Floodplain Nutrient Retention along the Tangipahoa River
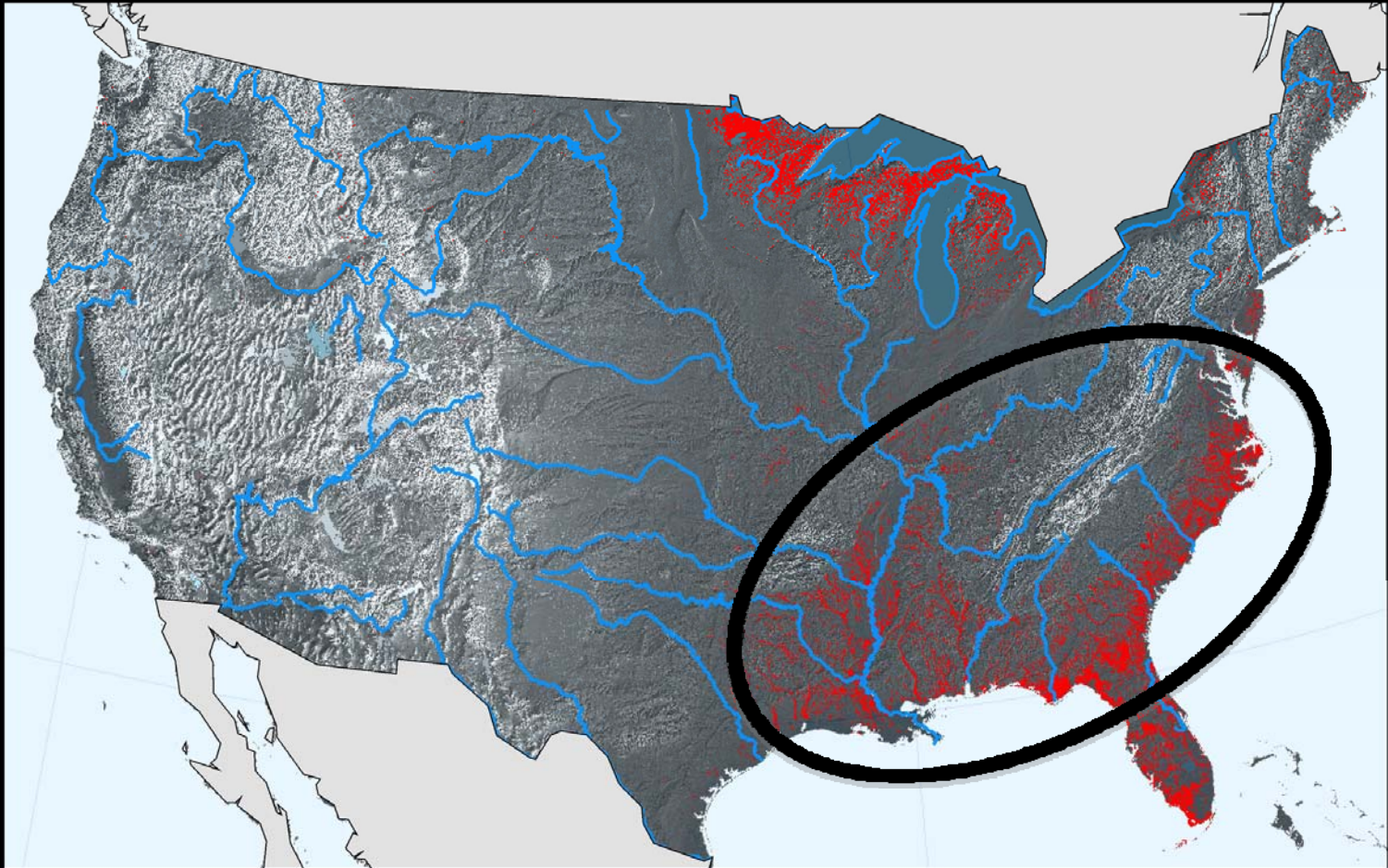

