

Effects of clear-cutting on nitrate dynamics in a forested watershed using the triple oxygen isotopes as tracers

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Temporal variations in the triple oxygen isotopic compositions of nitrate in stream water were investigated to understand the effect of clear-cutting on trees (January to March, 2003) and subsequent stripcutting of understory dwarf bamboo (*Sasa senanensis*) (October 2003) on biogeochemical processes of forested watershed in northern Japan. In accordance with the significant increase in stream nitrate concentration up to 15 micromols L⁻¹ in spring 2004, probably in response to the *Sasa*-cutting (Fukuzawa et al., 2006), we found significant increase in the ¹⁷O anomalies. The maximum anomaly (+14 permil) suggest that the direct drainage of atmospheric nitrate occupied more than 50% of total nitrate being exported from the forested watershed during spring 2004. Similar increases in both concentrations and the ¹⁷O anomalies were found in spring 2005 as well. On the other hand, we found little anomalies in the other seasons, irrespective to increases in stream nitrate concentration. That is to say, most portion of the increased nitrate, being exported from the forested watershed during the seasons other than spring, was remineralized nitrate: those preserved in the forested ecosystem as either organic-N or ammonium and then been converted to nitrate. The annual export flux of atmospheric and remineralized nitrate from the forest ecosystem increased to more than 20-times and 4-times, respectively, from those prior to the *Sasa*-cutting. These results suggest that *Sasa* is important not only for preventing nitrogen leaching from soil, but also for enhancing biological consumption of atmospheric nitrate before being exported from forest ecosystem, especially when significant quantities of atmospheric nitrate were added to forest floor through the spring thaw.

Keywords: forest ecosystem, nitrogen leaching, triple oxygen isotopic compositions, nitrate, clear-cutting of trees, *Sasa*