

Experimental Forests of the Northern Research Station



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FOREWORD

This publication provides an overview of the 22 experimental forests operated by the U.S. Forest Service, Northern Research Station. Additional information can be found at the Northern Research Station's Website on experimental forests: www.nrs.fs.fed.us/ef/

A broader look at experimental forests nationwide is compiled in General Technical Report (GTR) NE-321, which provides information, research opportunities, and long-term databases of the 77 experiment forests and ranges managed by the U.S. Forest Service. GTR-NE-321 is available at: <http://nrs.fs.fed.us/pubs/6741>

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Publications Group
Northern Research Station
359 Main Road
Delaware, OH 43015

CONTENTS

Introduction	2
Map of NRS Experimental Forest Locations and Forest Type	4
Overview of NRS Experimental Forests	5-13
Table of Annual Operating Costs of Experimental Forests in FY 08.....	8
Table of Funding Needs for NRS Experimental Forests.....	9
Descriptions of NRS Experimental Forests with Details of Needs	15-58
Argonne Experimental Forest, Wisconsin.....	15
Baltimore Ecosystem Study, Maryland	17
Bartlett Experimental Forest, New Hampshire	19
Big Falls Experimental Forest, Minnesota.....	21
Coulee Experimental Forest, Wisconsin	23
Cutfoot Experimental Forest, Minnesota.....	25
Dukes Experimental Forest, Michigan.....	27
Fernow Experimental Forest, West Virginia.....	29
Harshaw Research Farm, Wisconsin	31
Hubbard Brook Experimental Forest, New Hampshire	33
Kane Experimental Forest, Pennsylvania	35
Kaskaskia Experimental Forest, Illinois	37
Lower Peninsula Experimental Forest, Michigan	39
Marcell Experimental Forest, Minnesota	41
Massabesic Experimental Forest, Maine	43
Paoli Experimental Forest, Indiana.....	45
Penobscot Experimental Forest, Maine	47
Pike Bay Experimental Forest, Minnesota	49
Silas Little Experimental Forest, New Jersey.....	51
Sinkin Experimental Forest, Missouri.....	53
Udell Experimental Forest, Michigan.....	55
Vinton Furnace Experimental Forest, Ohio.....	57

INTRODUCTION

For 100 years, the U.S. Forest Service has been conducting scientific research, applying research findings on National Forest lands, and transferring them to others for use on all of the nation's forest lands. This combined mission of research, land management, and technology transfer sets the Forest Service apart as a natural resource agency.

Forest Service Experimental Forests are an integral and essential element in the discovery of knowledge about our forest and associated aquatic ecosystems. These living laboratories are dedicated to long-term research on ecosystem processes, silviculture and forest management options, wildlife habitat characteristics, and forest growth and development. The Northern Research Station administers 22 experimental forests, including an urban experimental forest. Their strength is in their longevity. Research and monitoring has been carried out for more than 50 years on several experimental forests, producing long-term, irreplaceable data sets that are valuable for not just our scientists, but scientists and land managers from a wide variety of educational institutions, foundations, agencies and organizations.

Research conducted on Northern Research Station experimental forests leads directly to changes in how forestry is practiced on the ground, promoting sustainable choices for our nation's lands. We've learned how to build roads in forests to minimize erosion and sedimentation and which silvicultural treatments optimize varying forest benefits, from wood quality to wildlife habitat. Acid rain was first recognized through long-term studies on one of our experimental forests. Most of the forest practices used on public land and much private land throughout our region trace their origins to long-term studies on experimental forests.

Yet today, forests face challenges that many believe are unprecedented. Our cities sprawl into our forests, and the pollution that we produce changes their soils and waters, and in turn, plant resilience to other stresses. Globalized commerce brings invasive plant and animal pests from around the world. Successful suppression of fire throughout much of the region has changed the structure and composition of our forests, making it ever more difficult to sustain key species such as the oaks. Climate changes may make our region's weather more like that currently experienced in the southeast within the next century, interacting with other challenges that forests face. An urbanizing population needs demonstration and observation opportunities to build environmental literacy and contribute to smart, responsive stewardship policy. For managers to make intelligent responses and sustain the values and benefits that forests provide, long-term studies are resources that only grow more important and provide a context-rich record of these changes as they occur. These studies also provide the best framework for testing the success of management responses to these challenges.

In addition to the important results that will come from the individual experimental forests in these challenging times, our 22 sites represent several important gradients. Our experimental forests occur in every major forest type in our region and include sites from large blocks of continuous forest through urbanizing landscapes to urban centers, representing dramatic latitudinal and development gradients. They also capture nearly the full range of pollution loading observed in our region. As we provide support for increasingly significant monitoring technology and synthesis across these gradients, we will be well positioned to answer complex regional questions while we continue to provide good guidance for local management adaptations.

Experimental forests are a priority research asset in the Northern Research Station, and are carefully and diligently managed by the scientists who work there. Opportunities to increase the depth and breadth of research conducted on individual experimental forests and across networks of thoughtfully chosen sites abound. During the past century, we have built a strong foundation for sustaining experimental forests, and the numerous contributions thus far represent only the beginning of the values and benefits they provide.

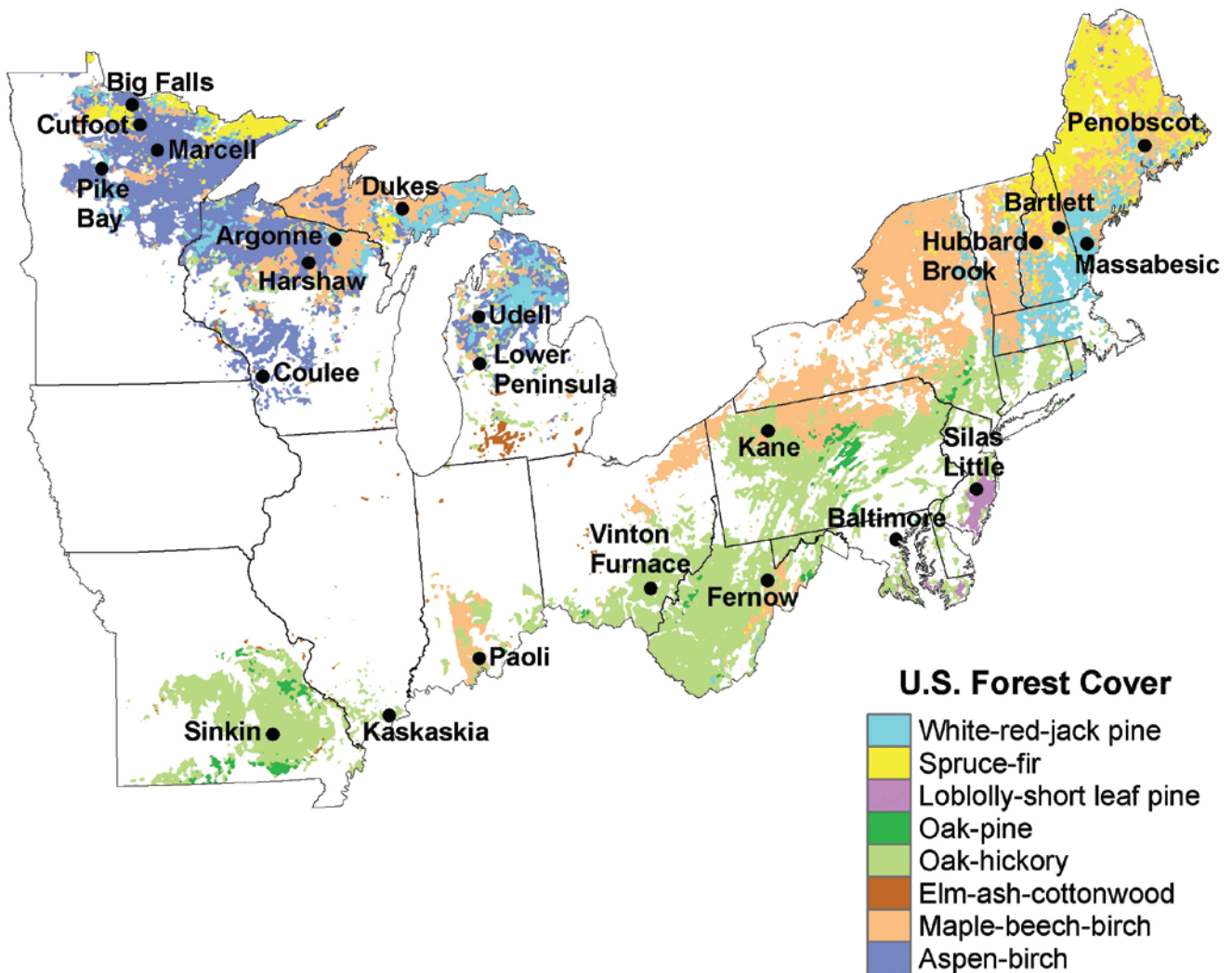
What Is An Experimental Forest?

The Forest Service Manual (FSM 4062) lists three key attributes that define an experimental forest:

- “...lands for conducting Research and Development that serves as a basis for management of forests and rangelands.”
- “The Chief reserves the authority to approve the designation of experimental forests....”
- “An approved establishment record is required....”

Of the 22 sites listed in this atlas, 20 meet all the requirements as designated experimental forests. The Baltimore Ecosystem Study in Maryland, and the Harshaw Forestry Research Farm in Wisconsin, while not technically experimental forests, are critical long-term research sites for NRS and are included in order to provide a comprehensive overview of field site resources available to NRS scientists and cooperators.

NORTHERN RESEARCH STATION EXPERIMENTAL FORESTS



The 22 experimental forests managed by NRS for long-term ecological and management research are found in all the major forest types of the Northeast and Midwest. Forest types range from spruce and fir in the station's northern extent, to mixed hardwood and mixed pine throughout the mountains and lower elevations of the central part of the region, to oak-hickory and oak-pine along the southern portion of the NRS territory. Not only do the experimental forests represent a broad range of forest types, but they also represent extensive gradients of latitude, longitude, and elevation. (Map courtesy of NRS Forest Inventory and Analysis).

Key Attributes of Northern Research Station Experimental Forests

Experimental Forest	Location	Size (acres)	Year Established	Research Strengths	Facilities ^a
Argonne	WI	6,499	1947	Northern hardwood ecology and management	
Baltimore	MD	148,000 ^b	1998	Urban social ecology	L,O
Bartlett	NH	5,789	1932	Northern hardwood ecology and silviculture; wildlife habitat; remote sensing	C,H,L,O
Big Falls	MN	2,040	1961	Black spruce silviculture; wetland ecology	
Coulee	WI	3,000	1960	Steep land management; reforestation	
Cutfoot	MN	3,100	1932	Red pine ecology and silviculture	
Dukes	MI	5,500	1926	Northern hardwood silviculture; management of forested swamps	
Fernow	WV	4,700	1934	Mixed hardwood silviculture; watershed hydrology and management; atmospheric deposition; prescribed fire	C,H,L,O
Harshaw	WI	520	1972	Free Air Carbon Enrichment (FACE) project; hybrid poplar culture	C,L,O
Hubbard Brook	NH	7,750	1955	Ecosystem processes; watershed hydrology and management; wildlife habitat; atmospheric deposition	C,H,L,O
Kane	PA	3,563	1932	Allegheny hardwood ecology and silviculture; wildlife management, especially white-tailed deer; atmospheric deposition	C,H
Kaskaskia	IL	1,150	1942	Central hardwood silviculture	
Lower Peninsula	MI	3,400	1954	Pine plantation management; atmospheric deposition	
Marcell	MN	2,820	1960	Peatland ecology, hydrology, and management; atmospheric deposition; mercury pollution	C,H,L,O
Massabesic	ME	3,700	1942	Mixed pine-oak ecology and silviculture; seasonal wetland ecology; prescribed fire	H,O
Paoli	IN	632	1963	Central hardwood ecology and silviculture	
Penobscot	ME	4,000	1950	Northern conifer ecology and silviculture	C,H,O
Pike Bay	MN	3,914	1932	Aspen ecology and management; soil productivity	
Silas Little	NJ	590	1933	Pine genetics; fire weather and hazardous fuels; remote sensing	C,H,L,O
Sinkin	MO	4,100	1950	Mixed oak ecology and silviculture; prescribed fire	
Udell	MI	3,800	1961	Hydrology of glacial sands	
Vinton Furnace	OH	3,200	1952	Mixed oak ecology and silviculture; prescribed fire; rare species management	C,H,O

^a C=conference room; H=housing; L=laboratory; O=office space

^b Entire area not dedicated to research but research is conducted throughout the area

Research Activity Level

The current level of activity at NRS experimental forests varies, however, they are all valuable for field-based research and demonstration by NRS staff and cooperators. Regardless of the activity level, the array of sites represent several important gradients of urban development, water quality, temperature and precipitation, soil and other site characteristics; and forest types.

Experimental Forest	Current Level of Research Activity (2008)		
	Very Active	Active	Little Activity
Argonne		X	
Baltimore	X		
Bartlett	X		
Big Falls			X
Coulee			X
Cutfoot		X	
Dukes		X	
Fernow	X		
Harshaw	X		
Hubbard Brook	X		
Kane	X		
Kaskaskia		X	
Lower Peninsula		X	
Marcell	X		
Massabesic		X	
Paoli		X	
Penobscot	X		
Pike Bay		X	
Silas Little	X		
Sinkin		X	
Udell			X
Vinton Furnace	X		

Very active: Multiple NRS and external partners and cooperating researchers.
 Active: Active studies by researchers from at least one NRS Research Work Unit.
 Little activity: In caretaker status.

Research Networks

Experimental Forest	Important Existing Networks						
	AmeriFlux	CASTNET	FS 18	LTSP	LTSP	NADP	NEON
Baltimore	X		X	X			
Bartlett	X						X
Fernow		X	X		X	X	
Hubbard Brook		X	X	X		X	
Kane		X				X	
Lower Peninsula						X	
Marcell			X		X	X	
Pike Bay					X		
Silas Little	X		X				
Sinkin					X		

Much of the research on NRS experimental forests is in conjunction with other national and international research networks. NRS experimental forests are part of the following research networks:

AmeriFlux: A network of sites that provides continuous observations of exchanges of CO₂, water, energy and momentum spanning several time scales. AmeriFlux is composed of sites from North America, Central America, and South America.

CASTNET: Clean Air Status and Trends Network measures concentrations of key air pollutants involved in acid deposition. The program is administered and operated by the U.S. EPA.

FS 18: A network of 18 U.S. Forest Service experimental forests providing a landscape-scale research platform for addressing transcontinental questions on the effects of environmental change on ecosystem function and services.

LTSP: Long-term Ecological Research network is a collaborative effort involving more than 1800 scientists and students investigating ecological processes over long temporal and broad spatial scales. The network promotes synthesis and comparative research across sites and ecosystems and among other related national and international research programs.

LTSP: Long-term Soil Productivity program is a national network of large-scale experiments intended to evaluate effects of soil porosity and organic matter on plant production and identify useful measures or surrogates for monitoring soil productivity and the status of soil quality.

