Enhance 90-years of forest monitoring at Black Rock Forest

Summary

Black Rock Forest manages over 90 years of monitoring data on a 1586-hectare forest in New York. While local in geographic scope, the length and breadth of record is unique and may provide a valuable resource to better understand, manage, and protect northeastern forested ecosystems in a changing world. We requested funds to maintain long-term plot infrastructure, digitize historic records, and upgrade existing monitoring programs to better manage, share, and synthesize these novel data sets. We hired a research technician who digitized historic data, maps, and supported ongoing forest monitoring. We also began the process of standardizing and expanding our forest monitoring program. Numerous datasets were made publicly available through FEMC data archive and the Environmental Data Initiative.

Rationale

Black Rock Forest in Cornwall, NY established in 1927 as a "Research and Demonstration Forest", has been actively participating in forestry and ecological research since its conception (Tryon 1930). The 96-year history of forest monitoring provides a valuable opportunity to better understand long-term trends in forest health and changes in climate, browsing pressure, and invasive plants. Plots established in the 1930s are maintained and visited annually to track changes in tree growth, composition, and health and provide data on changes in carbon sequestration and community composition (Schuster et al. 2008). Deer have been studied and managed for over three decades and the forest maintains detailed records of harvest, acorn mast, winter tracking, and population estimates. Paradoxically, the strength of history is also a weakness as best practices of information management, forest monitoring, and mapping have changed considerably in the last century. Many of our records were still on paper, in software formats from the 1980s and 1990s that are no longer supported or relied on outdated research methods. As long-term staff retire, our institutional knowledge may be lost unless these locations, detailed methodology, and paper records are preserved and become available for the next generation of science.

We requested funds to: continue and maintain long-term forest inventory and monitoring plots; digitize key historical data sets, upgrade our existing monitoring programs to increase comparability with other systems nationally, and support educational experiences for diverse audiences.

Forest Ecosystem Monitoring Cooperative Grant Final Report
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Funding Results

Objective 1: Continue and maintain long-term forest monitoring plots.
Black Rock Forest hired a research technician, Bomin Kim, in August 2023 to assist with forest monitoring. Bomin and Katie Terlizzi, our Research Manager, were able to visit all forest monitoring plots and complete the data collection between August & September (Figure 1). In all plots, trees were mapped, identified to species, measured for diameter at breast height (DBH), assessed for canopy health (e.g., alive or dead), and assigned a canopy class (dominant, co-dominant, intermediate or suppressed). Plots were remarked and spatial data was collected for all corners, fencing, and center posts and organized into a new GIS database of forest monitoring plots. Data were also collected during the 2024 field season.

Figure 1. Research technician, Bomin Kim, revisited long-term plots and measured trees to better understand trends in forest health and growth.
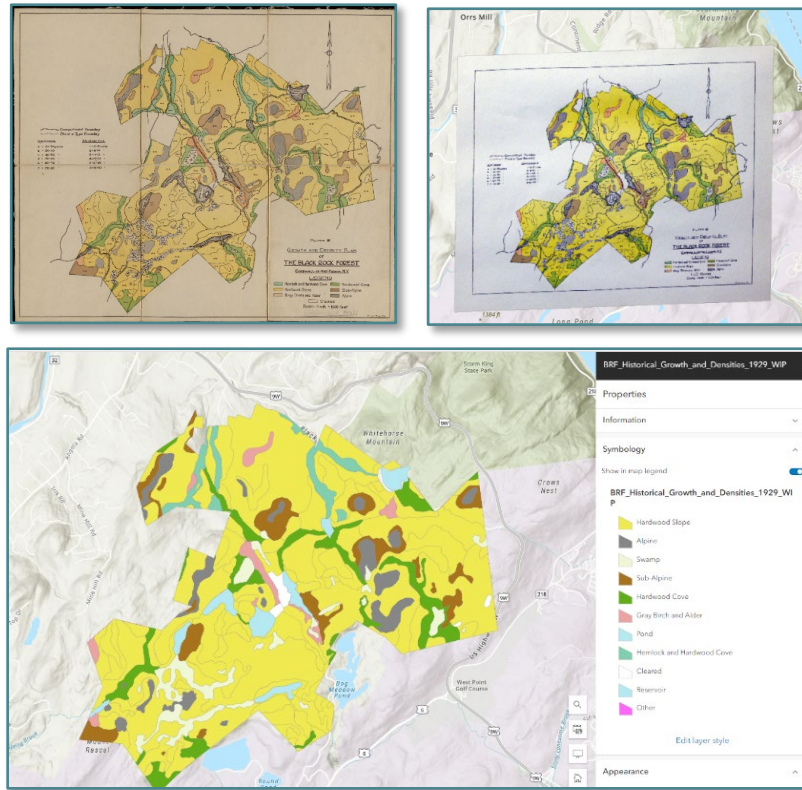

