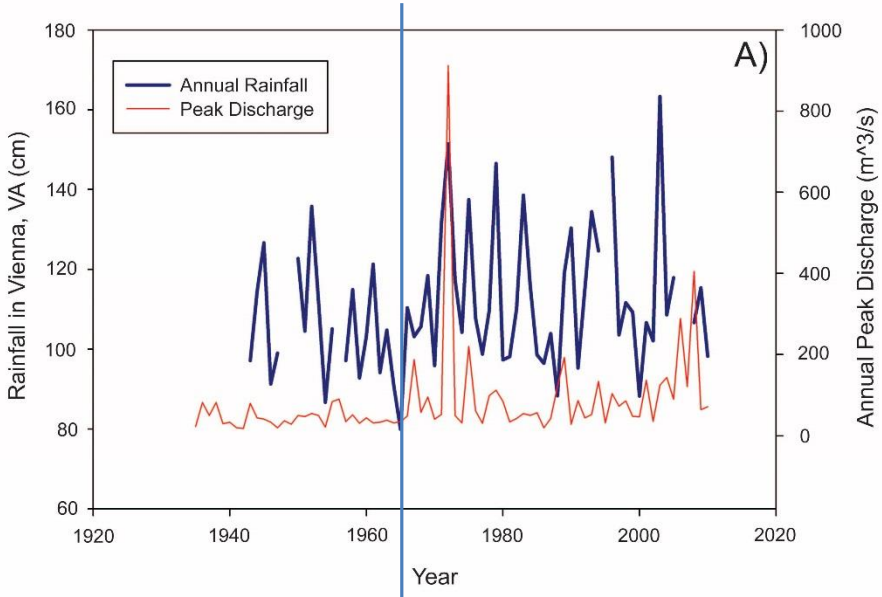
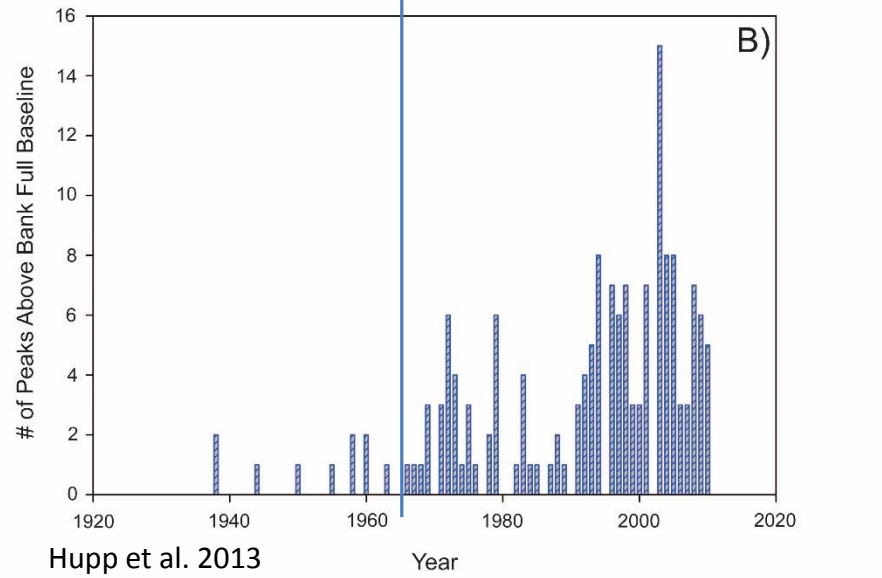
BACKGROUND:

- Fifth-order stream in crystalline Piedmont of Virginia
- 151 km^2 watershed with 25 km of main stem channel
- Experienced extensive land clearing/colonial row crop agriculture
- Area largely reforested (some dairy) by mid twentieth century
- Floodplain and riparian areas part of Fairfax Co. Park Authority
- Urbanization began (construction of Reston) around 1965 (20% IC)
- 6 low-head mill dams on stream mid 1700s through 1800s

Discharge and Rainfall



urbanization



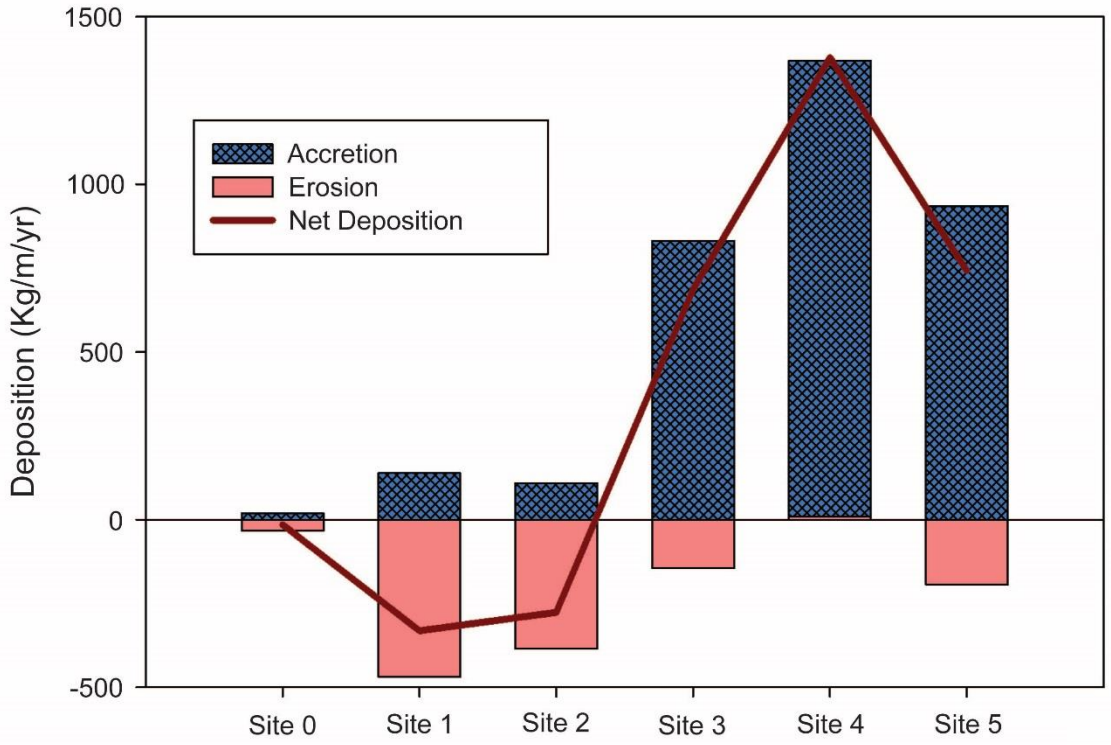
Hupp et al. 2013

Difficult Run has been gaged Since 1935

Four-fold increase in peak Q
Since 1965

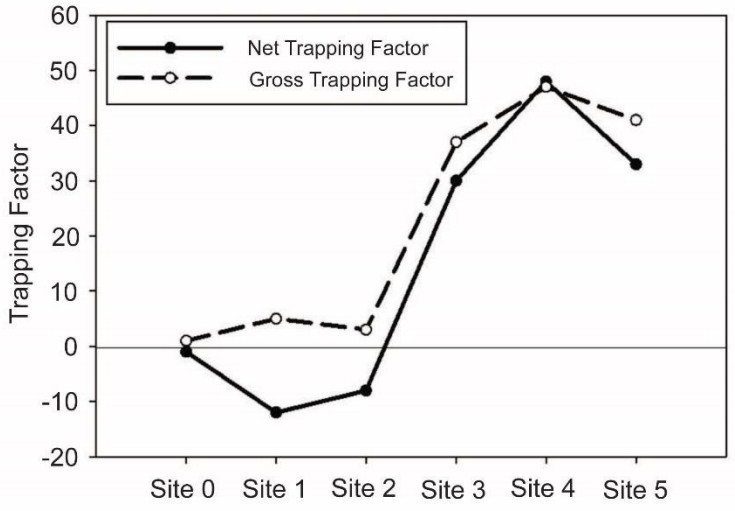
Peaks above Base Q
(28m^3/s, bankfull)

