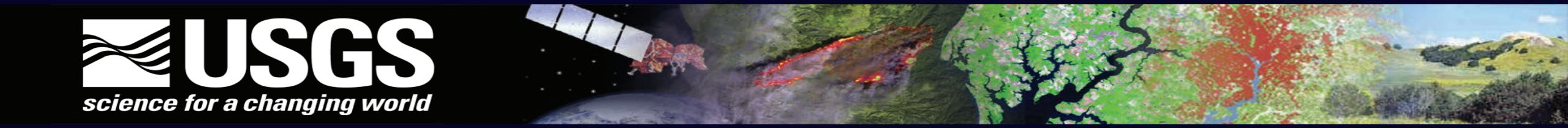

Development of multi-temporal high-resolution land cover and land use data for the Chesapeake Bay watershed

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U.S. Department of the Interior
U.S. Geological Survey

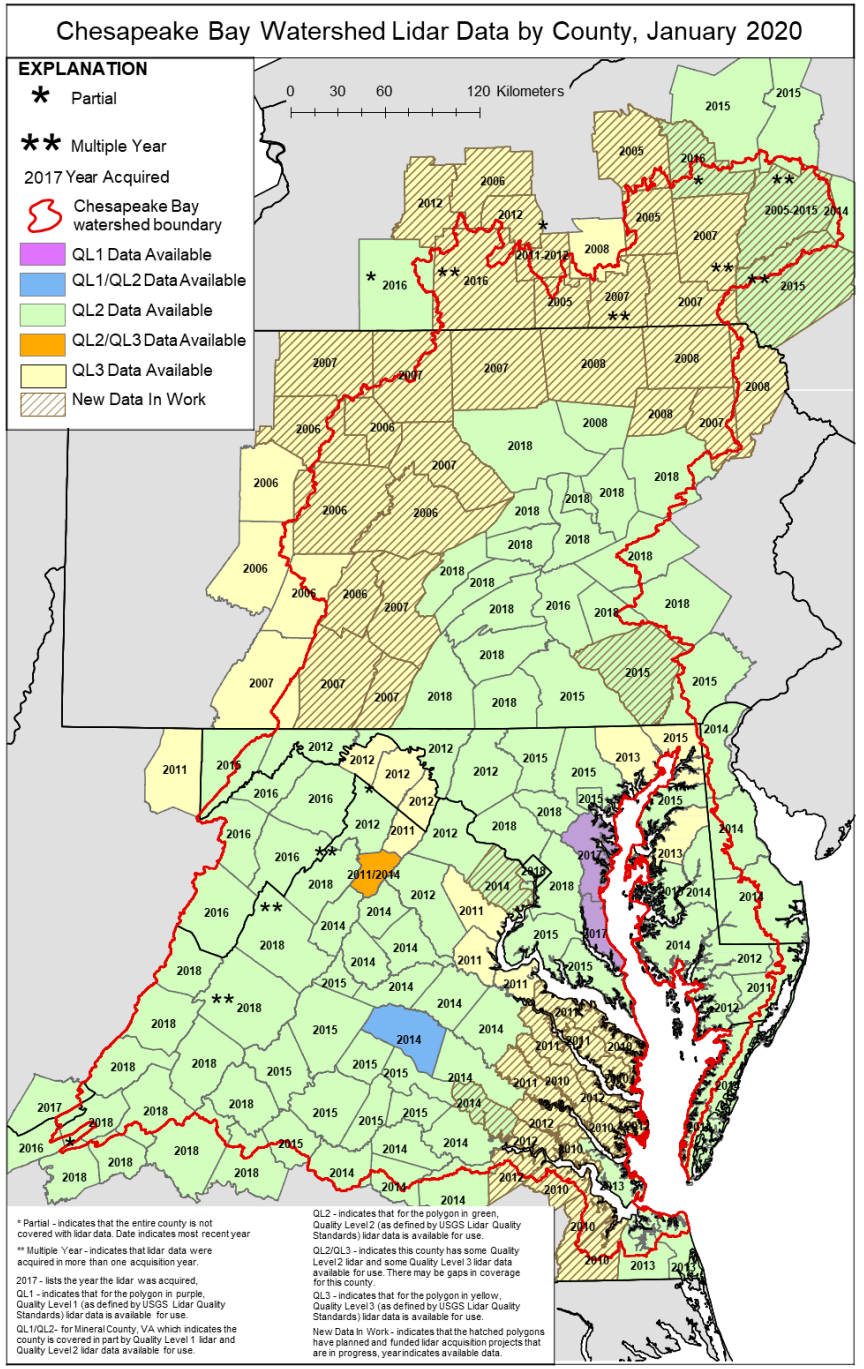
Chesapeake Bay 1-Meter Resolution Data

1. Land cover (12 classes): 2013/14, 2017/18, 2021/22
2. Land use (58 classes): 2013/14, 2017/18, 2021/22
3. Streams/ditches: best available LiDAR vintage
    - Stream channel and floodplain attributes

USGS

Additional LiDAR Derivatives

- Height (normalized DSM to ground elevation, 1m LiDAR)
- Compound Topographic Index (3m, LiDAR)
- Topographic Wetness Index (3m, LiDAR)
- Multiscale Landforms (3m, LiDAR)

