Mapping New Forest Land Uses in the Chesapeake Bay Watershed

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

Problems

1. Scientific studies have demonstrated that the hydrologic and nutrient processing characteristics of wooded areas vary based on factors including species composition, density, age, geology, soils, local landscape position, and upslope land use characteristics. None of these factors are applied to existing land uses in the CBW model.

2. Riparian Forest Buffers (RFB) and Urban Tree Planting are “approved” Best Management Practices that are credited as land use conversions. RFB’s are further credited with reductions in nutrients and sediment from upslope acres which are always assumed to be agricultural. Reduction efficiencies vary by physiographic province. These BMP effects are not applied to existing RFBs and urban tree canopy.

Proposed Solution

1. Map three new “forest” land use types:
    - Upland Forest
    - Floodplain / Riparian Forest
    - Urban Tree Canopy

2. Develop unique loading rates for each.

Regional Data for Mapping New Forest Land Uses

- Land Cover (30m; 1984, 1992, 2001, and 2006)…(2010/2011 dataset available in 12/2013)
- Forest Inventory and Analysis
- Hydrography (1:100k and 1:24k National Hydrography Dataset)
- Elevation(National Elevation Dataset, 30m)
    - Synthetic streams (< 1:24,0000 scale)
    - Landforms (ridge, slope, levee, etc.)
- Roads (NAVTEQ 2010)
- SSURGO (1:12K to 1:63k NRCS County Soil Surveys)
- Hydrogeomorphic regions
- FEMA floodplains (Digital Flood Insurance Rate Maps, DFIRMs)
- NWI wetlands

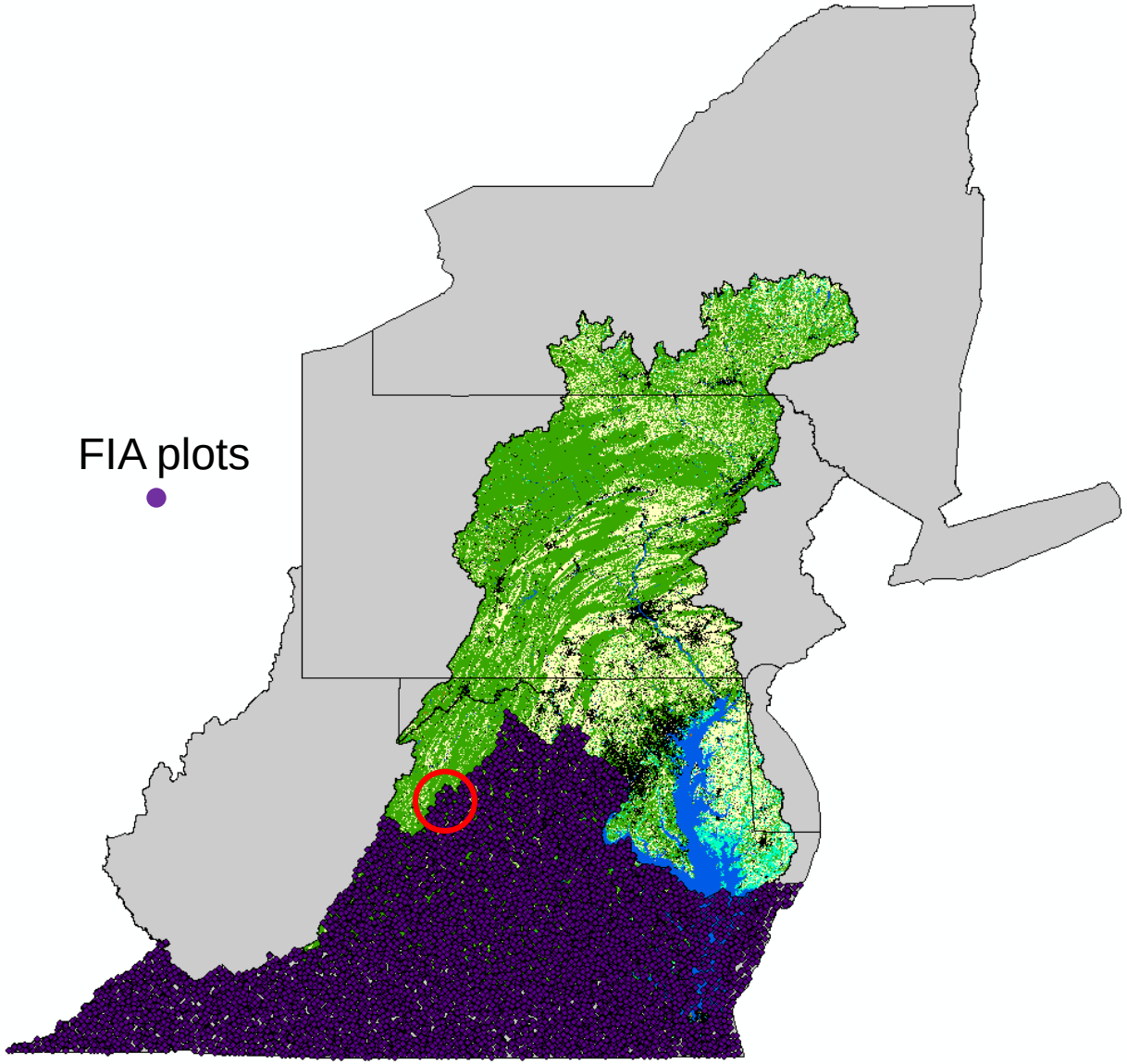
Local Data for Mapping Forests

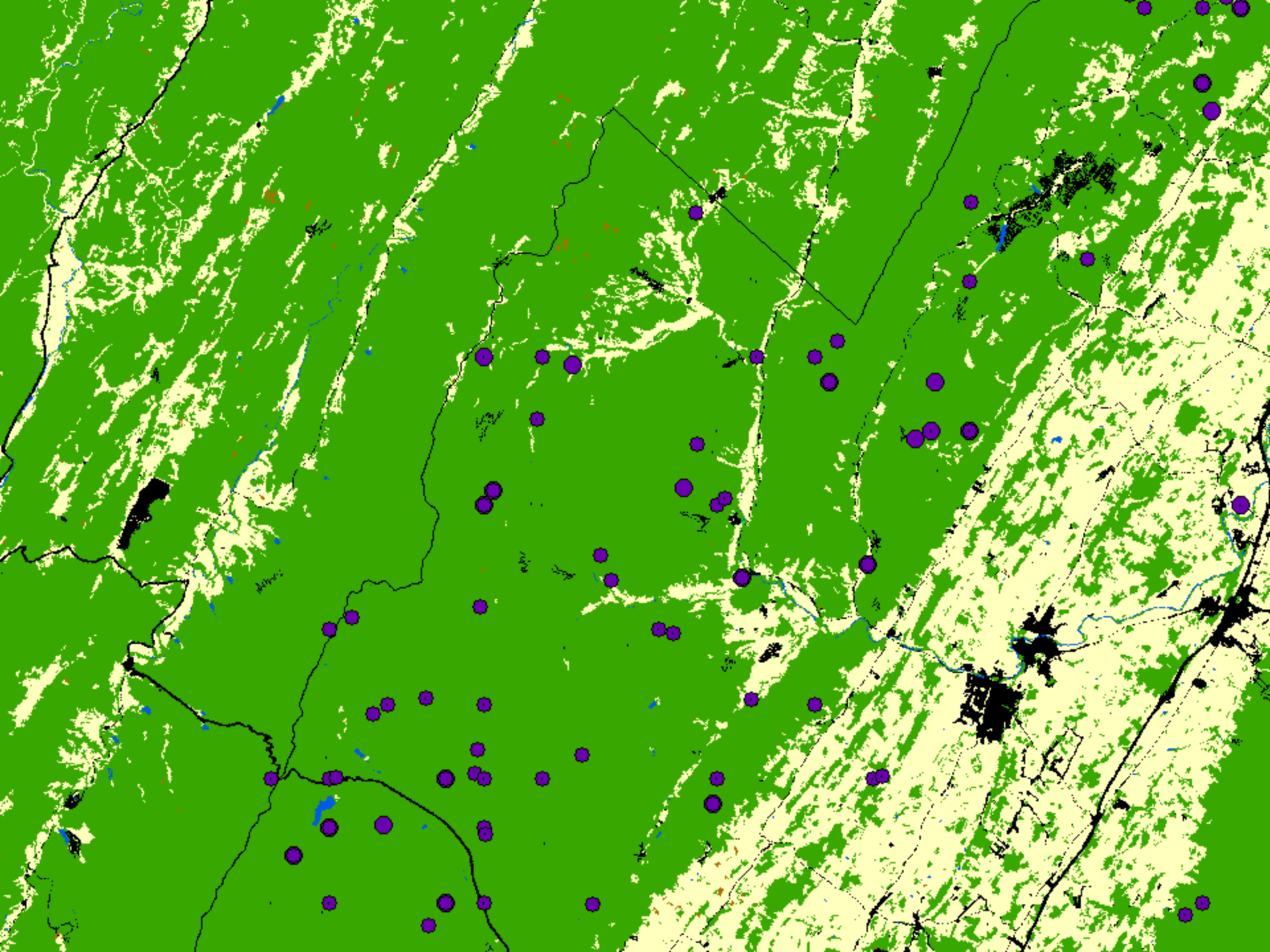
- Land Cover (Aerial photography or High-res satellite, <= 1m)
- Land Use (parcels attributed with designated use)
- Elevation, slope, and flow accumulation (LiDAR, 2m)
- Hydrography (<= 1:5000 scale)
- Roads (more recent than 2010 vintage)

