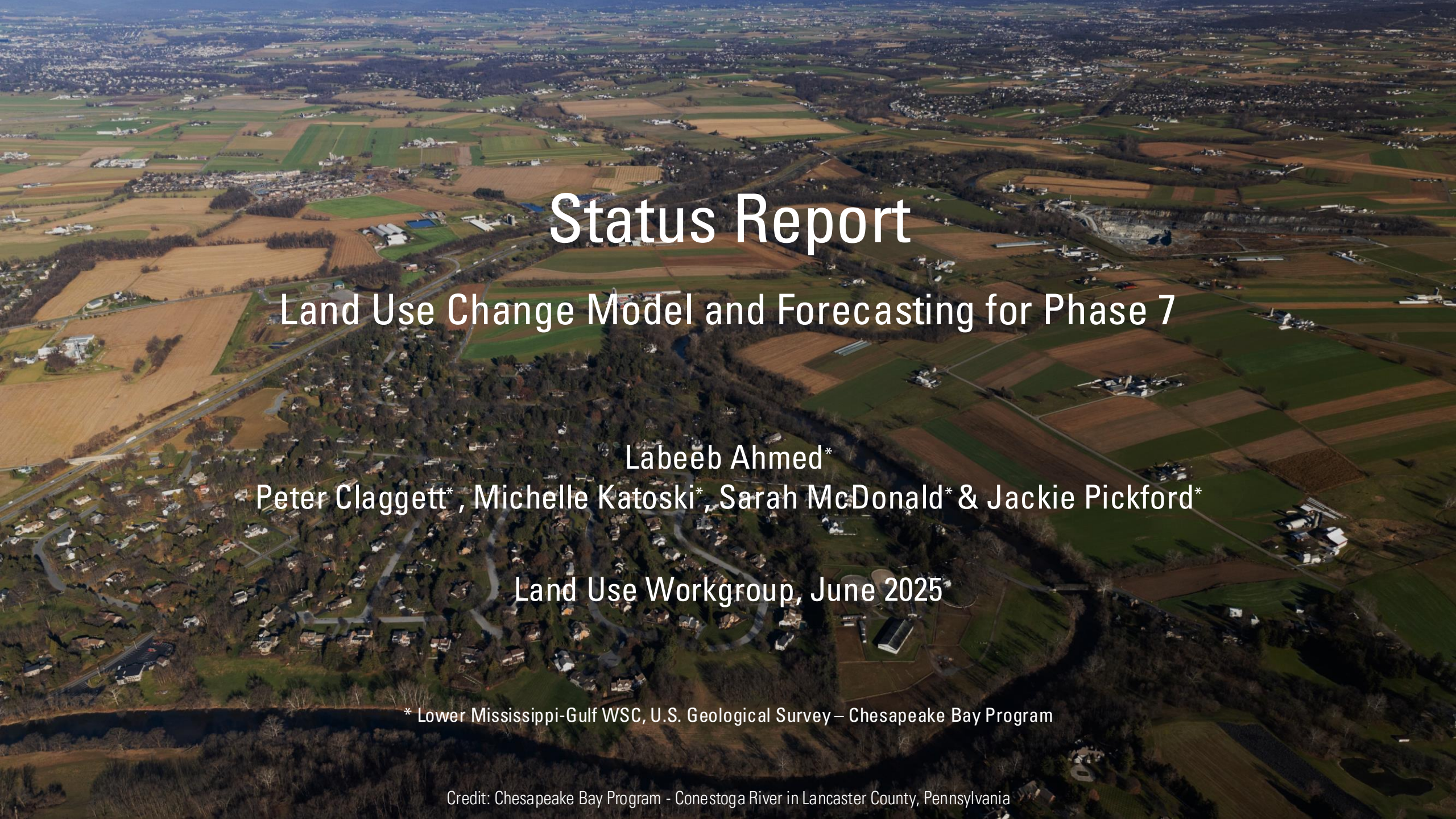

Status Report

Land Use Change Model and Forecasting for Phase 7

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Land Use Workgroup, June 2025

* Lower Mississippi-Gulf WSC, U.S. Geological Survey – Chesapeake Bay Program

Credit: Chesapeake Bay Program - Conestoga River in Lancaster County, Pennsylvania

