



 USGS



Chesapeake Bay Program
A Watershed Partnership

Thematic and Jurisdiction-Specific Land Use Scenarios

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Water Quality Goal Implementation Team

Chesapeake Bay Future Scenarios

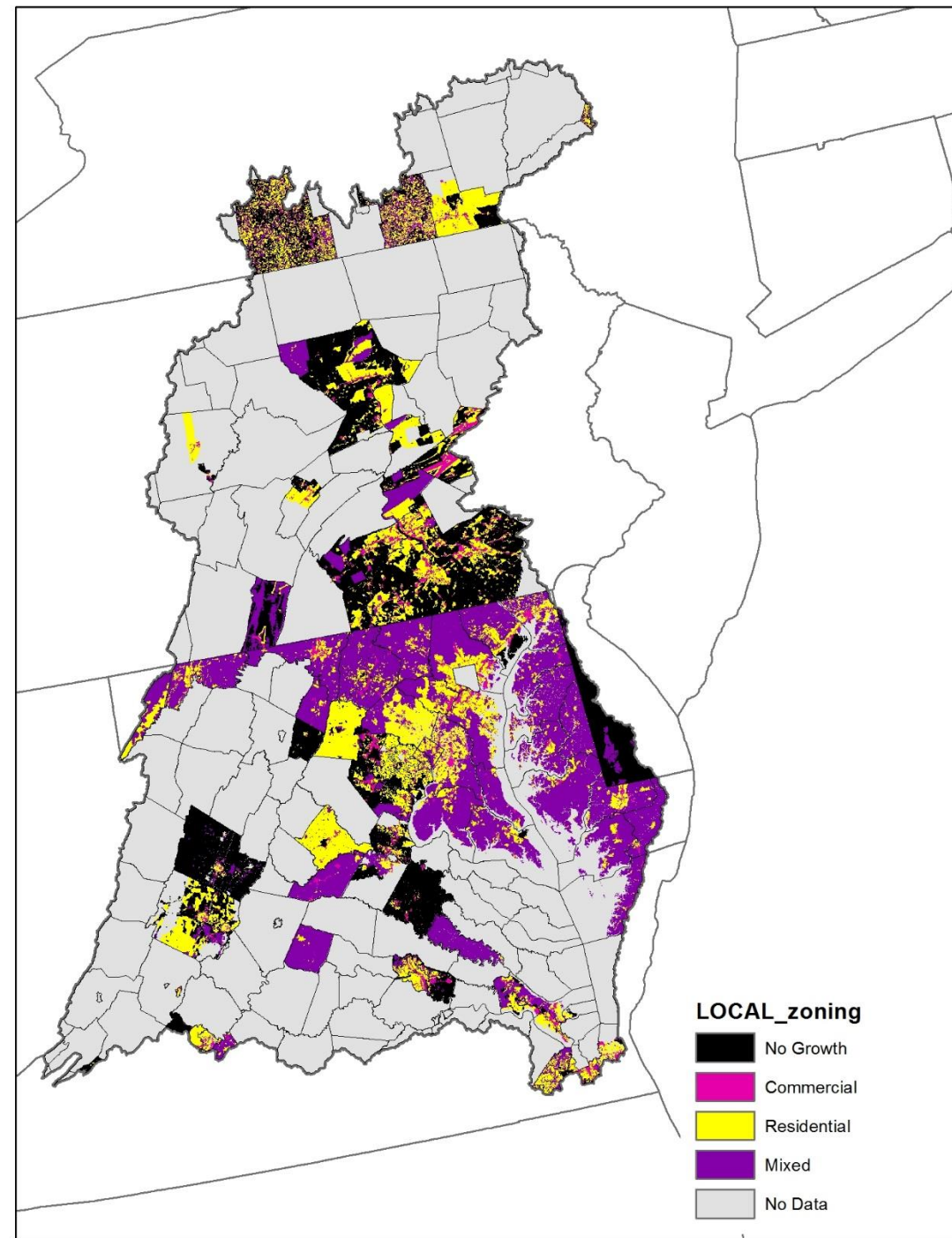
Historic Trends:

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.

Extent of Local Zoning Data



Collected by CBP from local and state agencies, 2013 - 2017

Alternative Future Thematic 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.