NADP: National Atmospheric Deposition Program is a network of precipitation monitoring sites. The purpose of the network is to collect data on the chemistry of precipitation for monitoring of geographical and temporal long-term trends. The network is a cooperative effort between many different state, federal and private entities.

NEON: National Ecological Observatory Network is a continental-scale research platform for discovering and understanding the impacts of climate change, land-use change, and invasive species on ecology.

Annual Operating Costs for Northern Research Station Experimental Forests

Experimental Forest	Vehicles	Utilities	Services	Materials and Supplies		Equipment Support	Other	Seasonal Employees	Permanent Employees	Data Management	Total
				- Office -	- Field -						
Argonne	\$1,700	\$400		\$1,000	\$1,000	\$1,000		\$3,000	\$23,727	\$8,552	\$39,379
Baltimore	\$10,000			\$10,000	\$5,000	\$100,000		\$38,000	\$597,000	\$52,000	\$822,000
Bartlett	\$5,200	\$14,400	\$800	\$700	\$2,000	\$1,500		\$33,000	\$93,800	\$59,000	\$210,000
Cutfoot	\$1,700			\$1,000	\$1,000	\$1,000		\$3,000	\$23,727	\$8,552	\$38,979
Dukes	\$1,700			\$1,000	\$1,000	\$1,000		\$3,000	\$23,727	\$8,552	\$38,979
Fernow	\$40,000	\$5,000		\$15,000	\$7,500	\$10,000		\$10,000	\$270,000	\$80,916	\$438,416
Harshaw	\$2,000	\$5,000		\$1,500	\$2,000			\$3,000	\$250,000	\$70,000	\$333,500
Hubbard Brook	\$15,000	\$13,500		\$2,500	\$8,000	\$8,000	\$9,000	\$16,000	\$209,000	\$30,000	\$320,000
Kane	\$3,204	\$11,700		\$1,000	\$5,000	\$5,000	\$3,000	\$5,000	\$285,861	\$24,699	\$344,464
Kaskaskia, Paoli, and Sinkin	\$13,000			\$20,000	\$5,000		\$2,000	\$12,000	\$90,000		\$142,000
Lower Peninsula			\$10,000		\$2,500						\$12,500
Marcell	\$25,000	\$5,000	\$4,000	\$3,000	\$20,000	\$3,000		\$7,000	\$217,339	\$42,968	\$327,307
Massabesic	\$3,400	\$2,200		\$250	\$1,800	\$300		\$13,500	\$17,550	\$36,000	\$75,000
Penobscot	\$5,800	\$6,200	\$1,200	\$700	\$2,000	\$1,200		\$16,500	\$66,000	\$62,400	\$162,000
Pike Bay	\$1,700			\$1,000	\$1,000	\$1,000		\$3,000	\$23,727	\$8,552	\$38,979
Silas Little	\$6,500	\$2,400		\$2,200	\$50,000	\$5,000	\$31,000	\$10,000	\$92,900		\$200,000
Vinton Furnace	\$15,000	\$5,000		\$1,000	\$10,000	\$5,000	\$10,000	\$35,000	\$120,000	\$80,000	\$281,000
Total	\$150,904	\$70,400	\$16,000	\$41,350	\$145,800	\$47,500	\$165,000	\$211,000	\$2,404,358	\$572,191	\$3,824,503
Average for the above 19:											\$201,290

Note: Operating costs for Big Falls, Coulee, and Udell Experimental Forests are minimal and therefore not listed in this table.

Funding Needs for Northern Research Station Experimental Forests

Experimental Forest	Immediate Needs					Long-Term Development Needs					Total	
	Facilities	Data or Equipment	Permanent Staff	Operating	Site Protection	Subtotal	Facilities	Data or Equipment	Permanent Staff	Operating		Subtotal
Argonne		\$80,000				\$80,000	\$800,000				\$800,000	\$880,000
Baltimore	\$15,000	\$235,000	\$145,000			\$395,000		\$20,000	\$30,000		\$50,000	\$445,000
Bartlett	\$45,000	\$150,000		\$45,000		\$240,000	\$100,000	\$30,000		\$14,000	\$144,000	\$384,000
Cutfoot		\$80,000				\$80,000	\$80,000				\$80,000	\$160,000
Dukes		\$80,000				\$80,000						\$80,000
Fernow	\$125,000				\$500,000	\$625,000	\$1,050,000				\$1,050,000	\$1,675,000
Harshaw										\$2,400,000	\$2,400,000	\$2,400,000
Hubbard Brook			\$150,000			\$150,000		\$200,000	\$75,000		\$275,000	\$425,000
Kane	\$10,000					\$10,000	\$150,000		\$100,000		\$250,000	\$260,000
Kaskaskia									\$90,000	\$50,000	\$140,000	\$140,000
Lower Peninsula		\$20,000				\$20,000	\$150,000	\$25,000			\$175,000	\$195,000
Marcell		\$83,000				\$83,000						\$83,000
Massabesic	\$35,000	\$38,000		\$13,000		\$86,000	\$600,000	\$25,000		\$23,000	\$648,000	\$734,000
Paoli										\$50,000	\$50,000	\$50,000
Penobscot		\$20,000		\$19,000		\$39,000	\$100,000	\$20,000		\$14,000	\$134,000	\$173,000
Pike Bay		\$80,000				\$80,000	\$800,000				\$800,000	\$880,000
Silas Little		\$25,000				\$25,000	\$100,000	\$50,000			\$150,000	\$175,000
Sinkin									\$90,000	\$50,000	\$140,000	\$140,000
Vinton Furnace		\$50,000			\$5,000,000	\$5,050,000			\$405,000		\$405,000	\$5,455,000
Total						\$7,043,000					\$7,691,000	\$14,734,000

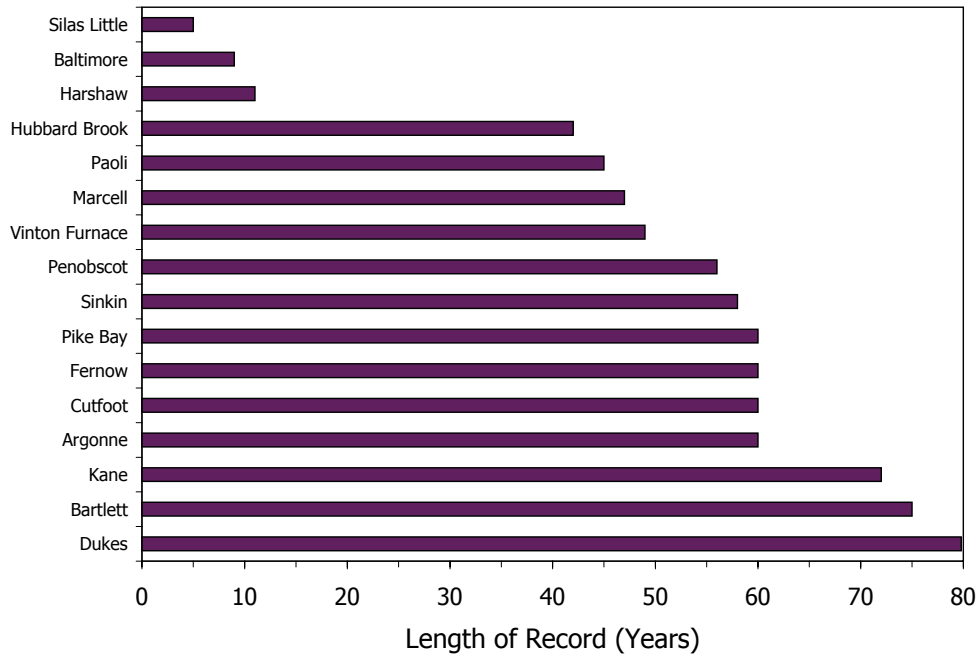
Note: Funding needs for Big Falls, Coulee, and Udell Experimental Forests are minimal and therefore not listed in this table.

Research Topics

Research at NRS experimental forests covers a number of topics or disciplines. Many experimental forests were established for forest management research; consequently, tree growth and development have been measured the longest, while research on a broader range of topics started about 40 years ago. Because of high costs and the need for large experimental units, some kinds of research, such as hydrology and fire, are done at only a few locations. This combination of research topics highlights the value of experimental forest for addressing the entire spectrum of questions that are asked about the ecology and management of natural resources. More information about past and current research, as well as research opportunities, is provided in the section of this publication devoted details about individual experimental forests that begins on page 13.

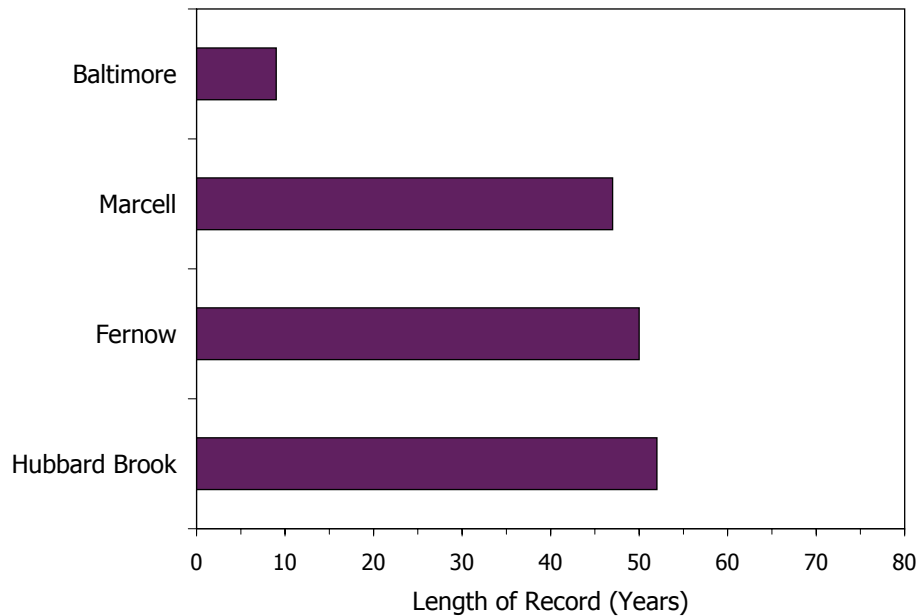
Research Topic	Number of Experimental Forests	Length of Record Through 2008 (years)	
		Average	Maximum
Forest Vegetation Dynamics	16	49.3	80
Hydrology	4	39.5	52
Weather / Atmosphere	10	30.6	58
Soil Processes	9	19.7	50
Biogeochemistry	7	18.6	45
Ecology	10	19.0	45
Wildlife	8	17.6	35
Remote Sensing	5	8.8	15
Fire	5	8.0	12

Forest Vegetation Dynamics Research



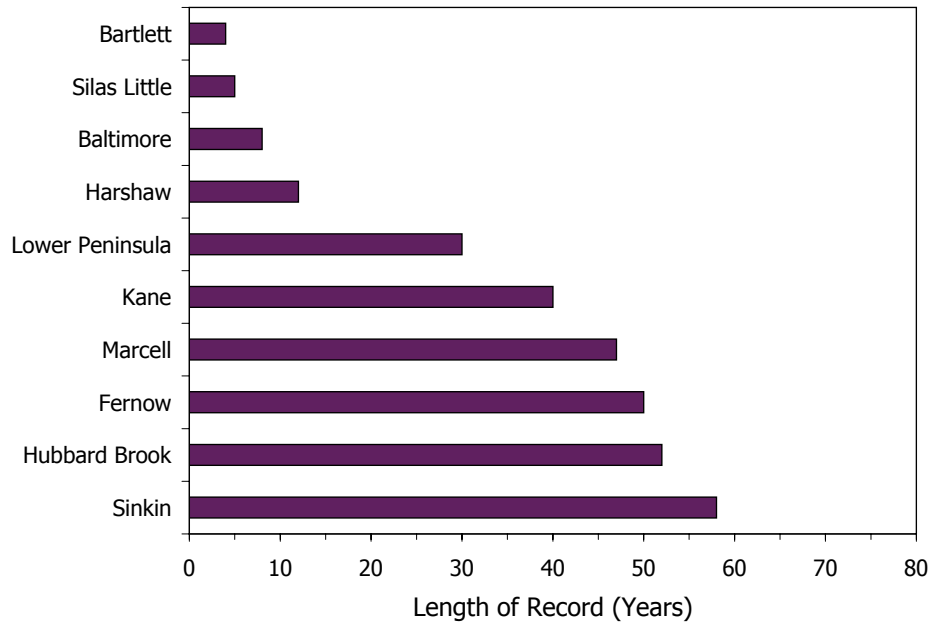
The studies on NRS experimental forests represent a lengthy record of forest change across the range of forest types found in the Northeast and Midwest. Early studies almost always focused on commercial tree species, but more recently a broader range of woody, and in some cases nonwoody, plants have been studied.

Hydrology Research



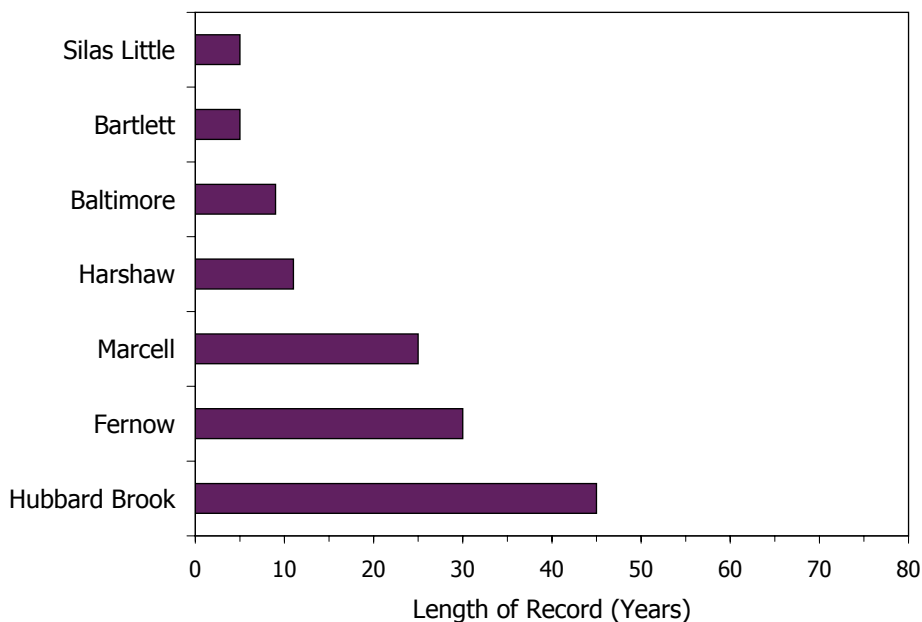
Hydrology research, or the study of how water cycles through ecosystems, has been an important component of Forest Service research for almost as long as the study of forest dynamics. In NRS, Fernow and Hubbard Brook Experimental Forests contain a number of distinct, small forested watersheds that are monitored. At Marcell Experimental Forest, the hydrology of bogs and fens is studied. At the Baltimore Ecosystem Study, hydrological research in an urban and suburban environment is a relatively new line of investigation.

