# Land Use Workgroup Call

**Peter Claggett**
**Research Geographer, U.S. Geological Survey**
**Coordinator, CBP Land Use Workgroup**

**April 4, 2018**

# Chesapeake Bay Future Scenarios

**Historic Trends**:

Continuation of historic development patterns and constraints as existed over the 2000's. Includes the best available regional and local data representing current conditions.

**Current Zoning**:

Same as Historic Trends with the addition of local zoning, increased infill rates (MD counties), and expanded sewer service areas (Jefferson and Berkeley Counties, WV) to reflect current constraints on new development and reported rates of growth on septic.  The Chesapeake Bay Program Partners adopted this scenario as the representing the most probable conditions in 2025 and therefore serves as a baseline for evaluating the effects of land use planning and land conservation BMPs.

# Alternative Future Thematic Scenarios

**Forest Conservation (with or without zoning):**
Organizations and governments proactively pursuing a variety of actions to conserve forests and wetlands which provide the greatest benefits to wildlife, human safety, and water quality.  Example priority areas include riparian zones, shorelines, large contiguous forest tracts, and other high-priority forest conservation areas.

**Growth Management (with or without zoning):**
Organizations and governments proactively pursuing a variety of actions to encourage growth in areas with supporting infrastructure.  Example priority areas include undeveloped or under-developed areas with adequate existing roads, wastewater, and water supply infrastructure.

**Agriculture and Soil Conservation (with or without zoning):**
Organizations and governments proactively pursuing a variety of actions to conserve farmland and productive soils.  Example priority areas include agricultural districts, prime farmland, farmland of state importance, floodplains, and other high-priority farmland conservation areas.

# Chesapeake Bay Watershed Scenario Elements

- Conserve riparian zones (default width = 30m)
- Conserve wetlands (NWI, State Designated Wetlands, and Potential Conservable Wetlands (PA only))
- Conserve all lands subject to inundation due to sea level rise (default = 1m rise by the year 2100)
- Conserve all lands surrounding National Wildlife Refuges (default = 1 mile buffer)
- Conserve all large forest tracts (default >= 250 acres)
- Conserve Bay shorelines (default = 305m buffer (~1000-ft) of the tidal Bay and Atlantic shorelines)
- Conserve all high-value forest and forested wetlands identified by the Chesapeake Conservation Partnership

- Increase proportion of growth occurring as infill/redevelopment (default = 10% per decade)
- Increase urban densities (default = 10% per decade)
- Increase proportion of urban vs rural growth (default = 10% per decade)
- Expand sewer service areas (default = ~1 mile))
- Avoid growth on all soils unsuitable for septic systems (based on depth to bedrock, drainage class, saturated hydraulic conductivity, and flood frequency)

- Conserve all farmland within designated Agricultural Districts
- Conserve all lands within the floodplain (default = 100-year recurrence interval)
- Conserve all lands with flooded soils (default = frequently flooded)
- Conserve all prime farmlands and farmland of state importance
- Conserve potential restorable wetlands (applies only to PA farmland)
- Conserve all high-value farmland identified by the Chesapeake Conservation Partnership

# State Land Use Data Files

**CBLCM_dLU_VA.csv**

| VA | Impervious | Pervious | Natural | Agriculture | MixedOpen |
|---|---|---|---|---|---|
| HT | 43,689 | 103,830 | (82,072) | (55,409) | (10,071) |
| FCHT | 42,042 | 110,809 | (59,141) | (79,510) | (14,242) |
| GMHT | 35,342 | 86,035 | (63,464) | (49,776) | (8,185) |
| ACHT | 39,441 | 82,891 | (99,217) | (19,701) | (3,453) |
| CZ | 33,777 | 85,527 | (67,874) | (44,233) | (7,225) |
| FCCZ | 30,929 | 87,533 | (46,694) | (62,419) | (9,383) |
| GMCZ | 25,966 | 69,559 | (50,325) | (39,300) | (5,930) |
| ACCZ | 29,458 | 66,231 | (78,670) | (14,684) | (2,372) |
| 2013 | 779,674 | 1,438,950 | 11,137,797 | 2,706,502 | 357,581 |

- Data represent full-county coverage for all 197 counties in Phase 6 Domain.

- 2013 land use acres represent base conditions. All scenario land use acres represent forecasted change from base conditions.

- AgOpenSpace represents wild hay that has been steadily increasing over the past several decades in many counties.

