Living Collections Policy

North Carolina Botanical Garden (NCBG)
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Adopted: September 1, 2017

NORTH CAROLINA
BOTANICAL
GARDEN

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Introduction and Background

The North Carolina Botanical Garden (NCBG) is a public, university-affiliated botanical garden with a strong conservation ethic that is integrated into all of its programs. The mission of the North Carolina Botanical Garden is *"to inspire understanding, appreciation, and conservation of plants and to advance a sustainable relationship between people and nature."* Central to this mission are core values of conservation, education, and native plant horticulture. As a 'conservation garden', we feature plants native[1] to the different regions of North Carolina and the southeastern United States in our habitat and display gardens. The vast diversity of native plant species in our collections make it the most extensive native plant display in the state of North Carolina. Additionally, as the most comprehensive center of knowledge on plants in North Carolina and the southeastern United States, NCBG is the state's premier location to learn about native plant horticulture and conservation.

Purpose

The purpose of the Living Collections Policy is to guide the development and management of the living plant and seed collections at NCBG. Management of and adherence to the Living Collections Policy is the responsibility of the Collections Committee, which is composed of the NCBG Director, Director of Horticulture, Director of Conservation, Collections Manager, Habitat Gardens Curator, Nursery Manager, and Seed Program Coordinator. The Collections Committee is responsible for periodic review and revision (if necessary) of the Collections Policy. North Carolina Botanical Garden staff will implement the Collections Policy under the guidance of the Collections Committee.

Collections Overview

The North Carolina Botanical Garden comprises more than 1,000 acres, including numerous natural areas throughout the Triangle area of North Carolina. The managed living collections that are covered in this Policy are shown on the Display Gardens Map **(Appendix A)** and the Managed Areas Map **(Appendix B)** and are described as follows:

Habitat Gardens

- Piedmont Habitat
- Coastal Plain
- Sandhills Habitat
- Mountain Habitat
  Purpose: To display southeastern native plants and plant communities in settings approximating their natural habitats and to foster awareness of the need to conserve these plants and communities.

[1] Native plant – with respect to a particular ecosystem, a species that, other than the result of an introduction, historically occurred or currently occurs in that ecosystem (Executive Order 13751).

These collections focus on the diversity of North Carolina and southeastern native plants and plant communities and are maintained for educational purposes as well as aesthetic ones. All plants are native to and typical of the region and community they are meant to represent. Strong emphasis will be placed on accessions with known wild provenance, when possible. Natural hybrids[2] of native species or plants exhibiting natural variation such as atypical color forms are acceptable in these collections if they are representative of the plant community on display but with few exceptions, these collections consist of straight species. These collections also display a number of rare and protected species. The habitat collections are maintained by the Habitat Gardens Curator under the supervision of the Director of Horticulture.

Native Plant Landscapes

- Entrance Garden
- Courtyard Gardens
- Rare Plant Garden
- Totten Oak Garden
- Carnivorous Plant Collection
- Water Gardens
- Perennial Circle
- Children's Wonder Garden
- Entryway Garden

Purpose: To display southeastern native plants in attractive horticultural settings and to encourage their appreciation and use in home gardens and landscaping. Within this group of collections there are various themes but all highlight the beauty and encourage the cultivation of plants native to all parts of the southeastern United States. These collections include straight species, hybrids of native species, cultivars[3], and natural variants[4] of species native to the southeastern United States. Rare and protected species should not be planted in these collections unless they are accompanied by interpretation which describes their conservation status. As is the case with all plant collections at the Garden, they illustrate sustainable gardening practices and feature elements including food and shelter for pollinators and other wildlife, regular use of locally generated mulch and compost, and thoughtful use of water. These landscapes and display gardens are maintained by staff curators and horticultural technicians under the supervision of the Director of Horticulture.

Plant Family Garden

Purpose: To provide an attractive and intensively interpreted visual representation of the evolutionary relationships between plant groups. Beds are laid out according to the taxonomic classification system developed by Arthur Cronquist with each bed

[2] hybrid – a plant produced by crossing two different plant species, occurring either in cultivation or in the wild

[3] cultivar – a variety of plant that has been bred in cultivation for one or more horticulturally desirable traits and that would not normally be found in the wild

[4] natural variant – an atypical form of a species found in the wild that has been brought into cultivation and named

representing a subclass. Specimens include plants of economic, horticultural, and conservation significance and are chosen to facilitate the illustration and interpretation of their relationships. This collection is comprised of southeastern native plants and non-native, non-invasive plants from around the world, including straight species, cultivars, and hybrids that support the educational mission of this collection. Rare and protected species should not be planted in this collection unless they are accompanied by interpretation which describes their conservation status. The Plant Family Garden is maintained by staff curators and horticultural technicians under the supervision of the Director of Horticulture.

Mercer Reeves Hubbard Herb Garden (including the Poisonous Plants Garden and Native American Garden)

Purpose: To provide a visually appealing as well as educational representation of plant specimens that have been cultivated for their usefulness to peoples of different cultures. Specimens include plants that are grouped according to their culinary, medicinal, and economic or industrial significance. The collection includes non-native, non-invasive plants from around the world, including straight species, cultivars, and hybrids that support the mission of this collection. The collection also includes a display of garden plants that possess toxic properties as well as southeastern native plants with relevance to indigenous peoples of the Southeastern United States. Rare and protected species should not be planted in this collection unless they are accompanied by interpretation which describes their conservation status. The herb garden is maintained by the Herb Garden Curator under the supervision of the Director of Horticulture.

Vegetable / Edible Gardens

- Horticultural Therapy Beds
- Children's Vegetable Garden
- Carolina Campus Community Garden (off-site, on UNC-CH campus)
- Edible Campus Beds

Purpose: To provide attractive and accessible spaces which can be planned, tended, and enjoyed by a number of different user groups. These beds have varied and changing themes and are comprised of both native and non-invasive non-native annuals and perennials that meet the needs of their user groups. These spaces are maintained by education staff under the supervision of the Director of Education.

Nursery / Greenhouse

Purpose: To maintain a living stock of plant material for supplying the NCBG daily plant sale, annual spring and fall plant sales, and to provide NCBG curators with plants for all habitat and display gardens. The NCBG nursery staff germinates seeds and grows seedlings and plants acquired through collecting trips, donations, vegetative propagation, and purchase. Plants are cultivated in the nursery until they are large and healthy enough to either be sold through the plant sales or planted out in the living collections. The nursery is the primary source of plant material for the habitat gardens, and because of this, emphasis is placed on propagating and cultivating plants native to North Carolina and the southeastern United States. The Nursery Collection is maintained by the Nursery Manager under the supervision of the Director of Horticulture.

Horticulture and Conservation Seed Collections

Purpose: To promote the Garden's concept of 'conservation through propagation' and to maintain the preservation of genetic material of rare and imperiled species for future research and conservation projects. A collection of native seeds is maintained to supply the NCBG nursery with sufficient material for propagation and to provide seed for public distribution through various components of the NCBG Seed Distribution Program. The horticulture and conservation seed collections are maintained by the Seed Program Coordinator under the supervision of the Director of Horticulture and the Conservation Ecologist and Conservation Botanist under the supervision of the Director of Conservation.

Coker Arboretum (located on the UNC – CH campus) / **The Rocks**

Purpose: To provide an educational and historical environment for students of all ages, to inspire awe and appreciation for our native plant species, vicariads[5] *and traditional southern garden species, and to be a sanctuary for contemplation, plant study and quiet enjoyment.* This historical collection dates back to 1903 and consists of a wide variety of plantings including native and non-native, non-invasive flowering trees and shrubs, as well as bulb and perennial displays. Rare and protected species should not be planted in this collection unless they are accompanied by interpretation which describes their conservation status. The Coker Arboretum and The Rocks (a small garden on the estate of Dr. William Chambers Coker and in close proximity to the Coker Arboretum) are maintained by the Coker Arboretum Curator under the supervision of the Director of Horticulture.

