Forest Systems:
The Understory

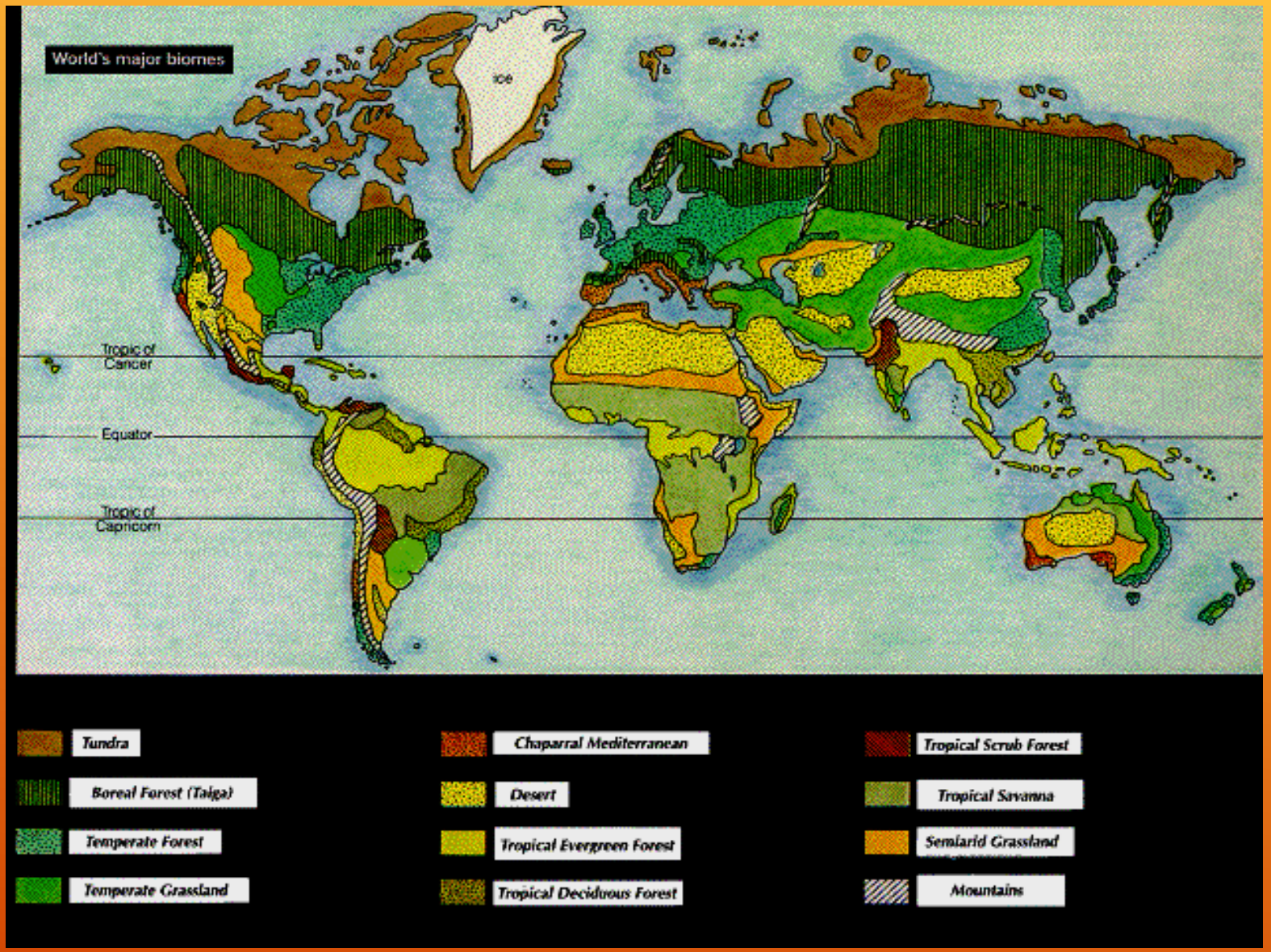
NC Master Naturalists - 2025

Johnny Randall
Director of Conservation (Retired)
North Carolina Botanical Garden

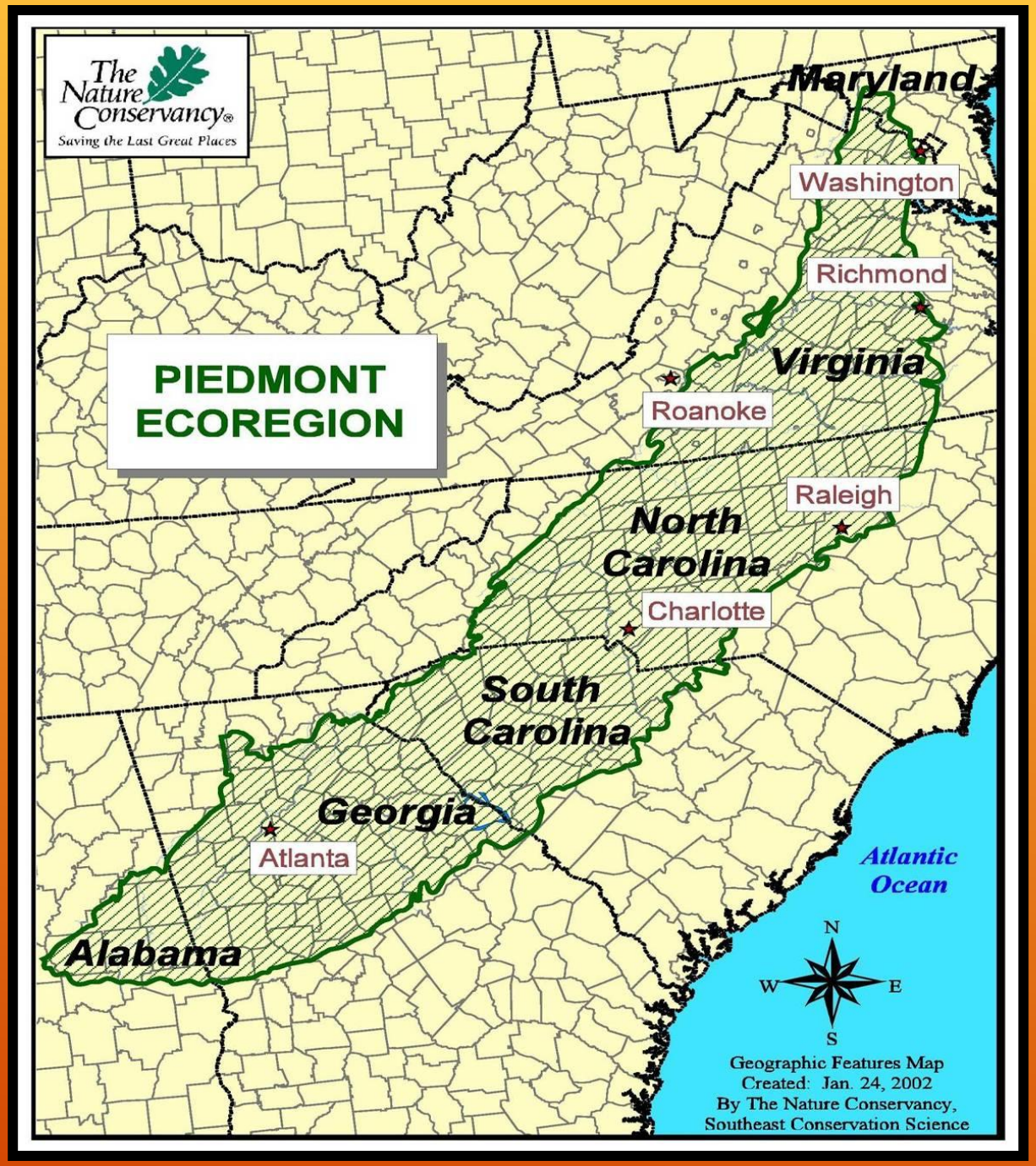
THE UNDERSTORY OUTLINE

- The nature of the understory
  - Biomes and ecoregions
  - Forest structure and ecology
- Some Piedmont forest types
- Understory composition
- Invasive species threats
- Piedmont Nature Trails field trip (*brrrrrrrrr*)
- Understory trees, shrubs, vines, herbs, bryophytes, ferns, and your understory thoughts

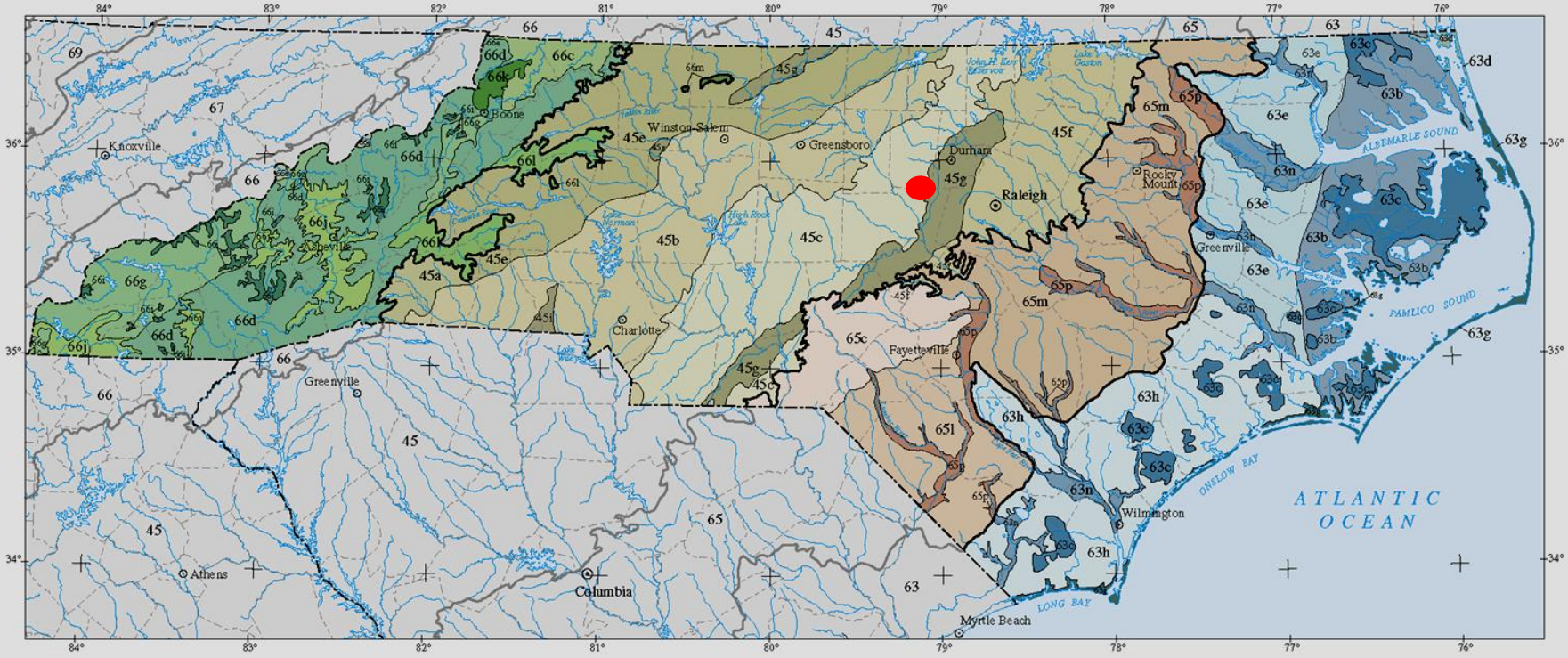
GLOBAL BIOMES



NORTH AMERICAN ECOREGIONS


The Nature Conservancy
Saving the Last Great Places
PIEDMONT ECOREGION
Maryland
Washington
Richmond
Virginia
Roanoke
Raleigh
North Carolina
Charlotte
South Carolina
Georgia
Atlanta
Alabama
Atlantic Ocean
N
W
E
S
Geographic Features Map
Created: Jan. 24, 2002
By The Nature Conservancy,
Southeast Conservation Science