Disclaimer

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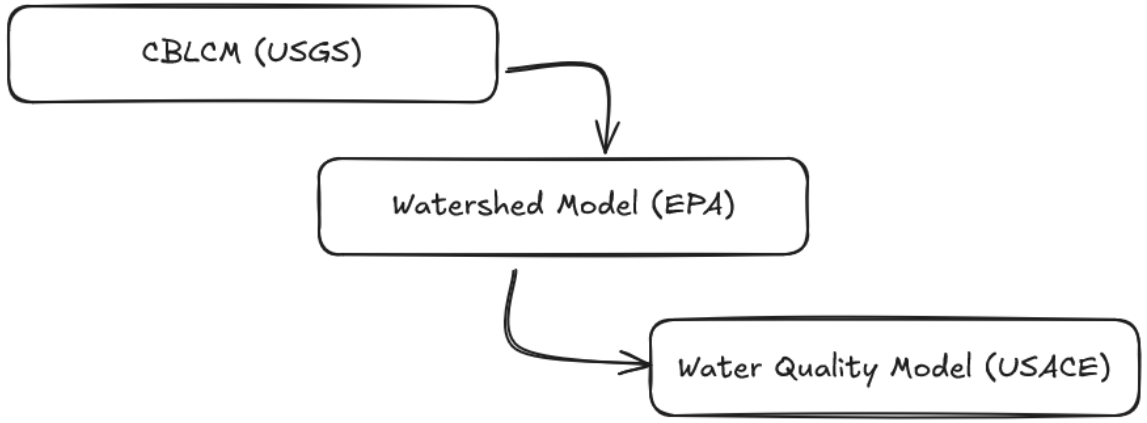
QUICK INTRO

- Chesapeake Bay Land Change Model (CBLCM)
- Quantify impacts of land use change on water quality in the Bay
- Land policy BMPs (scenarios)
- Outputs inform watershed (CAST) & water quality models

Chesapeake Bay TMDL Models
(Total Maximum Daily Loads)



AGENDA

- Model Documentation
- Highlights:
  - New data products
  - Major model updates
  - Pending updates
- Products and Timelines

MODEL DOCUMENTATION

- Audience: Phase 7 Modelers, stakeholders & jurisdictions
- Requirement for Phase 7
- Structure & Organization:
  - Inputs
  - Processing & Analyses (assumptions)
  - Outputs
  - Implications – scenarios & water quality
- Guide to developing custom scenarios

HIGHLIGHTS:
Data, Products & Model Updates

NEW DATA PRODUCTS

- Census data:
  - 2000 to 2010
  - 2010 to 2020
- National Land Cover Database (NLCD): 2001, 2011, 2021 (*legacy*)
- Longitudinal Employer-Household Dynamics (LODES8) (2000-2023)*
- Block Level Housing Density (1990-2020)
- Protected Lands
- Sewer Service Areas (updated footprints June 2025)
- FEMA 100-year floodplain & Floodways
- Parcel-based residential and commercial masks

RESIDENTIAL & COMMERCIAL MASKS

Previous Method:

