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Water-quality effectiveness of stream restoration

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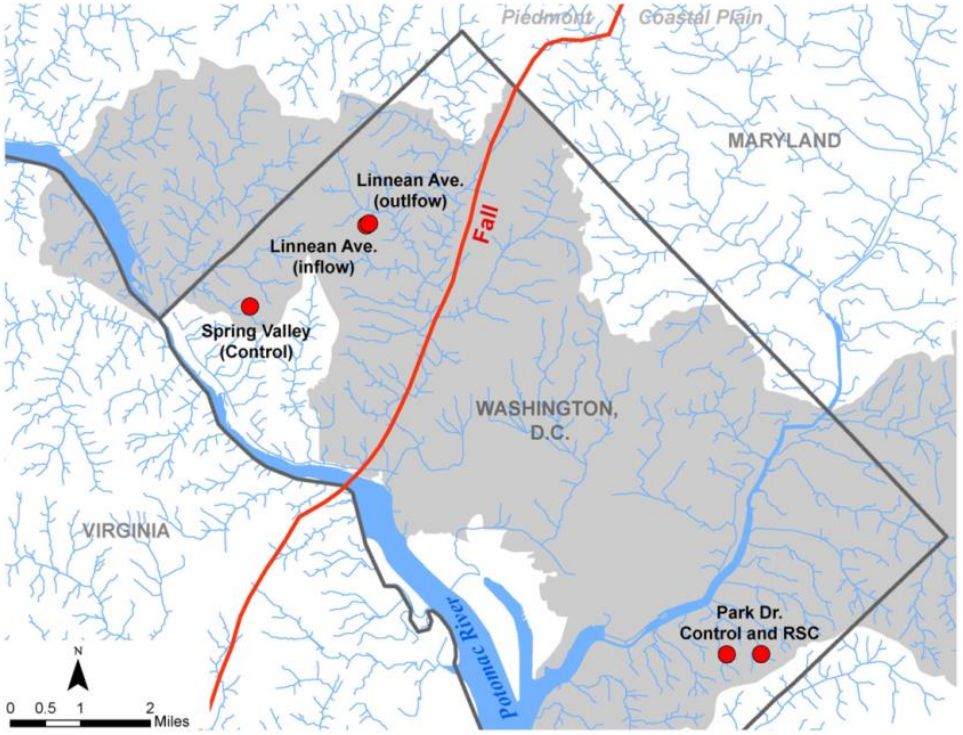
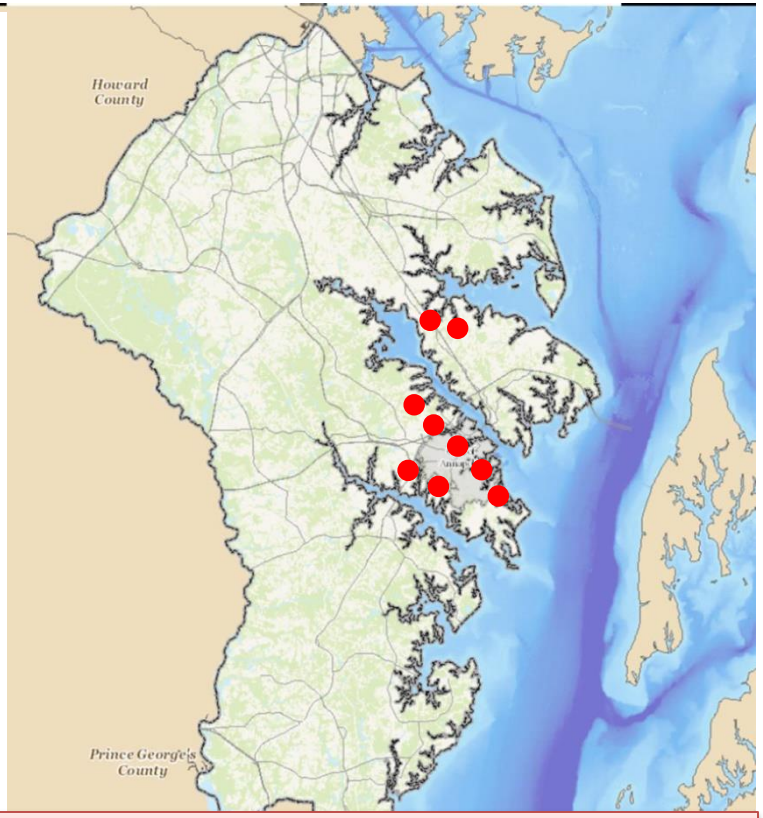
Location of Monitored Streams