**CAST_dLU_VA.csv**

| VA | Impervious | Pervious | Natural | Agriculture | MixedOpen | AgOpenSpace | Septic |
|---|---|---|---|---|---|---|---|
| Historic Trends (HT) | 45,609 | 96,829 | (81,914) | (69,909) | (11,016) | 20,402 | 268,222 |
| Forest Conservation (FCHT) | 43,956 | 103,040 | (59,027) | (91,614) | (16,071) | 19,717 | 268,613 |
| Growth Management (GMHT) | 38,362 | 78,804 | (63,359) | (65,251) | (9,131) | 20,576 | 212,539 |
| Agricultural Conservation (ACHT) | 42,217 | 76,497 | (98,976) | (38,046) | (3,314) | 21,623 | 267,934 |
| Current Zoning (CZ) | 36,826 | 78,148 | (67,738) | (60,334) | (7,677) | 20,776 | 262,362 |
| Forest Conservation with Zoning (FCCZ) | 34,182 | 79,261 | (46,588) | (76,760) | (10,369) | 20,275 | 260,922 |
| Growth Management with Zoning (GMCZ) | 30,003 | 61,884 | (50,224) | (56,254) | (6,348) | 20,941 | 210,431 |
| Agricultural Conservation with Zoning (ACCZ) | 33,321 | 59,282 | (78,464) | (33,799) | (2,098) | 21,759 | 258,124 |
| 2013 Conditions | 761,434 | 1,364,781 | 11,085,359 | 2,787,699 | 348,449 | 72,739 | 483,839 |
| 1985 Conditions | 445,500 | 820,475 | 11,429,037 | 3,227,419 | 460,338 | 37,693 | 286,338 |

# Relative Nutrient Export Rates

| Forest | Mixed / Ag Open Space | Hay | Pasture | Developed* | | Cropland |
|---|---|---|---|---|---|---|
| 1.8 | 3.5 | 8.3 | 11.2 | 15.5 | | 30.5 |

Nitrogen Export Rate (lbs/acre/yr)

| Forest | Mixed / Ag Open Space | Hay | | Developed* | Cropland | Pasture |
|---|---|---|---|---|---|---|
| 0.1 | 0.2 | 0.3 | | 0.7 | 0.8 | 1.2 |

Phosphorus Export Rate (lbs/acre/yr)

* Includes impervious surfaces (roads, rooftops, parking lots), pervious surfaces (turf grass), and land under construction.

# "No Action", Edge-of-Stream Total Nitrogen Loads

| VA | Impervious | Pervious | Natural | Agriculture | MixedOpen | AgOpenSpace | Other* | Septic | Total |
|---|---|---|---|---|---|---|---|---|---|
| **Historic Trends (HT)** | 542,574 | 642,695 | (294,369) | (1,447,346) | (17,067) | 61,854 | 212,717 | 1,928,438 | 1,629,496 |
| **Forest Conservation (FCHT)** | 525,334 | 714,283 | (267,178) | (1,741,121) | (25,101) | 59,960 | 186,859 | 1,929,351 | 1,382,387 |
| **Growth Management (GMHT)** | 456,318 | 478,648 | (272,301) | (1,387,381) | (14,217) | 62,347 | 123,149 | 1,438,188 | 884,751 |
| **Agricultural Conservation (ACHT)** | 503,838 | 451,111 | (315,561) | (1,087,153) | (4,879) | 65,361 | 229,340 | 1,927,941 | 1,769,998 |
| **Current Zoning (CZ)** | 453,135 | 495,415 | (280,652) | (1,335,149) | (12,330) | 62,786 | 180,846 | 1,861,677 | 1,425,728 |
| **Forest Conservation with Zoning (FCCZ)** | 423,919 | 519,346 | (255,084) | (1,550,299) | (16,809) | 61,332 | 156,209 | 1,847,618 | 1,186,232 |
| **Growth Management with Zoning (GMCZ)** | 370,186 | 344,481 | (259,393) | (1,291,113) | (10,240) | 63,278 | 101,213 | 1,406,636 | 725,048 |
| **Agricultural Conservation with Zoning (ACCZ)** | 412,571 | 314,794 | (294,677) | (1,025,641) | (3,393) | 65,711 | 187,521 | 1,824,891 | 1,481,777 |
| **2013 Conditions** | 9,729,372 | 10,928,411 | 17,338,041 | 48,270,721 | 597,473 | 224,119 | 12,992,115 | 4,227,761 | 104,308,013 |
| **1985 Conditions** | 5,798,097 | 6,720,366 | 17,556,888 | 53,034,846 | 776,883 | 117,367 | 12,430,209 | 2,807,645 | 99,242,301 |
| | | | | | | | | | |
| **Max Diference** | 172,388 | 399,489 | (60,477) | (715,480) | (21,708) | 5,751 | 128,127 | 522,715 | 1,044,950 |

