

# Acid Rain: Environmental Damages

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## Context:

As 2023 was regarded as one of the worst in terms of environmental damages, multiple associated issues have come to discussion.

## Background:

Acid Rain is a complex environmental issue with multiple causes and widespread consequences, and it has its origins in fossil fuels.

## About Acid Rain:

Acid rain or acid deposition is a broad term that includes any form of precipitation with acidic components, such as sulfuric or nitric acid that fall to the ground from the atmosphere in wet or dry forms. This can include rain, snow, fog, hail, or even dust that is acidic.

## Formation of acid rain:

1. When  $\text{SO}_2$  (Sulphur Dioxide) and  $\text{NO}_x$  (Nitrogen Oxide) combine with water and oxygen in the atmosphere, they form sulfuric acid ( $\text{H}_2\text{SO}_4$ ) and nitric acid ( $\text{HNO}_3$ ), respectively.
2. These acids then dissolve in water droplets, leading to the creation of acid rain, snow, or fog.

## Causes of acid rain:

1. Burning of fossil fuels, particularly those containing sulfur, releases sulfur dioxide ( $\text{SO}_2$ ) and, at higher temperatures, nitrogen oxides ( $\text{NO}_x$ ).
2. Fossil fuel combustion is prevalent in vehicles such as automobiles and the combustion of coal in power plants and industrial processes.
3. Volcanic eruptions and lightning contribute to the presence of sulphur dioxide and nitrogen oxides in the atmosphere.
4. In the atmosphere, the pollutants  $\text{SO}_2$  and  $\text{NO}_x$  undergo chemical reactions, forming sulfuric and nitric acids. When combined with water vapor, they create acid rain during precipitation.

## Consequences/impacts of acid rain:

1. Acid rain can make water bodies, such as rivers and lakes, inhospitable to certain species of aquatic life as the increased acidity disrupts their reproductive patterns and can lead to fish population decline in affected rivers and lakes.
2. The increased acidity alters the pH of marine environments, adversely impacting the distribution and survival of various organisms.
3. Shell-forming marine species, like molluscs and certain types of plankton, face particular challenges as acidification interferes with their ability to build and maintain protective shells.
4. Acid rain poses substantial threats to physical structures and monuments, causing

deterioration and discoloration. Notable examples include the Taj Mahal, whose iconic white marble has been affected, exhibiting a yellowish hue due to sulfuric acid reactions.

Dr. Shivakumar's



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