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

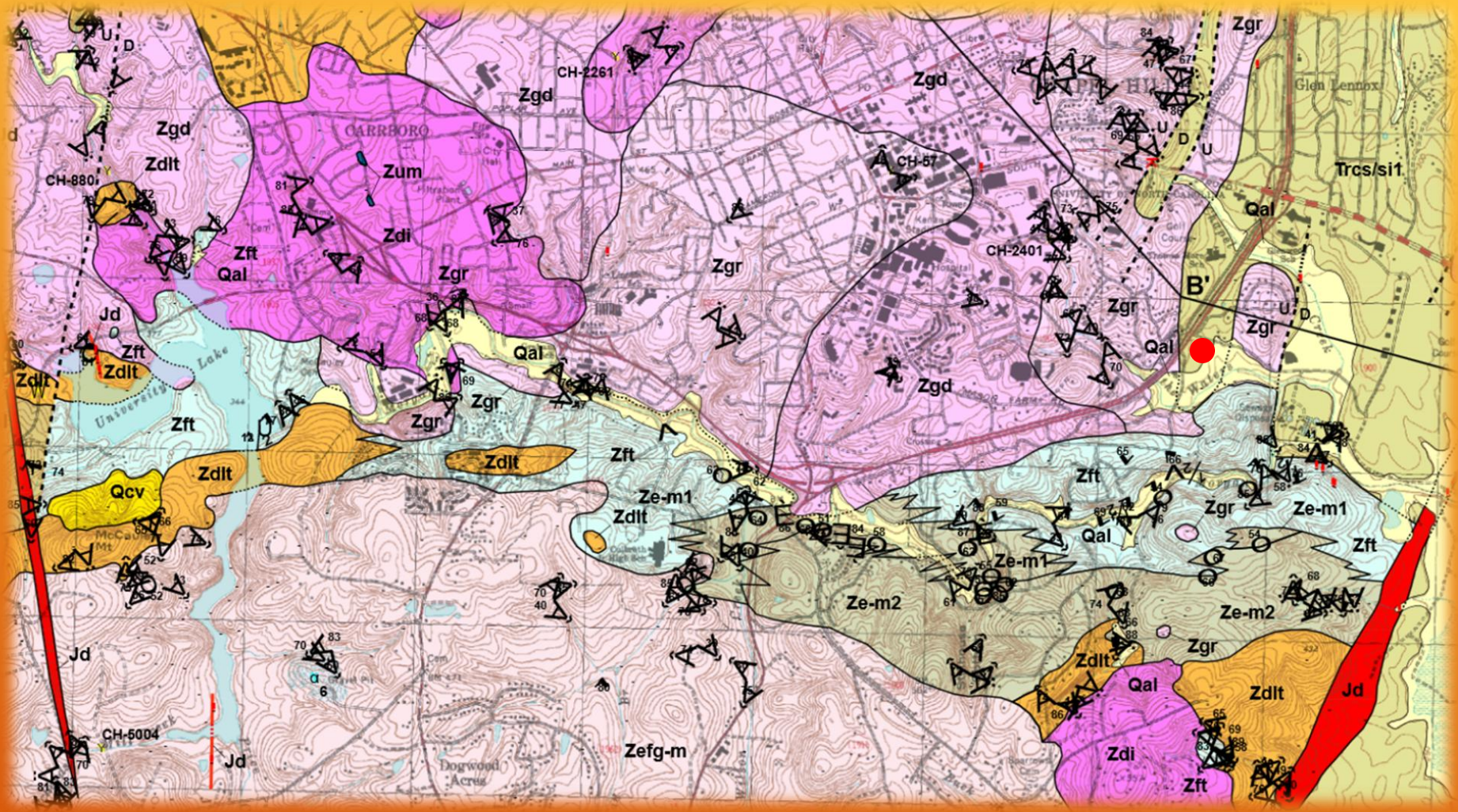
66 Blue Ridge
- 66c New River Plateau
- 66d Southern Crystalline Ridges and Mountains
- 66e Southern Sedimentary Ridges
- 66g Southern Metasedimentary Mountains
- 66i High Mountains
- 66j Broad Basins
- 66k Amphibolite Mountains
- 66l Eastern Blue Ridge Foothills
- 66m Sauratown Mountains

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

15 10 5 0 30 60 mi
30 20 10 0 60 120 km
Albers Equal Area Projection

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.

A complex geology



Zgd – Granodiorite
Zgr – Granite
Zft – Felsic tuffs

Zdlt – Dactic lava and tuffs
Ze-m1&2 – Siltstones and sandstones
Qual – Alluvium

Zum - Ultramafic
Jd - Diabse
Zdi - Diorite

Soils here and everywhere…

Search

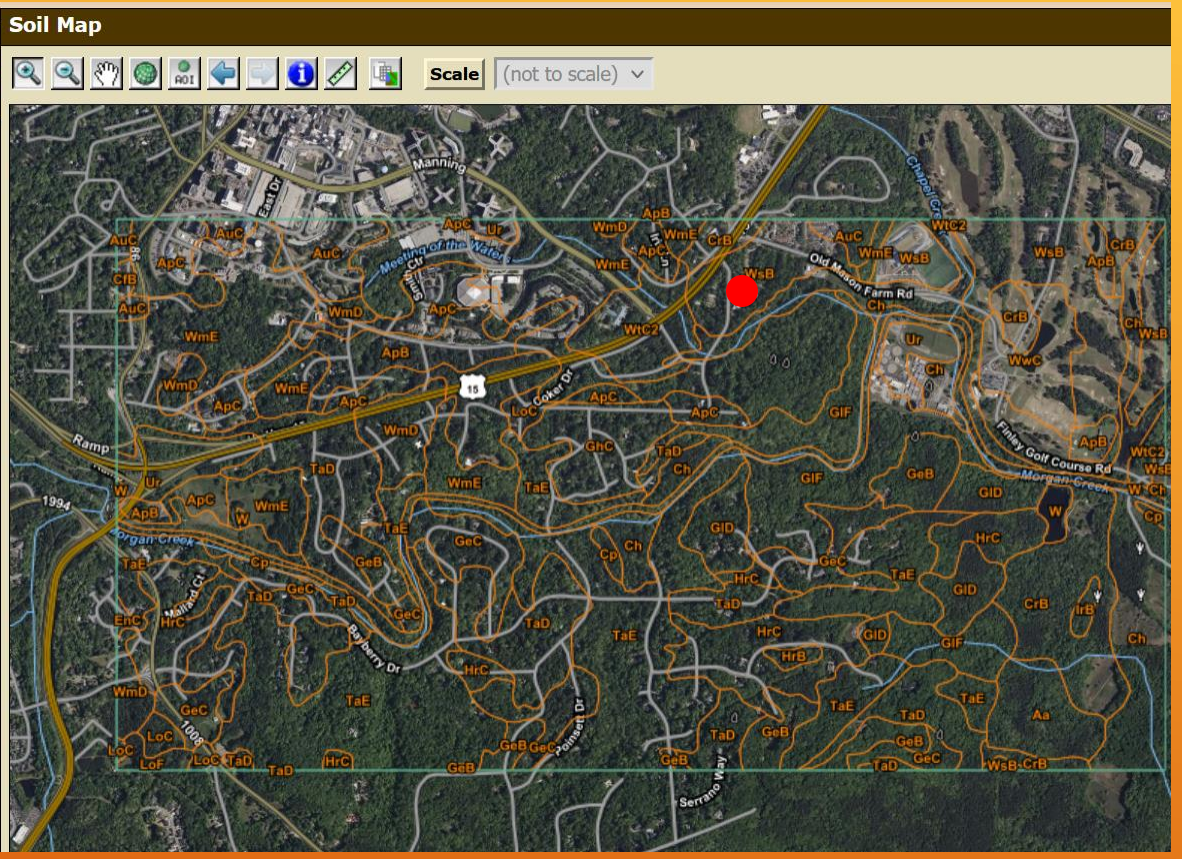
Map Unit Legend

Orange County, North Carolina (NC135)

Orange County, North Carolina (NC135)

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Aa	Altavista fine sandy loam, 0 to 3 percent slopes, occasionally flooded	29.6	1.5%
ApB	Appling sandy loam, 2 to 6 percent slopes	53.8	2.7%
ApC	Appling sandy loam, 6 to 10 percent slopes	112.1	5.6%
AuC	Appling-Urban land complex, 2 to 10 percent slopes	36.7	1.8%

Legend

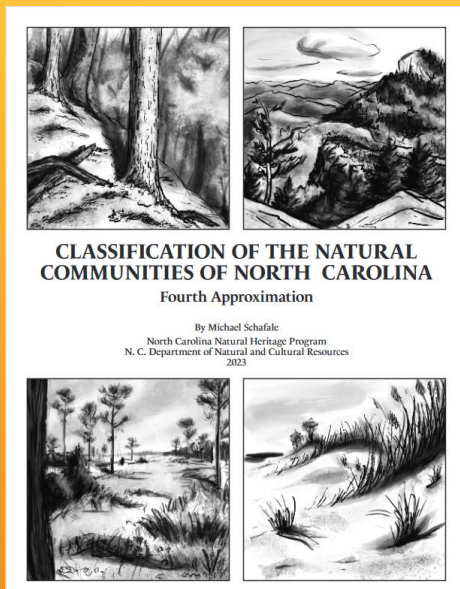


35 different soil types in the "area of interest."