Natural Areas

- Mason Farm Biological Reserve
- Battle Park and Forest Theatre
- Penny's Bend Nature Preserve
- Piedmont Nature Trails
- Coker Pinetum
- Merritt's Pasture
- William Lanier Hunt Arboretum
- Stillhouse Bottom Nature Preserve
- Parker Preserve
- Laurel Hill Nature Preserve
- Highland Pond Preserve
- Gordon Butler Nature Preserve (Cumberland Co.)

Purpose: To protect and preserve the biological and cultural history of the North Carolina Piedmont and to support academic research, public education, and outdoor recreation and appreciation of the natural world. The natural areas managed by NCBG are more naturalistic than the rest of the living collections and display gardens and are

[5] vicariads – pairs of species or taxa that share a common ancestor but are genetically distinct from each other as a result of biogeographic isolation and subsequent evolution

managed as such. Management activities include maintenance and clearing of the well-defined paths, removal of non-native invasive[6] species, removal of hazard trees and debris, prescribed burning, and mowing. Planting of North Carolina Piedmont native species may be done in certain managed areas as part of ecological restoration projects and rare species reintroductions. The NCBG natural areas are managed and maintained by the NCBG Land Manager and the Battle Park Manager under the supervision of the Director of Conservation. Privately owned properties under conservation easements held by the Botanical Garden Foundation (BGF), the NCBG non-profit support organization, are not considered part of the living collections and are thus not included in the Living Collections Policy. Any inquiries regarding these conservation easements should be addressed to the Director of Conservation.

Acquisitions

New plant material is acquired by NCBG through staff and collaborator collecting activities in the field, on-site garden projects, exchanges with other institutions and individuals, plant rescues, contracts, gifts, or purchases.

Collected Plant Material

The North Carolina Botanical Garden may collect any native plant taxon, with the collection priority focused on representing the native flora of North Carolina and the southeastern United States. The state of North Carolina encompasses four distinct ecoregions as defined by the U.S. Environmental Protection Agency: the Blue Ridge, Piedmont, Southeastern Plains, and Middle Atlantic Coastal Plain (map found online ftp://newftp.epa.gov/EPADataCommons/ORD/Ecoregions/nc/nc_eco_pg.pdf, and in **Appendix C**). The Piedmont is the "home" ecoregion of NCBG, however the living collections include species native to all four ecoregions. In general, the first priority for collection and display is placed on species native to any of these four ecoregions of North Carolina. The second priority is placed on species native to adjacent or nearby ecoregions of the southeastern United States, including the Southern Coastal Plain, Ridge and Valley, Central Appalachians, Southwestern Appalachians, and the Northern Piedmont. A map of these ecoregions can be found online ftp://newftp.epa.gov/EPADataCommons/ORD/Ecoregions/us/Eco_Level_III_US.pdf and in **Appendix D**.

Collections may include seeds, spores, cuttings, or whole plants. Preference is given to collecting seeds from plants with known wild provenance, following collection procedures that will ensure genetic diversity while protecting population viability. The digging or removal of whole plants from the wild should only be done in rescue situations following approval of appropriate agencies or landowners. Rescued plants will

[6] invasive – with regard to a particular ecosystem, a non-native organism whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health (Executive Order 13751).

not be offered for sale by NCBG, but may be planted in the managed living collections covered in this Policy or grown as stock plants in the NCBG nursery. Staff will not accept plants known to have been illegally or unethically collected from the wild. Any plants purchased from outside sources will be purchased from entities that maintain ethical nursery propagation standards and do not engage in illegal or unethical collection. For rare plant species or species of conservation concern, collecting will be conducted according to the guidelines published by NCBG and the Center for Plant Conservation (CPC) in the Summary of CPC Seed Collection Guidelines **(Appendix E)** and with approval of the Director of Conservation and any necessary external regulatory agencies. All collecting will be done in accordance with local, state, and national law, and collecting will not occur on private property without the written or verbal permission of the landowner. For collections made on private property a Plant Collection Permission Form **(Appendix F)** will be completed and signed by the property owner.

For each off-site field collection made, a Field Collection Data Sheet **(Appendix G)** will be completed, documenting the species information, type of collection (seed, cuttings, etc.), collection location, population demographics, and habitat information. Data from the Field Collection Data Sheet will be recorded in the NCBG's online Garden Records and Information Management system (GRIM). For any on-site seed collections made in any curated area of the main display gardens or Coker Arboretum, a Field Collection Data Sheet is not necessary (see 'Accessioning and Plant Records' section below for more information on this).

Purchased or Donated Plant Material

For any plant material that is either donated or purchased from outside nurseries, vendors, or other sources, a Plant Materials Acquisition Form **(Appendix H)** will be completed. Staff purchasing / receiving such plant material should inquire as to its provenance and, if available, include this information on the Plant Materials Acquisition Form. Donated plant material will only be accepted if it aligns with the NCBG's Living Collections Policy and is free of restrictions or limitations on its use. NCBG staff members will not provide appraisals for donated material, but if the donor of the plant material requests an official receipt for tax purposes, staff will work with the Garden's development department to document the gift.

The responsibility for initiating and documenting acquisitions is shared between the members of the Collections Committee. The Collections Manager is responsible for managing all Field Collection Data Sheets and Plant Materials Acquisition Forms, as well as entering all data into GRIM.

Accessioning and Plant Records

An accession is the record of a plant or group of plants of the same species acquired from the same source at the same time. All native species planted in the habitat gardens, native plant landscapes, Plant Family Garden, Mercer Reeves Hubbard Herb Garden, and Coker Arboretum will be accessioned, and select non-native species (including long-lived perennials, shrubs, and

trees) planted in these areas will also be accessioned. When a plant or group of plants are planted in the Garden, an accession number will be assigned and the associated accession data will be recorded on an Accession Records Sheet **(Appendix I).** The accession number will be assigned based on the following format: year + number for the year (ie. 2017-0026 for the 26th accession in the year 2017). For each accession record, the recorded data will include accession number, accession date, scientific name, common name, source of the plant material (including seed collection number if the plant material was propagated in-house), associated provenance information, location of planting in the Garden, and quantity of individuals planted. The accepted authorities for scientific and common names of accessions are outlined in the Policy on Botanical Nomenclature **(Appendix J)**. It is the responsibility of the Curator completing the planting to either fill out the Accession Records Sheet or to provide the Collections Manager with timely information about the planting. The Collections Manager is responsible for managing all Accession Records Sheets, as well as entering all accession data into GRIM.

Typically plants are not accessioned until they are planted in the Garden, and likewise, seeds are typically not accessioned unless they are sown directly in the Garden (ie. NOT when they are sown in the nursery for propagation). However, all seeds collected by the garden staff (including both off-site wild collections and on-site collections from cultivated individuals) and any seeds donated to the Garden from outside sources will be assigned a seed collection number which will be recorded in the Seed Collection Log notebook at the time of collection. The seed collection number will be assigned based on the following format: month + day + year + number for the day (ie. 07-27-17-001 for the first collection of June 27th, 2017). For off-site collected seed from wild populations, this collection number needs to also be recorded on the Field Collection Data Sheet. The Seed Program Coordinator will be responsible for the assignment of the seed collection number and the maintenance of the Seed Collection Log notebook.

Plants that are located in the nursery and/or destined for the plant sale or to be given away as membership or gift plants will not be accessioned.

The development of a comprehensive online plant records database with digital images and maps for each of the Garden's collections is an institutional goal of the North Carolina Botanical Garden. The maintenance and accuracy of the plant records database is the responsibility of the Collections Manager under the supervision of the Director of Horticulture.

Evaluation

Periodic evaluations of the living collections will be done to assess their health, general condition, aesthetics, and relevance to the Garden's mission. Quick, informal "spot check" evaluations will be done on a daily basis by NCBG staff curators to address immediate problems and concerns within each curator's area of responsibility. A more formal internal evaluation of the living collections will be completed every 3-5 years. This evaluation will consist of a detailed review of the collections and will include an inventory of all accessions to ensure that current accessions in the database still exist in the landscape (and if not, identify those records to be de-accessioned). This evaluation will also include a review of the accuracy of plant names and labels within the collections and will also provide recommendations for collections maintenance.

