

How to Reduce Acid Deposition

The negative effects of acid deposition must be viewed as a public problem since the pollutants are created from the combustion of fossil fuels. The most important step is for you to write your congressional leaders demanding more stringent emission standards for coal-fired power plants and vehicle emission. Technology, such as emission scrubbers, can be used to remove sulfates from the air. Also, minimize your use of vehicles. Drive less or take public transportation whenever possible. Regular tune-ups will reduce your car emissions, and driving fuel-efficient cars will further reduce the pollutants responsible for acid deposition. Making your home as energy efficient as possible will further reduce the pollution caused by power plants. Simple tips include weatherproofing your home, using fluorescent light bulbs, and minimizing the use of air conditioning. We must do our part to preserve our national parks for future generations. The Great Smoky Mountain National Park is a unique ecosystem that must be protected. **Remember the little things matter and make a big difference!**



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- <http://www.epa.gov/acidrain/>
- <http://www.nps.gov/grsm/naturescience>

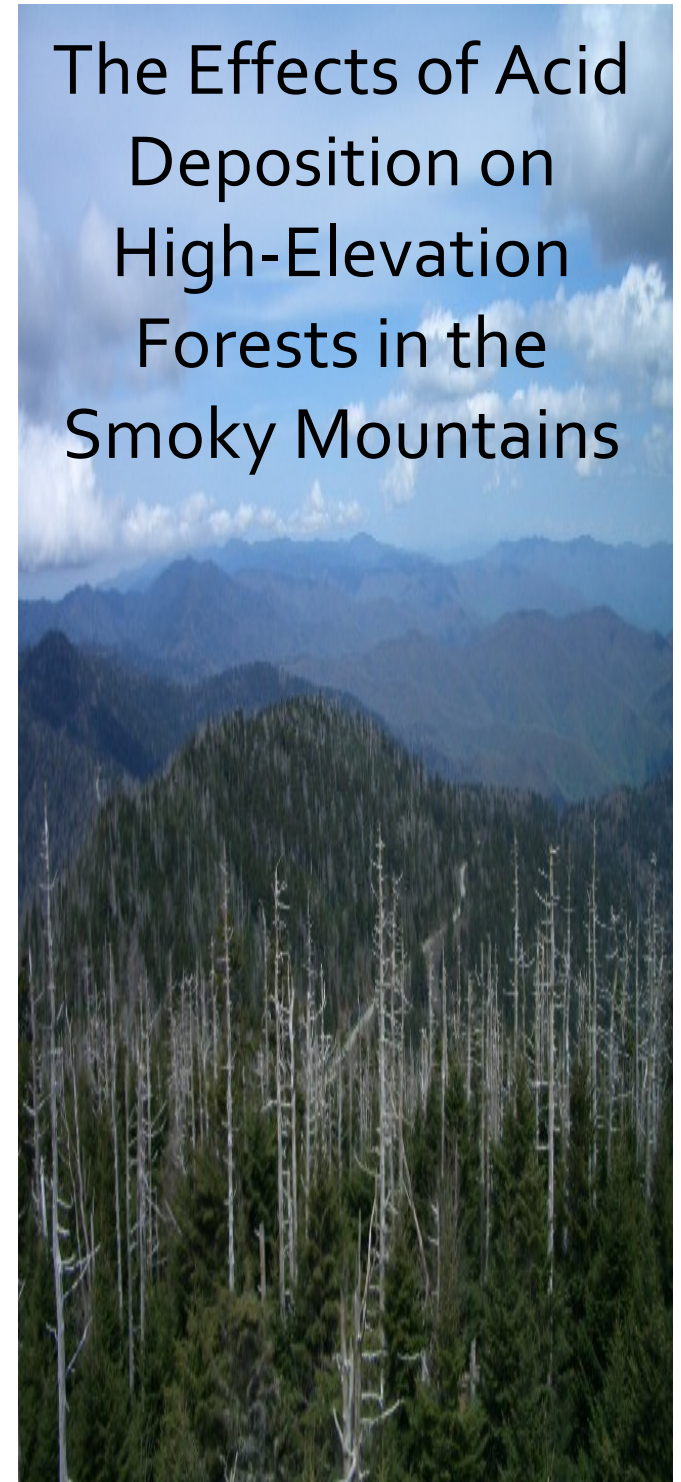
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The Effects of Acid Deposition on High-Elevation Forests in the Smoky Mountains



Acid deposition is a pressing concern for the Great Smoky Mountains, especially affecting high- elevation (higher than 4,000 ft) forests.

Nitrates and sulfates, two pollutants released from vehicle emissions and power plants respectively, are emitted into the air during the combustion of fossil fuels. In the air, these nitrates and sulfates combine with water vapor and are integrated into clouds. The clouds, which have become acidified from the pollutants, facilitate the transport of these pollutants towards the Smoky Mountains. Acid deposition is especially harmful to forests because of the many forms it can take in the Smoky Mountains. The acidified water can reach the forests in many different forms including rain, snow, and the historic fog from which the park received its name. This vast abundance of precipitation entails that the forests are constantly subjected to the effects of acid deposition. Also, the acidified particles can reach the trees as particulate falls directly from the clouds without water. The many forms of acid deposition cause great harm to the forests of the Smoky Mountains because its effects are multiplied as the acidified water moves towards the ecosystem's central waterways.

The Effects of Acid Deposition on High-Elevation Red Spruce Populations

Acid deposition has caused the death of much of the Smoky Mountains' red spruce population. The high-elevations of the Smoky Mountains used to have abounding spruce forests, but all that remains are the dead trunks of trees killed by acid deposition. Acid deposition harms red spruce in a variety of ways. First, acid deposition creates sulfuric and nitric acid that directly attack leaves and affect their ability to process light energy into sugars. Essentially, the leaves are destroyed by acid. Also, acid deposition leeches away critical minerals from the tree so basic metabolic processes cannot occur. As more acid deposition falls, the soil chemistry is drastically altered, but red spruce require a specific pH range for their roots to efficiently absorb nutrients from the soil. As the soil becomes more acidified, red spruce lose the ability to absorb nutrients such as calcium, phosphorus, and potassium. Without these nutrients, the trees cannot survive. Acid deposition leeches calcium from cell membranes, but this calcium is crucial for cold hardiness. Upon the arrival of winter, the red spruce fall victim to the harsh climate. The acid deposition causes red spruce to become extremely sensitive to winter injuries, and entire populations of red spruce can die in a single season.

Acid Deposition and Aluminum Toxicity

Once acid deposition enters the soil it begins to degrade the quality of the soil, and the pH of the soil begins to drop. The soil in the Smoky Mountains has granite bedrock, which does not produce compounds to counteract acidification. Thus, the soil has a low buffer ability, and consequently acid deposition mobilizes many harmful earth metals. The increased acidity of the soil allows many tree species to absorb free aluminum. But, aluminum is highly toxic to trees. Along with the direct effects of acid deposition, aluminum poisoning has killed many trees in the Smoky Mountains. Yet, aluminum does not harm only trees. Once mobilized by acid deposition, aluminum makes its way into the many waterways in the mountains. Here, aluminum poses a serious threat to many fish and invertebrate species. Aluminum is highly toxic to these species and has caused brook trout to be exterminated from many of its native streams in the Smoky Mountains.

The devastating impact of acid deposition can be seen in this Smoky Mountain forest, where most of the red spruce have already died. The remaining red spruce are in poor health.

