Spatial patterns of N, P and K around trees in a grazed silvopastoral system

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Regression and geostatistical methods were used to model the spatial variation of soil total nitrogen (N), available phosphorus (P) and potassium (K) in a sheep-grazed silvopastoral experiment on *Lolium perenne* pasture. We used Hybrid Larch (*Larix eurolepis*) at 100 (HL100), 200 (HL200) and 400 (HL400) stems·ha^{-1} in a square planting pattern and an agricultural control (AC). Soil samples (0–20 cm) were collected at 0.5 m and at 1 m intervals thereafter in the four main compass directions from two randomly selected trees and were analysed for N, P and K. In AC, two random locations were used as sampling bases. Regression analysis determined spatial trends in N, P and K with distance from the tree as the explanatory variable. Semivariograms, a measure of dissimilarity between pairs of samples plotted against increasing sample separation (from 1m up to a maximum of half the distance between trees), were used in all four compass directions to determine the spatial dependence in N, P, and K. The results of the regression analysis showed an initial increase in N with distance from the tree in HL100, HL200 and HL400, but then N decreased towards the mid-point between trees in all spacings. P and K showed no trends with distances from trees. There was no trend in the AC for N, P or K. Semivariograms of N and K showed no spatial dependence in any treatment. P had spatial dependence in HL100 and AC. The results indicate that different processes may be influencing the spatial distribution of each of these major nutrients in silvopastoral systems.

Soil-plant-animal interactions in the establishment phase of a silvopastoral system in NE Scotland

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The behaviour of animals grazing in silvopastoral systems is modified by the presence of the trees which are used by the animals for shelter. Studies were carried out at two planting densities (100 and 400 trees·ha^{-1}) of hybrid larch (*Larix eurolepis*) carrying similar sheep stocking rates. A woodland control planted at 2 500 trees ·ha^{-1} without grazing was included. Sheep were observed less than 1m from trees 5.7 times more than would be expected by random distribution at 100 trees·ha^{-1} and 3.4 times more than expected at 400 trees·ha^{-1}. Nine years after planting, both survival (88 ± 5.1%, 99 ± 1.3% and 100 ± 0.0% for 100, 400 and 2500 trees·ha^{-1}) and total height (355 ± 26.0 cm, 463 ± 38.0 cm and 541 ± 26.0 cm, for 100, 400 and 2500 trees·ha^{-1}) were affected, especially at the lower tree planting density. It is argued that modified animal behaviour has an effect on the growing conditions for trees and pasture due to soil compaction (Wairiu et al., Agrofor. Syst. 24 (1993) 295–306; Nwaigbo, 1996, PhD Thesis, Univ. Aberdeen) and modified patterns of the return of nutrients to the soil through dung and urine (Nwaigbo et al., Ann. Zootech. 47 (1998) this volume). Understanding and quantifying these interactions will lead to better design and management of silvopastoral systems to meet user requirements.