Impacts of Growth on Ecosystem Services

The Unsustainable Spiral of Growth Forum

Chesapeake Environmental Protection Association

Anne Arundel Community College

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Maryland Department of Natural Resources

Outline

1. Growth
2. Land-use in MD
3. Ecosystem Services
4. Results for Anne Arundel Co.
5. Solutions

Growth in…?

Population

Maryland Grew 9% from 2000 to 2010 (21st)

Development

In 1973 10.5% of MD was developed,
27% in 2015, rate of growth 153% of population growth

Economy

Maryland GSP Grew 32% from 2000 to 2013

Quality of Life

The Maryland Genuine Progress Indicator
Grew 23% from 2000 to 2013. Go to
www.dnr.maryland.gov/mdgpi/

Growth in…?

Growth in Population and Development

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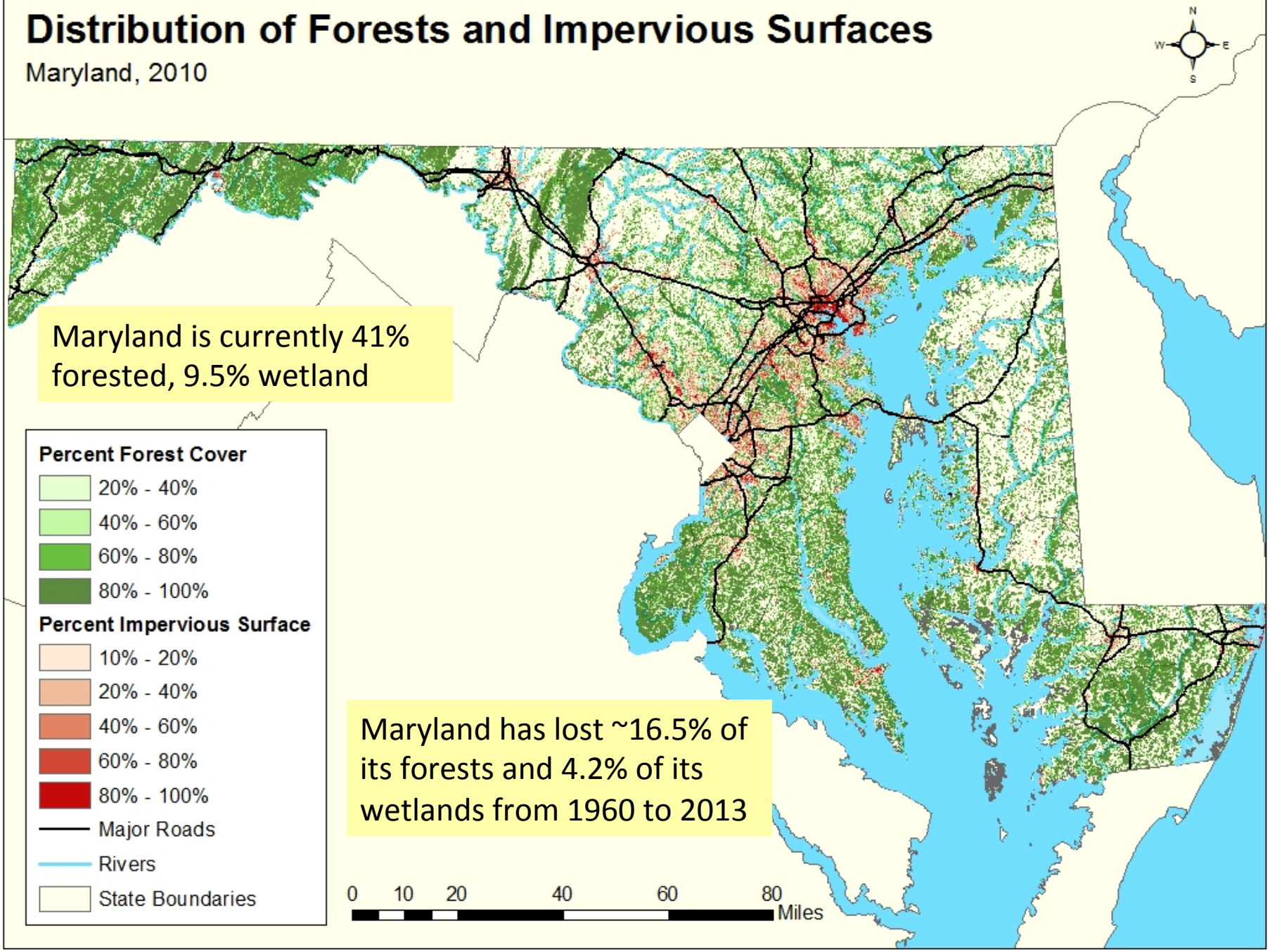
Growth in Economy and Quality of Life

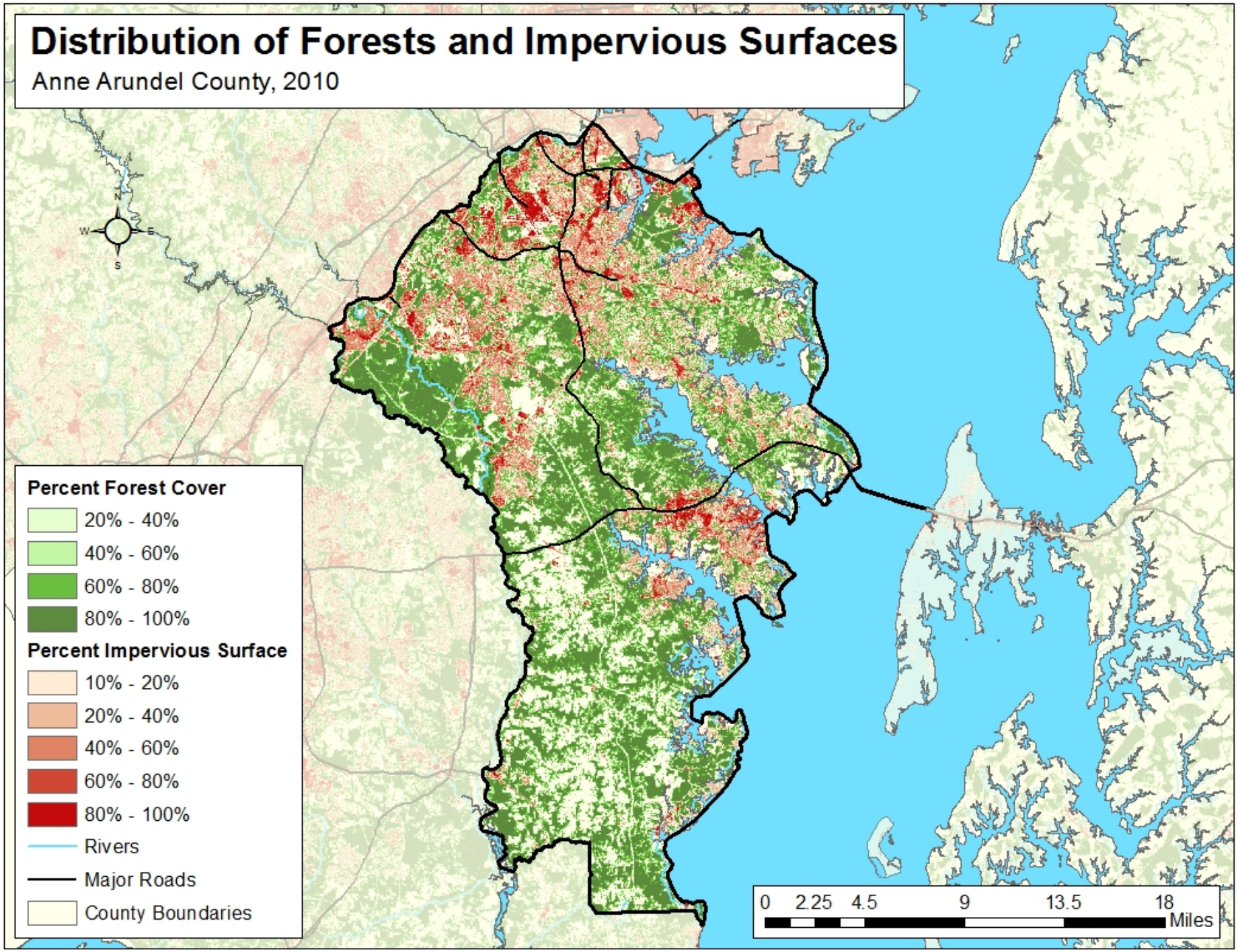
Fodor 2010 examined the 100 largest US municipal areas

