Land Use Methods and Metrics Outcome

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Through the Chesapeake Bay Watershed Agreement*, the Chesapeake Bay Program has committed to…*

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

Goal: Conserve landscapes treasured by citizens in order to maintain water quality and habitat; sustain working forests, farms and maritime communities; and conserve lands of cultural, indigenous and community value.

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

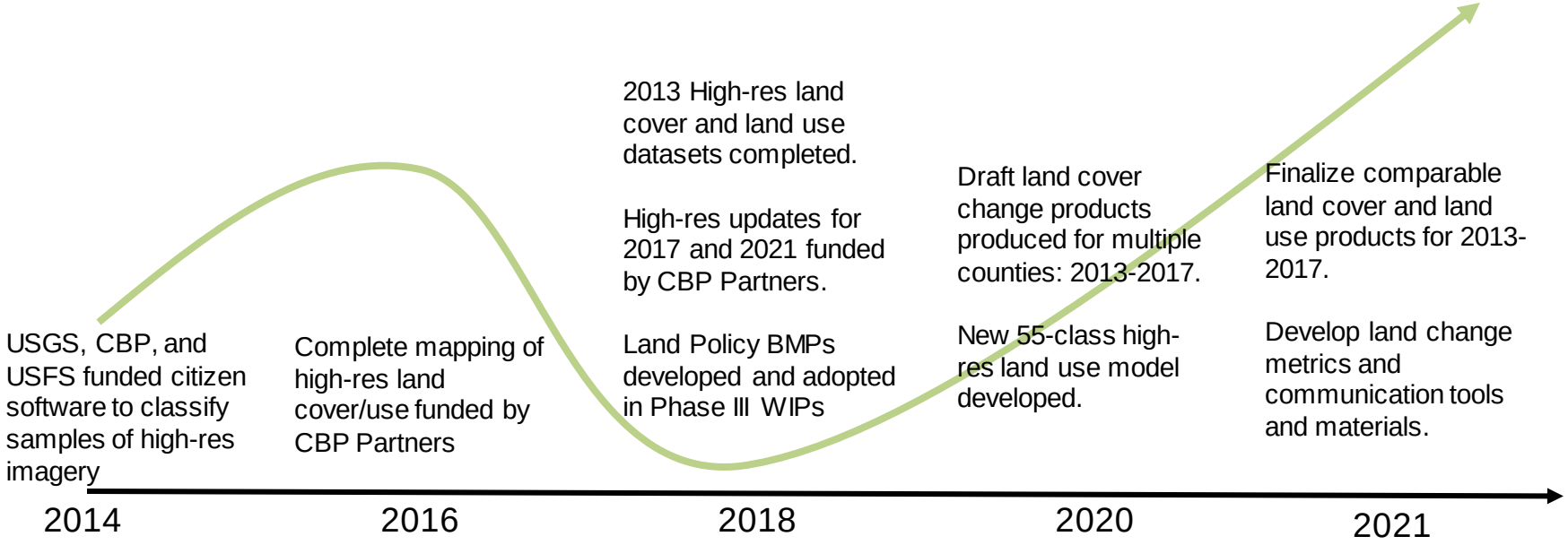
Through the Chesapeake Bay Watershed Agreement, *the Chesapeake Bay Program has committed to…*

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.

What is our Expected and Actual Progress?



Learn

What have we learned in the last two years?

What we've learned

High-resolution land use and land cover data representing every square meter of the Bay watershed are:

- Foundational- informing outcomes managed by every Goal Implementation Team and enabling transparent and authoritative assessments of pollutant sources, wildlife habitats, and development patterns.

