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Long-term nitrogen input alters plant and soil bacterial, but not fungal beta diversity in a semiarid grassland

Weixing Liu[1,2] | Lingli Liu[1,3] | Xian Yang[2] | Meifeng Deng[1] | Zhou Wang[3,4] | Pandeng Wang[5] | Sen Yang[1,3] | Ping Li[1] | Ziyang Peng[1,3] | Lu Yang[1,3] | Lin Jiang[2]

[1]State Key Laboratory of Vegetation and Environmental Change, Institute of Botany, Chinese Academy of Sciences, Beijing, China

[2]School of Biological Sciences, Georgia Institute of Technology, Atlanta, GA, USA

[3]University of Chinese Academy of Sciences, Beijing, China

[4]Key Laboratory of Vegetation Restoration and Management of Degraded Ecosystems, Provincial Key Laboratory of Applied Botany, Chinese Academy of Sciences, South China Botanical Garden, Guangzhou, China

[5]State Key Laboratory of Biocontrol, School of Ecology, Sun Yat-sen University, Guangzhou, China

Correspondence
Lingli Liu, State Key Laboratory of Vegetation and Environmental Change, Institute of Botany, Chinese Academy of Sciences, Xiangshan, Beijing 100093, China.
Email: Lingli.liu@ibcas.ac.cn

Lin Jiang, School of Biological Sciences, Georgia Institute of Technology, Atlanta, GA 30332, USA.
Email: lin.jiang@biology.gatech.edu

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Abstract

Anthropogenic nitrogen (N) input is known to alter plant and microbial α-diversity, but how N enrichment influences β-diversity of plant and microbial communities remains poorly understood. Using a long-term multilevel N addition experiment in a temperate steppe, we show that plant, soil bacterial and fungal communities exhibited different responses in their β-diversity to N input. Plant β-diversity decreased linearly as N addition increased, as a result of increased directional environmental filtering, where soil environmental properties largely explained variation in plant β-diversity. Soil bacterial β-diversity first increased then decreased with increasing N input, which was best explained by corresponding changes in soil environmental heterogeneity. Soil fungal β-diversity, however, remained largely unchanged across the N gradient, with plant β-diversity, soil environmental properties, and heterogeneity together explaining an insignificant fraction of variation in fungal β-diversity, reflecting the importance of stochastic community assembly. Our study demonstrates the divergent effect of N enrichment on the assembly of plant, soil bacterial and fungal communities, emphasizing the need to examine closely associated fundamental components (i.e., plants and microorganisms) of ecosystems to gain a more complete understanding of ecological consequences of anthropogenic N enrichment.

KEYWORDS
community assembly, deterministic processes, environmental heterogeneity, N deposition, stochastic processes, β-diversity

