Ecosystem Service Benefits of Conservation and Restoration

Local Government Advisory Commission
Chesapeake Bay Program

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Ecosystem Services

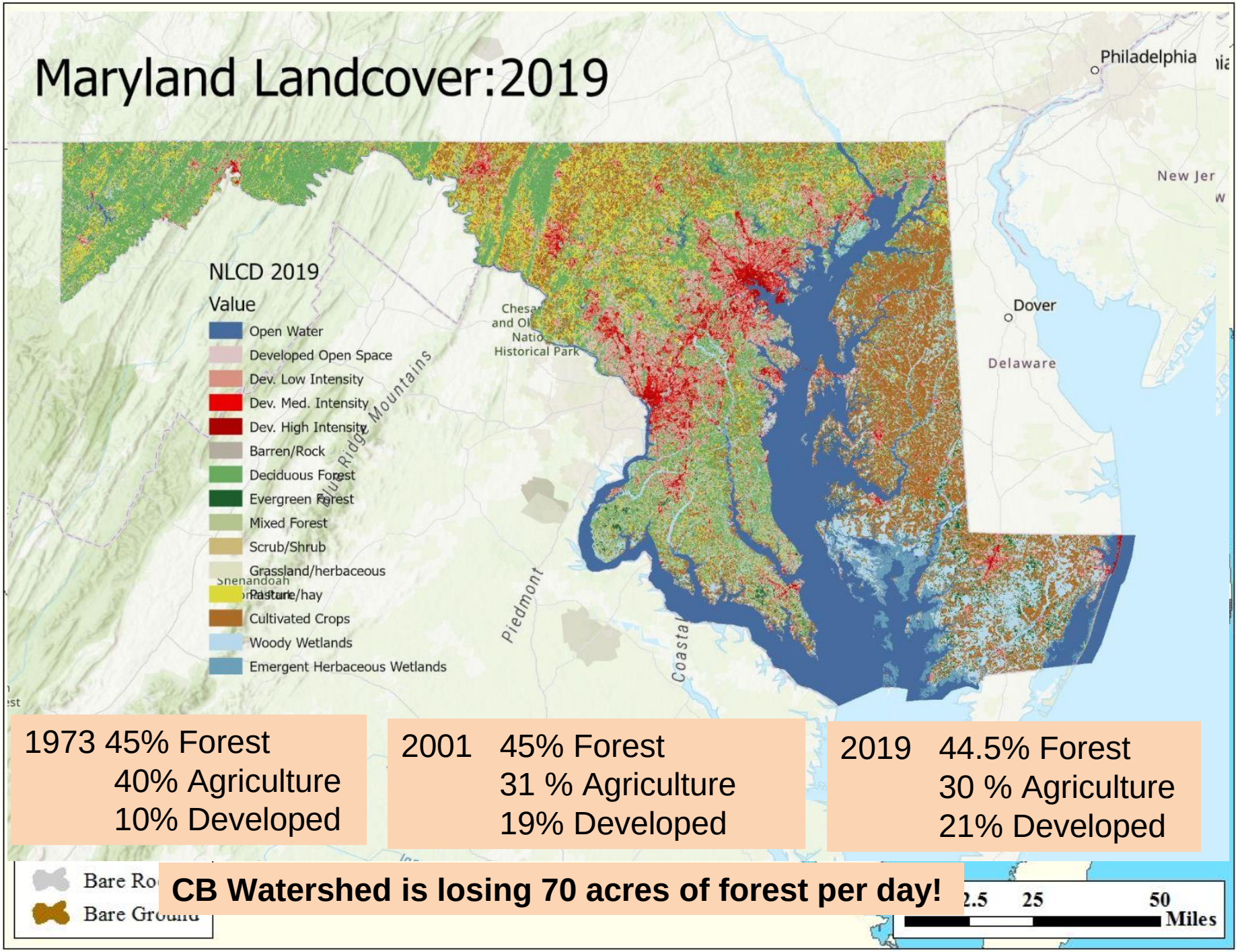
Broadly- "*Benefits gained by people from the environment*"

Practical definition for inclusion in decision making-

"*Benefits gained by people from the environment that are not already being paid for in a market and are contributing to a marginal increase in human well-being*"

MD DNR has developed information to quantify Ecosystem Services from natural lands and restoration opportunities

Maryland Landcover:2019



1973 45% Forest
40% Agriculture
10% Developed

2001 45% Forest
31 % Agriculture
19% Developed

2019 44.5% Forest
30 % Agriculture
21% Developed

CB Watershed is losing 70 acres of forest per day!