https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm

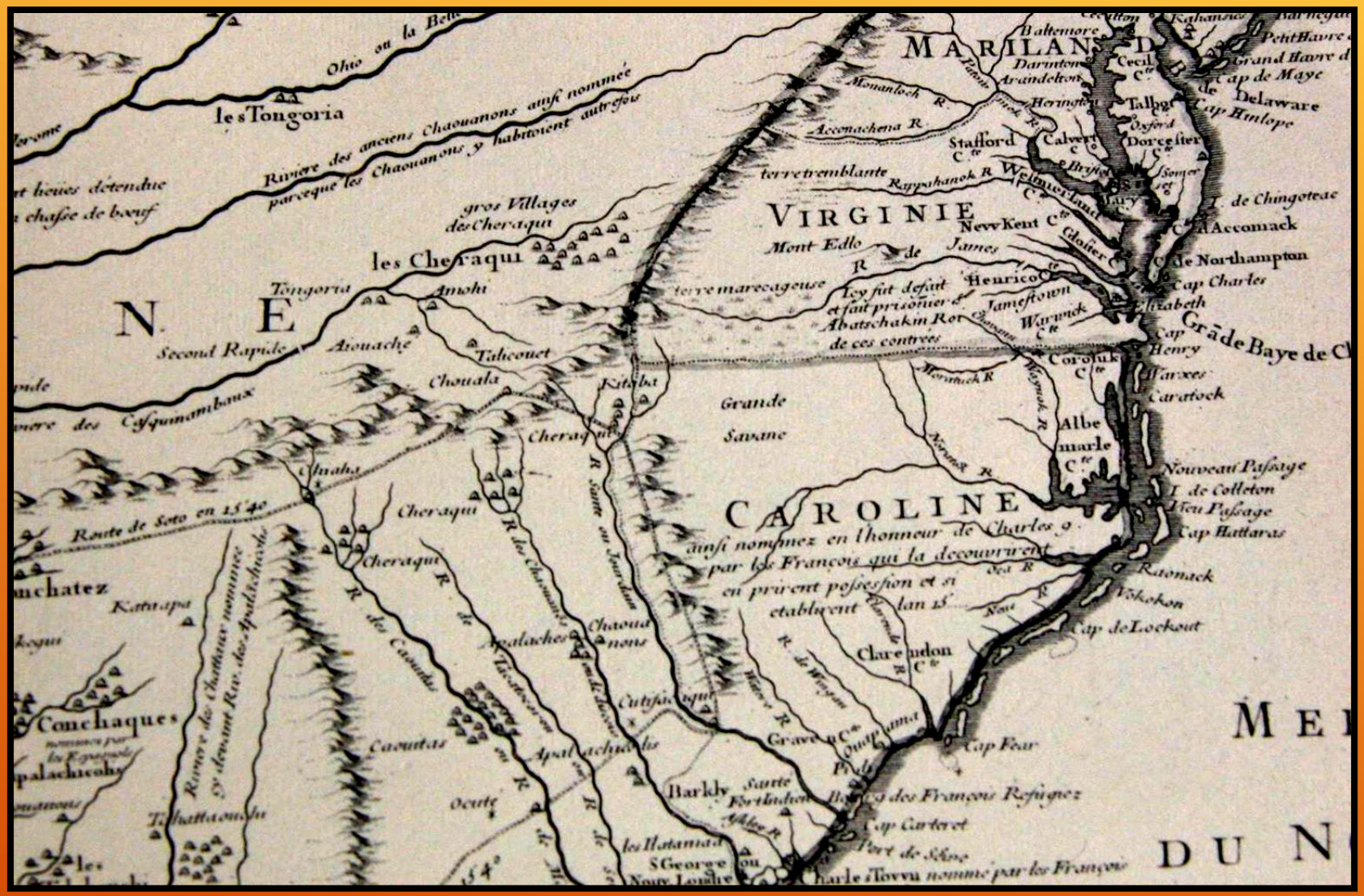
Some Piedmont Forest Types

DRY-MESIC OAK–HICKORY FOREST (PIEDMONT SUBTYPE)
DRY-MESIC OAK–HICKORY FOREST (COASTAL PLAIN SUBTYPE)
DRY OAK–HICKORY FOREST (PIEDMONT SUBTYPE)
DRY OAK–HICKORY FOREST (COASTAL PLAIN SUBTYPE)
DRY-MESIC BASIC OAK–HICKORY FOREST (PIEDMONT SUBTYPE)
DRY-MESIC BASIC OAK–HICKORY FOREST (COASTAL PLAIN SUBTYPE)
DRY BASIC OAK–HICKORY FOREST
PIEDMONT MONADNOCK FOREST (TYPIC SUBTYPE)
PIEDMONT MONADNOCK FOREST (PINE SUBTYPE)
PIEDMONT MONADNOCK FOREST (HEATH SUBTYPE)
MIXED MOISTURE HARDPAN FOREST
SWAMP ISLAND EVERGREEN FOREST
MESIC MIXED HARDWOOD FOREST (PIEDMONT SUBTYPE)
MESIC MIXED HARDWOOD FOREST (COASTAL PLAIN SUBTYPE)
BASIC MESIC FOREST (PIEDMONT SUBTYPE)
BASIC MESIC FOREST (COASTAL PLAIN SUBTYPE)
PIEDMONT/COASTAL PLAIN HEATH BLUFF
CAPE FEAR VALLEY MIXED BLUFF FOREST



Ice Age relict rhododendron bluffs along Morgan Creek

The Piedmont Savannas



DeLisle, 1718 (in Cumming, 1962)

Early testaments to Piedmont savanna(s) and fire frequency

"There are many spacious tracts of meadow-land...burdened with grass six feet high."

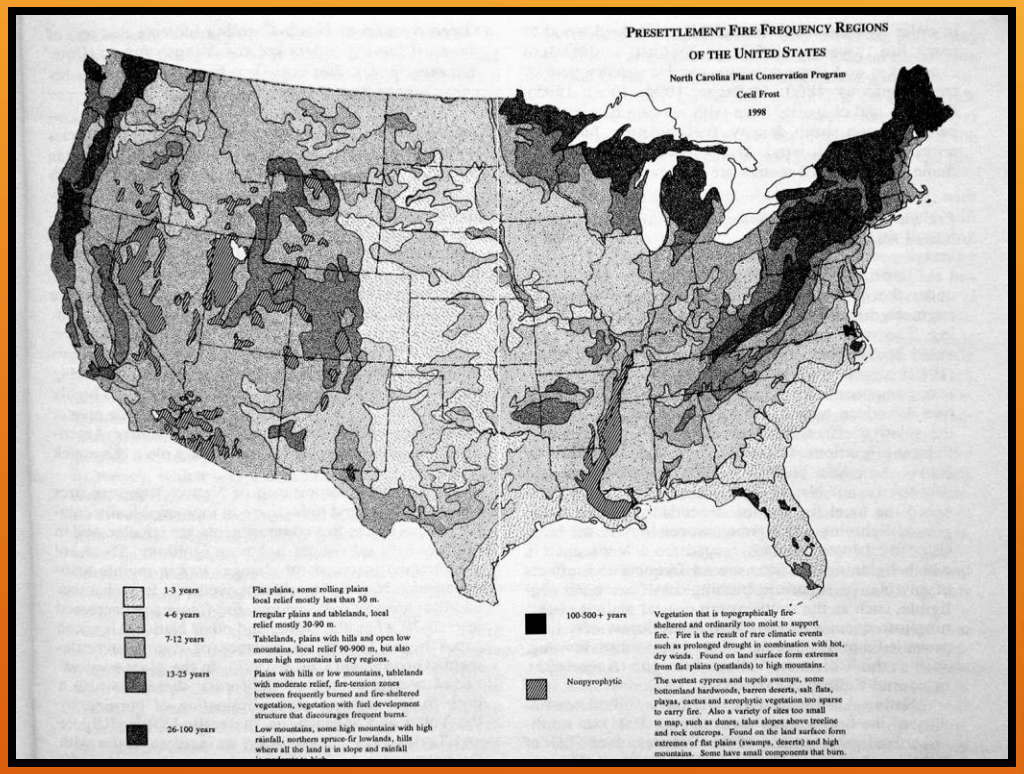
"The buffaloes ranged in droves feeding upon the open savannas morning and night."

Mark Catesby, 1763

"In February and March the inhabitants have a custom of burning the woods...an annual custom of the Indians in their huntings, of setting the woods on fire many miles in extent."

