Fine root production in a cool-temperate forest covered with Sasa dwarf bamboo

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Fine roots are considered to be an important component for supply of carbon and nitrogen to the soil because they die and decompose repeatedly as well as leaves. However, fine root production and mortality have not been evaluated quantitatively because of its invisibleness, remaining unclearness in the mechanism of carbon and nitrogen dynamics in the soil. Understory vegetation is also considered to play an important role in carbon and nitrogen dynamics in the soil. Cool-temperate forest in northern Japan is characterized by dense understory vegetation, *Sasa* bamboo. In addition, there is concern that global change in environment and natural or anthropogenic disturbance such as clearcutting affect nutrient cycling in forest ecosystems. However, no work has focused on the effects of these disturbances on fine root dynamics and nutrient dynamics and relationship between nitrogen cycling and *Sasa* and fine root after clearcutting. Simultaneous observations of nitrogen leaching and fine root dynamics will clarify the mechanism of nitrogen cycling in the soil. The objective of this study was to clarify the role of the fine root in carbon and nitrogen cycling in the cool-temperate forest covered with *Sasa* bwarf bamboo. In specifically, the role of fine root production and mortality in net primary production (NPP) and the supply of carbon and nitrogen to the soil, the role of the fine root production and Sasa in carbon dynamics and nitrogen leaching after clearcutting. For that purpose, we evaluated fine root production and mortality quantitatively in undisturbed and cleared forest and relate fine root dynamics to soil solution and stream water chemistry.

Study site located in a cool-temperate forest in Teshio Experimental Forest of Hokkaido University. Dominant species are mongolian oak and birch species with Sasa darf bamboo (*Sasa senanensis*) as an understory vegetation. We cleared 14 ha including 8 ha watershed in January to March 2003 and strip-cut *Sasa* in October 2003. We used minirhizotron and observed the pattern of the fine root production and mortality. We define production as appearance and elongation and mortality as disappearance. We calculated fine root turnover rate as the ratio of the production and mortality to the maximum root length density. We measured fine root biomass using core-sampling technique in undisturbed and cleared (cut-*Sasa* and uncut- *Sasa*) forest. We evaluated fine root production and mortality by multiplying the fine root biomass by the respective turnover rate.

Fine root biomass to a depth of 60 cm was 774 g m^{-2}, of which 71 % was accounted for by Sasa, indicating that *Sasa* was a major component of the fine root biomass. NPP of *Sasa* was larger than that of trees for both above- and below-grownd. Fine root production was 630 g m^{-2} yr^{-1}, which account for 37 % of the whole NPP. Carbon and nitrogen supply to the soil via fine roots were 293 gC g m^{-2} yr^{-1}, 4.9 gN g m^{-2} yr^{-1}, respectively. They accounted for 40 % of carbon and 27 % of nitrogen supply. These results showed that *Sasa* was more important than trees in NPP and carbon and nitrogen supply and fine roots as well as litterfall are important for carbon and nitrogen supply. After clearcutting, fine root biomass was maintained because of increase of *Sasa* fine roots despite decrease in tree fine roots. However, fine root biomass decreased by 50 % in cut-*Sasa* plot, suggesting that *Sasa* play important roles in fine root production and maintenance of fine root biomass after clearcutting. These results showed that fine roots of *Sasa* play an important role in carbon and nitrogen flux between plant and soil in a cool-temperate forest covered with *Sasa* dwarf bamboo and the increase of *Sasa* fine roots after clearecutting buffer nitrogen loss from forest ecosystem to the stream.