Mapping Ecosystem Services

- Ecosystem Services vary spatially across the landscape
- ES vary in the biophysical supply of the service (e.g. amount of carbon that is sequestered, water being recharged to aquifers)
- ES vary in the way and amount that people benefit (e.g. number of people and value of infrastructure vulnerable to flooding)
- We consider both sources of variation when mapping ES in Maryland

Ecosystem Services Mapped

Air pollution mitigation- USFS i-Tree landscape

Carbon sequestration- USFS i-Tree and MD DNR

Groundwater recharge- USGS National Hydrography Dataset (1 km)

Nitrogen Removal- USGS SPARROW model w/ literature removal rates by loading/ecosystem type

Flood Prevention/Stormwater mitigation- Index of Mitigation Potential (EPA/MD DNR)

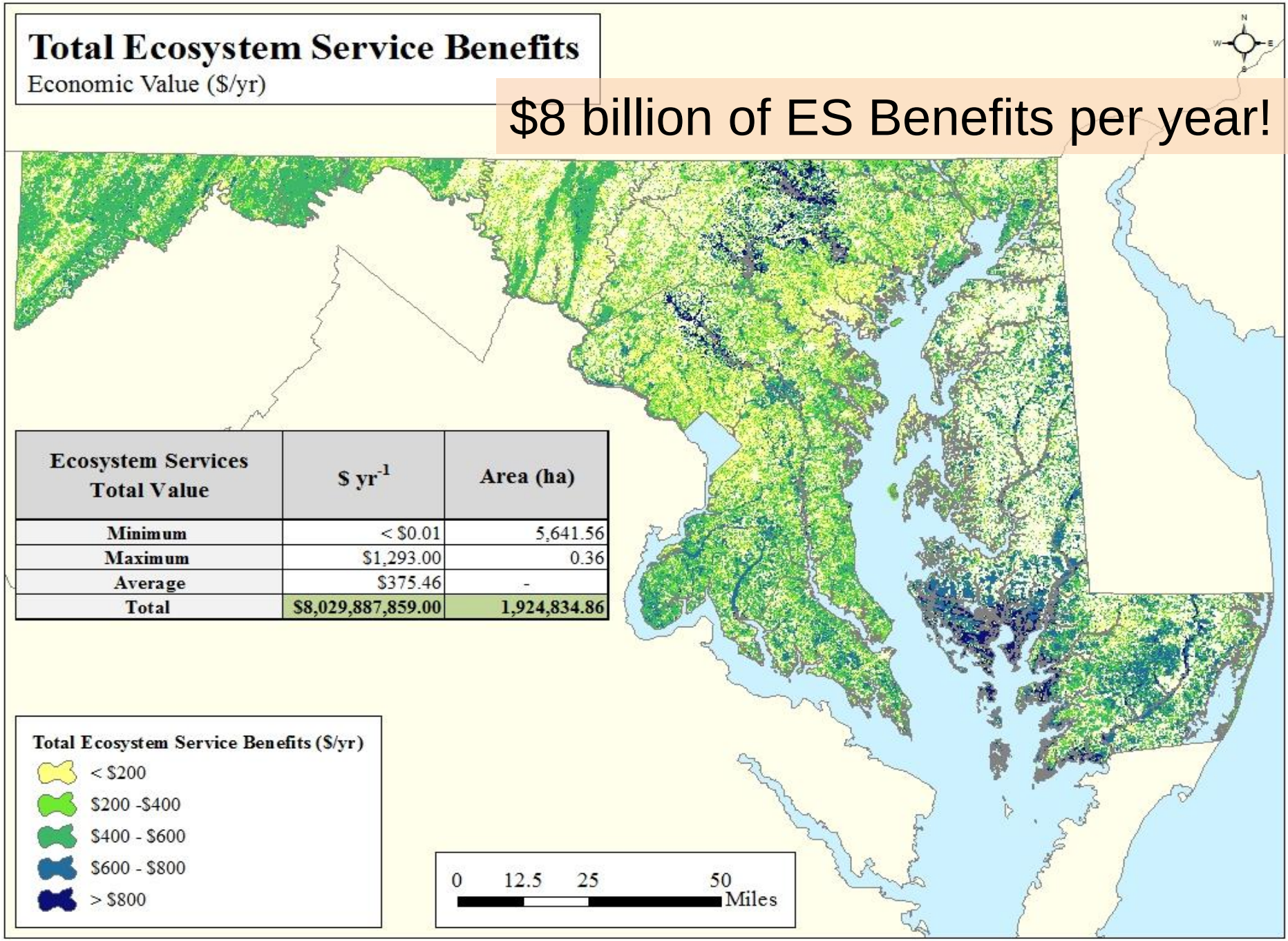
Wildlife- Habitat Quality Index, MD DNR

