Geospatial Support for Phase 7 Model Development

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Land Use Workgroup Meeting
June 26, 2024

High-Priority Geospatial Support Activities

- Consider additional land use classes (LUWG)

- Update land-to-water delivery factors based on landscape characteristics (USGS and Modeling WG)

- Backcast high-res LULC to 1985 (USGS & LUWG)

- Forecast P7 land uses from 2021 to 2100 (USGS & LUWG)

- Reconcile mapped and backcasted land uses with reporting to minimize double counting and improve the spatial allocation of reported land uses (FWG & USWG)

- Reconcile cropland area and change over time from Census of Agriculture and mapped cropland (AMT)

- Update P7 summary units: federal lands and MS4's (USWG & FFWG)

- Update P7 segmentation: 2020 County Boundaries + orographic regions + NHD catchments + Shoreline (USGS)

- Attribute P7 Main-Bay-Model with height and slope of upland/marsh interface (USGS)

≋USGS

Rollup of High-Res Land Use Classes for Phase 6

1. Impervious, Roads (1)
20 Roads

2. Impervious, Non-Roads (6)
21 Structures
22 Other Impervious (Parking lots, driveways)
31 Extractive Impervious
32 Solar Field Panel Arrays (?)
90 Agricultural Structures
91 Animal Operation Impervious

3. Tree Canopy Over Impervious (5)
23 TC over Roads
24 TC over Structures
25 TC over Other Impervious
94 TC over Agricultural Structure
95 TC over Animal Operation Impervious

4. Turf Grass (1)
27 Turf Grass

5. Tree Canopy over Turf Grass (1)
26 Tree Canopy over Turf Grass

6. Forest (6)
40 Forest
41 Tree Canopy, Other
53 Riverine Wetlands Tree Canopy
54 Riverine Wetlands Forest
63 Terrene Wetlands Tree Canopy
64 Terrene Wetlands Forest

7. Mixed Open (14)
15 Bare Shore
28 Bare Developed
30 Extractive Barren
33 Solar Field Barren
34 Solar Field Herbaceous
35 Solar Field Shrubland
36 Suspended Succession Barren
37 Suspended Succession Herbaceous
38 Suspended Succession Shrubland
42 Natural Succession Barren
43 Natural Succession Herbaceous
44 Natural Succession Shrubland
45 Harvested Forest Barren
46 Harvested Forest Herbaceous

8. Wetlands, Riverine Non-forested (4)
50 Riverine Wetlands Barren
51 Riverine Wetlands Herbaceous
52 Riverine Wetlands Shrubland
55 Riverine Wetlands Harvested Forest

9. Wetlands, Terrene Non-forested (4)
60 Terrene Wetlands Barren
61 Terrene Wetlands Herbaceous
62 Terrene Wetlands Shrubland
65 Terrene Wetlands Harvested Forest

10. Cropland (5)
80 Cropland Barren
81 Cropland Herbaceous
82 Orchards and Vineyards Barren
83 Orchards and Vineyards Herbaceous
84 Orchards and Vineyards Shrubland

11. Pasture / Hay (4)
85 Pasture/Hay Barren
86 Pasture/Hay Herbaceous
92 Animal Operation Barren
93 Animal Operation Herbaceous

