Developing a Prioritization Tool for Wetland Restoration

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The Nature Conservancy

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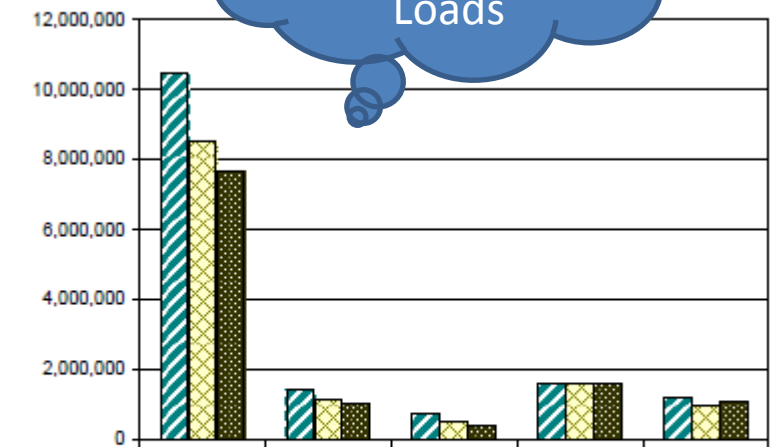
Restoring the Chesapeake Bay : MD's Eastern Shore Pollution Diet (TMDL)

Required: 20 to 25% Reduction in TN (and TP) Loads



	Agriculture	Urban	Septic	Forest	Wastewater
2009	10,450,365	1,449,911	761,172	1,612,904	1,215,831
2017 Target	8,515,194	1,157,435	531,973	1,624,126	954,921
2020 Target	7,685,835	1,032,088	433,744	1,628,936	1,090,187

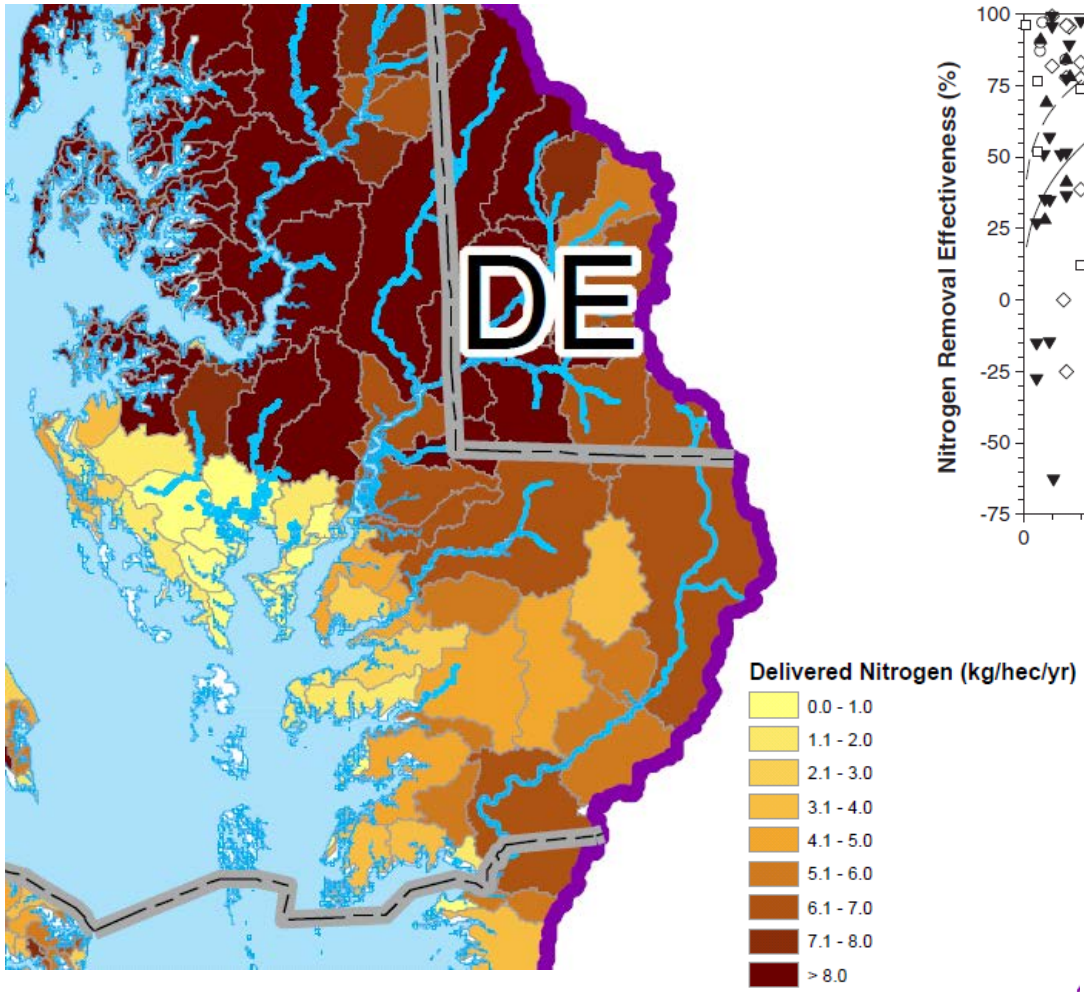
Potential Management Strategies:

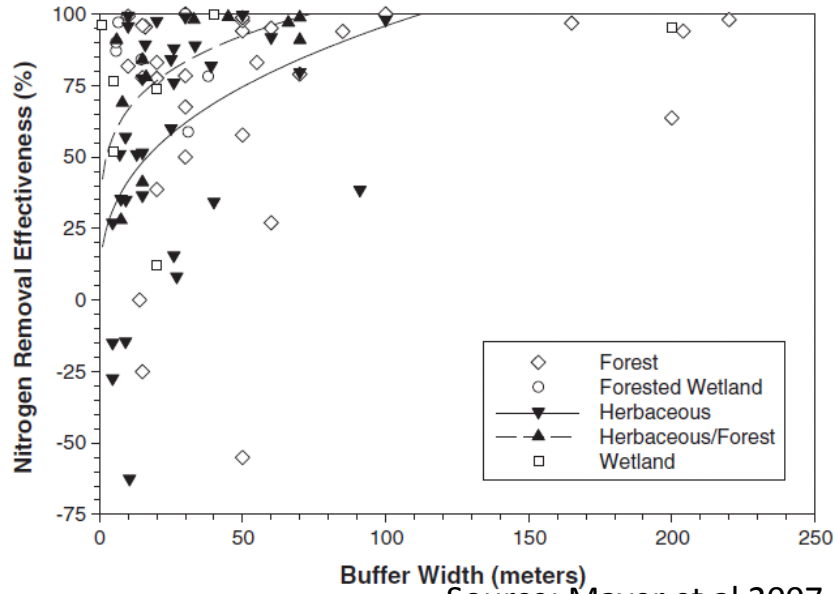
Riparian Forest Buffers - Nutrient and Sediment Reduction Efficiencies			
	TN	TP	TSS
Inner Coastal Plain	65	42	56
Outer Coastal Plain Well Drained	31	45	60
Outer Coastal Plain Poorly Drained	56	39	52
Tidal Influenced	19	45	60

Riparian Grass Buffers - Nutrient and Sediment Reduction Efficiencies			
	TN	TP	TSS
Inner Coastal Plain	46	42	56
Outer Coastal Plain Well Drained	21	45	60
Outer Coastal Plain Poorly Drained	39	39	52
Tidal Influenced	13	45	60

Source: Simpson and Weammert 2009

Limited Availability of Priority and Assessment Tools

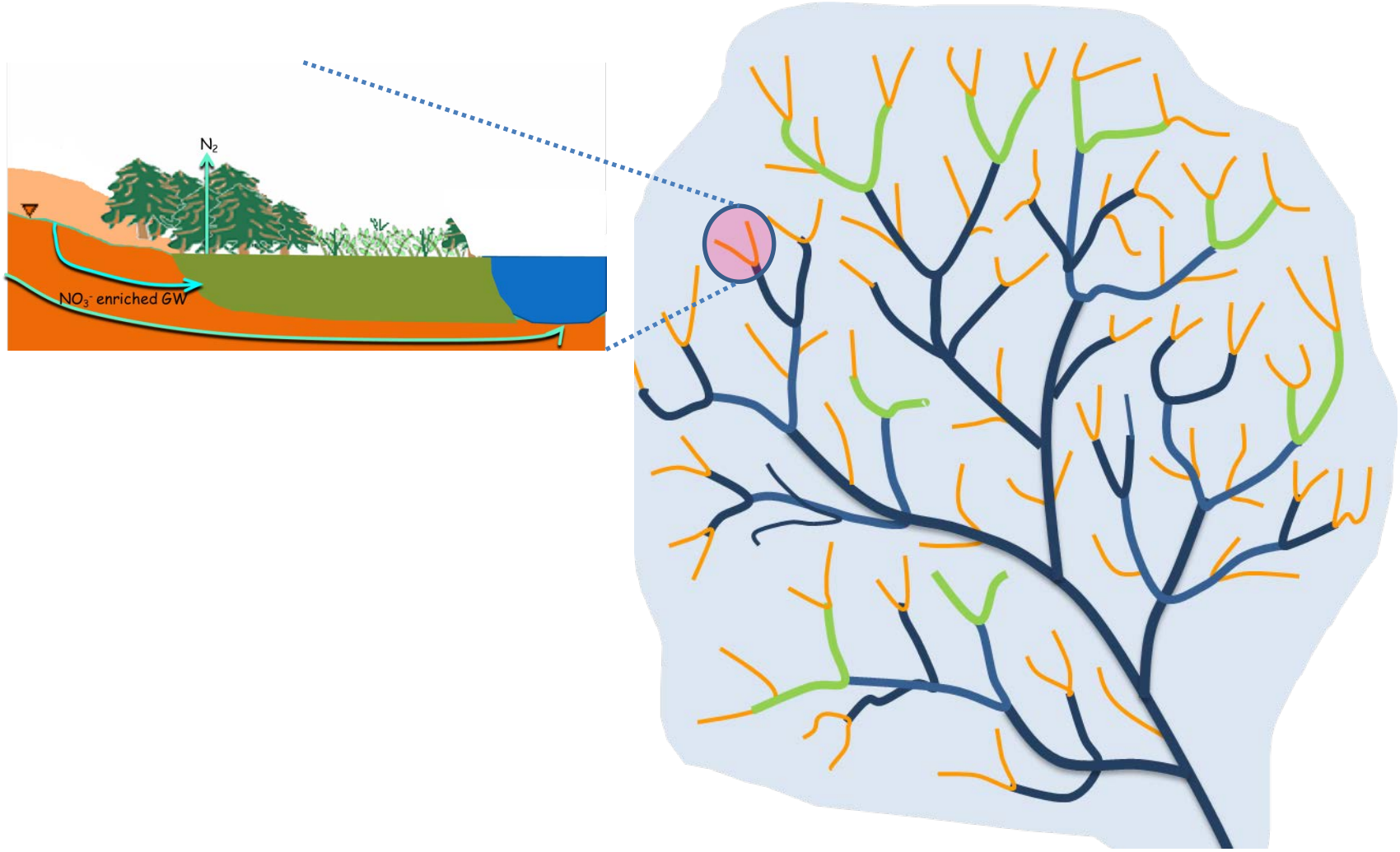




Source: Mayer et al 2007

http://www.chesapeakebay.net/maps/map/delivered_yield_of_total_nitrogen_agricultural_sources