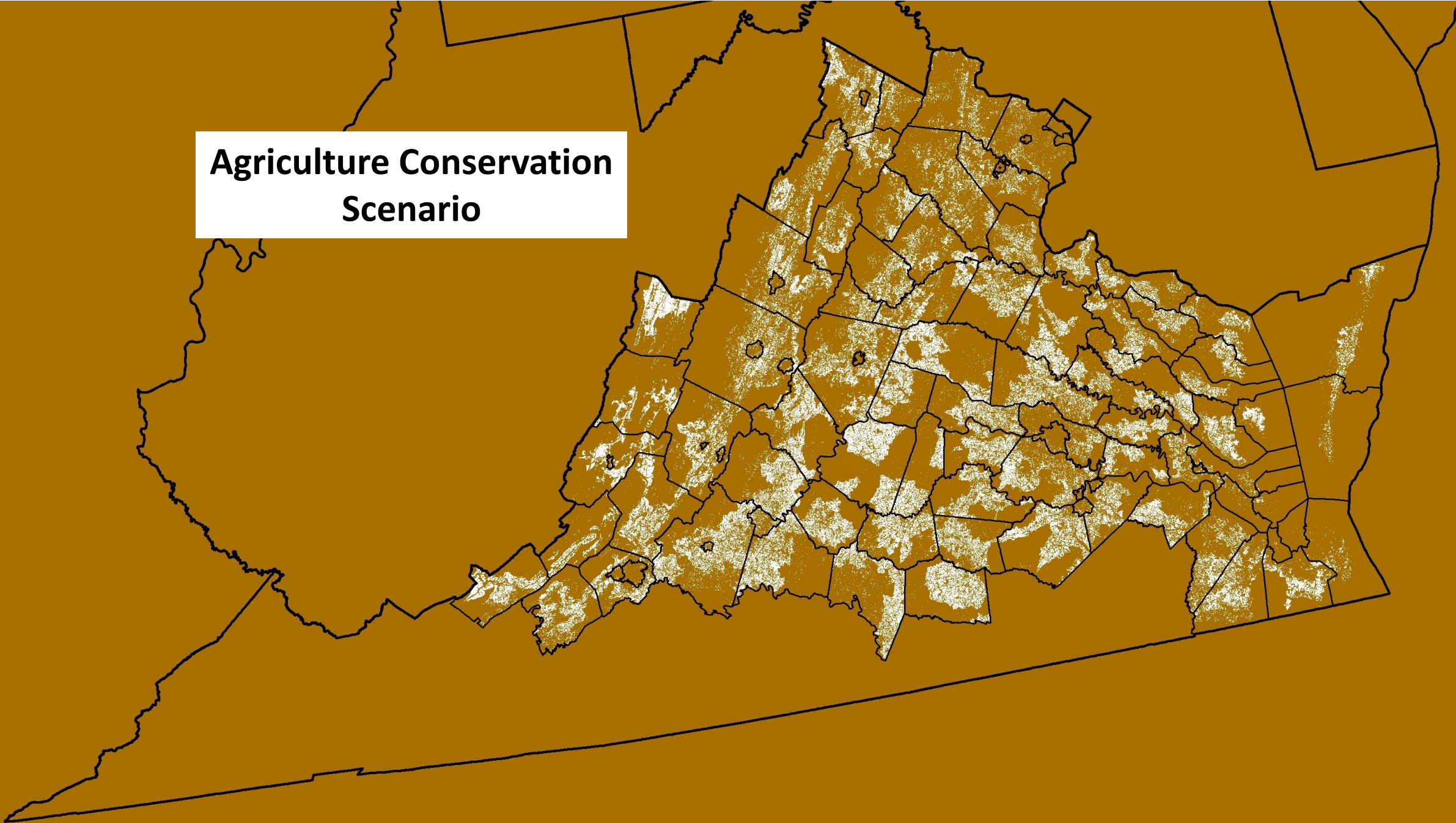
Chesapeake Bay Watershed Scenario Elements

- 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 \geq 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

**Agriculture Conservation
Scenario**



Virginia Thematic Scenario Results

2025 Land Use

VA	Developed	Natural	Agriculture	MixedOpen	AgOpenSpace	Septic
Historic Trends (HT)	142,438	(81,914)	(69,909)	(11,016)	20,402	71,685
Forest Conservation (FCHT)	146,996	(59,027)	(91,614)	(16,071)	19,717	72,075
Growth Management (GMHT)	117,166	(63,359)	(65,251)	(9,131)	20,576	16,009
Agricultural Conservation (ACHT)	118,713	(98,976)	(38,046)	(3,314)	21,623	71,398
Current Zoning (CZ)	114,974	(67,738)	(60,334)	(7,677)	20,776	65,824
Forest Conservation with Zoning (FCCZ)	113,443	(46,588)	(76,760)	(10,369)	20,275	64,381
Growth Management with Zoning (GMCZ)	91,887	(50,224)	(56,254)	(6,348)	20,941	13,900
Agricultural Conservation with Zoning (ACCZ)	92,603	(78,464)	(33,799)	(2,098)	21,759	61,587
2013 Conditions	2,126,215	11,085,359	2,787,699	348,449	72,739	483,839

(negative values in parentheses)