12. Water (4)
11 Lakes & Reservoirs
12 Riverine Ponds
13 Terrene Ponds
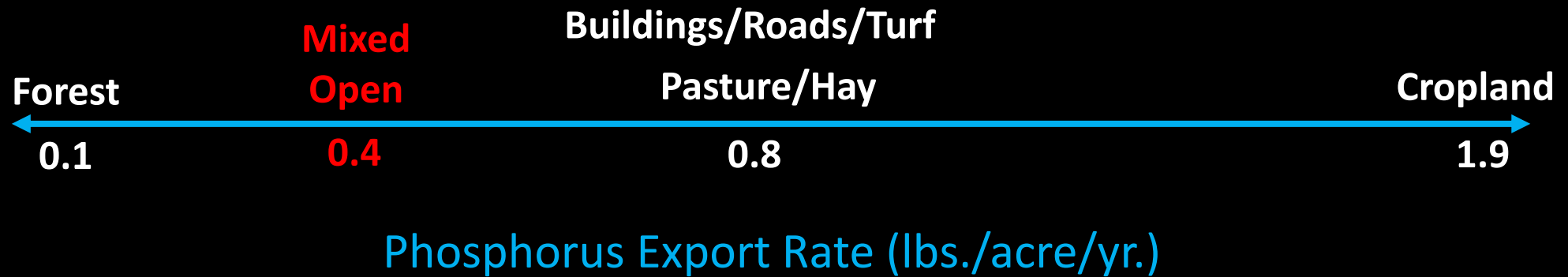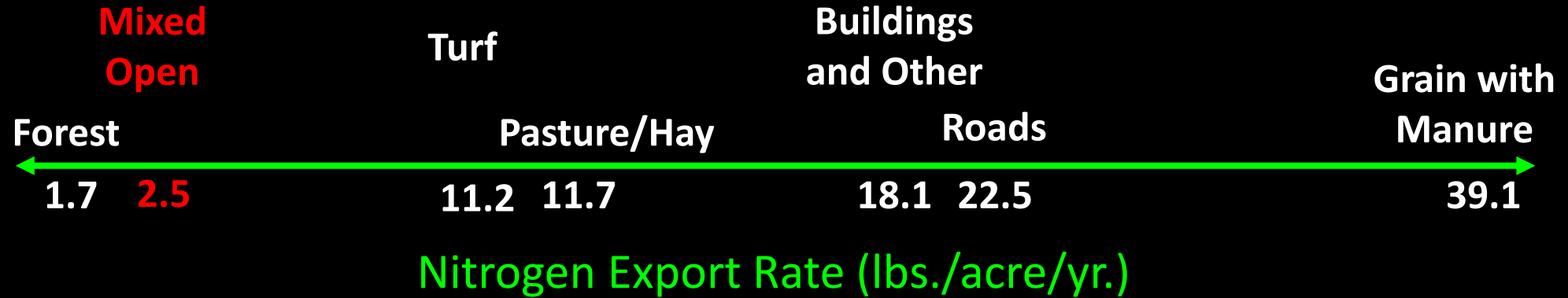14 Streams and Rivers (visible water)

Water Quality Model Classes (7)
10 Tidal Waters
70 Tidal Wetlands Barren
71 Tidal Wetlands Herbaceous
72 Tidal Wetlands Shrubland
73 Tidal Wetlands Tree Canopy
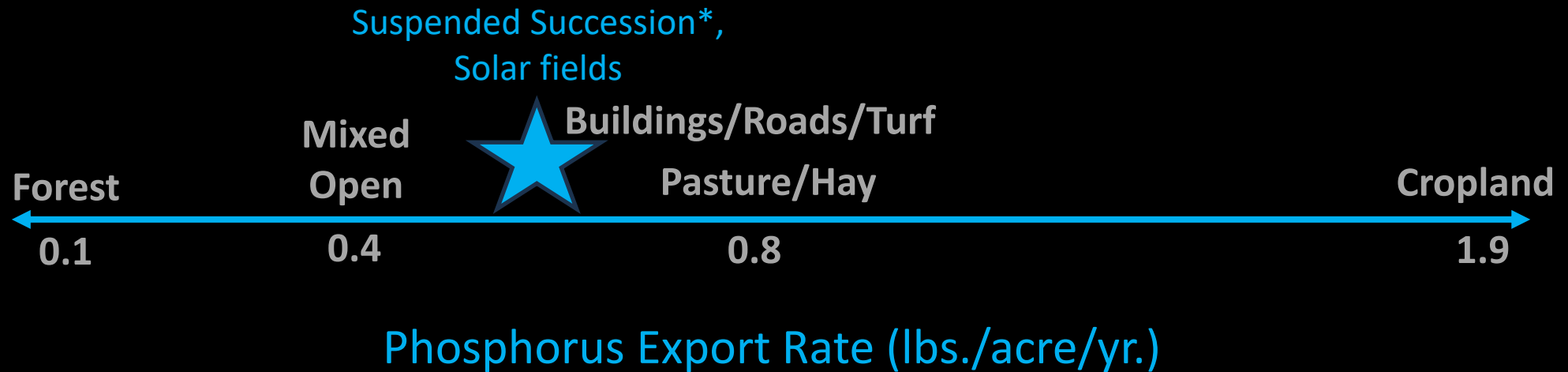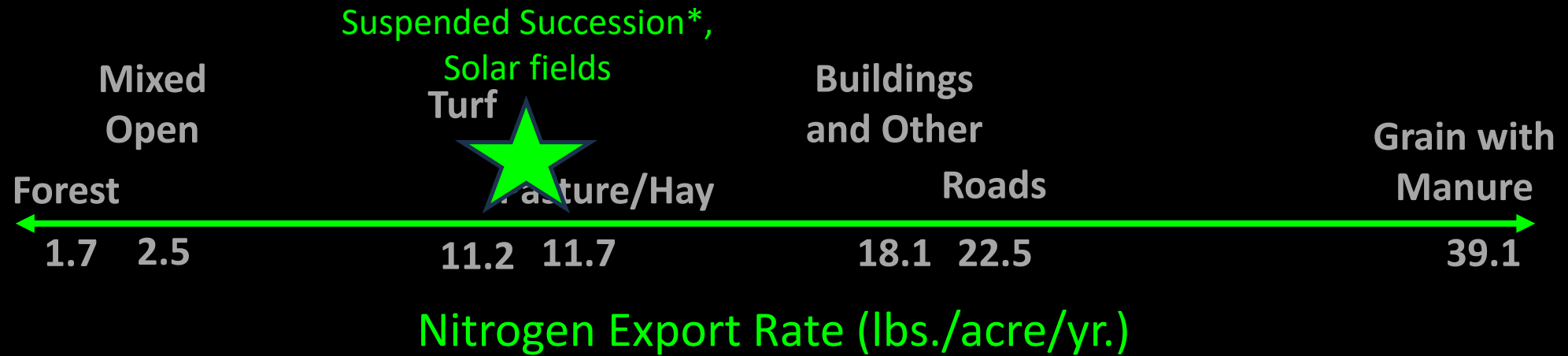74 Tidal Wetlands Forest
75 Tidal Wetlands Harvested Forest

