Chronic drought severely alters plant species composition in arid grasslands

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Question and Methods
How does mean annual precipitation relate to severity of drought effects?

EDGE (Extreme Drought in Grasslands Experiment) used identical infrastructure to impose rainfall reductions at six sites spanning desert grassland, shortgrass steppe, mixed grass prairie, and tallgrass prairie.

We imposed chronic drought of 66% rainfall reduction in the growing season (June-October) for four years.

Results and Conclusions
We found a nonlinear, negative relationship between the mean annual precipitation of the sites and the magnitude of drought effects on the dominant plant species. This pattern was largely driven by the two driest sites, located at the Sevilleta Long Term Ecological Research site (SEV) in New Mexico.

Plant species composition between chronic drought and control treatments diverged most rapidly at the SEV sites, and compositional differences were largest at the SEV sites in the last year of treatment.

At the SEV sites, chronic drought caused an extreme drop in abundance of the dominant C4 grass species, followed by temporary booms in annual forbs.

Other sites showed similar composition changes (decreases in C4 dominants and increases in C3 subdominants or annuals in the drought treatment), but with smaller magnitudes.

Our results indicate that arid desert grasslands may be particularly vulnerable to extreme drought under future climate change.

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