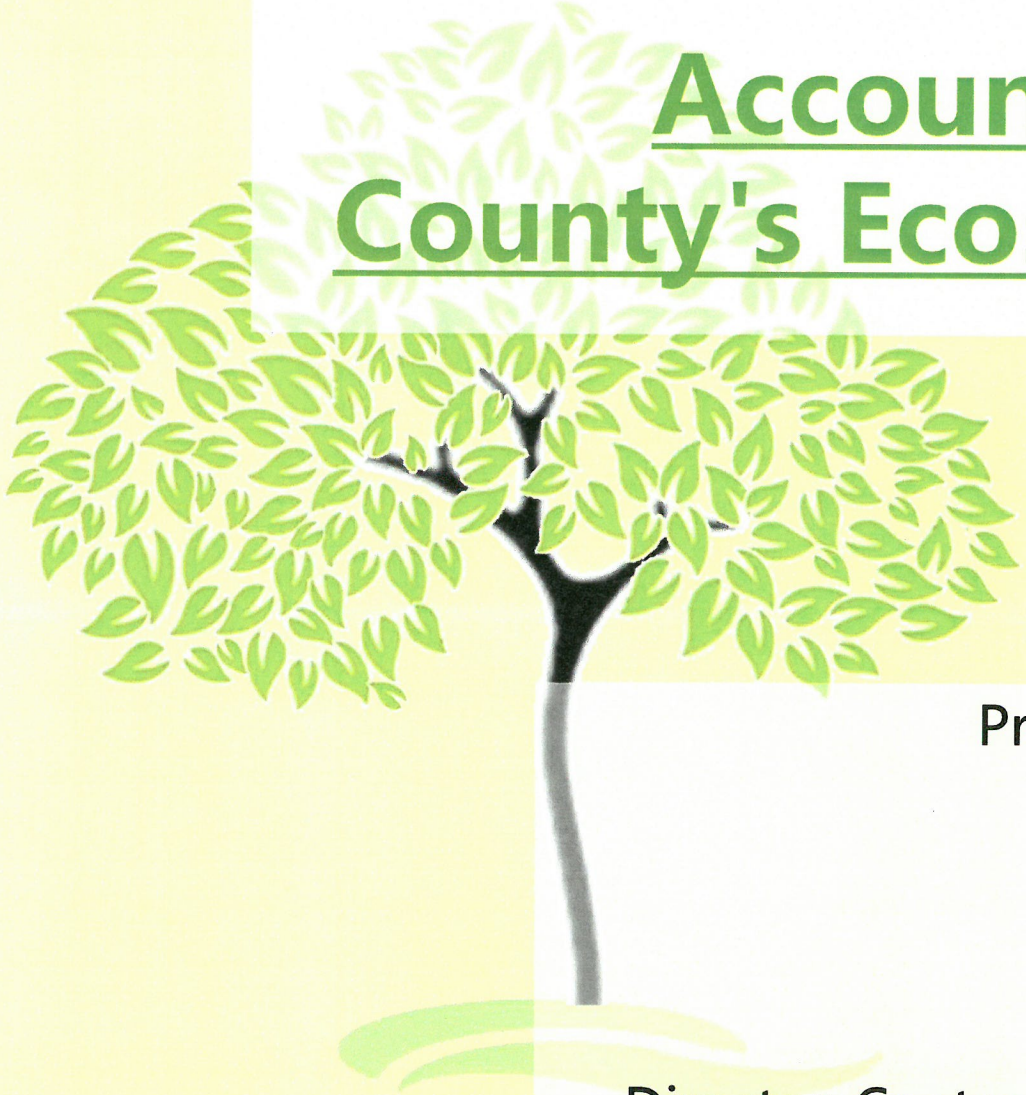
Dr. Elliott Campbell, Director of the Center for Economic and Social Science at Maryland Department of Natural Resources attended the January 30, 2017 meeting of the Environmental Commission and spoke with us about "Accounting for Calvert County's Ecosystem Services". Dr. Campbell talked about the numerous benefits people in the County gain from a healthy environment, and how our natural resources can be degraded or lost when the value of ecosystem services are not considered in land use decision-making. Lost ecosystem services diminish the quality of life for County residents, decrease long-term sustainability, and can be costly to replace. Some lost ecosystem services are irreplaceable at any cost. Dr. Campbell also talked about the methods he is using to assign a dollar value to individual ecosystem services such as groundwater recharge, nutrient uptake, and stormwater mitigation--to name just three. These valuation data can help Calvert County government agencies calculate the dollar value of ecosystem services that would be lost to potential development and thereby lead, hopefully, to smarter land use planning.

MARYLAND DEPARTMENT OF NATURAL RESOURCES

Accounting for Calvert County's Ecosystem Services



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

Elliott Campbell, PhD
Director, Center for Economic and Social Science
Maryland Department of Natural Resources

Outline

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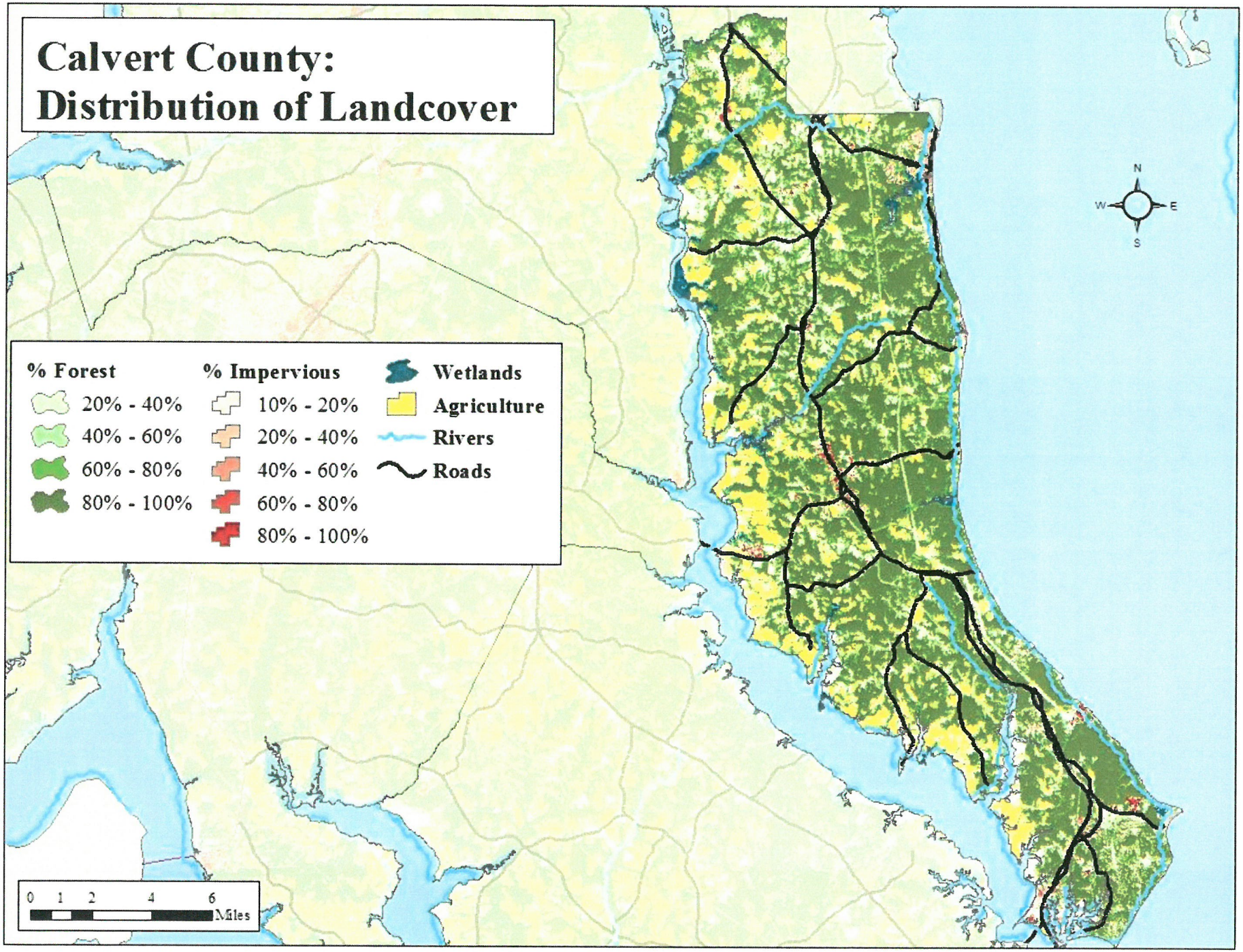
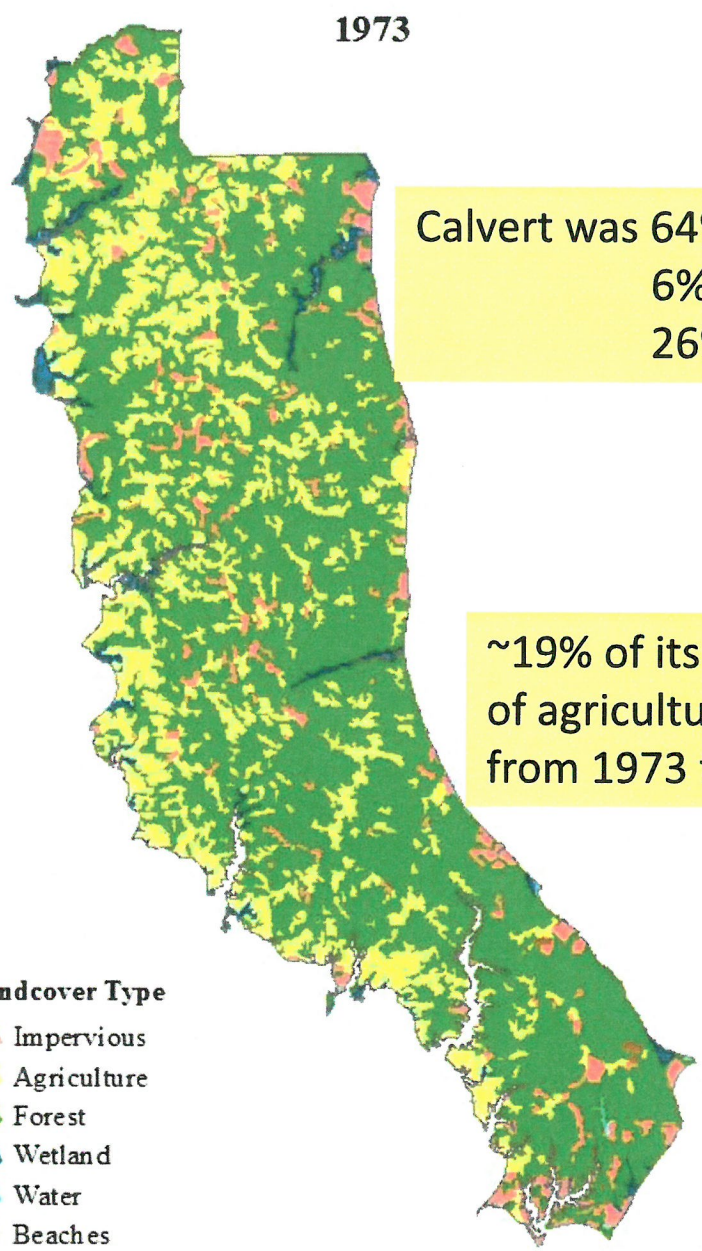
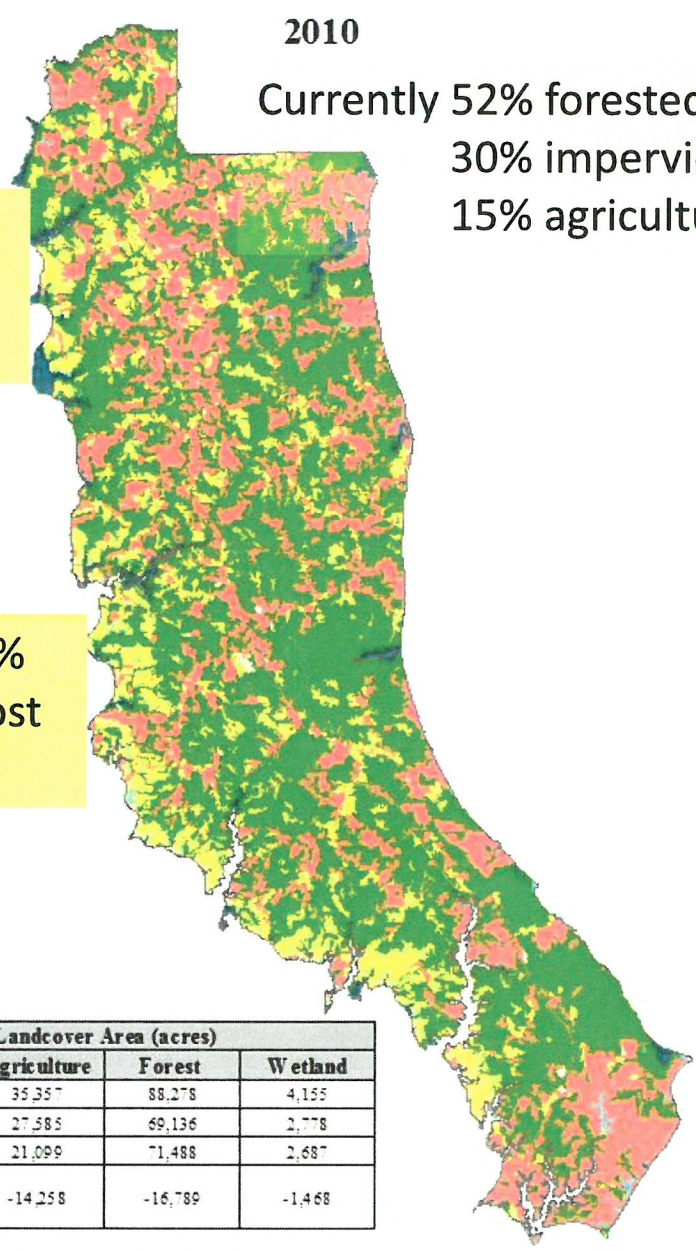
1. Environment and Quality of Life
2. Land-use in Calvert Co.
3. Ecosystem Services
4. Results
5. Potential Applications

