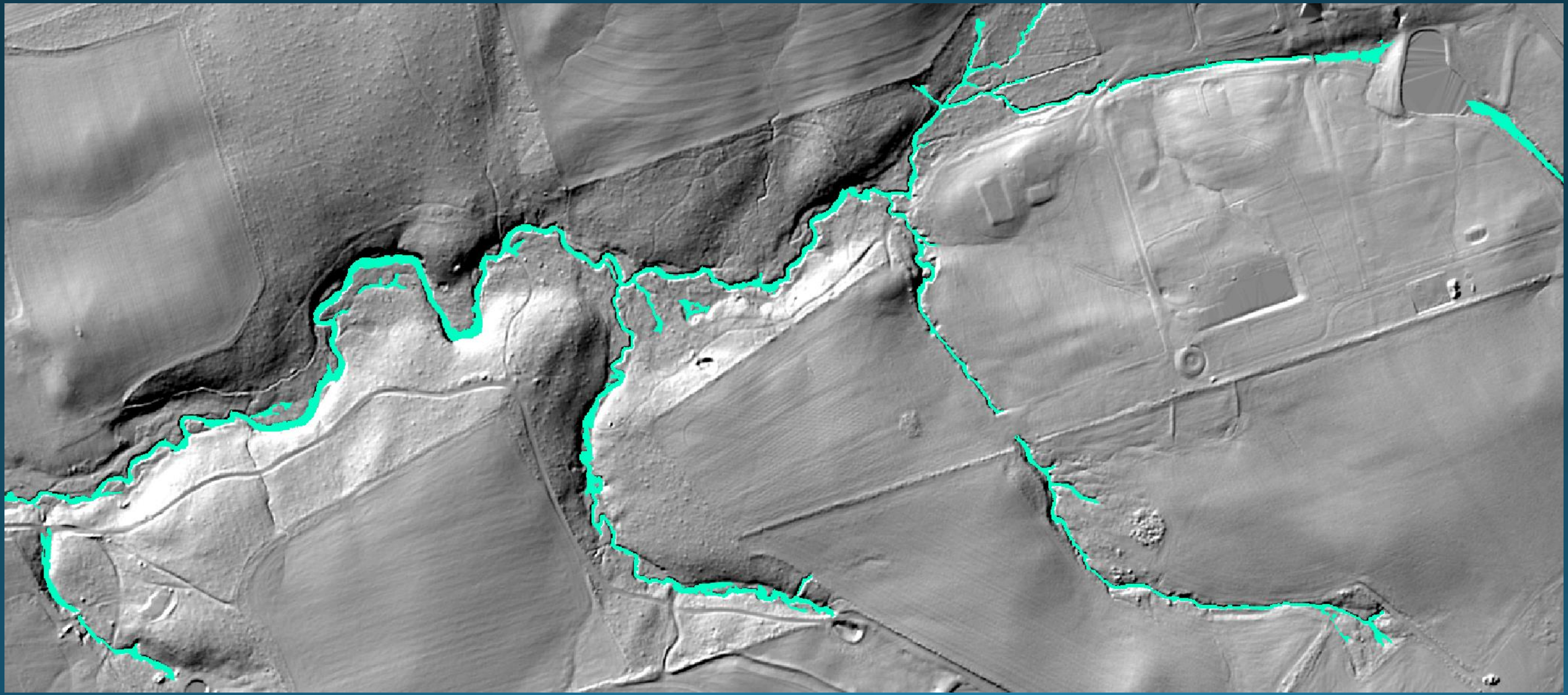
Objective 2: Implications of High-Res Hydrography in Bay Modeling