Weather and Atmospheric Research



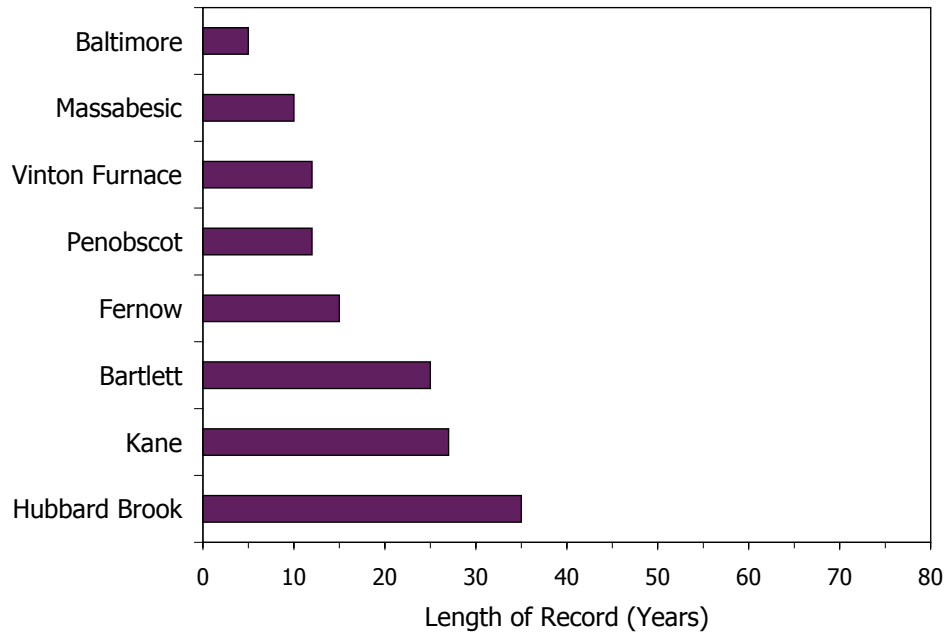
Several years of temperature and precipitation records are available for some of the NRS experimental forests. Today the range of weather and atmospheric measurements has expanded greatly to include energy (sunlight), relative humidity, and fluxes of gases such as CO₂ due to advances in automated measuring instruments over the past decade. Those forests with relatively short records are also benefiting from these new instruments and we now are collecting vast amounts of data to help understand interactions between the atmosphere and forests.

Biogeochemistry Research



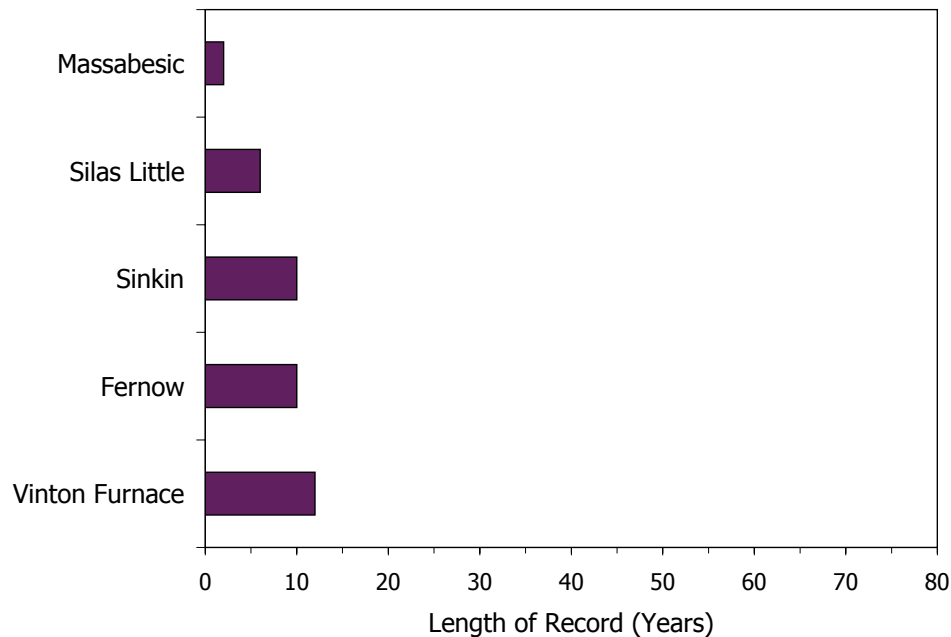
Biogeochemistry is the study of nutrient cycling in ecosystems. Biogeochemistry research started at experimental forests originally established to study hydrology because of the intimate link between the movement of nutrients and the flow of water. Because the insights biogeochemistry research provides about ecosystem productivity and health are so valuable, it has been integrated at a number of other experimental forests as well.

Wildlife Research



Wildlife habitat and wildlife ecology research have become integrated with studying forest vegetation response to natural disturbances and silvicultural manipulations at many NRS experimental forests. The integration of these fields of study provides forest managers much more comprehensive information upon which to base management decisions.

Fire Research



Modern fire research, on both wildfire and prescribed fire, is relatively recent in the Northern Research Station. However, with an increasing amount of wildland-urban interface, understanding fire is essential for protecting both human safety and forest health.



ARGONNE EXPERIMENTAL FOREST

Three Lakes, Wisconsin



The 6,499 acre (2,631 ha) Argonne Experimental Forest is located within the Chequamegon-Nicolet National Forest in northeastern Wisconsin and was established in 1947. The primary vegetation types on the forest are northern hardwoods, mixed lowland conifers, and jack and red pine. The primary objectives of most studies here are to learn how to bring second-growth northern hardwoods under management. Information from studies on the Argonne Experimental Forest has been used to develop management guides for northern hardwood forests in the Lake States. These guides are the primary source of management information throughout the region. The Argonne also serves as an excellent demonstration site for landowners and land managers interested in managing northern hardwoods. Thousands of land managers from the United States and Canada have toured and been trained at the Argonne Experimental Forest.



Assets

Scientists: 3 Northern Research Station scientists conduct studies here.

Scientific support: 2 technicians and/or professionals support the work of these scientists.

Cooperators: Chequamegon-Nicolet National Forest, Wisconsin DNR, University of Wisconsin, Michigan Technological University

Needs

Annual operating costs: \$39,379

Critical needs: Updated ecosystem classification and stand inventory maps

Long-term needs: Field lab (dry) with living quarters - \$800,000

The Argonne Experimental Forest is administered by:

U.S. Forest Service, Northern Research Station
5985 Highway K, Rhinelander, WI 54501

Key Contact:

Brian Palik, 218-326-7116, email bpalik@fs.fed.us

More About the Argonne Experimental Forest

Location: Lat. 45°45' N, long. 89°0' W

The Argonne is located about 15 miles southeast of Three Lakes, WI, in the northeastern portion of the state.

Vegetation: The vegetation types on the Argonne Experimental Forest vary according to the soil type. The Iron River loam supports northern hardwoods dominated by sugar maple, yellow birch, basswood, and hemlock. Other species found mixed in this type are white ash, black cherry, quaking aspen, northern red oak, and American hornbeam. The Carbondale peat supports mixed lowland conifers dominated by black spruce and tamarack. Jack and red pine, quaking aspen, and paper birch dominate the Tawas sand. Most stands of trees on the Argonne are second-growth and even-aged, though there are small areas of old-growth northern hardwoods on the forest.

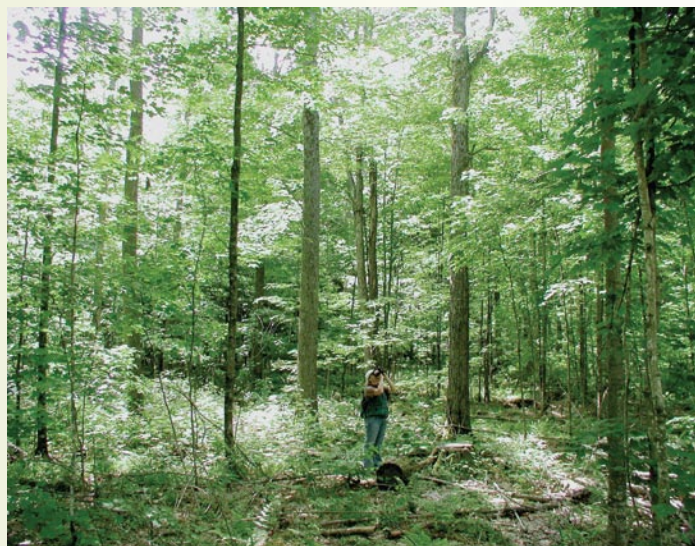
Climate: The climate is continental, with an average annual temperature of 41°F (5 °C). Summer maximums of 90°F (32 °C) are common and winter minimums can reach (-40 °F) -40 °C. Average annual rainfall is 33 inches (813 mm), mostly occurring during the growing season. Snowfall averages 61 inches (1,524 mm) per year. The growing season averages about 100 days.

Research—past and present: Research on the Argonne began in 1947. The primary objective of most studies is to learn how to bring second-growth northern hardwoods under management. The Cutting Methods study (comparing nine different types of cutting) is replicated and is the highest priority study on the forest. More recently, this study has been used to examine the carbon storage consequences of long-term forest management. A new large-scale multidisciplinary study, in collaboration with the Wisconsin Department of Natural Resources, has been added that examines methods to promote old-growth characteristics in second-growth forests.

Research opportunities: The Argonne provides an opportunity to study the silviculture and ecology of the three main vegetation types. The active studies provide opportunities to compare treatments of many components of the forest.

Facilities: There is a small field station located on the Argonne, but the building is without water, heat, or bathroom facilities.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/wi/argonne/>





BALTIMORE ECOSYSTEM STUDY

Baltimore, Maryland



The Baltimore Ecosystem Study (BES) is a Long-Term Ecological Research (LTER) project initiated in 1997 that explores metropolitan Baltimore as a social-ecological system. BES is one of two LTER sites that began with an urban and interdisciplinary focus. The research program advances scientific understanding of urban ecosystems and serves as a resource for education and decision making by communities and land managers responsible for sustaining livelihoods and quality of life for millions of citizens in the Baltimore metropolitan area. The project involves researchers and educators from the Northern Research Station and over 30 colleges, universities, community groups, and government agencies.



Assets:

Scientists: 6 Northern Research Station scientists are conducting research affiliated with the Baltimore Ecosystem Study (2 on-site, 4 off-site)

Scientific Support: 2 on-site and 2 off-site full-time technicians and/or professionals and up to 5 part-time technicians support the work of these scientists

Cooperators: Cary Institute of Ecosystem Studies administers the project, and the Center for Urban and Environmental Research and Education and the University of Vermont's Spatial Analysis Laboratory are primary cooperators, plus an additional 30 or more government agencies, universities, and community groups.

Needs:

Annual operating costs: \$822,000

Critical Needs

- Climate controlled and regular storage facilities
- 3 gauging stations in area of eddy flux tower
- Household data collections
- Remotely sensed imagery
- Permanent technical support staff and half-time GIS/cartographic staff

Long-term needs:

- Permanent laboratory and office space
- Administrative support staff
- GIS Computational Capacity (hardware and software)



The Baltimore Ecosystem Study is hosted by:

Center for Urban and Environmental Research and Education
1000 Hilltop Circle, Baltimore, MD 21250

Key Contact:

Rich Pouyat, 410-455-8014, email rpouyat@fs.fed.us

More About the Baltimore Ecosystem Study (BES)

Location: Lat: 39°24'47" N, long. 76°31'19" W

The Baltimore Ecosystem Study encompasses the city of Baltimore, MD, and the surrounding 5-county area.

Vegetation: The Baltimore city and county area includes nearly 60,000 ha of intact forests, some 120 years old or older. The Baltimore metropolitan area was previously dominated by hardwood deciduous forests with smaller areas of riparian and wetland vegetation. After European colonization and before the development of the city, the forested areas were transformed to agricultural uses. Forest cover, mostly outside the city, is dominated by chestnut oak, yellow-poplar, box elder, green ash, sycamore and silver maple. Overall, Baltimore city has a canopy cover of approximately 21 percent with the majority of tree stems occurring in remnant forest patches, vacant land, and residential areas that are dominated by ash species, American elm, American beech, black cherry, black locust, and tree-of-heaven.

Climate: The Baltimore metropolitan area has hot humid summers and cold winters with average annual air temperatures of 58 °F (14.5 °C) in the city. Precipitation is distributed evenly throughout the year and average 43 inches (108 cm) per year in the city of Baltimore. The greatest rainfall intensities occur in the summer and early fall.

Research—past and present: Research outcomes include an urban watershed monitoring network for water quality and flows (13 gauging stations installed); a network of permanent (11) and extensive (400) plots to measure various ecosystem characteristics; the only permanent urban eddy flux tower in the U.S.; development of innovative low-impact storm water management techniques; assessments of community well-being and social capital and relating these measurements to environmental quality and stewardship; long-term U.S. Census data (1790-present) and parcel level data (1880-present) related to landuse and landcover change, environmental justice, and valuation of ecosystem services; development of management and planning tools such, as iTree and urban tree canopy protocols; and the implementation of classroom enrichment, teacher training, and science instruction throughout the Baltimore region, including training and recruitment of minorities into natural resource professions.



Research opportunities: The Baltimore Ecosystem Study program encourages researchers from the biological, physical, and social sciences to collect new data and synthesize existing information on how the ecological, social and engineered systems of Baltimore interact and work. As a part of the National Science Foundation's Long-Term Ecological Research network, BES also seeks to understand how Baltimore's human ecosystems change over long time periods (e.g., decades).

Facilities: The Baltimore Ecosystem Study is equipped with an Ameriflux eddy flux tower and 13 urban watershed stream monitoring stations. There are 11 permanently marked vegetation/soil monitoring plots, over 400 geographically referenced 0.1 ha plots, long-term household (3,300 telephone, 999 field observation) and neighborhood surveys (26), and a comprehensive, long-term GIS database of the Baltimore metropolitan area.

More information can be found at: <http://beslter.org/>



BARTLETT EXPERIMENTAL FOREST

Bartlett, New Hampshire



The 5,789 acre Bartlett Experimental Forest in New Hampshire was established in 1932 as a location to study silviculture and management of northern hardwoods. For the last two decades silviculture-wildlife habitat relationships have been studied at Bartlett, and since 1995 this experimental forest has become increasingly important as a site for studies of carbon and nutrient cycling. Research at Bartlett has been instrumental in understanding how northern hardwood forests respond following silvicultural treatments and natural disturbances and today management of northern hardwoods in New England is largely based on research conducted here. In addition, much of the knowledge about using airborne and satellite remote sensing to evaluate primary productivity and health of northern hardwood forests has been developed from Bartlett EF research. Technology transfer is a major component of the program at Bartlett with numerous workshops and tours annually for land managers and owners, students, and the public.



Assets:

Scientists: 6 Northern Research Station scientists are currently working on studies at Bartlett EF.

Scientific Support: 2 professionals support the work of these scientists.

