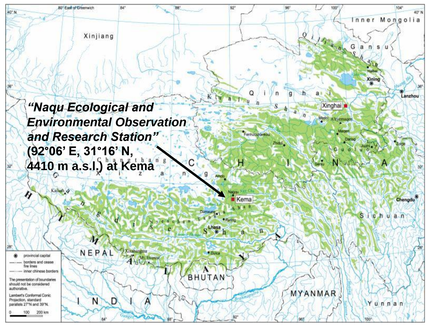
EGU General Assembly 2014
Vienna, April 27 – May 2

BG2.1, G44

Carbon fluxes of *Kobresia pygmaea* pastures on the Tibetan Plateau

KEMA-WORKING GROUP: WOLFGANG BABEL[1] AND

T. BIERMANN[1], E. FALGE[1], J. INGRISCH[2], J. LEONBACHER[1], P. SCHLEUSS[3], Y. KUZYAKOV[3], Y. MA[4], G. MIEHE[5], T. FOKEN[1,6]



Courtesy: Enderle, University of Marburg

Kobresia pygmaea pastures

With an approximate cover of 450,000 km² on the Tibetan Plateau (TP), the Cyperaceae *Kobresia pygmaea* forms he world's second largest alpine ecosystem. This species, especially adapted to grazing pressure, grows to a height of only 2-6 cm and can be found in an altitudinal range of 4000 to 5960 m a.s.l. A special characteristic of this ecosystem is the stable turf layer, which is built up from roots and plays a significant role in protecting soil from erosion. This is of great importance since soils on the TP store 2.5 % of the global soil organic carbon stocks.

Topic of the research

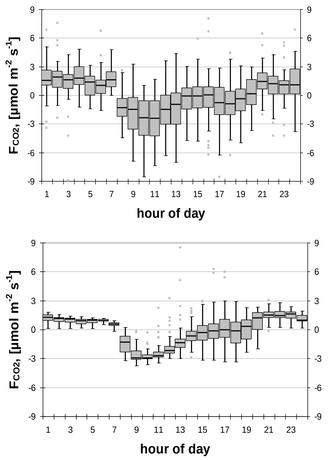
The aim of the investigation was the study of the carbon storage and the impact of human-induced land use change on these *Kobresia pygmaea* pastures. We therefore applied eddy-covariance measurements and modelling to control of the fluxes between the atmosphere and the pastures, $^{13}CO_2$ labelling for the investigation of flux partitioning, and chamber measurements to investigate the degradation of the pastures.

Degraded *Kobresia pygmaea* pastures

Stadium at Kema site	Intact Root Mat	Degraded Root Mat	Bare Soil
short-name and letter in Figure	IRM (a)	DRM (b)	BS (c)
proportion of total surface area (%)	64.7	16.6	18.7
mean vegetation cover within the surface classes (%)	87.5 (±5.7)	26.4 (±9.8)	11.8 (±7.9)
maximal vegetation cover (%)	99	65	35
minimal vegetation cover (%)	72	5	0
root mat layer	Yes	Yes	No
mean height difference (cm)	9.4 (±2.0)	8.5 (±2.0)	-
dominant plant species	*Kobresia pygmaea*	*Kobresia pygmaea*, Lichens, Algae	Annuals e.g. *Axyris prostrata*

Comparison of Eddy-Covariance (EC) measurements and modelled data

with SVAT-CN at Kema 2010 (tile approach for simulations of IRM, DRM, and BS according to data in Table)

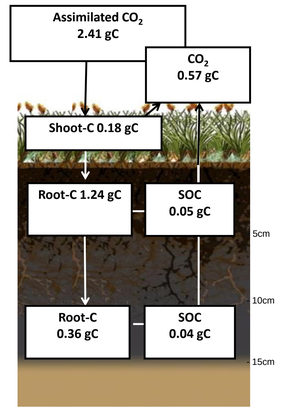


EC-system: sonic anemometer Campbell CSAT-3 and infrared gas analyzer Li-COR 7500