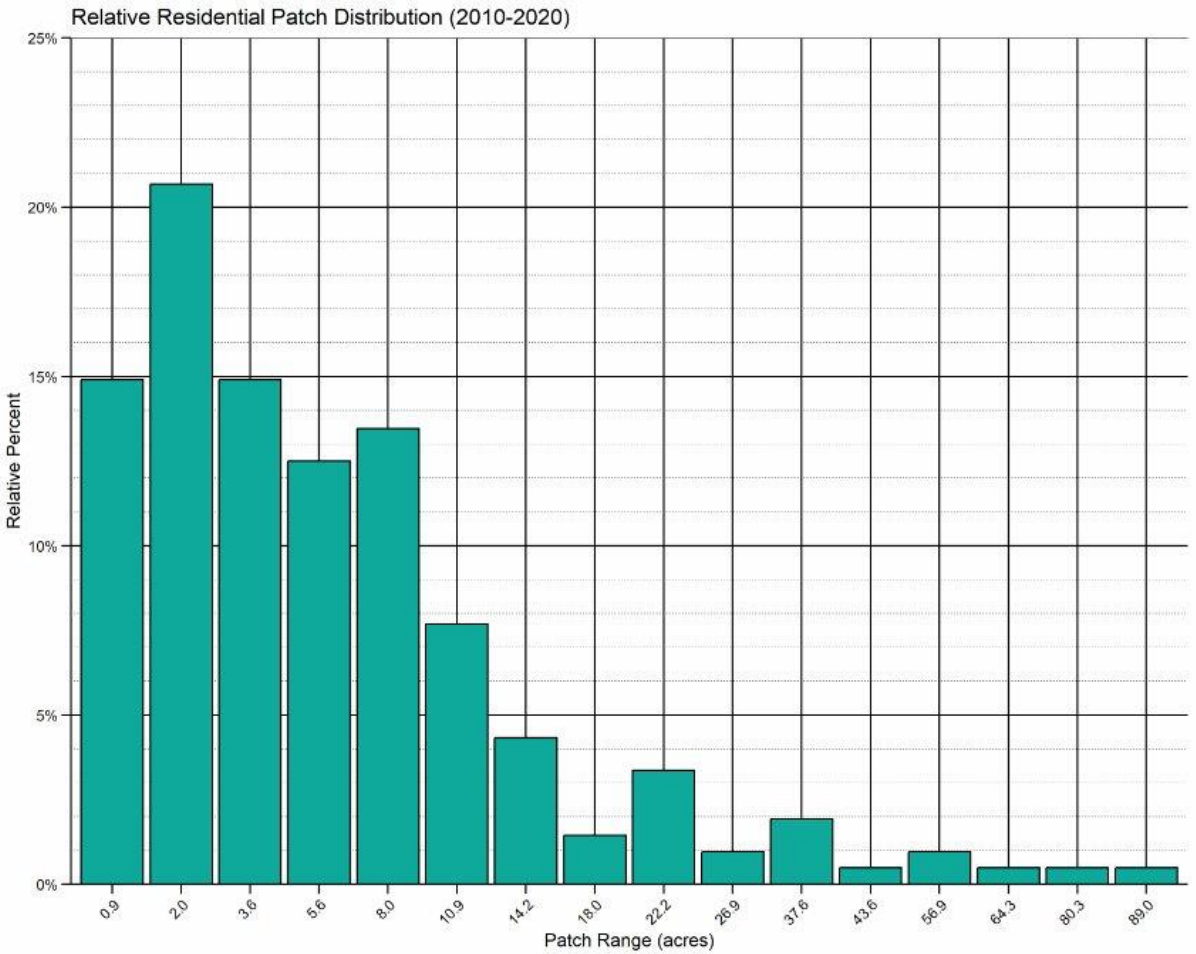
Modeled on census block-level using housing density vs job density (hot-spots)

New Method:

Rule based approach applied on parcel-geometry and relies on ancillary attributes such as as NLCD, CDL, Residential Delivery Indicator (RDI) etc.,

