Testing BMP Efficiency in 3 experimental watersheds in the Choptank Basin

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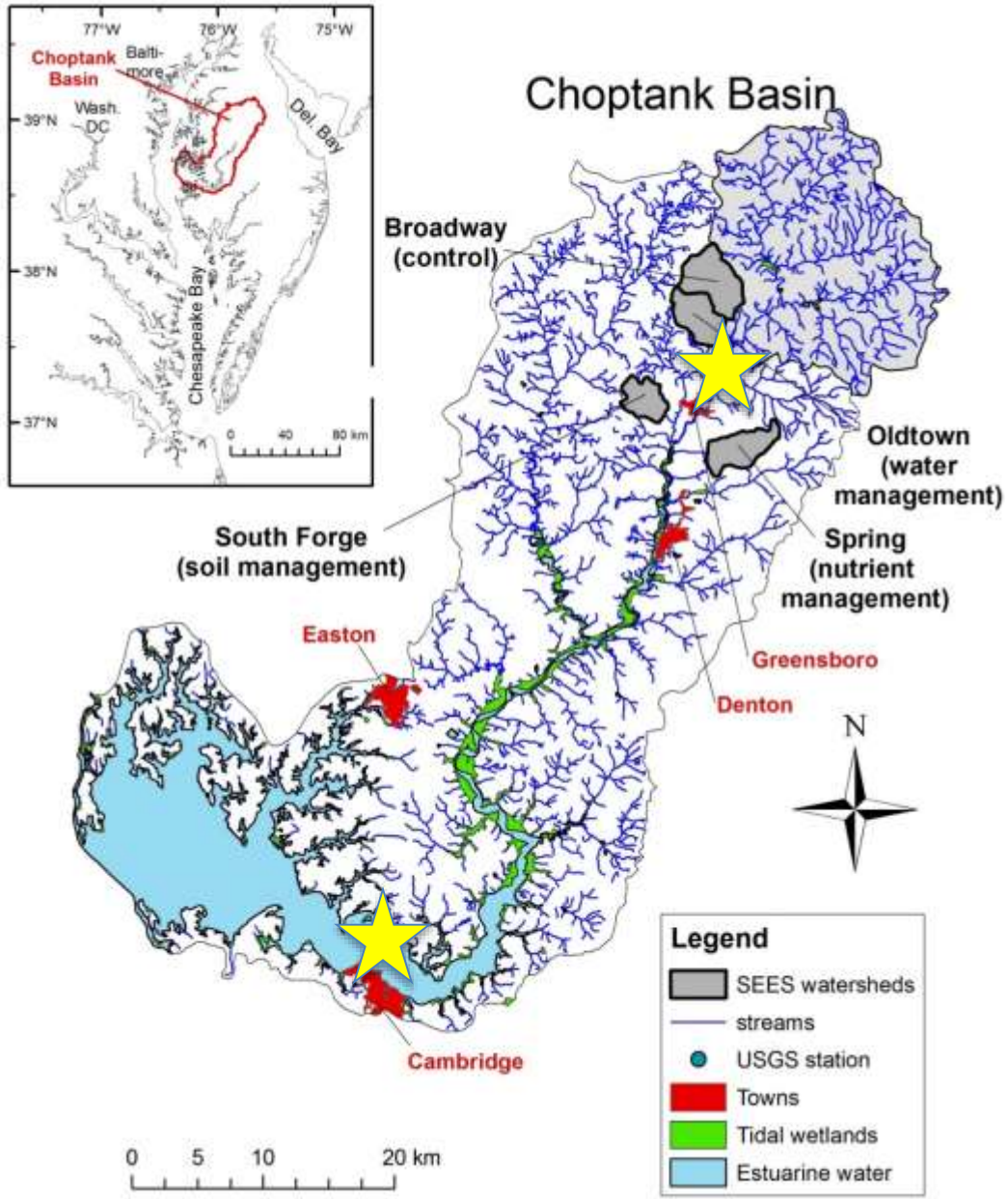