Mapping Forests

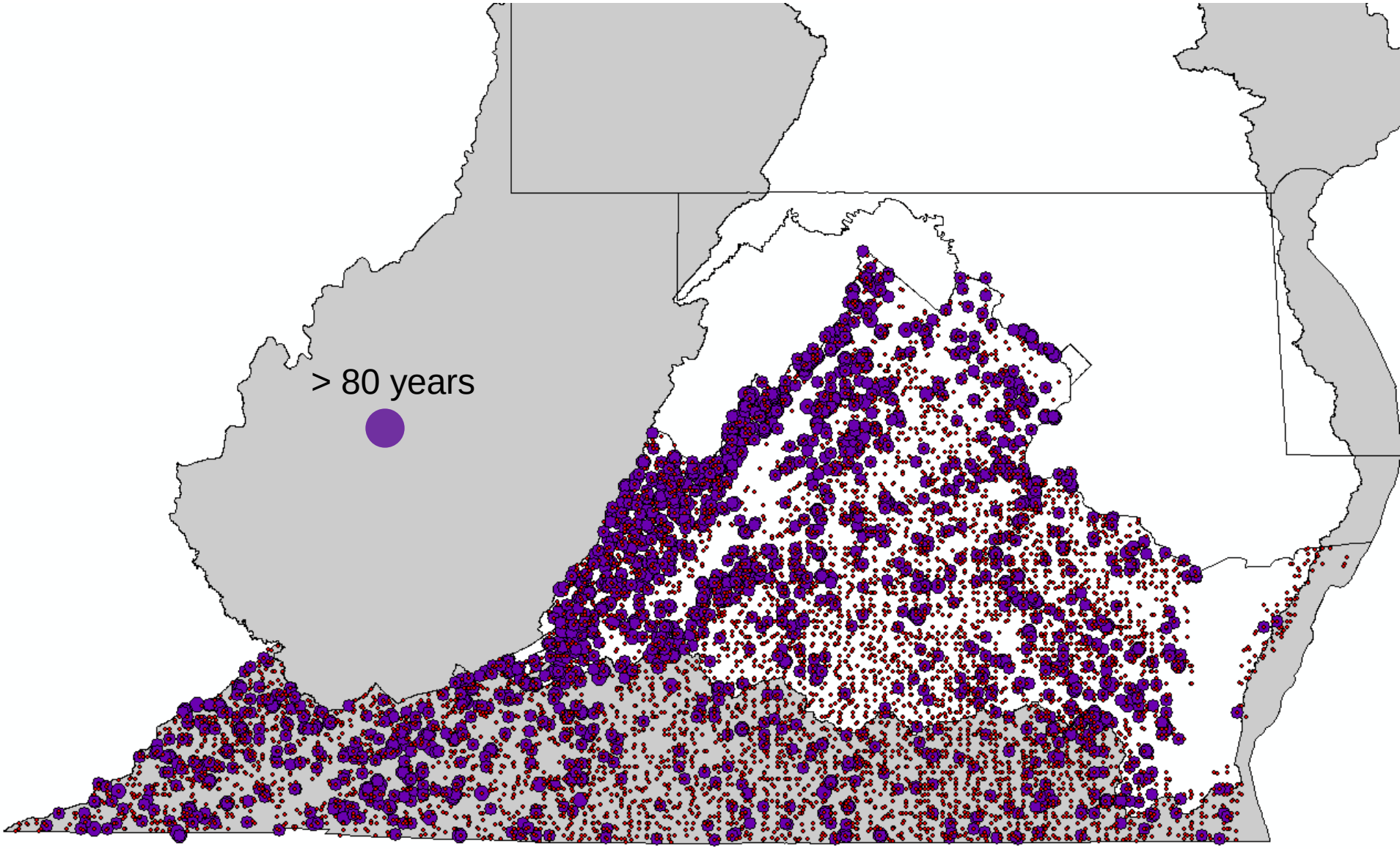
1. Tree Canopy
   - Land cover (categorical)
   - Land cover (fractional)
2. Fragmentation
   - Roads, energy transmission lines, forest gaps
3. Forest characteristics
   - Stand age
   - Species composition
   - Structure

