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## Effects of five years of frequent N additions, with or without acidity, on the growth and below-ground dynamics of a young Sitka spruce stand growing on an acid peat: implications for sustainability

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**Abstract.** A field manipulation study was established to demonstrate effects of simulated wet N and S deposition on a young (planted 1986) stand of Sitka spruce growing on a predominantly organic soil in an area of low (8–10 kg N ha<sup>-1</sup> yr<sup>-1</sup>) background N deposition in the Scottish borders. From 1996, treatments (six) were applied to the canopies of ten-tree plots in each of four blocks. N was provided as NH<sub>4</sub>NO<sub>3</sub>, either with H<sub>2</sub>SO<sub>4</sub> (pH 2.5) at 48 or 96 kg N ha<sup>-1</sup> yr<sup>-1</sup> inputs or without, at 48 kg N ha<sup>-1</sup> yr<sup>-1</sup> along with wet (rain water) and dry controls (scaffolding) and a S treatment (Na<sub>2</sub>SO<sub>4</sub>). Positive responses (+ >20% over 5 years) with respect to stem area increment were measured in response to N inputs, irrespective of whether acid was included. The positive response to N was not dose related and was achieved against falling base cation concentrations in the foliage, particularly with respect to K. The results suggest young trees are able to buffer the low nutrient levels and produce new growth when there is sufficient N. Inputs of 96 kg N ha<sup>-1</sup> yr<sup>-1</sup>, in addition to ambient N inputs, on this site exceeded tree demand resulting in elevated foliar N, N<sub>2</sub>O losses and measurable soil water N. These excessive N inputs did not reduce stem area growth.

**Keywords:** acid, canopy application, nitrogen, acid organic soil, simulated wet deposition, soil water, sulphur, young Sitka spruce

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