

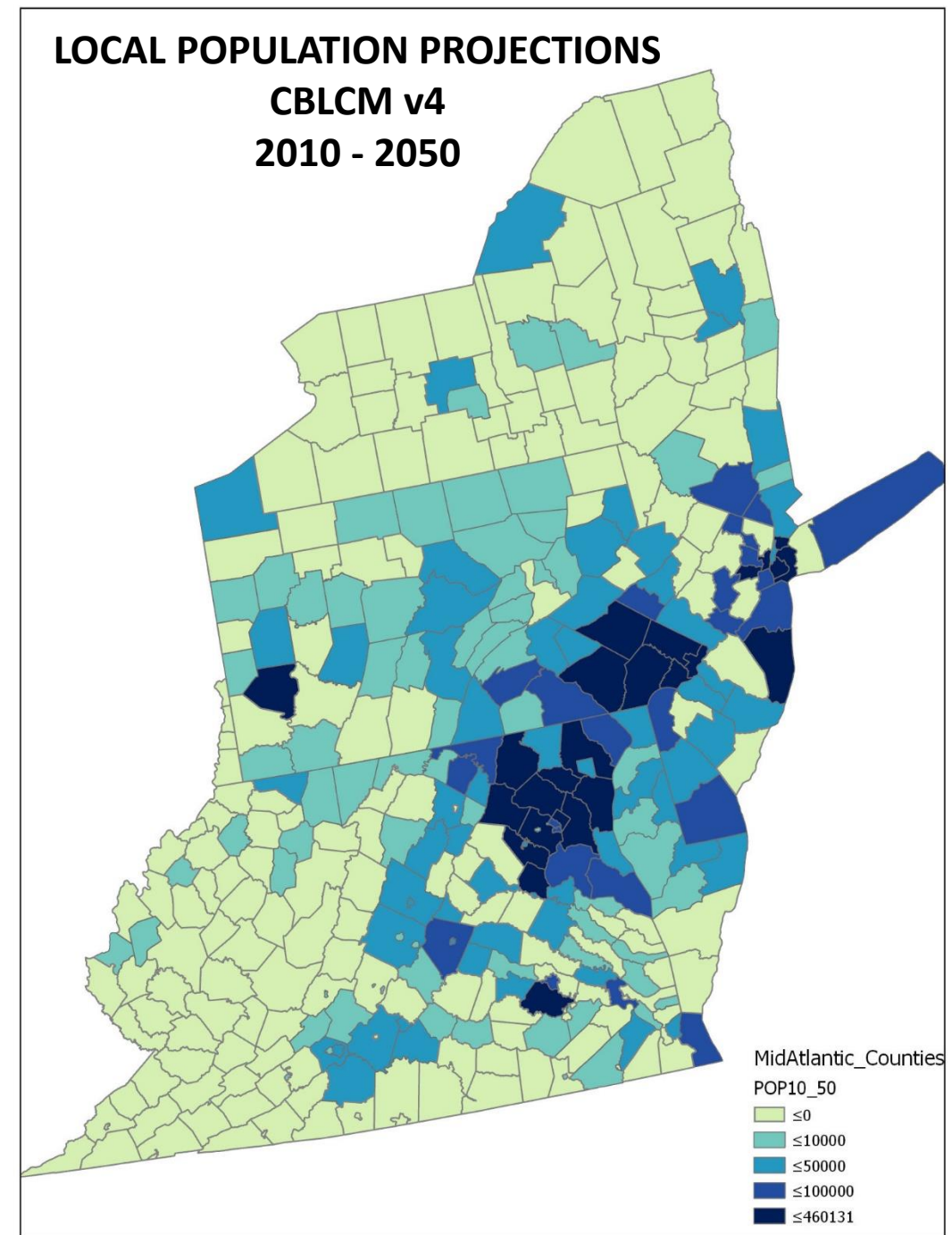
Chesapeake Bay Land Change Model (CBLCM): Overview

Peter Claggett, Labeeb Ahmed, and Sarah McDonald
U.S. Geological Survey

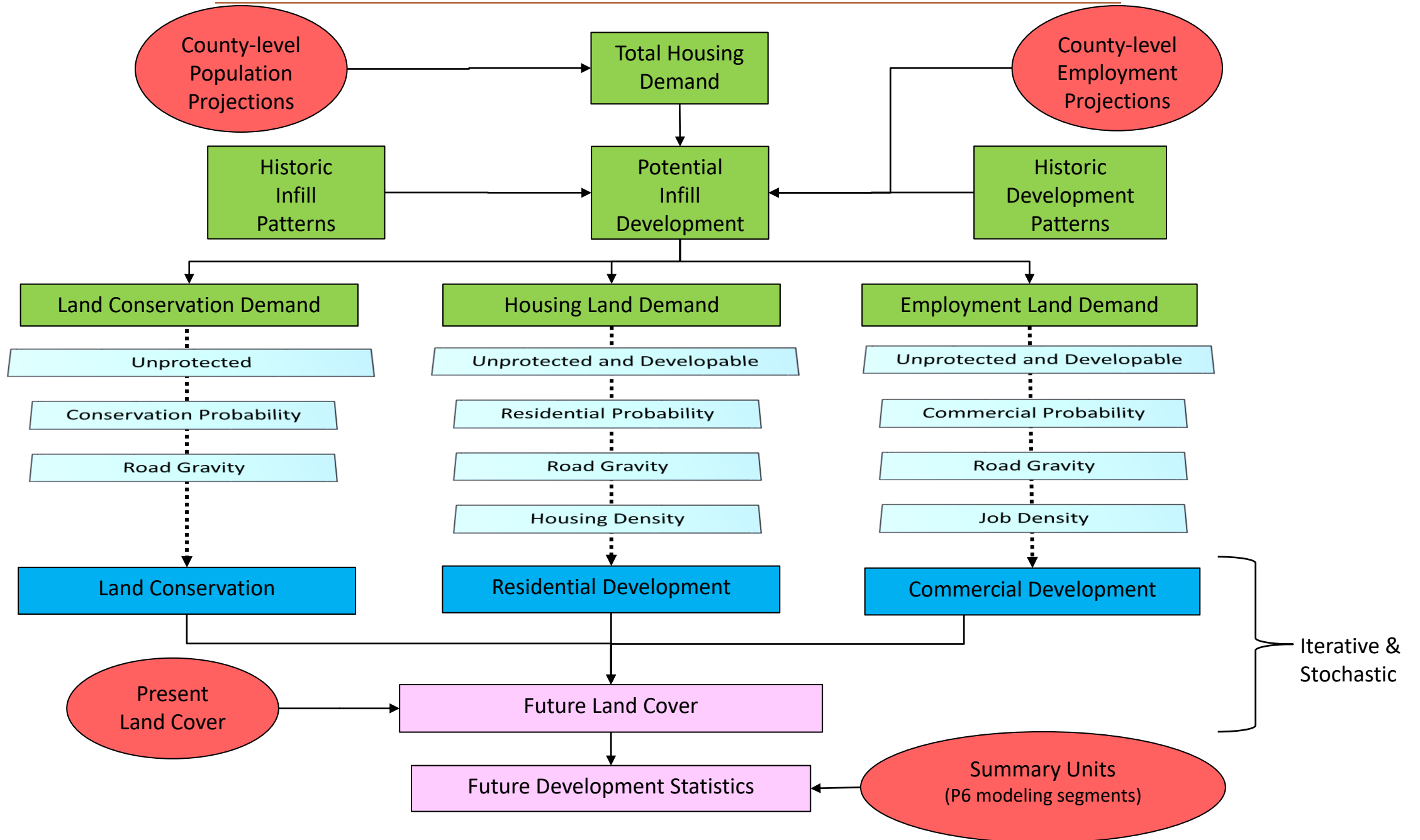
Land Use Workgroup Meeting
November 3, 2021

