



# Accounting for Calvert County's Ecosystem Services

Presentation to the Calvert County  
Environmental Commission  
Prince Frederick, MD 1/30/2017

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# Outline



1

Environment and Quality of Life

2

Land-use in Calvert Co.

3

Ecosystem Services

4

Results

5

Potential Applications



# Environment and Quality of Life



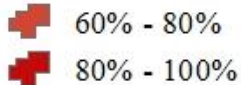
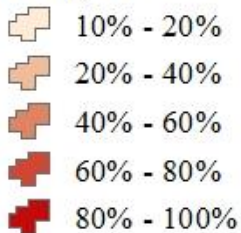


# Calvert County: Distribution of Landcover

## % Forest



## % Impervious



## Wetlands





# Calvert County: Landuse Change



1973

2010

Calvert was 64% forest  
6% developed  
26% agriculture

Currently 52% forested  
30% developed  
15% agriculture

~19% of its forests and ~40%  
of agricultural lands were lost  
from 1973 to 2010

## Landcover Type

- Impervious
- Agriculture
- Forest
- Wetland
- Water
- Beaches
- Bare Rock

	Landcover Area (acres)			
	Impervious	Agriculture	Forest	Wetland
1973	8,774	35,357	88,278	4,155
2002	36,455	27,585	69,136	2,778
2010	40,533	21,099	71,488	2,687
Change 1973 - 2010	31,759	-14,258	-16,789	-1,468

0 4 8 16 Miles

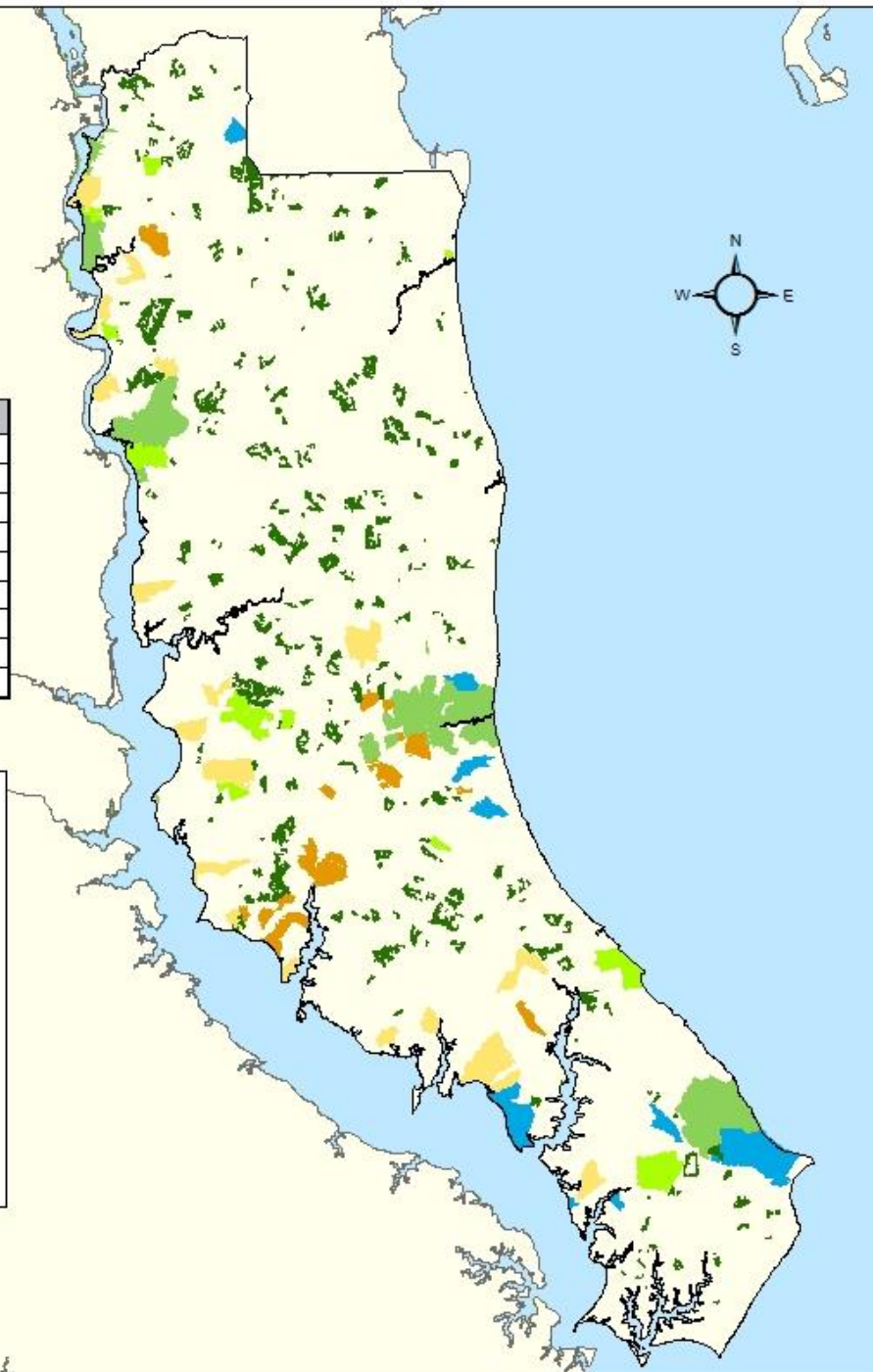
# Calvert County: Protected Lands

Calvert County Protected Lands	Area (acres)	Percent Area
Local Protected Lands	1,775.17	0.01
DNR Properties and Conservation Easements	5,019.77	0.04
Protected Federal Lands	0.00	0.00
Forest Conservation Act Easements	3,112.79	0.02
MD Agricultural Land Preservation Foundation Easements	4,168.67	0.03
Rural Legacy Properties	1,881.20	0.01
MD Environmental Trust Easements	2,172.52	0.02
Total Public Protected Lands	18,130.11	0.13
Calvert County	137,121.00	-

## Protected Lands

- Local Protected Lands
- DNR Properties and Conservation Easements
- Protected Federal Lands
- Forest Conservation Act Easements
- MD Agricultural Land Preservation Foundation Easements
- Rural Legacy Properties
- MD Environmental Trust Easements