Environment and Quality of Life


Calvert County:
Distribution of Landcover
% Forest
20% - 40%
40% - 60%
60% - 80%
80% - 100%
% Impervious
10% - 20%
20% - 40%
40% - 60%
60% - 80%
80% - 100%
Wetlands
Agriculture
Rivers
Roads
N
W
E
S
0 1 2 4 6
Miles

Calvert County: Landuse Change





Currently 52% forested
30% impervious
15% agriculture

Calvert was 64% forest
6% impervious
26% agriculture

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

Landcover Type

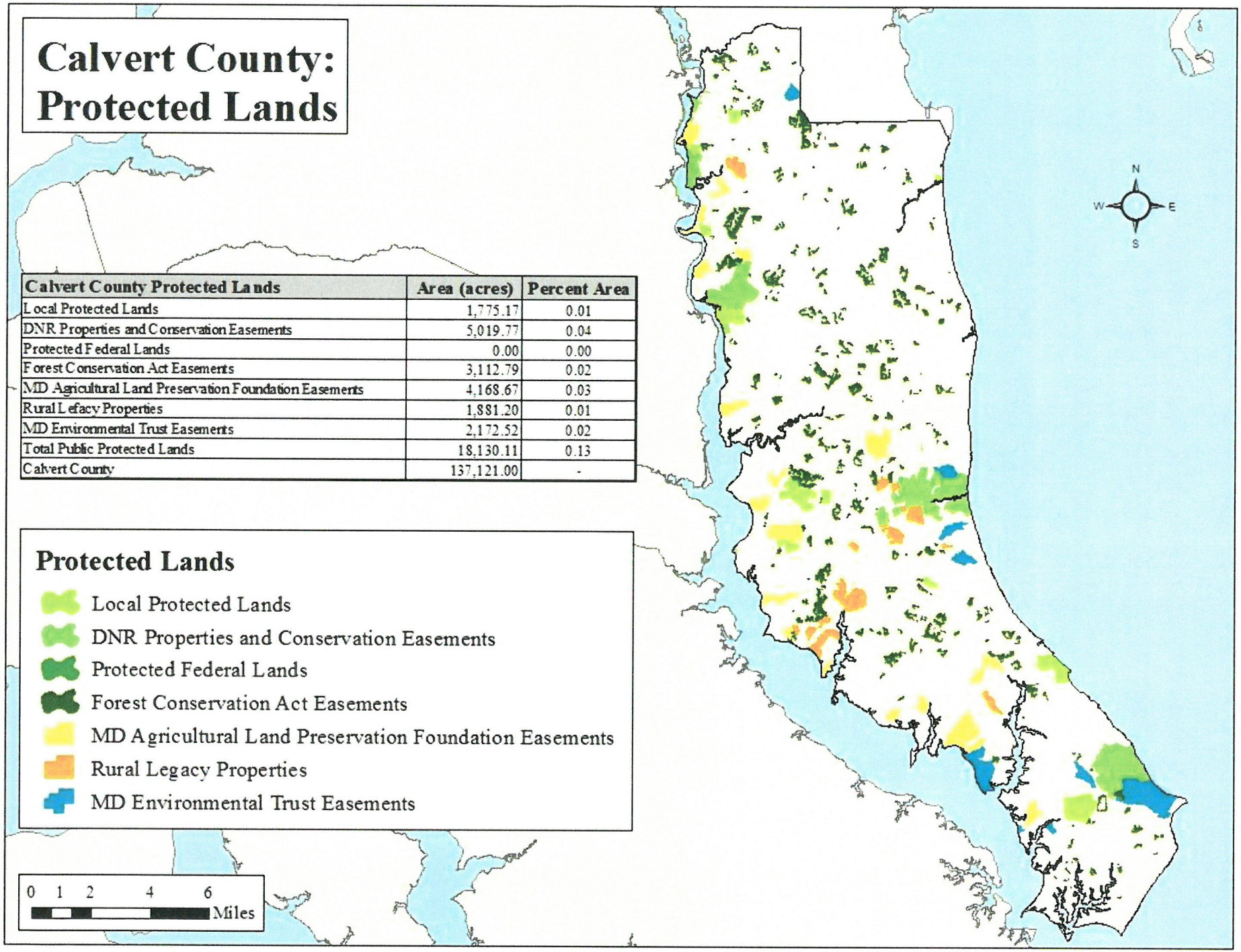
- Impervious
- Agriculture
- Forest
- Wetland
- Water
- Beaches
- Bare Rock

