



NOAA
FISHERIES

To Integrate or Inform: Experience Using Fisheries Ecological- Economic Models in Chesapeake Bay

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Economics**

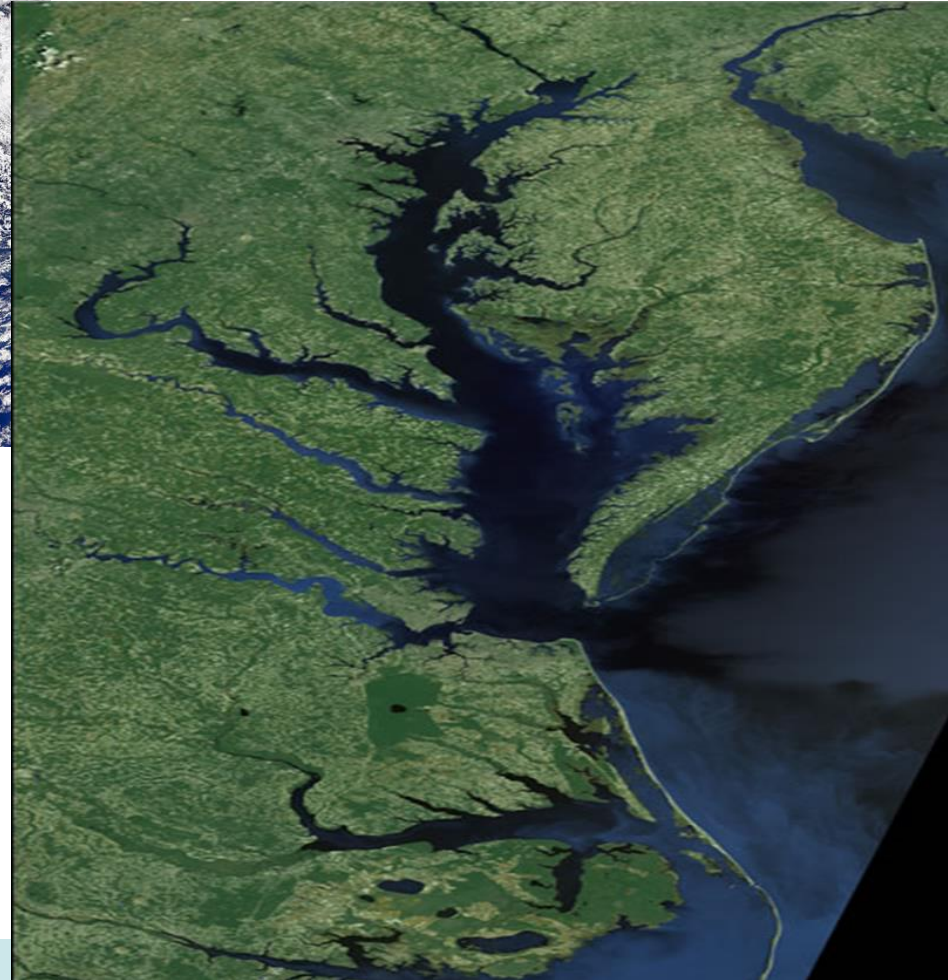
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Chesapeake Background



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Chesapeake Bay Ecological Restoration

- Large scale ecosystem restoration focused on reducing nutrient pollution (nitrogen & phosphorus) to reverse effects on living resources
- Involves local, state and Federal government
- Until recently, voluntary controls, now under regulatory limits of Clean Water Act – Total Maximum Daily Load

Early Chesapeake Bay Example of Independent Researchers Integrating Ecology and Economics

- Kahn and Kemp (1985)
 - Striped bass and seagrass abundance
- Bockstael, McConnell and Strand (1989)
 - Nitrogen & phosphorus
 - Rec fishing, beach use
- Bockstael – Costanza
 - Land Use – Watershed – WQ integrated model?