- Found no positive relationship between population growth rate and per capita income, unemployment rate, or poverty rate
- Found faster growth rates are associated with lower incomes, greater income declines, and higher poverty rates

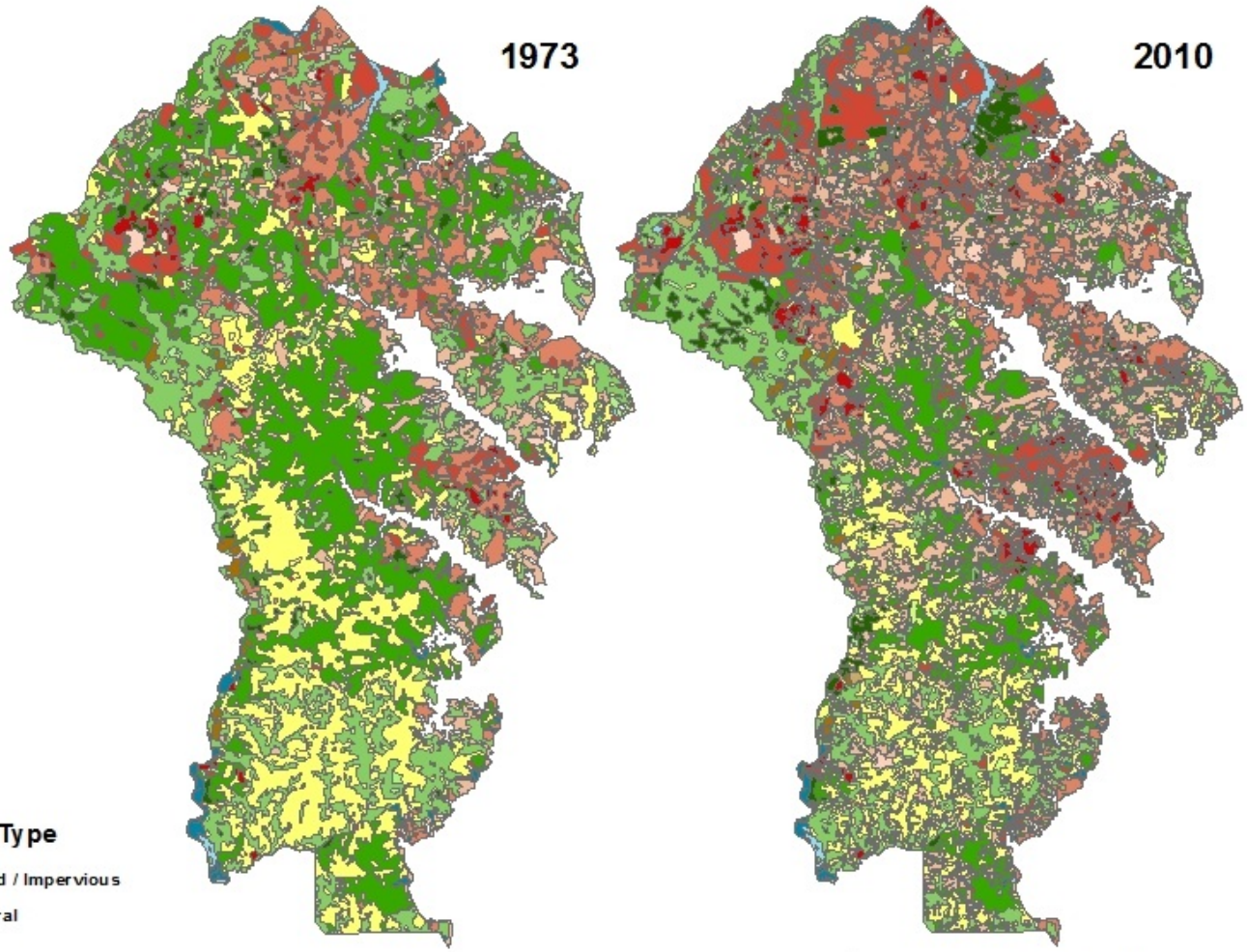
Distribution of Forests and Impervious Surfaces

Maryland, 2010




Distribution of Forests and Impervious Surfaces
Anne Arundel County, 2010
N
W
E
S
Percent Forest Cover
20% - 40%
40% - 60%
60% - 80%
80% - 100%
Percent Impervious Surface
10% - 20%
20% - 40%
40% - 60%
60% - 80%
80% - 100%
Rivers
Major Roads
County Boundaries
0 2.25 4.5 9 13.5 18
Miles

Anne Arundel County
Landcover Change: 1973 - 2010



Landcover Type

- Developed / Impervious
- Agricultural
- Forest
- Water
- Wetlands
- Beaches
- Bare Ground
- Extractive

