Impact of agriculture on nutrient pollution of the Potomac River A case of animal farming in three counties

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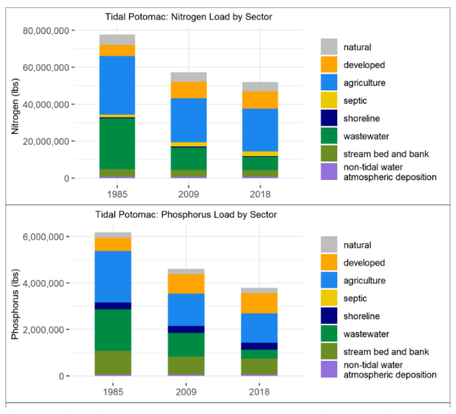
Problem Statement

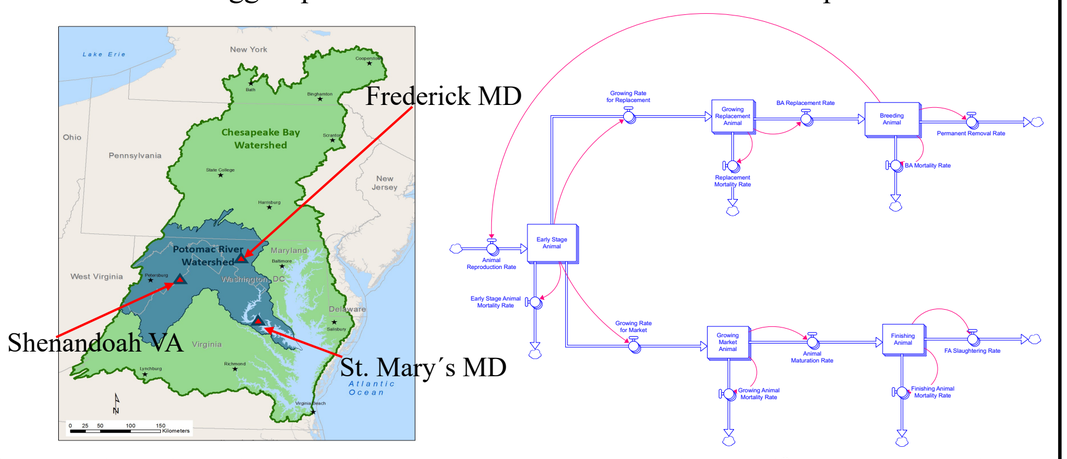
- Agriculture is the largest source of N & P load to the Chesapeake Bay[1]
  - 40% total nutrient runoff to CB is only from agriculture
  - 18% N and 27% P annual load to the CB come only from animal manure



- Agriculture loads have proven to be challenging to reduce
  - Only 8% N & 12% P load were reduced from agriculture between 2009 – 2018

Approach

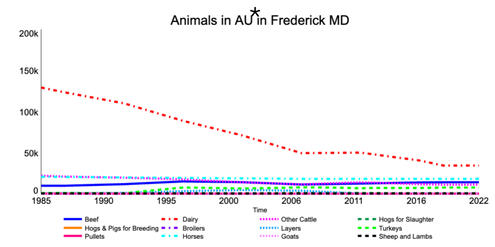
- We are missing socio-economic models that
  - Help to identify the drivers and incentives for high level of nutrient load in agriculture
  - Assess & suggest policies that would alter the current development



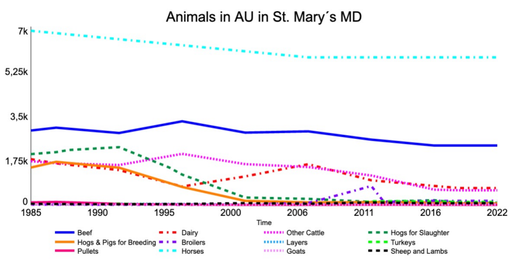
- Using the Chesapeake Assessment Scenario Tool[2] (CAST) as data source, we develop a model for three pilot counties with features
  - Animal production
  - Manure generation
  - Account for manure available Vs applied to crops

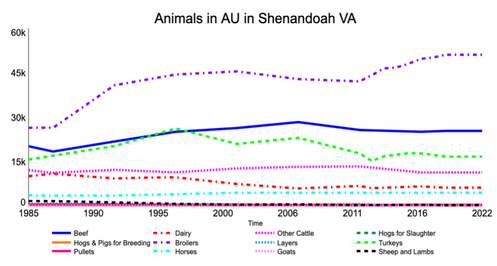
Results

- Behavior resulting from structure



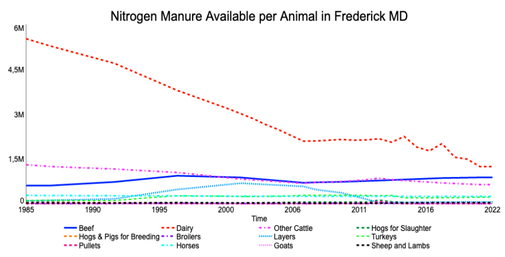
  - Dairy production has been the most dominate in Frederick, while Beef and Broilers production have been increasing in Shenandoah. In St. Mary´s, the Horse production has been the most dominant.