Presentation to Land Use and Forestry Workgroups

David Saavedra, Matt Baker – December 4, 2019

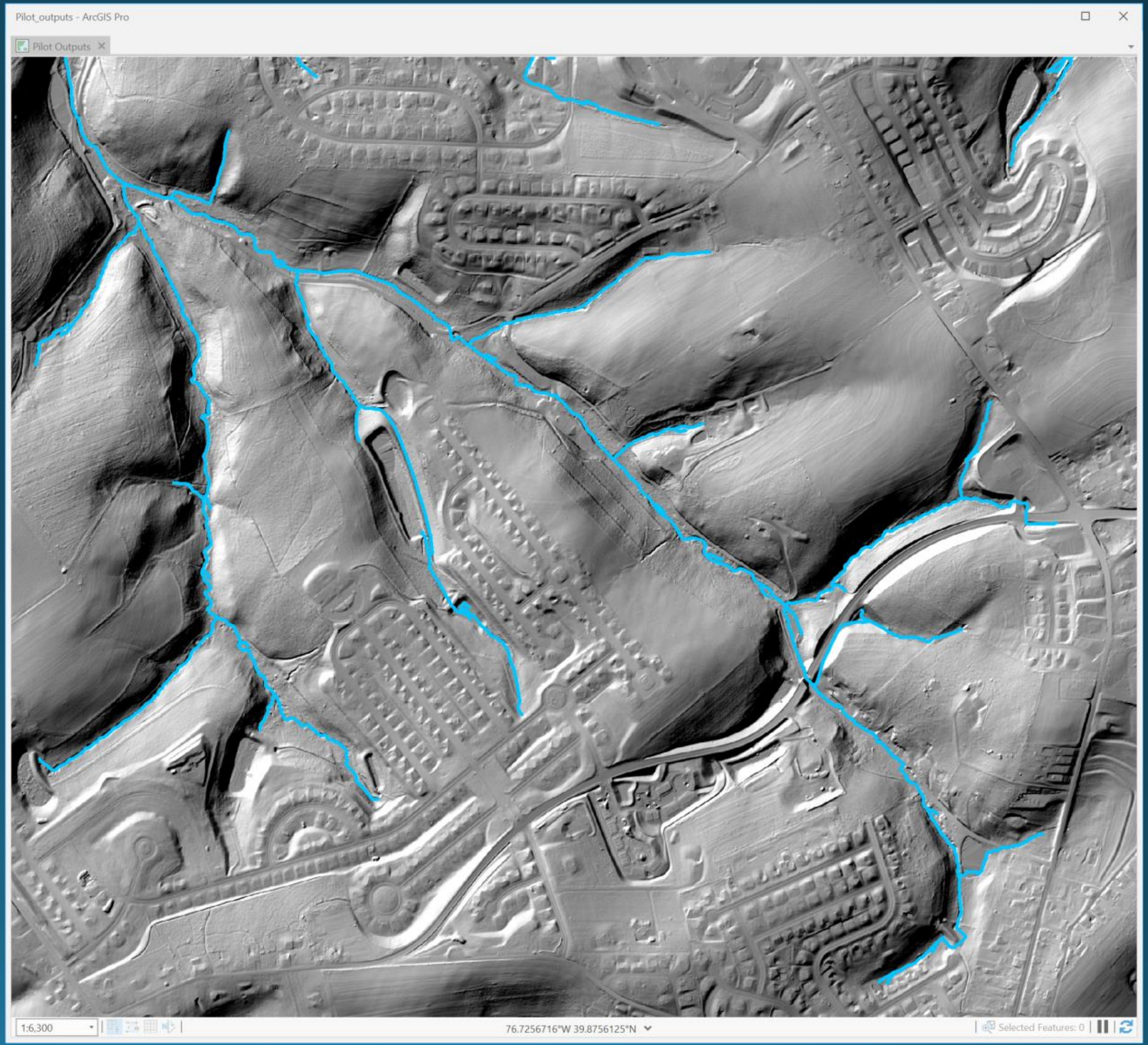


Overview

- Methods
- Impacts on stream length and density
- Bufferable extent
- Variable buffer efficiencies
- Estimates of bank height

Methods: Channel extraction

1. Lidar elevation
2. Valley-scale classification
3. Channel-scale classification
4. Extract valley network
5. Extract channels using valley network
6. QAQC channel skeleton
7. Connect stream network

