

THE DUKE FOREST

LOG

A bulletin from the
Office of the Duke Forest

Fall 2019



Management Spotlight: Forest Inventory

Every ten years, Duke Forest performs a forest inventory to better understand the composition of the Forest and to ensure that we are responsibly managing the resource over time. Staff use the data collected to estimate tree volume, growth, and regeneration, and to assess issues that affect the Forest such as invasive plants and deer browse. The numbers we derive for volume and growth allow us to set an annual benchmark for sustainable harvest levels within our timber management stands, while the regeneration data help us learn about the young forest growing up in places we do not actively manage.

This year, we implemented a new methodology known as a continuous forest inventory (CFI). After discussions with managers at other educational research forests, colleagues in the forest industry, and forestry professors, we realized that a CFI has several advantages. First and foremost, a CFI requires the installation of permanent plots, which vastly improve the ability to compare information across inventory periods. It allows each round of data collection to easily build upon the past, creating a body of knowledge that more clearly demonstrates the effects of management and environmental changes on individual trees and the forest as a whole.

The CFI protocol also uses fixed-area plots, which greatly simplify data analysis and facilitate use of the inventory for remote-sensing teaching and research applications. In addition, a CFI produces data that is easily compatible with a widely applied Forest Vegetation Simulator (USDA Forest Service).

This allows Nicholas School students to use Duke Forest data to learn about forest growth and yield and to generate a Duke Forest-specific model, which can be updated and refined during subsequent data collection periods.



Duke Forest Management Intern Colin Carroll measures the height of trees at a sampling location.

Getting started with our new CFI methodology was no easy task! We had three exceptional interns who spent the entire summer installing 150 permanent CFI plots. This required navigating to a designated location, installing a center point, permanently marking trees within the plot, mapping the location of each tree in the plot, and then collecting data. At each plot, interns measured the diameter, height, and form of each tree and recorded additional information about ground cover, invasive species, and deer browse.

Now that the plots are installed and initial measurements have been taken, a portion of the CFI plots will be resampled every two years. The trees within the plot will be re-measured and forest changes will be tracked over time. Duke Forest staff have moved into the number crunching phase, and we are excited to see the first round of results from our new CFI program.

THE DUKE FOREST comprises over 7,000 acres of land in Durham, Orange, and Alamance counties and has been managed for research and teaching purposes since 1931. The mission of the Duke Forest is to facilitate research that addresses fundamental and applied questions across a variety of disciplines and to aid in the instruction of all students in their pursuit of knowledge, especially regarding the stewardship of our natural resources. In addition to supporting education at local universities, the Forest also participates in community outreach through tours and other events.



dukeforest.duke.edu

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Forest Greetings

From the Director's Desk

Four years ago, I wrote to you in this greeting about what I saw in the Forest's future. At the time, I had been the Director for just over a year, and we were already preparing a new strategic plan. I am excited to share in this greeting and throughout this edition of *The LOG*, tremendous examples of the progress we are making.

In our strategic plan, stewardship for long-term sustainability is one of three overarching goals, which describes how we intend to steward the Forest's natural, financial, and human resources to ensure its role as a major university asset. On the following page, you'll see a story about a collaborative conservation project that we helped kick off back in 2015. This effort specifically demonstrates that within the rapidly growing Triangle region, the Duke Forest is critically important for maintaining and connecting a natural network of lands that functions for the benefit of both people and animals.

As established in 1931, the Duke Forest remains a teaching and research laboratory, and our second strategic goal is to facilitate a broader use of the Forest across a variety of disciplines—from the sciences to the arts. In 2018, we completed a transfer of over 90 linear feet of Duke Forest history and data to the Duke University Archives in an effort to centralize and enhance access to this incredible resource. We could not have anticipated how quickly and for what a unique purpose that this information would be used. Check out the

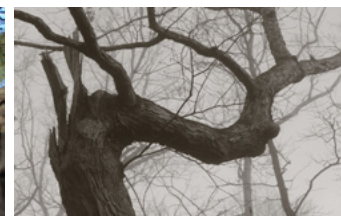
story on artist Heather Gordon to learn more!