- Transformative- changing the way we interpret the landscape, how it's changing through time, and enabling parcel-level targeting of BMPs and small catchment assessments of BMP effectiveness

Successes and Challenges

Challenges:

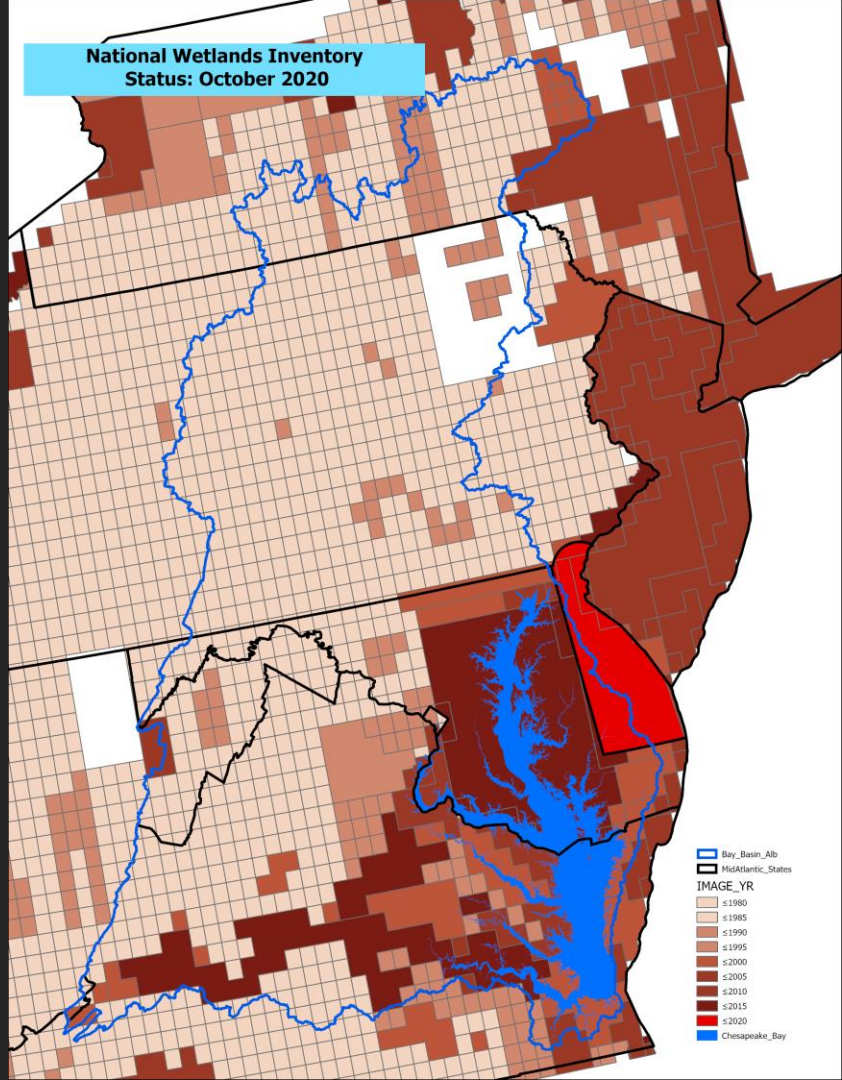
- Automating the classification of land cover and land use
- Separating signal from noise when mapping change in land conditions
- Outdated inventory of non-tidal wetlands
- Communicating the complexities of high-resolution land change

Successes:

- CBP Partnership support for monitoring both land cover and land use change at high resolution
- Refinement of land cover mapping techniques (Univ. of Vermont)
- Development of high-res land use mapping techniques (USGS, Chesapeake Conservancy)
- Evolving understanding of high-res land cover/use change and potential impacts to water quality and healthy watersheds