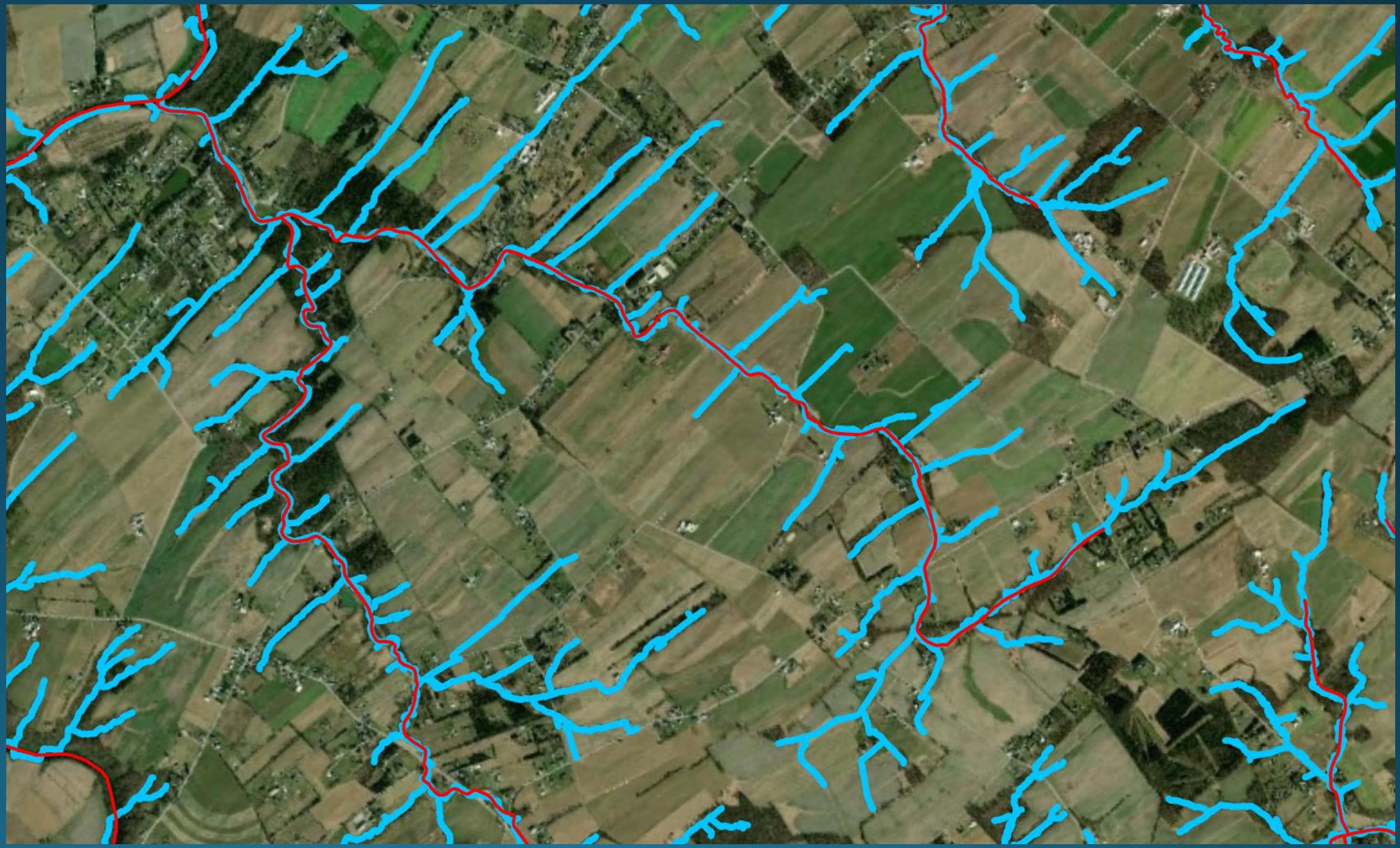


Impacts on stream length

- Higher spatial resolution equates to increase in total stream length
  - Example: Walnut Run in Strasburg, PA:
    - NHD+ HR (red): 5.14 km
    - High-res maps (blue): 6.30 km
  - Numerous other zero- and first-order streams also identified that were absent from NHD

Impacts on stream density

- Greater number of streams identified in headwater areas
- Increased drainage density overall
- Regional factors also impact drainage density (e.g. density may appear lower in karst landscapes)



