecologically important and diverse Amazonian plant groups such as the Burseraceae, Lecythidaceae, Melastomataceae, and members of the legume family (*Ormosia* and *Swartzia*), shed light on the evolutionary processes shaping the Amazonian flora.

As part of our work in Amazonia, NYBG scientists have prioritized training and supporting a broad range of stakeholders, from community representatives, local land managers, and field biologists to policymakers and academics. This has forged close partnerships with government agencies (e.g., the Brazilian Ministry of the Environment, Brazilian Forest Service), as well as academic partners (e.g., Jardim Botânico do Rio de Janeiro, Federal University of Acre), to provide guidance for best practices in forest management and conservation.

Through our century-long dedication to exploration and collaboration, NYBG has solidified its position as a global leader in Amazonian botanical research. As we continue to expand our work in the region, our depth of staff expertise, collections resources, and strong collaborative partnerships ensure that NYBG remains at the forefront of Amazonian botanical science for generations to come.

30,000+

Plant species known from the Amazon Basin alone

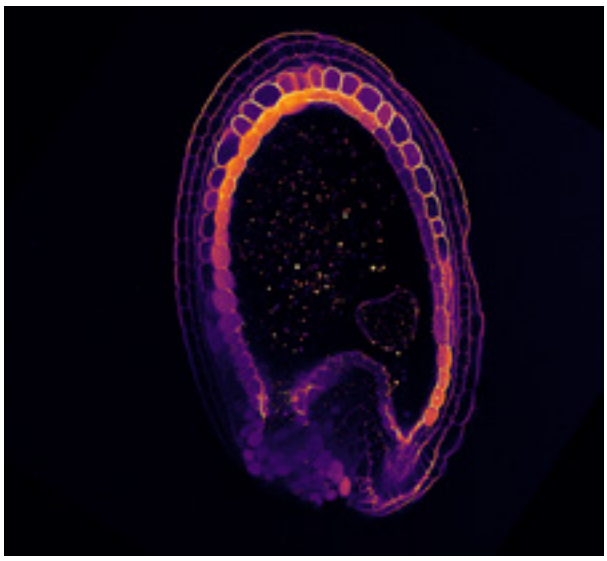
150,000+

Specimens from the Brazilian Amazon in the Steere Herbarium

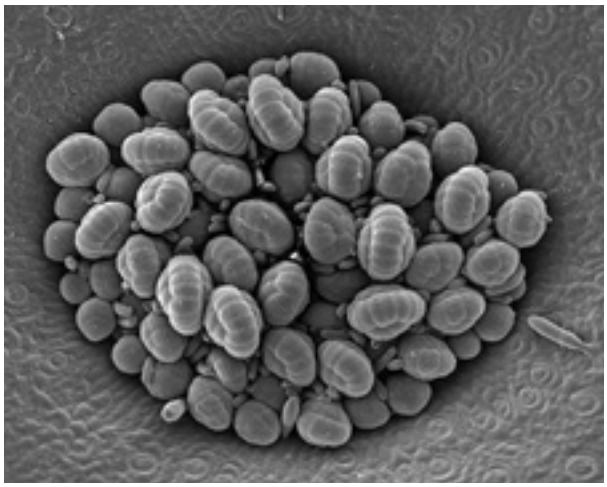
THEME 2: INTEGRATIVE BIODIVERSITY RESEARCH

INTRODUCTION

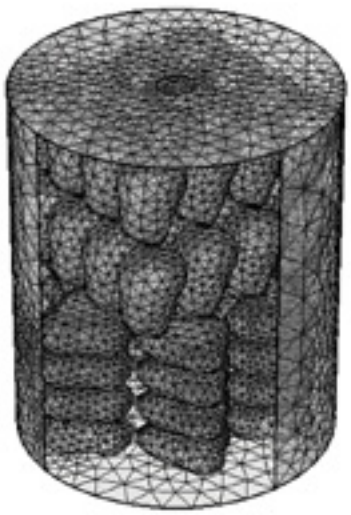
The Integrative Biodiversity Research program at the New York Botanical Garden (NYBG) is at the forefront of biodiversity exploration, across scales from molecules to ecosystems. Leveraging cutting-edge technologies, we accelerate the integrative understanding of biodiversity on a global scale. Through interdisciplinary approaches that combine structural botany, molecular biology, computational biology, and modeling, our research investigates structure-function relationships, biodiversity patterns, species interactions, and ecosystem dynamics.



By advancing foundational knowledge and developing new tools and methodologies, our goal is to lead integrative biodiversity research. Our scientists integrate taxonomic expertise with advancements in microscopy, molecular biology, genomics, and computational biology to generate holistic insights into the factors shaping biodiversity. By examining plant functional morphology across diverse environments and utilizing three-dimensional imaging and computer modeling, we uncover the mechanistic basis of plant and fungal diversity to develop foundational knowledge that can be applied towards innovative solutions to global challenges such as biodiversity loss and climate change. This work is essential to our Cross-Cutting Initiatives (i.e., *Plants for Climate Resilience*, *Food Plants: A Global Conservation Priority,* and *Artificial Intelligence: Unlocking the Power of Plants and Fungi*).



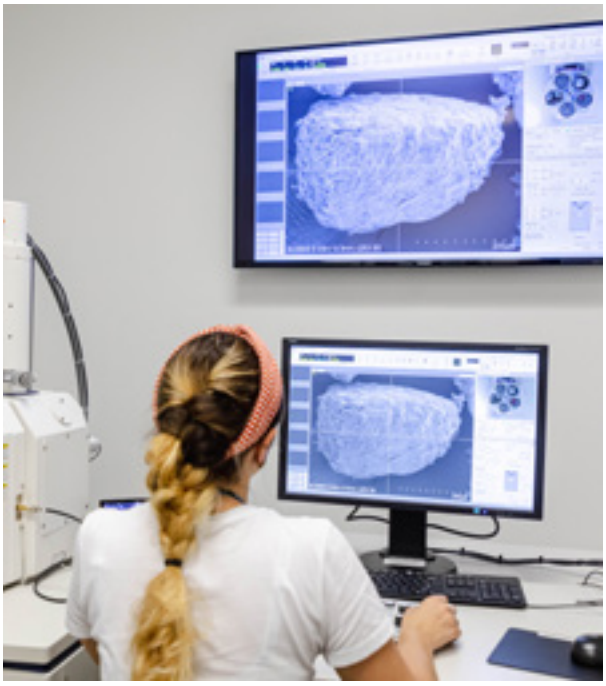
The Laboratory for Integrative Biodiversity Research is a center for research activities that fosters diverse collaborations and provides innovative training for the next generation of biodiversity scientists. Ultimately, our work contributes to a world where the value of biodiversity and our interconnectedness with it are comprehensively understood, empowering society to make informed conservation decisions.



AREAS OF FOCUS

2.1. Investigate Biodiversity Patterns and Processes Across Scales

We investigate the patterns and processes of biodiversity to achieve a comprehensive understanding of genomes and organisms, and their interactions within their environments. By exploring genome structure and evolution, our scientists aim to decipher the genetic makeup of organisms and uncover the evolutionary forces that have shaped their diversity. Studying organismal structure and function provides insights into the adaptations and traits that enable species to thrive in their niche. Furthermore, examining organisms in their environment, including their biotic and abiotic interactions, reveals the complex relationships that shape community dynamics and ecosystem functioning. This holistic approach to biodiversity research is essential for understanding the intricate web of life, predicting species responses to environmental change, and informing conservation strategies to protect and sustainably manage our planet's ecosystems.



Goal 2.1.1: Expand our understanding of biodiversity genomics

Biodiversity genomics will provide insight into the evolution and development of reproductive structures and plant architecture to understand patterns, organization, development, and evolution of plant and fungal life on Earth. Our genomic investigations include sequencing and annotating the genomes of diverse organisms from our field, living, and herbarium collections.

Goal 2.1.2: Analyze the connections between organismal structure and function

Our structure-function analyses focus on several critical plant organs: roots, leaves, seeds, and sporangia, all of which were key innovations during plant evolution and have substantial economic importance for humans. Investigations into leaves focus on leaf structure and its relationships with carbon assimilation, light capture, and energy balance, while research on seeds and sporangia centers on understanding structural development and evolution, as well as applications to agriculture and crop resilience.

Goal 2.1.3: Examine organismal adaptation to their environments across scales

Plants and fungi occupy diverse and sometimes extreme environments. We will examine plants in diverse habitats to uncover the biological basis of their adaptations. Synergistic analyses will be done across scales from molecules to ecosystems. Understanding how organisms survive and thrive in and with their environment is essential for designing effective plant based solutions.

2.2. Develop and Deploy New Techniques for Analysis and Visualization of Biodiversity Data

The advancement of biological research is heavily dependent on the development and deployment of innovative tools and technologies. Cutting-edge techniques such as DNA sequencing, computational biology, and advanced imaging allow scientists to delve deeper into the complexities of living organisms. These tools enable us to explore both genome structure and evolution, and organismal structure and function, with unprecedented levels of detail, providing insights into genetic diversity, the forces shaping adaptation, and the intricate mechanisms underlying cellular processes and physiological traits. By deploying technologies to monitor organisms in their natural environments, we are shedding light on ecological interactions, population dynamics, and ecosystem functioning. The integration of these new tools and technologies is essential for advancing our understanding of biodiversity and paving the way for breakthroughs in agriculture and environmental conservation.

Goal 2.2.1: Develop and employ new computational tools for biodiversity research

We will continue to lead the field in the development and employment of modern technological tools to better understand biodiversity. Bioinformatic tools we are actively developing include the GetOrganelle bioinformatic pipeline to assemble organelle genomes, and iCurate, a tool for automatic species identification from herbarium specimens that incorporates emerging AI technology.

Goal 2.2.2: Leverage imaging and modeling tools to visualize biodiversity

We employ the latest imaging technologies such as scanning electron microscopy, confocal microscopy and microCT to investigate plants and fungi at the cellular level, and we employ cutting-edge modeling techniques to better understand how those individual cells pattern larger structures.

Goal 2.2.3: Analyze plants in their environment

We will continue to deploy the latest technologies for analyzing plants within their environments, such as LI-COR environmental instruments for measuring gas exchange and photosynthesis, and MinION portable sequencers for gathering eDNA and other genetic data in the field. Sampling in the field, these handheld devices are minimally destructive and facilitate real-time rapid analysis and results.

2.3. Foster Laboratory-Based Collaborations and Capacity Building

The Laboratory for Integrative Biodiversity Research boasts an array of computational resources and modern molecular and imaging equipment, providing researchers with cutting-edge tools for advancing biological research. The Laboratory staff's vast expertise in molecular biology, genomics, and imaging techniques, combined with expertise in plant structure and diversity, enables our scientists to explore the intricate details of living organisms. The Laboratory's proximity to NYBG's extensive living and herbarium collections further enhances our research capabilities, allowing direct access to thousands of diverse biological specimens for study. Environmental growth chambers are necessary to investigate the genetic response to different biotic stimuli. This unique combination of modern equipment, expertise, and access to collections provides an exceptional platform to support collaborations and capacity building. Researchers from various disciplines leverage the Laboratory's resources to pursue interdisciplinary projects, share knowledge, and develop innovative approaches to complex biological questions, while the availability of training and educational programs enables the Laboratory to nurture future generations of scientists and support the development of a skilled workforce in the field of biodiversity research.

Goal 2.3.1: Leverage the Living Extended Laboratory

We will promote the Living Extended Laboratory by leveraging the proximity of our laboratory technologies to world-class living collections. The gardens and glasshouses at NYBG feature ca. 18,000 plant species, each an opportunity to maximize genomic, developmental, and ecophysiological insights from diverse, non-model organisms. Laboratory technology also supports long-term ecosystem monitoring of the old-growth Thain Family Forest.

Goal 2.3.2: Promote the Laboratory for Integrative Biodiversity Research to the global botanical community

The concentration of resources and opportunities in New York City attracts talent from around the world, and the unparalleled combination of facilities and resources at NYBG makes us a global destination for botanical research. The Laboratory will focus on fostering long-term collaborations with visiting scientists and students, by ensuring a dynamic space for research synergies across biological scales.

Goal 2.3.3: Cultivate capacity building through training and workshops

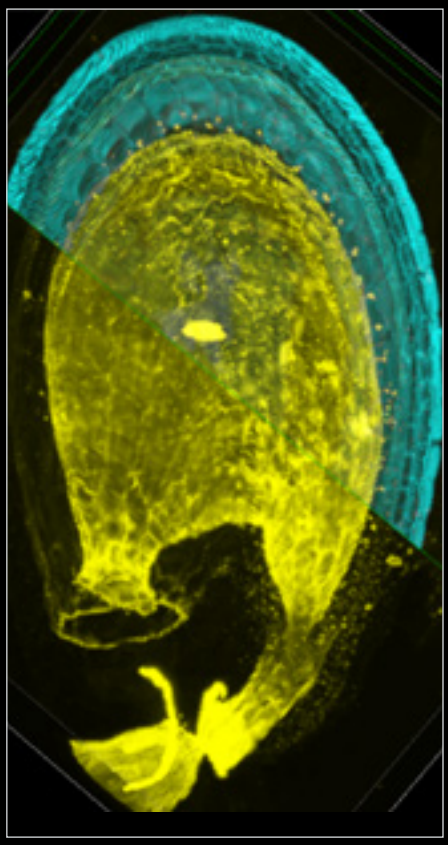
We will continue to make Laboratory tools and analyses accessible to a wide range of scientists, students, and staff. As leaders in integrative biodiversity research, we will not only develop new tools and analyses but also teach these skills and approaches to others through mentoring, workshops, and public outreach, to engage scientists with diverse skills and help train the next generation of biodiversity scientists.

