Global Change Effects on Grasslands and Feedbacks with Regard to Greenhouse Gas Fluxes

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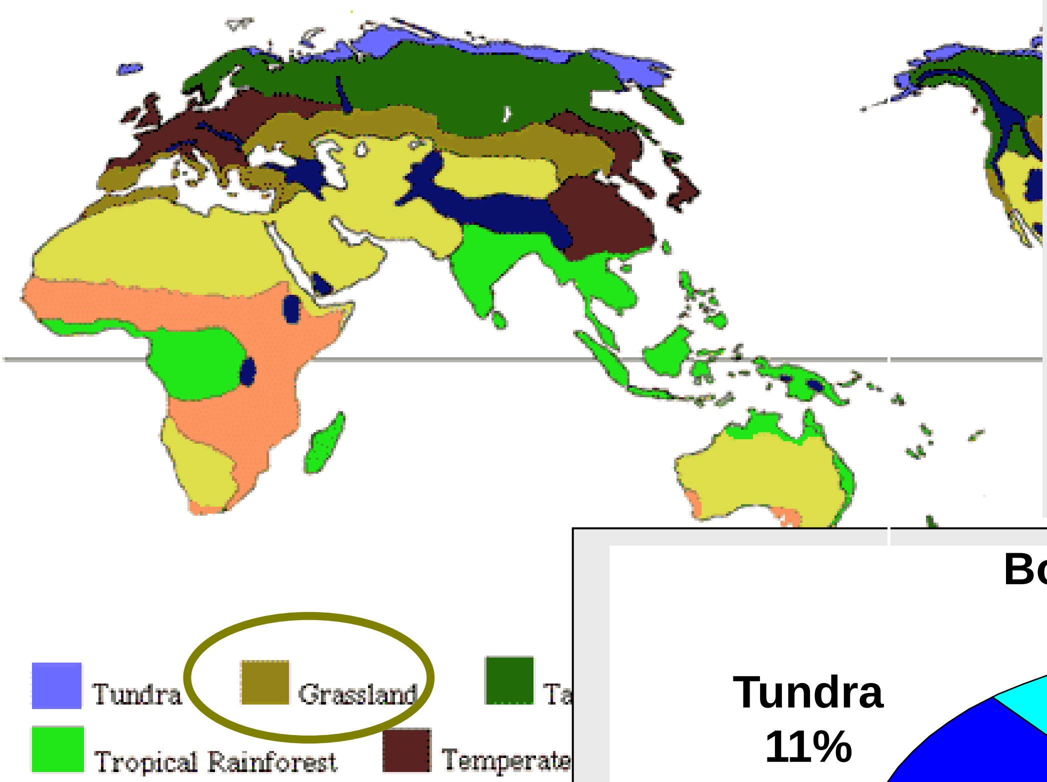
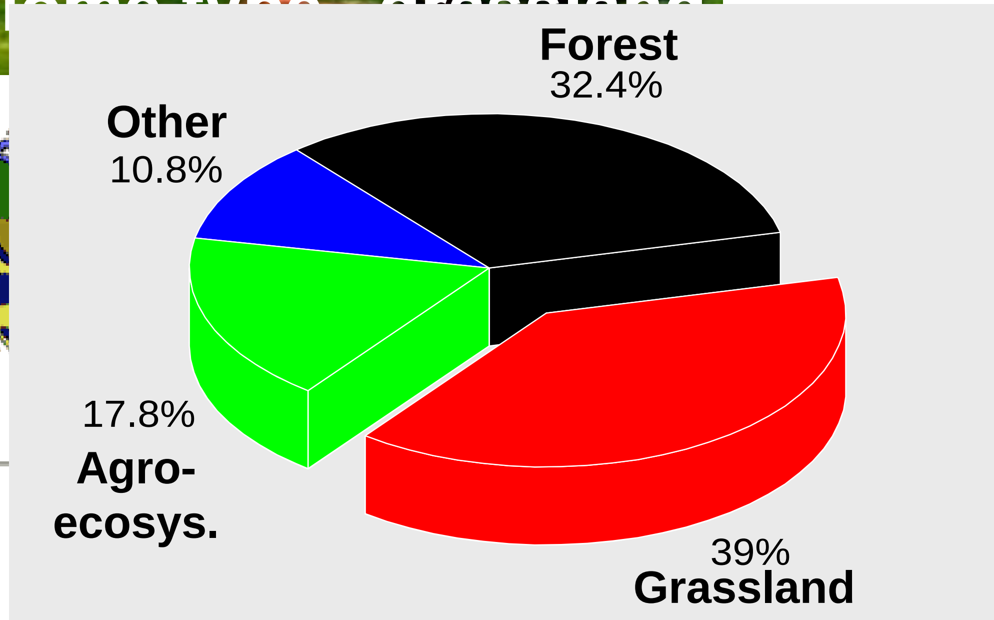
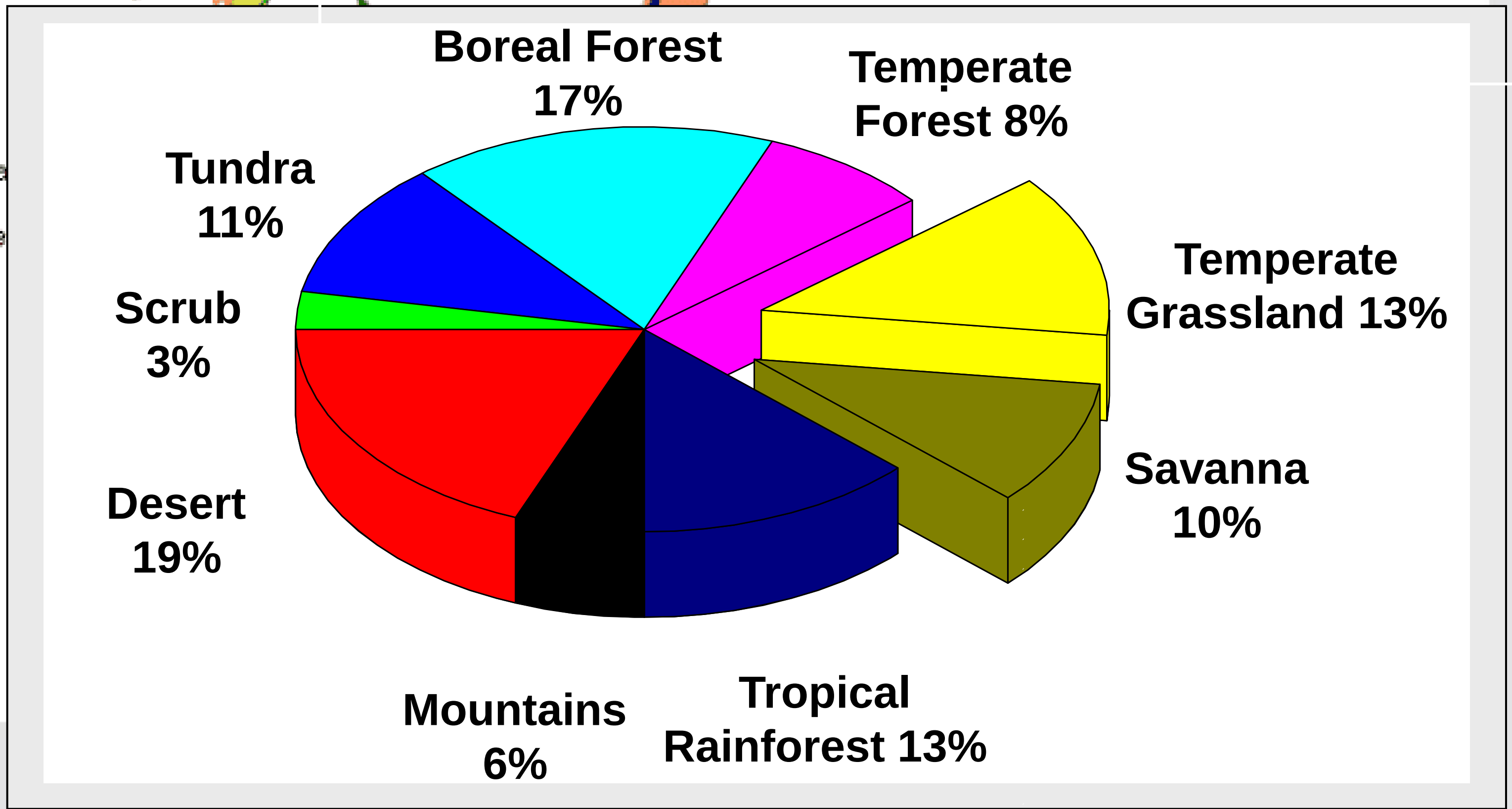
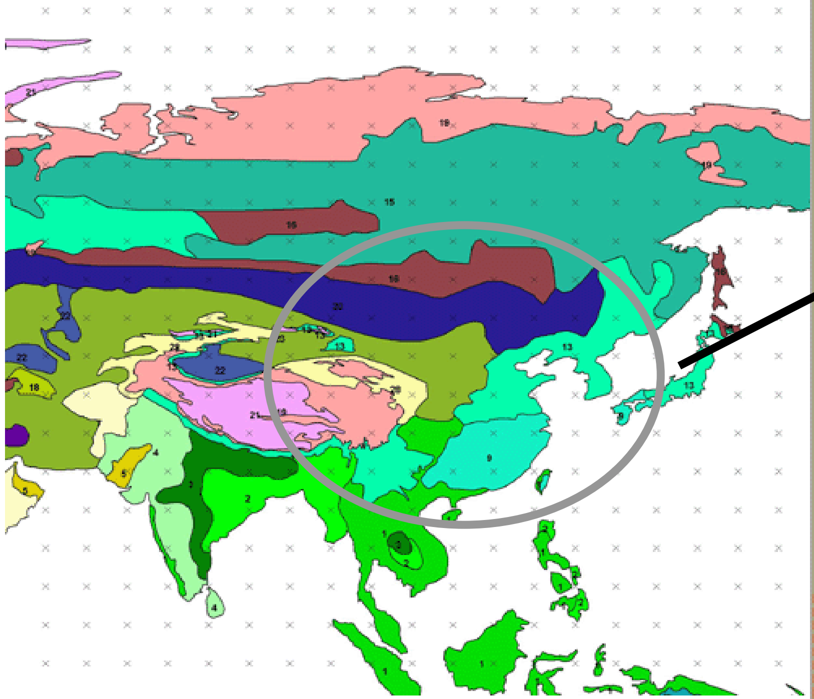
Global importance of the bi...