	Area (acres)		
Landcover Type	1973	2010	Change, 1973 - 2010
Impervious Surface	66,539	121,412	54,873
Forests	135,307	104,431	-30,877
Wetlands	2,182	1,685	-497
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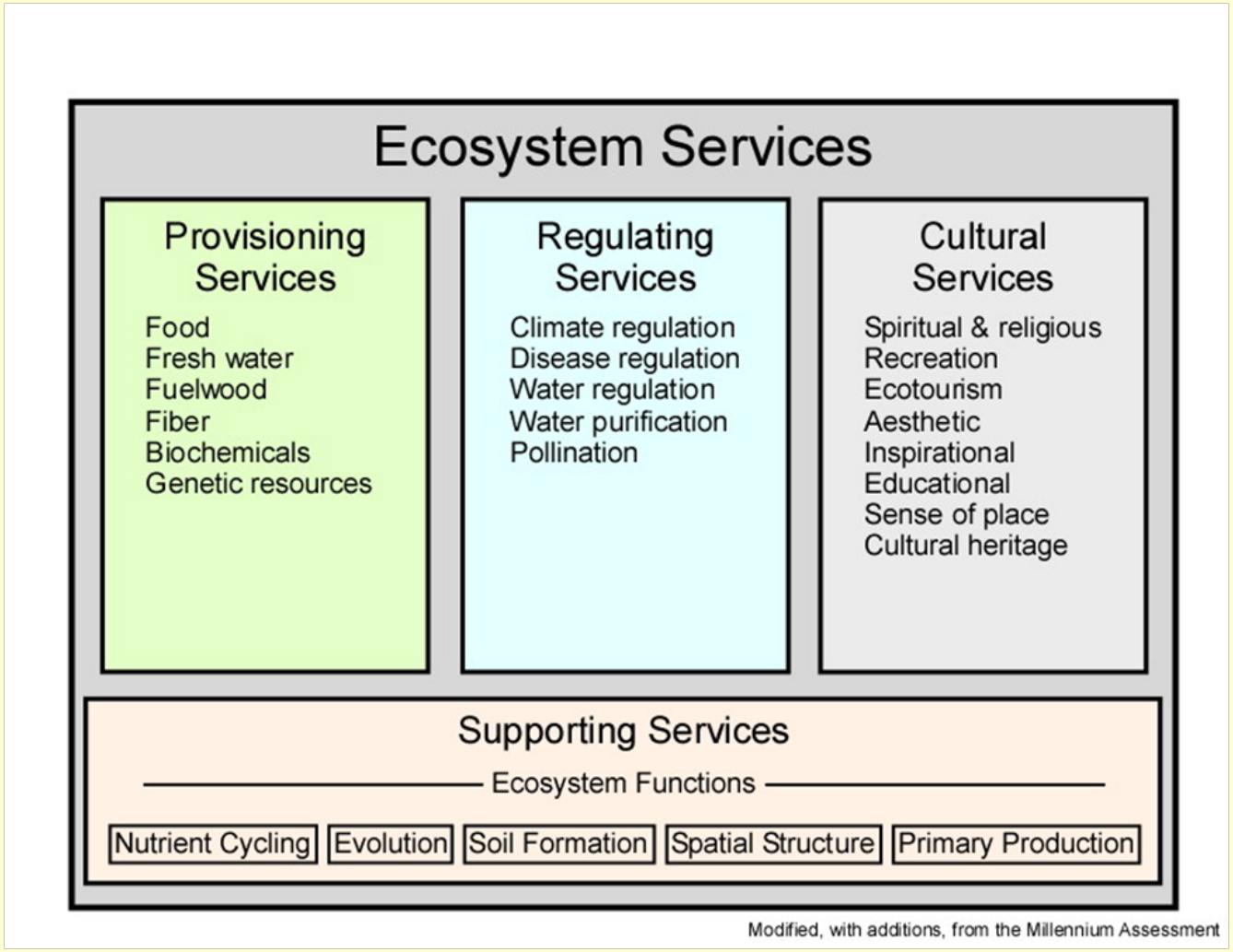
Ecosystem Services

"Benefits gained by people from the environment"



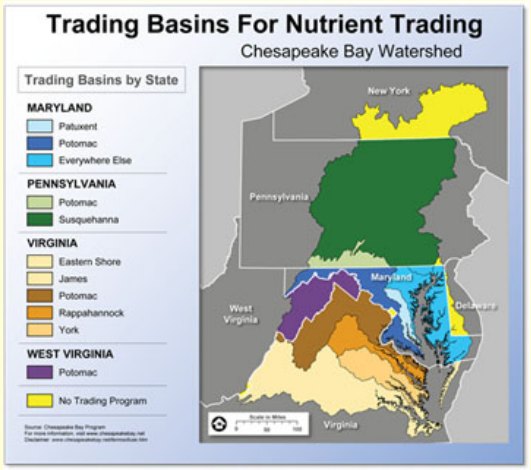
As classified by the Millennium Ecosystem Assessment (MEA 2005)

Ecosystem Services in Maryland

- 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
- Ecosystem services currently considered spatially include
  - Air Quality improvement
  - Carbon sequestration
  - Groundwater recharge
  - Nutrient Uptake
  - Wildlife habitat and biodiversity
  - Stormwater mitigation
- Not presented here- services from agriculture, services specific to coastal wetlands and the Chesapeake Bay

Example Eco-Price: Nutrients

- Price Signals
  - Bay Restoration Fund
    - It costs, on average $13.33 per lbs of nitrogen load reduction
  - Nutrient Trading in the Chesapeake Bay Watershed
    - $3.80 per lbs N on the PA market
  - Maryland BMP Cost Share
    - $1.80 per pound of nitrogen reduction
  - Average cost for BMP implementation/ maintenance
    - 14.50 per pound N Reduction
- Average: $8.36 per pound of N