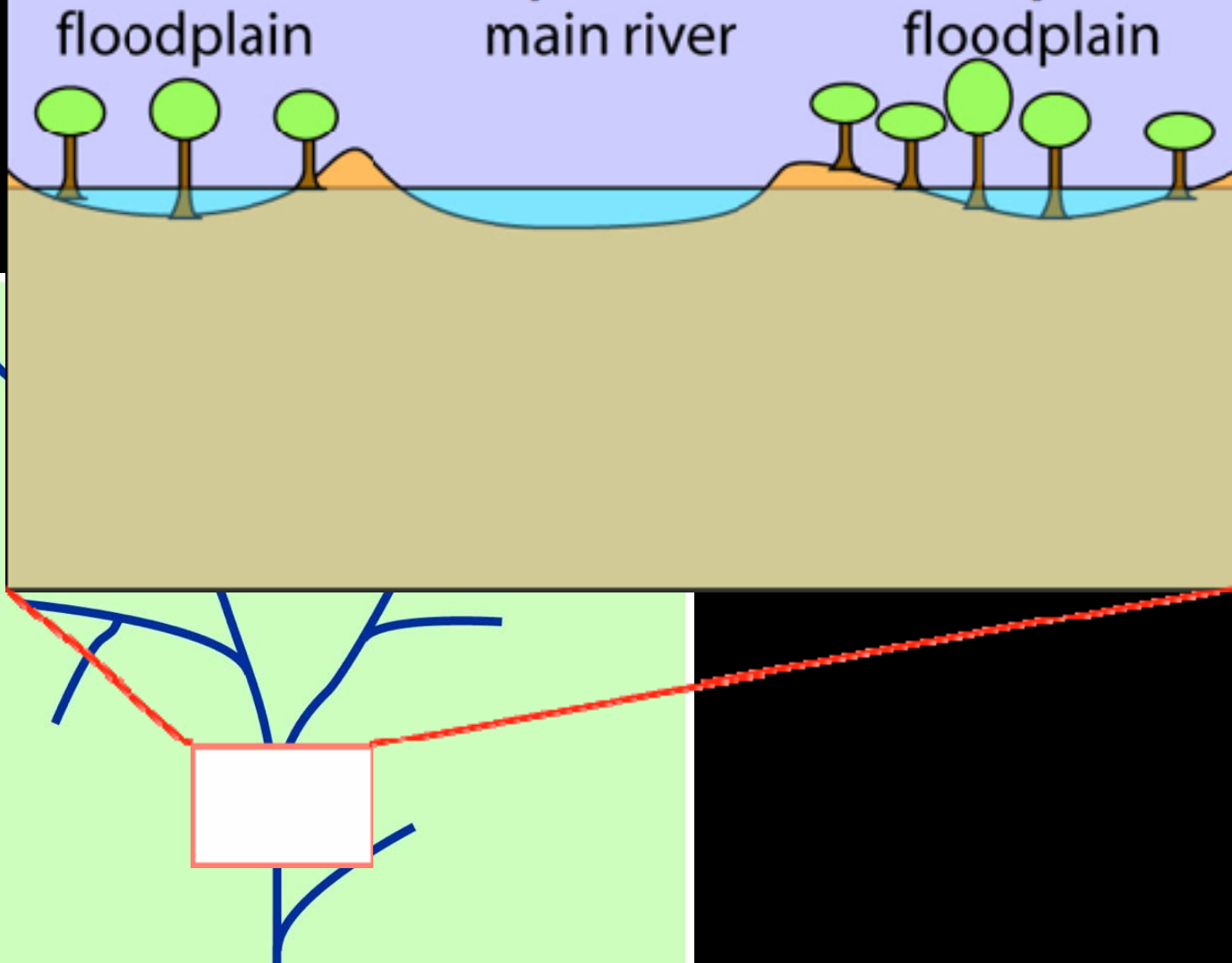
J. Harvey, G. Noe, Dan Kroes, D. Scott

Driving Questions

- What influence do floodplains have on riverine N loads and speciation?

- When are floodplains a source or sink for N? What forms of N and what N reactions are involved?

Abundance of active, forested floodplains in Southeastern US

River - floodplain connectivity

floodplain   main river   floodplain

Majority of water & nutrient flux occurs when river & floodplain waters are connected!