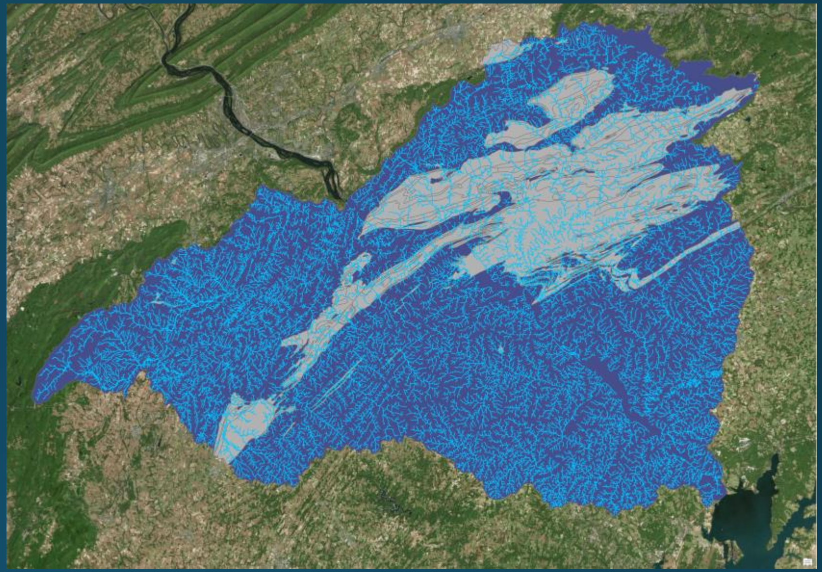
Example: Preliminary estimates from Lower Susquehanna

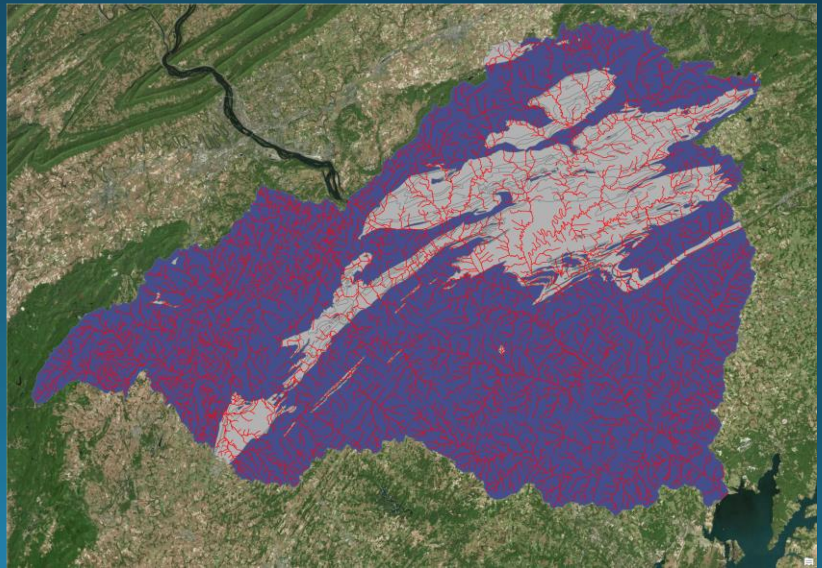
- High-res (blue):

Total density (km/km^2)	2.70
Density, carbonate (km/km^2)	2.26
Density, non-carbonate (km/km^2)	2.82

- NHD+HR (red):

