Chesapeake Bay Program
A Watershed Partnership

Crediting Conservation in the Bay TMDL

Peter Claggett
Research Geographer, U.S. Geological Survey
Coordinator, CBP Land Use Workgroup

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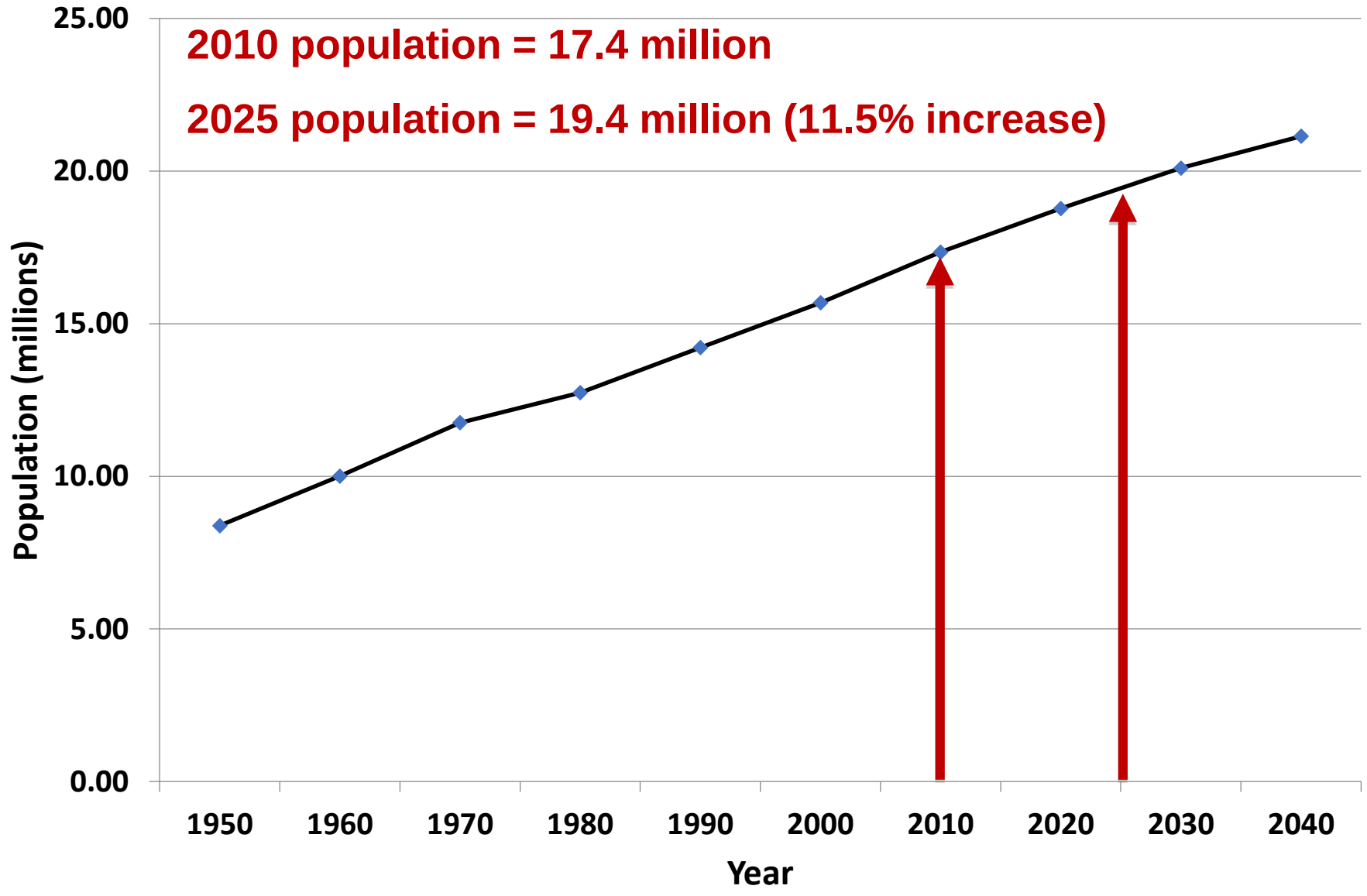
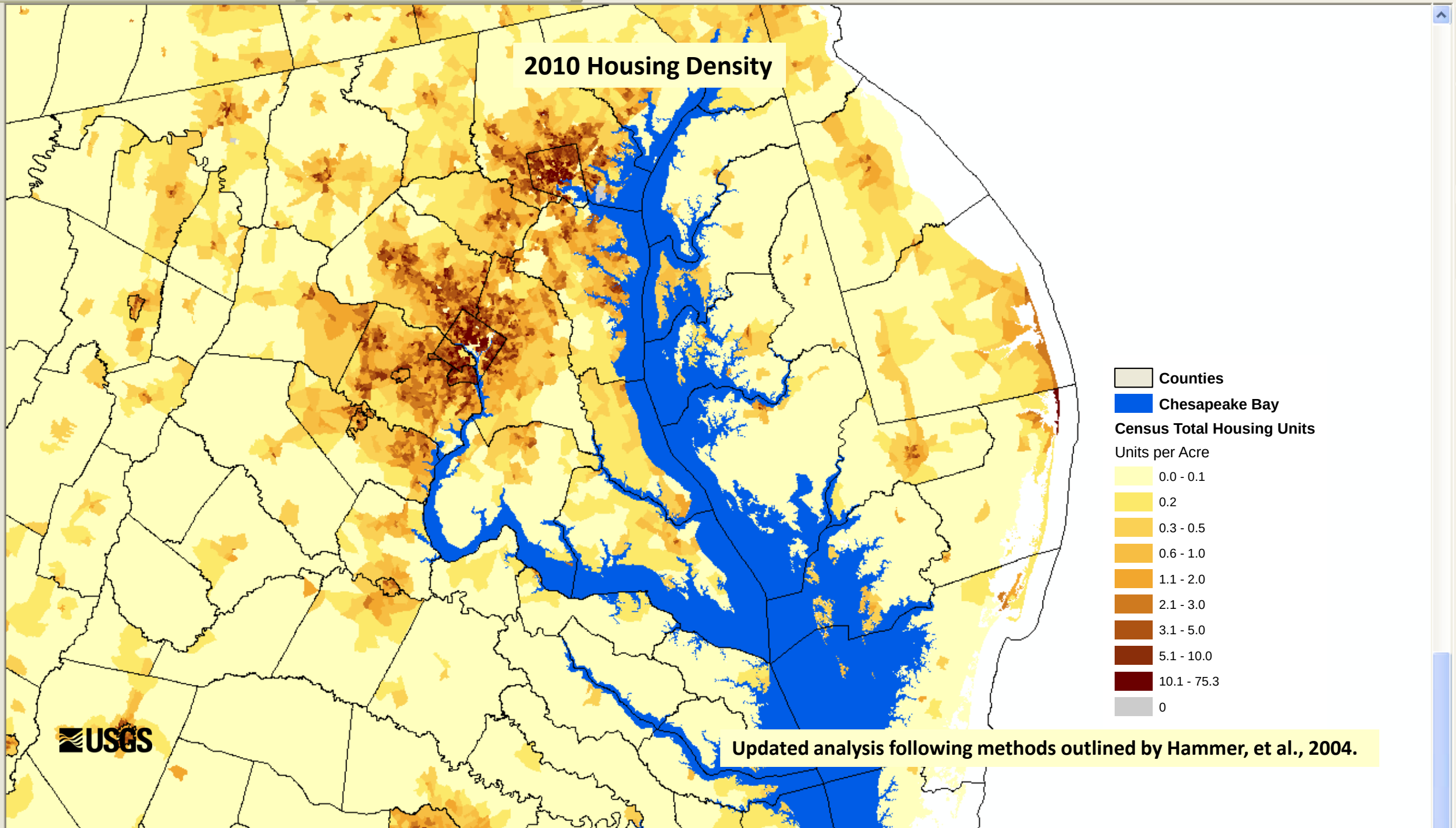
Edgewater, Maryland