Mapping Forests





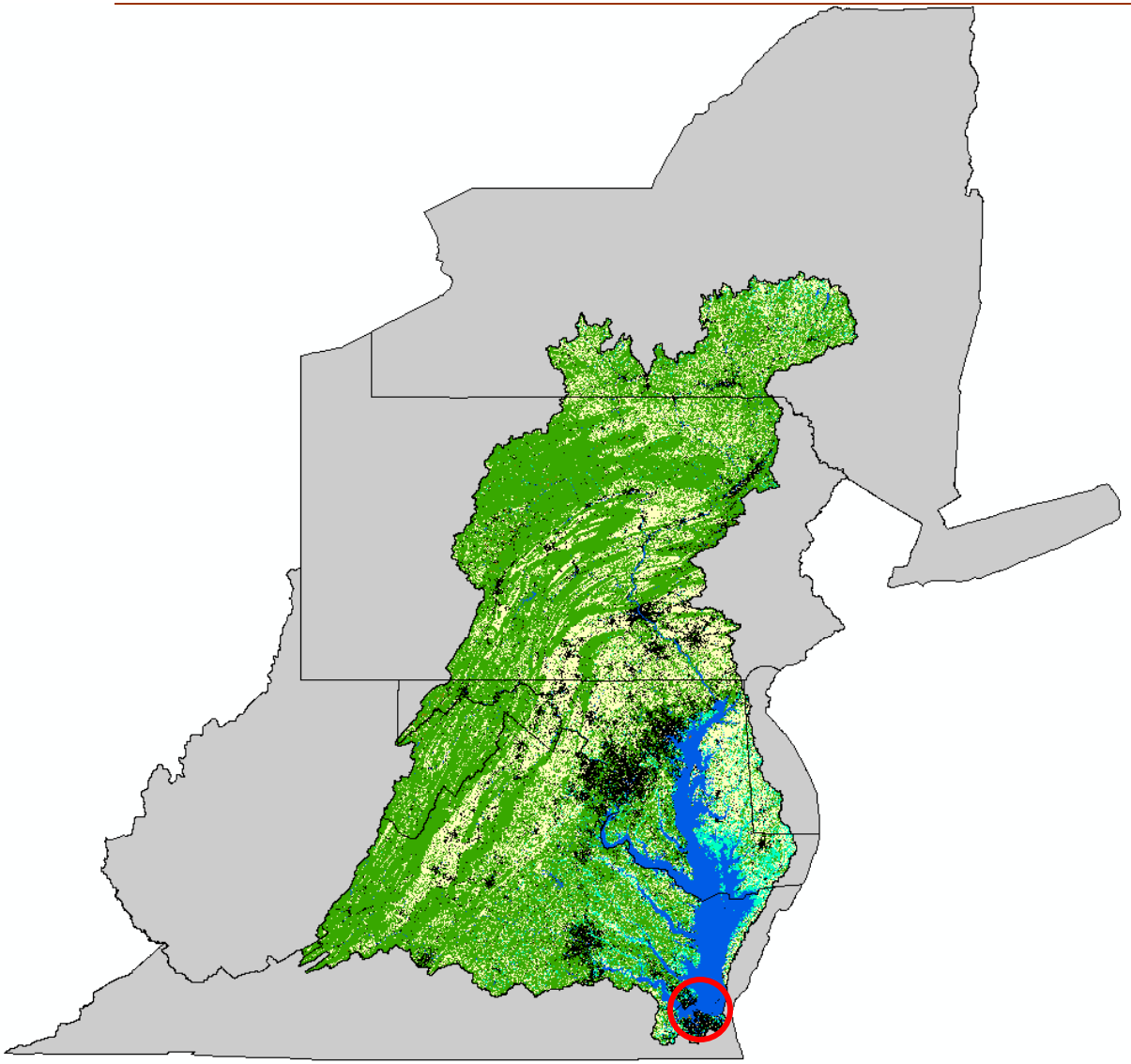
FIA Stand Age

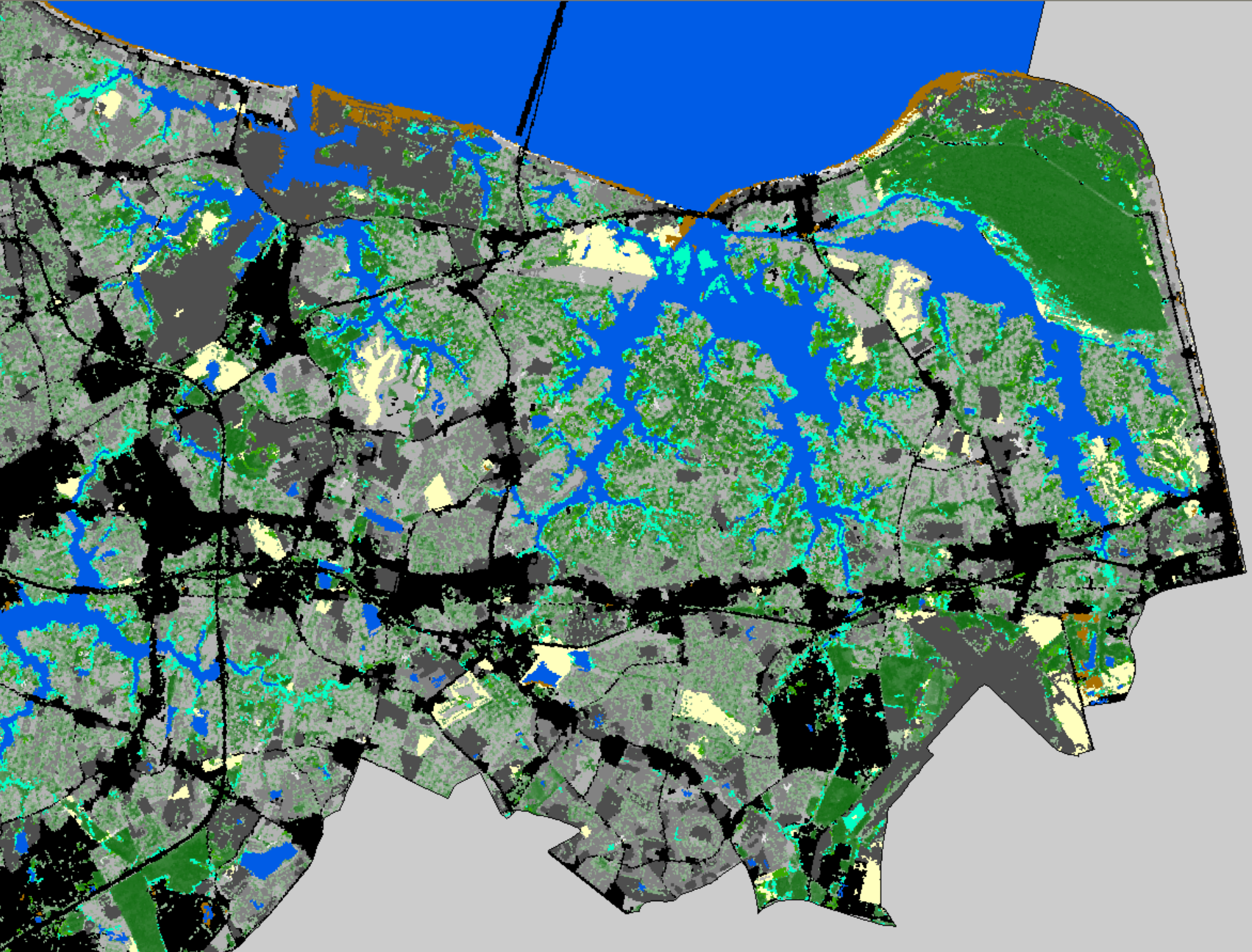


Mapping Urban Tree Canopy

1. **Tree Canopy**
   - **Land cover (categorical)**
   - **Land cover (fractional)**