Order of magnitude increase in peaks

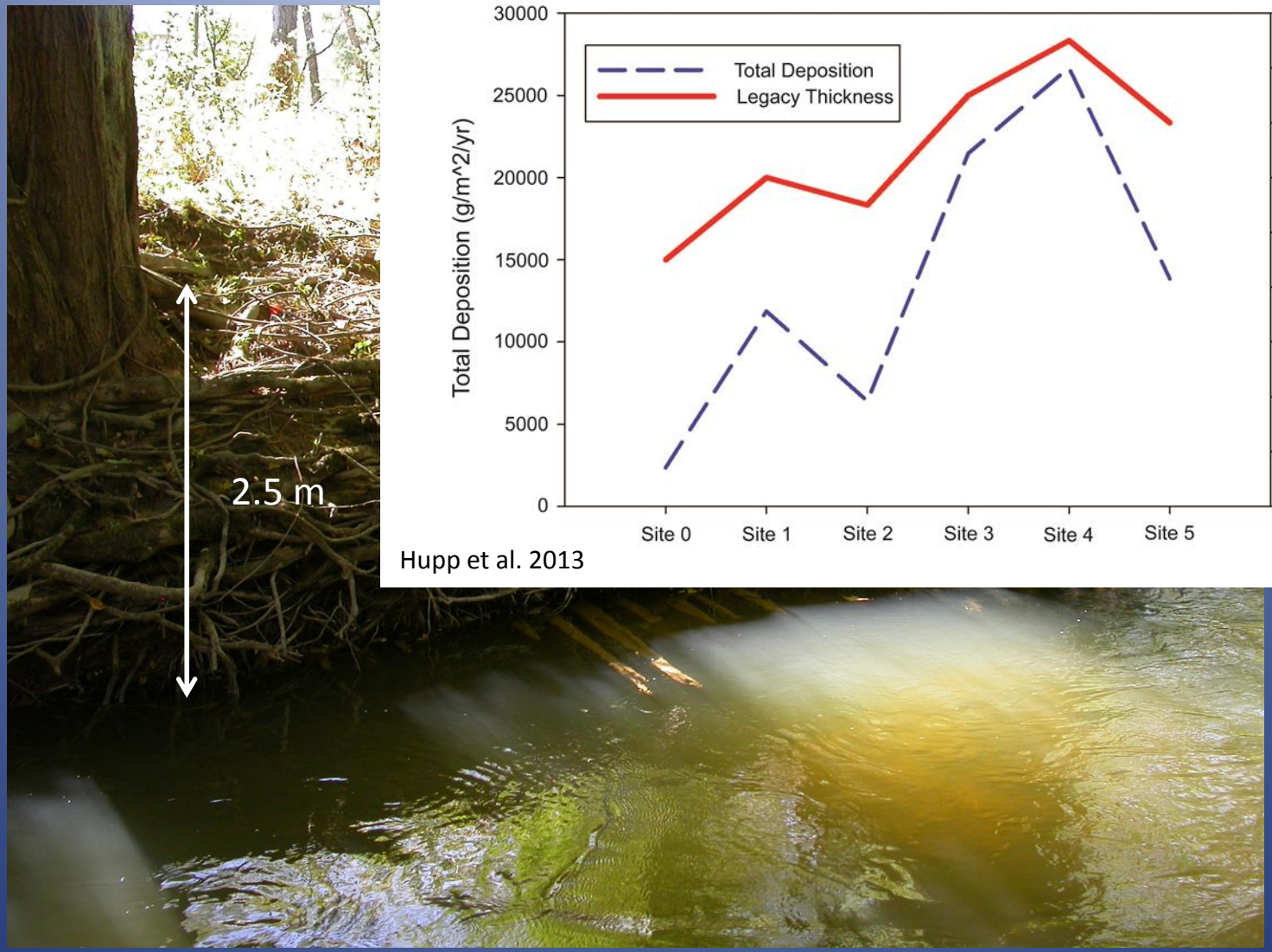


Sediment Balance

+ 2184 kg/m/yr



Hupp et al. 2013



Hupp et al. 2013

Difficult Run floodplain stores on average 132 cubic meters of sediment per meter of reach length.

Our results suggest that the Difficult Run floodplain is composed of fill/legacy sediment but that mill ponds are not requisite for substantial historic deposition on floodplains and that they remain active fluvial features, not terraces.

Regimes may have changed, but the floodplain is still a floodplain

The floodplain traps most of the sediment supplied by the watershed (+ 2184 kg/m/yr) thus maintaining an ecosystem function and underscores the importance of preserving floodplain connectivity.

Lower Roanoke River Floodplain, North Carolina

Upper and middle reaches are characterized by incised channels and relatively steep banks, which are the source of most suspended sediment. Lower reaches have low to almost no banks and trap substantial amounts of suspended sediment. Previous and ongoing studies focus on floodplain sedimentation dynamics, bank erosion, and the development of a sediment budget.

Lower Roanoke bottom supports the largest intact forested wetland in the Mid Atlantic