CASE STUDY: UNRAVELING THE GENOMICS OF SEED EVOLUTION

Seeds are integral to the life cycle of many plants, serving as vehicles for reproduction, dispersal, and survival, and they are critical for human food security because they serve as the foundation of agriculture, providing direct nutritional benefits as well as the genetic diversity needed to sustainably produce diverse, resilient crops for current and future generations. Seeds are what's known as a "key innovation" that arose during plant evolution, yet the genetic basis of the seed remains largely unexplored, creating a significant gap in our understanding of plant biology. We are leveraging NYBG's vast living collections and scientific expertise, and partnering with leaders in both systems biology and computational biology, to investigate the origin and diversity of seeds.

Using a bioinformatic pipeline that we optimized for transcriptomic analysis of seeds enabled us to focus on that portion of the genome (the transcriptome) that is expressed, or active. Using this pipeline, we performed comparative transcriptomic analyses of seeds from seventeen species of seed plants and close relatives that do not have seeds. We identified the genes that support the origin of the seed in the seed plant lineage and identified novel genes involved in seed development. These results provide the foundation for understanding the molecular genetics of seed diversity and expanding applications in agricultural biotechnology.

We performed further detailed comparative transcriptomics on developing seeds in the gymnosperms *Ginkgo biloba*, *Ephedra californica,* and *Gnetum gnemon* and discovered that, surprisingly, the molecular genetic networks that build seeds are not entirely the same between gymnosperms and angiosperms. We also identified novel genes that could potentially be utilized in biotechnological improvements of seeds. Additional work has focused on sequencing the genomes of five gymnosperm species whose genome sizes range from nearly 3 gigabases (the size of the human genome) to more than 20 gigabases, during which we developed new analyses to better understand the structure and function of the genes comprising these genomes. These comparative genomic analyses are still providing insights into not only seed origin and diversity but also the genomic basis of plant resilience as related to reproduction and seeds.



96%

Of all vascular plants are seed plants —an estimated 400,000 species

30–40

Seed plant species are agronomically important for food production due to their edible seeds

THEME 3: PLANTS, PEOPLE AND CULTURE

INTRODUCTION

In a time of rapid global change, humankind's ability to ensure food and health security while maintaining resilient environments is a significant challenge. Populations around the world are growing more vulnerable, and the most vulnerable are often those with the fewest options. Local and Indigenous peoples manage up to 25% of natural areas on earth, and many of these communities have developed regionally-adapted and resilient strategies for sustainable coexistence with their environments. There is a growing awareness that learning from, including, and supporting these communities is essential for successful conservation and sustainability measures. As a leader in the study of plants and fungi, NYBG is ideally positioned to lead these efforts, which has inspired our Cross-Cutting Initiatives: *Food Plants: A Global Conservation Priority* and *Plants for Climate Resilience*. Through equitable botanical, ecological, sociological, and anthropological partnerships at all levels, we develop models to help maintain and increase the resilience of environments and the communities that live within them. We employ state-of-the-art scientific tools and techniques to address important global issues at the intersection of humans and plants, such as food security, climate adaptation, and conservation. The fusion of biological, cultural, and technological diversity underpins society's ability to cope with and even benefit from environmental, social, and economic challenges.

11,000

Specimens make up one of the finest collections of culturally significant plants from the Caribbean, New York City, South America, and Oceania, including some that date back to the late 1800s

26

Projects in 10 countries

10,567

Never-documented local language names for plants and natural history objects were collected and recorded in Vanuatu, with images and made widely available

AREAS OF FOCUS

3.1. Traditional Ecological Knowledge and Resource Management

Indigenous peoples and local communities steward an exceptionally large portion of the world's biodiversity. Traditional knowledge about plants and ecosystems plays a key role in sustainable interactions with the habitats that harbor this biodiversity and support peoples' sustainable livelihoods. This knowledge, and the communities' rights to apply it, are threatened in many parts of the world. In partnership with Indigenous, diasporic, urban, and rural communities, we document, support, and revitalize traditional botanical and ecological knowledge, and develop sustainable resource management for improved livelihoods and environmental health. We develop diverse collaborations, innovate new community-centered tools and resources, train the next generation of scientists and biocultural educators, contribute to local research infrastructure, and house and increase access to biocultural collections. Our collaborative projects involve local communities, NGOs, and government partners in Canada, Ethiopia, the Federated States of Micronesia, Mexico, Palau, the Republic of Georgia, the U.S.A., Vanuatu, and many other countries.

Goal 3.1.1: Work with local communities as partners in conservation of their own ecosystems

We will develop, test, and implement innovative conservation initiatives that are in line with the established and effective strategy known as community-based natural resource management. This includes identifying important areas for useful plant species and implementing ecocultural restoration, livelihood-based sustainable resource management, and cultural-keystone-species-informed approaches.

Goal 3.1.2: Build cutting-edge digital tools to support the preservation of traditional ecological knowledge

We will build on our previous experiences building tools that are both scientific and community-centered interactive resources. Examples include the Vanuatu Talking Dictionaries, the Plants and People of Vanuatu app, a Shinnecock ethnobotany database, a Wixárika plants and language database, and contributions to the Periodic Table of Food Initiative.

Goal 3.1.3: Innovate the use of technologies such as AI, GIS, and remote sensing to help document, preserve, and share traditional ecological knowledge

We will focus in particular on using data science to contribute to communities' efforts to identify remnant cultural ecosystems that were actively managed in the past, and to study, conserve, and revitalize these systems through forward-looking approaches.

3.2. Food Security and Resilience

Healthy and resilient food systems are essential to human survival, but are currently threatened by disruptions from intersecting climate and geopolitical challenges. Climate change is anticipated to reduce crop yields by an average of 17% by the year 2050 while, by the same year, it is anticipated that we will need to produce an additional 50% to feed the growing global population. Through hundreds or thousands of years of observation and experimentation, farmers and land stewards have developed locally-adapted, resilient, and sustainable approaches to producing food. Like other forms of traditional knowledge, these practices are threatened by market forces, policy, and other factors. We support and promote food security, food sovereignty, nutrition, soil health, climate adaptation and resilience through studies of agrobiodiversity and agroecology and in partnership with local communities, the public and private sectors, as well as international organizations that seek to address these critical issues faced by much of the world's population.

Goal 3.2.1: Document, revitalize, and promote traditional climate-smart, regenerative, and locally adapted food practices

We will work with local land stewards and farmers to develop the knowledge capacity necessary to counteract the vulnerabilities of globalized industrial food systems. Through agroecological, laboratory, and ethnographic expertise and resources, we aim to ensure that local farmers and communities are able to continue the practices they have developed over generations.

Goal 3.2.2: Support diversity and resilience, including in agricultural systems

We will help preserve the extraordinary diversity of crops and crop varieties that humans have created, as well as wild crop relatives essential to ensuring food security in the face of new threats such as outbreaks of pests and pathogens, and unstable weather patterns.

Goal 3.2.3: Support the traditional practices that balance human needs and biodiversity

For over 10,000 years, humans have shaped nearly every environment on the planet. Some traditional stewardship practices support biodiversity rather than diminish it. We will work to identify and preserve the traditional practices that balance human needs and biodiversity, and evaluate their potential for application elsewhere.

3.3. Human Health

Approximately 25% of all prescription medicines are based on molecules found in plants and fungi. In addition, nearly 80% of the world's population use traditional medicines primarily derived from plants and fungi for some aspects of their primary health care. In the United States, it is estimated that between 30–40% of the adult population uses some form of herbal remedy each year. Plants are widely available in many places, inexpensive, culturally relevant, and efficacious for many therapeutic conditions. There is a growing demand for information on the use of plant therapies for which there is scientific evidence of efficacy, and we can help to provide this. We will investigate the contributions of plants and fungi to human health, not only in rural parts of the world but also in urban areas, where diasporic communities often embrace their use. In addition, we will investigate the application of evidence-based botanical medicines to contemporary clinical care, through the field of integrative medicine, combining approaches from traditional medicine and biomedicine.

Goal 3.3.1: Support and revitalize traditional medicine for improved primary healthcare delivery, particularly in underserved areas

We will continue to work with communities to develop livelihoods based on medicinal plants while ensuring their sustainable management and conservation.

Goal 3.3.2. Participate in teaching and training of integrative health care practitioners

We will provide information about evidence-based clinical applications of herbal remedies through formal classes, seminars, and tours. Integrative medicine combines therapies from conventional biomedicine and complementary treatments, including herbal remedies, as a patient-focused approach to health care.

Goal 3.3.3. Investigate the therapeutic potential of plant compounds

We will collaborate with research groups investigating the pharmacology of molecules derived from plants and fungi. Our role will be to collect, identify, and document sources of these compounds using robust botanical practices.

CASE STUDY: CROP MIXTURES AND FOOD SECURITY

Globally, we face unprecedented and interconnected challenges related to nutritional insecurity, climate change, and agrobiodiversity loss. Staple crops such as wheat, barley, and other small grains face substantial yield losses under all projected future climate change scenarios. This is in part due to modern agriculture relying almost exclusively on monocropping.

Traditionally, many grain crops in Africa, Europe, and Asia looked like wild grasslands, with mixtures of different species of wheat, barley, rye, and other crops, rather than a monocrop field. This historical practice of growing mixed grains, or "maslins," persists in many areas because of its inherent resiliency. This traditional farming technique may represent a risk-management strategy for coping with climate variability in the future.

Through funding from the Rockefeller Foundation and Atkinson Center for Sustainability, we are working to investigate and revitalize mixed farming practices in Ethiopia, Morocco, Georgia, the UK, the U.S. and Lebanon, countries that are already experiencing the impacts of climate change through altered drought cycles and range expansion of pests.

In partnership with local farmers, universities, agricultural research institutes, and public health institutes, we are carrying out agricultural experiments, interviews with farmers, and nutritional analyses. This approach generates data and documents knowledge about these traditional strategies, which are quickly being lost in many areas. Preliminary data indicates that many farmers plant crops with complementary profiles: for example, one crop that is resistant to drought will be paired with another resistant to waterlogging. These strategies ensure that a harvest can be reaped under a wider range of environmental conditions. Some mixtures, such as wheat and barley, appear to increase yield even in a bad year. We plan to explore ways to continue scaling this work to additional regions, mechanized contexts, and different crops.

THEME 4: CONSERVATION AND RESTORATION ECOLOGY

INTRODUCTION

In the 21st century, plants and people are living in a world transformed by ongoing urbanization, climate change, and biodiversity loss. Conservation and restoration ecology provide essential tools to address the outcomes of these interrelated challenges and can help to slow biodiversity loss, mitigate climate change impacts, and promote environmental justice for sustainable ecosystems and human health. Through our activities in conservation and restoration research, NYBG scientists work to transform how human beings relate to ecosystems by improving our understanding of how plants and fungi interact with the rest of nature, including humans, and how we can make the world better for biodiversity—and consequently ourselves. This is a guiding principle of our Cross-Cutting Initiative focused on *Plants for Climate Resilience*.

We work across scales and disciplines, using our skills and capacity in landscape ecology, forest ecology, global change ecology, invasion ecology, and restoration ecology to promote environmental action, stem biodiversity loss, mitigate and adapt to climate change, and redress environmental justice issues. We work to understand planetary-scale changes, including through on-the-ground efforts in biodiverse regions, particularly in South America, Southeast Asia, and the Pacific, and in cities around the world. We also work regionally and locally, including the northeastern U.S., the New York City metropolitan area, and our own beautiful and ecosystem-diverse NYBG grounds to understand urban nature and issues specific to ecology, conservation, and management in urban environments. We work with colleagues across NYBG to put into practice what we have learned and share it with others.

82

Publications in ecology and conservation in the last 5 years

35,586

Herbarium specimens collected in New York City

10,091

Ecosystem relationships mapped as part of the Welikia Project into the pre-colonial historical ecology of New York City

AREAS OF FOCUS

4.1. Conservation

The world's ecosystems have been seriously transformed by habitat destruction, climate change, biodiversity loss, and the spread of invasive species. Through conservation ecology research, our goal is to help plants and fungi living in the world today. We seek to understand which species and habitat types are threatened by human activity, why those threats are occurring, and how threats can be reduced or eliminated, so ecosystems can continue to support and provide key services, such as carbon sequestration, freshwater storage, and a multitude of biotic interactions essential for human and planetary wellbeing. Our efforts are guided by international conservation frameworks, such as the Convention on Biological Diversity and the Global Strategy for Plant Conservation, and we are cognizant of the reality that all lands and waters must be sustainably managed for the benefit of local communities and the long-term maintenance and evolution of biological diversity.

Goal 4.1.1: Guide sustainable ecosystem management

We will conduct research on how to sustainably manage lands, using a bottom-up, community-directed approach and creatively integrating new technologies, from remote sensing to artificial intelligence, to achieve long-term, economically viable conservation outcomes that preserve critical ecosystem services.

Goal 4.1.2: Identify, assess, and conserve threatened species and habitats

We will leverage our taxonomic and data science expertise to efficiently assess rare and endangered species and determine what threatens them and their habitats. We will design and implement conservation action plans for the threatened species and ecosystems, deploying in-situ and ex-situ approaches, tailored to the local context.