Status of the National Wetlands Inventory October 2020

Vintage of the NWI in the majority of watershed is ~1980's



USGS

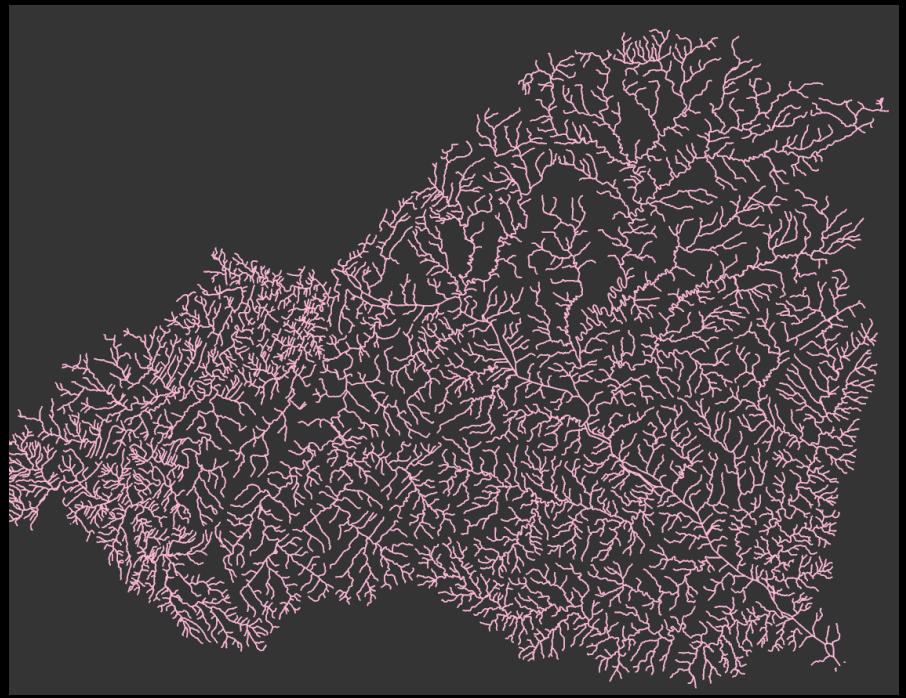
Chesapeake Bay Program Land Use Classification (55 classes)

- **1. Water (8)**
  - 1.1 Lentic
    - 1.1.1 Estuary
    - 1.1.2 Lakes & Ponds
  - 1.2 Lotic
    - 1.2.1 Streams
      - 1.2.1.1 Sunlit
      - 1.2.1.2 Shaded
      - 1.2.1.3 Culverted/ Buried
    - 1.2.2.Ditches
      - 1.2.2.1 Sunlit
      - 1.2.2.2 Shaded
      - 1.2.2.3 Culverted/ Buried
- **2. Developed (12)**
  - 2.1 Impervious
    - 2.1.1 Roads
    - 2.1.2 Structures
    - 2.1.3 Other Impervious (Parking lots, driveways)
  - 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
  - 2.3 Tree Canopy (TC)
    - 2.3.1 TC over Roads
    - 2.3.2 TC over Structures
    - 2.3.3 TC over Other Impervious
    - 2.3.4 TC over Turf Grass
- **3. Forest (6)**
  - 3.1 Forest (>= 1 acre)
  - 3.2 Harvested Forest
    - 3.2.1 Barren
    - 3.2.2 Herbaceous
  - 3.3 Natural Succession (> 3 years)
    - 3.3.1 Barren
    - 3.3.2 Herbaceous
    - 3.3.3 Scrub-shrub
- **4. Production (13)**
  - 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
  - 4.2 Solar fields
    - 4.2.1 Barren
    - 4.2.2 Herbaceous
    - 4.2.3 Scrub-shrub
    - 4.2.4 Impervious
  - 4.3 Extractive
    - 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
  - 5.2 Non-tidal
    - 5.2.1 Riverine - Floodplain
      - 5.2.1.1 Barren
      - 5.2.1.2 Herbaceous
      - 5.2.1.3 Scrub-shrub
      - 5.2.1.4 Forest
    - 5.2.2 Riverine - Headwater
      - 5.2.2.1 Barren
      - 5.2.2.2 Herbaceous
      - 5.2.2.3 Scrub-shrub
      - 5.2.2.4 Forest
    - 5.2.3 Terrene
      - 5.2.3.1 Barren
      - 5.2.3.2 Herbaceous
      - 5.2.3.3 Scrub-shrub
      - 5.2.3.4 Forest
  - 5.3 Bare shore