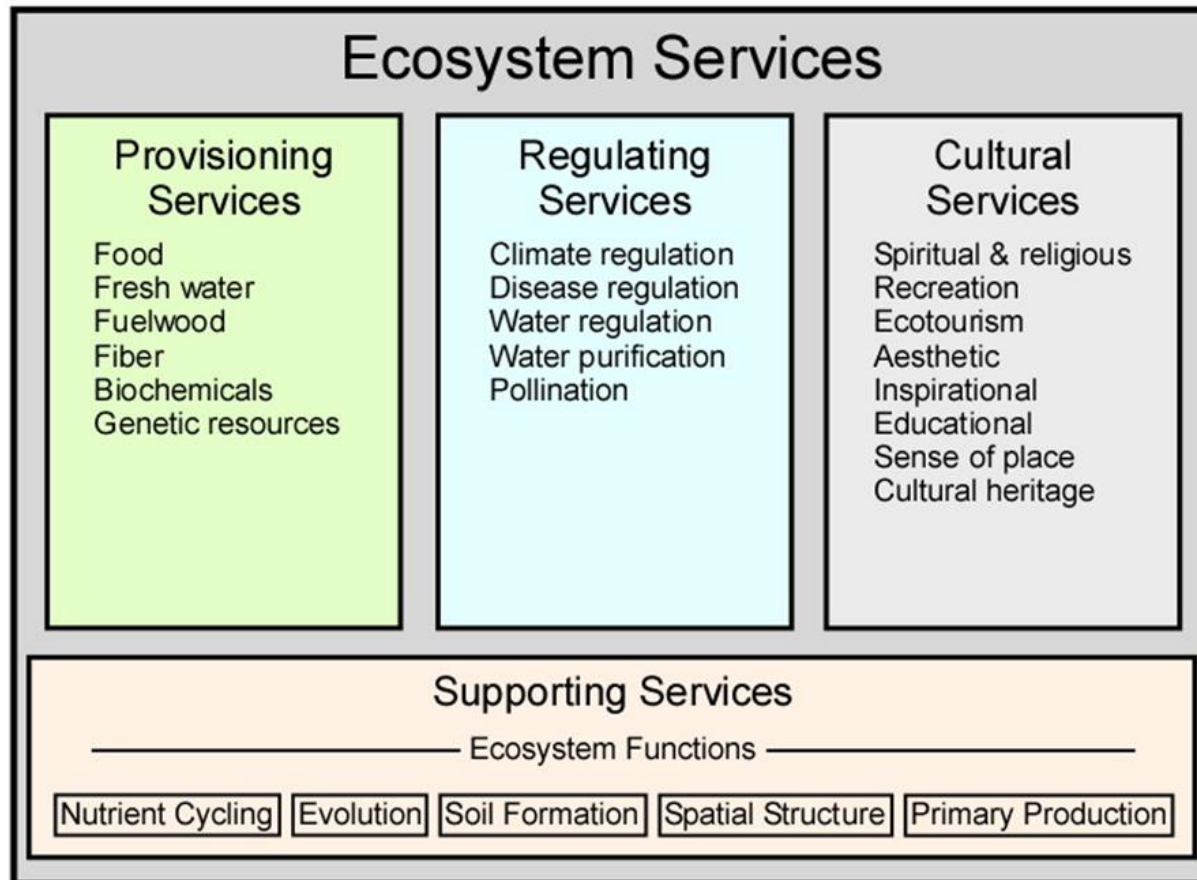
0 1 2 4 6  
Miles



# Ecosystem Services



*"Benefits gained by people from the environment"*



Modified, with additions, from the Millennium Assessment

As classified by the Millennium Ecosystem Assessment (MEA 2005)





# Why Value Ecosystem Services?



- Resources are lost or degraded when the value of ecosystem services are not considered in decision making
- This decreases the long term sustainability of the state and quality of life for citizens
- If lost, ecosystem services will have to be replaced
  - Investment in additional built infrastructure
  - Restoration of natural lands
  - Of course, some values are irreplaceable





# Accounting for Maryland's Ecosystem Services (AMES)



- Use established models from USGS, USFS, DNR, US EPA for quantity of the ecosystem service (mt of carbon, kg of N, etc.)
- Assigns a dollar value to individual ecosystem services using the “eco-price” methodology (Campbell, in press)
- Ecosystem services currently considered across the landscape of Maryland include
  - Air Quality improvement
  - Carbon sequestration
  - Groundwater recharge
  - Nutrient Uptake
  - Wildlife habitat and biodiversity
  - Stormwater mitigation
- Not presented here- services specific to coastal wetlands and the Chesapeake Bay



# 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 market
  - Cost of restoration
  - Through mitigation fees
  - Cost to regulate

Assesses the Social Value





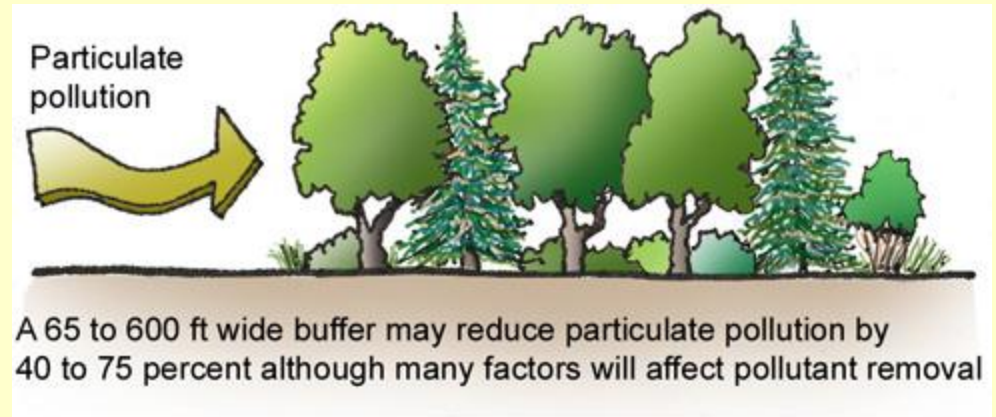
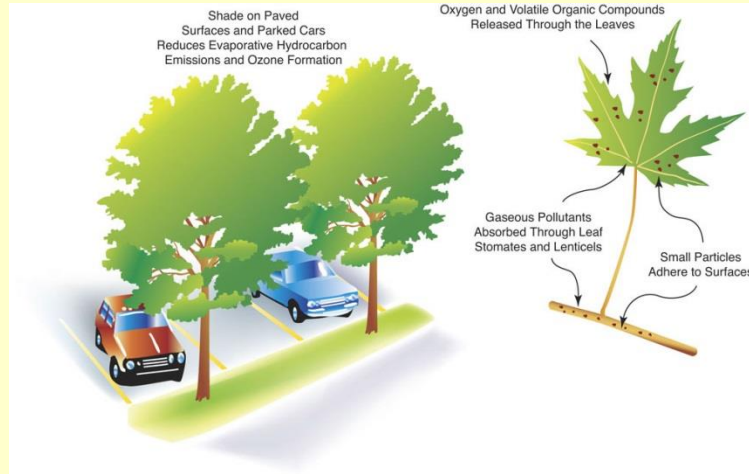
# Types of Economic Value



- **Market Value**
  - Traditional measure of price
  - Compensatory value
- **Non-market Value**
  - Attempts to recreate market value by asking people what they might be willing to pay or looking at proxy markets
- **Social or Public Value**
  - Novel, developing way to assess value from the perspective of the public, rather than individual, good



