TiP (DFG SPP 1372) Atmosphere - Ecology - Glaciology - Cluster

Joint *Kobresia* Ecosystem Experiment 2010

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Motivation

The Atmosphere Ecology Glaciology cluster (AEG) conducted a multidiscipline experiment in Kema to investigate the response of *Kobresia pygmaea* pastures to land use and climatic changes. Main focus laid on the carbon and water cycle with measurements on a wide range of temporal and spatial scales, as well as vegetation dynamics.

KEMA
Kobresia Ecosystem Monitoring Area

The measurement site at Kema was selected since it lays in the center of the main distribution of *Kobresia pygmaea* (Fig. 1).

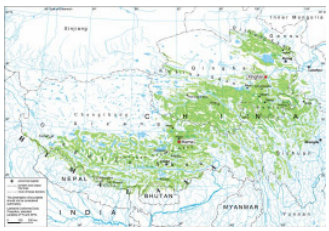

Fig. 1: Distribution of *Kobresia pygmaea* and location of the KEMA field site (4410 m a.s.l.). The research area Kema is marked by a red square in the center of the map.

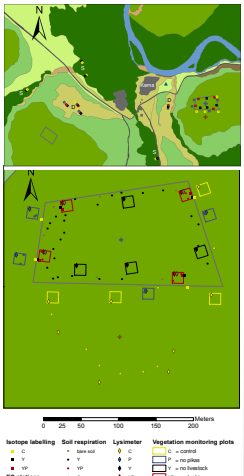

Fig. 2: Overview of the land use at KEMA and setup during the 2010 Experiment.

Permanent Setup

- 2 livestock grazing exclosures (1.5x100x250m, 2009, 2010) with 16 exclosures for small mammals (Plateau Pika, *Ochotona curzoniae*) in and outside
- 16 vegetation monitoring plots on degraded slopes(D)
- 8 vegetation monitoring plots in wetlands (S)

Fig. 3: Scientists at Kema Station during the 2010 Experiment

Fig. 4: Grazing exclosure fences, in the foreground the "pika fences" in the back the "Yak fences"

Fig. 5: Grazing yaks around one of the EC stations

Fig. 6: Soil chamber measurements

Measurements 2010

Basic meteorological parameters:	Automatic weather station (AWS),EC, rain gauge, visual observation, kite
Surface Fluxes and Energy balance	2 Eddy Covariance stations (EC)
Identification of C & N fluxes/pools	^{13}C and ^{15}N pulse labeling
Evapotranspiration (ET):	Lysimeters, EC
Soil respiration:	Soil respiration chamber
Dew fall	2 logging lysimeter
Effect of water availability on soil respiration and biomass growth:	Irrigation experiment, soil respiration chamber, lysimeter
Nutrient availability:	Fertilization experiment
Grazing effects:	Vegetation monitoring, biomass harvest

Fig. 7: Collars for the soil chamber, Lysimeter

Fig. 8: Measurements of few fall with lysimeter, tensiometer, rain bucket

Fig. 9: Lysimeter installation

Fig. 10: Isotope Pulse Labeling Experiment

A Documentation and more detailed information about the experiment and the field site can be found in :

Biermann T, & Leipold T. with contributions from Babel W, Becker L, Coners H, Foken T, Guggenberger G, He Siyuan, Ingrisch J, Kuzyakov Y, Leuschner C, Miehe G, Richards K, Seeber E, Wesche K. 2011 Joint Kobresia Ecosystem Experiment: Documentation of the first Intensive Observation Period Summer 2010 in Kema, Tibet. Arbeitsergebnisse Nr. 44, Universität Bayreuth, Abt. Mikrometeorologie, Bayreuth, ISSN 1614-8916.

