Effects of different stocking densities on soil properties in montane pastures of the Chinese Altai Mountains

www.watercope.org

IFAD
Investing in rural people
Funding number I-R-1284

Mariko Ingold[1], Sven Goenster-Jordan[1], Ramia Jannoura[2], Andreas Buerkert[1], Rainer Georg Joergensen[2]

[1] Organic Plant Production and Agroecosystems Research in the Tropics and Subtropics (OPATS), Universität Kassel-Witzenhausen, Germany

[2] Soil Biology and Plant Nutrition, Universität Kassel-Witzenhausen, Germany

Introduction & Objectives

- Overgrazing is a major threat for extensive steppe systems in Central Asia
- Increasing livestock pressure and changes of traditional mobile pastoralism in the Chinese Altai Montains likely affect soil properties

The objective of this study was:

➡ to investigate the effects of different stocking densities on soil properties

Figure 1. Experimental site with fenced paddocks on a summer pasture at Akbulak, Quinghe County, China.

Materials & Methods

- Grazing experiment using a completely randomized block design with 0, 8, 16, and 24 sheep ha^{-1} in 2014 and 2015
- Summer pasture in the Chinese Altai Mountain range, 2400 m a.s.l.
- 174 mm precipitation and average monthly temperatures of -26 to 30° C
- Topsoil samples were collected after two grazing periods of 56 days per year
- Analysis of physical, chemical and microbiological soil properties

Figure 2. ***Top:*** Fat-rumped sheep of the Altay breed grazing within a fenced paddock. ***Bottom:*** Subalpine steppe vegetation with a high diversity of grasses and herbes.

Results

Table 1. Soil properties of a summer pasture after two grazing periods at differing sheep stocking rate . Data show means and coefficients of variation (CV).

Stocking rate	Sheep/ha	**0**	**8**	**16**	**24**	**CV %**
Sand	%	34.9	36.2	36.1	37.4	6.6
Silt	%	41.7	41.5	41.5	40.6	9.4
Clay	%	23.3	23.6	22.5	21.8	6.0
SOC	%	3.9	3.9	3.8	3.7	13.5
N	mg g^{-1}	3.6	3.7	3.6	3.6	8.8
C/N		10.4	10.5	10.3	10.4	0.9
Cmic	µg g^{-1}	840.7	832.1	801.5	851.2	5.2
Ergosterol	µg g^{-1}	5.8	6.0	5.6	5.5	5.0
CO_2-C	µg g^{-1} d^{-1}	10.4	10.7	10.0	9.4	8.2
***q* CO_2**	µg mg^{-1} Cmic d^{-1}	13.5	12.9	12.5	12.2	6.0