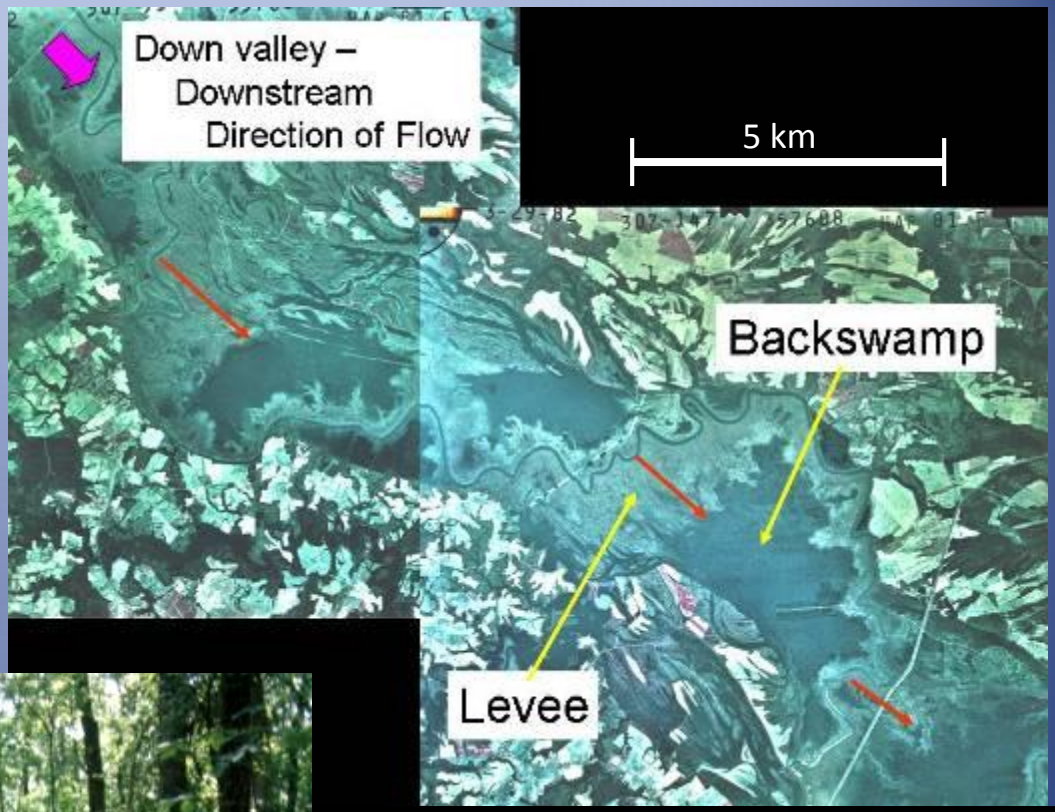
This bottomland experienced considerable post-colonial aggradation, up to 6 meters

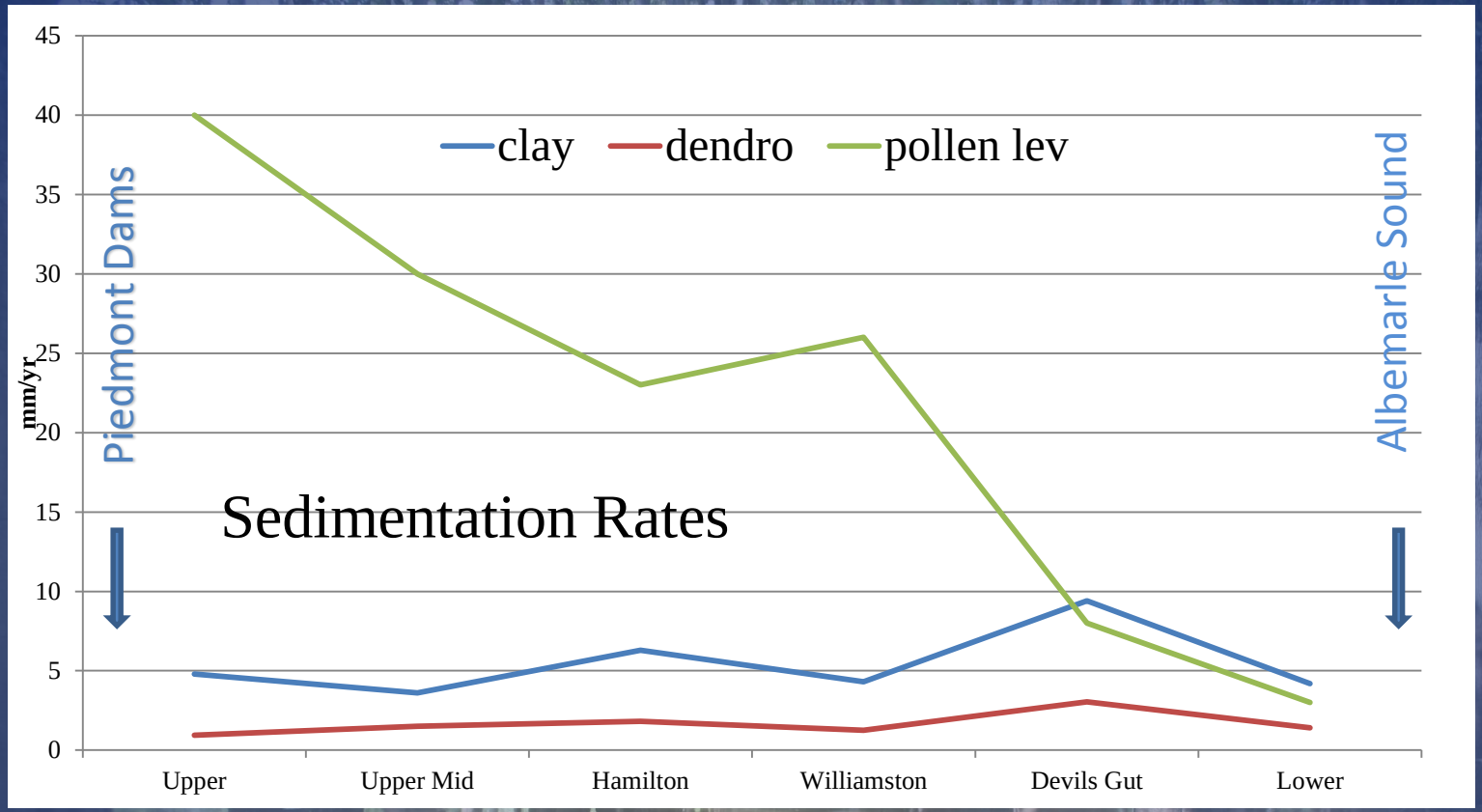
Stream flow has been regulated by a series of Piedmont dams for about 60 years