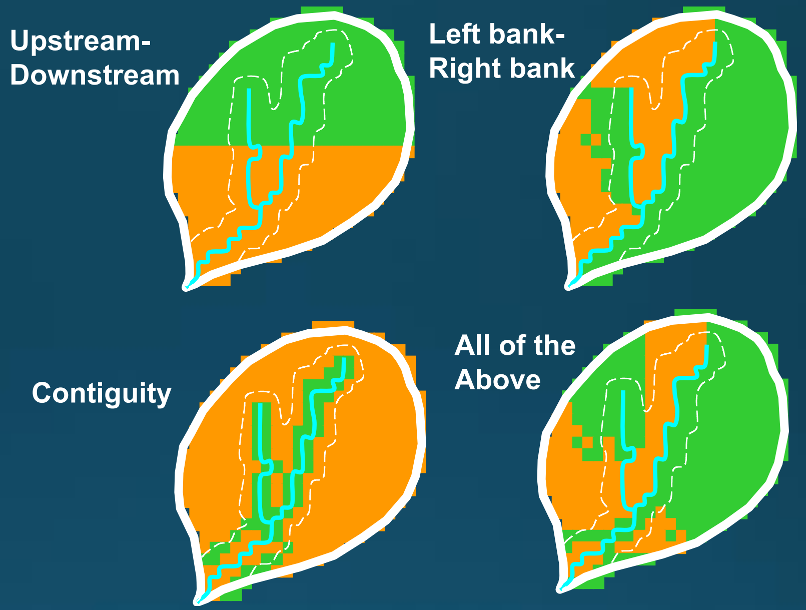
Total density (km/km^2)	1.22
Density, carbonate (km/km^2)	1.29
Density, non-carbonate (km/km^2)	1.20

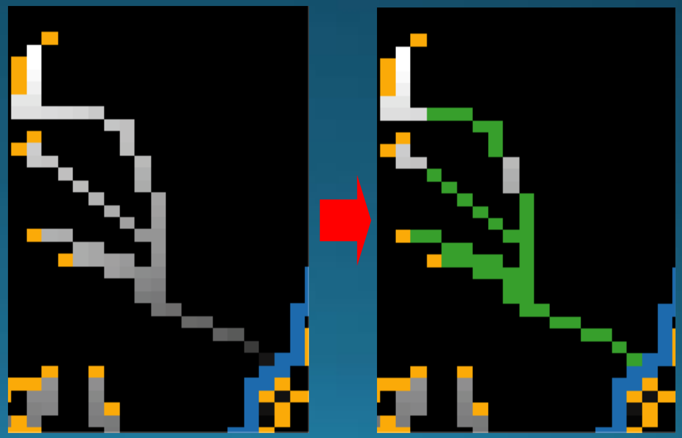




Bufferable extent

- Proximity to a stream is not a good measure of buffer effect
- Tracing flow pathways allows integration of source areas





Baker, M. E., Weller, D. E., & Jordan, T. E. (2007). Effects of stream map resolution on measures of riparian buffer distribution and nutrient retention potential. Landscape Ecology, 22(7), 973-992.