John Lawson, 1709
A New Voyage to Carolina

Presettlement fire frequency

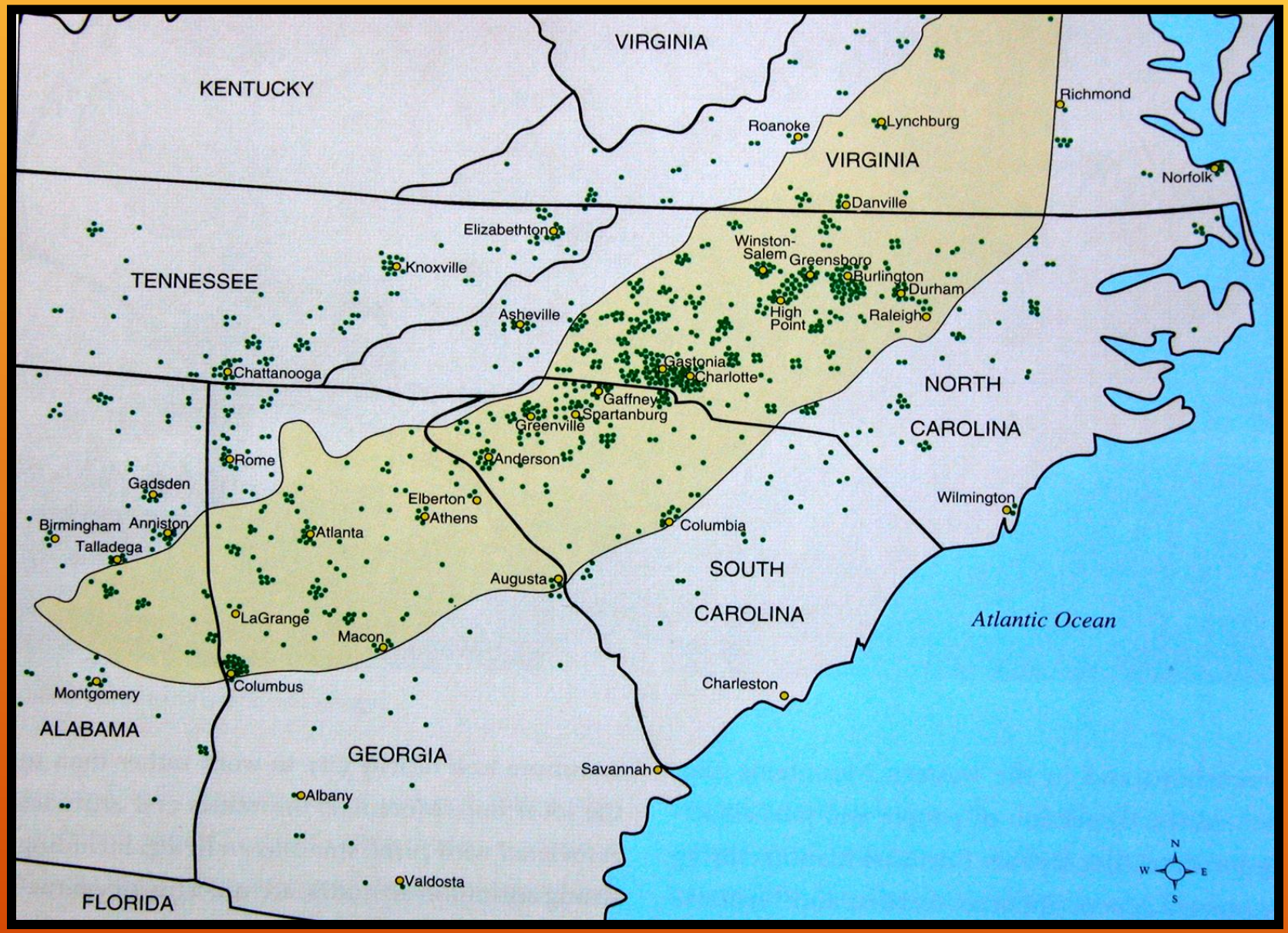



BUFFALO RANCH
WESTERN STORE & PARK
STAGECOACH RIDES

Penny's Bend Shortleaf Pine Bluff 2005

Penny's Bend Shortleaf Pine Bluff 2022

Piedmont Industry

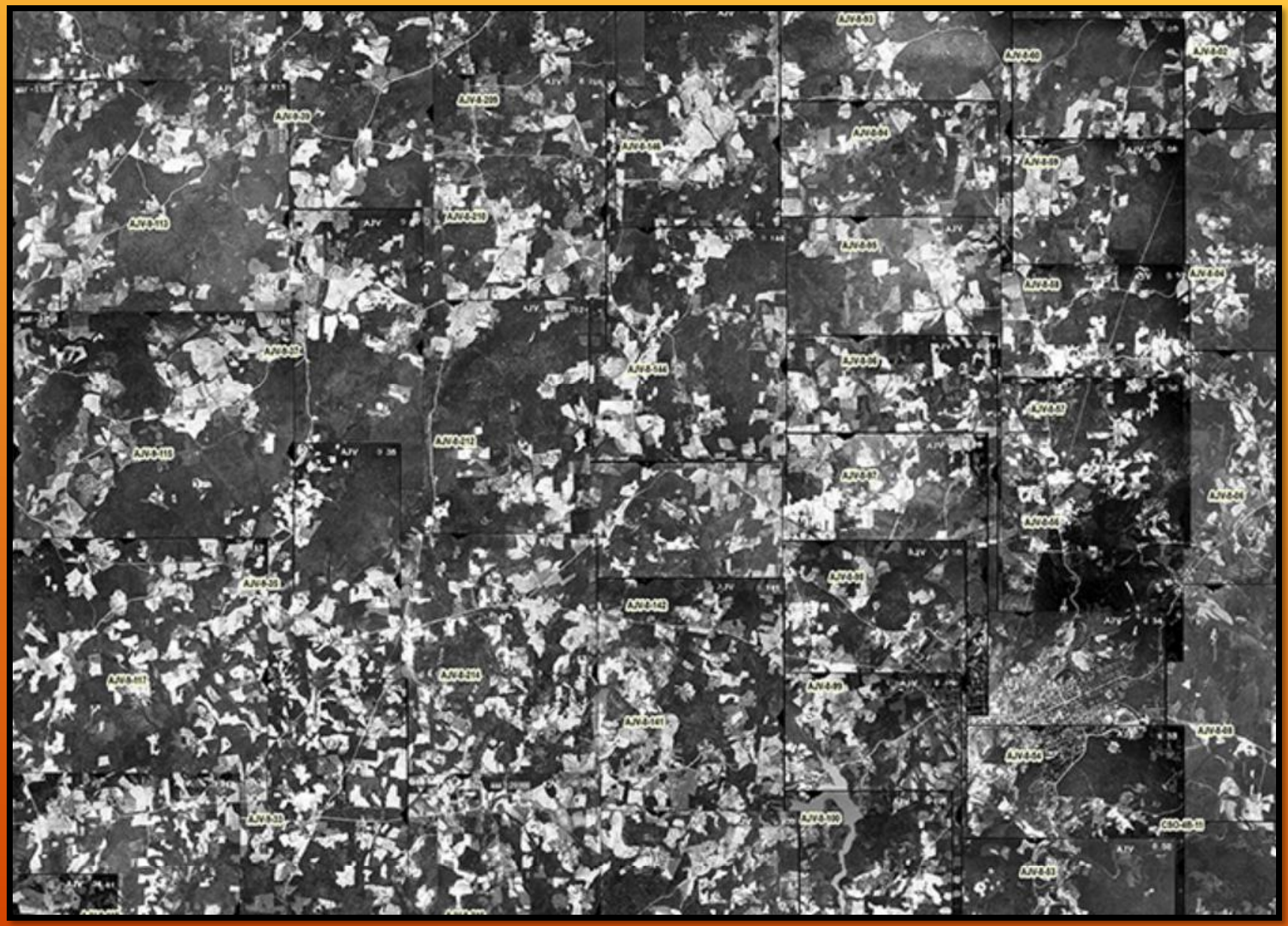


From History of North Carolina -

“The Piedmont has either been paved, plowed, or is undergoing ecological succession.”

Michael Godfrey
A Field Guide to the Piedmont

A portion of Orange County NC - 1938



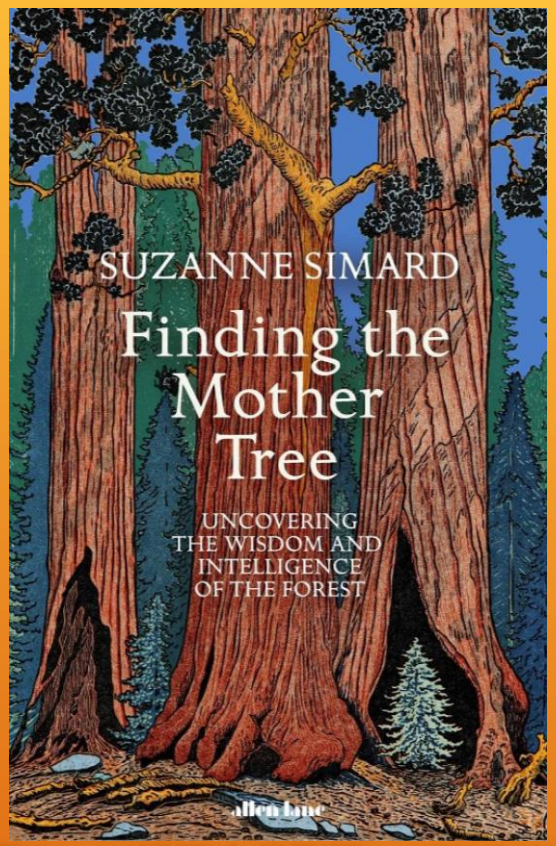

The Understory

FOREST STRUCTURE

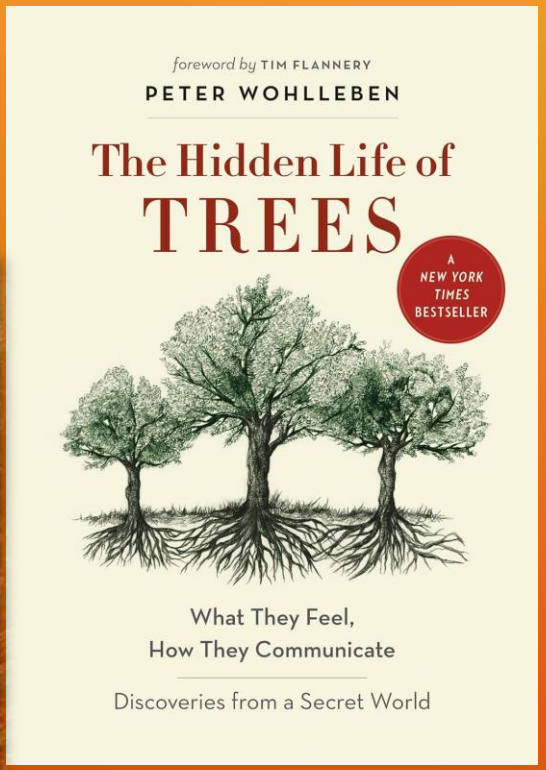
www.alamy.com/temperate-deciduous-forest-layers-illustration-image245901451.html

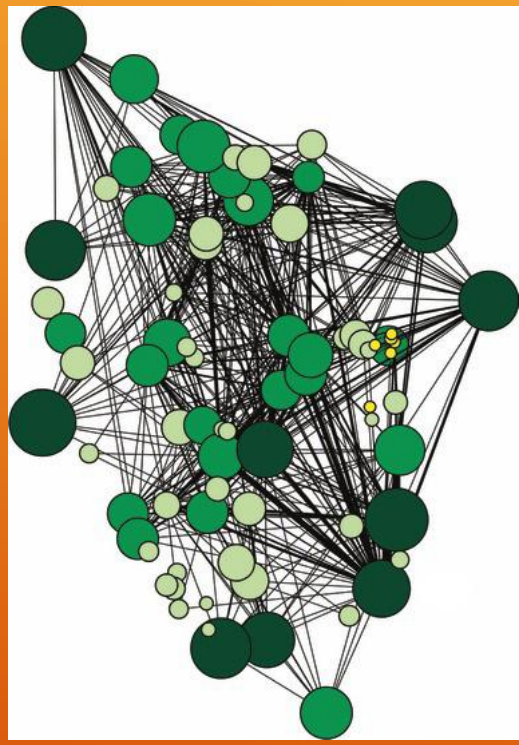
Vertical structure

Fungi



The "Wood-Wide Web," "Mother Trees," and the emerging understanding of plant communication.





Herbaceous plants

Bloodroot (*Sanguinaria canadensis*)

Shrubs

Saplings

Vines

Gelsemium sempervirens

Campsis radicans

Wisteria frutescens

Gonolobus suberosus var. *suberosus*

Canopy

White Oak (*Quercus alba*)

"He laid his hand upon the tree beside the ladder: never before had he been so suddenly and so keenly aware of the feel and texture of a tree's skin and of the life within it.

He felt a delight in wood and the touch of it, neither as forester nor as carpenter; it was the delight of the living tree itself."

