Nutrient and Sediment Cycling and Retention in Urban Floodplain Wetlands

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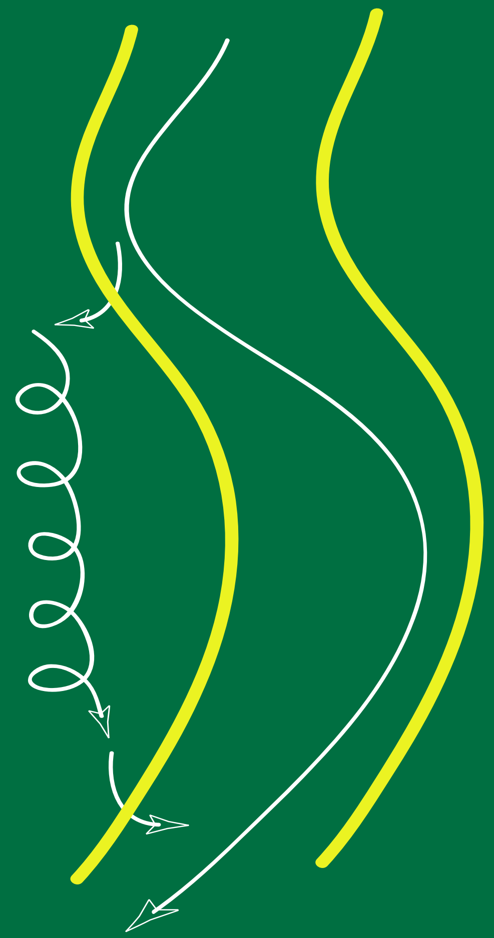
Floodplain nutrient and sediment retention

Floodplains are last location in watersheds for significant material retention before river loading into coastal waters

What are nutrient cycling and sediment deposition rates?

What are the controls?

What is the percent retention of river loads by floodplains?



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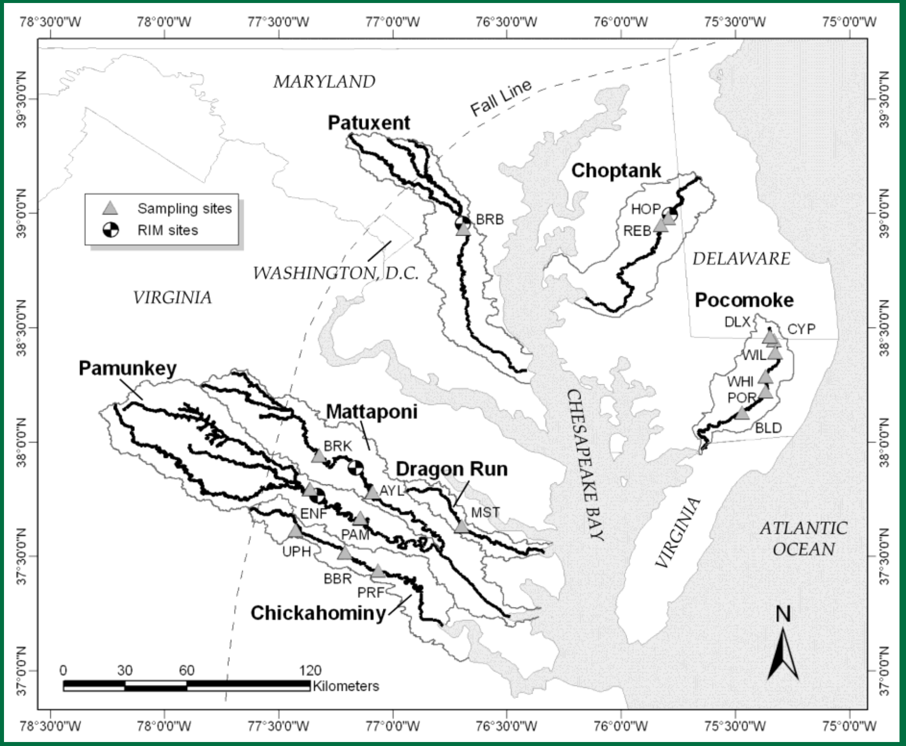
Coastal Plain floodplains trap large nutrient loads

1) Measured sedimentation fluxes in plots
2) Scaled to entire CP extent of floodplain
3) Compared to river load

$$\frac{g\ m^{-2}\ yr^{-1} \quad \times \quad m^{2}}{g\ yr^{-1}}$$

Percent retention for 7 rivers:

	Median	Range
Nitrogen	22%	(5 to 150%)
Phosphorus	59%	(14 to 587%)
Sediment	119%	(53 to 690%)



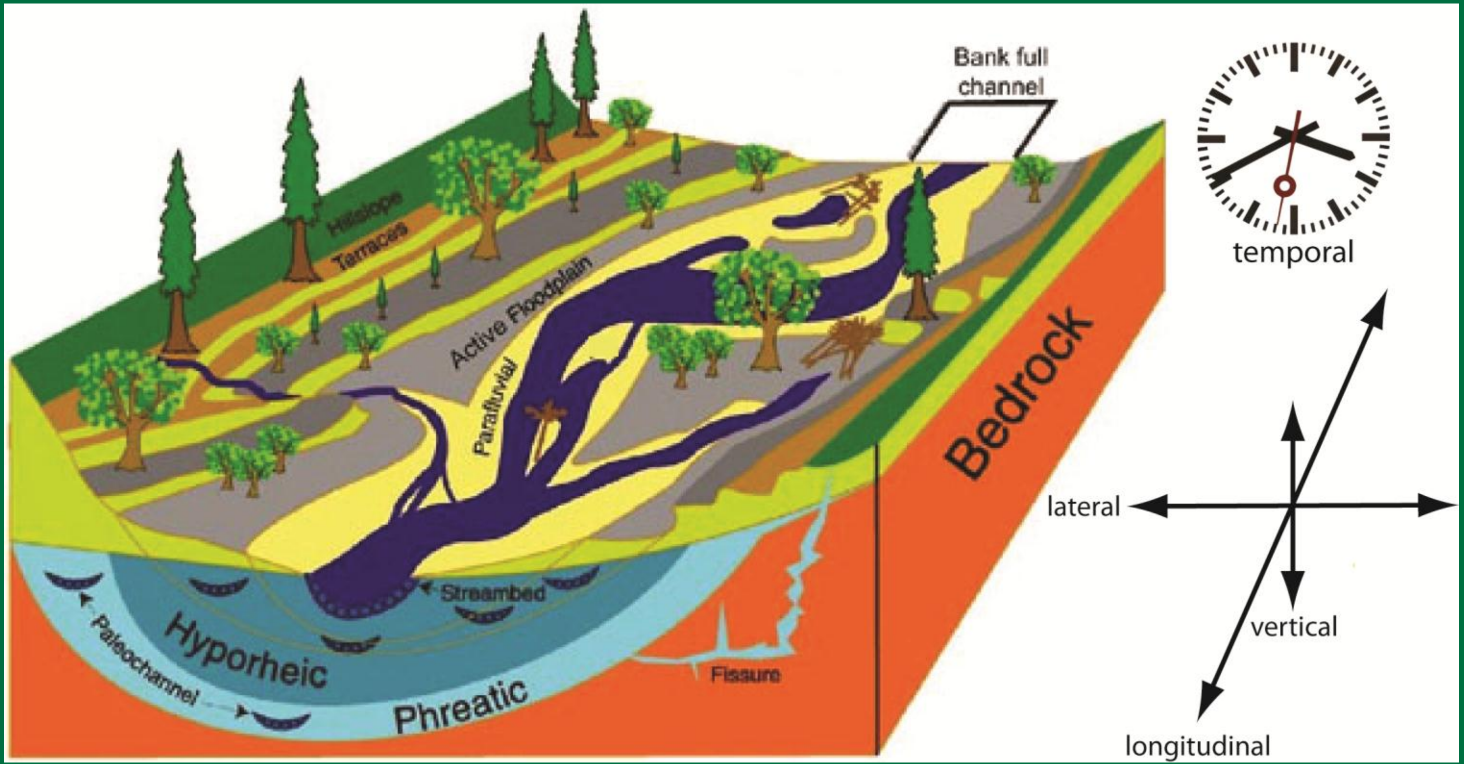
Noe and Hupp. 2009. *Ecosystems*.