Relative Nutrient Export Rates



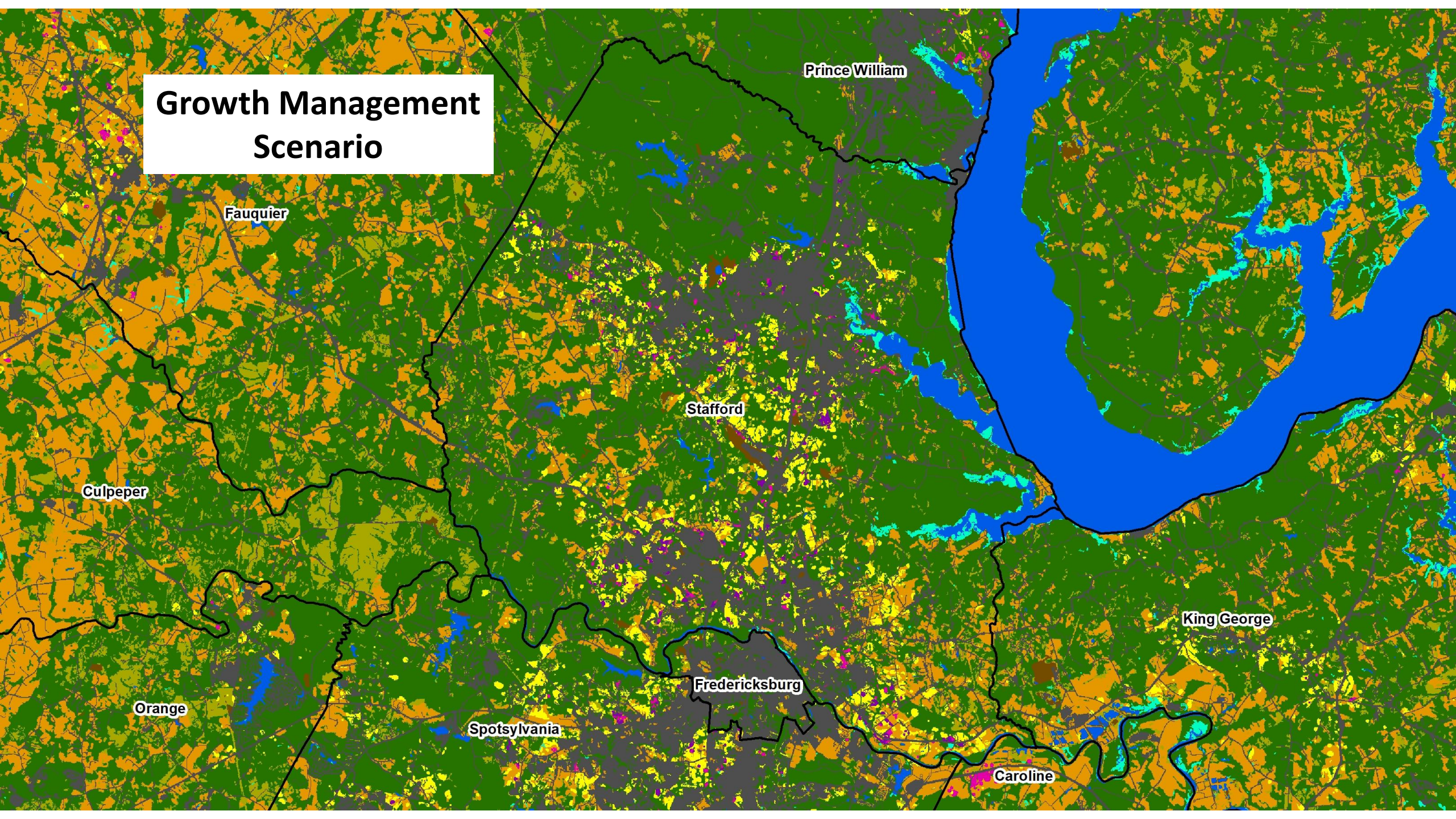
* Includes impervious surfaces (roads, rooftops, parking lots), pervious surfaces (turf grass), and land under construction.

Virginia Thematic Scenario Results

No Action, Edge-of-Tide Change in Total Nitrogen Loads 2013 – 2025

VA_NoAction	Developed	Natural	Agriculture	MixedOpen	AgOpenSpace	Other	Septic	NetChange
Historic Trends (HT)	642,604	(159,955)	(706,971)	(7,882)	30,432	88,745	899,408	786,381
Forest Conservation (FCHT)	645,650	(145,964)	(829,663)	(11,512)	29,515	76,539	894,080	658,645
Growth Management (GMHT)	519,166	(149,195)	(679,436)	(6,562)	30,719	45,328	640,161	400,181
Agricultural Conservation (AHT)	509,465	(169,822)	(513,150)	(1,444)	32,365	97,459	905,541	860,414
Current Zoning (CZ)	522,067	(152,760)	(657,970)	(5,557)	30,991	72,095	868,063	676,929
Forest Conservation with Zoning (FCCZ)	493,798	(138,866)	(749,498)	(7,571)	30,307	59,859	854,765	542,794
Growth Management with Zoning (GMCZ)	393,725	(141,700)	(629,777)	(4,451)	31,298	33,025	624,503	306,623
Agricultural Conservation with Zoning (ACCZ)	394,318	(159,032)	(491,777)	(366)	32,573	75,428	851,514	702,658
2013 Conditions	10,940,293	7,322,390	23,556,722	298,976	104,110	7,140,779	2,027,163	-

