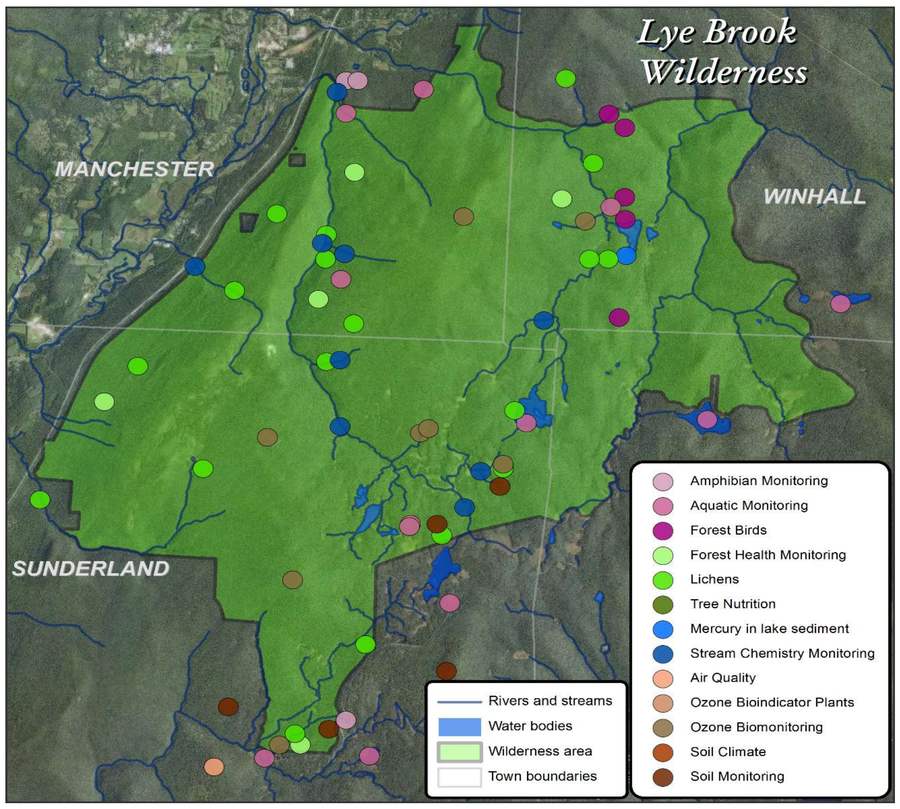
VMC and GMNF Research at Lye Brook

Vermont Monitoring Cooperative
Green Mountain National Forest
University of Vermont
Vermont Agency of Natural Resources

The Vermont Monitoring Cooperative (VMC) was initiated in 1990 as a state, university and federal partnership. It was designed to enhance information exchange between natural resource managers, scientists and other stakeholders on forested ecosystems in Vermont. Research initially focused on Mt. Mansfield and was extended to the Lye Brook Wilderness Area with additional support from the Green Mountain National Forest (GMNF), which became a partner in the VMC, and funded research and monitoring efforts in and near the Lye Brook Wilderness Area.

The Lye Brook Wilderness Area (WA) provides a southern Vermont complement to the Mount Mansfield site. It is a Class I Wilderness Area under the US Clean Air Act that encompasses 15,000 acres of National Forest land; a range of elevations (900 to 2,900 ft.) and aspects; northern hardwood, spruce-fir and paper birch forests similar to the northern site; and surface waters identified as sensitive to acidic deposition.



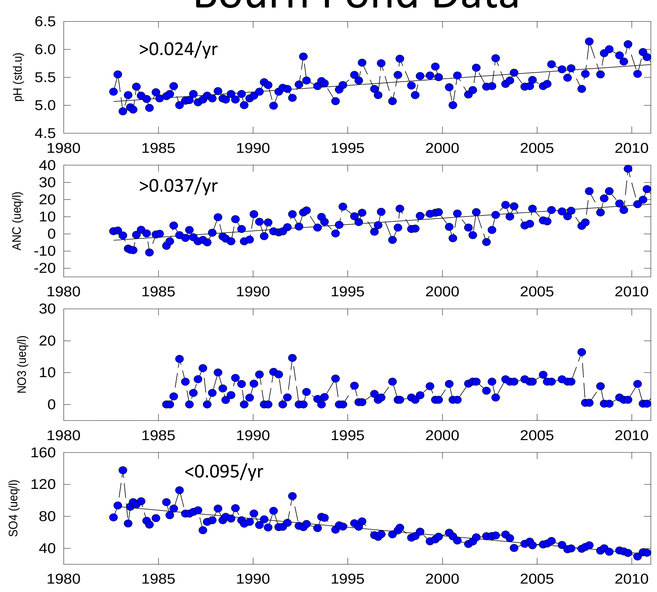
VMC research plots in the Lye Brook Wilderness Area

