

Comparison of Phosphorus Retention Capacity between Floodplain Sediments and Streambed Sediments in an Agricultural Drainage Ditch



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ABSTRACT

Ditchbed sediments and floodplain sediments were collected simultaneously at three specific locations and extracted from May to August 2008. Extracted aliquots were analyzed for EPCo and PSI. Results showed that floodplain sediments P buffering capacity were higher than streambed sediments ($p = 0.0910$ at $\alpha = 0.10$ significance level). The assessment of differences in EPCo concentrations between both types of sediments was not conclusive.

INTRODUCTION

Even though a substantial number of studies have discussed the role of various biotic and abiotic processes in mediating the movement and dynamics of nutrients in stream environments, little consideration has been given to stream geometry and its role in nutrient removal.

OBJECTIVES

The objectives of this study were to determine if a significant difference exists in:

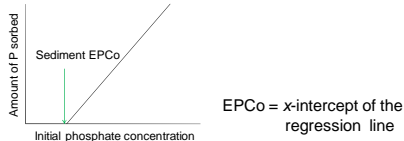
1. Equilibrium phosphorus concentration (EPCo) between floodplain sediments (FP) and streambed sediments (SB).
2. P sorption index (PSI) between flood plain sediments and streambed sediments.

METHODS

- Sediments were collected and extracted PSI and EPCo using methods outlined by Chaubey et al. (2007).
- PSI is a single point measurement of the ability of sediments to adsorb P (Chaubey et al., 2007).

$$PSI = \frac{X}{C} \quad \text{where} \quad \begin{array}{l} X = \text{mg/kg dry sediments} \\ C = \text{mg/L} \end{array}$$

- EPCo is the concentration of water column P at which net P exchange rate between benthic sediments and water is zero (Haggard et al, 2004).



STUDY SITE DESCRIPTION

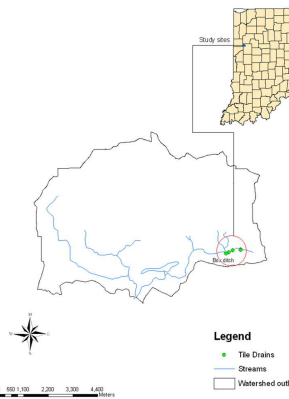
The study was conducted in Box ditch in West Lafayette, Indiana. The ditch is a headwater stream which drains approximately 1000 acres of agricultural and livestock field of corn and soybeans into Little Pine Creek-McFarland/Otterbein Watershed. The watershed is located approximately 7 miles northwest from Purdue University (northwest Tippecanoe County, Indiana) and covers 13,175.3 acres.



Box Ditch in Summer



Box Ditch in Winter



Little Pine Creek Watershed

Table 1: Water column Characteristics

Date	Sampling Location	pH	Salinity (ppt)	Dissolved Oxygen (mg/L)	Specific Conductivity (μs)	Temperature (°C)
5/6/2008	1	9.2	0.3	3.91	468.0	13.5
5/6/2008	2	8.4	0.3	3.35	445.5	11.3
5/6/2008	3	7.9	0.3	3.81	385.7	11.3
7/11/2008	1	7.8	0.1	2.93	118.7	19.0
7/11/2008	2	7.6	0.3	4.21	519.0	17.9
7/11/2008	3	7.7	0.3	3.99	618.0	19.8
8/11/2008	1	7.5	0.4	1.21	652.0	21.8
8/11/2008	2	7.4	0.4	1.50	656.0	22.3
8/11/2008	3	7.9	0.3	1.70	500.0	24.2



Sediment Collection



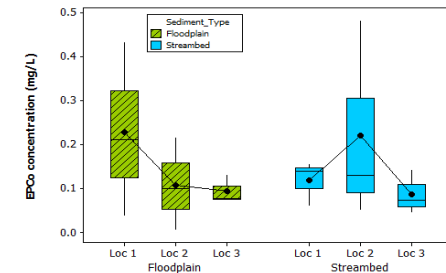
Sediment Extraction

RESULTS

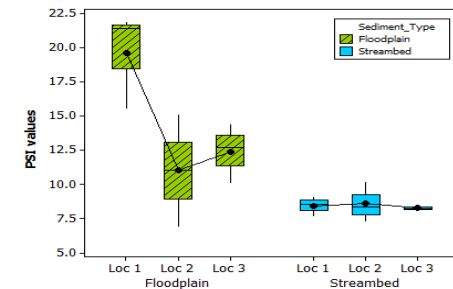
Table 2: Mean EPCo and PSI values

	PSI		EPCo (P mg/L)	
	Floodplain	Streambed	Floodplain	Streambed
Location 1	19.62	8.45	0.228	0.119
Location 2	11.02	8.59	0.108	0.221
Location 3	12.40	8.26	0.095	0.087

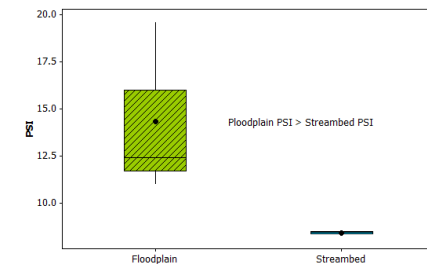
FP EPCo vs. SB EPCo



FP PSI vs. SB PSI



Mean FP PSI vs. Mean SB PSI



CONCLUSIONS

- Floodplain PSI > Streambed PSI.
- Evaluation of EPCo between the two types of sediments was inconclusive; more study is needed.