Valuation Methodology: Eco-Price

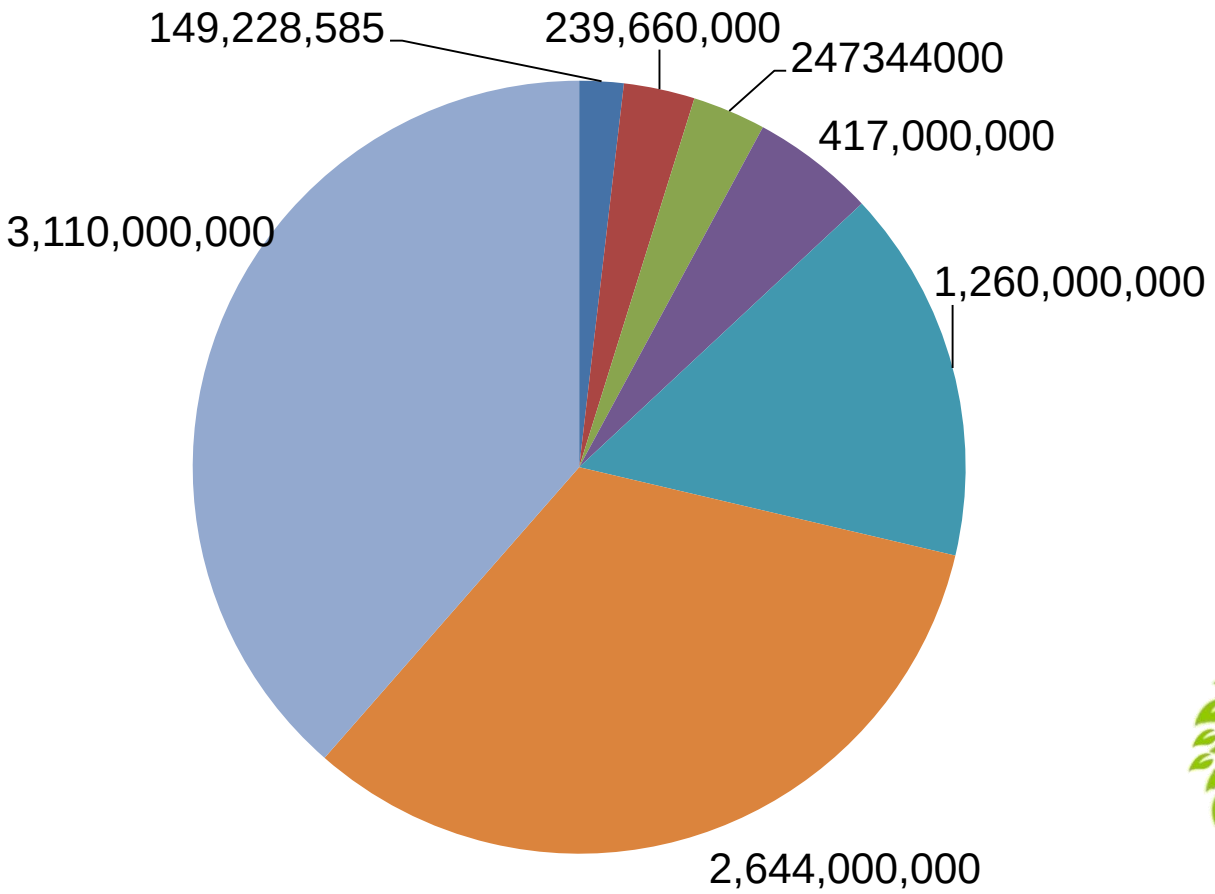
- Ecosystem services are paid for in many different ways
- People view responsibility for providing ecosystem services to be a collective obligation
- We look at the many different ways society invests in protecting or replacing the environment
  - In a regulatory market
  - Cost of restoration
  - Through mitigation fees
  - Cost to regulate

Assesses the Social Value for decision making

≠ Market Value


Total Ecosystem Service Benefits
Economic Value ($/yr)
$8 billion of ES Benefits per year!
N
W
E
S
Ecosystem Services Total Value | $ yr-1 | Area (ha)
Minimum | < $0.01 | 5,641.56
Maximum | $1,293.00 | 0.36
Average | $375.46 | -
Total | $8,029,887,859.00 | 1,924,834.86
Total Ecosystem Service Benefits ($/yr)
< $200
$200 -$400
$400 - $600
$600 - $800
> $800
0 12.5 25 50
Miles