Goal 4.1.3: Inform invasive species management and prevent new invasions

We will investigate how plant invasions occur, including identifying factors that promote invasiveness and that make ecosystems more susceptible to invasion. We will work with horticulturalists and land managers to develop strategies to prevent new invasions and improve ecosystems' capacity to resist and recover from invasion.

4.2. Restoration

While conservation research and practices can help us protect species, habitats, and ecosystems, conservation alone is not enough. More than 75% of Earth's land surface has been significantly modified by human activities such as agriculture, urbanization, and infrastructure development. The loss of habitat brings with it a significant loss of ecosystem services and a reduction of natural resilience. NYBG scientists will use our botanical, biocultural, and ecological expertise to design innovative solutions for restoring degraded spaces and managing landscapes to be adaptive. Through restoration ecology research we will build the scientific understanding and practical expertise needed to restore ecosystems and all the essential functions and services that they provide humans and other species.

Goal 4.2.1: Guide science-based systematic restoration

By synthesizing historical ecology with collections data, we will develop informed profiles of potential restoration targets. We will use remote sensing technology, computer modeling, taxonomic expertise, and community science to monitor changes and innovate solutions. To scale these insights into impactful action, we will share best practices for restoration, from urban forests to the Amazon Basin and beyond.

Goal 4.2.2: Enhance nature-based solutions

Nature-based solutions (NbS) are actions that address societal and socio-environmental challenges by incorporating processes derived from or inspired by nature. We will contribute to NbS development by investigating how species interact to provide services in managed environments, evaluating the benefits and risks of implementing NbS, and aligning NbS with other societal efforts to adapt to and mitigate global change. By concentrating on improved NbS for cities, in forests, and along the shore, NYBG will maximize its impact where people are concentrated and ecosystem degradation has been most severe.

Goal 4.2.3: Expand environmental horticulture

We will leverage our expertise in horticulture and experience working on garden grounds to advance in-situ and ex-situ conservation and restoration efforts. We will work with nurseries to expand the availability of species resilient to change in local conditions, thwart the spread of invasive species by the horticultural trade, and educate landscapers and gardeners about the benefits of genetic diversity, climate-smart gardening, and native plants.

4.3. Transformation

Adapting to and addressing the biodiversity, climate, and environmental justice crises will entail fundamental transformations in how human beings relate to plants and ecosystems. We study ecosystems of the past and make predictions about the future to help society mitigate and adapt to change. Through our transformative and translational ecological and global change research, we seek to build healthy and reciprocal engagements with the natural world. We will catalyze these shifts by putting ecosystem service tools within reach of more people, to promote ecological democracy, and we will share our findings with policymakers to develop better environmental governance. We will continue to reach out, engage, and educate, with a particular focus on learning from Indigenous and local community stewards and sharing our findings with governmental organizations, bilateral and multilateral agencies, and visitors to The New York Botanical Garden.

Goal 4.3.1 Leverage historical ecology

The world has not always been the way it is now. By studying and communicating about the ecology that once was, we can begin to help people imagine what could be. NYBG has particular expertise in the historical ecology of its own landscape and in New York City through the Mannahatta and Welikia Projects. We will continue to share our historical approaches to envisioning future ecologies with other cities.

Goal 4.3.2 Build ecological democracy

Environmental decisions are often made by a small number of individuals in a top-down manner, while the principle of ecological democracy affirms that including diverse voices and perspectives results in more equity and accountability. We will work with local Indigenous, diasporic, urban, and rural communities, policymakers, scientists, and other stakeholders to enhance ecological knowledge and engagement for all people.

Goal 4.3.3 Foster environmental governance

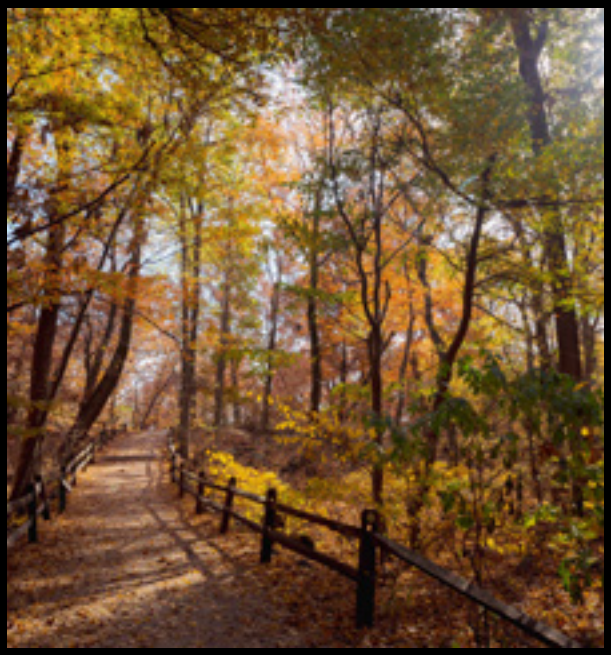
Environmental decision-making is hampered by an imperfect pipeline from scientific research to policy. Using translational ecology – an approach that is evidence-based, interdisciplinary, engages practitioners, and treats research and management as intertwined and iterative processes – NYBG will continue its long tradition of sharing data and information, suggesting alternatives, and creating an open, global knowledge hub that facilitates dialogue and informs best practices to address biodiversity, climate, and environmental justice issues.

CASE STUDY: THE THAIN FAMILY FOREST: 125 YEARS OF URBAN FOREST RESEARCH

The Thain Family Forest, a 20-hectare stand in the heart of NYBG's grounds, is the world's premier urban research forest. As the only old-growth forest remaining in New York City, and the reason for NYBG's chosen location along the Bronx River gorge, the Thain Family Forest has been the epicenter for 125 years of impactful conservation and restoration research. With its first flora completed in the 1890s by NYBG founding director Nathaniel Lord Britton, the Thain Family Forest provides the longest continuous record of forest change in one of the world's most populous cities. Complementing the ongoing biodiversity inventory, urban ecosystem research began with NYBG scientists in the 1980s, who compared the structure and function of the Thain Family Forest to other forests, in increasingly remote areas, and identified specific impairments arising from urbanization. To address these issues and restore the Forest, leaders in NYBG Horticulture established the Thain Family Forest Program in 2008, including the Continuous Forest Inventory program that has documented the success of invasive species control and the resilience of the forest to extreme weather and pathogens. NYBG-led research and restoration complement projects carried out by dozens of other institutions and researchers who are leveraging this unique resource to conduct studies that cannot be done elsewhere. The unique land-use history and unparalleled research record of the Thain Family Forest helps NYBG Science implement cutting-edge technology and diverse partnerships to lead international efforts towards a practical understanding of the particular challenges facing urban forests, and how these forests protect city dwellers from climate change and biodiversity loss. contexts, and different crops.

6,000+

Herbarium records from the Thain Family Forest and other NYBG natural areas have been collected over the past 125 years.

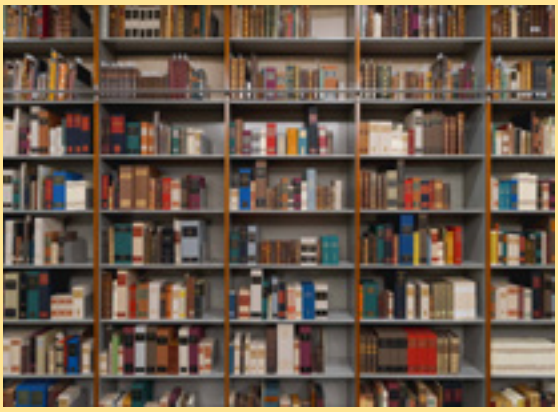


THEME 5: SCIENCE AND HUMANITIES COLLECTIONS

INTRODUCTION

Science and Humanities Collections have been at the heart of NYBG since the institution's inception and serve as the foundation for modern integrative botanical and ecological science. The physical objects in our collections enable research from molecules to ecosystems, underpin a wide range of digital derivatives, and contribute to NYBG's standing as one of the world's most comprehensive resources for botanical information, as well as a global leader in collections care and management. Overall, the collections we steward serve as a hub for botanical research, education, and exploration, preserving a vast wealth of plant and fungal diversity and providing unparalleled resources and opportunities for discovery and scholarship on biodiversity and conservation. Our collections also provide the primary data that support our Cross-Cutting Initiatives: *Plants for Climate Resilience* and *Food Plants: A Global Conservation Priority*. Additionally, our collections staff are adopting and developing the tools that will enable us to leverage AI, which supports our third Cross-Cutting Initiative: *Artificial Intelligence: Unlocking the Power of Plants and Fungi*.

The Science and Humanities Collections at NYBG include the following:



The NYBG Science Collections Strategy

While a collections strategy is beyond the scope of this document, it is essential for the stewardship and growth of NYBG's Science and Humanities Collections. Serving as a roadmap for integrating physical and digital resources, it will reinforce NYBG's role as a global repository for botanical specimens and research materials. Aligned with and derived from the broader science strategy, it will establish priorities that enhance scientific research and biodiversity conservation.

The Laboratory for Integrative Biodiversity Research

The Laboratory for Integrative Biodiversity Research, which houses NYBG's DNA Bank and collections of wood, seeds, plant resins, microscope slides, liquid-preserved specimens, and phytochemical research collections.

The LuEsther T. Mertz Library

The LuEsther T. Mertz Library, one of the world's premier collections of botanical and horticultural literature and art from throughout world history, and the largest such archive in the Western Hemisphere.

The William and Lynda Steere Herbarium

The William and Lynda Steere Herbarium, home to approximately 8 million specimens of plants, algae, and fungi (including lichens), as well as biocultural and ethnographic objects, archival materials, and extensive digital data. It is one of the largest and most active herbaria in the world.

We also have a growing collection of landscape and urban ecology data, including extensive GIS and Lidar datasets, and our scientists work closely with the exceptional staff and resources of NYBG's Living Collections. We are both a repository for physical specimens and materials, and primary data generators, with a duty to steward these resources and ensure access for the global research community.

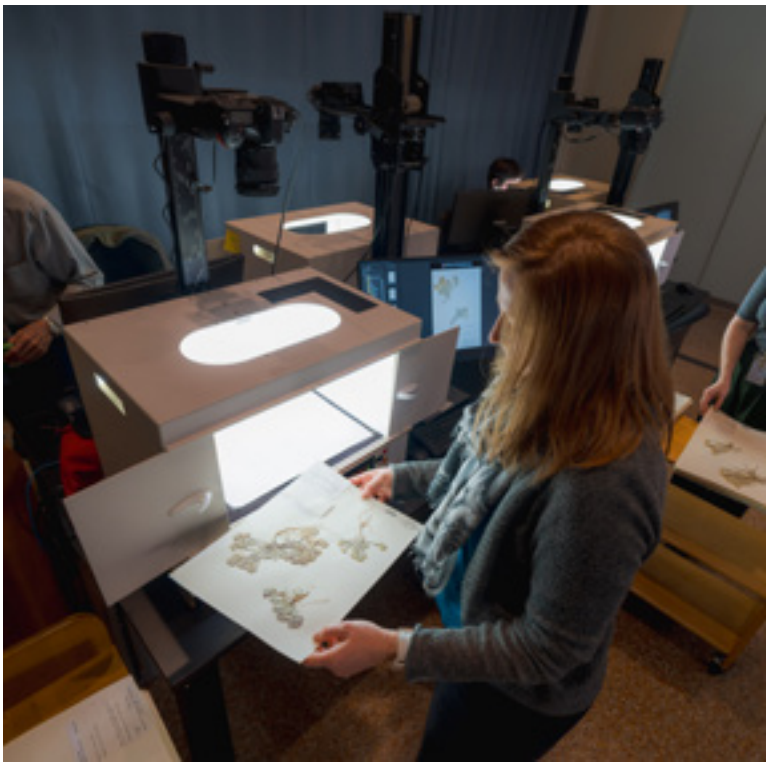
AREAS OF FOCUS

5.1. Commitment to Digitization Excellence and Integrated Digital Resources

NYBG is home to unparalleled collections, with a long-standing emphasis on digitization and global accessibility through platforms like our own Mertz Digital Library and C. V. Starr Virtual Herbarium, as well as data repositories like the Global Biodiversity Information Facility (GBIF) and Biodiversity Heritage Library (BHL). We are committed to providing digital access to these resources, and to improving findability, accessibility, interoperability, and reusability in order to enhance cross-collections discovery within our own NYBG digital ecosystem and beyond.

We recognize that a commitment to digital access, including the best data-sharing practices and standards, is a commitment to breaking down barriers to access for researchers globally. Allowing researchers to explore and understand the links between our collections, place the collections in their historical context, and digitally explore our millions of specimens, archival documents, books, and art, fulfills our mission of enabling scholarship and discovery.

Digitization is a valuable preservation tool, promoting diverse and creative uses of the collections, while also allowing proper stewardship of the physical collections. Along with its commitment to digitization, NYBG recognizes the value of the physical specimens and archival materials and is devoted to their continued conservation and preservation, to allow future use and study of these materials in perpetuity.



30,000

Specimens added to the Herbarium annually (on average)

4.7

Million specimens digitized and available on the C.V. Starr Virtual Herbarium

300,000

Specimens imaged and added to the C.V. Starr Virtual Herbarium annually (on average)

400+

Papers published annually that use our data

1,800+

Visitation days by researchers annually

Goal 5.1.1: Develop a plan for comprehensive digitization of NYBG's collections

Collections staff will outline work plans, timelines, and funding models to comprehensively digitize our collections. We will follow best practices for metadata documentation and adhere to international standards for data sharing and accessibility per FAIR guiding principles: Findable, Accessible, Interoperable, and Reusable.