If plants that have naturally seeded into the collection are deemed desirable, they can be formally accessioned as part of this evaluation process. The status of weedy or potentially invasive species within the collections will also be assessed, and if it is determined that any species may pose a future threat to the health of the collection, removal will be recommended. Following the evaluation, any relevant data or updates to the condition of the collections will be recorded in GRIM and on any associated garden maps. The formal internal review will be completed by the Collections Manager, with assistance provided as needed by the Director of Horticulture.

Maintenance

The curators and nursery staff of the North Carolina Botanical Garden, under the direction of the Director of Horticulture, are responsible for the care and maintenance of the living collections. Their primary goal is to keep the plants healthy and reproducing to the best of their ability, keep them aesthetically appealing, and to minimize the risk of accident or injury to the public, staff, and volunteers. As a 'conservation garden', the North Carolina Botanical Garden practices and promotes environmentally friendly and sustainable gardening practices including integrated pest management, rainwater harvesting, composting and other practices that minimize harm to the soil, water, air, and other living organisms. Invasive species will be removed from the living collections and destroyed. More information on non-native (also known as exotic[7]) and invasive species, and why NCBG strives to remove invasive species, can be found in the Exotic Plant Policy and Procedures **(Appendix K)**.

The Seed Program Coordinator, Conservation Ecologist, and Conservation Botanist are responsible for maintaining and managing the NCBG seed collections. The Collections Manager, with the cooperation of the curators, is responsible for maintaining an accurate, complete, and current plant records system consisting of filed and archived paper records as well as a computerized, online database (GRIM). The computerized plant records database will be backed up regularly. The North Carolina Botanical Garden will take all reasonable measures to secure the plant and seed collections and collections records from loss or harm.

Deaccessioning and Disposal

Deaccessioning is the process of recording plant accessions that have been removed from the Garden's living collections. A plant accession may be deaccessioned due to death, deterioration, lost identification, loss of relevance to the collection or mission of the Garden, or replacement by a more appropriate accession. The data associated with deaccessioned plant material will be maintained.

If deaccessioning is a result of circumstances other than plant death and the plant still exists in

[7] Exotic – with respect to a particular ecosystem, an organism, including its seeds, spores, or other biological material capable of propagating that species, that occurs outside of its natural range (Executive Order 13751); an exotic species may or may not be invasive.

the living collections, it will be removed and either returned to the nursery, donated to outside sources, or destroyed. Deaccessioned dead plants that pose a hazard to staff, visitors, or volunteers will be removed and disposed of properly. Diseased or damaged plants will either be treated using the appropriate sustainable gardening practices or removed depending on the threat to the health of the rest of the collections.

The NCBG Curators are responsible for initiating deaccessions, and the Collections Manager is responsible for recording the date and reason for deaccession on the Accession Records Sheet and also managing deaccessions in the online plant records database and on any associated garden maps.

Access and Use

The NCBG living collections are primarily for public display and are intended to educate the public about local and regional plant communities and ecology, native plant identification and horticulture, sustainable gardening practices, and the relationship between plants and people. The main display gardens are also available for private rentals such as weddings and other special events. However, the nursery and greenhouse area, horticulture and conservation seed collections are not for public use and public access is restricted.

The removal or collection of seeds or other plant material from any part of the living collections by anyone other than NCBG staff members is strictly prohibited. When removing plants or seeds during routine garden maintenance, staff curators should check with the Nursery Manager and/or Seed Program Coordinator to make an effort to find a use for them before discarding the material. Any extra material that is not needed may be given to staff or volunteers, or may be discarded as appropriate.

Special permission may be given to allow the removal of plant material from the living collections including restricted areas. Permission must be obtained from the Director of Horticulture prior to collecting plant material and the collector must adhere to any restrictions provided by the Curator(s) of the areas where plant material is being collected from. The decision to approve or deny such requests will be at the discretion of the Director of Horticulture.

Plants propagated in the NCBG nursery will be sold to the public at the daily plant sale as well as at larger semi-annual plant sales located at the Garden. The sale of rare plant species or species of conservation concern will be limited as outlined in the NCBG Policy on the Sale of Rare Plants **(Appendix L)**.

Seeds contained within the NCBG seed collection can be used for public distribution in accordance with the NCBG Seed Distribution Policy **(Appendix M)**. Requests for donations of seed will be considered on a case by case basis and approved or rejected at the discretion of the Seed Program Coordinator.

Appendices

Appendix A:

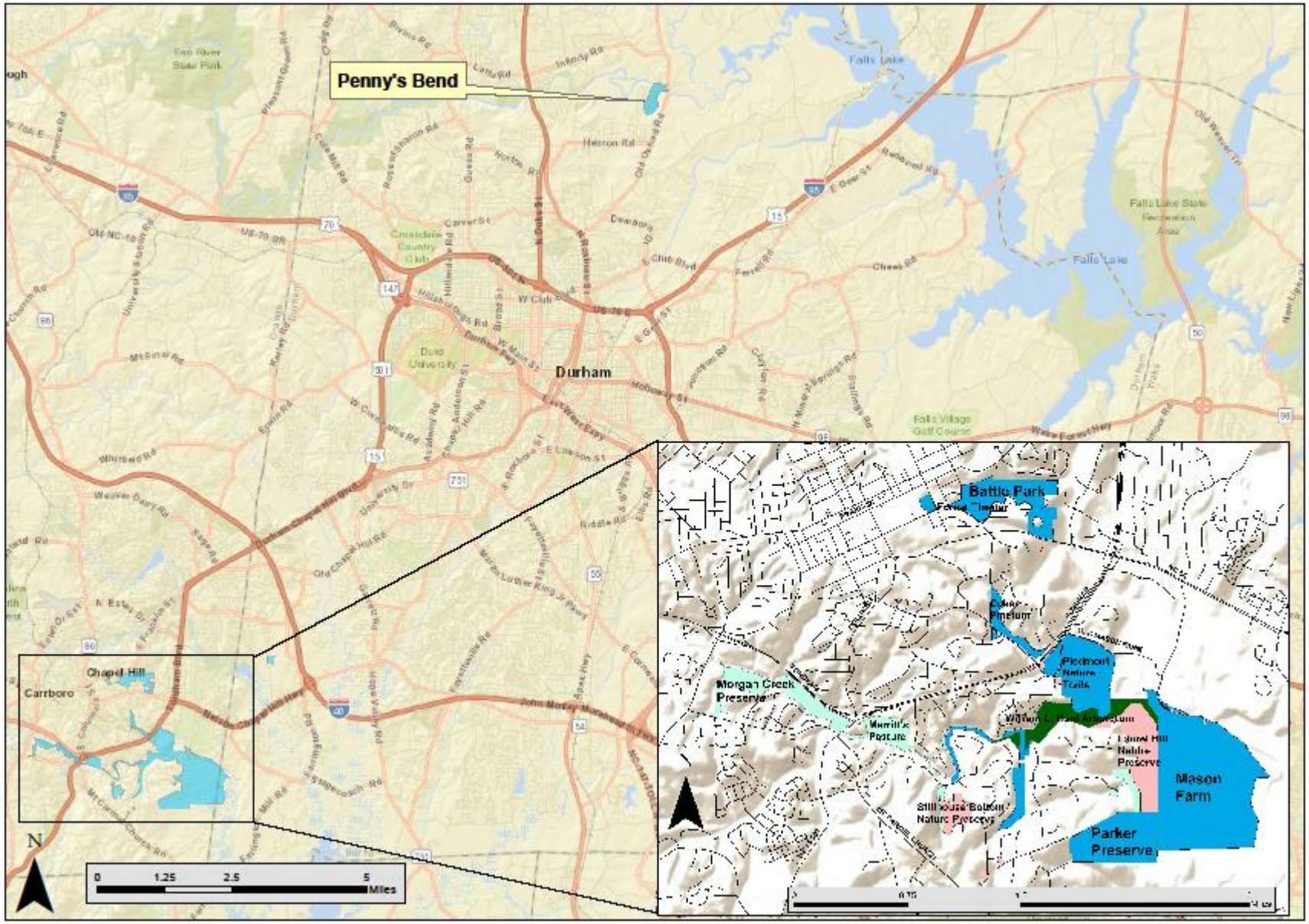
NCBG Display Gardens Map


Display Gardens
Allen Education Center
A Auditorium
B Visitor Information & Exhibits
• Garden Shop
• Plant Sale
• Library
C Classrooms
Gardens
1 Entrance Garden
2 Children's Wonder Garden
3 Courtyard Gardens
4 Piedmont Habitat
5 Sandhills Habitat
6 Coastal Plain Habitat
7 Mountain Habitat
8 Perennial Circle
9 Water Gardens
10 Carnivorous Plant Collection
11 Plant Family Garden
12 Totten Oak Garden
13 Herb Garden
14 Poisonous Plants Garden
15 Native American Garden
Landmarks
A Bird Blind
B Cattail Gate
C Turtle Pond
D Salamander Pool
E Storytellers' Chair
F Paul Green Cabin
G Rare Plant Chess Set
H Gathering Circle
I Herb House
J Rose Arbor
K Gazebo
Streamside Trail
Meeting-of-the-Waters Creek
Bike-Pedestrian Path
Streamside Trail
Totten Center (staff only)
Drop-Off
Picnic Area
Bus Parking
Bus Stop
Old Mason Farm Rd
NC 54 / Fordham Blvd
N
200 Feet
Key
Parking
Information Kiosk
Restroom
Drinking Fountain
Accessible Parking
Bicycle Accessible
Dog Walking Path
Bike Rack

Appendix B:

NCBG Managed Areas Map

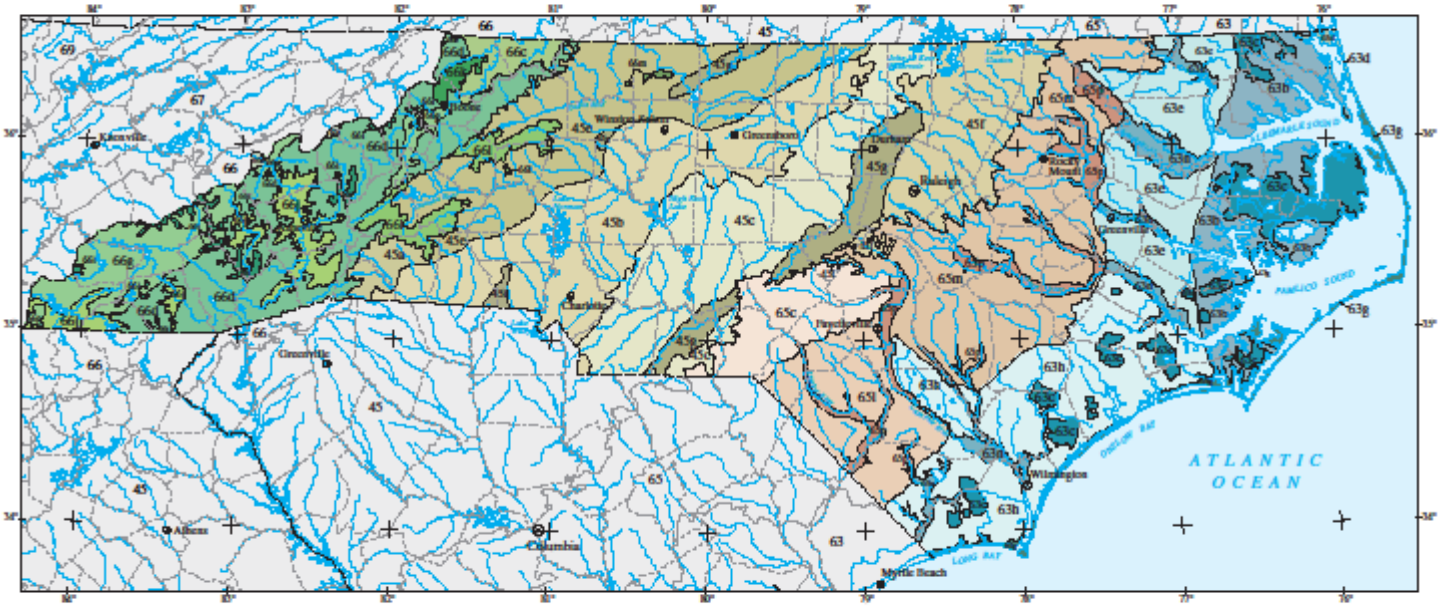
NCBG Managed Areas



Appendix C:

EPA Ecoregions of North Carolina

Ecoregions of North Carolina



45 Piedmont
- 45a Southern Inner Piedmont
- 45b Southern Outer Piedmont
- 45c Carolina Slate Belt
- 45e Northern Inner Piedmont
- 45f Northern Outer Piedmont
- 45g Triassic Basins
- 45i Kings Mountain

63 Middle Atlantic Coastal Plain
- 63b Chesapeake-Pamlico Lowlands and Tidal Marshes
- 63c Nonriverine Swamps and Peatlands
- 63d Virginian Barrier Islands and Coastal Marshes
- 63e Mid-Atlantic Flatwoods
- 63g Carolinian Barrier Islands and Coastal Marshes
- 63h Carolina Flatwoods
- 63n Mid-Atlantic Floodplains and Low Terraces

65 Southeastern Plains
- 65c Sand Hills
- 65l Atlantic Southern Loam Plains
- 65m Rolling Coastal Plain
- 65p Southeastern Floodplains and Low Terraces

66 Blue Ridge
- 66c New River Plateau
- 66d Southern Crystalline Ridges and Mountains
- 66e Southern Sedimentary Ridges
- 66g Southern Metasedimentary Mountains
- 66i High Mountains
- 66j Broad Basins
- 66k Amphibolite Mountains
- 66l Eastern Blue Ridge Foothills
- 66m Sauratown Mountains

- Level III ecoregion
- Level IV ecoregion
- County boundary
- State boundary

Ecoregions denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. They are designed to serve as a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. The approach used to compile this map is based on the premise that ecological regions can be identified through the analysis of the patterns of biotic and abiotic phenomena that reflect differences in ecosystem quality and integrity. These phenomena include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. The relative importance of each characteristic varies from one ecological region to another regardless of the hierarchical level.

The Ecoregions of North Carolina map was compiled at a scale of 1:250,000. Compilation of this map is part of a collaborative project primarily between the US EPA, USDA-NRCS, NC DENR, as well as with other state and federal agencies. Comments and suggestions regarding this map should be addressed to Glenn Griffith, USDA-NRCS, 200 SW 35th Street, Corvallis, OR 97333, (541) 754-4465, email: griffith.glenn@epa.gov, or to James Omernik, U.S. EPA - NHEERL, 200 SW 35th Street, Corvallis, OR 97333, (541) 754-4458, email: omernik.james@epa.gov.