Chesapeake Bay Watershed PopulationTrends



USGS

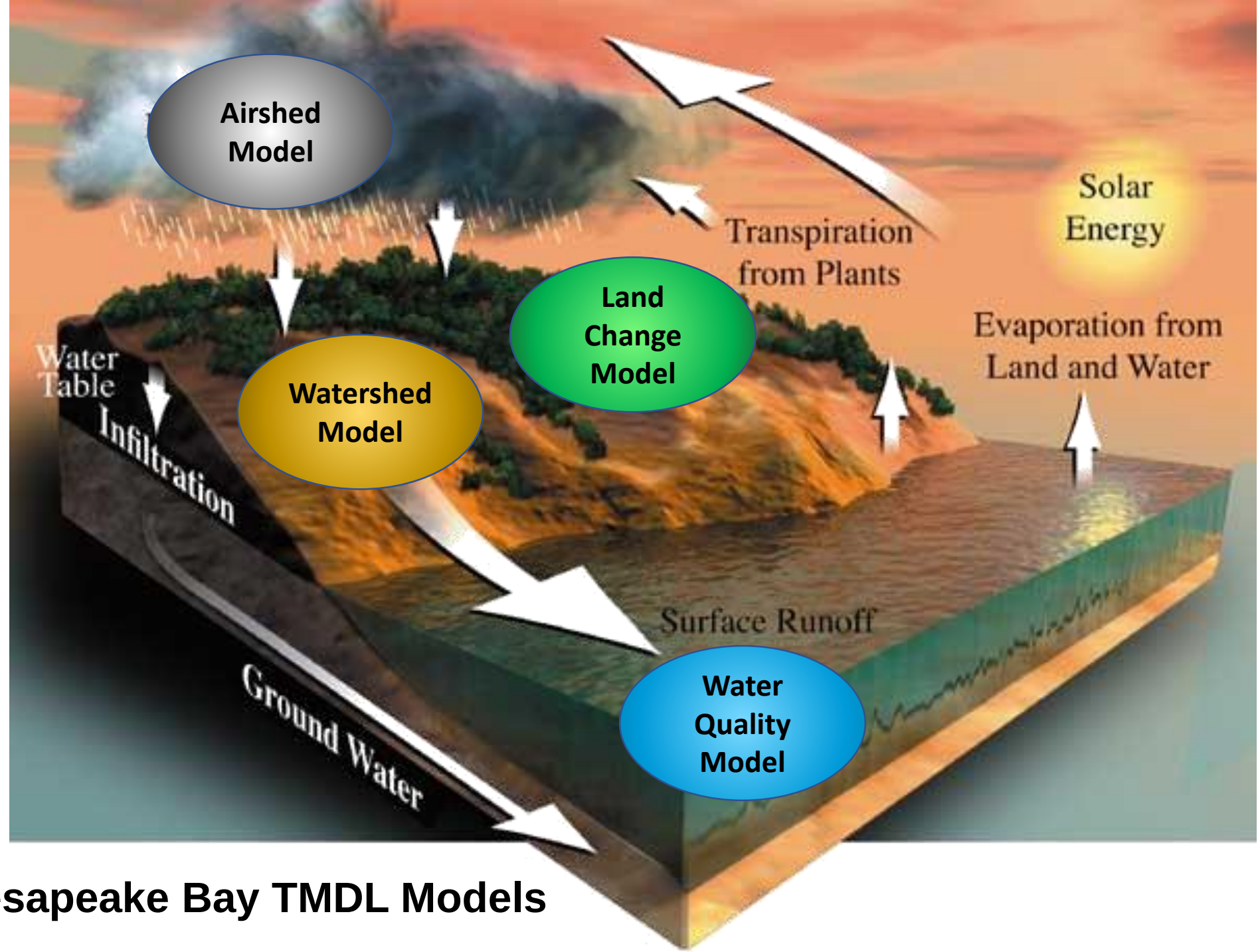

2010 Housing Density
Counties
Chesapeake Bay
Census Total Housing Units
Units per Acre
0.0 - 0.1
0.2
0.3 - 0.5
0.6 - 1.0
1.1 - 2.0
2.1 - 3.0
3.1 - 5.0
5.1 - 10.0
10.1 - 75.3
0
USGS
Updated analysis following methods outlined by Hammer, et al., 2004.

Crediting Land Conservation and Planning in the Bay TMDL

Overall Concept

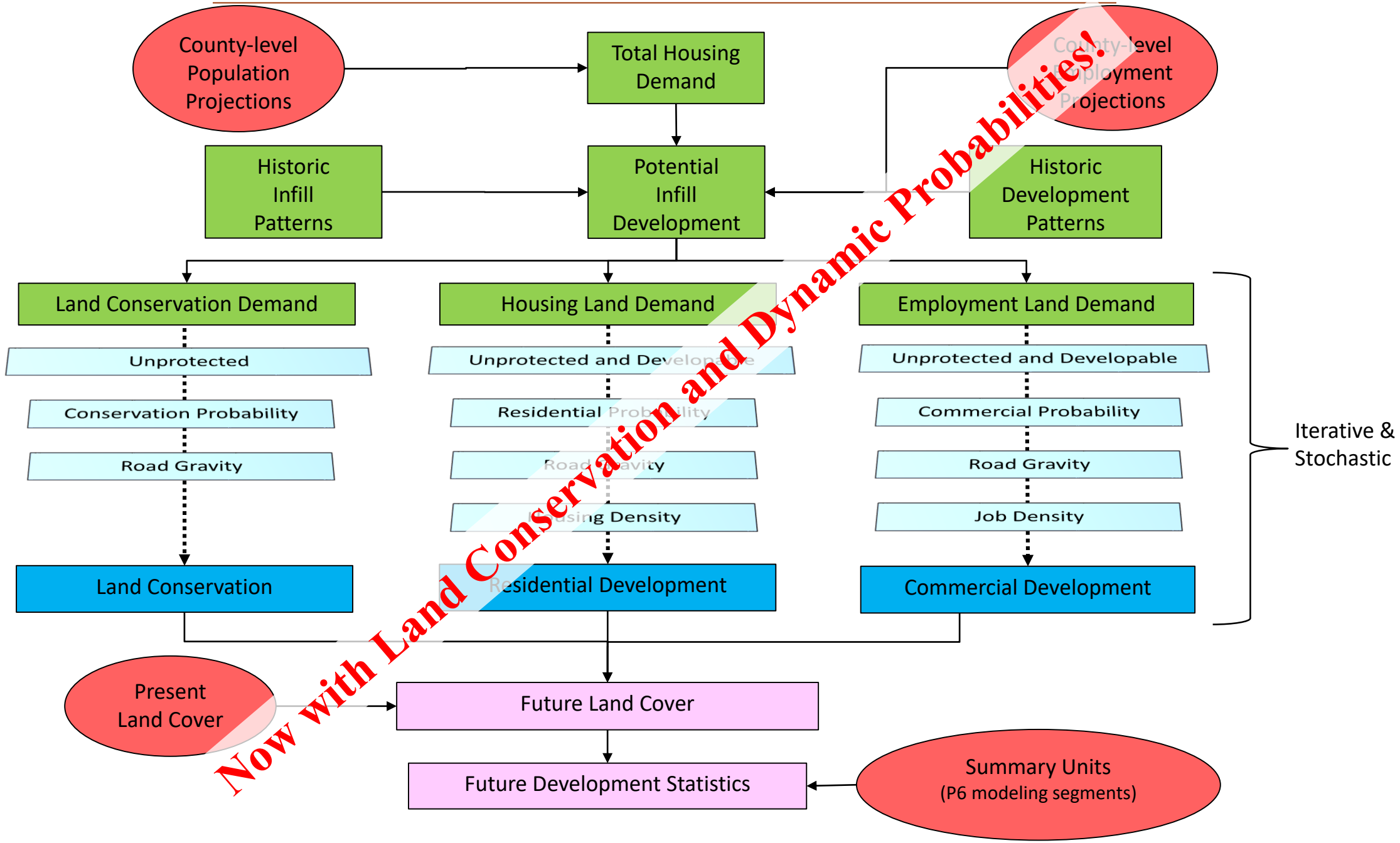
Land conservation and land use planning actions may reduce the future conversion of land to more polluting land uses.

Example: conservation easements, transfer of development rights, and zoning collectively serve to reduce the potential conversion of forests to residential subdivsions on septic.