USGS

Hydrogeomorphic controls in floodplain ecosystems

Four dimensions of river corridors influence floodplain ecosystem processes through river-floodplain ***hydrologic connectivity***

This heterogeneity is critical to the prediction and scaling of floodplain effects on water quality



Noe. 2013. *Treatise of Geomorphology.* Modified from NRC 2002.

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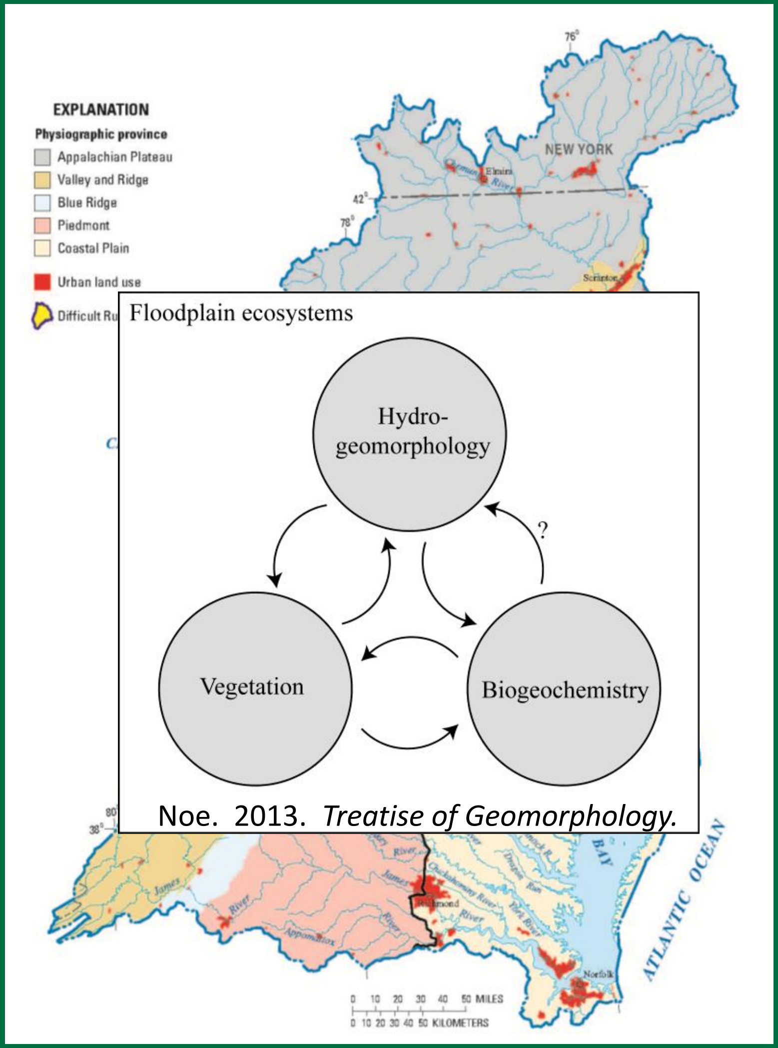
Difficult Run Floodplain Study

measuring sediment and nutrient retention along lateral and longitudinal floodplain gradients in an urban, Piedmont watershed



Noe. 2013. *Treatise of Geomorphology.*

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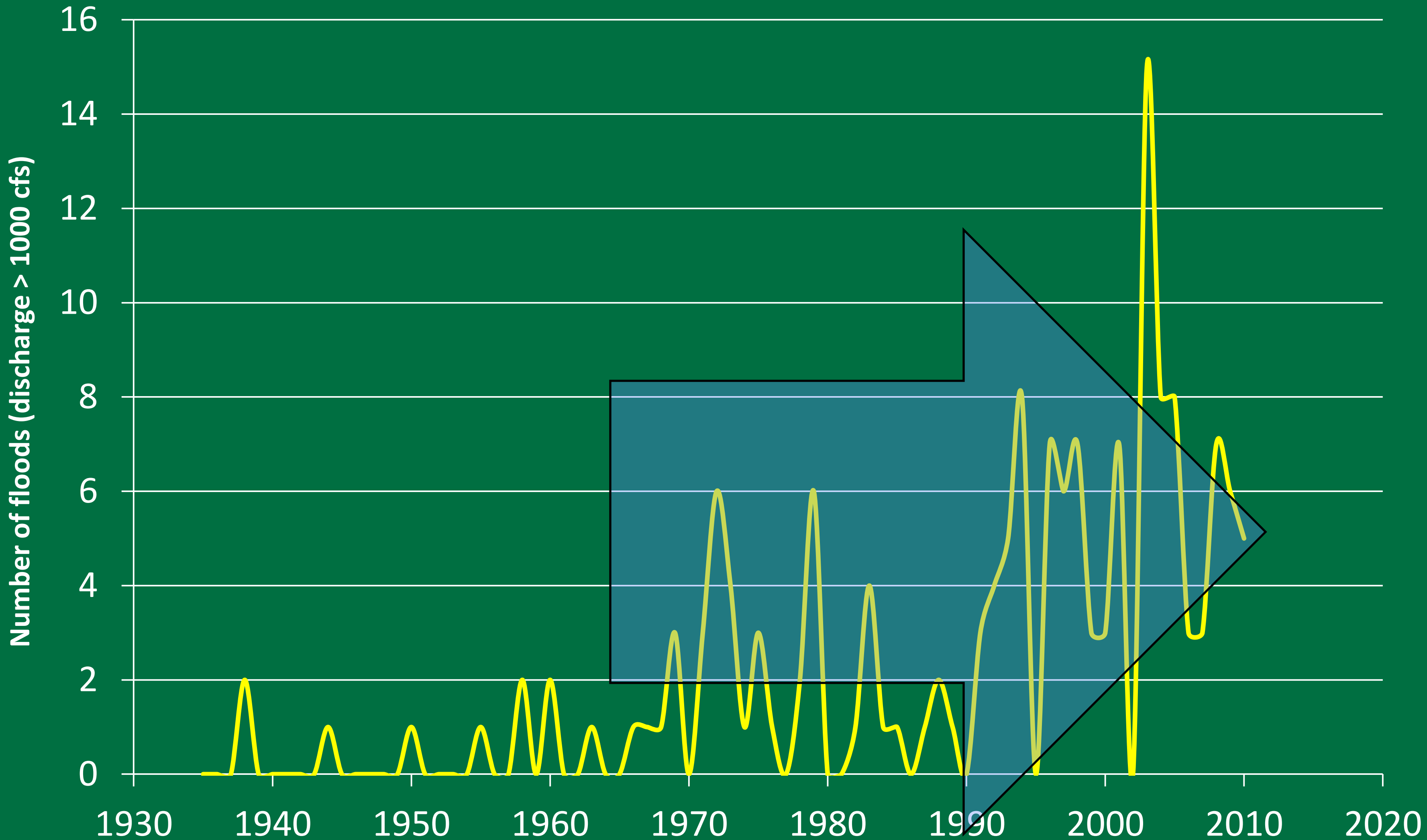
Urbanization influence on flooding