Washington D.C.



Monitored for 3 years – from 2014 through 2016

Anne Arundel County



Monitored for 18 months to 5 years – between 2008 and 2016

Position of Monitored Streams

Zero to first-order channels
Urban/Suburban

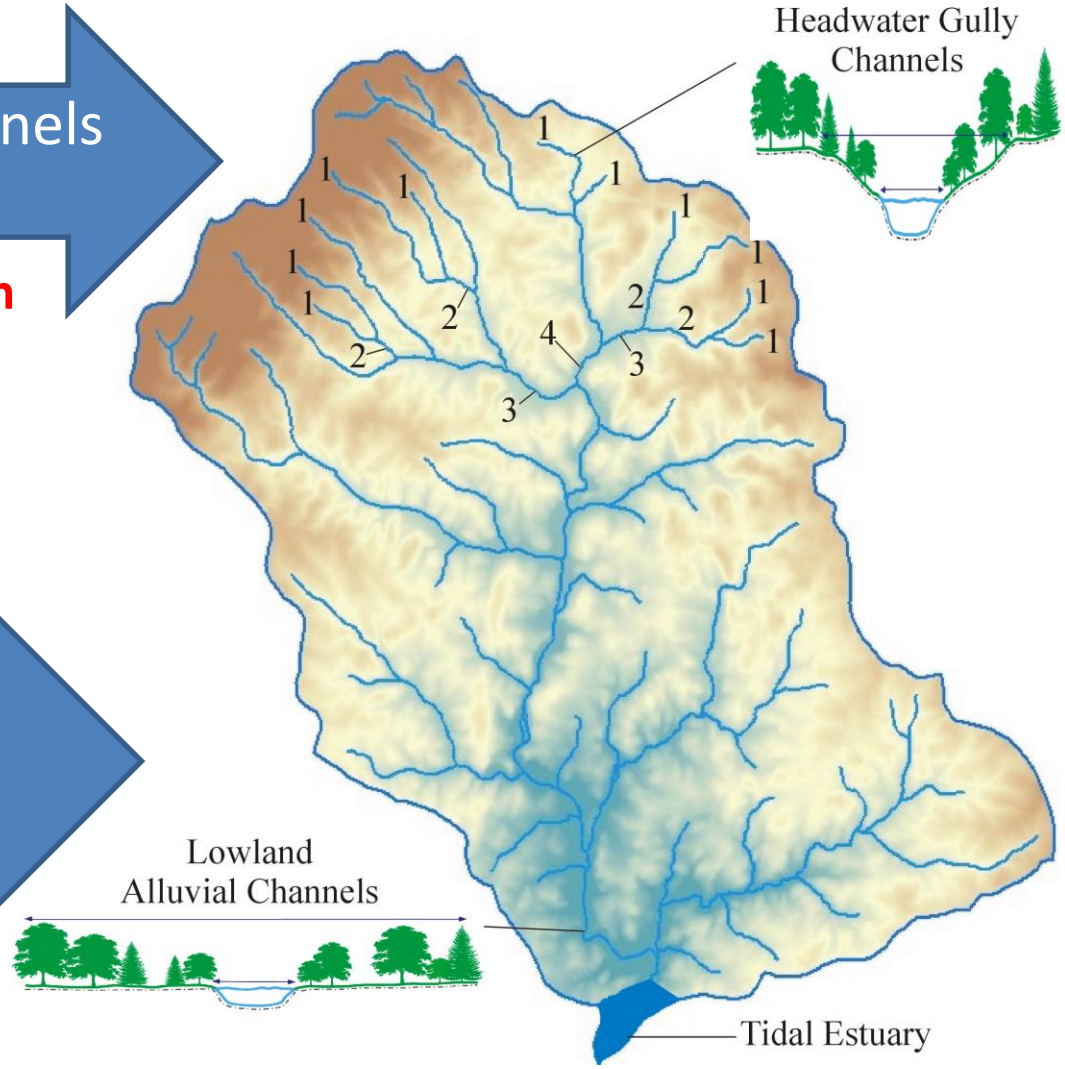
Piedmont & Coastal Plain

Drainage area ≈
0.05 to 0.15 km^2

Higher-order channels
Suburban

Coastal Plain

Drainage area ≈
1 to 1.4 km^2



Relevant Information About Sediment Sources

From Smith & Wilcox (2015):

- In small watersheds, sediment yield is higher in suburban land cover than in agriculture and forest.
- First-order channel enlargement is an important source but non-channel sources can provide 1/3 to 2/3 of the sediment load.

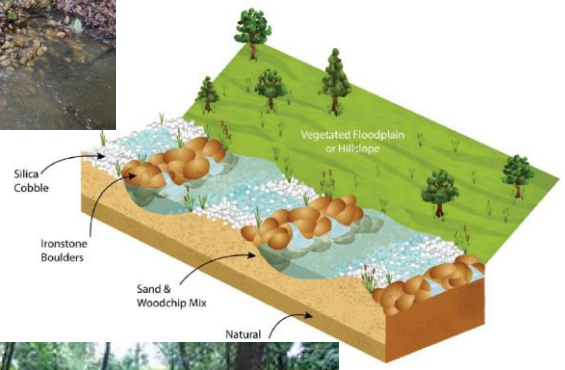
From Donovan et al. (2015)

- Streambanks contribute a large fraction (70% ± 50%) of sediment yield.
- The majority of streambank sediment loads were from first- and second-order tributaries.
- Legacy sediment constitute a greater proportion of streambanks along larger channels.
- Sediment deposition is increasingly important in larger drainages.

