



Chesapeake Bay Program Strategic Science & Research Framework:



Land Use Methods and Metrics and
Land Use Options Evaluation outcomes

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Land Use Methods and Metrics Outcome

Through the Chesapeake Bay Watershed Agreement, the Chesapeake Bay Program has committed to...

Outcome: Assess and understand the impacts of land use change on watersheds, habitats, and communities at a scale relevant to county-level decision-makers.

1. Measure rate of farmland, forest and wetland conversion, and the extent and rate of change in impervious surface coverage.
2. Quantify the potential impacts of land conversion to water quality, healthy watersheds and communities.
3. Launch a public awareness campaign to share this information with citizens, local governments, elected officials and stakeholders.

Land Use Options Evaluation Outcome

By the end of 2017, with the direct involvement of local governments or their representatives, **evaluate policy options, incentives and planning tools** that could assist them in continually **improving their capacity to reduce the rate of conversion** of agricultural lands, forests and wetlands as well as the rate of changing landscapes from more natural lands that soak up pollutants to those that are paved over, hardscaped or otherwise impervious. **Strategies should be developed for supporting** local governments' and others' efforts in reducing these rates by 2025 and beyond.



<https://blog.nature.org/science/2016/09/08/energy-sprawl-is-the-largest-driver-of-land-use-change-in-the-u-s/>

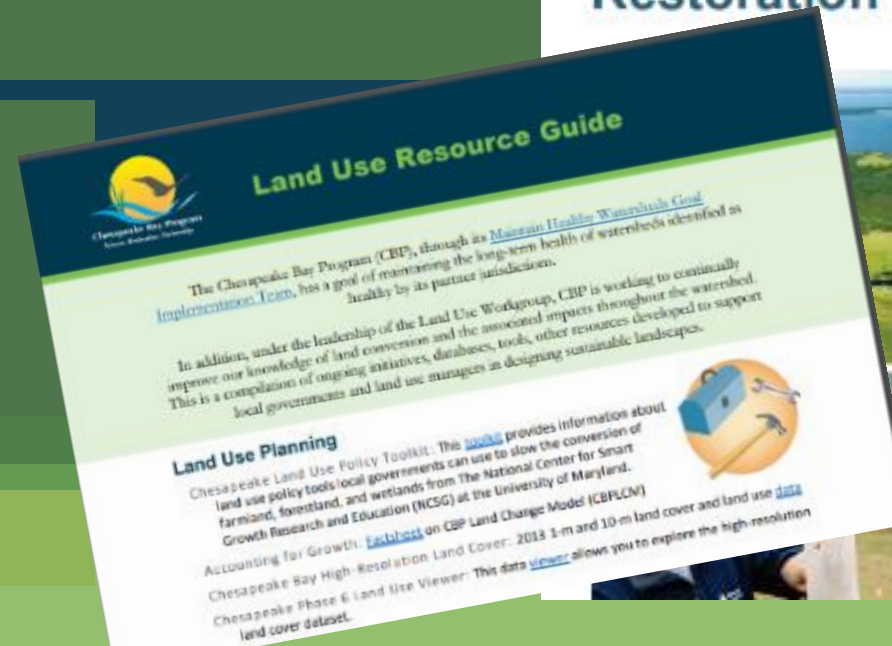
Projects

- Cross-Outcome Watershed Educational Materials
- Conservation of Working Lands-Finance Forum consultants
- Improving Technical Service Delivery for Private Landowners
- Targeted local outreach for green infrastructure vulnerable areas
- Chesapeake Watershed Finance Intensive Workshop



Communications

- Land Use Resources Guide
- Forest Restoration Strategy
- Land Policy Data Dashboard resources
- Presenter, panelist, speaker



Chesapeake Bay Environmental Justice and Equity Dashboard (DRAFT)

