The mobility of nitrogen between tree rings of Norway spruce (*Picea abies* L.) and the isotopic effect of its extraction

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Studies utilising tree ring stable isotopes of nitrogen ($\delta^{15}N$) are rare in comparison to those of carbon ($\delta^{13}C$) and oxygen ($\delta^{18}O$); this is partly due to the ability of mobile N compounds to translocate between tree rings (Hart & Classen, 2003). The effects of this translocation are usually negated through the removal of these mobile N compounds prior to analysis in a pre-treatment extraction procedure. Studies in the recent past, however, have begun to question the necessity of this extraction procedure (Doucet et al., 2011).

We compared five Norway spruce (*Picea abies* L.) trees from a plot labelled with ^{15}N in 1995/6, and under experimentally elevated N deposition (Schleppi et al. 1999), with five control trees to study the mobility of the nitrogen between tree rings and the effect of the extraction on the tree-ring $\delta^{15}N$ and N concentration. The effect of the extraction on the tree-ring $\delta^{13}C$ isotope and C concentration was also examined.

The ^{15}N label was found in all measured tree rings from the labelling plot, between the years 1963-2009; this suggests a high radial redistribution of N within the tree stem. The extraction procedure had no significant effect on either the $\delta^{15}N$ or $\delta^{13}C$ in both the labelled and control trees, whilst N content also remained unaffected. These results imply that the pre-treatment removal of mobile N compounds is not necessary before the use of $\delta^{15}N$ and $\delta^{13}C$ in dendrological studies.

References

1) Doucet, A., Savard, M. M., Begin, C., & Smirnoff, A. (2011). Is wood pre-treatment essential for tree-ring nitrogen concentration and isotope analysis? Rapid Communications in Mass Spectrometry, 25(4), 469-475.

2) Hart, S. C., & Classen, A. T. (2003). Potential for assessing long-term dynamics in soil nitrogen availability from variations in $\delta^{15}N$ of tree rings. Isotopes in Environmental and Health Studies, 39(1), 15-28.

3) Schleppi, P., Bucher-Wallin, L., Siegwolf, R., Saurer, M., Muller, N., & Bucher, J. B. (1999). Simulation of increased nitrogen deposition to a montane forest ecosystem: partitioning of the added ^{15}N. Water, Air, & Soil Pollution, 116(1), 129-134.