

C-3 Studies on critical loads for acidic substances (Final Report)

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Daily analysed data of rain, throughfall and stemflow at a Sugi (*Cryptomeria japonica* D. Don) stand were applied to the model for determining dry deposition at a tree canopy. The result suggested that dry deposited amount of acidic substance onto tree standing area could be much higher than wet deposited amount.

The seedlings of Sugi, Hinoki (*Chamaecyparis obtusa*) and Akamatsu (*Pinus densiflora*) were cultured in solutions for three years. The growth aspects of seedlings were observed in relation to the mineral uptake and the effects of solution acidity (lowest is in pH 3.2). A buffering ability against acid of seedling have been found out.

The effects of soil acidification on growth and nutrient status of two-year-old Sugi were investigated. From the results obtained in this study, the molar ratios of in the soil such as $(Ca+Mg+K)/Al$ are considered to be useful indicators for evaluating the critical load of acidic deposition. K concentration of old Sugi needles or ex.K in the soil was somewhat lower in declined stands. Sugi seedlings cultivated in low potassium soil revealed that their photosynthetic rate and stomatal conductance decreased along with drought. Sugi seedlings showed strong resistance to H_2SO_4 solution (pH2.0 18750 ml per pot) and little differences on root development, biomass and activity.

Japanese forest soils are strongly acidic (average pH5.1) and have already high ex.Al. The effects of volcanic ash of quaternary period are clear in surface soil pH. For estimation of acid buffering capacities, ex.cation are useful, but ex.acidity is more practical. Acid buffering capacity of volcanic ash soil was compared with granitic soil. Cation supply by weathering is significantly high in volcanic ash soil. Volcanic ash soil has high sulfate adsorption capacity, but major part is already occupied. When volcanic ash soil is acidified, Al release is high due to rapid dissolution of clay minerals. Precipitated protons had relatively small effect on soil than nitrification in O horizon.

Method to apply the steady state mass balance model for estimation of critical load of acid substances to Japanese ecosystem was investigated. Definition of an acidification criterion suitable for the ecosystem and accurate data on material cycle were crucially important for reliable estimation of critical loads. A dynamic model was developed to estimate acidification processes of a specific ecosystem and was verified by applying it to soil acidification experiment using simulated acid rain.