Overview

Demographic Indicators

Cross-Outcome Applications

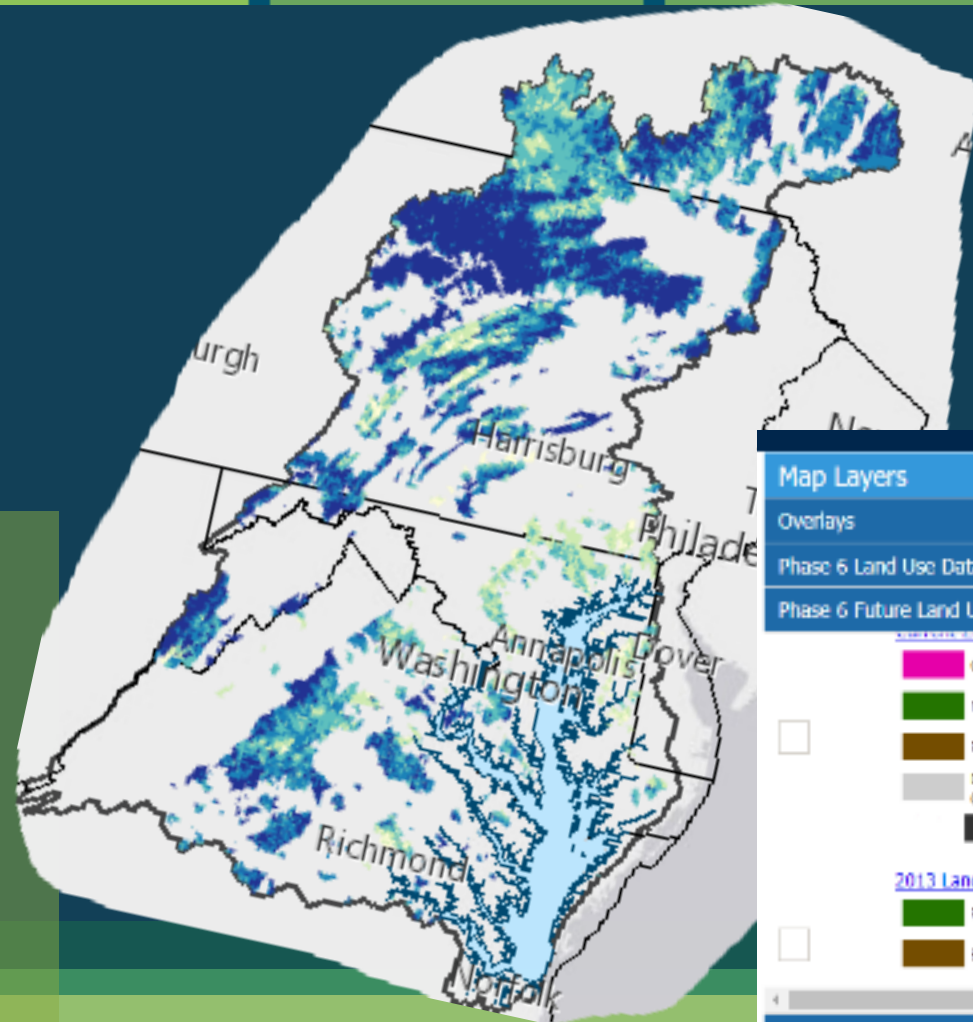
Current Initiatives

Acknowledgements

.."Evaluate policy options, incentives and planning tools that could assist in continually improving capacity.."

Data and Tools

- Hi-res land cover
- Phase 6 Land Use Viewer
- Data Dashboard
- Chesapeake Healthy Watersheds Assessment
- Environmental Justice and Equity Dashboard



