New Insights into the Effects of Heavy Metal Pollution on Forests

An international team of researchers has investigated the impacts of heavy metal pollution and acid rain on a young forest ecosystem. They have succeeded in recording the different impacts of acid rain and heavy metal pollution on certain tree species. Their results, which are very important for our understanding of the effects of heavy metal pollution on forests, can also help develop better solutions for cleaning heavy metal polluted soil.

Heavy metals such as lead, cadmium, zinc, copper or arsenic are emitted from the earth’s crust into the soil, air and water environmental media by anthropogenic sources such as non-ferrous metal industry or non-renewable energy consumption. The main problem with these substances is that, even at low concentrations in soils, they can lead to major damage to human health or to ecosystem stability. To deal with this issue, the European Union has taken numerous initiatives. For example, in 2001 the EU council signed the 1979 Convention on Long-range Transboundary Air Pollution on Heavy Metals. Several studies have investigated the impacts of heavy metals on trees and plants, but their impacts on ecosystems are still little understood.

For the first time, an international team of researchers has investigated the effects of heavy metal soil pollution on young forest ecosystems. 32 replicates of a constructed model ecosystem (including 4 European forest trees species, and herbaceous and under storey plants from Europe) were installed in open-top chambers and kept under natural temperature and light conditions. The researchers used two types of soil, calcareous and acidic. To examine the potential effect of heavy metals and acid rain, they treated the ecosystems with acid (pH 3.5) or ambient (pH 5.5) rain and with or without heavy metal pollution (copper, zinc, cadmium and lead). After three years of processing and analyses, they evaluated the effects of these treatments

The results are as follows:

- Except for one of the four tree species investigated, fine root biomass decreased under the metal treatment.
- Total leaf area per tree was slightly reduced by heavy metal pollution.
- Heavy metal pollution also reduced water use efficiency of each species.
- Acidic soil inhibited above- and below-ground growth for two of the four tree species.

Overall, the researchers observed that the potential impacts of acid rain and HM pollution in soil in forests depend upon the type of plant species and the type of soil. They also observed that climate conditions such as drought could enhance the impacts of the pollutions. Acid rain was not found to have any substantial effect.

These results can help us to understand the impacts of acid rain and heavy metal pollution on forests and might be helpful when making decisions for forest and ecosystem protection. Furthermore, the results may contribute to the development of new remediation technologies. Indeed, this study provides crucial information on the most resistant species to heavy metal pollution depending on the soil and climatic conditions, information that can be used to better design remediation of polluted soils.

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