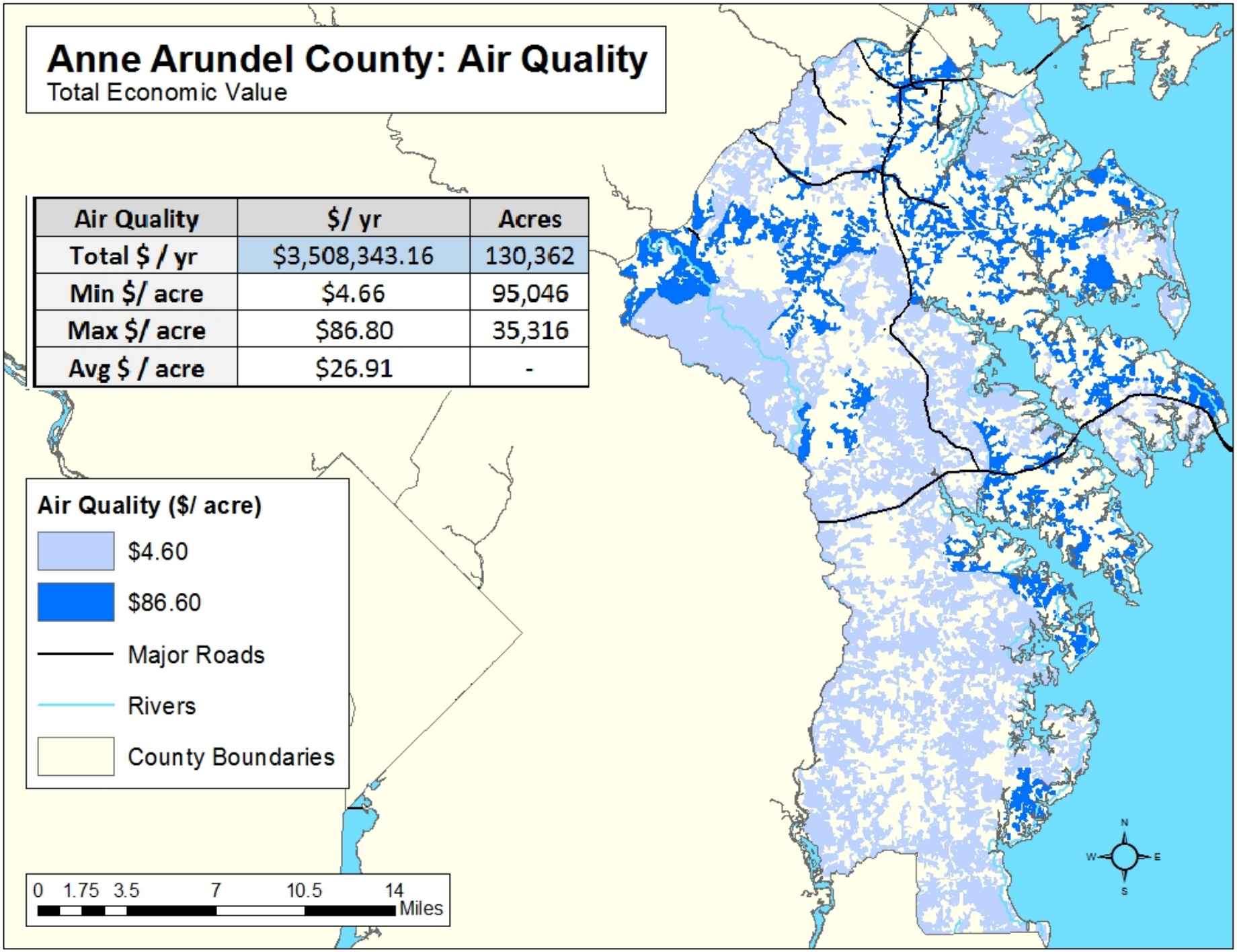


Pinchot Institute 2010

Anne Arundel County: Air Quality

Total Economic Value

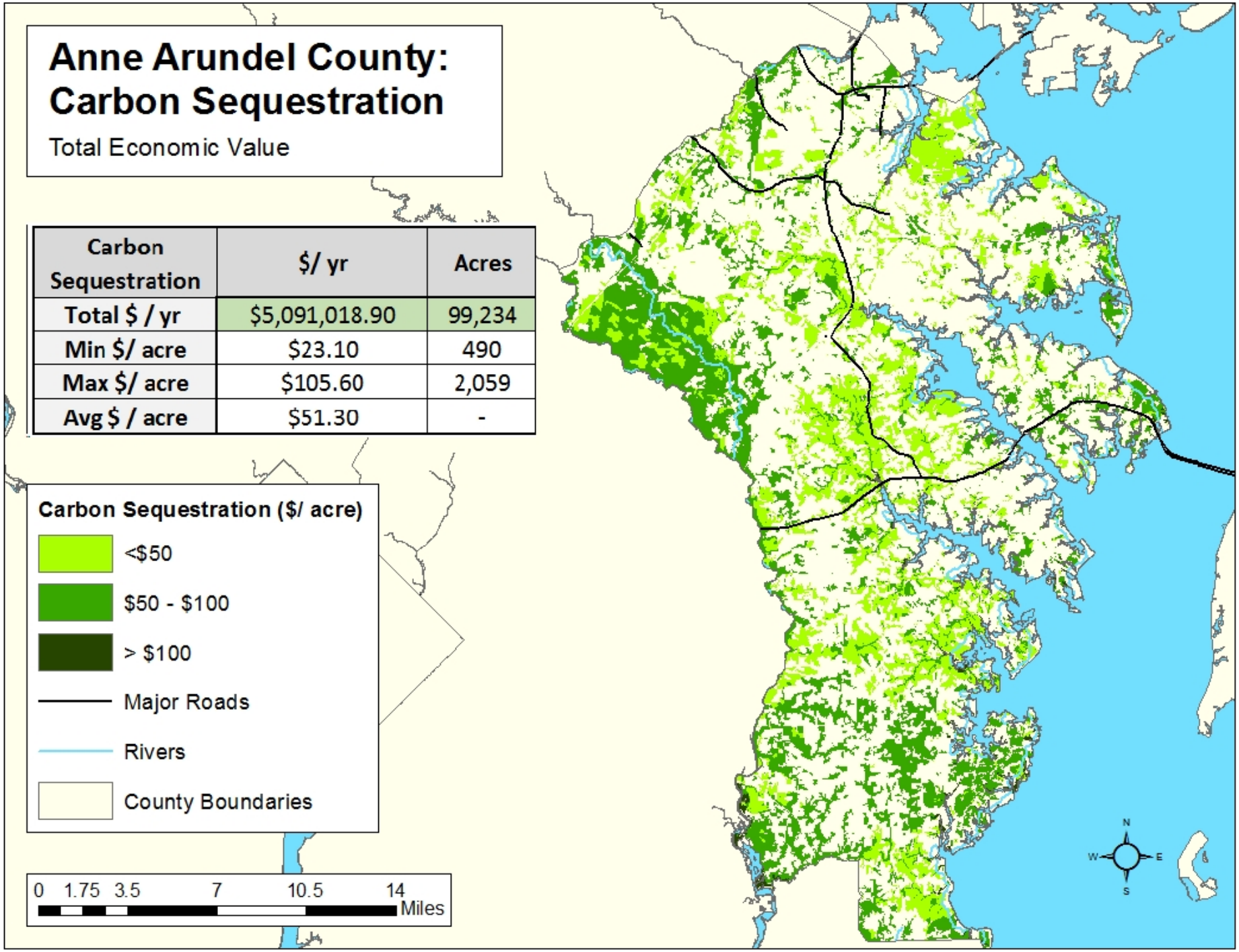
Air Quality	$/ yr	Acres
Total $ / yr	$3,508,343.16	130,362
Min $/ acre	$4.66	95,046
Max $/ acre	$86.80	35,316
Avg $ / acre	$26.91	-