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Hupp et al. *in review*

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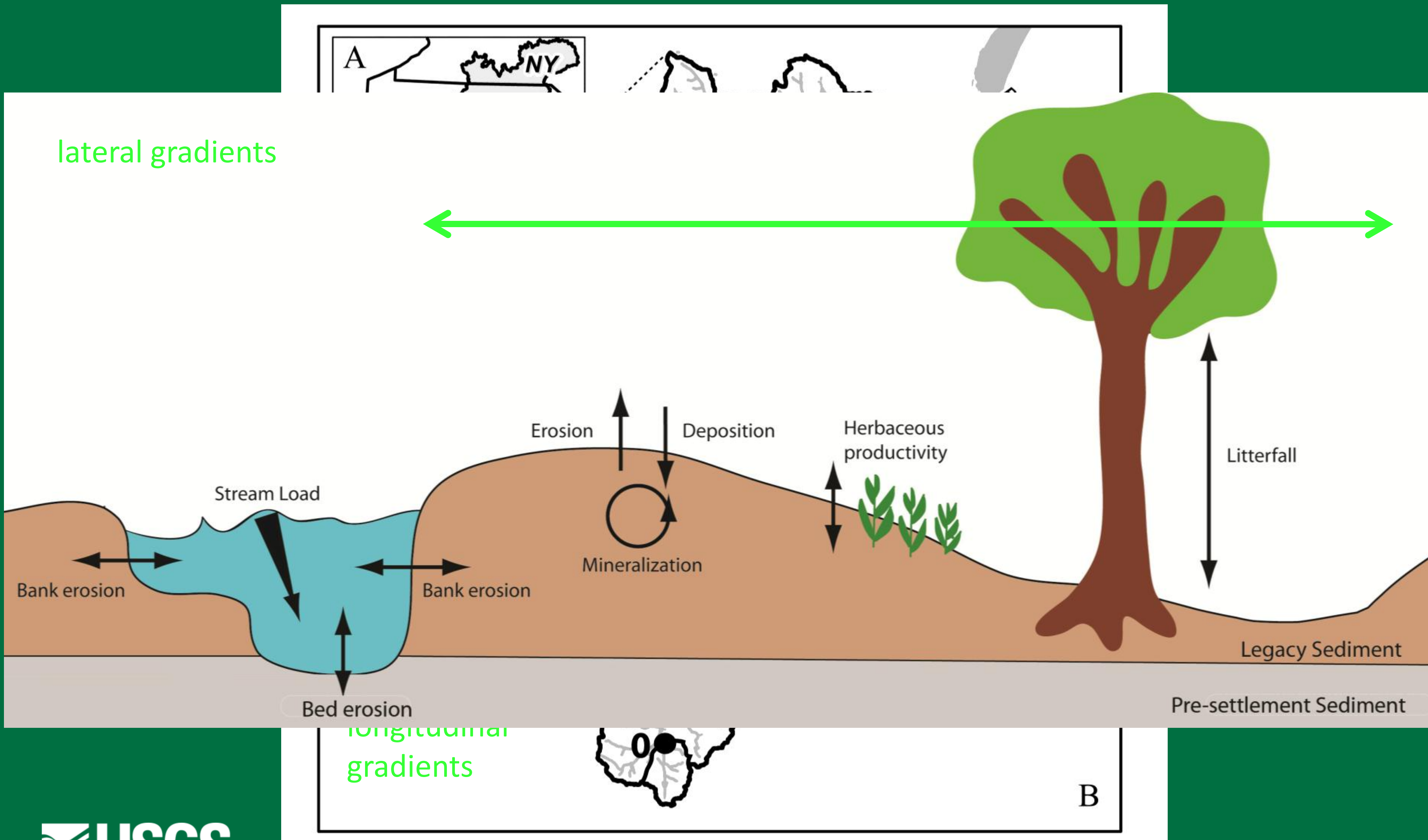
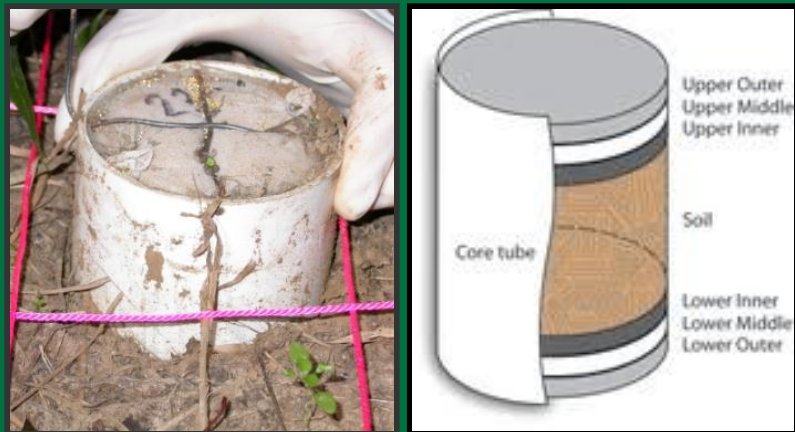