Last but not least, our third strategic goal is to engage with the university and public communities to expand the Forest's role as a stage for learning. Beyond academy walls, community engagement leverages the Forest's mission to connect people with science; to educate about natural resources conservation and forest management; and to empower the public with information about issues affecting the environment. Since announcing it in last year's *The LOG*, we've completed a full season of two citizen science programs, which directly engage Duke staff and members of the public in collecting data that build knowledge about the Forest's natural resources. This information has already been used in Nicholas School student master's projects and contributed to a national database. Again, more in this edition.

As always, none of this would be possible without our incredibly dedicated and talented staff—so, a huge thanks to Bev, Blake, Craig, Jenna, and Tom. I also want to note our appreciation for the tremendous student intern team we were lucky to have this summer—thanks Colin, Matt, and Trevor!



Sara DiBacco Childs
Duke Forest Director



Volunteer Photography Corps Photos: Susan Pratt, left; Jeff Soo, top right; Samantha Dominguez, lower right
See more at: dukeforest.duke.edu/gallery

Collaborative Conservation Work

The Duke Forest and other protected and managed lands across our landscape provide an anchor of wildlife habitat and ecosystem services (e.g. clean air, clean water, carbon sequestration). However, as these conservation areas become isolated and disconnected from other natural spaces—due to road infrastructure, real estate development, and other permanent conversions of land—their habitat and service values diminish over time. In 2014, Steve Hall, Ph.D. (independent ecologist, retired from the NC Natural Heritage Program) wrote about this fact in a letter to Orange County following the publication of their State of the Environment report. He noted the need for specific work to identify opportunities to preserve, and in some cases restore, existing connections between these important places.

After Steve shared the letter with Duke Forest staff, we planned an initial meeting with conservation partners. Our goal was to explore opportunities for a collaborative effort to identify and preserve landscape corridors that connect significant natural areas in Orange and Durham Counties (subsequently expanded to include parts of Chatham and Wake). It was evident from the first meeting that partners recognized both the need for this work and the benefit of working together to see it completed.

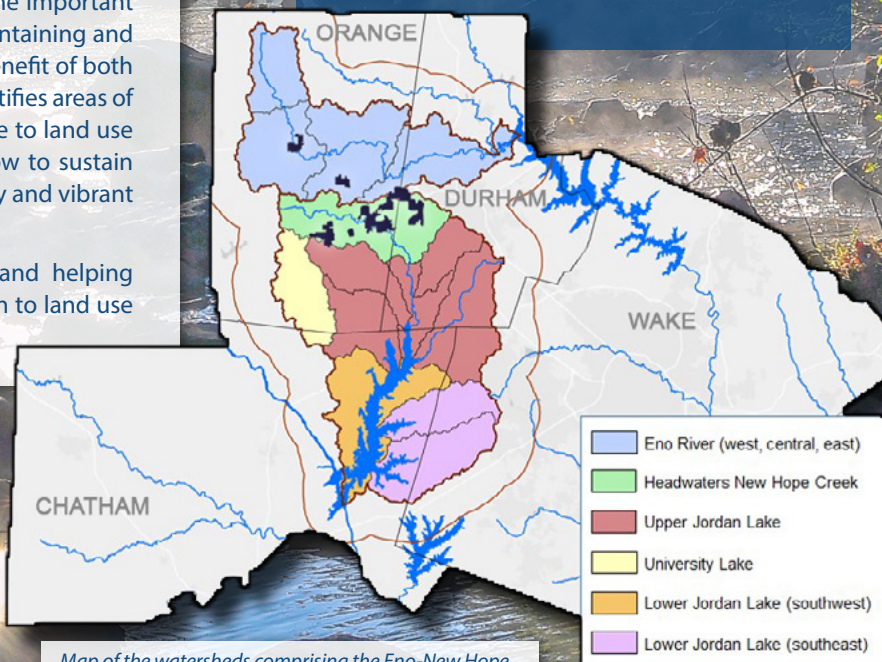
Almost four years from that first meeting, the Eno-New Hope Landscape Conservation Group is set to unveil the results of this ambitious project, which was funded by Partners for Green Growth, led by ecologist Julie Tuttle, Ph.D., and administered by Johnny Randall, Ph.D., with NC Botanical Garden. Once the project was funded, Duke Forest staff shifted from a coordinating role to serving as members of the steering and technical committees.