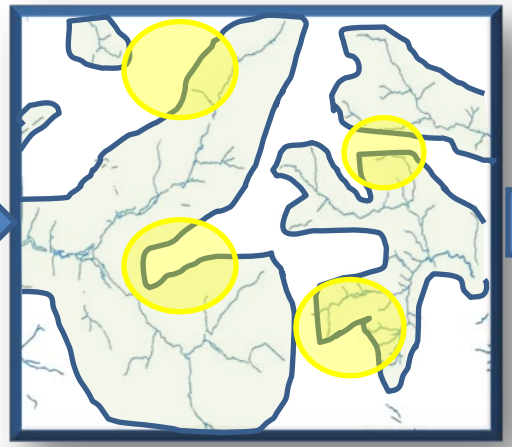
Reducing Uncertainty in BMP Efficiencies Requires Assessment of Local and Basin-scaled BMP Impacts



Challenge: Where, What, How Much

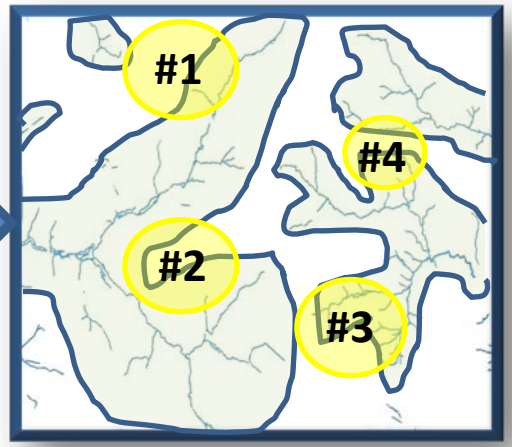
Conceptual Approach:

I. Define Ecohydrologically Active Areas



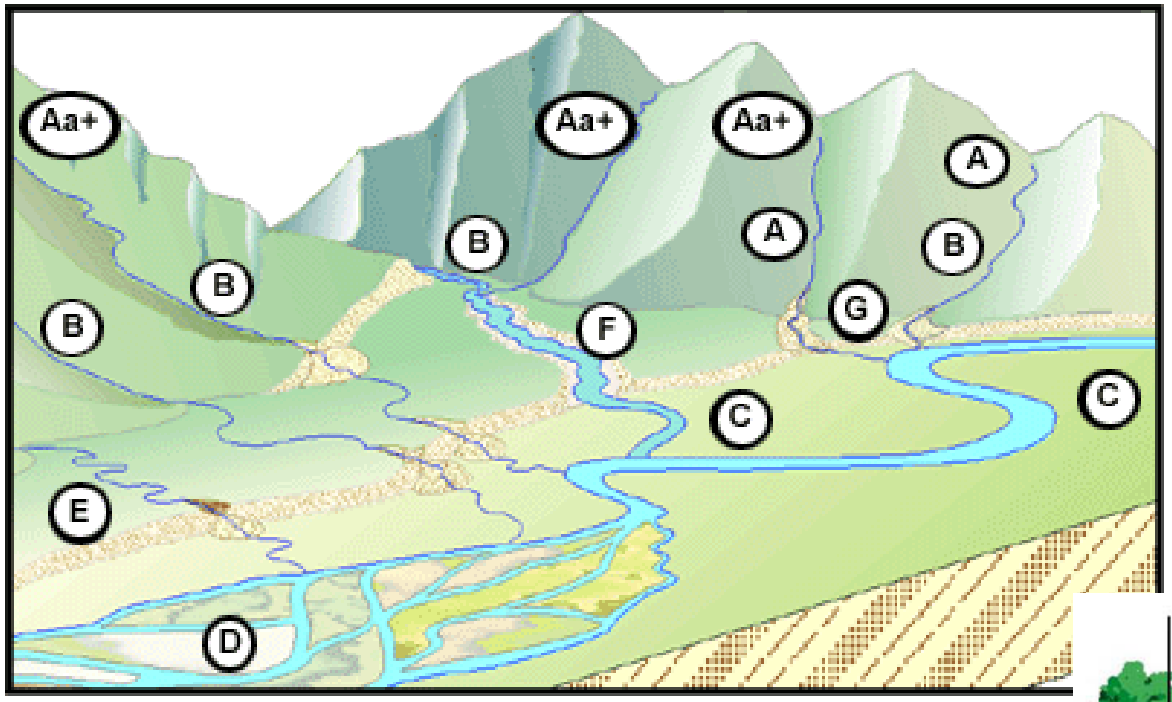
II. Identify Contributing Nutrient Sources

III. Consider Additional Prioritization Criteria

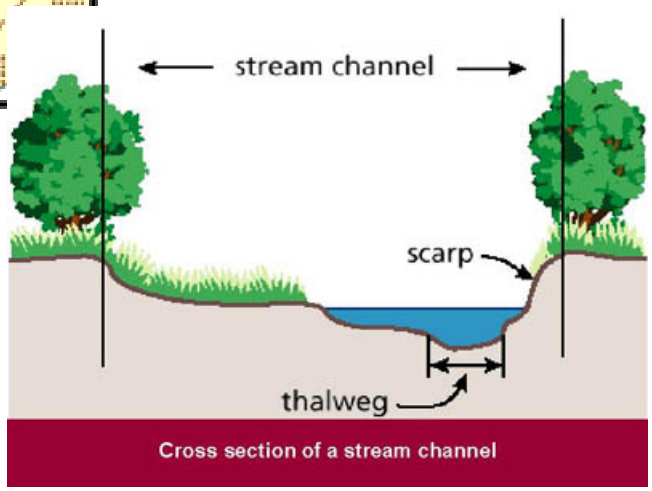


Results: Rank opportunities to maximize return on $$ invested to install bmp's and improve water quality.

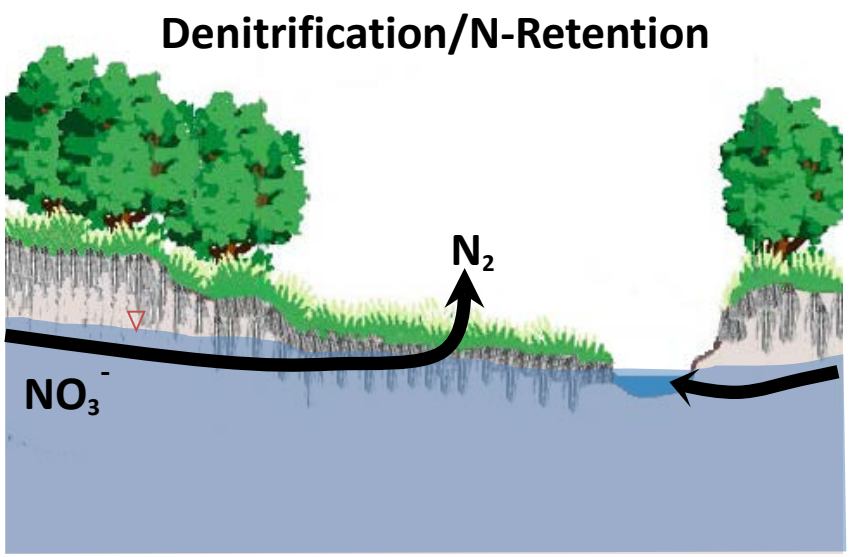
A fluvial geomorphologist's persective:

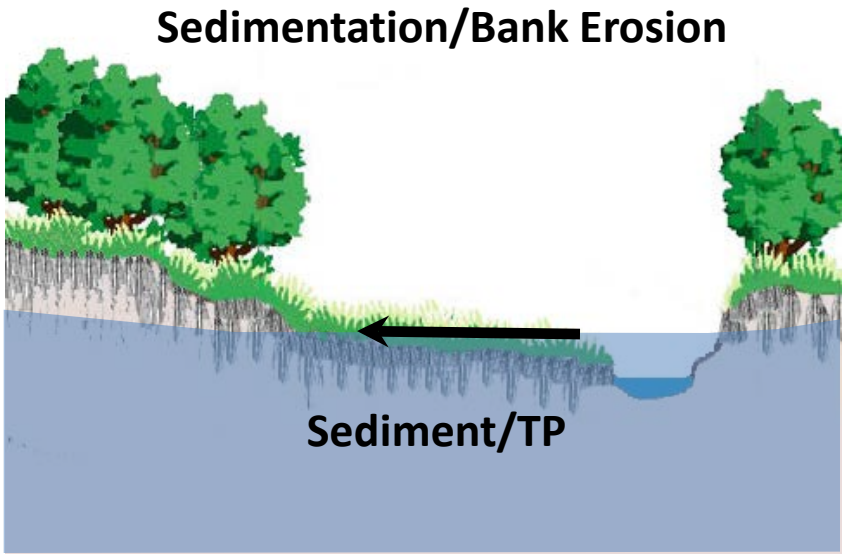


Rosgen's Stream Scheme (1996).



Floodplain - Riparian Processes:
Nutrient/Sediment Sink, Source, or Transformer?