Growth Management Scenario



Prince William

Fauquier

Stafford

Culpeper

King George

Orange

Spotsylvania

Fredericksburg

Caroline

Potential Pollution Reductions

2017 Progress, Current Zoning Scenario

Stafford County, Virginia

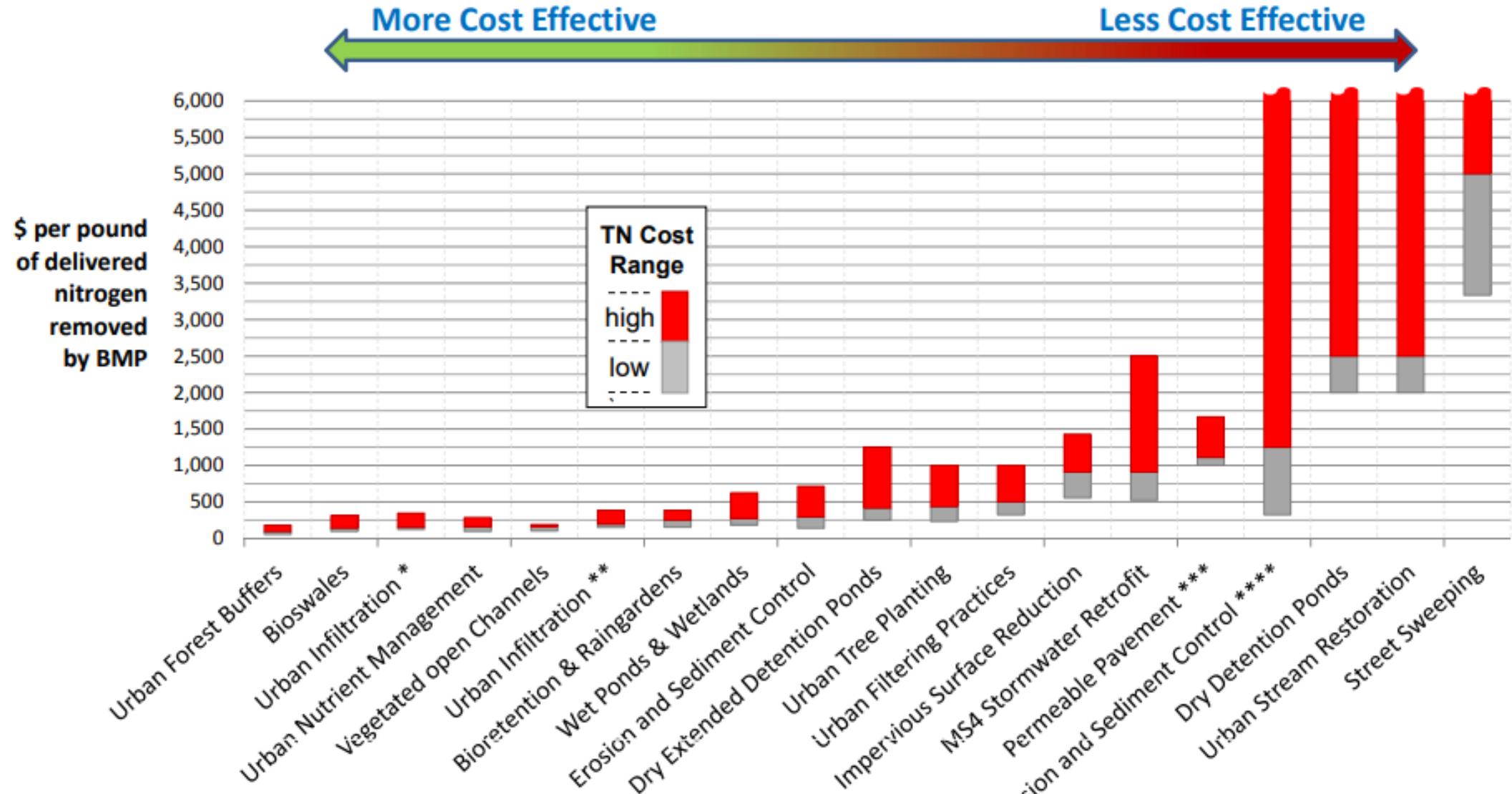
Nitrogen

Current Zoning	base
+ Forest Conservation	- 28,915
+ Growth Management	- 32,823
+ Agricultural Conservation	- 6,540

Phosphorus

Current Zoning	base
+ Forest Conservation	- 2,326
+ Growth Management	- 1,100
+ Agricultural Conservation	- 1,014

Range in Costs for Reducing 1 Pound of Nitrogen



* with sand & vegetation, no underdrain
 ** with sand & vegetation, no underdrain

*** on A or B soils, with underdrain
 **** on extractive land use

Potential Pollution Reductions

2017 Progress, Current Zoning Scenario
Stafford County, Virginia

Nitrogen

Current Zoning
+ Forest Conservation
+ Growth Management
+ Agricultural Conservation

base
- 28,915
- 32,823
- 6,540

Cost Savings!