Anne Arundel County: Carbon Sequestration

Total Economic Value

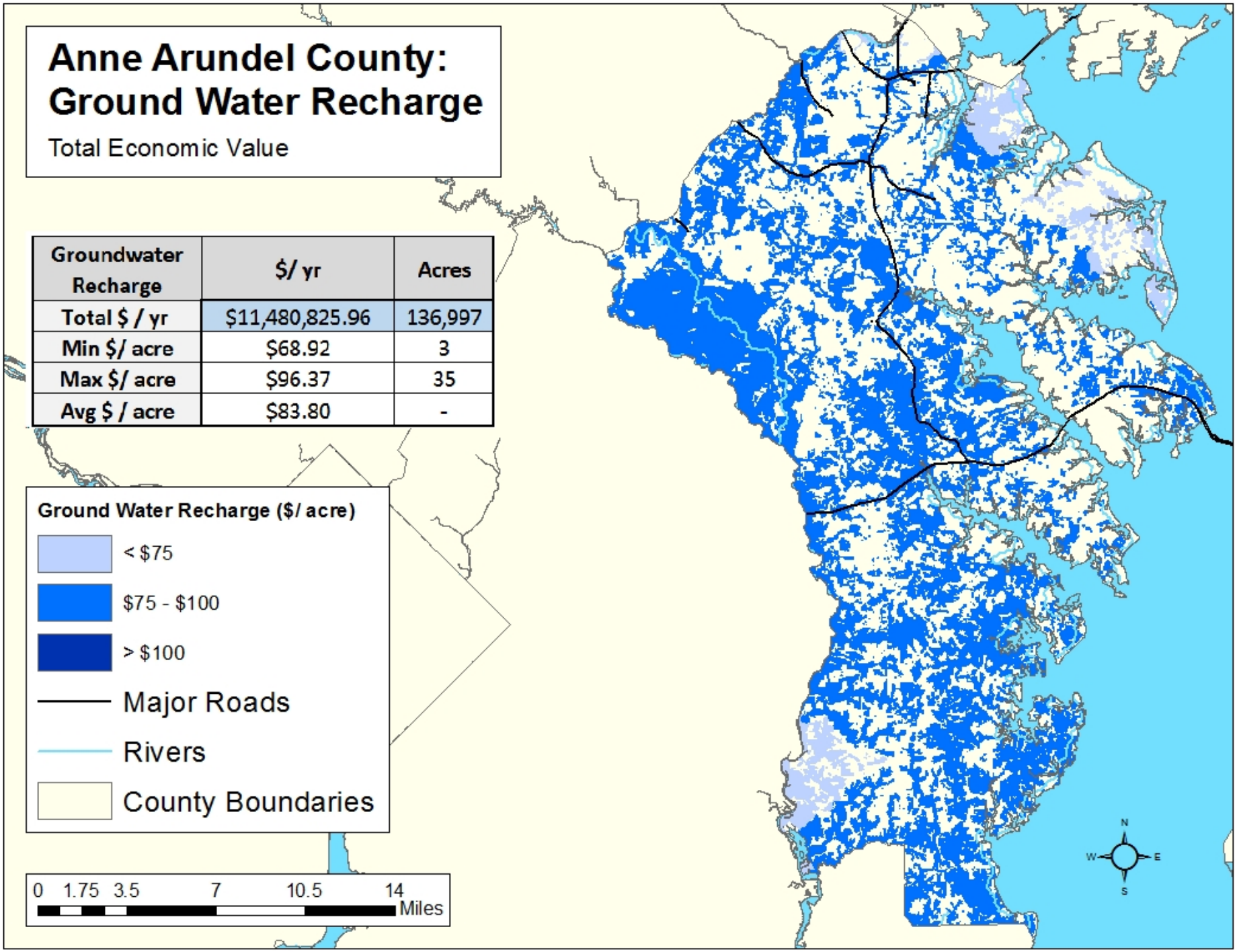
Carbon Sequestration	$/ yr	Acres
Total $ / yr	$5,091,018.90	99,234
Min $/ acre	$23.10	490
Max $/ acre	$105.60	2,059
Avg $ / acre	$51.30	-



Anne Arundel County: Ground Water Recharge

Total Economic Value

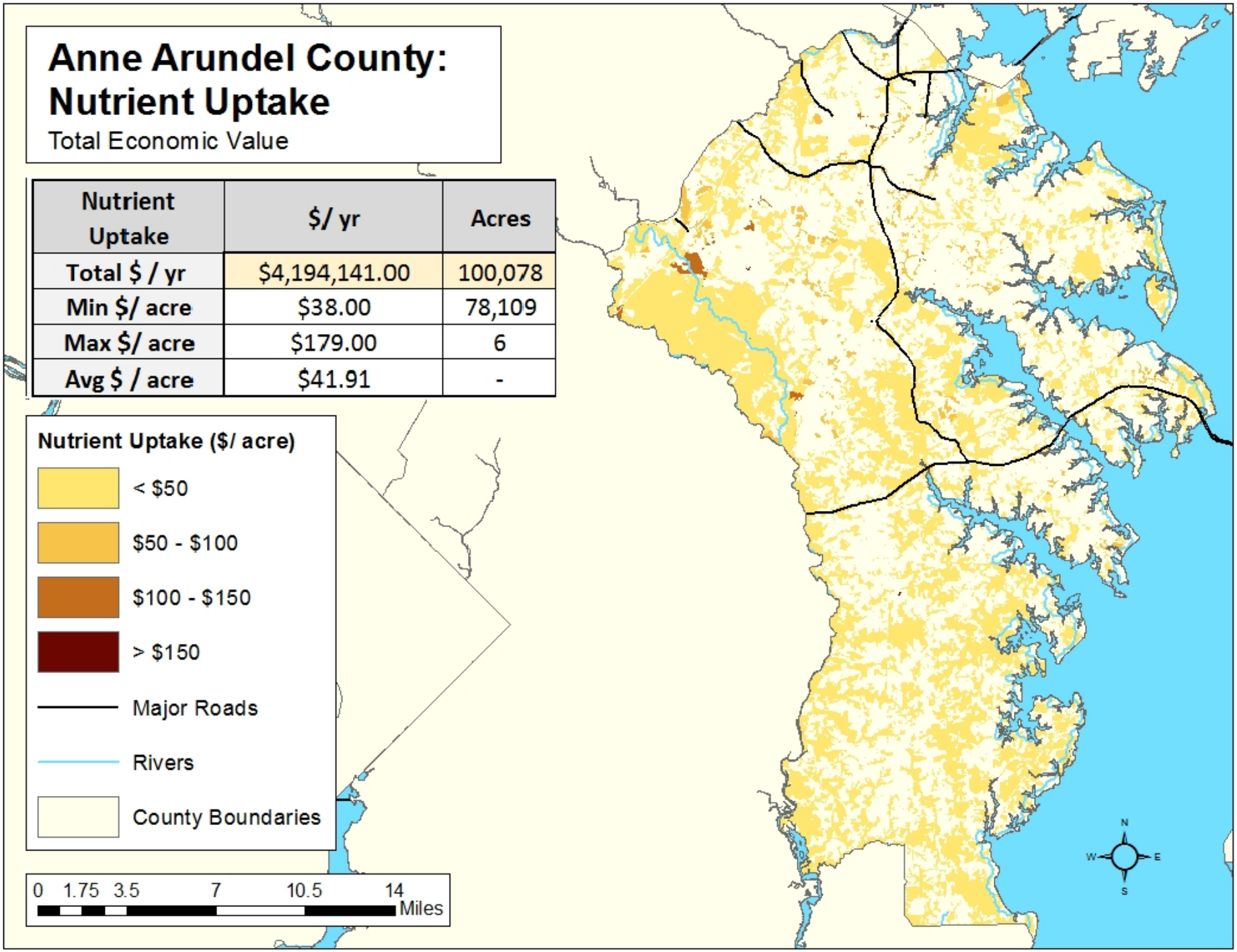
Groundwater Recharge	$/ yr	Acres
Total $ / yr	$11,480,825.96	136,997
Min $/ acre	$68.92	3
Max $/ acre	$96.37	35
Avg $ / acre	$83.80	-