Location of the target region



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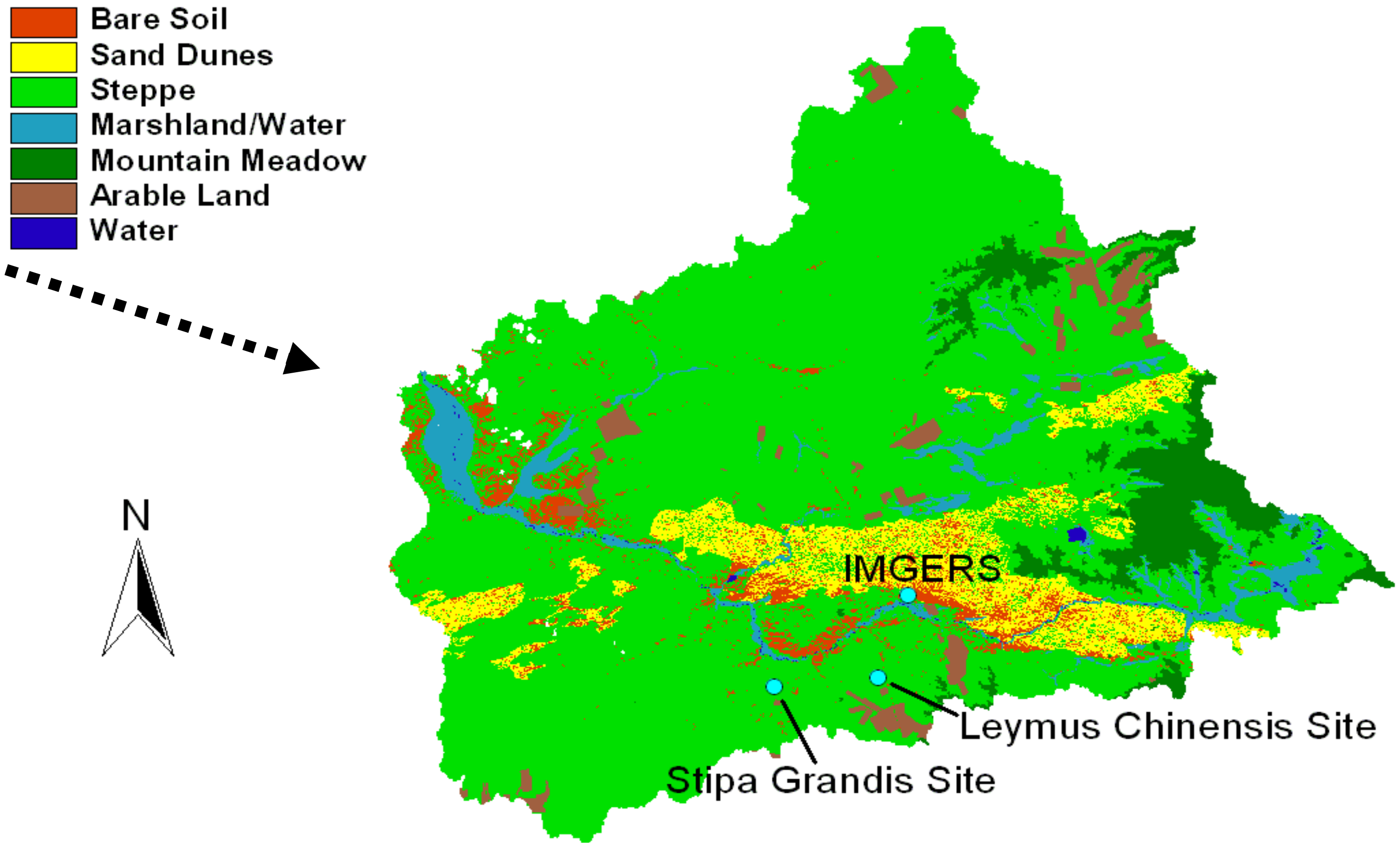

