Geophysical Research Abstracts
Vol. 20, EGU2018-8800, 2018
EGU General Assembly 2018

Combining extreme drought experiments with chronic precipitation manipulations: altered species composition prevents fast recovery of ecosystem functioning

György Kröel-Dulay, Gábor Ónodi, Katalin Szitar, Barbara Lhotsky, Andrea Mojzes, and Miklós Kertész
MTA Centre for Ecological Research, Institute of Ecology and Botany, Hungary (kroel-dulay.gyorgy@okologia.mta.hu)

Review and concept papers on climate change experiments often conclude with a call for experiments that push ecosystems beyond ecological thresholds. This is becoming even more relevant with the advancement of climate change, which will increasingly lead to major shifts in ecosystem composition and functioning (regime shifts). Situations when the dominant species or lifeforms die may provide unique insights into ecosystem functioning and recovery compared to less severe perturbations.

Extreme climatic events are often catalysts of such regime shifts, but in the current climate change they act in parallel with changing climatic means. To mimic this situation, we designed a field experiment where a single extreme drought (extreme vs. control in 2014) were combined with a subsequent chronic change of precipitation (plus/minus/control in 2015 through 2017) in a full factorial design.

Extreme drought caused a very high mortality of the dominant perennial grasses and a huge decline in productivity in 2014. In 2015-2017, perennial grasses showed slow recovery in irrigated plots, and no recovery in chronic drought plots. Instead, annual species gained dominance, but these species could only partially offset productivity decline. This altered species composition thus led to a lower productivity even three years after the extreme drought. This altered species composition also led to an altered soil moisture dynamics.

We conclude that extreme events that induce shift in dominant species or life forms may have long-lasting effects on ecosystem functioning, and recovery after extreme events may depend on the weather conditions of the subsequent years. We need further studies on experimental regime shifts to understand and forecast ecosystem responses and support modelling work on such drastic changes.