Ecosystem process measurements

Mineralization



CO_2 flux

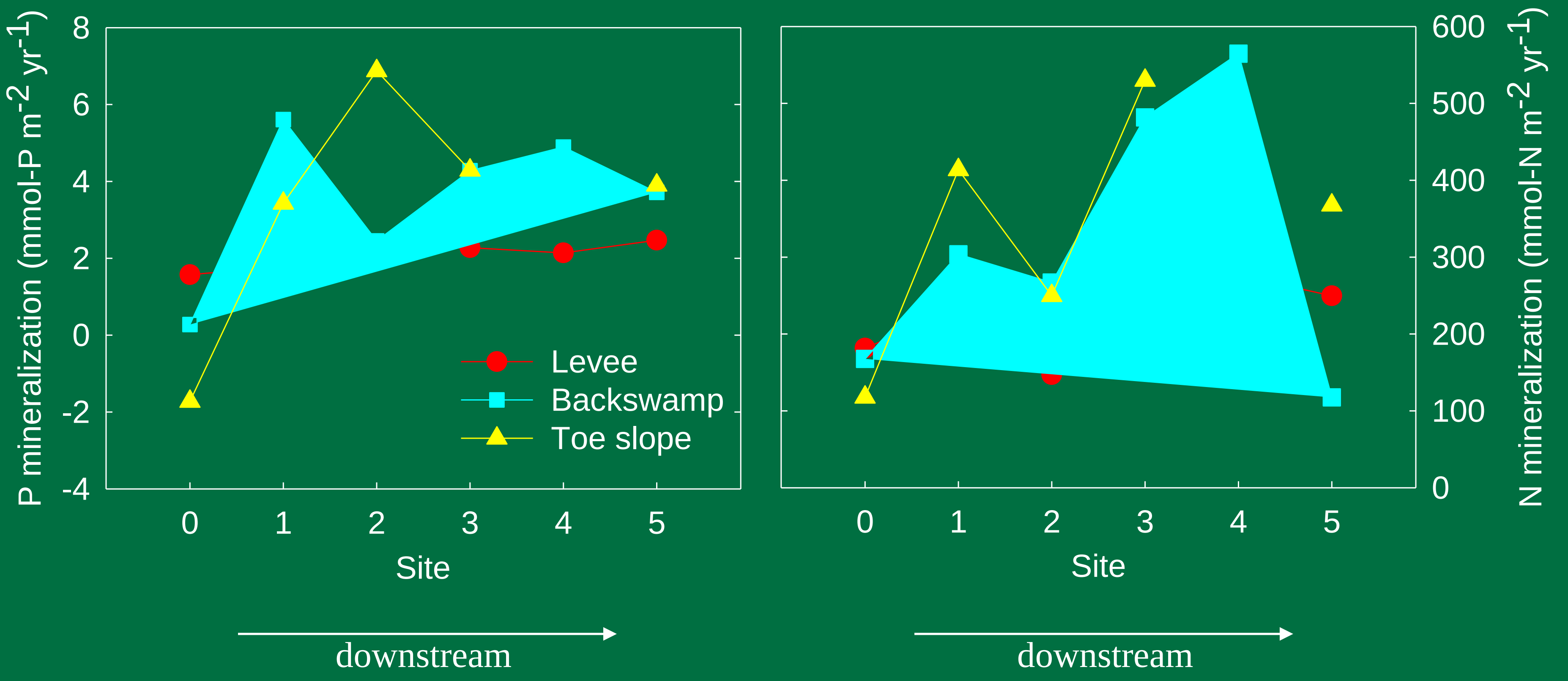
Hydroperiod

Litterfall

Sedimentation

Bank erosion

Annual net mineralization rates



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Noe et al. *in review*

Turnover of soil N and P pools

Rate	Areal mineralization (mmol m^{-2} yr^{-1})	Turnover rate (mol mol^{-1} yr^{-1})	Turnover time (yr)
P mineralization	3.60	0.0027	369
N mineralization	319	0.046	22

% nitrification	66%

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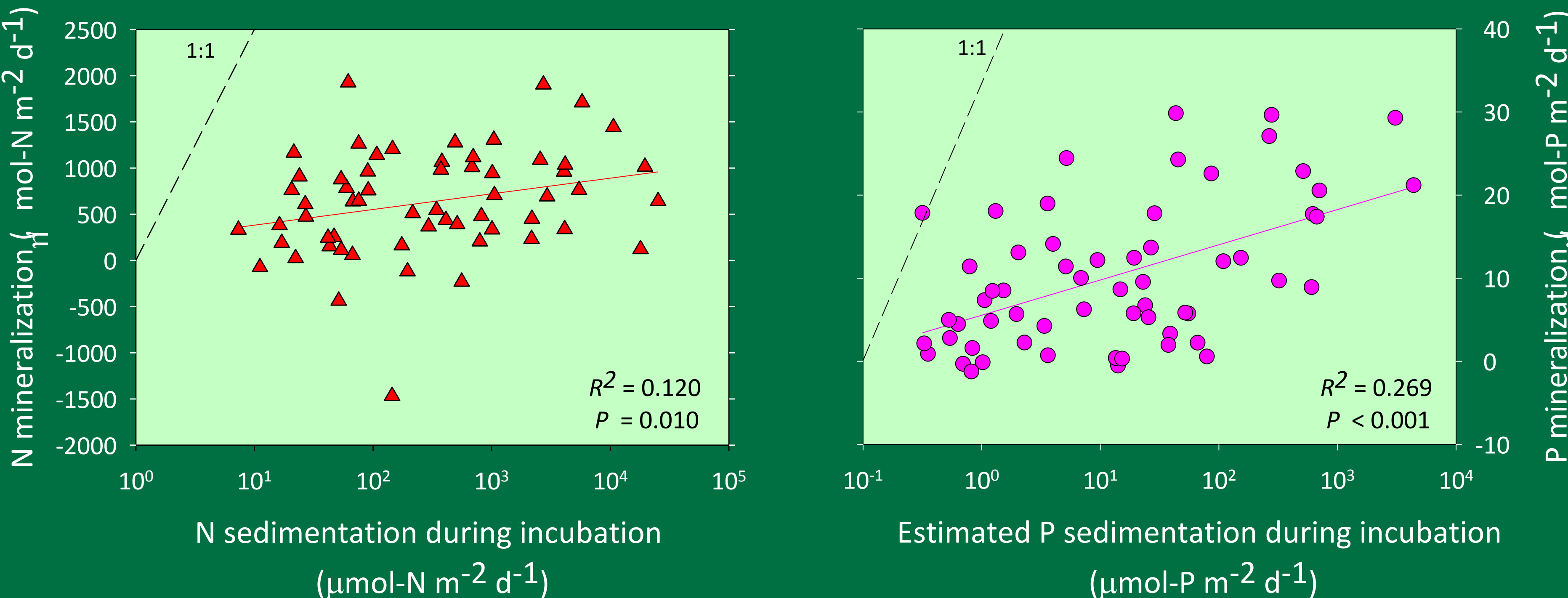
Noe et al. *in review*