Mapping Urban Tree Canopy

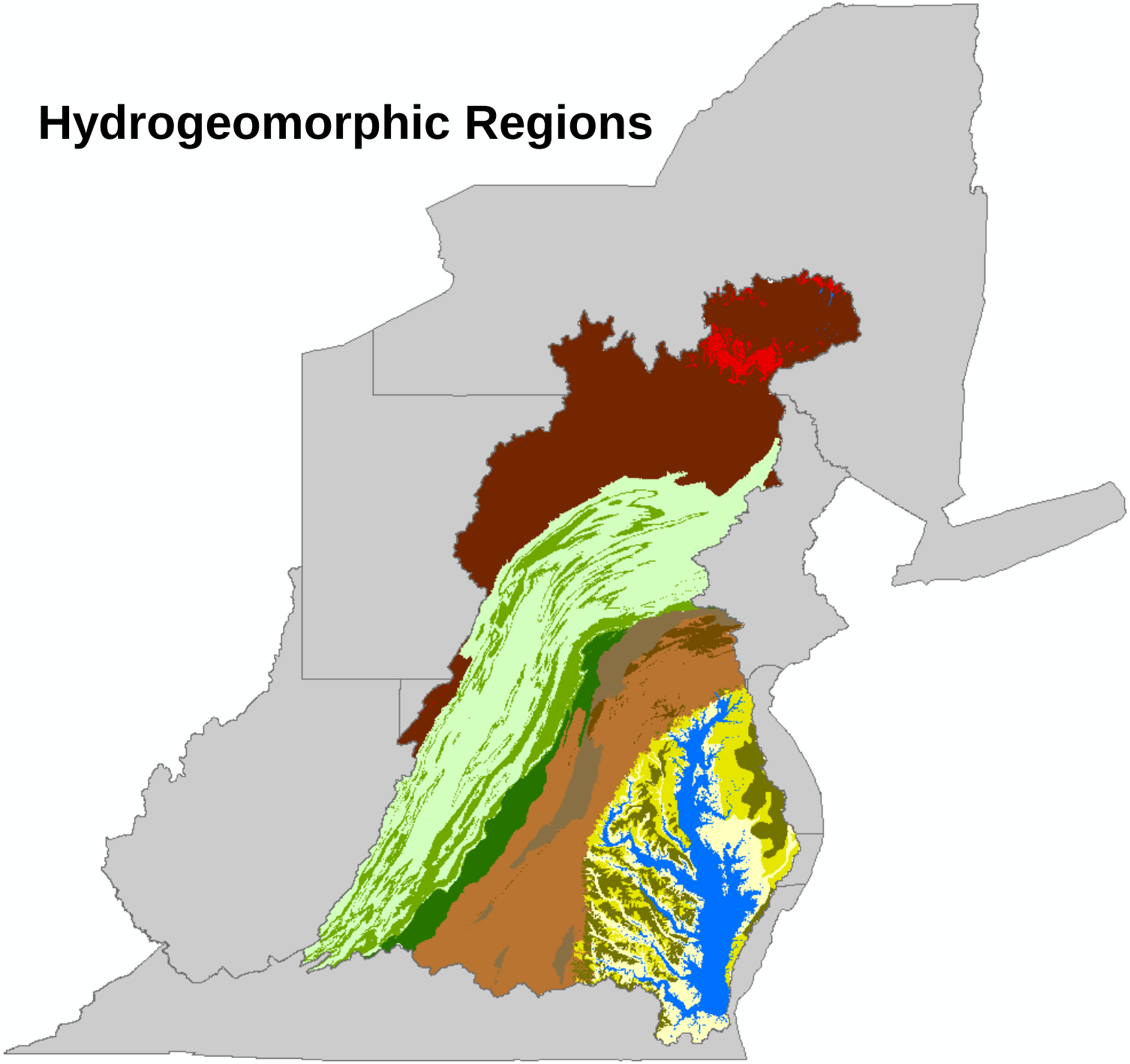




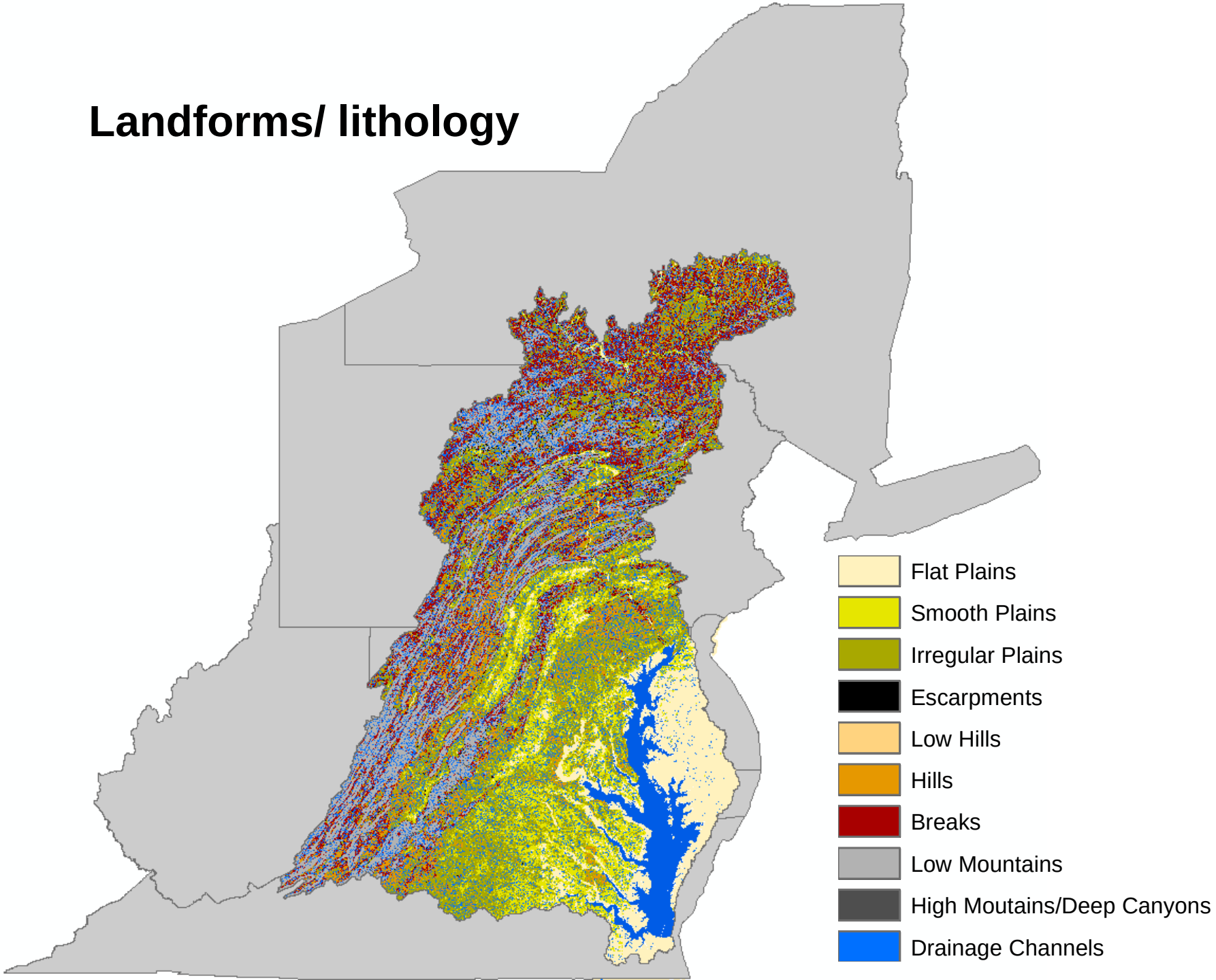
Mapping Riparian Areas / Floodplains

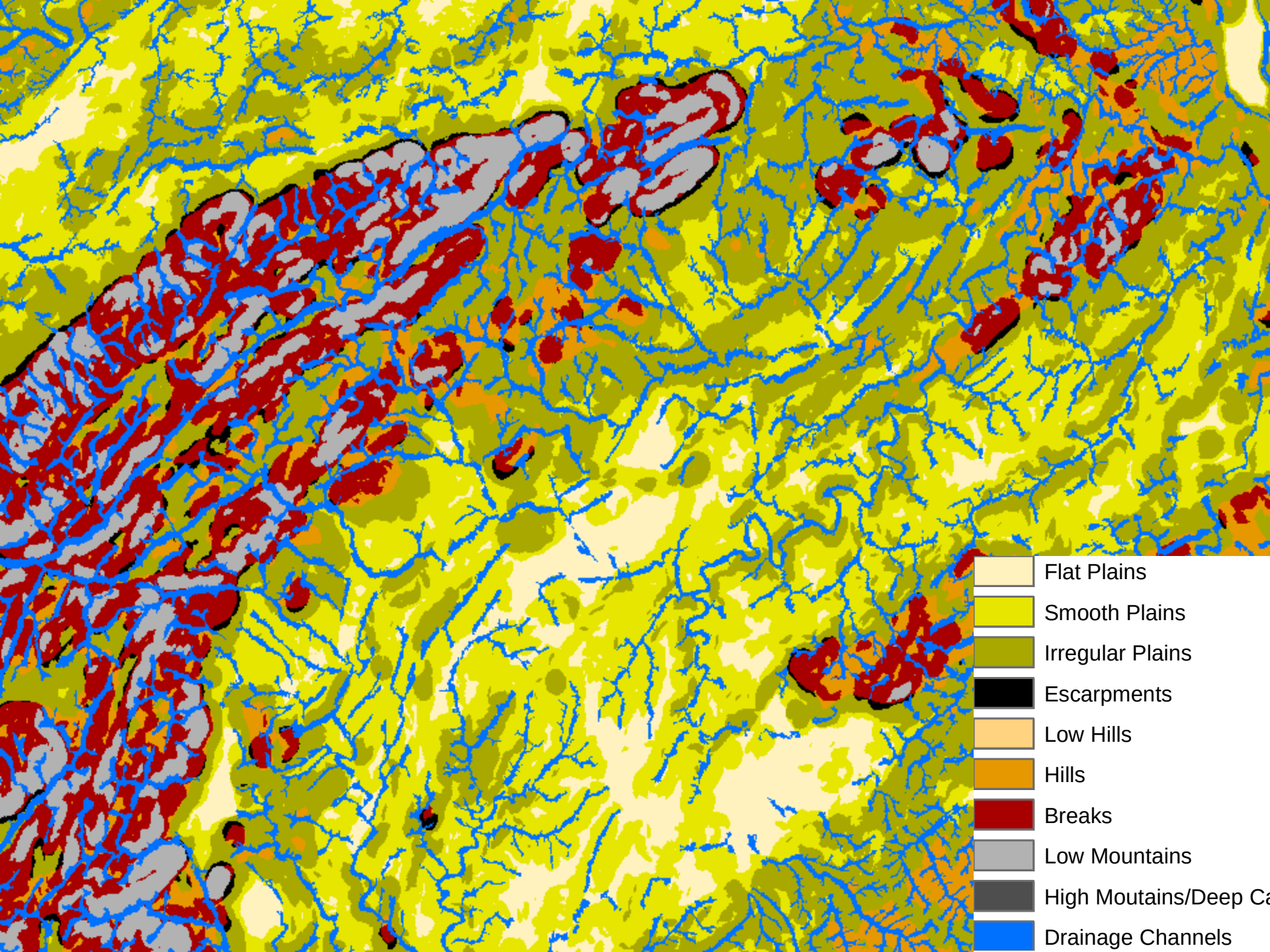
1. Tree Canopy
   - Land cover (categorical)
   - Land cover (fractional)
2. Hydrography (NHD-Plus and NHD-H)
3. Slope (derived from DEM)
4. Landforms (derived from DEM)
5. Soils
6. Structural hazard zone (FEMA DFIRMs)