	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

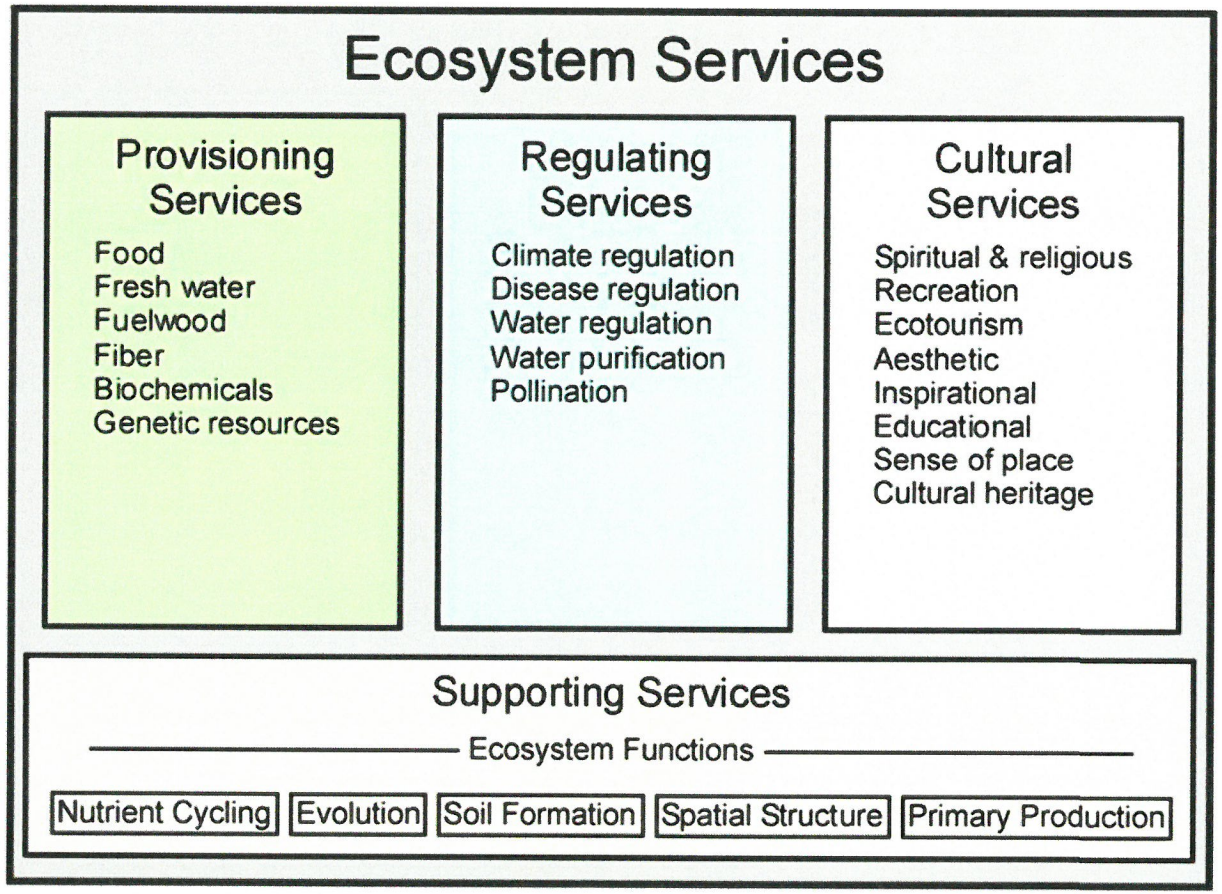
Calvert County: Protected Lands

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 Lefacy 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	-



Ecosystem Services

"Benefits gained by people from the environment"

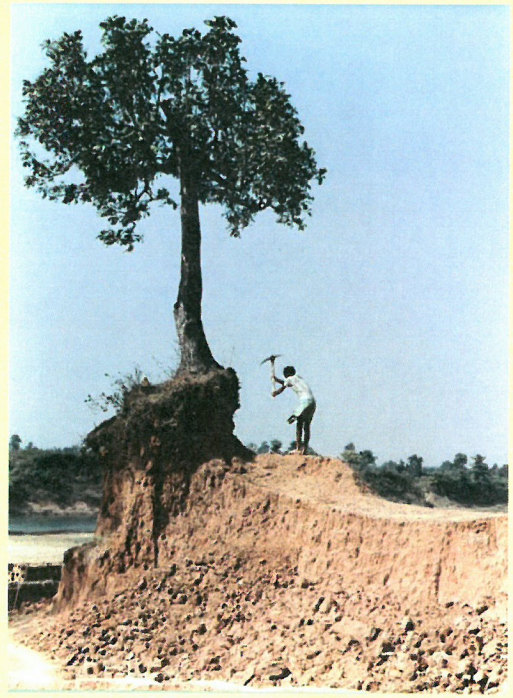


Modified, with additions, from the Millennium Assessment

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

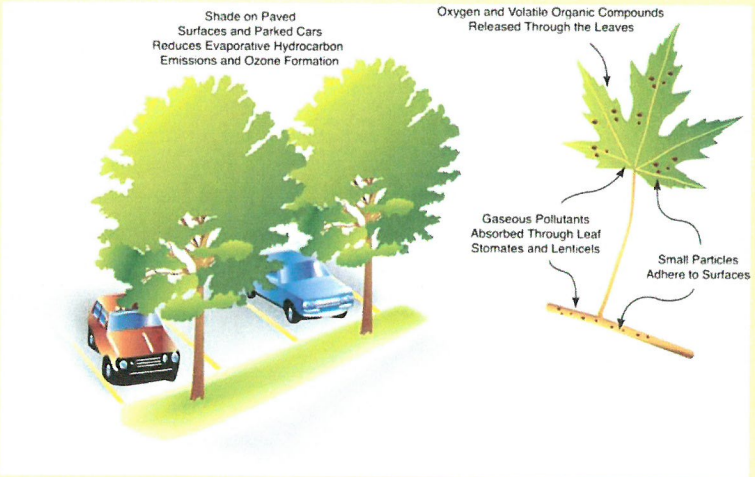
- Ecosystem services are paid for in many different ways
- People view responsibility for providing ecosystem services to be a collective obligation
- We look at the many different ways society invests in protecting or replacing the environment
  - In a market
  - Cost of restoration
  - Through mitigation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

