In North America, a total of 30.7 million metric tons a year of sulfur dioxide go into the atmosphere. About 25.7 million metric tons come from U.S. sources and some 5 million metric tons are from Canada.

A total of 24 million metric tons of nitrogen oxides go into the air every year as well. The U.S. accounts for about 22 million metric tons a year, while in Canada emissions total about 2 million metric tons.

Three things are necessary for these airborne pollutants to create the problems we now face:

– the first is the pollution source, usually in areas where there are a lot of industries;
– the second is weather conditions which carry these pollutants over long distances allowing for the changes to take place; and
– the third is areas which are sensitive to the build up of this acid rain or snow.

Unfortunately, wide areas, some of them beautiful recreation spots, are this sensitive.

There are now many lakes in parts of eastern Canada and the United States which no longer have any fish because this high acidity has stopped new fish from hatching. Many more lakes are showing unmistakable signs of this happening. Many thousands more are in danger.

The tourist, agriculture and forest industries could also suffer with increased environmental damage.

Buffering

In some cases, nature can cope with this change in acidity.

One rainfall will not turn a lake acidic. It is the accumulation of this rainfall and melting snow combined with the limited ability of the lake to neutralize the acid, which harms certain types of lake. Lakes in limestone areas are able to neutralize the acid but others are not able to fight off the effects. Lakes with a pH of below 5.5 and of low buffering capacity, are considered to be in serious danger. Even in lakes which are considered to be well buffered, acidic precipitation can still have dramatic and damaging results. The acids can accumulate in the snow, and heavy snow can be followed by sudden, warm spring weather which melts it quickly. As the melt-off runs into lakes and streams, the acid levels are so high that the lake cannot neutralize the acid fast enough. In some cases, not only is fish reproduction harmed, but small fish are killed by this sudden acid shock.

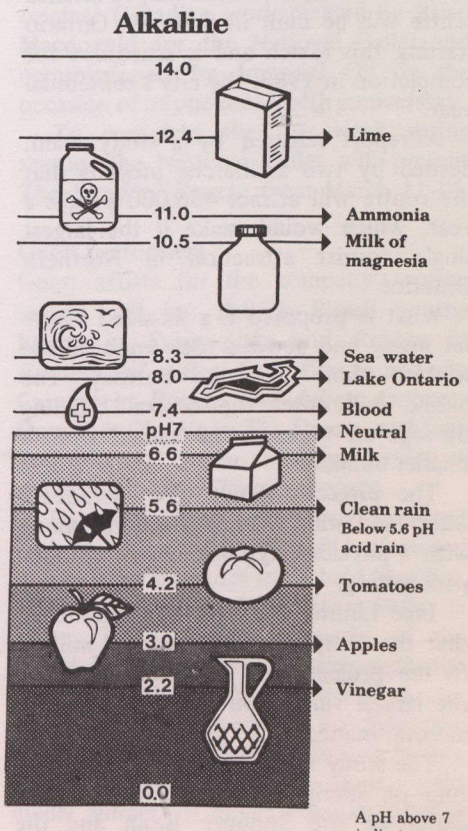
But large areas of eastern Canada have lakes which do not have the ability to neutralize increasing amounts of acid rain. Lakes in these areas may eventually end up as crystal clear, but without fish or other aquatic life.

When a lake is unable to cope with the increased acid levels, there is a sharp decline – in some cases to the point of extinction – of fish.

Certain micro-organisms and stages in the aquatic life cycle are intolerant of acids and they are usually the first to be harmed. Newly-hatched fish are especially sensitive and the years of acid rain falling in certain lakes may result in the death of eggs and young fish.

Reproduction processes may also be harmed as female fish develop eggs which cannot be fertilized. In lakes where the eggs are still fertilized, newly hatched fish may die as acid levels accumulate or as spring runoff with high acid levels rushes into the waters.

Older fish do survive at first, but as younger fish die off, the older ones lose their main source of food and eventually die off as well.



The first species to show signs of being harmed are bass, walleye, salmon and aurora trout, followed by pike and lake trout. The most acid-tolerant fish such as lake herring, rock bass, perch and carp, last longer but in extreme cases die off as well.

The damage caused by acid rain and snow, however, is not confined to lakes and rivers. Soils can also suffer damage. Although soils which have a high limestone content can neutralize the acid, soils on granite bedrock, with a low buffering capacity, may be damaged. Early evidence indicates that acid rain does affect sensitive soils, subtly impairing the cycle essential for soil fertilization, and taking out vital nutrients needed by trees and other plants.

The eastern part of Canada could be seriously affected by acidic precipitation because the soils and aquatic systems in southwestern New Brunswick and Nova Scotia, as well as throughout Newfoundland, have little natural buffering capacity.

Widespread damage

The changes produced by acid rain are obviously far-reaching. But the problems are not confined to any one province or country – acid rain does not respect political boundaries.

Because we share the problem with our neighbours, we must work together to share the solution. A Canada/United States research group has already been formed and federal and provincial governments are working to co-ordinate research.

Research

In order to understand the whole problem, scientists must list all the sources of sulfur dioxide and other pollutants in both Canada and U.S. They must study how the pollutants are carried and how they are changed so that they can eventually predict how much acid rain will fall and where, under various weather conditions.

It is a study which includes all aspects of the environment – meteorology, geology, forestry, atmospheric and water chemistry and fish and animal life.

Certain wilderness areas within Canada's national parks have been singled out for detailed study. Because these are wilderness areas, there will be fewer outside influences such as new industry or cottages – factors which could affect the information being gathered.