



Temporal Trends in the Concentration of Heavy Metals in Mosses in Europe

Mosses are cheap and convenient bioindicators that show how heavy metals from the atmosphere are deposited on terrestrial ecosystems. In a recent study, a European team of scientists analysed the trends in the deposition of 10 heavy metals across Europe between 1990 and 2000. Overall, the metal concentration in mosses decreased with time for all metals. Metal- and country-specific temporal trends were observed.

Human activities such as fuel combustion, manufacturing industries or metal production and processing are sources of anthropogenic emissions of heavy metals in the atmosphere. Heavy metals in the atmosphere may travel over large distance before being redeposited on soils. Conventional measurements of heavy metal deposition are based on precipitation analysis. Measuring large areas therefore implies deploying large numbers of precipitation collectors with an associated long-term programme of sample collection and analysis. Alternatively, the technique of moss analysis provides a surrogate, time-integrated measure of metal deposition from the atmosphere into soils. This technique is easier, cheaper, less prone to contamination, and allows a much higher sampling density than conventional analysis. A biomonitoring network coordinated by the United Nations Economic Commission for Europe (UNECE) International Cooperative Programme on Effects of Air Pollution on Natural Vegetation and Crops (ICP Vegetation)¹ provides data on the concentration of 10 heavy metals in mosses from about 7000 sites across Europe. The purpose of this monitoring programme is to provide information on the spatial and temporal distribution of heavy metals in Europe, identify the main polluted areas and develop the understanding of long range transboundary pollution.

A European team of scientists has recently analysed the monitoring data of 10 heavy metals across Europe between 1990 and 2000. The metals are arsenic, cadmium, chromium, copper, iron, lead, mercury, nickel, vanadium and zinc. Results were compared with trends in the modelled total deposition or the anthropogenic emission of metals reported by the UNECE Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP). The main results are as follows:

- Whereas the arsenic, cadmium, copper, lead, vanadium, and zinc concentration in mosses decreased significantly between 1990 and 2000, the decreases for chromium, iron, mercury and nickel were not significant. Country-specific temporal trends were observed for all the metals.
- The temporal trends for cadmium (-42%), lead (-57%) and mercury (-8% between 1995 and 2000) were similar to the ones reported by EMEP regarding modelled total deposition of cadmium (-45%), lead (-52%) and mercury (-8%) in Europe.
- Currently, no data is available for the modelled deposition of other heavy metals in Europe. However, decreases in the anthropogenic emissions of arsenic, copper, chromium, nickel and zinc between 1990 and 2000 have been reported by the EMEP programme.
- On a smaller scale (regions, provinces, etc. . .), trends can be different due to local conditions.

The authors conclude that mosses provide a cheap and effective method for monitoring temporal trends in heavy metal pollution in Europe. Reductions in the anthropogenic emissions of heavy metals between 1990 and 2000 have resulted in a significant reduction of the accumulation of arsenic, cadmium, copper, lead, vanadium and zinc in mosses. Lastly, the observed temporal trends in the concentration of heavy metals in mosses were not only metal-specific but also country-specific.

¹For more information see: <http://icpvegetation.ceh.ac.uk>

Sources: Harmens H., Norris D.A., Koerber G.R., Buse A., Steinnes E., Rühling A. (2007) "Temporal trends in the concentration of arsenic, chromium, copper, iron, nickel, vanadium and zinc in mosses across Europe between 1990 and 2000", *Atmospheric Environment* (41):6673-6687

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