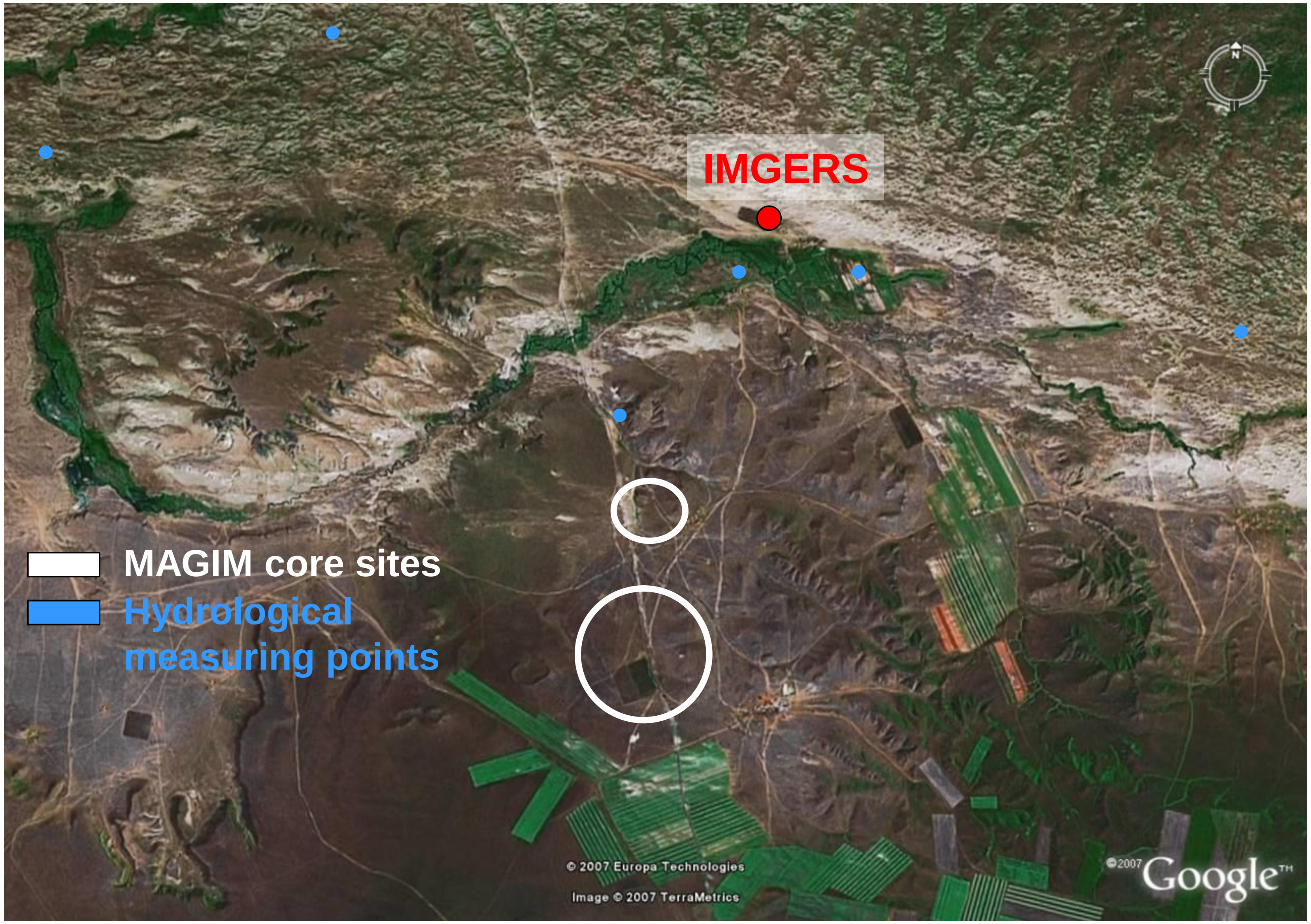
IMGERS
MAGIM core sites
Hydrological measuring points
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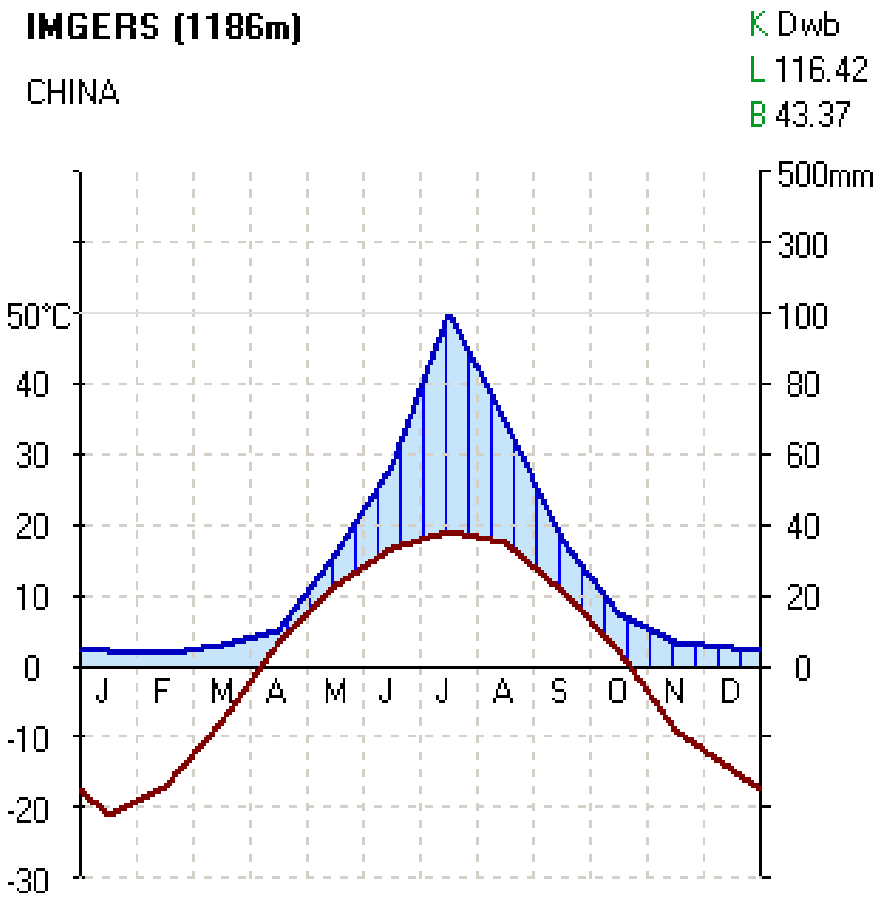
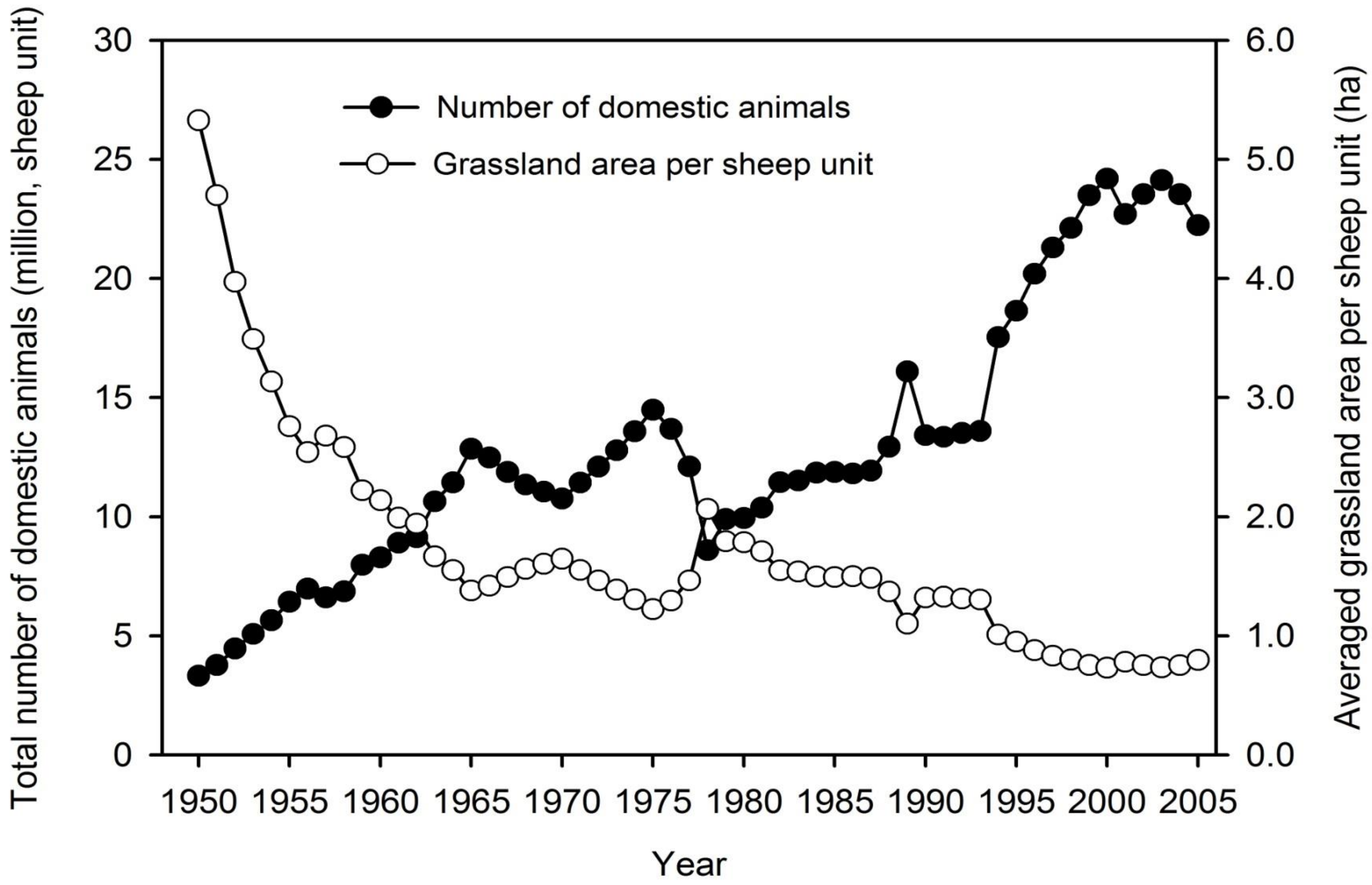
Climatic constraints