The results of this project, which will be discussed at the 2019 Orange County Environmental Summit, clearly demonstrate the important role of the Duke Forest and other partner lands in maintaining and connecting a natural network that functions for the benefit of both people and animals. Most importantly, the project identifies areas of high conservation value that are potentially vulnerable to land use conversions. This work offers critical insight about how to sustain the natural spaces and wild things that create a healthy and vibrant environment for all.

Now begins the work of sharing this information and helping others use it to inform priorities—from land protection to land use planning.

Conservation Partners

- Chatham County Conservation Partnership
- Duke University, Office of the Duke Forest
- Durham County Open Space and Real Estate
- Eno River Association
- NatureServe
- New Hope Creek Corridor Advisory Committee
- North Carolina Biodiversity Project
- North Carolina Botanical Garden, UNC–Chapel Hill
- North Carolina Natural Heritage Program
- North Carolina Wildlife Resources Commission
- Orange County Commission for the Environment
- Orange County Department of Environment, Agriculture, Parks & Recreation
- Southern Conservation Partners
- Town of Chapel Hill Stormwater Management
- Triangle Land Conservancy
- Wake County Parks, Recreation, and Open Space
- Wildlands Network



Map of the watersheds comprising the Eno-New Hope Landscape Conservation Group project area. Duke Forest lands shown in dark blue.

Project Updates



Citizen Science Engages Community

Engaging the community in science and nature is a core component of our strategic plan. One way the Duke Forest does this is by harnessing the passion and knowledge of our local community through citizen science. Citizen science helps the Duke Forest by generating data that inform our management activities, contribute to national data collection efforts, and/or provide a baseline for future research.

In February through April of this year, 40 volunteers contributed to our *Tree Phenology* program. Volunteers walked along two transects monitoring sets of Maples, Beeches, and Oaks in the Korstian Division to determine when flowering and leaf-out occurred. Each year, changing weather patterns and climate change influence the timing of these natural events (or phenology). These data were uploaded to the National Phenology Network's database, which annually tracks the onset of spring in the U.S.



Left, trees marked for citizen scientists; Right, Dr. Nicolette Cagle demonstrates proper monitoring of a herpetofauna cover board.

In March through October, we held our first full season of *Herpetofauna of the Duke Forest*. Close to 40 volunteers ventured out weekly to six transects in the Durham Division to monitor amphibians and reptiles. This citizen science program helps us understand what species currently live in the Forest so we can explore management activities that support their survival. We also share this data with wildlife biologists, faculty, and students that have teaching and research interests related to these animals. This program represents a significant commitment of time and energy by our volunteer teams.



Artist Heather Gordon talks about using 80-year-old Duke Forest archival data for new designs and perspectives.

Artist Heather Gordon Delves into Archives

Durham artist Heather Gordon held residency at Duke University's Rubenstein Arts Center in August to work on a project called *The Forest for the Trees*. Heather is known for her love of data and her unique process of turning data into large geometric paintings using principles from origami. For this project, she made a special request to sift through the massive Duke Forest archive recently transferred to Duke Libraries. She looked for small datasets that, once graphed, formed the structures upon which she built her characteristic geometric designs. Heather was particularly drawn to luminosity datasets (i.e. measures of the amount of light coming through the trees) from the 1930s.

Watch an interview with Heather explaining her process and the unexpected value of the Duke Forest archival data for art: dukeforest.duke.edu/heather

Good Leashes Still Make Good Neighbors

Our *Good Leashes Make Good Neighbors* campaign aims to educate recreational users about the damage that off-leash dogs can have on the teaching and research mission of the Forest. We receive phone calls and emails reporting off-leash—and sometimes out of control—dogs running, swimming, and digging around. Unfortunately, the dogs' owners are unaware (or unconcerned) that their pets are disrupting unmarked research sites, disturbing wildlife, and scaring (and sometimes harming) other recreational users. We encourage people to think "research first" when entering the Duke Forest and to help us steward this awesome resource by keeping their dogs on leashes. As part of the campaign, we have stationed staff and students at busy gates, and we maintain a set of educational signs that pop up at different locations around the Forest. We have also given out almost 200 leashes to urge dog owners to take responsibility and follow the stated rules.



