Testing BMP Efficiency in 3 experimental watersheds in the Choptank Basin

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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?
N and P concentrations are stable or increasing, with only a few decreasing!

<table>
<thead>
<tr>
<th>Watershed</th>
<th>Current Total N mg N/L</th>
<th>Decadal trend</th>
<th>Current Total P mg P/L</th>
<th>Decadal trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greensboro</td>
<td>1.9</td>
<td>+</td>
<td>0.12</td>
<td>+</td>
</tr>
<tr>
<td>Broadway</td>
<td>2.0</td>
<td>+</td>
<td>0.050</td>
<td>NC</td>
</tr>
<tr>
<td>Oldtown</td>
<td>3.2</td>
<td>-</td>
<td>0.042</td>
<td>NC</td>
</tr>
<tr>
<td>South Forge</td>
<td>5.1</td>
<td>-</td>
<td>0.047</td>
<td>NC</td>
</tr>
<tr>
<td>Spring</td>
<td>6.1</td>
<td>+</td>
<td>0.038</td>
<td>NC</td>
</tr>
</tbody>
</table>
Anthropogenic N & P sources in watersheds

Focus on agricultural BMPs
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)