

Effects of clear-cutting on the loss of ion and DOC from cool-temperate forested watershed in northern Japan

FUKUZAWA, Karibu^{1*} ; SHIBATA, Hideaki¹ ; TAKAGI, Kentaro¹ ; NOMURA, Mutsumi¹

¹FSC, Hokkaido University

Nitrate and dissolved organic carbon (DOC) concentrations in stream water before and after clear-cutting of trees and subsequent strip-cutting of understory vegetation, dwarf bamboo (*Sasa* spp.) were investigated to understand the effect of these disturbances on biogeochemical processes in forested watershed in Teshio Experimental Forest in northern Japan. Trees of 8 ha watershed except riparian zone were clear-cut in January-March of 2003. *Sasa* was strip-cut in October of 2003 and larch seedlings were planted on the cut line immediately after the *Sasa* cutting. Stream water was sampled every two or three weeks from 2002 to 2013. Tree-cutting did not cause a significant increase of nitrate concentration in stream water during the growing season after the cutting. Subsequent *Sasa*-cutting caused significant increase of stream nitrate concentration to ca. 15 micro mol L⁻¹. At the cut site, it has been reported that *Sasa* compensated the decrease in tree fine root biomass. Thus, we suggest that nitrogen uptake by *Sasa* was very important in mitigating nitrogen leaching after tree-cutting, and the decline of this nitrogen uptake after *Sasa*-cutting lead to marked nitrate leaching to the stream. However, after that stream nitrate concentration fluctuated in the range of <0.1 to >20 micro mol L⁻¹ depending on date and year, and was especially high in 2007 throughout the year. It did not get back to pre-cutting level. Cation (K⁺, Na⁺, Ca²⁺, Mg²⁺) concentration and pH fluctuated much depending on the flow rate and changes by both cutting were not observed. On the other hand, ammonium was detected in 2007 and synchronized with increase in nitrate concentration. DOC concentration in stream water was not changed after both cuttings of tree and *Sasa* and had clear seasonal pattern that peaked in late summer. Stream DOC concentration increased in growing period with low runoff from late May to August and then decreased after runoff increased in fall, indicating that dilution by the runoff reduce stream DOC concentration after late summer. However, DOC concentration remained low during winter when runoff was stably low, suggesting that high temperature also promote DOC production in soil during the early summer. DOC loss from ecosystem was not influenced by the cutting of trees and *Sasa* in this watershed owing to the adsorption to the soil at the cut area. These results indicate the response to cutting is different between NO₃⁻ and DOC due to the different source area of these solutes in the watershed with cool climate and the gentle basin topography.

Keywords: nitrate, DOC, cation, *Sasa*, stream discharge