Cooperators: Other NRS units, White Mountain National Forest, University of New Hampshire, Brown University, SUNY-ESF, Northeastern Area, State & Private Forestry, NASA, NH Dept. of Resources and Economic Development, NH Fish and Game Department, Audubon Society of New Hampshire, NH Timberland Owners Association

Needs:

Annual operating costs: \$210,000

Critical needs:

- Establish permanent sample plots on and inventory the areas of the experimental forest added in 2005 that doubled the size of the Bartlett
- Install high-speed internet connection; consolidate all long-term data and metadata into readily accessible and web-compatible formats

Long-term needs:

- Expand quarters and upgrade laboratory facilities
- Upgrade GPS/GIS capabilities and improve expertise among staff
- Modernize data collection technology with electronic data-logging systems and wireless remote

The Bartlett Experimental Forest is administered by:

U.S. Forest Service, Northern Research Station
271 Mast Road, Durham, NH 03824

Key Contact: Mariko Yamasaki, 603-868-7659, email myamasaki@fs.fed.us

More About the Bartlett Experimental Forest

Location: Lat. 44°2'39" N, long. 71°9'56" W

The Bartlett Experimental Forest is located in Bartlett, NH, about 90 miles north of Durham, NH.

Vegetation: The Bartlett Experimental Forest consists of areas of old-growth northern hardwoods with American beech, yellow birch, sugar maple, and eastern hemlock the dominant species. Even-aged stands of red maple, paper birch, and aspen occupy sites that were once cleared. Red spruce stands cover the highest slopes, and eastern white pine is confined to the lowest elevations.

Climate: Summers are warm with high temperatures occasionally reaching above 90 °F (32 °C). Winters are cold with low temperatures often reaching -30 °F (-35 °C). Average annual precipitation is 51 inches (1,270 mm), well distributed throughout the year. In winter, individual storms can drop more than 24 inches (600 mm) of snow, which most years accumulates to depths of 5 to 6.5 feet (1.5 to 2 m).

Research—past and present: For the first 50 years, research on the Bartlett focused on managing northern hardwood stands for timber. An array of silvicultural prescriptions was applied, including single-tree selection, group and patch cutting, clearcutting, and diameter-limit harvesting. Although these are among the longest running studies in this forest type, many management questions remain and silvicultural research continues. For the past 20 years, relationships between vegetation management and needs of wildlife throughout their life cycles have been investigated intensely. Such research focuses on amphibians, small mammals, and birds. The Bartlett's long-term data provide the ground observations needed to develop remote sensing data layers that can be extended to broader landscape and regional scales. These data are also used to develop and test forest ecosystem models designed to estimate current ecosystem condition and predict changes through time caused by factors such as acid precipitation, climate change, insect infestation, and various other disturbances.



Research opportunities: Opportunities for studying all aspects of ecology and management of northern hardwood forests in New England are nearly unlimited on Bartlett EF and manipulative experiments are possible in collaboration with NRS scientists. Project staff will facilitate nonmanipulative studies that do not conflict with the long-term mission of the forest.

Facilities: Facilities at the Bartlett include an office and laboratory space, a conference room, and quarters, including a kitchen and laundry, for up to 25 people.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/nh/bartlett/>



BIG FALLS EXPERIMENTAL FOREST

Big Falls, Minnesota



The Big Falls Experimental Forest was established in 1961 entirely on state land in Minnesota that was set aside primarily for management of lowland black spruce forest. At the time, research goals included silvicultural, harvesting and utilization, and economic studies.

Assets:

Scientists: No Northern Research Station scientists are currently working on the Big Falls.

Cooperators: In the past, studies have been carried out with the Minnesota Division of Forestry.

Needs:

Annual operating costs: none

Critical needs: none

Long-term needs: none

More About the Big Falls Experimental Forest

Location: Lat. 48°10' N, long. 94° W

Big Falls EF is located about 80 miles north of Grand Rapids, MN.

Vegetation: Primary overstory species on Big Falls are black spruce and tamarack, with associated understory vegetation of alder, swamp birch, blueberry, calamus, sedges, grasses, bog Labrador tea, raspberry, willow, and moss.

Climate: The climate is continental. Maximum summer temperatures are > 90 °F (32 °C) with high humidity (80 percent) and minimum winter temperatures to -31 °F (-35 °C). Growing season length is 100 to 120 days. Average annual precipitation is 20 to 26 inches (500 to 640 mm). About two-thirds of precipitation occurs as rain and one-third as snow. Snow depths average 1 to 2 m. Although prolonged summer droughts occur, rainfall is usually adequate during the growing season.

The Big Falls Experimental Forest is administered by:

U.S. Forest Service, Northern Research Station

1831 Highway 169 E, Grand Rapids, MN 55744

Key Contact:

Brian Palik, 218-326-7116, email bpalik@fs.fed.us

Research—past and present: Research on the Big Falls Experimental Forest has focused on Black spruce regeneration, growth and yield, cutting methods, prescribed burning studies, and general wetland ecology

Research opportunities: Currently there is no formal research program on the Big Falls Experimental Forest. Research proposals can be directed to the U.S. Forest Service’s Northern Research Station in Grand Rapids, Minnesota.

Facilities: There are no facilities at the Big Falls Experimental Forest.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/mn/big-falls/>





COULEE EXPERIMENTAL FOREST

LaCrosse County, Wisconsin



The 3,000 acre (1,214 ha) Coulee Experimental Forest located on land owned by the state of Wisconsin was formally dedicated in 1960. The Coulee consists of upland oak forests, experimental tree plantings, ridge-top open fields, rock outcroppings, and several small “goat prairies” on steep topography. Much of the research initiated on the Coulee looked at the effect of land use and steep land management on floods, soil erosion, and stream sedimentation. Other studies examined the adaptability of various tree species and classes of planting stock to different sites to guide landowners in their tree planting programs. Although the experimental forest is owned and administered by the Wisconsin Department of Natural Resources it is leased to the Northern Research Station for forest research and related scientific purposes through a long-term (15 year) lease agreement. The lease was last renewed on December 30, 2004.

Assets:

Scientists: No Northern Research Station scientists are conducting research on the Coulee at this time.

Cooperators: Past collaborators included the USDI Fish and Wildlife Service, Wild Turkey Federation, Ruffed Grouse Society, Wisconsin Woodland Owners Association, USDA Natural Resources Conservation Service, Audubon Society, and Whitetails Unlimited.

Needs:

Annual operating costs: The Coulee Experimental Forest is leased from the state of Wisconsin by the Northern Research Station for a nominal fee per year for forest research and related scientific purposes.

The Coulee Experimental Forest is administered by:

U.S. Forest Service, Northern Research Station
1831 Highway 169 E, Grand Rapids, MN 55744
218-326-7116

Key Contact:

Brian Palik, 218-326-7116, email bpalik@fs.fed.us

More About the Coulee Experimental Forest

Location: Lat. 43°48' N, long. 91° W

The Coulee Experimental Forest is located in LaCrosse County, WI, about 2 hours northwest of Madison, near the Wisconsin-Minnesota border.

Vegetation: The ridge tops of the Coulee, formerly used for agricultural crops, are now planted to pines, spruces, larches, and mixed hardwoods. Species and seed source experimentation were part of the reforestation projects here. Some open land remains and is currently rented by neighboring farmers. Natural and established prairie sites are managed for native plants and wildlife habitat. The forest is predominantly an oak-hickory type with red and white oak, shagbark hickory, basswood, and elm providing the major volume. The steeper slopes are productive because they were never used for agriculture as fields or pasture.

Climate: The average annual temperature at Coulee is 44 °F (6.7 °C), with summer maximum temperatures occasionally exceeding 100 °F (38 °C) and winter minimums as low as -40 °F (-40 °C). Average annual precipitation is 35 inches (864 mm), with the highest rainfall usually occurring during the growing season. Average annual snowfall is 45 inches (1,118 mm). Average length of the growing season is 138 days.

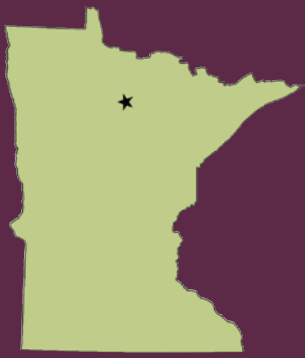
Research—past and present: Past research on the Coulee Experimental Forest focused on the effects of land use and steep land management on flooding, erosion, and sedimentation. There are no active research projects on the Coulee Experimental Forest. Reforestation, including the adaptability of various tree species and classes of planting stock to different sites was also a research focus.

Research opportunities: Opportunities for research are available on the Coulee through coordination with the Northern Research Station and the Wisconsin Department of Natural Resources.

Facilities: There are no facilities on the Coulee Experimental Forest.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/wi/coulee/>





CUTFOOT EXPERIMENTAL FOREST

Grand Rapids, Minnesota



The 3,100 acre (1,255 ha) Cutfoot Experimental Forest was established in 1932 in northeastern Minnesota, but has research dating back to 1923. Roughly 75 percent of the Cutfoot Experimental Forest is red pine (*Pinus resinosa*). The Cutfoot EF has been home to over a hundred studies on thinning, cutting, growth, and reforestation in pine forests. Results of the studies conducted here have been influential in shaping today's red pine management practices across the Lake States. As with other experimental forests, silvicultural studies initiated for other reasons decades ago have great relevance for addressing today's important forest management questions such as carbon sequestration and soil productivity. The Cutfoot Experimental Forest also has the unique distinction of being the final resting place of Raphael Zon, the father of Forest Service research.



Assets:

Scientists: 3 Northern Research Station scientists are currently doing research on the Cutfoot.

Scientific support: 2 technicians and/or professionals support the work of these scientists.

Cooperators: University of Minnesota, Michigan Technological University, Chippewa National Forest

Needs:

Annual operating costs: \$38,979

Critical needs: updated ecosystem classification and stand inventory maps

Long-term needs:

- Field lab (dry) with living quarters. (This facility would be shared with Pike Bay EF (MN) and the Chippewa National Forest) - \$800,000

The Cutfoot Experimental Forest is administered by:

U.S. Forest Service, Northern Research Station

1831 Highway 169 E, Grand Rapids, MN 55744

Key Contact:

Brian Palik, 218-326-7116, email bpalik@fs.fed.us

More About the Cutfoot Experimental Forest

Location: Lat. 47°40' N, long. 94°5' W

The Cutfoot Experimental Forest is located about a 45-minute drive southeast of Grand Rapids, Minnesota.

Vegetation: Roughly 75 percent of the Cutfoot is red pine with varying amounts of jack pine (*P. banksiana*) and eastern white pine (*P. strobus*) also present. Paper birch and quaking aspen are common components of the pine-dominated stands and in some places are the most dominant species. The majority of the red pine stands in the forest are of natural origin. There have been 7 major fires on the Cutfoot Experimental Forest, but most red pine originated after a major fire in 1870. There are scattered red pines that are more than 200 years old. Plantations occupy a small percentage of the Cutfoot. A major feature of the red pine in the forest is the understory composed mostly of beaked hazel.

Climate: The climate at the Cutfoot is continental. Maximum summer temperatures can be greater than 90°F (32 °C) with high humidity (80 percent) and minimum winter temperatures may plunge to -31°F (-35 °C). Growing season length is 100 to 120 days. Average annual precipitation is 20 to 26 inches (50 to 64 cm). In winter snow depths average 3.3 to 6.5 feet (1 to 2 m). Although prolonged summer droughts occur, there is usually adequate rainfall during the growing season.

Research—past and present: Research on the Cutfoot Sioux began in the mid-1920s, before the area was officially designated as an experimental forest. Research to date has focused almost exclusively on silviculture of the red pine type, with emphasis on methods of thinning and intermediate cutting. For example, in the growing stock levels study of red pine, research has established that culmination of mean annual increment for red pine can extend well beyond the traditional rotation age of 50 to 70 years. In fact, mean annual volume increment curves show no strong indication of culmination at 140 years of age, due at least in part to periodic growth increases after thinnings, which did not begin until the trees were 85 years old. This study is now being used to look at carbon allocation and soil productivity impacts after 55 years of management.

Research opportunities: The Cutfoot EF is home to the oldest extended rotation thinning study on red pine in the Great Lakes region. Opportunities to do additional work on the Cutfoot include research to describe the understory or study individual tree growth in the long-term study areas.

Facilities: There is no on-site housing on the Cutfoot Experimental Forest, but resorts in the area—Squaw Lake to the north and Deer River to the south—provide opportunities for short-term rentals. There are numerous woods roads in the forest, making most of the area readily accessible.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/mn/cutfoot/>





DUKES EXPERIMENTAL FOREST

Marquette, Michigan



The 5,500 acre (2,227 ha) Dukes (formerly Upper Peninsula) Experimental Forest was established in 1926 in the Upper Peninsula of Michigan. The uplands are dominated by old growth northern hardwoods and hemlock-hardwoods. Primary studies on the Dukes EF consist of stocking level experiments in hardwoods and swamp conifers and cutting cycle and cutting methods experiments in northern hardwoods. In 1974, a Research Natural Area (233 acres) was established within the Dukes Experimental Forest boundaries. Information from studies on the Dukes has been used to develop management guides for northern hardwood forests in the Lake States. These guides are applied by virtually all management organizations in the region. Long-term data records on growth and yield and mortality in management of old-growth northern hardwoods make the Dukes an especially unique asset.

Assets:

Scientists: 3 Northern Research Station scientists are currently conducting studies on the Dukes.

Scientific support: 2 technicians and/or professionals support the work of these scientists.

Cooperators: Hiawatha National Forest, University of Minnesota.

Needs:

Annual operating costs: \$38,979

Critical needs: Updated ecosystem classification and stand inventory maps.



The Dukes Experimental Forest is administered by:

U.S. Forest Service, Northern Research Station
5985 Highway K, Rhinelander, WI 54501

Key Contact:

Brian Palik, 218-326-7116, email bpalik@fs.fed.us

More About the Dukes Experimental Forest

Location: Lat. 46°21' N, long. 87°10' W

The Dukes EF is located about 16 miles southeast of Marquette, in the upper peninsula of Michigan. The Dukes can be accessed by Dukes Road off Highway 94.

Vegetation: The uplands of the Dukes are dominated by old-growth northern hardwoods and eastern hemlock-hardwoods. Hemlock dominates the somewhat poorly drained soils and northern white-cedar-spruce and hardwood-conifers dominate the poorly drained soils and muck. Although a small amount of white pine and elm were logged during the early 1900s, the remaining forest is essentially old growth today.

Climate: Average annual precipitation on the Dukes is about 35 inches (86 cm) and is distributed evenly through the year. Lake-effect snowfall is considerable and averages 142 inches (355 cm) per year, with up to 304 inches (760 cm) some years. Proximity to Lake Superior results in a cool lacustrine climate, with moderated minimum and maximum temperatures. Average annual temperature is around 41 °F (5 °C), and the growing season averages 110 days.

