U.S. Geological Survey Noon Seminar
Thursday, January 26th, 12:00 PM

Dennis Deconcini Environmental and Natural Resources Building (ENRB1)
Catalina Room, #253

Post-Wildfire Potential for Carbon and Nitrogen Retention and Sequestration in the Southwestern United States in Restored Ephemeral and Intermittent Stream Channels

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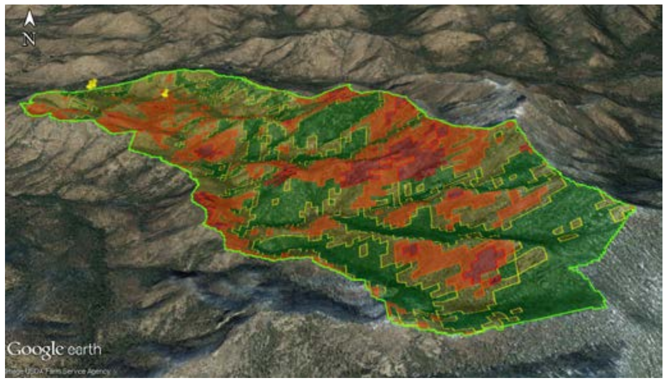
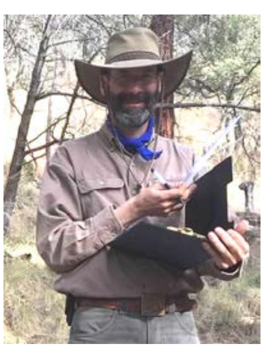


Although ephemeral and intermittent streams have characteristics of both floodplains and perennial streams, they play a unique role in ecohydrologic systems. Globally, they make up more than half the length of all rivers and streams. Yet, studies focused on their hydrologic and biochemical function remain limited, particularly with respect to carbon (C) and nitrogen (N) storage and movement. Increased frequency and extent of high intensity wildfires is causing significant losses of C and N from ecosystems through wind transport of vapor and ash, and through water transport of ash, char, and woody debris. Losses caused by water transport are exacerbated by decreased permeability of charred soils and decreased surface roughness, both of which can promote flooding, erosion, and debris flows. These in turn promote biological and chemical oxidation C and N, and consequent losses to the atmosphere. Efforts to stabilize hillslopes and reduce erosion in burned and degraded watersheds can reduce loss of C and N by promoting above and below-ground storage through capture and burial of C- and N-rich sediments, growth of new vegetation, and anoxic conditions below rising water tables. This study measured C and N and their stable isotopes in samples of sediments from ephemeral channels and hillslopes upgradient of erosion control structures (ECS). Two watersheds were sampled, one with older structures only (20-30 yr) and one with structures added after the 2011 Horseshoe 2 fire. We combined the results with information on landcover, watershed characteristics, and fire history and severity to understand sources and amount of C and N. Results indicate that ECS was linked to increased C and N content in sediments captured upgradient of erosion control structures. $\delta^{13}C$ results indicate that a higher proportion of C_3 plant material was delivered in sediments captured by post-2011 installed ECS, in the watershed that had a higher proportion of forest, a greater proportion of slopes > 30%, and greater burn severity. Additionally C/N, $\delta^{13}C$, and $\delta^{15}N$ results indicate that sediments stored upstream of older ECS in the less flood and scour prone watershed contain a combination of higher microbial biomass and a higher portion of C_4 plant material. The potential for sequestration of carbon in the southwest US was calculated using the median carbon content found upgradient of erosion control structures, yielding a conservative estimate of 0.011 Pg of carbon. Though relatively small compared to the amount estimated in previous studies to be stored globally in the top meter of soils (>1500 Pg), it is significant in terms of ecosystem services and regional efforts to promote storage and reduce losses of carbon.



About the presenter:

James Callegary is a hydrologist with the USGS Arizona Water Science Center. He specializes in the study of transboundary aquifers, and various aspects of watershed and eco-hydrology including groundwater-surface-water interactions, hydrologic effects of wildfire and watershed restoration, carbon and nitrogen transport and sequestration, and ephemeral and intermittent streams.