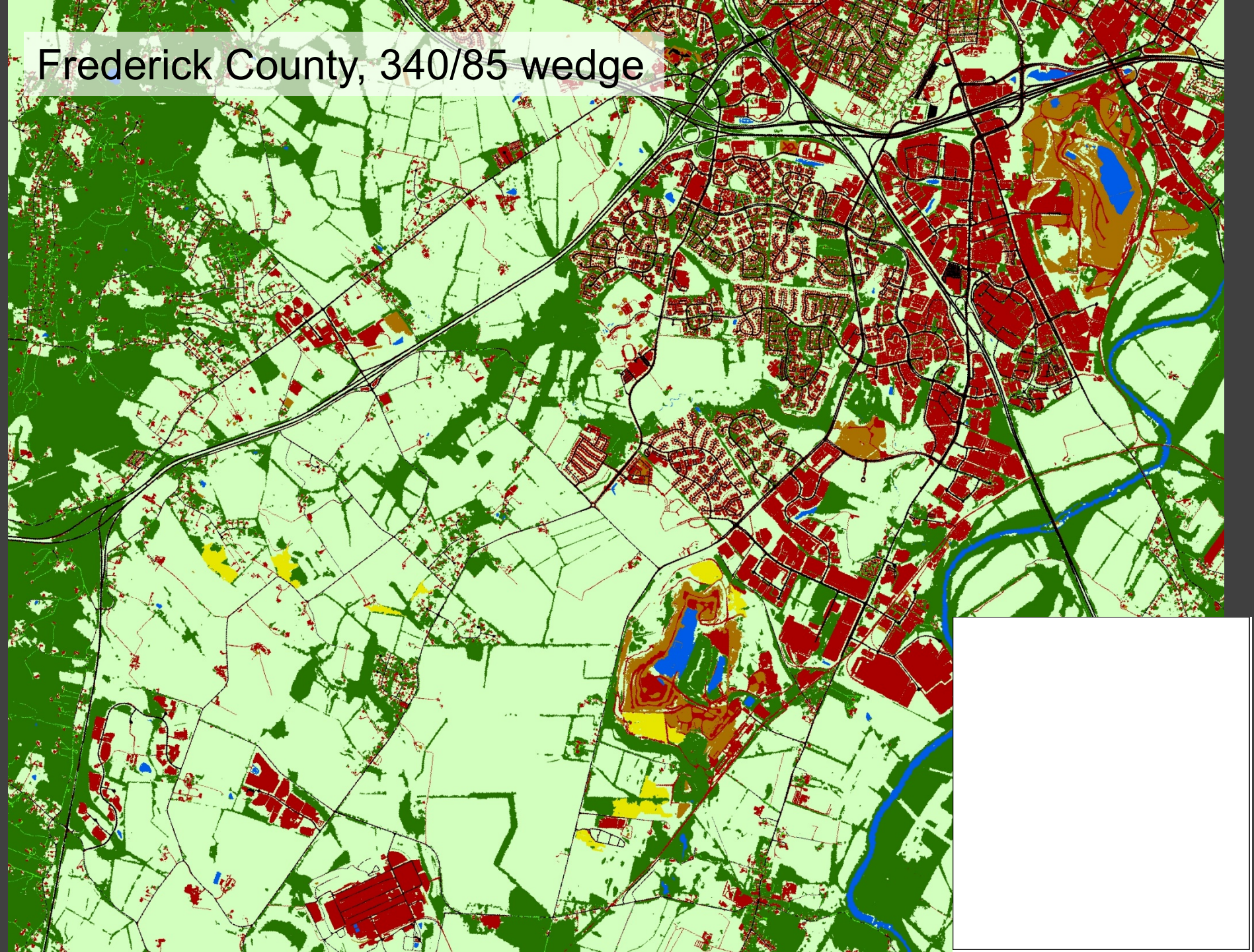


USGS

Frederick County, 340/85 wedge

USGS

Frederick County, 340/85 wedge



USGS

Local land use and parcel data

- Low-density Residential
- Recreation
- Agriculture
- Roads

High-resolution land cover data

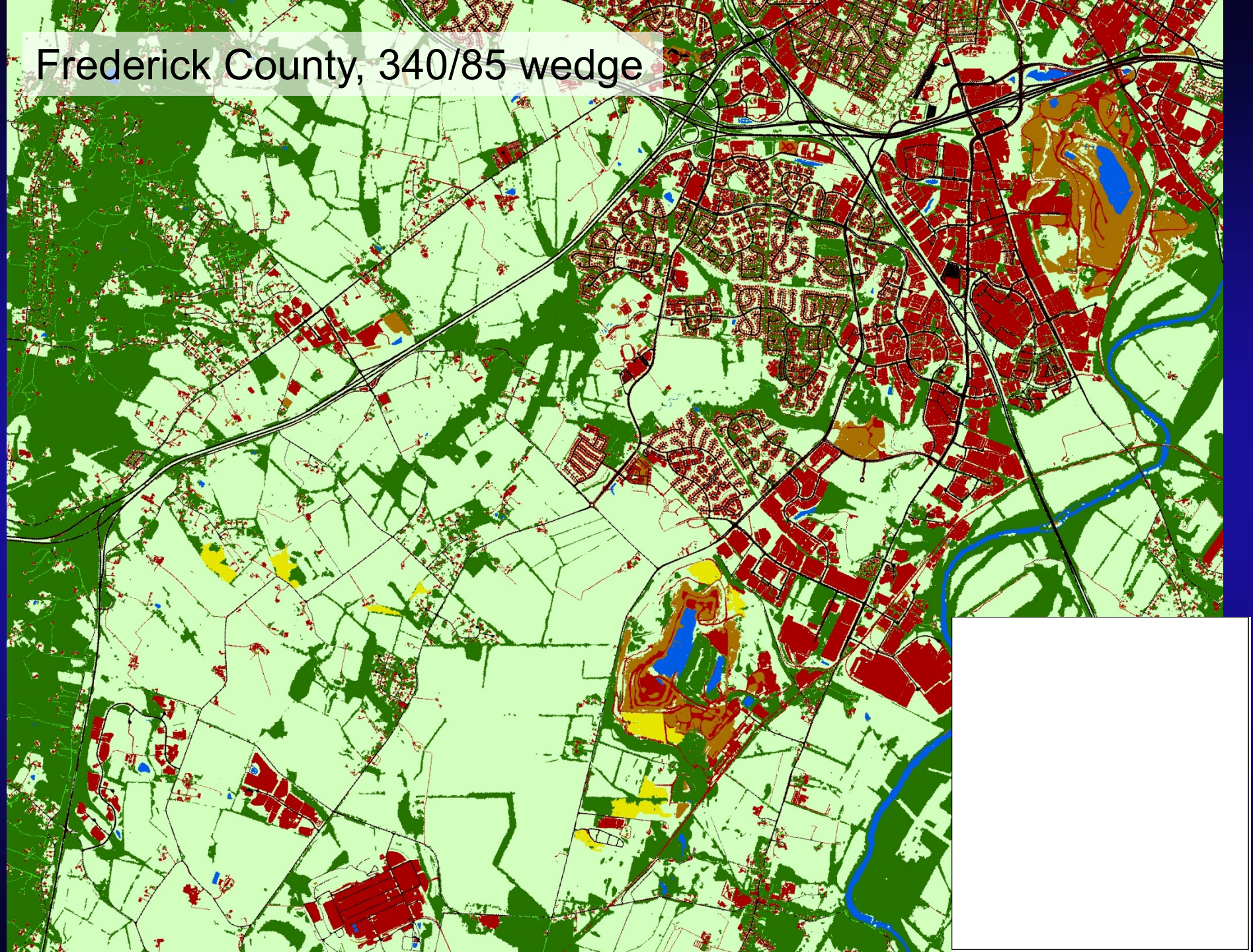
- Impervious surfaces
- Tree canopy
- Low vegetation
- Water