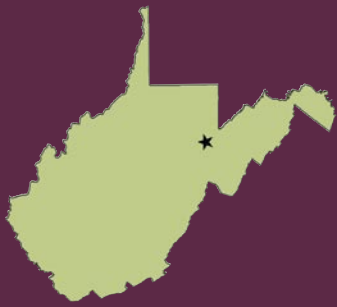
Research—past and present: Research began on the Dukes in the 1920s. Studies consisted of stocking levels of hardwoods and swamp conifers, cutting cycles, regeneration, and cutting methods of northern hardwoods. Pioneering work by Carl Arbogast on a sustainable age structure for uneven-aged northern hardwoods was conducted on the Dukes Experimental Forest. This structure (known as the Arbogast guide) is applied to millions of acres of northern hardwoods in the Lake States and more broadly to uneven-aged forests in general. Currently, only the stocking-level studies and a red maple growth and yield study remain active. The Duke is home to the oldest running northern hardwood management experiments in the Great Lakes region.



Research opportunities: There are research opportunities to study the silviculture and ecology of all the vegetation types on the Dukes. There also are opportunities for comparing treatments that have been applied since the 1920s. Much of this is managed old growth, of which little remains in the Lake States. The Dukes RNA is available for nondestructive research in old-growth northern hardwoods.

Facilities: There are no facilities on the Dukes Experimental Forest. Roads are well maintained but are not plowed during the winter.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/mi/dukes/>



FERNOW EXPERIMENTAL FOREST

Parsons, West Virginia



Located in north central West Virginia, the 4,700-acre (1,902 ha) Fernow Experimental Forest was set aside in 1934 and named after Bernhard Fernow. The Fernow is renowned for long-term silvicultural research and long-term watershed research, both spanning more than 50 years. Current research topics include silviculture, hydrology, soil productivity, the use of fire for restoration purposes, managing for threatened and endangered wildlife species, and the effects of acidic deposition on forest ecosystems. The information gleaned from the Fernow has significantly improved management of these mixed-hardwood forests and still provides practical information to forest managers and landowners. Research in the Fernow is in demand by public and private landowners, policymakers at the State and Federal level, and scientists around the globe. The Fernow is part of several national and international scientific networks, including the National Atmospheric Deposition Program, the National Trends Network, and the Long-Term Soil Productivity Studies.



Assets:

Scientists: 12 Northern Research Station scientists are conducting studies on the Fernow.

Scientific Support: 1 full-time data manager, 14 professionals and technicians, and a 3-person logging crew (the only such crew in the U.S. Forest Service) provide support to these scientists.

Cooperators: West Virginia University, Virginia Polytechnic Institute and State University, University of Georgia, The Nature Conservancy, University of Pittsburgh, WV Division of Forestry, other Northern Research Station units

Needs:

Annual operating costs: \$438,416

Critical needs:

- Control of mineral rights, through purchase, or surface occupancy controls - \$500,000
- Climate controlled sample storage building - \$125,000

Long-term needs:

- A new water quality laboratory to relieve space shortages that hinder the productivity of the water quality research program - \$450,000
- Improved conference and bunkhouse facilities for visiting scientists, graduate students, etc. - \$600,000

The Fernow Experimental Forest is administered by:

U.S. Forest Service, Northern Research Station

P.O. Box 404, Parsons, WV 26287

Key Contact:

Mary Beth Adams, 304-478-2000 x-130, email mbadams@fs.fed.us

More about the Fernow Experimental Forest

Location: Lat. 39°3'15" N, long. 79°41'15" W

The Fernow EF is located just south of the city of Parsons, WV off Route 219. The Parsons area is home to a number of woodworking industries and the world's largest charcoal manufacturing plant.

Vegetation: The Fernow was heavily cut over between 1905 and 1911. The second growth vegetation is mixed hardwoods and has been classified as mixed mesophytic forest. Principal overstory species include northern red oak, sugar maple, yellow-poplar, and red maple. There are 22 commercial tree species on the Fernow.

Climate: The climate on the Fernow is classified as rainy and cool. Mean annual precipitation is 60 inches (1,470 mm) distributed evenly throughout the year. Mean annual temperature is 48°F (8.9°C), with a frost free season of about 145 days. Although winter snowfall can be heavy, the snow pack is intermittent.

Research—past and present: Scientific studies on the Fernow have followed two lines of research, with considerable overlap. Silvicultural research focused mostly on mixed-hardwood stands, addresses questions relating to regenerating, growing, tending and harvesting trees and stands. Watershed research has addressed some of the more basic questions about water use by forests and forest hydrology, as well as critical issues affecting roads, best management practices, and forest management effects on water and soil resources. The Fernow has been in the forefront of research on acid deposition and nitrogen saturation. Recently, research on threatened and endangered species has taken on a more prominent role due to the presence of the Indiana bat and running buffalo clover on the Fernow.



Other assets: EPA approved water quality laboratory, fireproof/flood-proof data storage.

Research opportunities: The opportunities for research on the Fernow EF are abundant thanks to its long-term studies and the wealth of data. There is the opportunity for stand manipulations as the Fernow has its own logging crew and equipment.

Facilities: Facilities of the Fernow include a water quality laboratory, a second general laboratory facility, fireproof/flood-proof data storage, and a small historic bunkhouse. The nearby Timber and Watershed Laboratory of the Northern Research Station has laboratory facilities, and offices.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/wv/fernow/>



HARSHAW FORESTRY RESEARCH FARM

Rhineland, Wisconsin



Located in north central Wisconsin, the 520 acre (210 ha) Harshaw Research Farm was established in 1972 from a former agricultural farm to provide a venue for important experiments with planted trees. During the 1970s and 1980s experiments at Harshaw Farm focused on short-rotation intensive culture of hybrid poplars (*Populus*), funded by the U.S. Forest Service and U. S. Department of Energy (DOE). Ultimately, these studies led to large-scale industrial plantings for fiber production and formed the basis for our current leading position in bioenergy crops. In 1997, the Aspen FACE (Free-Air Carbon Dioxide and Ozone Enrichment) Project was installed at the Harshaw Farm through support from a variety of collaborators (see list below). This major international multi-institutional climate change experiment is evaluating the direct effects of the increased concentrations expected by the year 2050 of the greenhouse gases, carbon dioxide, and ozone on northern hardwood ecosystems.

Assets:

Scientists: 7 Northern Research Station scientists are working at this site.

Scientific support: 18 technicians and/or professionals provide support for these scientists.

Cooperators: More than 20 research institutions from 8 countries are involved in the research, with over 50 scientists per year working in the project. Collaborating organizations include: U.S. Department of Energy, Michigan Technological University, Brookhaven National Laboratory, Canadian Forest Service, National Council for Air and Stream Improvement, and the National Science Foundation

Needs:

Annual operating costs: \$2,400,000



Harshaw Forestry Research Farm is administered by:

U.S. Forest Service, Northern Research Station
Institute for Applied Ecosystem Studies
5985 Highway K, Rhineland, WI 54501

Key Contact:

Eric Gustafson, 715-362-1152, email egustafson@fs.fed.us

More About Harshaw Farm

Location: Latitude 45.60 N, Longitude 89.50 W

The Harshaw Research Farm is located 9 miles west of Rhinelander, WI.

Research—past and present. During the 1970s and 1980s the Harshaw Farm hosted a program of experiments on short-rotation intensive culture of hybrid poplars (*Populus*). In the 1980s and 1990s replicated genetics plantings of larch (*Larix*), jack pine (*Pinus banksiana*), willow (*Salix*), and trembling aspen (*Populus tremuloides*) were established and continue to the present. The Free Air Carbon Enrichment (FACE) project was established in 1997 in association with the U.S. Department of Energy, Michigan Technological University, and other organizations. The project focuses on the effects of elevated carbon dioxide and ozone, alone and in combination, on the growth and health of northern forest trees under near natural conditions. The purpose of studies at the FACE facility is to determine how these two atmospheric gases will affect the composition and health of future forests, so that forest management and regulatory policies can be based on solid science. This is the only FACE facility in the world studying northern forest trees and the only one studying the effects of ozone on trees.

Research opportunities: Propose research projects to the Aspen FACE Steering Committee online. See Aspen FACE website for process (<http://aspenface.mtu.edu/>).

Facilities: The property includes an 80-acre area enclosed within a deer-proof fence with a water supply for irrigation, a heated office/shop building, unheated storage buildings, a utility building housing ozone generators, and a 2,500 sq. ft. office/laboratory building constructed in 2007.

More information on the Aspen-FACE can be found at:
<http://aspenface.mtu.edu/>





HUBBARD BROOK EXPERIMENTAL FOREST

West Thornton, New Hampshire



Located in the White Mountain National Forest in a bowl-shaped valley in central New Hampshire, the 7,750-acre (3,138 ha) Hubbard Brook Experimental Forest was established in 1955 as a major center for hydrologic research in New England. The Hubbard Brook Experimental Forest (HBEF) is covered by northern hardwoods and contains a network of streams which are ideal for watershed research. In 1988 the HBEF was designated as a Long Term Ecological Research (LTER) site by the National Science Foundation. Long-term measurements from the Hubbard Brook EF are used to document and assess the ecological effects of disturbance at regional, national and global scales, including ecosystem effects from air pollution and climate change.



Assets

Scientists: 5 Northern Research Station scientists are conducting studies on the Hubbard Brook.

Scientific support: 10 technicians and/or professionals support the work of these scientists.

Cooperators: Cary Institute of Ecosystem Studies, Cornell, Syracuse, Yale, Brown, Wellesley, University of New Hampshire, SUNY-ESF, Plymouth State University, Boston University, California - Berkeley, U.S. Geological Survey, and Hubbard Brook Research Foundation.

Needs

Annual operating costs: \$320,000

Critical needs: Full-time data manager and one additional field technician - \$150,000.

Long-term needs:

- Modernization of field data collection at watersheds: automated, wireless data collection of hydrological and meteorological data, including technical support - \$200,000 initial and \$75,000 recurring
- Stream gauging station on the main branch of Hubbard Brook - \$150,000



The Hubbard Brook Experimental Forest is administered by:

U.S. Forest Service, Northern Research Station
271 Mast Road, Durham, NH 03824
603-868-7636

Key Contact:

Scott W. Bailey, 603-535-3262, email swbailey@fs.fed.us



More about the Hubbard Brook Experimental Forest

Location: Lat. 43°56' N, long. 71°45' W"

The HBEF is located just west of the village of West Thornton, NH which is about 75 miles north of Manchester, NH.

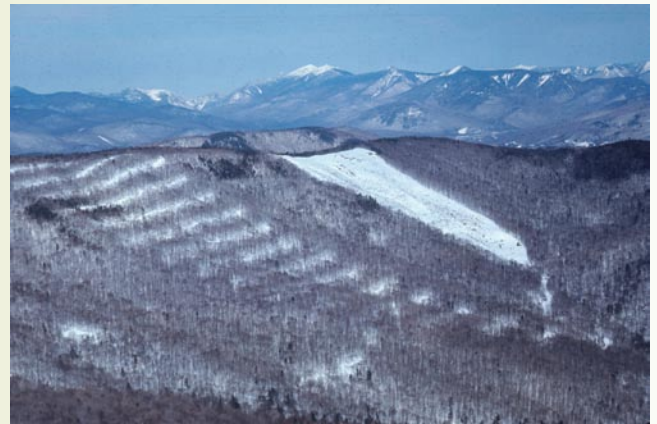
Vegetation: Second growth even-aged forest and is composed of 80-90 percent northern hardwoods and 10-20 percent spruce-fir.

Climate: Annual precipitation at Hubbard Brook averages about 65 inches (1400 mm), with about one-third to one-half of that precipitation occurring as snow. The month of January is coldest and averages about 16 °F (-9 °C). The warmest month is July where the temperature averages 65 °F (18 °C).

Research—past and present: Hubbard Brook is renowned for its long-term record of ecosystem measurements and experiments that began when the Hubbard Brook Ecosystem Study was initiated in 1963. There are many long-term databases at the Hubbard Brook including instantaneous stream flow and daily precipitation, weekly snow depth, and weekly soil temperature and moisture. Long-term measurements from the HBEF are used to document and assess the ecological effects of disturbance at regional, national and global scales, including ecosystem effects from air pollution and climate change, and the response and recovery from catastrophic and noncatastrophic forest events. In addition, studies of birds, mammals, amphibians, snails, and insects draw heavily on the long-term data record. Among the topics currently being studied are: the role of calcium in forest and aquatic systems, stream systems, acid deposition, canopy nitrogen and calcium content, animal populations and communities, and nitrogen retention and nitrogen gas fluxes.

Research opportunities: The Hubbard Brook staff welcomes new studies and collaboration on existing ones. The Hubbard Brook has 9 long-term experimental watersheds.

Facilities: The Robert S. Pierce Ecosystem Laboratory located at Hubbard Brook provides 8,940 sq. ft. (835 m²) of space including 6 offices, 4 laboratories, a conference room, 6 dormitory rooms and a kitchen, baths and showers. There is also a sample archive building and maintenance, storage, garage and shop facilities.



More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/nh/hubbard-brook/>



KANE EXPERIMENTAL FOREST

Kane, Pennsylvania



The Kane Experimental Forest was set aside in 1932 in northwestern Pennsylvania to conduct forestry research. Today the 3,563 acre (1,443 ha) experimental forest located on the Allegheny National Forest is dedicated to long-term research on the ecology and stand-development processes in stratified mixed hardwood forests and the interaction of these processes with forest management. Some studies span more than 70 years, and are entering their second generation of trees. Information gleaned from research on the Kane has significantly improved management of mixed hardwood forests, especially of the Allegheny hardwood forest type. Research findings provide practical information to forest managers and landowners. Sustainable forest management training offered annually at the Kane is eagerly sought by forest and resource managers from public, private, and nongovernmental organizations. The Kane is part of the National Atmospheric Deposition Program, the National Trends Network, and the Clean Air Status and Trends Network.



Assets:

Scientists: 7 Northern Research Station scientists are currently conducting studies on the Kane, including an emeritus research plant physiologist.

Scientific support: 12 professionals and/or technicians provide support for these scientists, including a data manager and supervisor.

Cooperators: The Pennsylvania State University, The State University of New York College of Environmental Science and Forestry, the University of Pittsburgh, University of Georgia, other FS research units, the Allegheny National Forest, the Pennsylvania Bureau of Forestry, and others.

Needs:

Annual operating costs: \$344,464

Critical needs: High-speed internet access

Long-term needs:

- Rewire and equip classroom facility with laptop computers and internet access for modern forestry and natural resources instruction - \$50,000
- Secure data storage (fire, water, wind resistant) - \$100,000

The Kane Experimental Forest is administered by:

U.S. Forest Service, Northern Research Station

P.O. Box 267, Irvine, PA 16365

814-837-7349

Key Contact:

Susan Stout, 814-868-7632, email sstout@fs.fed.us

More About the Kane Experimental Forest

Location: Lat. 41°35'52" N, long. 78°45'58" W

The Kane Experimental Forest is located on the Allegheny National Forest about 7 miles southeast of Kane, PA or about 130 miles northeast of Pittsburgh, PA.

Vegetation: Vegetation is primarily of the Allegheny hardwood variant of the northern hardwood type. Tree species include black cherry, sugar and red maple, American beech, eastern hemlock, sweet birch, and striped maple.