SVAT-CN model (references see below)

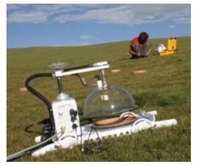
Coupling of $^{13}CO_2$ Labeling and EC

Combining relative $^{13}CO_2$ pulse labeling results with mean carbon uptake observed by the eddy-covariance method (EC) for July 2010 enabled us to estimate the absolute C fluxes into different ecosystem compartments

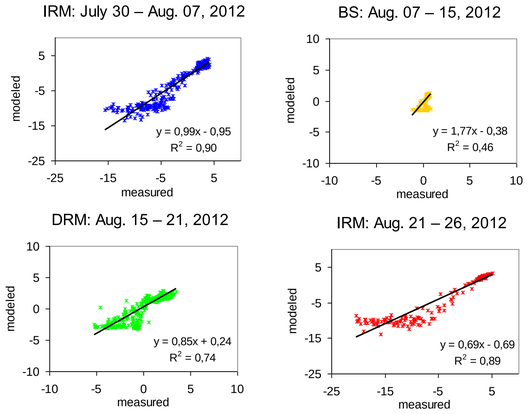


Comparison of chamber measurements and modelled data

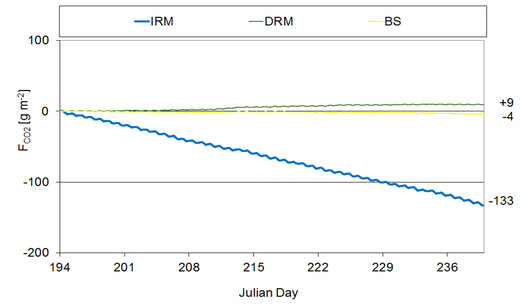
with SVAT-CN at Kema 2012 for IRM, DRM, and BS



The Li-COR long term chamber system contains the Li-8100 Infrared Gas Analyser which is linked with an automated multiplexing system (Li8150) and two automated chambers for measurements of NEE and respiration.



Summer carbon uptake based on SVAT-CN modelling at Kema 2012 for surface classes IRM, DRM, and BS



Conclusions

- Most of the assimilated carbon is stored within the unique turf/root layer of the *Kobresia* pastures.
- *Kobresia* pastures are a small carbon sink in summer (42 days in 2012).
- Degraded *Kobresia* pastures and soil are carbon neutral in summer; the respiration does not depend on the amount of stored carbon but on atmospheric conditions.
- The degradation of *Kobresia* pastures is strongly connected with a loss of carbon (source).
- *Kobresia* pastures are an ecological system characterized by limited grazing by yaks (nomads). No grazing: other species will dominate; over-grazing: degradation.
- The preservation of *Kobresia* pastures is an ecological and political problem!

[1] *Department of Micrometeorology, University of Bayreuth, Bayreuth, Germany*
[2] *Institute of Ecology, University of Innsbruck, Innsbruck, Austria*
[3] *Institute of Soil Science of Temperate Ecosystems, Georg-August University Göttingen, Göttingen, Germany*
[4] *Laboratory of Tibetan Environment Changes and Land Surface Processes, Institute of Tibetan Plateau Research, Chinese Academy of Sciences, Beijing, PR China*
[5] *University of Marburg, Institute of Geography, Marburg, Germany*
[6] *Member of Bayreuth Center of Ecology and Ecosystem Research, Bayreuth, Germany*

Reference for SVAT-CN:
Falge, E., Reth, S., Brüggemann, N., Butterbach-Bahl, K., Goldberg, V., Oltchev, A., Schaaf, S., Spindler, G., Stiller, B., Queck, R., Köstner, B., and Bernhofer, C.: Comparison of surface energy exchange models with eddy flux data in forest and grassland ecosystems of Germany, Ecol. Mod., 188, 174-216, 2005.

Funded by German Science Foundation:
DFG Deutsche Forschungsgemeinschaft

www.bayceer.de