Effect of environmental changes in national scale on nitrogen mineralization rate in forest surface soils

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Nitrogen mineralization in forest soil is important process for tree growth, soil fertility and formation of stream water quality. Therefore, it is quite important to understand the pattern of responses, their mechanisms and the driving factors of soil nitrogen mineralization against the recent environmental changes such as climate change and air pollution. In this study, we aimed to clarify the response and the factors of surface soil nitrogen mineralization rate in soil against the change in temperature and moisture through the field transplant incubation experiments. Previous laboratory incubation experiments and modeling studies have indicated that the soil nitrogen mineralization increased with the increase of soil temperature, and that nitrification rate fluctuated with the soil moisture regimes. However, it has not been clarified enough that actual fluctuation pattern of the soil nitrogen dynamics under the changes in field conditions. Through the field transplant incubation of soil in different place in national wide distribution including northern Hokkaido, northern Kanto, central Kinki and southern Kyusyu, we tried to clarify the change of pattern in net nitrogen mineralization rate in surface forest soil against the realistic change in soil temperature and moisture. This study was conducted as a part of ReSIN project (Regional and comparative Soil Incubation study on Nitrogen dynamics in forest ecosystem).

This study was conducted at Uryu experimental forest of Hokkaido University in northern Hokkaido, FM Kusaki of Tokyo University of Agriculture and Technology in northern Kanto, Kamigamo experimental station of Kyoto University in central Kinki and Takakuma experimental forest in Kagoshima University in southern Kyusyu. Field incubation was carried out during June to August in 2008, active growing season for soil microbe. Surface mineral soil (0-10 cm depth) was collected and sieved (5mm mesh) to remove the gravel and roots. Soil was incubated in the cylinder column (about 150 cc) attached with ion exchange resins upper and lower edges to trap the input of nitrogen in rainfall to soil and the output of nitrogen leaching from soil, respectively. The water was supplied to soil by the actual rainfall because the ion exchange resin was water permeable. The collected soil in each site was transported to other three sites under the low temperature (below 4oC) and incubated in each site, respectively. The replication of the incubation was five for each soil in each site. Inorganic nitrogen contents in the incubated soil and the ion exchange resin was extracted using potassium chloride and analyzed before and after the incubation. The sum of the net increase of inorganic nitrogen contents in the soil and the leaching amount of inorganic nitrogen from soil was calculated as the net soil mineralization rate during the incubation period. Preliminary results indicate that the net nitrogen mineralization in soil was fluctuated with the filed soil temperature, while the characteristics of mineralized nitrogen such as nitrification rate were influences by the original features in the original environment. In this report we will discuss the interaction of the response pattern between environmental change and the original mineralization characteristics and their driving factors and mechanisms.