* Represent assumed composition of "mixed open" based on assigned loading rates

* Require subtraction from reported acreages to avoid double counting

Average P6 Land Use Nutrient Export Rates

Mixed Open

Turf

Buildings and Other

Grain with Manure

Forest

Pasture/Hay

Roads

1.7 2.5   11.2 11.7   18.1 22.5   39.1

Nitrogen Export Rate (lbs./acre/yr.)

Buildings/Roads/Turf

Mixed Open

Forest

Pasture/Hay

Cropland

0.1   0.4   0.8   1.9

Phosphorus Export Rate (lbs./acre/yr.)

Average P6 Land Use Nutrient Export Rates

Nitrogen Export Rate (lbs./acre/yr.)

Suspended Succession*,
Solar fields

Mixed
Open

Turf

Buildings
and Other

Grain with
Manure

Forest

Pasture/Hay

Roads

1.7   2.5   11.2   11.7   18.1   22.5   39.1

Phosphorus Export Rate (lbs./acre/yr.)

Suspended Succession*,
Solar fields

Mixed
Open

Buildings/Roads/Turf

Pasture/Hay

Forest

Cropland

0.1   0.4   0.8   1.9

*Suspended succession = road rights-of-way, landfills, reclaimed surface mines, utility transmission lines

Update land-to-river deliver factors: CalCAST

- Impervious Surface connectivity

- Septic connectivity

- Channel/ditch density

- Road density

- Pond density (all ponds and isolated ponds)

Backcasting Land Use

SPATIAL DATA

LCMAP / NLCD (30m)

LANDFIRE

High-Resolution Land Use

Parcel and Road Segments

1987 | 1990 | 1992 | 1997 | 2000 | 2001 | 2002 | 2004 | 2006 | 2007 | 2008 | 2010 | 2011 | 2012 | 2013/14 | 2017/18 | 2020 | 2021/22

