Unforeseen plant phenotypic diversity in a dry and grazed world

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Résumé

Earth harbors an extraordinary plant phenotypic diversity that is at risk from ongoing global changes. However, we do not know how increasing aridity and livestock grazing pressure - two major global change drivers shape the trait covariation underlying plant phenotypic diversity. Here, we assessed how covariation among 20 chemical and morphological traits responds to aridity and grazing pressure within global drylands. Our analysis involved 133,769 trait measurements spanning 1,347 observations of perennial plant species surveyed across 326 plots from six continents. Crossing an aridity threshold of _˜0.7 (close to the transition between semi-arid and arid zones) led to an unexpected 88% increase in trait diversity. This threshold appeared in the presence of grazers, and moved toward lower aridity levels with increasing grazing pressure. Moreover, 57% of observed trait diversity only occurred in the most arid and grazed drylands surveyed, highlighting the phenotypic uniqueness of these extreme environments. Our work indicates that drylands act as a global reservoir of plant phenotypic diversity and challenge the pervasive view that harsh environmental conditions reduce plant trait diversity. They also highlight that many alternative strategies may allow plants to cope with increases in environmental stress induced by climate change and land-use intensification.

Mots-Clés: Trait diversity, functional biogeography, global dryland, plant trait spectrum, aridity, grazing, threshold

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