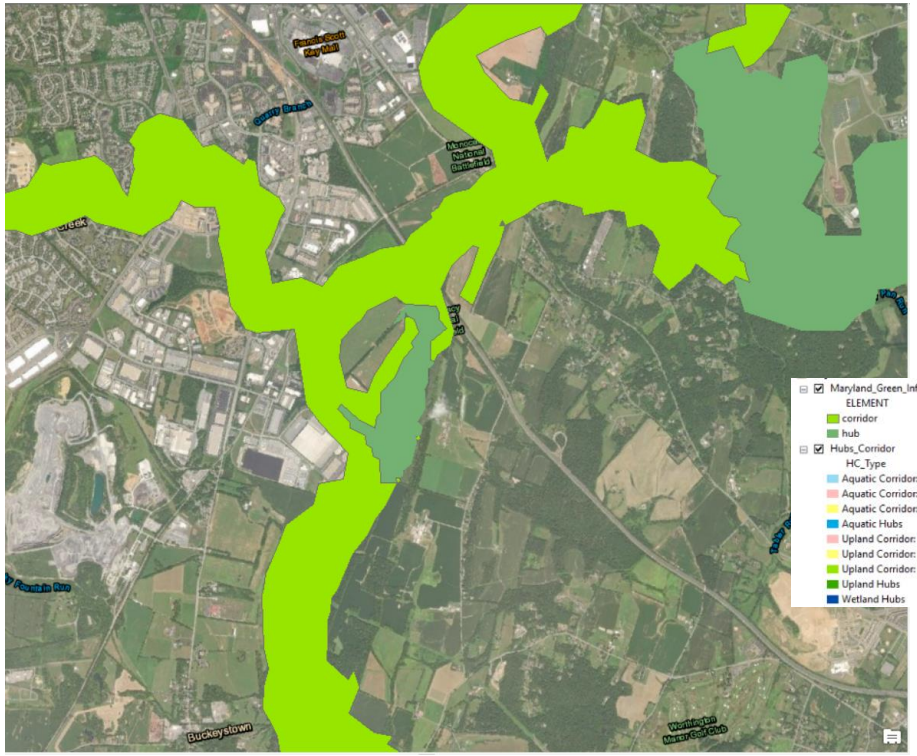
Ecosystem Service Totals



Units= $ per year

New Project
Updating Maryland's Green Infrastructure

Existing GI Hubs and Corridors



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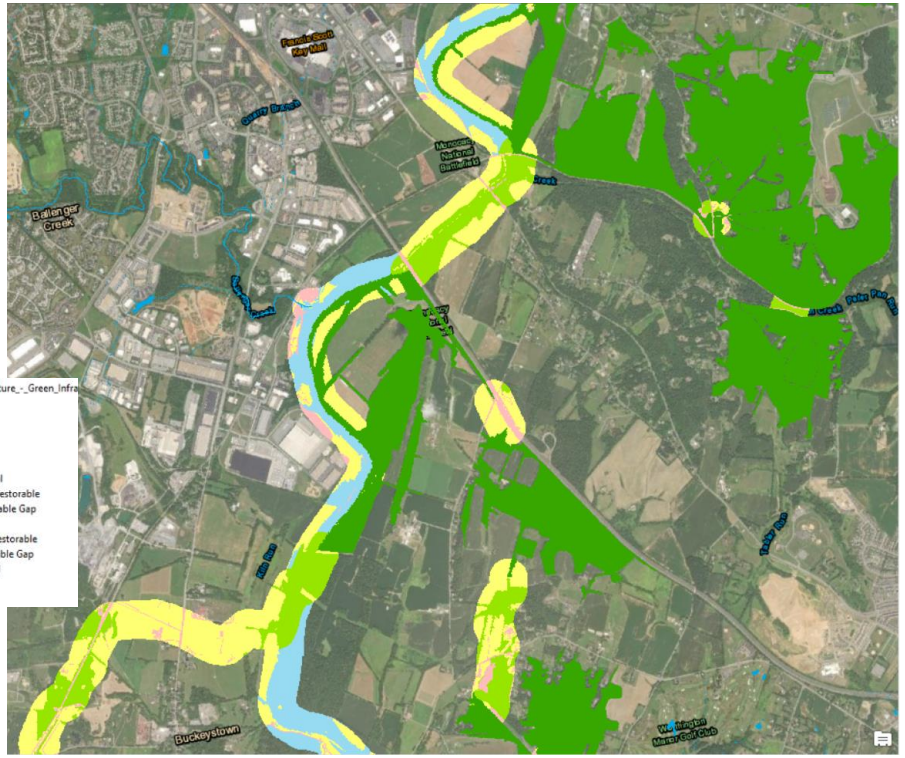


Collaboration with the Chesapeake Conservancy Conservation Innovation Center

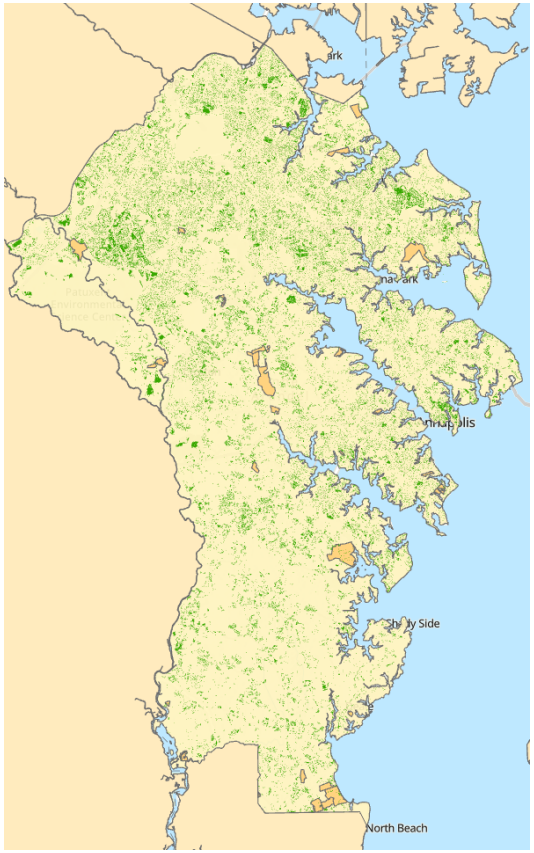
Mapping and Scoring Potential Restoration Co-benefits

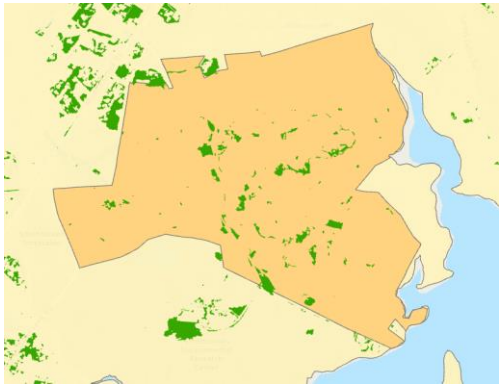
- **Develop and implement a restoration co-benefit scoring approach that is consistent with DNR's Ecosystem Service Valuation methodology for select restoration practices**
  - **Ecosystem Services Considered**
    - Carbon sequestration
    - Air quality benefits
    - Flood mitigation
    - Water supply protection
    - Wildlife habitat