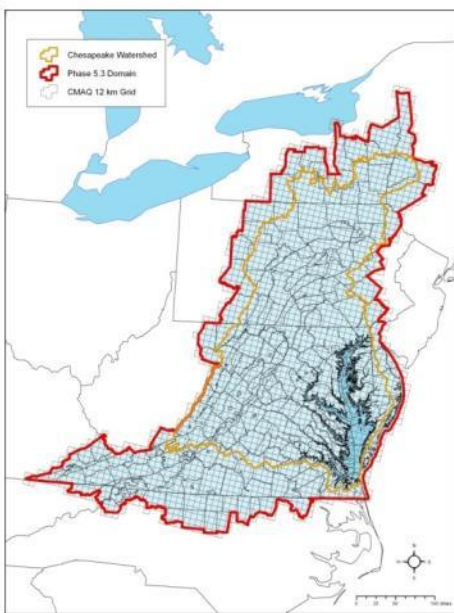
The Original Chesapeake Bay Ecosystem Model

Circa 1978



How Do We Integrate Economics Into That?





Chesapeake Bay Airshed Model



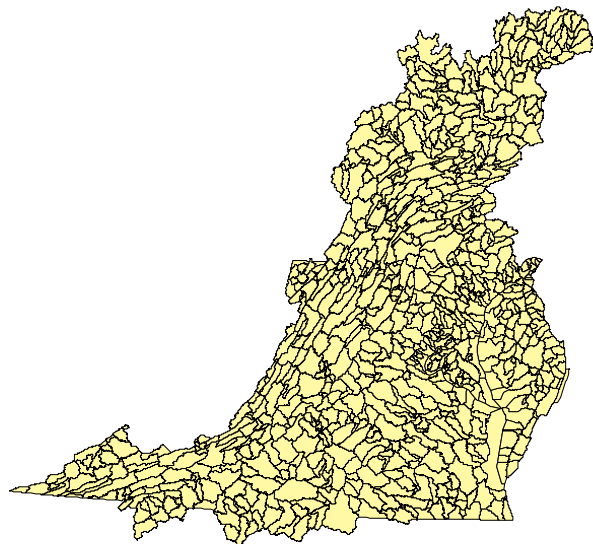
Chesapeake Bay Land Change Model

- BMP Type and location (NEIEN/State supplied)
 - Land acres
 - Remote Sensing, NASS Crop land Data layer
 - Crop acres
 - Yield
 - Animal Numbers (Ag Census or state supplied)
 - Land applied biosolids
 - Septic system (#s)
- Inputs**

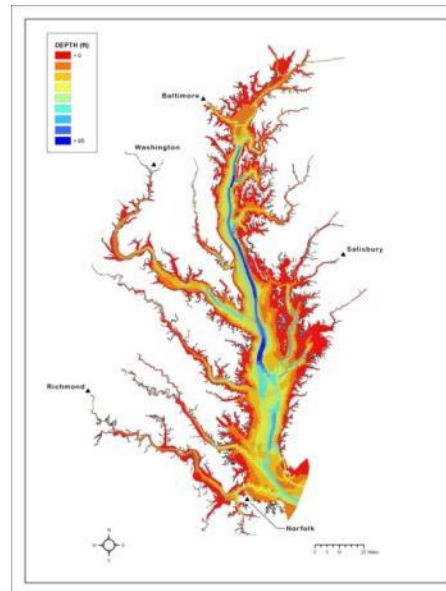
- Parameters**
(Changeable by user)
- BMP types and efficiencies
 - Land use change (BMPs, others)
 - RUSLE2 Data: % Leaf area and residue cover
 - Plant and Harvest dates
 - Best potential yield
 - Animal factors (weight, phytase feed, manure amount and composition)
 - Crop application rates and timing
 - Plant nutrient uptake
 - Time in pasture
 - Storage loss
 - Volatilization
 - Animal manure to crops
 - N fixation
 - Septic delivery factors