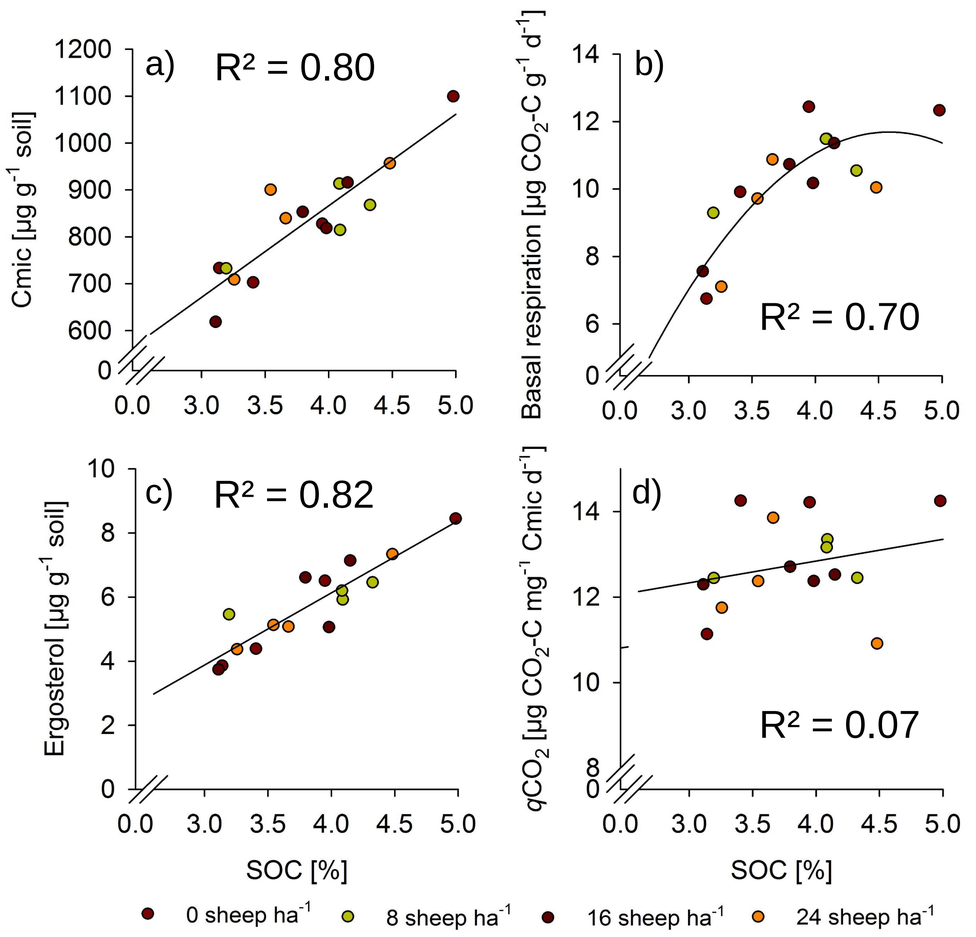

Figure 3. Correlation between soil organic carbon (SOC) and microbial carbon (Cmic; **a**), basal respiration (**b**), ergosterol (**c**) and the metabolic quotient (qCO_2; **d**).

Conclusions

- *q*CO_2 decreased with increasing stocking rate
- Other chemical and microbial soil parameters remained unaffected
- Soil organic carbon (SOC) strongly correlated with microbial indices, except for *q*CO_2, showing its significance for preserving soil quality of summer pastures in Central Asia.

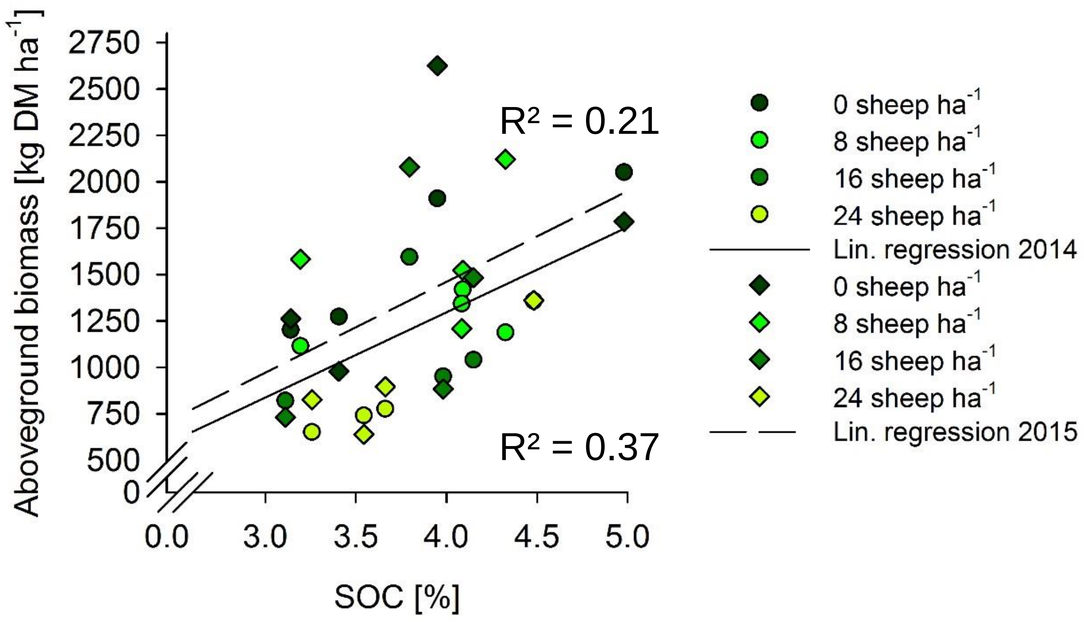

Figure 4. Correlation between soil organic carbon (SOC) and average aboveground plant biomass in the two grazing periods 2014 and 2015.

ingold@uni-kassel.de

www.uni-kassel.de/fb11agrar/

Funded by IFAD (I-R-1284-WATERCOPE)

Link to the watercope homepage

organicagriculturalsciences UNIKASSEL