# Air Pollutant Removal

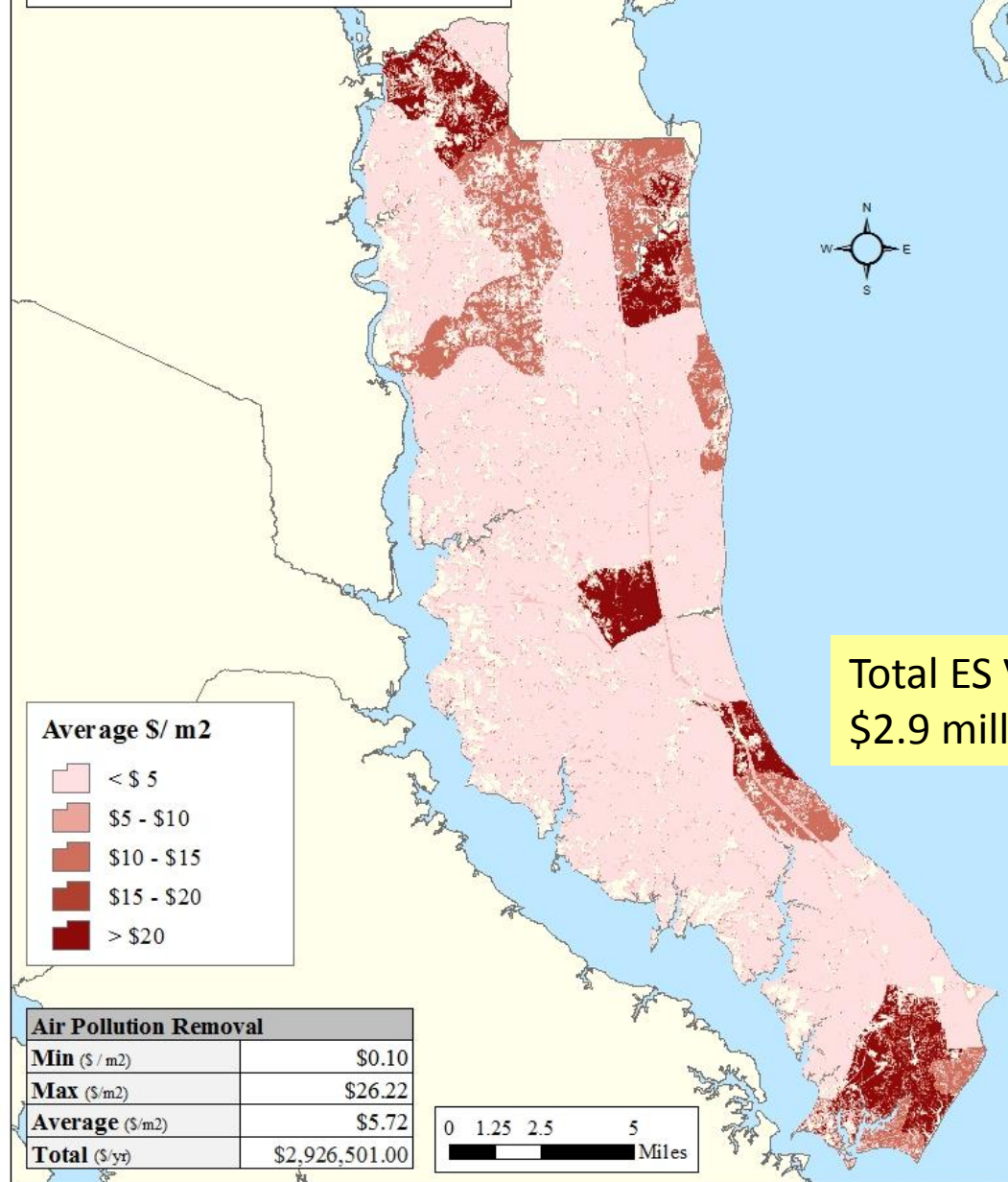


- *ES across the landscape:* Trees remove more air pollutants with a greater impact on human health in urban areas
- We use the economic impact that tree air pollution removal has on health costs (see Nowak et al. 2014)



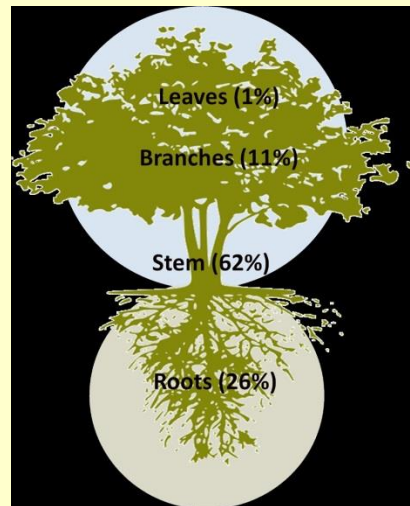
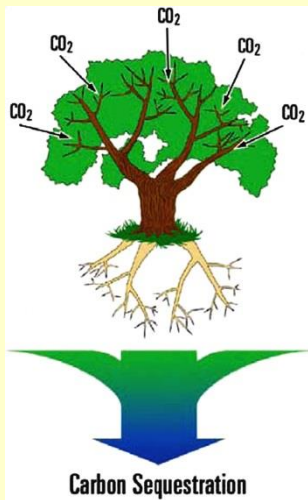
# Air Pollution Removal

*Economic Value*



Total ES Value:  
\$2.9 million per year

# Carbon Sequestration

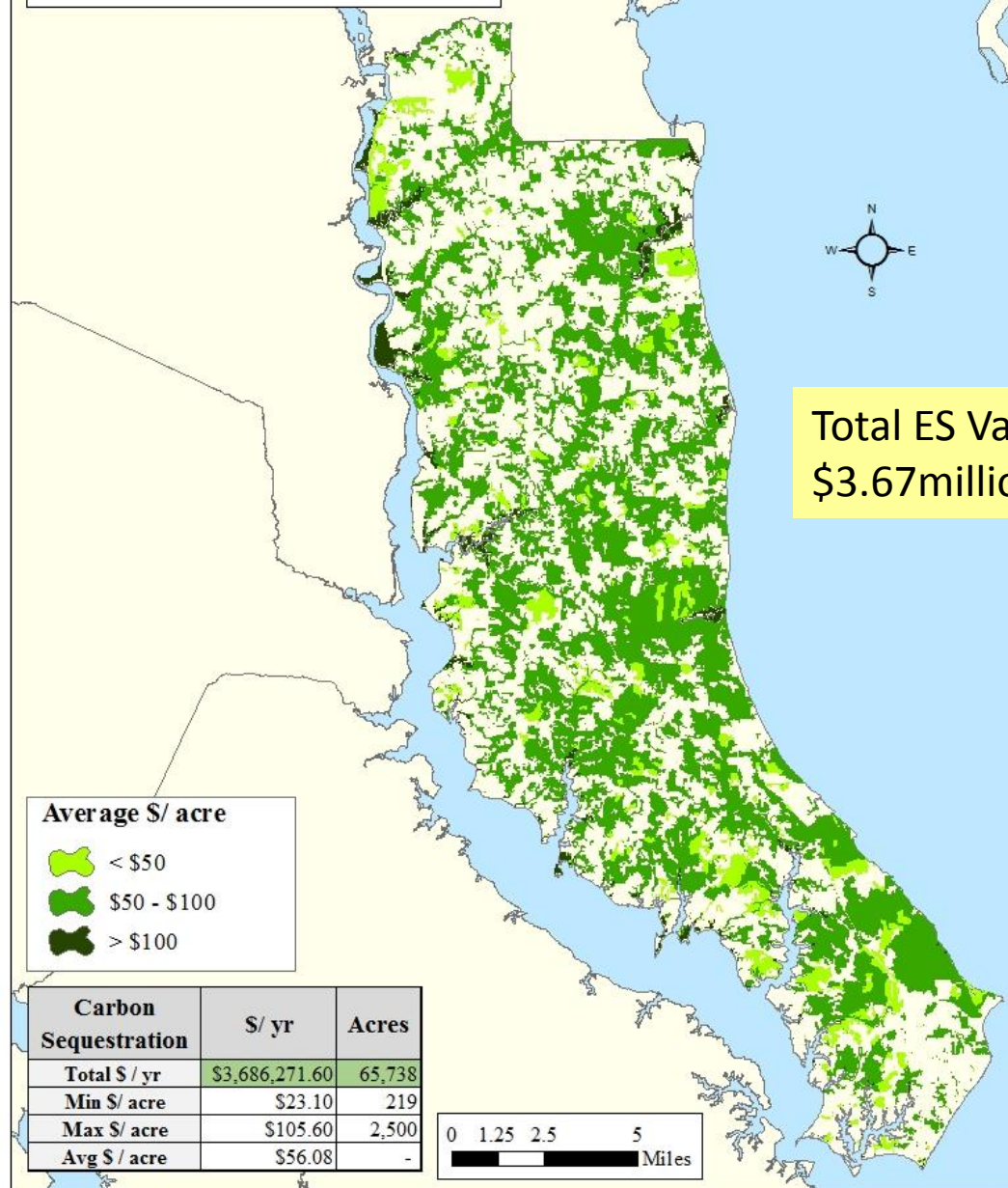


- *ES across the landscape:* Certain ecosystems (coastal wetlands, deciduous forests) sequester large amounts of carbon than others (shrublands, coniferous forests)
- *Eco-Prices:* the Social Cost of Carbon (estimate of the costs of climate change), Regional Greenhouse Gas Initiative (RGGI) market price, cost to comply with Clean Power Plan. Averages \$77 per mt of carbon



