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Leaf stoichiometry of deciduous tree species in different soils exposed to free-air O_3 enrichment over two growing seasons

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Highlights:

- Birch (*Betula platyphylla* var. *japonica*) was observed to have negative correlations between foliar N and the metal elements
- Beech (*Fagus crenata*) with determinate shoot growth pattern was rather more sensitive to O_3 stress on foliar contents.
- Oak (*Quercus mongolica* var. *crispula*) was possibly susceptible to O_3 on dynamics of immobile elements.
- Soil nutrients have distinct impacts on retranslocation rate of K, Fe, and P
- Mn and K were indices in assessing the O_3 and soil effects in both short and long term monitoring of the tree growth

Abstract:

The effects of elevated O_3 in different soil conditions on foliar elements stoichiometry were investigated in 3 native tree species with free-air enrichment systems in northern Japan over two growing seasons. Essential elements (Mg, K, Ca, Mn, Fe, Ni, P, N) and two non-essential elements (Cr, Al) were analyzed in leaf samples obtained from 6 different treatments of O_3 and soils at 5 collection times from 2014 to 2015. In this study, relationships among the foliar elements within each species were investigated and negative correlations between foliar N and the metal elements were observed in birch (*Betula platyphylla* var. *japonica*). From the differences of foliar contents as well as their re-translocation rate, beech (*Fagus crenata*) with determinate shoot growth pattern was rather more sensitive to O_3 stress on foliar contents, meanwhile oak (*Quercus mongolica* var. *crispula*) was possibly susceptible to O_3 on dynamics of immobile elements. Soil nutrients have distinct impacts on retranslocation rate of K, Fe, and P. Principal component analysis revealed that Mn and K can become indices in assessing the O_3 and soil effects in both short and long term monitoring of the growth of these tree species. Our findings are essential in further comprehension to nutrient conservation mechanism in the nutrient dynamics of cool-temperate forests.

Keywords: Stoichiometry; ; ; ; , Foliar nutrients, Free-air ozone, volcanic ash soil, Serpentine soil

1. Introduction

Tropospheric ozone, namely ground-level ozone (O_3) as the characteristic of strongly oxidizing, is recognized as one of the important widespread atmospheric pollutants, inducing