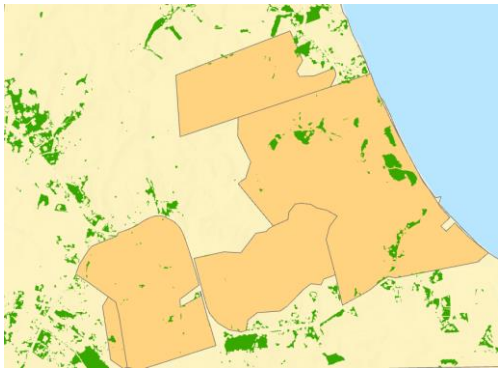
Also mapping climate resilience and social vulnerability

Tree Planting Opportunities

- Leveraged Chesapeake Conservancy “Plantable Area” data, created as part of the the Maryland Forest Technical Study
- We can look at different thresholds to narrow down potential tree planting opportunities
- This map looks at contiguous areas greater than 1 acre
- Note, this data does not include planting opportunities on agricultural lands

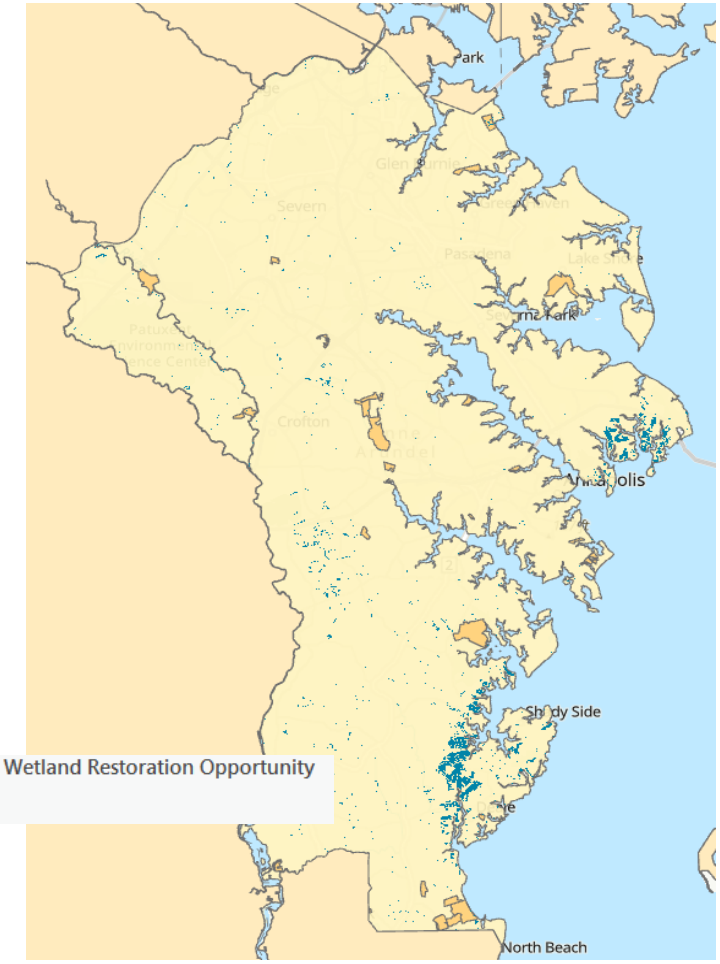


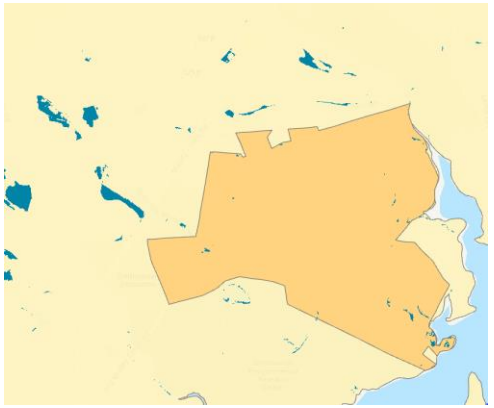


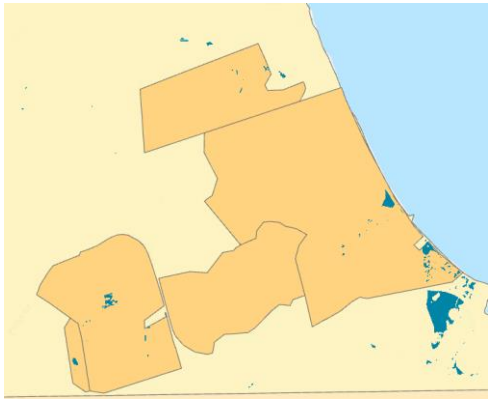


Wetland Restoration Opportunities

- Leveraged the “absolute factors” of the Watershed Resources Registry (WRR) model, to consider :
  - Soil type
  - Size of parcel
  - Prior land-use
- Includes areas projected to transition to wetlands due to sea level rise