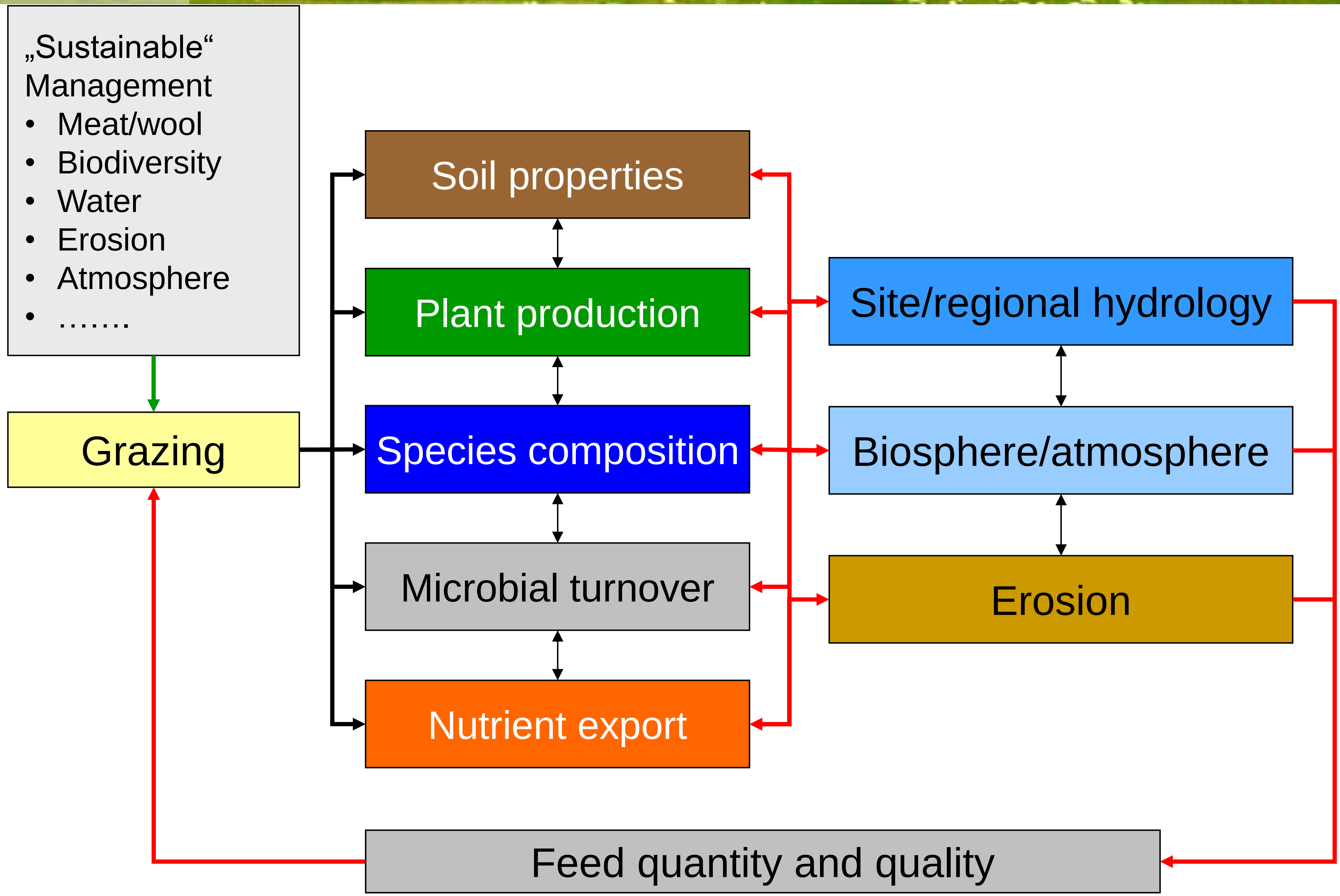
	Precipitation [mm]
Mean	343.4
2003	371.3
2004	324.6
2005	166.1