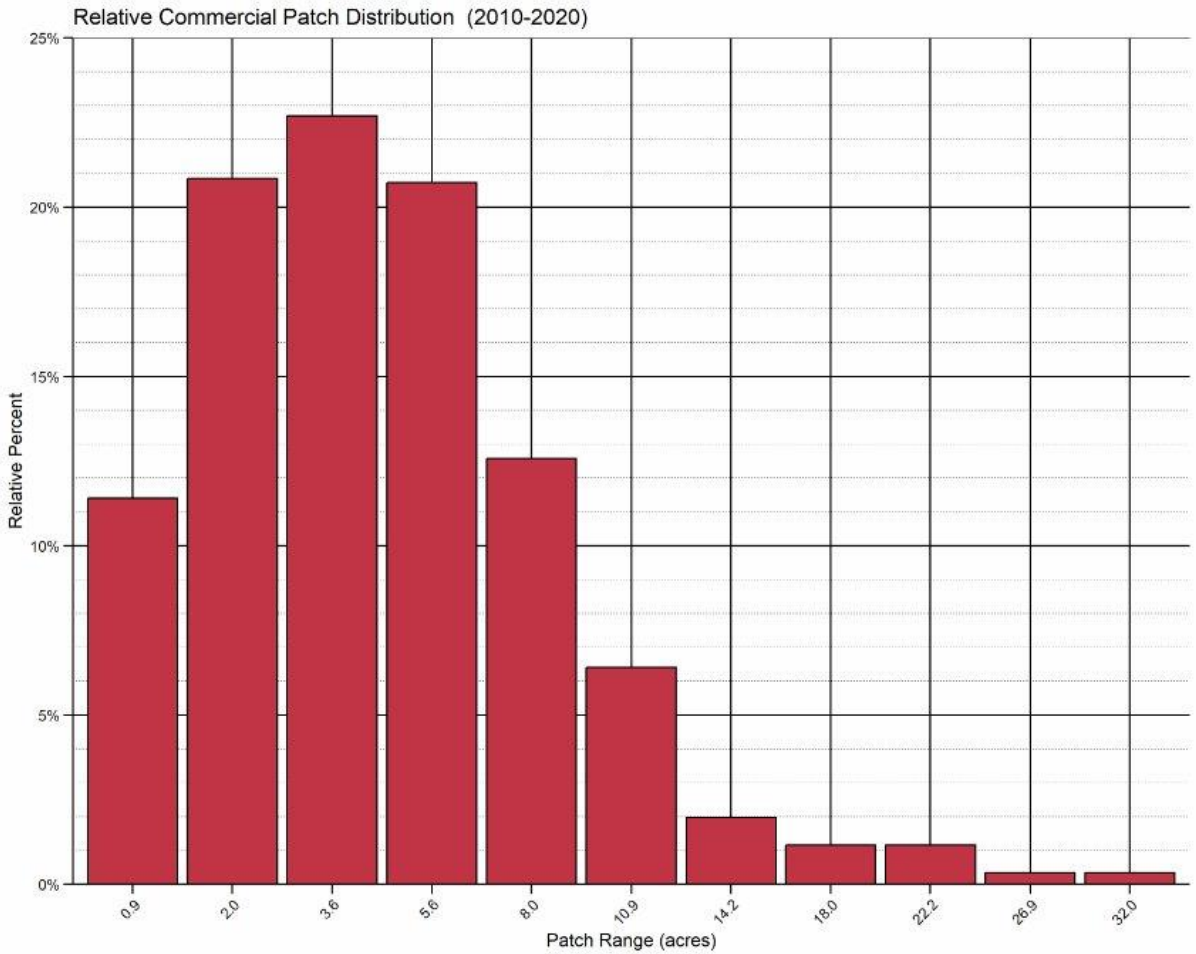
OBSERVED IMPERVIOUS CHANGE PATCH SIZES

Residential Patch Size Distribution



Impervious Patch Size (acres)

Commercial Patch Size Distribution



Impervious Patch Size (acres)

ESTIMATING DEVELOPMENT DENSITIES

Previous Method:

Densities were calculated using develop vs undeveloped acres from NLCD, house holds from census and jobs from lodes7. Inconsistent application in urban versus rural areas. Missing residential vs commercial footprints

New Method:

Uses parcel-based res vs com footprints, housing densities from SILVIS, application of minimum lot sizes by county, urban and rural and res vs com

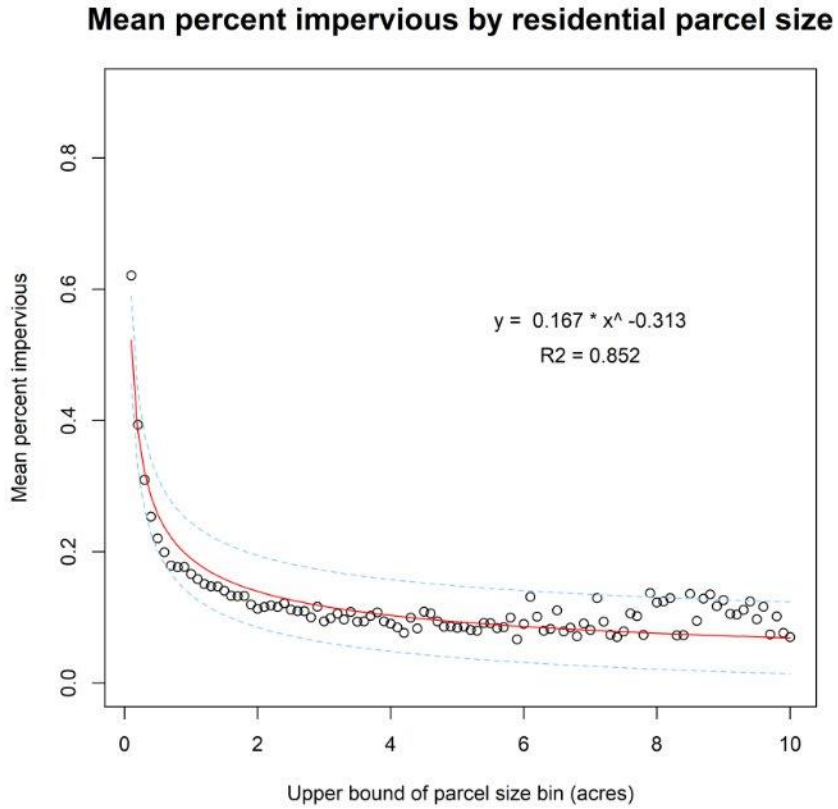
Improved measures of densities impacts infill modeling as well