Map Layers

Overlays

Phase 6 Land Use Datasets

Phase 6 Future Land Use



2013 Land Use/Cover Projection Base

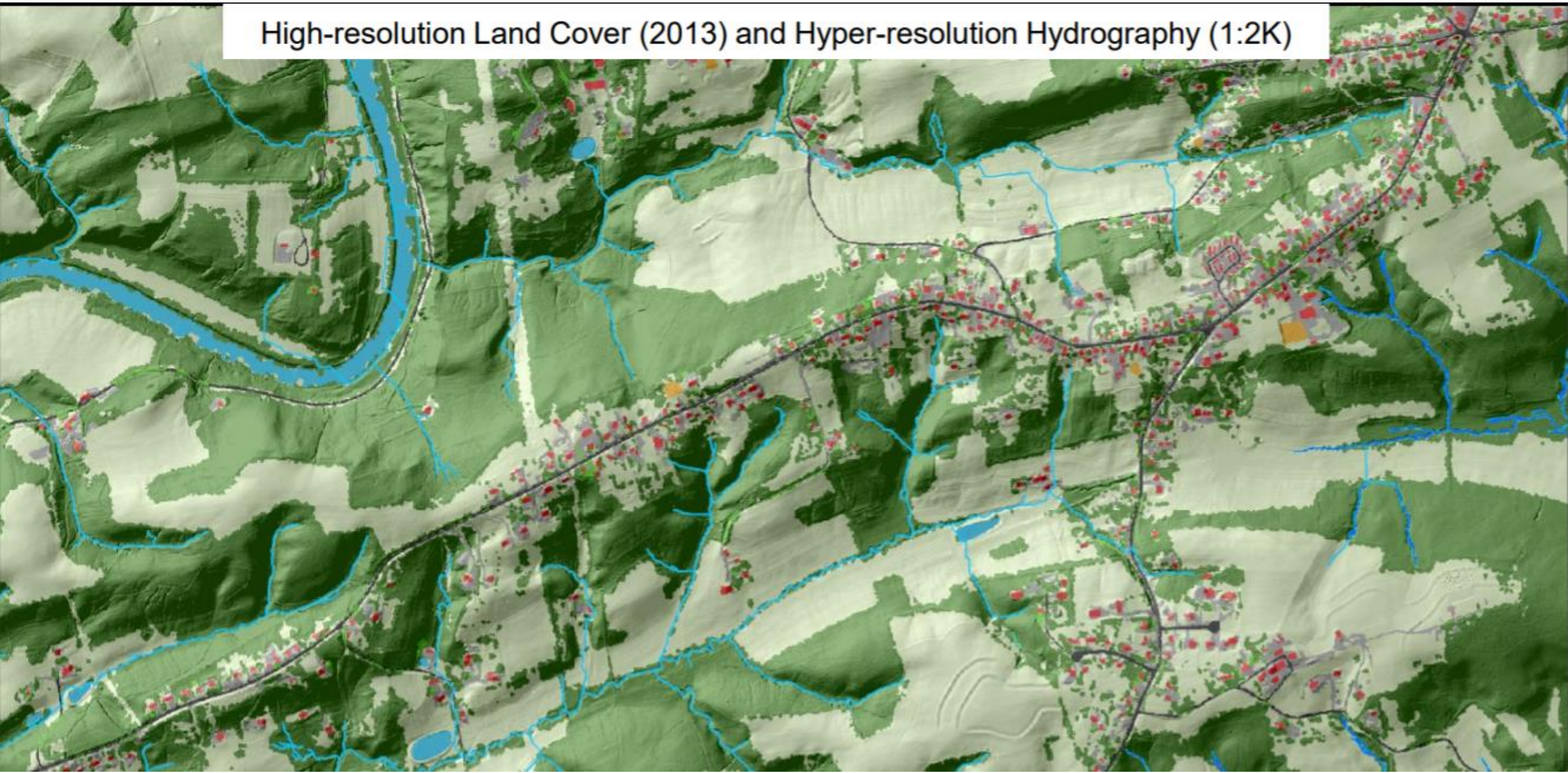


Base Map

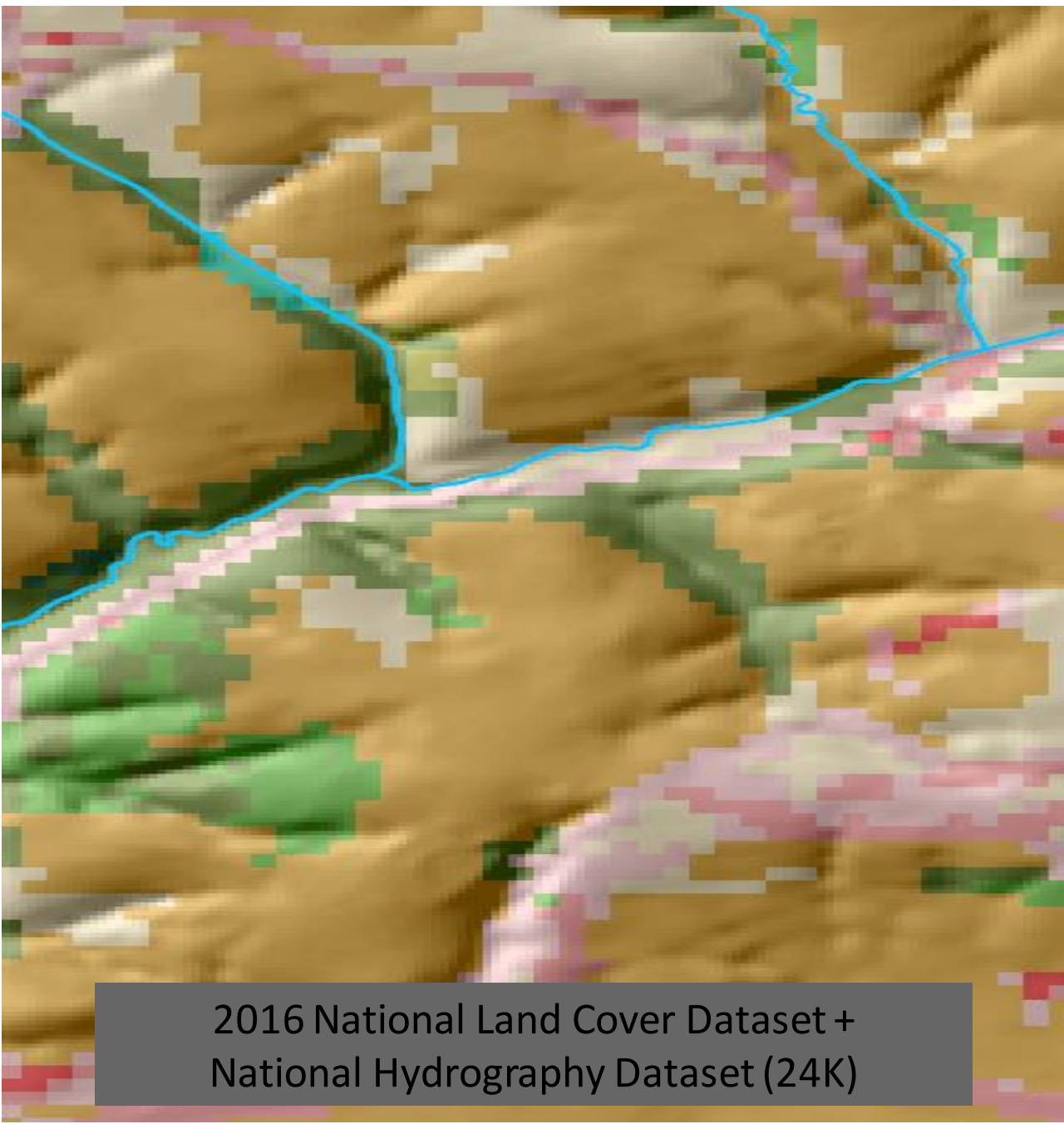
Data and Metadata Download

Submit Comments to USGS

High-resolution Land Cover (2013) and Hyper-resolution Hydrography (1:2K)