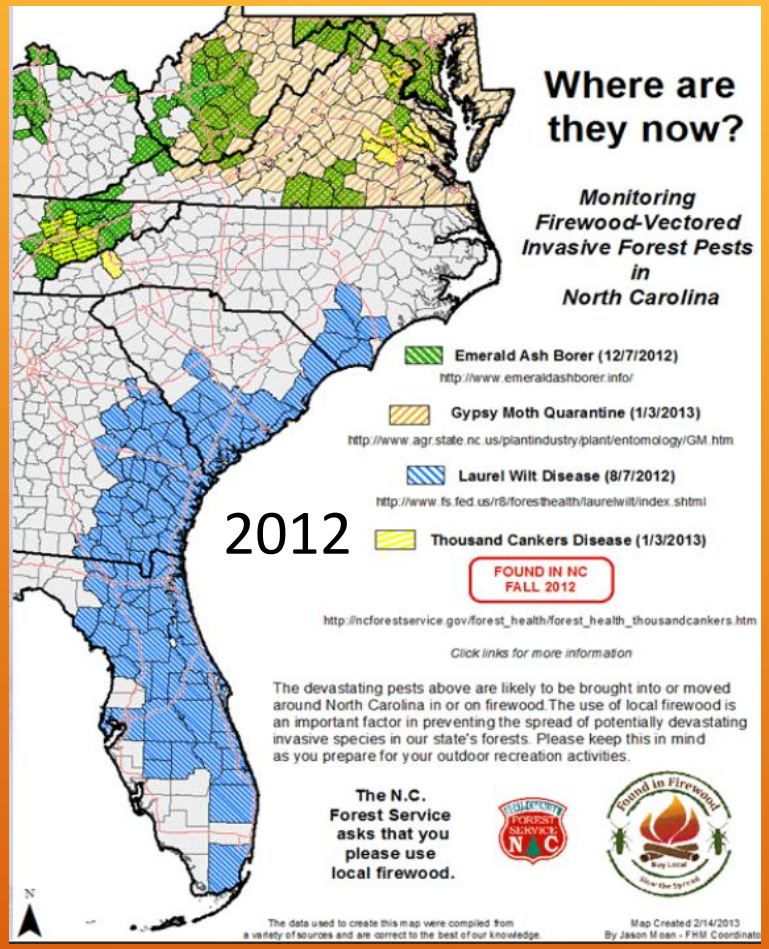
Frodo Baggins in Lothlórien

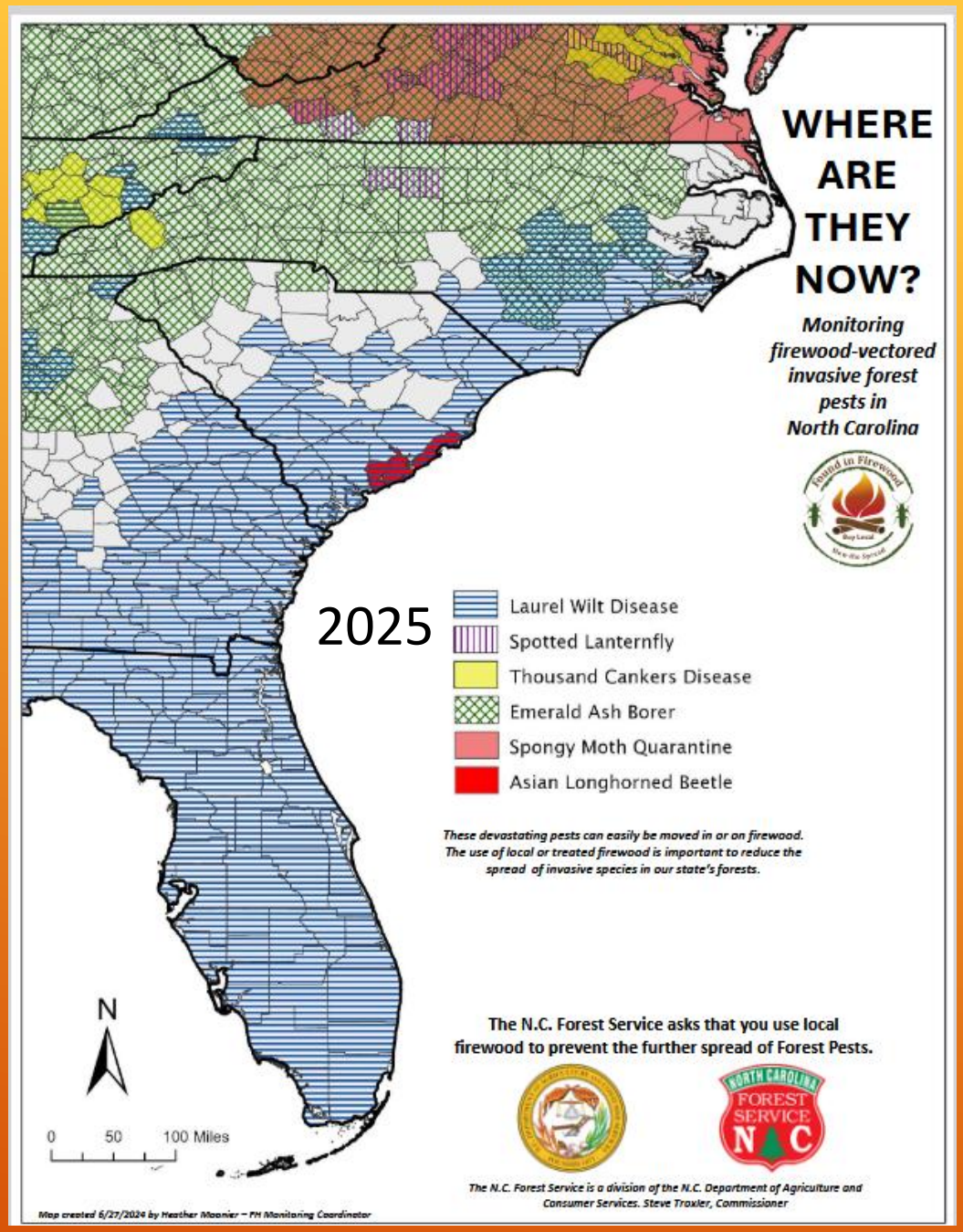

Lichens
Hornworts
Ferns
Mosses
Liverworts
Selaginellas

Gaps

Invasive species and forest systems disruption

Invasive pests in NC





Invasive Plants

Any guesses?

Fig Buttercup Project

What is Fig Buttercup, and why is it a problem?

Fig buttercup (***Ficaria verna***) is an invasive plant that is aggressively taking over floodplain and streamside ecosystems in North Carolina. It spreads easily when its bulblets and tubers spread through water to start new colonies. Once established, it creates dense mats that out-compete native plants and disrupts the natural balance of our ecosystems.

Also called lesser celandine and pilewort, fig buttercup is generally only visible above ground in winter and spring. It puts out leaves in winter, and then its yellow flowers appear in March and April. By early summer, the flowers and leaves die back, and the plant becomes dormant until the following winter.

Native to Europe, North Africa, and West Asia, fig buttercup has long been invasive in the northeastern U.S. In the last 10 to 15 years, it has increasingly become a problem here in North Carolina. Sometimes grown as an ornamental plant, it can spread from home gardens into drainage ways to nearby streams and floodplains

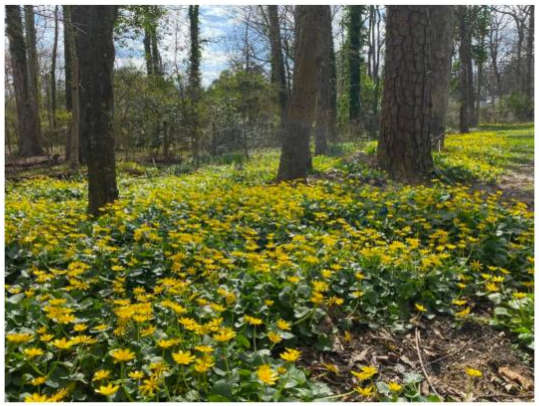
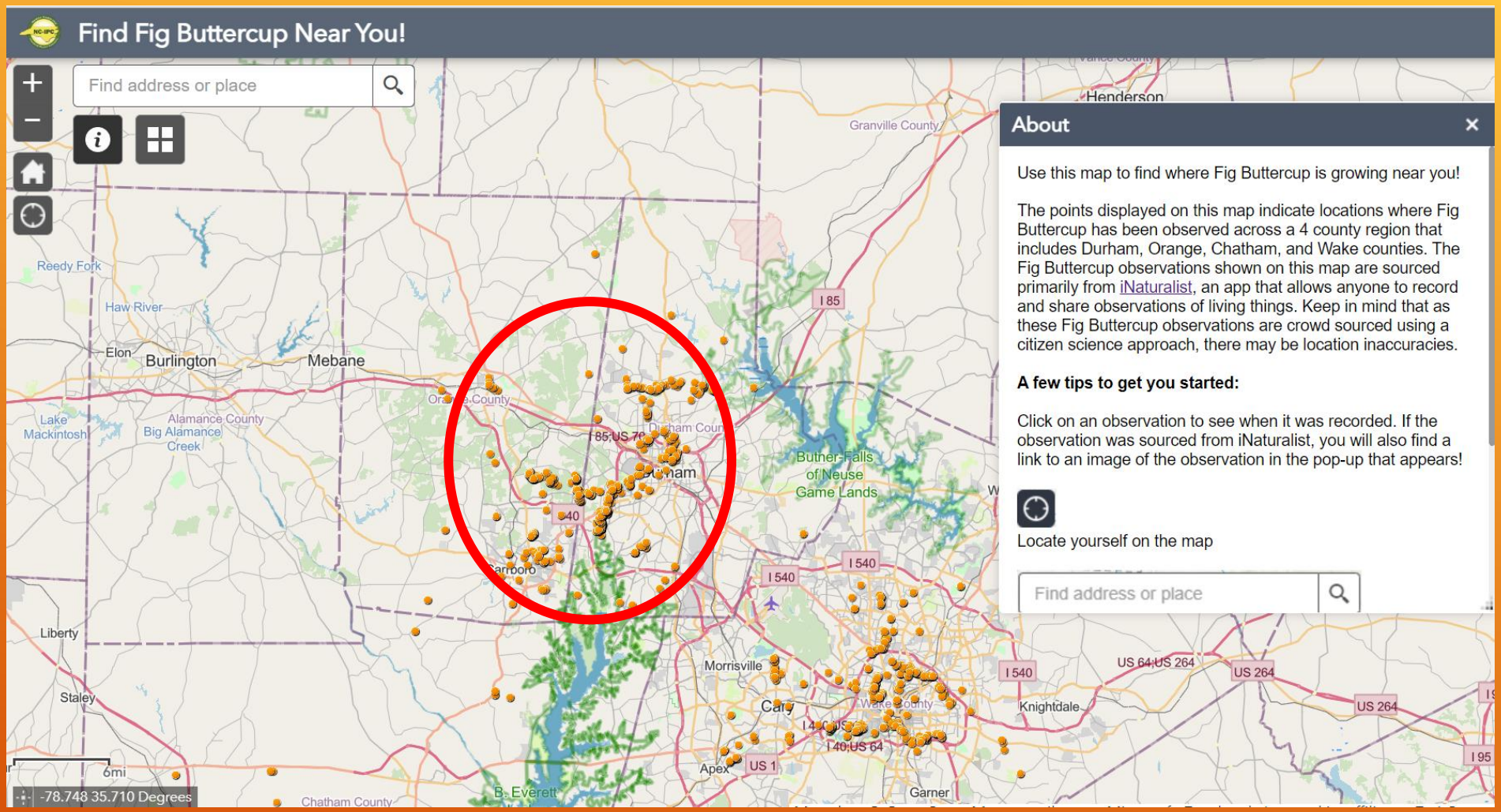
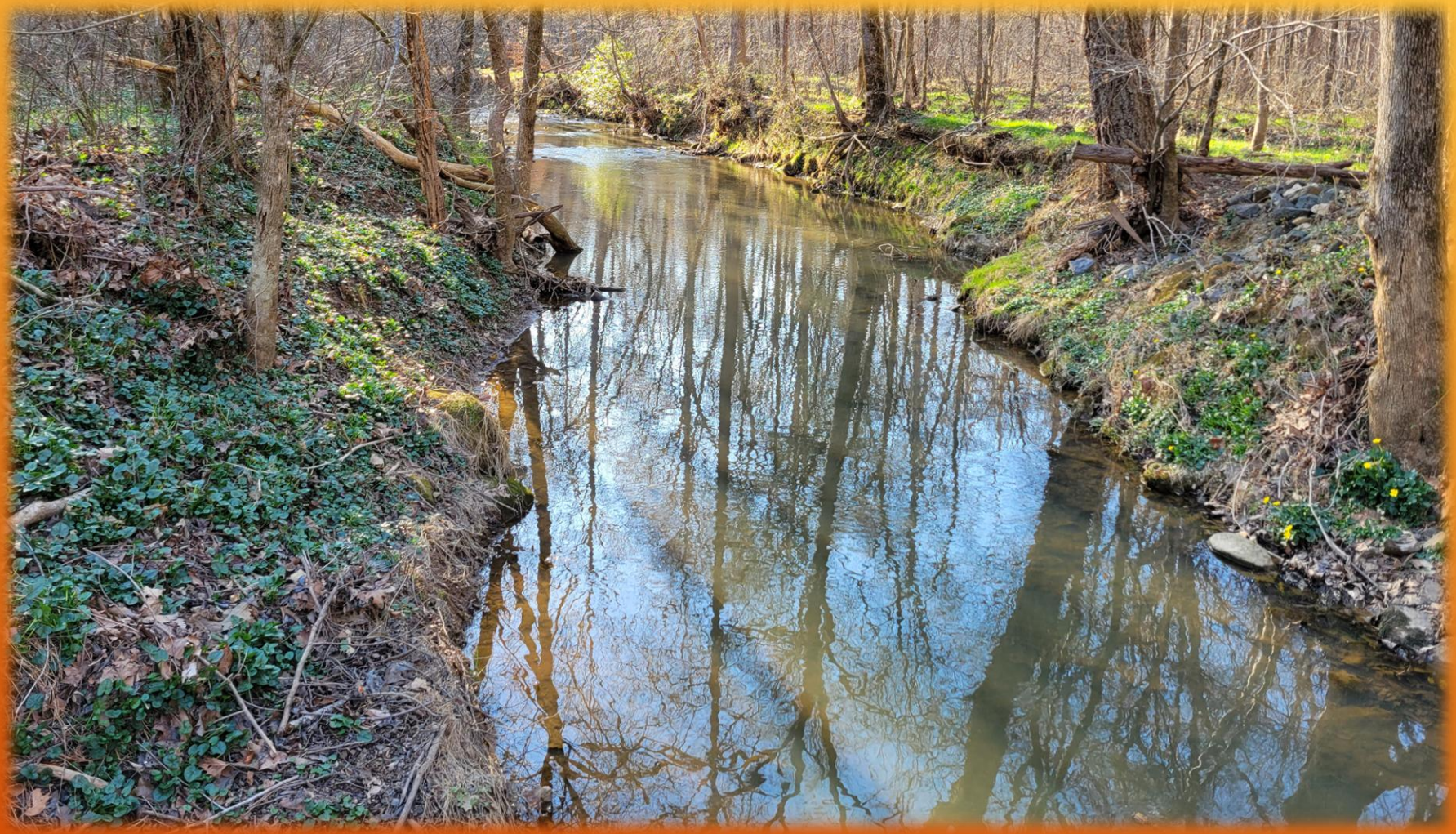


