

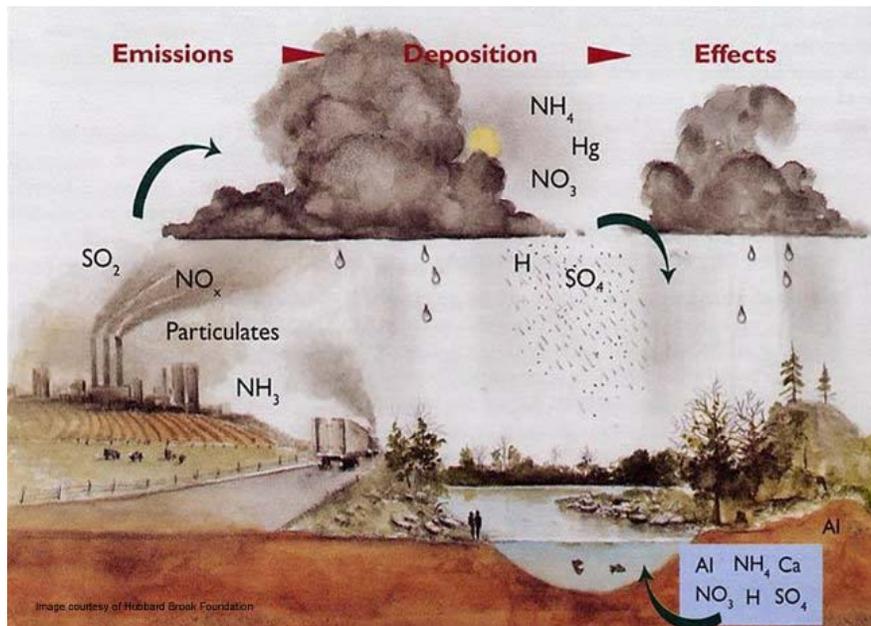
Environmental Transport and Fate

Chapter 9

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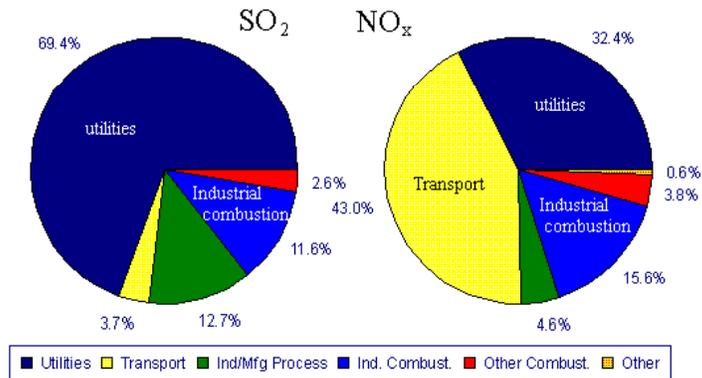
Acid Precipitation

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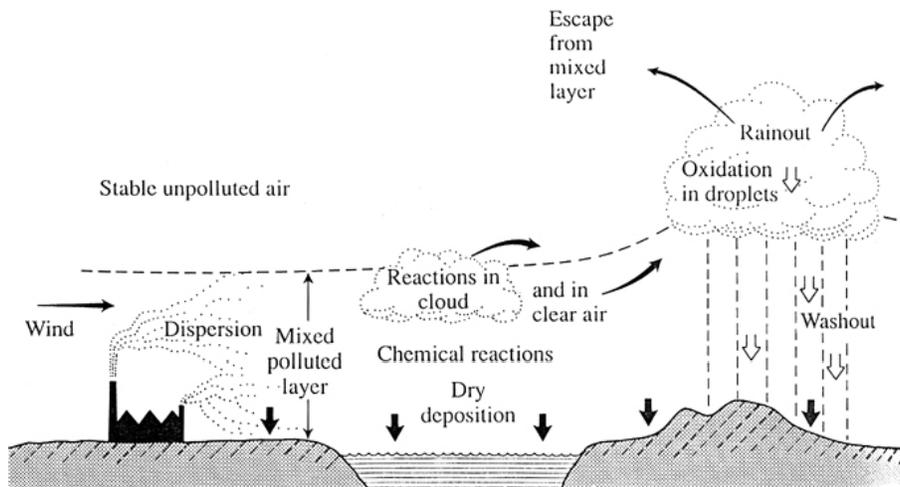
(<http://maine.gov/dep/air/acidrain/>)