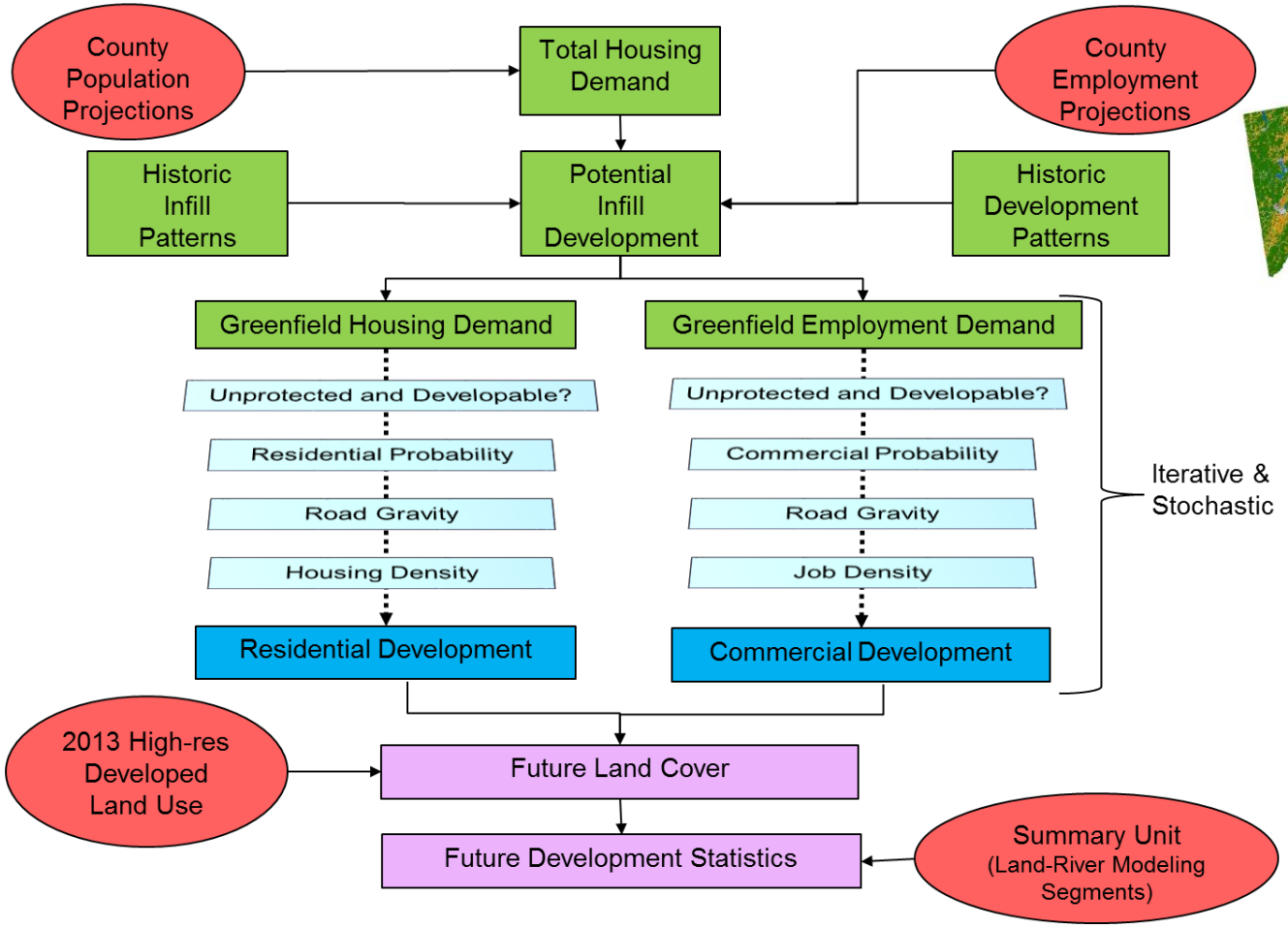


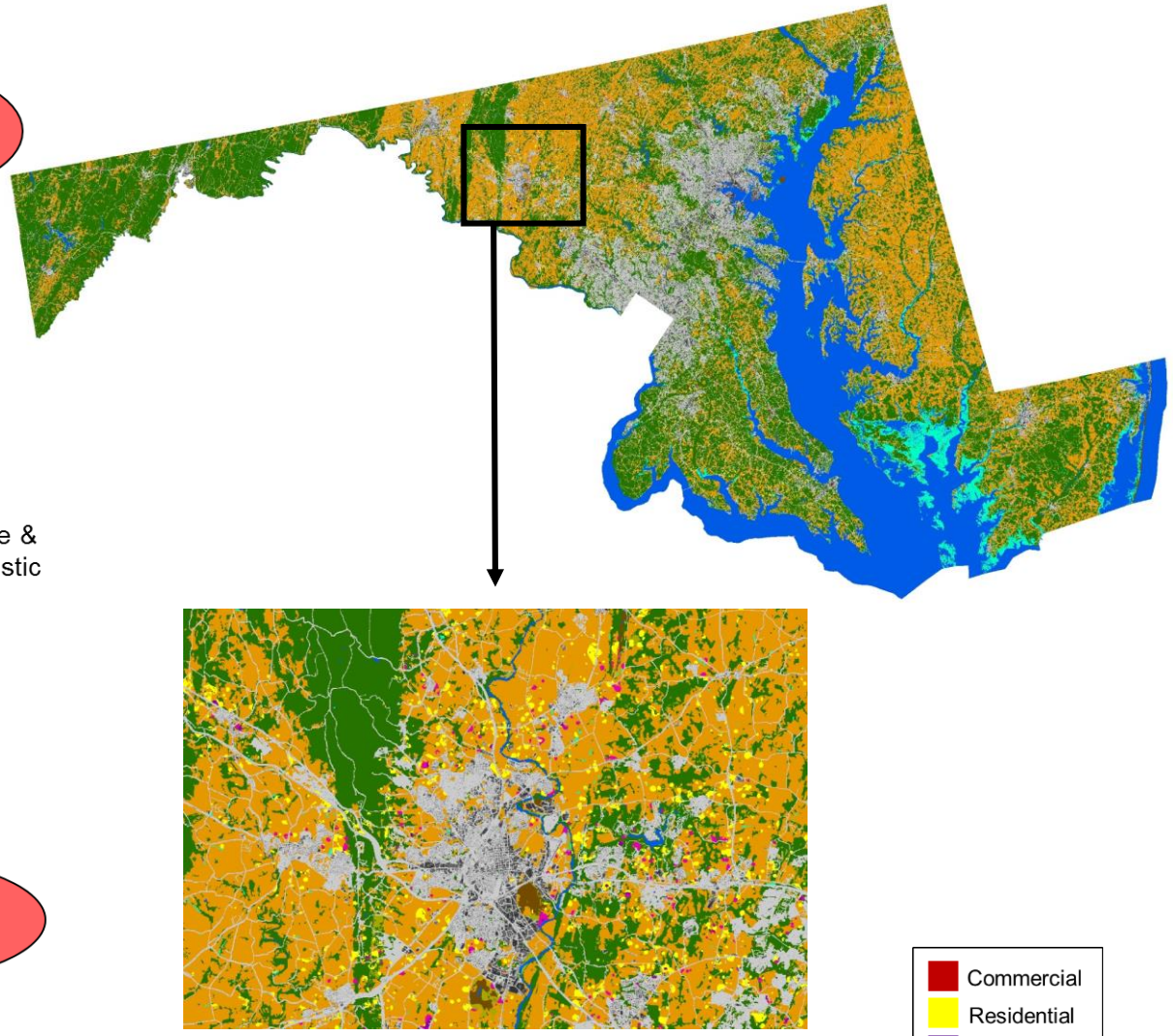
Chesapeake Bay TMDL Models

Chesapeake Bay Land Change Model v4

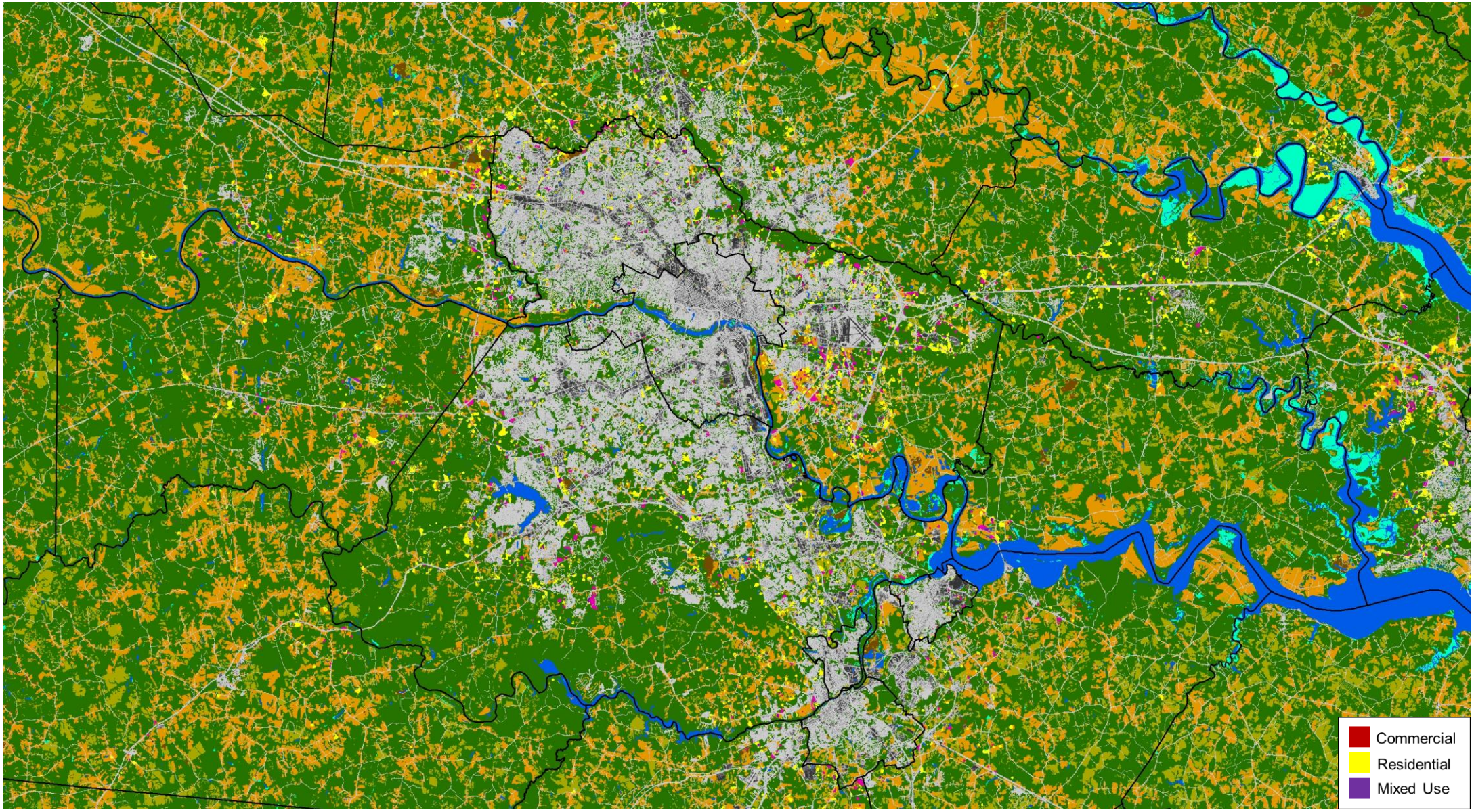


Partnership's Chesapeake Bay Land Change Model

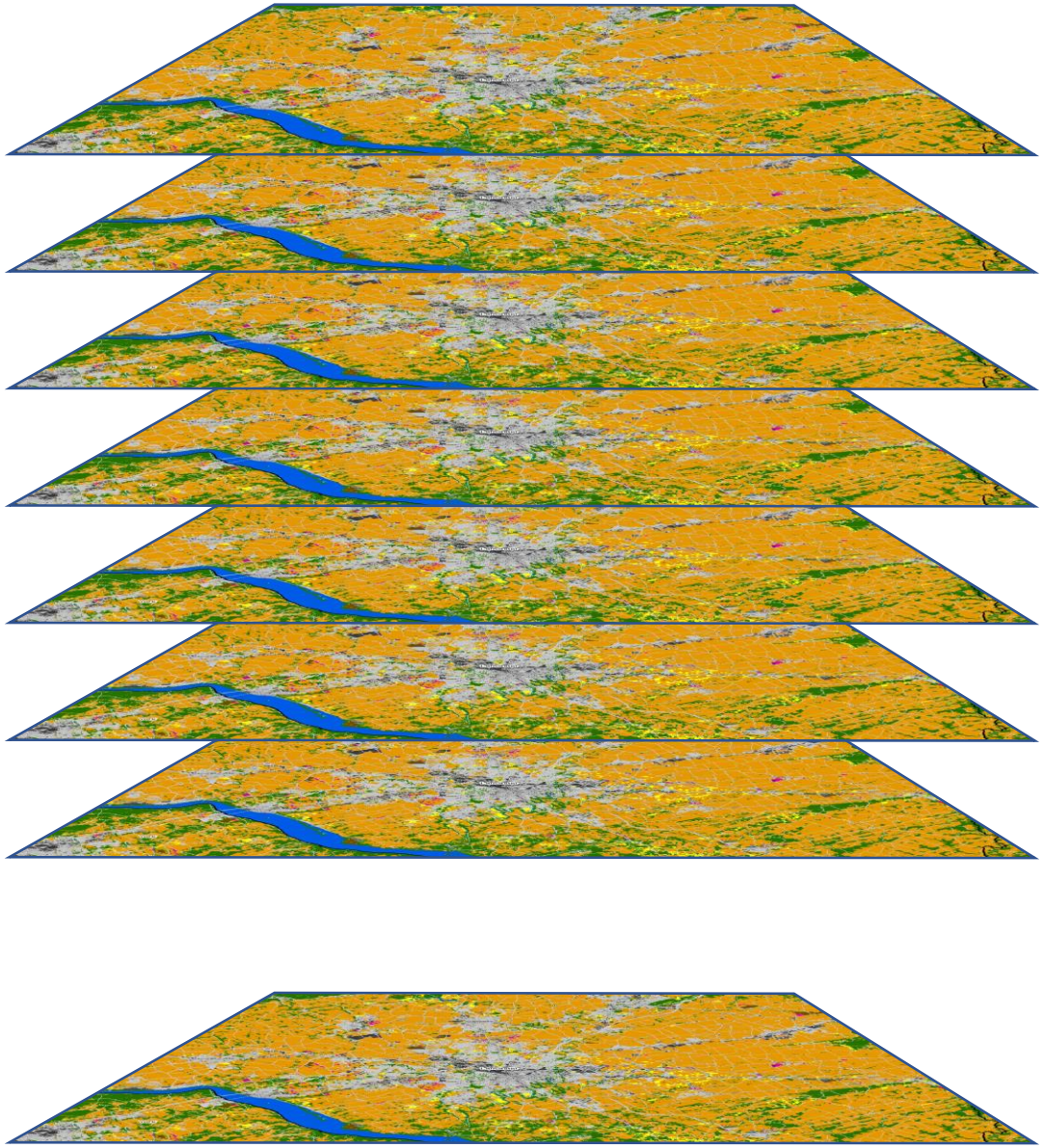




Assessing Uncertainty at Local Scales



Assessing Uncertainty at Local Scales



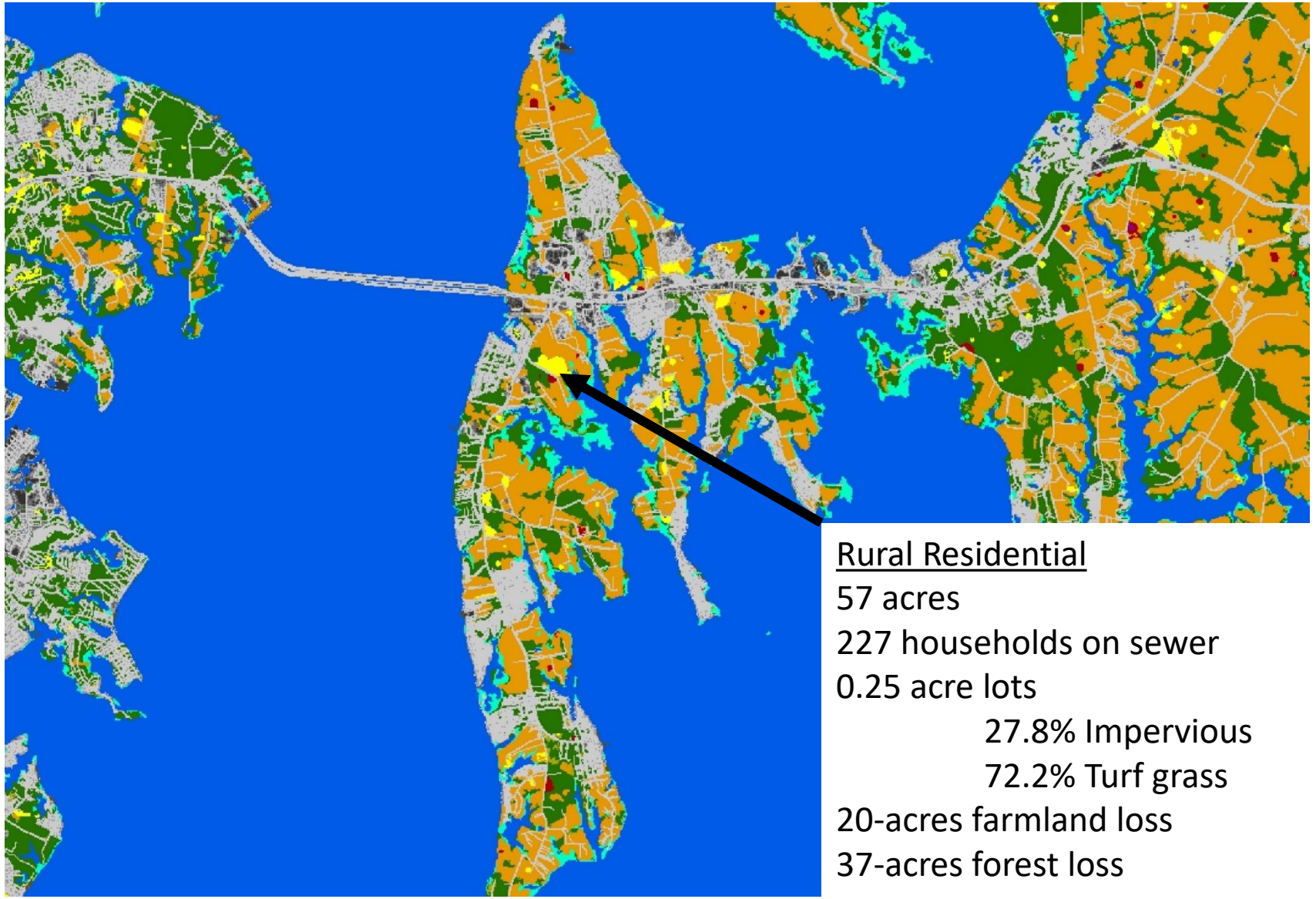
Every county is simulated 101 times for each scenario and target year, i.e., 2025.

Average of simulations by land-river segment = future development

Relative Standard Deviation = estimate of uncertainty

Land Change Model Outputs

- Impervious surface and turf grass expansion
- Forest conversion to development