Fig buttercup blanketing a Triangle-area lawn. Photo by Charlie Innis for the News & Observer.


Find Fig Buttercup Near You!
Find address or place
About
Use this map to find where Fig Buttercup is growing near you!
The points displayed on this map indicate locations where Fig Buttercup has been observed across a 4 county region that includes Durham, Orange, Chatham, and Wake counties. The Fig Buttercup observations shown on this map are sourced primarily from iNaturalist, an app that allows anyone to record and share observations of living things. Keep in mind that as these Fig Buttercup observations are crowd sourced using a citizen science approach, there may be location inaccuracies.
A few tips to get you started:
Click on an observation to see when it was recorded. If the observation was sourced from iNaturalist, you will also find a link to an image of the observation in the pop-up that appears!
Locate yourself on the map
Find address or place
Granville County
Henderson
Reedy Fork
Haw River
Elon
Burlington
Mebane
Lake Mackintosh
Alamance County
Big Alamance Creek
I 85
I 85;US 70
Butner-Falls of Neuse Game Lands
I 40
I 540
Liberty
Staley
Morrisville
Cary
Wake County
Knightdale
US 64;US 264
US 264
I 40;US 64
Apex
US 1
Garner
I 95
6mi
-78.748 35.710 Degrees
Chatham County

Upper New Hope Creek (2023)



NC Invasive Plant Council

Promoting public awareness of invasive plants and facilitating solutions since 2002

NC Invasive Plants List adopted by NC-IPC, November 16, 2023

This list has been compiled with input from representatives of the NC Natural Heritage Program, USDA Forest Service, NC Botanical Garden, NC Department of Agriculture & Consumer Services, Piedmont Land Conservancy, NC Native Plant Society, NC Invasive Plant Council, and other groups & individuals.

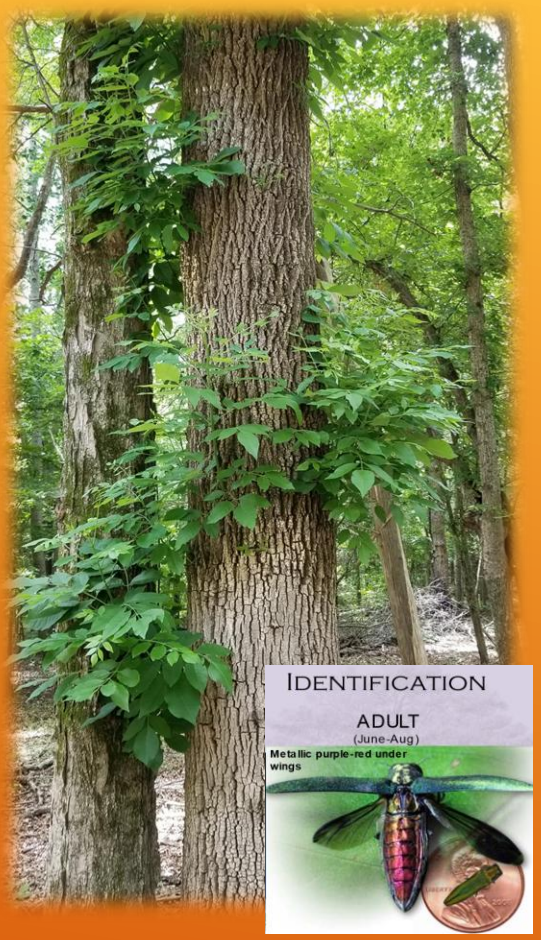
FNWL = on Federal Noxious Weed List **NCNWL** = North Carolina Noxious Weed List

Rank 1 – Severe Threat: Exotic plant species that have invasive characteristics and spread readily into NC native plant communities, displacing native vegetation.

Scientific Name	**Common Name**
Ailanthus altissima	Tree-of-heaven, Copal Tree
Albizia julibrissin	Mimosa, Silktree
Alliaria petiolata	Garlic Mustard, Hedge Garlic
Alternanthera philoxeroides	Alligator-weed
Ampelopsis glandulosa [= *Ampelopsis brevipedunculata*]	Porcelain-berry, Amur Peppervine
Celastrus orbiculatus	Oriental Bittersweet [NCNWL]
Dioscorea polystachya [= *Dioscorea oppositifolia*]	Chinese Yam, Cinnamon Vine
Elaeagnus umbellata	Autumn Olive, Oriental Silverleaf
Ficaria verna [= *Ranunculus ficaria*]	Lesser Celandine, Fig Buttercup
Hedera helix	English Ivy, Common Ivy
Humulus scandens [= *Humulus japonicus*]	Japanese Hops
Hydrilla verticillata	Hydrilla [FNWL]
Lespedeza bicolor	Bicolor Lespedeza, Shrubby Lespedeza
Lespedeza cuneata	Sericea Lespedeza, Chinese Lespedeza
Ligustrum japonicum & cultivars	Japanese Privet
Ligustrum lucidum & cultivars	Glossy Privet

Emerald Ash Borer at Penny's Bend Nature Preserve

Hemlock wooly adelgid NC Mountains



Lepidopteran Use of Native & Alien Ornamental Plants

Landscaping paradigms have promoted the use of alien ornamentals over native plants with ornamental value for over a century. The bias toward landscaping with alien ornamentals has been so complete that the first trophic level in suburban/urban ecosystems throughout U.S. is now dominated by plant species that evolved elsewhere. If alien ornamentals are not the ecological equivalents of native species, particularly in their palatability to herbivores that transfer energy to higher-level consumers, herbivore productivity, as well as the biomass of organisms that depend on herbivores will be compromised in landscapes in which alien plants comprise a large portion of the plant biomass.

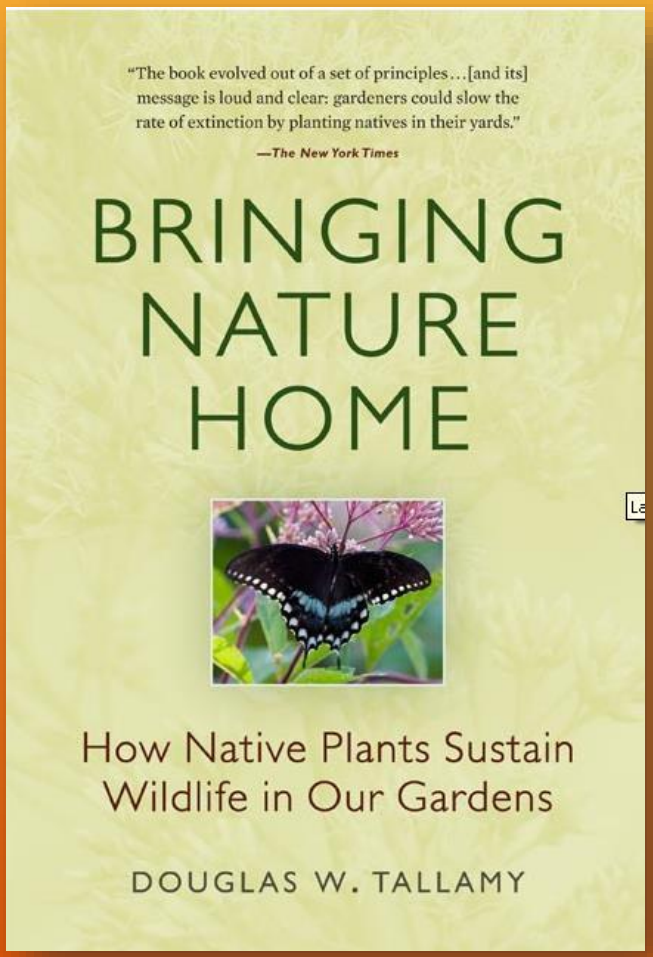
The following list is our attempt to categorize native and alien plant genera in terms of their ability to support insect herbivores and, by inference, overall biodiversity. We did this by ranking all native plant genera (woody and herbaceous) in terms of the number of Lepidoptera species recorded using them as host plants. Our hope is that this ranking will be used as one of the criteria for plant selections in managed and unmanaged landscapes by restoration ecologists, landscape architects and designers, land managers, and homeowners