Goal 5.1.2: Deploy technical infrastructure aligned with best practices for digital asset management, data standards, and semantic interoperability

State-of-the-art infrastructure aligned with best practices will allow NYBG to integrate the rich data associated with our digitized collections. We will work to implement a Digital Asset Management System to unify all Science digital assets and integrate them with existing collection-specific information management systems. The latter will incorporate links and identifiers for external networks and data repositories, including consensus taxonomic backbones and genetic sequence databases.

Goal 5.1.3: Contribute to the Extended Specimen Network

By seamlessly integrating NYBG's digitized herbarium specimens, laboratory collections (e.g., DNA sequence data, tissue samples, microscope slides, phytochemical collections), and library resources (e.g., taxonomic literature, field notes, research publications, archived datasets), we will enable a more comprehensive exploration of their historical and scientific context.

5.2. Facilitating Scholarship and Impact in Biodiversity Science and Humanities

NYBG's Science and Humanities Collections include millions of specimens and objects that are unique and global in their scope, and which contribute significantly to research in myriad fields of science and the humanities. Our fundamental role is to steward, preserve, and share these resources with the global community in order to facilitate an interdisciplinary understanding of biodiversity amongst experts and novices in any relevant area. Our aim is for our scientists and the global botanical and humanities research communities to continue leveraging the collections to create groundbreaking scholarship across disciplines. In addition, through a range of educational programs and outreach opportunities, we are committed to continually improving access and accessibility to the collections for all audiences.

As home to one of the largest herbaria and largest botanical libraries in the world, we recognize our key leadership role in the global collections community and our responsibility to improve visibility and understanding of these collections and their impact. We have traditionally emphasized the size of the collections and the remarkable numbers of objects and specimens in our care, but the reach and impact of the scholarship that leverages these objects is even more significant and should receive increased focus in our narratives and educational efforts about the importance of the collections.

7,000

Pages digitized on average each year

3,500

Pages contributed annually to the Biodiversity Heritage Library (BHL)

1,700

Item records added to the catalog on average each year

2,100

Plant information inquiries handled on average each year

400

General reference inquiries received annually

7,500

General visitors welcomed on average each year

Goal 5.2.1: Develop enhanced metrics of success for NYBG Science and Humanities Collections, and implement data collection for their assessment and tracking

Improved metrics will allow monitoring of essential information on stewardship, growth, use, and impact. The data we gather will be useful for internal and external reports, visual displays and exhibitions, and media coverage. In addition, these metrics and the methodologies we develop can be applied to and shared with biodiversity collections broadly, to help similar institutions tell richer and more engaging stories about the importance of collections for science and society.

Goal 5.2.2: Grow our visitor programs across Science

Robust visitor programs in the Steere Herbarium and Mertz Library already result in hundreds of visitor-days and research products (papers, presentations, etc.) every year, and we aim to continue growing and enriching these programs, with a particular focus on students, to ensure that the collections will be accessed and used to their fullest potential.

Goal 5.2.3: Continue to record and preserve the history of The New York Botanical Garden in our institutional Archives

These archival materials are the primary repository for information about the history of NYBG. Given the prominence of the institution in the development of the botanical and horticultural sciences, these materials are also essential resources for understanding the development of these fields. thwart the spread of invasive species by the horticultural trade, and educate landscapers and gardeners about the benefits of genetic diversity, climate-smart gardening, and native plants.

5.3. Collections Stewardship and Growth

The dynamic nature of scientific and societal needs underscores the importance of robust programs for stewardship and growth of NYBG collections, and the sheer diversity of our physical and digital collections creates both challenges and opportunities. We will actively maintain, curate, use, expand, and provide access to these collections so they will continue to be maximally accessible to the scientific community and the general public.

The objects in our collections (specimens, books, photographs, DNA, etc.) are the fundamental resources that will continue to provide a physical backup to digital data, and will also enable future applications not yet imagined. For example, analysis of DNA from herbarium specimens was a fantasy merely thirty-five years ago, but now is routine.

We are leaders in collections management, use, and accessibility largely because of the expertise we have gained from stewarding NYBG's collections. Our collections staff will continue to lead the way as new challenges emerge and we develop new best practices. We will continue to share our knowledge about collections with stakeholders, especially in the biodiversity, library, and humanities communities, and we will continue to seek opportunities for fruitful collaboration with other institutions and individuals in the collections communities.

Goal 5.3.1: Develop a plan for reasonable and responsible growth of the collections

The Earth's biosphere is changing more rapidly than ever before, making the continued documentation of biodiversity via scientific collections more important than ever. Growth of our collections is essential to continue meeting the needs of the scientific and humanities research communities. We must develop a thoughtful and coordinated plan for sustainable physical and digital growth, to continue serving as a primary global repository for botanical specimens and associated collections, texts, and materials.

Goal 5.3.2: Adhere to responsible stewardship practices

We will closely follow evolving conversations and policy landscapes regarding specimen access, benefit sharing, and Indigenous rights and data sovereignty, and will adhere to internationally accepted guidelines for fair and equitable access to data, including the Nagoya Protocol on Access and Benefit Sharing and the CARE Principles for Indigenous Data Governance: Collective Benefit, Authority to Control, Responsibility, and Ethics.

Goal 5.3.3: Embody innovative and inclusive leadership

We will center source communities in the curation of specimens and the knowledge they document. Historic and contemporary collections can be challenging for source communities to access and engage with. We will work with Indigenous peoples and local, urban, and diasporic communities to develop new and inclusive curation strategies.

CASE STUDY: COLLECTIONS CONNECTIONS: DOCUMENTING THE AFRICAN AMERICAN GARDEN

The African American Garden (AAG) at NYBG uses plants and their stories to celebrate and educate visitors about African American culture. Each year, the garden helps visitors to explore different facets of the Black experience in the United States, the Caribbean, and Central and South America through the lens of plants. The AAG is co-curated by food historian and NYBG trustee Dr. Jessica B. Harris, in collaboration with the Edible Academy and the Humanities Institute, and with support from the Mellon Foundation. In its inaugural year in 2022, the AAG focused on plants that have impacted Black lives in the United States, including rice, okra, cotton, and tobacco. In 2023 and 2024, it highlighted plants used as remedies, food staples, and sources of inspiration in the Caribbean and other African Diasporic communities throughout the Americas.

The AAG is significant both for its documentation of botanical and cultural legacies of Black Americans, and for its importance to The New York Botanical Garden and local communities with ties to these histories. In order to formally record and preserve the presence of the AAG and its plants in NYBG's institutional memory, staff from the Steere Herbarium, Mertz Library, and Humanities Institute have worked together each year to collect 149 specimens of plants from the AAG for permanent preservation in the Herbarium. Duplicate specimens are made and sent to our partner institutions—Howard University, Cornell University, and the Smithsonian Institution—to ensure that these records are preserved and available for study beyond NYBG.

The African American Garden and associated collections have influenced NYBG staff and interns in their work and research, and inspired us to expand our documentation of local plants and foodways by partnering with community gardeners to make specimens of plants being grown throughout the Bronx. Student interns in the Urban Foodways program have been inspired to write stories about plants grown in the AAG, such as tobacco and vanilla, for the Herbarium's storytelling platform The Hand Lens, and large-format images of specimens from NYBG have been used in Juneteenth programming at the Edible Academy. These collaborations have created new opportunities for staff and visitors across NYBG to learn about and celebrate the African American experience through plants and their stories.

THEME 6: TRAINING FUTURE BOTANISTS

INTRODUCTION

Never before has the study of plants and fungi been so important to our survival. Botanical scientists study and address important issues facing society, such as biodiversity loss, food security, the need for new medicines, and how to develop strategies for living in a changing climate. However, there is a critical scarcity of botanical scientists trained to conduct the biodiversity research required to meet these challenges. Sadly, many colleges and universities are downsizing or eliminating their botany programs and related facilities, resulting in a decline of botanical expertise when it is most needed.

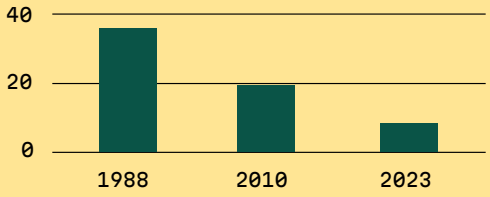
NYBG is ideally positioned to fill this critical gap by providing training in the plant sciences. We have unparalleled botanical collections, state-of-the-art research facilities, long-standing expertise in the field, and a broad range of educational programs that offer students hands-on experiences with field-, laboratory-, and collections-based approaches. NYBG's Graduate Studies Program offers comprehensive training to Master's and Ph.D. students, preparing them for successful careers in the botanical sciences and related fields. NYBG's internship program provides hands-on experience for undergraduate and high school students, promoting scientific literacy and positioning botany as a gateway to science and careers in STEM fields. The success and continuity of our three Cross-Cutting Initiatives depend on contributions from the next generation of scientists, who will be inspired to advance and sustain this work.

NYBG Science can best serve society by bolstering common pathways for students into our botanical training programs. To maximize its impact, we are establishing the following areas of focus for developing an innovative curriculum, recruiting the best students, and strengthening ties with external and internal partners.

The Need for Botanical Education and Training

Data showing diminishing botanical expertise in the United States.

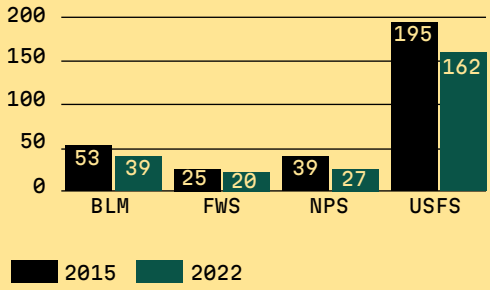
A. Number of the top 50 NSF funded universities that had botany or plant science departments in 1988 versus currently.



B. Number of Botany or Plant Science degrees conferred, 1995 versus 2023.

	Bachelor's		PhD	
	Biology	Botany	Biology	Botany
1995	30,000	20,000	5,000	102
2023	78,254	254	8,550	12

C. Number of staff Botanists employed by federal agencies, 2015 vs. 2022.



D. Course requirements for federally employed Botanists (GS-0439 series positions).

Botany
Mycology
Plant Taxonomy
Plant Systematics
Field Botany

(A from the National Science Foundation, B from the National Center for Education Statistics, C from OpenPayrolls.com, D from U.S. Office of Personnel Management)

Graduate training partner programs

Columbia University
The Graduate Center
LMU
FIU
Cornell University
Yale School of the Environment
New York University
Fordham University

AREAS OF FOCUS

6.1. Curriculum Development

NYBG Science provides botanical training and research opportunities for students, from teens through the graduate level. Consolidating botanical training activities will offer structured learning for students in the areas of our greatest strengths: using collections-, lab-, and field-based methods combining traditional and cutting-edge approaches. Our current curriculum includes graduate and undergraduate courses, lectures, workshops, seminars, and enrichment activities for interns. We will expand upon this curriculum and open courses for cross-registration, so students from different programs can participate as students or instructors. We will expand community-building initiatives such as virtual science seminars, field trips, workshops, and social gatherings, and we will establish a formal alumni network, showcase alumni achievements, and host a virtual seminar series for alumni. These efforts will further support collaboration, networking, support, and inclusivity in the NYBG community, and they will help to cultivate a strong student community.

Goal 6.1.1: Strengthen pathways programs

We will reinforce connections among diverse botanical training activities, which will offer structured, integrated learning for students, guiding them systematically through botanical skills and principles from basic to advanced levels, from teen programs to graduate studies. We will establish formal pathways to motivate engagement, document achievements and proficiency, and inspire sharing of knowledge about plants.

Goal 6.1.2: Formalize and expand our curricula

We will create formal botany curricula that are tailored to each of our target audiences (e.g., teens, interns, graduate students) and emphasize NYBG's strengths and expertise and include, as appropriate, workshops, lectures, and course modules in biodiversity collections management, herbarium curation, grant proposal writing, nomenclature, revisions and monographs, biodiversity data science, and responsible conduct of research. Regular assessment of the effectiveness of the curricula will be conducted to ensure alignment with current best practices in botany education and to continuously improve its relevance and impact.

Goal 6.1.3: Cultivate a strong community of students and alumni

We will establish a formal alumni network to build collaboration and provide networking opportunities. We will enhance community-building initiatives such as seminars and symposia to highlight student research, and we will host special events, field trips, workshops, orientation sessions, and regular social gatherings to promote a sense of belonging and inclusion among NYBG students.

6.2. Enhancing Impact Through Recruiting

NYBG's science education programs have a powerful impact by inspiring curiosity, fostering environmental stewardship, and equipping diverse communities with the knowledge and skills necessary to understand, appreciate, and protect plant diversity for generations to come. We have an established history of providing learning opportunities for students from high school through graduate school. Our science internships offer hands-on experience in botany, allowing students to work with NYBG scientists and participate in cutting-edge research. These internships offer valuable educational experiences, enhancing resumes and preparing students for the future. For five decades, NYBG has partnered with degree-granting institutions to train graduate students from around the world, including those from countries with high biodiversity. International alumni have returned to their home countries to conduct important botanical research, notably in Latin America. A strong recruiting strategy aims to attract top talent, foster interest in STEM fields, and produce graduates who make a difference globally. Leveraging reputation, collaborations, and partnerships, NYBG offers diverse opportunities, supporting the development of a vibrant botanical community.