Restoration of Headwater Channels

BEFORE

AFTER



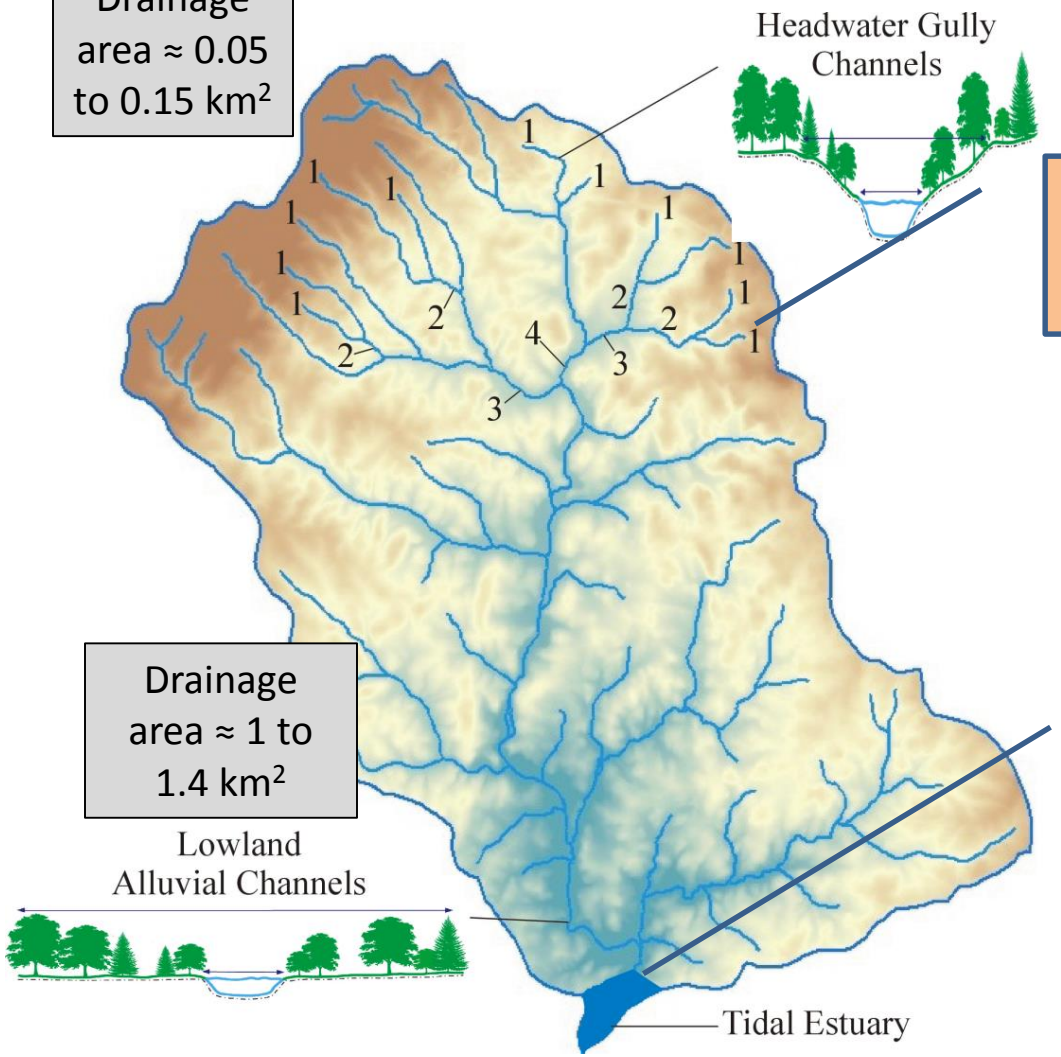
Restoration of Lowland Channels

BEFORE

AFTER

Sediment Export Observed

Drainage area ≈ 0.05 to 0.15 km^2



TSS = 62 to 229 Mg/km^2/yr (Piedmont & Coastal Plain)