- BMPs, # and location
 - Land use
 - % Bare soil, available to erode
 - Nutrient uptake
 - Manure and chemical fertilizer (lb/segment)
 - N fixation (lb/segment)
 - Septic loads
- Outputs**

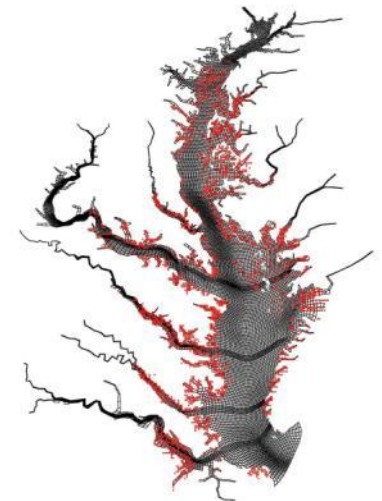
Chesapeake Bay Scenario Builder



Chesapeake Bay Watershed Model



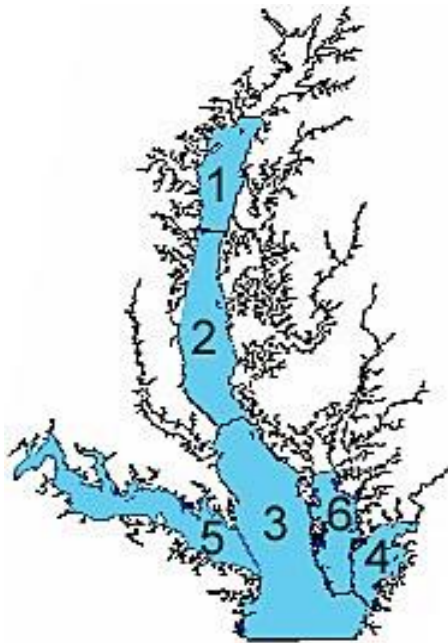
Chesapeake Bay Water Quality and Sediment Transport Model



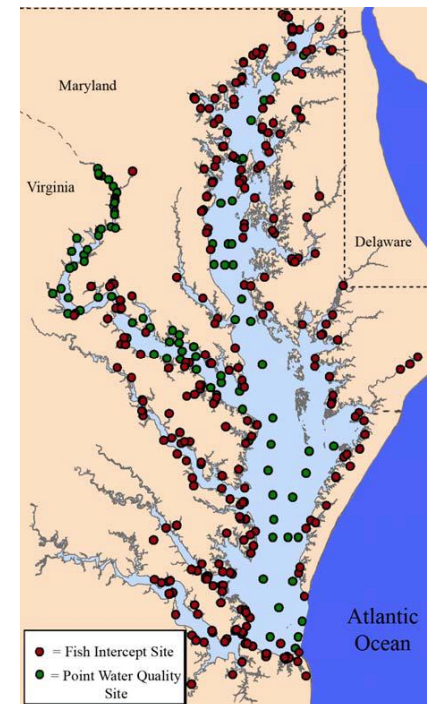
Chesapeake Bay Filter Feeder Model

Reported Fishing Locations

Commercial



Recreational (red dots)



Two approaches:

- Lipton & Hicks (2003)
 - Recreational Valuation (striped bass)
 - Medium resolution fishing location (intercept sites)
 - Nearest neighbor water quality station
- Ball (2014)
 - Commercial (blue crab fishery)
 - Low resolution fishing location
 - Interpolated high resolution water quality data

Summary & Concluding Comments

- Ideally, ecological monitoring and fishery reporting data would be designed jointly to provide most useful input to coupled ecological-economic models
- In the real world, precision is lost due to temporal or spatial data incompatibility
- New technologies can help close the gap
 - Commercial - electronic monitoring and reporting
 - Recreational - crowd-sourced data (e.g., ISnapper)
- In Chesapeake Bay the “Bay Model” and its outputs are the policy driver. Use those same model outputs under different scenarios directly in the fishery economic model (see Ball 2014) if you want the managers to listen.



Questions?