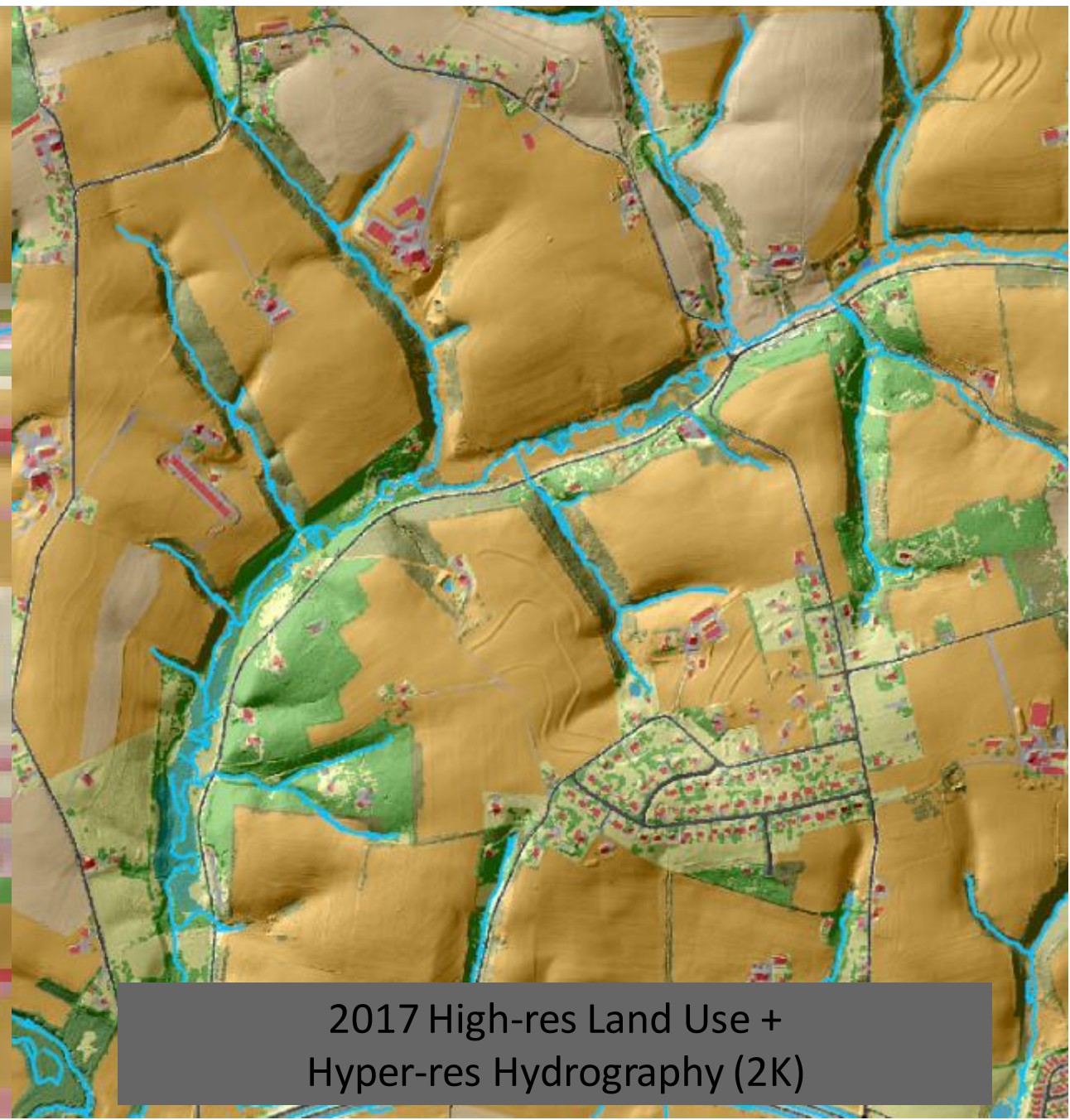


30-meter Resolution



2016 National Land Cover Dataset +
National Hydrography Dataset (24K)

1-meter Resolution



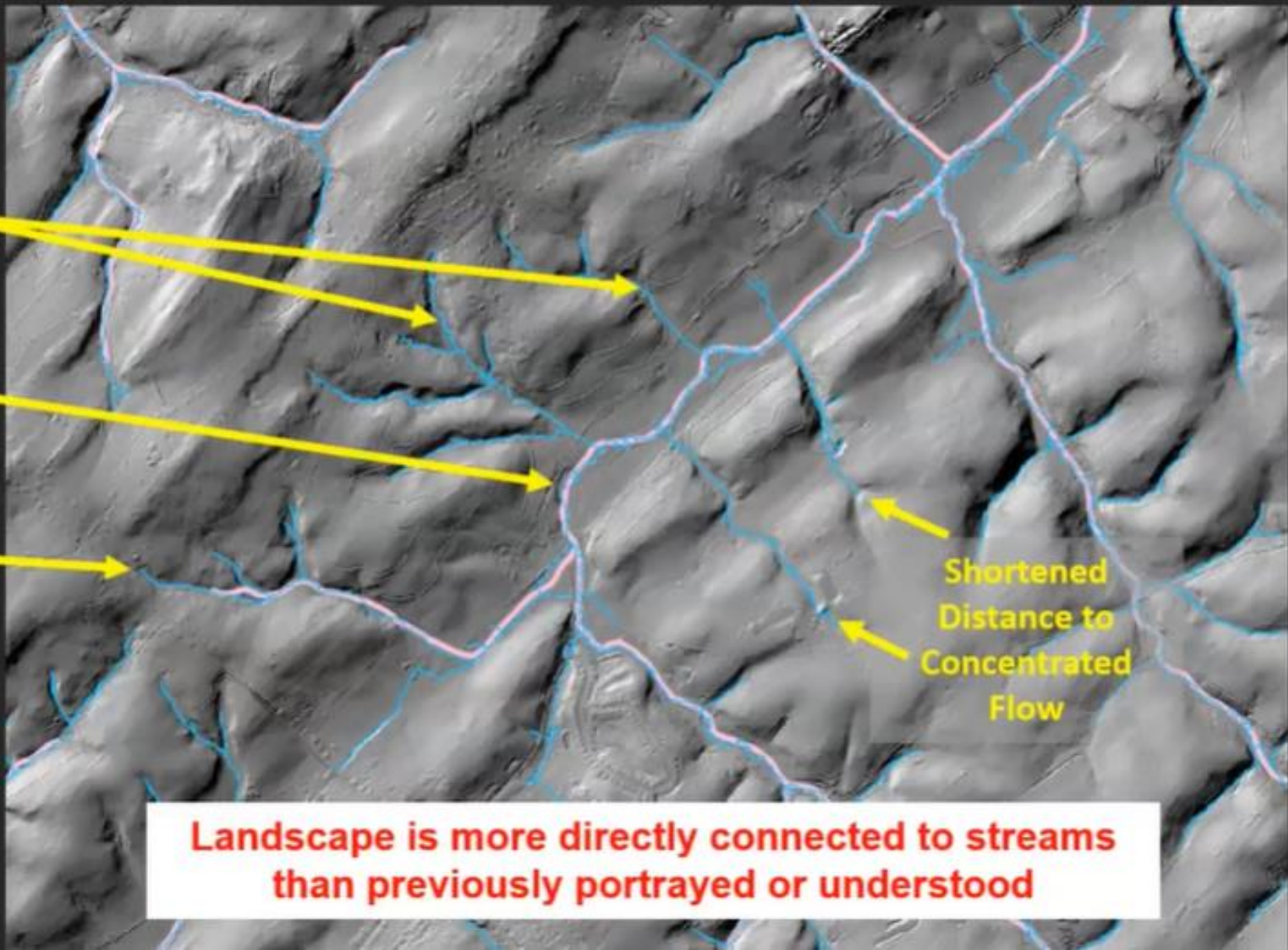
2017 High-res Land Use +
Hyper-res Hydrography (2K)

Hyper-resolution Hydrography

Added
Tributaries

Increased
Complexity

Extended
headwaters



Shortened
Distance to
Concentrated
Flow

- NHD24K
- HyperRes

Landscape is more directly connected to streams than previously portrayed or understood

Ancillary Data

- County Land Use
- Abandoned Mine Lands
- Landfills
- Roads

Land Cover Data

- Impervious surfaces
- Tree canopy
- Low vegetation
- Water

Land Use Data

- Impervious-Roads
- Forests
- Turf Grass
- Cropland

CBP Full Land Use/Cover Classification (61 classes, final version)

1. Water (10)

1.1 Lentic

- 1.1.1 Estuary (tidal)
- 1.1.2 Lakes & Ponds

1.2 Lotic

- 1.2.1 Streams
 - 1.2.1.1 Open Channel
 - 1.2.1.2 Tree Canopy over Channel
 - 1.2.1.3 Culverted/ Buried Channel
- 1.2.2 Ditches
 - 1.2.2.1 Open Ditch
 - 1.2.2.2 Tree Canopy over Ditch