Duke Forest Assistantship Student Kelli Palaka greets recreational users at a Forest gate to educate about keeping dogs on leash.

The Duke Forest... more than just the woods.

An outdoor classroom and living laboratory inviting students and teachers of all ages, disciplines, and backgrounds. A responsibly-managed working forest demonstrating renewable resource extraction and best management practices. A bastion of diverse habitats protecting plants, wildlife, and ecosystem services. An environmental education and outreach tool offering opportunities to learn about natural resources and forest management. An aesthetic and recreational resource alleviating our collective nature deficit disorder.

A different kind of Forest, a different kind of support.

The Duke Forest is unique, and it takes a different kind of support to keep it healthy and strong. Our best supporters are people like you who take the time to learn about the Forest and endeavor to understand its many benefits. Together, we can deepen the reach of its mission and the quality of its resources for teaching, research, conservation, and community engagement.

Help us share *the gift of the Duke Forest*
by sharing your gift today.

Other important ways to support the Forest

Planned gifts - Include the Duke Forest in your will or living trust, or name the Forest as a beneficiary of your retirement plan.

Endowments - Provide regular and guaranteed income for the Duke Forest with an endowment in your family's name.

With other gifts - Make a gift to the Forest in combination with a gift to another area at Duke.

Payroll deduction - Support the Forest monthly as an employee of Duke.

Donation of assets - Donate stocks, land, or vehicles to support the Duke Forest.

Please contact blake.tedder@duke.edu if you have questions about giving to the Duke Forest.



Friends of the Duke Forest 2018 - 2019

- | | |
|-------------------------------|---------------------------|
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dukeforest.duke.edu/give



Teaching & Research

First and foremost, the Duke Forest is an outdoor classroom and living laboratory, and it is our mission to facilitate this use through our daily operations and strategic initiatives. We help establish and maintain dozens of research projects every year, and we assist faculty and teachers in creating high impact learning experiences for students of all ages.

Researchers implemented 19 new projects this year, which included two student master's projects that have implications for wildlife management on the Duke Forest. Julia Geschke, in fulfillment of her Master of Environmental Management (MEM) degree at the Nicholas School of the Environment, used field data collected in the Forest and other spatial datasets to model salamander habitat and connectivity. As development and urbanization fragments the landscape and reduces water quality, salamanders and other sensitive amphibians are at risk. Julia's project helps us better understand where and how salamanders use the Forest and how we might manage habitats to support salamander populations. Another MEM student, Madison Cole, expects to graduate next spring after completing a master's project focused on understanding small mammal distribution and habitat use in the Duke Forest. Nicholas School faculty member, Nicki Cagle, advised both projects.

Educators from K-12, undergraduate, graduate, and lifelong learning programs hosted 32 formal teaching activities on the Forest. One of the newest offerings came from Joe Bachman, a new forestry faculty member and executive-in-residence in Natural Resource Finance at the Nicholas School. With deep experience in the forestry industry, Joe used the Duke Forest and Forest staff to teach forest finance in his class *Valuing Ecosystems for Investment and Conservation*.

AT A GLANCE	2018 - 2019	
	Number of research projects <i>(19 new)</i>	49
	Number of primary investigators	42
	Number of research affiliations	16
	Total research dollars <i>(17 of 49 reporting)</i>	\$1,181,300
	Number of teaching activities	32
	Number of educators	21
	Number of class visits	96
Number of participating students	948	



Forest Supervisor Tom Craven leads a Silviculture class field trip in the Duke Forest for Nicholas School students.

Management & Stewardship

The management of the Duke Forest is certified by NEPCo to Forest Stewardship Council® guidelines, a strict set of environmental, social, and economic standards. Duke Forest staff use a holistic approach to resource management and stewardship and often accomplish multiple goals with a single management activity. In the last fiscal year, we did not operate across a large area, but we completed incredibly important work to protect the Forest's unique resources and improve the health and vigor of its trees.

