Vegetation Change in Drylands: Understanding Fluvial Fluxes via Hydrological Connectivity

Alan Puttock[1,2], Richard Brazier[1], Jennifer Dungait[2], Roland Bol[3], and Kit Macleod[4]

1) Conclusions

a. Transitions from grass-woody vegetation, result in increased heterogeneity of vegetation cover and soil resource structure.

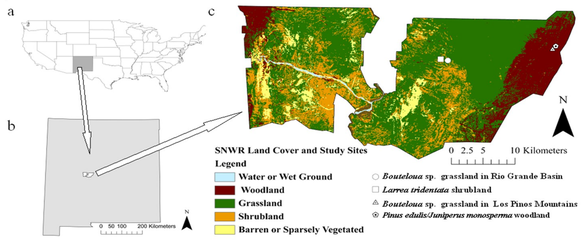
b. Reduction in vegetation cover results in increased potential for runoff generation and increased response to rainfall-runoff events.

c. Results in significantly larger fluxes of water, sediment, organic matter and carbon from shrubland/woodland in contrast to grassland.

d. Connectivity (hydrological) provides a unifying framework to understand changing ecohydrological interactions over dryland vegetation transitions.

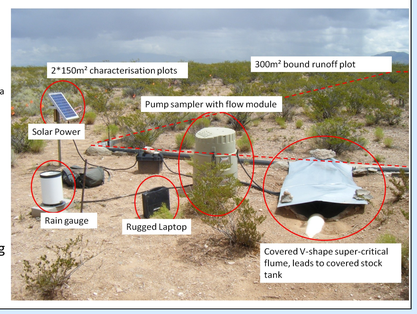
2) Project Objectives

- Characterise monitoring plots constructed across two grass-woody vegetation transitions (Structure)
- Quantify fluvial fluxes of water, sediment and carbon (Function)

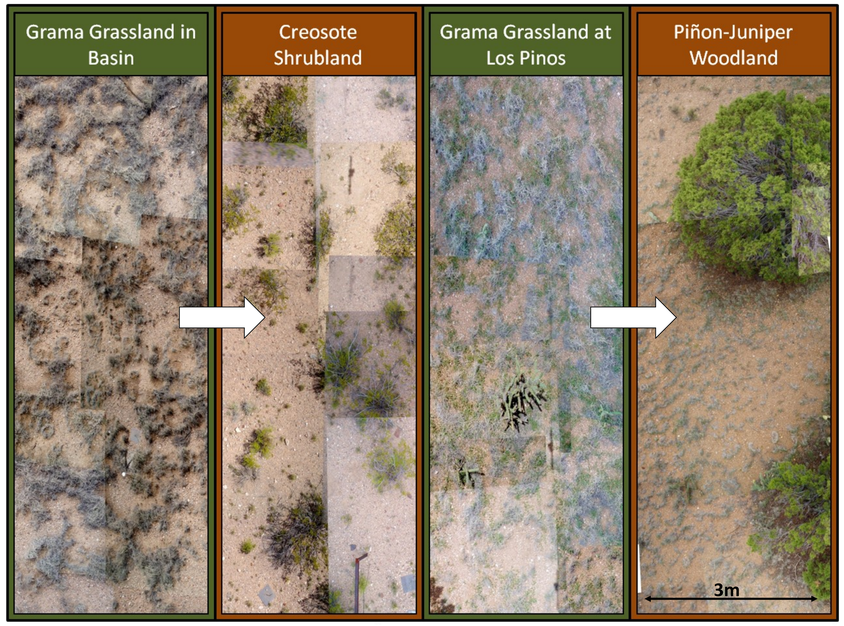


3) Methods

- Two contrasting dryland grass-woody transitions investigated (grama grassland -creosote shrubland and grama grassland to piñon –juniper woodland) at the Sevilleta National Wildlife Refuge [c], New Mexico [b], USA [a]
- Structure characterised via aerial photos and nested geostatistical vegetation and soil sampling.
- Bound and instrumented plots allow response to rainfall- runoff events to be investigated, monitoring inter event dynamics and total event fluxes of water, sediment and carbon.
- Further laboratory analysis is developing further techniques to quantify and trace these techniques using biogeochemical analysis (see abstracts/presentations: EGU2012-366 (SSS8.1) and EGU2012-2416 (HS2.8).