CBP Land Uses

- Impervious-Roads
- Forests
- Turf Grass
- Open Space

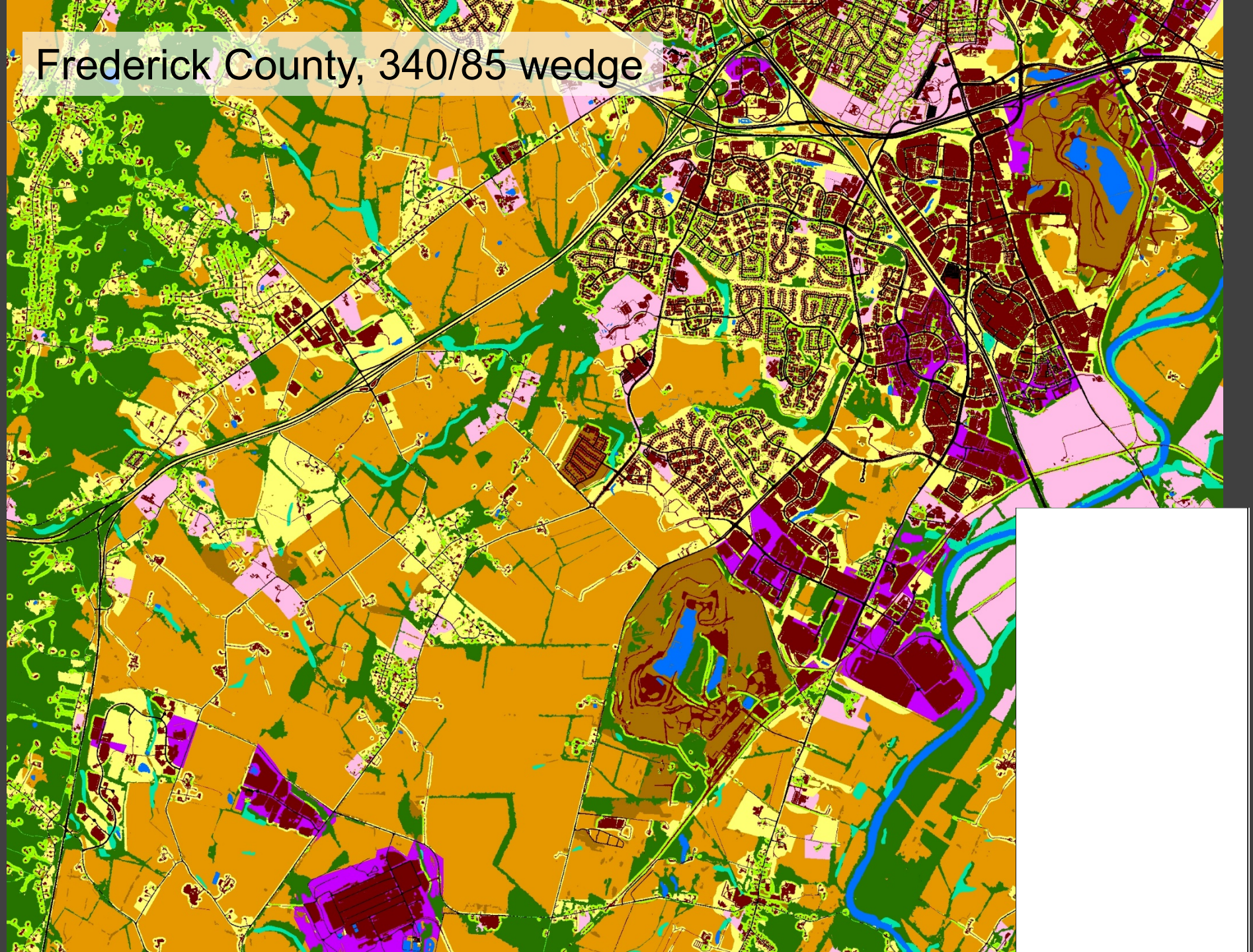
USGS

Frederick County, 340/85 wedge

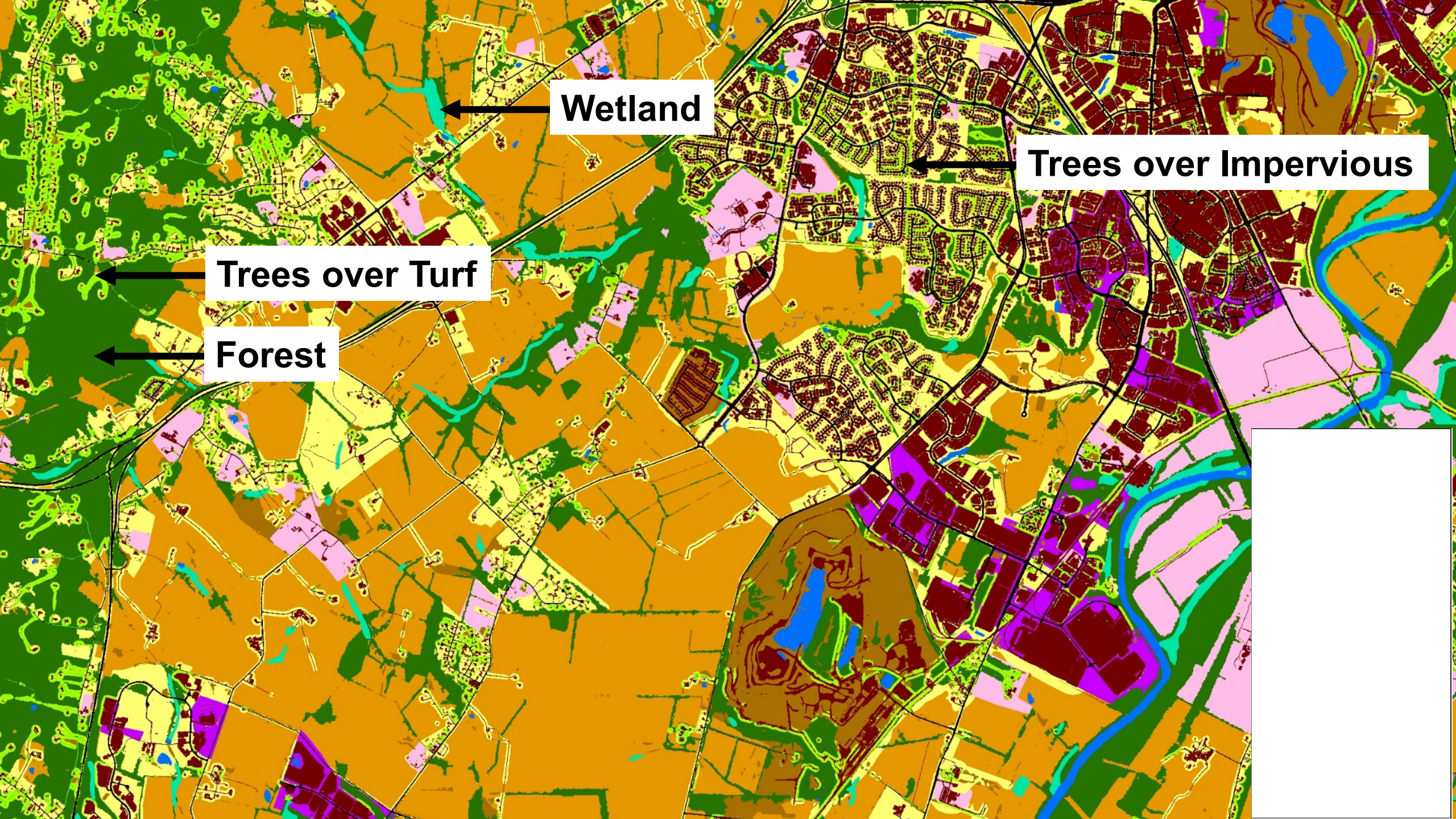


USGS

Frederick County, 340/85 wedge

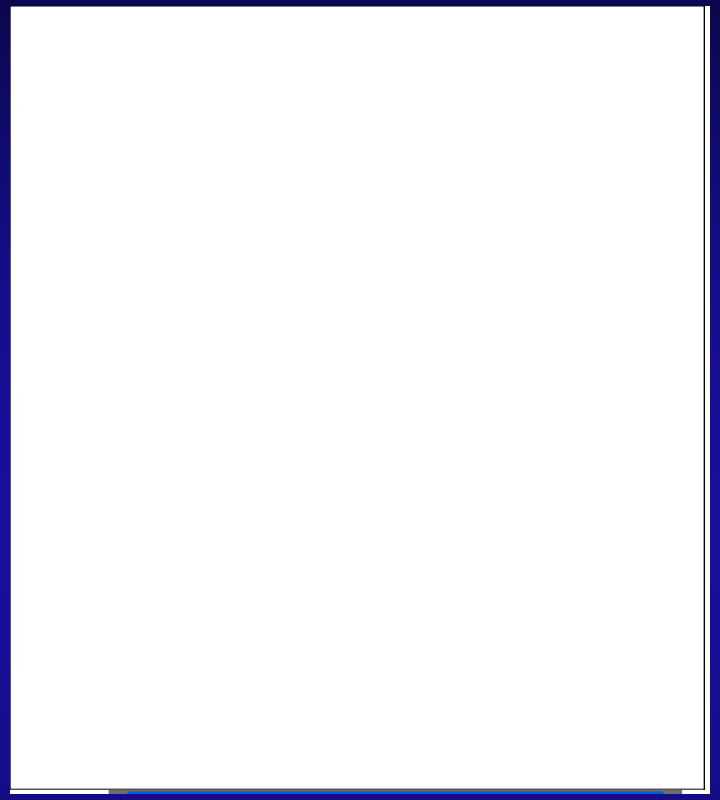


USGS

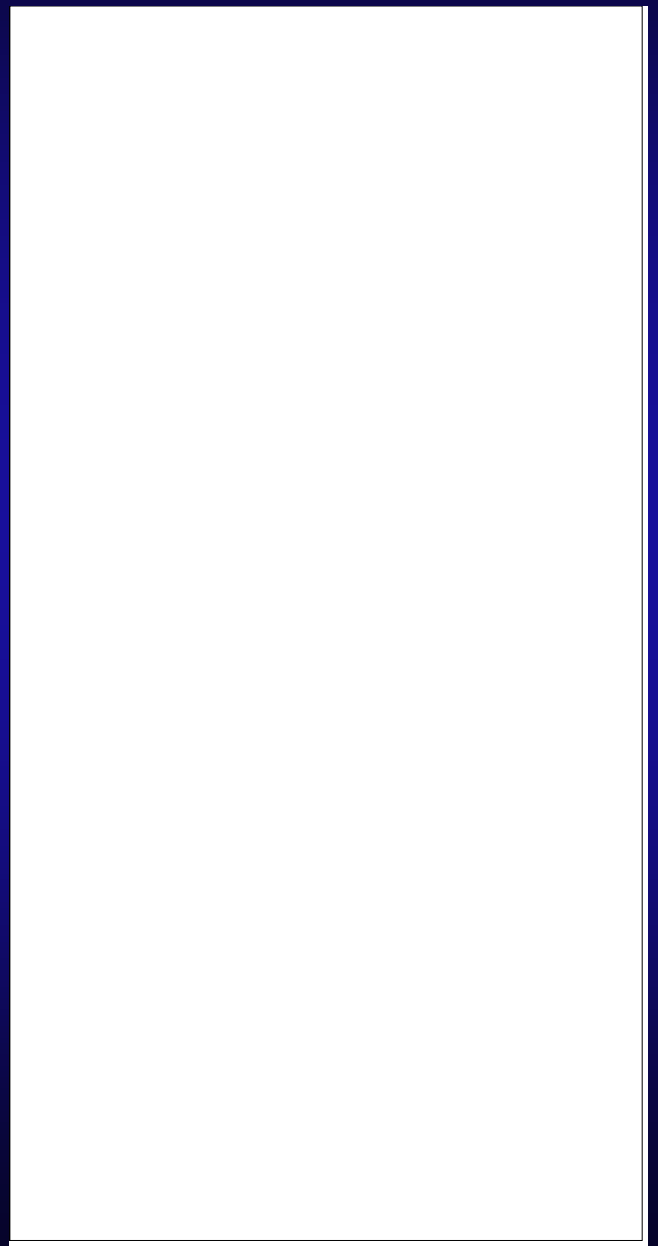

Wetland
Trees over Impervious
Trees over Turf
Forest

2013/14 Chesapeake Bay Watershed Land Cover/Use Data

1m Land Cover



1m Land Use



10m Land Cover/Use

Impervious Roads
Impervious Non-Roads
Tree Canopy Over Impervious
Tree Canopy Over Turf Grass
Turf Grass
Forest
Wetlands (Floodplain)
Wetlands (Other)
Wetlands (Tidal)
Water
Mixed Open
Cropland
Pasture