- Farmland conversion to development
- Future population on sewer and septic

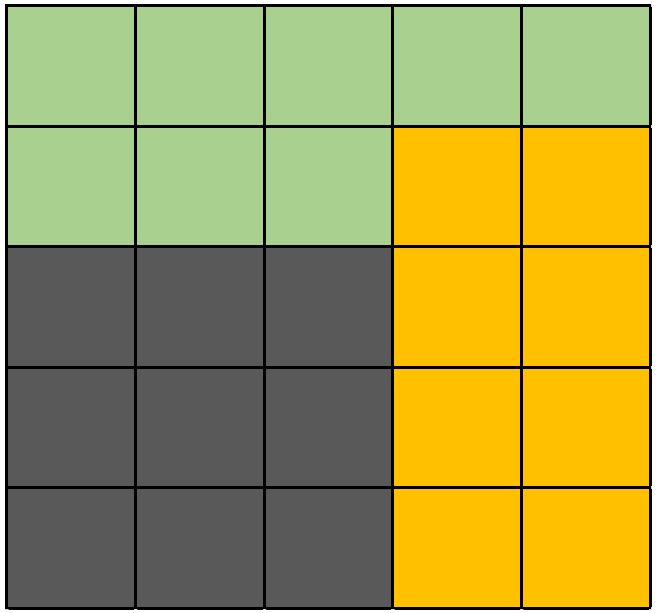


<u>Rural Residential</u>
57 acres
227 households on sewer
0.25 acre lots
27.8% Impervious
72.2% Turf grass
20-acres farmland loss
37-acres forest loss

Conservation Effects on Future Land Use (hypothetical example)

Land Area = 25 cells

9 cells developed
8 cells forest
8 cells farmland



No Conservation Scenario

Greenfield Capacity = 46 units

22 units on forests
24 units on farmland

2 units	2 units	2 units	2 units	2 units
4 units	4 units	4 units	4 units	2 units
			4 units	2 units
			4 units	2 units
			4 units	2 units

Units = housing units

No Conservation Scenario

Future Demand for Growth = 12 units