Anne Arundel County: Nutrient Uptake

Total Economic Value

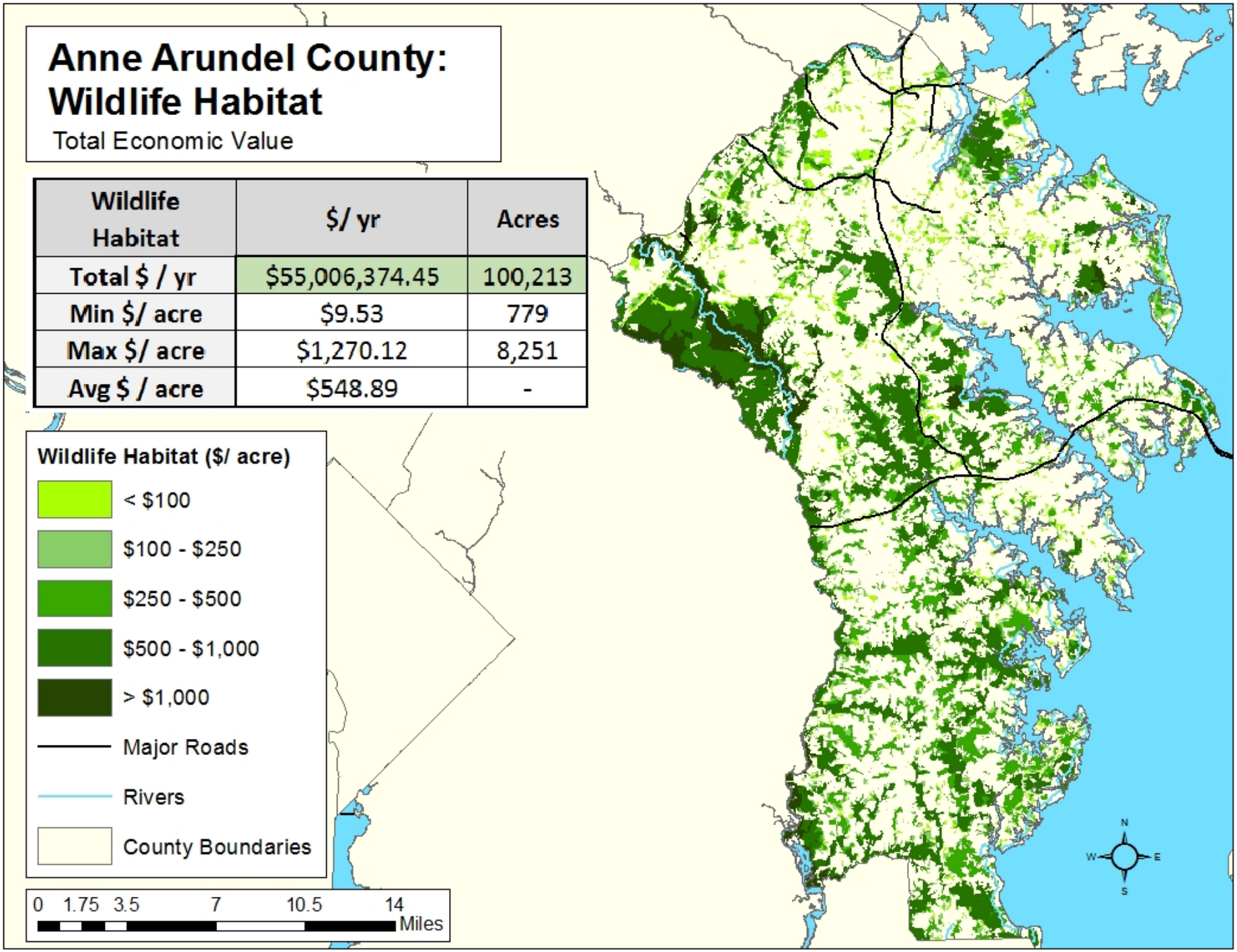
Nutrient Uptake	$/ yr	Acres
Total $ / yr	$4,194,141.00	100,078
Min $/ acre	$38.00	78,109
Max $/ acre	$179.00	6
Avg $ / acre	$41.91	-



Anne Arundel County: Wildlife Habitat

Total Economic Value

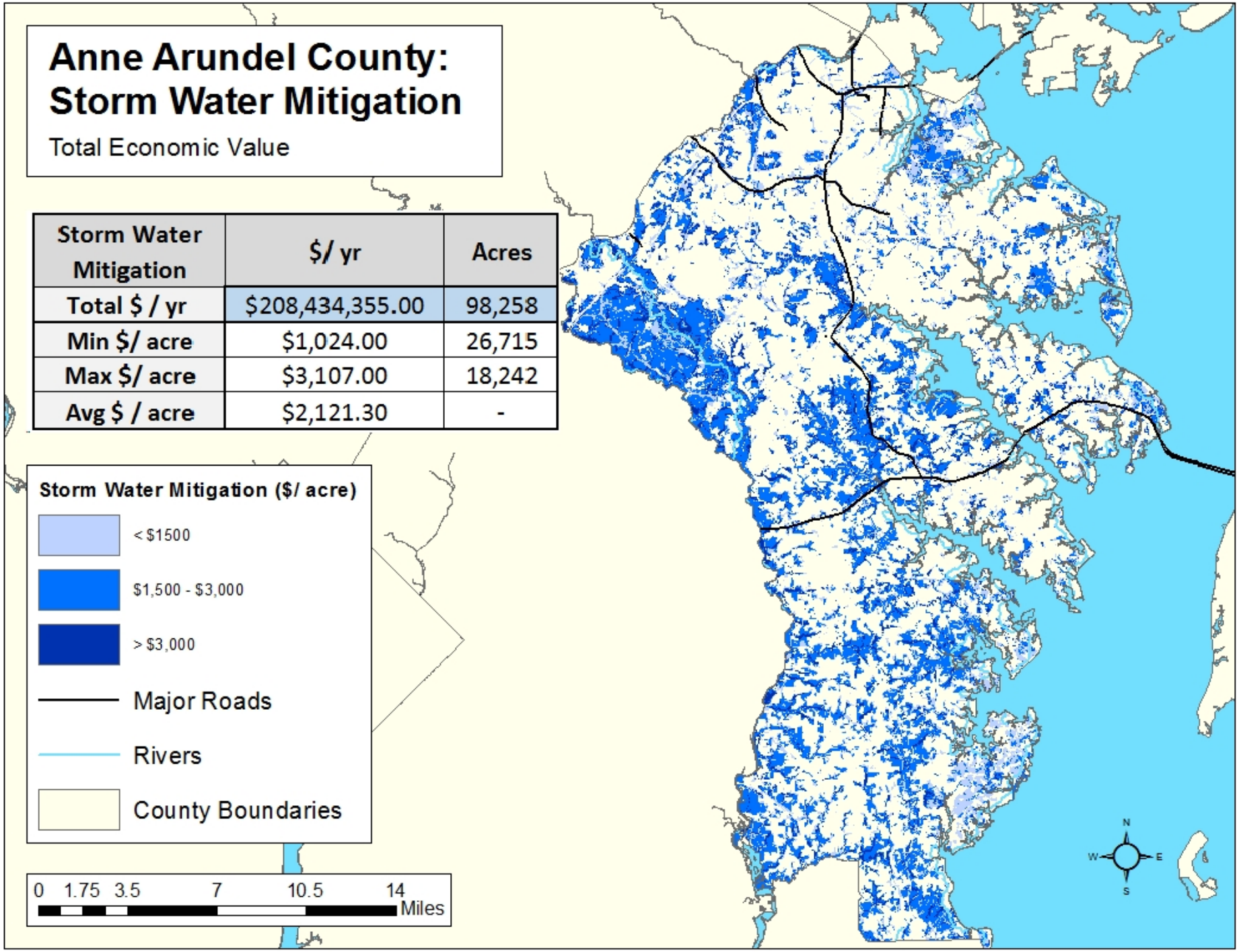
Wildlife Habitat	$/ yr	Acres
Total $ / yr	$55,006,374.45	100,213
Min $/ acre	$9.53	779
Max $/ acre	$1,270.12	8,251
Avg $ / acre	$548.89	-



