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Natural abundance of ^{13}C and ^{15}N trends in Kalahari Transect

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Relationships of foliar δ^{13}C and δ^{15}N have been previously observed with rainfall, substrate age and disturbance gradients at different geographic scales. However, in most studies, different species or seasonality are combined, or soil substrate was different and therefore difficult to infer the underlying mechanisms affecting ^{15}N and ^{13}C along the gradients. In this study, foliar δ^{15}N and δ^{13}C patterns for both C_3 and C_4 plants were observed on a sub-continental scale, over the Kalahari Transect (KT), for both dry and wet seasons during 2004-2005. The KT is characterized by a distinct rainfall gradient and geologically homogeneous substrate- the Kalahari sands. For the wet season 2005, in addition to trends in foliar δ^{13}C and δ^{15}N, isotope compositions at species levels for C_3 and C_4 plants were also compared, aiming to better understand tree-grass interactions in these savanna ecosystems. Foliar δ^{15}N signatures decreased as aridity increased for both C_3 and C_4 plants in both seasons, but the magnitude of change was different for the two distinct plant functional types. Foliar δ^{13}C signatures decreased as aridity increased for C_3 plants in the wet season but not in dry season, and the relationship between foliar δ^{13}C signatures and aridity in C_4 plants were more complex. There were also significant changes in soil δ^{15}N as aridity increased. The soil δ^{15}N signatures explained approximately 95% of the total variance in foliar δ^{15}N signatures in both seasons for C_3 plants. The soil δ^{15}N signatures explained 99% and 93% of the total variance in foliar δ^{15}N signatures of C_4 plants in wet and dry season, respectively. Because the soil is the major source for plant nitrogen in this area, the strong correlation between soil and plant δ^{15}N indicated that soil δ^{15}N was the determinant factor for the foliar δ^{15}N pattern. The consistently higher foliar δ^{15}N and lower soil δ^{15}N of C_3 plants may indicate that C_4 plants are a superior competitor for N. The different foliar δ^{13}C relationship with rainfall for C_3 plants and C_4 plants

indicates different water use strategies for these plant function types.