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Long-term changes in nitrogen discharge from watershed of restored artificial forest

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Forest restoration practice has a greatest impact on nitrogen (N) dynamics in forest ecosystems. While there are a number of studies surveying forest cutting and successive regrowth of vegetation, the extent of increase and its duration of N leaching differs among these studies (Oda et al. 2013). There are mainly three processes that affect N leaching from a forested watershed after cutting; (1) N input via precipitation, (2) N uptake by vegetation and (3) N mineralization and nitrification in soil. To understand the impact of forest cutting both quantitatively and periodically, it is necessary to investigate the long-term changes in these three processes before and after the practice.

In Japan, the area of old-aged forest is now increasing due to the decreases in forest activities and restoration practices (Forest Agency 2013). While old-aged sugi (*Cryptomeria japonica*) lowers nutrient uptake (Ohata 1996), soil N mineralization and nitrification retain considerably high rates (Oyanagi et al. 2004). Therefore, increase in N leaching from old-aged artificial forest is expected.

There are ”nitrogen saturated” forested watersheds in the suburban region (Ohrui and Mitchell 1997). Because the amount of cross-border pollutants from continental region is increasing, the nitrogen saturation might become widespread. Therefore, it is necessary to maintain the streamwater quality by enhancing nutrient uptake of forest stands by efficient restoration of artificial forest.

The objective of this study is to clarify the changes in N dynamics caused by cutting and restoration of the artificial forest. We investigated the changes in three processes before and after the partial cutting of old-aged forest which had been in a state of nitrogen saturation.

The study site locates in Field Museum Oyasan in Gunma prefecture, Japan. The watershed area is 1.8 ha, and sugi was planted on the lower to middle slopes, while hinoki (*Chamaecyparis obtusa*) was planted on the upper slope. The sugi plantation on the lowest slope (0.3 ha, 18% of the watershed area) was felled in 2000, and sugi was replanted the following year. The ages of replanted and un-cut old-aged stands are now 15 and 107, respectively.

The long-term hydro-chemical monitoring has been conducted in this site. The amount of N input via precipitation and N leaching from streamwater was estimated from Urakawa et al. (2012). N uptake by sugi before cutting was referred from Oyanagi et al. (2004) and that after cutting was estimated from the aboveground tree biomass surveyed in 2014. Soil net N mineralization and nitrification was measured by in situ incubation conducted intermittently before and after the cutting.

The amount of N leaching from streamwater, which was 10-15 kgN/ha/y before cutting, increased to 15-20 kgN/ha/y for 11 years after cutting, and declined to 10 kgN/ha/y in recent 3 years. By contrast, N input via precipitation maintained stable amount of 9-13 kgN/ha/y. Increases in annual amounts of N mineralization and nitrification were limited for 4 years after cutting, but from the fifth year of the cutting, these rates settled back to the level of the pre-cutting. Rapid growth of replanted sugi began from the 10th year after the cutting, suggesting that the significant decline in streamwater nitrate concentration in recent years attributed to increase in N uptake.

Forest restoration even in 20% of the area was suggested to recover the state of nitrogen saturation caused by aging stands and increase in N input.

References

Forest Agency 2013, Annual report on forest and forestry in Japan, pp. 226
Likens et al. 1970, Ecol. Monogr. 40: 23-47.
Ministry of Environment 2014, Report of long-term cross-border pollutants and acid deposition monitoring (H. 20-24), pp. 238.
Oyanagi et al. 2004, J. Jpn. For. Soc. 86: 134-143.
Oda et al. 2013, AGU Fall Meeting, H11D-1178.
Ohata 1996, Forest Ecology, pp. 84-114.
Ohrui and Mitchell 1997, Ecol. Appl. 7: 391-401.
Urakawa et al. 2012, Ecol. Res. 27: 245.

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