Tangipahoa River

Tcheluncte River

Hammond

Covington

BATON ROUGE

Pass Manchac
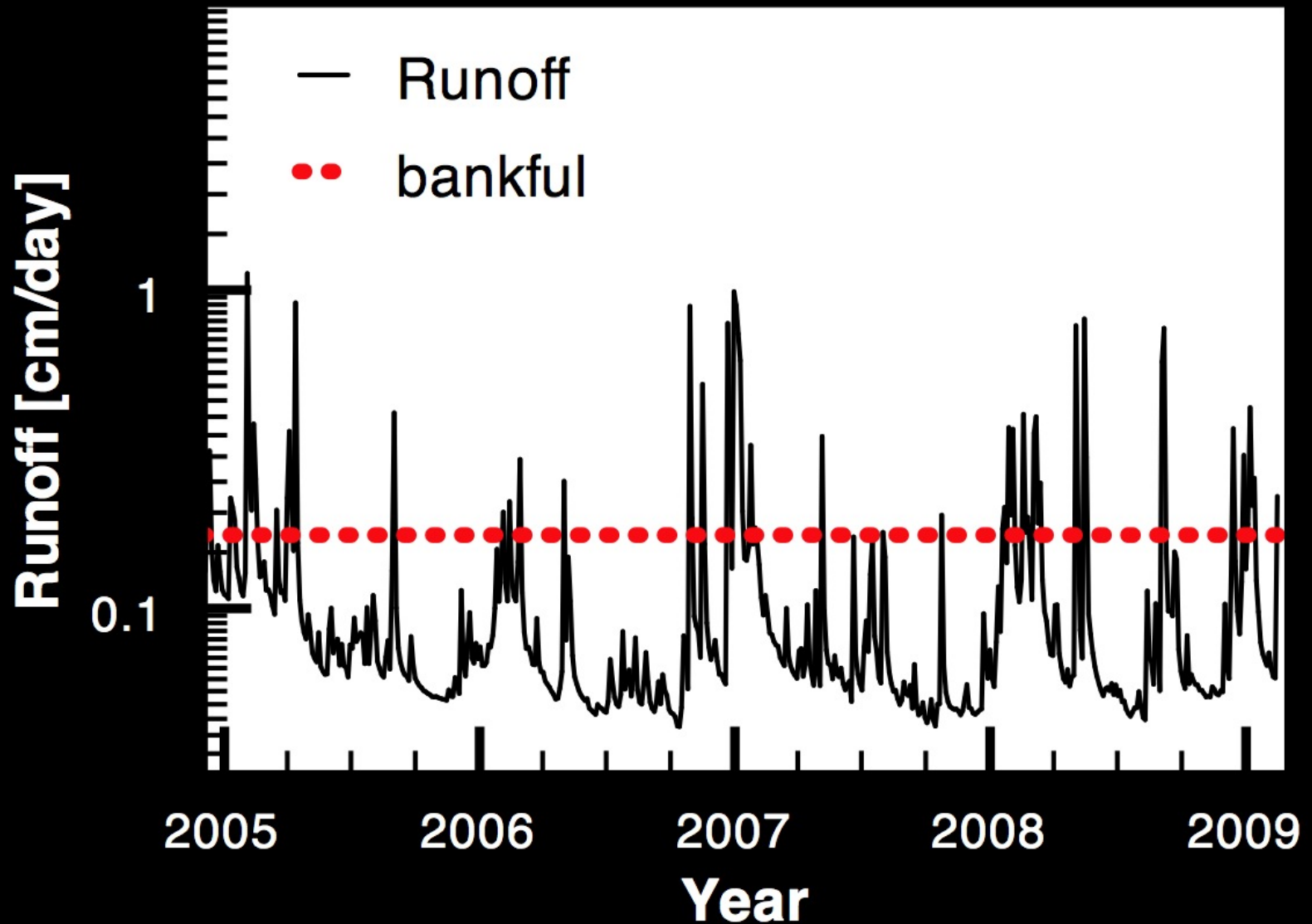
Slidell

Rigolets

Lake Maurepas

LAKE PONTCHARTRAIN

Lake Borgne

MISSISSIPPI

NEW ORLEANS
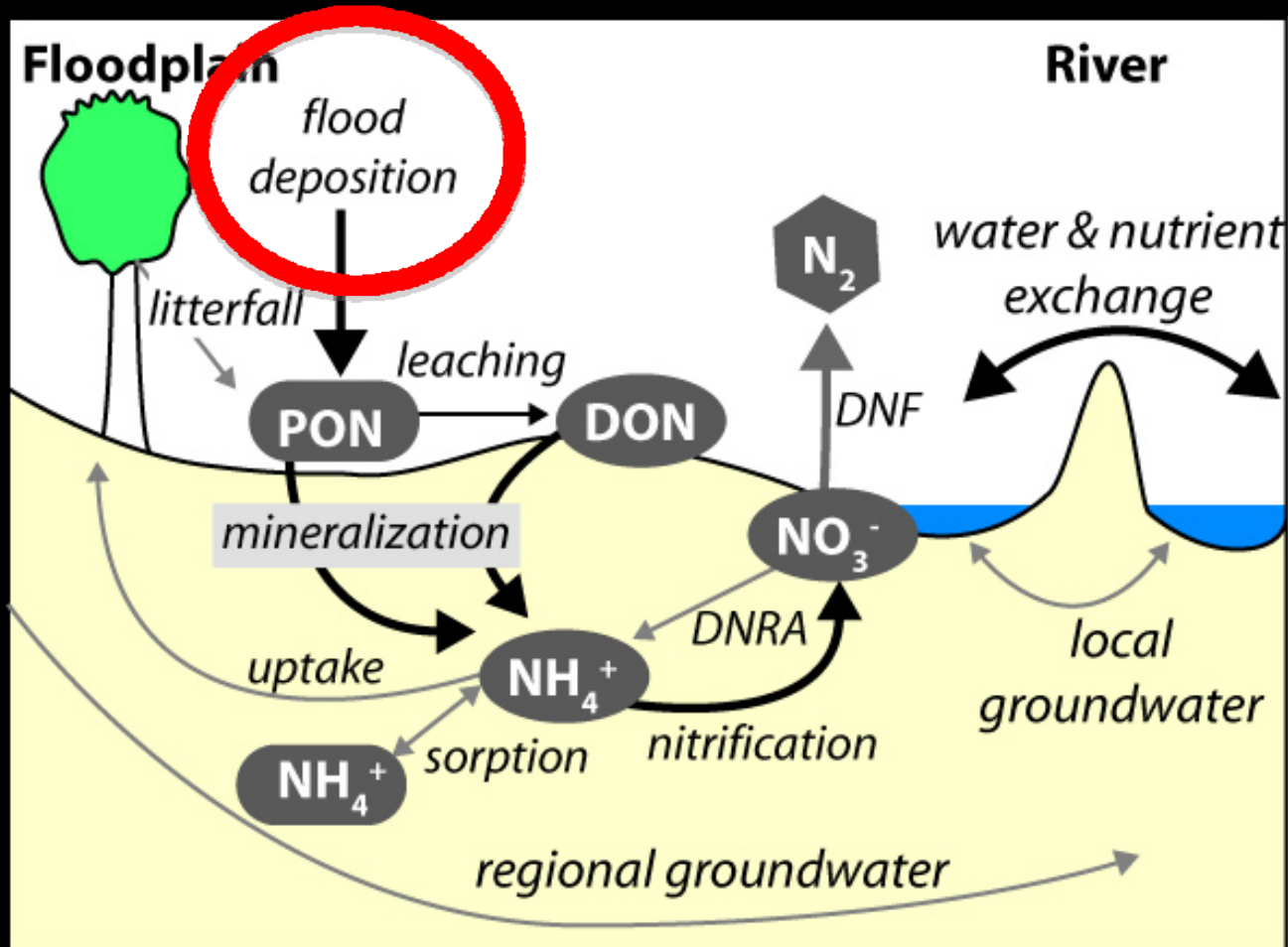
RIVER

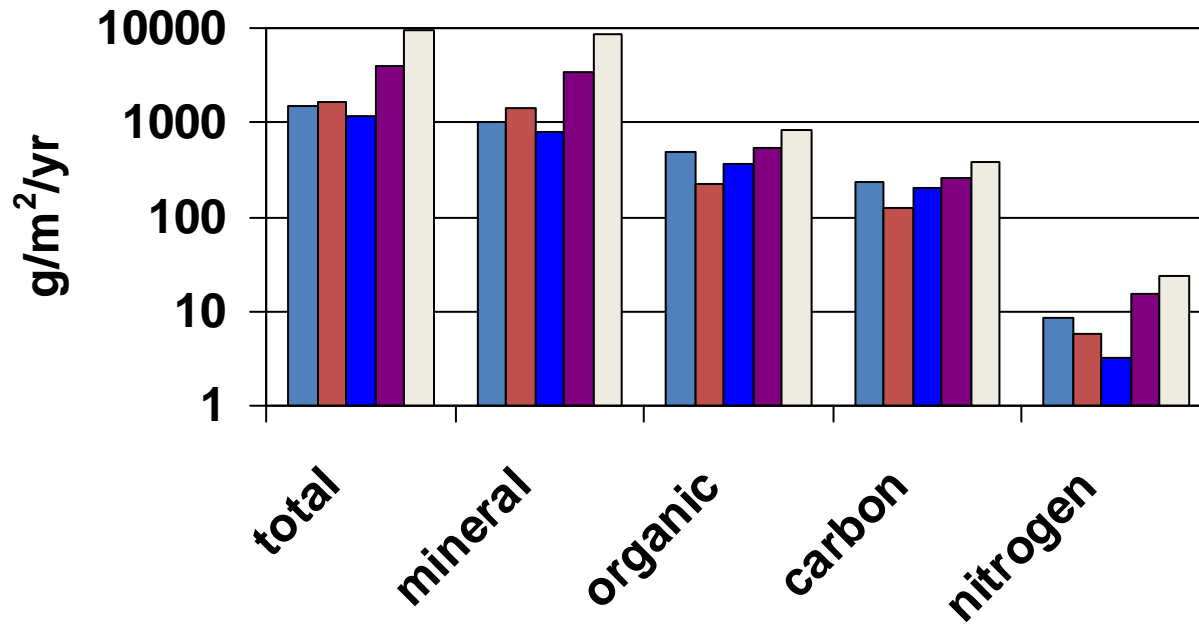# When does connectivity occur?