SO₂ and NO_x emissions by source type in the United States



(<http://www.ehso.com/ehshome/acidrain.php>)

The fate of acidifying gases after emissions from a power plant smokestack
(Adapted from CEEB, 1987)



Contaminants, such as SO₂ and NO_x, can travel for hundreds or even thousands of kilometers, during which they get oxidized and then converted into acids.

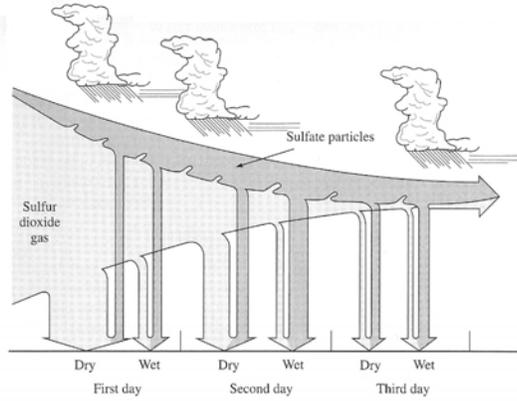
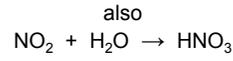
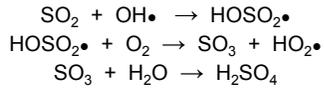


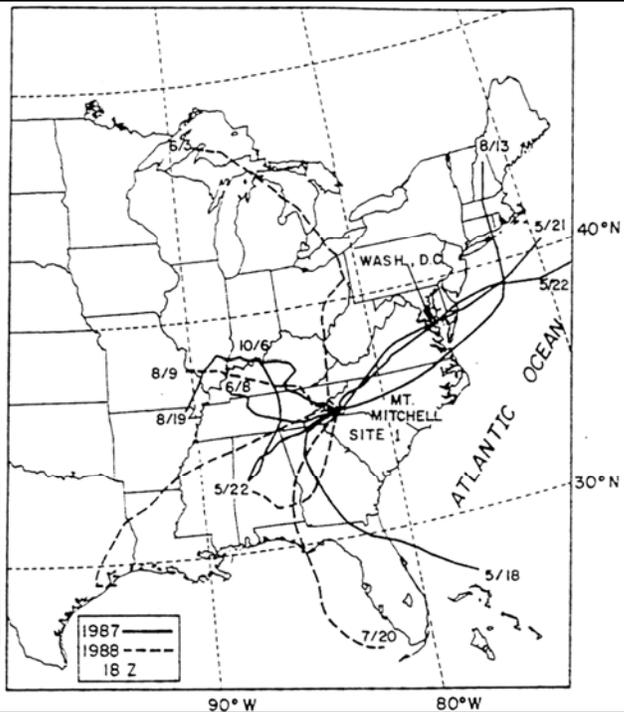
FIGURE 7.10 The effects of time and distance on conversion and deposition of sulfur pollution. (Source: OTA, 1984.)

(Source: OTA, 1984 – also Masters, 1997, page 357)

Average wind speed of 5 m/s implies travel of 432 km/day
 → 1296 km = 805 miles in 3 days.

In three days, air masses can come from afar, witness tree damage by acid precipitation on Mount Mitchell in North Carolina.