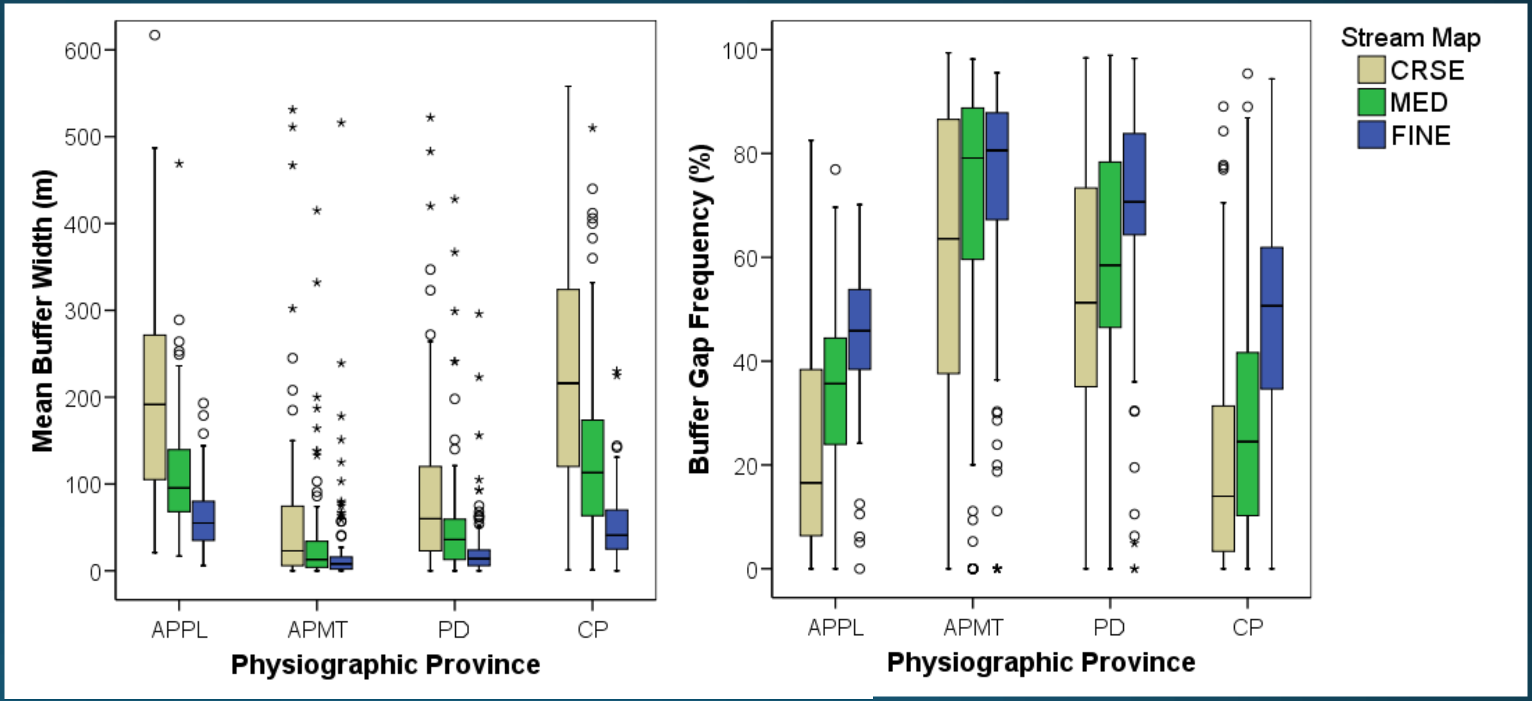
Bufferable extent

- “In some watersheds, switching from a coarse resolution to a fine resolution stream map completely changed [the] perception of a stream network from well buffered to largely unbuffered”

Baker, M. E., Weller, D. E., & Jordan, T. E. (2007). Effects of stream map resolution on measures of riparian buffer distribution and nutrient retention potential. Landscape Ecology, 22(7), 973-992.

Bufferable extent

- "In some watersheds, switching from a coarse resolution to a fine resolution stream map completely changed [the] perception of a stream network from well buffered to largely unbuffered"



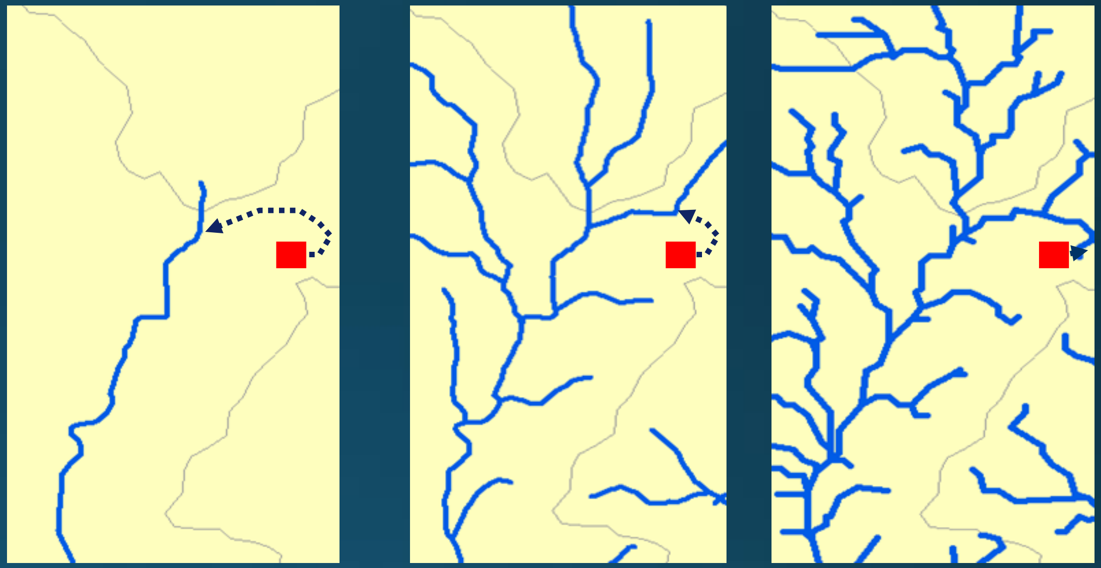
Baker, M. E., Weller, D. E., & Jordan, T. E. (2007). Effects of stream map resolution on measures of riparian buffer distribution and nutrient retention potential. Landscape Ecology, 22(7), 973-992.