Retention: *f*(biogeochemistry, hydrology)

Deposition

- Multiple tiles distributed across floodplain

- Measuring *net* deposition

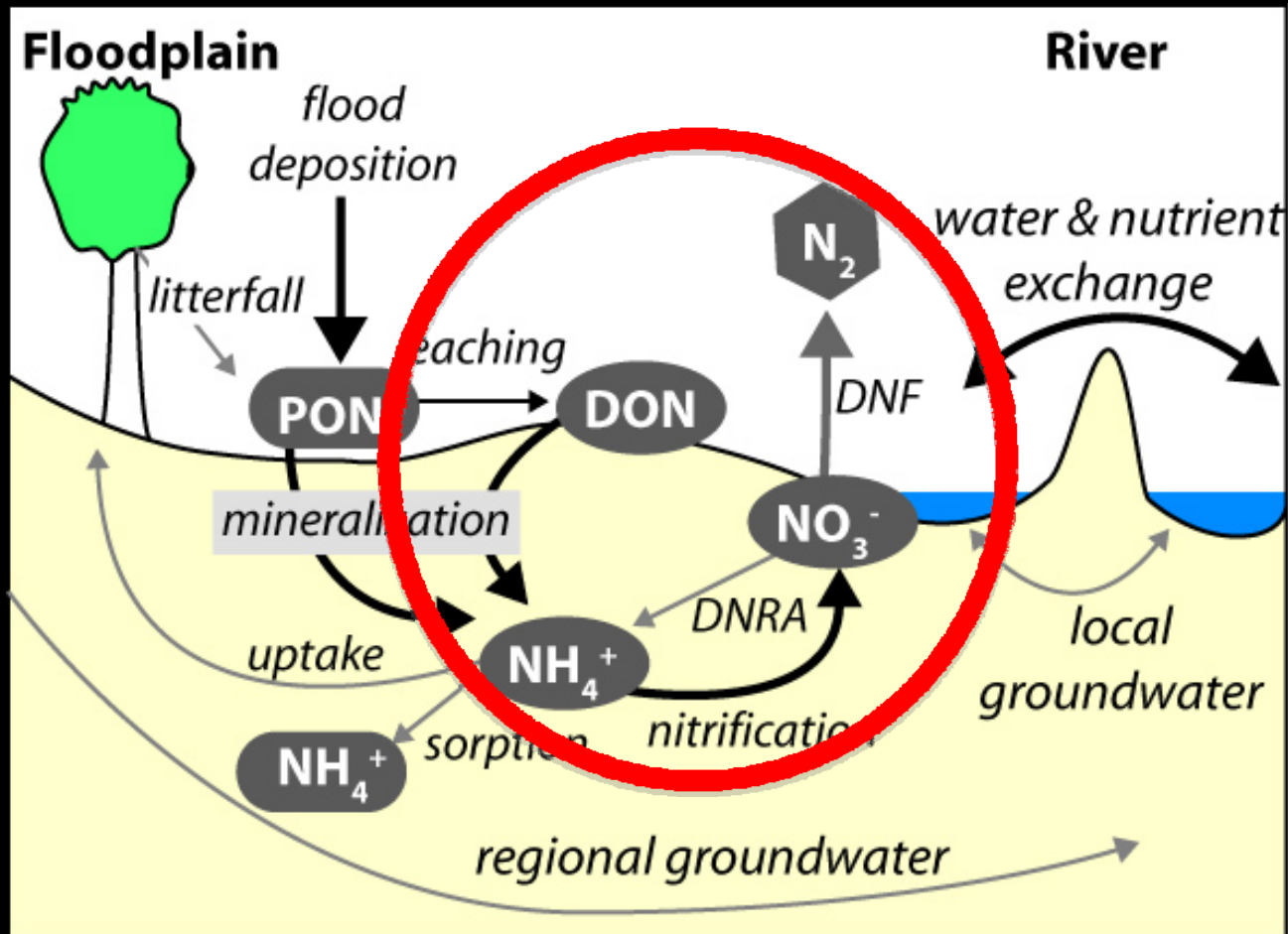- $3.2 - 23.4$ g m^{-2} yr^{-1} of N

deposited components

Single stage samplers

Retention: *f*(biogeochemistry, hydrology)
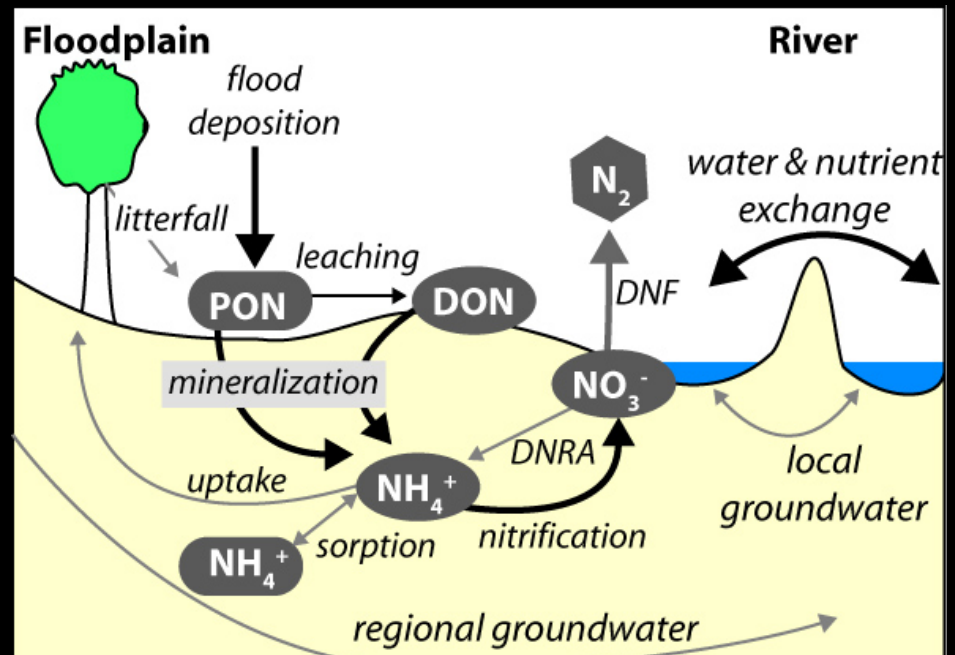
N-biogeochemistry

- N mass balance during floods

U_{event} [mg m^{-2} d^{-1}]			
	DON	NH$_4^+$	NO$_3^-$
Slough A	-136	-100	-278
Slough B	-353	-463	-527