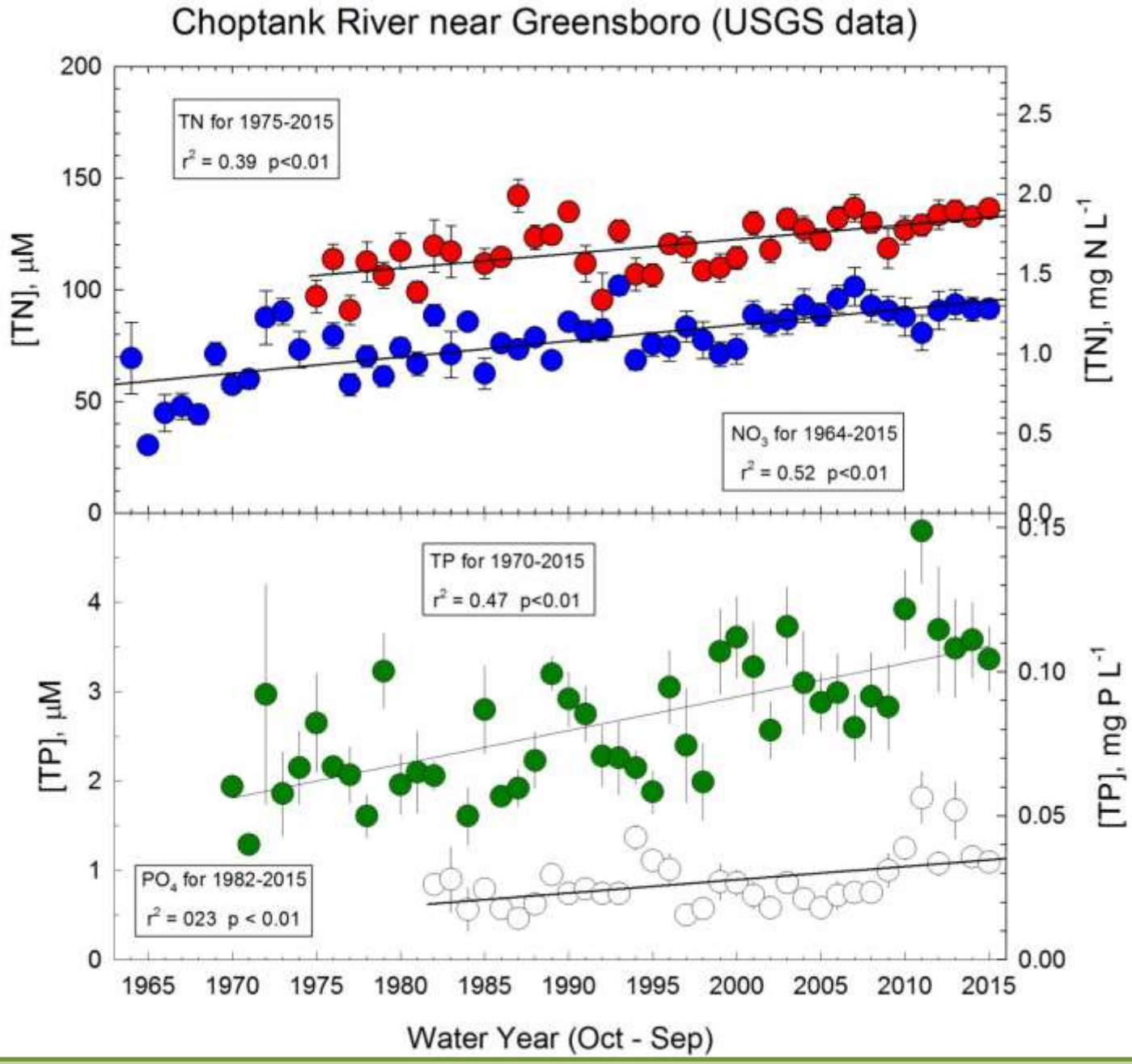
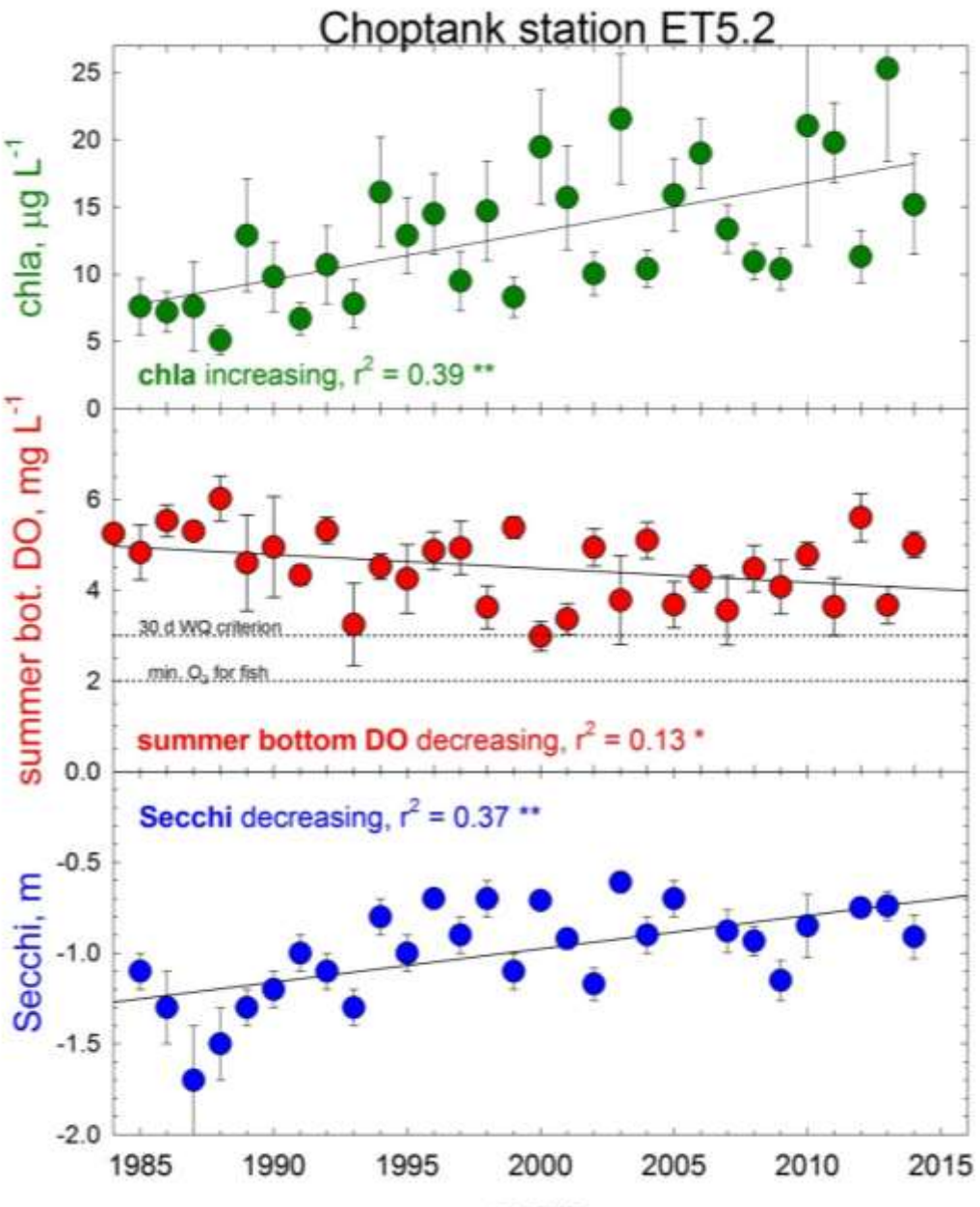

