Geophysical Research Abstracts
Vol. 12, EGU2010-529, 2010
EGU General Assembly 2010

The influence of vegetation on the distribution of soil properties in a semiarid floodplain

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Floodplains rely on specific inundation patterns to maintain soil fertility and vegetation stability. Concerns have been raised that a shift in these patterns has had a negative impact on the health of floodplain ecological communities; especially in semi-arid areas where water is limited. Soil analyses on the semi-arid Lowbidgee floodplain in south-western New South Wales, Australia, were conducted to determine relationships between flood inundation frequency and the soil properties of the floodplain and adjacent hillslope, and to investigate the applicability of the resource islands concept for this environment. Soils were sampled from zones representing four flood inundation frequency categories: high (return interval every year), intermediate (return interval every five years), low (return interval every ten years) and never flooded (hillslopes). Initially, differences between soil properties in the floodplain and the hillslope were evident when vegetated and non-vegetated soils were compared. Within floodplain soils, the electrical conductivity, pH, organic content and concentrations of eight soil geochemicals were higher for vegetated soils than non-vegetated soils, suggesting the resource island concept might apply in this environment. This is somewhat counterintuitive in that floodplains are ordinarily viewed as locations of nutrient enrichment where flood events replenish and redistribute nutrients across floodplain surfaces. Although increasing evidence has been presented to suggest that this replenishment is non-uniform along topographic gradients, this work provides some of the first evidence to suggest that vegetation may also play an important role in the distribution of nutrients and other elements in floodplains. It should be noted, however, that floodplain regions were always nutrient enriched relative to surrounding hillslope areas which suggests that the entire floodplain area (even those areas between existing vegetation patches where nutrient levels are comparatively low) has the potential to support vegetative growth when water becomes available.

Comparative results for hillslope soils only identified electrical conductivity, organic content and the concentration of Na to statistically vary between vegetated and non-vegetated soils. Thus, resource islands appear to occur on the floodplain but are not evident on the adjacent flat hillslopes. This result may be a consequence of the relatively flat (slopes of approximately 0.2%) hillslopes that do not have sufficient gradient to generate erosive overland flows and, therefore, have their elements remaining immobile within the soil. Although hillslope regions were generally nutrient poor and chemically depleted relative to adjacent floodplains, the lack of any specific concentration of nutrients under vegetation implies that these hillslopes are open to colonization by vegetation when seeds are present in the soil and sufficient water is available to stimulate growth. This is a situation that is unlikely to occur on slopes where resource islands are present as the intershrub regions tend to be nutrient poor and hostile to vegetation growth.