Hydrogeomorphic Regions

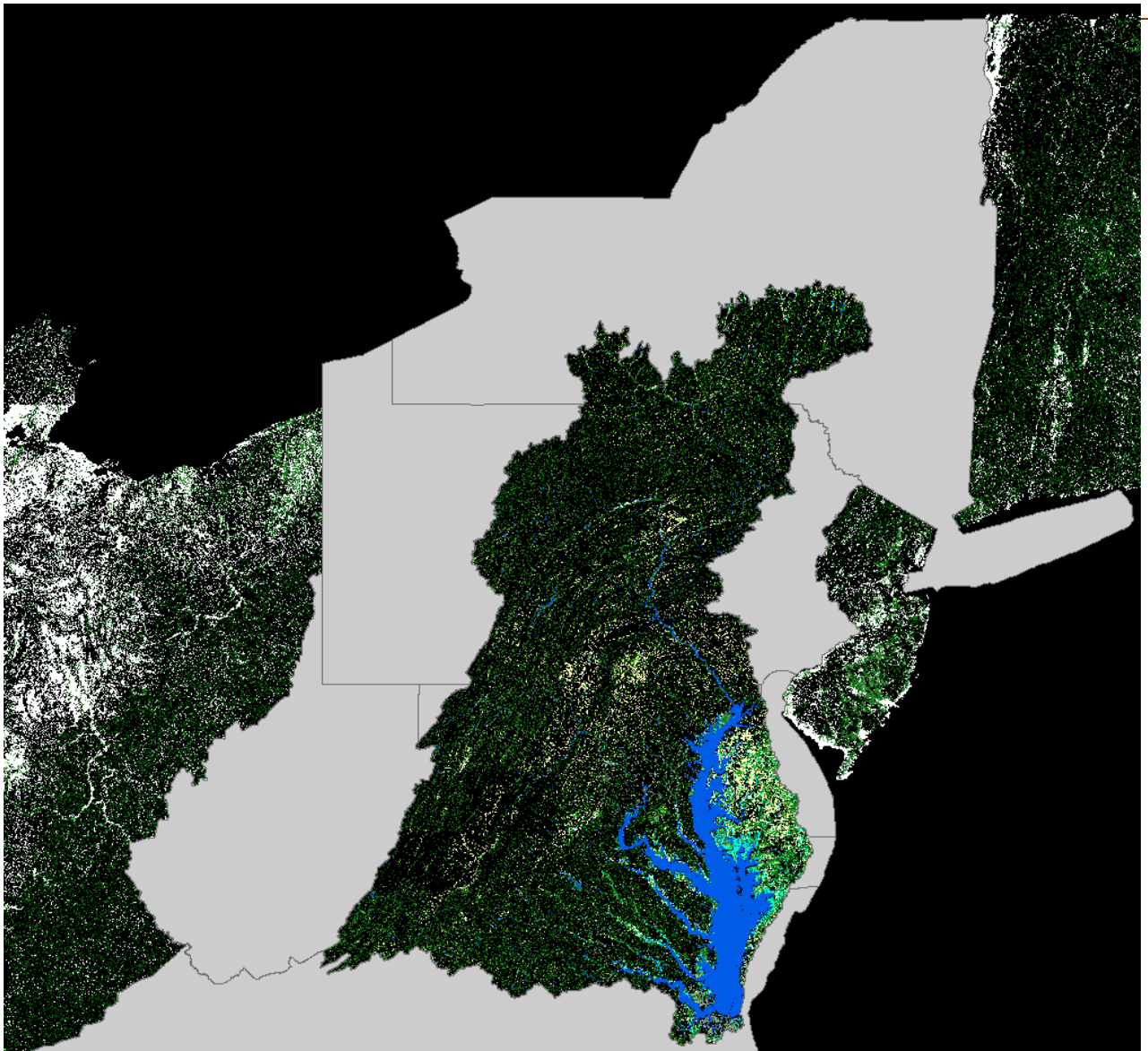


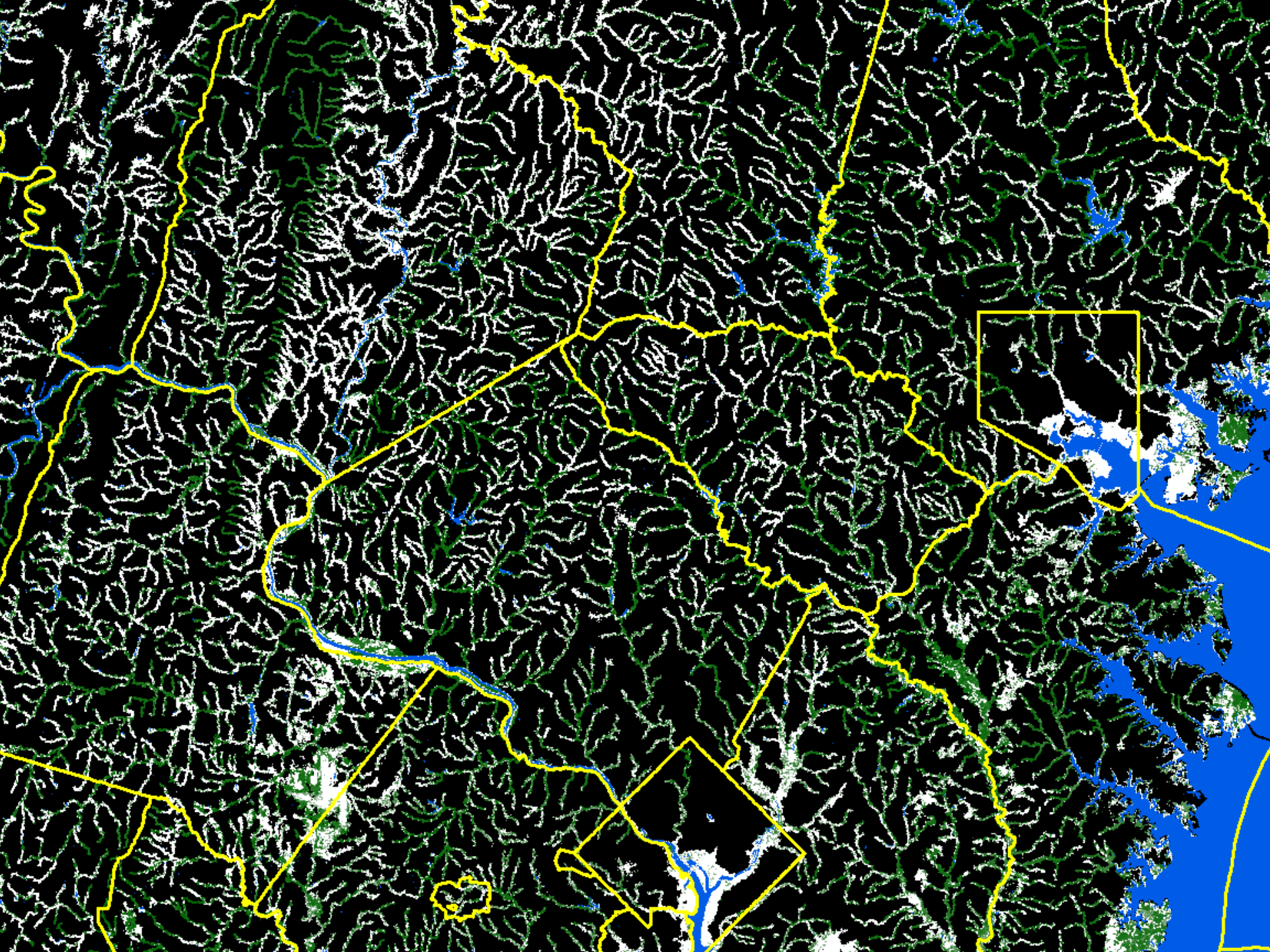
Landforms/ lithology

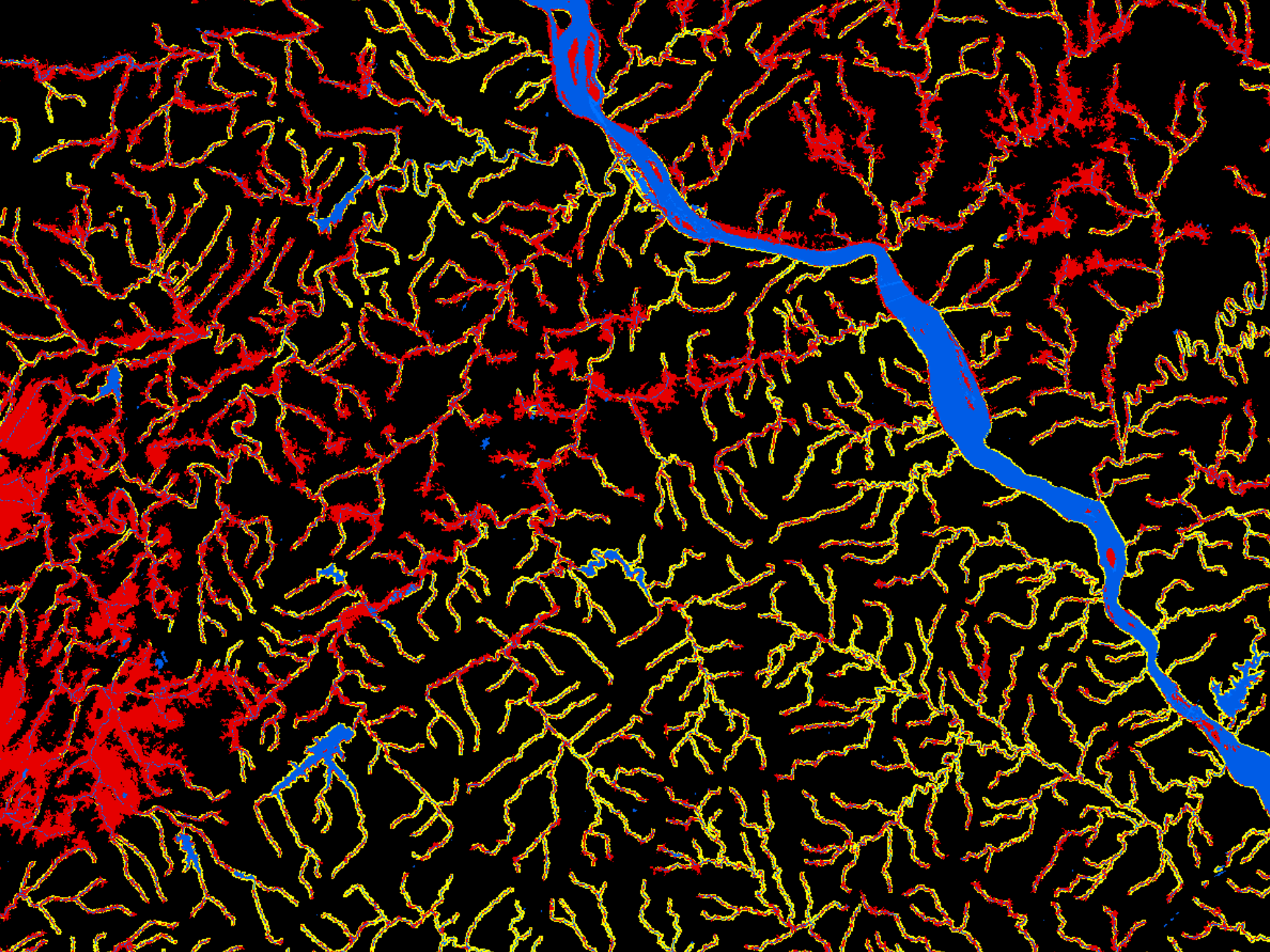


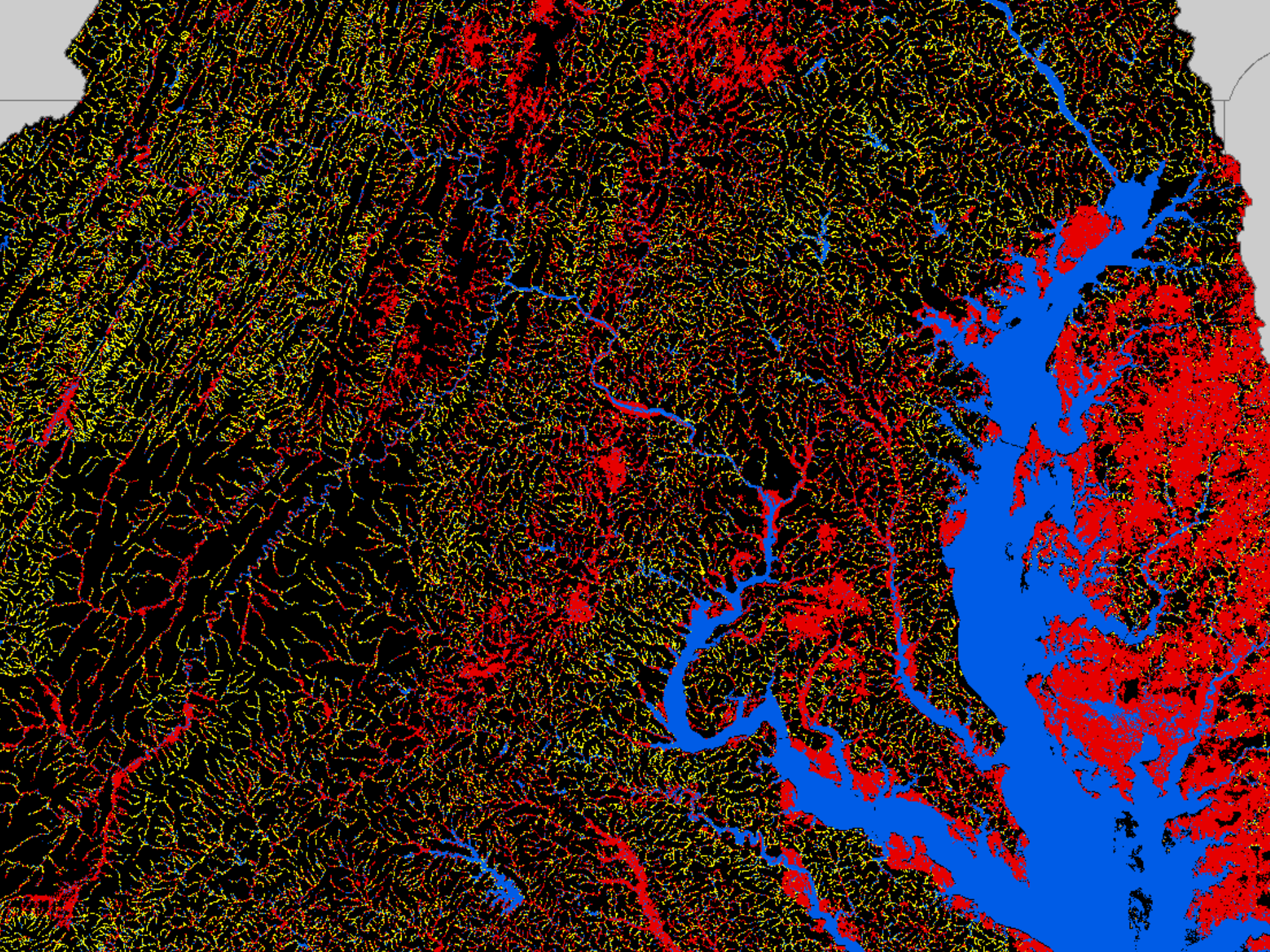

Flat Plains
Smooth Plains
Irregular Plains
Escarpments
Low Hills
Hills
Breaks
Low Mountains
High Moutains/Deep Ca
Drainage Channels