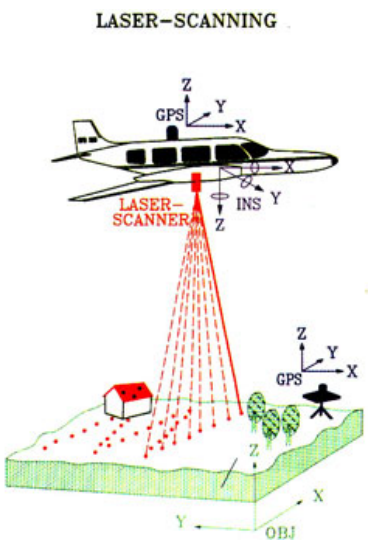




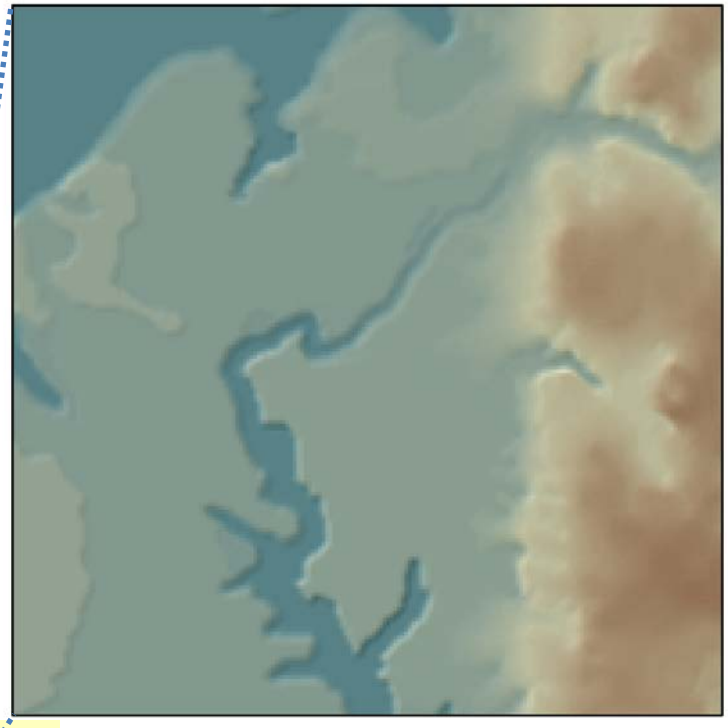
Nitrogen

Sediment / Phosphorus

LIght Detection And Ranging (LIDAR) Data Reveal Patterns in Channel Morphology

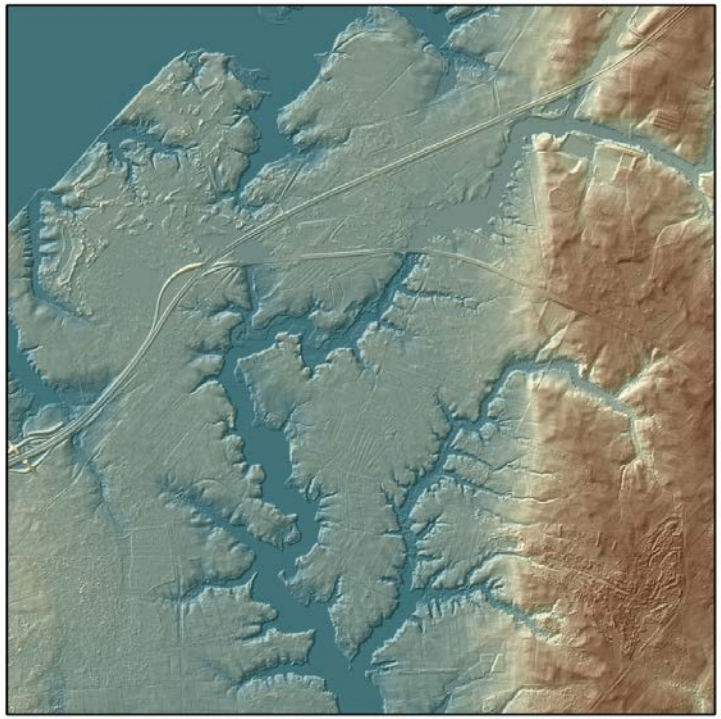


Flood and Gutelius 1997



USGS 30 m DEM

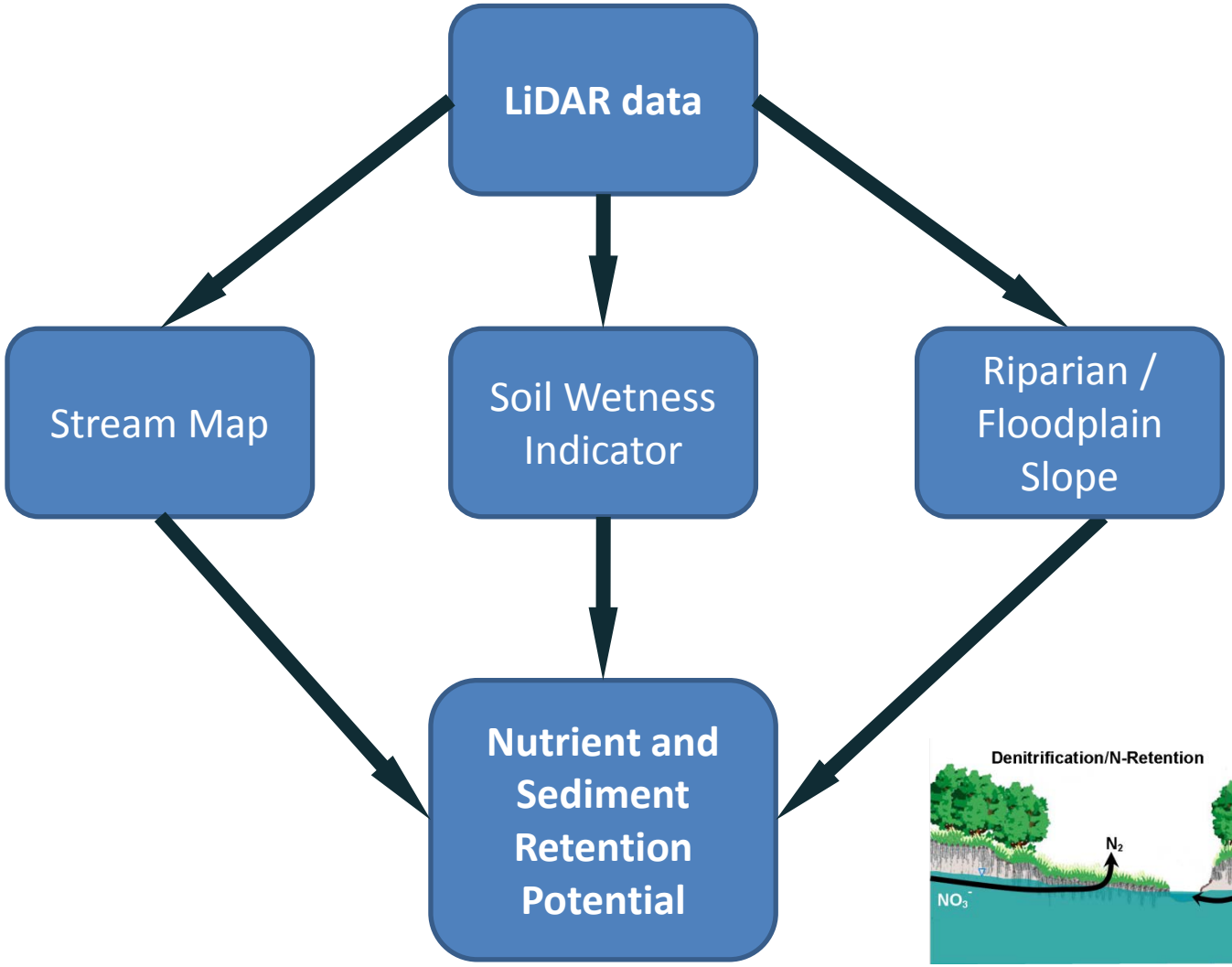
(7 to 10 m vertical accuracy)

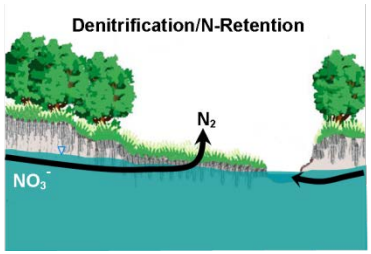


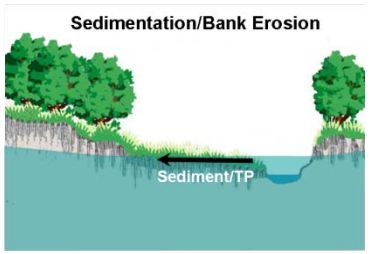
LiDAR 2m DEM

(15 cm vertical accuracy)

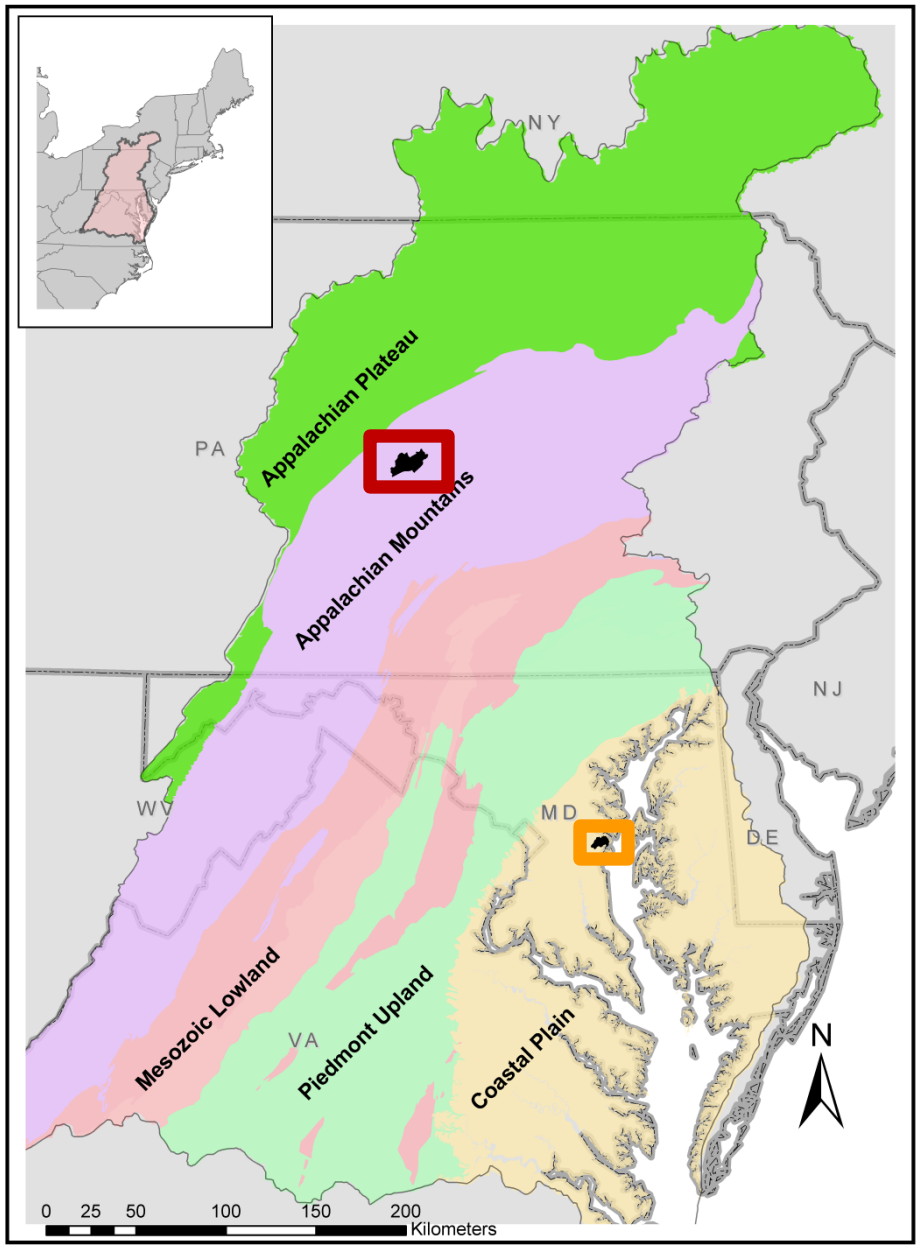
Predicting riparian/floodplain connections with fine-scale topography data

