

## Outcomes

Aspen FACE research results have influenced the establishment of current ozone pollution standards by the U.S. Environmental Protection Agency. Other major applications include informing national climate change policy and forest management plans for important northern hardwood species. Short rotation woody crop research results have influenced renewable energy by providing genotypes for optimal biomass production and advancing pollution remediation.

## Partners

Collaborating with universities, state agencies, and other federal agencies is the cornerstone of the Forest Service's research program on the REF. The Northern Research Station's Institute for Applied Ecosystem Studies oversees administration of the REF and a team of Forest Service scientists coordinate activities and review proposals for new research installations. Many scientists from domestic and foreign agencies and institutions use the REF for their research.

## Facilities

All current facilities are located in the West Unit within an 80-acre fenced study area that includes an office, workshop, and a field laboratory with large capacity drying ovens, chest freezers, and sample processing rooms. An instrumented meteorological monitoring tower is located at the north end of the secure study area. The East Unit is adjacent to the Institute for Applied Ecosystem Studies that has offices and multiple laboratories including dendrochronology, genetics, and a plant and soil analytical laboratory.

## U.S. Forest Service Experimental Forest and Range Network

Forest Service Research and Development (R&D) works at the forefront of science to improve the health and use of our nation's forests and grasslands. Research has been part of the Forest Service mission since the agency's inception. Today, Forest Service researchers work in a range of biological, physical, and social science fields; their research covers all 50 states, U.S. territories, and commonwealths. The Northern Research Station is one of six in R&D, and includes 20 states in the north-central and northeastern U.S., comprising both the most densely populated and most heavily forested portions of the country.

The Experimental Forest and Range (EFR) network contributes importantly to R&D's research infrastructure and is increasingly viewed as one of its most valued assets. There are currently 22 official experimental forests in the Northern Research Station, and 80 EFRs nationwide. Taken together, these sites provide a record of forests and forest change that dates back more than 100 years. Though initially focused on local and regional topics, EFRs are becoming increasingly networked to address issues of national and international concern such as climate change, carbon sequestration, air and water quality, and invasive plants and animals.

## For more information

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### Websites:

<http://www.nrs.fs.fed.us/ef/locations/wi/rhinelander/>

Archived Aspen FACE datasets:  
<http://www.fs.usda.gov/rds/archive/>

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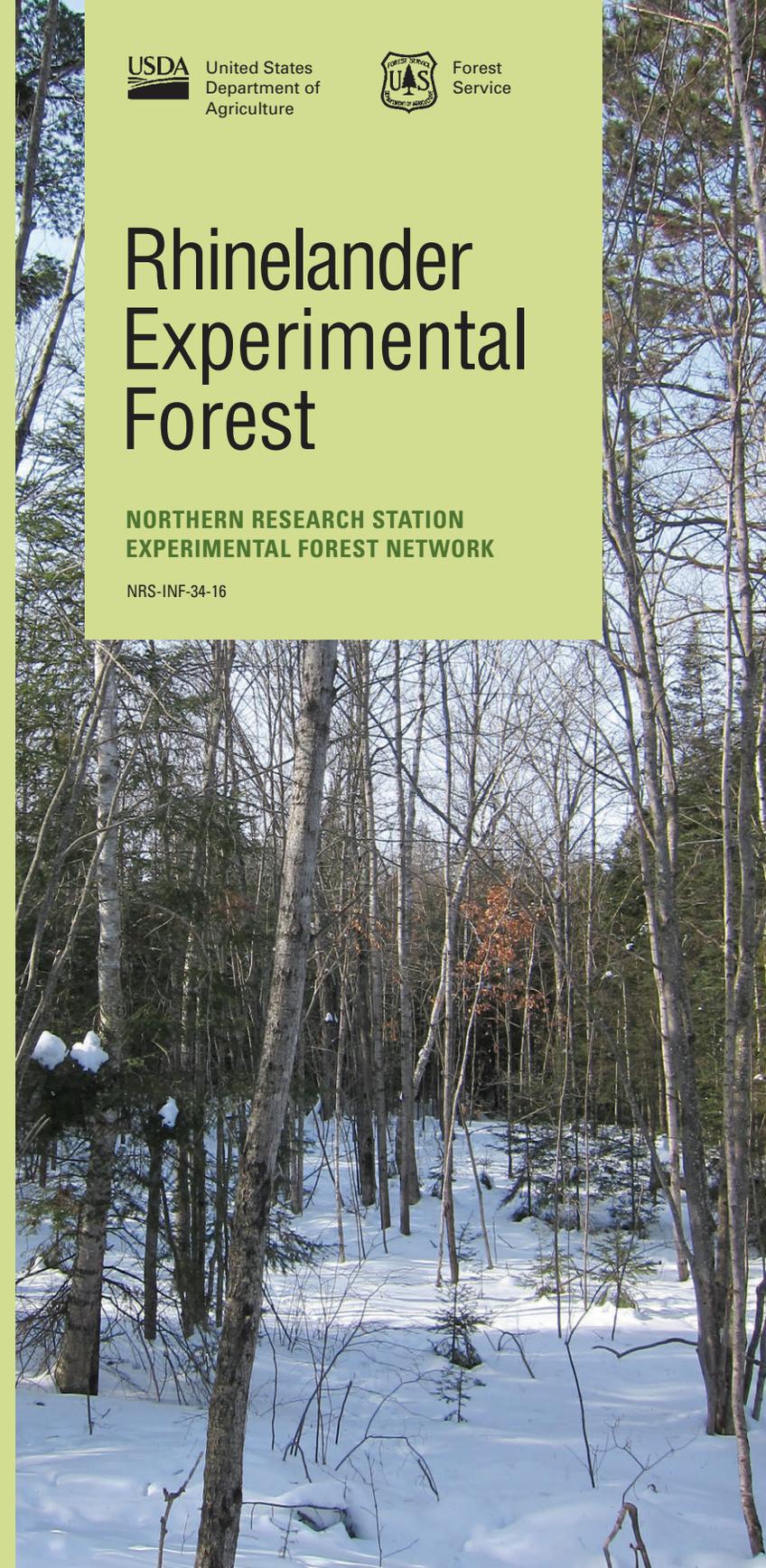
Cover photo: Northern hardwoods.  
Photo by Sue Lietz, U.S. Forest Service.



