Impacts of Altered Precipitation Regimes on the Distribution of Dryland Soil Nitrogen

Kwiecinski, Jarek

Drylands make up 41% of the biosphere and support 38% of the world's population. The intensity and frequency of rainfall events controls processes that drive dryland soil nutrient cycling. Climate change is predicted to alter aridland precipitation regimes. This study evaluated the impacts of predicted rainfall changes on nitrogen (N) cycling in the Chihuahuan Desert. Plots exposed to two precipitation treatments or ambient rainfall since 2007 were established to include one tussock of black gramma grass adjacent to soil biocrust. During a month-long test period, biocrust N2 fixation and biomass development were measured via acetylene reduction assay and chlorophyll a (chla) extraction respectively. A 15N tracer was used to track the translocation of N away from crusts; a 13C tracer added to plants served a similar purpose. Finally, NH4+, NO3-, and ergosterol concentrations were measured to estimate available N and fungal biomass levels.   No measurable N2 fixation was detected. Crusts and fungi collected near plants were more productive than those from soil interspaces separating grass clumps. NH4+ and NO3- concentrations were elevated near plants or in interspaces respectively. After a large rainfall event, rhizosphere NO3- levels sharply declined and did not recover. 13C and 15N were translocated between interspace crusts and roots 4 days after tracer addition. Chla and NH4+ concentrations were significantly elevated after large rainfall events before returning to lower levels. Fungi were unaffected by a lengthy dry period, suggesting their importance to nutrient cycling when water is limited. These data show that rainfall pulses prime only short-lived biological activity and illustrate the impacts of long-term precipitation variability on dryland N cycling.

Awards Won:

Fourth Award of $500