Modeling the Effects of Population Growth on Land Use Change and Pollutant Loads

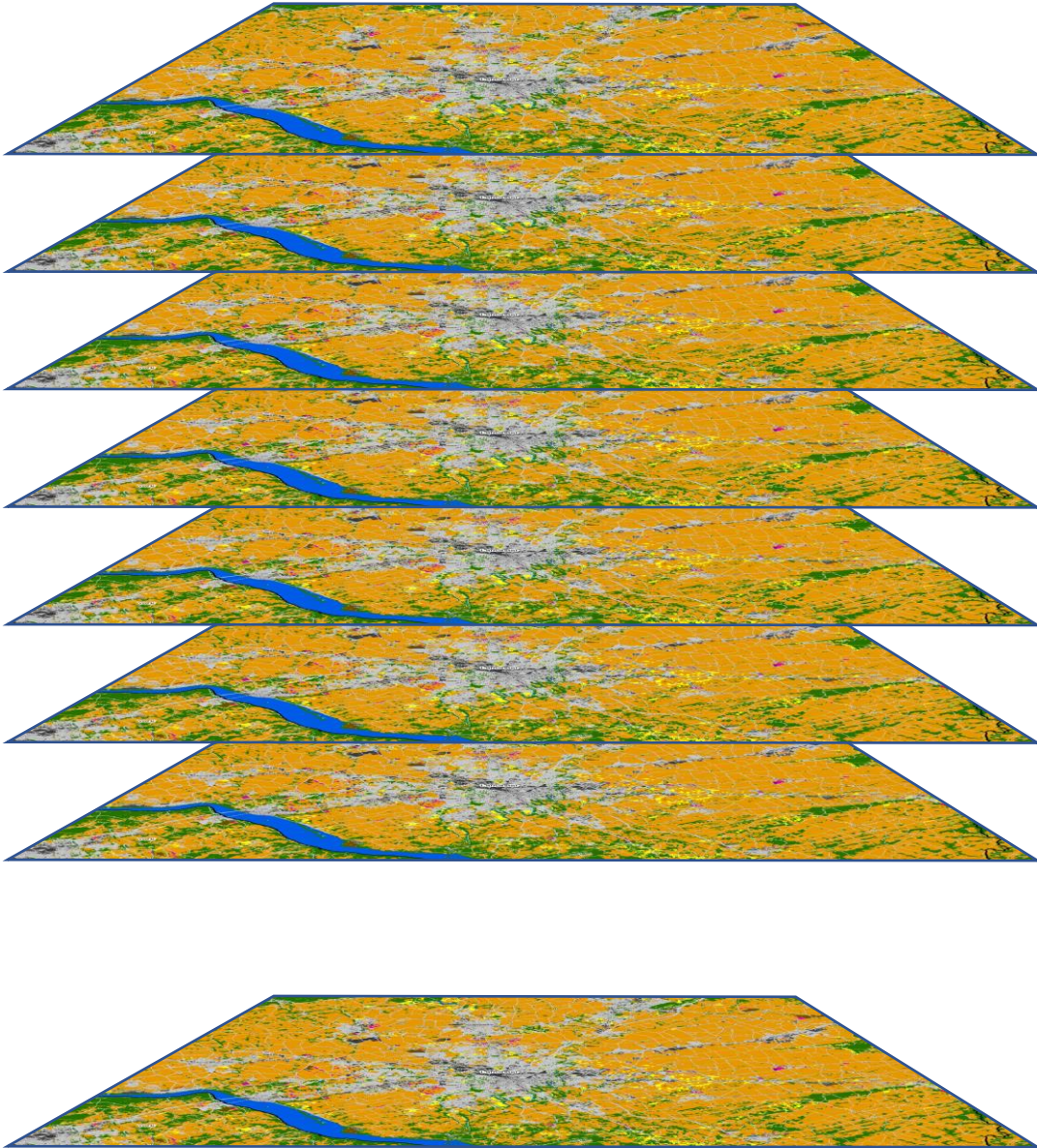
Modeling Assumption:
Urban development results from growth in
population and employment.