Climate: Approximately 44 inches (1,100 mm) of precipitation falls on the Kane Experimental Forest each year, mostly as rain, including 4 inches (10 cm) per month during the growing season. Wind events of all scales are the most common natural disturbances. Precipitation can be highly acidic, as the Kane receives some of the highest deposition levels of both sulfate and nitrate in the eastern United States.

Research—past and present: Research at the Kane EF is aimed at understanding ecology and stand-development processes in stratified mixed hardwood forests and the interactions of these processes with forest management. Current research topics include silviculture, regeneration and renewal processes in managed and unmanaged forests, impact of white-tailed deer on forests, recovery from wind disturbance, stress and nutrient requirements of northern hardwood species, including the effects of acidic deposition on forest ecosystems, wood production, carbon sequestration, and wildlife habitat.

Research opportunities: In addition to the opportunities that arise simply because long-term data sets are associated with many plots on the Kane, there are numerous subjects for which data from existing study plots could provide important insights on herbaceous plant communities, soil mega- and micro fauna, lichens, fungi, genetics of tree and other plants, and various wildlife communities. Because a great deal is known about the disturbance history of much of the Kane, such studies could be rich and rewarding in a short time. There is also the opportunity to resume hydrologic studies.

Facilities: Facilities on the Kane include a conference center with classroom and meeting capabilities, 2 residences that can provide housing for up to 8 people, an office building, and a garage/storage facility.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/pa/kane/>





KASKASKIA EXPERIMENTAL FOREST

Golconda, Illinois



The 1,150 acre (466 ha) Kaskaskia Experimental Forest in southern Illinois was originally established on the Shawnee National Forest in 1942. In 1948, forty compartments were established on mixed-hardwood and oak-hickory sites to study long-term impacts of commercial-type forest management practices under uneven-age silviculture. These compartments have remained undisturbed since 1972 when active management ended. More than 30 research studies have been conducted within the Kaskaskia including a systematic comparison of harvesting and regeneration methods for central hardwood forests. Only 2 studies remain active, one documenting long-term changes in an old-growth natural area and the other documenting forest regeneration in group openings of differing sizes.



Assets:

Scientists: 3 Northern Research Station scientists are currently maintaining the old-growth study on the Kaskaskia and data from the experimental forest supports research for other Northern Research Station scientists and university collaborators.

Scientific support: 2 full-time technicians and 2 seasonal technicians shared with the Sinkin and Paoli Experimental Forests support the work of these scientists.

Cooperators: Southern Illinois University, Shawnee National Forest, Illinois Department of Natural Resources, University of Arkansas-Fayetteville, Auburn University.

Needs:

Annual operating costs: \$142,000 shared with the Sinkin (MO) and Paoli (IN) Experimental Forests.

Long-term needs:

- Additional technician for data collection and a data manager shared with the Sinkin and the Paoli Experimental Forests - \$90,000/yr
- Operating funding to facilitate cooperative research - \$50,000

The Kaskaskia Experimental Forest is administered by:

U.S. Forest Service, Northern Research Station
202 Natural Resources Building, University of Missouri
Columbia, Missouri 65211
814-837-7349

Key Contact:

John Kabrick, 573-875-5341 x-229, email jkabrick@fs.fed.us

More About the Kaskaskia Experimental Forest

Location: Lat. 37°32' N, long. 88°21' W

The nearest town is Golconda, IL. Neighboring towns include Glendale, Simpson, Robbs, and Elizabethtown.

Vegetation: About 40 percent of the Kaskaskia Experimental Forest is composed of mixed-hardwood forests found on the lower and middle north and east slopes. Coves and stream bottoms are dominated by yellow-poplar, northern red oak, white oak, black oak, several hickory species, black gum, elm, American beech, and maples. About 50 percent of the area is of the oak-hickory type found along south- and upper north-facing slopes and on the ridge tops dominated by black, white, post, scarlet, southern red, and black jack oak, and a mix of hickories. There is also a small disjunct stand of chestnut oak.

Climate: The average length of the growing season (frost-free period) is 190 days. Annual average temperature is 55 °F (13 °C) and regional annual rainfall is 44 inches (1,098 mm) distributed equally throughout the year. However, prolonged dry periods during the growing seasons are not unusual. Average annual snowfall is 10 inches (25 cm). On average, winter minimum temperature is 39 °F (4 °C), and winter maximum temperature is 45° F (7 °C). Summer average minimum temperature is 64°F (18 °C) and maximum summer temperature is 86 °F (30 °C).

Research—past and present: Past studies on the Kaskaskia EF include a compartment study with 40 plots treated with various cutting methods, cutting cycles, rotation lengths, and management intensities using uneven-age silviculture. Additional research has been conducted on conversion of farm woodlands to managed forests, chestnut, and cottonwood provenance progeny tests, regeneration and growth following small group-selection cutting, and documenting natural succession on upland oak-hickory forests. Of the 2 studies that remain active, one documents long-term changes in a 20-acre (8-ha) old-growth natural area (Kaskaskia Woods). The other active study documents forest regeneration in group openings of differing sizes.

Research opportunities: The compartment study provides an opportunity to evaluate long-term changes in vegetation subjected to a range of cutting methods and cycles to implement an uneven-age silvicultural system. Most areas on the Kaskaskia are available for cooperative research, subject to approval by the Northern Research Station and the Shawnee National Forest.

Facilities: No buildings are being maintained on the Kaskaskia.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/il/kaskaskia/>





LOWER PENINSULA EXPERIMENTAL FOREST

Newaygo and Wexford County, Michigan



The 3,400 acre (1,376 ha) Lower Peninsula Experimental Forest, made up of the Pine River and Newaygo Units, was formally established in 1954. The forest was initially used for silvicultural research, studies of chemical release of overstory hardwoods in pine plantations, and growth and yield of northern hardwoods under different stocking levels. The Pine River Unit, located in the southwest corner of Wexford County, contains 2,760 acres. The Newaygo Unit, located in Newaygo County, contains 640 acres. The experimental forest is a collection site for the National Atmospheric Deposition Program (NADP). Because of its diversity of forest types, it has potential as a replicate for regionwide field studies.

Assets:

Scientists: 1 Northern Research Station scientist is involved with the NADP research.

Scientific support: 1 technician supports the work of the scientist.

Cooperators: Huron-Manistee National Forest.

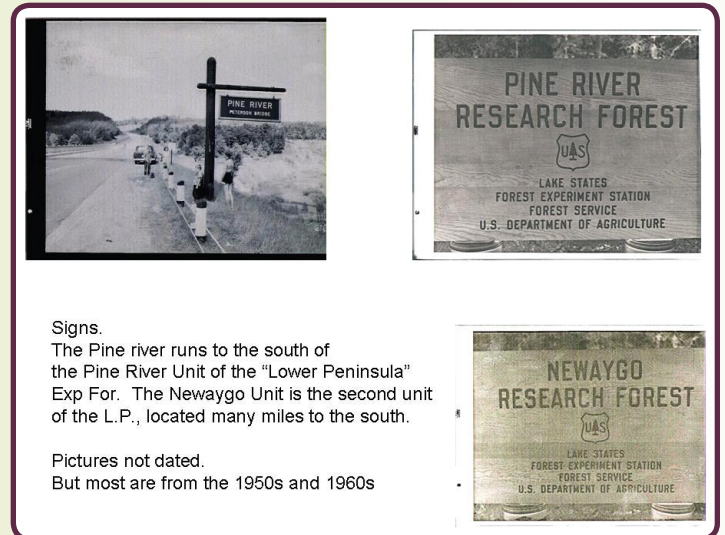
Needs:

Annual operating costs: \$10,000

Critical needs: None

Long-term needs:

- Develop accurate GIS database, including physical and vegetative features and research locations



The Lower Peninsula Experimental Forest is administered by:

U.S. Forest Service, Northern Research Station

271 Mast Road, Durham, NH 03824

Key Contact:

John Brissette, 603-868-7632, email jbrissette@fs.fed.us

More About the Lower Peninsula Experimental Forest

Location: Lat. 43°25' N, long. 85°40' W

The Lower Peninsula Experimental Forest is located in Newaygo and Wexford Counties in Michigan about 65 miles north of Grand Rapids, MI.

Vegetation: The Lower Peninsula Experimental Forest consists of 2 separate parcels: the Pine River Unit and the Newaygo Unit. In the Pine River Unit, the following 3 natural forest types prevail: oak, aspen (ranging from pure stands to mixtures with oak and maple), and second-growth northern hardwoods. The oaks are mainly pin, white, northern red, and black oak. Considerable areas of pine, including red, jack, and eastern white, have been planted. In the Newaygo Unit, mixed white pine-oak type is the principal forest type. This unit also contains about 160 acres (65 ha) of plantations, most of which are red pine, with several acres of jack and white pines.

Climate: The average temperature on the Lower Peninsula EF in January ranges from 10 to 28 °F (-12 to -2 °C). In July temperatures typically range from 55 to 82 °F (13 to 28 °C). The average rainfall is 32 inches (80 cm) and snowfall 72 inches (183 cm).

Research—past and present: Studies in the Pine River Unit include herbicide release of pine plantations, growth and yield of northern hardwoods, and municipal sewage sludge fertilization of aspen sprouts and pine plantations. In the Newaygo Unit, research evaluated prairie restoration and removal of red pine stands planted on prairie sites, as well as changes in insects and vegetation as the prairie comes back, with emphasis on the endangered Karner-blue butterfly.

Research opportunities: Although no new studies have been installed on the Lower Peninsula Experimental Forest since 1981, there is potential for a range of ecological and management experiments. Early silvicultural studies have been measured, reported, and discontinued. Plans for future research will be developed over the next few years.

Facilities: In Wexford County, Michigan, there is a 30 acre (12-ha) site commonly called the Wellston Field Laboratory, which consists of an 80-m² building, a shop and garage, and a flammables storage building. A National Atmospheric Deposition collection site is located here. Also on the site is a 2 acre (0.8-ha) cleared area enclosed with a deer-proof fence. Currently, this facility is maintained and used by the Huron-Manistee National Forest.



More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/mi/lower-peninsula/>



MARCELL EXPERIMENTAL FOREST

Grand Rapids, Minnesota



Located in northern Minnesota, the 2,820 acre (1,140 ha) Marcell Experimental Forest (MEF) was established in 1960 to study forest management and hydrology in both peatlands and uplands. The MEF includes two parcels owned by federal, state, and local entities. Meteorological variables, streamflow, groundwater levels, snow water content, soil frost, soil temperatures, and water chemistry are routinely measured on the MEF with some records dating back nearly 50 years. The MEF is part of the National Atmospheric Deposition Program / National Trends Network, the Mercury Deposition Network, the Long-Term Soil Productivity Project, and the Climate and Hydrology Database Projects (CLIMDB/HYDRODB). With sensors deployed to measure water, carbon gas, and solute fluxes, the MEF is poised for studies of climate change effects on northern forests and other emerging issues in the ecosystem sciences.



Assets:

Scientists: 2 Northern Research Station scientists are conducting research on the MEF.

Scientific support: 5 technicians and/or professionals, including a full-time data manager, a site manager, and a chemist, provide support for this work.

Cooperators: University of Minnesota Twin Cities, Minnesota Division of Natural Resources, MN Pollution Control Agency, Science Museum of Minnesota, St. Croix Watershed Research Station, University of Toronto-Mississauga, Gustavus Adolphus College, U.S. Geological Survey, Southern Research Station, Rocky Mountain Research Station.

Needs:

Annual operating costs: \$327,307

Critical needs:

- Update sensors and chart recorders to electronic data-logging systems with capacity to remotely monitor streamflow via phone or satellite access - ~\$125,000
- Extend power lines 1 mile to a bog site where an eddy covariance system measures carbon dioxide and methane fluxes - ~\$15,000
- Provide LAN /wireless access to scientists and collaborators working at the Marcell

The Marcell Experimental Forest is administered by the:

U.S. Forest Service, Northern Research Station
1831 Highway 169 East, Grand Rapids, MN 55744
218-326-3152

Key Contact: Randy Kolka, 218-326-7115, email rkolka@fs.fed.us

Address of the MEF:

Marcell Research Center
43122 Wilderness Trail

Long-term needs:

- Update lab space, address structural deficiencies at the Grand Rapids Chemistry Lab (\$650,000 approved for 2010)
- Data management support to put written records into digital database - \$6,500/yr

More About the Marcell Experimental Forest

Location: Lat. 47°32' N, long. 93°28' W

The MEF is located about 25 miles (40 km) north of the city of Grand Rapids, MN.



Vegetation: In the MEF, sandy outwash soils in the uplands support red and jack pine in fire-origin stands or in plantations, along with mixed stands of aspen, white birch, balsam fir, and white spruce. Sandy loam till soils in the uplands support mainly aspen, birch and northern hardwood stands. Forested bogs contain black spruce and tamarack. Both forested and open bogs are dominated by sphagnum mosses and ericaceous shrubs. Forested fens contain similar species as the bogs but also include northern white cedar and black ash. Open, poor fens are dominated by sedges and a variety of mosses.

Climate: The climate at the MEF is continental, with moist warm summers and relatively dry, cold, and sunny winters. Mean annual precipitation is 31 inches (780 mm) with about one-third occurring as snow. The mean annual temperature is 38 °F (3.3 °C) with mean monthly temperatures are between 61 and 66 °F (16 and 19 °C) in June, July, and August and between 5 and 12 °F (-11 and -15 °C) in December, January, and February.

Research—past and present: Early studies in the 6 calibrated watersheds quantified water and energy budgets, characterized the physical properties of peat, and measured hydrological responses to silvicultural treatments in uplands and wetlands. In recent decades, Forest Service scientists and collaborators have studied nutrient and metal biogeochemistry, atmospheric pollutants, trace gas emissions from wetlands, carbon cycling, and the effects of mercury pollution. Information from the site has been used to understand peatland functions in northern ecosystems, develop hydrologic models, implement best management practices in forested ecosystems, and evaluate techniques that have later been incorporated into national research programs.

Research opportunities: The comprehensive long-term water, soil, atmosphere, and vegetation databases at the MEF afford graduate students and collaborative scientists a unique opportunity to study watershed and landscape aspects of upland and peatland systems in the northern Lake States. In addition to the experimental watersheds, other research areas and demonstration sites are available for study.

Facilities: The new Marcell Research Center was dedicated in October 2006. The facility has sleeping quarters, laboratory space, a conference room, full kitchen and dining areas, and a washer/dryer. The Marcell Research Center is available to host meetings, classes, and small conferences, as well as house our collaborators.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/mn/marcell/>



MASSABESIC EXPERIMENTAL FOREST

York County, Maine



Located in southwestern Maine, the 3,700 acre (1,497 ha) Massabesic Experimental Forest was established in the late 1930s. The land purchased by the Forest Service for the experimental forest was typical of abandoned agricultural lands across New England that recovered to “old field” pine, mostly eastern white pine. Early studies focused on silviculture and management of eastern white pine. In 1947, following years of drought, a fire destroyed 80 percent of the trees on the experimental forest. Today most stands are a rich mixture of pine and hardwoods, most notably northern red oak. Consequently, research now focuses on mixed pine-oak management with emphasis on wildlife habitat as well as forest products. Part of the research program is on prescribed fire as a management tool. There is also increasing interest in the many seasonal and permanent wetlands on the forest. The permanent wetlands are dominated by some of the most extensive stands of Atlantic white-cedar in New England.



