

Comparison of biogeochemical cycling and their control function in forest soil along with the environmental gradient.

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Forest soil is a key component for biogeochemical cycling in forest ecosystem. The biogeochemical processes in soil relates to various environmental change and the response of the ecosystem. It is quite important for public and scientific concern to understand the ecosystem functions associated with the carbon sequestration, nitrogen retention, water quality formation or neutralization of acid rain, and to clarify the control mechanisms of biogeochemical cycling by the soil system. However, biogeochemical cycling in soil often varies depend on inter-relationship between the surrounding environmental conditions (climate, geology and so on) and the internal factor (characteristics of vegetation and soil) in each ecosystem, causing the difficulties of the generalization and extrapolation from the single case study in the limited region.

Japanese archipelago has large geographical distribution from north to south, providing the unique gradient of spatial distribution for different characteristics of climate, geology and so on. These spatial patterns could affect the geophysical pattern of biogeochemical processes, while their pattern and mechanisms has not been well known at this point. The understandings of the interrelationship between the external environment change and biogeochemical functions of forest ecosystem would be quite important for the future prediction of the ecosystem changes.

This study was designed for the regional comparison of control function for biogeochemical cycling in soil with special attention to the environmental gradient in Japanese archipelago. This project includes the cross-incubation of soil in field with different regimes of climate and atmospheric deposition to propose the general patterns and mechanisms of the biogeochemical processes in soil. The study sites are located broadly in Japanese archipelago, consisting of northern Hokkaido, central Kanto, southern Shikoku and southern Kyushu.

In this report, we present the result from the pre-experiment of soil in summer of 2007 for the main research program in 2008. We conducted the resin-core filed incubation using disturbed and undisturbed surface soil (0-10 cm depth) in the cylindrical tube to determine the net nitrogen mineralization and nitrification rate in summer (two month from August to September 2007) in each site. The ion exchange resins were attached in the bottom of the tube to determine the leaching fluxes of nitrogen from the soil during the incubation. We also attached the resin on the top of the some tubes to test the effect of atmospheric nitrogen deposition on the nitrogen metabolisms in the soil. The nitrogen content in soil and resin was analyzed after the extraction by potassium chloride. The preliminary results indicated the cold climate and less air pollution remarkably decreased the net nitrification in northern Hokkaido forest compared to the other regions. In main program in 2008, we will conduct the exchange and cross-incubation of soil each other in each site to understand the response pattern and mechanisms of nitrogen metabolisms in soil against their environmental changes.