Chesapeake Bay Land Change Model v5



Multiple Stochastic Iterations





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

Average of simulations by summary unit = future development

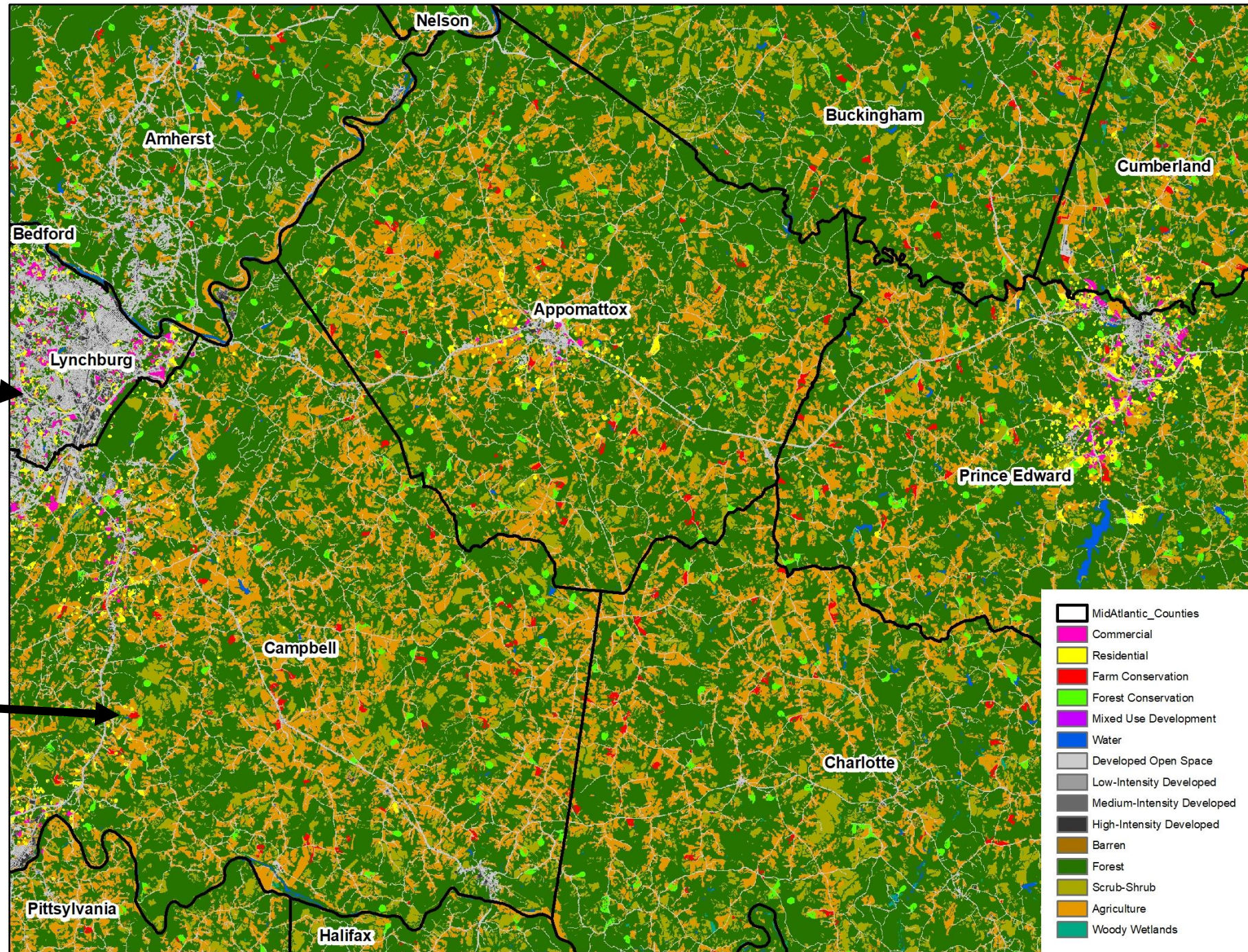
Relative Standard Deviation = estimate of uncertainty