Bufferable extent

- Livestock exclusion fencing implications:
  - To set goals and track progress, total amount of streams through pasture must be known
  - Improved stream maps and land use maps could be instrumental in goal setting and tracking

Variable buffer efficiencies

- Densified stream maps affect apparent connectivity and lengths of connecting flow pathways
- Spatial configuration of transport pathways important–not all near-stream forest effectively reduces nutrient transport [1]
- Higher resolution stream and land use maps provide more information for analyzing and modeling variable efficiencies



1 National Hydrography Dataset (CRSE)1:100,000

2 Digital Line Graph (MED)1:24,000

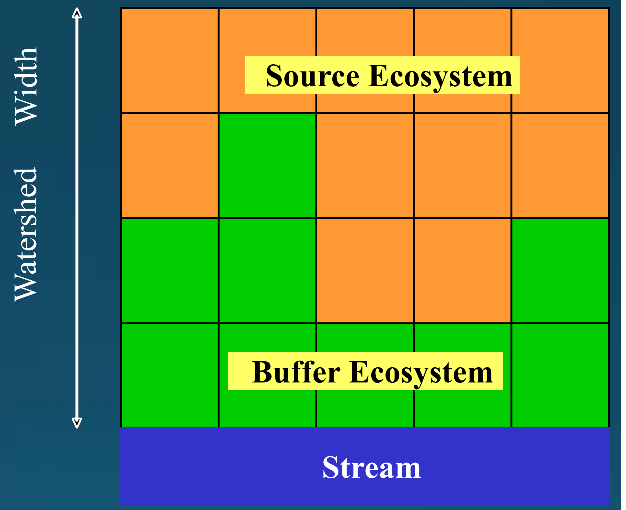
3 High-resolution derived streams (FINE) >1:24,000

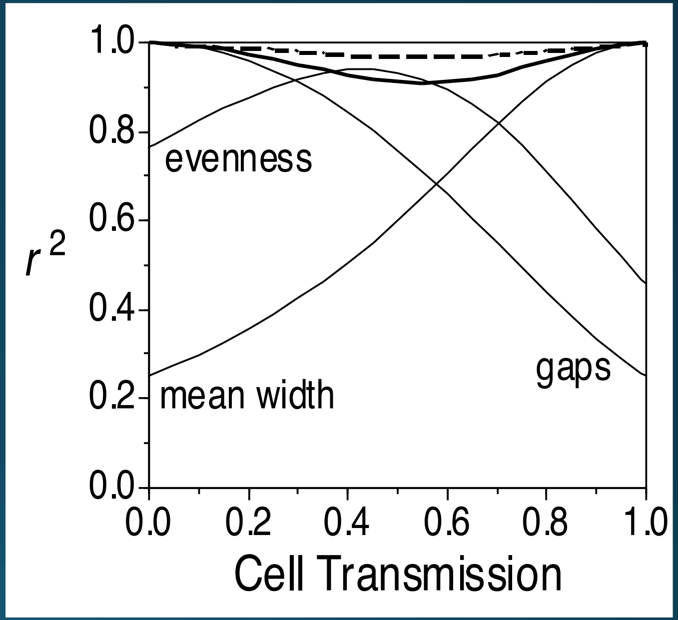
Baker, M. E., Weller, D. E., & Jordan, T. E. (2007). Effects of stream map resolution on measures of riparian buffer distribution and nutrient retention potential. Landscape Ecology, 22(7), 973-992.

