
The shape of the trait abundance distributions to unveil assembly rules in managed and natural plant communities

Nathan Rondeau*¹, Yoann Le Bagousse-Pinguet², Frédérique Louault¹, Raphael Martin¹, Pascal Carrere¹, Katja Klumpp¹, Pierre Liancourt³, and Nicolas Gross¹

¹Unité Mixte de Recherche sur l'Ecosystème Prairial - UMR – VetAgro Sup - Institut national d'enseignement supérieur et de recherche en alimentation, santé animale, sciences agronomiques et de l'environnement, Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement – France

²Institut méditerranéen de biodiversité et d'écologie marine et continentale – Avignon Université : UMR7263, Aix Marseille Université : UMR7263, Institut de recherche pour le développement [IRD] : UMR237 : UMR7263, Centre National de la Recherche Scientifique : UMR7263, Avignon Université, Aix Marseille Université, Institut de recherche pour le développement [IRD] : UMR237, Centre National de la Recherche Scientifique – France

³Stuttgart State Museum of Natural History – Allemagne

Résumé

Biodiversity crisis is one of the most pressing environmental issue of our time with important consequences for the functioning of ecosystems. Yet, predicting biodiversity changes requires to understand how contrasting abiotic and biotic drivers impact community assembly and dynamic. However, community dynamics are complex and influenced by stochastic factors which can blurred the effect of deterministic drivers on species assemblage, making difficult to anticipate biodiversity response in a changing world.

Plant functional trait has been as an effective tool for studying how species respond to abiotic and biotic drivers and assemble within communities. Here, we used the latest advances in community and functional ecology to explore the relationship between plant trait dynamics and biodiversity changes in response to land use intensification, a key drivers of biodiversity loss in grassland ecosystems.

We used a long-term experiment conducted over twenty years in permanent grasslands (Theix, Massif-central) to evaluate the effect of contrasting management practices on trait abundance distributions (TADs) and plant species richness dynamics. Our experiment took place in a highly productive and species poor grasslands in which four experimental management practices were applied since 2004 according to a gradient of management intensity manipulating nutrient inputs and perturbation (mowing). Management practices were kept constant for 20 years, so that inter-annual variation in community composition and diversity is not related to variation in management practices. TADs, were quantified using four traits related to species response to nutrient inputs, disturbance and plant-plant interactions: The specific leaf area (SLA) and leaf dry matter content (LDMC) revealing conservative or acquisitive strategies, and the vegetative height (VH) and leaf area (LA) characterising plant

*Intervenant

morphology.

Our study shows that plant trait dynamic was not random, and followed management dependent dynamical assembly rules. In management, without mineral supply, TADs follow a predictable temporal trajectory where communities converged towards the maximum of trait evenness. These change in trait evenness were associated with a long-term increase of species richness observed over 20 years. In contrast, in grassland managed with high N supply TADs were highly uneven, making communities unstable over time and keeping species richness at a significantly low level. Our study unravels how land use intensification is altering the underlying assembly rules driving community dynamics on multiple traits simultaneously, threatening the long-term persistence of functionally contrasting species in grasslands, one of the most species-rich ecosystems on Earth.

Mots-Clés: Trait abundance distribution (TAD), assembly rules, land use, management practices, long, term experiment, restoration, stability, trait diversity, functional evenness, skewness, kurtosis relationship (SKR)