https://chesapeake.usgs.gov/phase6/map/#map=7/-8582732.74/4851421.17/0.0/0,4

USGS

Chesapeake Bay Program Land Use Classification

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

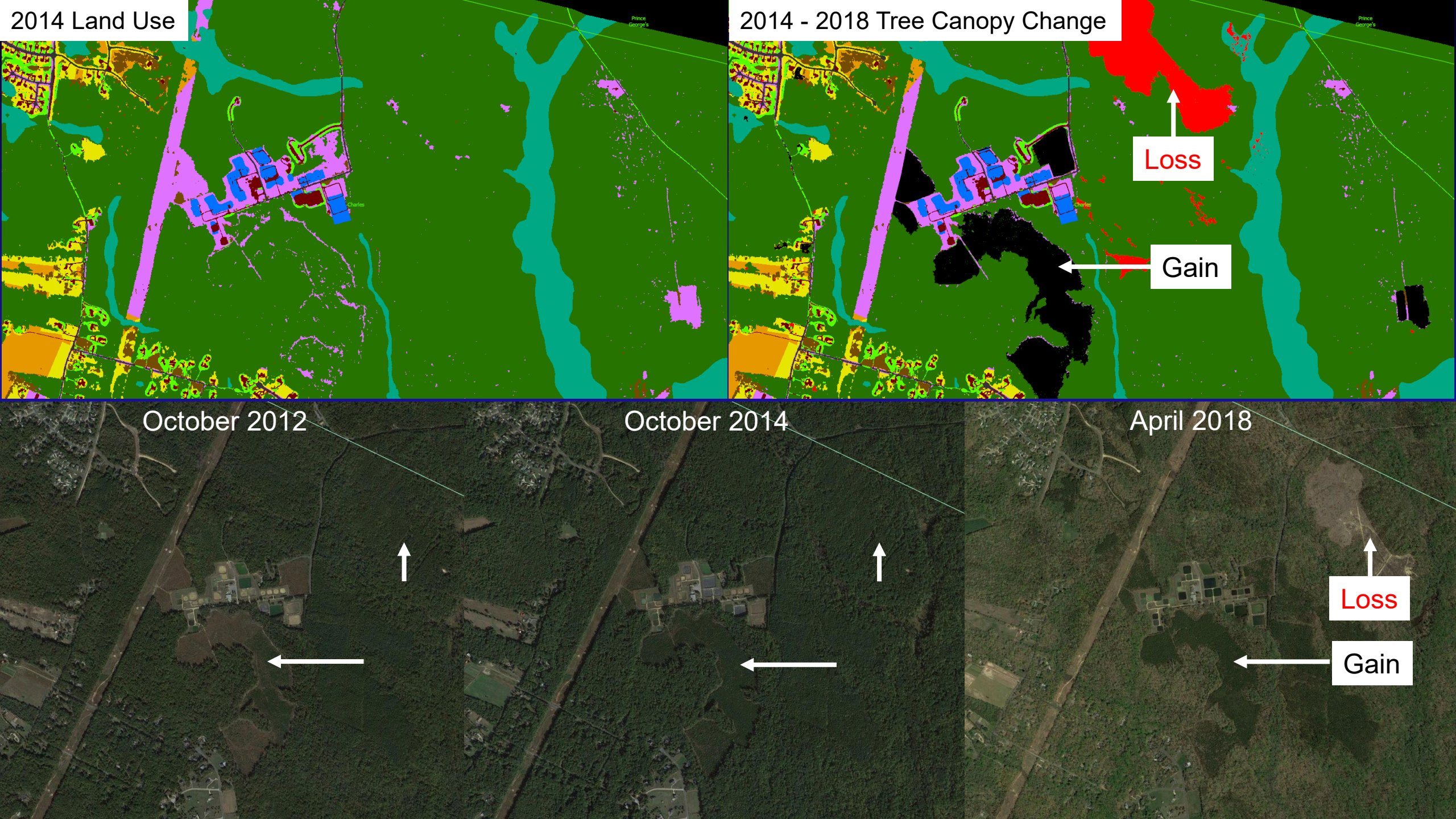
2. Developed (12)
- 2.1 Infrastructure
  - 2.1.1 Roads
  - 2.1.2 Tree Canopy (TC) over Roads
  - 2.1.3 Structures
  - 2.1.4 TC over Structures
  - 2.1.5 Other Impervious
  - 2.1.6 TC over Other Impervious
  - 2.1.7 Suspended Succession (rights-of-way)
    - 2.1.7.1 Barren
    - 2.1.7.2 Herbaceous
    - 2.1.7.3 Scrub-shrub
- 2.2 Bare Construction
- 2.3 Turf Grass
- 2.4 Tree Canopy over Turf Grass

3. Forest (5)
- 3.1 Contiguous (> 1 acre)
- 3.2 Fragmented (< 1 acre)
- 3.3 Natural Succession (e.g., Fallow)
  - 3.3.1 Barren
  - 3.3.2 Herbaceous
  - 3.3.3 Scrub-shrub

4. Production (14)
- 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 Timber Harvest
  - 4.2.1 Barren
  - 4.2.2 Herbaceous
  - 4.2.3 Scrub-shrub
- 4.3 Extractive
  - 4.3.1 Barren
  - 4.3.2 Herbaceous
  - 4.3.3 Scrub-shrub
- 4.4 Solar fields

5. Wetland (19)
- 5.1 Tidal
  - 5.1.1 Open water
  - 5.1.2 Barren
  - 5.1.3 Herbaceous
  - 5.1.4 Scrub-shrub
  - 5.1.5 Contiguous Forest
  - 5.1.6 Fragmented Forest
- 5.2 Non-tidal
  - 5.2.1 Floodplain/ Headwater
    - 5.2.1.1 Open water
    - 5.2.1.2 Barren
    - 5.2.1.3 Herbaceous
    - 5.2.1.4 Scrub-shrub
    - 5.2.1.5 Contiguous Forest
    - 5.2.1.6 Fragmented Forest
  - 5.2.2 Other
    - 5.2.2.1 Open water
    - 5.2.2.2 Barren
    - 5.2.2.3 Herbaceous
    - 5.2.2.4 Scrub-shrub
    - 5.2.2.5 Contiguous Forest
    - 5.2.2.6 Fragmented Forest
- 5.3 Bare shore

USGS


2014 Land Use
2014 - 2018 Tree Canopy Change
Loss
Gain
October 2012
October 2014
April 2018
Loss
Gain

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 within forest or wetlands
  - shrub/scrub; edge of forest
- 54% of gain occurred in developed areas
- 29% of gain occurred on agricultural lands

Anne Arundel County: 2014 - 2018

TC Loss (2,544 acres):