→ **The climatic conditions limits NPP and make the steppe vulnerable to land use changes and grazing intensification**

Grazing pressure and degradation



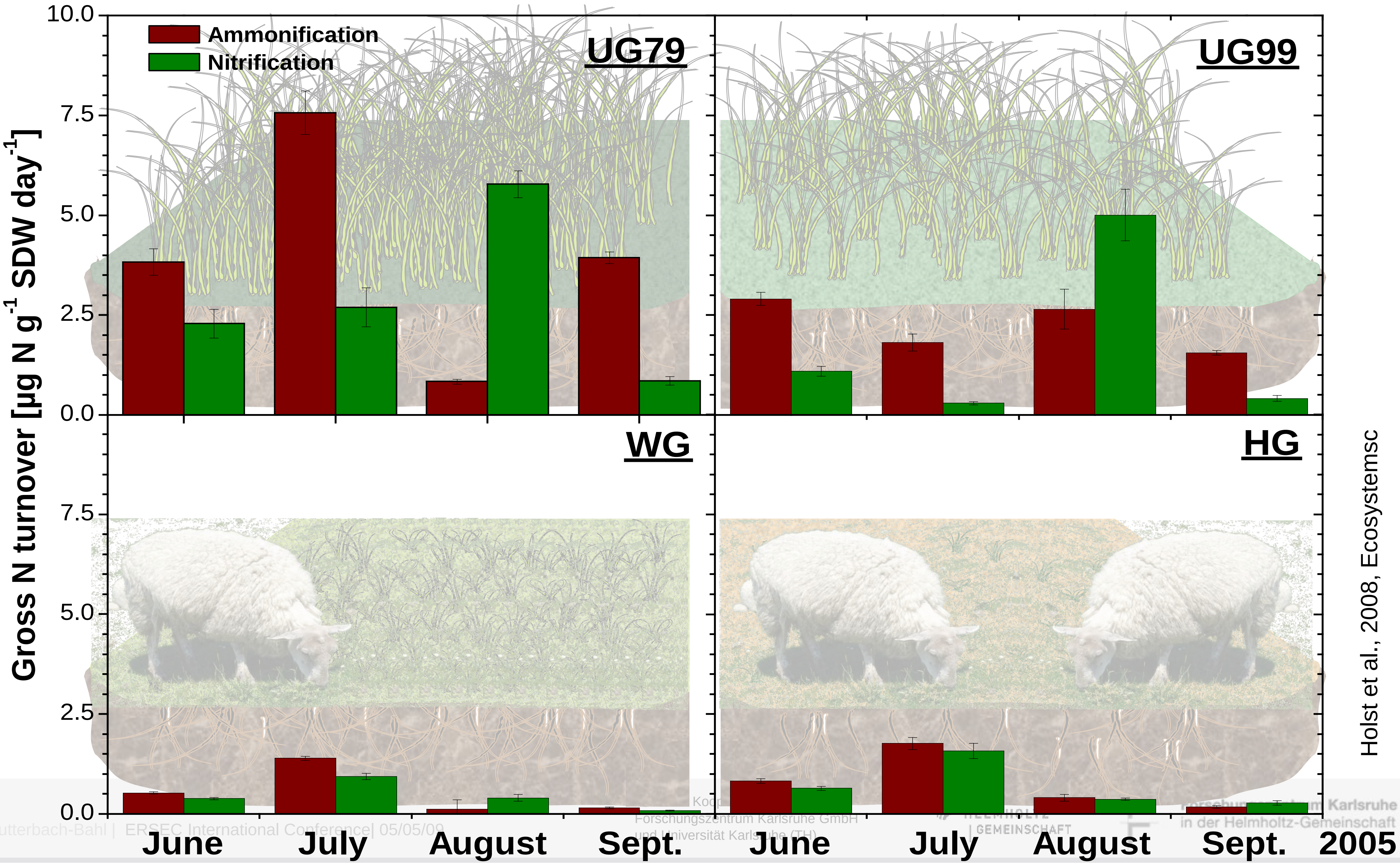
Grazing effects



Steppe degradation

Matter fluxes in grasslands of Inner Mongolia as influenced by stocking rate

Gross N turnover rates: Significant differences between grazed and ungrazed sites