TABULAR DATA

USDA Census of Agriculture

Decennial Census of Population and Housing

American Community Survey

LCMAP: Land Change Monitoring, Assessment, and Projection; CBLCD: Chesapeake Bay Land Cover Data series;
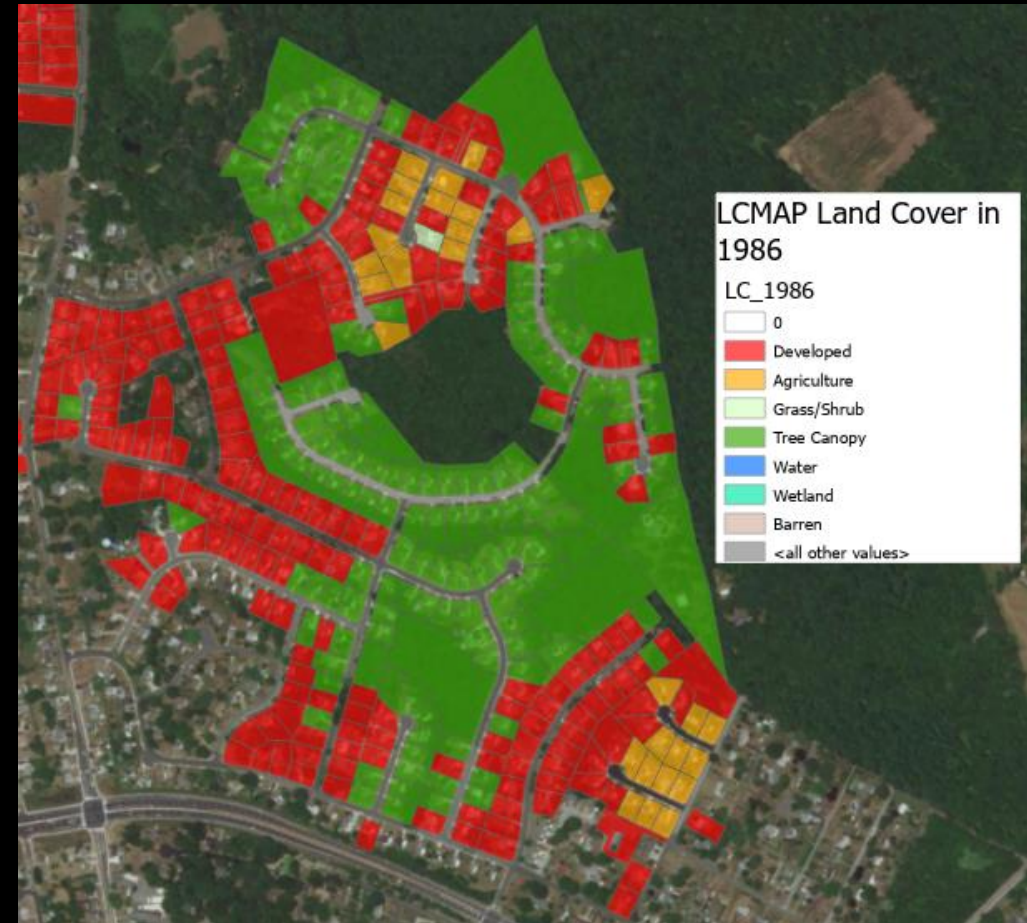NLCD: National Land Cover Database