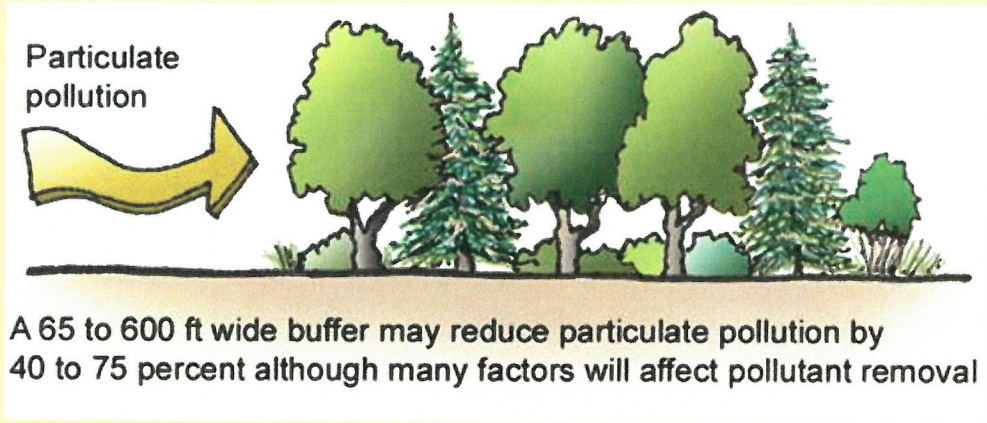
Assesses the Social Value

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

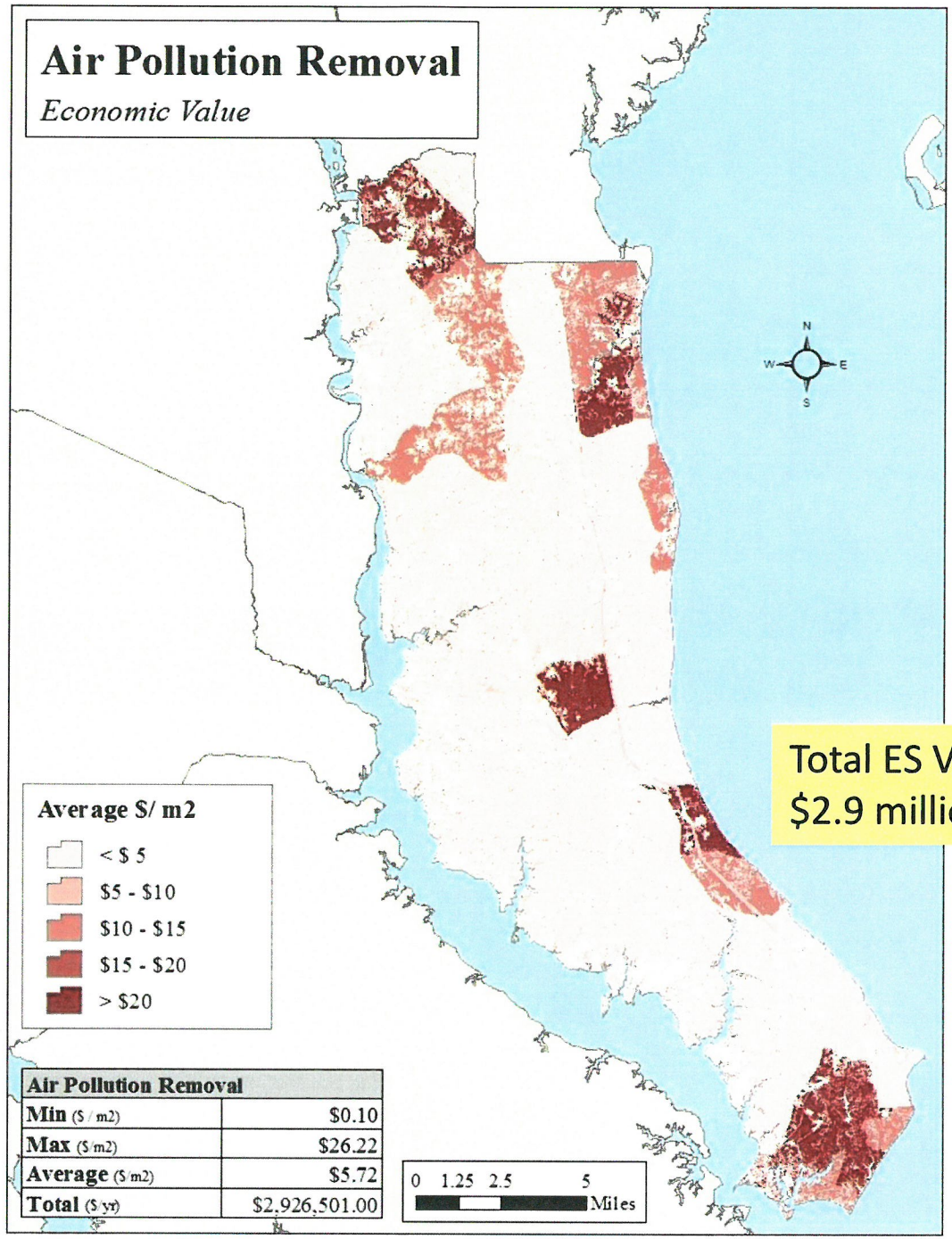
Air Pollutant Removal





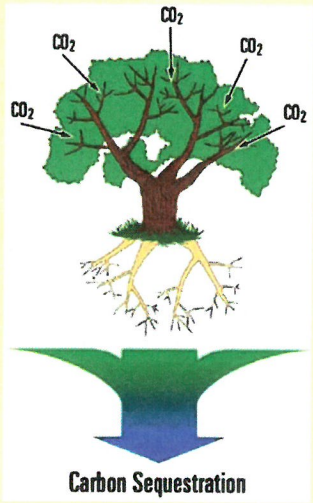
- *ES across the landscape:* Trees remove more air pollutants with a greater impact on human health in urban areas

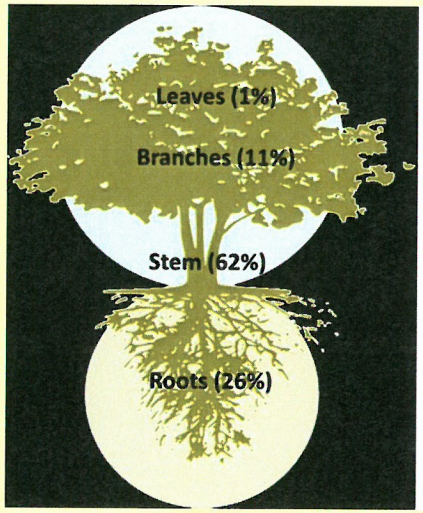
- We use the economic impact that tree air pollution removal has on health costs (see Nowak et al. 2014)



Total ES Value:
$2.9 million per year

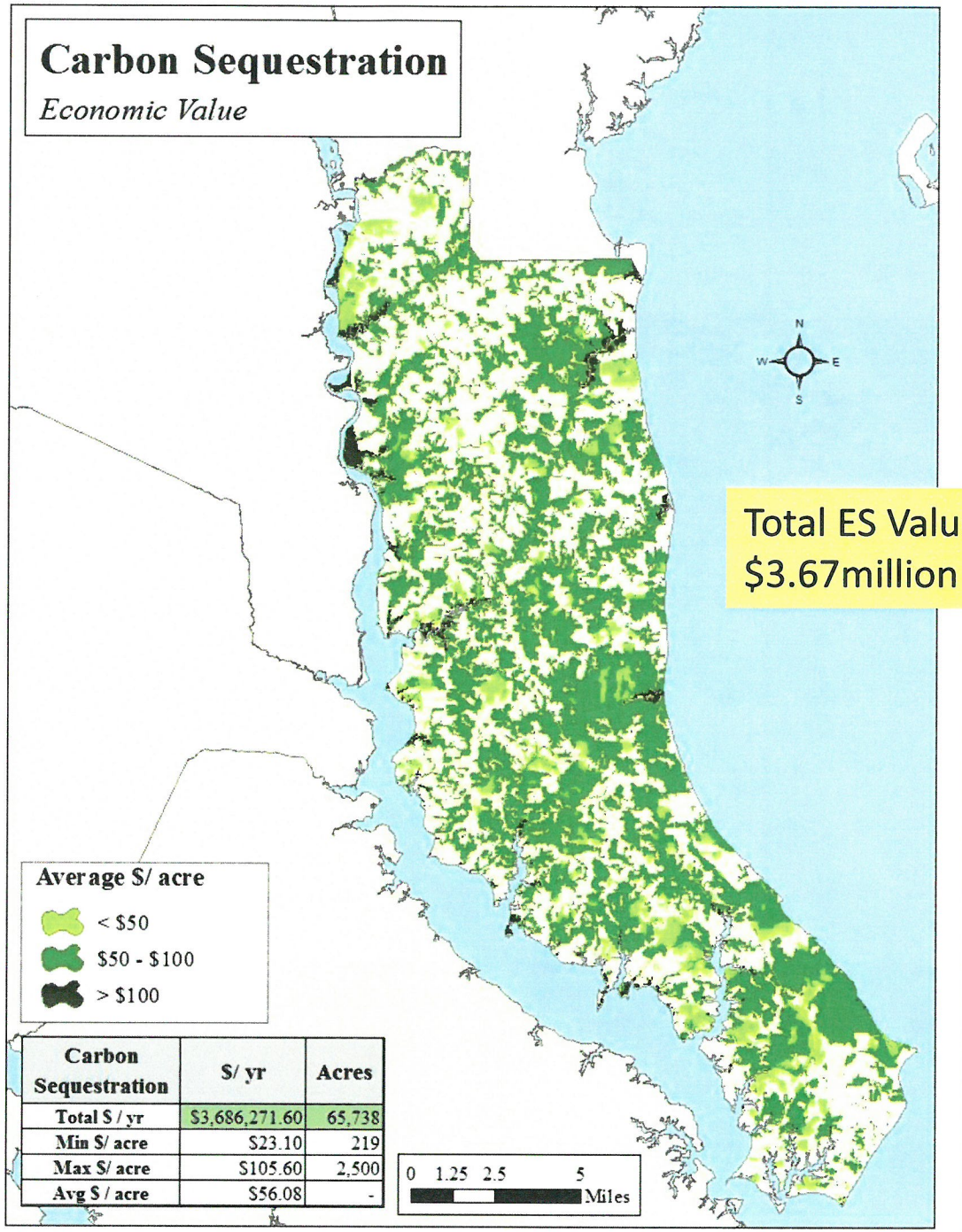
Carbon Sequestration





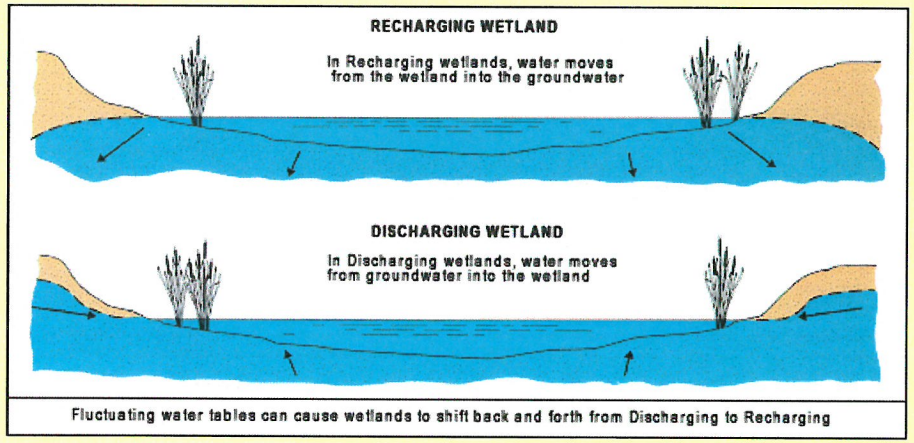
- *ES across the landscape:* Certain ecosystems (coastal wetlands, deciduous forests) sequester large amounts of carbon than others (shrublands, coniferous forests)

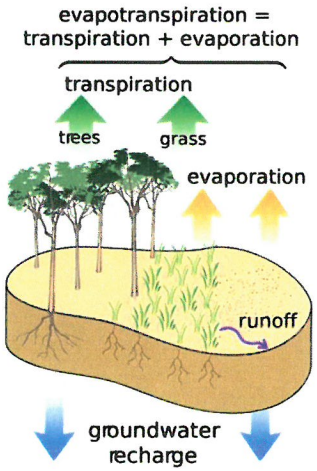
- *Eco-Prices:* the Social Cost of Carbon (estimate of the costs of climate change), Regional Greenhouse Gas Initiative (RGGI) market price, cost to comply with Clean Power Plan. Averages $77 per mt of carbon