Air quality monitoring sites were established near GMNF's Lye Brook WA in cooperation with the Interagency Monitoring of Protected Visual Environments (IMPROVE) program and EPA's Clean Air Status and Trends Network (CASTNet). In addition, researchers from many different fields (hydrology, geology, biology, chemistry, and others) direct their efforts towards understanding complex forested ecosystems with a focus on the effects of human impacts within these intensive long-term study sites.

Both sites are within the Green Mountains, yet represent unique features of the northern and southern biophysical regions. Together, the Mount Mansfield and Lye Brook sites allow the VMC monitoring and research program to assess ecosystem interactions in localized areas with application to Vermont forests as a whole.

The Vermont Monitoring Cooperative and GMNF have helped coordinate, facilitate and enact monitoring projects that keep track of trends in forested VT ecosystems, including the Lye Brook WA. For more information, go to http://www.uvm.edu/vmc/

The Wilderness Act requires protection of the natural quality of wilderness areas. Passage of additional legislation, such as the Clean Air Act and the Clean Water Act has led to some improvements in acid deposition effects, shown here. Buffering capacity and biological recovery are still limited.

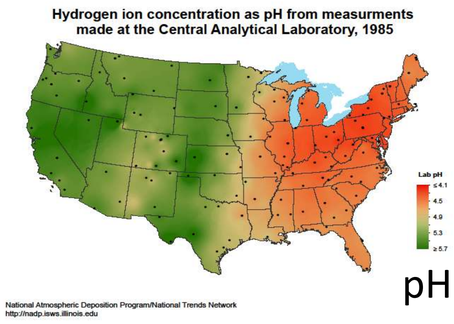


pH

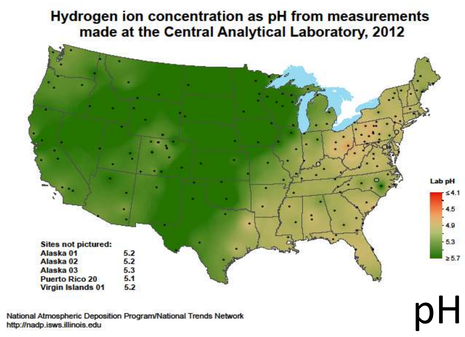
Acid Neutralizing Capacity

Nitrate

Sulfate



pH in 1985



pH in 2012

VMC sponsored research at the Lye Brook Wilderness Area:

1982

Biological and Chemical Survey of Selected Surface Waters in the Lye Brook Wilderness Area
Determine the present biological and chemical characteristics of principal water bodies in and around Lye Brook Wilderness Area so that changes to air quality related values (AQRV) can be documented.

1988

Fine Aerosol Monitoring
Determine concentrations and composition of fine aerosols (PM-2.5) of relevance to light scattering, light absorption, human health and biological effects. Data available for use in conjunction with other biological, physical and chemical variables in trend and relationship assessments.
Incidence of ozone and its effects on vegetation in Lye Brook Wilderness Area
To monitor ozone concentrations near and within Lye Brook Wilderness (LBW) and relate these concentrations to the degree of injury to vegetation within LBW.
Particulate Matter Monitoring
Determine compliance with (PM-10) National Ambient Air Quality Standards; determine concentrations and composition of fine aerosols (PM-2.5) of relevance to light scattering, light absorption, human health and biological effects.