USGS
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Backcasting Land Use
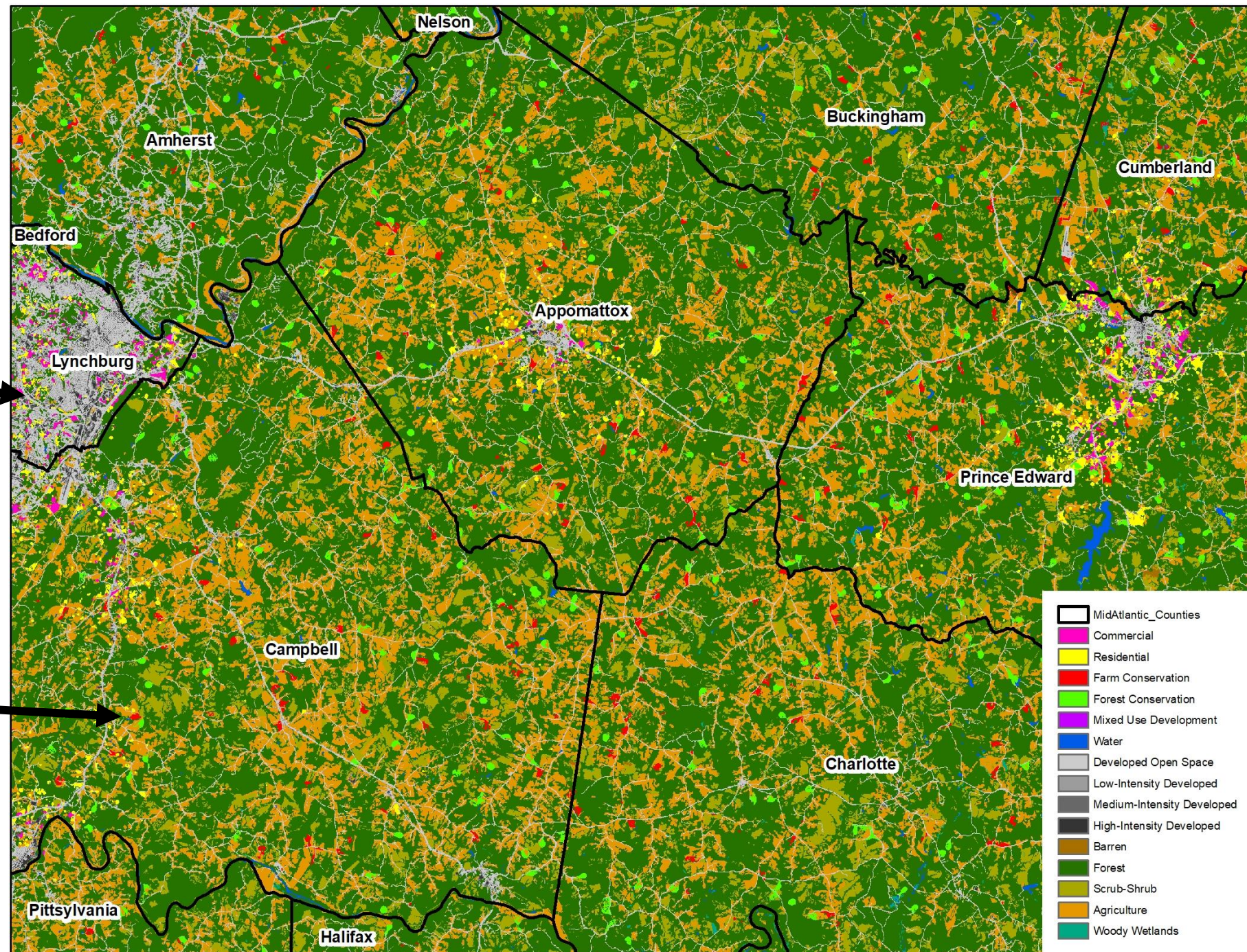

Year Developed (LCMAP)
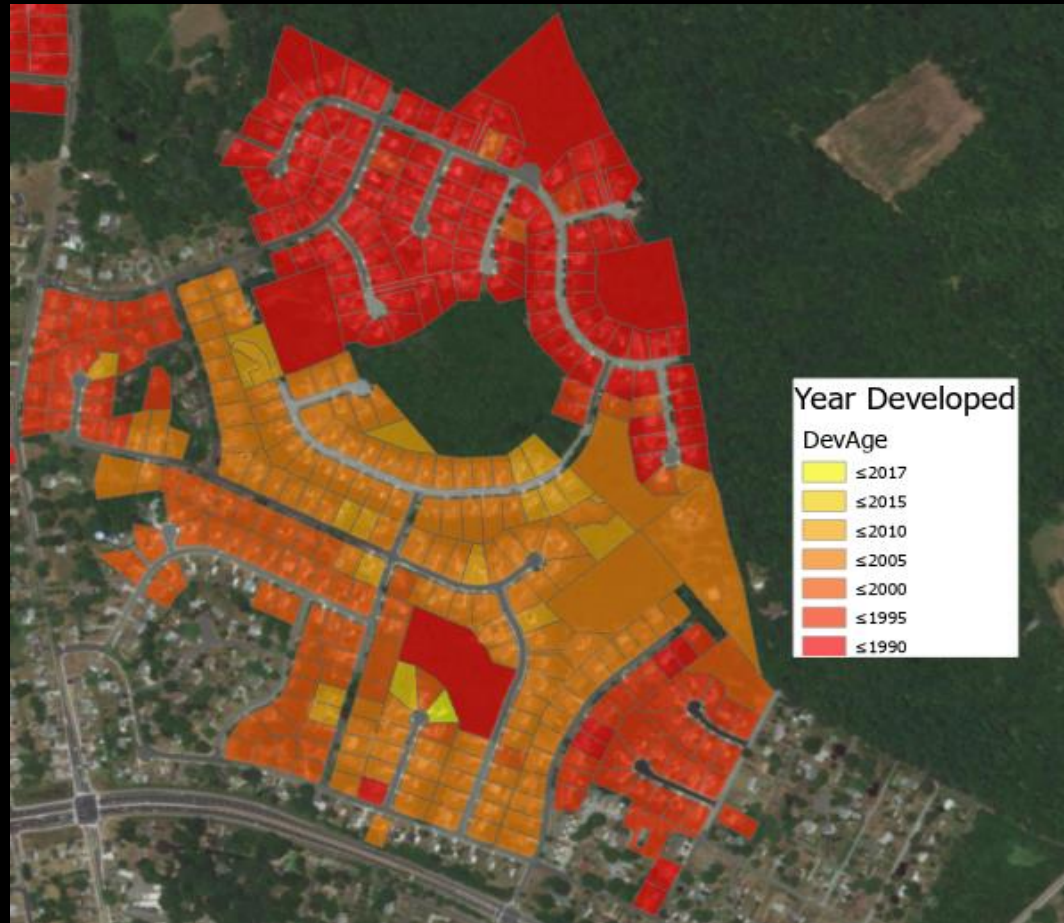
Land Cover 1986 (LCMAP)