New Development = 3-6 cells

2 units	2 units	2 units	**2 units**	2 units
4 units	4 units	**4 units**	**4 units**	**2 units**
			4 units	2 units
			4 units	2 units
			4 units	2 units

Iteration #1 (of 101)

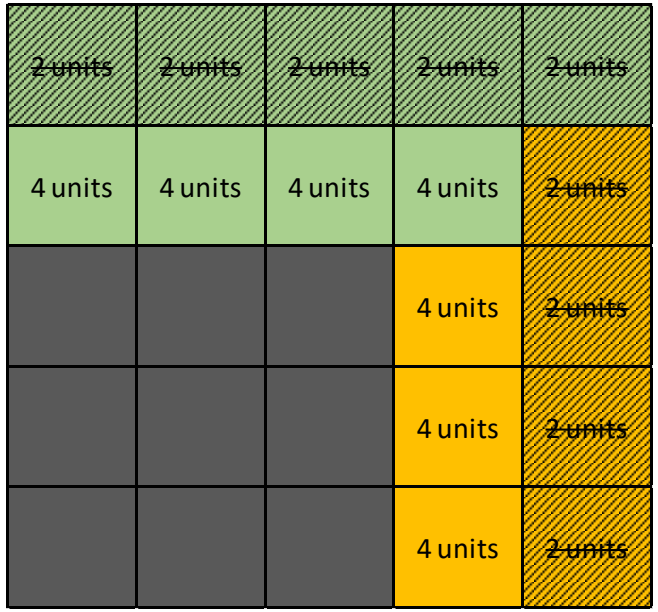
Conservation Scenario #1: conserve all low-density lands

Conservation Scenario #1

Greenfield Capacity = 28 units

12 units remaining on forest lands
16 units remaining on farmland

18 units of reduced capacity

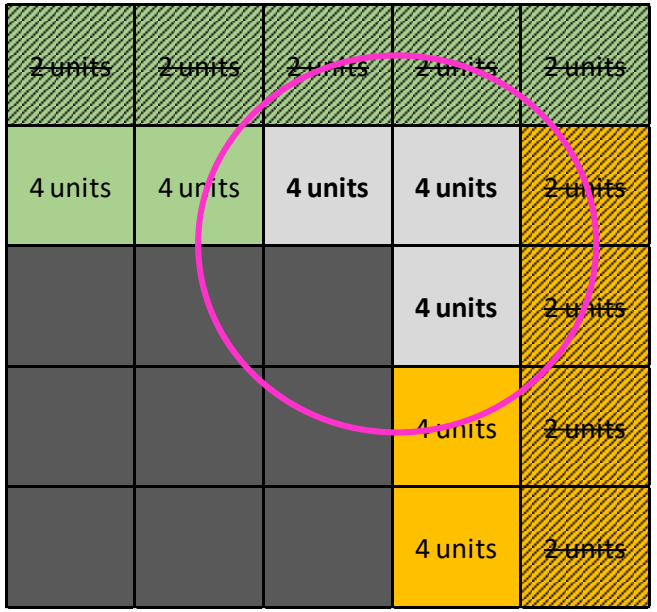


Conservation Scenario #1

Future Demand for Growth = 12 units

Development = 3 cells

Avoided development = 1-3 cells



Iteration #1 (of 101)

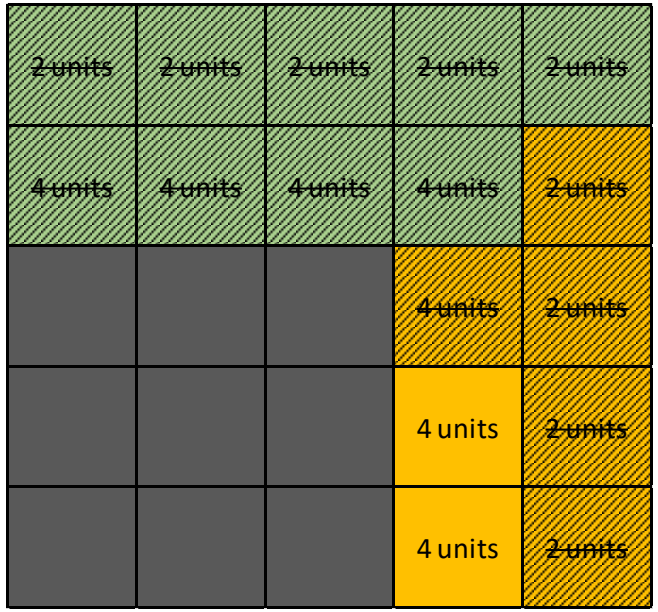
Conservation Scenario #2: reduce capacity below demand

