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Interactive effects of nitrogen addition and clipping on microbial nitrogen transformations and biomass in an old field in Inner Mongolia

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Microbial nitrogen (N) transformations are playing a key role in regulating N cycling in terrestrial ecosystems. However, there is still dispute on how N addition affects microbial activity and N transformations. A field experiment was conducted to examine the effects of N addition and clipping on microbial N transformation and biomass in an old field ecosystem in northern China since June 2006. N was added at a rate of 10 g N m-2 yr-1 in the form of $NH4NO_3$ in both clipped and unclipped plots. Parameters examined included monthly (June to August) measurements of in situ rates of net ammonification (Ramm), nitrification (Rnit) and mineralization (Rmin) from 2006 to 2009. As well as measurements of soil microbial biomass carbon (MBC) and N (MBN) or microbial respiration (MR), peak aboveground biomass was measured once a year in the middle growing season (August) from 2006-2009. Over the four years, N addition significantly stimulated Rnit, Rmin, and MBN, on average, by 288%, 149%, and 11.6%, respectively. However, N addition significantly decreased MBC and the ratio of MBC/MBN on average by 10.4% and 22.8%, respectively, whereas an effect of N addition on MR could not be demonstrated. Clipping significantly decreased MBN, MR and qCO_2 by 9.2%, 28%, and 23.7%, respectively, but no effects were found on microbial net N transformation rates and MBC. N addition and clipping interactively affected soil moisture content, Ramm and Rmin, and MBN, MBC/MBN. Clipping increased the soil temperature, due to increased radiation reaching the soil surface. Thus, we observed that N induced a decrease in soil moisture, and clipping increased soil temperature, which strongly highlights the need to study the interactive effects of clipping and N addition on N transformation and microbial activities in old field communities in northern China.