ACIDIFICATION OF FOREST SOILS DEVELOPED ON THE ŘÍČANY GRANITE AND ON CENOMANIAN SANDSTONES OF THE ČERNOKOSTELECKO REGION - TRENDS IN THE MOBILIZATION OF SELECTED MINOR AND TRACE ELEMENTS.
Results of the monitoring of elemental fluxes in the years 1986 - 1996.

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Biogeochemical fluxes of selected elements and ions (Al, As, Be, Cd, Cu, Fe, Mn, Pb, Sr, Zn, H^+, Cl^-, CO_3^{2-}, F^-, NO_3, PO_4^{3-}, SO_4^{2-}) have been studied in the experimental catchment "Lesní potok" and in the experimental station "Truba" of the Faculty of Forestry, Czech Agricultural University, some of them since 1986. The catchment (on the bedrock of the Říčany granite) is situated in the afforested and permanently uninhabited Nature State Reserve "Voděradské bučiny" in the Černokostelecko region approx. 35 km SE from Prague, Czech Republic. The samplig locality "Truba" (having the bedrock of cenomanian sandstones) is placed in a 5 km distance from "Lesní potok" to the NE. Methods of the monitoring of selected fluxes (surface discharge, bulk precipitation, throughfall and stemflow) are presented elsewhere (Skřivan *et al.* 1993, Skřivan, Vach 1993, Skřivan *et al.* 1995).

Main input of protons into the experimental plots is caused by both the wet and dry deposition. Bulk samples of the atmospheric precipitation have been collected monthly since May, 1989. Since May 1993, its pH value has been determined regularly, using two independent pH-meters. The pH values of the atm. precipitation, together with the resulting trend, are shown in Fig. 1. The diagram confirms clearly the continuing input of anthropogenic acidificants, with recently decreasing sulphuric compounds, but increasing nitrogen orides (see Fig. 2.), mainly originating in the vehicular emissions. The mean volume-weighted pH of precipitation over the

Fig.1: pH of the bulk precipitation sampling locality Truba (TR)

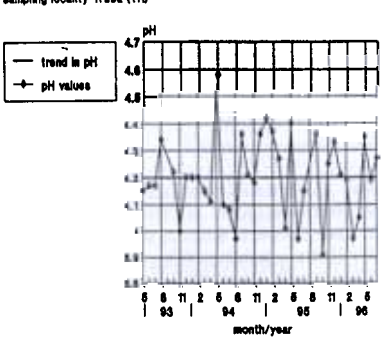
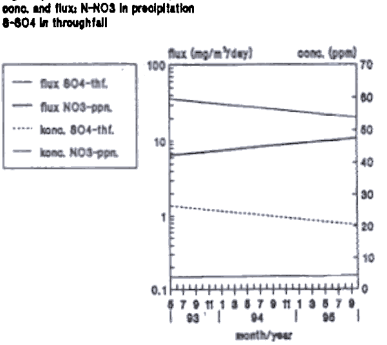


Fig.2: Inputs of acidificants: SO4, NO3 conc. and flux: N-NO3 in precipitation & SO4 in throughfall



whole time period averages 4.21 (n=38), which represents the annual input of 0.4kg $H^+.ha^{-1}$. Theoretical input, taking into account the pH value of the atm. precipitation which is in equilibrium with atmospheric CO_2 only, should equal to 0.015 kg $H^+.ha^{-1}$. The continuing intensive input of protons into the soil cover (which in both cases exhibits poor buffering capacity) results in the gradual mobilization and depletion of the main neutralizing adsorbed cations, K^+, Ca^{2+} and Mg^{2+}. The continuing soil acidification shifts the distribution of a number of minor and trace elements between the solid and liquid phases towards the dissolved forms. The enhanced mobilization of elements is then reflected both in the growing concentration and in the flux of these elements in the surface discharge. It should be also observed in changes of the chemistry and elemental fluxes in the forest throughfall as this flux of matter is considerably affected by the metabolic processes of trees (Skřivan *et al.* 1995).

Fig. 3 shows the continuing decrease in pH of a streamflow of the catchment Lesní potok which is accompanied with growing concentration of dissolved forms of Al and Be. Figs. 4, 5 and 6 document the growing amount of essential elements (Mn, Zn, and Cu respectively), which are recycled from soil through the plant uptake (in

Fig.3: Lesní potok catchment
trend in pH of surface water and
in concentration of Al and Be

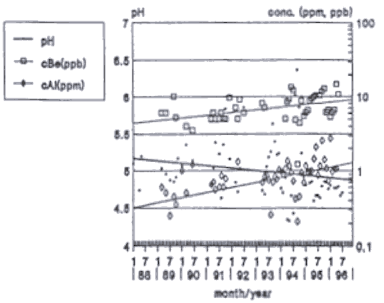
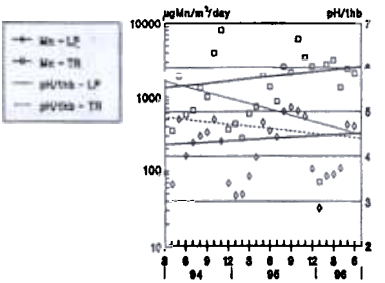


Fig.4: Trends in the deposition flux: Mn
flux in beech throughfall (thb)
bedrock: LP-granite, TR-cenomanian



this case *Fagus sylvatica* L.), leached from the tree assimilation organs by the acid precipitation and deposited again into the soil in the form of throughfall. The growing trend in the flux of these elements in throughfall is evident for both types of bedrock, with the exception of Cu flux in throughfall on the bedrock of the Říčany granite.

Fig.5: Trends in the deposition flux: Zn
flux in beech throughfall (thb)
bedrock: LP-granite, TR-cenomanian

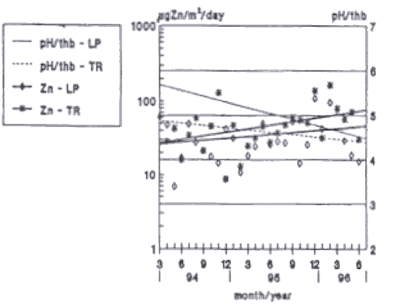
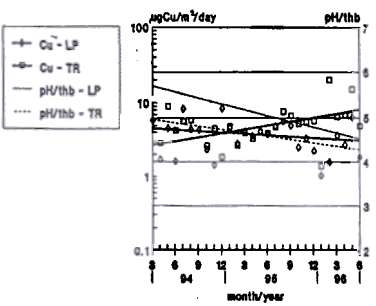


Fig.6: Trends in the deposition flux: Cu
flux in beech throughfall (thb)
bedrock: LP-granite, TR-cenomanian



The interpretation of the data obtained through the monitoring of throughfall chemistry is a very complex problem, as the living and growing organisms are involved. It is, therefore, necessary to take into account all possible biotic and abiotic factors which affect the resulting chemical composition of throughfall. Nevertheless, the presented proceeding trends in the flux of matter imply the possibility of irreversible changes in the soil chemistry, which could seriously afflict the forest ecosystems.

Refereaces

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