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Chlorine distribution in an forest ecosystem gradient – role of understory

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The view of chlorine in nature is undergoing major change as a result of the recent decades of research. It is now clear that chloride, previously considered non-reactive and dominant, instead in many cases is reactive and does not always constitute the dominant form. For example, an extensive natural chlorination of organic matter occurs in top-soil layers in terrestrial ecosystems leading to an accumulation of organic chlorine. The chlorination is suggested to be driven mainly by microbial processes, but the knowledge on environmental factors influencing the storage and turnover of Cl in forested ecosystems are scattered. A recent study found that tree species could alter soil chlorine cycling either directly or indirectly. Therefore, it is possible that the effect of vegetation on terrestrial Cl dynamics may have been underestimated .

We here present results from a field study in Sweden, where the concentrations of chloride and chlorinated organic matter (Clorg) in understory vegetation has been examined along ecosystem gradient. The gradient runs from upland dry coniferous forest, over moist coniferous forest and wet alder forest wetlands, ending in lake margin marsh vegetation. All understory vegetation in a plot of 1 m2 was sampled and divided into three vegetation types, shrub, field and bottom layers. Biomass and tissue nutrient concentration data were used to estimate storage per plot and per area. We also collected soil samples at each plot to determine soil chloride and Clorg content as well as other nutrients. A tree close to each sampling plot was sampled for foliage and phloem.

The concentrations of Cl in vegetation were dominated by chloride, even though Clorg was present in all vegetation samples (<100 ug g-1). The concentrations of Cl in vegetation varied greatly but overall the highest concentrations of Cl was found in the field layer with concentrations up to 15 mg g-1. There are indications that the highest Cl concentrations are found in the field layer at the sites with high moist level and that plant Cl concentrations are not directly related to the soil Cl concentrations. Whether this is due to different plant uptake among different species or by different soil processes in the moist soil altering the bioavailability of Cl remains to be investigated. Our results call for attention of investigating which role vegetation, and especially in the field layer with a high turn-over rate, has on terrestrial Cl cycling.