Sedimentation stimulates mineralization



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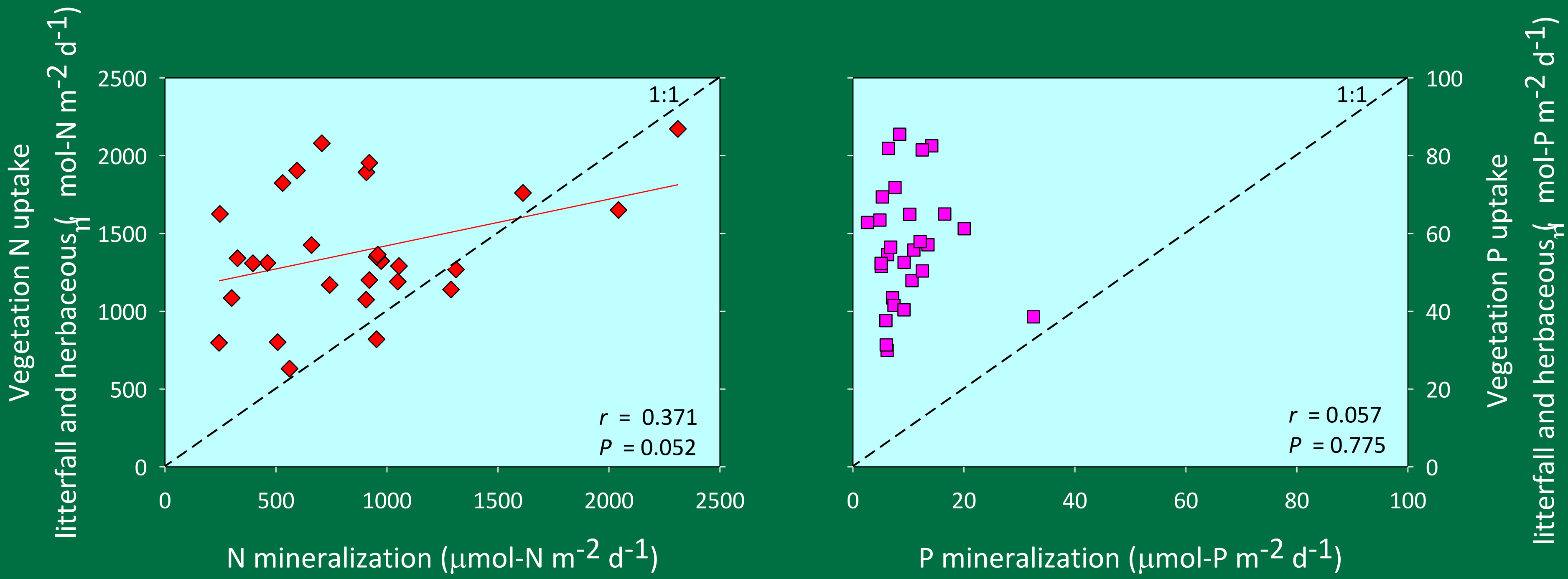
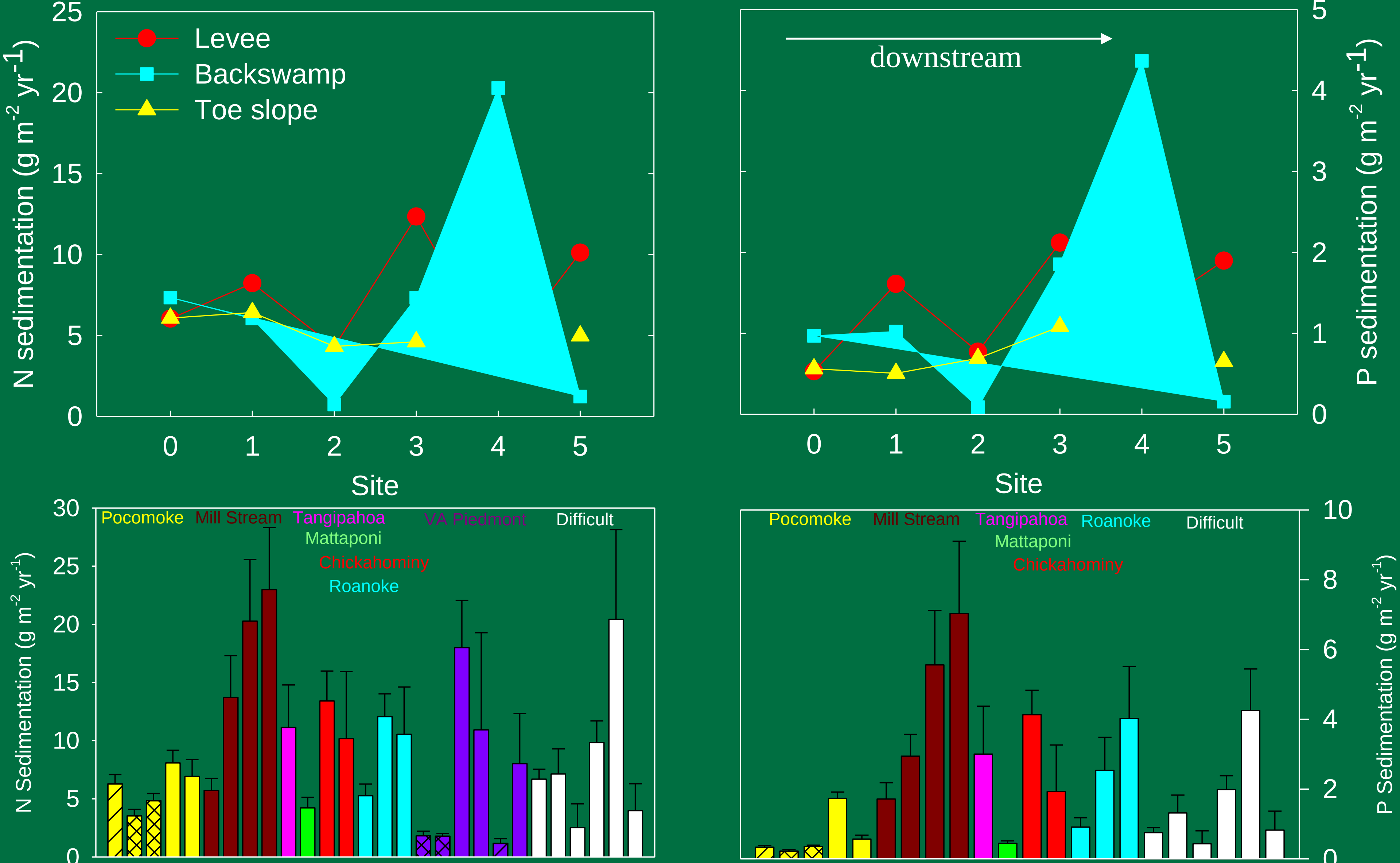
Noe et al. *in review*

