

# Acid Deposition Impacts in the Tug Hill Region

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### TUG HILL COMMISSION

Dulles State Office Building

317 Washington Street

Watertown, New York 13601-3782

315-785-2380/2570 or 1-888-785-2380 ~ fax: 315-785-2574

e-mail: [tughill@tughill.org](mailto:tughill@tughill.org) website: <http://www.tughill.org>



# **Acid Deposition Impacts in the Tug Hill Region**

## ***What is Acid Deposition?***

Acid deposition, sometimes referred to as 'acid rain,' is a result of chemical reactions between sulfur and nitrous oxides with other substances in the atmosphere. The reactions convert these pollutants into weak acids, which may return to earth as components of rain, fog, snow or dry particles. Acid deposition is just one type of atmospheric deposition, which can also include substances such as mercury, pesticides, and persistent toxic compounds that accumulate in the food chains of lakes and streams.

## ***Where Does Acid Deposition Come From?***

The pollutants that cause acid deposition are mainly a result of the burning of fossil fuels such as oil and coal. The United States discharges nearly 50 million tons of sulfur and nitrogen oxides every year into the air. Power plants burning coal, oil and natural gas account for about 70 percent of the sulfur dioxide emissions in the United States. Cars and trucks, coal-burning power plants and industrial boilers and heaters account for most of the nitrogen oxide emissions. Most of these sources are located west of New York State, with combustion products carried east with prevailing winds.

## ***What Are The Effects of Acid Deposition?***

Acid deposition has caused lakes and streams to become acidic and unsuitable for many fish, damaged forests, and caused deterioration of many man-made structures worldwide. Acidic precipitation on forests and other non-farmlands have, over time, been shown to cause extensive changes in soil chemistry. Hundreds of lakes in North America, including a significant number of lakes in the Adirondacks, have become so acidic that they can no longer support fish life. Impacts are from both the acidity of the precipitation itself, and from its impacts on soil and water composition, bacterial interactions, and plant growth.

For example, the effect of deposited nitrogen in forests depends on how it is distributed in the environment. If fixed nitrogen is deposited as nitrate in forests, it may act as a fertilizer, stimulating growth and enhancing the forest's ability to remove carbon dioxide from the atmosphere. This may lead to a period of greater, healthy growth of plants and trees. The enhanced growth, though, is not sustainable. Plants growing in the shade of a more robust canopy eventually receive less sunlight and resources, resulting in fewer ground and mid-level plants and potential wildlife population shifts. Additionally, once too much nitrogen accumulates in the soil, soil fertility drops and carbon uptake declines.

## ***How Is Tug Hill Being Impacted by Acid Deposition?***

The Tug Hill region is the third largest, intact, forested landscape in New York State, behind the Adirondack and Catskill Parks. Extensive wetlands comprise approximately a quarter of the Tug Hill. Its high-quality streams support world-class fisheries and provide drinking water for municipalities, businesses and homeowners. Twenty-nine rare animal species and seventy rare plant species are found in the region. The region's forests produce a significant portion of the State's wood products. Given Tug Hill's significance for wildlife habitat, forest products, fisheries, recreation, and drinking water, it is critical to understand the extent to which the region's forests and waters are being impacted by atmospheric deposition.

The U.S. Geological Survey (USGS), the lead federal agency for the monitoring of wet atmospheric deposition as part of the National Atmospheric Deposition Program, National Trends Network (NADP/NTN), monitors over 250 sites nationwide, including one located at Bennett's Bridge, near Altmar, in Oswego County. According to that monitoring, the Tug Hill region has the highest long-term average annual deposition rates (1980-2002), compared to other regions of New York State that are impacted by acid deposition, such as the Adirondacks, Catskills and the Allegheny Plateau. Even more broadly, the Tug Hill region consistently receives among the highest levels of acidic precipitation (in all forms) and nitrogen deposition in the eastern United States. To date, no documented effects have been reported on lakes or streams in the Tug Hill region from acidification, leading to questions about how Tug Hill's water and soil chemistry may combat acid deposition. The potential exists for the Tug Hill region to display symptoms of nitrogen saturation and acidification, however when that time will come is unclear.

Despite knowing that Tug Hill has significant acid deposition rates, the region has not been the subject of monitoring to see what the environmental effects may be until recently. It is unclear whether Tug Hill's forests and waters are at risk of crossing a threshold over which impacts might become severe. Researchers at the S.U.N.Y. College of Environmental Science and Forestry in Syracuse, N.Y., are currently finishing a two-year survey of surface water quality, soil chemistry and live plant tissue chemistry across the Tug Hill to determine the extent to which the region's forests and their respective watersheds display symptoms of excess nitrogen deposition received. The research will also compare the range of conditions with those reported in studies of other regions of New York State.



*The Bennett's Bridge monitoring station is located near Altmar, NY, in Oswego County.*

## ***How Can We Help Reduce Acid Deposition on Tug Hill and the Northeast?***

Passage of the Clean Air Act and additional efforts to reduce air pollution, have led to limited lake recovery in the Adirondacks and elsewhere. The findings of a 12-year analysis on the recovery of Adirondack lakes from the effects of acid rain, funded by the U.S. Environmental Protection Agency's Adirondack Effects Assessment Program (AEAP), could eventually allow scientists to use bacteria whose populations correlate with acidity levels as indicators of lake recovery. The research is part of a much broader study on how Adirondack lakes are recovering from the impacts of acidification. However, as previously noted very little is known about the impacts of acid deposition on the Tug Hill region's ecosystems. Securing funding, partners and projects that focus on Tug Hill's unique environment, in particular, would do much to improve the understanding of what the capacity of the Tug Hill landscape is regarding pollutants deposited here by the wind. Being able to estimate this capacity would inform next steps to prevent negative impacts and/or prepare for potential changes.

### ***For More Information:***

Great Lakes Information Network (GLIN)

[www.great-lakes.net/envt/air-land/airdep.html](http://www.great-lakes.net/envt/air-land/airdep.html)

Mercury Deposition Network (a network of the NADP)

[nadp.sws.uiuc.edu/mdn/](http://nadp.sws.uiuc.edu/mdn/)

National Atmospheric Deposition Program (NADP)

[nadp.sws.uiuc.edu/](http://nadp.sws.uiuc.edu/)

U.S. Environmental Protection Agency Atmospheric Deposition Page

[www.epa.gov/glindicators/air/airb.html](http://www.epa.gov/glindicators/air/airb.html)

U.S. Geological Survey (USGS) Atmospheric Deposition Program

<http://bqs.usgs.gov/AcidRain/>

U.S. Environmental Protection Agency's Adirondack Effects Assessment Program (AEAP),

[http://www.nyserda.org/programs/Environment/EMEP/conference\\_2005/Boylen.pdf](http://www.nyserda.org/programs/Environment/EMEP/conference_2005/Boylen.pdf).