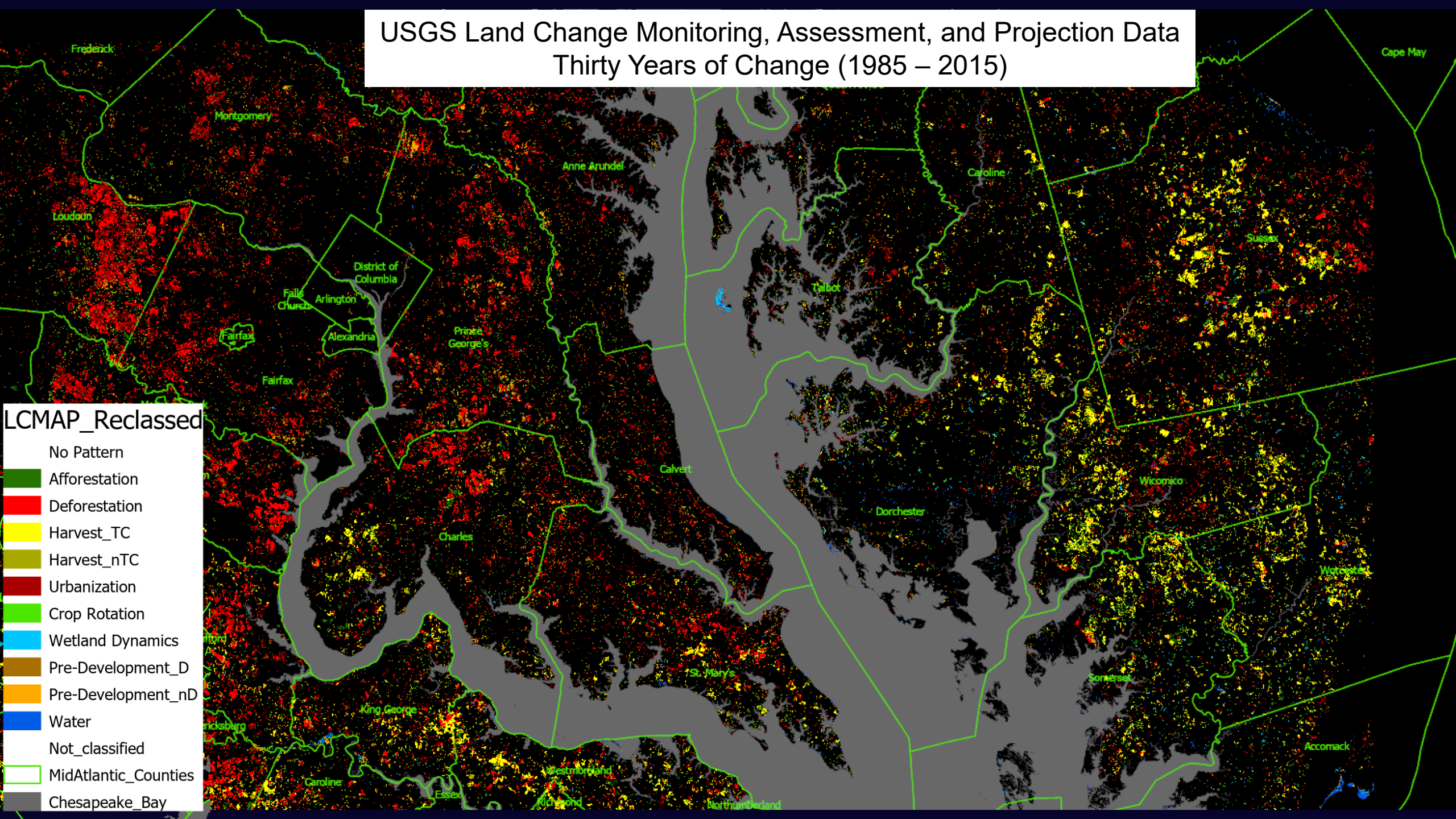
- 57% of loss change occurred within forest or wetlands
- 42% of loss occurred in developed areas

TC Gain (188 acres):

- 9% of gain occurred within forest or wetlands
  - shrub/scrub; edge of forest
- 55% of gain occurred in developed areas
- 35% of gain occurred on agricultural lands

USGS

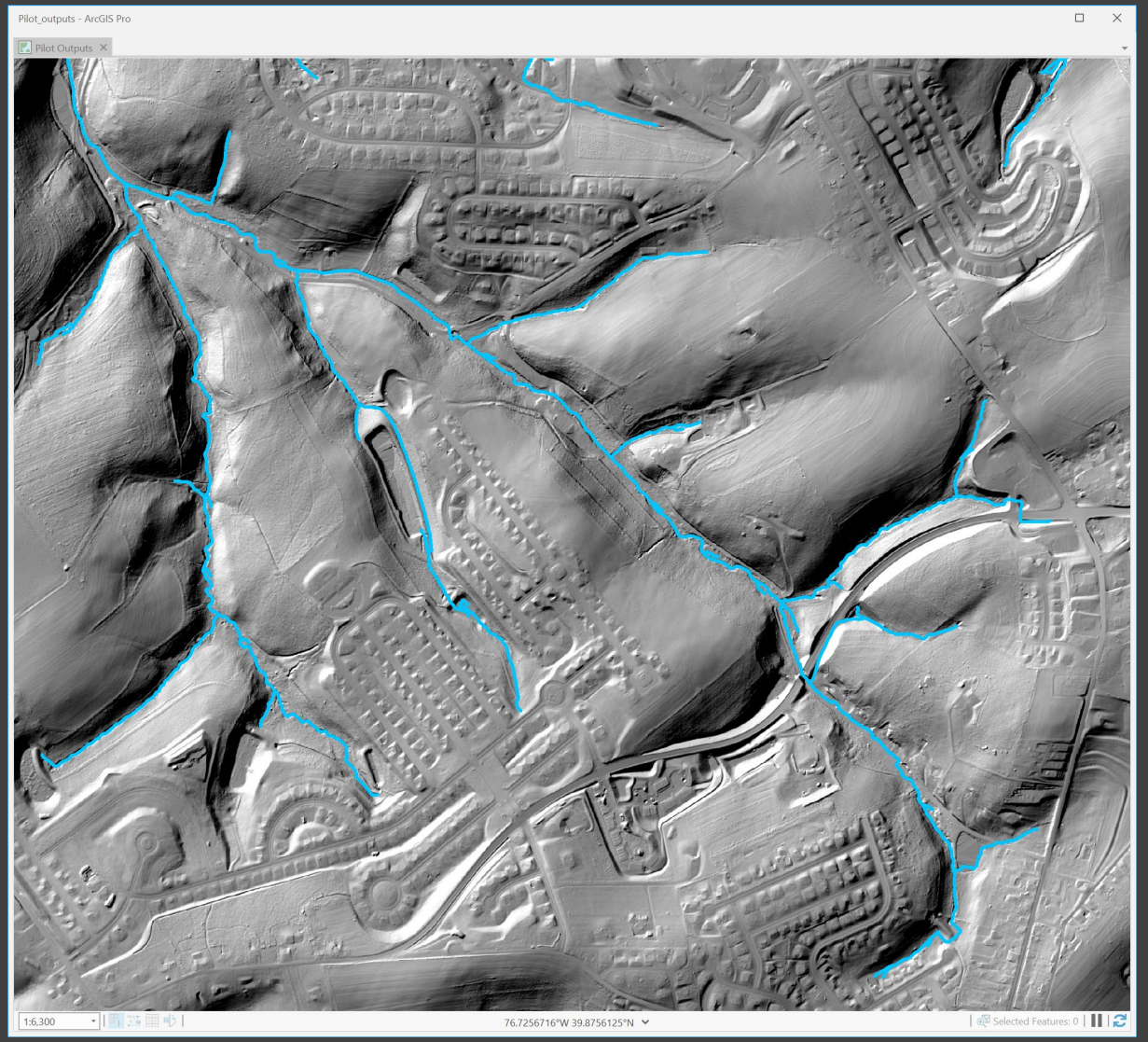
USGS Land Change Monitoring, Assessment, and Projection Data
Thirty Years of Change (1985 – 2015)