Mapping Active River Areas

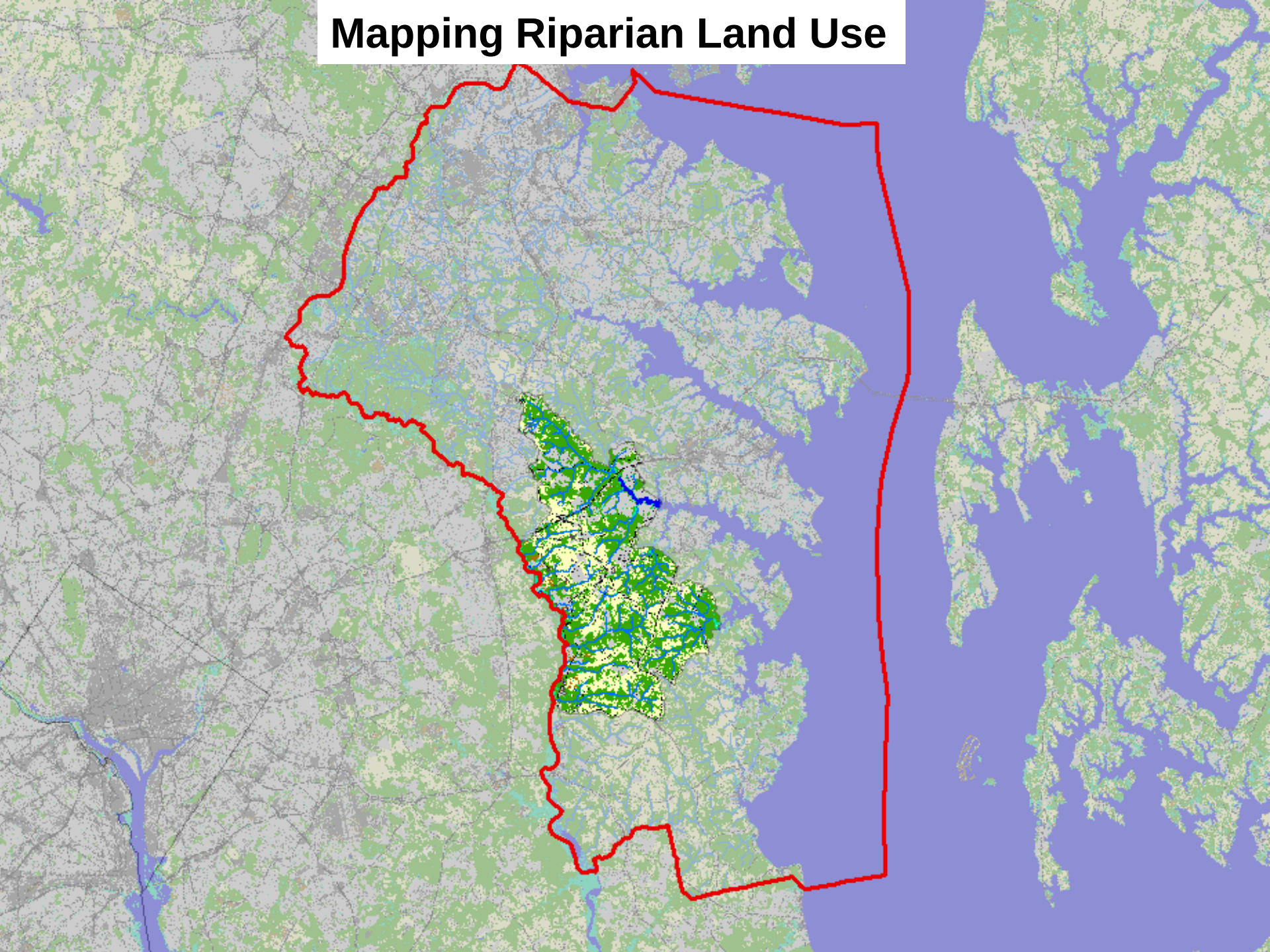








Mapping Riparian Land Use



Define the riparian zone (scale)

(e.g., Anne Arundel County, MD)

1:100K (1,489 km)

1:24K (2,457 km)

65% more stream banks and shorelines

Define the riparian zone (scale)

(e.g., Anne Arundel County, MD)

1:24K (193 km)

6 ha. min. drainage (239 km, + 24%)

4 ha. min. drainage (567 km, + 193%)

Note: Fairfax County found 65% more perennial stream miles through field surveys compared to 1:24K USGS “blue lines”

Define the riparian zone (scale)

(e.g., Anne Arundel County, MD)

6 ha. min. drainage

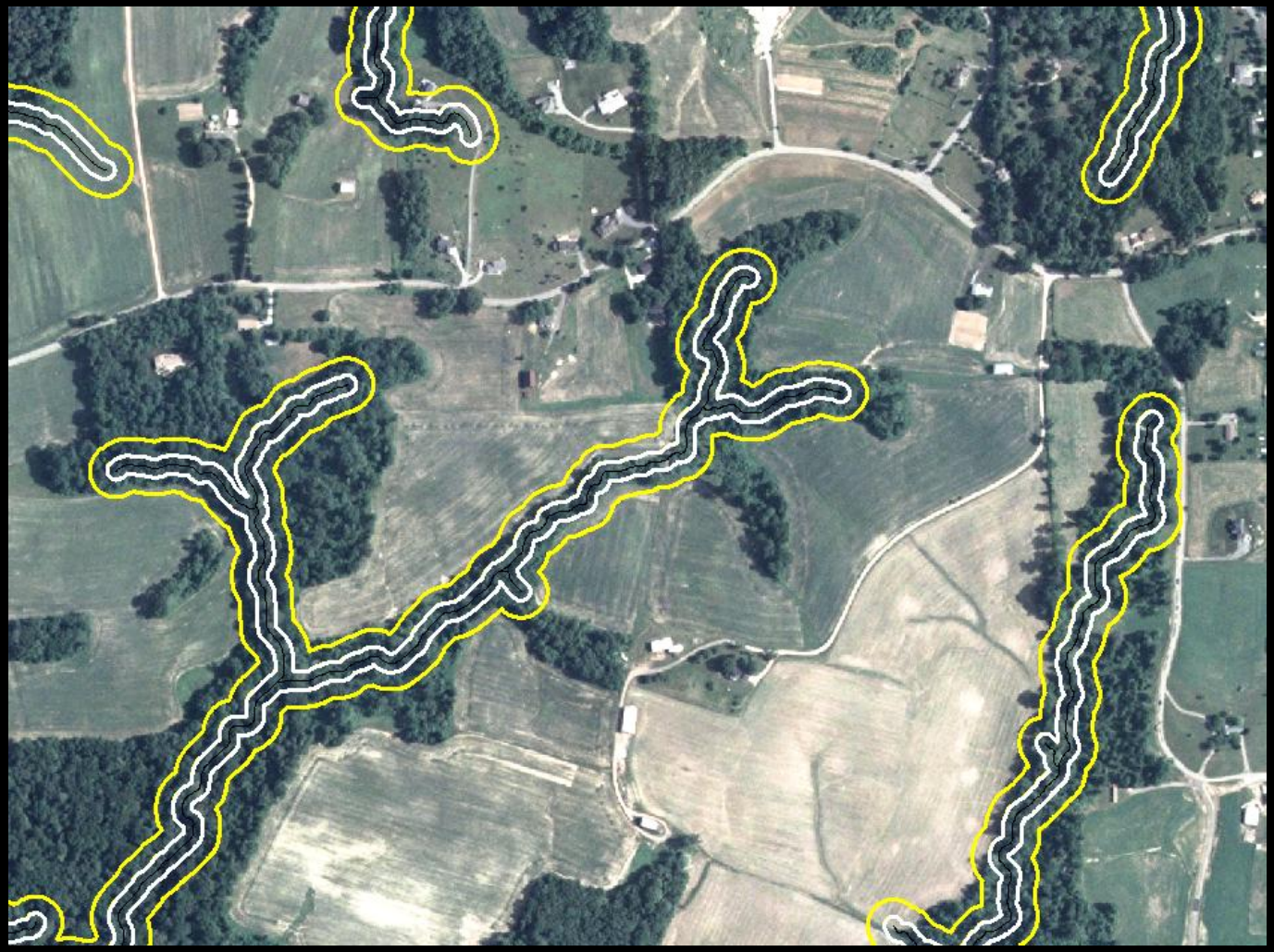
4 ha. min. drainage

Defining the riparian zone (buffer width)

(e.g., Anne Arundel County, MD)

