



Long-term ^{15}N tracking from biological N fixation across different plant and humus components of the boreal forest

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Biological N₂ fixation by cyanobacteria associated with feather mosses is an important cog in the nitrogen (N) cycle of boreal forests; still, our understanding of the turnover and fate of N fixed by this association remains greatly incomplete. The $\delta^{15}\text{N}$ signature of plants and soil serves as a powerful tool to explore N dynamics in forest ecosystems. In particular, in the present study we aimed to investigate the contribution of N₂ fixation to $\delta^{15}\text{N}$ signatures of plants and humus component of the boreal forest. Here we present results from a long-term (7 years) tracking of labelled $^{15}\text{N}_2$ across the humus layer, seedlings of the tree species *Pinus sylvestris*, two common dwarf shrub species (*Empetrum hermaphroditum* and *Vaccinium vitis-idaea*) and the feather moss *Pleurozium schreberi*. The enriched experiment was conducted in 2005 in a natural boreal forest in northern Sweden. Two different treatments (10% $^{15}\text{N}_2$ headspace enrichment and control) were setup in nine different plots (0.5 x 0.5 m) within the forest. We observed a significant reduction of $\delta^{15}\text{N}$ signature of the ^{15}N -enriched moss that could be explained by a growth dilution effect. Nevertheless, after 5 years since $^{15}\text{N}_2$ enrichment some of the label ^{15}N was still detected on the moss and in particular in the dead tissue. We could not detect a clear transfer of the labelled $^{15}\text{N}_2$ from the moss-cyanobacteria system to other components of the ecosystem. However, we found consistent relationship through time between increments of $\delta^{15}\text{N}$ signature of some of the forest components in plots which exhibited higher N fixation rates in the moss. In particular, changes in natural abundance $\delta^{15}\text{N}$ that could be associated with N fixation were more apparent in the humus layer, the dwarf shrub *Vaccinium vitis-idaea* and the pine seedlings when comparing across plots and years.