Phase 6 Scenario Runs
- No Action
- 2017 Progress
- Phase II WIPs
- Phase III WIPs (TBD)
- E3 (Everything by Everyone, Everywhere)
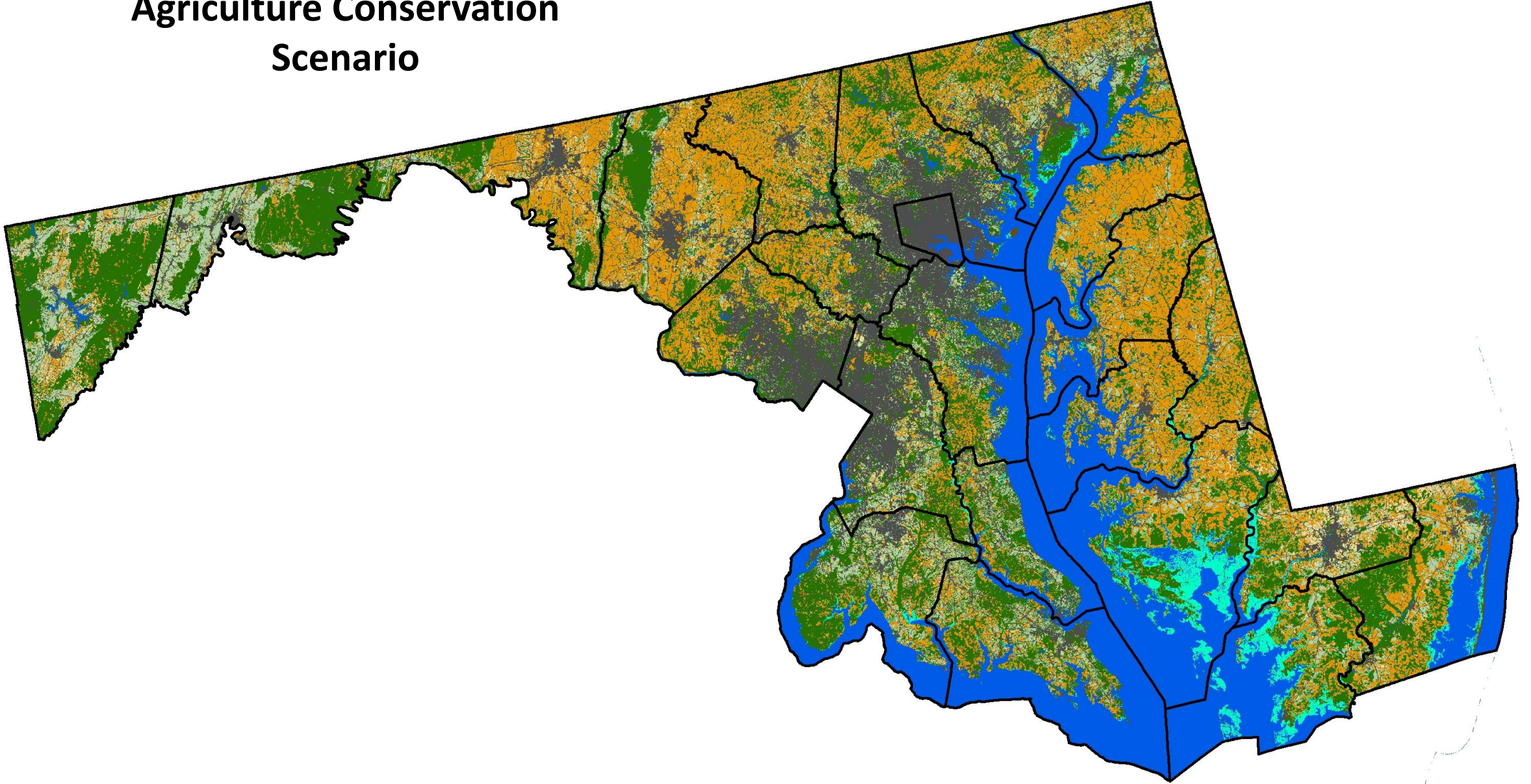
Phase 6 Scenario Runs
- Edge-of-Stream
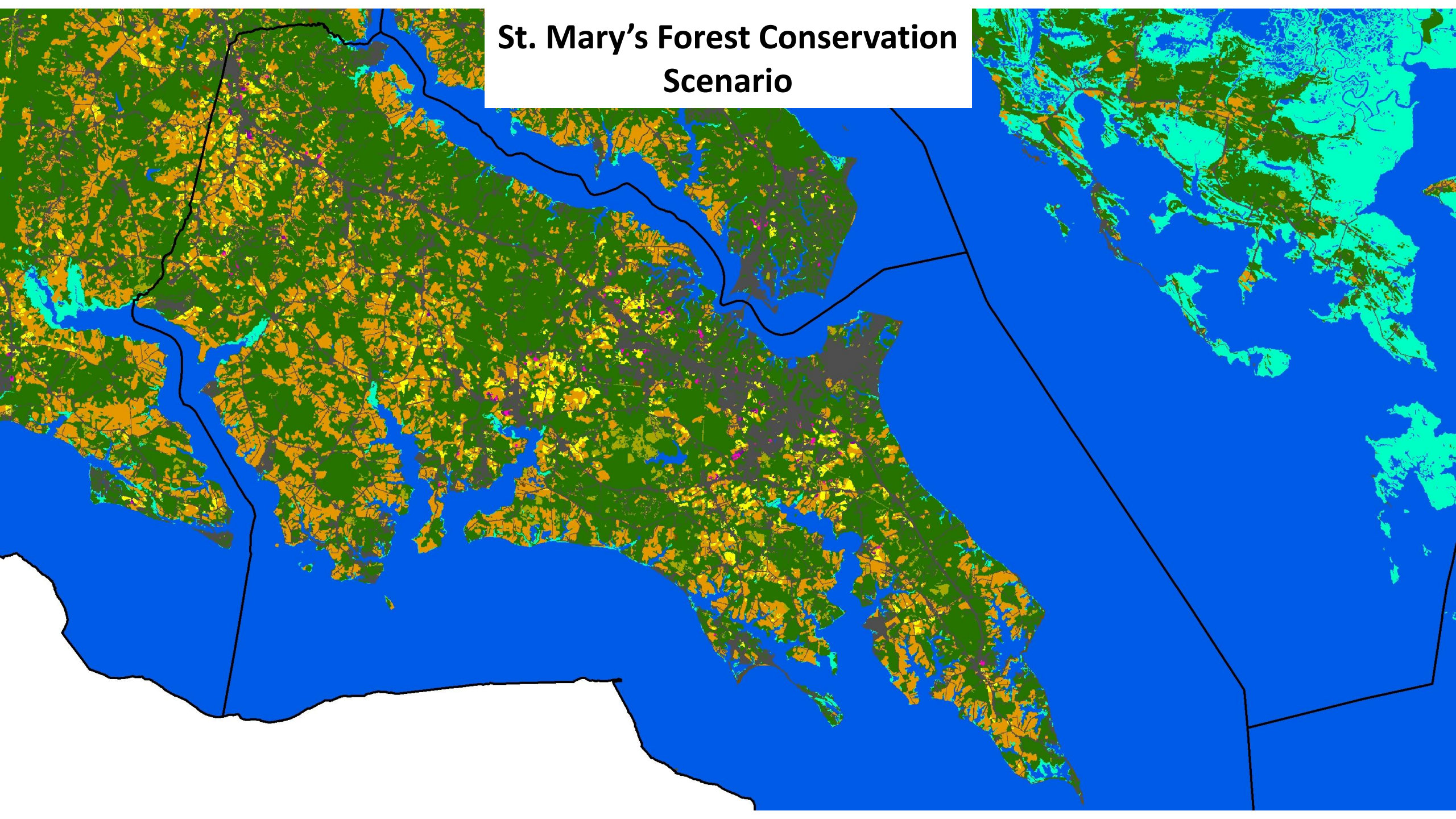- Edge-of-Tide