<u>35-feet</u>
minimum required by USDA-CREP

<u>100-feet</u>
minimum recommended by USFS



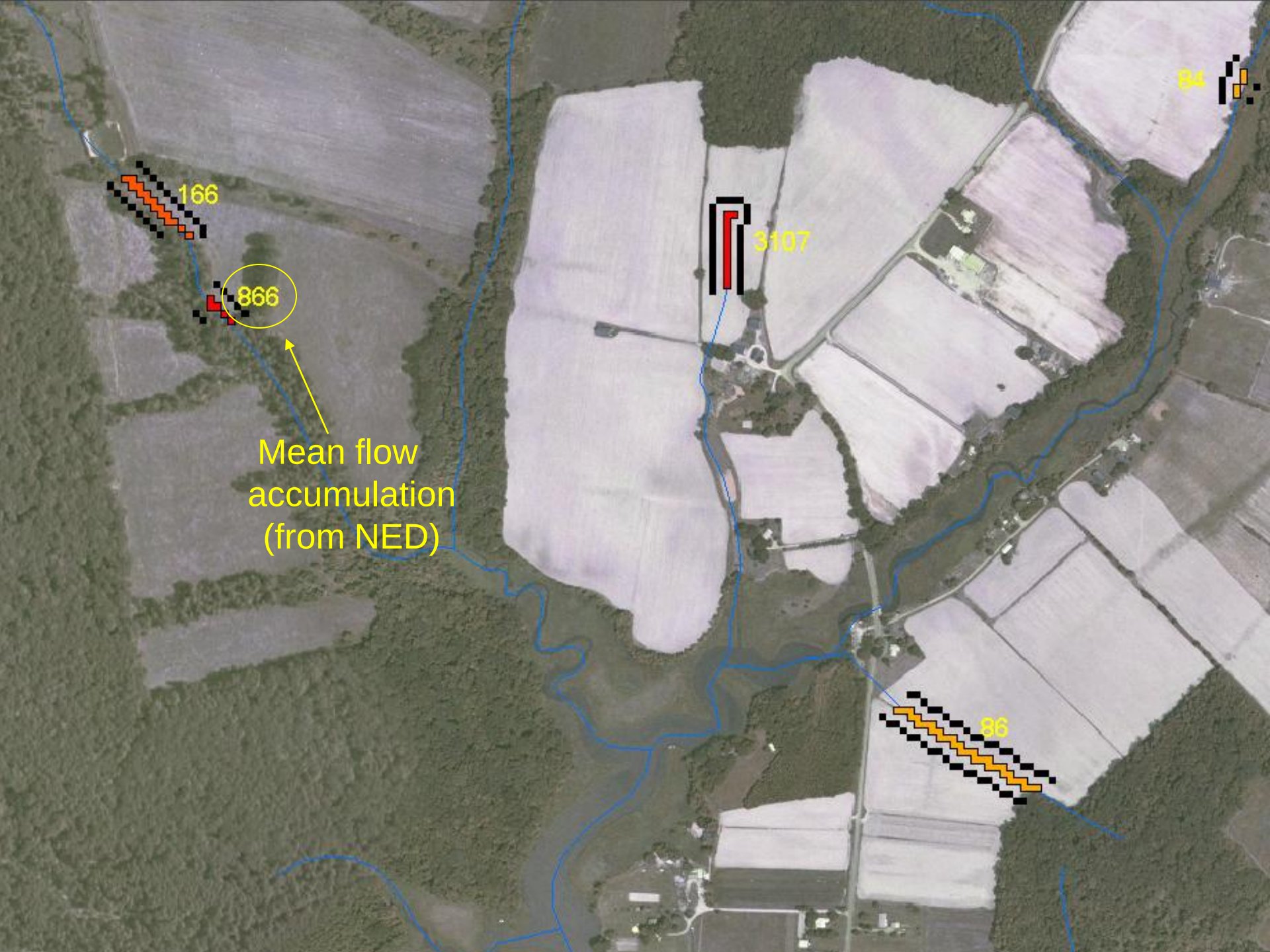
Data for mapping forest cover

IKONOS- forest cover 2004

<u>35-feet</u>
minimum
required by
USDA-CREP

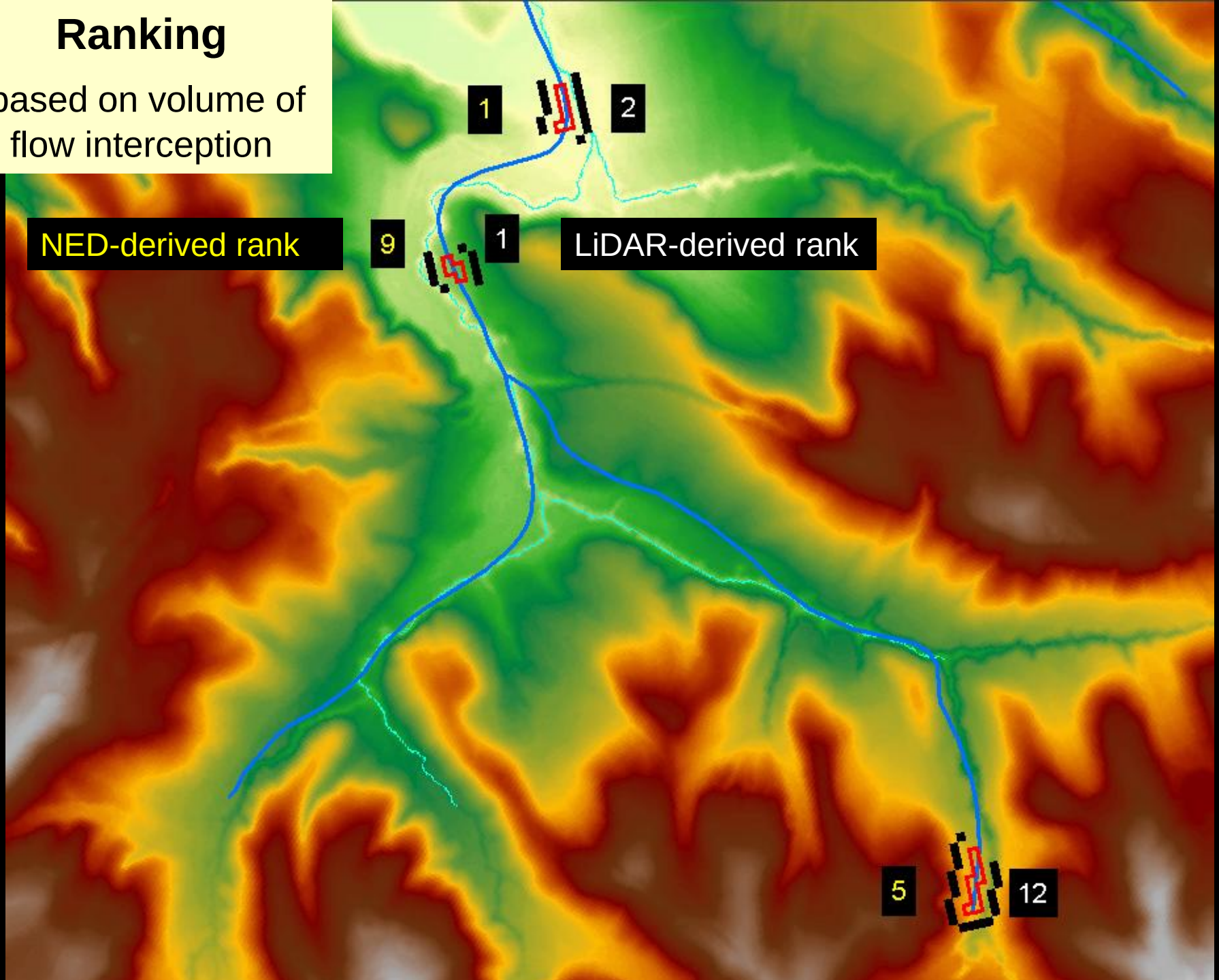
<u>100-feet</u>
minimum
recommended
by USFS

Weighting efficiencies based on upslope characteristics

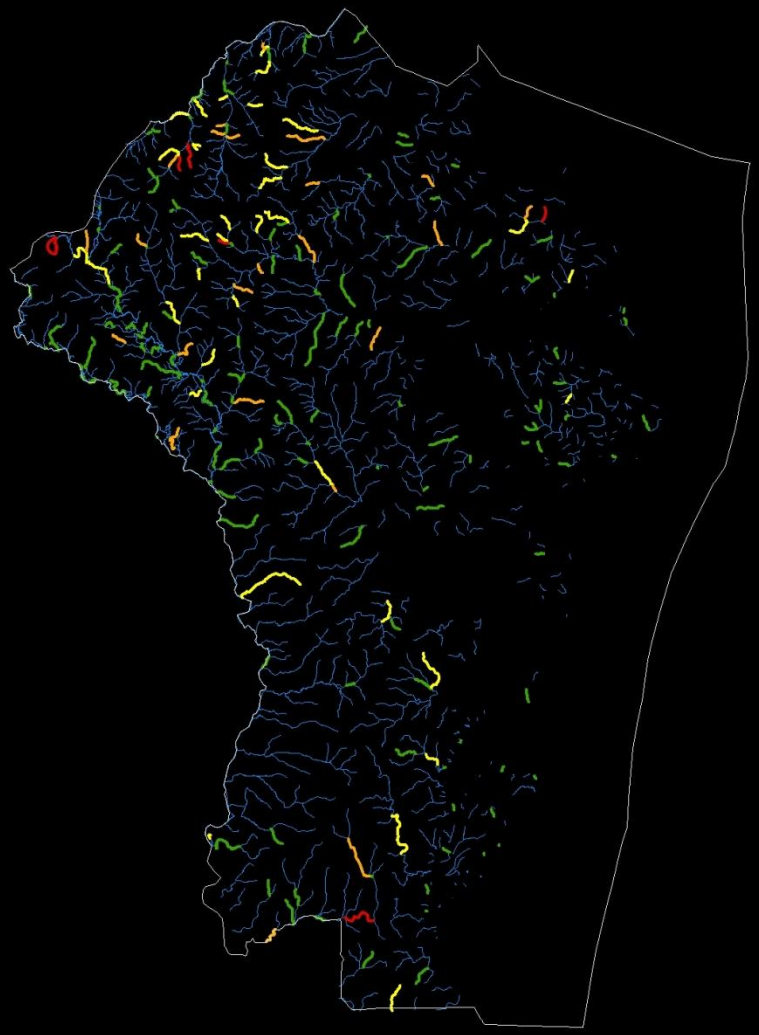

166
866
3107
86
Mean flow accumulation (from NED)