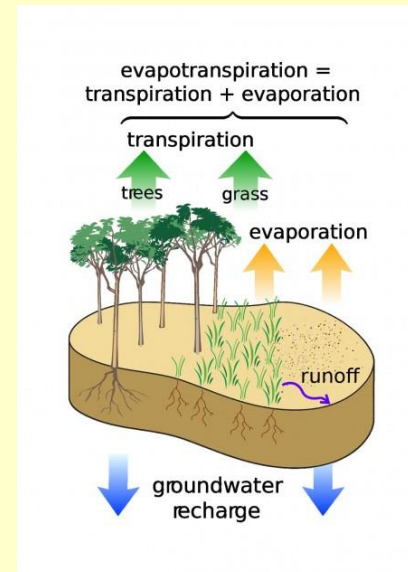
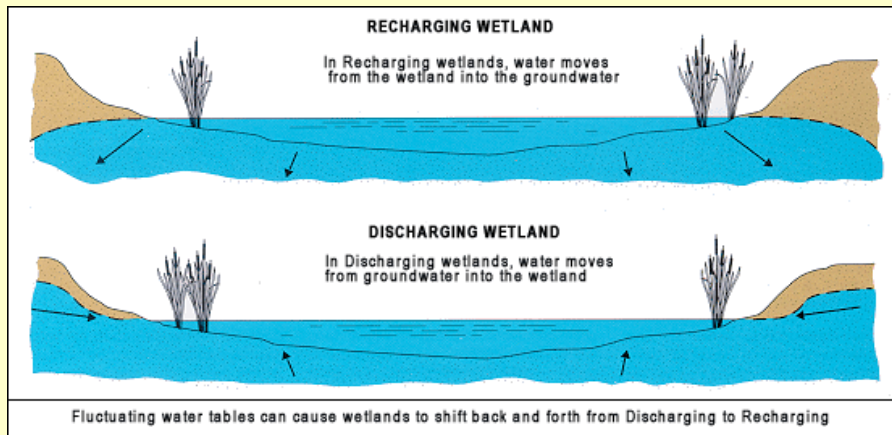
# Carbon Sequestration

*Economic Value*



Total ES Value:  
\$3.67million per year

# Groundwater Recharge

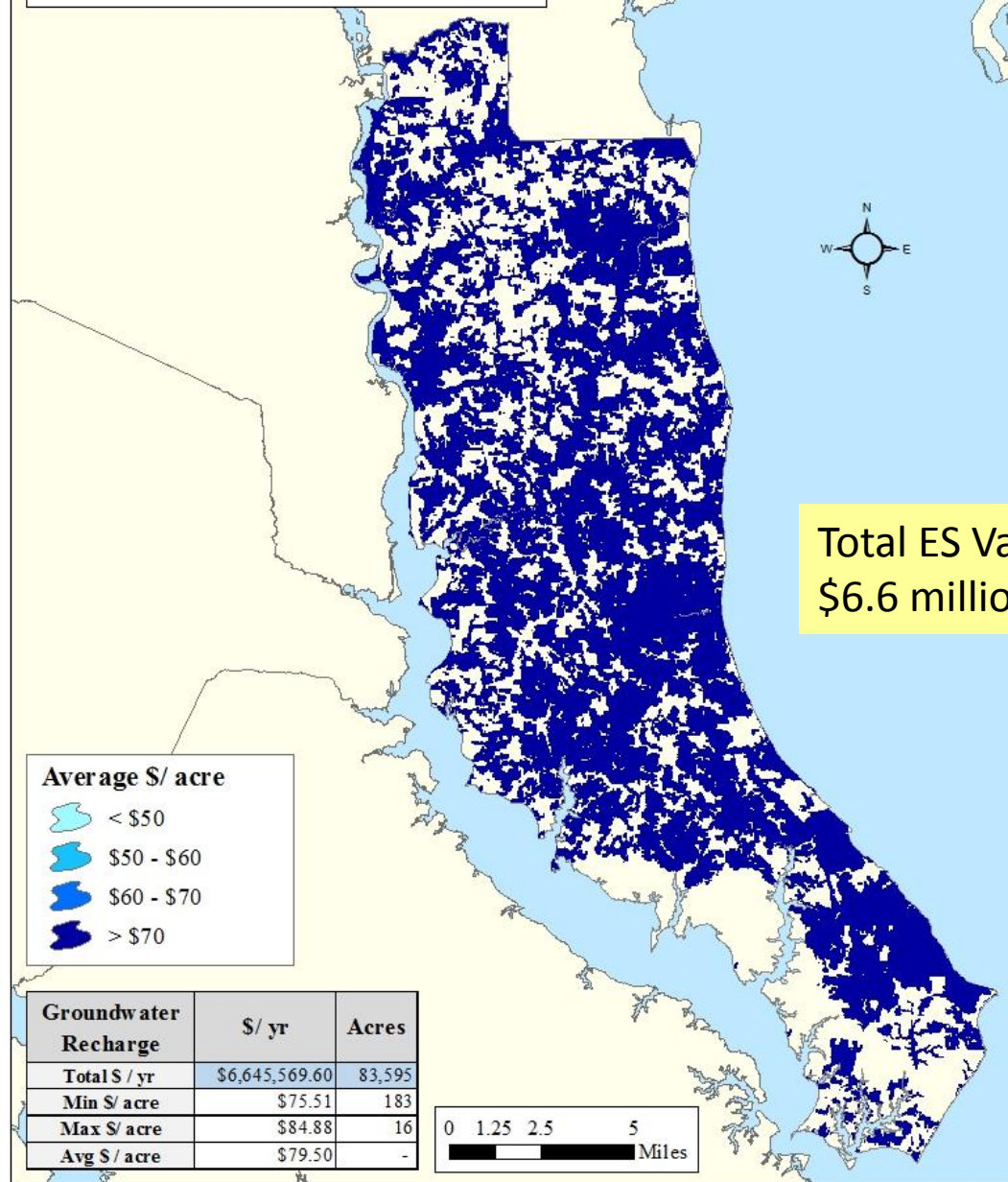


- *ES across the landscape:* Geology is the primary driver of the rate that water enters unconfined and confined aquifers
- *Eco-prices:* Average municipal price of water, value of water for recreation, investment in watershed protection. Averages \$0.35 per m<sup>3</sup> water



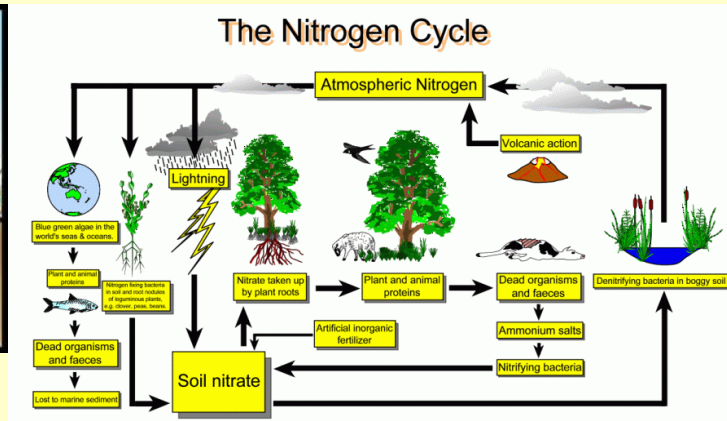
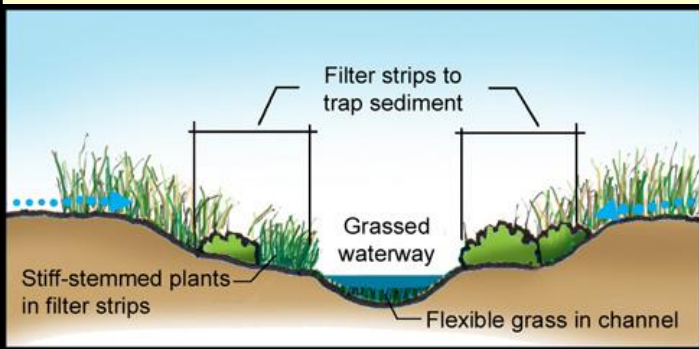
# Groundwater Recharge