Plant uptake vs. mineralization

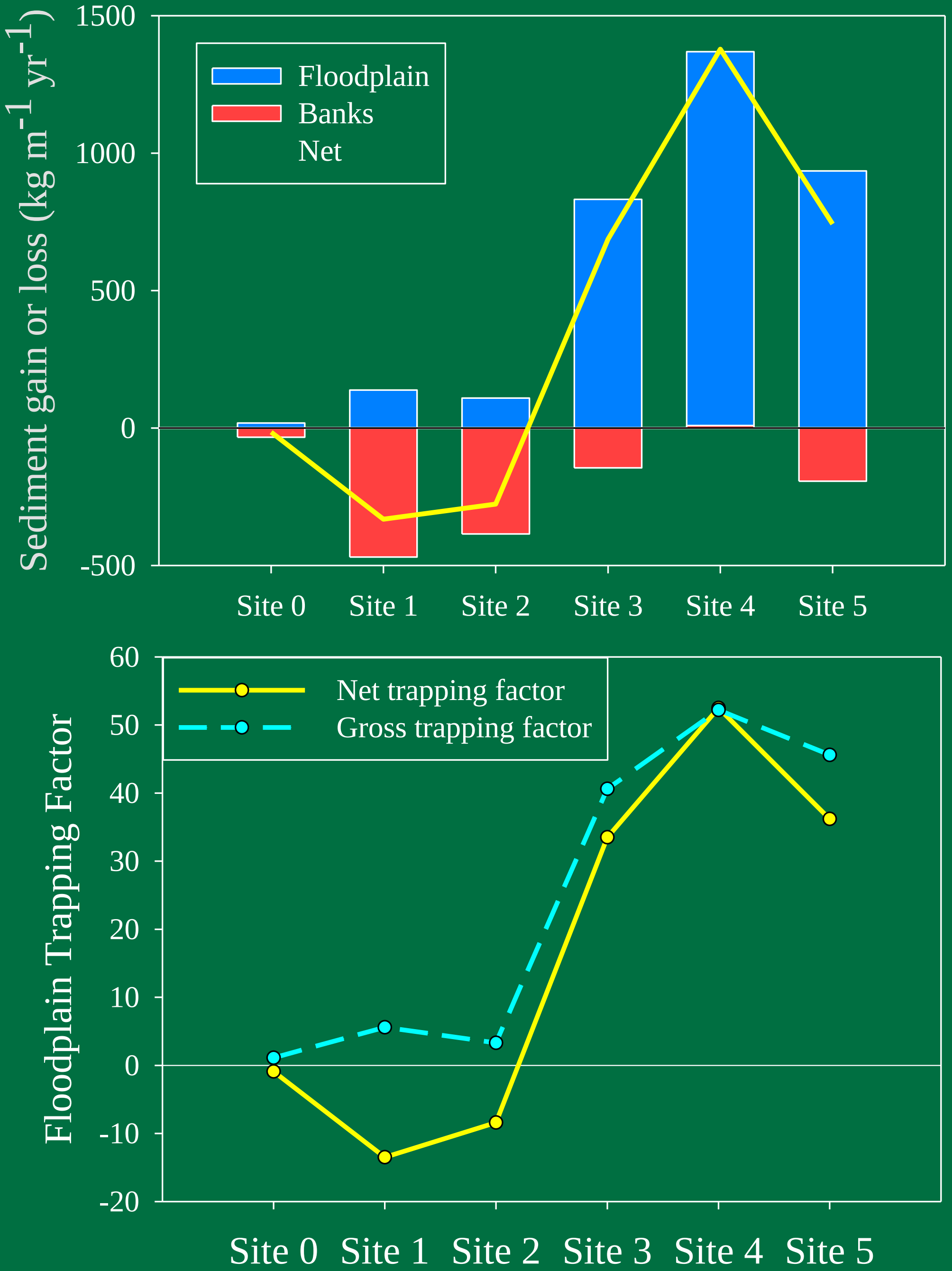


Rybicki et al. *in prep.*

Nutrient sedimentation rates

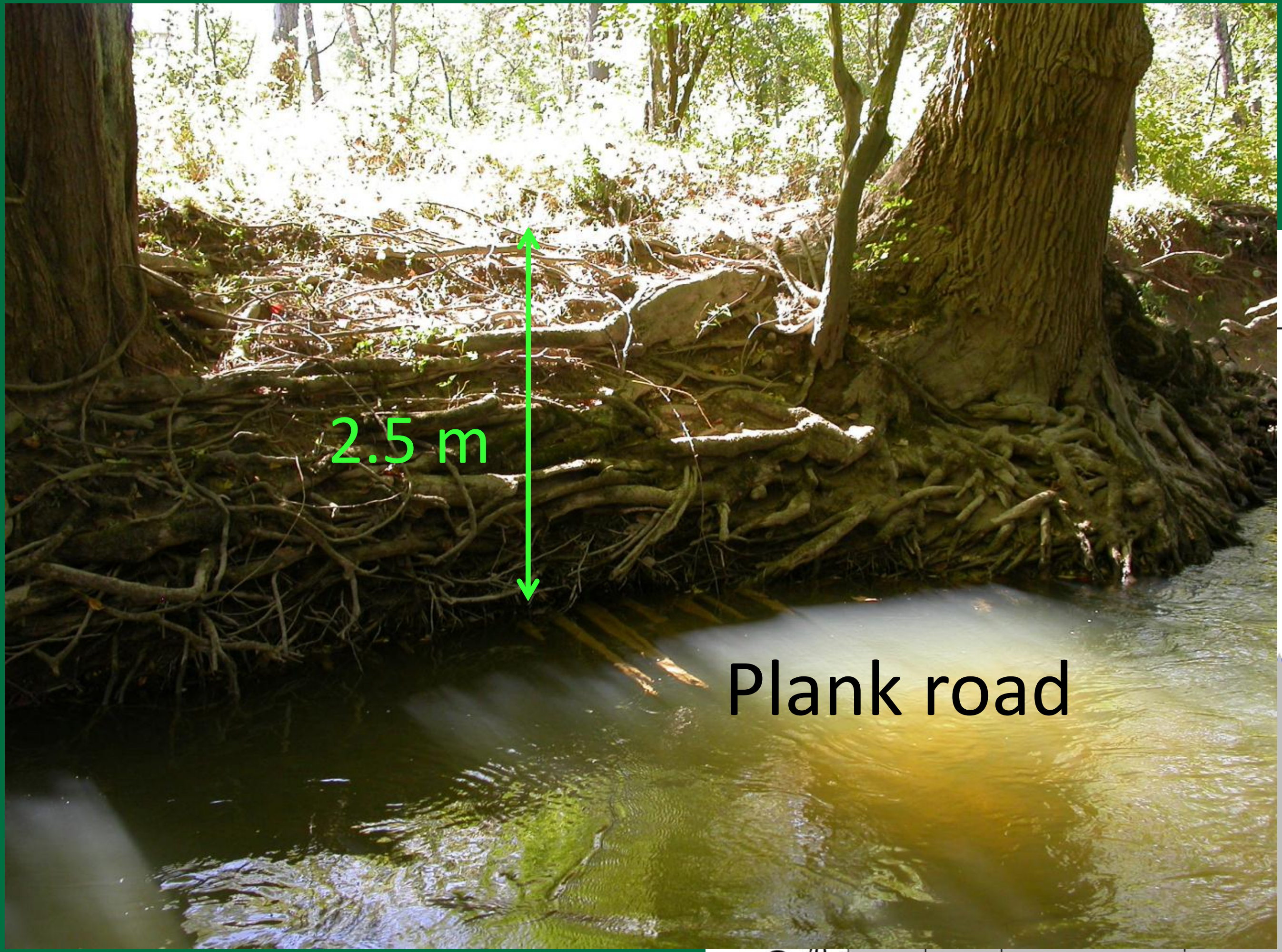


Geomorphic controls on sediment retention and loss

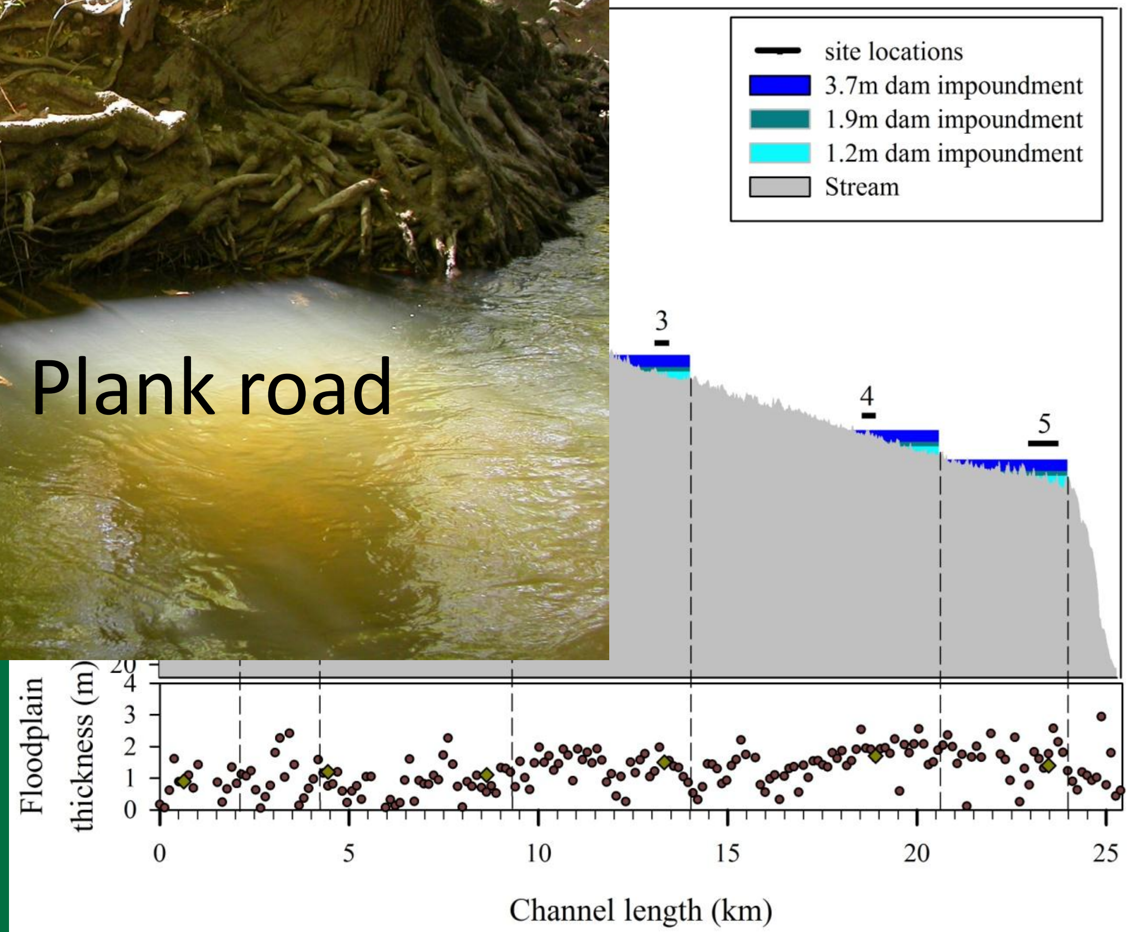


Hupp et al. *in review*

