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森林生態系の窒素飽和の指標としてのドングリの窒素安定同位体比の使用
Testing the use of 15N natural abundance acorn as an indicator of nitrogen saturation of forests

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The natural abundance of stable N isotopes (delta 15N) has been used for interpreting N cycles in forest ecosystems because isotopic fractionations during microbial transformations such as mineralization, nitrification, and denitrification can leave different delta 15N for each N pool (Nadelhoffer and Fry 1994). It has been conceived that the delta 15N of plants can reflect the isotopic signatures of soil (Hogberg et al. 1997), thus can be used as an indicator of N dynamics, especially N availability and progress of N saturation (Pardo et al. 2006, Craine et al. 2009). Foliar delta 15N values have been used as the representative for plant body. However, ideal foliar sampling is sometimes difficult due to the large canopy and possible heterogeneity of leaf chemistry in a canopy. Compared with leaves, delta 15N of acorns would have some advantages as the delta 15N of plant body; the stragegy of the acorn production would be different from the one for leaves, which can allow us to get more insights into N economy of the plants including retranslocation of N, and less decomposability of acorns that can allow us to use the dropped acorns as the samples, making the sampling efforts much easier. However, the information on delta 15N of acorns together with other delta 15N of leaves and soil N pools is totally limited. Thus, we selected several watersheds with different N status and collected acorns together with soils and plant leaves to see if acorn delta 15N can be similar with that of leaves to be used as an indicator of N status.

Sampling was carried out in Kamigamo Experimental forest (Kyoto Univ) in Kyoto, several forests in in Fukushima prefecture, FM Tamakyuryo (TUAT) in Hachioji, Tokyo. We collected soils, leaves and acorns. We measured delta 15N of ammonium (NH4+-N), nitrate (NO3?-N), acorn, leaves, and the bulk soil. The delta 15N of NO3?was measured using the denitrifier method. The delta 15N of NH4+ was measured using ammonia diffusion, followed by persulfate oxidation of recovered NH4 +onto a glass fiber filter and the denitrifier method.

We tentatively consider the concentration of dissolved inorganic nitrogen (DIN: NH4++ NO3?) in the soil as an indicator of the nitrogen saturation. We thought progress status of nitrogen saturation as bellow, Kyoto, Fukushima, and Hachioji. Between Hachioji and Fukushima, we found the decreasing in delta15N of acorns, which is the same trend observed for leaves (Takebayashi et al. 2010). This results suggest that delta15N of acorns can have a possibility to be used as an indicator of nitrogen saturation. However, the variation in delta15N of acorns in a forest was quite large compared with that of leaves. This large variation is difficult to interpret but we suspect that this large variation possiblty due to the strong N retranslocation in acorn production and will discuss the potential of the use of this variation in delta15N in the presentation.

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