Appendix D:

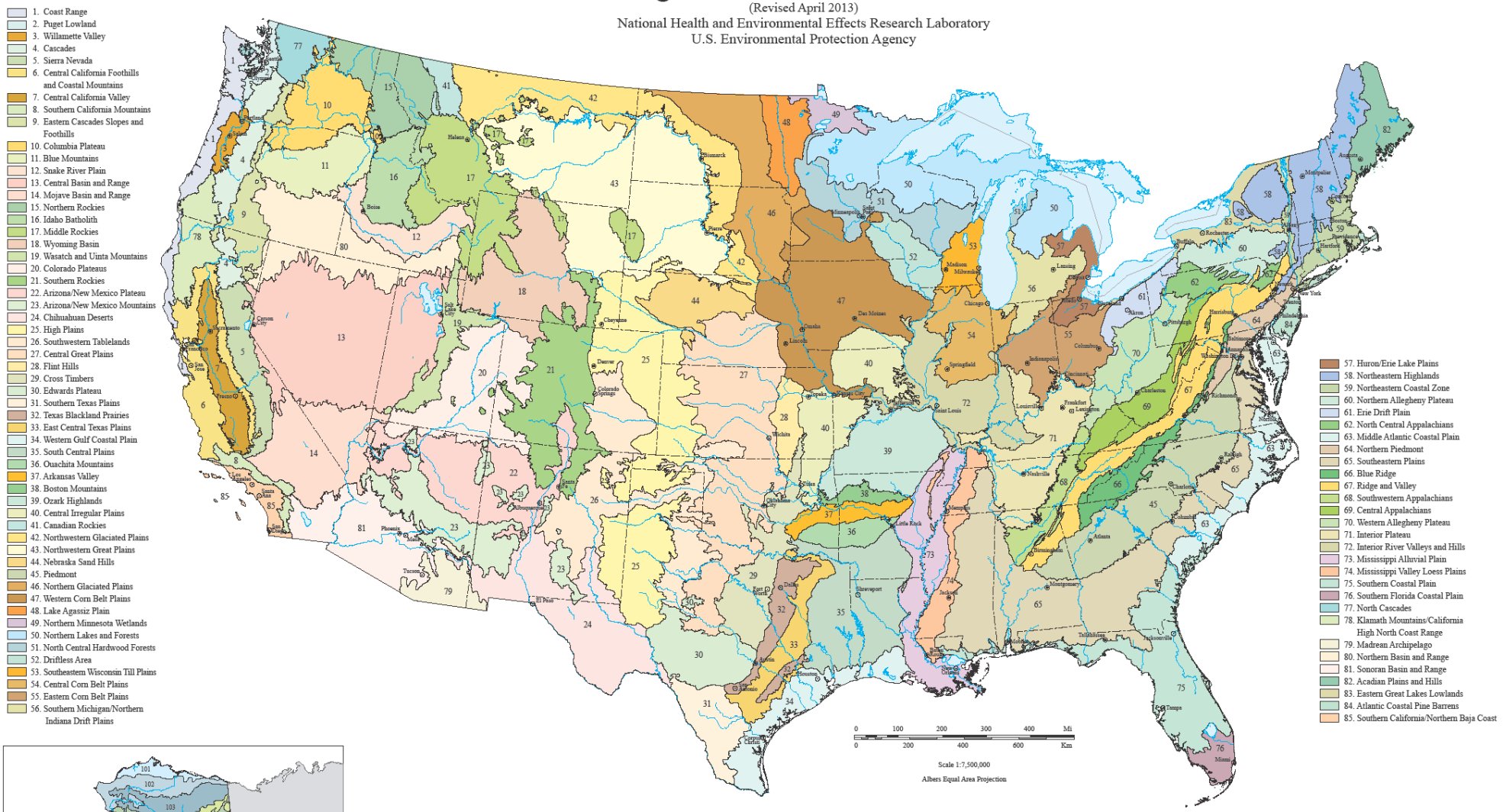
EPA Level III Ecoregions the United States

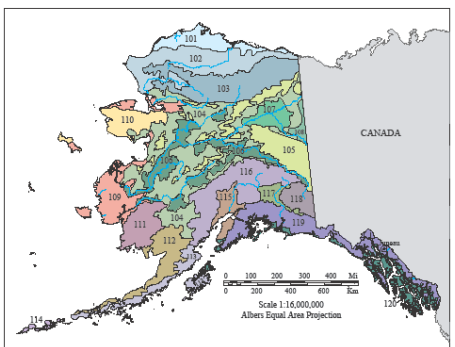
Level III Ecoregions of the Continental United States

(Revised April 2013)

National Health and Environmental Effects Research Laboratory

U.S. Environmental Protection Agency





Ecoregions are areas where ecosystems (and the type, quality, and quantity of environmental resources) are generally similar. This ecoregion framework is derived from Omernik (1987) and from mapping done in collaboration with U.S. EPA regional offices, other Federal agencies, state resource management agencies, and neighboring North American countries (Omernik and Griffith 2014). Designed to serve as a spatial framework for the research, assessment, and monitoring of ecosystems and ecosystem components, ecoregions denote areas of similarity in the mosaic of biotic, abiotic, terrestrial, and aquatic ecosystem components, with humans considered as part of the biota. These ecoregions have been used to develop regional biological criteria and water quality standards, set management goals for nonpoint source pollution, assess land cover trends, report on ecosystem carbon sequestration, and frame wildlife conservation research, among other applications.

Ecological regions can be identified by analyzing the patterns and composition of biotic and abiotic phenomena that affect or reflect differences in ecosystem quality and integrity (Omernik 1987, 1995). These phenomena include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology. The relative importance of each characteristic varies from one ecological region to another regardless of the hierarchical level. A Roman numeral classification scheme has been adopted for different levels of ecological regions. Level I is the coarsest level, dividing North America into 15 ecological regions; at Level II the continent is subdivided into 50 classes (CEC 1997, 2006). Level III, shown here, has 105 ecoregions in the continental U.S. For the conterminous United States, the ecoregions have been further subdivided to 967 Level IV ecoregions. Details about the ecoregions or their applications are explained in reports and publications from the state and regional projects (e.g., Bryce et al., 1998, 2003; Chapman et al., 2001, 2006; Gallant et al., 1989, 1995; Griffith et al., 2004, 2009, 2014; McGrath et al., 2002; Omernik, 2004; Omernik et al., 2000; Thorson et al., 2003; Wiken et al., 2011; and Woods et al., 1996, 2002, 2004). For additional information, contact James M. Omernik, USGS, c/o U.S. EPA, 200 SW 35th Street, Corvallis, OR 97333, phone (541) 754-4458, email omernik.james@epa.gov; or Glenn Griffith, USGS, c/o US EPA, 200 SW 35th Street, Corvallis, OR 97333, phone (541) 754-4465, email ggriffith@usgs.gov.

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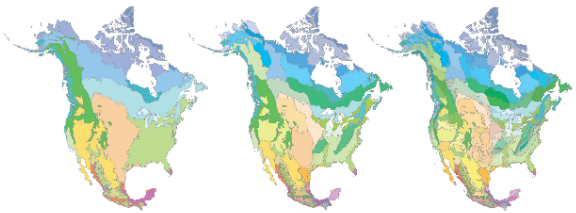
ECOLOGICAL REGIONS OF NORTH AMERICA



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Appendix E:

Summary of CPC Seed Collection Guidelines

North Carolina Botanical Garden

Summary of CPC Seed Collection Guidelines (2004)

OVERALL SAFE COLLECTION RULES:

- Collect only 10% of seeds in 10% of years for any single population (10/10 rule). Observe this rule over any of the other guidelines listed below!
- *Unsafe collection is 50% of seeds in 50% of years for any given population (50/50 rule). This level of collection is likely to drive a population to extinction.*

HOW MANY POPULATIONS SHOULD I COLLECT FROM?

- Up to 50 populations of each species. We hope to collect from *5 wild populations* of each species in the CPC National Collection.
  - If there are fewer than 50 populations, collect from as many as resources allow, up to all 50.
  - If there are more than 50 populations, collect from as many populations as is practical, up to 50.
- Collect first from the largest and most secure populations.
- It is better to collect fewer seeds from many populations than collect many seeds from fewer populations.
- If you are visiting populations often, space your collections over time and years.

HOW MANY INDIVIDUALS SHOULD I COLLECT FROM?

- Up to 50 individuals of each population. Our target is to collect from *50 individuals* in each population, or from all individuals if there are < 50.
  - If there are less than 50 individuals in a population, an effort should be made to collect from *all* individuals over time (but only 10% each year).
  - If there are more than 50 individuals, collect from 50 individuals.
- Maintain in *separate envelopes* seeds from each individual plant (maternal line) that you collect from. We can supply these if you need them.
- Try to avoid oversampling from the largest and most fecund of plants.
- Try to sample plants on both the perimeter and interior of the population, or implement a stratified random sampling method to obtain an even sample.

HOW MANY PROPAGULES SHOULD I COLLECT?