Land Change Model Outputs

Commercial  and Residential  Growth

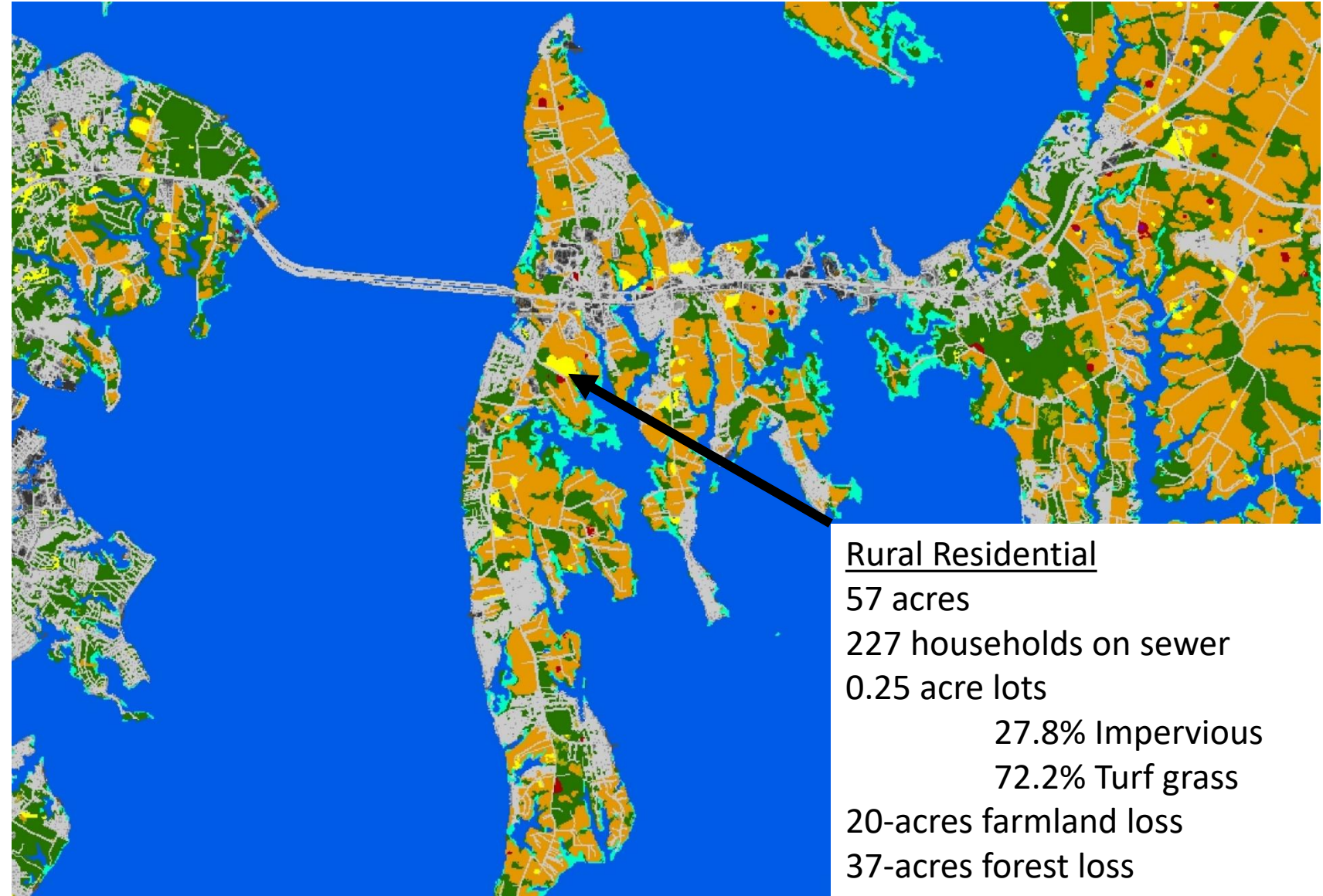


Farmland  and Forest  Conservation



Land Change Model Outputs: Summary Statistics

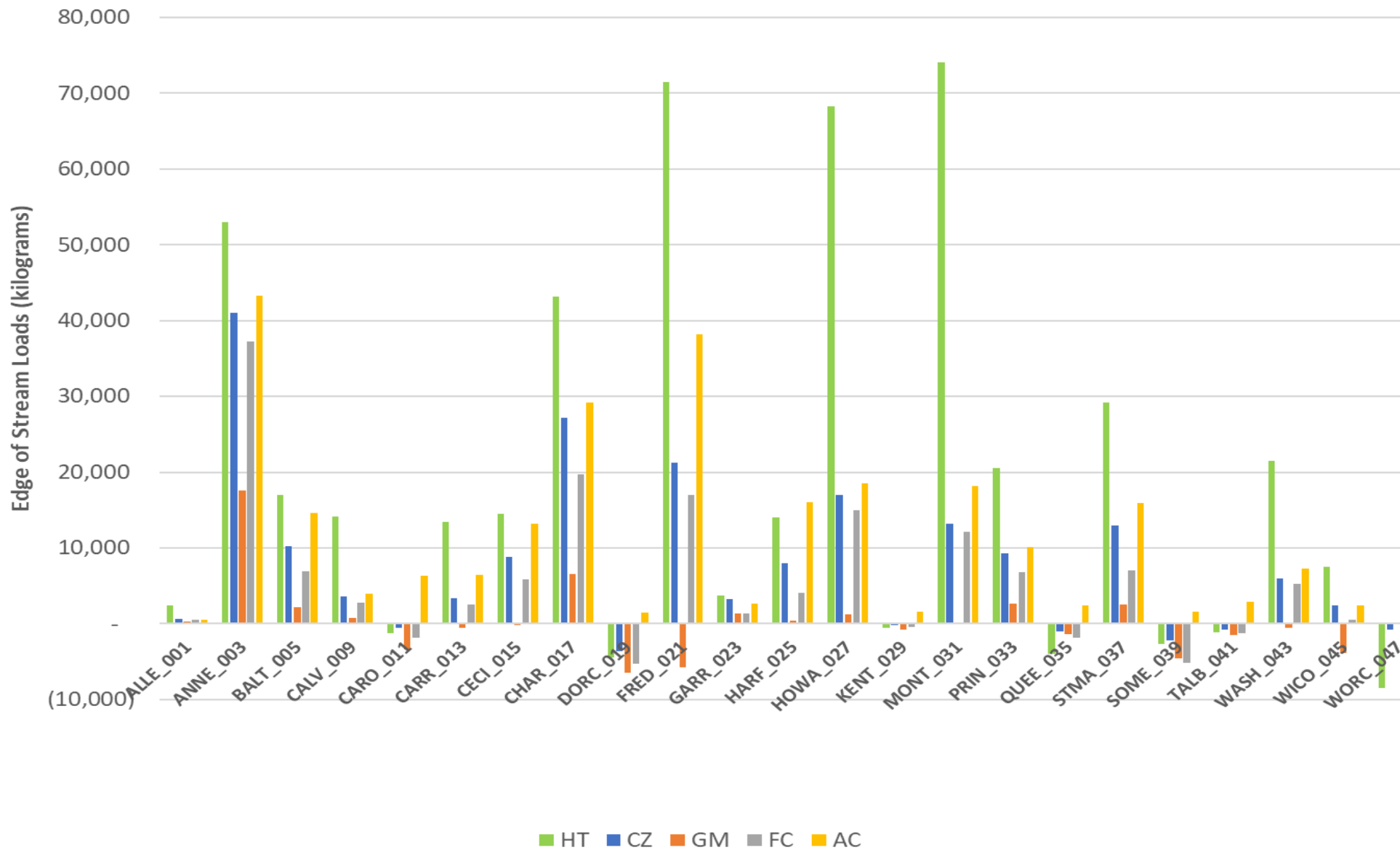
- Impervious surface and turf grass expansion
- Forest conversion to development
- Farmland conversion to development
- Future population on sewer and septic



Forecasted Land Use Change in Maryland, 2013-2025, under five different scenarios