NYBG Science: Outreach and Engagement

NYBG and its Science Programs reach diverse audiences locally and globally by connecting plants and fungi to everyday life through engagement and education. On site, visitors learn about plants with exposure to our research and collections firsthand. In New York City, we strengthen community ties through partnerships with schools, cultural institutions, and community gardens, promoting STEM education and urban biodiversity research that informs policy and local engagement. Globally, we amplify our impact through digital resources, scientific publishing, and active participation in conferences and policy discussions. By broadening access to our research and fostering collaborations, NYBG enhances scientific literacy, inspires a love of nature, and addresses biodiversity and climate challenges.

1,180+

People participate annually in herbarium tours, conducted across 118 tours

200+

People attend each tabling event held annually on the grounds, with a total of 7 to 8 events per year

150+

Visiting researchers come each year, contributing a total of 2,000 research days

Goal 6.2.1: Intensify local recruiting for science internships

Recruiting diversity into botany and other STEM fields enhances innovation, benefiting science and society. Internships are an important entry to careers in botany and the sciences. We can enhance our impact by strengthening ties with local partners, participating in New York City internship networks, and maximizing the number of paid science internships.

Goal 6.2.2: Broaden graduate student recruiting to expand local and global reach

Students pursue graduate study at NYBG because of our staff expertise, state-of-the-art facilities, unmatched collections, funding available for research, and for the benefits of the consortium program. Our recruiting efforts are very successful, but we can enhance the impact of our programs by expanding opportunities for our own pipeline of interns in order to better serve students from the Bronx and New York City.

Goal 6.2.3: Build critical mass

Students often learn as much from each other as they do from instructors, and a rich and diverse student community will improve the learning environment for all. We will build critical mass, beyond our formal partnerships, by expanding student exchange programs and leveraging specialized fellowships, such as Fulbright and foreign government fellowships and EU exchange initiatives. Formal recognition in the form of program certificates for visiting students will acknowledge student contributions and incentivize participation.

6.3. Building Training Partnerships and Opportunities

Partnerships play a pivotal role in enhancing the effectiveness and reach of NYBG's educational programs. Collaborating with other educational institutions, community organizations, and industry stakeholders enables NYBG to benefit from resources, expertise, and networks far beyond its own capacities. These partnerships facilitate the development of innovative curricula, access to diverse perspectives, and expanded opportunities for students and staff.

Our graduate studies program is a cooperative effort between NYBG and eight degree-granting institutions. Students apply to and enroll at one of these universities and complete the degree requirements of the school, but have full access to the staff, facilities, and research opportunities available at NYBG. We also partner with local schools, government programs, and NYC cultural institutions to provide internship opportunities for high school and college students.

By working together with our partners, NYBG will create more comprehensive and impactful educational experiences that address the complex challenges facing botanical science, resource use, and conservation. Additionally, partnerships will broaden the audience and increase engagement with NYBG's programs, building greater awareness and appreciation for the importance of preserving biodiversity and fostering environmental stewardship.

Goal 6.3.1: Strengthen key university partnerships and explore new ones

NYBG will strengthen collaborations with CUNY while exploring new partnerships with institutions such as Penn State and MIT. New partnerships will expand opportunities for collaborative research, enhance training in biodiversity conservation, and advance nature-based solutions by connecting botanical expertise with leading institutions, experts, and real-world projects that address biodiversity loss and ecosystem restoration.

Goal 6.3.2: Reinforce internal collaborations at NYBG

We will expand our internal engagement by building stronger connections between programs in Science and, for example, Children's Education. Our robust ecosystem of educational opportunities can contribute significantly to enriching programs across the Garden, and we can be particularly strategic by seeking funding for science internships—an important steppingstone between funded programs (e.g., the NYBG High School Explainers Program and graduate fellowships).

Goal 6.3.3: Expand training opportunities to build a larger NYBG science community

We will enhance our educational impact by expanding partnerships that support student exchanges. For example, graduate student exchange programs with partners in high-biodiversity countries like Bolivia, Peru, and Ecuador will strengthen collaboration, build conservation capacity, and facilitate knowledge sharing, giving researchers hands-on experience while contributing to biodiversity preservation and nature-based solutions in places where it is most needed.

CASE STUDY: CULTIVATING BOTANICAL EXCELLENCE: THE NYBG-CUNY PARTNERSHIP

The partnership between The New York Botanical Garden (NYBG) and the Graduate Center of the City University of New York (CUNY) has a rich history dating back to 1968 when the first cohort of CUNY/NYBG Ph.D. students graduated. The partnership is centered at NYBG and Lehman College, where students access world-class facilities and mentorship. Since its inception, this collaboration has produced more than 110 Ph.D. graduates. CUNY has been NYBG's most successful partnership by any indicator—number of students, placement of students, and impact of students' research—over the past 50 years. With CUNY as its partner, NYBG has been a global hub for training graduate students from countries rich in biodiversity and in need of botanical expertise. Notably, many international alumni, especially from Latin America, particularly Colombia (16 students) and Brazil (10 students), have graduated through the CUNY program, returned to conduct vital botanical research in their home countries and built their own educational programs. Graduates of the CUNY/NYBG program have excelled across academia, industry, and conservation organizations, advancing plant biology and biodiversity conservation globally. Looking ahead, the partnership aims to enhance its impact through continued investment in infrastructure, interdisciplinary collaborations, and initiatives to promote diversity, equity, and inclusion. The NYBG-CUNY partnership epitomizes collaborative excellence in botanical education and research, poised to continue shaping the future of the field for years to come.

110

CUNY–NYBG Graduates since 1968

57

Years of partnership

Locations of CUNY alumni working as botanists:

18

Countries

26

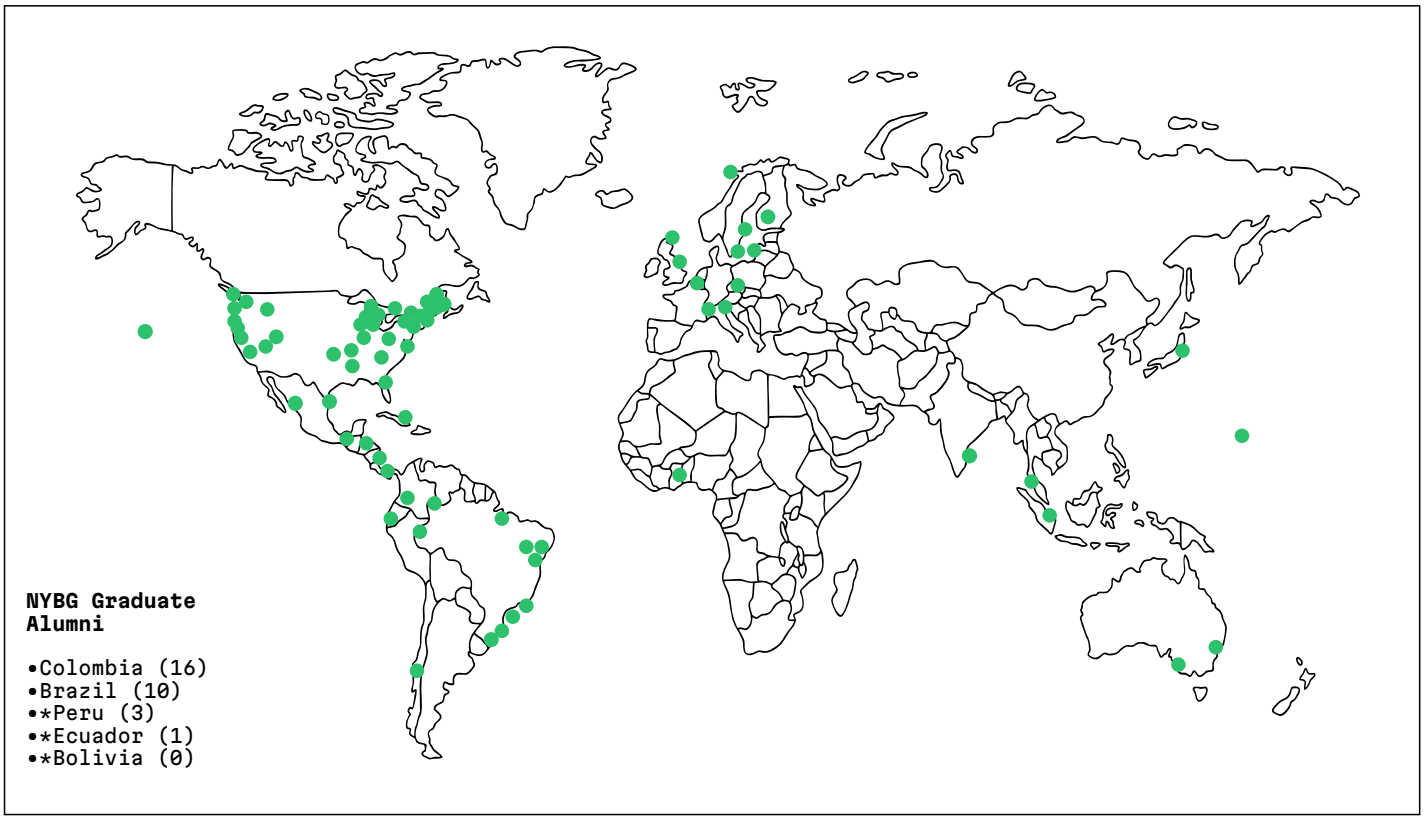
States in the U.S.A.

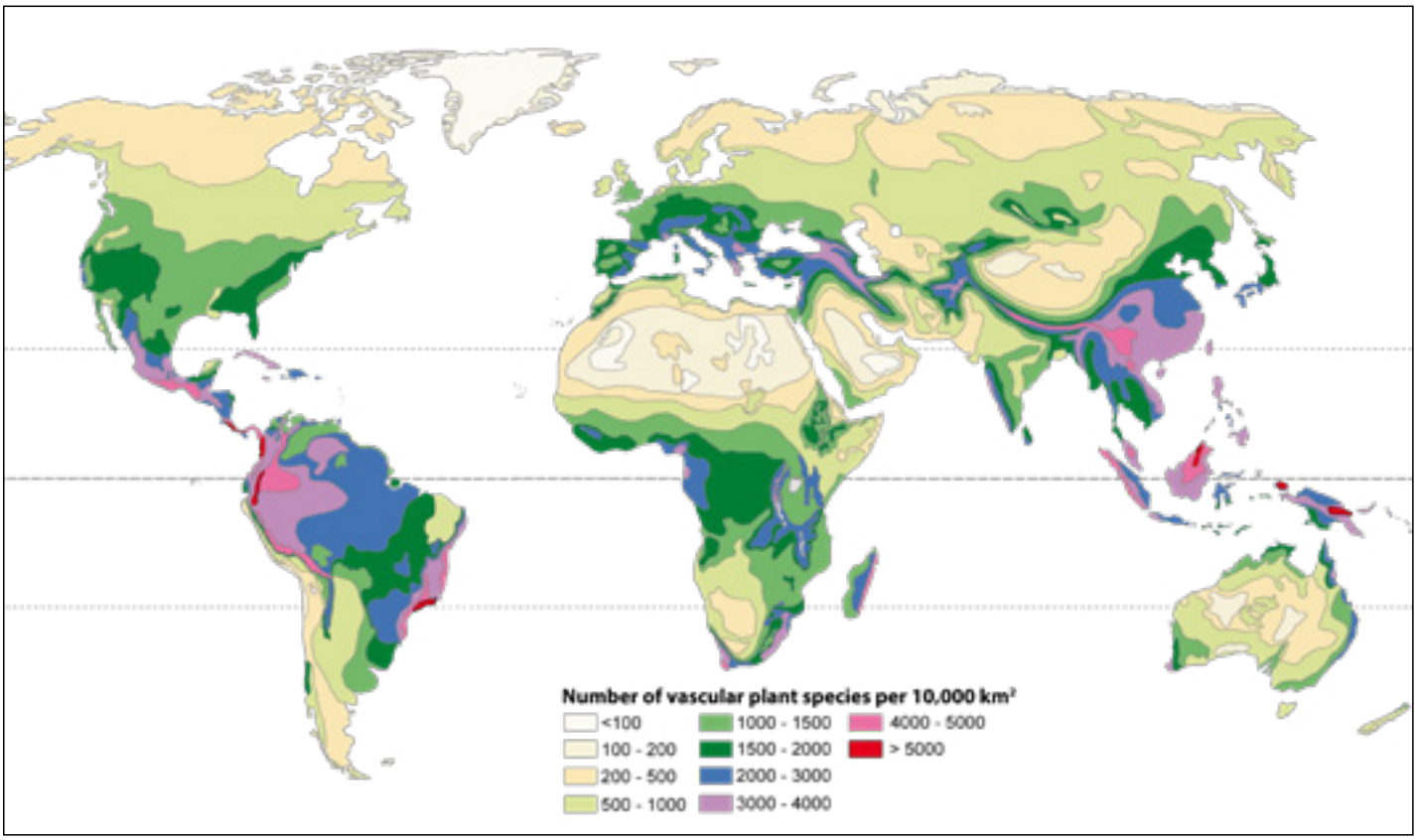
Funding for NYBG-CUNY Graduate Students:

- CUNY Graduate Center
- NYBG Fellowships
- NYBG Curator Research Grants (Federal and Private sources)
- Lehman College Adjunct Teaching
- Fulbright Foundation

The Need for Botanical Education and Training

Map showing locations of NYBG graduates currently working as botanists (top), highlighting NYBG's limited impact in Peru, Ecuador, and Bolivia, countries where botanical diversity is highest (bottom).





