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# The mobility of nitrogen between tree-rings of Norway spruce (*Picea abies* L.) and the effect of extraction on tree-ring $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$

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Studies utilising stable isotopes of nitrogen ( $\delta^{15}\text{N}$ ) in tree-rings are rare in comparison to those using carbon ( $\delta^{13}\text{C}$ ) and oxygen ( $\delta^{18}\text{O}$ ). This is mainly due to the potential distortion of environmental signals by the translocation of mobile N compounds between tree-rings (Hart & Classen, 2003). Thus, pre-treatment extraction procedures have been used to remove these mobile N compounds prior to isotope analysis. Studies in the recent past, however, have begun to question the necessity of this extraction procedure (Doucet et al., 2011).

We studied the magnitude of the mobility of tree-ring nitrogen by comparing five Norway spruce (*Picea abies* L.) trees from a plot labelled with  $^{15}\text{N}$  in 1995/6, and under experimentally elevated N deposition (Schleppi et al. 1999), with five control trees. We also investigated the effect of the extraction of mobile N compounds on the tree-ring  $\delta^{15}\text{N}$  and N concentration, as well as the tree-ring  $\delta^{13}\text{C}$  and C concentration.

The  $^{15}\text{N}$  label was found in all tree-rings between 1951-2009 at the labelling plot, suggesting a high radial redistribution of N within the tree stem sapwood. The extraction procedure had no significant effect on either the  $\delta^{15}\text{N}$  or  $\delta^{13}\text{C}$  in either the labelled or control trees. Similarly the N concentrations from both plots were also unaffected by the extraction procedure. These results imply that the pre-treatment removal of mobile N compounds is not necessary prior of using  $\delta^{15}\text{N}$  and  $\delta^{13}\text{C}$  in dendrological studies. However, the use of Norway spruce tree-ring  $\delta^{15}\text{N}$  to understand tree response to changing environmental conditions must be carried out with extreme care due to the high radial mobility of N within the tree stem.

## REFERENCES

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