- Up to 20 propagules (seeds) per individual, *not to exceed* 10% of total seed produced by the population in a given year. The number of seeds collected from each plant will also depend on the species and conditions that year.
- Keep newly collected seeds cool and dry. A cooler with a dry shelf or air tight containers works well to keep seeds cool on hot days.
- Use separate paper envelopes or paper bags for each individual plant.
- Don't wrap seeds in plastic or leave them on the dashboard of your car.
- Don't collect seeds in the rain or right after a rain, when humidity is high.

Appendix F:

Plant Collection Permission Form

North Carolina Botanical Garden

Plant Collection Permission Form

The holder of this form is an authorized plant collector for the North Carolina Botanical Garden at The University of North Carolina at Chapel Hill. Plants and plant propagules (seeds, cuttings, roots, bulbs, corms, etc.) collected on your property with your permission may be used by NCBG in its research, propagation, or in its botanical garden.

By filling out and signing this form, you give our authorized collector permission to collect plants or plant propagules of one or more plant species – per your instructions – on your land.

By signing this form, the North Carolina Botanical Garden's authorized collector agrees to abide by all comments or restrictions included on this form.

Date: _____

Landowner (or authorized agent) name: _____

Address: _____

City: _____ State: _____ Zip Code: _____

Comments or restrictions: _____

_____

_____

_____

Landowner (or authorized agent) signature:

_____

Plant Collector's printed name and signature:

_____

Appendix G:

Field Collection Data Sheet

NCBG - FIELD COLLECTION DATA SHEET

(to be completed for all off-site collections)

Date entered into GRIM:

_____

COLLECTION INFORMATION

Scientific name: _____

Collector(s) name: _____

Collector(s) affiliation (if not NCBG): _____

Collection location: _____

EPA Level III Ecoregion: _____

USDA symbol: _____ **Collection Date**: _____

NCBG collection #: _____

Lat: _____° _____' _____" **Long:** _____° _____' _____" **Elevation:** _____

Form: ____ seed ____ cutting ____ bulb/corm ____ division ____ plant ____spore

Quantity Collected: _____ **Condition of collection:** _____

POPULATION INFORMATION

Population size: ____ 1-10 ____ 11-50 ____ 50-100 ____ 101-500 ____ >500

Species abundance: ___ dominant ___ abundant ___ very common ___ common ___ frequent ___ occasional ___ infrequent ___ rare ___ scattered ___ unknown

Area covered: _____ m^2 / acres (circle one)

HABITAT INFORMATION

Exposure: ___ full sun ___ ¼ shade ___ ½ shade ___ ¾ shade ___ full shade

Slope: ____ flat ____ gentle ____ steep ____ cliff **Aspect:** _____

Habitat description: _____

Moisture: ___ dry ___ moist ___ wet ___ seasonally moist **Soil type:** _____

Associated species: _____

_____

NOTES / COMMENTS:

Appendix H:

Plant Material Acquisition Form

North Carolina Botanical Garden

Plant Material Acquisition Form

(to be completed for any plant material that is either donated or purchased from outside nurseries, vendors, or other sources)

Species Name	**Propagule Type** (ie.seed, cutting, whole plant)	**Number of propagules** (if known)	**Size** (ie. container size)	**Origin of Plant Material** (include provenance when known)	**Cost** ($0 if donated)

Comments:

Donor or Vendor: _____ Phone: _____

Address: _____

Donor / Vendor Contact Person: _____ E-mail: _____

Receiving NCBG staff: _____ Date received: _____

Appendix I:

Accessions Record Sheet

NCBG – ACCESSIONS RECORD SHEET

(to be completed for all plants planted into the Garden)

Date entered into GRIM: _____

ACCESSION INFORMATION

Accession #: _____ **Accession date:** _____

Lineage # (original genetic material that came to NCBG)**:** _____

USDA symbol: _____ **Species name:** _____

Form (ex. plant, rhizome, seed, etc.): _____ **Quantity:** _____

Container (bare root, pot, etc.):_____ **Size:** _____

Condition: _____

NCBG Collection # (collected material this specific accession was derived from)**:**

_____

Provenance type: ___ wild-collected ___ cultivated but of known wild origin ___ cultivated

Propagation history: (info from plant tag) _____

Intervening accession codes (any previous accessions b/w Lineage # and current Accession #)**:**

_____

Does this accession contain sensitive information: Y / N

Reason for accession: _____

Receiving staff member: _____

LOCATION(s) PLANTED:

Loc – grid code: _____ **#plts:** _____ **Loc – grid code:** _____ **#plts:** _____

Loc – grid code: _____ **#plts:** _____ **Loc – grid code:** _____ **#plts:** _____

Date planted: _____ **Planted by:** _____

Additional notes associated with planting: _____

_____

STATUS / LOCATION UPDATE:

 # changed: _____ **Moved from:** _____ **Moved to:** _____

Date changed: _____ **Condition:** _____

If dead, reason why: _____

Has this accession been deaccessioned: Y / N **Additional notes:** _____

_____

Appendix J:

Policy on Botanical Nomenclature

North Carolina Botanical Garden

Policy on Botanical Nomenclature

July 2017

Accepted Authorities

Authority for Scientific Names
The *Flora of the Southern and Mid-Atlantic States* (Weakley, 2015) is the taxonomic authority for the North Carolina Botanical Garden (NCBG). In those cases where the taxon is not included in the *Flora of the Southern and Mid-Atlantic States,* the *Plants Database* (USDA, NRCS. 2017) will serve as the Garden's taxonomic authority.

Authority for Common Names
There are no rules governing the application of common names and there is no formal process for their application. It is usually not possible to determine when a common name was first used and the identity of the plant or plants to which it was applied. There is no single published authority on common names that is recognized by NCBG. For any taxa for which no preferred common name has been selected, it is recommended that the most widely recognized common name be used. For species with records in the NCBG Plant Database, the common name assigned the number one priority will be the preferred common name for use at NCBG.

Nomenclatural Guidelines

Scientific Names
All scientific names have three components. For example: ***Quercus alba* L.**

1. ***Quercus*** is the genus name for the group of related species commonly known as oaks. The first letter of the genus is always capitalized and the entire word is either italicized or underlined. Note that after the first time the genus is spelled out in a written article, it may be abbreviated by the first letter in subsequent use (ex. *Q. alba*). The NCBG convention is to always italicize the genus.

2. ***alba*** is the specific epithet and is Latin for white (descriptive of the bark and wood of the plant commonly known as white oak). Like the genus, the specific epithet must be either italicized or underlined. Unlike the genus, it should be written in lowercase although the firslt letter can be capitalized if it is derived from a person's name, a former generic name or a common name. The NCBG convention is to always italicize the specific epithet and to always write it in lowercase.

3. **L.** is the authority and is an abbreviation of the name of the person who first described the plant. In this case, L. stands for Linneaus who first coined a formal name for this oak species. A publication called Index Kewensis provides references to original descriptions

by author. The NCBG convention is to leave off the authority unless the scientific name is being used in a peer-reviewed scientific publication.

In addition to these three components, scientific names may also include one or more of the following additional components:

a) Variety, the descriptor is written as "var." and is not italicized, underlined, or capitalized
b) Subspecies, the descriptor is written as "ssp." and is not italicized, underlined, or capitalized
c) Undetermined species, the descriptor is written as "sp." and is not italicized, underlined, or capitalized.
d) Undetermined multiple species, the descriptor is written as "spp." and is not italicized, underlined, or capitalized.

Common Names

Common names are not italicized or underlined. When a common name stands alone such as on plant labels, plant sale signage, online plant detail page or similar, the NCBG convention is to capitalize the first letter of all the words in a common name not preceded by a hyphen.

Examples: Boxelder
Maidenhair Fern
Florida Bear-grass
Hopi-tea
Rocky Mountain Bluebells

When the common name is embedded in text such as in a newsletter or magazine article, a written description, or similar, the NCBG convention is to follow standard grammatical rules for capitalization (beginning of a sentence, proper name or noun, etc.)

Examples: Longleaf pine is a sight to behold when it is mixed with savannah iris, wiregrass, Venus flytrap, hooded pitcher plant, and St. Andrew's cross.