Hyper-Resolution* Hydrography

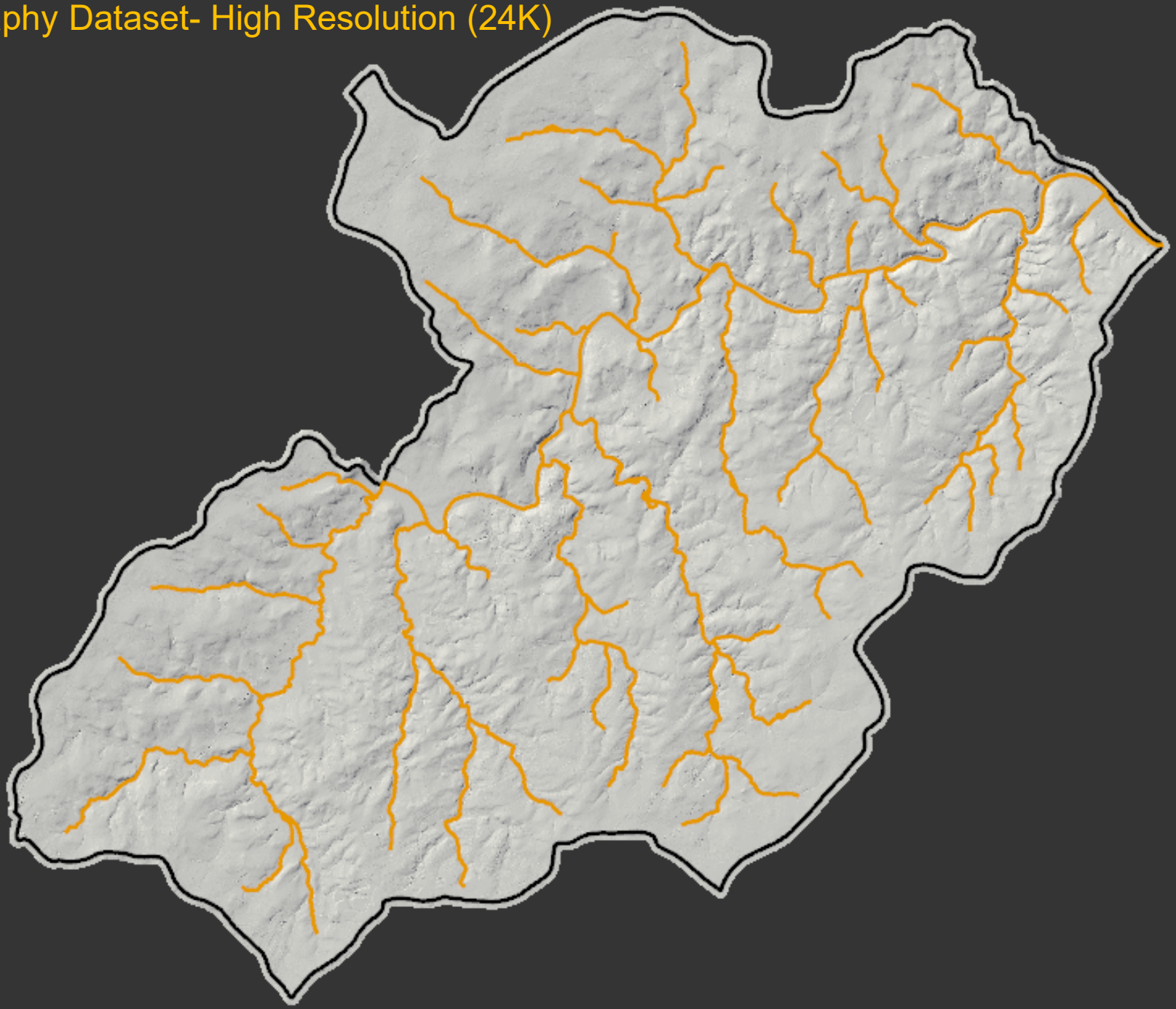
CONSERVATION INNOVATION CENTER
CHESAPEAKE CONSERVANCY
UMBC

1. Lidar elevation
2. Valley-scale geomorphons
3. Channel-scale geomorphons
4. Extract valley network
5. Extract channels using valley network
6. QAQC channel skeleton
7. Connect stream network



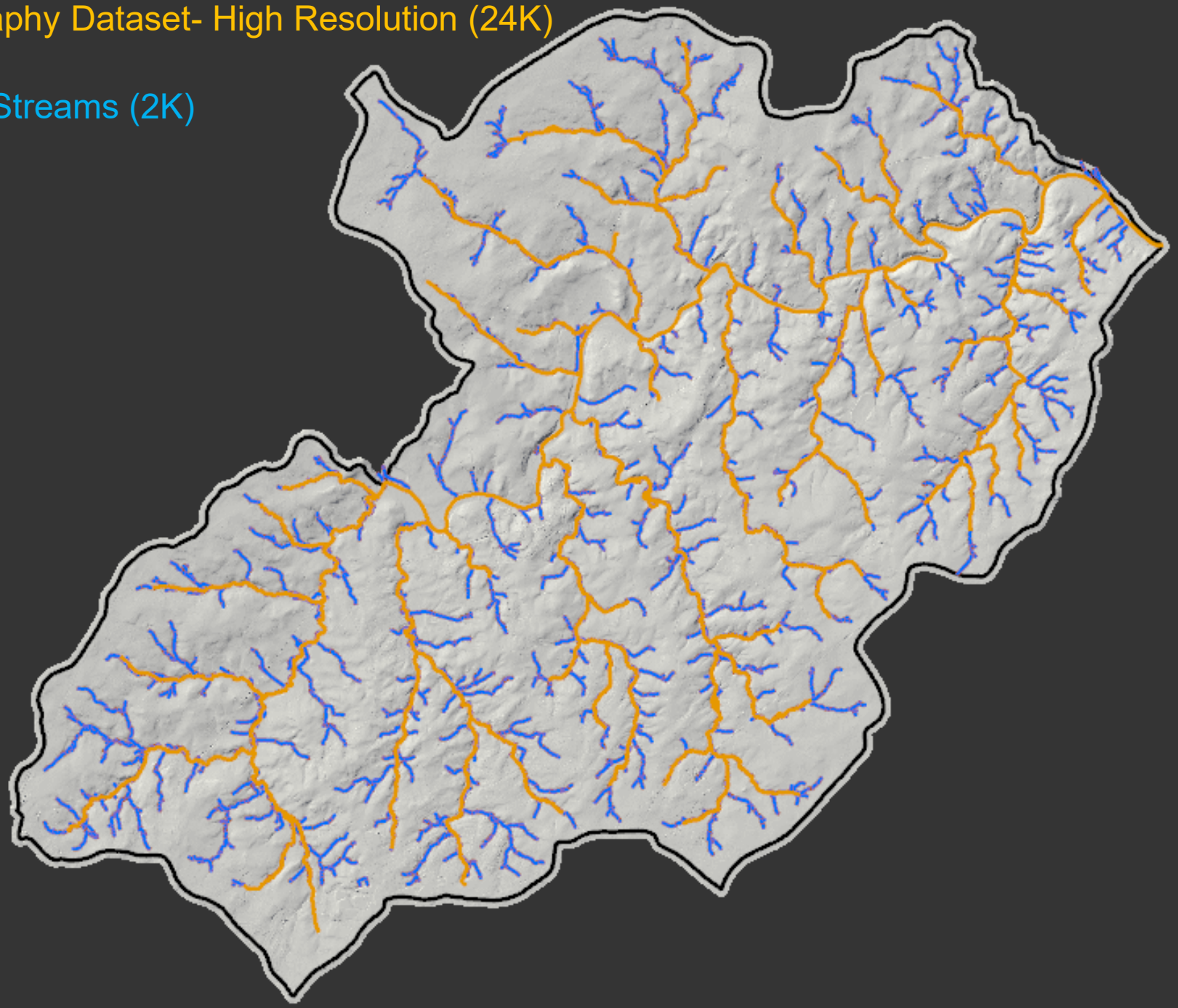
* 1-meter raster, 1:2000 scale

National Hydrography Dataset- High Resolution (24K)



National Hydrography Dataset- High Resolution (24K)