# Rhinelander Experimental Forest

**NORTHERN RESEARCH STATION  
EXPERIMENTAL FOREST NETWORK**

NRS-INF-34-16





Photos from left: Open land; undeveloped shoreline of Langly Lake; and northern hardwood communities within the experimental forest. Photos by Sue Lietz and Adam Wiese, U.S. Forest Service.

# Rhinelanders Experimental Forest

The Rhinelanders Experimental Forest (REF) is located in the towns of Cassian and Crescent, west of Rhinelanders, in north-central Wisconsin. This 685-acre experimental forest was established in 2015 as a site for long-term Forest Service research and management studies of environmental change. The REF is composed of a 184-acre East Unit and a 501-acre West Unit. The West Unit was formerly known as the Harshaw Forestry Research Farm and has been managed for more than 40 years by the Forest Service as a venue for experiments related to trees as bioenergy crops.

## Features

The REF is located in the major physiographic region called the Northern Highlands. The West Unit represents upland communities of northern hardwoods (primarily aspen, paper birch, and red maple), small red pine woodlots, shrublands, and open grasslands. Lowland forests and riparian communities including several undeveloped lakes dominate the East Unit. Combined, lands offer research opportunities across a gradient of land uses and disturbances on topics such as agroforestry, follow-up studies on existing plantations, expansion of tree genetics research, phytoremediation, and establishment of long-term research projects.

- Gently rolling topography of glacial outwash plain with loamy drift over sand and gravel in uplands, and organic soils of muck in lowlands
- Continental climate with cold winters and warm summers
- Mean annual rainfall is 31.4 inches, with 36 percent falling during the 122-day growing season between April and September. Mean annual snowfall is 39.1 inches.
- Mean annual daily maximum and minimum temperatures are 52.4 °F and 31.0 °F, with mean daily temperature during the growing season of 65.9 °F.

## Research

Historically, research focused on genomics, genetics of northern conifers, and maximum fiber yield through short-rotation woody crops. Bioenergy plantations from the 1970s are still in place and contribute to ongoing research advancing renewable energy sources and pollution remediation through short rotation woody crop production systems. From 1997–2009, the West Unit accommodated the Aspen FACE (Free-Air Carbon Dioxide and Ozone Enrichment) experiment, one of the world's largest climate change experiments as an important step to understanding large scale tree responses of northern tree species to elevated carbon dioxide (greenhouse gas) and ozone (urban pollution).

## Science Delivery

Forestry practitioners, students, landowners, and policy makers are beneficiaries of the research conducted on the REF. Research results are communicated through field trips, presentations, and publications. Over 50 scientists from 20 organizations and 8 countries conducted research at the Aspen FACE Experiment, which resulted in over 200 publications. Archived datasets from the Aspen FACE experiment include annual height and diameter measurements, hourly atmospheric CO<sub>2</sub> and O<sub>3</sub> concentrations, meteorological data, and four FACE harvests (Archived datasets can be accessed at <http://www.fs.usda.gov/rds/archive/>).