N-biogeochemistry

- N mass balance during floods
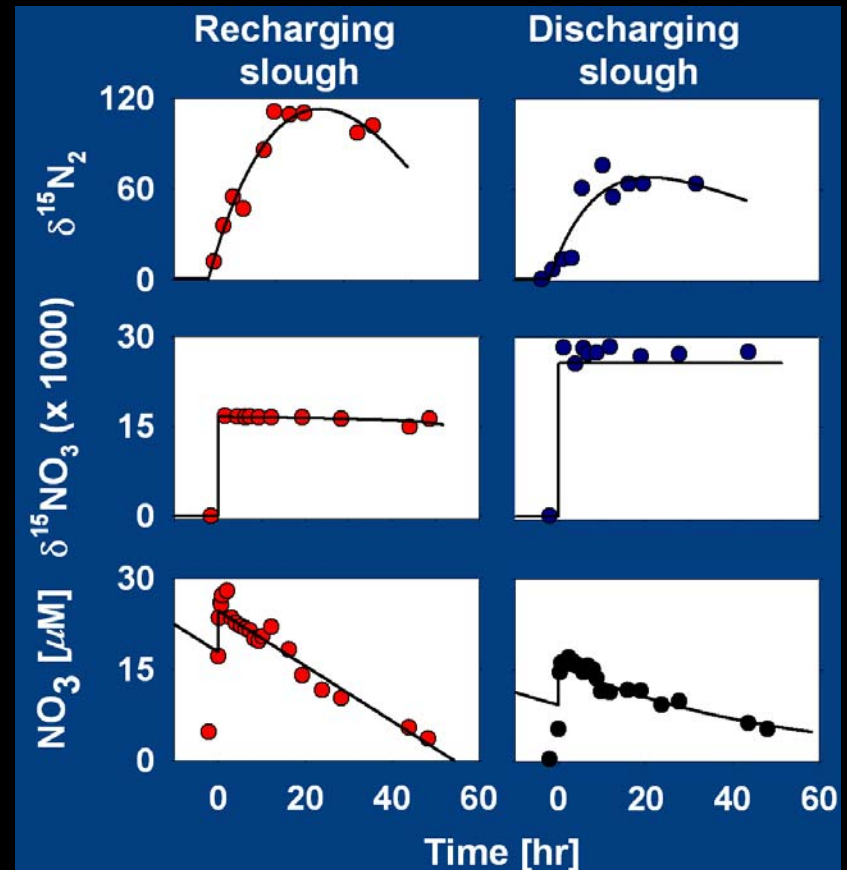
- High removal rates, suggests importance of:

Coupled mineralization – nitrification - denitrification

| U_{event} [mg m^{-2} d^{-1}]			
	DON	NH$_4^+$	NO$_3^-$
Slough A	-136	-100	-278
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N-biogeochemistry

- N mass balance during floods

- High removal rates

- NO_3^- primarily lost through denitrification
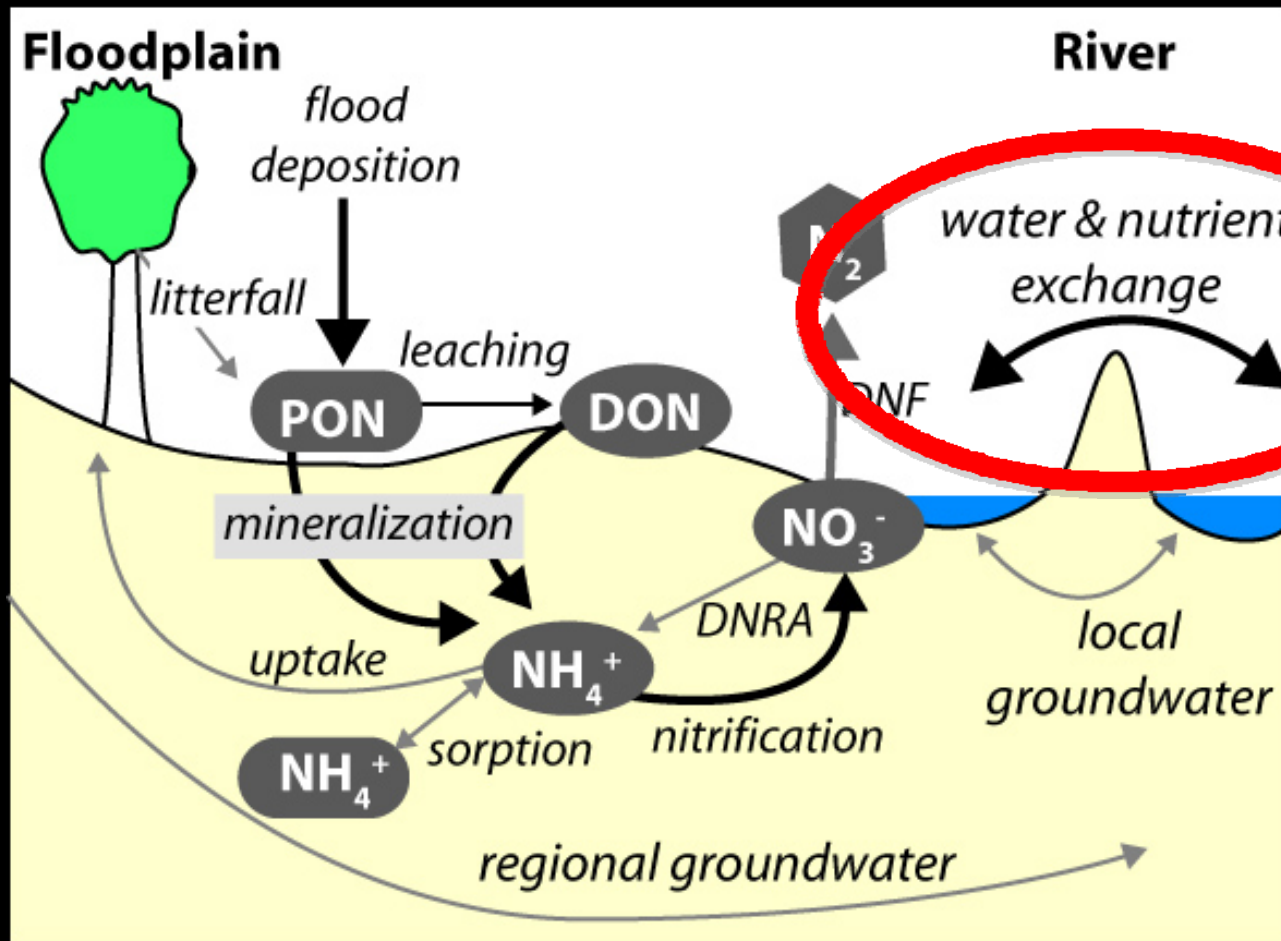