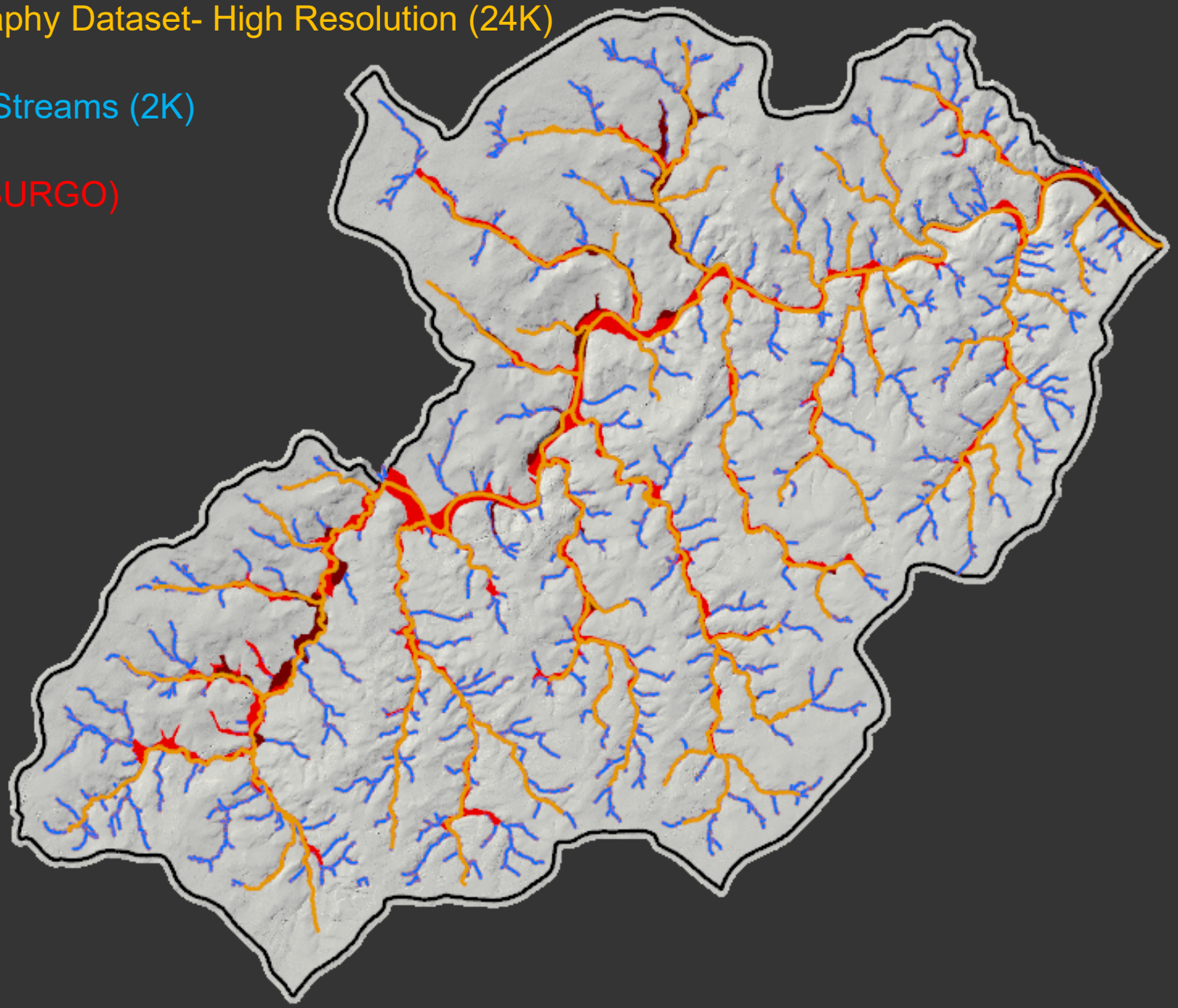
Hyper-resolution Streams (2K)



National Hydrography Dataset- High Resolution (24K)

Hyper-resolution Streams (2K)

Flooded Soils (SSURGO)

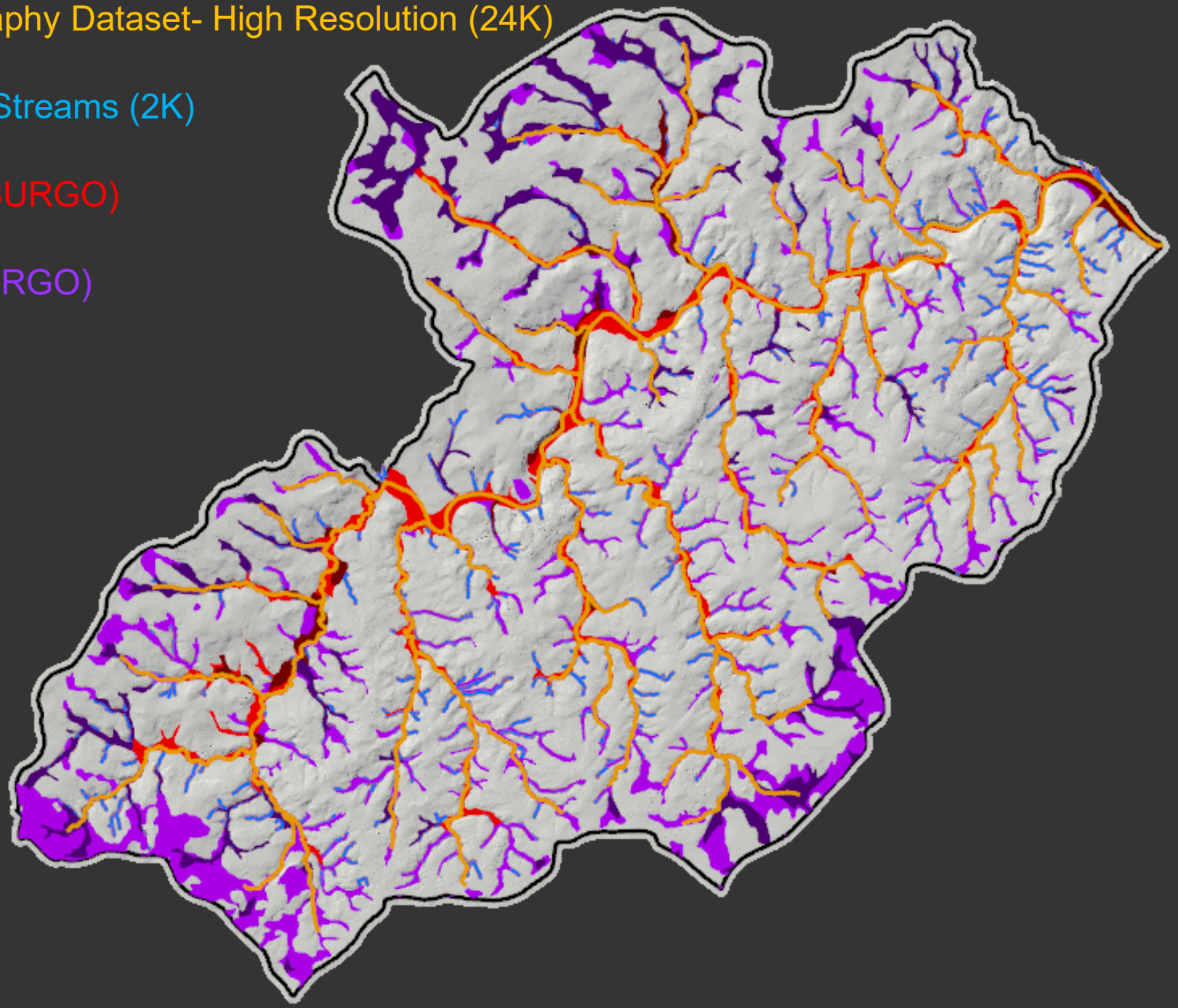


National Hydrography Dataset- High Resolution (24K)

Hyper-resolution Streams (2K)

Flooded Soils (SSURGO)

Hydric Soils (SSURGO)



National Hydrography Dataset- High Resolution (24K)