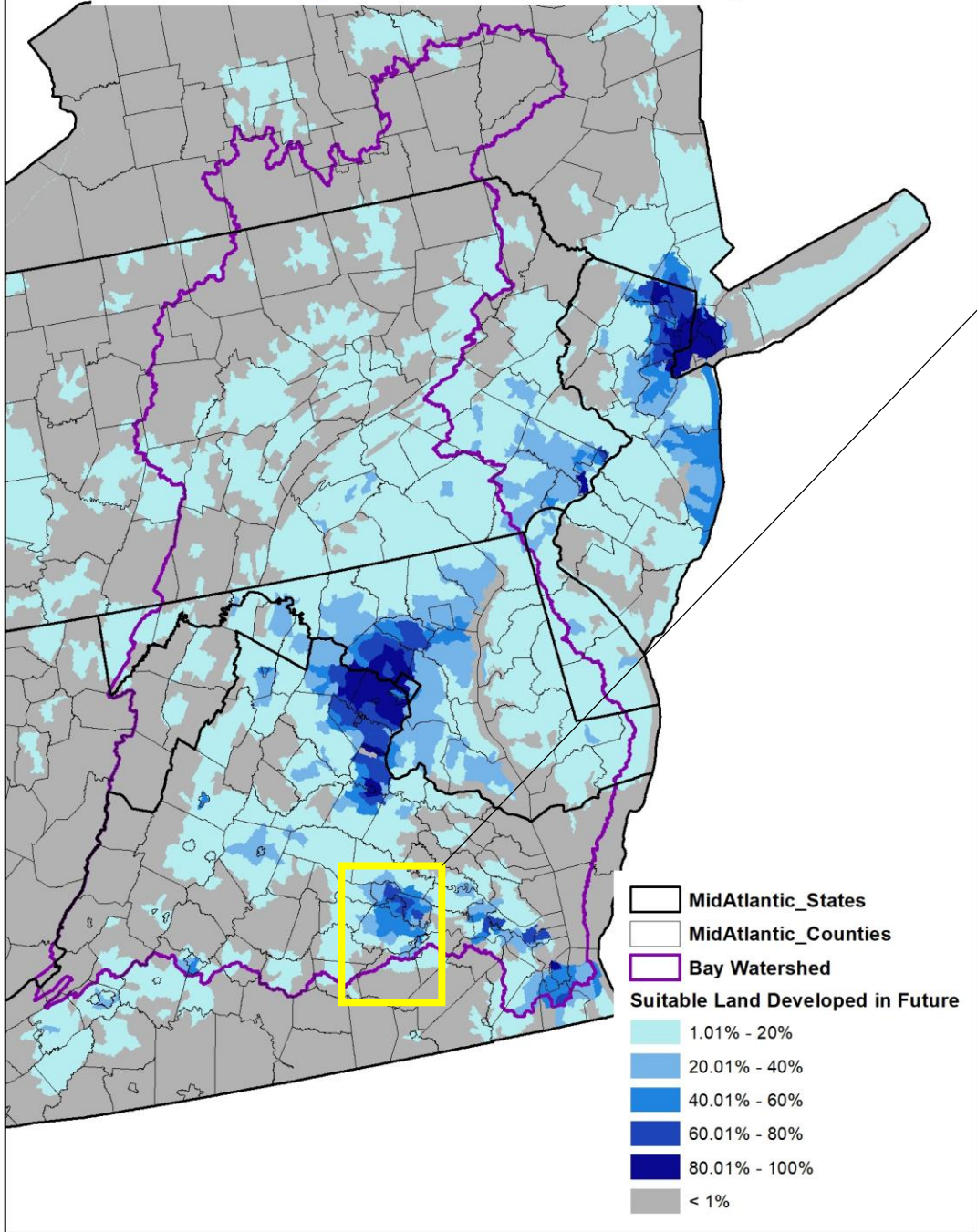
Phosphorus

Current Zoning
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base