Total ES Value:
$3.67million per year

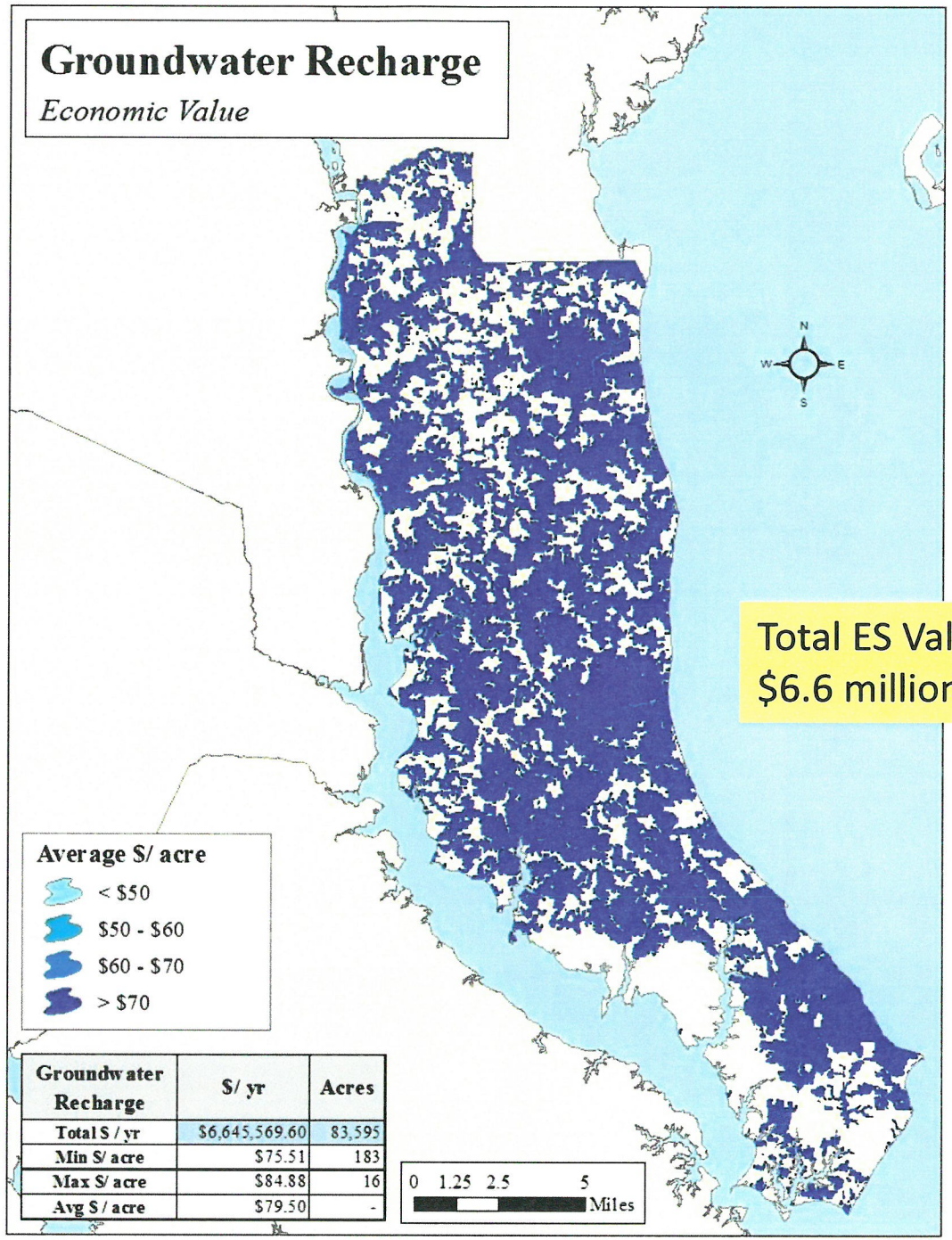
Groundwater Recharge





- *ES across the landscape:* Geology is the primary driver of the rate that water enters unconfined and confined aquifers

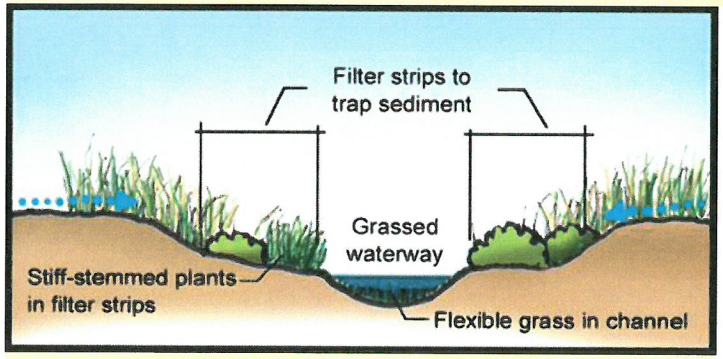
- *Eco-prices:* Average municipal price of water, value of water for recreation, investment in watershed protection. Averages $0.35 per m^3 water

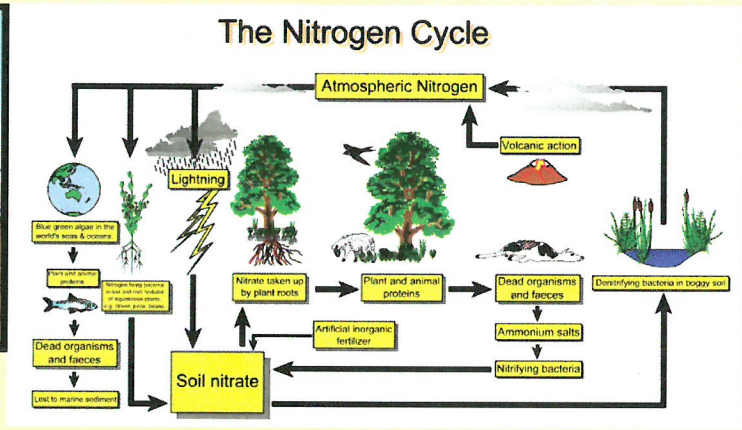


Groundwater Recharge	$/ yr	Acres
Total $ / yr	$6,645,569.60	83,595
Min $/ acre	$75.51	183
Max $/ acre	$84.88	16
Avg $ / acre	$79.50	-

Total ES Value:
$6.6 million per year

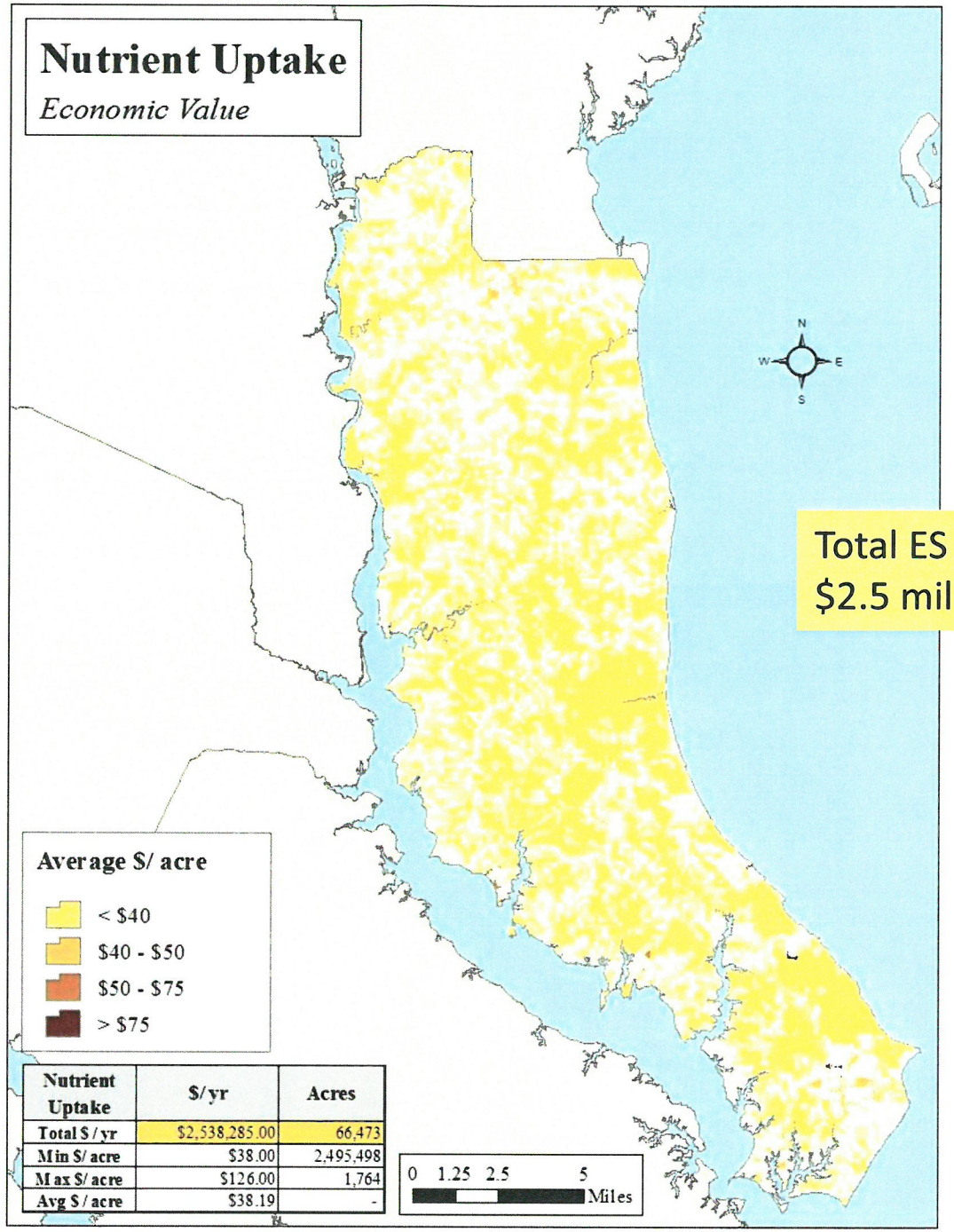
Nutrient Uptake





- *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	$/yr	Acres
Total $ / yr	$2,538,285.00	66,473
Min $/ acre	$38.00	2,495,498
Max $/ acre	$126.00	1,764
Avg $ / acre	$38.19	-