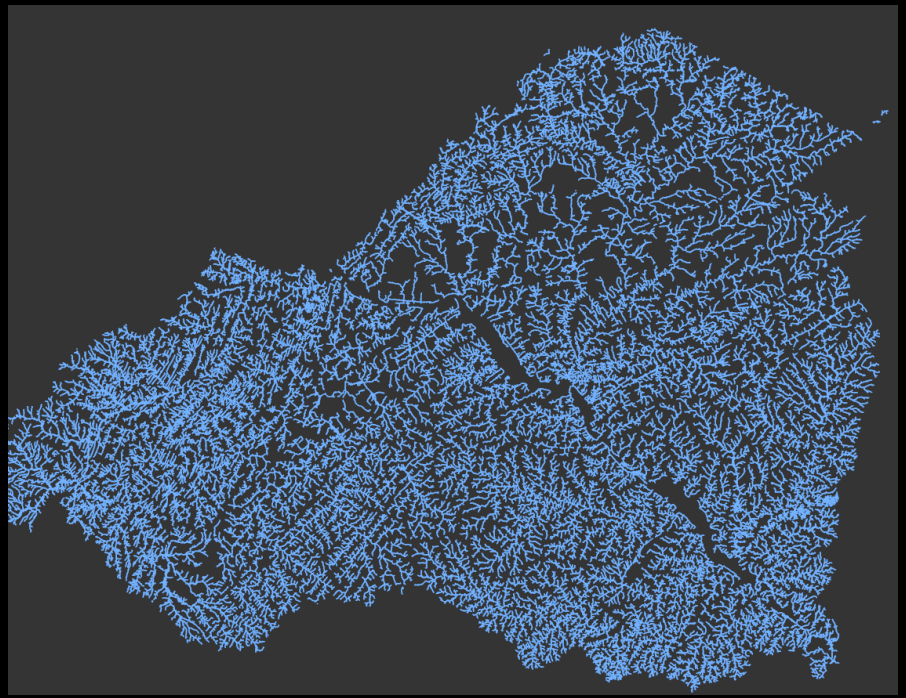
Enhanced Resolution Hydrography

Lower Susquehanna Example

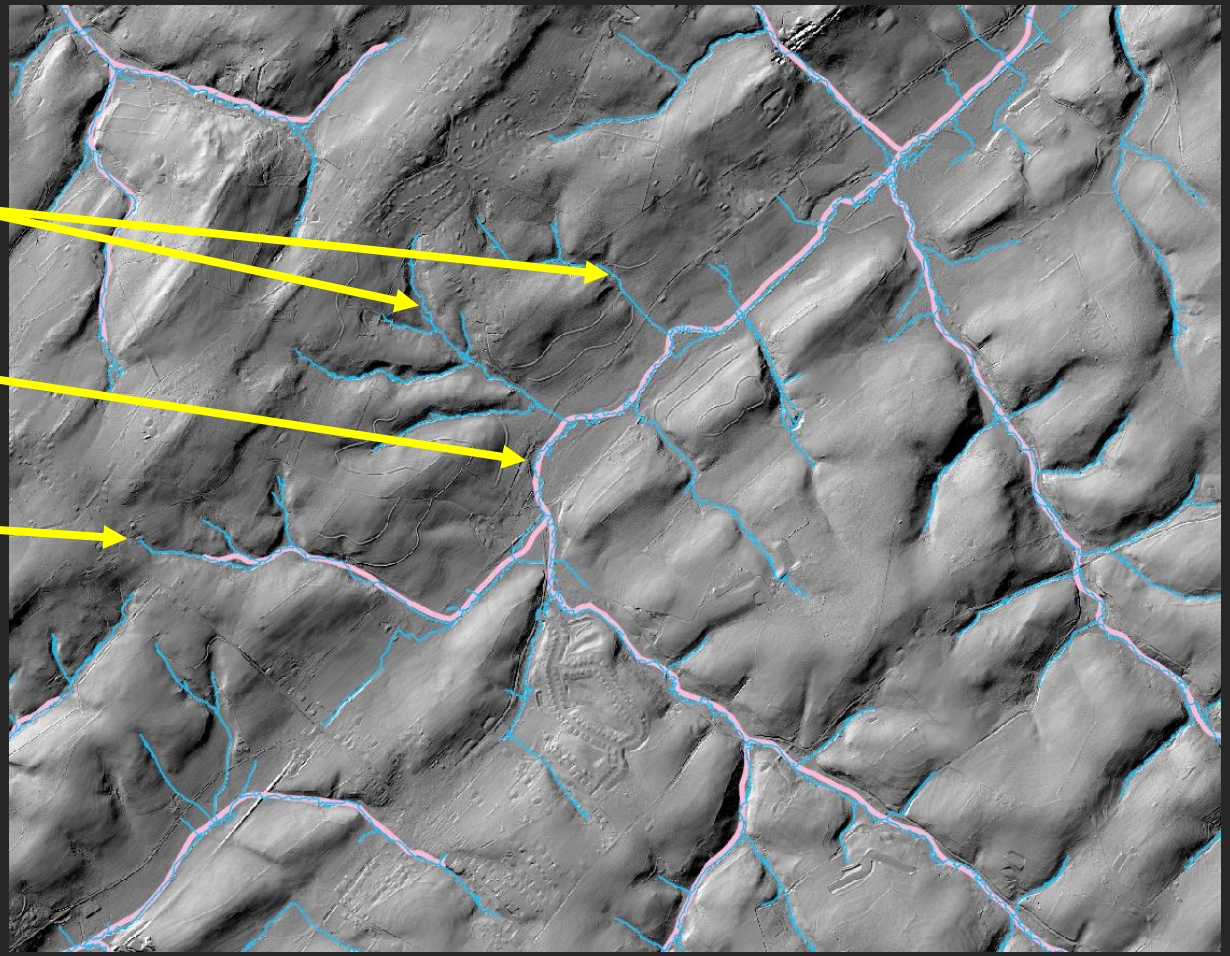
National Hydrography Dataset, 1:24,000
6,923.6 km