Results from mesocosm experiments

N-biogeochemistry

- N mass balance during floods
- High removal rates
- NO3- primarily lost through denitrification
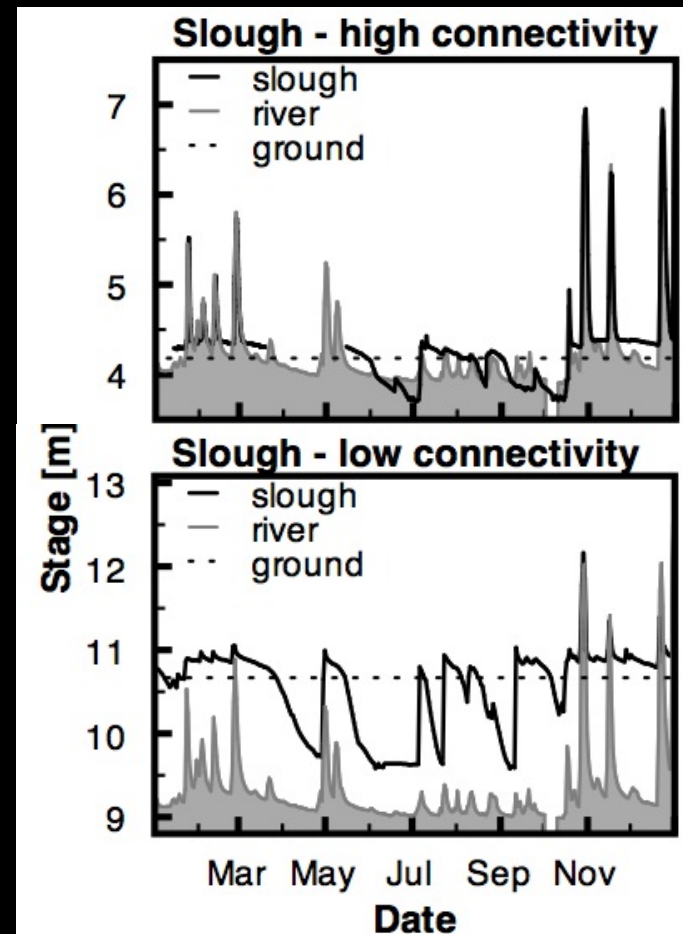- Removal rates are not limiting: NO$_3^-$ availability is
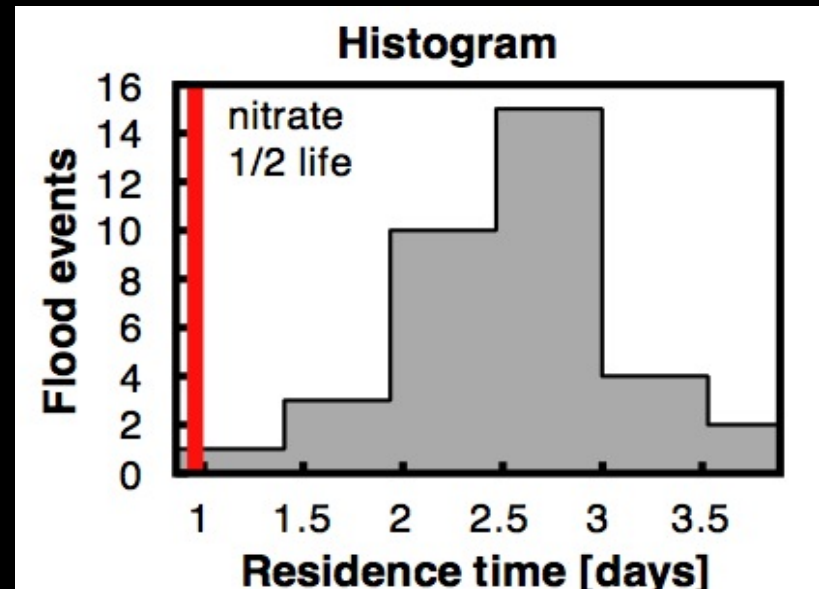
Distribution of flood residence time compared with nitrate 1/2 life

Retention: *f*(biogeochemistry, hydrology)

Hydrologic Connectivity

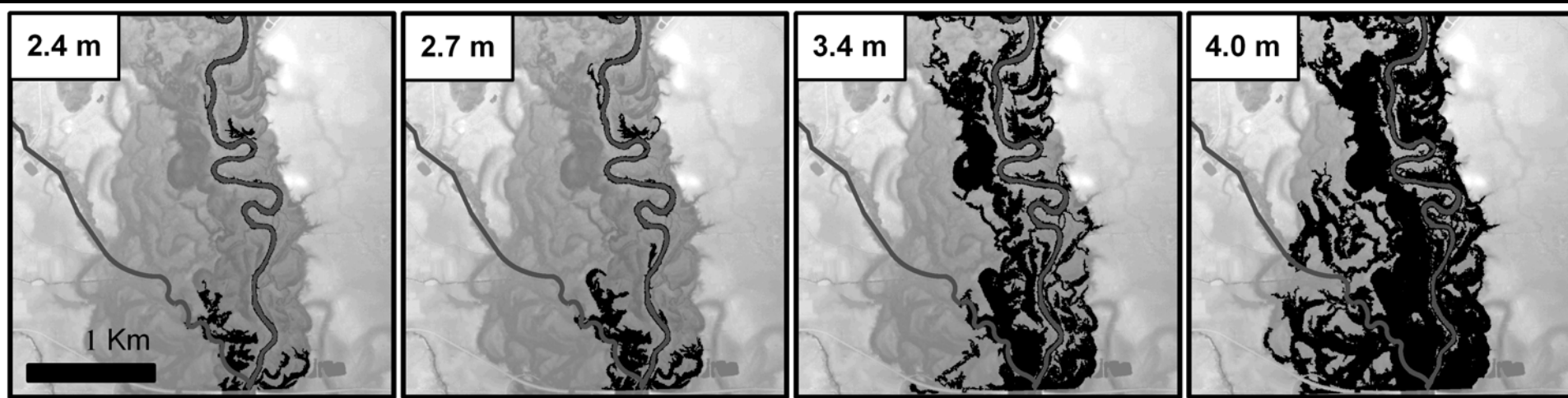- Connectivity = f(stage, topography)

- Physical measurements:
 - Water level sensors

Floodplain water level in 2 sloughs

Hydrologic Connectivity

- Connectivity = f(stage, topography)
- Physical measurements
- Developed GIS-based model: combines stage, topography to obtain inundation

2.4 m   2.7 m   3.4 m   4.0 m

1 Km

What is annual removal along reach?