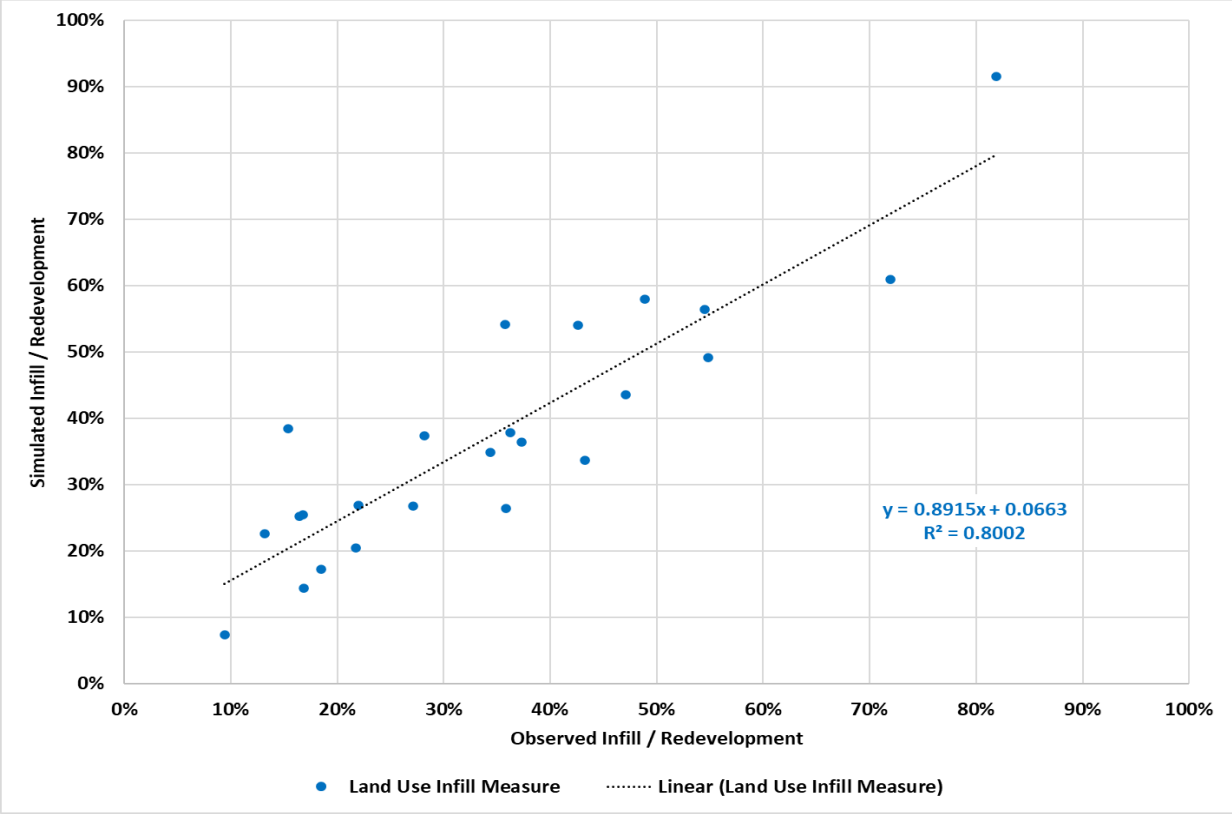


Total Nitrogen

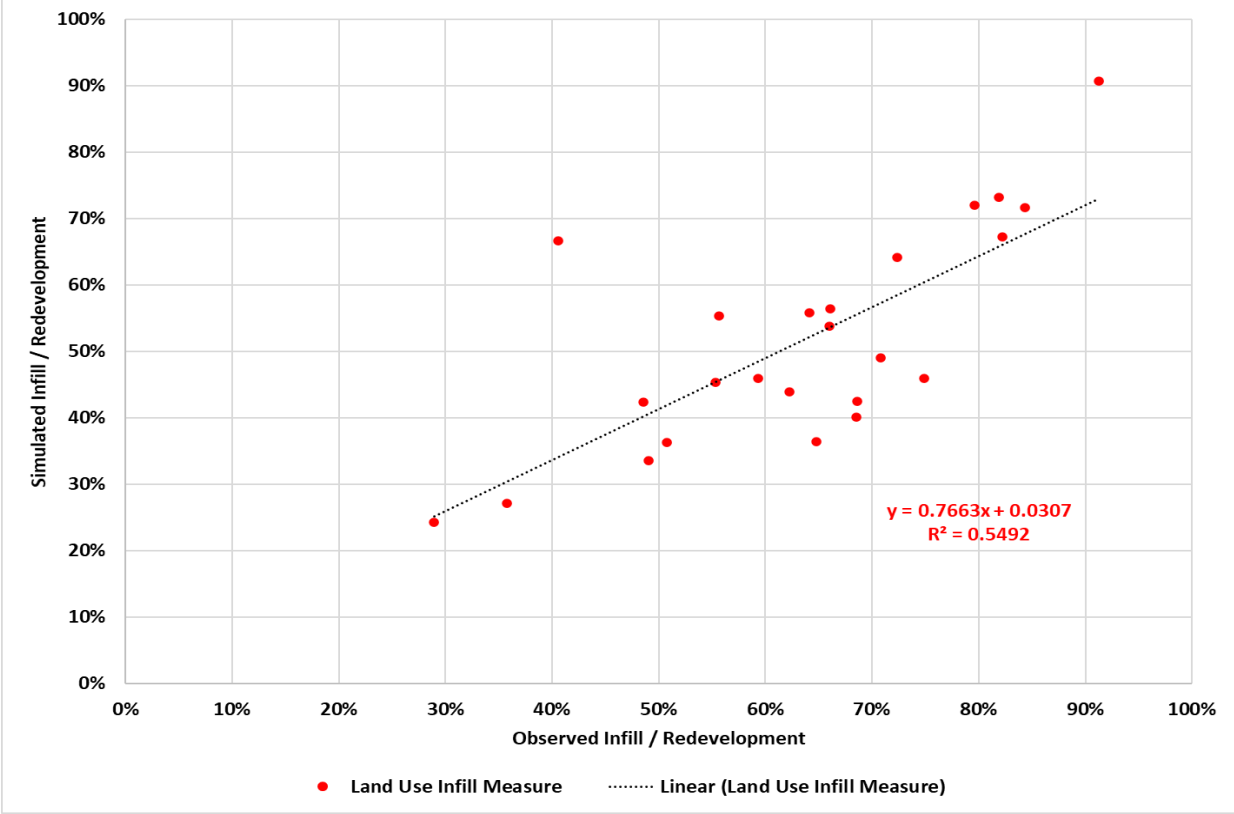


Model Validation: Infill/Redevelopment (Historic Trends Scenario)

