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Spatial and temporal trends in heavy metal accumulation in mosses in Europe

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The first European moss survey was conducted in 1990/1 and has since then been repeated at five-yearly intervals. The most recent survey was conducted in 2005/6, with mosses collected from over 6,000 sites in 28 countries. Samples were collected according to a standardised protocol and concentrations for 10 – 12 heavy metals were determined.

In 2005/6, the lowest concentrations of heavy metals in mosses were generally found in (north) Scandinavia, the Baltic States and northern parts of the United Kingdom, although higher concentrations were reported near local sources. Relatively low concentrations of iron, mercury, nickel and vanadium were also observed in central Europe. Depending on metal, the highest concentrations were often found in Belgium and eastern European countries, with localised lower concentrations being present. Antimony concentrations were generally high in densely populated areas and in eastern European countries with high metal pollution levels.

The decline in emission and subsequent deposition of heavy metals across Europe has resulted in a decrease in the heavy metal concentration in mosses since 1990 for the majority of metals. Between 1990 and 2005, the concentration in mosses has declined the most for lead (72.3%, based on 16 countries), arsenic (71.8%, five countries), vanadium (60.4%, 11 countries), cadmium (52.2%, 16 countries) and iron (45.2%, 13 countries). An intermediate decrease was found for zinc (29.3%, 16 countries), copper (20.4%, 16 countries) and nickel (20.0%, 16 countries) and no significant reduction for chromium (2%, 14 countries). Since 1995, the arsenic concentration in mosses has declined by 21.3% (14 countries), whereas mercury showed no significant decline (11.6%, eight countries). However, temporal trends were country or region-specific, with no changes or even increases being observed since 1990. Therefore, even in times of generally decreasing metal deposition across Europe, temporal trends are different for different geographical scales.