1991

Amphibian Survey and Monitoring
To document the occurrence of amphibian species at each study site; establish a baseline data set on their distributions and abundances; inventory data for the Vermont Herp Atlas, and gather basic natural history information and monitor reproductive status in relation to environmental conditions.
Forest Bird Surveys
The primary goal is to conduct habitat-specific monitoring of forest interior breeding birds and to determine trends over time.
Forest Health Monitoring
Annual re-measurements of forest plots to determine the condition, trends and relationship to stressors using the same plot design as in the National Forest Health Monitoring Program (NFHM).
Forest Pest Monitoring
Monitoring trends in major insect pest populations, and documenting the occurrence of damage to forests.
Ozone Bioindicator Plant Monitoring
Detect ozone injury on sensitive native plants, record first occurrence data for each species, and evaluate the maximum severity of the damage.
Tree Phenology Monitoring
Annual measurements of tree phenology to establish the timing of developmental events and trends, especially as they relate to changes in weather or insect and disease occurrence.

1993

Lichens and air quality in the Lye Brook Wilderness Area
Collect lichens for a lichen species list and for elemental analysis; study the health and distributions of species most sensitive to air pollution; and assess the effects of air quality
Lye Brook Area Ecological Land Type Classification
To classify ecological communities in the Lye Brook Area based on an integration of soils, vegetation & physiographic data, that will lead to mapping of these units within the area.
Clean Air Status and Trend Network (CASTNet)
To provide site specific data meteorology, dry deposition of sulfur and nitrogen species, wet deposition of major ions, and ozone. To provide air quality data specific to the Lye Brook Wilderness Area, a Class I Wilderness Area, to support research on the effects of air pollution on the Air Quality Related Values (AQRV) of the wilderness area.
Effects of acidic deposition on terrestrial and aquatic ecosystems of Class I Wilderness Areas.
Determine the distribution of areas sensitive to deposition of sulfur and nitrogen; determine the current status of sensitive areas utilizing atmospheric deposition of nitrogen; determine the degree of base cation leaching and aluminum mobilization (use soil, vegetation, land use history associations to identify impacts); verify deposition thresholds; and assess impacts to terrestrial and aquatic ecosystems if under the prevention of serious deterioration (PSD) process.

1995

Lye Brook - Wildlife
Quantify wildlife habitat and extent.

1999

Long-term soil monitoring
Detect changes in soils due to human caused impacts (i.e. climate change, air pollution, forest management) at two forested sites in Vermont
Paleostratigraphy of mercury in lakes and ponds
Assess mercury and methyl mercury in sediment cores from lakes and ponds in and around Lye Brook Wilderness Area.

2000

Soil Climate Analysis Network (SCAN) sites
The Soil Climate Analysis Network (SCAN) site is a comprehensive, nationwide soil moisture and climate system.

Tree nutrition status on long-term soil monitoring plots
Determine the content of major elemental nutrients in tree foliage, twigs and wood for use in initial characterization of the long-term soil monitoring sites, and for application in the New England Governors/Eastern Canadian Premiers Forest Sensitivity Mapping Project

2001

National Visitor Monitoring
Annual collection of visitor trends, including numbers and dates

2002

Biomolecular Indicators of Acid Stress
Investigate the effects of air quality, especially acid deposition, on terrestrial and aquatic ecosystems. Specific objectives include assessing the diversity and community structure of soil bacteria (nitrifiers and methanotrophs) in different acid deposition environments; develop a biomolecular method for determining ecosystem acid stress; and validate the PnET-BGC forest-soil-water model on field, GIS and remote sensing data then regionally apply the model.

2004

Campsite Monitoring
Five year sampling intervals on campsite conditions and experiences

2009

Long Term Wilderness Management Challenge Monitoring
Ten year sampling intervals to manage for wilderness characteristics such as primeval experience, solitude, etc. Includes an Air Quality plan for camping.

2013

Fish Stocking Monitoring
Lichen Survey
Lichens surveyed by Forest Service subcontractors

2014

Recreation Effects at Bourne Pond
Fishing survey

Other

Aerial Surveys for Insects and Disease
Aerial surveys in the Green Mountain National Forest for insect pest and disease conditionss as a joint effort between the Northeastern Area State and Private Forestry and the Vermont Department of Forests, Parks and Recreation
Impaired Stream Monitoring
Monitoring of acid precipitation impaired streams outside of the Lye Brook Wilderness area: Bourne Pond Brook and Lye Brook as part of Total Maximum Daily Load regulation
Pond Core Monitoring
Examine diatom and chrysophyte communities as part of TMDL assessment.
Goal is for alkalinity of 2.5
Non-native Plant Survey