Holst et al., 2008, Ecosystemsc

Grazed versus non-grazed steppe systems: N_2O

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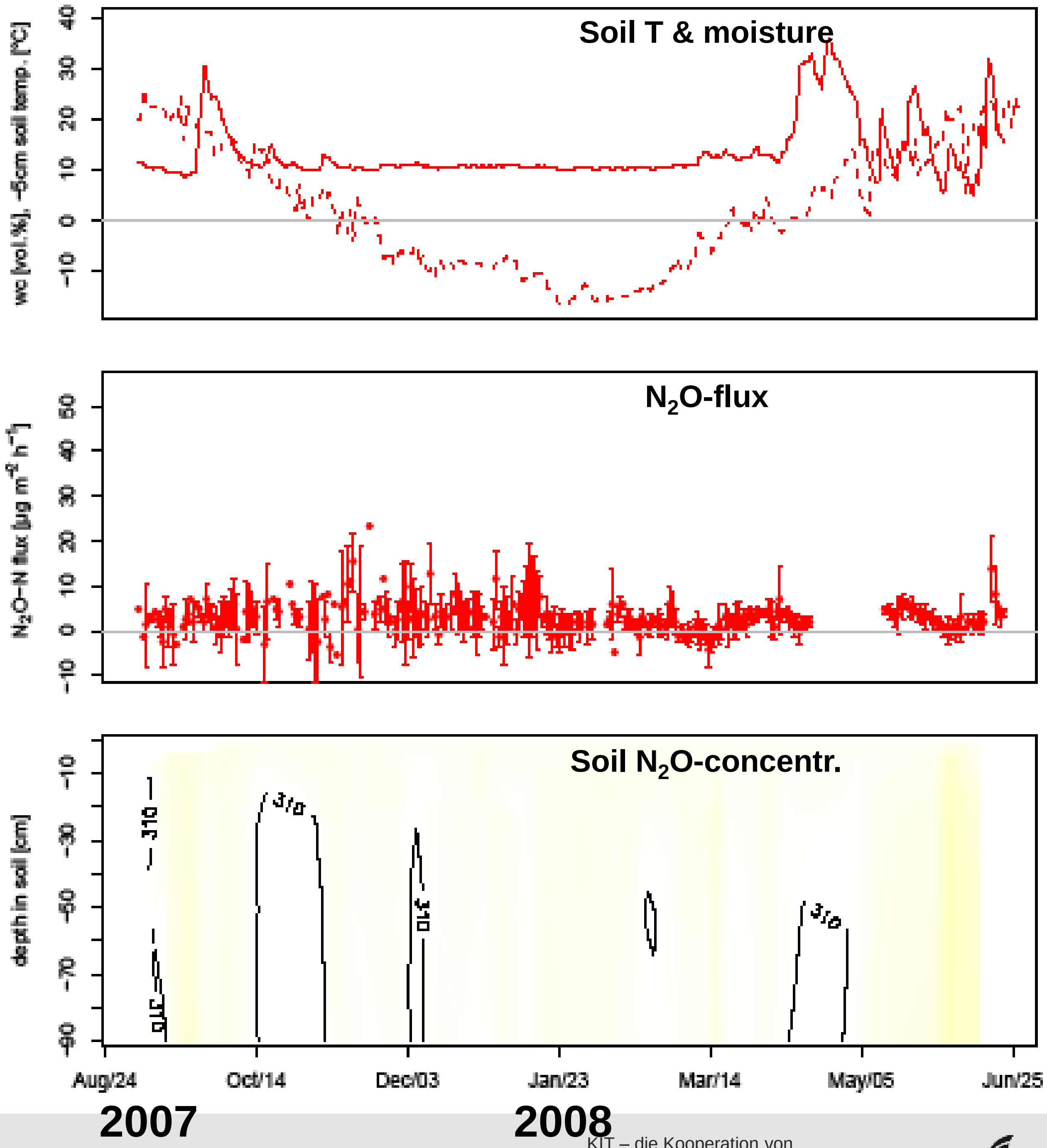

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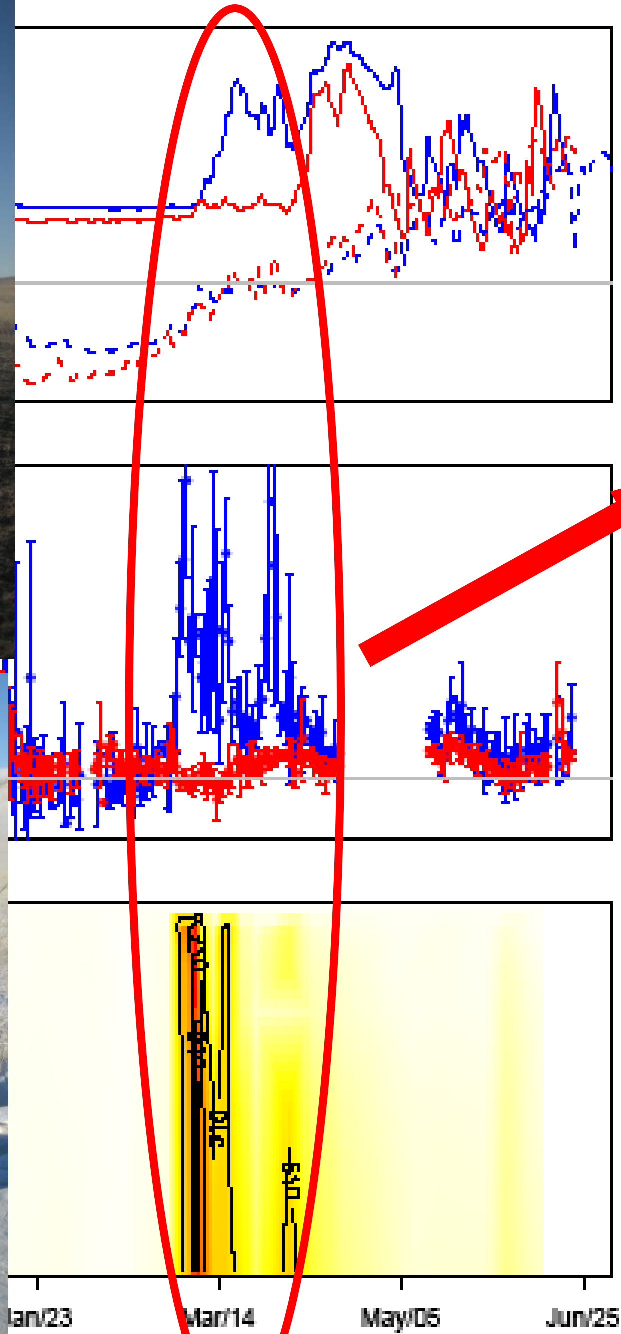
Grazed versus non-grazed steppe systems: N_2O