Modified from Barthlott W, MD Rafiqpoor, and J Mutke (2014) and Barthlott et al. (2019)

CASE STUDY: THE HAND LENS : BUILDING A PUBLIC OUTREACH PLATFORM

The Herbarium has been working actively for nearly thirty years to digitize its collections and make them available online and freely accessible to all. From its early days focused on specimen information, the C. V. Starr Virtual Herbarium has grown steadily into a rich resource for scientists, students, and plant enthusiasts worldwide, and now includes high-resolution digital images of specimens, geo-coordinates and mapping capabilities, field images of living plants and their habitats, species descriptions, and standardized taxonomic data. Although these resources are freely accessible, our virtual audience was largely limited to researchers with existing knowledge of what to look for when exploring our offerings. Herbarium staff created The Hand Lens to expand this audience and the accessibility of herbarium specimens, by offering a narrative platform that anyone can browse, with or without a scientific background, to find and enjoy stories about specimens that are relevant to their interests. The Hand Lens combines digital images of specimens with other multimedia items and a storytelling format to create relatable stories about botany, art, history, food, and numerous additional cultural themes relevant to NYBG's grounds, our local communities, and plants worldwide.

To date, there are more than 440 stories in The Hand Lens pages, written by Science staff, interns from Science and the Humanities Institute, and Humanities Fellows. Content ranges across many topics from plants grown on the grounds, such as in the Native Plant Garden and the Lilac Collection, to plants grown locally in community gardens, to research discoveries by our scientists around the world. By sharing these stories though NYBG's social media and website platforms we receive an average of 16,000 views annually.

We are committed to continued expansion of The Hand Lens as a tool to promote scientific exploration and discovery. Our goal is to enhance visibility and accessibility to new audiences by broadening the range of content writers to include a diverse array of staff, visiting researchers, artists, local stakeholders, and global research collaborators. We aim to enrich our content by incorporating resources from the Mertz Library, the Biodiversity Heritage Library (BHL), and the Living Collections, as well as leveraging the Plant Tracker platform. Through these efforts, we seek to create engaging digital offerings both on-site and online that showcase the fascinating stories and discoveries made possible by NYBG's scientific endeavors.

2,469,520

Visits to the C.V. Starr Virtual Herbarium (on average)

16,038

Views per year, on average from 2019 to 2023, are received by *The Hand Lens*

COLLABORATIONS AND PARTNERSHIPS

At NYBG Science, we know that the greatest challenges in conservation cannot be solved alone. Through strategic, impactful, and inclusive collaborations, we will continue to push the boundaries of scientific discovery, expand our collective knowledge of plant and fungal diversity, and drive meaningful action for biodiversity conservation. By uniting expertise, resources, and innovation, we are not just studying the natural world—we are actively shaping a more resilient and sustainable future for people and the planet.

All of our partnerships and collaborations, regardless of geography, scale, or the nature of the work, follow a set of core principles. Together with our partners, NYBG Science commits to being:

Influential:

We aim to help shape effective conservation policies, strategies, and frameworks that protect plant and fungal diversity at multiple scales. To this end, we commit to working closely with and providing scientific expertise and advice to policymakers, government agencies, and community and advocacy groups, to inform policy decisions and promote evidence-based legislation.

Impactful:

Through meaningful, mutually beneficial collaborative efforts with partners and stakeholders, we leverage our unique strengths and expertise to achieve shared conservation goals and create lasting positive impacts for people and the planet.

Inclusive:

The New York Botanical Garden is committed to an inclusive, diverse, equitable, and accessible work environment, and further recognizes that diversity fosters excellence in our mission of advocating for the plants of the world. We abide by local laws, rules, and regulations; include host-country representatives as equal partners in project planning and decisions; and respect international agreements and local customs regarding intellectual property and access and benefit-sharing.

Adhering to the principles above and in alignment with NYBG's Branching Out strategic plan, we are focused on continuing our existing successful collaborations and developing new and exciting partnerships, all of which are focused on improving understanding of plant diversity, tackling environmental problems, training and capacity building, and supporting evidence-based decision-making.

PARTNERSHIPS FOR UNDERSTANDING PLANT DIVERSITY

NYBG Science advances the understanding of plant and fungal diversity through collaborative research involving local and global partnerships. Leveraging collections resources like the Steere Herbarium, Mertz Library, and NYBG Living Collections, our scientists discover, document, and illuminate the evolution of biodiversity. Our field and specimen-based research generates foundational data essential for informing conservation decisions, nature-based solutions, food security, and restoration efforts. We integrate traditional and innovative tools to deepen our understanding of ecosystems, strategically expanding into new regions to maximize global and local impact. By fostering collaborations and capacity building, we ensure our research drives meaningful conservation outcomes.

Examples of NYBG Partnerships for Understanding Plant Diversity:

Bromeliad Life History, Nutrient Cycling, and Conservation Biology

Global Mangrove Alliance

Melastomataceae Working Group

New Manual of Vascular Plants of Northeastern United States and Adjacent Canada

New York Plant Genomics Consortium (CSHL, NYU, AMNH)

Podostemaceae Taxonomy Expert Network

The Plants and People of Vanuatu

Thematic Collections Networks

Urban Forests Project

PARTNERSHIPS FOR TACKLING ENVIRONMENTAL PROBLEMS

By sharing and exchanging knowledge and expertise, NYBG Science helps build the skills and capabilities of local communities, researchers, and conservation practitioners, empowering them to contribute to plant conservation and restoration efforts in their regions. Using our expertise and collections, NYBG Science and its collaborators identify plants and fungi, and ecosystems that are most at risk, and develop effective strategies to protect them. We also help to develop and deliver Nature-based Solutions, ensuring they are derived from the best available scientific evidence and achieve important goals while preserving or even enhancing biodiversity. These partnerships involve collaborative research, capacity building, community engagement, policy advocacy, and promoting effective conservation action at local, regional, and global scales.

Examples of NYBG Partnerships for Tackling Environmental Problems:

Botanical Gardens Conservation International

Climate Resilience Advisory Committee: Conservation scientists in the United States, United Kingdom, Colombia, Italy, Brazil, Australia

Global Conservation Consortium for Food Plants (GCCFP): Foodplants

Periodic Table of Food Initiative

Regional Invasive Species and Climate Change Management Networks (RISCCs)

PARTNERSHIPS FOR TRAINING AND CAPACITY BUILDING

Collaboration with local, national, and international universities, schools, and community organizations provides opportunities for training and capacity building at various levels. Our Graduate Studies program has maintained fruitful collaborations with six universities in the northeastern U.S., through which we have graduated over 320 PhD and Master's students, and we have recently established a partnership with Florida International University. Through our internship program, we provide training opportunities to dozens of local high school and college students every year, inspiring them to become the next generation of scientists.

Examples of NYBG Partnerships for Training and Capacity Building:

Conservation and Sustainable Management of Amazon Forests

Examples of NYBG Partnerships for Training and Capacity Building:

Forests for All New York City

New university partners: FIU, LMU-Munich

Sci Network Internships program

VisionMaker/Welikia

PARTNERSHIPS FOR SUPPORTING EVIDENCE-BASED DECISION-MAKING

Our scientists collaborate with policymakers, government agencies, and advocacy groups by sharing scientific expertise to support informed decision-making on biodiversity conservation. Through research and analysis, we contribute to the development of evidence-based strategies that address conservation challenges, support habitat protection, promote ecosystem restoration, and safeguard vital natural history collections. By sharing data and scientific insights, we aim to enhance the understanding of biodiversity issues and encourage the adoption of conservation-oriented policies and practices at various geographic scales.

Examples of NYBG Partnerships for Supporting Evidence-based Decision-making:

Bronx River Watershed Health and Resilience Program

Natural Science Collections Alliance

NYC urban conservation efforts

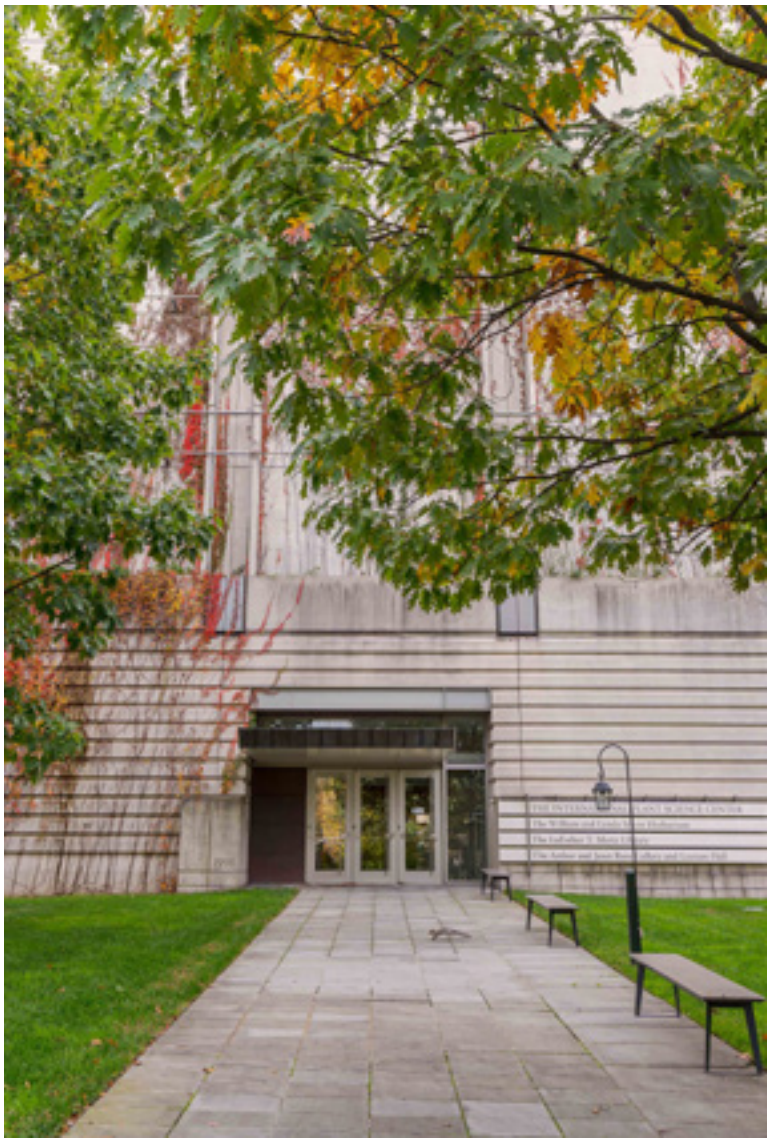
United Nations Biodiversity conferences

Vanuatu Kastom Forest Conservation Collaboration

SCIENCE AND HUMANITIES INFRASTRUCTURE

The Science and Humanities mission at NYBG relies on our unique institutional infrastructure, which includes expert staff, dedicated facilities, specialized instrumentation, computational resources, and extensive collections in the Pfizer Laboratory, Steere Herbarium, Mertz Library, and Living Collection. These physical and digital infrastructure elements are unique to NYBG, and their diversity and proximity embody our power of place, enabling our scientists, visitors, and trainees to seek knowledge and advance research through experiences that can only be found at the Garden.

Successfully implementing the strategic themes and cross-cutting initiatives outlined in this document will depend on maintaining our infrastructure and ensuring it can adapt and grow. These resources enable everything we do in NYBG Science; they have underpinned our historic impacts, and they make possible all of our current and future endeavors.



DIGITAL INFRASTRUCTURE: COMPUTATIONAL AND GEOSPATIAL RESOURCES

NYBG Science is powered by a variety of computational and related resources, including a high-performance computing cluster, Digital Imaging Laboratory that supports the digitization activities of the Herbarium and Library, and robust systems for collections and library information management that serve our data to online portals and the public. Supporting these operations and systems is the NYBG-managed network infrastructure that encompasses storage, backup, and servers. This hardware and associated software powers the databases that underlie the operations of the Mertz Library and Steere Herbarium, including the platforms our staff use daily to manage our collections, and the public-facing platforms that share our digitized resources with the world. Our collections staff have expertise across various digital domains, including metadata management, data mobilization, and bioinformatic data analysis. Our substantial geospatial resources include a GIS Laboratory and Geographical Information Manager in the Herbarium and expertise in geospatial analyses and ecological forecasting in the Center for Conservation and Restoration Ecology. Our growing AI expertise includes large language models and computer vision approaches deployed to aid species discovery and speed specimen transcription. These resources and expertise underpin our efforts to better understand the past, present, and future of botanical biodiversity; they have been instrumental to our work in Biological Diversity and Evolution (Theme 1), Conservation and Restoration Ecology (Theme 4), and collections-based activities and research (Theme 5). All our cross-cutting initiatives require robust computational resources for data storage, sharing, and analysis, and to facilitate collaboration.

