How does acid deposition affect Northeast ecosystems?

Acid deposition has had a greater environmental impact than previously projected.

Across the Northeast, acid deposition alters soils, stresses forest vegetation, acidifies lakes and streams, and harms fish and other aquatic life. These effects can interfere with important ecosystem benefits such as forest productivity and water quality. Years of acid deposition have also made many ecosystems more sensitive to continuing pollution. Moreover, the same pollutants that cause acid deposition contribute to a wide array of other important environmental issues at local, regional, and global scales (see Table 1).

TABLE 1: *Links between sulfur dioxide and nitrogen oxide emissions, and other environmental issues.*

Issue	Linkage to Emissions	Reference
Coastal eutrophication	Atmospheric deposition adds nitrogen to coastal waters.	Jaworski et al. 1997
Mercury	Surface water acidification enhances mercury accumulation in fish.	Driscoll et al. 1994
Visibility	Sulfate aerosols diminish visibility and views.	Malm et al. 1994
Climate Change	Sulfate aerosols may offset global warming in the short-term, but nitrous oxide is a potent greenhouse gas.	Moore et al. 1997
Tropospheric ozone	Emissions of nitrogen oxides contribute to the formation of ozone.	NAPAP 1998

Acid deposition has altered soils in areas of the Northeast.

Acid deposition has chemically altered soils with serious consequences for acid-sensitive ecosystems.

SUMMARY: Until recently, understanding of the effects of acid deposition on soils was limited. However, current research shows that acid deposition has chemically altered soils with serious consequences for acid-sensitive ecosystems. Soils compromised by acid deposition lose their ability to neutralize continuing inputs of strong acids, provide poorer growing conditions for plants, and extend the time needed for ecosystems to recover from acid deposition.

DETAILS: Acid deposition has altered and continues to alter soils in parts of the Northeast in three important ways. Acid deposition depletes calcium and other base cations from the soil; facilitates the mobilization of dissolved inorganic aluminum (hereafter referred to simply as aluminum) into soil water; and increases the accumulation of sulfur and nitrogen in the soil.

Loss of calcium and other base cations

In the past 50-60 years, acid deposition has accelerated the loss of large amounts of available calcium from the soil at the HBEF and other acid-sensitive areas in the Northeast. This conclusion is based on a limited number of soil studies, but at present calcium depletion has been documented at more than a dozen study sites throughout the Northeast, including sites in the Adirondacks, the White Mountains, the Green Mountains, and the state of Maine. Depletion occurs when base cations are displaced from the soil by acid deposition at a rate faster than they can be replenished by the slow breakdown of rocks or the deposition of base cations from the atmosphere. This depletion of base cations fundamentally alters soil processes, compromises the nutrition of some trees, and hinders the capacity for sensitive soils to recover.