Pollutant Type
- Nitrogen
- Phosphorous
- Sediment

*Other: shoreline erosion, stream bank and bed erosion

**Agriculture Conservation Scenario**
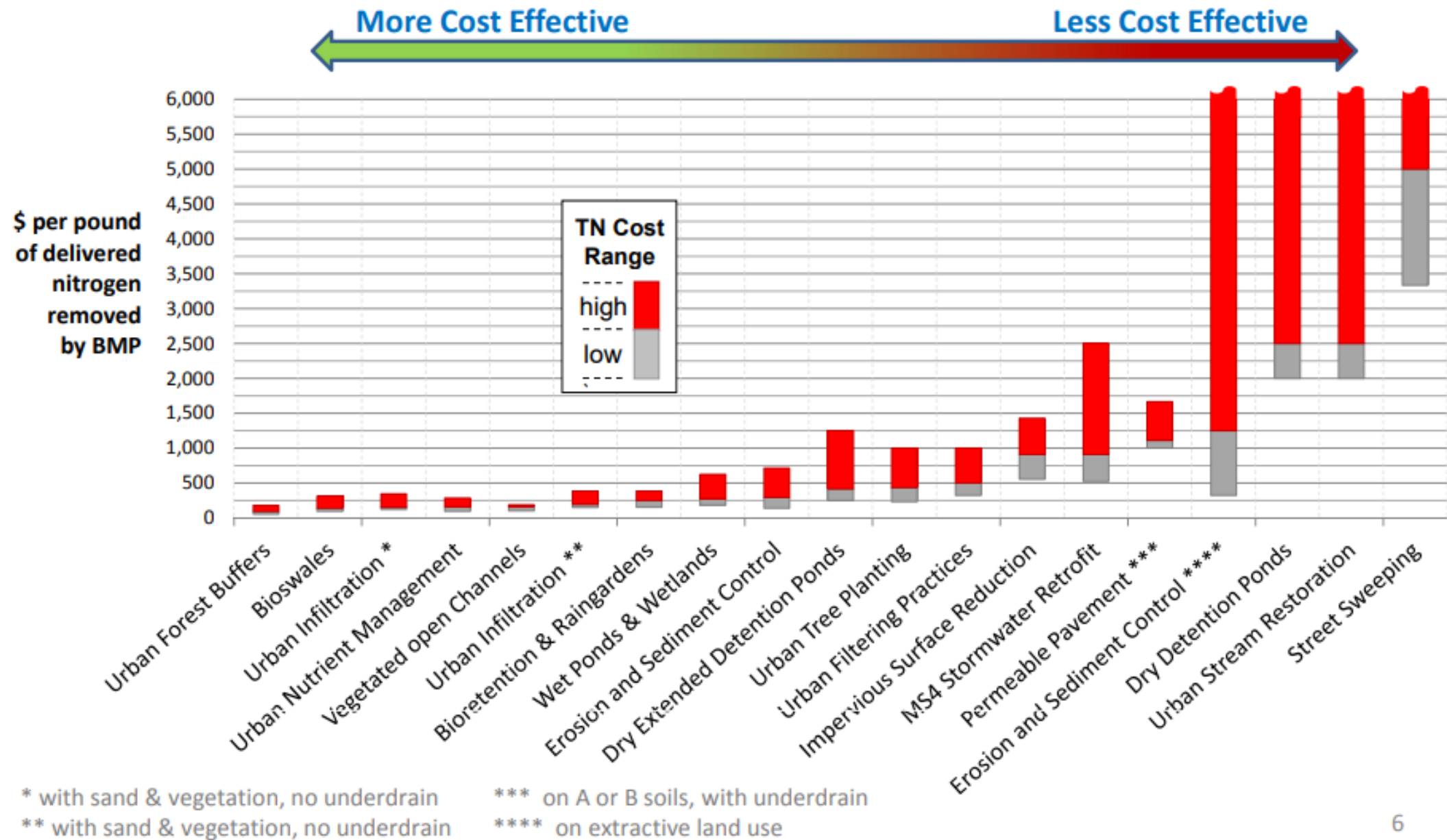
St. Mary's Forest Conservation Scenario

# Potential Pollution Reductions Due to Conservation
## St. Mary's County, Maryland

|  | Impervious | Pervious | Natural | Agriculture | Mixed Open | |
|---|---|---|---|---|---|---|
| **FC vs HT** | (185) | 333 | 1,152 | (1,107) | (193) | |
| **Total Nitrogen (lbs/acre/yr)** | 9.8 | 5.9 | 1.8 | 26.0 | 3.5 | |
| **Difference in loads (lbs/yr)** | (1,817) | 1,966 | 2,074 | (28,773) | (677) | (27,227) |

|  | Impervious | Pervious | Natural | Agriculture | Mixed Open | |
|---|---|---|---|---|---|---|
| **FC vs CZ** | (89) | 221 | 512 | (548) | (96) | |
| **Total Nitrogen (lbs/acre/yr)** | 9.8 | 5.9 | 1.8 | 26.0 | 3.5 | |
| **Difference in loads (lbs/yr)** | (871) | 1,304 | 922 | (14,244) | (338) | (13,227) |