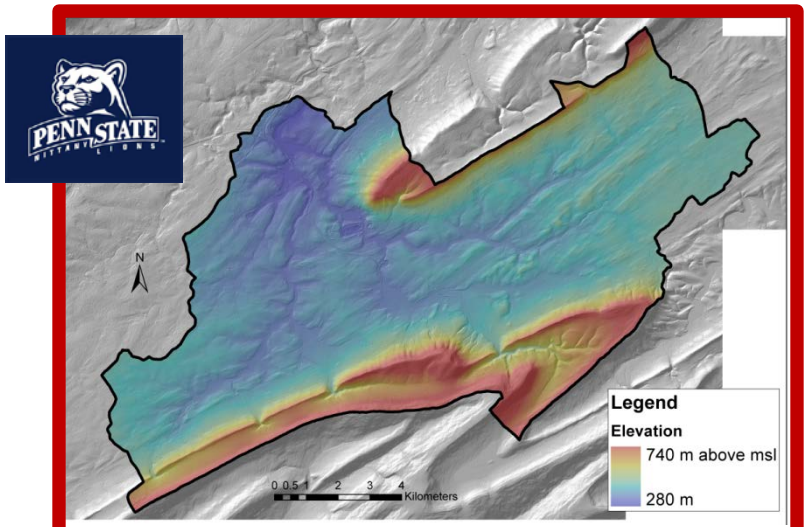




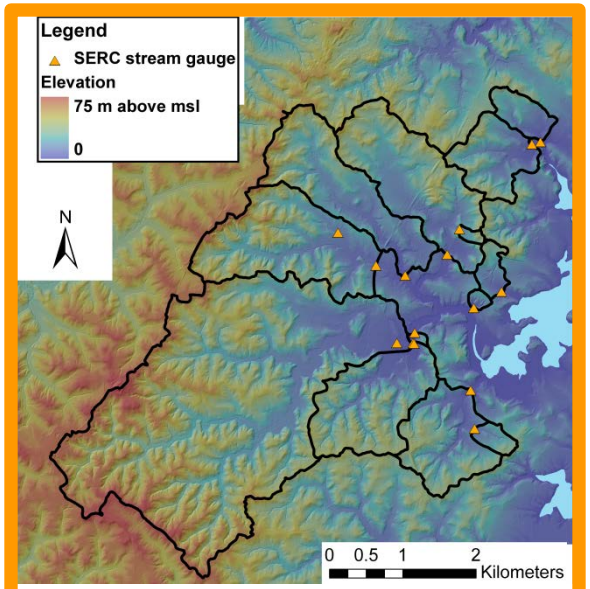


Study sites:





Spring Creek: 145 km^2
Humid-Continental Climate



Rhode River: 38 km^2
Humid Subtropical Climate

Smithsonian

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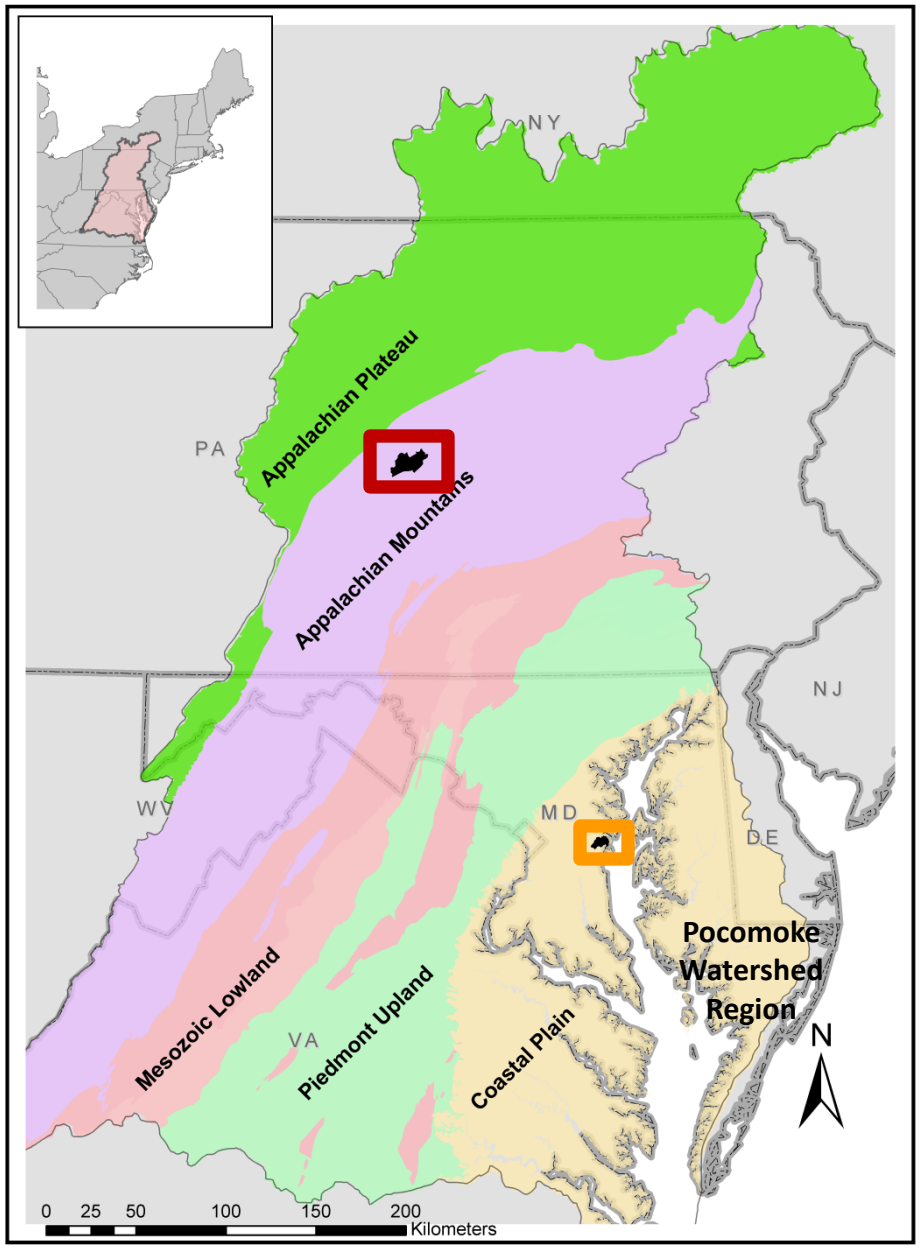

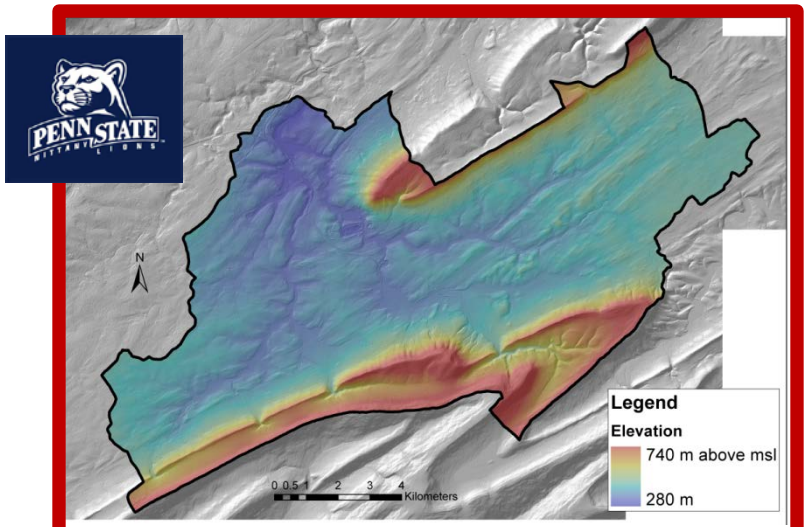

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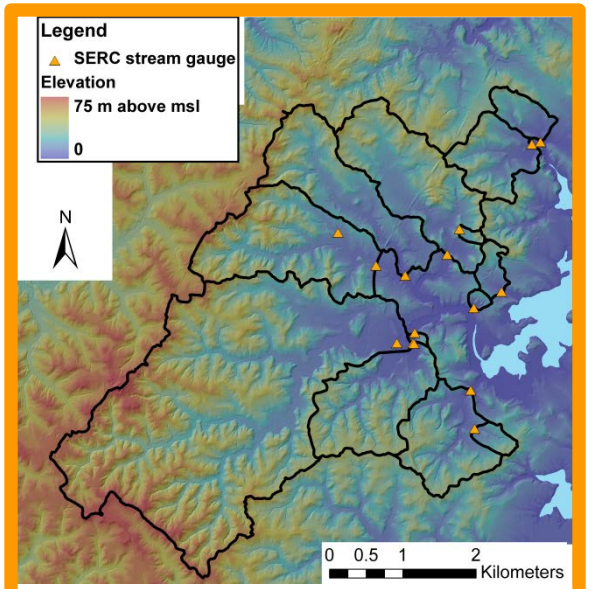