939,042

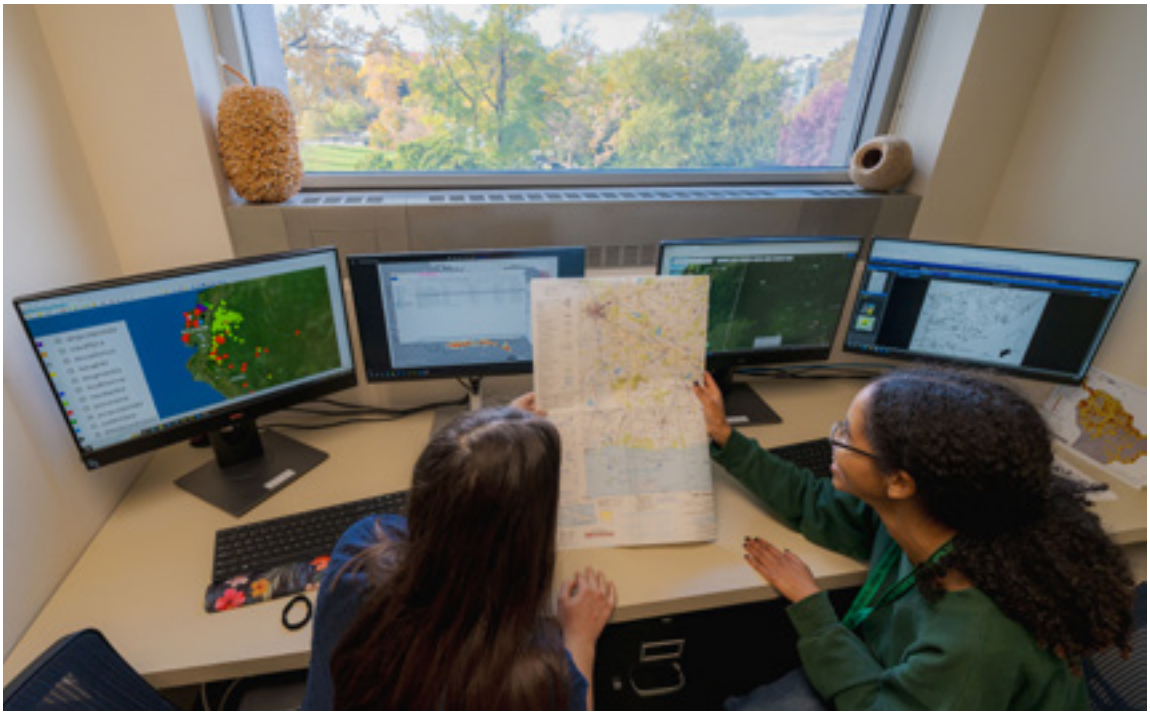
Virtual Herbarium Page Views in 2024

410,079

LibGuides views in 2024

818,490

Plant Info FAQs views in 2024



PHYSICAL INFRASTRUCTURE: RESEARCH LABORATORY AND COLLECTIONS FACILITIES

NYBG is renowned for its state-of-the-art collections and laboratory facilities, which house and maintain world-class collections spanning more than 800 years. These collections constitute an irreplaceable primary record of biodiversity and scholarship and are meticulously preserved in custom-designed, climate-controlled environments in the Steere Herbarium, Mertz Library, and Pfizer Laboratory. Our laboratory and collections staff exemplify curation, stewardship, and management excellence, prioritizing emergency preparedness, collaboration with visiting researchers, and comprehensive training opportunities for students (Theme 6). Our facilities and technologies for photomicroscopy, SEM, and genomics have enabled discoveries in Biological Diversity and Evolution (Theme 1) and Integrative Biodiversity Research (Theme 2), and an NYBG-wide physical infrastructure for environmental monitoring (including LiDAR and weather data) is supporting the work of Conservation and Restoration Ecology (Theme 4). Our biocultural collections document our research on Plants, People and Culture (Theme 3), and our identity as a collections-based institution (Theme 5) is intrinsically linked to the infrastructure that enable us to meticulously steward, preserve, and share these botanical treasures. The cross-cutting initiatives will all rely on our physical infrastructure to collect relevant data, provide training, and support collaboration.

88

Herbarium Visiting Researchers in 2024

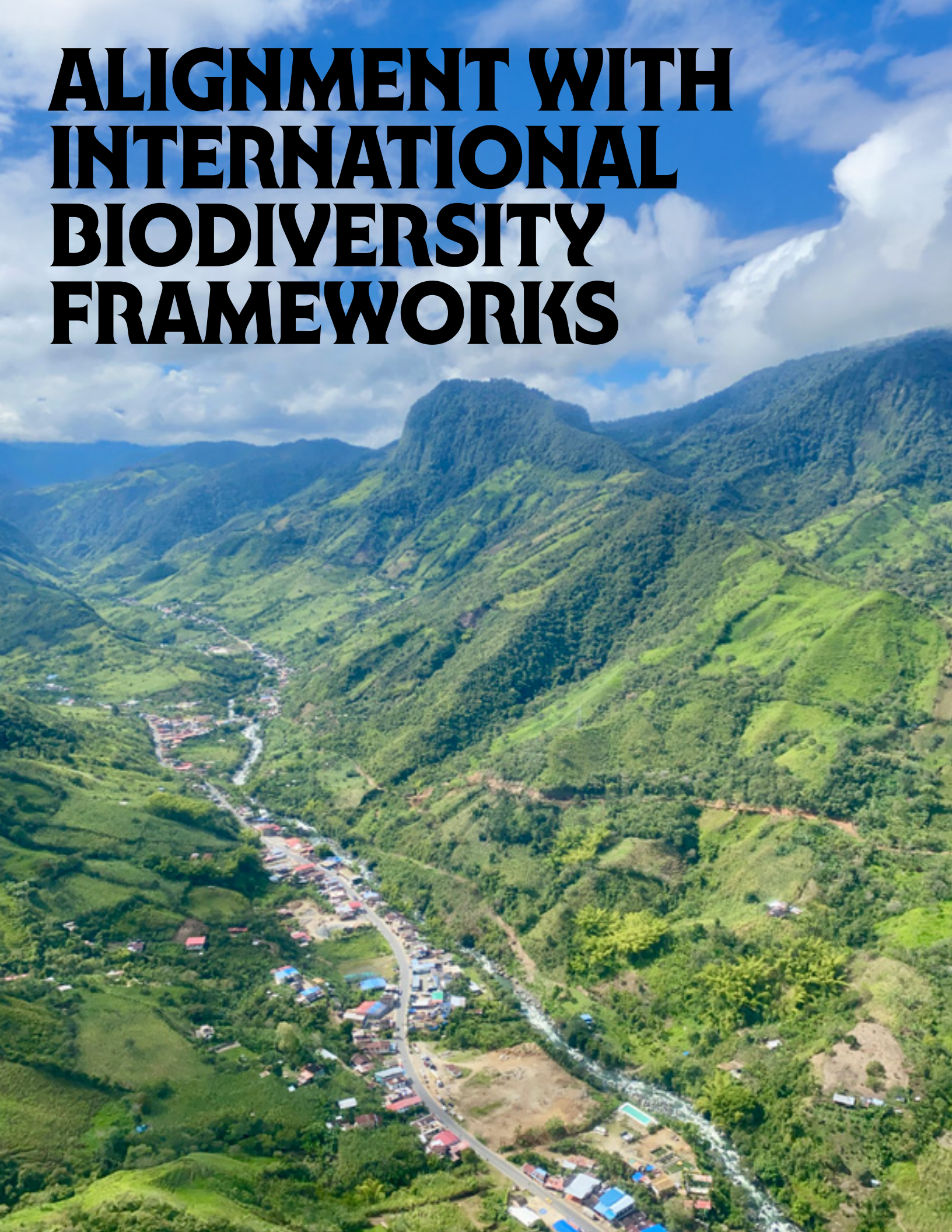
14,413

Library Visitors and Researchers in 2024

12

Laboratory Visiting Researchers in 2024

ALIGNMENT WITH INTERNATIONAL BIODIVERSITY FRAMEWORKS



NYBG's Science aligns with international frameworks such as the Convention on Biological Diversity (CBD), the Global Biodiversity Framework (GBF), the Sustainable Development Goals (SDGs), and the Global Strategy for Plant Conservation (GSPC) in the following ways:

Convention on Biological Diversity (CBD):

NYBG Science aligns with the CBD's call for an "online flora of all known plants" through its involvement in the World Flora Online (WFO) project. The WFO aims to create the first open-access online resource for comprehensive data on Earth's 400,000 known plant species, meeting the CBD's objective of conserving Earth's plants.

Global Biodiversity Framework (GBF):

NYBG Science contributes to the GBF by working with collaborators worldwide to identify plants, habitats and ecosystems at risk, and implementing strategies to protect and restore them. Through its research and conservation efforts, NYBG Science supports the GBF's goals of conserving and sustainably using biodiversity.

Sustainable Development Goals (SDGs):

NYBG Science aligns with several SDGs. We have contributed scientific knowledge to every single SDG, primarily: Goal 15: Life on Land (403 publications); Goal 17: Partnership for the goals (371); Goal 2: Zero hunger (98); and Goal 3: Good Health and Well-being (63). By conducting research, providing education and training, and advising on policy and practice, NYBG Science contributes to the conservation and sustainable use of terrestrial ecosystems and biodiversity.

Global Strategy for Plant Conservation (GSPC):

NYBG Science actively supports the GSPC, which aims to halt the loss of plant diversity and promote plant conservation worldwide. NYBG's Center for Conservation and Restoration Ecology particularly contributes through local and international collaborations to the GSPC's objectives of plant conservation, research, and education.

Through its various programs, collaborations, and initiatives, NYBG Science demonstrates a commitment to international frameworks and their goals. By aligning with these frameworks, NYBG Science contributes to global efforts to protect and conserve plant biodiversity, promote sustainable practices, and achieve a more sustainable future for our planet.

GOALS THROUGH 2030

The comprehensive objectives laid out in this strategy, aiming to understand, protect, and responsibly utilize biodiversity, center around Areas of Focus that are already progressing well with existing resources and funding. Realizing our complete vision requires dedicating resources to our personnel, assets, and infrastructure, we are committed to actively exploring additional funding avenues to support our scientific research endeavors related to our goals.

Theme 1: Biological Diversity and Evolution

Document and Describe the World's Plants and Fungi

- Advance species documentation in understudied regions
- Synthesize botanical knowledge
- Understand the evolution of key functional traits

Decipher the Complex History of Plant and Fungal Evolution

- Reconstruct evolutionary history using cutting-edge phylogenetic methods
- Understand biogeographic evolution and species distributions through time and space
- Assess population genetic and demographic processes

Develop and Disseminate New Tools and Resources for Biodiversity Discovery

- Develop resources and tools for discovering and describing biodiversity
- Create tools to efficiently use molecular data
- Invent tools for rapid assessment and monitoring of biodiversity

Theme 2: Integrative Biodiversity Research

Investigate Biodiversity Patterns and Processes Across Scales

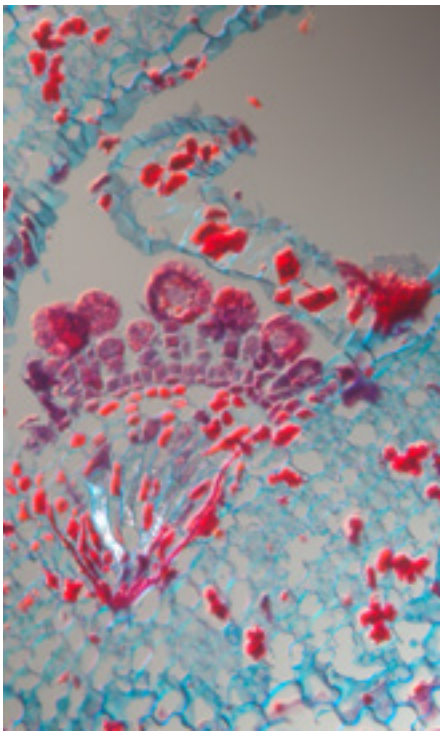
- Expand our understanding of biodiversity genomics
- Analyze the connection between organismal structure and function
- Examine organismal adaptation to their environments across scales to inform plant based solutions

Develop and Deploy New Techniques for Analysis and Visualization of Biodiversity Data

- Develop and employ new computational tools for biodiversity research
- Leverage imaging and modeling tools to visualize biodiversity
- Analyze plants in their environment

Foster Laboratory-based Collaborations and Capacity Building

- Leverage the Living Extended Laboratory
- Promote the Laboratory for Integrative Biodiversity Research to the global botanical community
- Cultivate capacity building through training and workshops



Theme 3: Plants, People and Culture

Traditional Ecological Knowledge and Resource Management

- Work with local communities as partners in conservation of their own ecosystems
- Build cutting-edge digital tools to support the preservation of traditional ecological knowledge
- Innovate the use of technologies such as AI, GIS, and remote sensing to help document, preserve, and share traditional ecological knowledge

Food Security and Resilience

- Document, revitalize, and promote traditional climate-smart, regenerative, and locally adapted food practices
- Support diversity and resilience, including in agricultural systems
- Support the traditional practices that balance human needs and biodiversity

Human Health

- Support and revitalize traditional medicine for improved primary healthcare delivery, particularly in underserved areas
- Participate in teaching and training of integrative health care practitioners
- Investigate the therapeutic potential of plant compounds

