Geophysical Research Abstracts
Vol. 18, EGU2016-17087, 2016
EGU General Assembly 2016


# Nitrogen uptake in a Tibetan grasland and implications for a vulnerable ecosystem

Per Schleuß (1), Felix Heitkamp (2), Yue Sun (1), and Yakov Kuzyakov (1)

(1) Soil Science of Temperate Ecosytems, Univiersity of Göttingen, Göttingen, Germany (pschleu1@gwdg.de), (2) Department of Landscape Ecology, University of Göttingen, Göttingen, Germany

Grasslands are very important regionally and globally because they store large amounts of carbon (C) and nitrogen (N) and provide food for grazing animals. Intensive degradation of alpine grasslands in recent decades has mainly impacted the upper root-mat/soil horizon, with severe consequences for nutrient uptake in these nutrient-limited ecosystems. We used 15N labelling to identify the role of individual soil layers for N-uptake by Kobresia pygmaea. We hypothesized a very efficient N-uptake corresponding mainly to the vertical distribution of living root biomass (topsoil > subsoil). We assume that K. pygmaea develops a very dense root mat, which has to be maintained by small aboveground biomass, to enable this efficient N-uptake. Consequently, we expect a higher N-investment into roots compared to shoots.

The 15N recovery in the whole plants (∼70%) indicated very efficient N-uptake from the upper injection depths. The highest 15N amounts were recovered in root biomass, whereby values strongly decreased with depth. In contrast, 15N recovery in shoots was generally low (∼18%) and independent of the 15N injection depth. This clearly shows that the low N demand of Kobresia shoots can be easily covered by N-uptake from any depth. Less living root biomass in lower versus upper soil was compensated by a higher specific root activity for N-uptake. The 15N allocation into roots was on average 1.7 times higher than that into shoots, which agreed well with the very high R/S ratio. Increasing root biomass is an efficient strategy of K. pygmaea to compete for belowground resources at depths and periods when resources are available. This implies high C costs to maintain root biomass (∼6.0 kg DM m-2), which must be covered by a very low amount of photosynthetically active shoots (0.3 kg DM m-2). It also suggests that Kobresia grasslands react extremely sensitively towards changes in climate and management that disrupt this above-/belowground trade-off mechanism.