

Abstract

Variation in the nitrogen isotopic composition of plants and soils affords an important approach for understanding the influence of environmental factors on the N cycle. In this study, $\delta^{15}\text{N}$ of leaves of three common woody plants with different growth forms was determined along a topoedaphic gradient in a subtropical savanna ecosystem in southern Texas, USA. Leaf $\delta^{15}\text{N}$ and N concentration ([N]) were measured in April and August 2005 on all individuals of *Prosopis glandulosa* (deciduous tree legume), *Condalia hookeri* (evergreen shrub), and *Zanthoxylum fagara* (evergreen shrub) present within a belt transect 308 m long x 12 m wide. Soil gravimetric water content (GWC), total N and $\delta^{15}\text{N}$ were also measured along the transect. At the landscape-scale, changes in soil GWC and soil [N] appeared to contribute to spatial patterns of leaf $\delta^{15}\text{N}$; leaf $\delta^{15}\text{N}$ was negatively related to elevation for all the three species along the topoedaphic sequence. In lower portions of the landscape, greater soil N availability and GWC are associated with relatively high rates of both N-mineralization and nitrification. Both soil $\delta^{15}\text{N}$ and leaf [N] were positively correlated with leaf $\delta^{15}\text{N}$ of non- N_2 fixing plants. Leaf $\delta^{15}\text{N}$ of *P. glandulosa*, a putatively N_2 fixing legume, did not correlate with leaf [N]; the $\delta^{15}\text{N}$ of *P. glandulosa*'s leaves were closer to atmospheric N_2 and significantly lower than those of *C. hookeri* and *Z. fagara*. Additionally, at smaller spatial scales, a proximity index (which reflected the density and distance of surrounding *P. glandulosa* trees) was negatively correlated with leaf $\delta^{15}\text{N}$ of *C. hookeri* and *Z. fagara*, indicating the N_2 -fixing *P. glandulosa* may be important to the N nutrition of nearby non- N_2 -fixing species. Our results indicate plant ^{15}N natural abundance can reflect the extent of N retention and help us better understand N dynamics and plant-soil interactions at ecosystem and landscape scales.

Key words: nitrogen isotope discrimination, N cycling, N_2 -fixing, spatial scale, nitrogen availability