



Rivers and lakes are dying

In Germany, a mention of acid rain immediately makes people think of dying forests, whereas Norwegians associate it with the death of fish in lakes and rivers. Thousands of trout stocks have been lost for ever. Parts of the Norwegian natural heritage have literally died out, and many rivers are only kept alive by regular liming.

There are several causes of acidification, and various mechanisms by which it may occur. Acid rain falling on water bodies has a direct effect. In areas where soils are acid, runoff from the soil transports acidic water, which may also contain aluminium, into lakes and rivers. Soil acidification may be caused by acid rain, but other factors may also be involved. For example, if pasture reverts to coniferous forest, the soil will become more acidic. Rain carrying large amounts of sea salt may also result in acidic runoff even though the rain itself is not acidic. Salty rain leaches acid components out of the soil and transports them to the rivers.

TOXIC WATER

The chemical content of acid rain is in itself dangerous to fish and other freshwater organisms. Another, equally important reason why fish populations are depleted, impoverished or, as is often the case, wiped out altogether, is that acid water leaches toxic aluminium from the soils and bedrock where it naturally occurs in large amounts. The combination of low pH and the presence of aluminium kills trout, char, salmon, perch and other fish in Norwegian waters. Spawn and fry are the most vulnerable stages. Salmon and rainbow trout have a lower tolerance for acid water than a number of other species. Salmon smolt, i.e. young fish that are ready to migrate to sea, are most sensitive. Since the 1970s, the number of lakes that have lost their fish stocks has more than doubled, and is now estimated at roughly 4,000 to 5,000. The critical loads for acid rain in Norwegian river systems have been exceeded across about 36 per cent of the country.

The damage caused by acidification in rivers and lakes is mainly a Scandinavian phenomenon. Further south in Europe, the rocks are richer in calcium and weather more easily, so that the water contains higher concentrations of substances that can neutralize acid inputs. Acidification of rivers is therefore unusual outside Scandinavia, although inputs of acid rain are higher in many other parts of Europe. However, in eastern North America, northern Scotland and parts of the Alps, the geology is more like that of Scandinavia, and there are more acid rivers.

A CENTURY OF ACIDIFICATION

Fish mortality caused by acid rain is not a new phenomenon. Fish stocks probably died out in a number of Norwegian lakes as early as the turn of the century, but it was not until the 1950s and 1960s that this phenomenon was associated with acid rain. The connection was not generally accepted by scientists until the 1970s, at about the same time as the area affected began to increase dramatically.

The southernmost counties of Norway have been hardest hit. This region has received large amounts of airborne pollution from abroad ever since the Industrial Revolution. In the mid-1970s, scientists estimated that fish stocks in an area of 13,000 km² had been wiped out, and that those in a further 20,000 km² had been damaged to some extent.

In 1986, the most extensive survey to date was made, involving measurements and sampling of 1,000 lakes. Scientists found that the area in which fish stocks had been lost completely had increased to 18,000 km², and the area in which they were damaged to 36,000 km².

In 1989, scientists showed that fish stocks in an area of 70,000 km² had been damaged by acid rain. This is not directly comparable with the figure from the 1986 survey because different methods were used. In 1993, it was estimated that there was damage in an area of 86,000 km². The steep increase is partly a result of improvements in methodology and the fact that a larger area has been studied, but there has also been a real increase in the extent of the damage.

Scientists now estimate that an area of more than 110,000 km² receives such large inputs of sulphur that the environment can no longer withstand acidification. If we include acidification caused by nitrogen, the total area affected is about 120,000 km².

RAPID SPREAD OF DAMAGE

In recent years, it has been shown that serious damage caused by acid rain is no longer confined to the southernmost counties of Norway. There is growing evidence of damage to fish stocks in Vestfold, Buskerud, Oppland, Akershus, Hedmark and Østfold as well. Eastern Norway is becoming acidic, and thousands of lakes are in danger.

Acid rain is affecting parts of Western Norway too. In 1989, it was found that 8.5 per cent of fish stocks in Hordaland county had been lost and 29 per cent depleted. The corresponding figures for Sogn og Fjordane were 5.5 per cent and 16 per cent, respectively. Further north, acid rain does not appear to be a problem as yet, except in eastern parts of Finnmark county. The large refineries on the Kola Peninsula in Russia spew out huge amounts of sulphur dioxide. The prevailing north-easterly winds carry most of this away from Norway, but despite this, more and more signs of damage are being discovered in rivers and lakes. Scientists estimate that critical loads have been exceeded in about 70 per cent of Sør-Varanger municipality.



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