CBP Hyper-Resolution Flowpaths, 1:2000
16,784.6 km



Why the 2x difference in “stream” length?



USGS

Tree Canopy Change in Two Suburban Counties

Prince George's County: 2014 - 2018

TC Loss (7,673 acres):
- 59% of loss change occurred within forest or wetlands
- 41% of loss occurred in developed areas

TC Gain (518 acres):
- 16% of gain occurred
  - shrub/scrub; edg
- 54% of gain occurred
- 29% of gain occurred

Anne Arundel County: 2014 - 2018

TC Loss (2,544 acres):
- 57% of loss change occurred within forest or wetlands
- 42% of loss occurred in developed areas

TC Gain (188 acres):

st or wetlands

oed areas

ltural lands

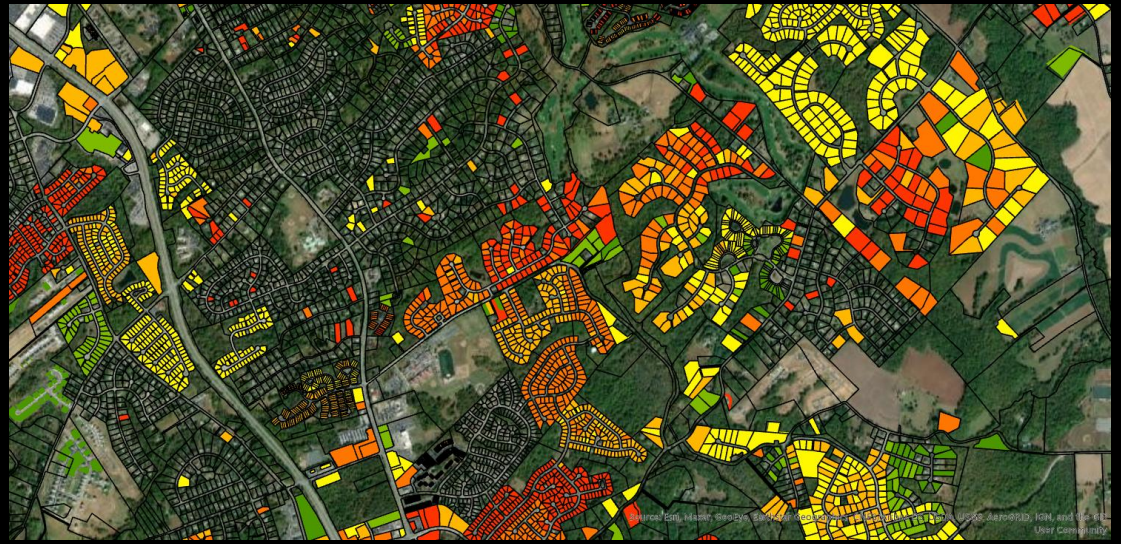
Communicating high-res tree canopy change requires distinguishing between timber harvests, natural forest dynamics, and permanent conversions.