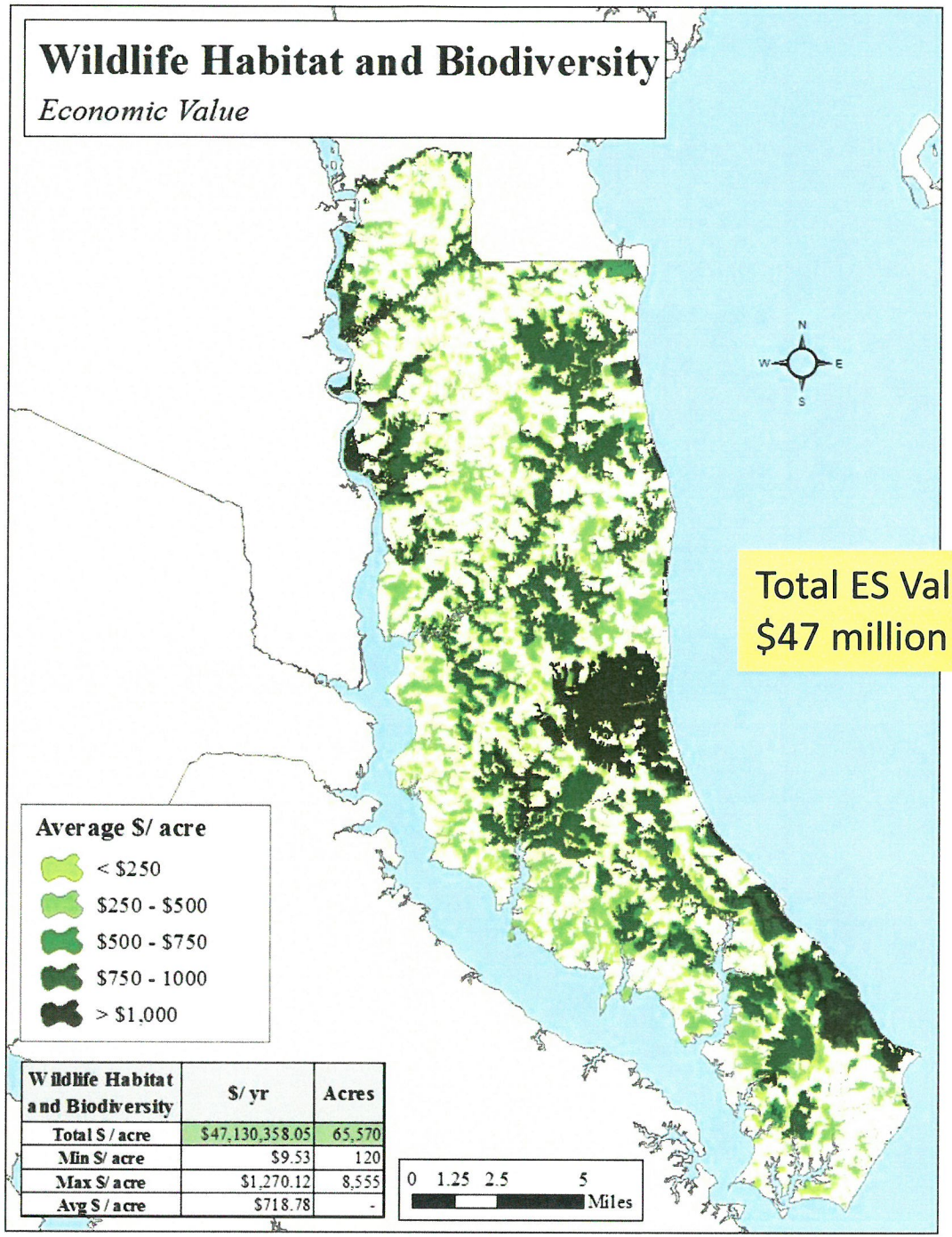
Total ES Value
$2.5 million per year

Biodiversity/Wildlife Habitat



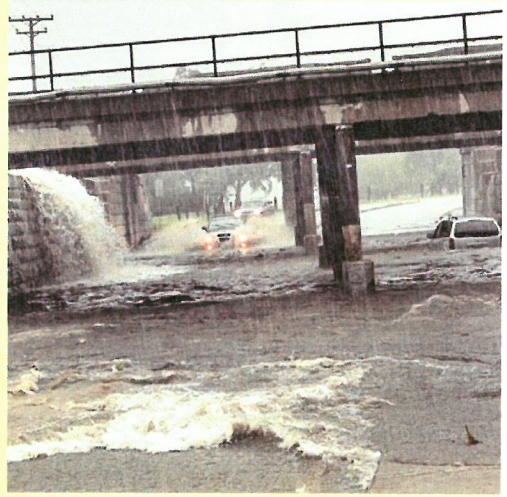
- *ES across the landscape:* We looked at the size of habitat, degree of connection to other habitats, and presence of rare species or habitats

- *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.