Forecast future land use change from 2021-2100

Commercial ⬛ and Residential ⬛ Growth

Farmland ⬛ and Forest ⬛ Conservation

Legend:
- ⬛ MidAtlantic_Counties
- ⬛ Commercial
- ⬛ Residential
- ⬛ Farm Conservation
- ⬛ Forest Conservation
- ⬛ Mixed Use Development
- ⬛ Water
- ⬛ Developed Open Space
- ⬛ Low-Intensity Developed
- ⬛ Medium-Intensity Developed
- ⬛ High-Intensity Developed
- ⬛ Barren
- ⬛ Forest
- ⬛ Scrub-Shrub
- ⬛ Agriculture
- ⬛ Woody Wetlands

Reconcile reported and mapped land uses

Problem: Timber Harvest Example

- Annually harvested acres are reported by most states or estimated (1.5% of true forest area)
- Clearcut harvests are mapped in the high-res LULC data
- Both mapped and reported/estimated acres are subtracted from "true forest" resulting in double counting.

Solution: Timber Harvest Example

- Annualize mapped clearcut acreages and subtract from the total reported harvest acreage (or estimated acreage) at the county scale
- Distribute clearcuts to NHD catchments with mapped clearcuts
- Distribute selective cuts and other harvest types to NHD catchments proportionally to "harvestable" forest acreages defined by forest patch sizes (> 10 acres) and/or harvest history.

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Reconcile reported and mapped land uses

Problem: Pond Example

- Stormwater ponds are reported as BMPs
- Floodplain ponds are accounted for by USGS's fluvial sediment flux estimates (Noe et al.)
- All ponds are mapped in our land use (e.g., headwater, farm ponds, other)

Solution: Pond Example

- Buffer mapped ponds to determine if located in an urban setting (potential stormwater ponds)
- Overlay reported stormwater pond BMP points to verify mapped vs reported stormwater ponds
- Derive a new dataset of non-stormwater, non-floodplain ponds for evaluation in CalCAST.

Update maps of MS4's and Federal Facilities

Municipal Separate Storm Sewer Systems (MS4s)