Anne Arundel County: Storm Water Mitigation

Total Economic Value

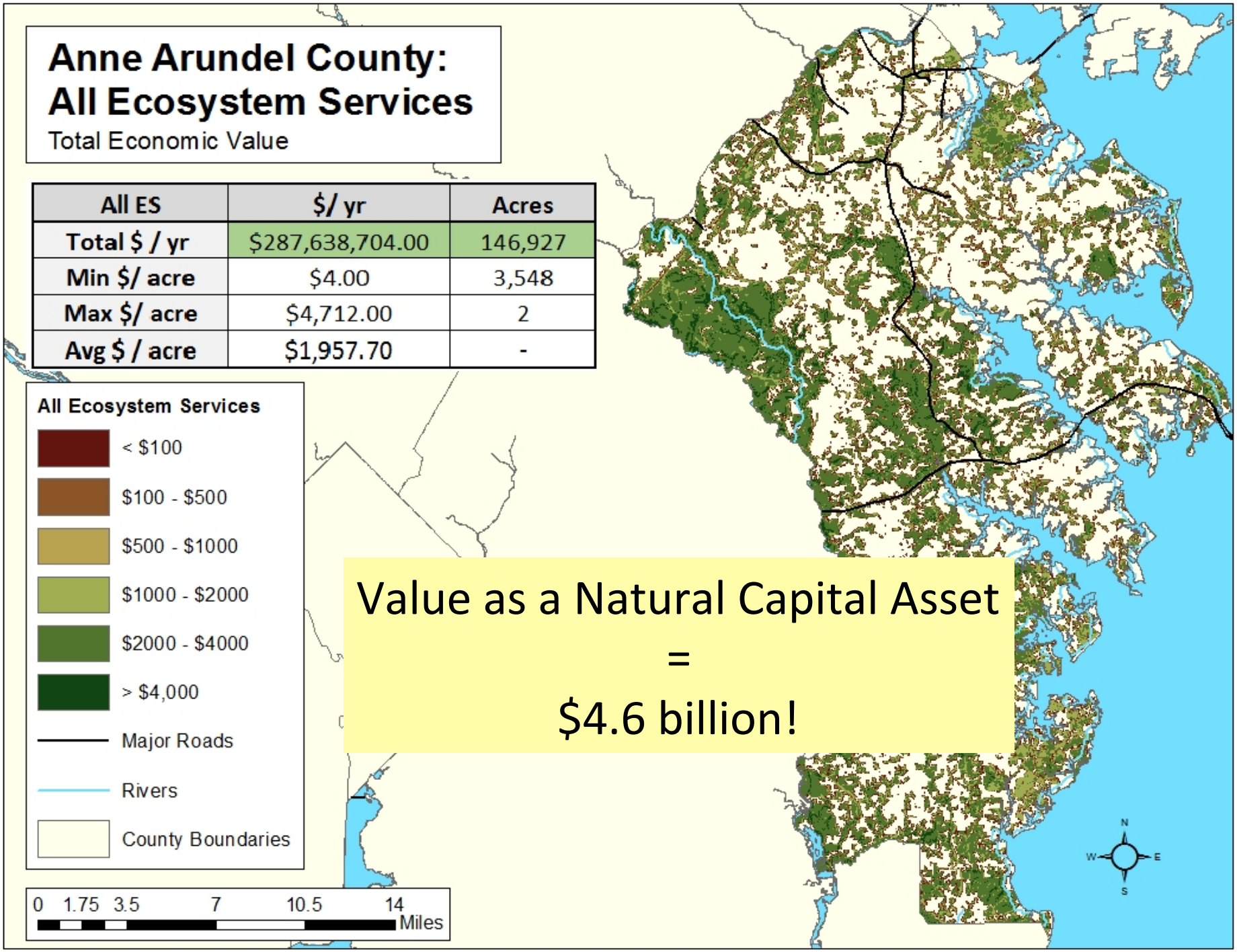
Storm Water Mitigation	$/ yr	Acres
Total $ / yr	$208,434,355.00	98,258
Min $/ acre	$1,024.00	26,715
Max $/ acre	$3,107.00	18,242
Avg $ / acre	$2,121.30	-



Anne Arundel County: All Ecosystem Services

Total Economic Value

All ES	$/ yr	Acres
Total $ / yr	$287,638,704.00	146,927
Min $/ acre	$4.00	3,548
Max $/ acre	$4,712.00	2
Avg $ / acre	$1,957.70	-