Interactions

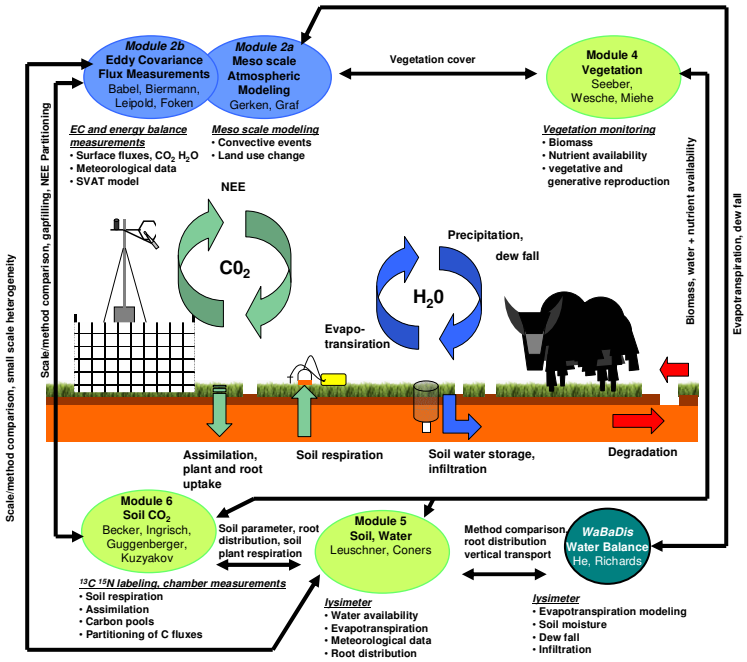

Fig 11: Tasks of the different groups participating in the 2010 Kema Experiment. Principal measurement techniques, interactions and overlap as well as the main focus is illustrated.

Results

- Separation of fluxes from different land use possible (Fig.12)
- No effect of the treatments noticeable in biomass or NEE
- 2010 was a dry year: expected rain in July app. 160 mm → in 2010 only 40 mm → hardly any grazing
- Availability of water had a strong effect on ET, biomass growth and CO_2 fluxes (Fig.13, 14, 15, 17)
- Artificial irrigation additional to natural occurring precipitation showed a significant raise in biomass growth (Fig.13)
- 1 moist (strong ET) and 2 dryer periods, identified via Bowen ratio (Fig.18) → strong effect on NEE (Fig. 15)
- Effect of heterogeneity of the underlying surface can be seen in chamber measurements → 50% smaller efflux on bare soil (Fig. 16)
- Variation of soil respiration is strongly soil temperature depended, which is altered fast due to changing cloud cover (Fig. 16)

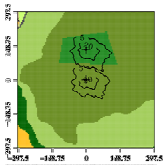

Fig. 12: Footprint climatology of the 2 EC stations

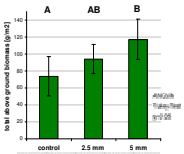

Fig. 13: Biomass growth after irrigation, additional to natural precipitation

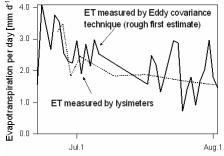

Fig 14: Comparison of ET measured by lysimeters and EC.

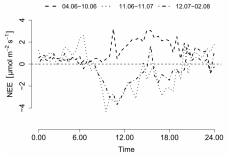

Fig. 15: NEE during periods with different water availability

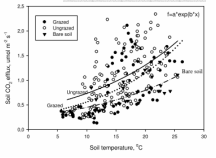

Fig. 16: Influence of soil temperature and land cover on soil efflux

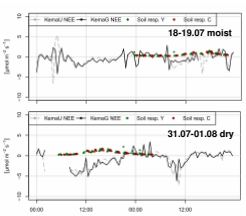

Fig. 17: 4 days of NEE and soil respiration measurements on the different treatments, under dryer and moister meteorological conditions. Y=Yak exclosure, C= Control

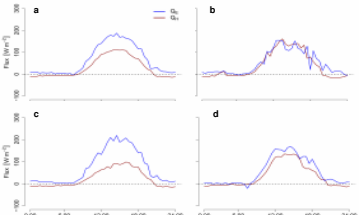

Fig. 18: Sensible (Q_H) and latent (Q_E) heat flux, for the whole period (a), dry: 04.06 till 10.06 (b), moist: 11.06 till 11.07 (c), dry: 12.07 till 02.08 (d)

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