- Compile a vector representation of the latest MS4 areas (accounting for 2020 Census changes)
- Post on a web viewer for jurisdictional review (edit online or submit new data)
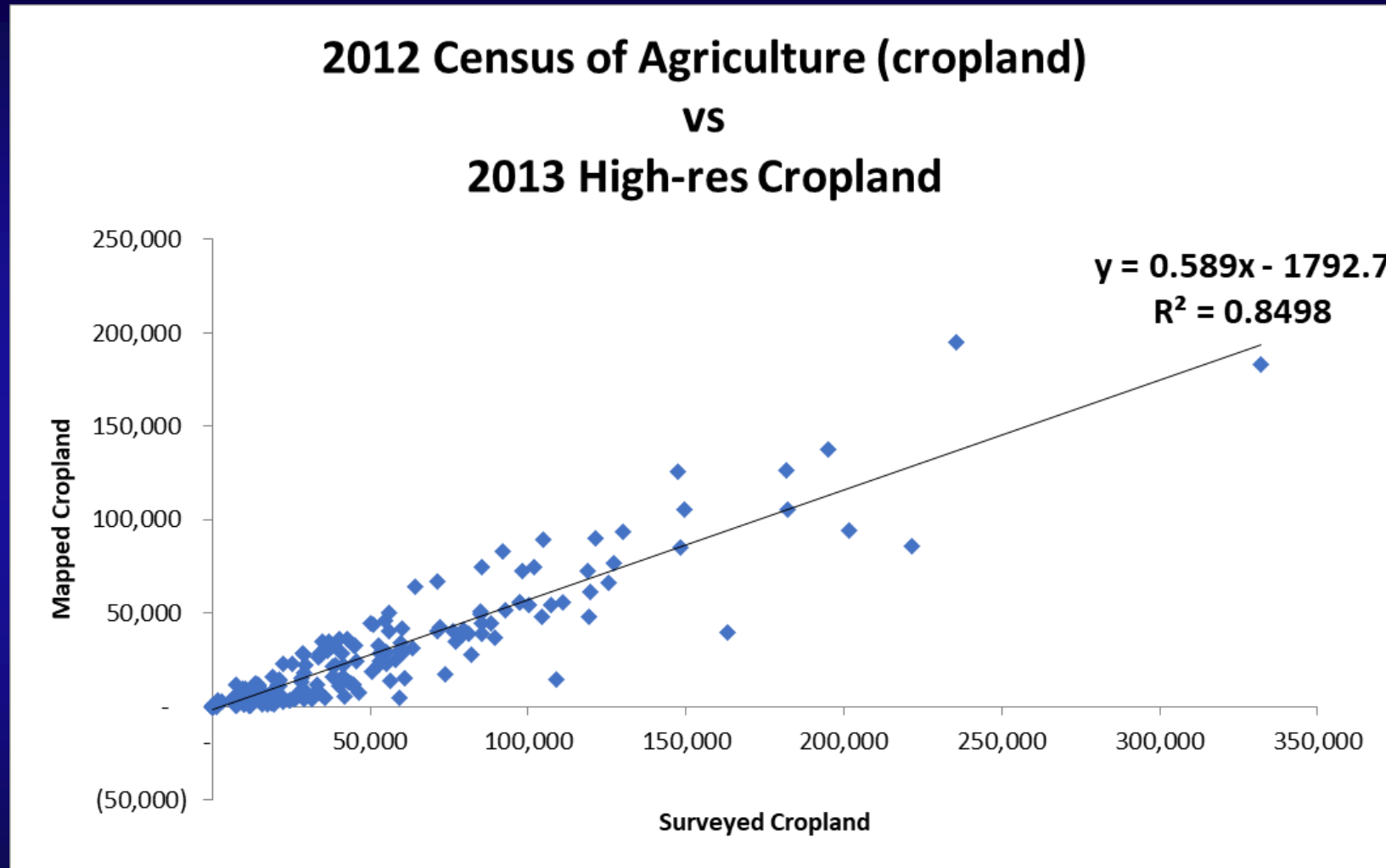- Finalize data and seek approval from the Urban Stormwater Workgroup

Federal Facilities

- Post latest vector data on a web viewer for jurisdictional review (edit online or submit new data)
- Finalize data and seek approval from the Federal Facilities Workgroup

Explore relationship between mapped and reported (Census of Agriculture) cropland and pasture

Static Comparison

2012 Census of Agriculture (cropland) vs 2013 High-res Cropland

$y = 0.589x - 1792.7$
$R^2 = 0.8498$

Mapped Cropland (y-axis)
Surveyed Cropland (x-axis)