 - 1.2.2.3 Culverted/ Buried Ditch

2. Developed (12)

2.1 Impervious

- 2.1.1 Roads
- 2.1.2 Structures
- 2.1.3 Other Impervious (Parking lots, driveways)
- 2.1.4 Tree Canopy (TC) over Impervious
 - 2.1.4.1 TC over Roads
 - 2.1.4.2 TC over Structures
 - 2.1.4.3 TC over Other Impervious

2.2 Pervious

- 2.2.1 Turf Grass
- 2.2.2 Bare Developed
- 2.2.3 Suspended Succession (rights-of-way)
 - 2.2.3.1 Barren
 - 2.2.3.2 Herbaceous
 - 2.2.3.3 Scrub-shrub
- 2.2.4 Tree Canopy over Turf Grass

3. Forest (7)

- 3.1 Forest (≥ 1 acre, 240-ft width)
- 3.2 Tree Canopy in Agriculture
- 3.3 Harvested Forest (≤ 3 years)
 - 3.3.1 Barren
 - 3.3.2 Herbaceous
- 3.4 Natural Succession (> 3 years)
 - 3.4.1 Barren
 - 3.4.2 Herbaceous
 - 3.4.3 Scrub-shrub

4. Production (16)

4.1 Agriculture

- 4.1.1 Cropland
 - 4.1.1.1 Barren
 - 4.1.1.2 Herbaceous
- 4.1.2 Pasture
 - 4.1.2.1 Barren
 - 4.1.2.2 Herbaceous
- 4.1.3 Orchard/vineyard
 - 4.1.3.1 Barren
 - 4.1.3.2 Herbaceous
 - 4.1.3.3 Scrub-shrub
- 4.1.4 Animal Operations (TBD)
 - 4.1.4.1 Impervious
 - 4.1.4.2 Barren
 - 4.1.4.3 Herbaceous