*Economic Value*



Total ES Value:  
\$6.6 million per year

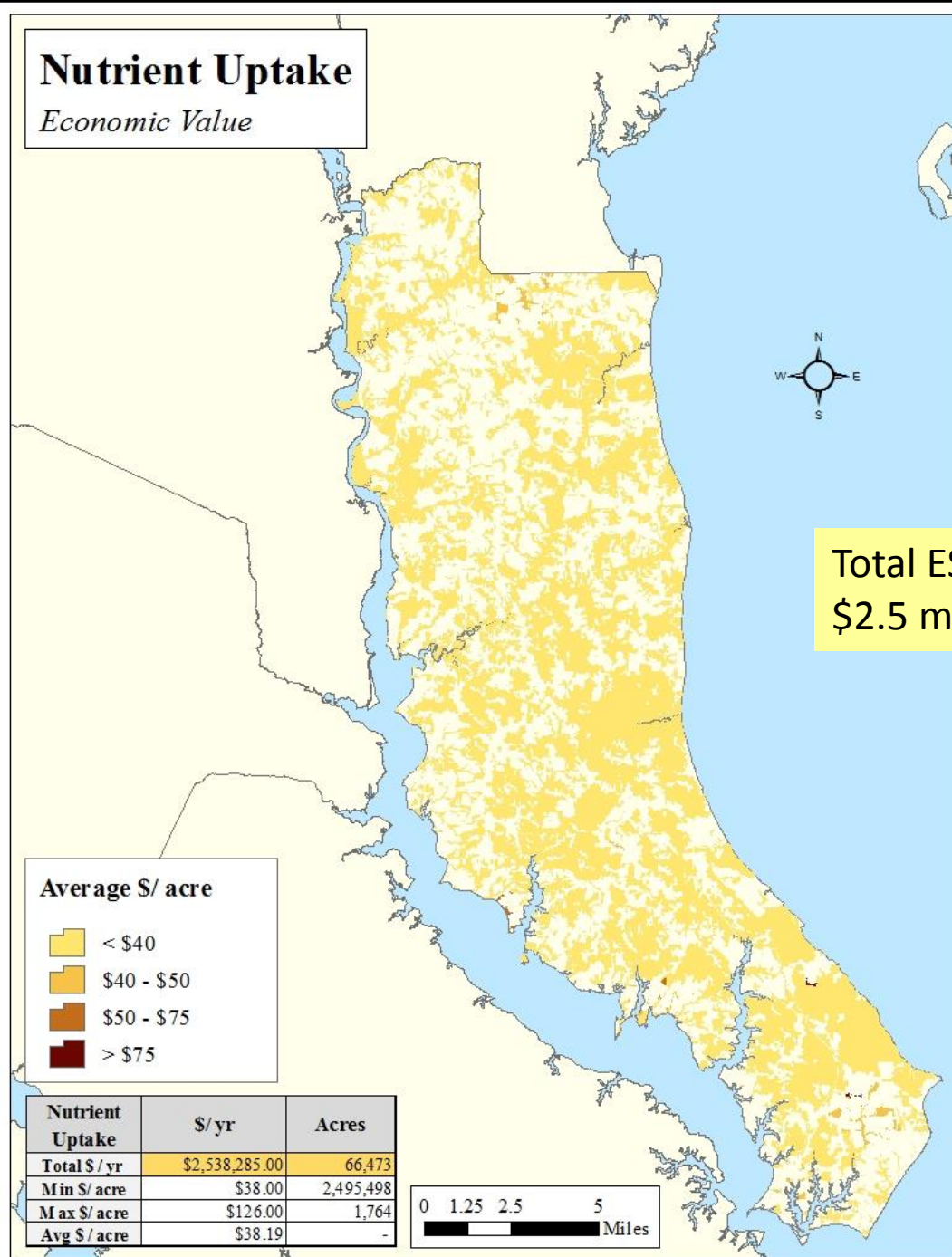
# Nutrient Uptake



- *ES across the landscape*: Forests and wetlands in watersheds with high amounts of urban or agricultural land-uses receive and take-up higher quantities of nutrients
- *Eco-Price*: Avg. cost to remove nutrients using best management practices and price on nutrient trading markets. Averages \$8.36 per lbs nitrogen or phosphorus