- 2,326
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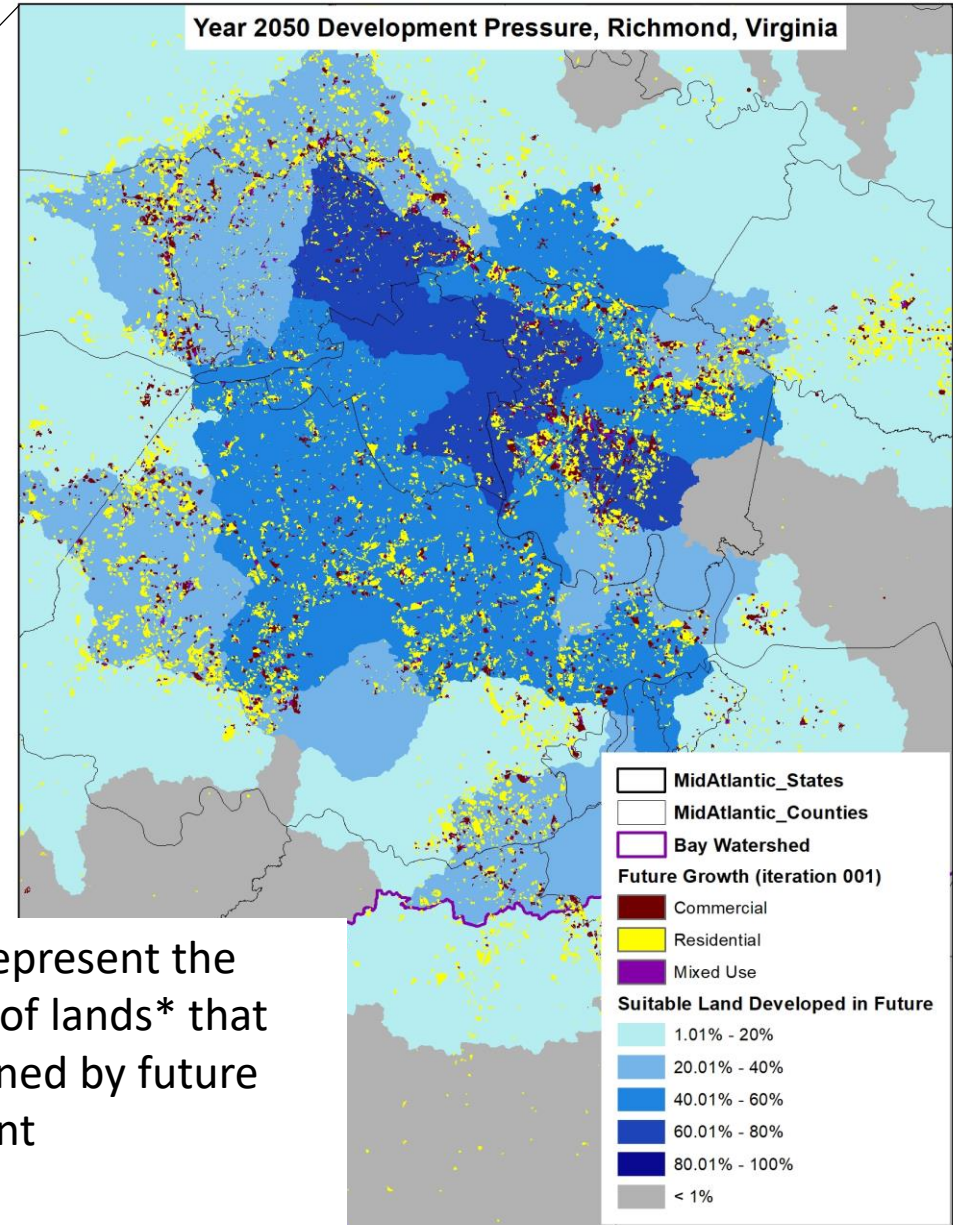