Plant Family Names

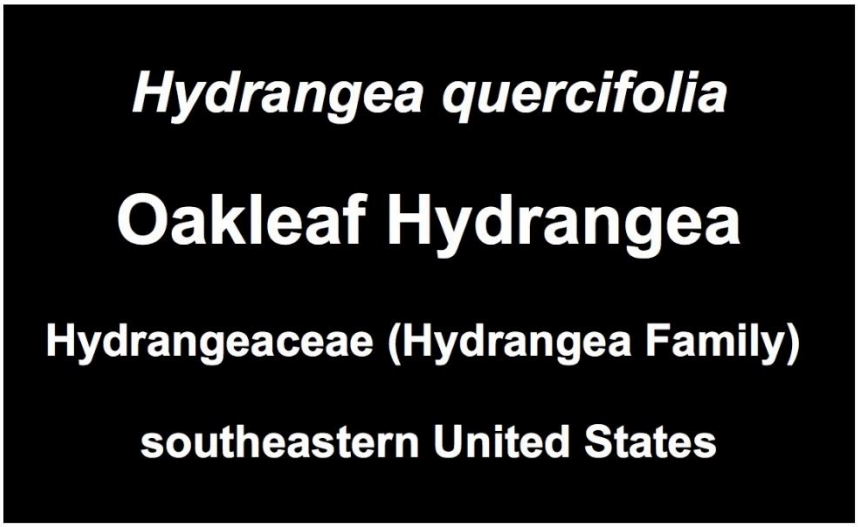
Family names are not italicized or underlined. The NCBG convention is to capitalize the first letter of all the words in the common or Latin family name not preceded by a hyphen. In written form, the Latin family name should appear first followed by the common family name in parentheses.

Examples: Asteraceae (Sunflower Family)
Balsaminaceae (Touch-me-not Family)
Lygodiaceae (Climbing Fern Family)

Applications

Garden labels

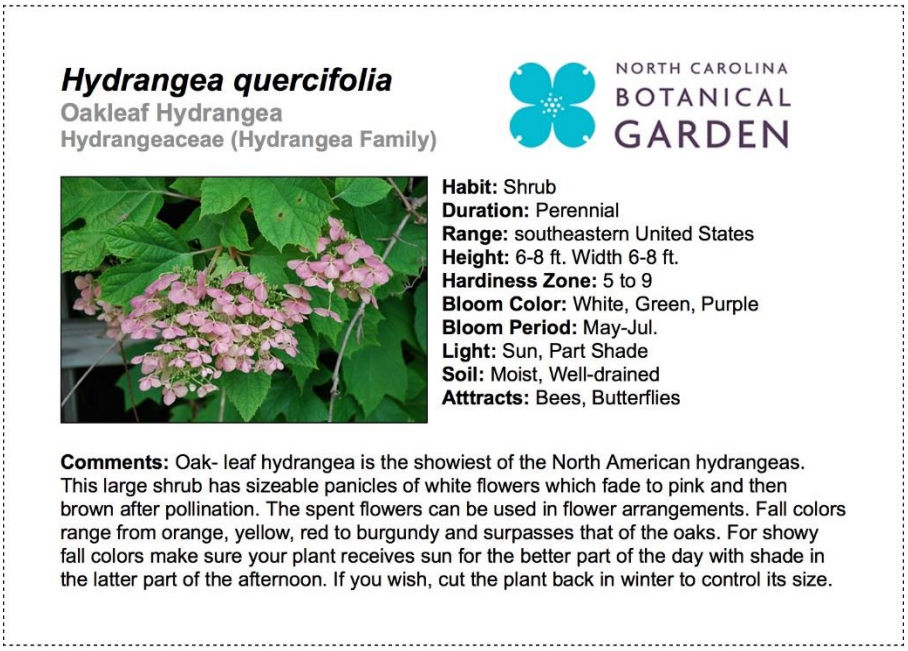
Garden labels are found throughout the garden and are the primary way to provide information to visitors about the plants contained within the collections. Scientific name is listed first in italics. A single common name is given below the scientific name. The Latin family name and the common family name in parentheses are given next followed by the species range. A sample label (not to scale) is provided below:



To access and print garden labels, log in to the maintenance section of the NCBG Plant Database (http://www.wotas.org/maintenance) and select a special collection from the drop down list. Garden labels for the entire collection or for a single species within the collection can be printed from the collections maintenance page.

Plant Sale Signs

Plant sale signs are used to give visitors information about plants that are available for purchase at the daily plant sale outside the Garden Shop and at biennial plant sales. Scientific name is listed first since plant sales are organized alphabetically by Latin name. Format of the plant sale label may vary depending on the availability of cultural information and other interesting information about the species. A sample plant sale sign is given below:



To access and print plant sale signs, log in to the maintenance section of the NCBG Plant Database (http://www.wotas.org/maintenance) and select a special collection from the drop down list. Plant sale signs for the entire collection or for a single species within the collection can be printed from the collections maintenance page.

Online and in Print

Photo captions, interpretive signs, Conservation Gardener magazine, website, e-newsletter, brochures and all other promotional material should present the scientific name first, followed by the common name in parentheses. Unless it is a peer-reviewed scientific publication, it is not necessary to include the author citation as part of the scientific name. In cases where a particular species is mentioned multiple times, it can be referred to by the common name after the first use.

References

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Appendix K:

Exotic Plant Policy and Procedures

North Carolina Botanical Garden

Exotic Plant Policy and Procedures

November 1998 (revised August 2017)

Introduction and General Policy Statement

Invasive exotic plant species have negatively affected the natural function of ecosystems, agriculture, and human health, world-wide. Humans have and continue to accidentally or purposefully homogenize the world's flora and have forced unlikely species interactions, many of which cause ecological disruption. The deliberate introductions of certain notorious invasive exotics to the southeastern United States, such as *Pueraria montana* (kudzu), *Ligustrum sinense* (Chinese privet), bamboo grass (*Microstegium vimineum*), and Japanese honeysuckle (*Lonicera japonica*), continue to be disruptive and have naturalized to the extent that they are now inextricable from the local landscape. Despite the acute awareness of the negative ecological consequences of invasive exotics, many botanical gardens and arboreta continue to be a source of potentially invasive exotic plant material.

A primary mission of the North Carolina Botanical Garden is "to participate in and promote the conservation of biological diversity." In accordance with this mission statement, our policy with regard to exotic plant species at the North Carolina Botanical Garden is to:

- **possess plant collections that do no harm natural to areas and the native plant diversity of North Carolina and the Southeast**
- **protect and restore our Garden's highest quality natural areas by eradicating invasive exotic species**
- **interpret and promote the natural diversity of North Carolina and the Southeast**
- **promote the preservation of native biodiversity**

Native Southeastern U.S. Taxa

Organisms evolve in response to the physical, chemical, climatalogical and biological processes characteristic of a particular region. Native species are those taxa that occur in the region, or regions, where they evolved. (Within a region there may be local site adaptations that create ecotypes and other subspecific taxa.) The Nature Conservancy divides the continental United States into 63 ecological regions ("ecoregions"), based on climate and geology, rather than by artificial political boundaries. Roughly eight ecoregions occur in the southeastern U. S. that are either partly or wholly in the states of Alabama, Arkansas, Delaware, the District of Columbia, Florida, Georgia, Kentucky, Louisiana, Mississippi, Maryland, North Carolina, Pennsylvania, South Carolina, Tennessee, and Virginia. We consider **any plant taxon that occurs within these ecoregions as native to the southeastern US., and those that occur outside of these boundaries as exotic.**

We will determine which taxa are native to the southeastern U.S. based on the available floristic assessments of this region that began in the early 1500s. Thus, native species are roughly those taxa that occurred in the southeast at the time of European exploration. We will make determinations using the available literature, primarily the *Synthesis of the North American Flora* (Kartez and Meacham, 1999) and other regional and local floras. Determinations of uncertain taxa will be made by consulting with the appropriate primary literature sources and/or individual systematists.