Assets:

Scientists: 4 Northern Research Station scientists are conducting studies on the Massabesic.

Scientific support: 1 professional supports the work of these scientists.

Cooperators: Other Northern Research Station units, Maine Department of Conservation, Small Woodland Owners Association of Maine, Conservation Commission, town of Alfred, Maine, White Mountain National Forest, Northeastern Area, State & Private Forestry, University of Maine, University of New Hampshire.

Needs:

Annual operating costs: \$75,000

Critical needs: Install high speed internet connection; establish protocol for managing long-term data and metadata and making it readily accessible for cooperators.

Long-term needs:

- Expand quarters and provide laboratory facilities
- Upgrade GPS/GIS capabilities and improve expertise among staff
- Modernize data collection technology with electronic data-logging systems and wireless remote monitoring capability



The Massabesic Experimental Forest is administered by:

U.S. Forest Service, Northern Research Station

271 Mast Road, Durham, NH 03824

603-868-7632

Key Contact: Mariko Yamasaki, 603-868-7659, email myamasaki@fs.fed.us

More About the Massabesic Experimental Forest

Location: Lat. 43°27'8" N, long. 70°40'44" W

The Massabesic Experimental Forest is located in the towns of Alfred and Lyman, ME, about 25 miles southwest of Portland.

Vegetation: The eastern white pine-northern red oak forest type dominates upland sites on the Massabesic. Eastern hemlock and red maple are also well represented throughout the forest. Nearly pure stands of paper birch occupy some areas cleared by the 1947 fire and subsequent salvage. Other cleared areas were planted or direct seeded to white pine or a mixture of white and red pine. Exotic species, including western white and Scots pines, were also planted. Common woody shrubs include beaked hazelnut, several species of Viburnum, winterberry, witch-hazel, sheep-laurel, and Vaccinium species. Common herbaceous plants are star flower, Canada mayflower, bracken fern, wild sarsaparilla, wintergreen, wild oats, and mountain rice. There are few nonnative invasive plant species.

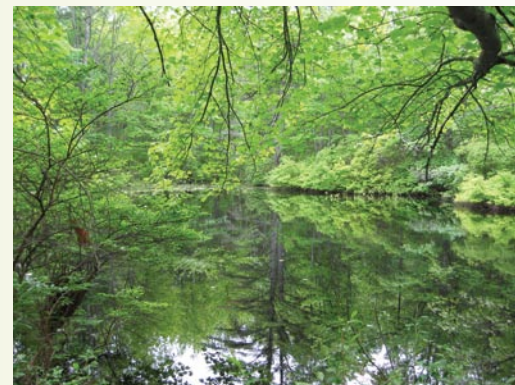
Climate: The Massabesic climate is moderated by its proximity to the Atlantic Ocean, which is about 20 miles away. Average annual temperature is 46.6 °F (8.1 °C), with July normally warmest at 70.2 °F (21.2 °C) and January coldest at 21.5 °F (-5.8 °C). Total annual precipitation averages 47 inches (119 cm), with September typically driest and November wettest. May 4 is the average date of the last killing frost and the growing season averages 157 days.

Research—past and present: When the Massabesic was established, permanent sample plots were installed but many plot location stakes were lost in the 1947 fire and never re-established. Following the fire, white pine management research was re-initiated but emphasis shifted to artificial regeneration research. Some of the earliest work on direct seeding and use of herbicides for releasing young stands from competition was done on the Massabesic Experimental Forest. Research on regeneration led to a focus on the then-developing field of forest genetics and tree improvement. In addition, the preponderance of young white pine stands and interest in genetics resulted in a research program on white pine weevil resistance. Recent research includes investigations of soil nitrogen processes, aquatic insects, amphibian and owl ecology, comparison of methods for sampling coarse woody material, and silvicultural treatments to regenerate and sustain pine-oak mixed forests.

Research opportunities: There are ample opportunities for research on all aspects of ecology and management of pine-oak and other mixed-species forests, especially with regard to meeting information needs of non-industrial landowners. Manipulative experiments are possible in collaboration with Northern Research Station scientists. Project staff members are willing to facilitate nonmanipulative studies that do not conflict with the long-term research and demonstration missions of the Massabesic.

Facilities: The Massabesic Experimental Forest has quarters for up to 8 people, a small office, and work and storage space.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/me/massabesic/>



University of Maine cooperator



PAOLI EXPERIMENTAL FOREST

Paoli, Indiana



The 632 acre (256 ha) Paoli Experimental Forest located in the Hoosier National Forest in south-central Indiana, was established in 1963. The primary mission of the Paoli EF is to conduct research on mixed hardwood species to demonstrate how to increase the number and quality of high-value species on good sites. Research conducted on the experimental forest has been used to develop prescriptions for regenerating oaks in mesophytic forests of the central hardwood region. The research has added to the knowledge of how oak regeneration dynamics vary by ecoregion in the eastern United States and was recently incorporated into a landmark synthesis on oak forest ecosystems, “The Ecology and Silviculture of Oaks” by P.A. Johnson, S.R. Shifley, and R. Rogers.



Assets:

Scientists: 3 Northern Research Station scientists actively work with data from the Paoli Experimental Forest and data from the experimental forest supports research for other Northern Research Station scientists and university collaborators.

Scientific support: 2 full-time technicians and 2 seasonal technicians shared with the Sinkin and Kaskaskia Experimental Forests.

Cooperators: Hoosier National Forest, Purdue University, and Indiana Division of Natural Resources.

Needs:

Annual operating costs: \$142,000 shared with the Sinkin and Kaskaskia Experimental Forests.

Long-term needs:

- Additional technician for data collection and a data manager shared with the Sinkin and Kaskaskia Experimental Forests - \$90,000/yr
- Operating funding to facilitate cooperative research - \$50,000

The Paoli Experimental Forest is administered by:

U.S. Forest Service, Northern Research Station
202 Natural Resources Building
University of Missouri, Columbia, MO 65211

Key Contact:

John Kabrick, 573-875-5341 x229, email jkabrick@fs.fed.us

More About the Paoli Experimental Forest

Location: Lat. 38°19' N, long. 86°18' W

The Paoli Experimental Forest is located near Paoli, IN, and is about 60 miles south of Bloomington.

Vegetation: The forest types are typical for southern Indiana and other areas of equally good sites in the region. Mixed hardwoods are on lower slopes, in valleys, and in coves. The oak-hickory type is found on the upper slopes and ridges. The predominant species are sugar maple, ash, beech hickory, white oak, and elm in the mixed hardwood type and white oak, hickory, sugar maple, red oak, and black oak in the oak-hickory type. Yellow-poplar is deficient in the overstory but scattered trees provide a seed source. Black walnut trees, though not numerous, are scattered through the mixed hardwood stands. Plantations and old fields are generally found on broad ridges. The old fields range from small fields with no woody species to those with volunteer trees and shrubs.

Climate: The climate on the Paoli Experimental Forest is temperate, with long summers and mild winters. The average frost-free period is 175 days. Annual precipitation averages 44 inches (1,092 mm) and it falls throughout the year, primarily as rain. Droughts can occur in late July and August.

Research—past and present: Research on the Paoli Experimental Forest has included studies on white and northern red oak plantings; effects of nursery undercutting and shoot pruning on growth of out-planted oaks; prescribed burning to stimulate both planted and natural stands of regenerated oak trees; the growth of black walnut as influenced by competition and site; and control competition to the oak from yellow-poplar, aspen, and maple.

Research opportunities: Opportunities for research include stand-level investigations into the forest ecology and silviculture of central hardwood forests. Monitoring ongoing research will continue to be productive and add to our knowledge of how forests respond to specific management disturbances. Periodic forest inventory will document forest succession in the absence of management.

Facilities: There are no facilities on the Paoli Experimental Forest.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/in/paoli/>





PENOBSCOT EXPERIMENTAL FOREST

Bradley and Eddington, Maine



The 4,000 acre (1,618 ha) parcel of land that now comprises the Penobscot Experimental Forest was purchased by nine pulp, paper, and land holding companies in 1950 and leased to the Forest Service as a site for long-term forest management research in the northeastern spruce-fir forest. The Penobscot is recognized internationally for silvicultural research. Research initially focused on management of mixed conifer stands for timber. Over the past 20 years, the focus has broadened to include studies on tree growth and maturation, biodiversity, root structure and function, economics, and various growth and yield modeling efforts. Analyses of studies conducted on the Penobscot have influenced management decisions throughout the region. Technology transfer is a major undertaking with numerous tours annually for students and professionals.



Assets:

Scientists: 2 Northern Research Station scientists are conducting research on the Penobscot.

Scientific support: 1 professional supports the work of these scientists.

Cooperators: University of Maine, other Northern Research Station units, University of New Hampshire, SUNY-ESF, Laval University, Maine Department of Conservation, Canadian Forest Service, V.N. Sukachev Institute of Forest, Russian Academy of Sciences, Northeastern Area, State & Private Forestry, Small Woodland Owners Association of Maine.

Needs:

Annual operating costs: \$162,000

Critical needs:

- Upgrade GPS/GIS capabilities and improve expertise among staff
- Consolidate all long-term data and metadata into readily accessible and web-compatible formats

Long-term needs:

- Expand quarters and provide laboratory facilities
- Modernize data collection technology with electronic data-logging systems and wireless remote monitoring capability



The Penobscot Experimental Forest is administered jointly by:

University of Maine and

U.S. Forest Service, Northern Research Station

271 Mast Road, Durham, NH 03824

Key Contact: John Brissette, 603-868-7632, email jbrissette@fs.fed.us

More About the Penobscot Experimental Forest

Location: Lat. 44°51' N, long. 68°37' W

The Penobscot Experimental Forest is located 9.3 miles (15 km) north of Bangor, ME.

Vegetation: The vegetation types on the Penobscot are typically more diverse than on the industrial spruce-fir forest farther north. The canopy is dominated by a mix of conifers, including hemlock, spruce (mostly red but some white and black), balsam fir, northern white-cedar, white pine, and occasional tamarack or red pine. Common hardwoods include red maple, paper and gray birch, and quaking and bigtooth aspen.

Climate: The climate of the Penobscot is cool and humid. Average annual temperature is 44 °F (6.6 °C), with February the coldest month and July the warmest. Normal precipitation is 42 inches (106 cm), with 48 percent falling during the growing season, which averages 156 days.

Research—past and present: Scientific studies on the Penobscot have traditionally focused on management of mixed conifer stands for timber. A long-term silvicultural experiment started in 1952 is the basis for most of the current research. The long-term study includes 10 replicated treatments representing a range of even-age and uneven-age prescriptions. It has the only examples of uneven-age management of conifers in the northeastern U.S. and eastern Canada where cutting cycles have been sustained over decades. Pioneering research on shelterwood removals, strip cutting, and pre-commercial thinning have also been part of the study. A companion study started by University of Maine researchers in 1994 examines the effects of expanding gap shelterwood on several attributes of ecosystem structure and function. Over the past 20 years, research was broadened to include fundamental studies of tree growth and maturation, spruce budworm predation, biodiversity, root structure and function, coarse woody material, economics, and growth-and-yield modeling.

Research opportunities: There are nearly unlimited research opportunities in all aspects of ecology and management of conifer dominated and mixed conifer-hardwood stands of the Acadian Forest. New research within the long-term silvicultural study is encouraged and facilitated by Forest Service scientists. Research in conjunction with Maine's Forest Ecosystem Research Program (FERP) is approved by the director of that program. All other research proposed must be presented to the university and Forest Service team that manages the research program.

Facilities: At the Penobscot Experimental Forest, there are quarters for up to 4 people, an office, shop, library, and storage space.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/me/penobscot/>





PIKE BAY EXPERIMENTAL FOREST

Cass Lake, Minnesota



The 3,914 acre (1,585 ha) Pike Bay Experimental Forest located on the Chippewa National Forest in Minnesota was officially established in 1932 although research on the site began in the late 1920s. Aspen research has been the dominant activity at Pike Bay. This research has been important in helping to develop and refine silvicultural prescriptions for aspen management. Currently the primary active research at Pike Bay is affiliated with the national Long-Term Soil Productivity (LTSP) network. LTSP research is important in predicting impacts to aspen productivity from soil compaction and organic matter removal. Results provide guidance to National Forests regarding sustainability of productivity in managed forests.



Assets:

Scientists: 3 Northern Research Stations scientists are currently conducting research at Pike Bay.

Scientific support: 2 technicians and/or professionals provide support for this work.

Cooperators: Chippewa National Forest, USFS Region 9, University of Northern British Columbia, University of Minnesota.

Needs:

Annual operating costs: \$38,979

Critical needs: Updated ecosystem classification and stand inventory maps

Long-term needs: Field lab (dry) with living quarters, shared with Cutfoot EF and the Chippewa National Forest - \$800,000

The Pike Bay Experimental Forest is administered by:

U.S. Forest Service, Northern Research Station

1831 Highway 169 E, Grand Rapids, MN 55744

Key Contact:

Brian Palik, 218-326-7116, email bpalik@fs.fed.us

More About the Pike Bay Experimental Forest

Location: Lat. 47°20' N, long. 94°40' W

The Pike Bay Experimental Forest is located just east of Cass Lake about 54 miles west of Grand Rapids, MN.

Vegetation: Much of the Pike Bay Experimental Forest is dominated by mature to over-mature aspen (60 to 80 years old). These are among the most productive aspen sites in northern Minnesota. Pike Bay once supported large white pines and northern hardwoods and examples of each remain. Pike Bay is noted for its abundance of small seasonal wetlands. These vary greatly in the depth of water and duration of flooding during the growing season. Black ash is the most common tree species in seasonal wetlands. Generally, these wetlands are 0.62 acres (0.25 ha) or less in size. At least historically, the eastern side of the forest is believed to have had species more tolerant to burning (for example more white and red pines). In the interior and western parts of the forest, fire was less common and vegetation is more sensitive to fire. Fire has generally been eliminated as a disturbance agent and the differentiation between these areas is not as obvious in present-day vegetation.

Climate: The climate at Pike Bay is continental. Maximum summer temperatures are 90 °F (32 °C) with high humidity (80 percent) and minimum winter temperatures descend to -31 °F (-35 °C). Growing season length is 100 to 120 days. Average annual precipitation is 20 to 26 inches (50 to 65 cm). Snow depths average ~3.3 feet (1 m). Although prolonged summer droughts occur, there usually is adequate rainfall in the growing season.

Research—past and present: Plantations established on the Pike Bay Experimental Forest in the 1930s have provided important areas for studying and comparing forest and soil development in aspen, red pine, and spruce growing on the same soils. Aspen research has been the most common at Pike Bay. Beginning in the 1940s, aspen research has included thinning in young stands, prescribed burning, and effects of clearcutting on soil and stand productivity. Currently, the most active work is related to the Long-Term Soil Productivity Study (LTSP), one of three aspen LTSP sites in the Lakes States (others are in the Upper and Lower Peninsulas of Michigan). There is a small amount of published work on white and red pine.

