

Comparative research on nitrogen dynamics with nitrogen isotope ratio of plant and soil among ecosystems

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Nitrogen isotope ratio ($\delta^{15}\text{N}$) of plant and soil is widely known as an indicator to trace the nitrogen movement in a ecosystem. Based on the global data collection of $\delta^{15}\text{N}$ plant and soil, recent research has focused on the consistent trend of $\delta^{15}\text{N}$ change with regions which has different climate (mean annual precipitation (MAP), mean annual temperature (MAT)) (Austin and Vitousek 1998; Austin and Sala 1999; Schuur and Matson 2001; Amundson et al. 2003). However the reasonable explanation which connects MAP difference, Nitrogen movement difference, and $\delta^{15}\text{N}$ plant and soil difference among ecosystems does not exist so far. This study aims to clarify the above mechanism, and evaluate the water effect on $\delta^{15}\text{N}$ plant and soil. For the purpose we have set the study sites with different water status in several spatial scales; 2 regions which have extremely different MAP, Several sites with different MAP in each region, and several points along a slope which have different degree of nitrogen loss as leaching.

Taiga forest in northern Mongolia and temperate forest in Hokkaido (Japan) were selected as 2 regions. The MAP of study sites ranges 215~353mm, 701~1731mm in Mongolia and Hokkaido, respectively. From 2003 to 2012 the plant leaf (include wood and grass) and soil (0~50cm depth) were collected along the slope per one site, and analyzed for $\delta^{15}\text{N}$ (per-mill vs. Air- N_2), N content (wt per-cent), soil water content (wt per-cent), extractable nitrate (NO_3^-) and ammonium (NH_4^+) content in soil (mgN gdw⁻¹).

Regional comparison between Mongolia and Hokkaido showed that $\delta^{15}\text{N}$ leaf had more variability and higher in Mongolia (-6~+6 per-mill) than in Hokkaido (-8~0 per-mill), although different plant species were compared. With respect to the smaller scale comparison along slope, $\delta^{15}\text{N}$ leaf decrease from upper to lower slope were observed at 5 of 7 sites in Mongolia, while no change at all sites in Hokkaido. One factor for the regional and slope scale difference in $\delta^{15}\text{N}$ leaf is nitrogen movement with water flow, however grazing effect in Mongolia should be as another factor. Combined the $\delta^{15}\text{N}$ leaf result to the other soil data result, we will discuss the water effect on $\delta^{15}\text{N}$ plant, soil and regional difference in nitrogen movement.

Keywords: nitrogen isotope ratio, plant and soil, nitrogen movement, water status, taiga-grassland boundary, Mongolia