Heavy metals in moss

Innholdsfortegnelse

Heavy metals in moss

Published 17.01.2018 by the Norwegian Environment Agency

Most of the heavy metal pollution in Norway can be classified as long-range, originating from other European countries. The last few decades have seen a reduction of this long-range pollution, in particular the deposition of lead.

Hylocomium splendens, commonly known as Glittering Wood-moss, Stair-step Moss and Mountain Fern Moss. Moss lacks a root system and therefore takes up nutrients - and pollutants - from the air. Photo: Wikimedia Commons

STATE

Deposition of heavy metals reduced

In Norway samples of Stair-step Moss (*Hylocomium splendens*) have been collected from locations throughout the country at five year intervals since 1977. This has been carried out to map the deposition of heavy metals. Moss takes up pollutants from the air, and is therefore well suited for this purpose. The highest concentrations of heavy metals in moss have been found in southern Norway.

The latest nationwide survey from 2015, shows that there has been a marked drop in concentrations of most heavy metals. There is, however, still cause for concern for mercury, because the depositions do not seem to be diminishing.

The first survey of mercury in moss was conducted in 1985, and the highest concentrations were measured then. In 1995, there were no significant changes in concentration levels, but they were slightly lower in 2000. The most recent survey shows that mercury concentrations are about the same as in 2000.

The highest concentrations of heavy metals are found in southern Norway.

PRESSURE

Anthropogenic emissions

Moss always contains a certain amount of all naturally occurring elements. Natural concentrations are called the background levels. Background levels for lead and cadmium have been determined to be 5 micrograms per gram and 0.1 micrograms per gram respectively.

If the concentrations of heavy metals measured in moss exceed the background levels, we interpret this as being a result of anthropogenic emissions.

Long-range transport from Europe an important source

Atmospheric long-range transport from other countries in Europe has been reduced considerably since the first nationwide survey was carried out in 1977. Nevertheless, long-range transport is still an important source of arsenic, cadmium, lead, zinc and vanadium deposited in Norway.

Between 1977 and 1990, deposition of arsenic, cadmium, lead, zinc and vanadium was reduced by more than 50 per cent. This was a result of measures introduced to control emissions, a changeover to less polluting energy sources, and the closure of many factories and plants in Eastern Europe.

In 1995, the drop in deposition rates appeared to have come to a halt for most metals, but the last four surveys have shown a continued slight reduction of lead and vanadium.

Local sources more important as long-range transport declines

Due to a reduction in long-range input, Norwegian sources subsequently mean more for the deposition of heavy metals locally in Norway.

For example, heavy metals such as chromium, nickel, copper, arsenic and antimony have had a smaller decline in the area around the Oslo Fjord than in the southernmost parts of Norway. This may indicate that activities in densely populated areas contribute to local emissions of these metals.

Surveys of some industrial sites in Norway show elevated concentrations of heavy metals in their surroundings. For example, deposition of metals is considerably elevated around Mo i Rana in Nordland. Other towns where deposition of pollutants from local sources has been registered are Odda, Årdal and Kristiansand. Chromium, copper and nickel deposition, and to some extent iron and mercury deposition, originates mainly from local point sources.

Smelters on the Kola Peninsula

Smelters on the Kola Peninsula are still responsible for substantial deposition of nickel and copper in eastern parts of Finnmark, and in addition to smaller amounts of arsenic and cobalt.

IMPACT

Plants and animals can absorb heavy metals

Deposition of heavy metals carried to the southernmost parts of Norway with long-range air pollution has resulted in higher concentrations of metals in plants and herbivorous animals. This relationship is particularly clear for lead.

A correlation has been shown between lead concentrations in the moss *Hylocomium spendens* and in the liver of willow grouse, black grouse and mountain hare.

However, the lead concentrations that have been measured are far below the levels at which harmful effects have been demonstrated.

RESPONSE

Agreements and action to reduce emissions

The Norwegian nationwide surveys of heavy metals in moss are included in an international program under the Convention on Long-range Transboundary Air Pollution. Several binding protocols have been adopted under the convention. One of these is the Aarhus Protocol on Heavy Metals.

Parties to the Aarhus Protocol have undertaken to reduce their emissions of lead, cadmium and mercury below their levels in 1990, and are required to take the following steps:

- reduce the content of metals in products
- introduce limit values for emissions from industrial sources
- phase out the use of leaded petrol.

Norway meets the requirements of this protocol.

Emissions of several heavy metals to be phased out

The environmental authorities have drawn up a priority list of substances that represent a serious health or environmental risk in Norway. The list includes arsenic, lead, cadmium, chromium and mercury. Norway's goal is to continuously reduce emissions of these substance with the intention of eliminating them by 2020.

Industrial enterprises taking part in the moss surveys

The Norwegian Environment Agency wishes to gain a better overview of the effects of environmentally hazardous industrial pollutants on the local environment around industrial sites. The nationwide surveys have therefore been extended to include some industrial plants. Extra samples of moss have been taken near these plants to evaluate the local inputs of heavy metals and polyaromatic hydrocarbons (PAH).

Additional collections of moss samples in the surrounding areas are therefore made to assess the local contribution of heavy metals and PAH.