(<http://mojo11.blogspot.com/2008/07/wordless-wednesday-acid-rain.html>)



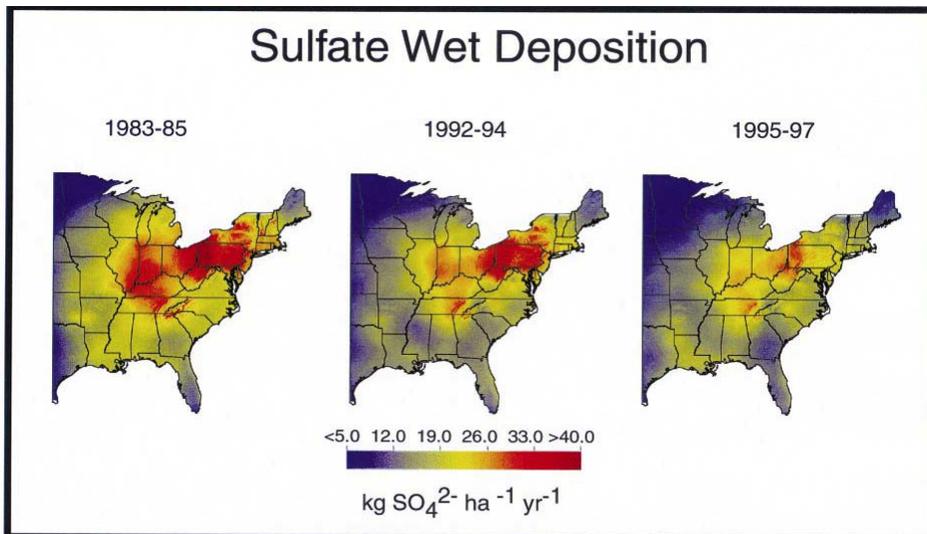
In mountains, because of elevation, acid make come in the forms of acid rain, acid snow and acid fog.



