Influence of aridity on carbon isotope discrimination in leaves of *Stipa* and other C3 species in central Asian grassland

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Introduction The carbon isotope discrimination (Δ) of C3 ecosystems is sensitive to water availability. Mean annual precipitation (MAP) is the most convenient and in some cases even the only known property to quantify water availability. The study reports the effects of MAP on Δ of *Stipa* species and other C3 plants.

Material and methods *Stipa* species and were sampled along aridity transects in Inner Mongolia (China) and in the Republic of Mongolia in 2005 and 2006. Δ of *Stipa* was compared with published data of *Stipa* and of other C3 species (including samples collected along the 2005 and 2006 transects and published data) covering several years and regions around Mongolia. Weather data were taken from Climate Source Inc. and the NOAA NNDC network and geostatistically interpolated to obtain temporally and spatially resolved information for the sampling sites.

Results and discussion In 2005 and in 2006 Δ for *Stipa* species increased linearly with MAP. The slope (Figure 1 a) was the same in both years there was an offset of 1.1‰. The latter was caused by a difference of about 0.7 mm day^{-1} of precipitation during the growing season. The Δ response was the same in both years when Δ was related to the year-specific mean daily precipitation during the growing season (Figure 1 b). An unbiased generalized relation of Δ with MAP was derived for *Stipa* species in Central Asian grassland. It has a slope of 0.0063‰ mm^{-1} and predicts Δ for average growing seasons. The effect on Δ of deviations of actual from mean precipitation can be accounted for. The generalized relation of Δ with MAP was validated with published *Stipa* data (Figure 2 a). The same relationship held true for other C3 species (Figure 2 b).

Conclusions The relationships established in this study can be used to estimate the mean Δ of C3 communities from MAP or annual precipitation during the growing period and *vice versa*.
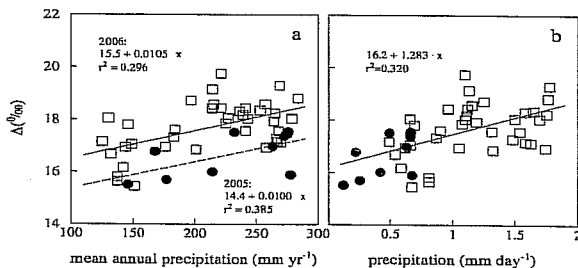
Figure 1 *(a) Relation between Δ and MAP for* <u>Stipa</u> *species for the years 2005 (●, dashed regression line) and 2006 (□, solid regression line). (b) Relation between Δ of* <u>Stipa</u> *sp. and year-specific mean daily precipitation during the growing period (April—August) for the years 2005 (●) and 2006 (□).*
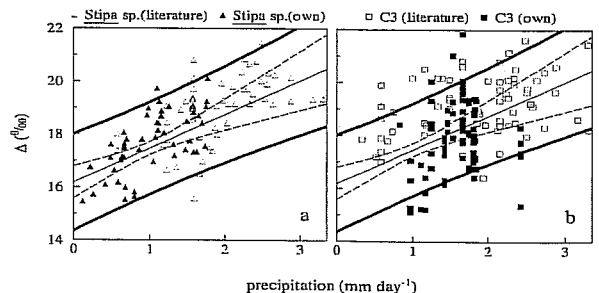
Figure 2 *Relation between Δ and mean daily precipitation (a)* <u>Stipa</u> *sp. from this study and from literature. (b) C3 species from this study and from literature.*
Bold lines denote 95% confidence interval of the individual values, dashed lines 95% confidence interval of the regression and thin line the regression, all calculated from <u>Stipa</u> *collected in 2005 and 2006.*

Reference
NOAA NNDC Climate Data Online (2006). http: //cdo. ncdc. noaa. gov/CDO/cdo.

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