The Sediments Story

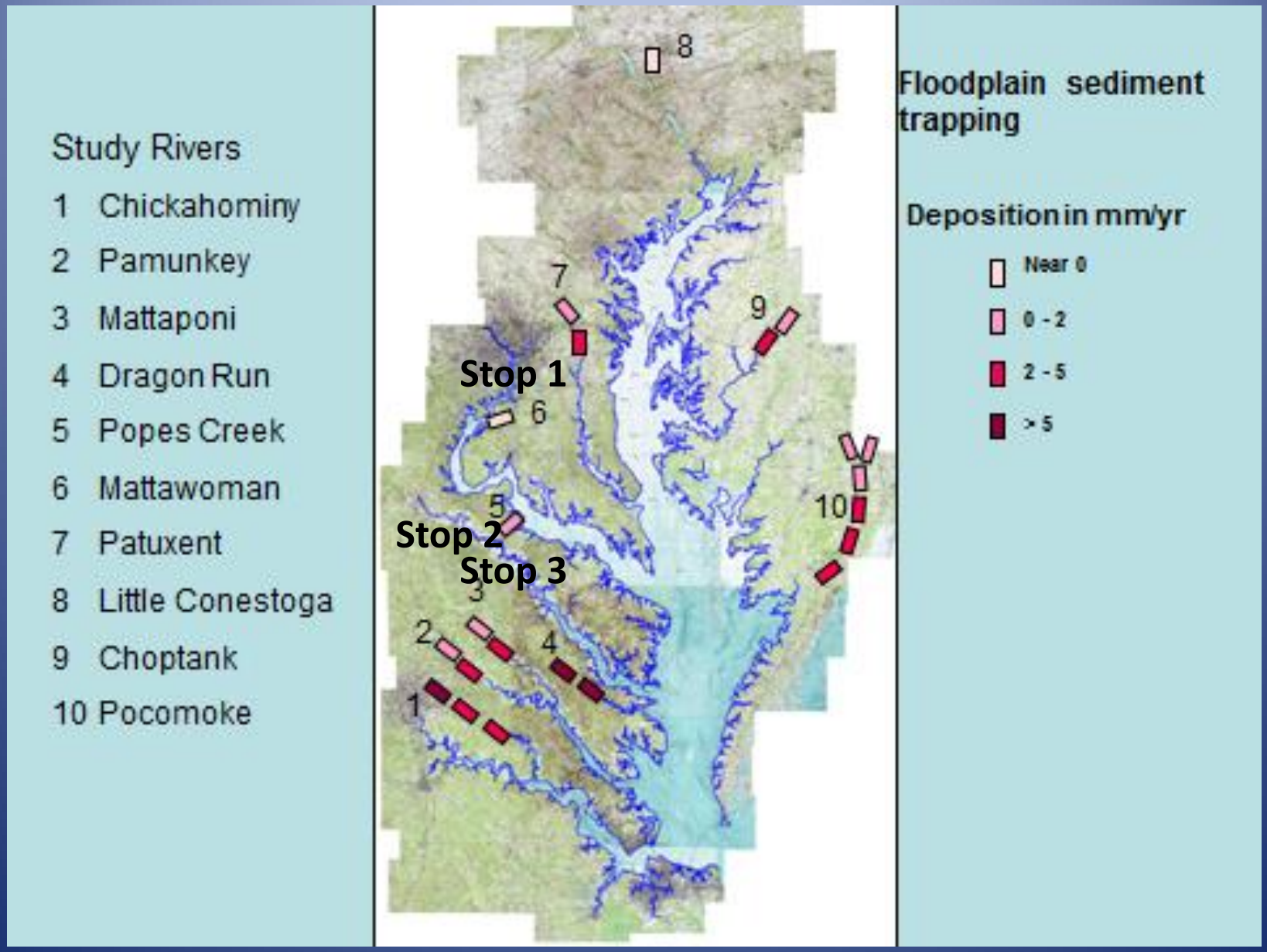
Effects of upland erosion and rapid sedimentation of the floodplain following European settlement.

5 + m deposition since about 1725





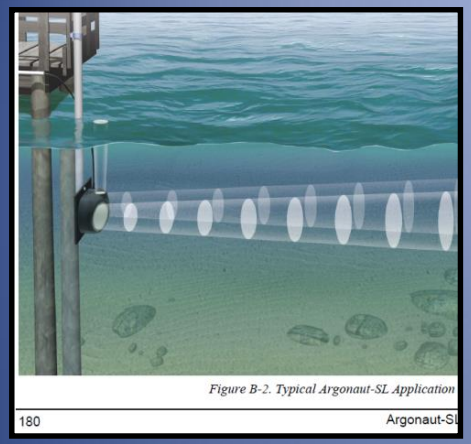
Hupp et al. 2015

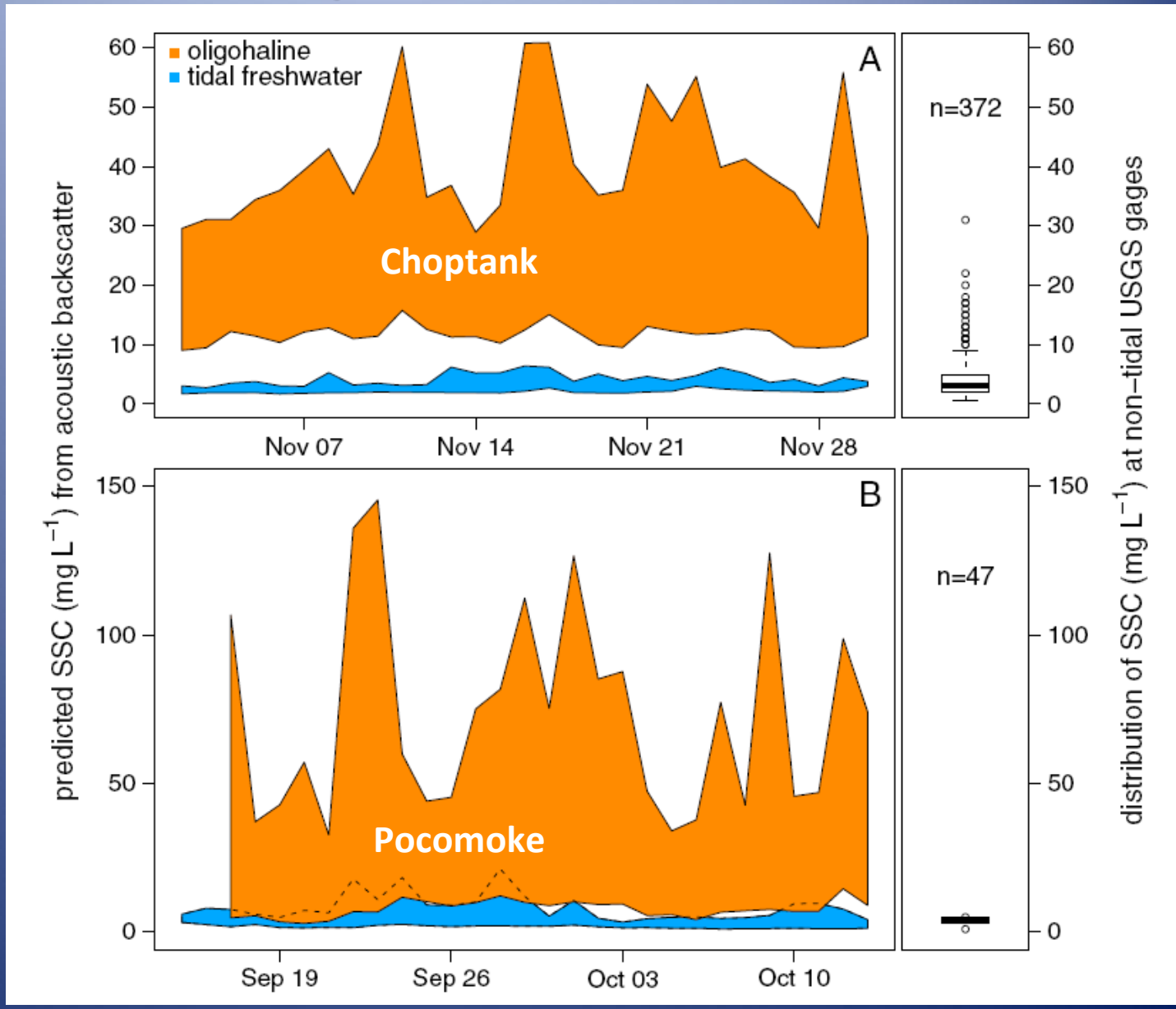


Gellis, Hupp et al. 2008

What happens once watershed loads hit tide?