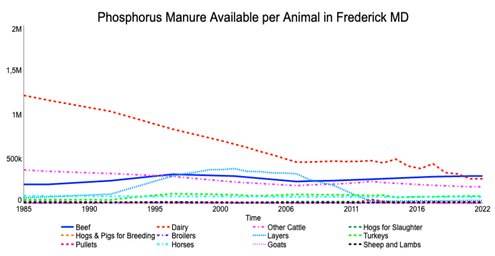


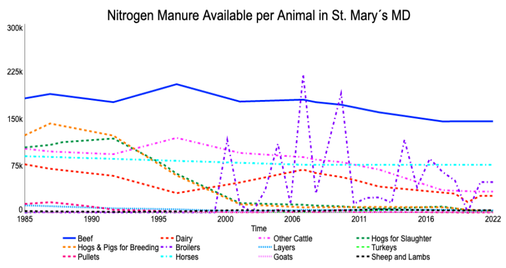


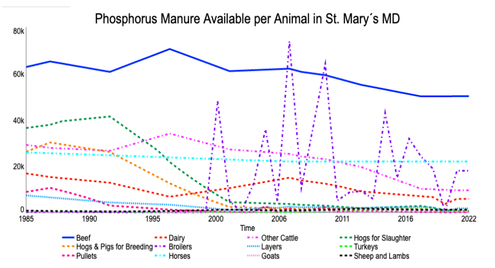
*1 au = 1 Horses = 1.14 Beef = 0.74 Dairy = 67 Turkeys

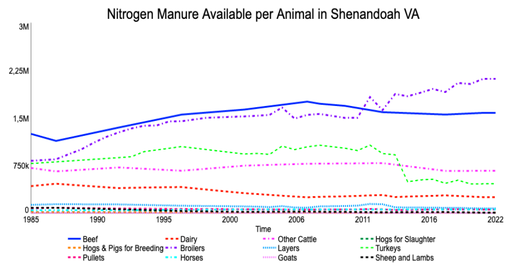
  - The large volume of N & P loads in Frederick & Shenandoah correspond to the respective number of animal production in the counties, while in St. Mary´s, it relates to the beef production.

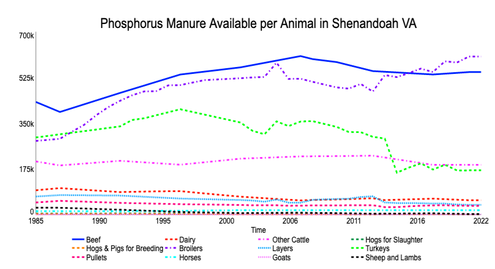




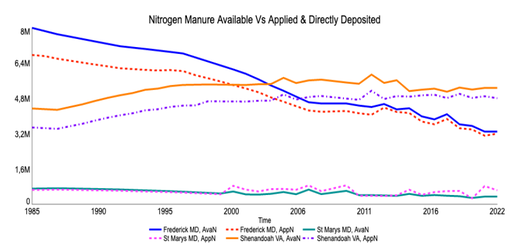


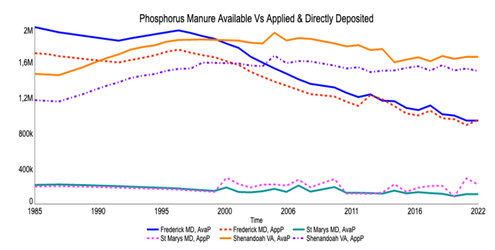






  - Except in St. Mary´s, there have been excess N & P beyond crop needs





Discussions

- The excessive nutrients in the counties run-off to the rivers and streams subsequently to the Bay fueling the growth of algae and creating hypoxia thereby damaging the aquatic life[3].
- If properly managed, manure can serve as a resource than a liability[4]
- Off-site transfer of manure can be hampered by logistical obstacles[4]
- ❖ Recommend policies
  - Manure transport subsidy that help manure transport out of highly concentrated counties to enhance manure usability and reduce its potential liability
  - Performance based nutrient reduction rewards, - reward for nutrient reduction from hot spot areas (Currently, nutrient reduction is awarded for reductions made from the whole farm, not from nutrient hot spots[4])

Next Steps

- To put our recommendations in place and identify nutrient hot spots, we have been developing a sub model that account the nutrient mass balance in the counties
- The sub model will show the nutrient flow from
  - Plant production and
  - Animal production to
  - Food consumption at household level and to
  - Environment

References

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2. Chesapeake Assessment Scenario Tool (CAST; https://cast.chesapeakebay.net/)
3. ECO HEALTH – Report Card indicators. Retrieved on 12.03.2024 from https://ecoreportcard.org/report-cards/chesapeake-bay/indicators/nitrogen/
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Acknowledgments

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