Choptank Basin
77°W
76°W
75°W
Choptank Basin
Balti-more
Wash. DC
Del. Bay
39°N
38°N
37°N
Chesapeake Bay
0 40 80 km
Broadway (control)
Oldtown (water management)
Spring (nutrient management)
South Forge (soil management)
Easton
Greensboro
Denton
Cambridge
N
Legend
SEES watersheds
streams
USGS station
Towns
Tidal wetlands
Estuarine water
0 5 10 20 km


Choptank River near Greensboro (USGS data)
TN for 1975-2015
r² = 0.39 p<0.01
NO3 for 1964-2015
r² = 0.52 p<0.01
TP for 1970-2015
r² = 0.47 p<0.01
PO4 for 1982-2015
r² = 023 p < 0.01
[TN], µM
[TN], mg N L-1
[TP], µM
[TP], mg P L-1
Water Year (Oct - Sep)



The estuary responds:

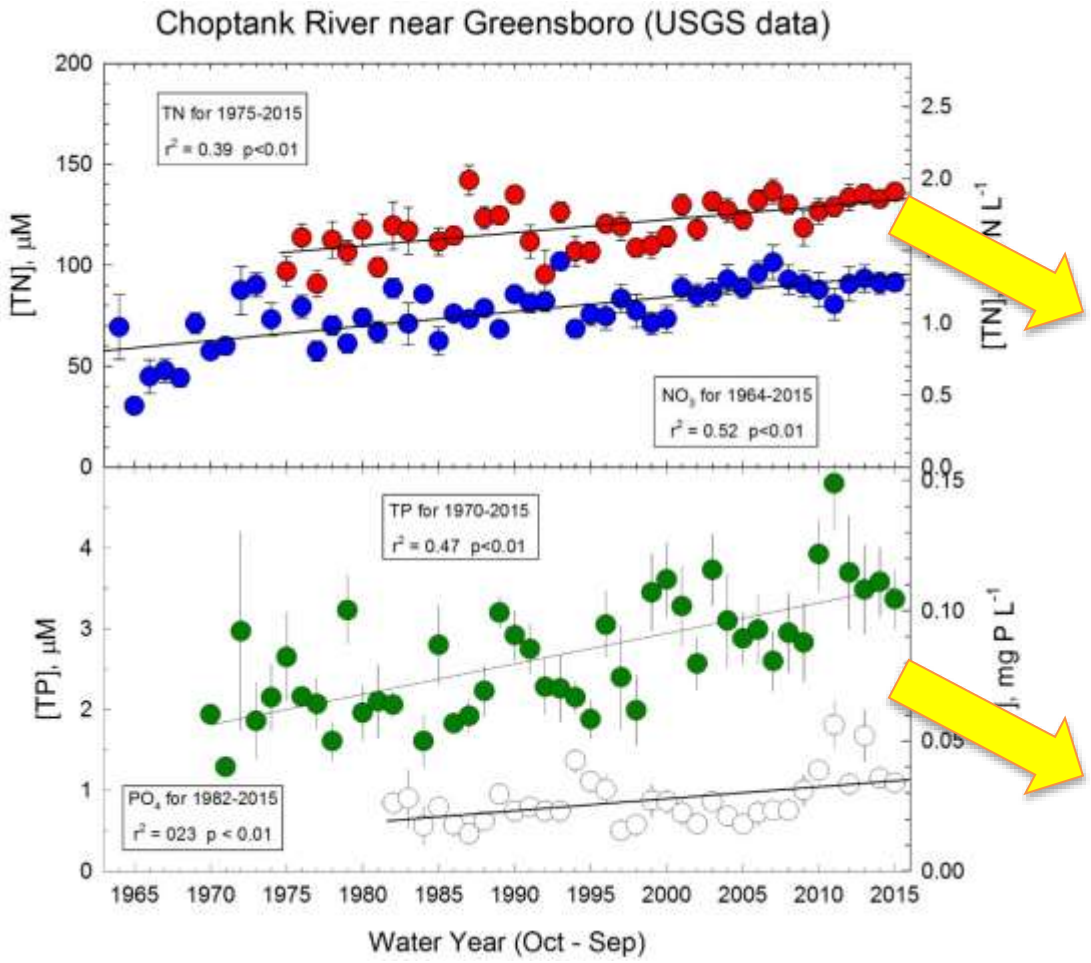
Increasing annual average chla

Decreasing summer bottom dissolved O_2

Decreasing annual average Secchi depths

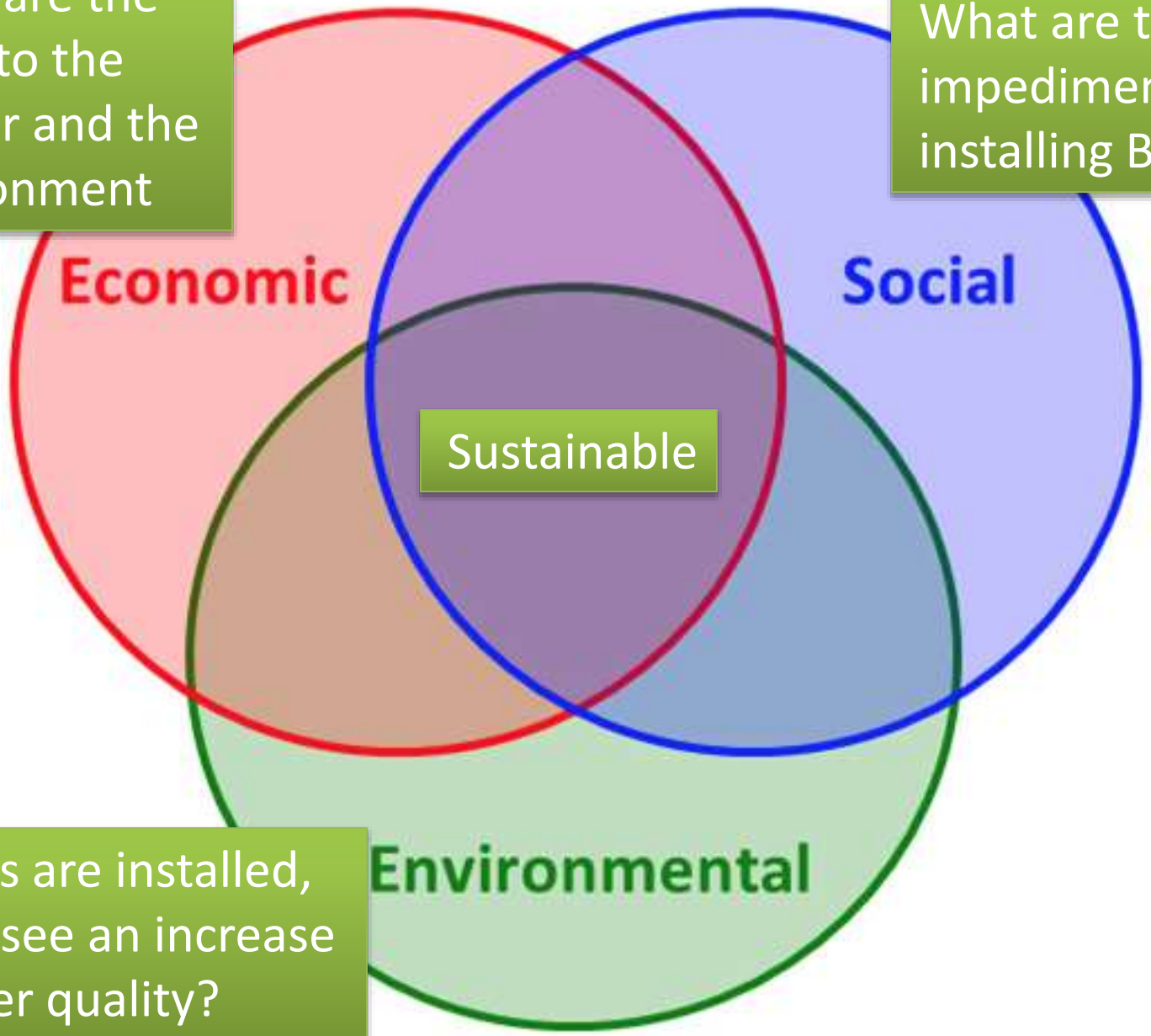
The solution?

- Hypothesis: Applying best management practices (BMPs) to agricultural and residential lands will improve water quality.