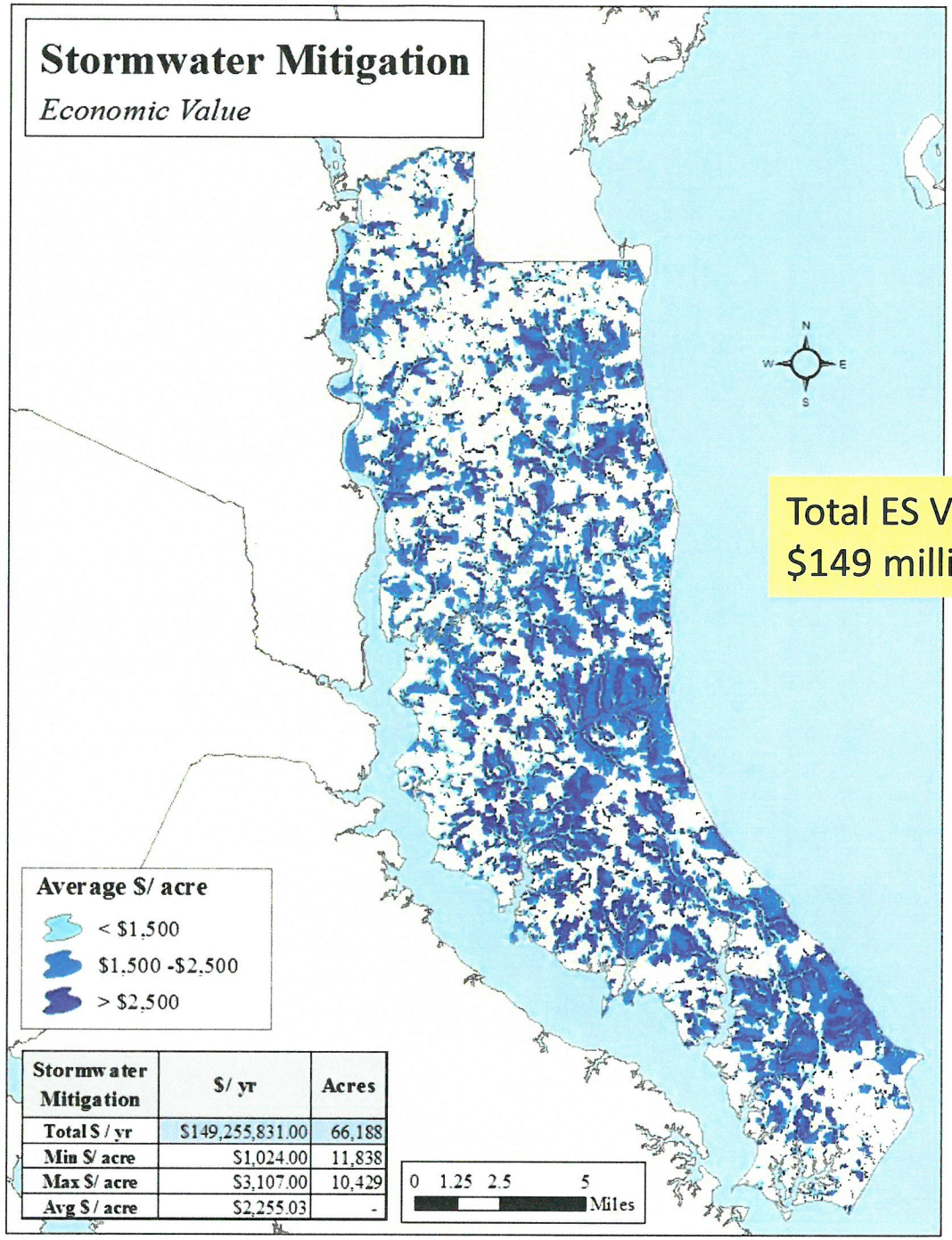


Total ES Value:
$47 million per year

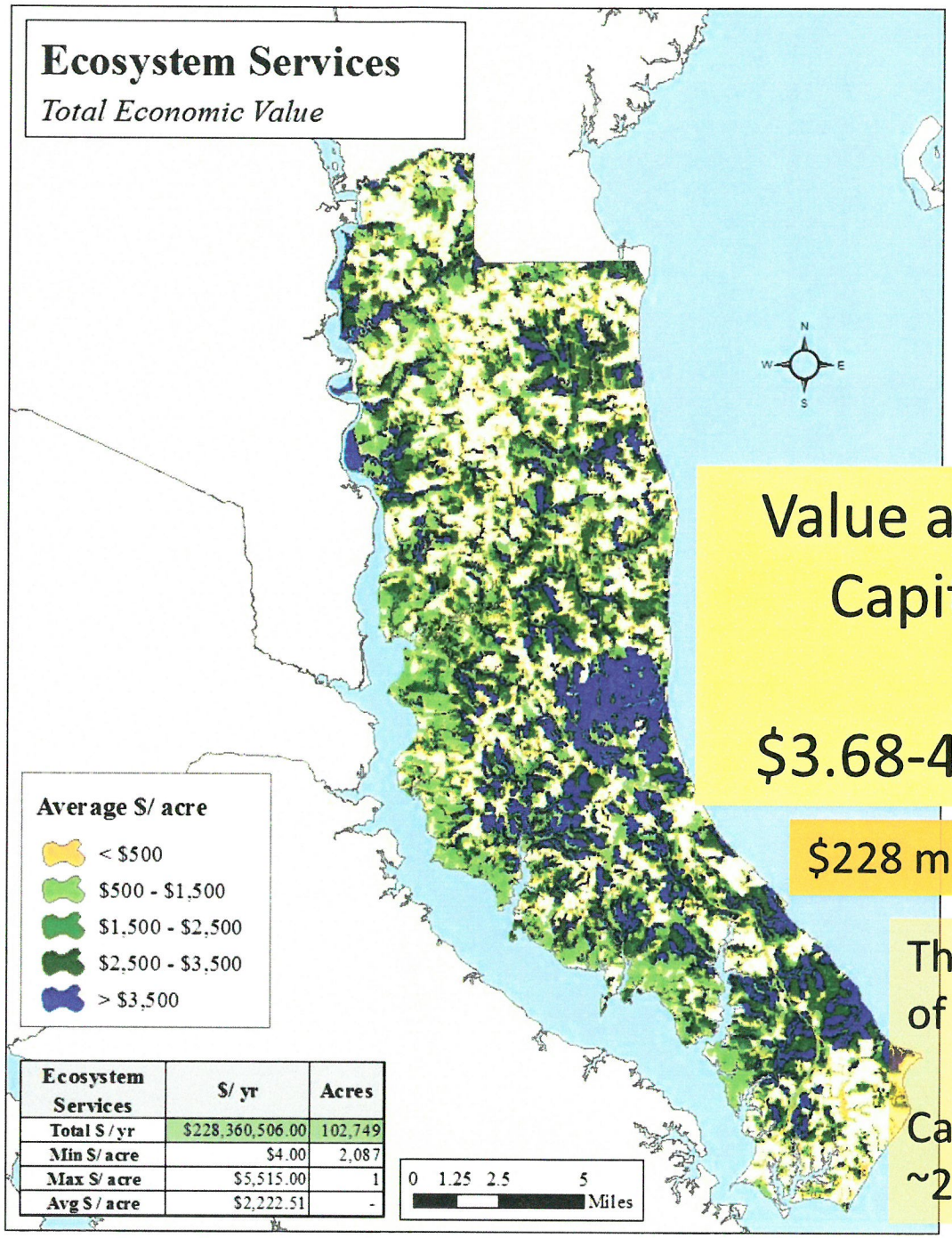
Stormwater Abatement Ecosystem Service



- *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^3 of water



Total ES Value:
$149 million per year



Value as a Natural Capital Asset

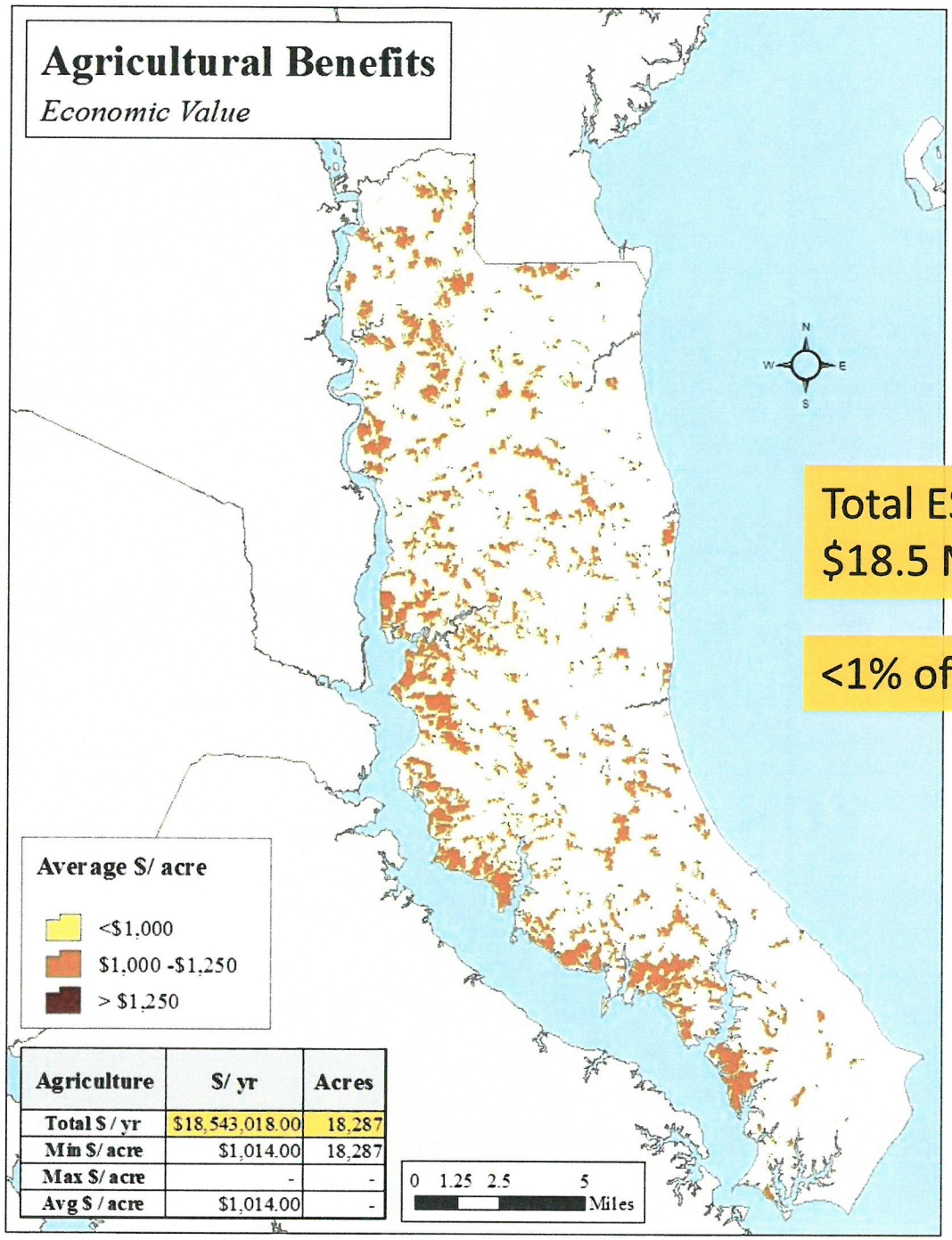
=

$3.68-4.89 billion!

$228 million Every Year!