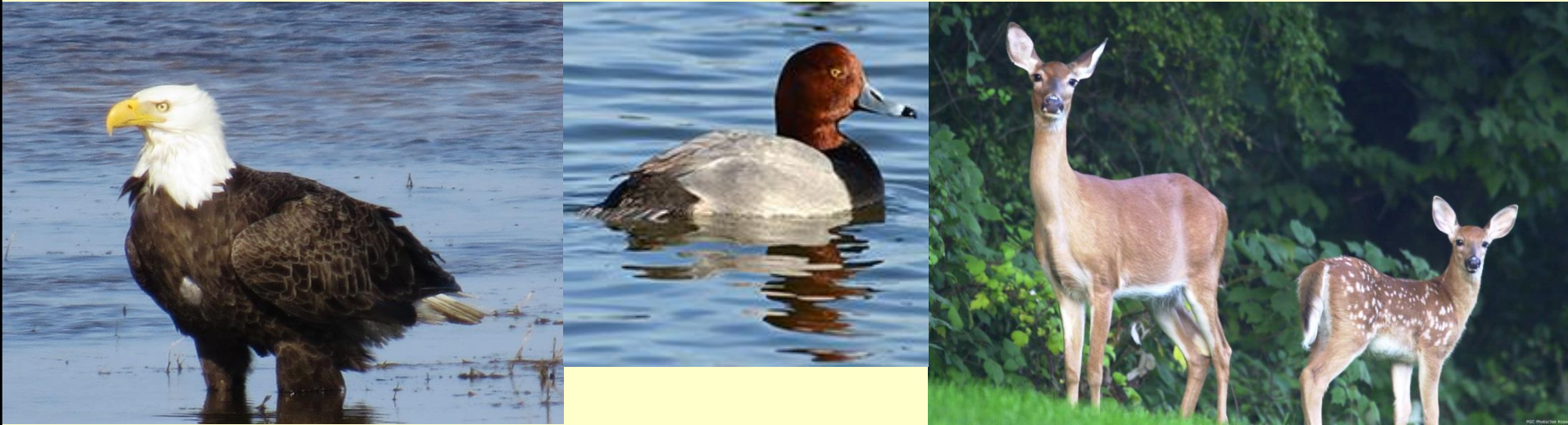
# Nutrient Uptake

*Economic Value*





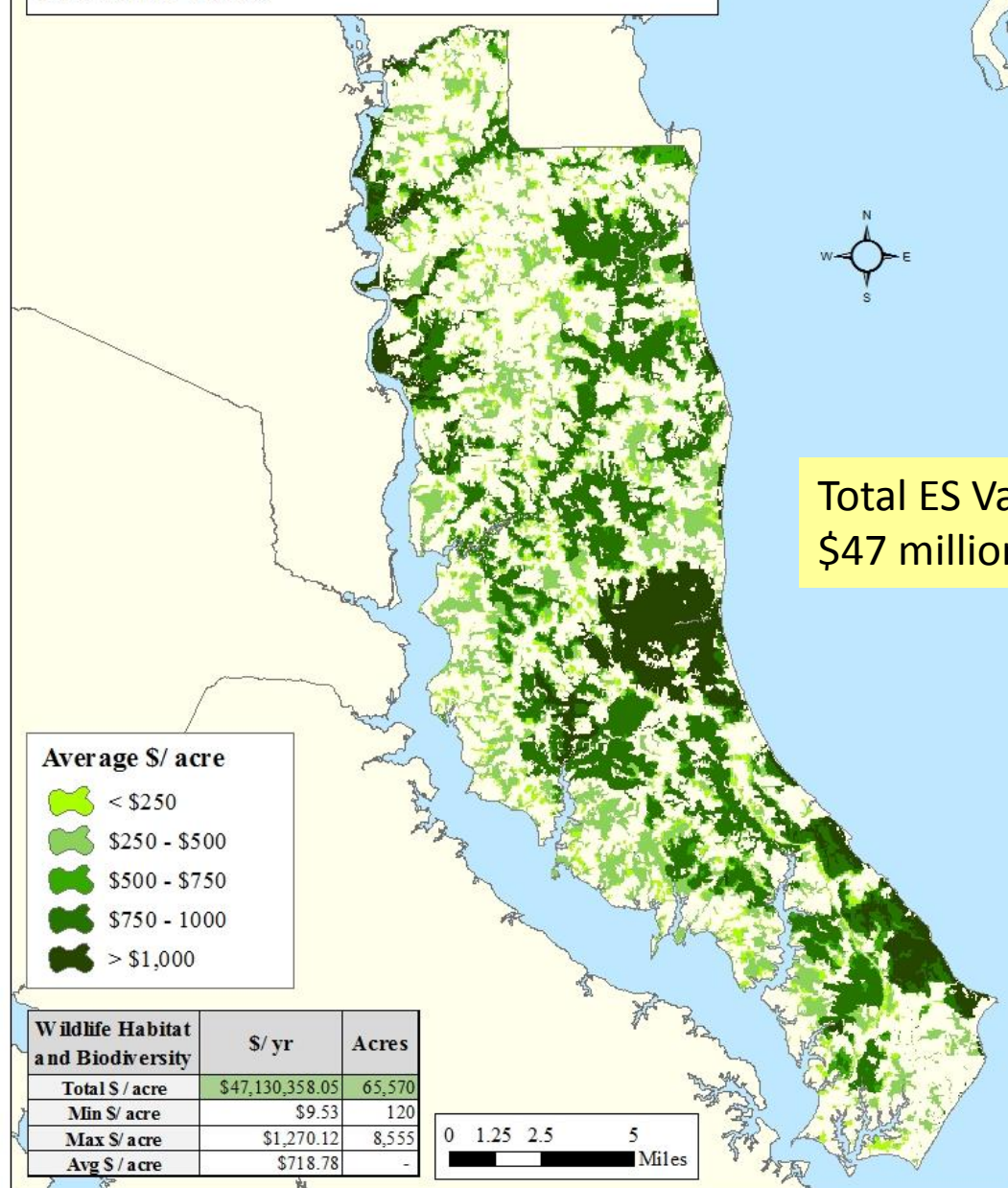
# Biodiversity/Wildlife Habitat



- *ES across the landscape:* We looked at the size of habitat, degree of connection to other habitats, and presence of rare species or habitats
- *Eco-price:* Cost to preserve natural land (i.e. Ducks Unlimited, Conservation Fund, habitat banking) annualized over 15 years, period that tax benefit can be spread. Averages \$1023 per acre of natural land.

# Wildlife Habitat and Biodiversity

*Economic Value*



# Stormwater Abatement Ecosystem Service

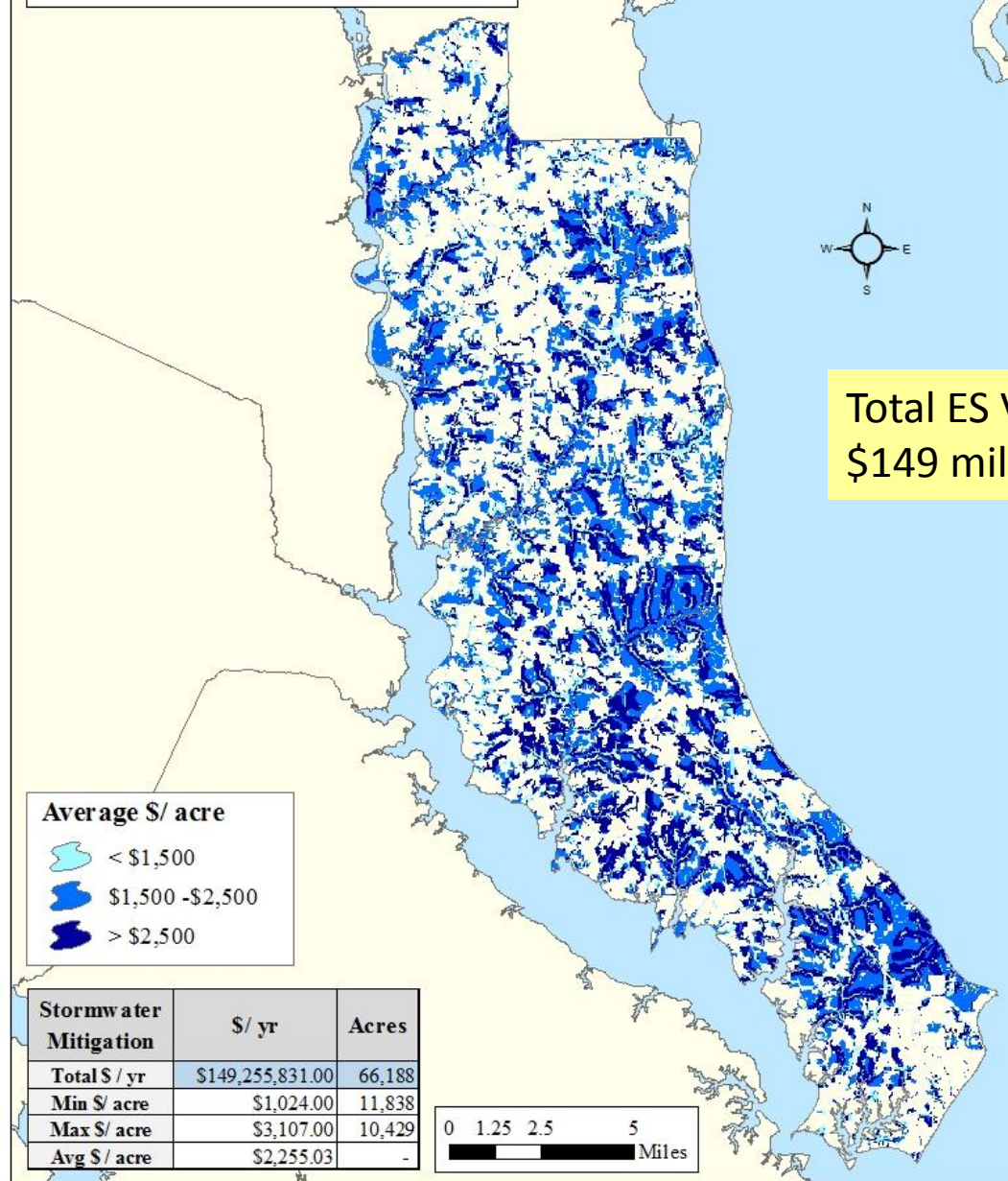


- *ES across the landscape:* Riparian areas and forests and wetlands in watersheds with high impervious area upstream are more important for reducing stormwater runoff
- *Eco-Prices:* the cost avoided of additional stormwater infrastructure, stormwater protection fee. Averages \$0.33 per m<sup>3</sup> of water



