Geophysical Research Abstracts, Vol. 7, 03195, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03195

Biosphere-Atmosphere-Exchange of C and N Trace Gases and Microbial N Turnover Processes in Differently Managed Grassland Ecosystems of Inner Mongolia

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Grassland ecosystems cover approx. 1/3 of the area of the global land surface. Though the C storage per area is rather low, globally 1/4 - 1/3 of the terrestrial carbon is stored in grassland ecosystems and here mainly in soils. Changes in climate or intensification of land use may significantly alter ecosystem processes and the biosphere-atmosphere exchange of environmental important trace substances such as N_2O, NO, NO_2, CH_4 and CO_2. In 2004 a German-Chinese research project was started, the MAGIM project (Matter Exchange in Grasslands of Inner Mongolia), which aims to quantify the magnitude of the biosphere-atmosphere exchange of the above mentioned trace substances and to characterize and quantify the involved microbial processes. First results of manual and automated trace gas measurements at two differently grazed sites in the Leymus chinensis steppe in the Xilin river basin, Inner Mongolia, PR China, revealed, that during the vegetation period 2004 (May-October) the uptake of atmospheric CH_4 was reduced by approx. 50% due to grazing and hay making to values of approx. -30 μg C m^{-2} h^{-1}. N_2O as well as NO emissions were found to be in the range of -5 - +5 μg N m^{-2} h^{-1} and in average only a very low net emission of approx. 0.5 -2 μg N m^{-2} h^{-1} was observed. However, also here grazing led to a slight reduction of N_2O emissions. Also with regard to the CO_2 exchange grazing was found to reduce

ecosystem respiration, which indicates that C and N cycling is slowed down in grazed versus ungrazed grassland ecosystems of Inner Mongolia. However, using a transect approach we were able to demonstrate that the effect of landscape position on the C and N trace gas exchange can override the grazing effects, e.g. that fluxes at the hill foot position are approx twice as high as at hill top positions. Microbial N turnover processes, namely gross ammonification, gross nitrification and NH_4 and NO_3 immobilization in grazed and ungrazed steppe ecosystems were not found to be significantly affected by landuse. However, rates were low and in a range of 0.3 – 4.5 μg N g^{-1} soil dry weight.