Conservation Scenario #2

Greenfield Capacity =
8 units

No units remaining on forest lands
8 units remaining on farmland

38 units of reduced capacity

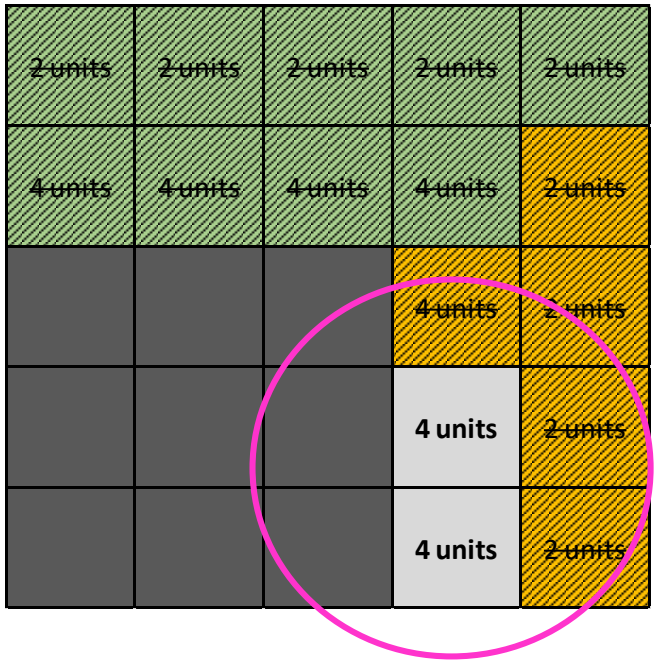


Conservation Scenario #2

Future Demand for Growth =
12 units

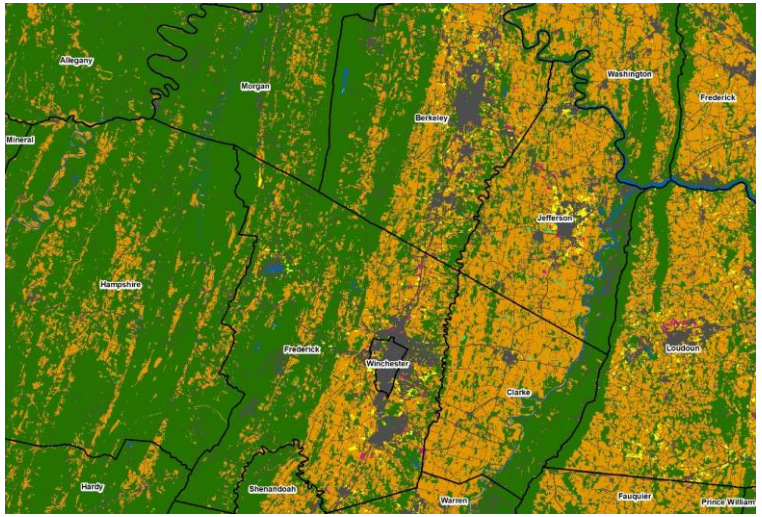
Development = 2 cells

Avoided development = 2-4 cells

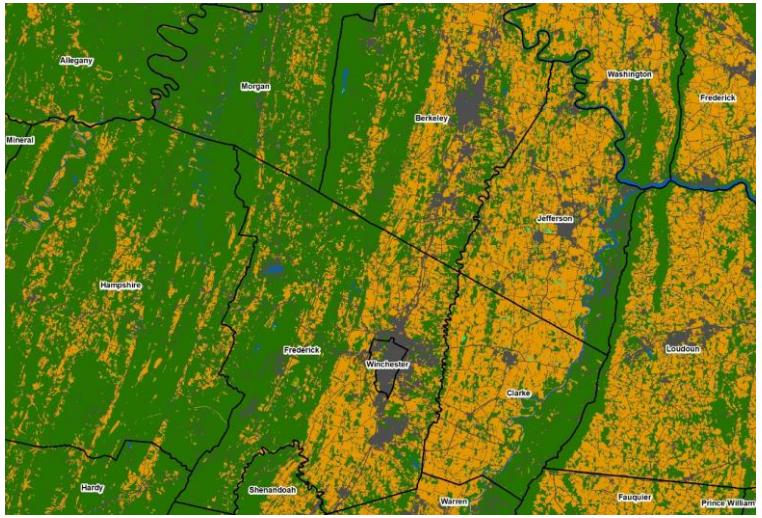


Crediting Land Conservation and Planning in the Bay TMDL

2025 Land Use (Conservation & Planning Scenario)



2025 Land Use (Mapped from Aerial Imagery)



Difference = credit afforded to all actions in the Conservation & Planning scenario

- Estimated credit based on modelled contribution towards meeting the pollution reduction goals established for each state, state-basin, or county (scale may vary by state).
- Actual credit based on monitored changes in land use and reported BMPs.

Chesapeake Bay Future Baseline Scenarios

Historic Trends:

Continuation of historic development patterns and constraints as existed over the 2000's. Includes the best available regional and local data representing current conditions.

Current Zoning (official baseline):

Same as Historic Trends with the addition of local zoning, increased infill rates (MD counties), and expanded sewer service areas (Jefferson and Berkeley Counties, WV) to reflect current constraints on new development and reported rates of growth on septic. The Chesapeake Bay Program Partners adopted this scenario as the representing the most probable conditions in 2025 and therefore serves as a baseline for evaluating the effects of land use planning and land conservation BMPs.

“Conservation Plus” Family of Scenarios

Forest Conservation (with or without zoning):
Organizations and governments proactively pursuing a variety of actions to conserve forests and wetlands which provide the greatest benefits to wildlife, human safety, and water quality. Example priority areas include riparian zones, shorelines, large contiguous forest tracts, and other high-priority forest conservation areas.

Growth Management (with or without zoning):
Organizations and governments proactively pursuing a variety of actions to encourage growth in areas with supporting infrastructure. Example priority areas include undeveloped or under-developed areas with adequate existing roads, wastewater, and water supply infrastructure.

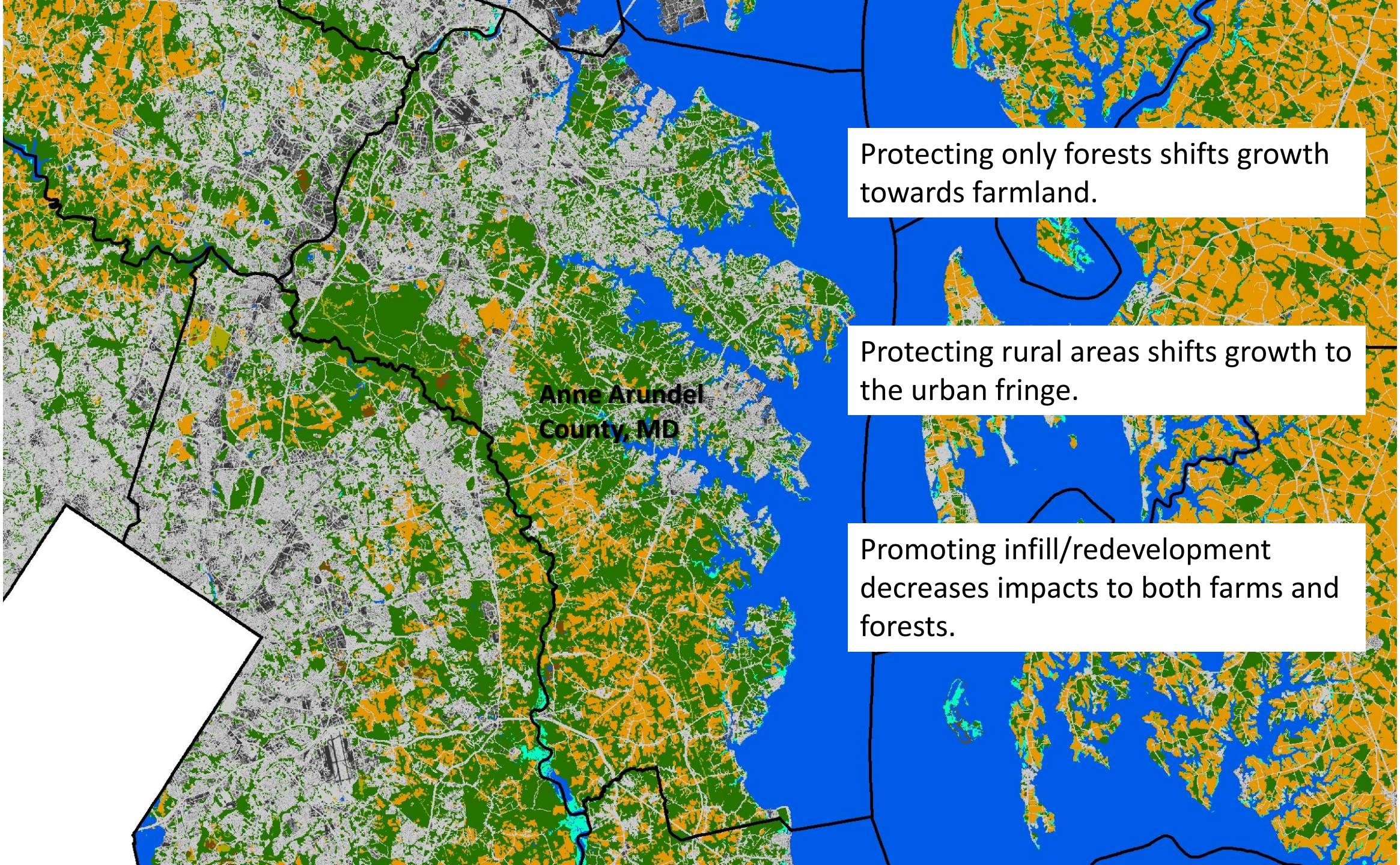
Agriculture and Soil Conservation (with or without zoning):
Organizations and governments proactively pursuing a variety of actions to conserve farmland and productive soils. Example priority areas include agricultural districts, prime farmland, farmland of state importance, floodplains, and other high-priority farmland conservation areas.