Channel suspended sediment

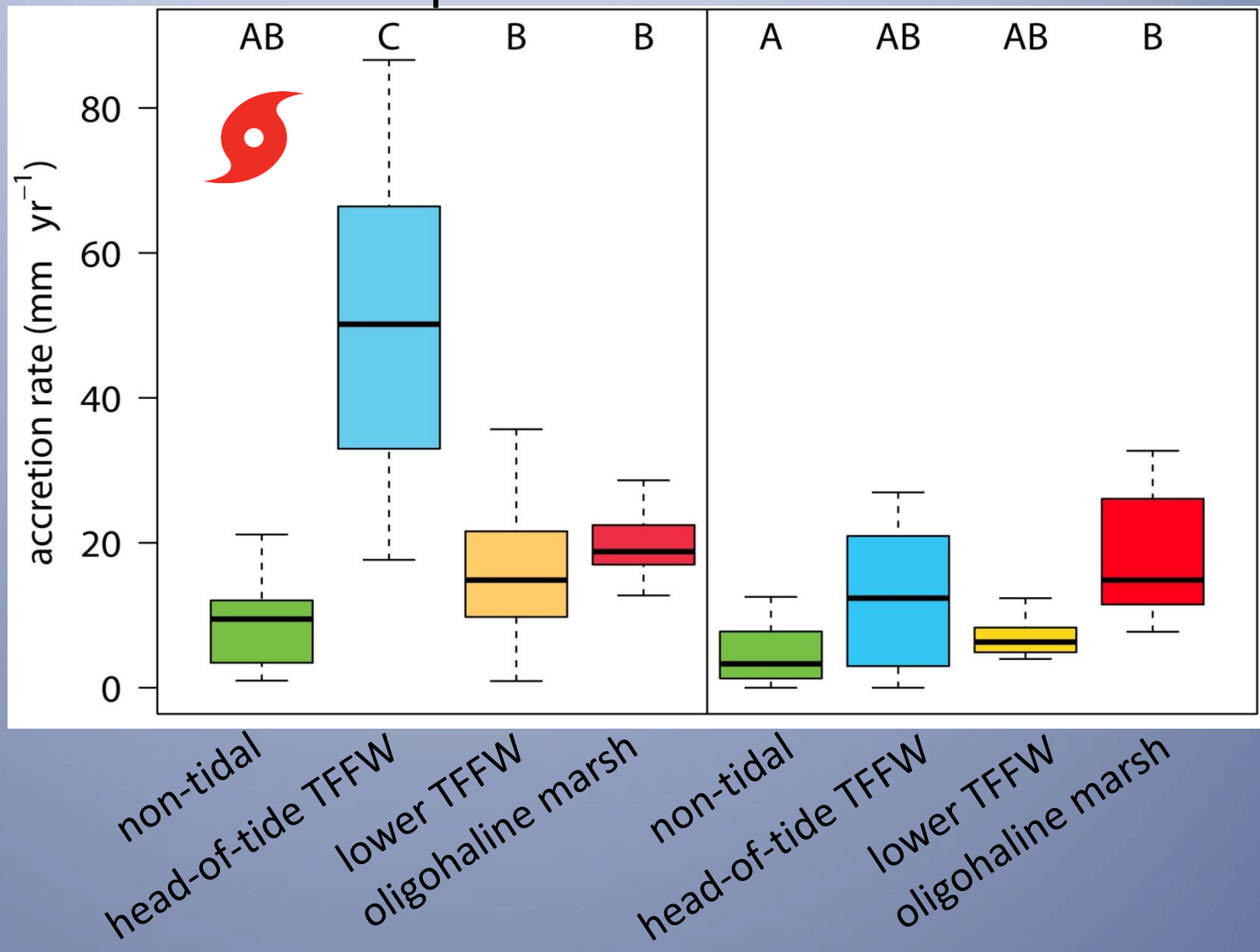




Ensign et al. 2014, *JGR-ES*

What happens once river loads hit tide?