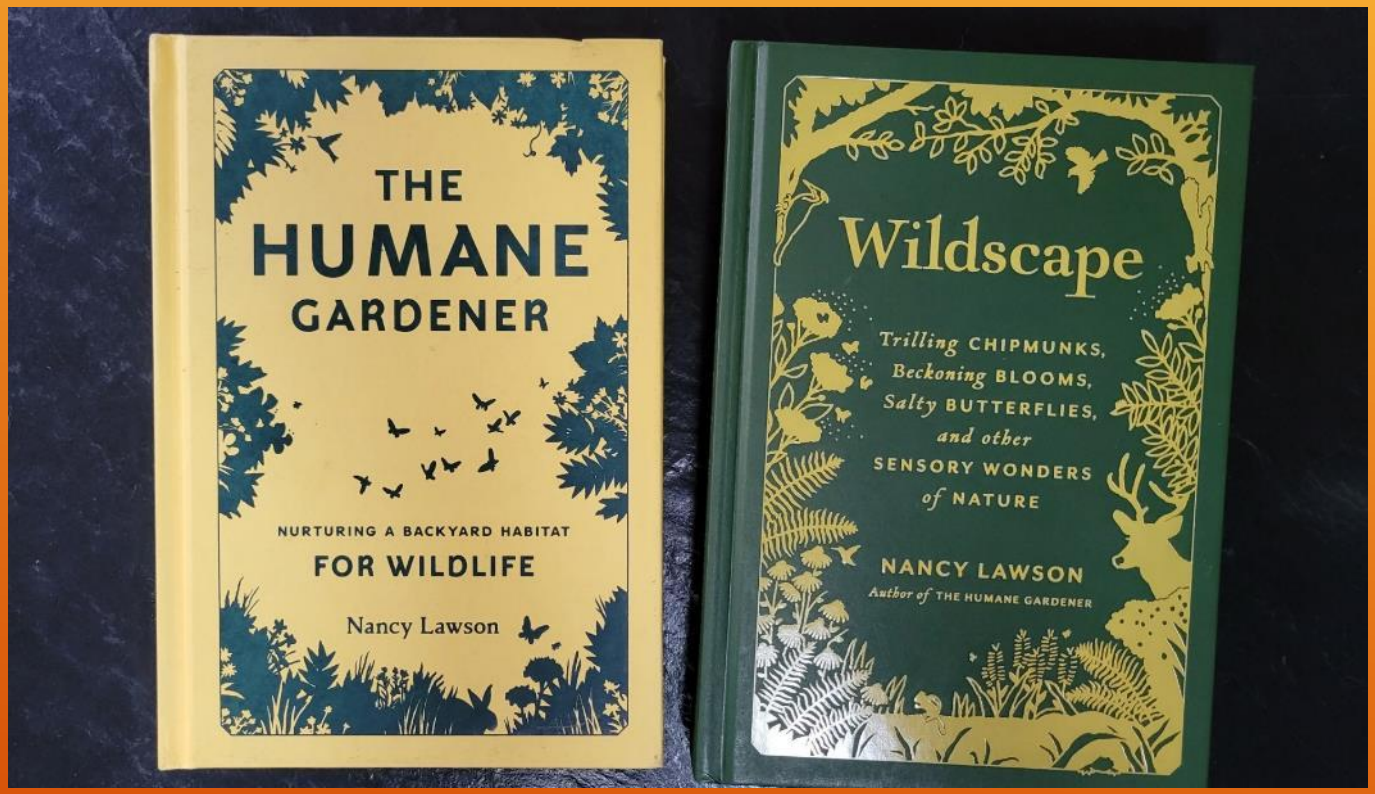
We chose Lepidoptera as surrogates for all insect herbivores for two reasons. Published host plant records for this group of herbivores, though far from definitive, are more complete than are host records for any other taxon of insect herbivores. Moreover, lepidopteran larvae (caterpillars) are disproportionately valuable sources of food for many terrestrial birds, particularly warblers and neotropical migrants of conservation concern. We restricted our search to moths and butterflies that develop on plant genera occurring naturally or planted ornamentally in the mid-Atlantic region of North America (Maryland, Delaware, Pennsylvania, Virginia, Connecticut, Rhode Island, New York, and New Jersey) for two reasons. First, the region is sufficiently diverse in both native and alien plant genera (1385 genera; 884 native genera; 501 alien genera) and native Lepidoptera species (≈3500 species) to reveal robust patterns of host use. Second, most host use records are only specified at the generic level; our early attempts to compare host use of alien and native plants in the same genus were thwarted by a serious lack of information at the species level.

We supplemented larval host associations and ranges described in Forbes (1923,1948,1954,1960), Tietz (1952), Covell (1984), Johnson and Lyon (1988), Robinson et al. (2002), and Wagner (2005) with records from over 400

http://udel.edu/~dtallamy/

Helping to repair the urban forest





Nancy Lawson – the Humane Gardener


LEAVES
ARE NOT
LITTER
THEY 'RE FOOD AND SHELTER FOR
BUTTERFLIES, BEETLES, BEES, MOTHS, AND MORE.
TELL FRIENDS AND NEIGHBORS TO JUST
#LEAVETHELEAVES
xerces.org


HMMM...WHAT'S BEING
SENT
AWAY TODAY?
MOURNING
CLOAK BUTTEFLY
GLOW WORM
OR
BABY FIREFLY
POLYPHEMUS
MOTH
COCOON
LUNA MOTH
COCOON
#LEAVETHELEAVES
POLLINATOR FRIENDLY YARDS ON FACEBOOK

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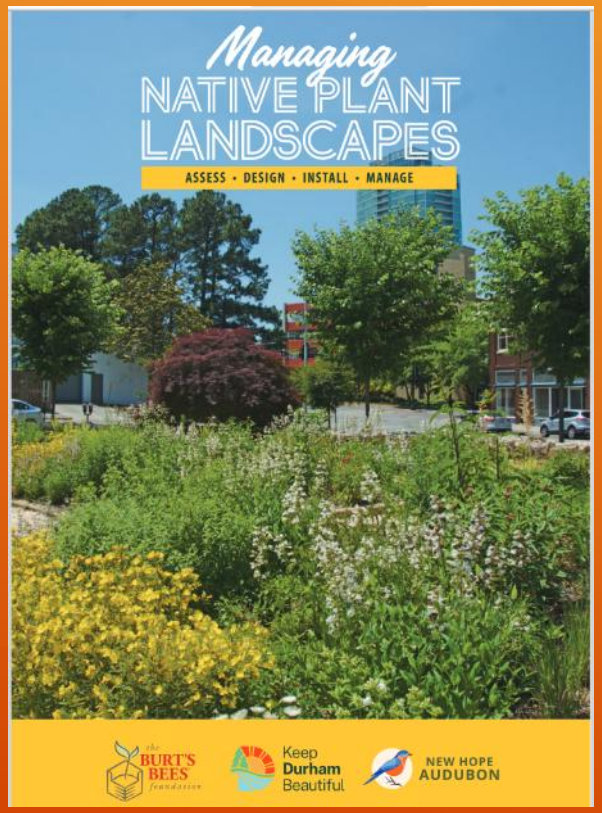

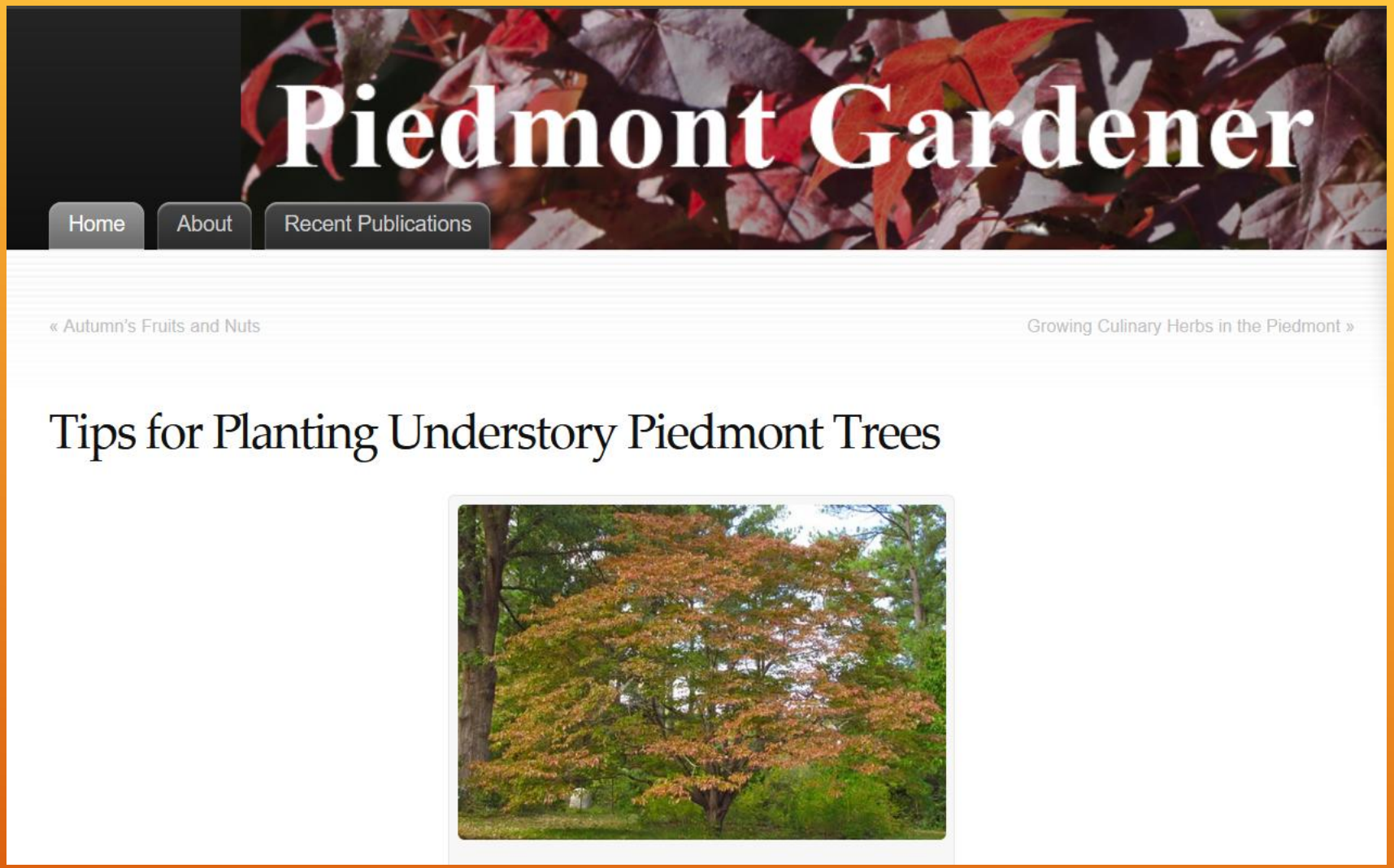

https://piedmontgardener.com/2012/10/12/tips-for-planting-understory-piedmont-trees/

NORTH CAROLINA BOTANICAL GARDEN

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Resources for Gardeners

Native plant gardening

- List: Native Trees & Shrubs for Your Garden [PDF]
- List: Native Wildflowers, Ferns, & Grasses for Your Garden [PDF]
- List: Recommended Sources for Native Plants
- List: Book Recommendations for Seed Germination and Perennial Gardening
- Seed Growing Instructions and Germination Codes [PDF]
- Growing Carnivorous Plants [PDF]

Gardening for biodiversity

- Creating Your Pollinator Garden [PDF]
- Conservation Gardening [PDF]
- Bird-Friendly Native Plants (Audubon North Carolina)
- Creating Nesting & Overwintering Habitat for Pollinators and Other Beneficial Insects (Xerxes Society PDF)

Invasive plants to avoid

- Booklet: Controlling Invasive Plants [PDF]
- List: Invasive Exotic Species (NC Native Plant Society)
- Invasives 101 (NC Invasive Plant Council)
- Plant This Instead! Eco-friendly Alternatives to Harmful Ornamental Plants (Coastal Landscapes Initiative)

NORTH CAROLINA BOTANICAL GARDEN

North Carolina Pollinator Toolkit

Prepared by the North Carolina Botanical Garden

University of North Carolina at Chapel Hill

April 2019

Understanding and appreciating the natural landscape

Tip-up mounds and tree bases

Critters

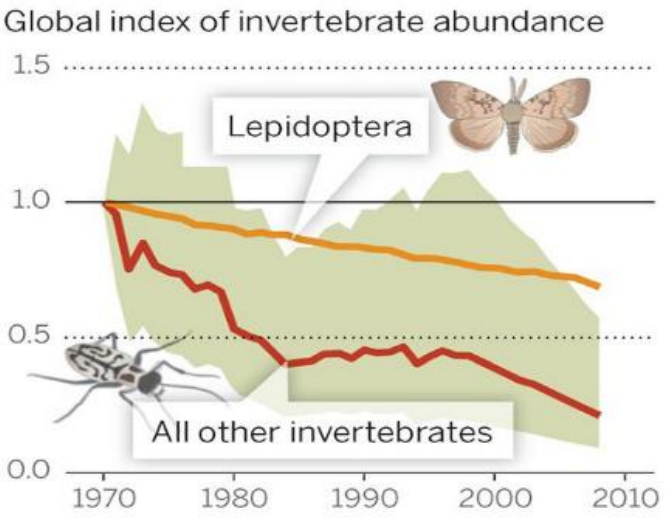
Invertebrates

Insect food!