“Conservation Plus” Scenario Elements

- Conserve riparian zones (default width = 30m)
- Conserve wetlands (NWI, State Designated Wetlands, and Potential Conservable Wetlands (PA only))
- Conserve all lands subject to inundation due to sea level rise (default = 1m rise by the year 2100)
- Conserve all lands surrounding National Wildlife Refuges (default = 1 mile buffer)
- Conserve all large forest tracts (default >= 250 acres)
- Conserve Bay shorelines (default = 305m buffer (~1000-ft) of the tidal Bay and Atlantic shorelines)
- Conserve all high-value forest and forested wetlands identified by the Chesapeake Conservation Partnership

- Increase proportion of growth occurring as infill/redevelopment (default = 10% per decade)
- Increase urban densities (default = 10% per decade)
- Increase proportion of urban vs rural growth (default = 10% per decade)
- Expand sewer service areas (default = ~1 mile))
- Avoid growth on all soils unsuitable for septic systems (based on depth to bedrock, drainage class, saturated hydraulic conductivity, and flood frequency)

- Conserve all farmland within designated Agricultural Districts
- Conserve all lands within the floodplain (default = 100-year recurrence interval)
- Conserve all lands with flooded soils (default = frequently flooded)
- Conserve all prime farmlands and farmland of state importance
- Conserve potential restorable wetlands (applies only to PA farmland)
- Conserve all high-value farmland identified by the Chesapeake Conservation Partnership

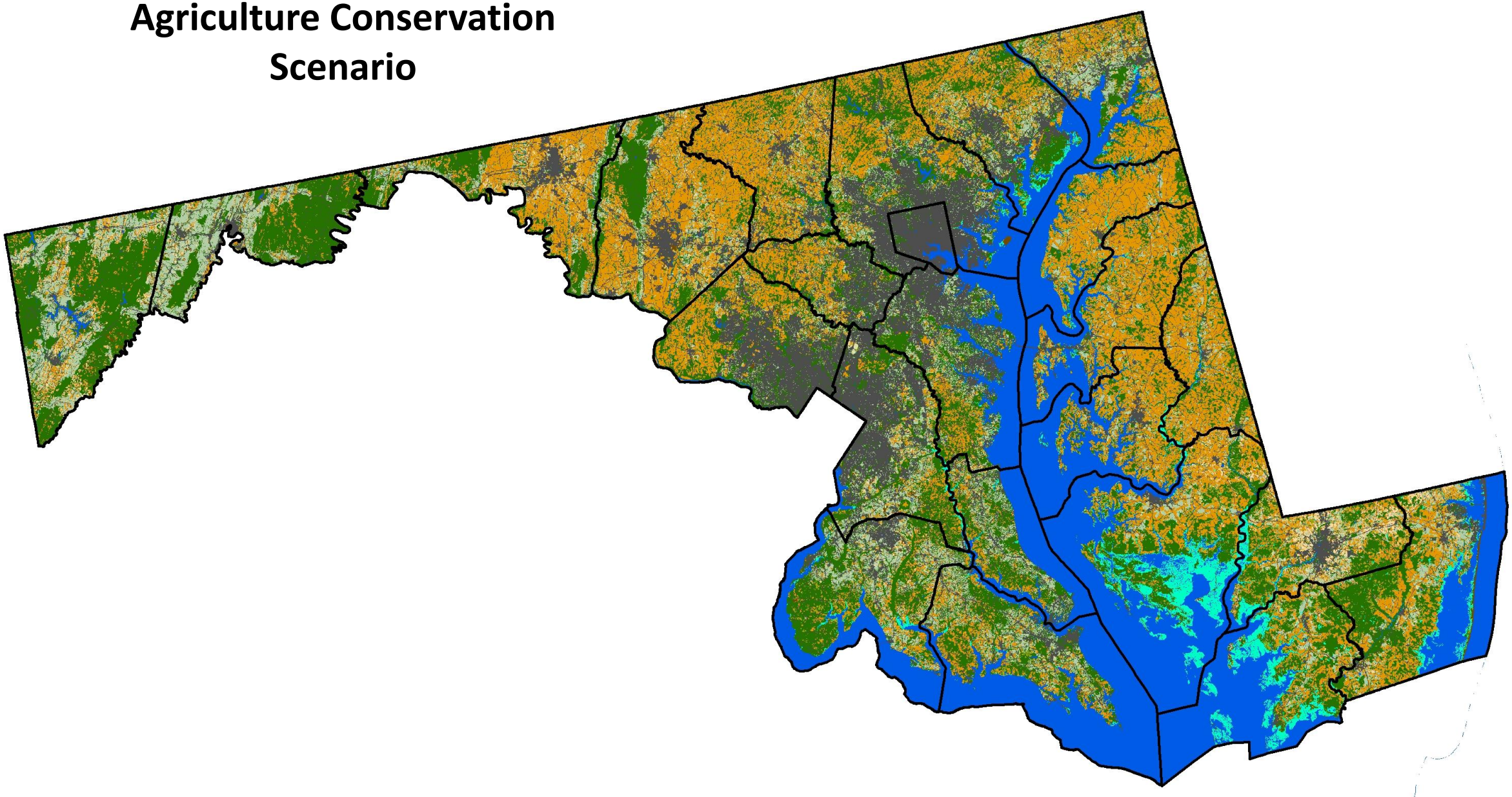


Protecting only forests shifts growth towards farmland.

Protecting rural areas shifts growth to the urban fringe.

Promoting infill/redevelopment decreases impacts to both farms and forests.