Wetland sedimentation

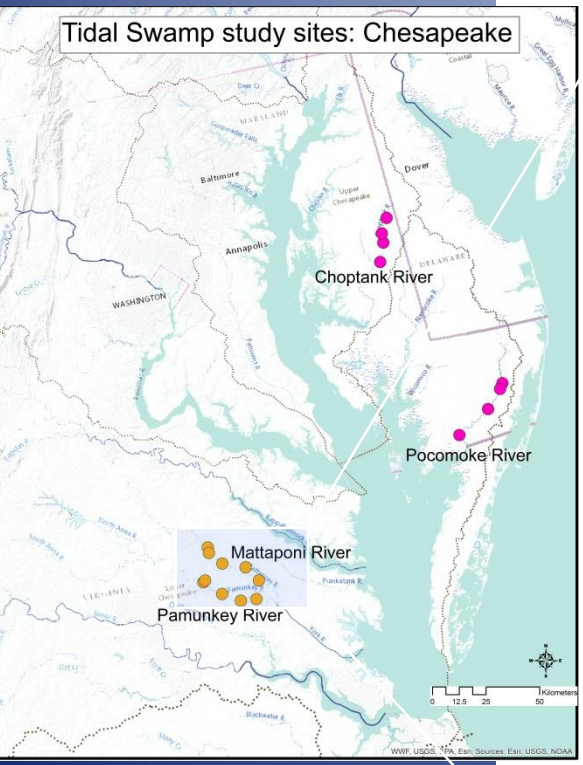


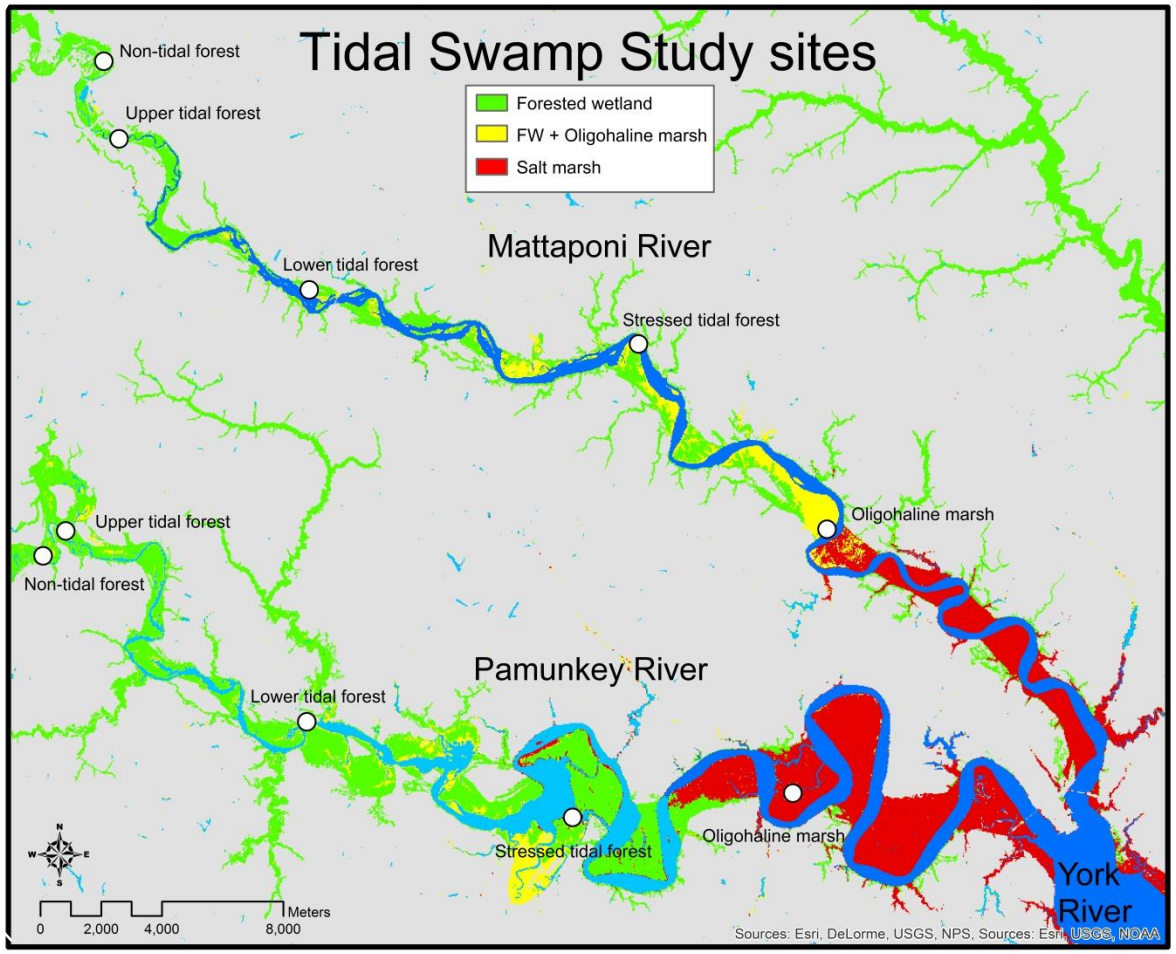
Ensign et al. 2014, *JGR-ES*

What happens once river loads hit tide?

and does it influence wetland resilience to sea level rise?

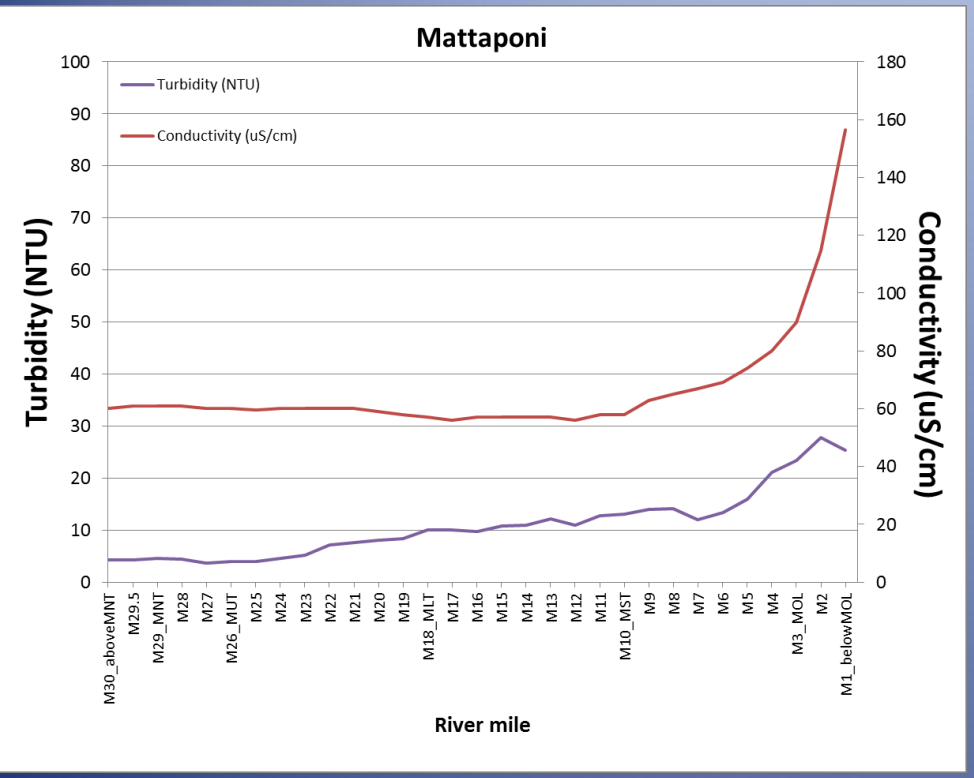
Watershed sediment load:
Pamunkey 6X > Mattaponi