1. Baker, M. E., Weller, D. E., & Jordan, T. E. (2006). Improved methods for quantifying potential nutrient interception by riparian buffers. Landscape Ecology, 21(8), 1327-1345.

Variable buffer efficiencies

- Retentive Buffers: gap frequency controls nutrient losses
- Leaky Buffers: Mean width controls nutrient losses
- We know a lot about what creates retentive buffers
- Specific tests can quantify buffer efficiencies





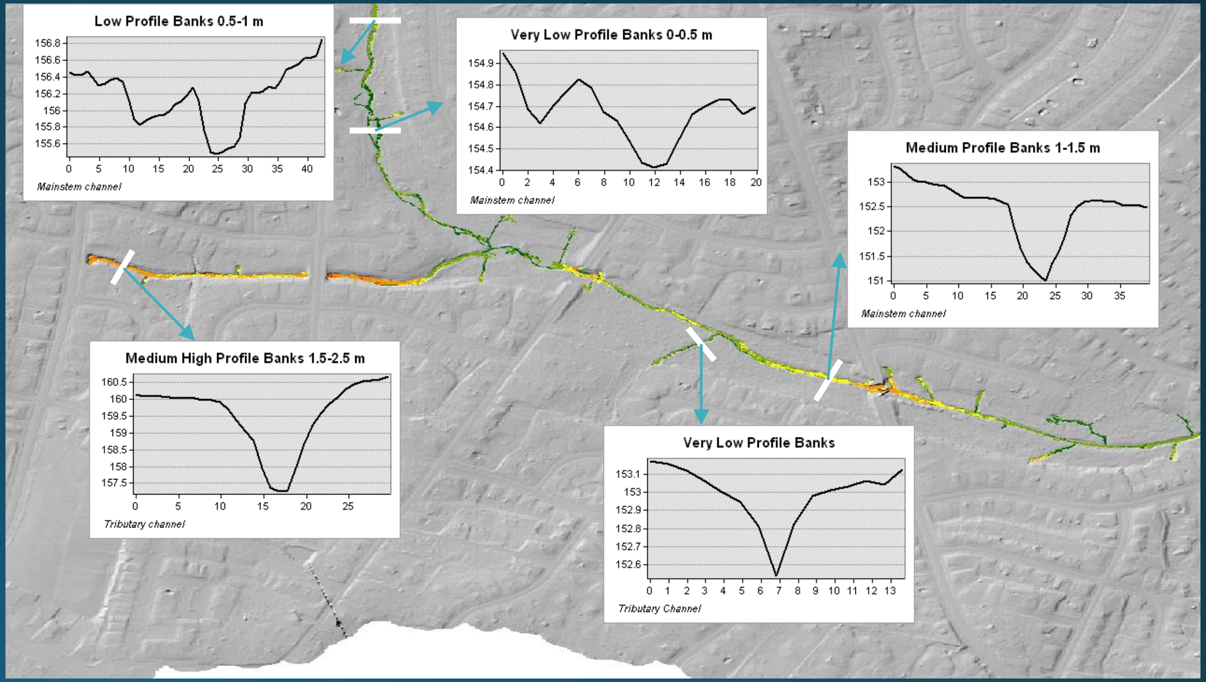
Weller, D. E., Jordan, T. E., & Correll, D. L. (1998). Heuristic models for material discharge from landscapes with riparian buffers. *Ecological Applications*, *8*(4), 1156-1169.

Weller, D. E., Baker, M. E., & Jordan, T. E. (2011). Effects of riparian buffers on nitrate concentrations in watershed discharges: new models and management implications. *Ecological Applications*, *21*(5), 1679-1695.

CONSERVATION
INNOVATION
CENTER
CHESAPEAKE CONSERVANCY
UMBC

Bank height and incision

- Terrain classification algorithm used to map streams allows bank height estimation for each pixel – can be aggregated to reach scale
- Valuable information for studying incision, targeting stream restoration, floodplain reconnection, etc.



Questions?

- Matt Baker:
  mbaker@umbc.edu
  410-455-3759

- David Saavedra:
  dsaavedra@chesapeakeconservancy.org
  443-321-3610