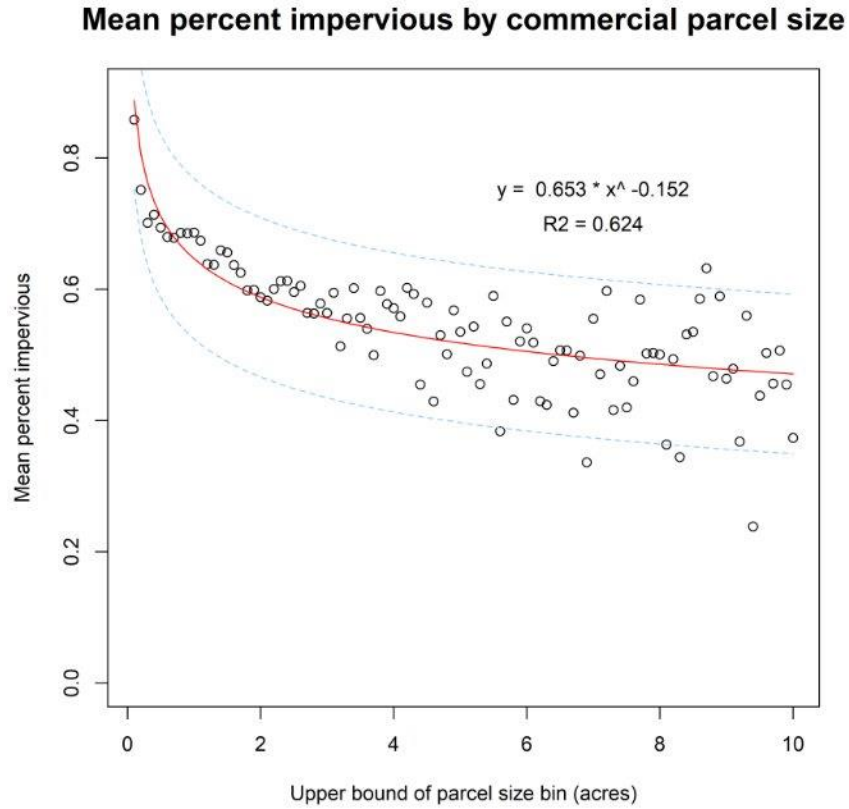
Density of new development (observed 2011-2021)

County	DE Zone	Mean Parcel Area (Acres)	St. Dev. Of Parcel Area
Kent	Investment Level 1	0.30	0.40
Kent	Investment Level 2	0.59	2.53
Kent	Investment Level 3	0.85	1.06
Kent	Investment Level 4	2.11	5.29
New-Castle	Investment Level 1	0.25	1.21
New-Castle	Investment Level 2	0.47	0.84
New-Castle	Investment Level 3	0.57	1.75
New-Castle	Investment Level 4	1.79	1.71
Sussex	Investment Level 1	0.51	2.33
Sussex	Investment Level 2	0.51	6.29
Sussex	Investment Level 3	0.57	3.71
Sussex	Investment Level 4	1.28	7.45

IMPERVIOUS SURFACE COEFFICIENTS

- Mean percent impervious for parcels binned at 0.1-acre intervals up to 10 acre lots.
- Power functions fit to the data produced best model fit.
- Residential model reflects lower residuals, values begin to deviate at lot sizes >= 6 acres
- Commercial model displays higher residuals (greater variability in percent impervious)





PENDING UPDATES

- Parametrizing CBLCM using 1-m LULC and backcast
- Post-process: automate Sewer and Septic estimations by LRSEGS
- Smart sewer service area expansion for future scenarios
- State-wide residential and commercial masks – especially counties outside of the watershed

PRODUCTS & TIMELINES

- Land Policy BMP scenarios
  - Historic Trends (Sep 2025)
  - Remaining Scenarios (Dec 2025)
- CBLCM documentation (December 2025)
- Watershed Data Dashboard Updates (October 2025)

Questions?

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