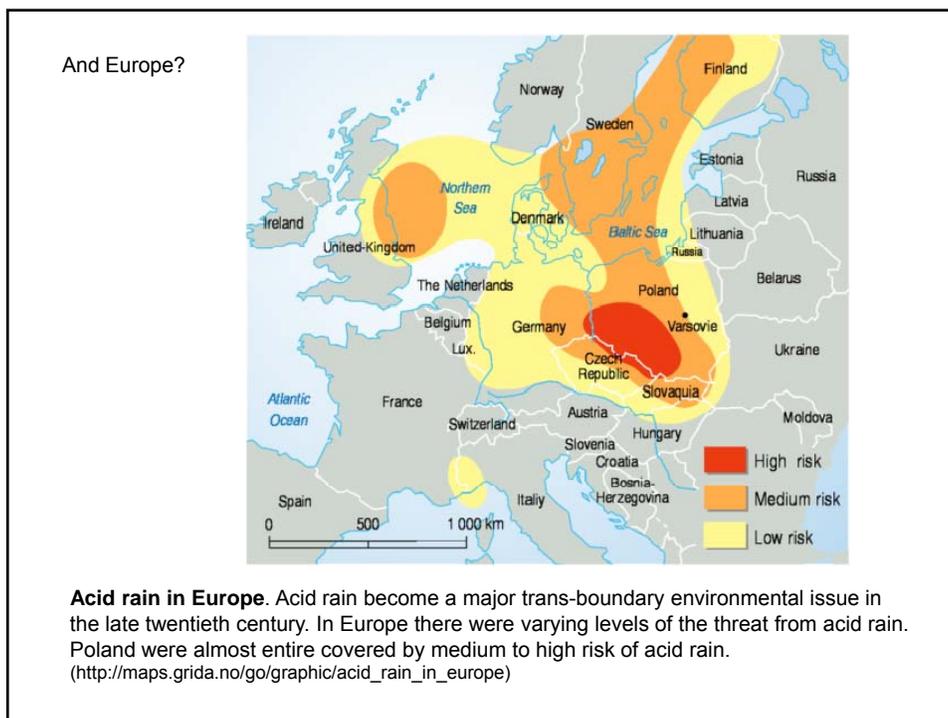
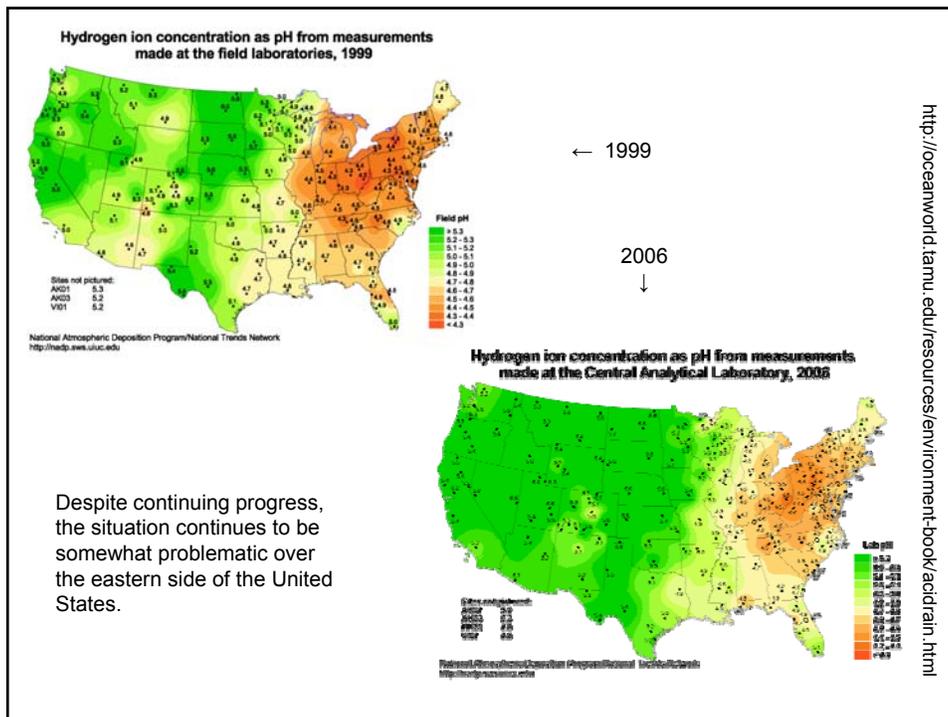
This is why a better terminology is **Acid Deposition**, instead of acid rain or acid precipitation.

(photos from websites no longer in existence)

The problem was acute in the mid 1980s, and subsequent action improved the situation.



(<http://oceanworld.tamu.edu/resources/environment-book/acidrain.html>)



Besides lakes and forests, valuable buildings are also being damaged

(<http://commons.wikimedia.org/wiki/>)



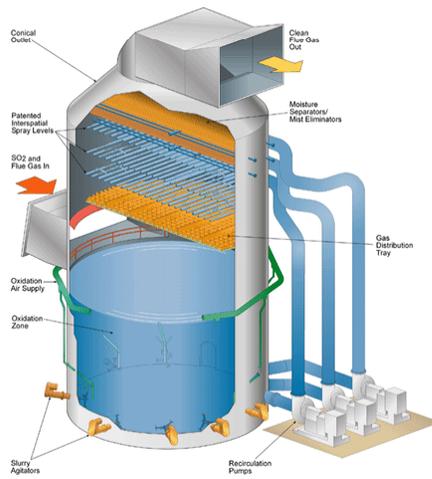
(http://www.ecoscene.com/eco_acidrain.htm)

Limestone + sulfuric acid → dissolution → deterioration

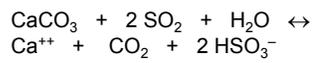
Remedy

Requirement that power plants curb their SO₂ emissions led to the development of wet scrubbers.

http://www.babcock.com/products/environmental_equipment/wet_fgd.html



Chemistry inside the vertical tank:



which substitutes CO₂ for the SO₂ and traps the sulfur in solution in the form of HSO₃⁻.