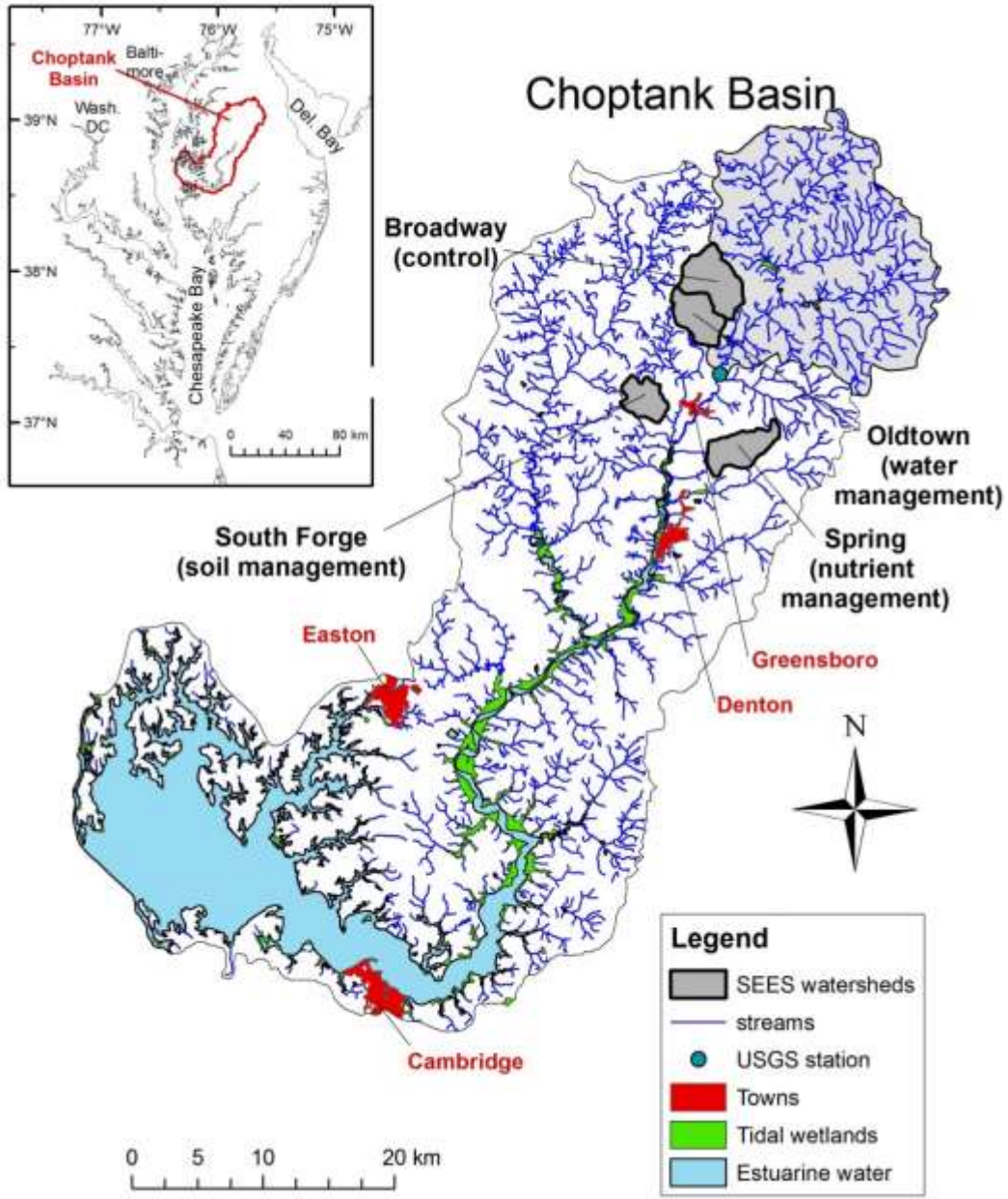


What are the costs to the farmer and the environment

What are the impediments to installing BMPs



If BMPs are installed, do we see an increase in water quality?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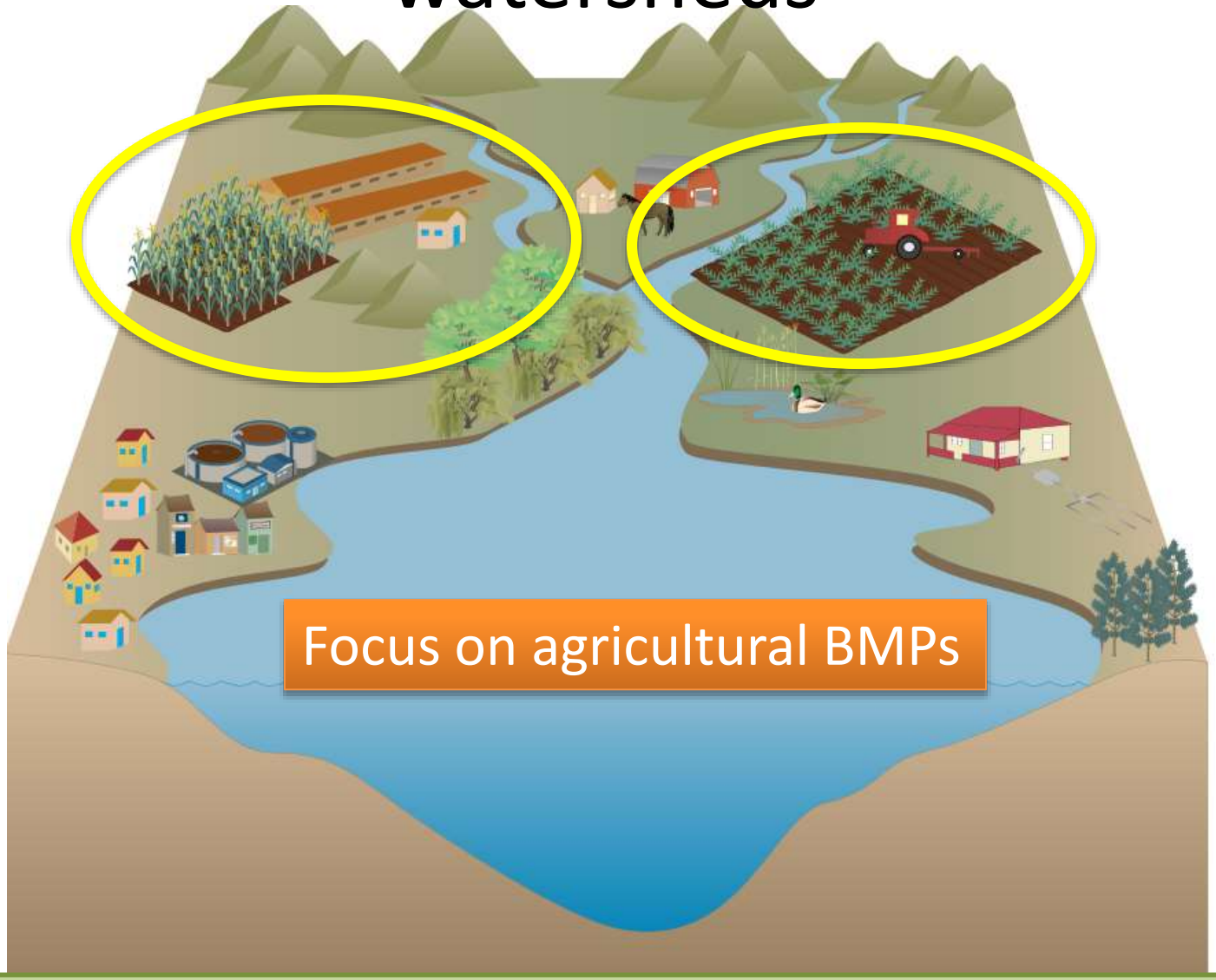
N and P concentrations are stable or increasing, with only a few decreasing!

Watershed	Current Total N mg N/L	Decadal trend	Current Total P mg P/L	Decadal trend
Greensboro	1.9	+	0.12	+
Broadway	2.0	+	0.050	NC
Oldtown	3.2	-	0.042	NC
South Forge	5.1	-	0.047	NC
Spring	6.1	+	0.038	NC

Anthropogenic N & P sources in watersheds



Initial impediments

- Non-cost-shared portion
  - Additional funding
- Paperwork requirements
  - Catalyzed interactions with NRCS
- Maintaining the BMPs
  - BMP monitoring and communication of results