Historic mill dams and legacy sediment



length impounded



Dam locations from FCPA

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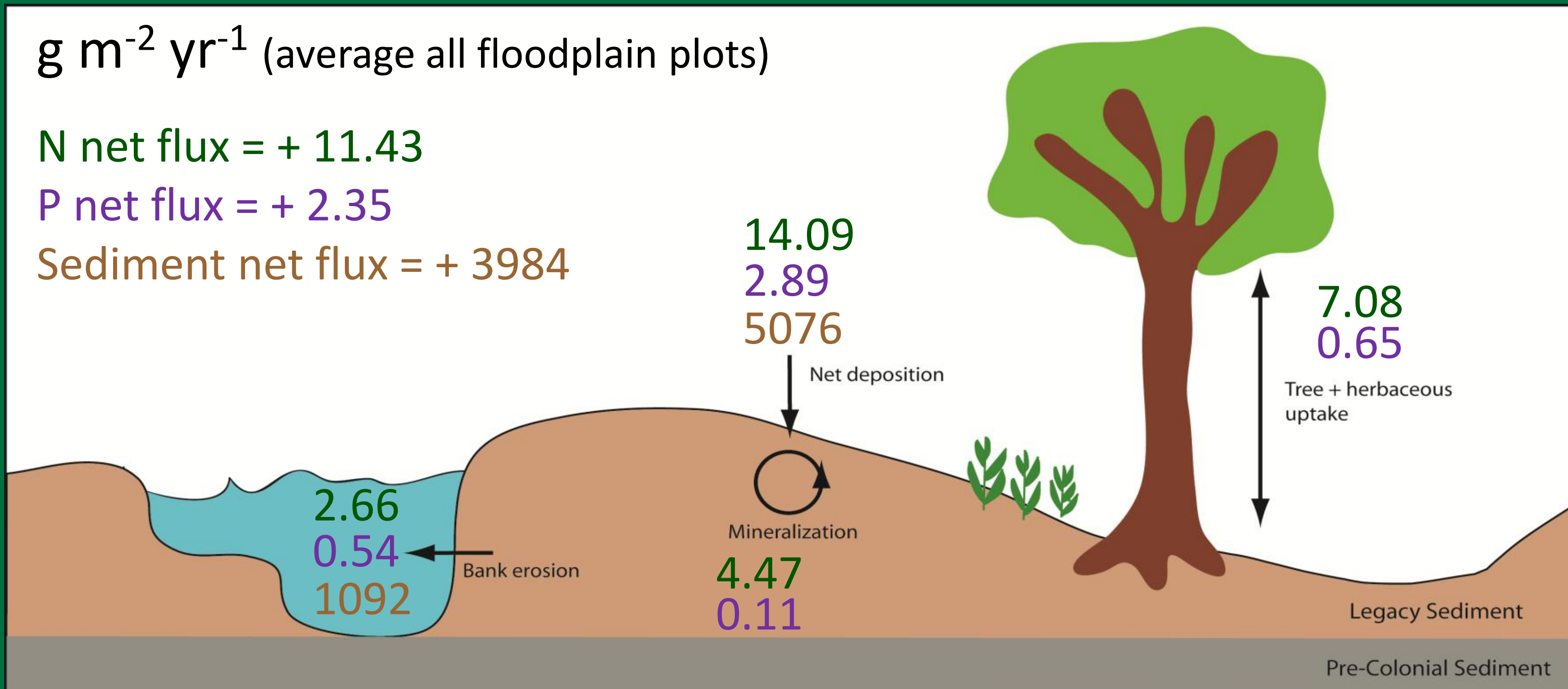
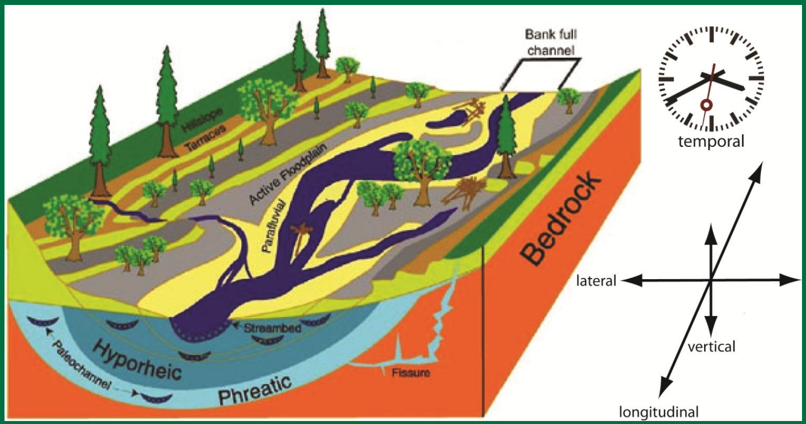
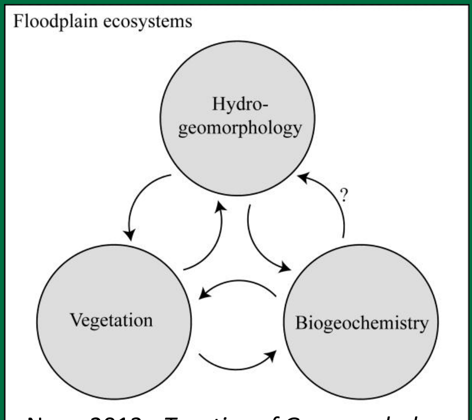
Hupp et al. *in review*