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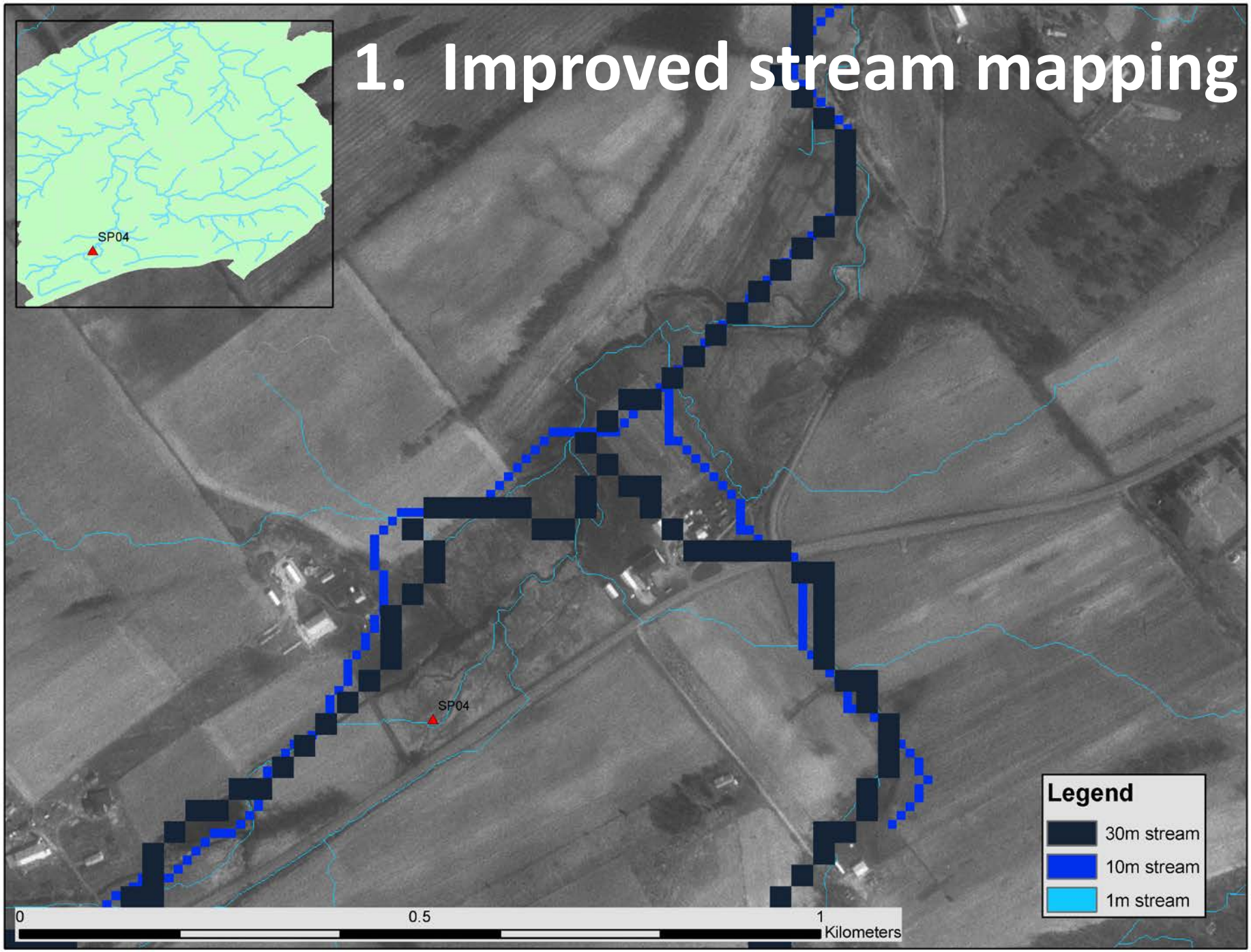
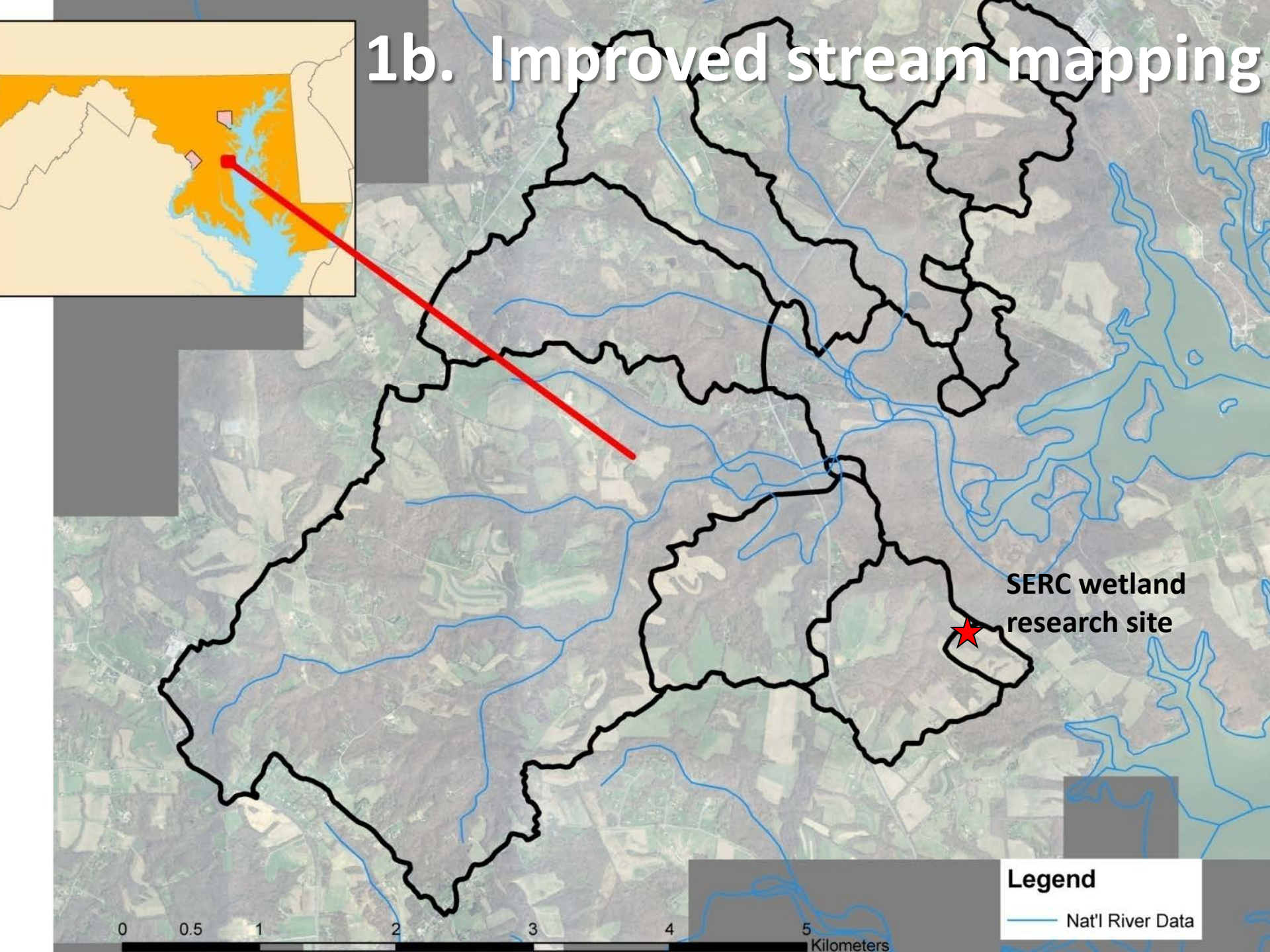
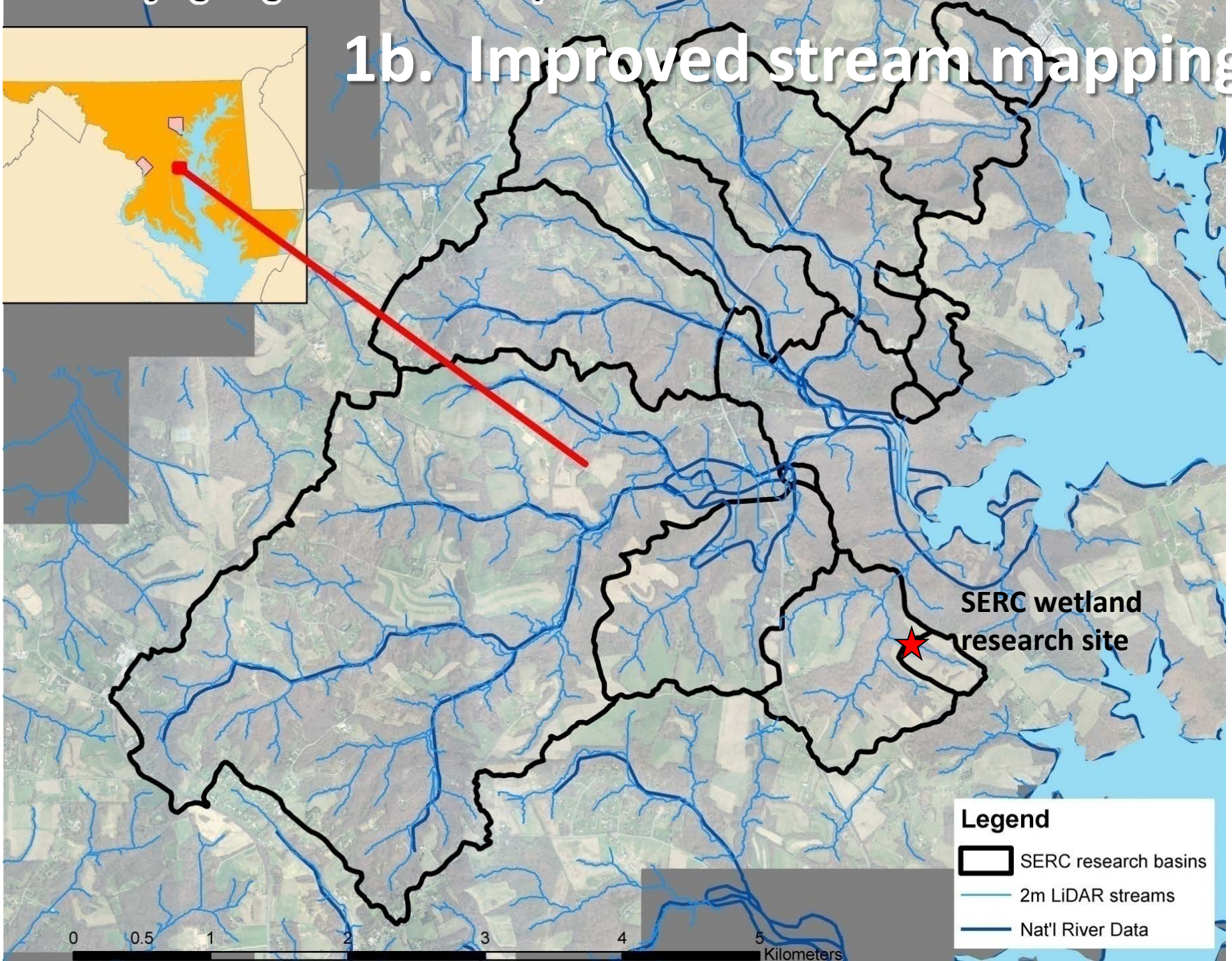
1. Improved stream mapping