- Apply flood removal rates to estimated inundated area along reach for each day of 30-year flow record
- Daily N-fluxes estimated from NWIS measurements
- Quantify net removal
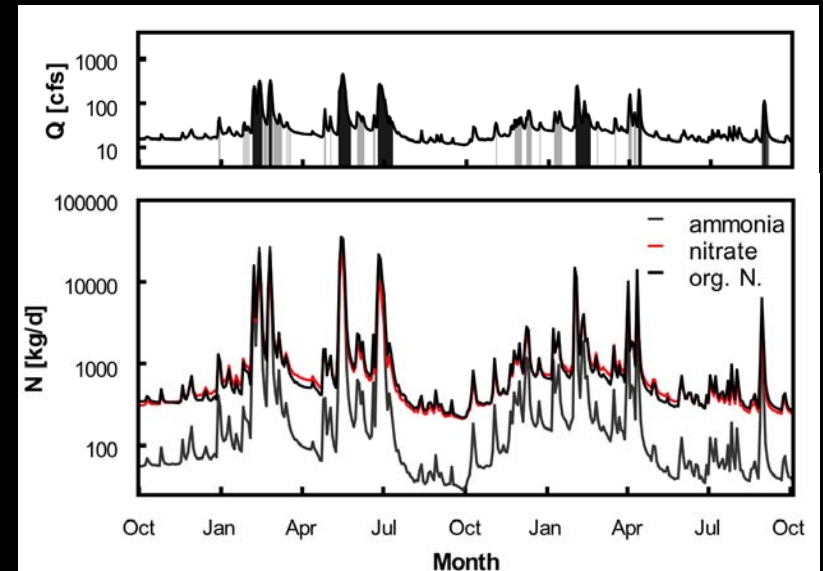
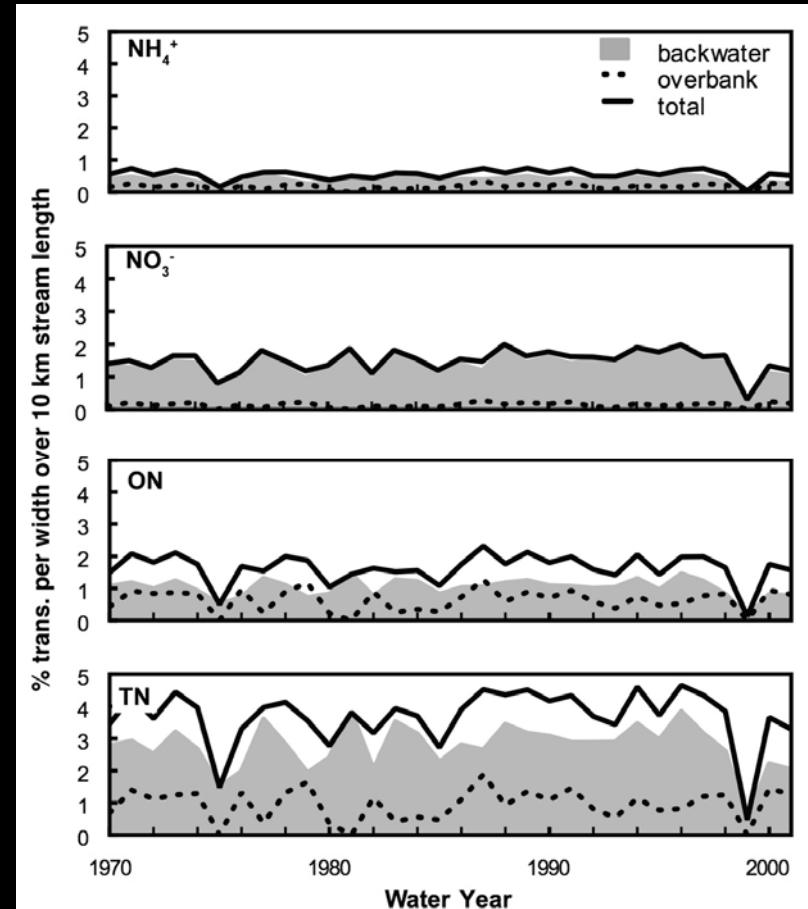Highlights high N –flux when river & floodplain connected

What is annual removal along reach?