Year 2050 Development Pressure, Chesapeake Bay Watershed



Exposure to the threat of land conversion

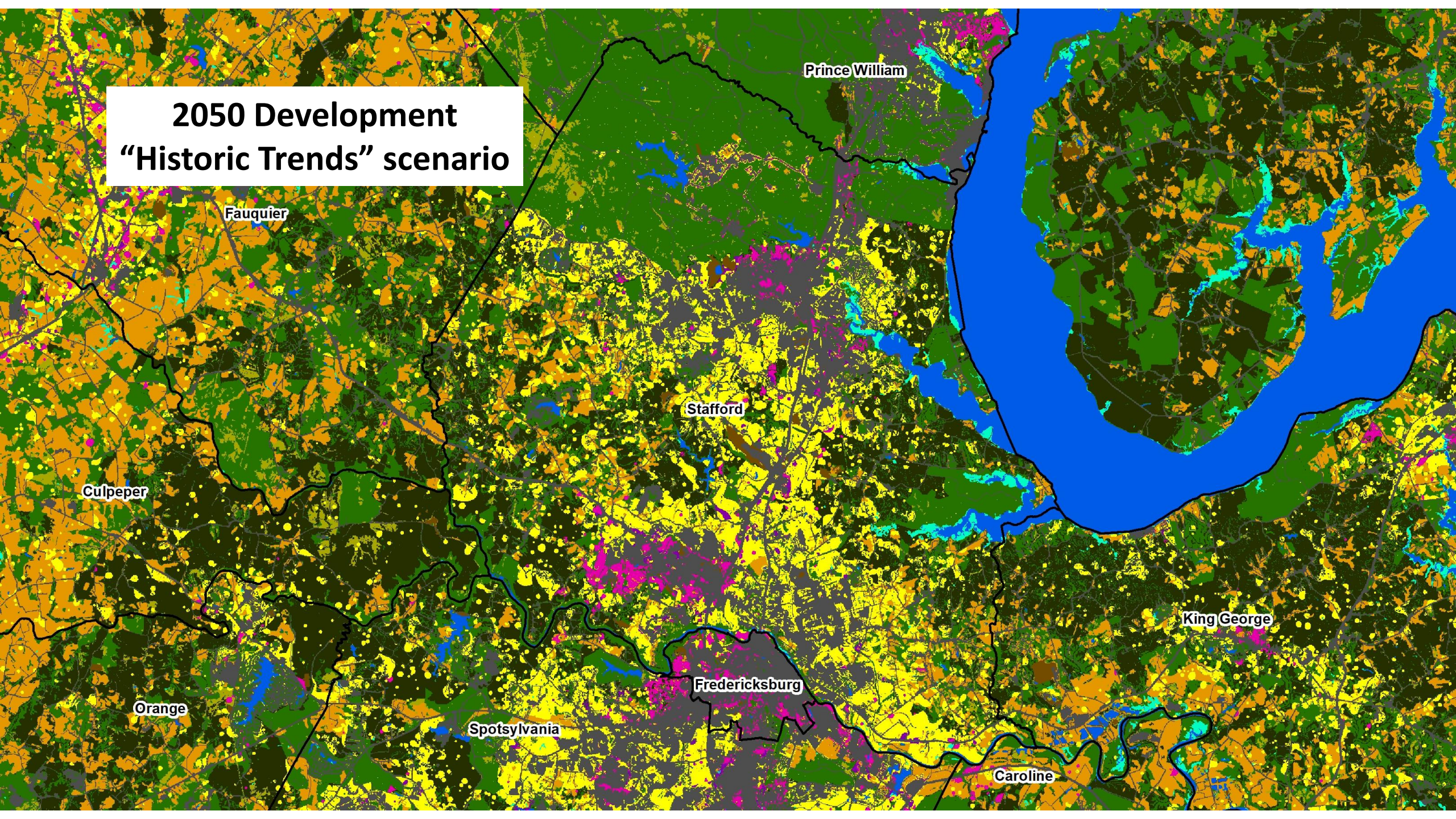
Year 2050 Development Pressure, Richmond, Virginia



Blue tints represent the proportion of lands* that are threatened by future development