4.2 Solar fields

- 4.2.1 Impervious
- 4.2.2 Pervious
 - 4.2.2.1 Barren
 - 4.2.2.2 Herbaceous
 - 4.2.2.3 Scrub-shrub

4.3 Extractive (active mines)

- 4.3.1 Barren
- 4.3.2 Impervious

5. Wetlands and Water Margins (16)

5.1 Tidal

- 5.1.1 Barren
- 5.1.2 Herbaceous
- 5.1.3 Scrub-shrub
- 5.1.4 Tree Canopy
- 5.1.5 Forest

5.2 Riverine (Non-tidal)

- 5.2.1 Barren
- 5.2.2 Herbaceous
- 5.2.3 Scrub-shrub
- 5.2.4 Tree Canopy
- 5.2.5 Forest

5.3 Terrene/Isolated (Non-tidal)

- 5.3.1 Barren
- 5.3.2 Herbaceous
- 5.3.3 Scrub-shrub
- 5.3.4 Tree Canopy
- 5.3.5 Forest

5.4 Bare shore

CBP 2017 Land Use Roll-up to Phase 6 Land Use/Cover Classes

1. Impervious Roads

- 2.1 Impervious
 - 2.1.1 Roads

2. Impervious Non-Roads

- 2.1 Impervious
 - 2.1.2 Structures
 - 2.1.3 Other Impervious
- 4.2 Solar fields
 - 4.2.1 Impervious

3. Tree Canopy Over Impervious

- 2.1 Impervious
 - 2.1.4 Tree Canopy over Impervious

4. Turf Grass

- 2.2 Pervious, Developed
 - 2.2.1 Turf Grass

5. Tree Canopy over Turf Grass

- 2.2 Pervious, Developed
 - 2.2.4 Tree Canopy over Turf Grass

6. Forest

- 3.1 Forest (\geq 1 acre, 240-ft width)
- 3.2 Tree Canopy in Agriculture

7. Wetlands, Floodplain

- 5.2 Riverine, Wetlands

8. Wetlands, Other

- 5.3 Terrene/Isolated, Wetlands

9. Wetlands, Tidal

- 5.1 Tidal, Wetlands

10. Mixed Open

- 2.2 Pervious, Developed
 - 2.2.2 Bare Developed
 - 2.2.3 Suspended Succession
- 3.3 Harvested Forest (\leq 3 years)
- 3.4 Natural Succession ($>$ 3 years)
- 4.2 Solar fields
 - 4.2.2 Pervious
- 4.3 Extractive (active mines)
- 5.4 Bare shore, Water Margins

11. Cropland

- 4.1 Agriculture
 - 4.1.1 Cropland
 - 4.1.3 Orchard/vineyard

12. Pasture

- 4.1 Agriculture
 - 4.1.2 Pasture

13. Water

- 1.1 Lentic
 - 1.1.1 Estuary (tidal)
 - 1.1.2 Lakes & Ponds
- 1.2 Lotic
 - 1.2.1 Streams

Parcel-Level Deconstruction of Urban Development (1985 – 2017)