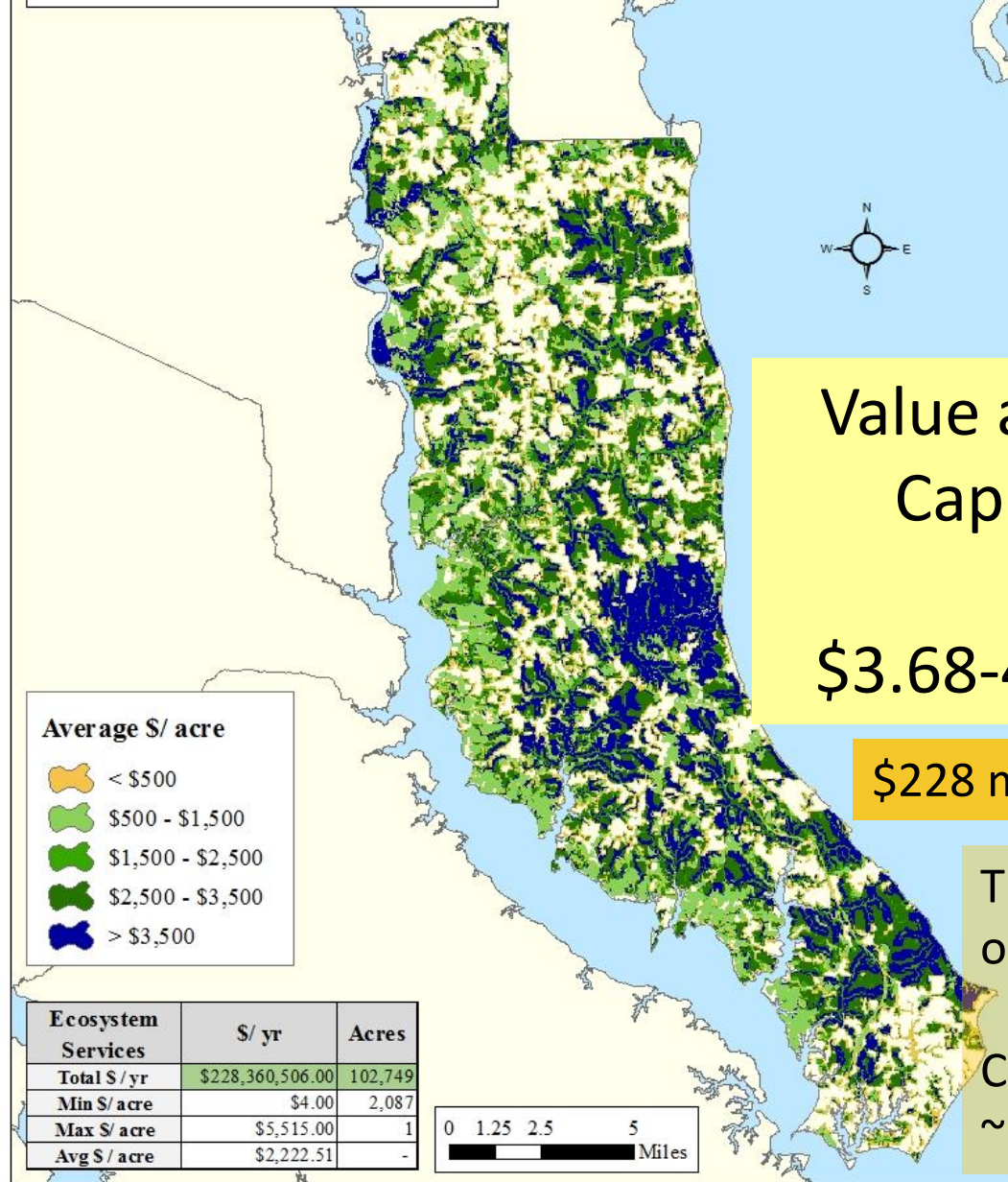
# Stormwater Mitigation

*Economic Value*



## Ecosystem Services

*Total Economic Value*



Value as a Natural  
Capital Asset  
=

\$3.68-4.89 billion!

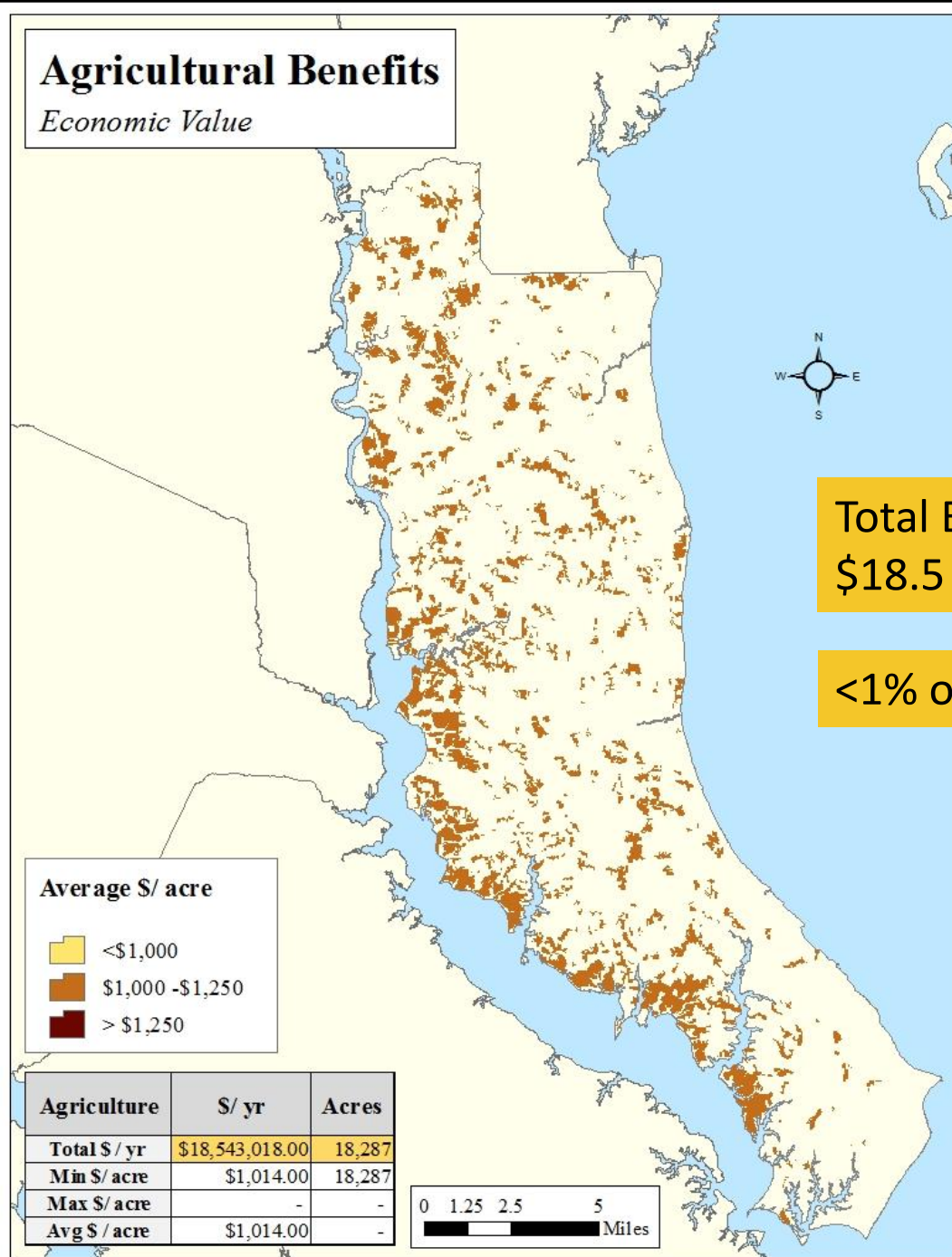
\$228 million Every Year!