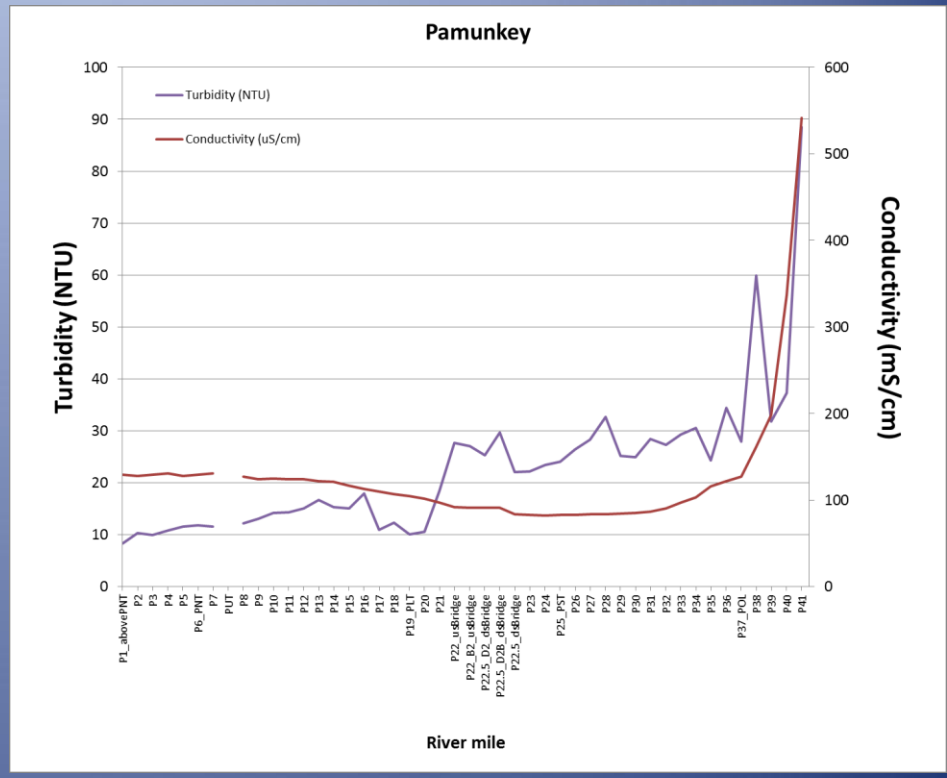




In-channel sediment availability

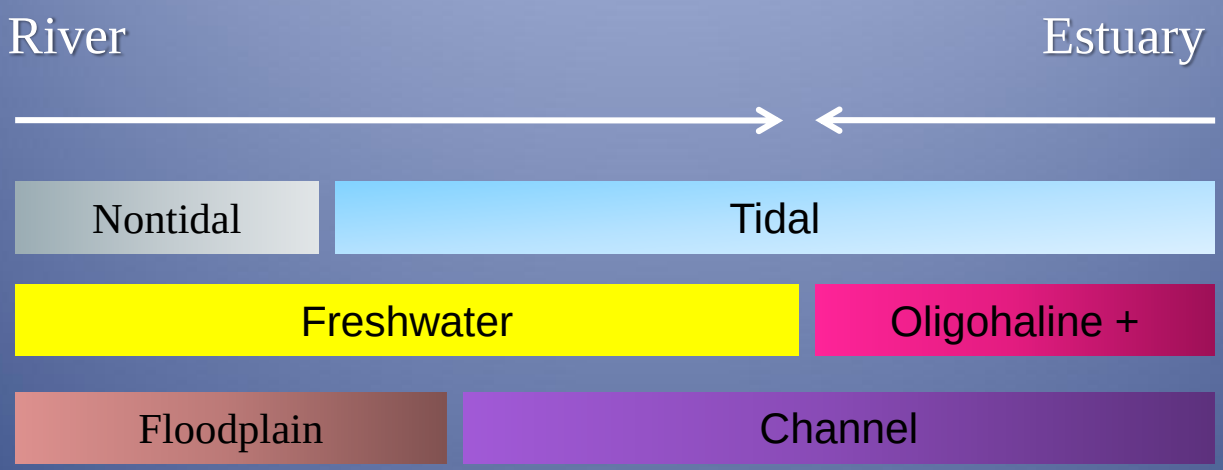
October 2016





Nontidal Tidal Fresh Oligohaline

Changes along the longitudinal landscape gradient



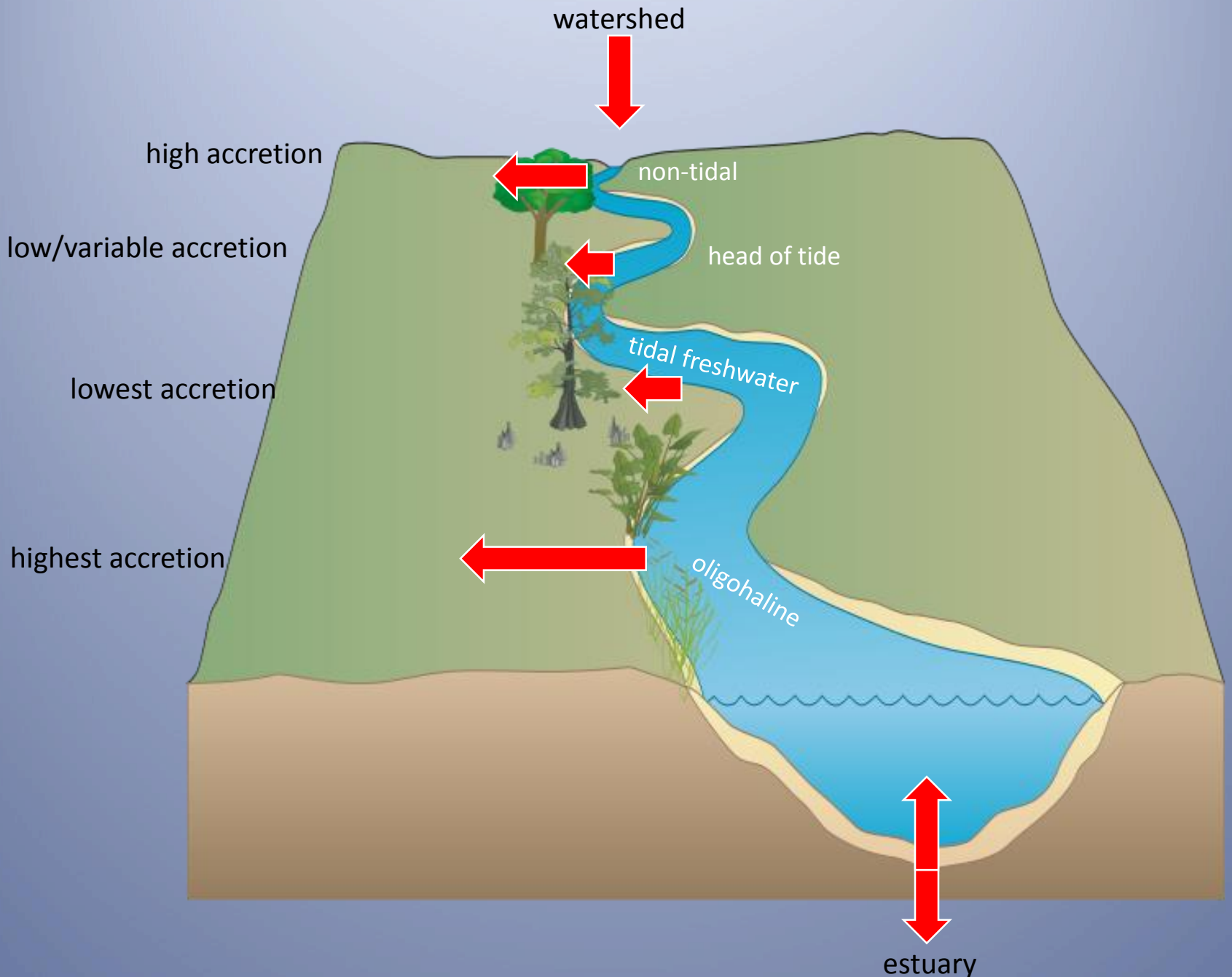
Bottomland hardwood

Tidal FW swamp

Tidal FW marsh

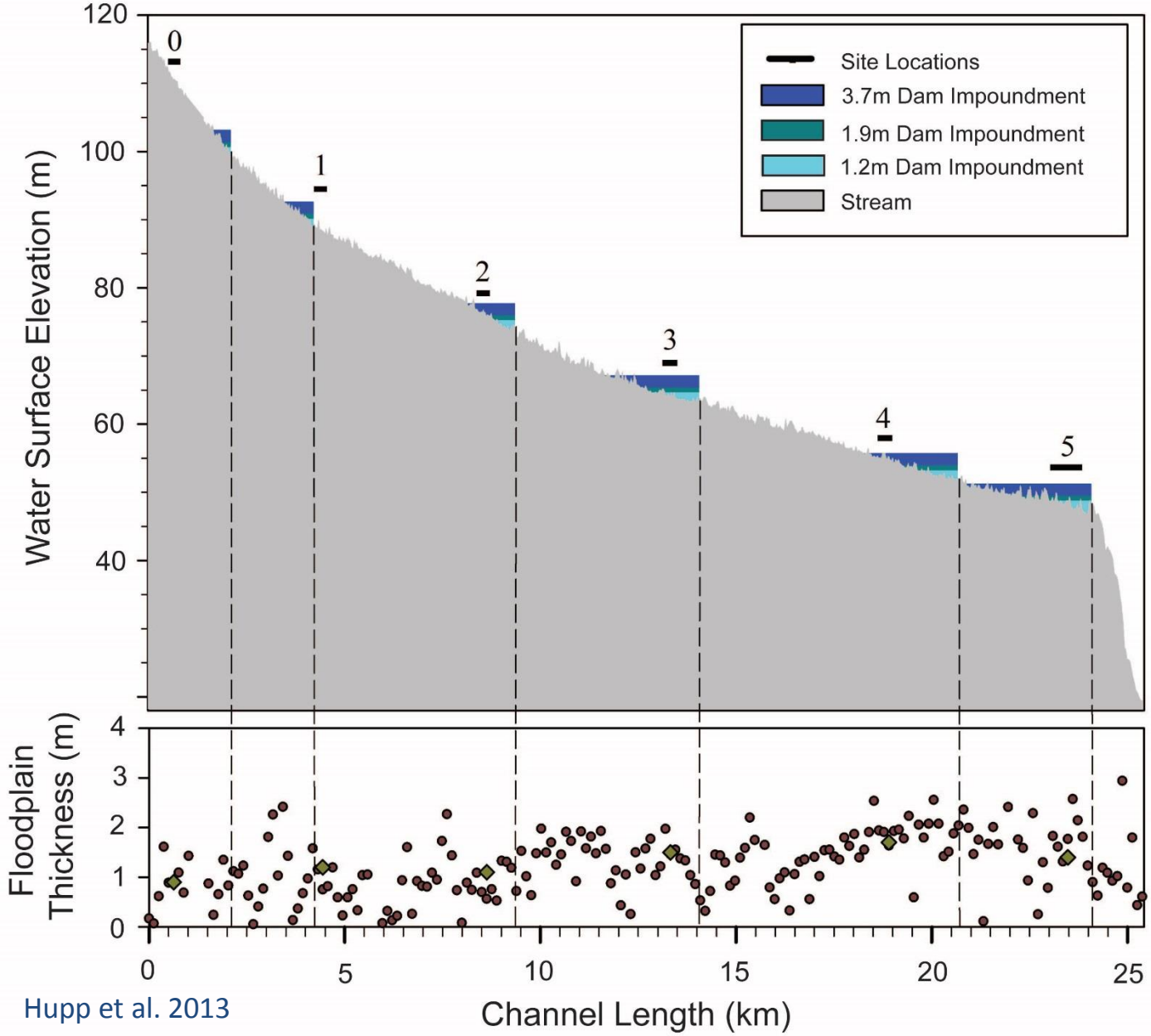
Oligohaline marsh +

Magnitudes of sediment sources change along tidal river gradient




Pocomoke River, MD
Thank You

LiDAR coverage, root mean square error 0.077



Hupp et al. 2013

No clear stepped conditions in profile or plan

The importance of floodplains to WQ

Measurement of functions

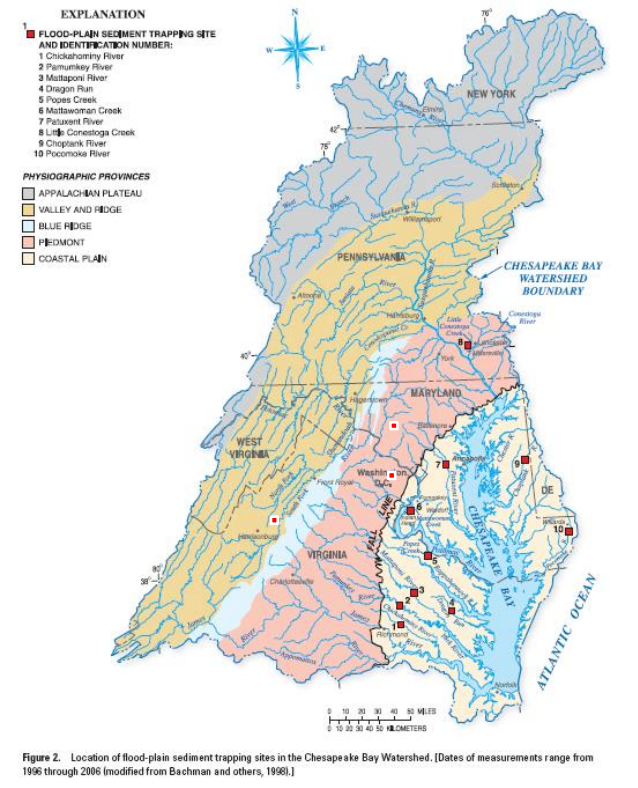
