Effect of a Grazing Intensity Gradient on Primary Production and Soil Nitrogen Mineralisation in a Humid Grassland of Western France

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Introduction Large herbivores have a major influence on the structure and the functions of humid grasslands and especially on primary production. Earlier work on the study site showed that grazing intensity was spatially varied and created a diversity of vegetation patches in the grassland (Loucougaray, 2003). The first objective of this study was to determine whether the variation in grazing intensity led to variation of primary production within the three plant communities located at three topographic levels in the grassland. The second objective was to determine whether a relationship linked primary production variation and net soil nitrogen (N) mineralisation.

Materials and methods For each vegetation patch, above ground net primary production (ANPP) was measured as the sum of positive biomass increments during four consecutive 15 day periods (May to June 2002) using temporary enclosures. Rates of net N mineralisation were measured in the first 15cm of the topsoil for each vegetation patch using the *in situ* buried bags method. Net N mineralisation rates were calculated as the difference between soil mineral N content at the beginning and end of an incubation period and were summed for 6 successive incubation periods (April to September 2002).

Results ANPP varied significantly between the plant communities and between the vegetation patches within the communities (nested ANOVA, $p < 0.001$). ANPP significantly decreased as the grazing intensity increased within each plant community (Figure 1). The decrease of ANPP along the gazing intensity gradient was stronger within meso-hygrophilous communities than within mesophilous and hygrophilous communities. Net N mineralisation rates varied significantly between vegetation patches. There was a linear negative relationship between ANPP and net N mineralisation rates (Figure 2, $R^2 = 43.7$ $p < 0.01$).

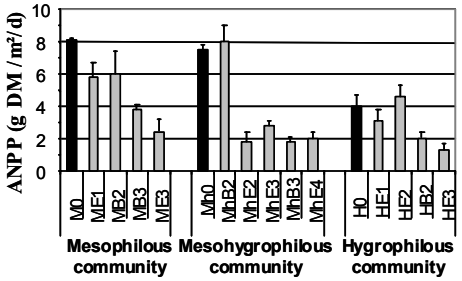

Figure 1 Effect of increasing grazing intensity on the ANPP of three plant communities. Values for ungrazed vegetation are reported in black.

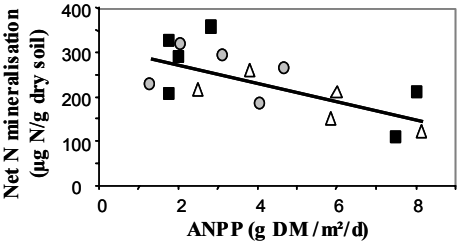

Figure 2 Relationship between ANPP and net N mineralisation. Mesophilous (triangles), meso-hygrophilous (squares) and hygrophilous (circles)

Conclusions Within grassland, the variation in grazing intensity led to variation of above ground net primary production between and within plant communities. The results of this study show that there is a linear negative relationship between ANPP and net N mineralisation variation at the grassland scale. We suggest that the variations of grazing intensity influence soil carbon availability for soil microorganisms through variation of ANPP (Holland & Detling, 1990). The decrease in soil carbon availability leads to a decrease in the biomass of soil microorganisms. Such a decrease in microbial biomass could lead to a decrease in nutrient immobilisation by microbes and a subsequent increase in net N mineralisation.

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