Theme 4: Conservation and Restoration Ecology

Conservation

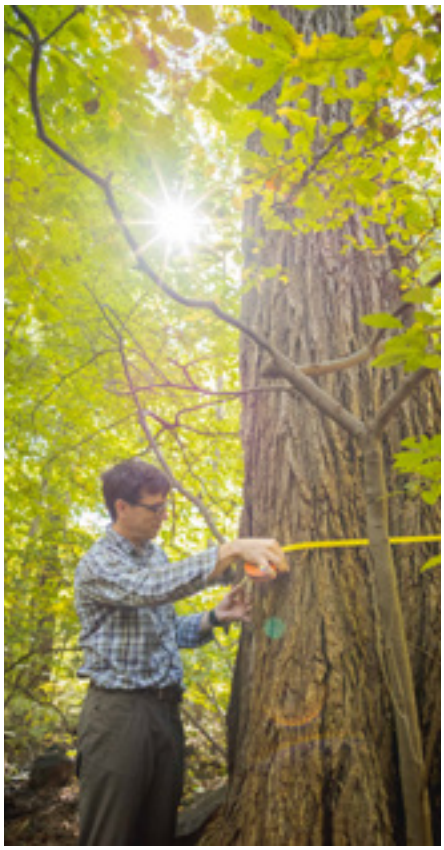
- Guide sustainable ecosystem management
- Identify, assess, and conserve threatened species and habitats
- Inform invasive species management and prevent new invasions

Restoration

- Guide science-based systematic restoration
- Enhance nature-based solutions
- Expand environmental horticulture

Transformation

- Leverage historical ecology
- Build ecological democracy
- Foster environmental governance



Theme 5: Science and Humanities Collections

Commitment to Digitization Excellence and Integrated Digital Resources

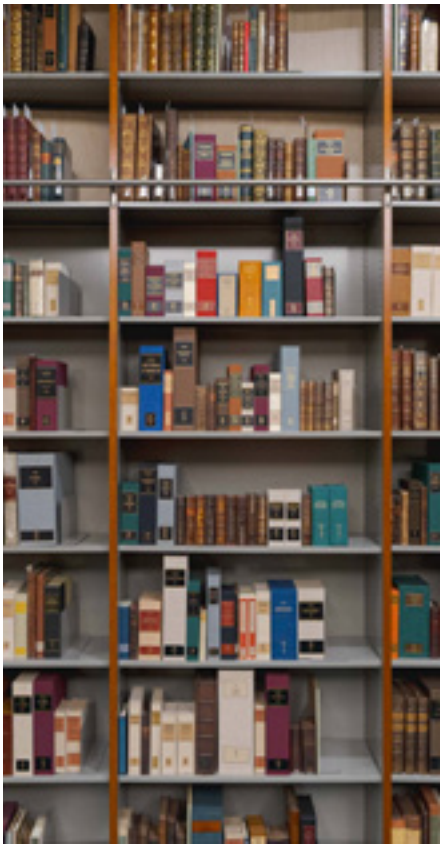
- Develop a plan for comprehensive digitization of NYBG's collections
- Deploy technical infrastructure aligned with best practices for digital asset management, data standards, and semantic interoperability
- Contribute to the Extended Specimen Network

Facilitating Scholarship and Impact in Biodiversity Science and Humanities

- Develop enhanced metrics of success for NYBG Science and Humanities Collections, and implement data collection for their assessment and tracking
- Grow our visitor programs across Science
- Continue to record and preserve the history of The New York Botanical Garden in our institutional Archives.

Collections Stewardship and Growth

- Develop a plan for reasonable and responsible growth of the collections
- Adhere to responsible stewardship practices
- Embody innovative and inclusive leadership



Theme 6: Training Future Botanists

Curriculum Development for Botanical Training

- Strengthen pathways programs
- Formalize and expand our curricula
- Cultivate a strong community of students and alumni

Enhancing Impact through Recruiting

- Intensify local recruiting for science internships
- Broaden graduate student recruiting to expand local and global reach
- Build critical mass

Building Partnerships and Collaborations

- Strengthen key university partnerships and explore new ones
- Reinforce internal collaborations at NYBG
- Expand training opportunities to build a larger NYBG science community

NYBG SCIENCE STRUCTURE

William and Lynda Steere Herbarium

LuEsther T. Mertz Library

Laboratory for Integrative Biodiversity Research

Center for Biodiversity and Evolution

Center for Plants, People and Culture

Center for Conservation and Restoration Ecology

Commodore Matthew Perry Graduate Studies Program

Core Resources

Centers

Overarching Program

NYBG'S STRATEGIC OBJECTIVES AND SCIENCE STRATEGY GOALS

NYBG's Strategic Plan envisions where we want to be as an institution in 2030 and how we will get there, focusing on five Strategic Objectives:

Environmental Action:

NYBG will investigate, elevate, and amplify the role of plants in solving the climate and biodiversity crises.

Bronx-Forward:

NYBG will respond to the interests and opportunities of our borough—a diverse, vibrant, immigrant and multi-ethnic community that is emblematic of today's America.

Power of Place:

NYBG will inspire more diverse audiences to seek beauty, knowledge, and wellbeing in the natural world through education and experiences that can only be found at the Garden.

Digital Impact:

NYBG will become a leading online global resource through our unparalleled collections, horticultural knowledge, and plant science expertise.

Management Excellence:

NYBG will be a model in the cultural and nonprofit sector, making us a premier place to work and a highly resilient, environmentally sustainable, collaborative, and effective organization.

These Strategic Objectives form the backbone of NYBG's commitments in the years ahead, and they are the pillars to advance botanical research, conservation, and education. The Strategic Objectives also guide institutional efforts in addressing critical challenges facing plant and fungal diversity while fostering innovation and collaboration at NYBG. All of the Science Strategy goals are aligned with at least one institutional Strategic Objective.

Themes	Areas of focus	Science Strategy goals
Biological Diversity and Evolution	**Document and Describe the World's Plants and Fungi**	Advance species documentation in understudied regions
		Synthesize botanical knowledge
		Understand the evolution of key functional traits
	Decipher the Complex History of Plant and Fungal Evolution	Reconstruct evolutionary history using cutting-edge phylogenetic methods
		Understand biogeographic evolution and species distributions through time and space
		Assess population genetic and demographic processes
	Develop and Disseminate New Tools and Resources for Biodiversity Discovery	Develop resources and tools for discovering and describing biodiversity
		Create tools to efficiently use molecular data
		Invent tools for rapid assessment and monitoring of biodiversity
Integrative Biodiversity Research	**Investigate Biodiversity Patterns and Processes Across Scales**	Expand our understanding of biodiversity genomics
		Analyze the connection between organismal structure and function
		Examine biotic and abiotic interactions of organisms in their environments, to inform conservation decisions
	Develop and employ new computational tools for biodiversity research	Develop and employ new computational tools for biodiversity research
		Leverage imaging and modeling tools to visualize biodiversity
		Analyze plants in their environment
	Foster Laboratory-Based Collaborations and Capacity Building	Leverage the Living Extended Laboratory
		Promote the Laboratory for Integrative Biodiversity Research to the global botanical community
		Cultivate capacity building through training and workshops
Plants, People and Culture	**Involve local communities as partners in conservation of their own ecosystems**	Work with local communities as partners in conservation of their own ecosystems
		Build cutting-edge digital tools to support the preservation of traditional ecological knowledge
		Innovate the use of technologies such as AI, GIS, and remote sensing to help document, preserve, and share traditional ecological knowledge
	Food Security and Resilience	Document, revitalize, and promote traditional climate-smart, regenerative, and locally adapted food practices
		Support diversity and resilience, including in agricultural systems
		Support the traditional practices that balance human needs and biodiversity
	Human Health	Support and revitalize traditional medicine for improved primary healthcare delivery, particularly in underserved areas
		Participate in teaching and training of integrative health care practitioners
		Investigate the therapeutic potential of plant compounds

Relevant | Highly relevant

	Plants for Climate Resilience	Food Plants	Artificial Intelligence	Environmental Action	Bronx Forward	Power of Place	Digital Impact	Management Excellence
	Relevant	Highly relevant	Highly relevant	Highly relevant				
	Highly relevant	Highly relevant	Highly relevant	Highly relevant				
	Highly relevant	Relevant	Highly relevant	Highly relevant				
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	Highly relevant	Relevant	Highly relevant	Highly relevant				
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		Relevant		Highly relevant				

Themes	Areas of focus	Science Strategy goals
Conservation and Restoration Ecology	**Conservation**	Guide sustainable ecosystem management
		Identify, assess, and conserve threatened species and habitats
		Inform invasive species management and prevent new invasions
	Restoration	Guide science-based systematic restoration
		Enhance nature-based solutions
		Expand environmental horticulture
	Transformation	Leverage historical ecology
		Build ecological democracy
		Foster environmental governance
Science and Humanities Collections	**Commitment to Digitization Excellence and Integrated Digital Resources**	Develop a plan for comprehensive digitization of NYBG's collections
		Deploy technical infrastructure aligned with best practices for digital asset management, data standards, and semantic interoperability
		Contribute to the Extended Specimen Network
	Facilitating Scholarship and Impact in Biodiversity Science and Humanities	Develop enhanced metrics of success for NYBG Science and Humanities Collections, and implement data collection for their assessment and tracking
		Grow our visitor programs across Science
		Continue to record and preserve the history of The New York Botanical Garden in our institutional Archives
	Collections Stewardship and Growth	Develop a plan for reasonable and responsible growth of the collections
		Adhere to responsible stewardship practices
		Embody innovative and inclusive leadership
Training Future Botanists	**Curriculum Development**	Strengthen pathways programs
		Formalize and expand our curricula
		Cultivate a strong community of students and alumni
	Enhancing Impact Through Recruiting	Intensify local recruiting for science internships
		Broaden graduate student recruiting to expound local and global reach
		Build critical mass
	Building Training Partnerships and Opportunities	Strengthen key university partnerships and explore new ones
		Reinforce internal collaborations at NYBG
		Expand training opportunities to build a larger NYBG science community

Relevant | Highly relevant

	Plants for Climate Resilience	Food Plants	Artificial Intelligence	Environmental Action	Bronx Forward	Power of Place	Digital Impact	Management Excellence
	■			■				
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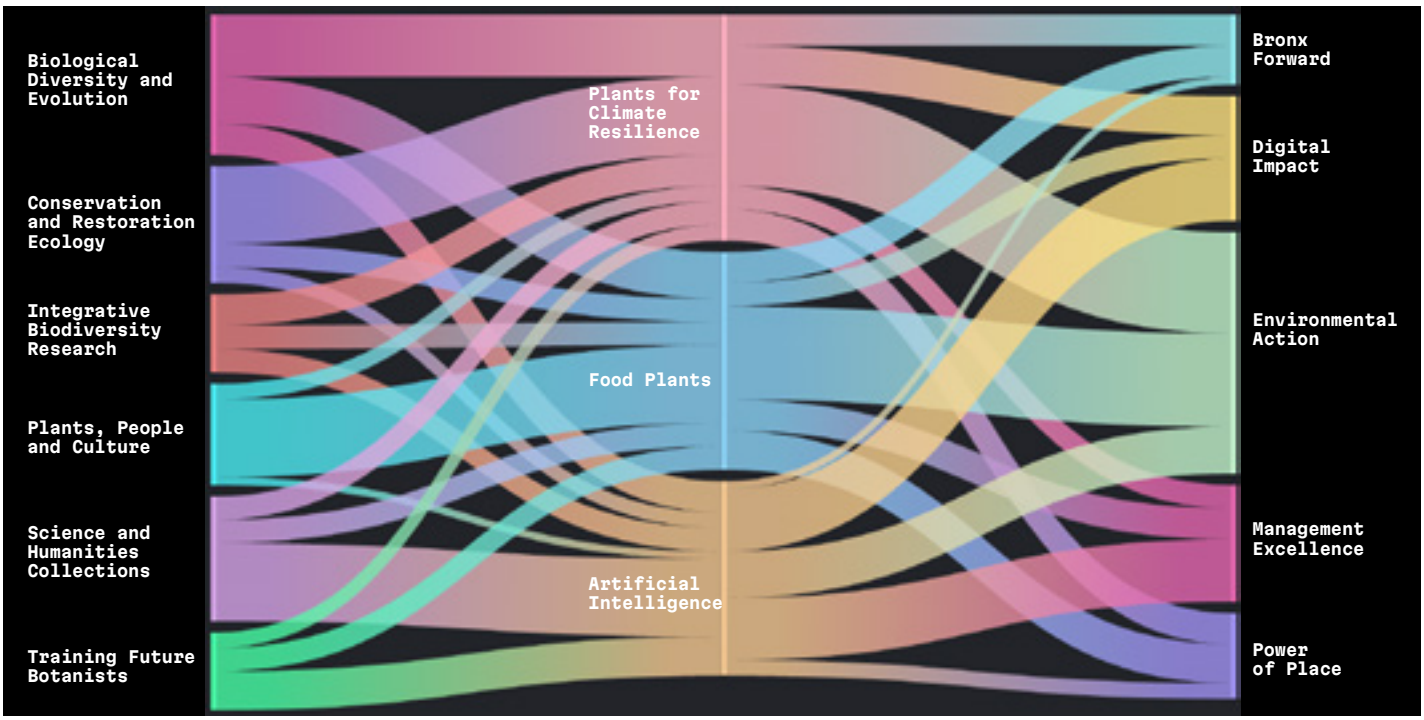
This Sankey diagram visualizes the *relevance relationships* among the Science Themes, Cross-Cutting Initiatives, and Institutional Strategic Goals. The flow thickness reflects the *degree of relevance*, based on a scale from 0 (no relevance) to 10 (very high relevance). This diagram helps illustrate the interconnected nature of NYBG's scientific agenda and its strategic alignment across programs and goals.



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