This is ~2.6% of Maryland's total

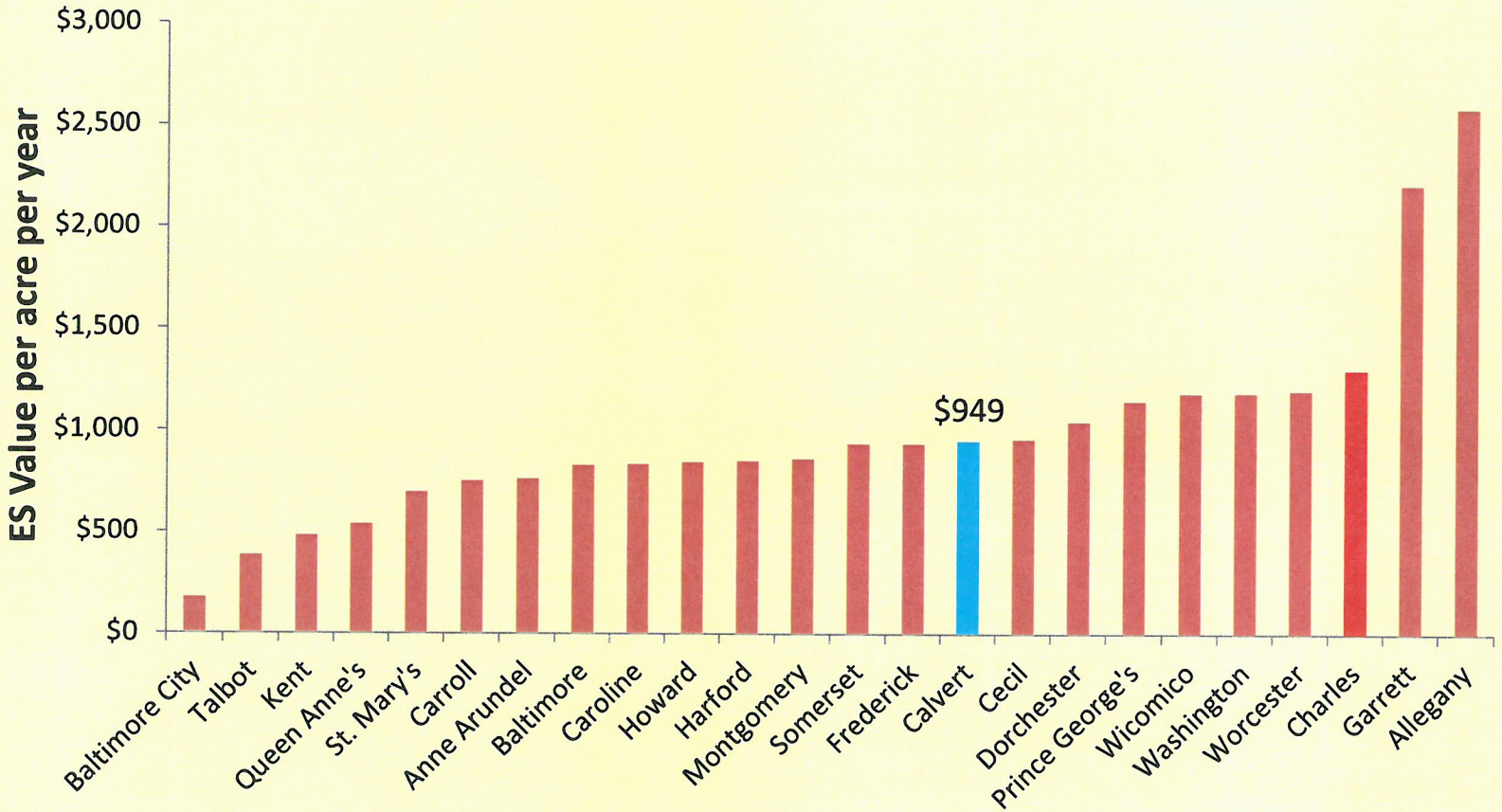
Calvert Co. land area ~2.2 % of MD



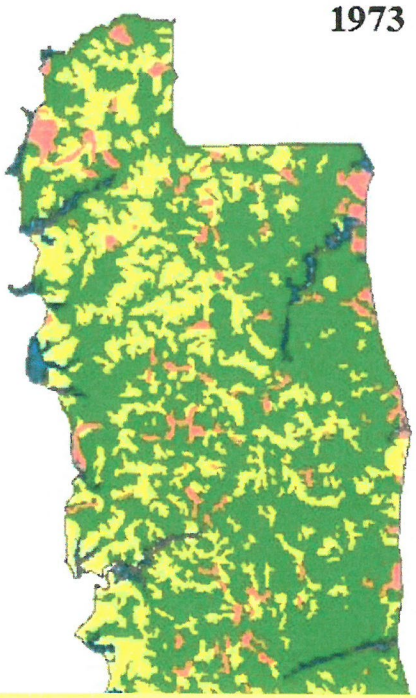
Total ES Value:
$18.5 Million per year

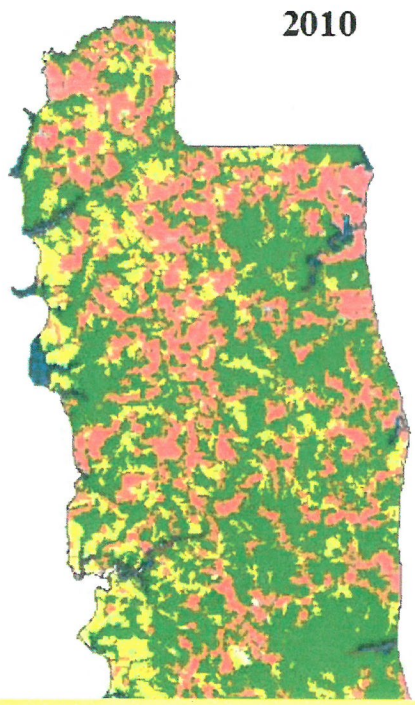
<1% of Maryland's total

County Breakdown



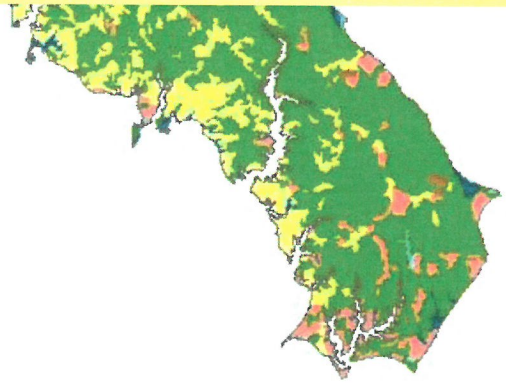
Calvert County: Landuse Change

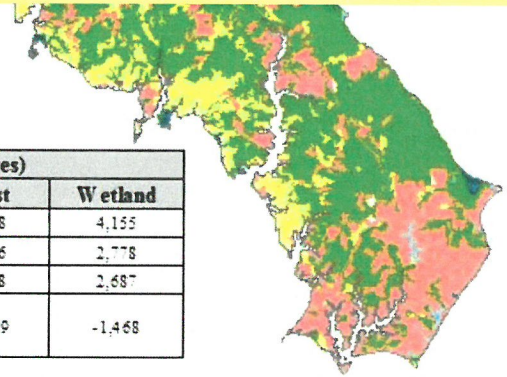




Approximately $55 million of annual Ecosystem Service Value was lost from 1973 to 2010

$888 million of Natural Capital





Landcover Type

- Impervious
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Change 1973 - 2010	31,759	-14,258	-16,789	-1,468

0 4 8 16 Miles

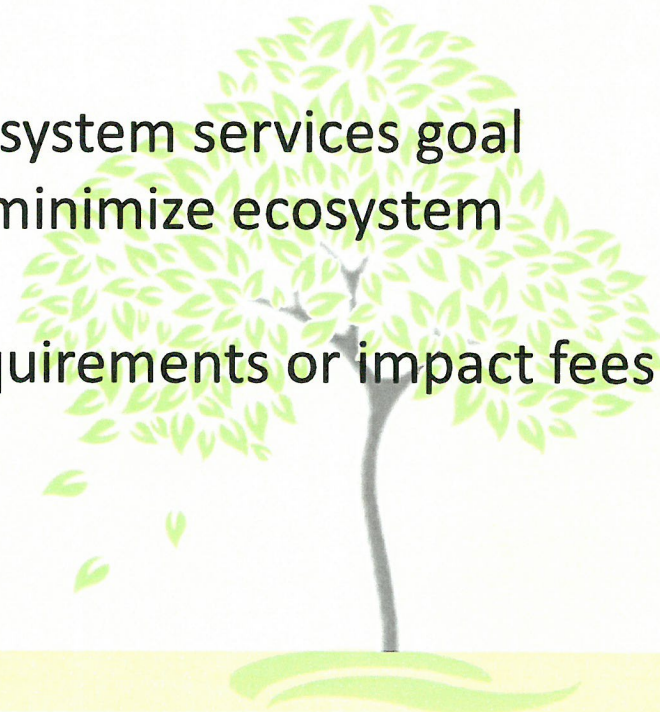
Potential Applications

- 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

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1. Refine Models
2. Create online tool
3. Collaborate with Partners
4. Analyze DNR programs/actions
5. Analyze Climate Change Scenarios

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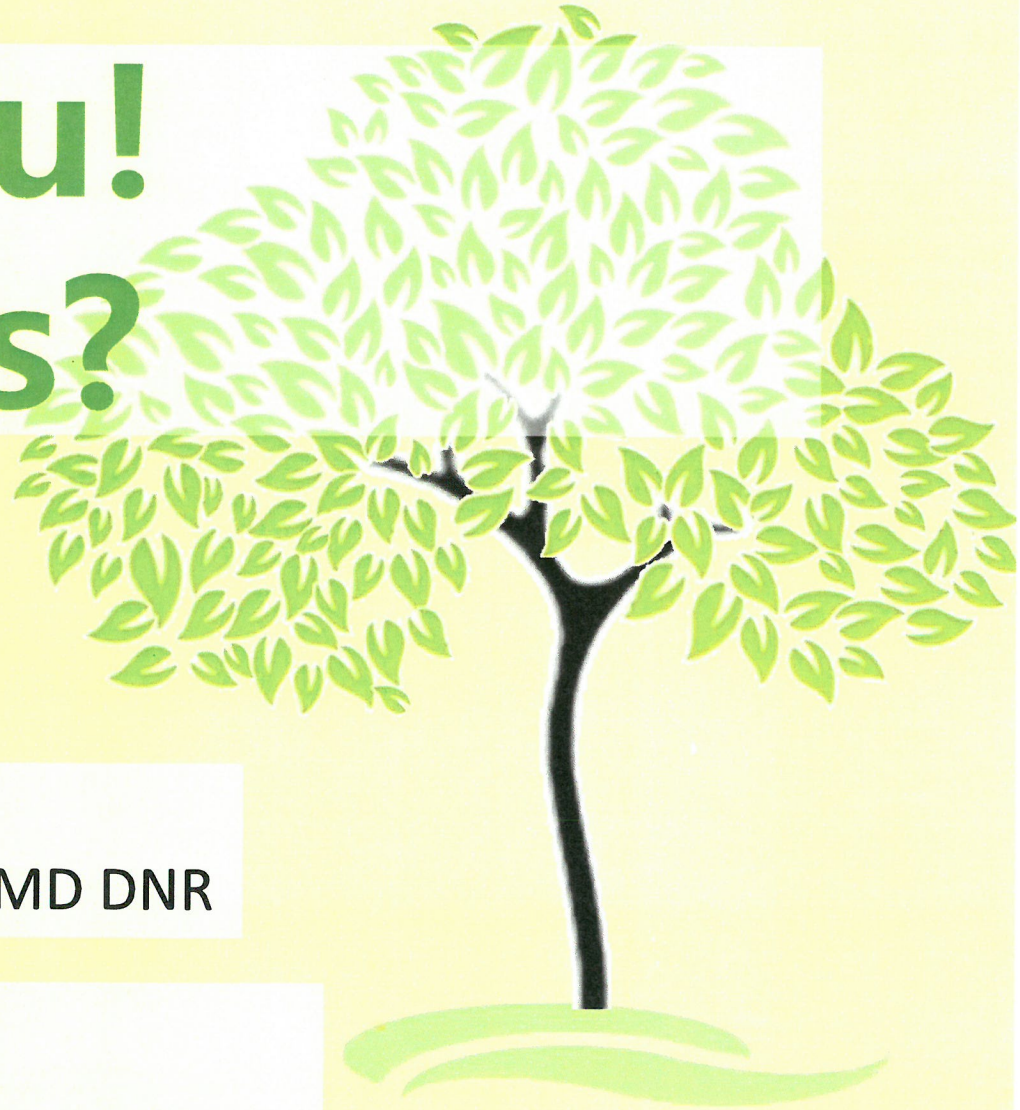
NATURAL RESOURCES

Thank you!
Questions?



Acknowledgements:
Christine Conn, Rachel Marks, MD DNR

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