Residential Infill

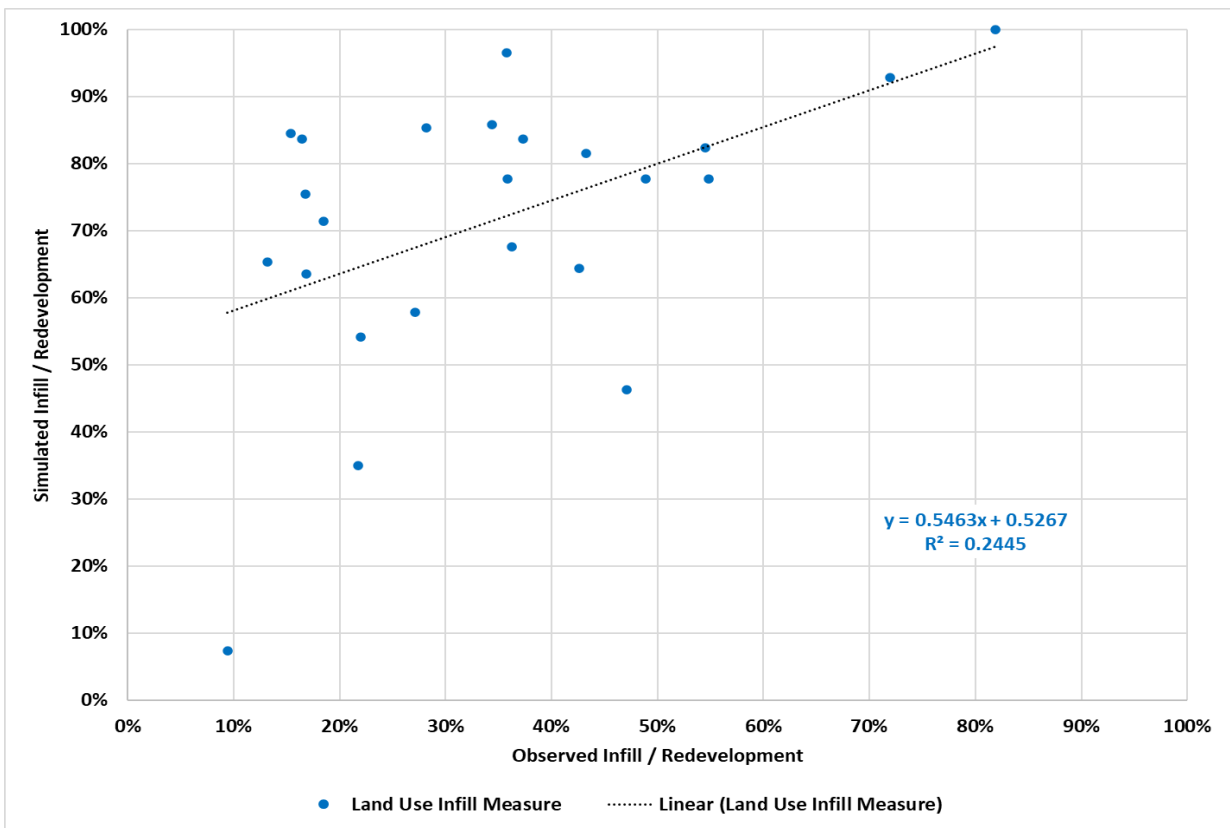


Commercial Infill

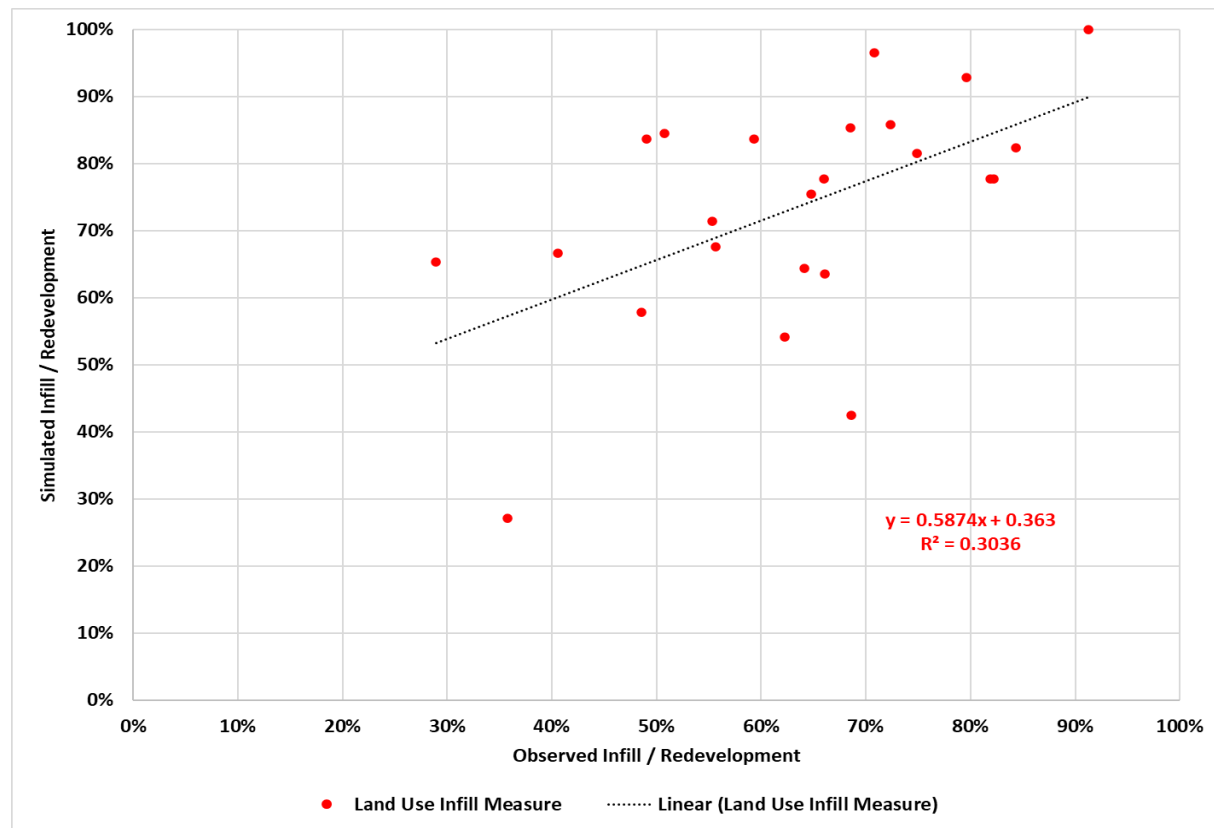


Model Validation: Infill/Redevelopment (Current Zoning Scenario)

