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Mutually supportive use of stable isotope and gas chromatography techniques to understand ecohydrological interactions in dryland environments

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Many drylands globally are experiencing extensive vegetation change. In the semi-arid Southwestern United States, this change is characterised by the encroachment of woody vegetation into environments previously dominated by grassland (Van Auken. 2009). The transition from grass to woody vegetation results in a change in ecosystem structure and function (Turnbull et al. 2008). Structural change is typically characterised by an increased heterogeneity of soil and vegetation resources, associated with reduced vegetation coverage and an increased vulnerability to soil erosion and the potential loss of key nutrients to adjacent fluvial systems.

This project uses an ecohydrological approach, monitoring natural rainfall-runoff events and resulting water and sediment fluxes over six bounded plots with different vegetation coverage at the Sevilleta National Wildlife Refuge, New Mexico, USA. The experiment takes advantage of a shift in the photosynthetic pathway of dominant vegetation from C_3 piñon-juniper (*Pinus edulis-Juniperus monosperma*) mixed stand through a C_4 pure-grass (*Bouteloua eriopoda)* to C_3 shrub (*Larrea tridentate*). This allows for the utilisation of natural abundance tracing techniques, specifically stable ^{13}C isotope and gas chromatography lipid biomarker analyses.

Results collected during the 2010 and 2011 monsoon seasons will be presented, using biogeochemical signatures, to trace and partition fluvial soil organic matter and carbon fluxes during runoff generating rainfall events. Results show that biogeochemical signatures specific to individual plant species can be used to define the provenance of carbon, quantifying whether more *Pinus edulis-Juniperus monosperma* derived carbon is mobilised from the upland plots, or whether more *Larrea tridentata* carbon is lost when compared to *bouteloa eripoda* losses in the lowlands. Results also show that biogeochemical signatures vary with event characteristics, raising the possibility of using these tracing techniques to further our understanding of ecohydrological interactions and rainfall-runoff dynamics over these dryland vegetation transitions.

Turnbull, L., J. Wainright, and R. E. Brazier. 2008. A conceptual framework for understanding semi-arid land degradation: ecohydrological interactions across multiple-space and time scales. *Ecohydrology* **1**:23-34.

Van Auken, O. W. 2009. Causes and consequences of woody plant encroachment into western North American grasslands. *Journal of Environmental Management* **90** 2931-2942.