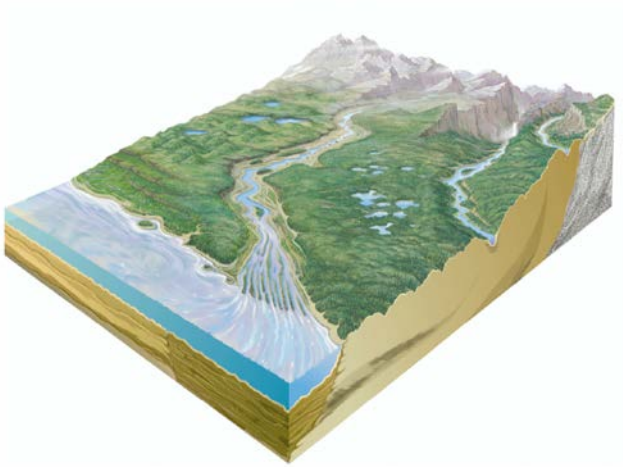
1b. Improved stream mapping



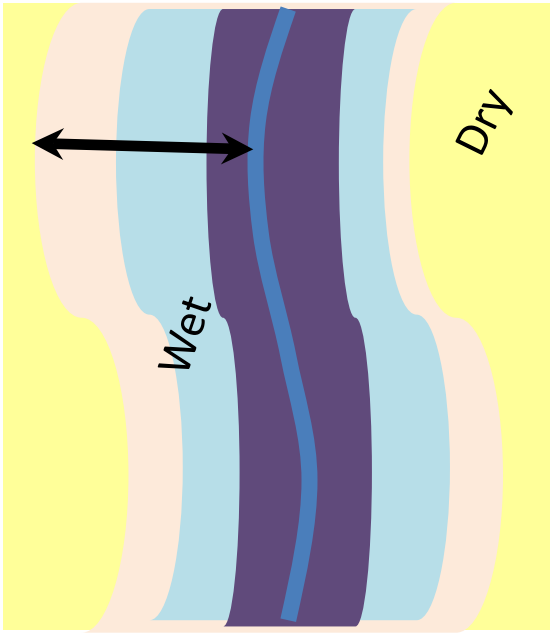
1b. Improved stream mapping



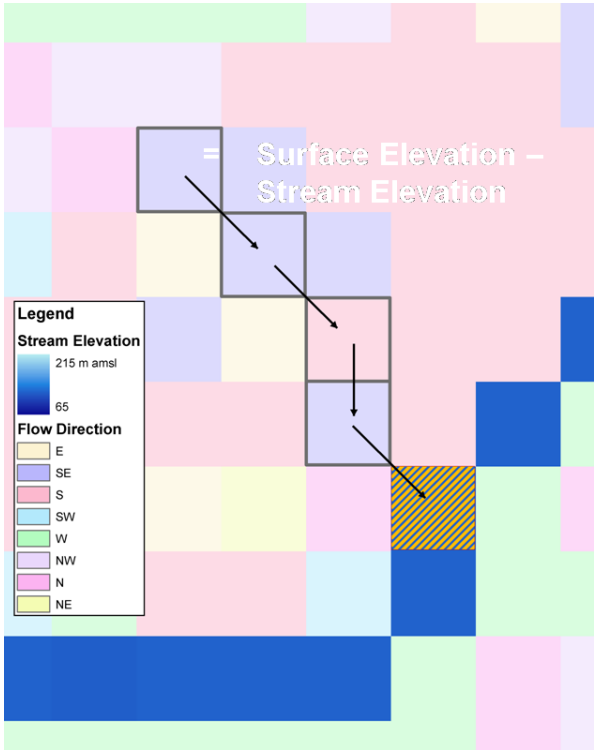
2. Mapping soil wetness (i.e., where C accumulates)



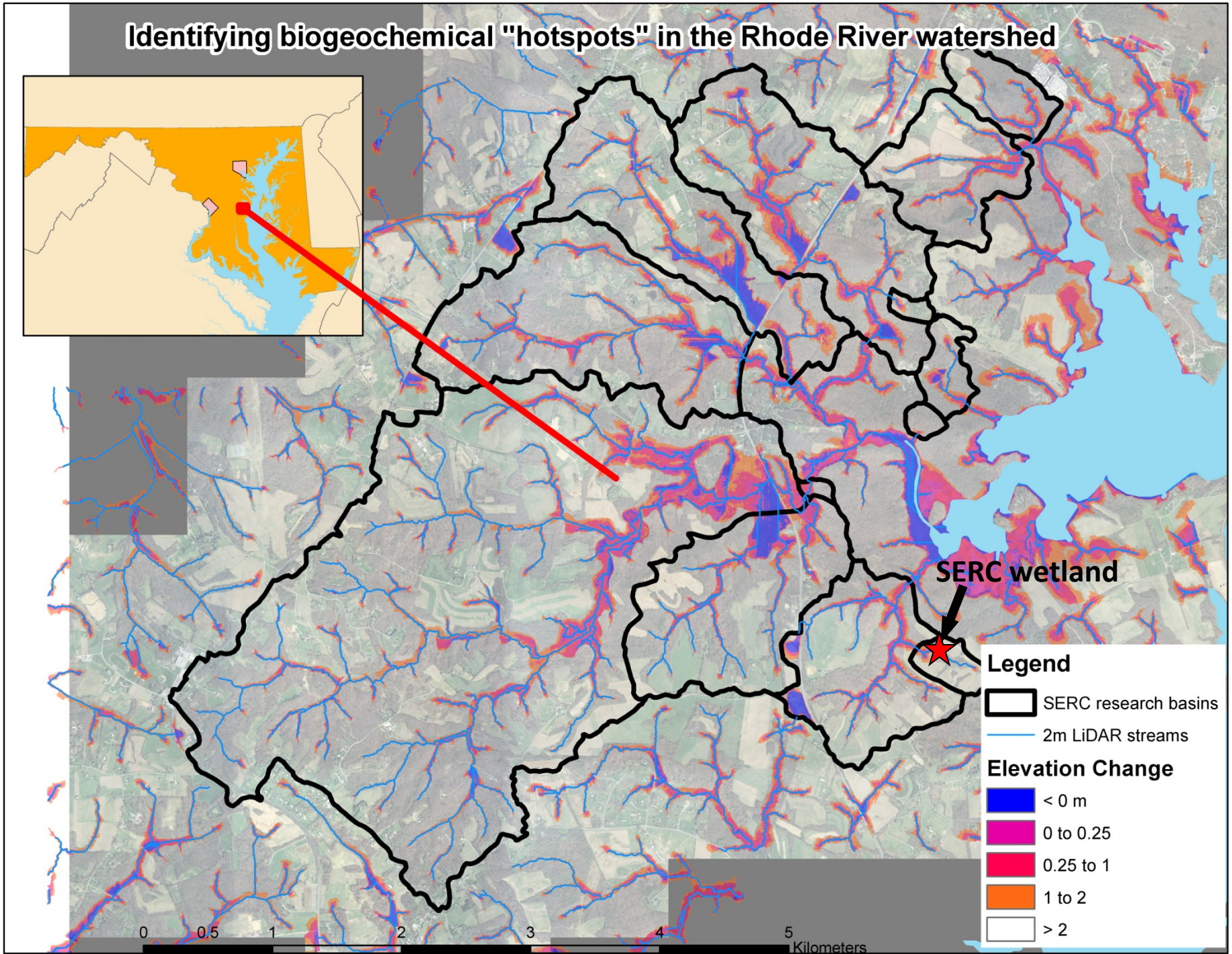
If surface waters considered watertable outcrops (e.g., Winter 1999)…

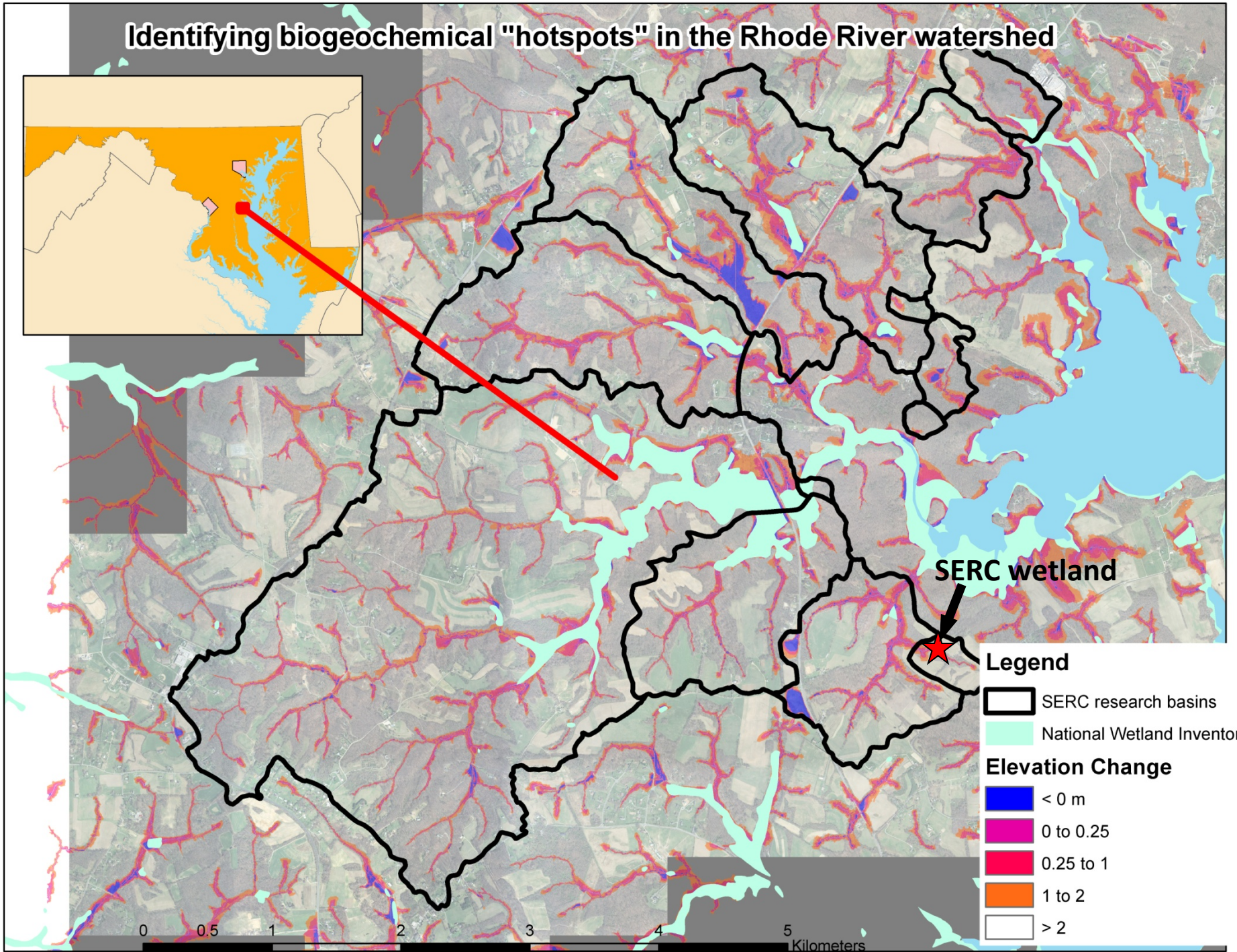


… then land areas within 1.5m elevation of surface water more likely wet.