Value as a Natural Capital Asset

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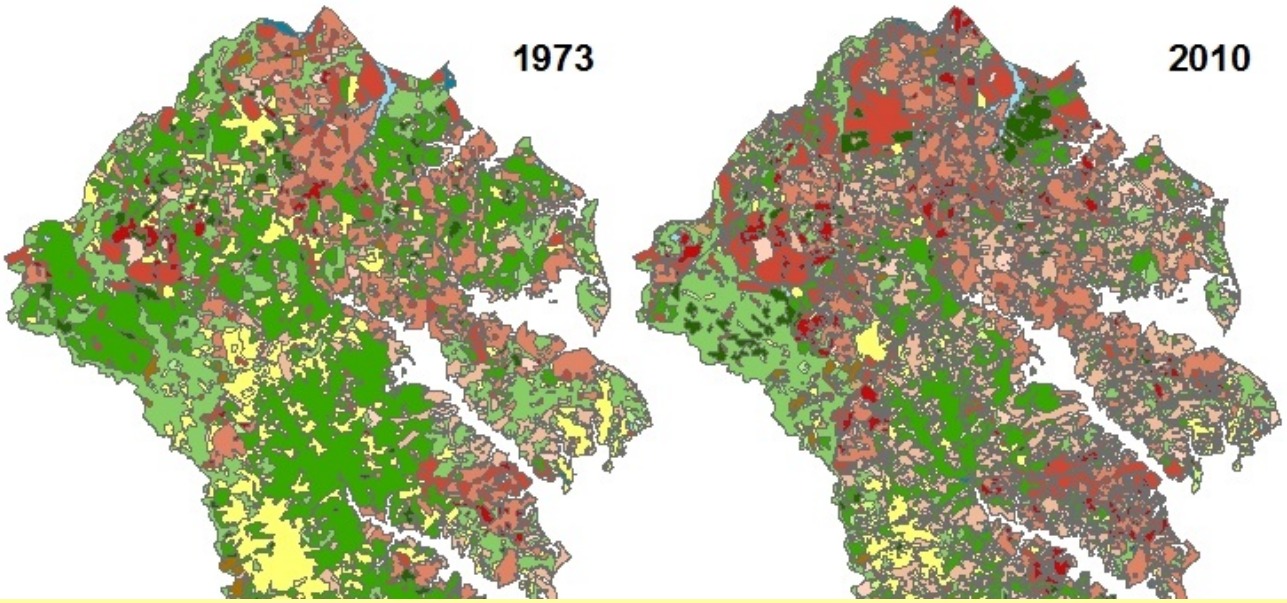
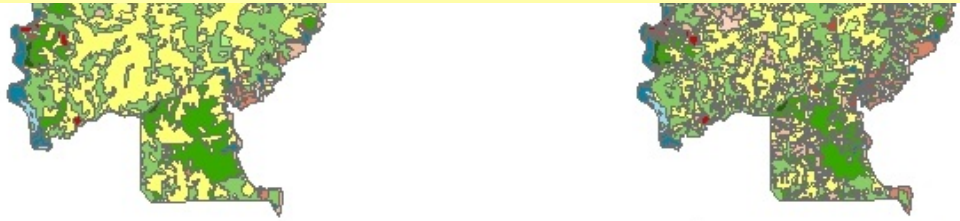
$4.6 billion!

Anne Arundel County
Landcover Change: 1973 - 2010



Approximately $69 million of annual Ecosystem Service Value was lost from 1973 to 2010

$1.1 billion of Net Present Value



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Potential Solutions

- Incorporate ES valuation into land-use planning process
  - Would allow impacts to be minimized
  - Plan for “no-net-loss” of ES

- Increase impact fees for new developments to compensate for ecosystem service loss

- Institution of ecosystem service marketplaces

- Aggressive zoning for conservation, transfer of development rights (TDR)

Potential Solutions

- Calculate quality of life indicators at the local level
  - The Maryland Quality of Life Initiative

- Institute a cap on impervious surface
  - Start with vulnerable watersheds

- Important first steps:

Growth in Population and Development

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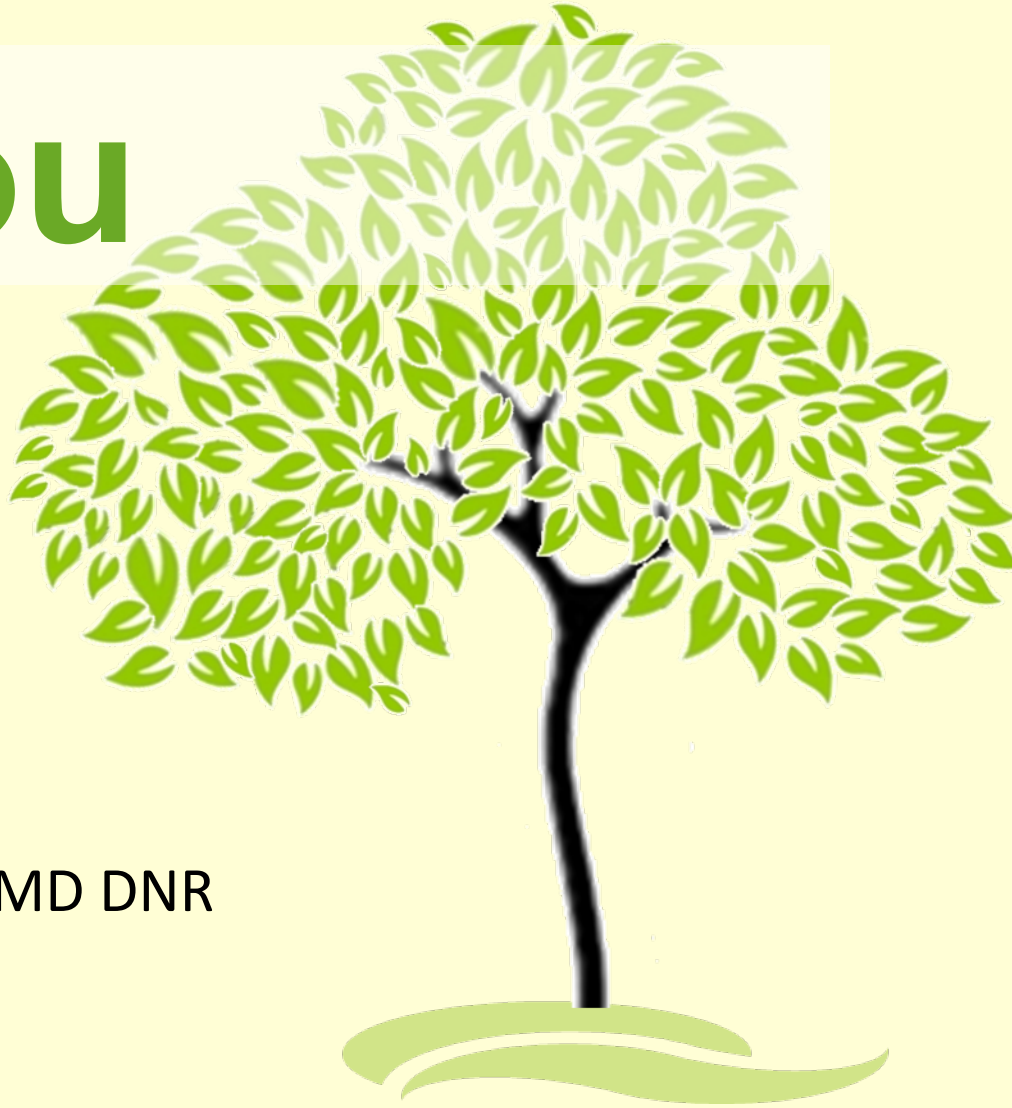
Growth in Economy and Quality of Life

Recognize that growth, in all forms, cannot be infinite!

Thank you



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