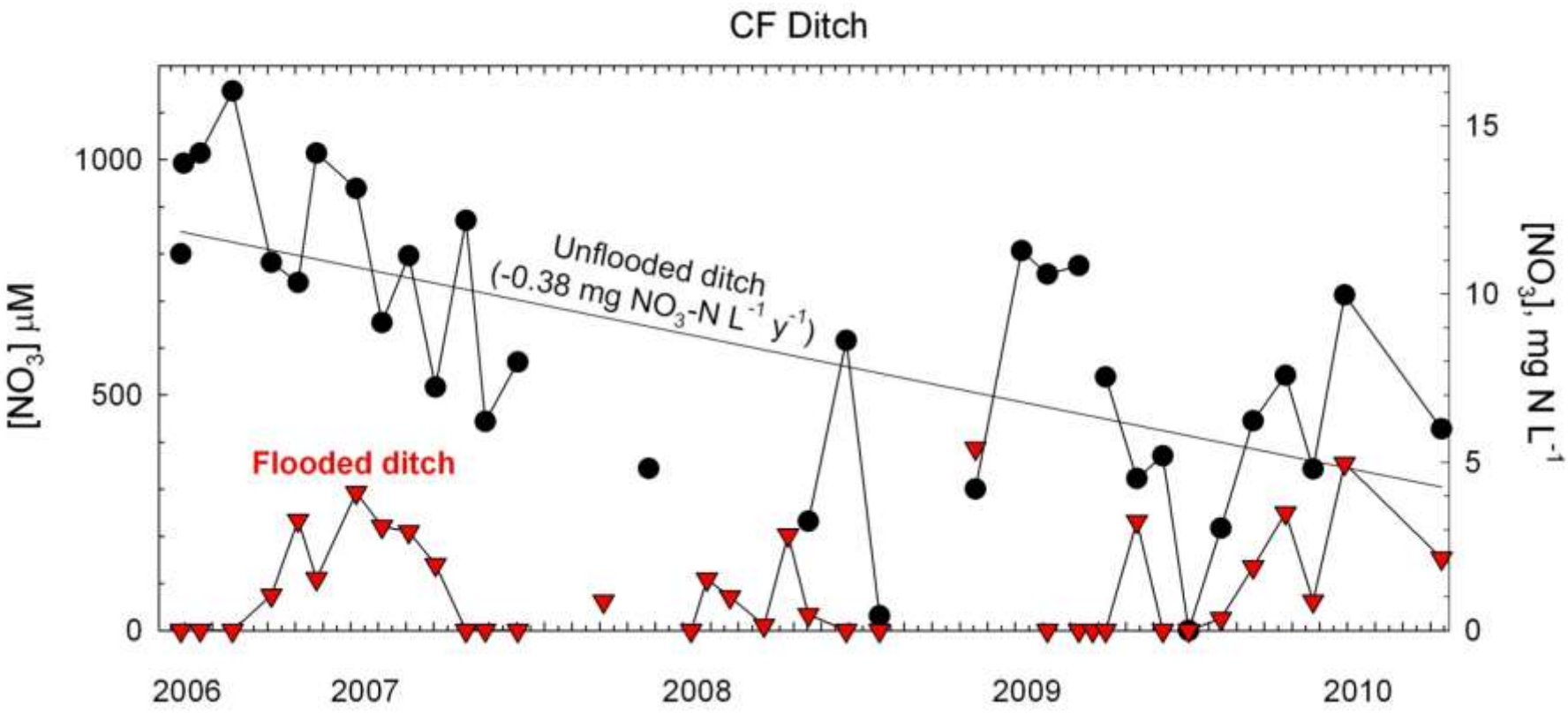
Drainage controls

Pro:

- Induce denitrification
  - Lose N_2 from soil
- Stores water in soil

Con:

- Expensive
  - ditches: $10-25k, tiles: $2k
  - Delays in engineering approval by USDA on Delmarva



- Large (1 km long, 2 m deep) ditch with drainage control structure in the middle
- Raised water level in upper portion by 1 m (1 m below soil surface)
- Upstream, nitrate was nearly undetectable in summer, 1-5 mg N/L in winter
- Downstream, nitrate declined from 10-15 to 5-10 mg N/L
  - Low nitrate water overtopping control
  - Downslope movement of low nitrate groundwater in soil around control

Wetland easements

Pro:

- Ideal conditions for denitrification
- Uptake nutrients
- Habitat restoration
- Duck habitat

Con:

- Difficult to implement
- Stringent rules for forested wetlands

Stream buffers

Pro

- Ideal conditions for denitrification
- Uptake nutrients
- Many farmers have buffers, just not 30 ft.

Con

- CREP is in decline due to high grain prices vs. low annual payments

Bioreactors and slag/gypsum traps for P

- Divert tile drains or ditches through a structure to remove N or P
- MRC data shows 95% nitrate removal
- MDA data shows 50-60% P removal

Cover crops

- Common after corn
- Rare after soybeans
  - Fly on after beans turn yellow
    - Need relaxed payment schedule for beans
    - Need combine (harvesting) modifications for wet falls

Split Fertilizer applications

- Split in June side-dress
- Closer match to the corn growth and demand
- Approved advanced BMP

Precision agriculture

- Spatially adjusted fertilizer application
- Uncommon due to cost but increasing

Conclusions

- Serious water quality issue in the Choptank
- We've been successful recruiting 2/3 farmers
- Increasing new BMPs (5-12 per watershed)
  - Many BMPs being installed/discussed this year
- Economics drives farm management decisions
  - Some external factors not easily addressed (e.g., grain prices)

PEOPLE · LAND · WATER

Everyone Contributes to Water Quality