Ranking

based on volume of flow interception

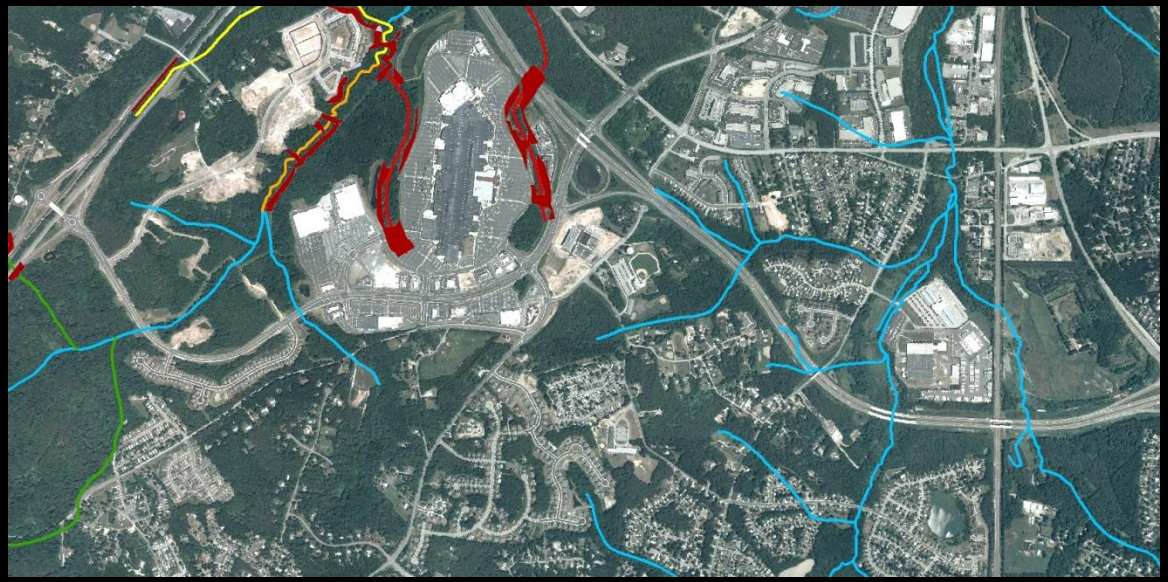


Using Sampling to Assess Riparian Land Use



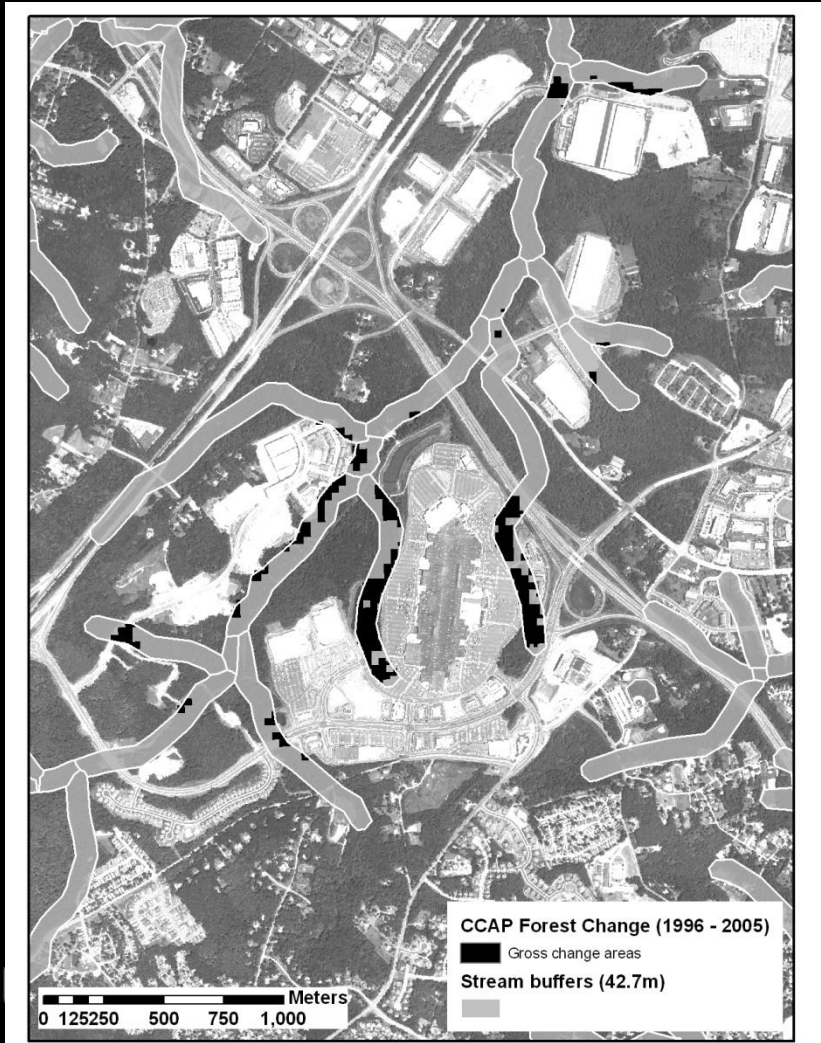
USGS

11-year gross change = 1.83% (SE=0.22%) of the riparian buffer area

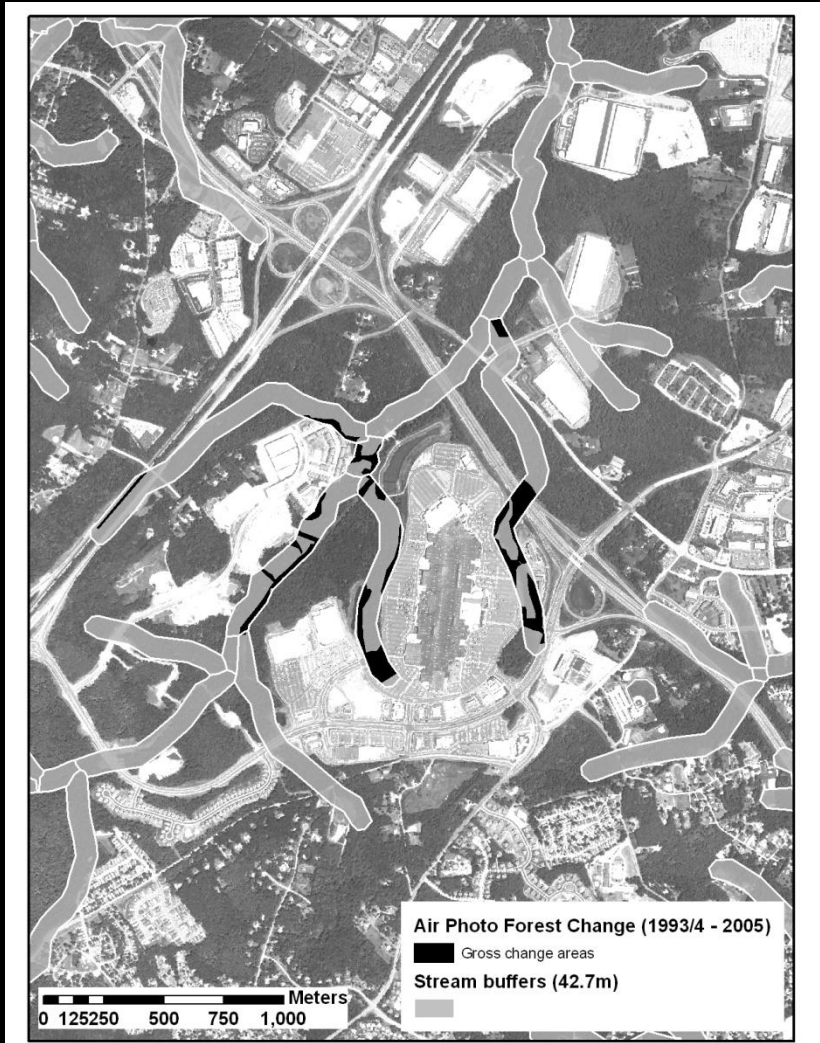


USGS

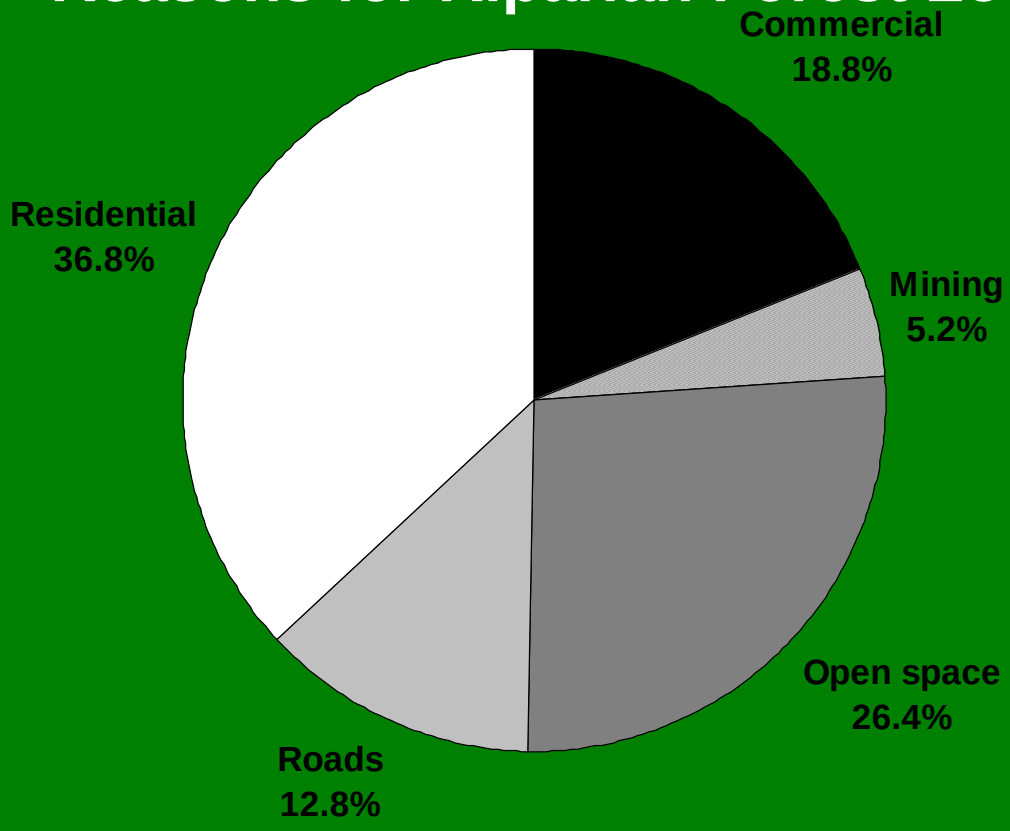
0.84% Gross Forest Change



1.83% (SE 0.22%) Gross Forest Change



Reasons for Riparian Forest Loss



USGS