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*Opinion*

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# The Science and Impact of Acid Rain: Causes, Effects, and Prevention Strategies

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## DESCRIPTION

Acid rain is a type of rainfall that has a higher than normal acidity level. It is primarily caused by emissions of sulfur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>) from human activities such as burning fossil fuels, industrial processes, and transportation. Acid rain can have significant impacts on the environment, including damage to forests, lakes, rivers, and wildlife, as well as on human health. The phenomenon of acid rain was first noticed in the 1800s when industrialization began to take hold in Europe and North America. At the time, the primary source of sulfur dioxide emissions was from the burning of coal for energy production. As industrialization continued to spread, so too did the problem of acid rain. In the 1960s and 1970s, scientists began to study the effects of acid rain in more detail, and by the 1980s, governments around the world were taking action to address the problem. Acid rain is caused by emissions of sulfur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>x</sub>) from human activities such as burning fossil fuels, industrial processes, and transportation. These emissions are released into the atmosphere, where they react with water, oxygen, and other chemicals to form various acidic compounds such as sulfuric acid and nitric acid.

**Power Plants** Coal-burning power plants are a significant source of sulfur dioxide emissions.

**Industrial Processes** Industrial processes such as metal smelting, paper manufacturing, and petroleum refining can release sulfur dioxide and

nitrogen oxides into the atmosphere. **Transportation Vehicles**, especially those with diesel engines, can release significant amounts of nitrogen oxides into the atmosphere. **Agriculture Fertilizer use** and livestock production can release ammonia into the atmosphere, which can react with other chemicals to form nitrogen oxides. Acid rain can have significant impacts on the environment, including damage to forests, lakes, rivers, and wildlife, as well as on human health. **Damage to Forests** Acid rain can damage forests by leaching important nutrients such as calcium and magnesium from the soil, making it harder for trees to grow. This can weaken trees and make them more susceptible to disease and pests. **Damage to Lakes and Rivers** Acid rain can also harm aquatic life by making lakes and rivers more acidic. This can cause fish and other aquatic animals to die, which can disrupt entire ecosystems. **Damage to Buildings and Infrastructure** Acid rain can also corrode buildings and infrastructure, especially those made of limestone or other calcium-rich materials. **Human Health** Acid rain can also have negative impacts on human health. It can cause respiratory problems, especially in people with asthma or other lung conditions. Governments around the world have taken steps to address the problem of acid rain.