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The response of litter dynamics of Sasa and trees to the long-term atmospheric nitrogen deposition in forest ecosystem

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Nitrogen is fundamental nutrient for plants and microbes in forest ecosystem. However, it has been concerned that increased nitrogen deposition cause a change of the internal cycling between soil and plant system such as enhancement of litter decomposition by increase nitrogen content in the litter and nitrogen leaching from soil to stream water. It has been known that responses of the forest ecosystem to nitrogen deposition vary with an amount of the nitrogen entering into the forest ecosystem, the period and comprised main plant species. In forest ecosystem of northern Hokkaido, Sasa dwarf bamboo on the forest floor is an important component of vegetation, in addition to the overstory tree. It has been reported that Sasa has a role reducing a change of short-term soil nitrogen increment after the forest management due to the nutrient absorption by Sasa. However, the influence the change of long-term soil nitrogen environment on Sasa litterfall and litter decomposition is not understood. This aim of this study is to clarify the influence the long-term nitrogen addition to soil on the litter dynamics of Sasa and tree in the forest ecosystem.

Nitrogen additional experiment was conducted on Nakagawa experimental forest of Hokkaido University in northern Hokkaido. The study area is a cool-temperate climate. Predominant tree species are birch (*Betula ermanii*), acer (*Acer mono*), oak (*Quercus crispula*) and fir (*Abies sacharinensis*). The forest floor is covered with understory vegetation, Sasa (*Sasa senanensis*) having high density and tall structure. Study sites were established in flat ridge of the experimental watershed (1.43 ha) and the adjacent control watershed (1.06 ha), respectively. Nitrogen of 5 g N m^{-2} $year^{-1}$ (particulate form of NH_4NO_3) has been added to the whole watershed at the snowmelt season from 2002. We investigated above-ground standing stock of Sasa and litterfall of Sasa and trees in each watershed. The litter decomposition experiment of Sasa and trees using litter samples collected from both watersheds conducted on the control watershed to avoid the directly effect of the nitrogen addition. Stream waster was collected in the outlet of each watershed to analyze the nitrogen export from each watershed.

The nitrogen amount of above-ground of Sasa and litterfall of trees were significantly higher in treatment site than in control site. The nitrate concentration in stream water was not significantly different between the watersheds before and 1-year after the first nitrogen addition, but tended to increase in the treatment watershed from three years after the initial addition. These results suggested that the nitrogen absorption of Sasa and trees and the nitrogen leaching from soil to stream increased by long-term nitrogen addition. The litter decomposition rate of tree leaf was faster in treatment watershed than that in the control watershed. The nitrogen content in initial litter increased in tree leaf, suggesting that the increased nitrogen content in initial litter influenced on enhancement of litter decomposition of tree leaf. On the other hand, those of Sasa leaf and culm litter were not significantly different between the watersheds. These results suggested that Sasa litter have some degree of the resilience capacity to maintain the nitrogen dynamics of the soil-vegetation system through the stable nitrogen concentration of litter against the atmospheric nitrogen deposition.

Keywords: Biogeochemistry, Understory vegetation, Nitrogen cycling, Litterfall, Litter decomposition, Litter-bag method