FEATURE

The Insect Apocalypse Is Here

What does it mean for the rest of life on Earth?

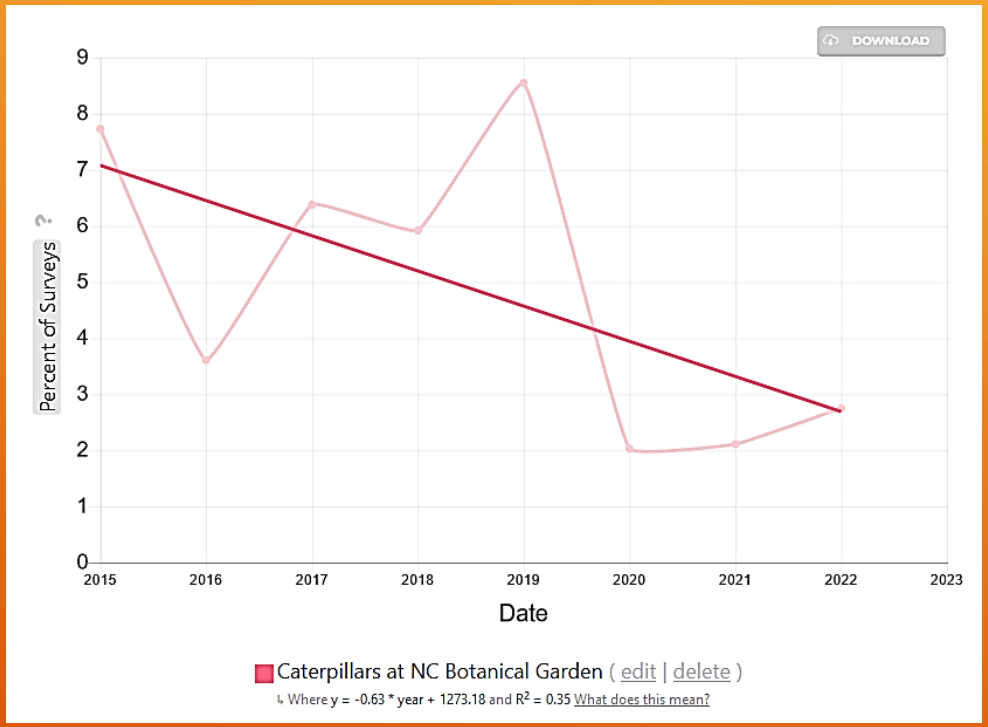


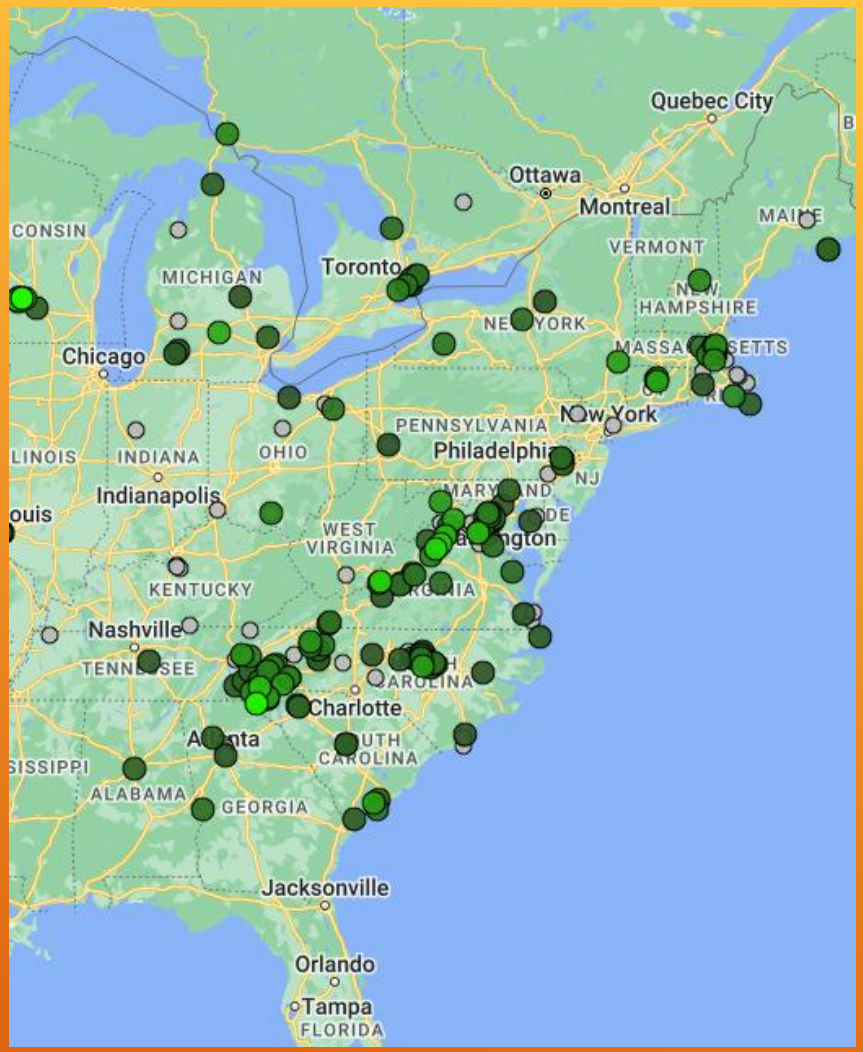
REVIEW

Defaunation in the Anthropocene

Rodolfo Dirzo[1,*], Hillary S. Young[2], Mauro Galetti[3], Gerardo Ceballos[4], Nick J. B. Isaac[5], Ben Collen[6]
+ See all authors and affiliations

Science 25 Jul 2014:
Vol. 345, Issue 6195, pp. 401-406
DOI: 10.1126/science.1251817





https://caterpillarscount.unc.edu/

What's wrong with this picture

Red-Spotted Purple Butterfly

Common understory trees and shrubs

Redbud (*Cercis canadensis*)

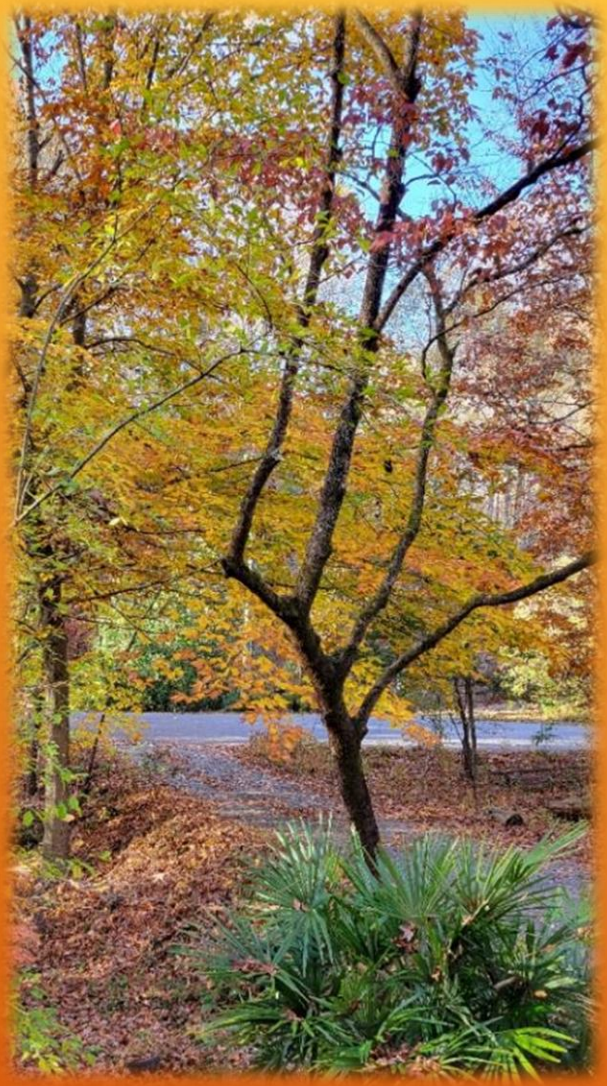
Persimmon (Diospyros virginica)

Fringe Tree (*Chionanthus virginicus*)

Hog Plum (*Prunus umbellata*)

Serviceberry (*Amelianchier arborea*)

Flowering Dogwood (*Benthamidia/Cornus florida)*



Muskie Cates

Dogwoods (*Cornus/Benthamidia florida* and *B. amomum*)

Sourwood (*Oxydendrum arboreum*)

Maples (*Acer rubrum and A. leucoderme*)

Southern Sugar Maple (*Acer floridanum*)

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Hop Hornbeam (*Ostrya americana*)

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Musclewood or Ironwood (*Carpinus caroliniana*)

Sassafras
(*Sassafras albidum*)

Bigleaf Magnolia (*Magnolia macrophyla*)

Pinxterflower (*Rhododendron periclymenoides*)

Witch-Hazel (*Hamamelis virginiana)*

Ilex montana

Deciduous Hollies

Ilex decidua

Hearts-A-Bustin'
(*Euonymous americanus*)


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Spicebush (*Lindera benzoin*)

Viburnum species (*Viburnum dentatum, V. rafinesquianum, V. acerifolium*)

Viburnum understory

Winged Sumac (*Rhus alata*)
Smooth Sumac (*R. glabra*)
Staghorn Sumac (*R. typhina*)
Fragrant Sumac (*R. aromatica*)

Fragrant Sumac (*Rhus aromatica*)

Poison Ivy
(*Toxicodendron radicans*)

Sweetshrub (*Calycanthus floridus*)

Sweetshrub (*Calycanthus floridus*)

Pawpaws (*Asimina triloba* and *A. parviflora*)


How about a walk in the woods!