Objective 2: Digitize historic forest monitoring data and make them publicly available.
The bulk of our funding and efforts were spent on digitizing key datasets and making them publicly available. For the non-spatial datasets, the data, metadata, and code for QA/QC were published through the Environmental Data Initiative. The longest records included 90 years of forest monitoring and 63 years of precipitation data. We also created a FEMC Project for Black Rock Forest that links to 5 of these datasets. See:
https://www.uvm.edu/femc/data/archive/project/black-rock-forest-1985-forest-inventory

Camera data and images were shared and made publicly available on Wildlife Insights. This includes 388,758 images of 43 species. See: https://app.wildlifeinsights.org/public-project/2004254/145625598251_2004254_116_black_rock_forest_ma

Historic maps were digitized, orthorectified, and then corresponding feature layers were created (Figure 2). This process allowed staff to bring maps from the 1930s into the field using ArcGIS FieldMaps. We completed a series of maps and made a set publicly available on AGOL. Others are available upon request. The focus was on forest treatment records – reforestation and cutting from 1930s to the present. Bomin Kim presented her work on this project at the Northeast Natural History Conference in April 2024 in Albany, NY.

Figure 2. A sample of a historic forest map (upper left) that has been scanned and orthorectified (upper right) and then corresponding feature layers were created in ESRI (lower).

Objective 3: Upgrade existing forest monitoring program.
The final objective was to upgrade the existing inventory & monitoring program to increase comparability with other field stations regionally and nationally to ensure long-term viability. We worked with Bomin Kim to review 6 forest monitoring protocols (Black Rock Forests, NEON, NPS, FIA, NASA Globe, ForestGEO) and held a workshop with research staff members to review approaches, determine if change was necessary, and decide on next steps. We reached out to partners within the Hudson Valley Environmental Monitoring and Management Alliance (EMMA) and the Lower Hudson Partnership for Regional Invasive Species Management (LH PRISM) to discuss monitoring approaches. In January, we met with Mohonk Preserve to discuss their forest monitoring program using the National Park Service, northeast temperate forest monitoring protocol (Tierney et al. 2022):

After thorough discussions and reviews, we decided that the National Park Service protocol is the best fit for Black Rock Forest because they support regional comparisons, plot sizes are manageable and similar to our existing series of plots, and methods are well-documented. We sent our staff in June 2024 for two days of training with the National Park Service field crews at Roosevelt-Vanderbilt National Historic Site in Hyde Park, NY (Figure 3).

Figure 3. Black Rock Forest staff work with National Park Service vegetation crew to better understand standardized field methods.

We established a draft sample design for Black Rock Forest using a rotating panel. We piloted the methods and plot establishment at two sites. Our priority for 2024 was to better understand and prepare for appropriate marking, data acquisition (database & field sheets), and equipment needs. Our intent is to start the full panel and schedule of monitoring during the 2025 field season.

Objective 4: Support educational experiences for diverse audiences.

Black Rock Forest hired a research technician, Bomin Kim, to manage this project. Asian-American women are underrepresented in forestry and we were happy to support her position and continued career in this field. We also provided summer science and field experiences for students from diverse backgrounds. Last year, we supported environmental education and science classes for youth with a reach of 8657 student days. We supported classes specifically in biometry and forestry for 64 Newburgh Enlarged School District summer science students. As of the 2022-2023 school year, 63% of students in the district were economically disadvantaged, 59% of students identified as Hispanic or Latino and 20% as Black or African American.

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Budget Detail

Item	FEMC Funds Invoiced	Non-Federal Matching Funds
Personnel		
Salaries & Wages	$18,320	$18,900
Personnel fringe benefits	$4,080	$4,725
Travel		$300
Supplies	$200	$1,075
Indirect Costs	$2,240	
Total	**$24,840**	**$25,000**

The majority of FEMC funds were used to support the salary of a research technician and data management assistant for the 9-month period from August 2023 – June 2024. Black Rock Forest provided matching salary to supervise and support the data publishing process. Travel funds were used to support driving to and from forest monitoring sites and to present the work at the Northeast Natural History Conference in April 2024. Supplies were purchased to complete forest monitoring in long-term plots and expand monitoring to new sites (e.g. DBH tapes and meter tapes).

Literature Cited

Schuster, W.S.F., K.L. Griffin, H. Roth, M.H. Turnbull, D. Whitehead and D.T. Tissue. 2008. Changes in composition, structure, and aboveground biomass over seventy-six years (1930-2006) in the Black Rock Forest, Hudson Highlands, southeastern New York State. Tree Physiology Special Issue: IUFRO workshop Regional Forest Responses to   Environmental Change. 28: 537-549.

Tierney G and Others. 2022. Northeast Temperate Network long-term forest monitoring protocol: 2022 revision. Natural Resource Report. NPS/NETN/NRR—2022/2434. National Park Service. Fort Collins, Colorado. https://doi.org/10.36967/2293861

Tryon, H.H. 1930. The Black Rock Forest. Black Rock Forest Bulletin No. 1. Cornwall Press, Cornwall, NY. 42 p.