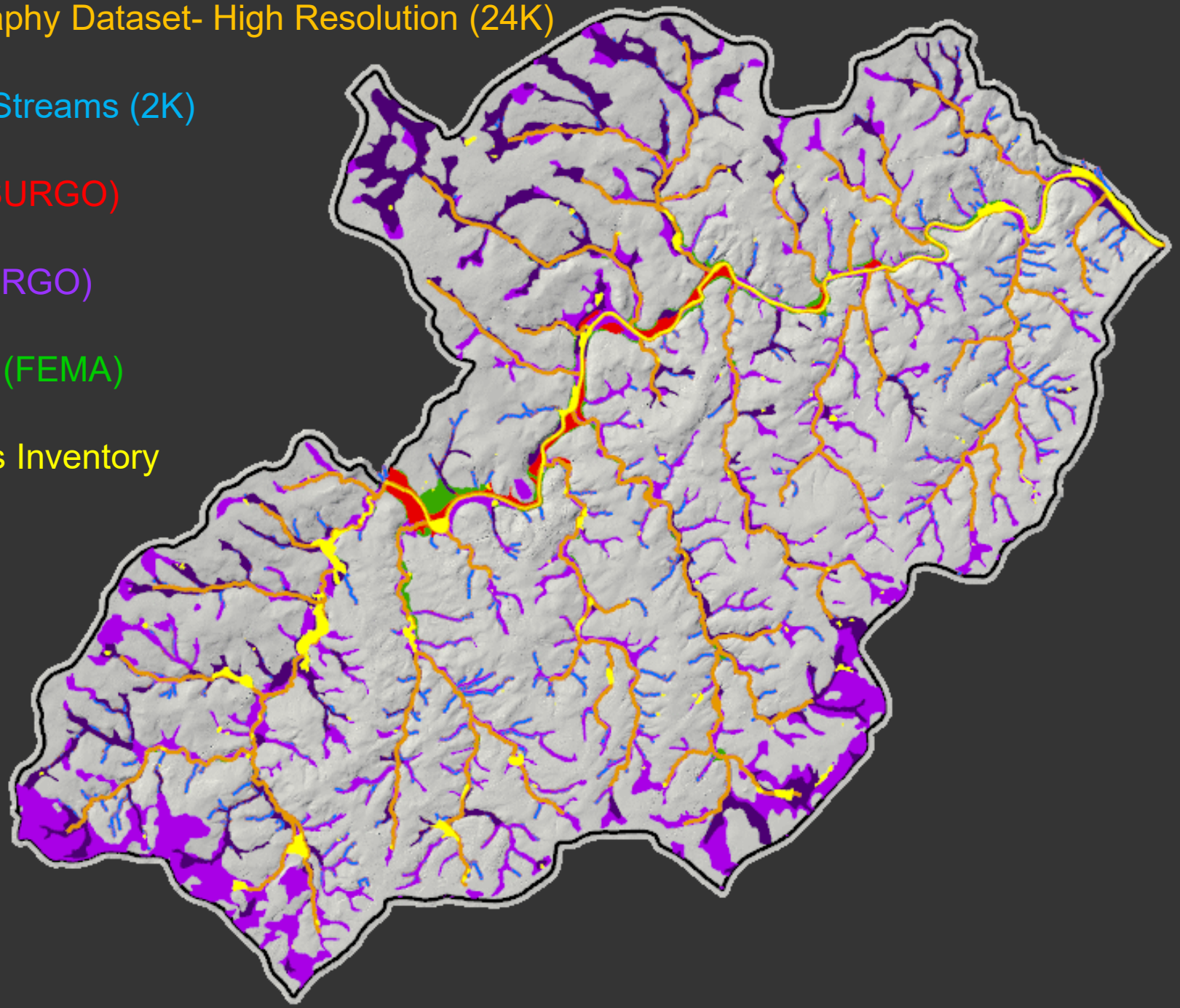
Hyper-resolution Streams (2K)

Flooded Soils (SSURGO)

Hydric Soils (SSURGO)

100-yr Floodplain (FEMA)

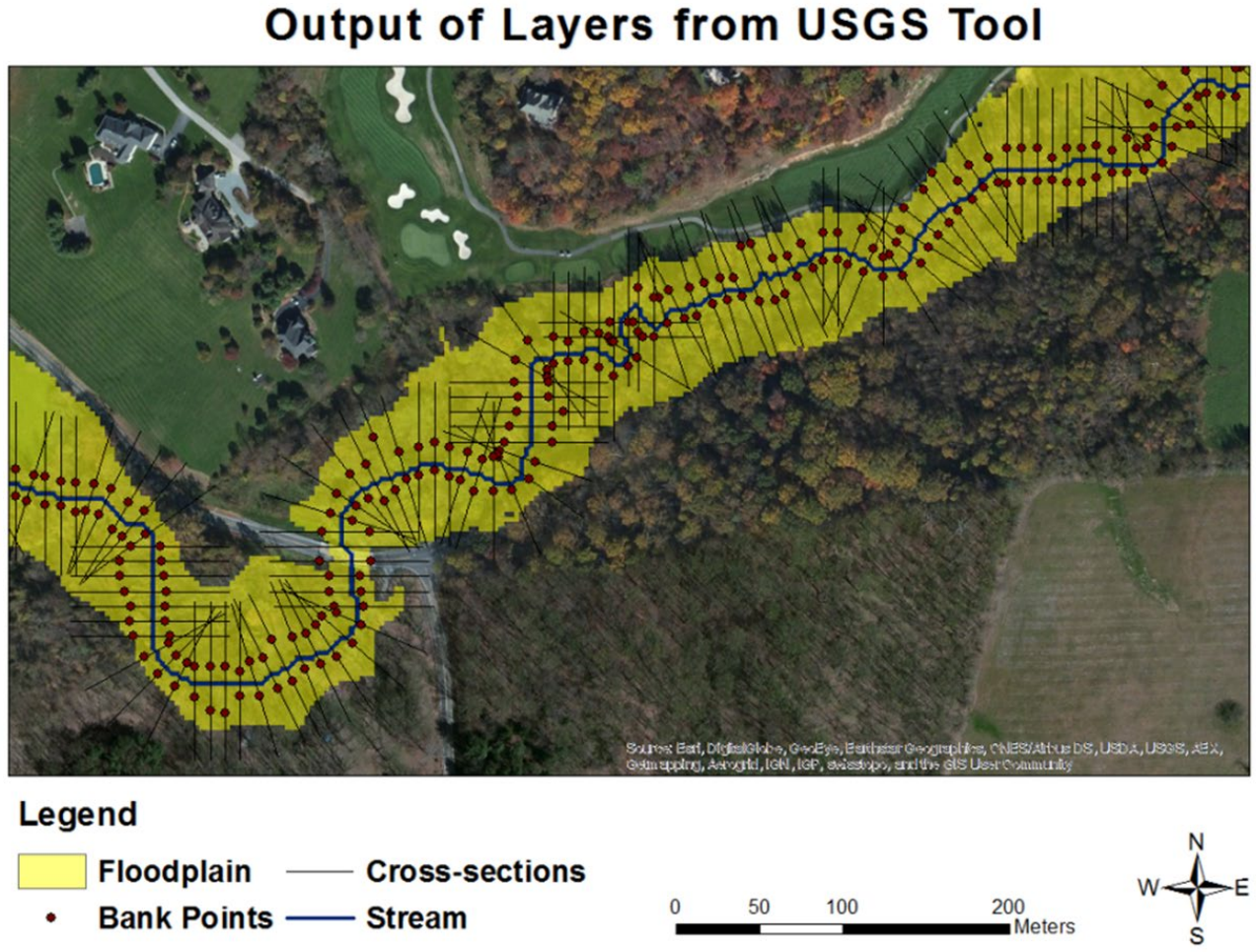
National Wetlands Inventory



USGS

USGS

USGS Floodplain and Channel Evaluation Toolkit



Channel Reach Measures

- Bank height (m)
- Bank angle, avg (deg)
- Bank angle, max (deg)
- Channel width (m)
- Channel length (m)
- Bankfull area (m^2)
- Sinuosisty
- Drainage area (km^2)
- Slope (%)
- Floodplain width (m)
- Floodplain elevation, range (m)
- Floodplain elevation, sd (m)

USGS

Summary

Under a 6-year Cooperative Agreement with the Chesapeake Bay Program, the Chesapeake Conservancy (CC) and University of Vermont (UVM) are producing 1-meter resolution land cover datasets for the years 2013/14, 2017/18, 2021/22 using the best available LiDAR and NAIP aerial imagery for the Bay watershed (including all of Maryland).

The CC and UVM are translating 12-classes of land cover into 58 of land use using ~15 ancillary datasets for each county.

The CC and UMBC are developing 1-meter resolution stream and ditch data, complementing the 1-meter resolution water bodies identified in the land cover data.

USGS has developed a GIS tool to extract channel width, height, bank angle, and floodplain width and volumes from LiDAR.

Chesapeake Bay 1-Meter Resolution Release Dates

Land cover (12 classes, 1-meter):

- 2013/14 (available now- https://chesapeakeconservancy.org/conservation-innovation-center/high-resolution-data/land-cover-data-project/)
- 2017/18 (summer 2021)
- 2021/22 (summer 2024)

Land use (16 classes, 1-meter):

- 2013/14 (available now- https://chesapeakeconservancy.org/conservation-innovation-center/high-resolution-data/land-use-data-project/)

Land use (13 classes, 10-meter):

- 2013/14 (available now- https://chesapeake.usgs.gov/phase6/map/#map=7/-8582732.74/4851421.17/0.0/0,4)

Land use (58 classes):

- 2013/14 (summer 2021)
- 2017/18 (summer 2021)
- 2021/22 (summer 2024)

Streams/ditches

- Draft (summer 2021)
- Final (summer 2023)

Stream channel and floodplain attributes (FACET)

- Version 1 (available now- https://www.sciencebase.gov/catalog/item/5cae39c3e4b0c3b00654cf57
- Version 2 (2022 - 2023)

USGS