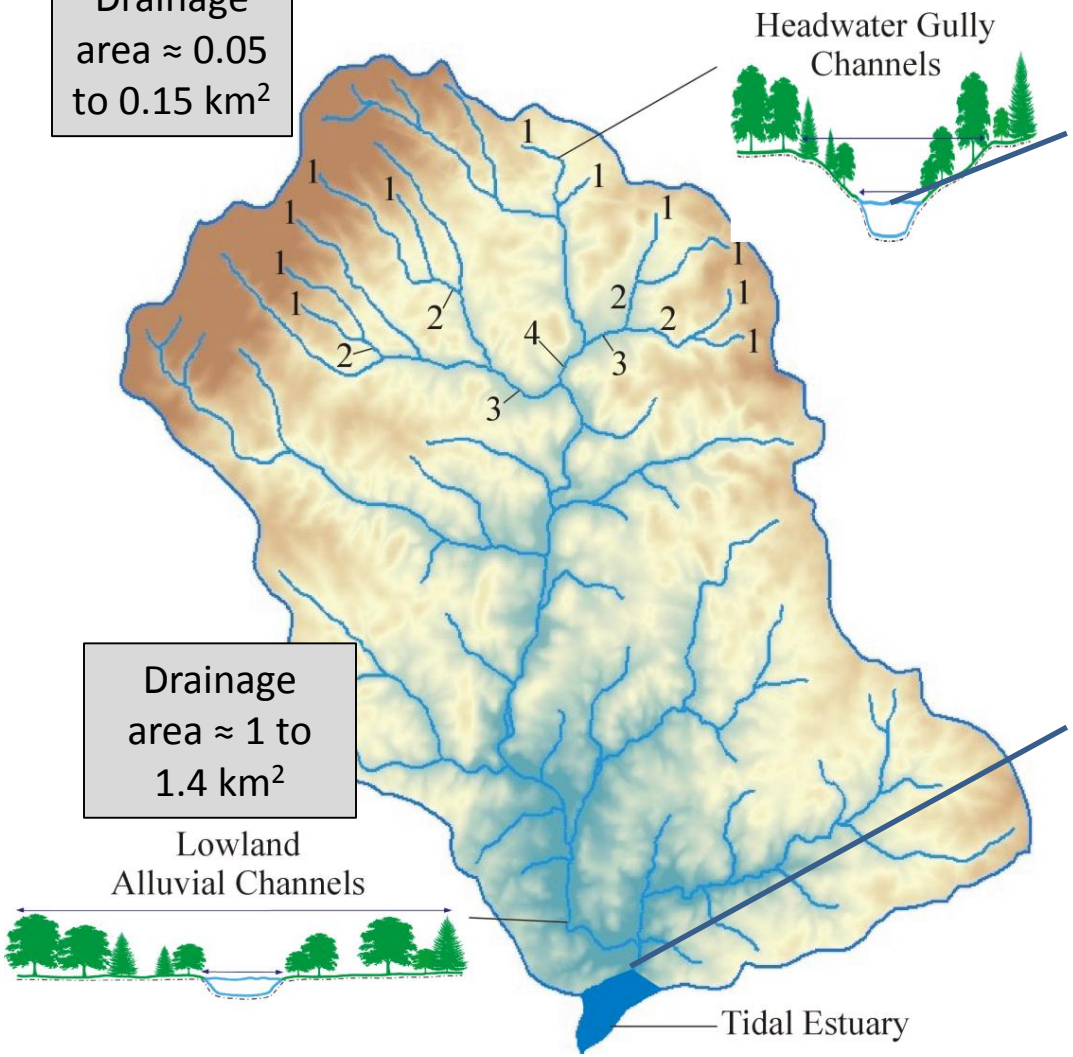
Drainage area ≈ 1 to 1.4 km^2

TSS = 14 to 35 Mg/km^2/yr (Coastal Plain)

Filoso et al., 2015, Env. Sci & Tech.; **Filoso** & Williams, *in prep*.)

Load Reductions Observed

Drainage area ≈ 0.05 to 0.15 km^2



Drainage area ≈ 1 to 1.4 km^2

↓**TSS** = 34 to 210 Mg/km^2/yr (Piedmont & Coastal Plain)

↓**TSS** = 0 to 10.8 Mg/km^2/yr (Coastal Plain)

Filoso et al., 2015, Env. Sci & Tech.; **Filoso** & Williams, *in prep*.)

Conclusions

- Sediment yield is larger in headwater watersheds than in larger drainages.
- Restored headwater channels reduce more sediment yield than restored lowland channels.
- Restoration of headwater channels prevent large amounts of sediment from being exported downstream.
- Load reduction in restored headwater channels is caused by bank erosion prevention followed by upland sediment retention (in RSCs).
- Load reduction in restored lowland channel combine sediment retention and streambank erosion prevention; retention is variable.

Final Remarks

- Sediment retention effectiveness in restored lowland reaches depends on the reduction of upstream sediment input.
- Restoration of lowland channels can increase export of other particulate material (TSS).
- Restoration of lowland channels probably reduce more legacy sediment export than restoration of upland channels, but the latter is more effective at reducing large amounts of sediment yield.

Acknowledgments

QUESTIONS?

Questions to Ask

- What is the relative contribution of legacy deposits in upland versus lowland channels?
- Does it even matter weather or not sediment export is from legacy versus other sources?
- Different methods can provide very different estimates of sediment yield (Smith & Wilcox, 2015)