Agriculture Conservation Scenario

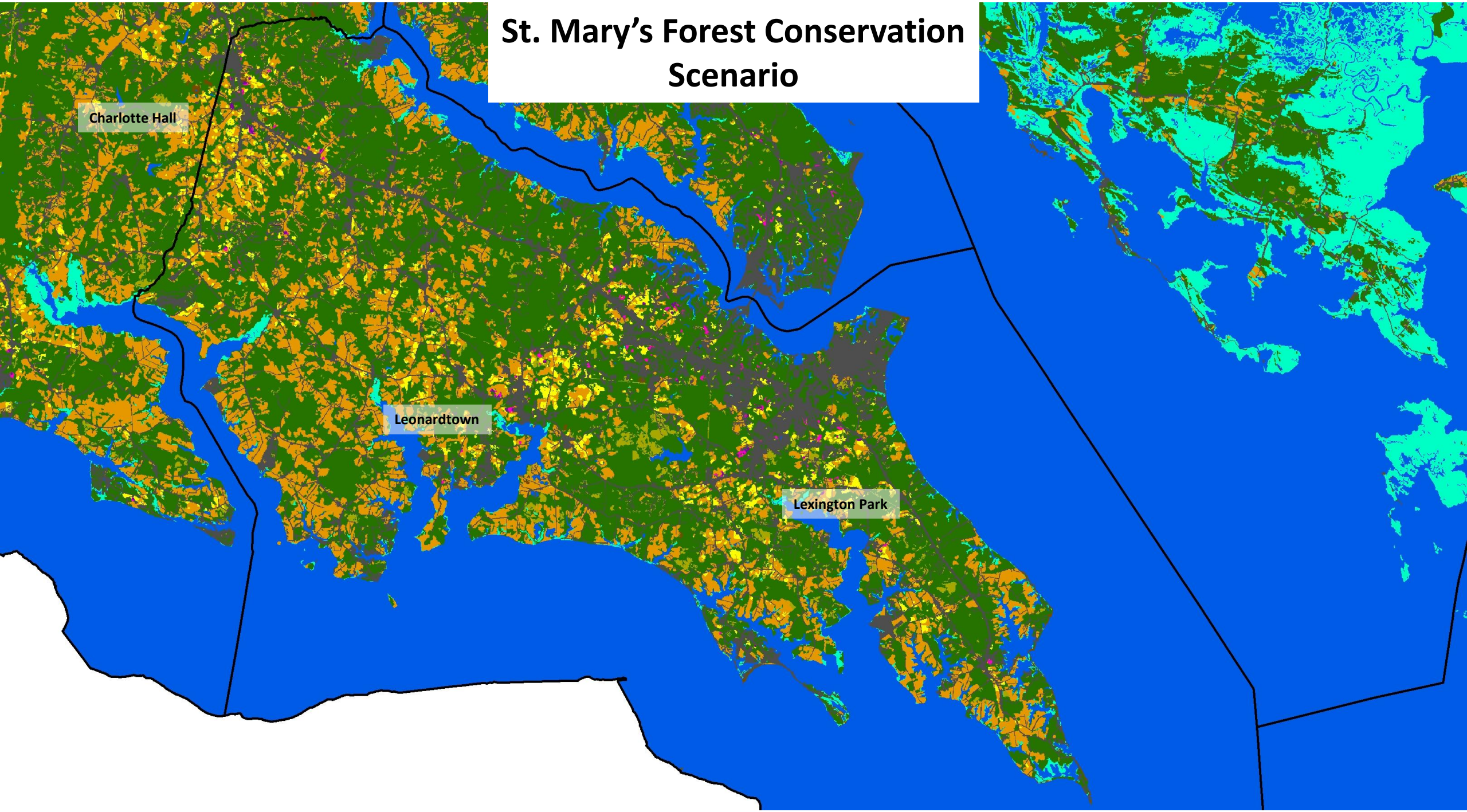


Thematic Scenario Results
2025 Land Use
Maryland

CBLCM Land Use (Maryland)					
Scenario	**Impervious**	**Pervious**	**Natural**	**Agriculture**	**Mixed Open**
Historic Trends (HT)	20,764	55,316	(35,737)	(35,235)	(5,136)
Forest Conservation (FCHT)	19,883	59,110	(25,074)	(46,709)	(7,212)
Growth Management (GMHT)	17,732	47,561	(27,709)	(32,649)	(4,953)
Agricultural Conservation (ACHT)	19,900	44,036	(53,781)	(8,668)	(1,467)
Current Zoning (CZ)	9,860	22,692	(16,559)	(14,135)	(1,867)
Forest Conservation with Zoning (FCCZ)	9,779	24,873	(11,994)	(19,758)	(2,903)
Growth Management with Zoning (GMCZ)	8,666	19,840	(13,393)	(13,313)	(1,807)
Agricultural Conservation with Zoning (ACCZ)	9,829	19,025	(24,738)	(3,543)	(577)

(negative values in parentheses)

St. Mary's Forest Conservation Scenario



Potential Nitrogen Reductions (lbs.) Due to Land Conservation
St. Mary's County, Maryland

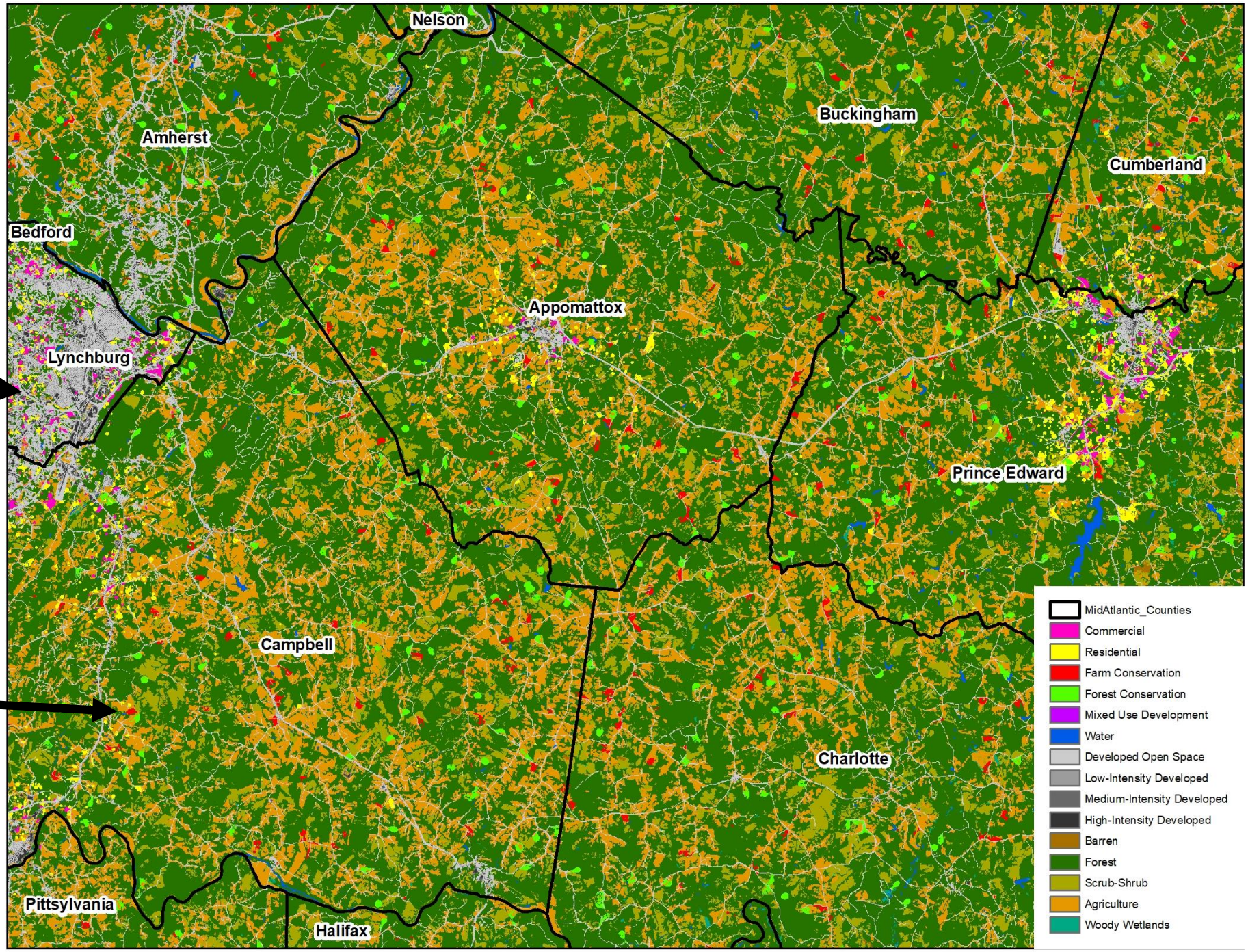
	Impervious	Pervious	Natural	Agriculture	Mixed Open	
FC vs HT	(185)	333	1,152	(1,107)	(193)	
Total Nitrogen (lbs/acre/yr)	9.8	5.9	1.8	26.0	3.5	
Difference in loads (lbs/yr)	(1,817)	1,966	2,074	(28,773)	(677)	(27,227)

	Impervious	Pervious	Natural	Agriculture	Mixed Open	
FC vs CZ	(89)	221	512	(548)	(96)	
Total Nitrogen (lbs/acre/yr)	9.8	5.9	1.8	26.0	3.5	
Difference in loads (lbs/yr)	(871)	1,304	922	(14,244)	(338)	(13,227)

Simultaneous Simulation of Development and Conservation

Commercial and Residential Growth

Farmland and Forest Conservation




USGS
science for a changing world