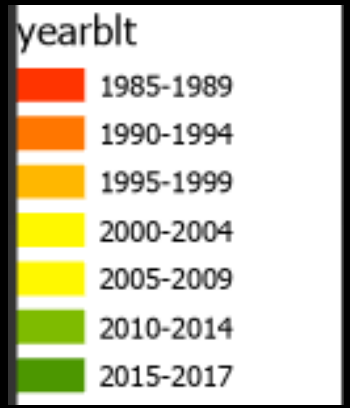
Even after doing so, we're losing significant amounts of tree canopy.

USGS

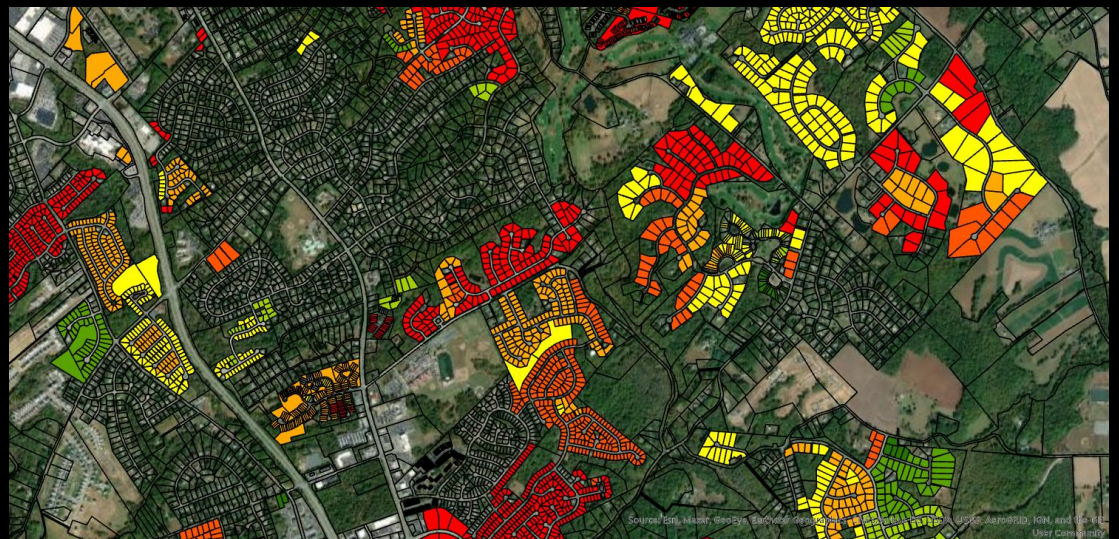
Parcel-Level Deconstruction of Urban Development (1985 – 2017)

Year-Built Attributes from Tax Records





Year-Built Attributes from USGS' LCMAP



Informing Land Use and Conservation Decisions with Data

On the Horizon

- Policies and regulations related to climate change with land use implications
- CBP Partner commitments to conserving 30% of land by 2030 and 50% by 2050
- Development of an effective CBP local engagement strategy (with science translators)
- Technological Innovations (e.g., LiDAR, satellite imagery, artificial intelligence)
- Increased understanding of the role of landscape context in estimating BMP efficiencies, pollutant loads, and impacts to stream flow and temperature
- CBP Partner uses and interest in the high-resolution land use/cover products

Adapt

How does all of this impact our work?

Based on what we learned, we plan to …

- Monitor changes in land cover (12 classes), land use (55 classes), and watershed health metrics every four years: 2013-2017-2021.
- Deconstruct high-res land use from 2013 to mid 1980's.
- Refine forecasts of land use change to include agriculture and timber harvests.
- Relate land use changes to effects on water quality, healthy watersheds, and communities.
- Formally publish the data and develop online viewers and other communication and interpretive products.

Help

How can the Management Board lead the Program to adapt?

Help Needed

- Support the long-term monitoring of land use conditions by re-soliciting a Cooperative Agreement to monitor land use/cover change every 4-5 years through 2030 (e.g., adding 2025/26 and 2029/30 dates).

- Support the refinement and implementation of the CBP's Local Engagement Strategy, leveraging data, metrics, and information generated by this Outcome and the Land Use Options Evaluation Outcome to inform a targeted set of local decisions.

Discussion