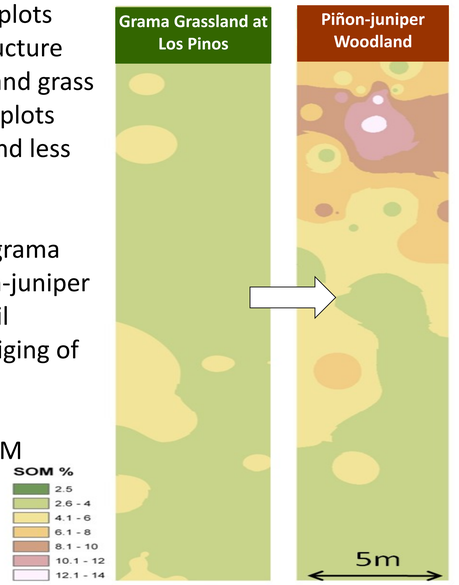


4) Change in Structure and Connectivity



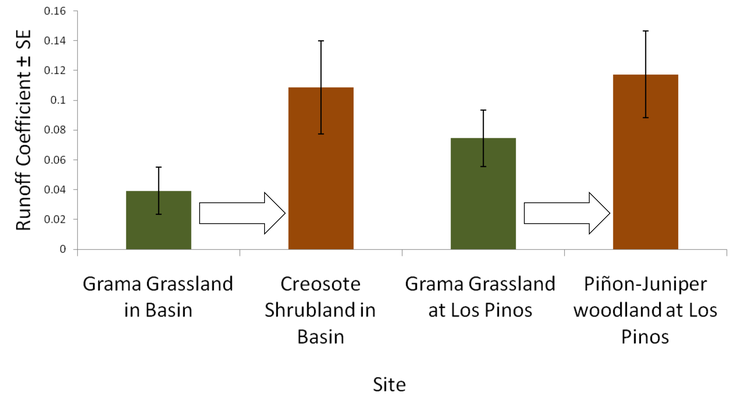
Above: Sections of rainfall-runoff plots showing change in vegetation structure over grass to creosote transition and grass to piñon-juniper transition. Grass plots overall have less % bare ground and less connected bare ground.

Right: Characterisation plots for grama grassland (at Los Pinos) and piñon-juniper sites; demonstrating change in soil resource structure by spherical kriging of SOM data. Grass plot: relatively homogenous. Piñon-juniper plot: heterogeneous with increased SOM under piñon-juniper 'islands'.



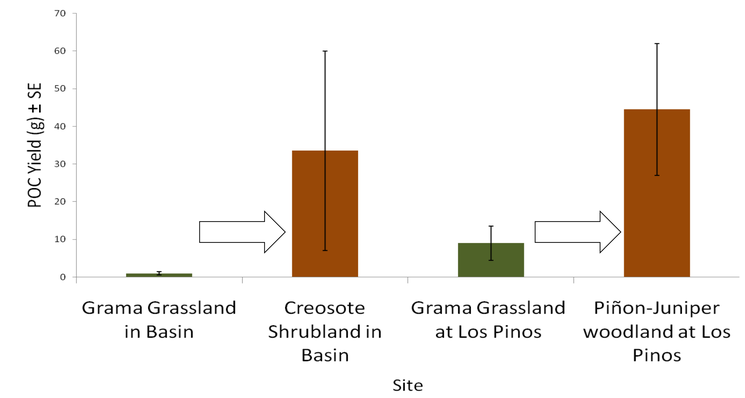
5) Change in Function

Change in structure and resulting increase in hydrological connectivity results in a larger runoff coefficient (fraction of rainfall resulting in runoff).



6) Change in Fluvial Fluxes

Increase in runoff results in larger total discharges, sediment yields and carbon yields from shrubland and woodland.



ap267@ex.ac.uk

[1]Geography, University of Exeter
[2] Rothamsted Research at North Wyke
[3]Institute of Bio- and Geosciences, Julich
[4]The James Hutton Institute