Research opportunities: Aspen research remains a major focus and there are significant opportunities for continuing the ongoing work and beginning new research on other aspects of aspen silviculture and stand development. The forest also provides opportunities for research on ecology and silviculture of northern hardwoods and mixtures of northern hardwoods and aspen/birch-white-pine.

Facilities: There are no on-site facilities at the Pike Bay Experimental Forest, but several nearby towns, such as Cass Lake several miles to the west and Bemidji, have lodging facilities for short-term stays. There is a well developed system of roads within the forest, but travel is difficult in wet weather.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/mn/pike-bay/>



SILAS LITTLE EXPERIMENTAL FOREST

New Lisbon, New Jersey



Located in New Jersey, the 590 acre (239 ha) Silas Little Experimental Forest (formerly the Lebanon Experimental Forest) was established in 1933 on land leased from New Jersey on the Brendan Byrne State Forest. The forest has a long history of fire and forest productivity research. In 1937, Dr. Silas Little was assigned to be the lead scientist on the experimental forest and served in that role until his retirement in 1979. In association with the New Jersey Forest Fire Service, Dr. Little pioneered research on the practice and effects of using prescribed fire as a tool to reduce wildfire risk on this Pine Barrens forest type. Today research focuses on wildland fire and fuels, including work on hazardous fuels management, predictions of fire weather and fire danger ratings, and use of Light Detection and Ranging (LIDAR) systems to characterize fuel loading and forest structure across the Pine Barrens.

Assets:

Scientists: 2 Northern Research Station scientists are currently conducting studies on the Silas Little.

Scientific support: 2 technicians and/or professionals support these scientists in their work.

Cooperators (abbreviated): New Jersey Forest Fire Service, NJ Department of Environmental Protection, NASA, U.S. Geological Survey, Rutgers University, Drexel University, University of Florida, NJ Pinelands Commission, other Forest Service units.

Needs:

Annual operating costs: \$200,000 (Forest Service share only.)

Critical needs: Replacement of the plant and soil analysis/water quality/microscopy labs, now housed in 2 old trailers owned by Rutgers University.



The Silas Little Experimental Forest is administered jointly by:

Rutgers University and

The U.S. Forest Service, Northern Research Station

P.O. Box 232, 501 Four Mile Road, New Lisbon, NJ 08064

Key Contact: Ken Clark, 609-894-0325, email kennethclark@fs.fed.us



More about the Silas Little Experimental Forest

Location: Lat. 39°54'58", long. 74°35'55"

The Silas Little Experimental Forest is located near New Lisbon, NJ and about 32 miles east of Philadelphia, PA.

Vegetation: The Silas Little represents a number of forest types in the Pine Barrens, including upland forest on sandy soils consisting of oaks and shortleaf and pitch pine (52 percent), upland forest on highly infertile sands supporting pitch pine and low-grade oaks (22 percent), and lowland forests on poorly

drained soils consisting of pitch pine (14 percent), and mixed hardwood swamp forests (12 percent).

Climate: The climate on the Silas Little is strongly influenced by the Atlantic Ocean. The coldest month is February when temperatures average 28 to 34 °F (-2 to 1 °C), and the warmest month is July when temperatures average 73 - 77 °F (23 - 25 °C). Average rainfall is ~45 inches per year, with reduced rainfall occurring in spring and fall. Wildfire activity is greatest in April and May, coinciding with reduced precipitation, increased solar radiation, and windy conditions in the late spring.

Research—past and present: Historically, one of the major research accomplishments from the Silas Little EF was improving strains of pitch and loblolly pine. The hybrid species developed there has now been planted throughout the eastern United States and southeastern Canada, on denuded hills throughout South Korea and France. In 1993, the International Paper Company began a planting program with this hybrid on its northern lands. Currently, research on the Silas Little is focused on fire weather and its interactions with hazardous fuels, and evaluating the carbon dynamics of prescribed fires and wildfires using eddy flux, field measurements, and LIDAR techniques. Other research focuses on the effects of disturbance, including gypsy moth defoliation, on short- and long-term forest productivity.

Research opportunities: There are numerous opportunities for research on all aspects of fire weather, wildfire ecology, and carbon sequestration. New research within the New Jersey Pine Barrens region is encouraged and facilitated by the Northern Research Station and the Rutgers Pineland Research Station and requires approval by the field station director and the Forest Service program manager.

Facilities: Facilities at the Silas Little include a main house with offices and a library, a bunk house that now serves as the Forest Service office, a workshop and sample preparation area, a dorm trailer with space for up to 12 people, a greenhouse, and 2 laboratory trailers that have complete instrumentation for plant, soil and water analyses. Two weather stations and instrumented flux towers are also available on the site.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/nj/silas-little/>





SINKIN EXPERIMENTAL FOREST

Dent County, Missouri



Located within the Mark Twain National Forest in southeastern Missouri, the 4,100 acre (1,666 ha) Sinkin Experimental Forest was established in 1950 to implement forest research on management and reproduction of shortleaf pine. The headwaters of Sinkin Creek originate in the general vicinity of the experimental forest, hence the name “Sinkin.” Current research is focused on methods for restoring oak and oak-pine woodland communities. Many of the silvicultural techniques and management guidelines used by foresters on the surrounding National Forest and throughout the central hardwood region were developed on the Sinkin Experimental Forest.

Assets:

Scientists: 3 Northern Research Station scientists are currently conducting studies on the Sinkin and data from the experimental forest supports research for other Northern Research Station Scientists and university collaborators.

Scientific support: 2 full-time technicians and 2 seasonal employees.

Technicians (shared with the Kaskaskia (IL) and Paoli (IN) Experimental Forests) support the work of these scientists.

Cooperators: The University of Missouri, the Missouri Department of Conservation, the Mark Twain National Forest

Needs:

Annual operating costs: \$142,000 shared with the Kaskaskia (IL) and Paoli (IN) Experimental Forests.

Long-term needs:

- Additional technician for data collection and a data manager shared with the Paoli and Kaskaskia Experimental Forests - \$90,000/yr
- Operating funds to facilitate cooperative research - \$50,000



Sinkin Experimental Forest is administered by:

Mark Twain National Forest and
U.S. Forest Service, Northern Research Station
202 Natural Resources Building, University of Missouri
Columbia, MO 65211
609-894-0325

Key Contact: John Kabrick, 573-875-5341 x229, email jkabrick@fs.fed.us

More About the Sinkin Experimental Forest

Location: Lat. 37°30' N, long. 91°15' W

The Sinkin EF is located about 25 miles to the northwest of Salem, MO.

Vegetation: Approximately 75 percent of the Sinkin (3,000 acres or 1,214 ha) is dominated by the red oak and white oak groups. Black and scarlet oaks are the most numerous species in the red oak group, with some northern red oak. The most numerous and largest trees of the white oak group are white and post oaks. Other species on the forest include hickory, black tupelo, sassafras, shortleaf pine, black cherry, maple, dogwood, and some black walnut. The youngest stands are 3 years old and the oldest exceed 100 years. The understory is composed of hardwood species and shade-tolerant herbaceous plants.



Climate: Weather data have been collected since the Sinkin Experimental forest was established in 1950. The average annual precipitation is 45 inches (1,118 mm) and falls mostly in the form of rain, with occasional freezing rain, sleet, and snow during the winter months. The coldest month is January and the warmest is July or August. The lowest temperature recorded on the site is -18 °F (-28 °C) and the warmest is 111 °F (44 °C). It is not uncommon during the winter months for temperatures to reach 50 to 59 °F (10 to 15 °C); this is known locally as the January thaw. The wettest months are April, May, and June, and the driest are December, January, and February.

Research—past and present: Initial research on the Sinkin concentrated on solving management and reproduction problems of shortleaf pine. Planting techniques, prescribed fire, use of herbicides to control competition, and thinning methods were developed to address these problems. Later research focused on the silvicultural issues with the management and reproduction of oak stands. Studies were established to answer questions about natural and artificial oak regeneration. Current research entails monitoring the long-term studies, conducting a Joint Fire Science Project with the Missouri Department of Conservation and the U.S. Geological Survey, studying the restoration of shortleaf pine and oak woodlands, and administrative studies of uneven-age management with the Mark Twain National Forest. A savanna management demonstration area highlights techniques for ecological restoration through silviculture.



Research opportunities: Studies of ecology and silviculture of central hardwood forests, oak decline, drought-related stress on tree growth and yield, insect pest and drought relations, and woodland silviculture could be developed.

Facilities: Although there are no physical facilities on the Sinkin Experimental forest itself, the forest has an automated weather station that is accessible by satellite and cell phone.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/mo/sinkin/>





UDELL EXPERIMENTAL FOREST

Manistee County, Michigan



In 1961, the 3,800 acre (1,538 ha) Udell Experimental Forest was established on the Huron-Manistee National Forest in Michigan as a field laboratory for studying the hydrology of forested glacial sand sites. One of the major objectives of past research was to compare water yields from the primary forest cover types including oak and aspen forests. Because of renewed interest in water quality and quantity from forest ecosystems, Udell Experimental Forest has potential for new research and as a replicate for regionwide field studies.

Assets:

Scientists: No Northern Research Station scientists are currently working on the Udell Experimental Forest.

Cooperators: Huron-Manistee National Forest.

Needs:

Annual operating costs: Currently there are no operating costs associated with the Udell Experimental Forest.

Critical needs: None.

Long-term needs: Develop accurate GIS database including physical and vegetative features and research locations.

More About the Udell Experimental Forest

Location: Lat. 44°15' N, long. 85°24' W

The Udell Experimental Forest is located in Manistee County about 14 miles east of Manistee, MI and 36 miles west of Cadillac, MI and is accessed off of M-55 (a major access highway).

Vegetation: Approximately 70 percent of the Udell Experimental Forest is in oak and aspen forest cover types. Stand composition in these types range from mixed oaks with relatively few aspen to pure aspen stands. There are about 1,500 acres (610 ha) of jack pine and red pine plantations that have been established on the eastern and western outwash plains. In the southeast and northwest portions, lowland hardwood forests of elm, red maple, and occasional northern white-cedar are found.

The Udell Experimental Forest is administered jointly by:

Huron-Manistee National Forest and
U.S. Forest Service, Northern Research Station
271 Mast Road, Durham, NH 03824
603-868-7632

Key Contact: John Brissette, 603-868-7632, email jbrissette@fs.fed.us

Climate: Average temperatures for January range from 16 to 28 °F (-9 to -2 °C). Temperatures in July range from 59 to 80 °F (15 to 27 °C). Average annual rainfall is 32 inches (790 mm). Average annual snowfall is about 96 inches (243 cm).

Research—past and present: Research at the Udell Experimental Forest has focused on the effects of forest type and partial cutting on groundwater yields and pulp and paper mill sludge fertilization of red pine plantations. Numerous reports have been published on changes in stream flow resulting from reforestation and cutting.

Research opportunities: Considerable portions of upland moraines, level outwash plains, and hardwood swamp areas are instrumented with wells and other measurement devices to determine the behavior of groundwater level under existing forest conditions.

Facilities: Field operations are centered at the Pine River Forest Laboratory, 10 miles (16 km) east of the forest near the junction of Highways M-55 and M-37.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/mi/udell/>



VINTON FURNACE EXPERIMENTAL FOREST

McArthur, Ohio



Located in southeastern Ohio on privately owned land, the 3,200 acre (1,300 ha) Vinton Furnace Experimental Forest was established in 1952, designated an experimental forest in 1963, and named after the nearby iron furnace that shaped the forests in the area. The Vinton is renowned for long-term silvicultural research spanning more than 45 years. The information gleaned from the Vinton has significantly improved management of mixed oak forests and still provides practical information to forest managers and landowners. Research in the Vinton is in demand by public and private landowners, policymakers at the State and Federal level, and scientists around the globe. The Vinton is part of the regional Cerulean warbler working group and the national Fire and Fire Surrogate network.



Assets:

Scientists: 6 Northern Research Station scientists and a full-time forest manager are currently conducting research on the Vinton Furnace.

Scientific support: 3 technicians and/or professionals support the work of these scientists with the addition of 6 seasonal technicians during the summer data collection.

Cooperators: Ohio University, Ohio State University, University of North Carolina, The Nature Conservancy, Ohio Division of Forestry, Ohio Division of Wildlife, Wayne National Forest, other Forest Service scientists

Needs:

Annual operating costs: \$281,000

Critical needs:

- Ownership by nonprofit or government agency, or conservation easement to ensure continued long-term research - \$5,000,000
- National Weather Service-quality meteorology station - \$50,000

Long-Term Development Needs:

- 2 forestry technicians for long-term study installation, maintenance, and data collection - \$120,000/year. Long-term studies are being abandoned and closed due to lack of funding for technical personnel.
- A wildlife ecologist and support technician to adequately study the effects of management to sustain oak forests on the resident animal species - \$150,000/year for scientist, \$60,000/year for technician, \$75,000/year operating budget

The Vinton Furnace Experimental Forest is administered by:

The U.S. Forest Service, Northern Research Station

359 Main Road, Delaware, OH 43015

740-368-0101

Key Contact:

Dan Yaussy, 740-368-0101, email dyaussy@fs.fed.us

More About the Vinton Furnace Experimental Forest

Location: Lat. 39°11' N, long. 82°22' W

The Vinton Furnace Experimental Forest is located near McArthur, OH and about 80 miles southeast of Columbus.

Vegetation: The Vinton Furnace comprises upland mixed-oak forests with chestnut oak on the ridgetops, tending to scarlet and black oak downslope, with white oak, red maple, and hickories midslope blending to yellow-poplar and Ohio buckeye in the mesic areas. Scattered areas of shortleaf pine and eastern hemlock account for most of the conifers found in the area. More than 50 tree species are found within the borders of Vinton Furnace.

Climate: Mean annual temperature at the Vinton Furnace is 53 °F (11.3 °C), which includes below-freezing temperatures during January. Precipitation, mostly rain, is distributed throughout the year with a mean annual precipitation of 41 inches (1,024 mm). The growing season consists of 158 frost-free days.

Research—past and present: Past studies concentrated on silvicultural practices, regeneration, and growth and yield of desirable hardwood species. Current research focuses on the effects of using shelterwood and prescribed fire to restore mixed-oak ecosystems and fire behavior and dynamics. Managing for rare plant and wildlife species, such as Bartley's reed bent grass, cerulean warbler, Indiana bat, and timber rattlesnake, is another area of study.

Research opportunities: As part of the Forest Service's National Fire and Fire Surrogates Ecosystem Study, the Vinton Furnace offers landscape-scale harvesting, burning, and control treatment areas with many components of the ecosystem well documented and monitored. Collateral, multidisciplinary studies are continually being added to these areas.

Facilities: The headquarters area of the Vinton Furnace contains a large meeting/training center, quarters for 6 visiting scientists and technicians, office equipment, broad-band internet connections, and a weather station.

More information can be found at: <http://www.nrs.fs.fed.us/ef/locations/oh/vinton-furnace/>



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