In a routine monitoring visit to the Stony Creek Registered Natural Heritage Area (RNHA), we discovered a significant stand of non-native, invasive Bamboo creeping into the site from an adjacent power line right-of-way. To mitigate this threat and implement our invasive action plan, we contacted Duke Energy and an adjacent neighbor to collaborate on an eradication effort. After cutting and piling the Bamboo stalks, Duke Energy's contractor mowed and mulched the area. When the Bamboo began to re-sprout, Duke Energy's contractor treated the power line area with herbicide while Duke Forest staff treated the wood line shared with Duke Forest and the neighbor. This cooperative treatment effort has been highly effective but will require consistent follow-up to ensure that the Bamboo does not displace native vegetation in the Stony Creek RNHA.

In timber management news, we completed a second-thinning of Loblolly Pine stands in the Dailey Division. A thinning is an intermediate treatment in the life of a stand in which a portion of the trees are removed to promote the growth of remaining trees while also generating revenue for forest operations. A second-thinning indicates that a higher proportion of the trees removed could be turned into lumber and wood panel products while a smaller proportion could be turned into pulp products or wood-chips. This pine stand will continue to grow and add volume for approximately 15 years before a final harvest in which we set the stand's clock back to 0 so a new Loblolly forest can grow.

Engagement & Outreach

With Blake on our team as the Communications and Engagement Coordinator, we had a much greater capacity for outreach and were able to develop several new initiatives. We designed and implemented a monthly e-newsletter, established our presence on Instagram and YouTube, and grew our audience significantly across all media. We endeavored to connect the Forest with new audiences, especially Duke undergraduate students, and successfully piloted a program to use Duke's LYFT service to bring students to the Shepherd Nature Trail.

We were also able to facilitate programming that engaged volunteers to accomplish teaching, research, and management goals. In the fall, we launched a pilot season of our citizen science program *Herpetofauna of the Duke Forest*, and in the spring, we launched the first full year of Herps and the first-ever season of the *Tree Phenology* citizen science project (see Project Updates). These efforts provided a dramatic increase in the number of volunteer opportunities, and we were pleased to find that each program filled to capacity with new and familiar faces.

Tapping the talent and artistic eyes of 15 photographers, the newly formed *Volunteer Photography Corps* generated hundreds of beautiful shots of the Duke Forest (dukeforest.duke.edu/gallery). These photographs dramatically enhance our communication and outreach materials. We also hosted four stewardship projects, relying on a dedicated team of volunteers for their sweat and muscle.

Thank you to all of our dedicated volunteers!



Volunteers help repair a culvert washed out by Hurricane Florence.

AT A GLANCE

2018 - 2019

Outreach Activities

Number of tours and activities	31
Number of participants	1621
Total outreach hours	69

Volunteer Activities

Stewardship Volunteer Projects	
<i>Number of volunteer events</i>	4
<i>Number of volunteers</i>	23
<i>Total volunteer event hours</i>	13
Citizen Science	
<i>Number of volunteers</i>	104
<i>Total number of data collection visits</i>	229
Volunteer Photography Corps	
<i>Number of volunteers</i>	14
<i>Number of photographs submitted</i>	353

AT A GLANCE

2018 - 2019

Harvests

46 acres
<i>Thinning</i> 46

Stand Improvements

30 acres
<i>Mechanical - Invasive control</i> 18
<i>Herbicide - Invasive control</i> 1
<i>Herbicide - Research</i> 2
<i>Prescribed burning</i> 9

Road & Trail Maintenance

97 miles
<i>Road grading & repair</i> 23
<i>Road mowing</i> 52
<i>Trail hazard mitigation</i> 11
<i>Trail trimming</i> 11



Bamboo encroachment in the Stony Creek RNHA (Edeburn Division) before and after treatment.



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Annual Gathering · November 7, 2019

Research Tour · December 6, 2019

11th Annual Pine Cone Pacer 5K · April 18, 2020