2007

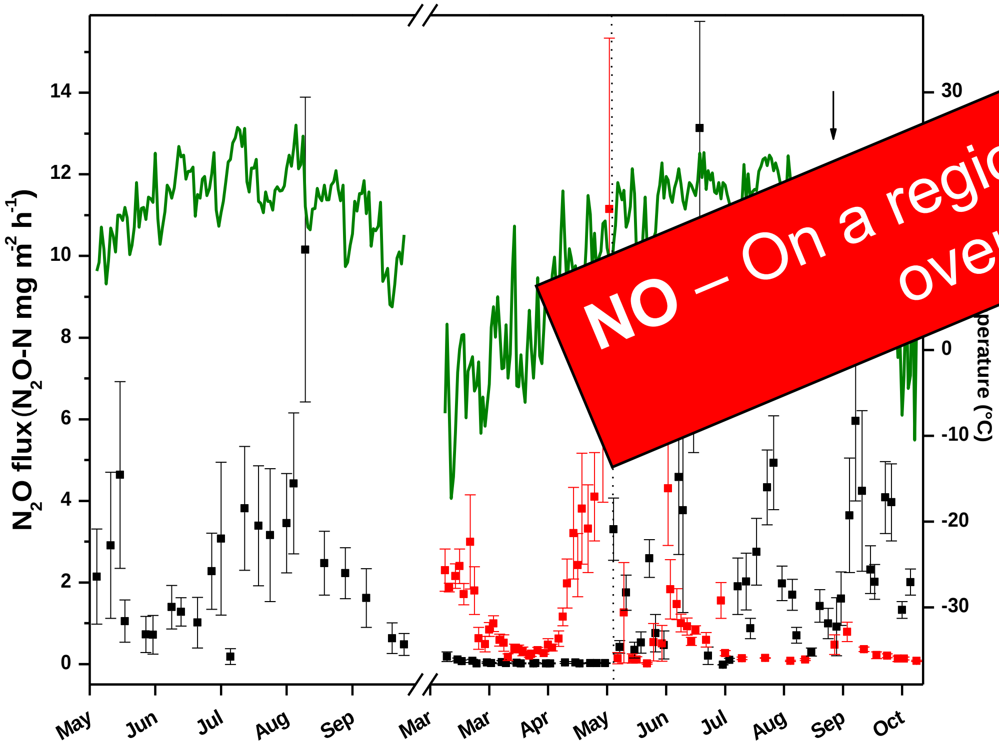
2008

Extremely high N_2O-fluxes during freeze-thaw from ungrazed steppe

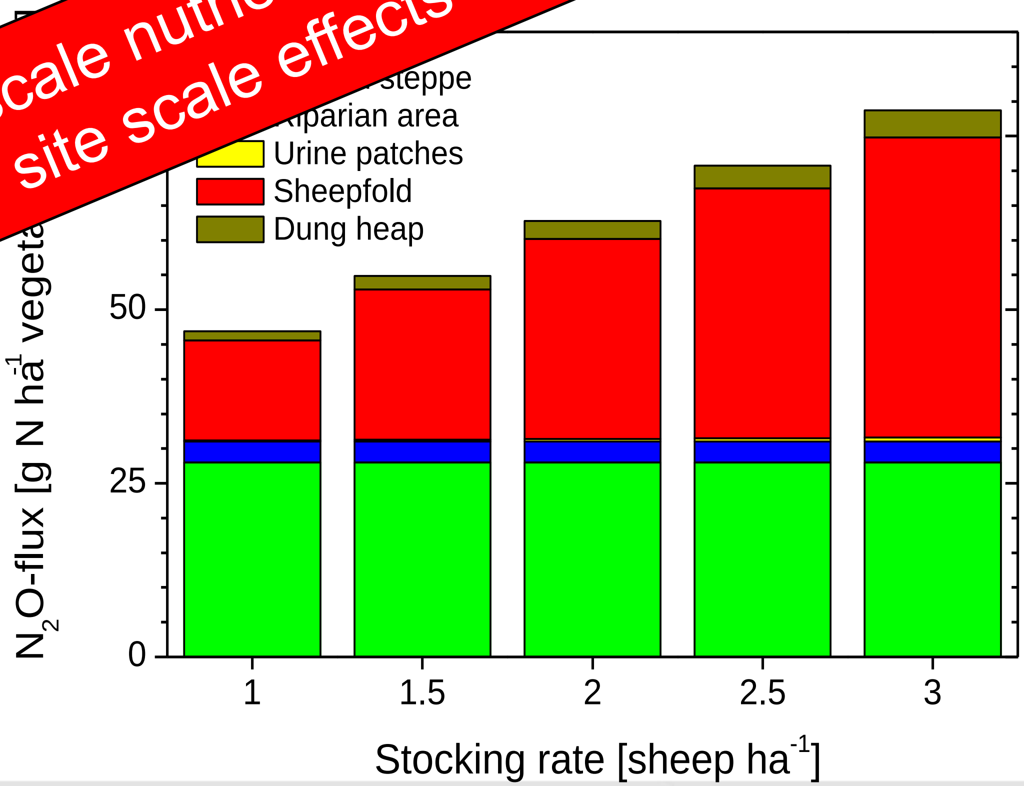
→ **>70% of annual fluxes**

Do natural steppe systems emit more N_2O than grazed systems?

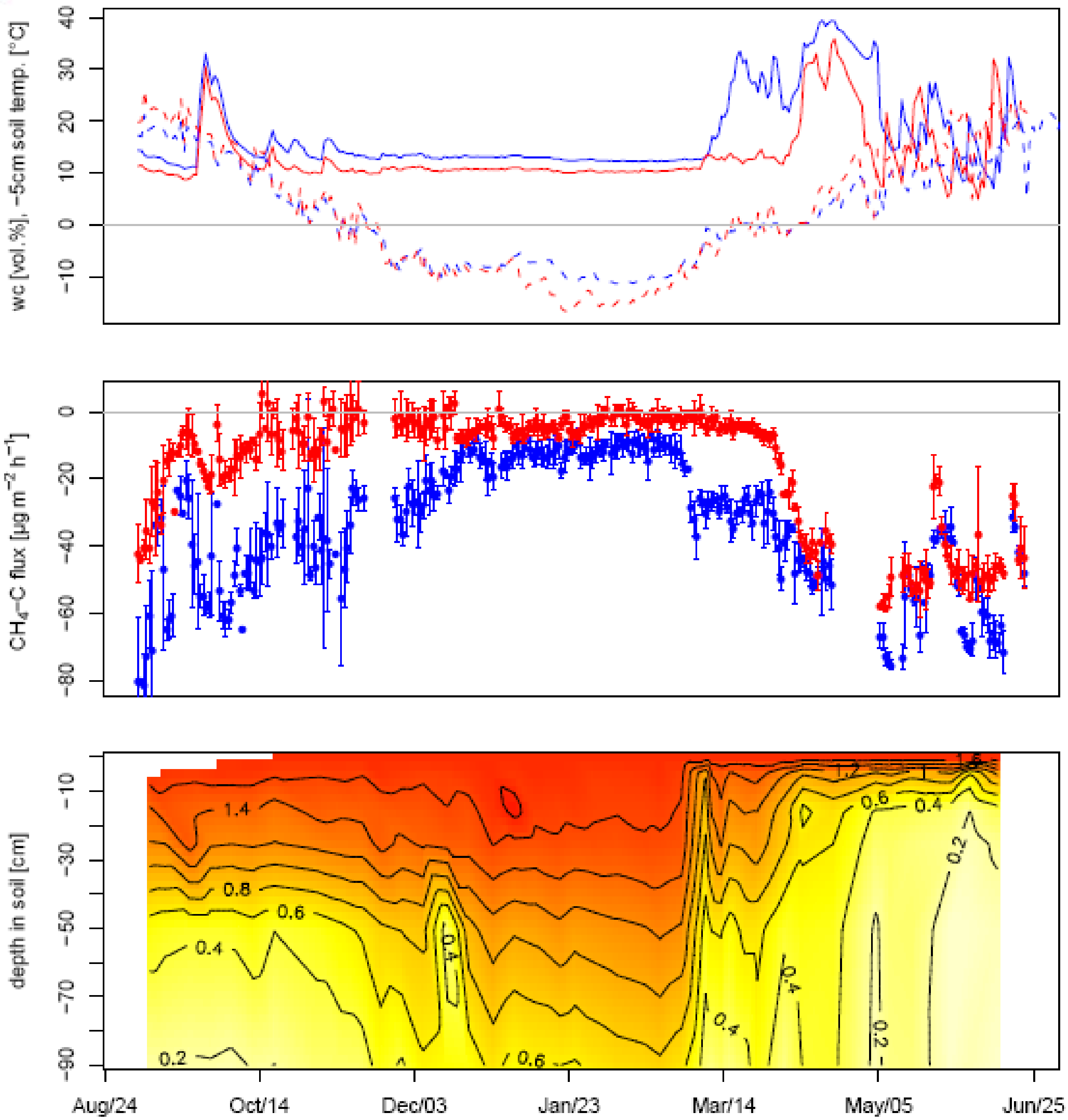
NO – On a regional scale nutrient management overrides site scale effects