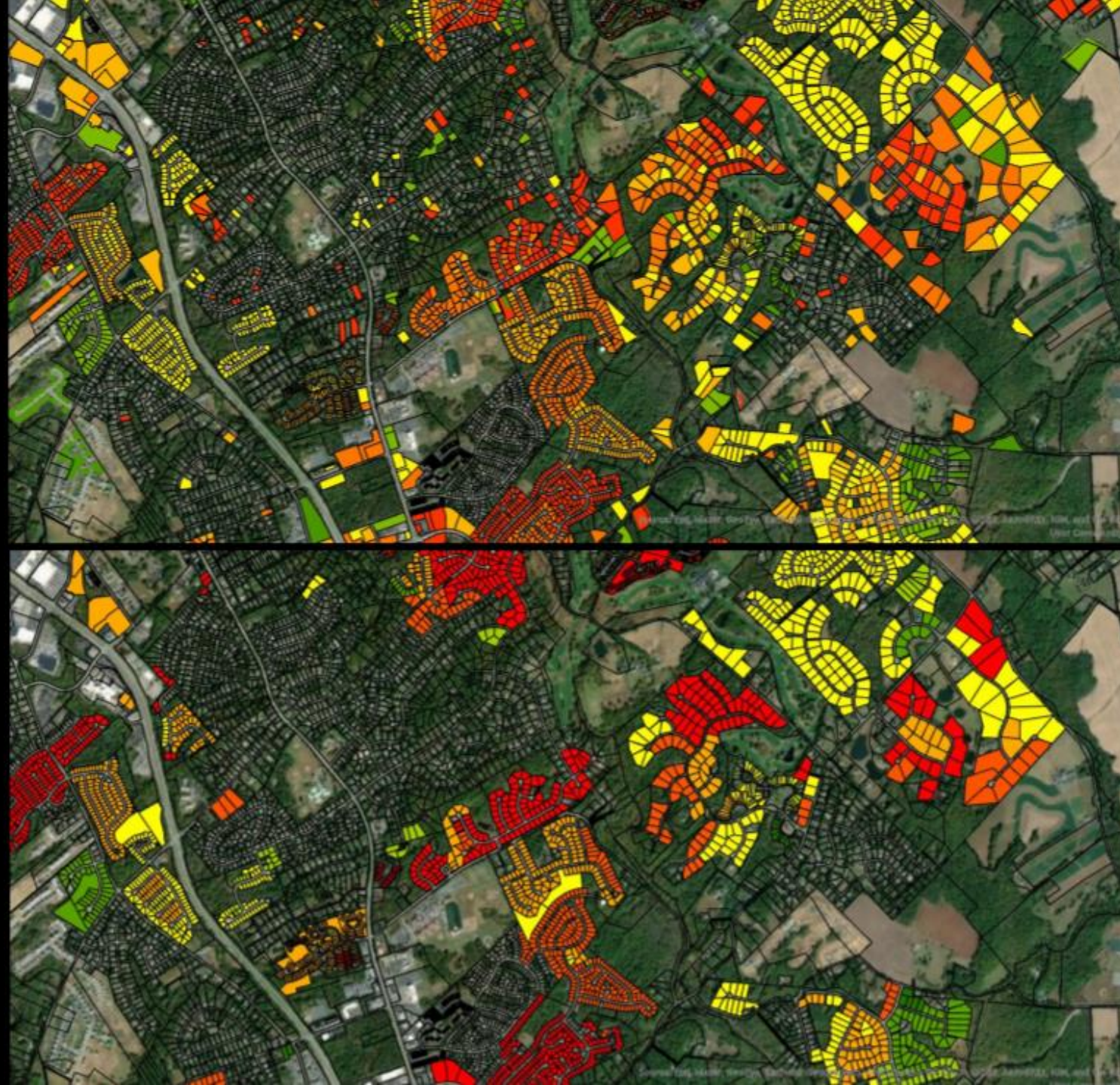
Year-Built Attributes
from Tax Records

yearbtl



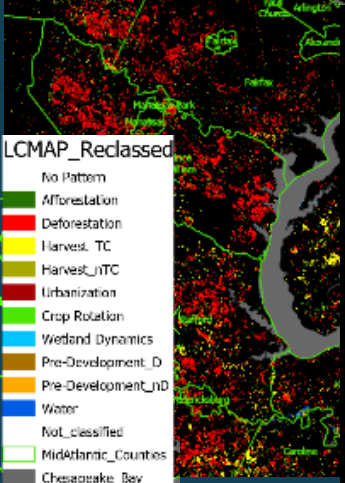
Year-Built Attributes
from USGS' LCMAP*

* Land Change, Monitoring,
Assessment, and Projection
(LCMAP)

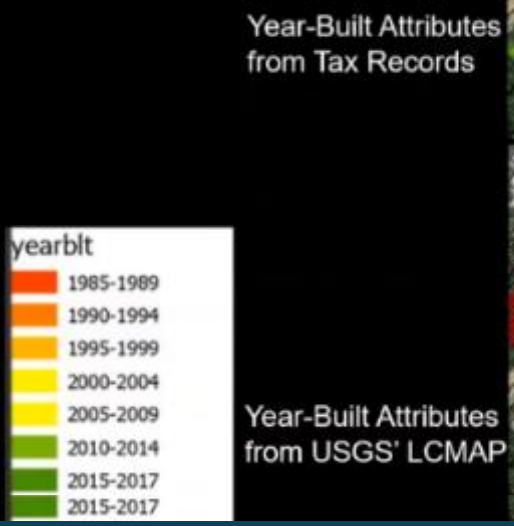


USGS Land Change Monitoring, Assessment, and Projection Data
Thirty Years of Change (1985 – 2015)

Increasing knowledge at a scale that is locally relevant



Parcel-Level Deconstruction of Urban Development (1985 – 2017)



- Rates of conversion:
- Farmland
 - Forest
 - Wetland
 - Impervious Cover

Science Needs

Land Use Methods and Metrics

Land Use options Evaluation Outcome

Baseline information (planned and resourced)

Publish the
DATA!!

- USGS will co-publish data and an interpretive paper with CIC and UVM on high-res land use characteristics and change in the Chesapeake Bay Watershed to contextualize the nature of observed changes in impervious cover, turf grass, forests, wetlands (loss only), tree canopy, and agriculture (2021/2022).
- USGS will incorporate the 2013 and 2017 land use data into the Phase 6 Watershed Model and Chesapeake Healthy Watersheds Assessment (2021 – 2024).
- USGS will co-publish a paper with UMBC and CIC on land use characteristics and change along hyper-resolution streams (2022 – 2023).

Hydrologic / Water Quality Impacts

How do the *increased density of streams* and *corresponding decrease in overland flow-path length* affect our interpretation and modeling of how *land use and land use change* affect nutrient processing and stream flow?

Land Use Metrics / Hi Resolution Data

COVID (future impacts on land use?)