Urban, Piedmont floodplain is retentive







Noe. 2013. *Treatise of Geomorphology.*

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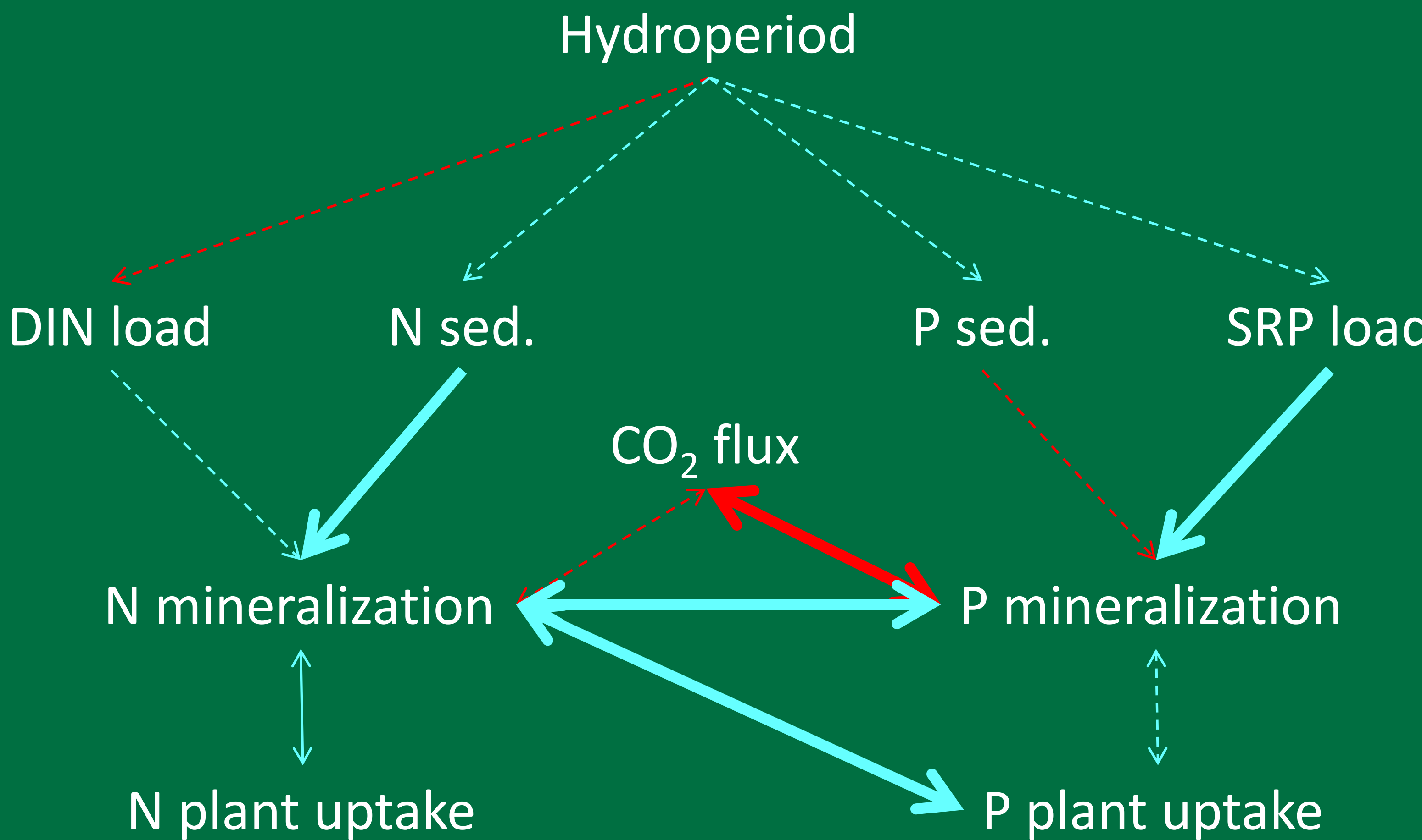
Correlations among ecosystem processes



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Nutrient and Sediment Cycling and Retention in Urban Floodplain Wetlands

Urban floodplain wetlands can still remove pollutants

- Despite legacy sediment, mill dams, and stormwater
- High nutrient and sediment inputs
- Efficient internal cycling of nutrients
- Coupled N and P biogeochemical processes
- High trapping rates relative to watershed losses

AGU Chapman Conference on Hydrogeomorphic Feedbacks and Sea Level Rise in Tidal Freshwater River Ecosystems

Reston, Virginia, USA 13-16 November 2012

ABSTRACT DEADLINE: 12 July 2012 (23:59 ET)

Tidal freshwater rivers link watersheds with estuaries and affect the flux of carbon, nutrients, sediment, and freshwater from land to the ocean. However, climate change is continually altering tidal river ecosystems as tides advance inland and watershed inputs change. This Chapman Conference will generate synthesis of feedbacks between geomorphic, biogeochemical, and ecological processes in tidal rivers to better predict ecosystem changes in response to climate change.

www.agu.org/TidalRivers