Short-term pH depressions, and elevated concentrations of metals, particularly aluminum, have been observed during periods of high infiltration or runoff. Metal accumulation in surface waters (Al, Mn, Fe, Zn, Cd, Cu, Pb, and Ni), first noted in streams and lakes of Scandinavia, also has been reported from such places as Hubbard Brook, the Adirondacks, and the Great Smoky Mountains of the U.S., and the southern Precambrian Shield area of Ontario, Canada. Artificial acidification of a lake in the Experimental Lakes Area of Ontario has also shown rapid mobilization of metals from lake sediments to the water column.

Data for 57 headwater streams in Muskoka-Haliburton show that 65% experience minimum pH values less than 5.5 and 26% have minimum pH values less than 4.5. Some inlet streams were observed to have pH values below 4.0 during spring snowmelt.

Data from intensive studies of 16 lakes in the Muskoka-Haliburton area of Ontario currently receiving about 23-29 kg/ha.yr sulphate in precipitation have shown that lakes which have summer alkalinity values up to about 40 μeq/L, experience pH depressions to values below about 5.5 during snowmelt. In Ontario and Quebec there are about 1.5 million lakes on the Precambrian Shield. In Ontario, of the 2,260 lakes sampled on the Precambrian Shield, 19% have alkalinities below 40 μeq/L. In the Shield area of Quebec, a 1981 survey of 162 lakes indicated 37% were extremely sensitive to acidification (CSI greater than 5.0), while 15% had summer pH values less than 5.0 (alkalinity less than 0).

A very large number of surface waters are being affected by acidic deposition, even though the total number of lakes and rivers in eastern North America which are known to have been acidified (alkalinity less than 0) by atmospheric acidic deposition is a relatively small percentage of the total aquatic resource.

Biological Effects

Detailed studies of watersheds have been carried out in sensitive regions of North America and Scandinavia under a range of sulphate deposition rates. The results of the studies conducted in North America are described below.

Observed changes in aquatic life have been both correlated with measured changes in the pH of water and compared for waters of different pH values. Differences have been documented in species composition and dominance and size of plankton communities in lakes of varying pH. Study results show that the number of species is lower in low pH lakes compared to lakes of higher pH. These alterations may have important implications for organisms higher in the food chain. Individual lakes often experience several symptoms of acidification at the same time. For example, in Ontario, Plastic Lake inlet streams have low pH