- Long term monitoring and evaluation
- Short term metrics and vulnerability
- Land policy BMP connections
- Understanding “thresholds” from a scientific and local government perspective.
- U.S. Geological Survey’s Land Change Monitoring, Assessment and Projection (LCMAP 1985 – 2019)

User Experience and Research

- Decision support tools for informing decisions
 - How can land use and land use change information best be communicated to select targeted audiences to inform land use and land conservation decisions?
- Understanding end user needs (of different stakeholder audiences)
- Improvements to data and communication to meet local needs



DEIJ and communities

- How does land use composition and land change impact those communities and or local governments?
 - Percent tree canopy, percent impervious cover, etc.
- Assess disproportionate impact of land use change over time in underserved communities
 - How have investments in economic* development, conservation and restoration benefited these communities? *Note: lack of development could be a negative impact?
 - Incorporation of public health considerations



Climate and Community

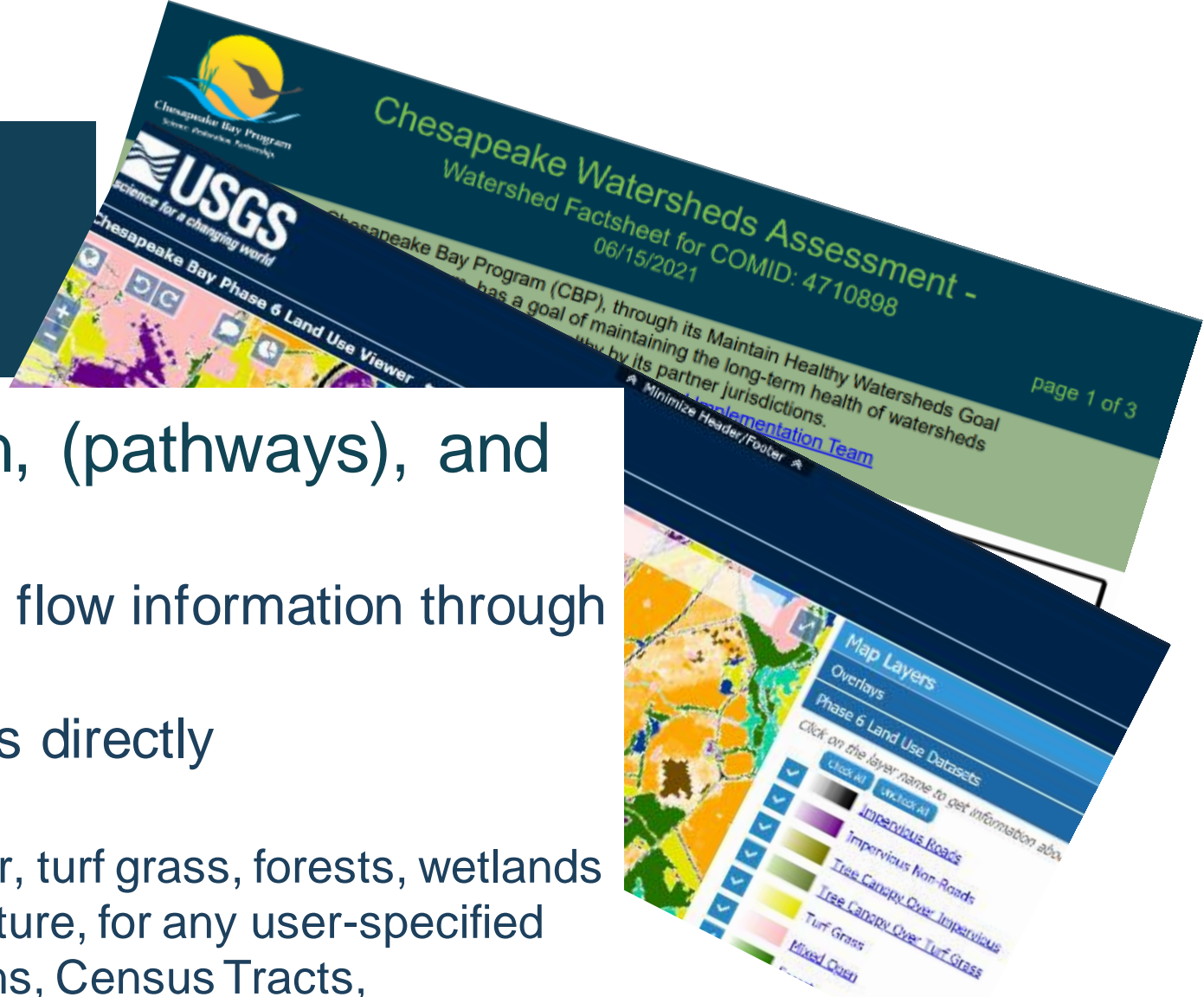
- Marsh Migration – potential for protection
- Protection of infrastructure and communities
 - Resiliency
 - Flood protection

Synthesis and Communication

- Communication, Translation, (pathways), and Engagement.
 - Translate, format, package and flow information through to trusted sources.
 - How to effectively engage locals directly

Online tools:

- Assess changes in impervious cover, turf grass, forests, wetlands (loss only), tree canopy, and agriculture, for any user-specified geography (e.g., user-drawn polygons, Census Tracts, Municipalities, etc.) Output a standardized set of graphs and interpretive text tailored to graph content.
- Adapt to report changes along concentrated flow paths in 2023.



Field Research Needs

- What's causing changes in land use and what are the management implications of those changes?
- Example: What proportion of tree canopy loss is ephemeral, associated with natural mortality vs permanent removal. (Iris Allen's work with MD-DNR)

Prince George's County Tree Canopy Loss





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Discussion