

## Effects of grazing and rainfall variation on root and shoot decomposition in steppe ecosystem

M. Giese<sup>1</sup>, N. Fanselow<sup>1</sup>, H. Brueck<sup>1</sup>, S. Lin<sup>2</sup>, Q. Pan<sup>3</sup> and K. Dittert<sup>1</sup>

<sup>1</sup> Institute of Plant Nutrition and Soil Science, Christian-Albrecht-University, Hermann-Rodewald-Str. 2, D-24118 Kiel, Germany, E-Mail: kdittert@plantnutrition.uni-kiel.de

<sup>2</sup> Department of Plant Nutrition, China Agricultural University, Yuanmingyuan West Road 2, 100094 Beijing, China

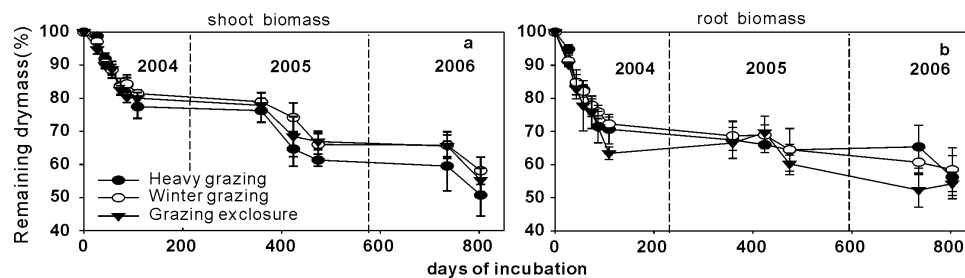
<sup>3</sup> Institute of Botany, Chinese Academy of Sciences, 20 Nanxincun Xiangshan Beijing, China

**Key words :** Nitrogen and carbon cycling, litter bag, semi-arid grassland, Inner Mongolia

**Introduction** Overgrazing affects large areas of Inner Mongolia semi-arid grassland. Grazing effects on above- and belowground decomposition as a key process of ecosystem carbon and nitrogen cycling are still unclear.

**Materials and methods** We studied the effects of grazing on shoot and root decomposition using the litter bag method in a long-term grazing enclosure, a moderately winter grazed site and a long-term heavily grazed site at Xilingole steppe (43°38' N, 116°42' E). Decomposition of control and site-specific root and shoot biomass were analysed to distinguish effects of local environmental factors and litter quality as altered by grazing. Growing seasons of average (2004) and very low precipitation (2005) allowed to study effects of inter-annual rainfall variation on decay dynamics.

**Results** Grazing impact on local environment (Figure 1) and litter quality parameters had no effect on decay rates of shoot and root dry mass. In contrast to expected grazing effects, we found pronounced impact of rainfall variability on decay rates (Table 1). In the year of average precipitation (2004) root decomposition was faster than shoot decay, while under dry conditions (2005) the opposite was observed. Not shown: fitting a simple exponential decay function, we found soil moisture storage the best parameter explaining root decomposition dynamics. Contrarily, shoot decay rates were almost constant and unaffected by annual rainfall variance. Initial N content had no effect on N release dynamics and net N immobilization was not observed during decay process of shoot and root (see Parton et al. 2007).



**Figure 1** Test for local environment effects on decay dynamics of shoot and root biomass among three grazing intensities from 2004-2006.

**Table 1** K-values of shoot and root biomass incubated in 2004 (325 mm rain) and 2005 (166 mm rain) at different grazing intensities. K-values calculated as  $LN(X/X_0) = kt$  (Olson 1963).

Site	k-value shoot		k-value root	
	2004	2005	2004	2005
Heavy grazing	0.28	0.36	0.40	0.20
Winter grazing	0.24	0.26	0.38	0.23
Grazing enclosure	0.26	0.29	0.41	0.17

**Discussion** When root decay is limited in dry periods, shoot decomposition becomes relatively more important for plant nutrient supply. Photodegradation (UV-B radiation) might explain balanced aboveground decay dynamics (Austin et al. 2006). Consequently, separate analysis of shoot and root decomposition is crucial to describe carbon and nitrogen cycling in semi-arid environments. Under average rainfall conditions grazing effects on nutrient supply through decomposition are less pronounced because of more active belowground processes. The grazing impact on C and N fluxes through decomposition of plant biomass, thus, likely exhibits a strong interaction with seasonal rainfall patterns.

### References

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