Holst et al., 2007, Plant and Soil

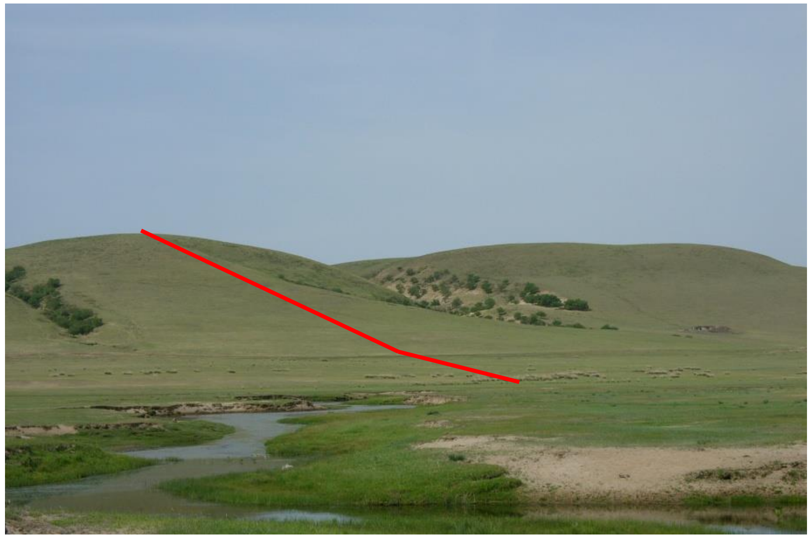


Grazed versus non-grazed steppe systems: CH_4

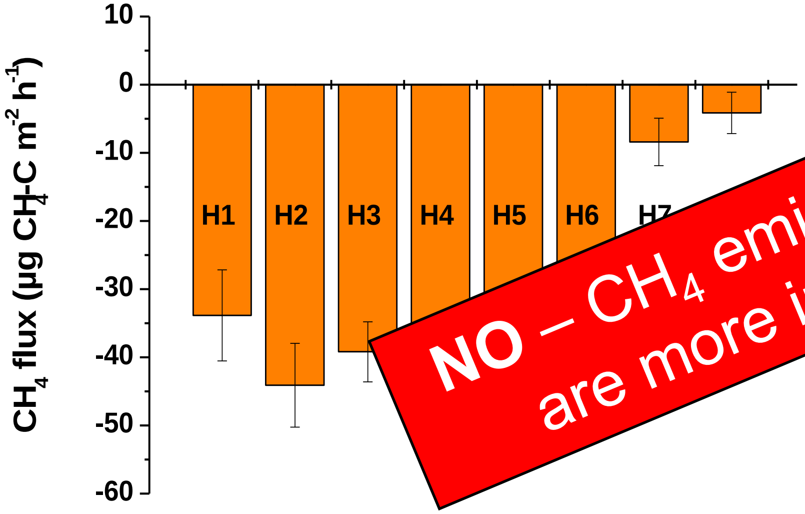


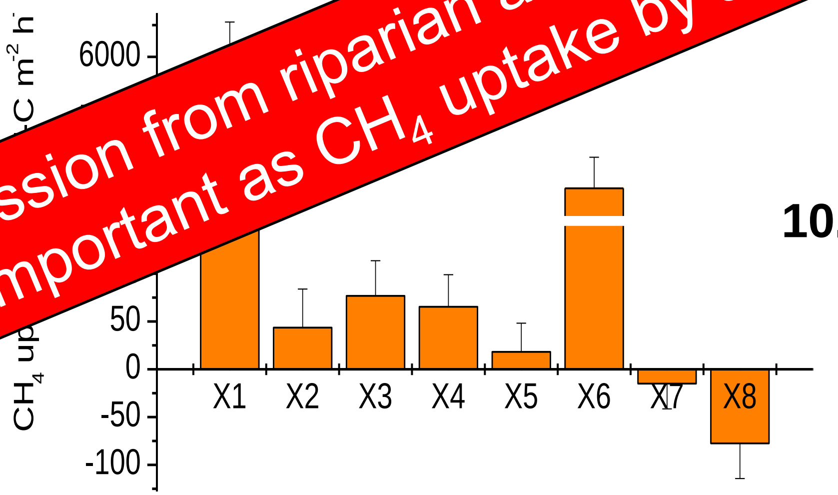
	UG	WG
Texture	sL	sL
pH	6.8±0.3	6.7±0.3
SOC [%]	2.5±0.6	2.6±0.5
Bulk dens. [g cm-3]	1.09±0.1	1.09±0.1
Gas Perm. -30kPa [cm d-1]	**99.6±67**	**55.5±38**

Do natural steppe systems take up more CH_4 than grazed systems?



NO – CH_4 emission from riparian areas and from sheep are more important as CH_4 uptake by steppe soils





Sheep CH_4 emissions
10.8 -14.3 g CH_4-C sheep day^{-1}

-50--60 µg CH_4-C m^{-2} h^{-1}

1.1 mg CH_4-C m^{-2} h^{-1}

≈2 kg C ha^{-1} growing season

≈ 70 kg C ha^{-1} growing season

≈ 2.2 kg C ha^{-1} growing season

x0.98 = -1.96 kg C ha^{-1}

X0.02 = 1.4 kg C ha^{-1}

X2 = 2.2 kg C ha^{-1}

Summary

- Grazing management has largely affected the biosphere atmosphere exchange of N_2O:
  - decreasing winter emissions
  - increase in N_2O emissions from sheep folds
- as well as of CH_4:
  - Decreasing uptake of CH_4
  - Increasing emissions from sheep
- Understanding of GHG fluxes on a regional scale requires a detailed system analysis