Cost effectiveness of BMPs: $ per pound of delivered nitrogen removed by BMP

**More Cost Effective** ← → **Less Cost Effective**

TN Cost Range
- high (red)
- low (gray)

BMPs (left to right):
Urban Forest Buffers, Bioswales, Urban Infiltration *, Urban Nutrient Management, Vegetated open Channels, Urban Infiltration **, Bioretention & Raingardens, Wet Ponds & Wetlands, Erosion and Sediment Control, Dry Extended Detention Ponds, Urban Tree Planting, Urban Filtering Practices, Impervious Surface Reduction, MS4 Stormwater Retrofit, Permeable Pavement ***, Erosion and Sediment Control ****, Dry Detention Ponds, Urban Stream Restoration, Street Sweeping

\* with sand & vegetation, no underdrain
\*\* with sand & vegetation, no underdrain
\*\*\* on A or B soils, with underdrain
\*\*\*\* on extractive land use

6

# State-Specific Scenarios

**Pennsylvania- Final** (using "Current Zoning" scenario as baseline):

- Conserve riparian zones (default width = 30m)
- Conserve wetlands (NWI, State Designated Wetlands, and Potential Conservable Wetlands (PA only))
- Increase proportion of growth occurring as infill/redevelopment (default = 10% per decade)
- Increase urban densities (default = 10% per decade)
- Increase proportion of urban vs rural growth (default = 10% per decade)
- Expand sewer service areas (default = 1 mile buffer)
- Avoid growth on soils unsuitable for septic systems
- Stochastically simulate rate of forest conservation by County based on participation in state programs and land trust activities.
- Stochastically simulate rate of farmland conservation by County on participation in state programs and land trust activities.

# State-Specific Scenarios

**Delaware- Draft** (using "Current Zoning" scenario as baseline):

- Conserve riparian zones (default width = 30m, ==exclude tax ditches and irrigated farmland== (need tax ditch dataset, irrigated farmland data will be sought from USGS)
- Conserve wetlands (need ==Delaware dataset on state-mapped wetlands-== including whale wallows)
- Conserve all lands subject to inundation due to sea level rise (default = 1m rise by the year 2100)
- Conserve all lands surrounding National Wildlife Refuges (default = 1/2 mile buffer)
- Conserve all large forest tracts in Legacy areas (need ==parcel data with tax emptions==. Lori will confirm average size of conserved parcels, 20 acres?)
- Conserve all high-value forest and forested wetlands identified by the Chesapeake Conservation Partnership
- Increase proportion of growth occurring as infill/redevelopment (default = 10% per decade)
- Increase urban densities (default = 10% per decade)
- Increase proportion of urban vs rural growth (default = 10% per decade)
- Expand sewer service areas ==10% (by area or in proportion to locally forecasted growth and using probability as weighted cost surface)==
- Conserve all farmland within designated Agricultural Districts
- Conserve all lands within the floodplain (default = 100-year recurrence interval)
- Conserve all lands with flooded soils (default = frequently flooded)
- Conserve all prime farmlands and farmland of state importance
- ==Conserve all irrigated farmlands (data from USGS)==
- Conserve all high-value farmland identified by the Chesapeake Conservation Partnership

# State-Specific Scenarios

**District of Columbia-Final** (using "Current Zoning" scenario as baseline):
- <mark>Restrict new development to areas where local forecasts indicate stormwater management regulations will be triggered by future development and/or redevelopment activities.</mark>

**Maryland** (using "Current Zoning" scenario as baseline):
- Under development

**Virginia** (using "Current Zoning" scenario as baseline):
- Under development

**West Virginia** (using "Current Zoning" scenario as baseline):
- Under development

**New York** (using "Current Zoning" scenario as baseline):
- **No feedback received.**

# Next Steps to Credit Conservation and Planning BMPs

- Complete State-specific Scenarios

- Simulate expected rates of forest and farmland conservation by county in PA and MD

- Translate conservation priority maps into future conservation probability maps

- Update the 1m-resolution land use/cover data using 2017 and 2018 imagery.

- Obtain annual rates of conservation, average sizes of conserved parcels, and contextual rules by County from state agencies and land trust community.

Thank you, Lindsey.
We will miss you!