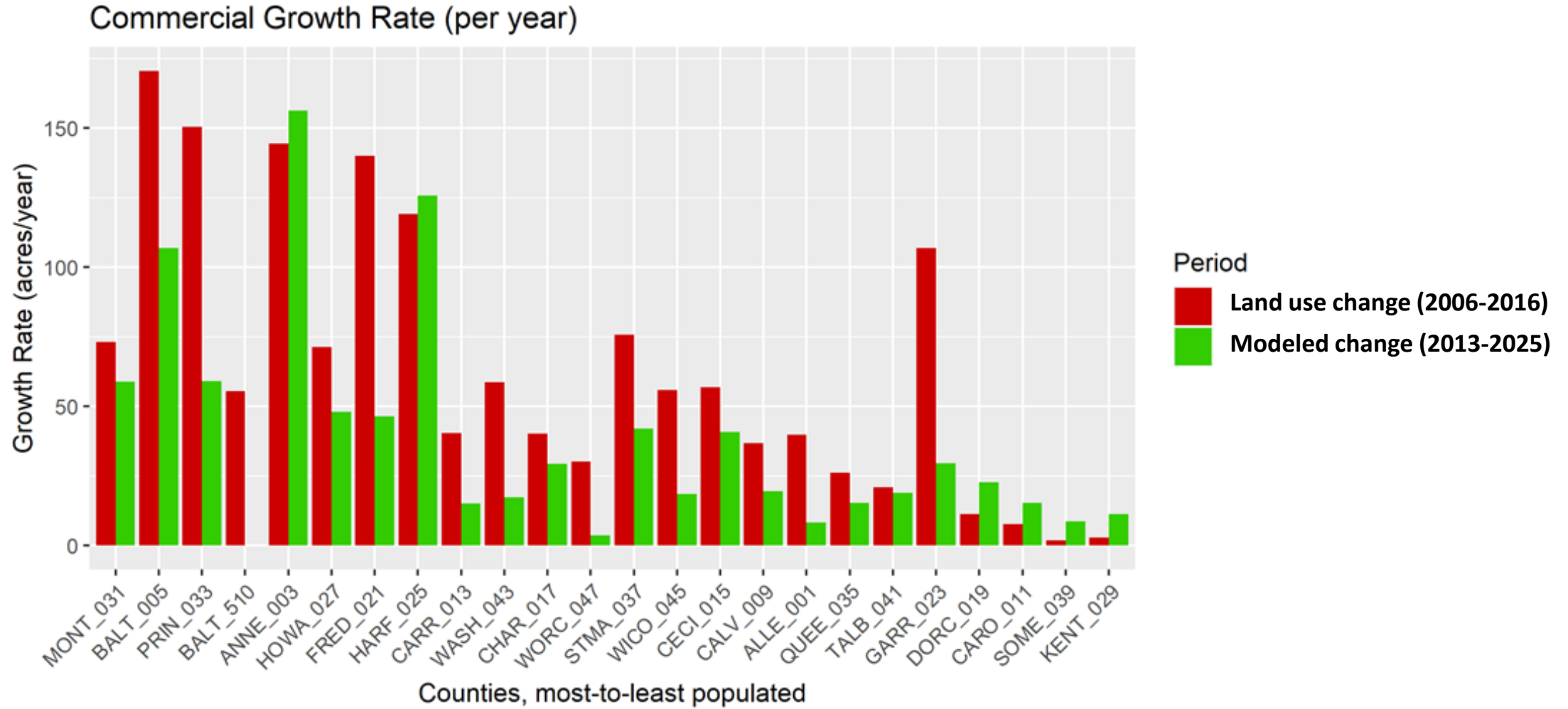
Residential Infill



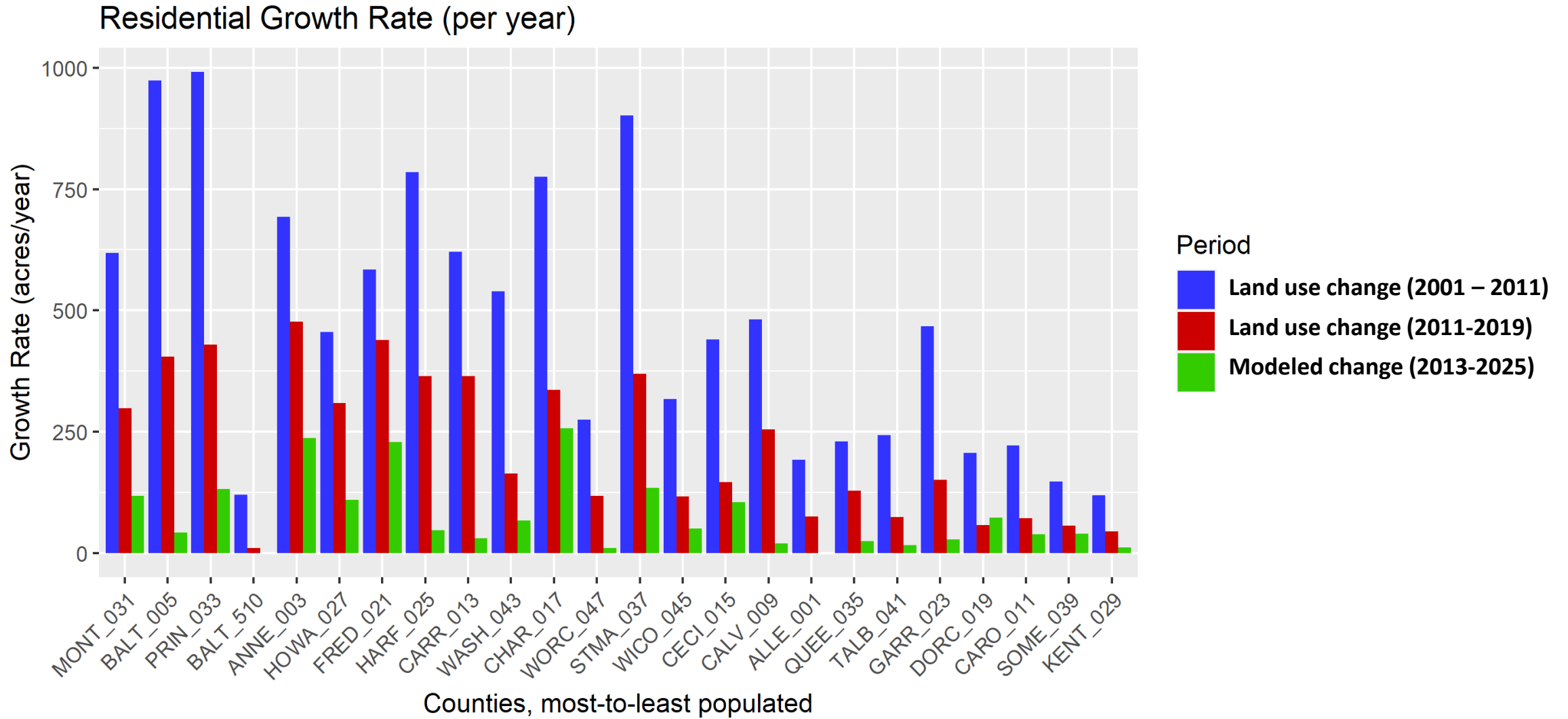
Commercial Infill



Model Validation: Commercial Growth

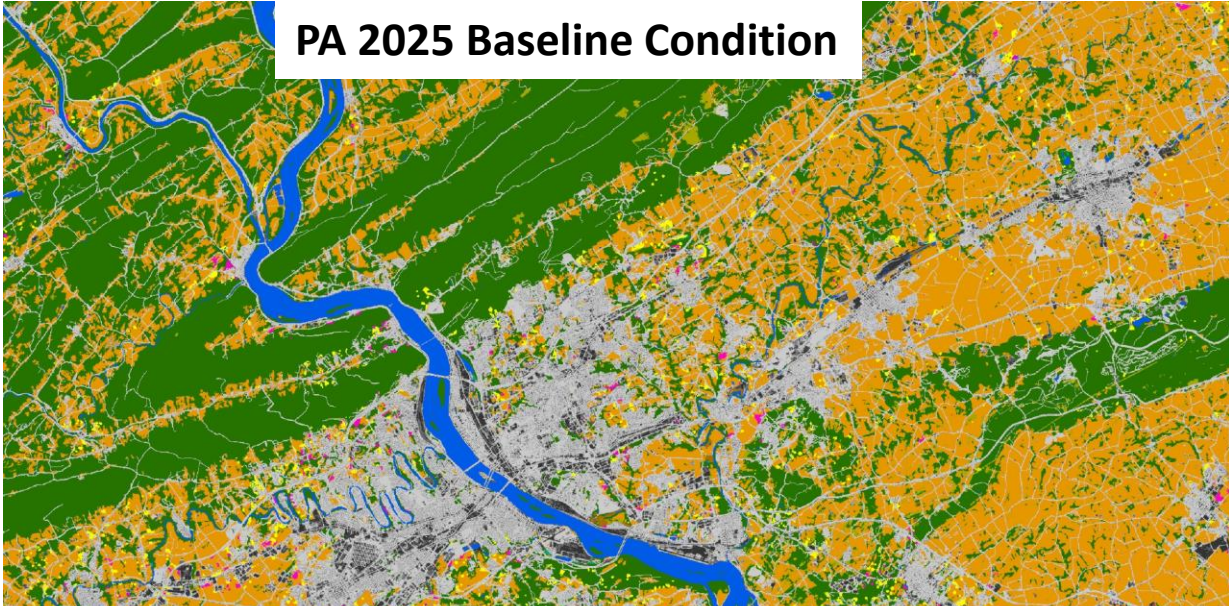


Model Validation: Residential Growth

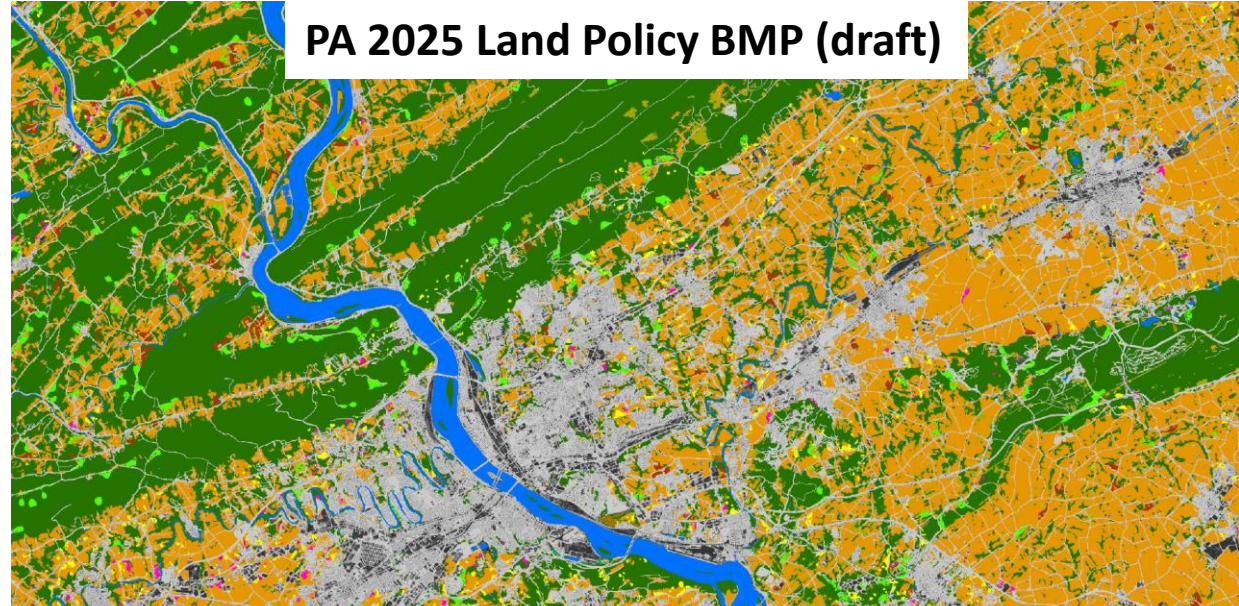


Crediting Land Conservation and Planning towards Water Quality Improvement

PA 2025 Baseline Condition



PA 2025 Land Policy BMP (draft)



