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Agricultural activities often contaminate watersheds with excess nutrients leading to poor water quality and eutrophication. Eastern Kentucky University's Meadowbrook Farm raises crops and livestock, contributing dissolved nutrients to the neighboring Muddy Creek watershed. Consequently, the Farm is developing methods to sequester and limit nutrient contamination.

Before phosphorous sequestration methods can be tested, the geochemistry of surface water and groundwater on the Farm need to be better understood to determine hydrological pathways. We use naturally-occurring, dissolved cations as tracers to identify the contribution of different water sources and interpret storm events.

Water samples taken from springs (groundwater), surface water, and storm water on the Farm were analyzed for dissolved cations via ICP-OES for sodium (Na^+), potassium (K^+), calcium (Ca^{2+}), and magnesium (Mg^{2+}). A V-notch weir was used to quantify volumetric flow for a rain event during tropical storm Cindy.

Ca^{2+} and Mg^{2+} concentrations (55.5-80.0 mg/L and 21.7-32.5 mg/L, respectively) and lower Na^+ and K^+ concentrations (9.6-14.8 mg/L and 1.7-18.3 mg/L, respectively) seem to predominantly characterize source groundwater. During Cindy, Ca^{2+}, Mg^{2+}, and Na^+ decreased with increasing volumetric flow rate, likely indicating dilution of groundwater. However, K^+ exhibited elevated concentrations that spike concurrently with initial discharge peaks and then progressively decrease over the duration of the storm event. We hypothesize that initial K^+ increases represent significant overland flow followed by dilution with groundwater and/or continued runoff. If nutrient runoff behavior is similar to potassium, those nutrients should exhibit peak export with initial runoff.

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