Exotic Species Versus Invasive Exotic Species

According to Executive Order 13751 (2016), an **exotic species** (also called alien, introduced, non-native, and non-indigenous species) is defined as an organism "whose seeds, eggs, spores, or other biological material capable of propagating that species, that occurs outside of its natural range." **Invasive exotic species** are "non-native organisms whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health."

It is sometimes difficult to draw a clear distinction between benign exotics and invasive exotics. Benign exotics include, for the most part, plant species that depend on humans for their survival (i.e., most cultivated plants). Invasive exotics, as aforementioned, threaten native plants because they can survive and reproduce without human intervention, and have become naturalized. A continuum exists between these two extremes and serves to complicate benign or invasive exotic determination. Moreover, a seemingly benign exotic species can become invasive if, for example, it begins to produce fruits that it did not previously form because a specific pollinator was absent (e.g., strangler figs in south FL). On the other hand, an invasive exotic species can become less invasive if it incurs a sufficient predator and/or pathogen load sufficient to limit its spread in natural areas (e.g., *Opuntia* in Australia).

Definitions Summary

Southeastern US Native - An indigenous, regionally native, taxon.

Exotic – An organism, including its seeds, eggs, spores, or other biological material capable of propagating that species, that occurs outside of its natural range. Exotic is synonymous with the terms non-native, alien, non-indigenous, and introduced.

Invasive exotic - An exotic species whose introduction causes or is likely to cause economic or environmental harm, or harm to human, animal, or plant health.

Existing Collections and Future Plant Accessions

The accession procedures for all plants, including exotics, is covered under the Living Collections Policy, adopted September 1, 2017. Our policy regarding known invasive exotics is that **we shall remove invasive exotic species from existing collections and prevent accession**

of any exotic plant known to be invasive. Furthermore, we will only introduce plant species to cultivation that are native to the southeastern United States.

Some areas of the Garden traditionally contain exotic species, such as the Coker Arboretum, Plant Families Garden, and Herb Garden. In these areas we will continue to be judicious in selecting new plant material, **will use native plants wherever possible, and strive to promote native plant cultivars and select varieties**. This will enable us to demonstrate to the public that spectacular native landscape material is available. (Appreciation for native biodiversity can also be gained by the public through interpretation of our exotic plant species policy and procedures.)

For exotic plant accessions, where limited or incomplete information is available regarding invasiveness, we will use screening devices to **identify the potential for invasiveness with a risk assessment scheme based on species life history traits** (currently in progress)**. We will create an invasive plant database from these data that will also include exotics already known or suspected to be invasive.** This database will be made available to other botanical gardens and arboreta, the nursery industry, and to the general public.

Appendix L:

Policy on the Sale of Rare Plant Species

North Carolina Botanical Garden

Policy on the Sale of Rare Plant Species

July 2008 (revised August 2017)

The overriding policy of the North Carolina Botanical Garden is that its activities will support the conservation of the plants and natural areas in North Carolina and the Southeast. Our sale and promotion of horticultural use of rare plants shall be accepted when these activities benefit conservation goals and will be rejected when these activities compromise conservation goals.

The potential conservation benefits of the commercial availability of rare plants are these:

> These plants are accompanied by educational materials that teach the significance, status, and conservation strategies for rare plants. Accompanying materials may include information about the plant's life history and ecology, the importance of genetic diversity, the ecology of their habitats, their threats in the wild, and the conservation programs of the Garden.
>
> Growing rare plants provides direct experience in seed storage, germination requirements, and general cultivation practices.
>
> Commercialization of rare plants can lessen the pressure on the collection of species from the wild. Examples include medicinal plants and plants prized by hobbyist collectors like carnivorous plants.

Despite these potential benefits, rare plants grown in horticulture (with the exception of those carefully done for *ex situ* conservation programs) are not conservation collections. They are not designed to capture genetic diversity (plants in horticulture usually include small numbers of individuals or individuals selected for horticultural traits), are recent plantings that may not be adapted fully to the site where used, they have an uncertain future (site owners, horticultural aims, or budgets for landscaping may change through time), and rare plants often lack the co-evolutionary relationships (e.g., pollinators and seed dispersers), that they would possess in natural populations. No species is an island – conservation must always address the community of organisms in a natural habitat rather than a species separated from its ecological context.

There are few and fortuitous cases in which the only remaining individuals of a species thought extinct in the wild are discovered in cultivated collections. Even in these cases, however, the outcome is not the result of a planned conservation strategy and the individuals are likely to be too few to capture much of the genetic diversity of the original wild population. While such plants as *Franklinia* and *Ginkgo* have been celebrated as species saved from extinction by gardeners, we cannot rely on horticultural activities to do what is needed to protect plant diversity. Horticulture results in selections directed towards plants that are considered beautiful, interesting, or useful, obviously a subset of the endangered flora.

We note also that the coming decades of climate change and the continued impacts of human land use may mean that new populations of rare species must be established on sites from which the plant is not known historically. Sometimes called "assisted migration" or "managed relocation," gardeners and horticulturists may be important in such projects in the future. Once again, however, we note that this has to be done as part of a carefully done conservation strategy in which genetic diversity, population size, and ecological habitat requirements are considered. It is not simply a function of horticultural availability and use.

The potential problems of the commercial availability of rare plants are several fold:

> Some species are regulated by State or Federal agencies, requiring permits for their sale or possession. Selling these plants would increase the paperwork burden of those charged with this regulation. And there is no assurance that the "paper trail" will accompany these plants into the future.
>
> Some species may be unknown from the State of North Carolina. Persistent cultivated collections, particularly if they spread away from the sites of cultivation, may result in time and energy being drawn away from other duties for research botanists, the state Heritage Program, and the North Carolina Plant Conservation Program.
>
> Even if the rare plant is documented in the State's flora, persistent cultivated collections, particularly if they spread away from sites of cultivation, can lead to uncertainty for the state Heritage Program and the North Carolina Plant Conservation Program in terms of populations for protection and restoration.
>
> Some species may cause gene flow to natural populations, potentially resulting in outbreeding depression.
>
> The public and government leaders may be misled to conclude that cultivated plants can replace the need to conserve species in the wild, in natural habitats, and without the biological and ecological associations required for sustained population viability.
>
> There is also an ethical argument. If a plant is "rare" because of human activities, such as through habitat alteration, is it ethical to use rarity as an advertisement for its sale?

It follows from the potential benefits and problems that each rare plant considered for sale at the North Carolina Botanical Garden be assessed. We will only sell rare plants, determined by the global and state status categories of The Nature Conservancy and the NC Plant Conservation Program, if the assessment shows that there is the potential for little or no harm to conservation goals.

We will sell North Carolina S1-ranked species and Southeastern native plants that are not present in North Carolina based on global ranking and status throughout their range rather than their ranking in any particular state. For example, NCBG will sell plants listed as S1 in NC if they are more widespread elsewhere and are not state-listed over their range.

Beyond the regulated species, the most endangered species globally are presumed those in the G1/G2 (and some G3) categories of The Nature Conservancy and those proposed for Federal listing under the Endangered Species Act. These lists are also likely to change through time, so the list of species subject to this policy would also change through time.

Appendix M:

Seed Distribution Policy

North Carolina Botanical Garden

Seed Distribution Policy

1998

Exotic species invasions have become one of the dominant threats to the natural plant diversity of wild areas. While the North Carolina Botanical Garden has historically emphasized native plants and restricted the use of exotic pest plants, we must remember that our southeastern native plants may be someone else's exotic invader. Therefore, we have chosen to limit our distribution of seeds to within a 12-state region of the Southeast, from the Mississippi River to the Atlantic Ocean and from the Gulf of Mexico north to Kentucky, West Virginia, Maryland and Delaware. Our goal is to reduce the risk of new exotic plant invasions that impact our natural areas and to encourage the use and appreciation of native plant seeds from local sources.

Our hope is that this revised seed distribution policy will result in an increased appreciation of a region's unique local flora and nurture the growth of all regional botanical and horticultural institutions throughout the country.