

Geomorphologic influences on bank sediments Phosphorus chemistry

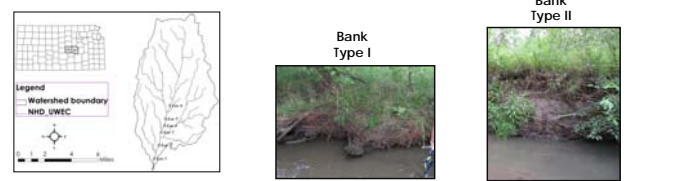
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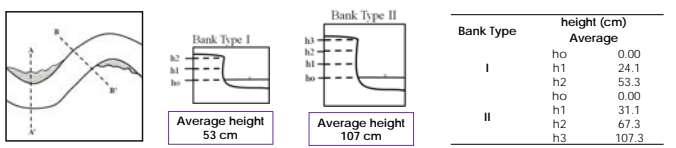
INTRODUCTION
Numerous hydrologic, geochemical, and upland processes govern the distribution, transport and fate of dissolved and sediment-bound phosphorus (P) at the watershed scale. Phosphorus is released from upland soils during runoff events and transported to stream channels. Once in the stream channel, the water interacts with sediments and soils which can alter bioavailability of P. Bank sediments play an important role in P retention and transport within stream systems because of their chemical and physical composition. Stream geomorphologic changes were noticed at Upper West Emma Creek watershed, which could affect the P adsorption behavior of bank sediments. Therefore, chemical and physical characteristics of sediments were evaluated as a function of bank geomorphology type and average height.

OBJECTIVE
To evaluate effects of stream geomorphology on phosphorus adsorption/desorption behavior at bank sediments and its influences on the stream water quality

METHODOLOGY
Eight stream bank profiles were selected along the main channel at Upper West Emma Creek Watershed.



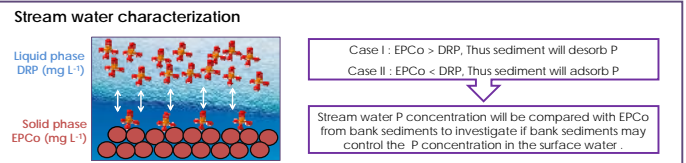
Bank categorization and sampling
Stream banks were categorized, based on height, as bank-type I (BTI) and bank-type II (BTII) with average heights of 53 cm and 107 cm, respectively. BTI were sampled at three heights while BTII were sampled at four different heights.



Bank sediments characterization

- Phosphorus Desorption Kinetics through sequential anion exchange extraction
 - Labile P (mg/kg)
 - P release rate (mg/kg h) (α)
$$\frac{\delta q}{\delta t} = \alpha \exp(-\beta \cdot q) \quad \text{Elovich equation}$$

q = mass of P released, t = time, and α , and β are constants.
- Phosphorus adsorption isotherm
 - Max. P adsorption capacity (mg/kg) (S_{max})
 - P binding energy (K_L)
$$q = \frac{S_{max} \cdot K_L \cdot C_{eq}}{(1 + K_L \cdot C_{eq})} \quad \text{Langmuir equation}$$
 - Oxalate extractable Al, Fe, and P.
 - Particle size distribution (not shown)
 - Water extractable P (P_{ex})



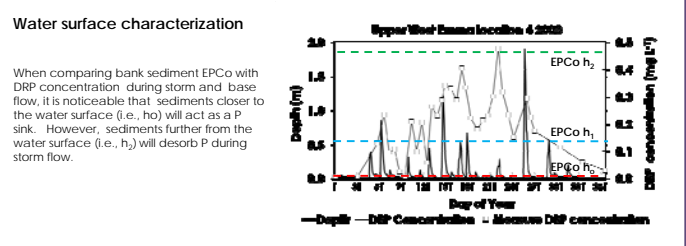
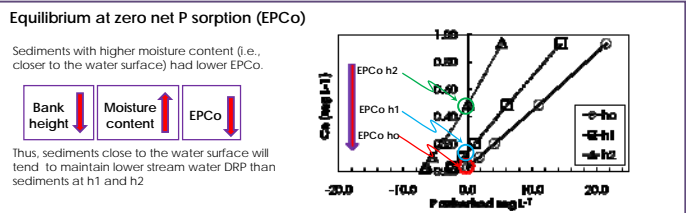
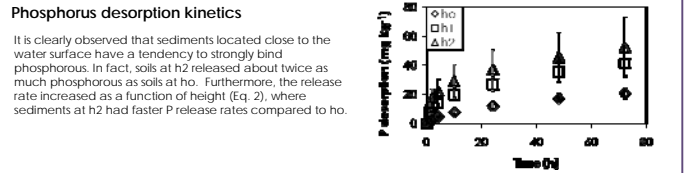
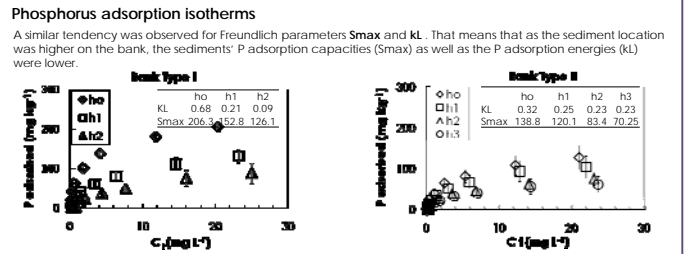
RESULTS

Statistical analysis
A multiple regression analysis showed that moisture, K_L and S_{max} were best fit by Eq. (1) $p < 0.05$, and EPCo, P release rate and Pw best fit by Eq. (2) $p < 0.005$.

$$\text{Moisture \%} = \alpha_0 + \alpha_1 h + \alpha_2 t + \alpha_3 ht \quad (\text{Eq. 1})$$

$$\text{EPCo} = \beta_0 + \beta_1 h + \beta_2 ht \quad (\text{Eq. 2})$$

Where h refers height and t refers to Type



CONCLUSIONS

- Sediments located at the top of stream banks (i.e., h2 or h3) have more potential to release phosphorus once in contact with the stream water.
- Storm flow events will increase stream water interaction with h2 and h3 sediments, resulting in P desorption and increased dissolved reactive P concentrations in the stream water.
- Erosion of sediments located at the top of the bank may have a major impact on the phosphorus concentration and transport in the stream water.
- Bank stabilization maybe an important best management practice for reducing P transport in watersheds with type F channels.



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