Update Septic Estimates and Methodology

Current Septic Approach
- Solicit mapped sanitary sewer service area footprints (ca. 2009)
- Model sanitary service areas where not provided
- Assess number of households outside areas served by sewer
- Data compiled and evaluated in linked worksheets (MS-Excel)
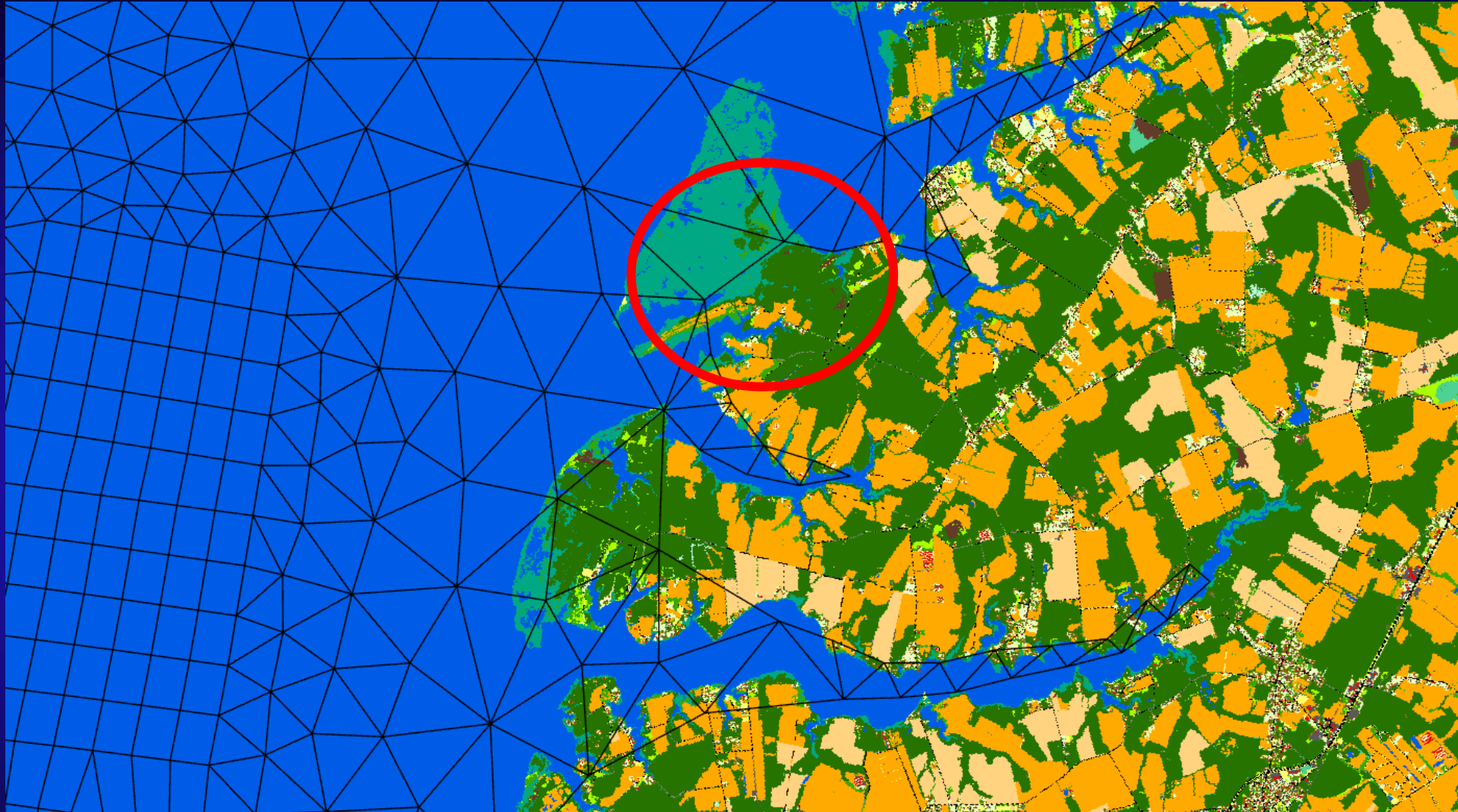
Problems with current approach
- Underestimates population on septic in some areas (e.g., Fairfax County, VA)

New Approach
- Inventory all large (> 0.5 acres) developed residential parcels outside sewer service areas.
- Compute sewer and septic estimates in R

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Attribute P7 Main-Bay-Model with height and slope of upland/marsh interface

USGS

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