→ Map land surface relative to surface water


Identifying biogeochemical "hotspots" in the Rhode River watershed
SERC wetland
Legend
SERC research basins
2m LiDAR streams
Elevation Change
< 0 m
0 to 0.25
0.25 to 1
1 to 2
> 2
0
0.5
1
2
3
4
5
Kilometers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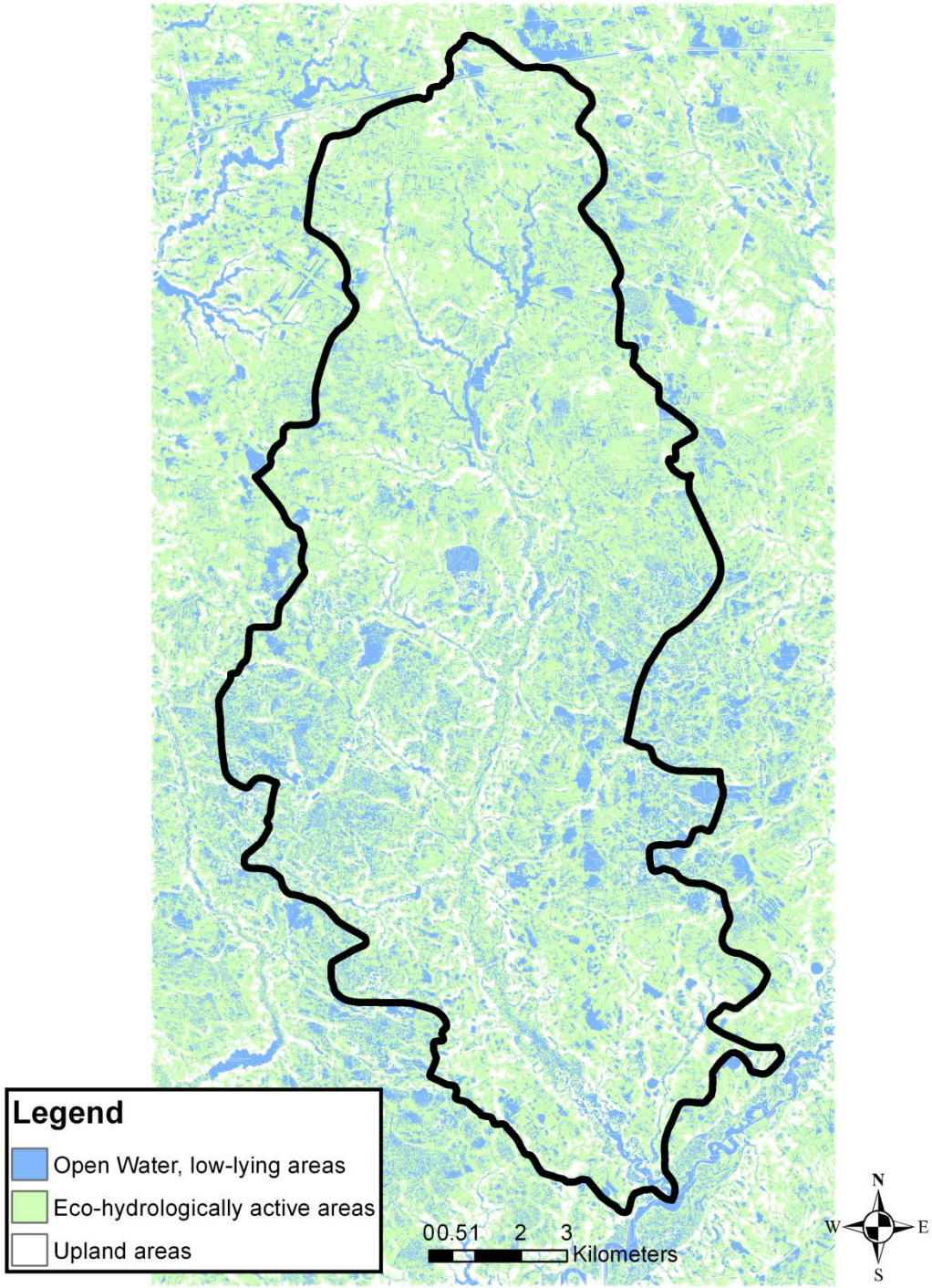
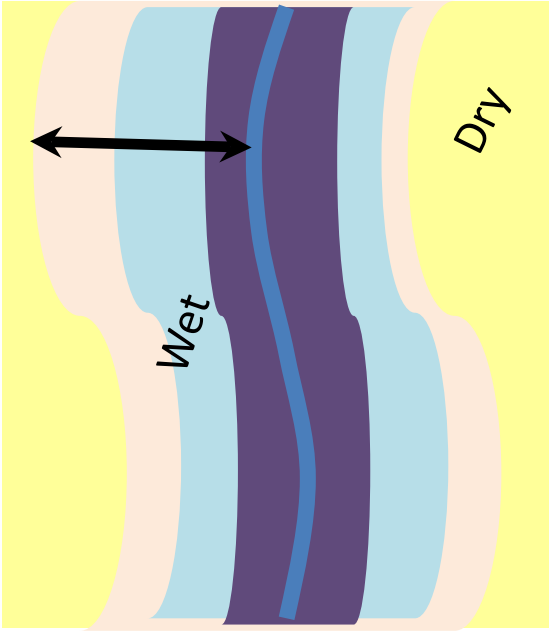
> 2
0
0.5
1
2
3
4
5
Kilometers

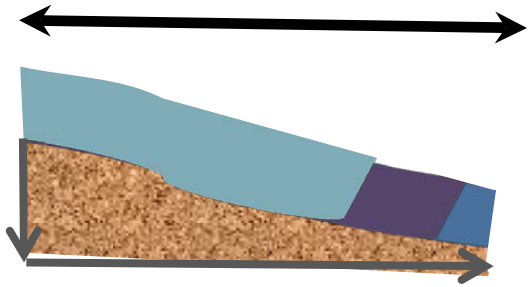
Nassawango Watershed: Ecohydrological Active Areas



3. Riparian/Floodplain Slope…because local topographic relief reflects hydrologic controls

(Devito et al. 2000)



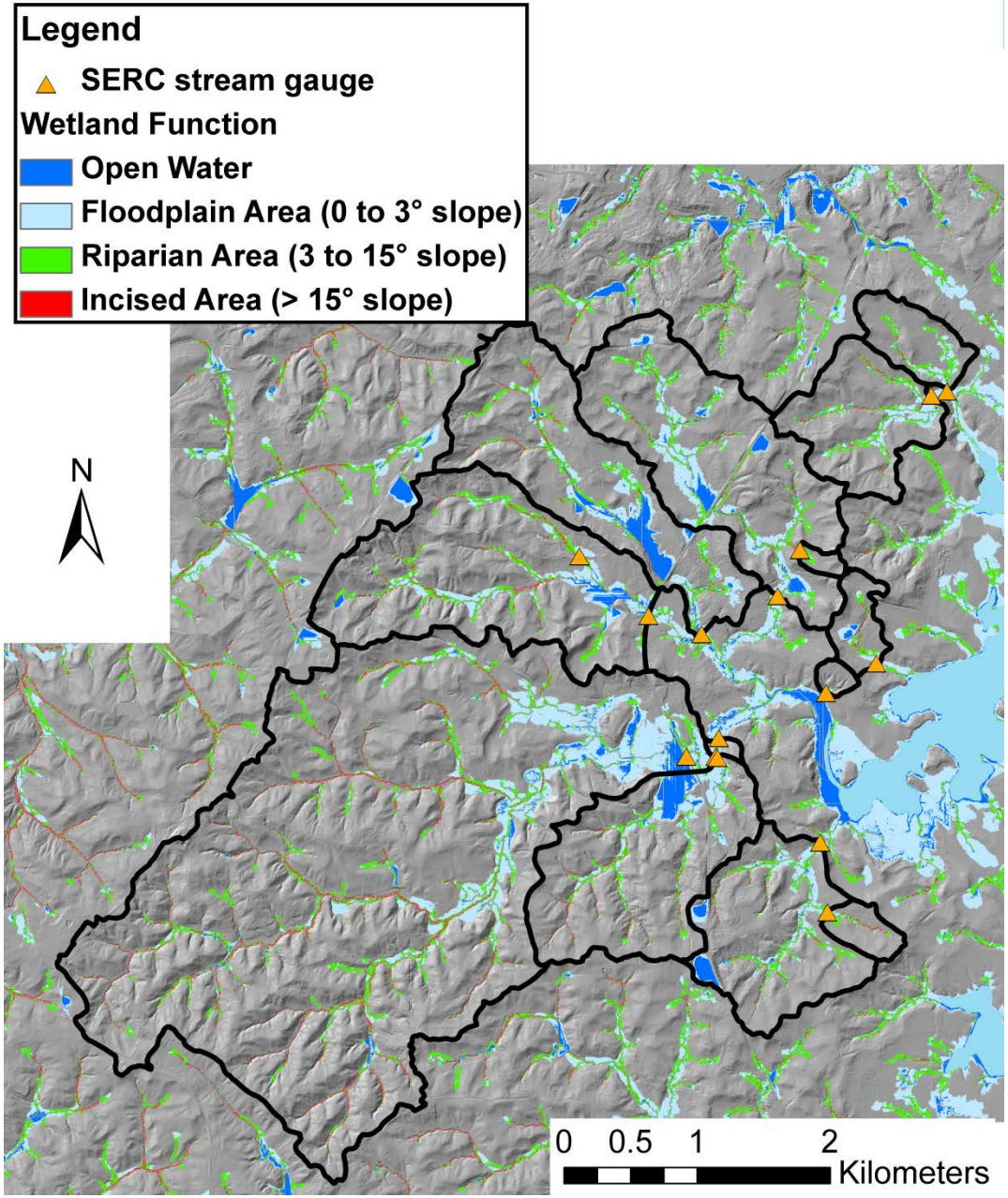


Slope = ΔElevation/ΔDistance

Legend

- **Open Water**
- **Floodplain Area (0 to 3° slope)**
- **Riparian Area (3 to 15° slope)**
- **Incised Area (> 15° slope)**

