Synthesis of Nitrogen Fixation Rates Across Major Biomes in Latin America

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Biological nitrogen fixation (BNF) is the main pathway by which nitrogen (N) is delivered to unmanaged ecosystems. Despite the importance of BNF on understanding and modeling key ecosystem functions such as carbon storage and climate feedbacks, information on BNF rates for natural ecosystems in Latin America (LA) is quite limited. In this study, we estimated total BNF rates for major biomes in LA using a literature-derived dataset and a modeling approach. We compiled published data on free-living and symbiotic BNF rates (kgN ha^{-1} y^{-1}) from primary and mature sites located in different biomes in LA. We found enough empirical data to estimate total BNF rates only for Moist, Tropical Dry, and Temperate forests and for desert biomes in LA. Furthermore, we used the conservative global model of Cleveland et al. (1999) and mean annual evapotranspiration data (ET) from NASA GLDAS to estimate potential total BNF rates for other biomes, and further evidence on the extent of BNF rates in forest and desert biomes in LA. The model overestimated total BNF rates but still had a reasonable predictive power (r^2=0.56). We found a large spatial variably on BNF rates across biomes in LA. Literature-derived rates were higher for Moist forests (10±2) than Tropical Dry forests (4±2), and similar between Temperate forests (2±2) and deserts (2±3). Modeled rates were higher for Moist forests (14±1), mangroves (12±1), Pantanal (11±1), and savannas (10±1), followed by Tropical Dry and Coniferous forests (9±1). Modeled rates were lower for the Mediterranean biome (2±2), followed by Montane grasslands (4±2), deserts (4±2), and Temperate grasslands (6±1) and forests (5±1). This study provided the first evidence on the extent of BNF rates for a range of biomes in LA. The information obtained in this study will greatly contribute to the refinement of our understanding of Latin America's N balance and to model critical ecosystem functions for a variety of societal needs. This study was supported by the project "Nitrogen cycling in Latin America: drivers, impacts and vulnerabilities" (Nnet, IAI/CRN3005 and FAPESP 2012/06416-1), and collaborators.

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