Nutrient sources in some Japanese forest ecosystems: the contribution of precipitation, weathering and litter fall

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Base cation such as calcium and potassium is important nutrient for tree growth in forest ecosystems. Major sources of base cation to forest soil are precipitation, weathering of parent material and litter fall. Weathering rate of base cation is estimated from the input from precipitation, runoff from stream and uptake by vegetation. For plant uptake two different properties, i.e., long-term accumulation in plant biomass and annual uptake should be quantified. Nutrient cycling of many Japanese forest ecosystems has been studied but information about the contribution of these sources is limited. This study compared three nutrient sources in four forest ecosystems in Japan. These forests are Oyasan (Gunma Pref.), Kamikamo (Kyoto Pref.), Kiryu (Shiga pref.) and Takatori (Kochi Pref.). We calculated nutrient budget of potassium, calcium and magnesium. The rate of rock weathering of base cation ranged from 0.22 to 4.37 kmolc ha^{-1} yr^{-1} and increased in the order of Kamigamo < Kiryu <Oyasan < Takatori. In potassium cycling, the contribution of litter fall was greater than that of weathering or precipitation. The runoff of calcium and magnesium from soil was greater in Takatori, where the rate of weathering was high. Although the rate of weathering varied substantially among forest ecosystems, the annual flux of litter fall was relatively constant. Similar calculation was applied for nitrogen cycling and the source from soil was treated as that from nitrogen accumulated during the past pedogenesis. Nitrogen input from the accumulated soil source was 36 % in Oyasan whereas that in other three forestswas 0%. Oyasan was considered as a nitrogen-saturated forest and the result of the study suggest the ecosystem relies on different nitrogen source.

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