- N-retention largely depends on connectivity. Along this river 8 to 14% retention
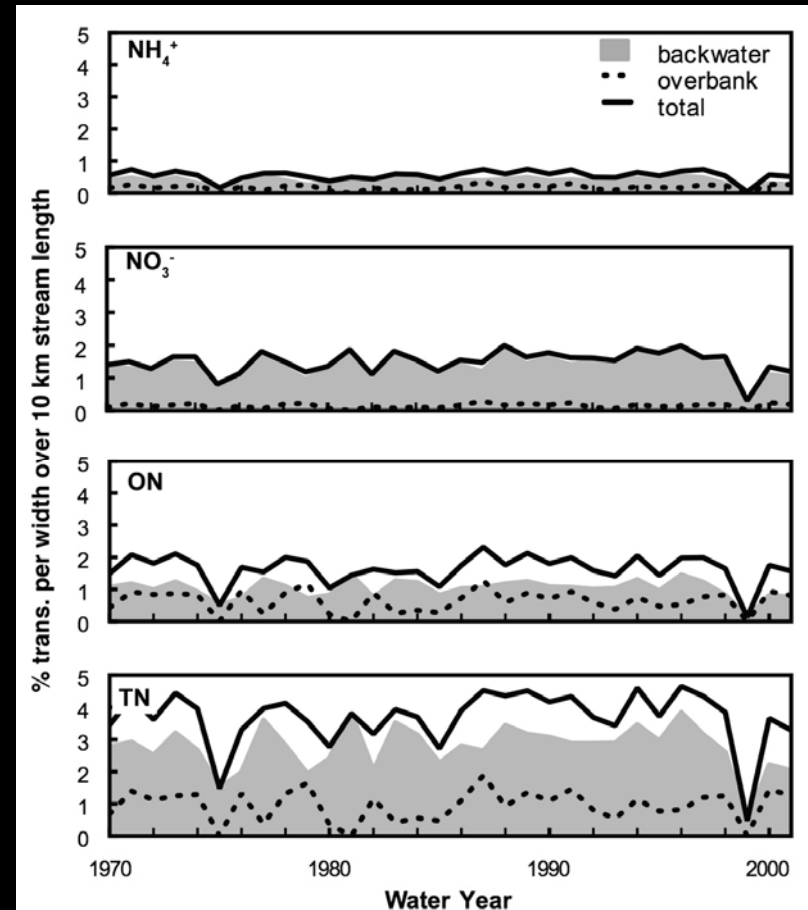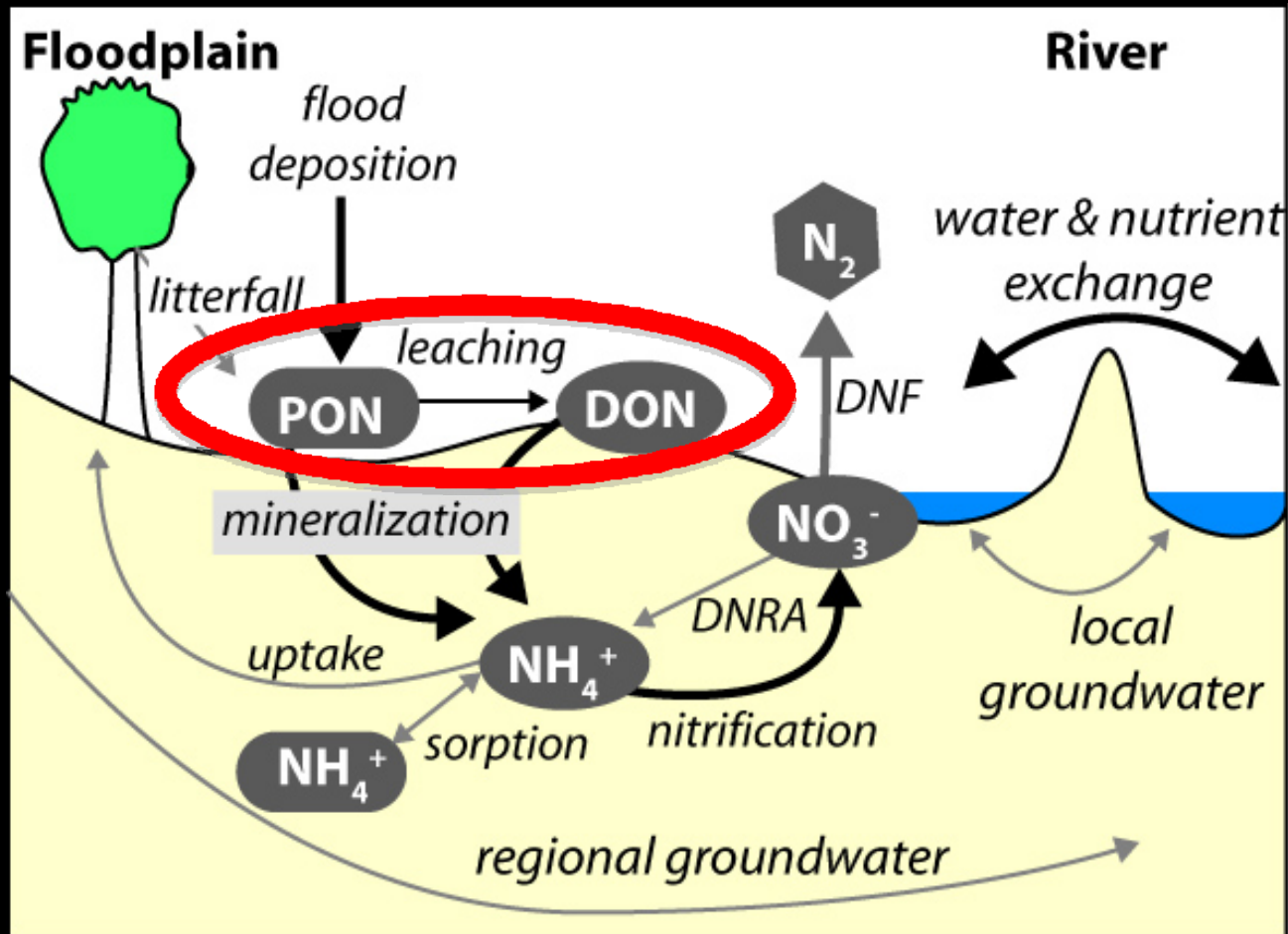
What is annual removal along reach?

- **But we need to understand N-fate during both wet & dry periods!**

Unknown biogeochemical ?'s

-Fate of particulate organic matter
-What happens between floods?

Current Focus & Next steps

- Identify water sources over range of flood magnitudes

- Examine fate of particulates deposited on floodplain

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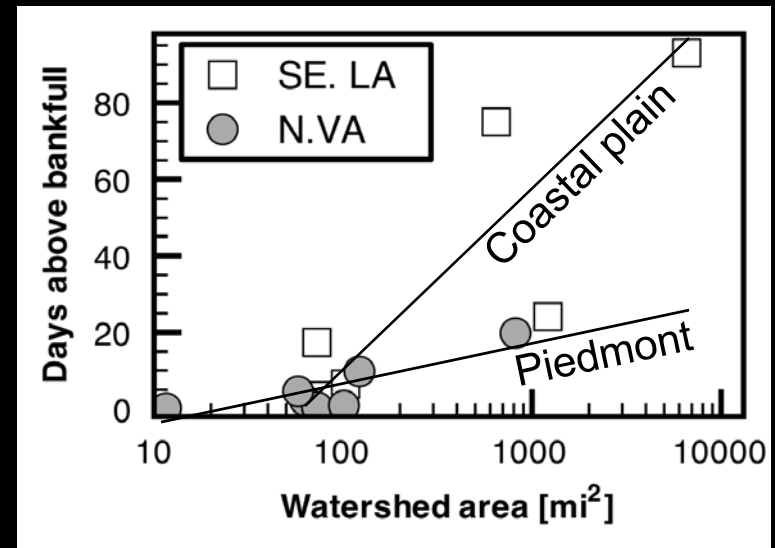
Plot showing the importance of floodplains in streams of different size & physiographic region: Floodplains are important!