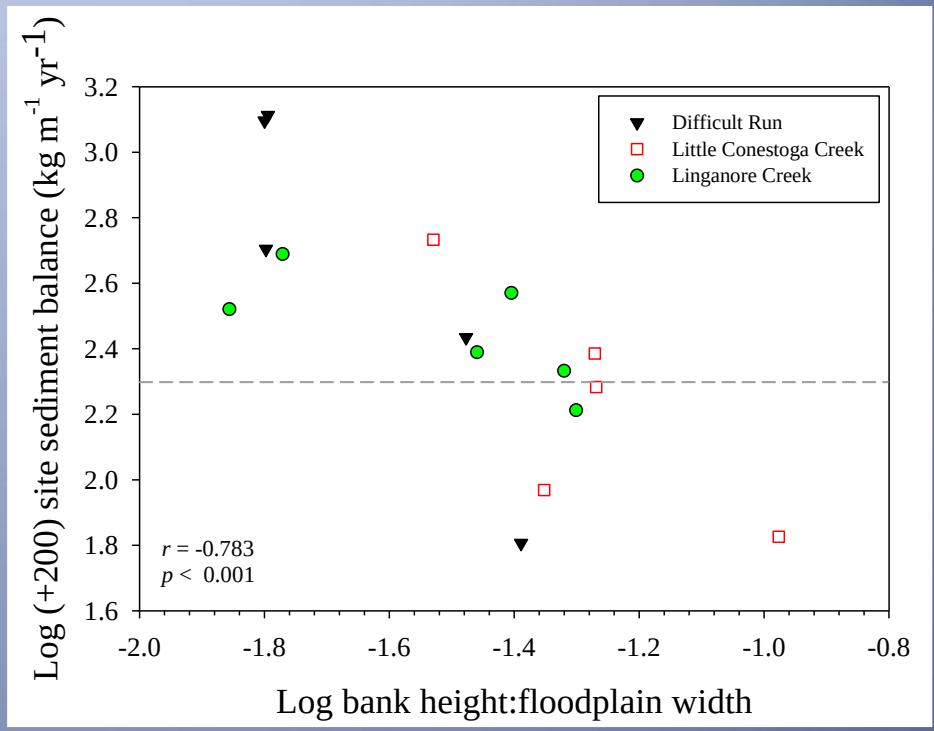


Figure 2. Location of flood-plain sediment trapping sites in the Chesapeake Bay Watershed. [Dates of measurements range from 1996 through 2006 (modified from Bachman and others, 1998).]

Ross et al. 2004
Noe and Hupp 2005
Noe and Hupp 2007
Gellis et al. 2008
Hogan and Walbridge 2009
Noe and Hupp 2009
Schenk and Hupp 2009
Kroes and Hupp 2010
Hupp et al. 2013
Schenk et al. 2013
Noe et al. 2013a
Noe et al. 2013b
Gellis et al. 2015

Predictability of functions



Schenk et al. 2013, *ESP&L*

Gellis et al. 2015, SIR

Only 3 Piedmont watersheds!

→ Not expected to be general, but shows promise of approach:

Easy geomorphic metrics may be predictive