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Cycling of nutrient base cations in a twelve year old Sitka spruce plantation in upland mid-Wales

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Abstract. The effects of the early growth of plantation forestry on the biogeochemical cycling of potassium, calcium and magnesium have been investigated in a stand of 12 year old Sitka spruce and adjacent moorland growing on acid peaty podzol soils in mid Wales. Element budgets have been calculated for both systems using measurements of soil and vegetation base cation pools and fluxes. In the moorland, the magnesium budget is approximately at steady-state with no net change to the soil store whilst the soil is accumulating potassium. The calcium budget is approximately balanced but contains significant uncertainties due to between plot variability in calcium leaching losses. Afforestation has greatly increased the above-ground living biomass which holds 7 to 15 times more nutrients compared to the living aerial biomass in the moorland. With the exception of magnesium, the base cation stores within the forest soil are being depleted as the increase in atmospheric deposition due to the forest canopy provides only a small offset to the much larger accumulation of base cations within the trees. The current net rate of change in the soil store of calcium is sustainable for only 65 years. However, as the trees mature, their demand for calcium will be reduced and they should be able to 'tap' deeper sources of calcium in the soil profile as well as in the drift and regolith material.

Keywords: Forestry, base cations, element cycling, calcium, magnesium, potassium

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