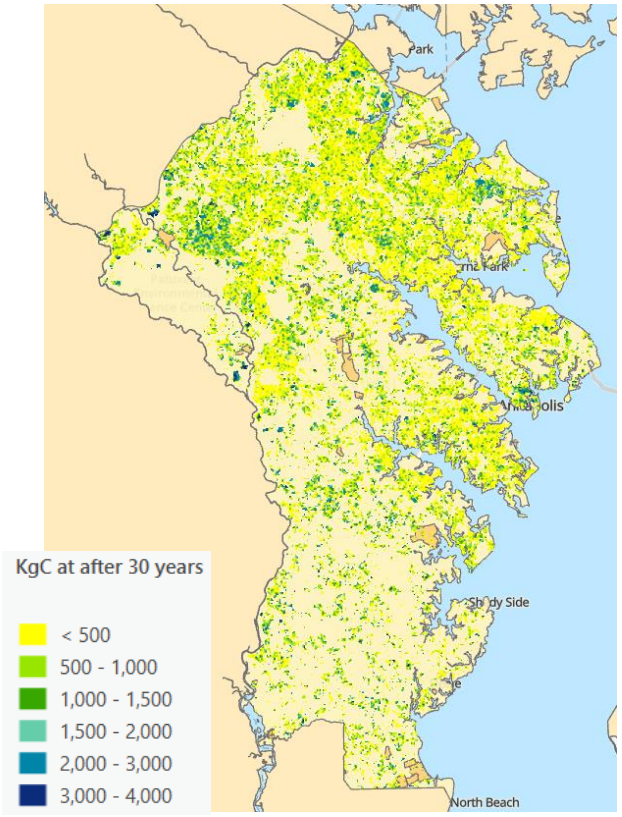


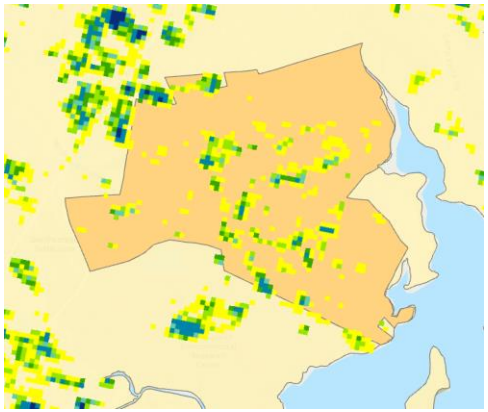


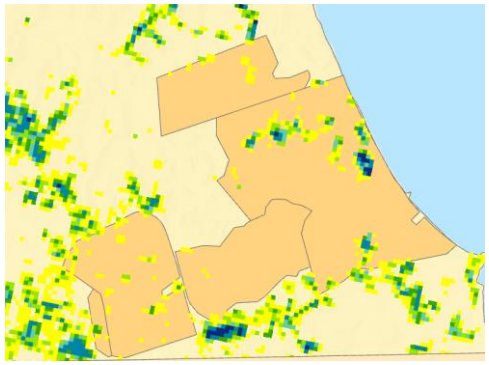


Carbon Sequestration Potential Carbon (kg in 30 year)

- Combined the plantable area analysis with UMD model of potential carbon sequestration through tree planting over different time periods (showing 30 years year)
- Larger planting opportunities with better site conditions will sequester more carbon
- Doesn't consider planting densities or species (assumes native species community similar to nearby sites)

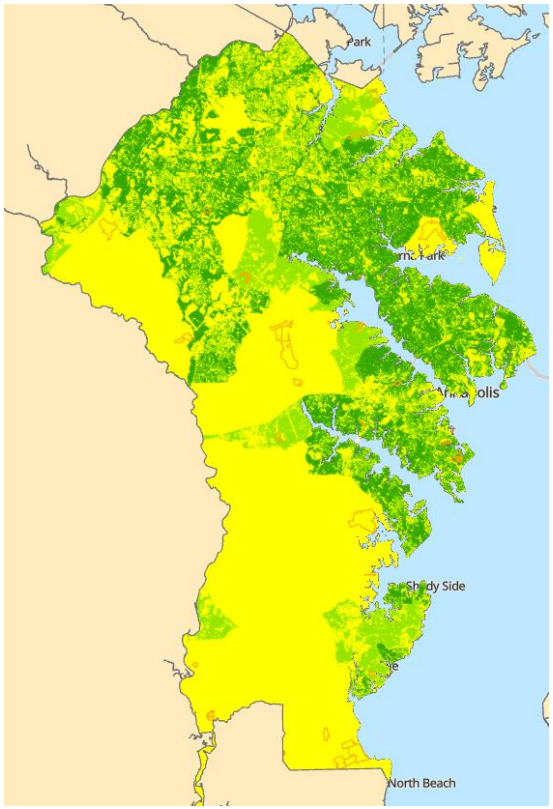


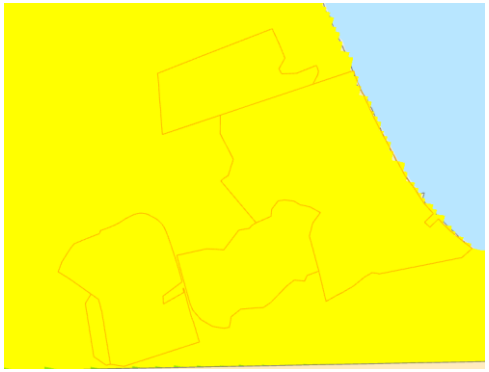


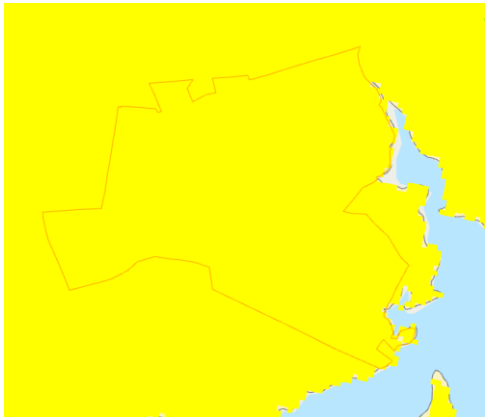


Air Quality

- Based on the i-Tree Landscape tool for air pollutant removal rates by tree canopy and the economic value of that removal from avoided health costs in nearby population (based on census block)
- We applied those rates to the tree planting opportunity areas