3. Riparian / Floodplain Slope



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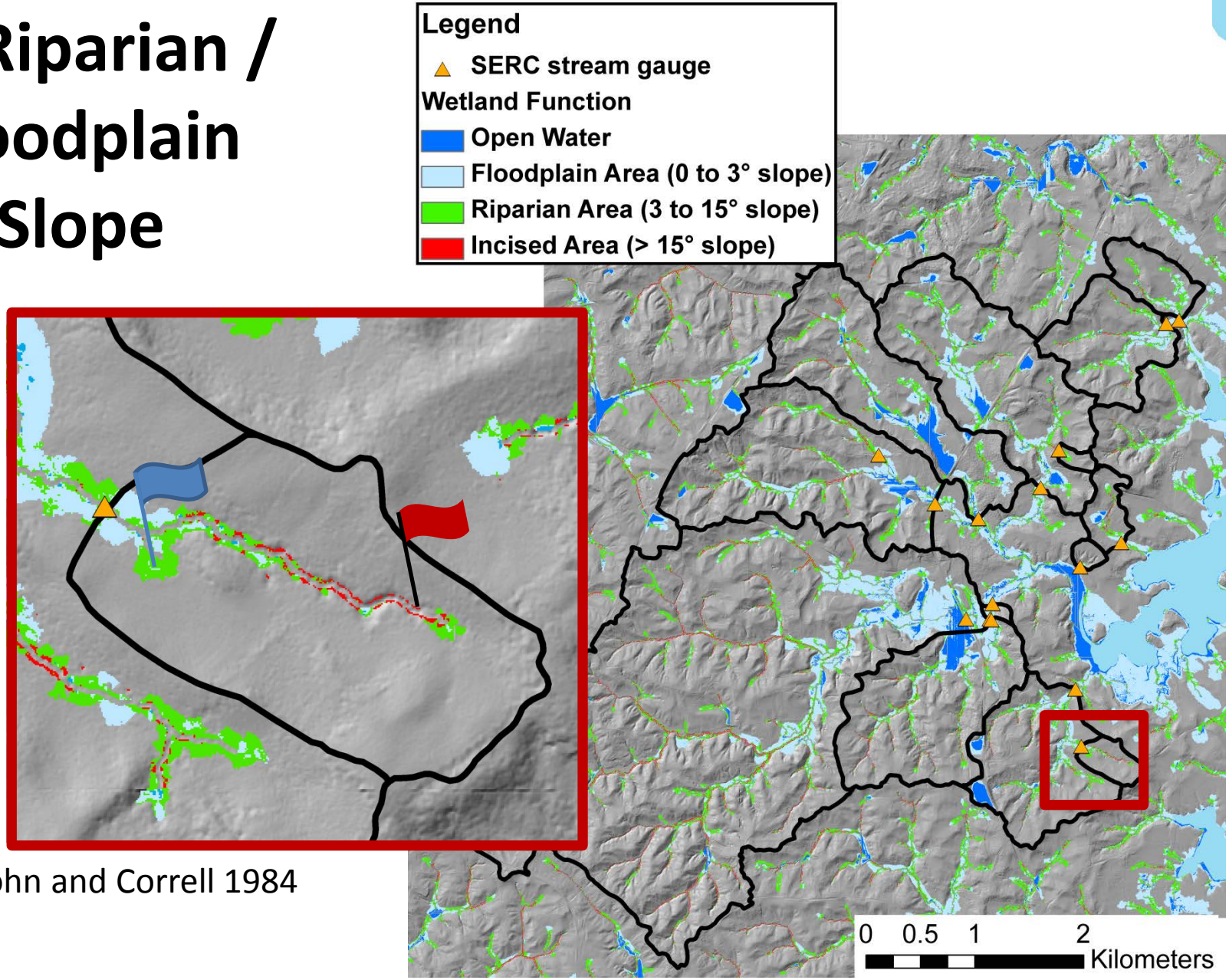
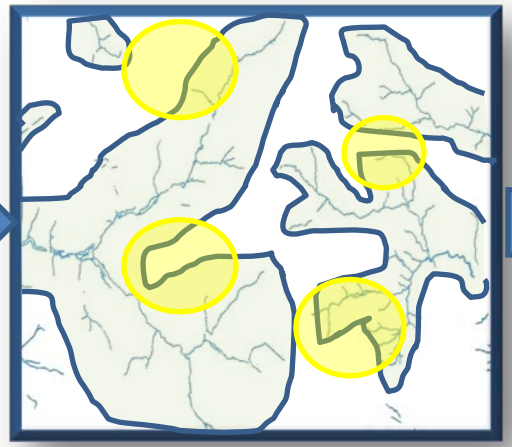


Peterjohn and Correll 1984

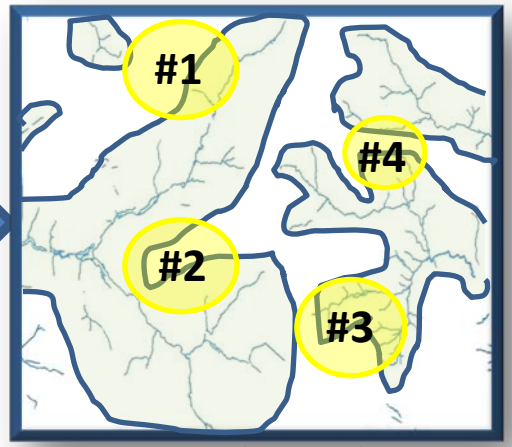
Bohlke et al. 2007

Proposed Prioritization Tool:

I. Define Ecohydrologically Active Areas



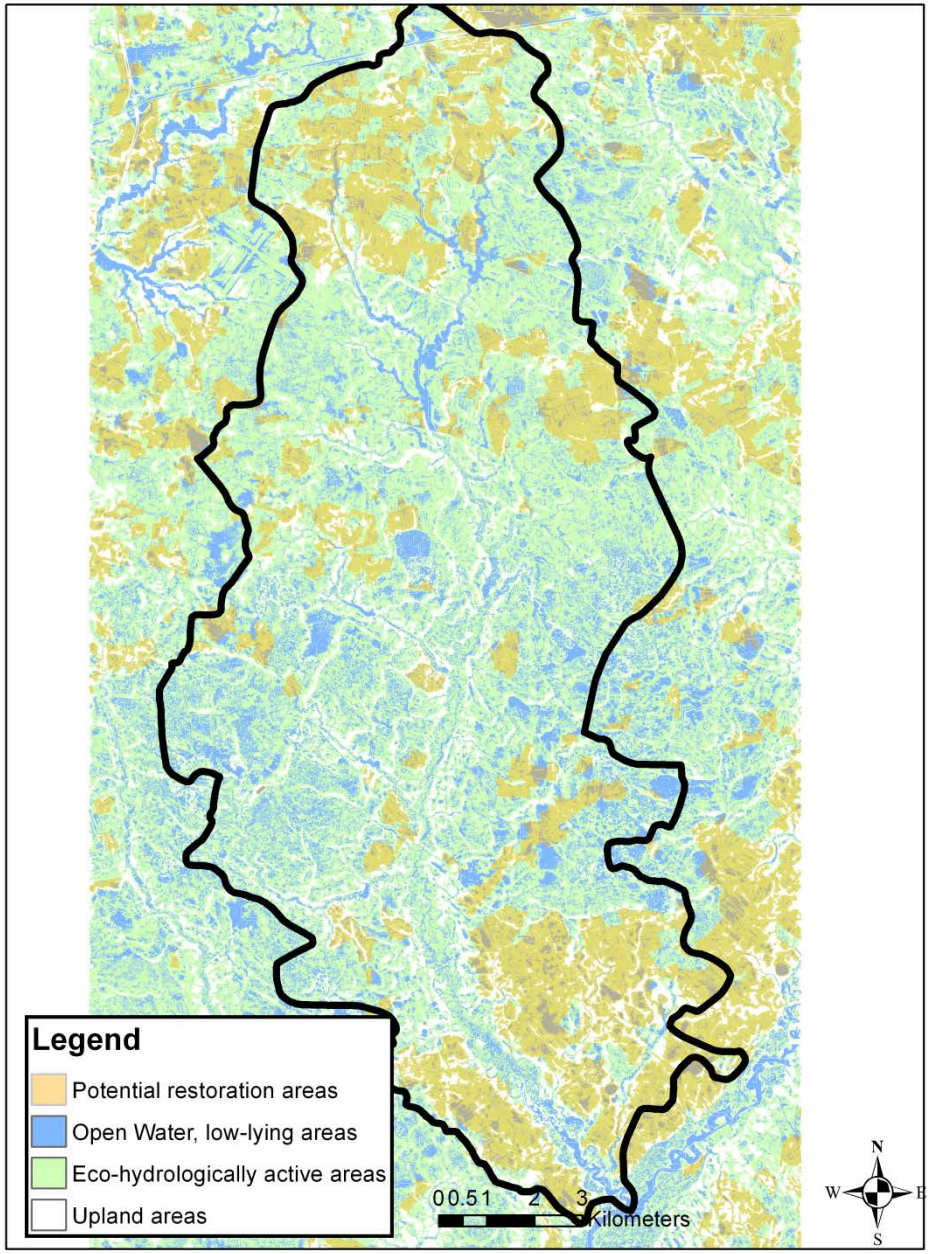
II. Identify Contributing Nutrient Sources



Results: Rank opportunities to maximize return on $$ invested to install bmp's and improve water quality.

III. Consider Additional Prioritization Criteria

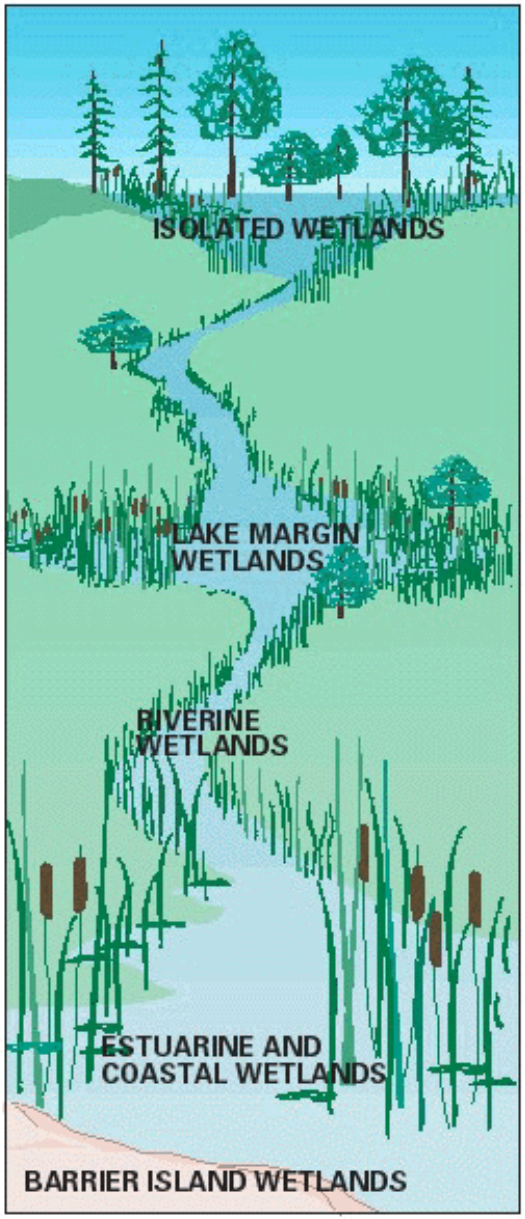
Nassawango Watershed: Hillslope Contributing Areas in Agricultural Land Use



Linking Form and Function: the Potential of Fine-Scale Topography Data

- Informs local planning decision-makers
  - Provide simple framework for evaluation of ecosystem services
  - Target conservation and restoration efforts

- Provides framework for linking field and regional-scaled field studies
  - Foster scientific collaboration



Environmental Law Institute 1983