* Land refers to areas that are suitable for near-term development

2050 Development "Historic Trends" scenario

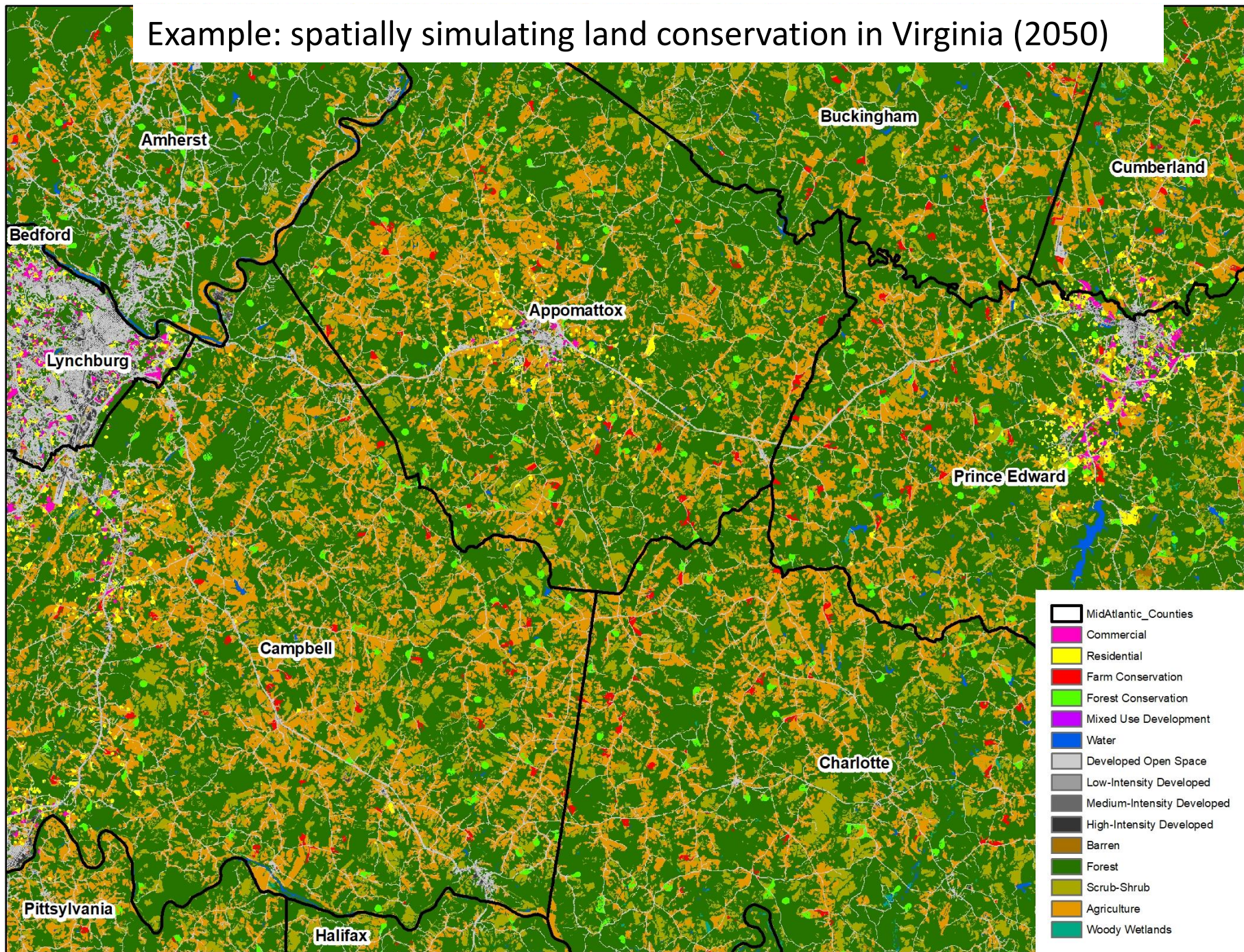


Jurisdiction-Specific Scenarios

Pennsylvania- Final (using “Current Zoning” scenario as baseline):

- Conserve riparian zones (default width = 30m)
- Conserve wetlands (NWI, State Designated Wetlands, and Potential Conservable Wetlands (PA only))
- 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 buffer)
- Avoid growth on soils unsuitable for septic systems
- Stochastically simulate rate of forest conservation by County based on participation in state programs and land trust activities.
- Stochastically simulate rate of farmland conservation by County on participation in state programs and land trust activities.

Example: spatially simulating land conservation in Virginia (2050)



Jurisdiction-Specific Scenarios

Delaware- Draft (using “Current Zoning” scenario as baseline):

- Conserve riparian zones (default width = 30m, **exclude tax ditches and irrigated farmland** (need tax ditch dataset, irrigated farmland data will be sought from USGS))
- Conserve wetlands (need **Delaware dataset on state-mapped wetlands-** including whale wallows)
- 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 = 1/2 mile buffer)
- Conserve all large forest tracts in Legacy areas (need **parcel data with tax exemptions**. Lori will confirm average size of conserved parcels, 20 acres?)
- 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 **10% (by area or in proportion to locally forecasted growth and using probability as weighted cost surface)**
- 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 all irrigated farmlands (data from USGS)**
- Conserve all high-value farmland identified by the Chesapeake Conservation Partnership

Jurisdiction-Specific Scenarios

Virginia- Draft (using “Current Zoning” scenario as baseline):

- Conserve riparian zones (100-ft) and/or that meet Virginia Land Conservation Fund ranking criteria
- Conserve wetlands (NWI, State Designated Wetlands)
- Conserve all large tracts (100+ acres with high conservation value)
- Identify locality designated growth areas based upon adopted comprehensive plans and existing infrastructure, such as water and sewer service areas and transportation corridors.
- Provisions for clustering of single-family dwellings and preservation of open space developments,
- Conserve designated open space areas
- Concentrate urban development in areas of the county with existing infrastructure
- Protect areas designated as rural conservation zones.
- Simulate potential for increase in growth area boundaries based upon approved locality capital improvement programs, regional transportation priority projects lists, and other approved local or regional plans
- Simulate a 10% increase in land included within designated growth areas by 2025
- Simulate a 10% increase in the amount of infill and redevelopment for 2025
- Simulate a 10% increase in the density of the urban growth area by 2025
- Simulate expansion of sanitary sewer service areas to extent of growth area boundaries by 2025
- Conserve all designated Agricultural and Forestal Districts as defined by § 58.1-3230
- Conserve 100-year floodplain
- Conserve prime farmlands and farmland of state importance (100 acres or more)

Jurisdiction-Specific Scenarios

District of Columbia-Final (using “Current Zoning” scenario as baseline):

- Restrict new development to areas where local forecasts indicate stormwater management regulations will be triggered by future development and/or redevelopment activities.

Maryland- Draft (using “Current Zoning” scenario as baseline):

- Develop three scenarios reflecting different levels of planning and land conservation actions.

Examples:

1. Current Regulatory/Funding Scenario;
2. Current Policy Scenario (+ Scenario 1);
3. Aspirational Approaches (+ Scenarios 1 & 2)

West Virginia (using “Current Zoning” scenario as baseline):

- Under development

New York (using “Current Zoning” scenario as baseline):

- Under development

Remaining Scenario Tasks- Summer 2018

1. Complete State-specific Scenarios

- Obtain jurisdiction-specific data for scenarios.
- Simulate expected rates of forest and farmland conservation by county.
- Translate conservation priority maps into future conservation probability maps
- Obtain annual rates of conservation, average sizes of conserved parcels, and contextual rules informing the location of future conservation efforts.

2. Develop verification protocols

- Monitor land cover and land use change every two years.
- Explore options for tracking conservation and planning actions