This is ~2.6%  
of Maryland's total

Calvert Co. land area  
~2.2 % of MD

# Agricultural Benefits

*Economic Value*

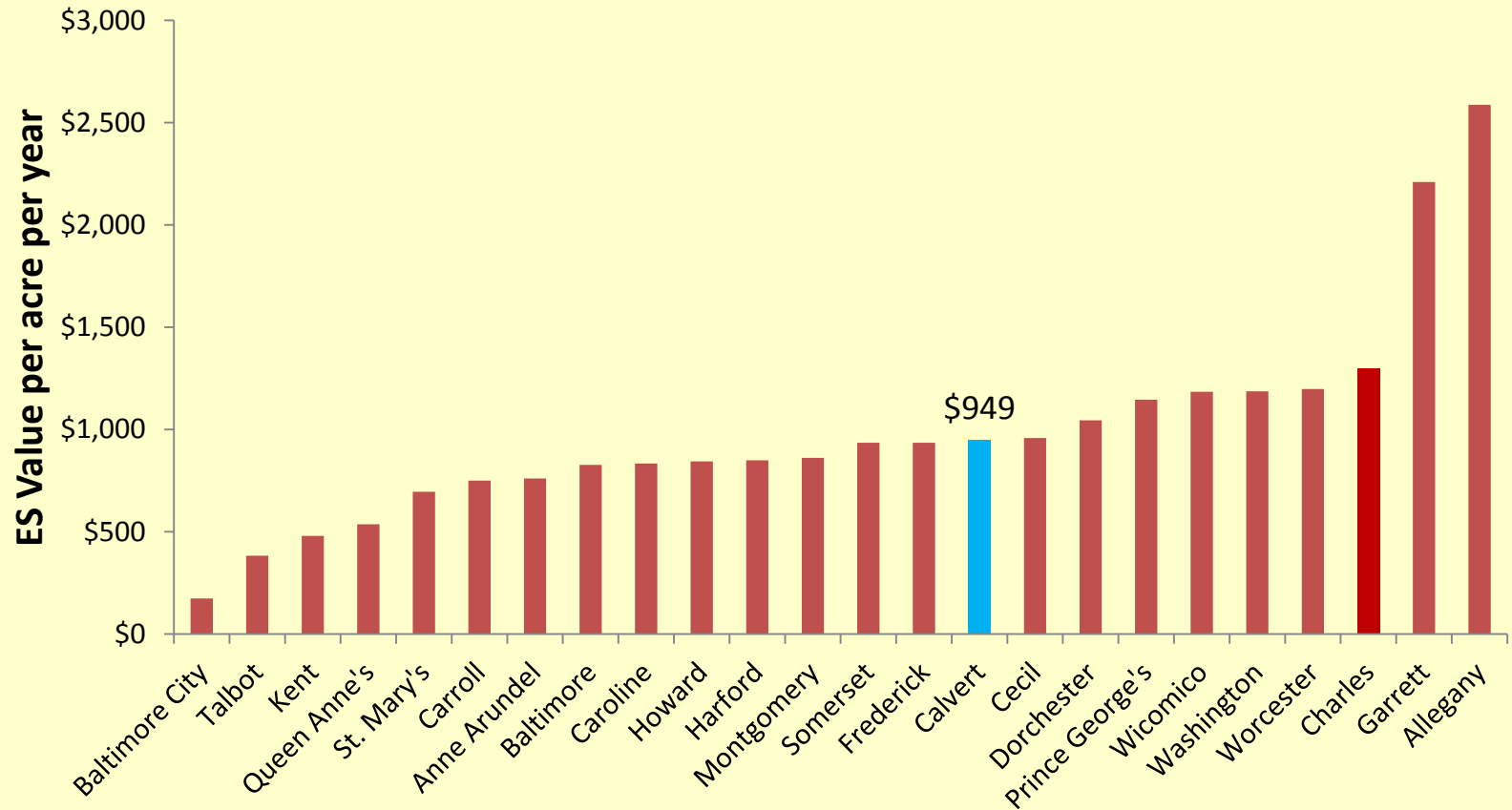


Total ES Value:  
\$18.5 Million per year

<1% of Maryland's total



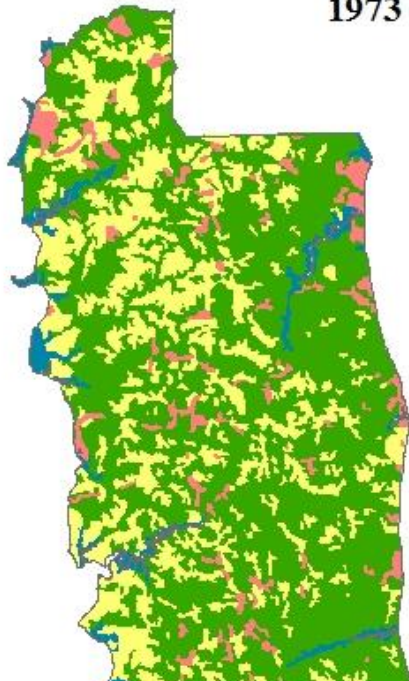
# County Breakdown



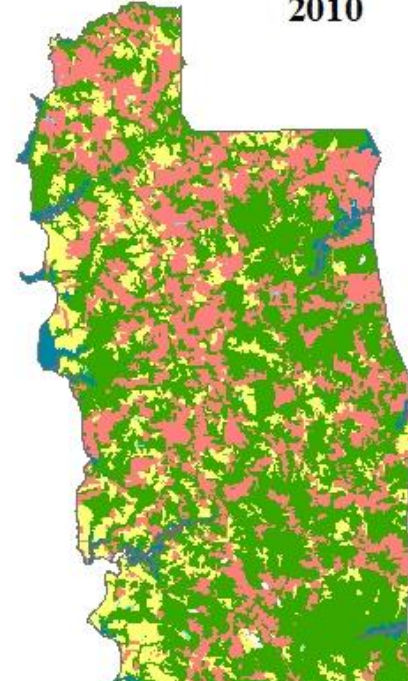
# Calvert County: Landuse Change



1973



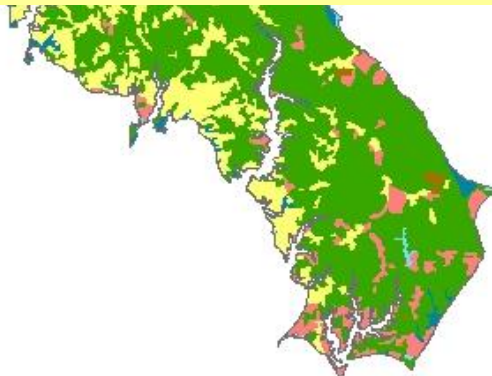
2010



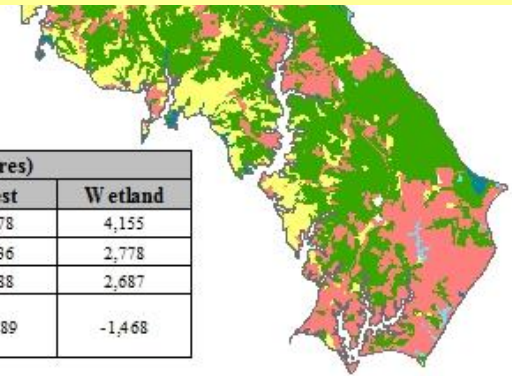
Approximately \$55 million of annual Ecosystem Service Value was lost from 1973 to 2010  
**\$888 million of Natural Capital**

## Landcover Type

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0 4 8 16 Miles

# Potential Applications

- Green vs. Grey infrastructure analysis
- Calculate Return on Investment
  - Restoration
  - Current or potential regulations
  - Conservation
  - Climate change mitigation
- Providing the basis for a no net loss of ecosystem services goal
  - Planning growth and development to minimize ecosystem service loss
  - Quantifying appropriate mitigation requirements or impact fees to adequately compensate for ES loss
- Integrate with ecosystem service markets





# Experience in Charles Co.



- Reinforces Existing/Proposed Zoning Decisions
  - Resource Protection Zone
  - Rural Conservation District
  - Proposed Watershed Conservation District
  - All have higher than average ES values
- They are considering using the values to justify reducing allowable uses in these zones
- Potentially could calculate ES value lost to potential development
- We could perform more detailed analysis for Calvert Co.
  - Evaluate proposed conservation areas critical area
  - Evaluate by watershed



# Next Steps

1

Refine Models

2

Create online tool

3

Collaborate with Partners

4

Analyze DNR programs/actions

5

Analyze Climate Change  
Scenarios



# Thank you! Questions?

Acknowledgements:

Christine Conn, Rachel Marks, MD DNR

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