**Difference in land use translated into a change in pollutant loads =
Water quality credit afforded to land conservation and land use planning**

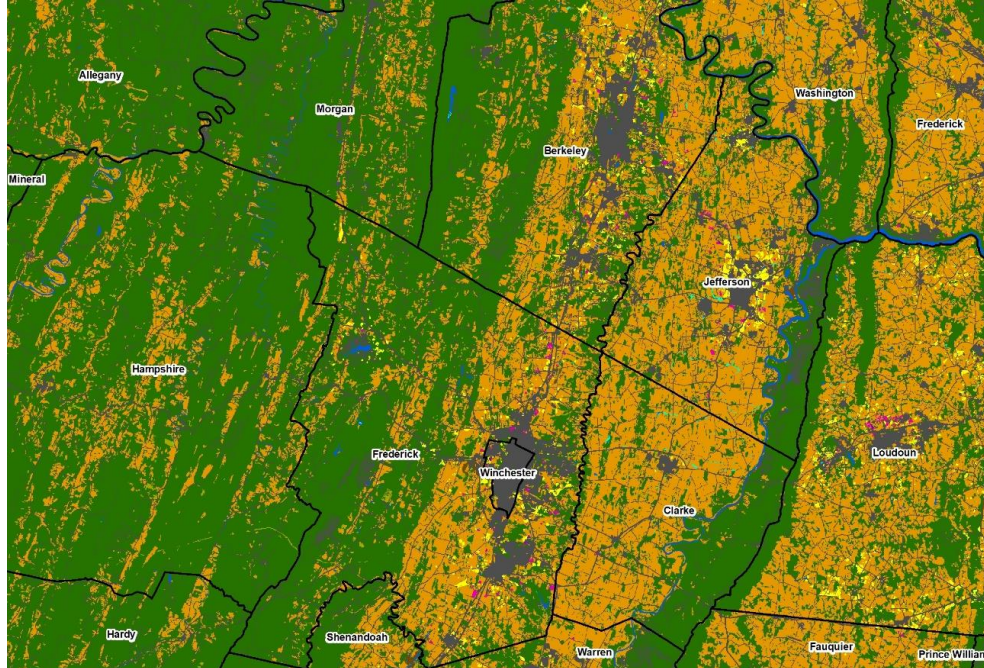
LandPolicyBMP	TN (lbs/yr)	TP (lbs/yr)	TSS (lbs/yr)
PA Custom (draft)	(158,146)	(943)	(1,080,715)

- Commercial
- Residential
- Mixed use

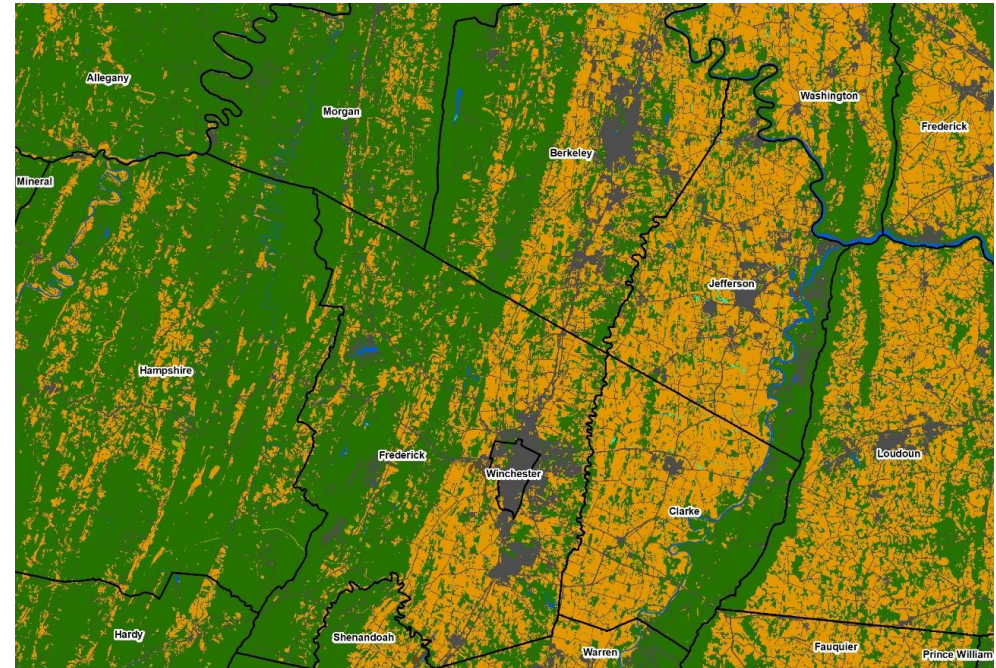
- Commercial
- Residential
- Mixed use
- Forest Conservation
- Farm Conservation

Verification of Land Policy BMPs

2025 Land Policy BMP



TBD: 2025 1-meter Resolution Land Use



In 2025, compare Land Policy BMP to Actual Mapped Conditions

CBLCM v5 (current version)

- Simulates residential, commercial, and mixed-use development and forest and farmland conservation.
- Simulates change in patches of cells.
- Estimates infill/redevelopment by county.
- Relies on Capiella and Brown (2001) impervious surface coefficients.
- Derives commercial and residential densities from Decennial Census and NLCD.
- Parameterized using 30-meter resolution NLCD: 2001-2011.

CBLCM v6 (CAST-23, Phase 7)

- Same as v5 plus different types of housing and commercial development, timber harvest, agricultural land in production.
- Simulates change in tax parcels or patches of cells.
- Simulates infill/redevelopment by parcel.
- Derives impervious surface coefficients from parcel and high-res land use data.
- Derives commercial and residential densities from parcel data (TBD).
- Parameterized using 1-meter resolution land use: 2013-2021 and the backcast of high-res land use to 1985.
- Tracks development capacity and age of housing stock and trees.
- Implement method for Smart Sewer expansion and validate septic estimates in Virginia.



science for a changing world