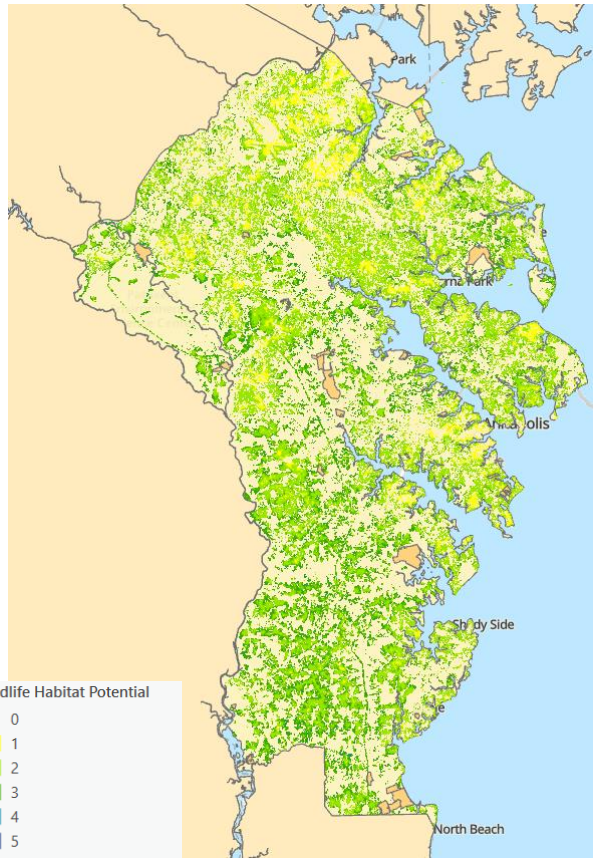


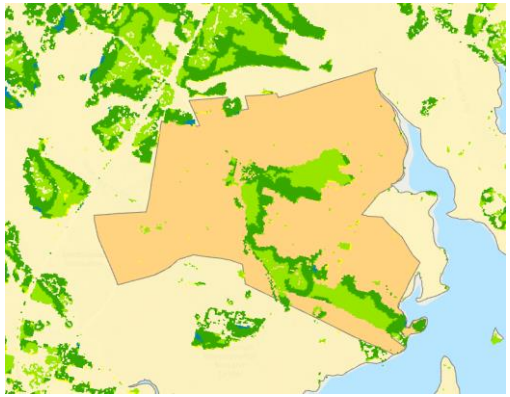


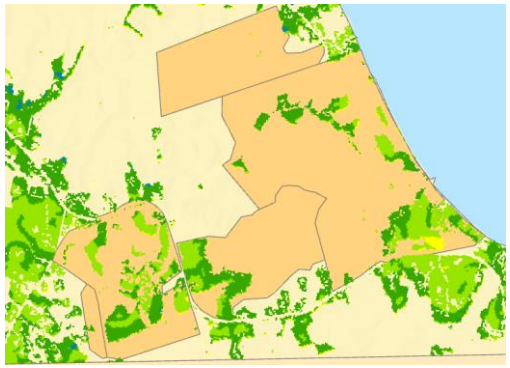


Wildlife Habitat Potential

Areas that are not currently forest or wetlands, but are located closer to existing habitat are given higher ranks, proximity to developed lands brings down the score

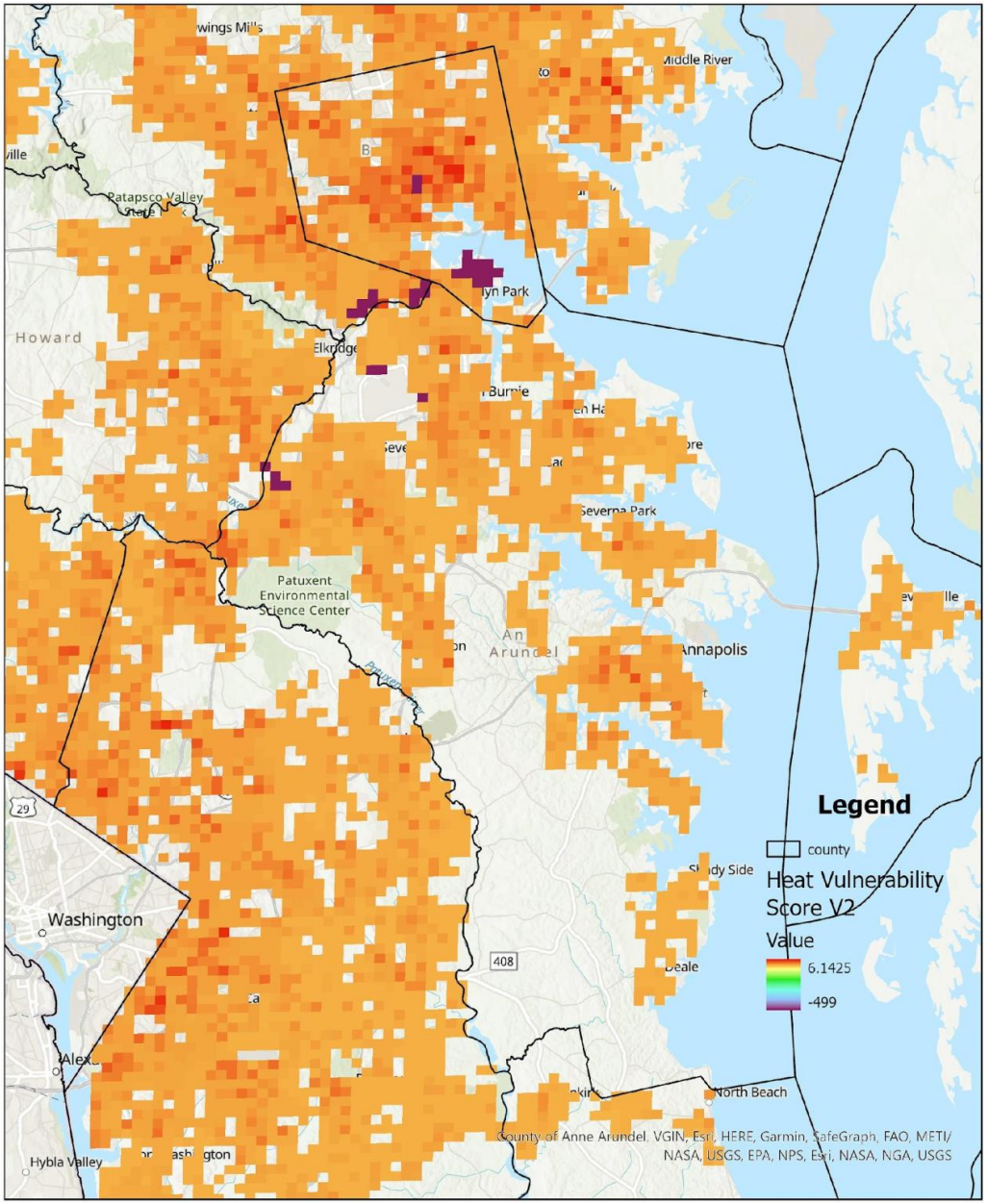






Climate Resilience: Heat Vulnerability

- Combination of dangerous heat days from recent years (2019, 2020, 2021) and the CDC Social Vulnerability Index
- Factors have some correlation, but does identify particular problem areas within developed regions
- Could help target tree planting programs



Summary

Conservation Benefits

Parcel Evaluation Tool: Ecological Benefit Ratings & Ecosystem Services

Maryland's Green Infrastructure *

Restoration Benefits

Mapping Restoration Opportunities Across Maryland

Mapping and Scoring Potential Restoration Co-Benefits

Mapping and Scoring Potential Restoration Climate Resiliency Benefits

Education and Communication

Taken together, these advancements will ensure that our decision making processes incorporate the latest understanding of how our investments can help to reduce impacts of a changing climate, maximize resiliency and other co-benefits

Other CB Watershed Ecosystem Service Resources

- PA
  - Kittatinney Ridge Return on Environment- https://kittatinnyridge.org/explore/roe/roe-studies/
  - Philadelphia Urban Decision Making https://penniur.upenn.edu/initiatives/urban-ecosystem-services-and-decision-making
- VA
  - Piedmont Environmental Council https://conservationtools.org/library_items/1131-The-Economic-Benefits-of-Virginia-s-Natural-Goods-and-Services
- WV
  - Urban Forests in West Virginia https://wvforestry.com/pdf/TC%20USA%20Canopy%20Coverage%20Publication%20-%20Summary.pdf
- DE
  - Economic Value of Nature and Ecosystems in the Delaware River Basin https://www.wrc.udel.edu/research/economic-value-of-nature-and-ecosystems-in-the-delaware-river-basin/
- NY
  - Urban Ecosystem Services https://www.sciencedirect.com/science/article/abs/pii/S2212041616300729 https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/eap.2390

Ecosystem Services in the Chesapeake Bay Watershed

- All States in the watershed have had ecosystem service studies done for at least a sub-region
- Studies used different methodology, are not directly comparable, and typically 1 off
- National Datasets, federal tools like the Enviro-Atlas and Watershed Resource Registry make a CB wide assessment possible that is consistent and could be maintained regularly

So… what local government want from a Watershed Ecosystem Service tool?

- What services are missing?
- Would economic ($) values be useful?
- How would you want to access the information?

More Information

- The GreenPrint Map and Parcel Eval
  http://geodata.md.gov/greenprint/

- Chesapeake & Coastal Service Ecosystem Service Website
  http://dnr.maryland.gov/ccs/Pages/Ecosystem-Services

- Maryland Ecosystem Service Webinar
  https://www.youtube.com/watch?v=56mDu3lH0- 0&feature=youtu.be

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