



# 2022 Webinar Series



## ***Land Cover, Land Use and Change: The Latest High Resolution Data for Chesapeake Bay Conservation & Restoration***

Wednesday, March 23rd, 2022

Presented by

**Katie Walker, Chesapeake Conservancy's Chesapeake Innovation Center (CIC)**

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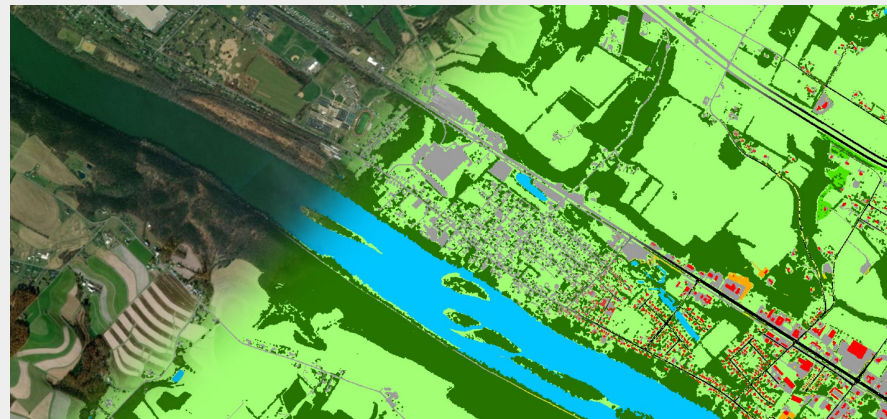


**Harry R. Hughes**  
CENTER FOR AGRO-ECOLOGY



# What is Land Cover/Land Use?

- Land cover describes the physical land surface (e.g., tree canopy, open water, low vegetation)
- Land cover is classified using satellite/aerial imagery, digital elevation data, and building footprints. The pixels within the imagery are grouped and segmented into "objects" that get classified.
- The 2017/18 land cover data were produced by the University of Vermont team after preliminary data was reviewed by local stakeholders, LUWG, and other Chesapeake Bay Program partners. Feedback was used to revise classification protocols and re-classify the landscape.



# What is Land Cover/Land Use?



- Land use indicates how people make use of the land (e.g., cropland, recreation, solar)
- Land use is derived from land cover data using ancillary data to translate physical land features into nuanced classes indicating the type of human activities on the land.
- The 2017/18 land use data are being produced by Chesapeake Conservancy in partnership with staff at USGS. Preliminary data was reviewed by Chesapeake Bay Program partners; feedback was used to revise the decision rules and protocols used to produce the classification.

# 2017/18 NAIP



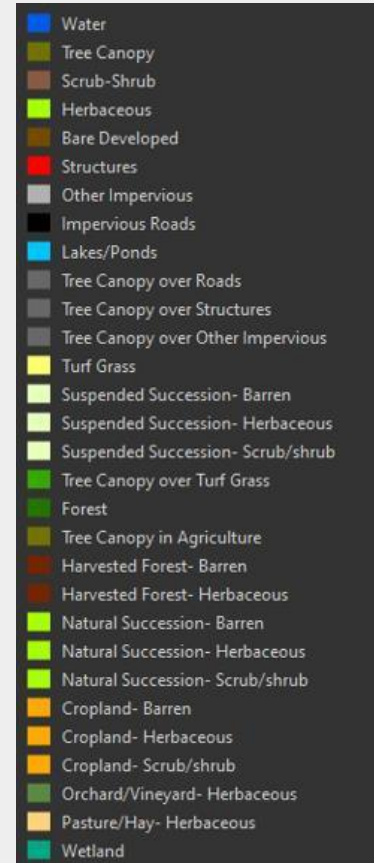
# 2017/18 Land Cover\* (12 class)



- Water
- Emergent Wetlands
- Tree Canopy
- Scrub/Shrub
- Herbaceous
- Barren
- Impervious Structures
- Other Impervious
- Impervious Roads
- Tree Canopy over Impervious Structures
- Tree Canopy over Other Impervious
- Tree Canopy over Impervious Roads

\* data shown is preliminary results and may differ from the final released data

# 2017/18 Land Use/Land Cover\* (18 class)



\* data shown is preliminary results and may differ from the final released data

- Spatial resolution (1-meter cells)
  - i.e. 53% more impervious in the Bay watershed compared to 30-meter resolution LULC data
- Categorical resolution (50+ classes)
- Accuracy (95% accuracy anticipated for tree canopy and impervious surface classes)

# Unique Qualities of the Land Use Data





# CBP Land Use/Cover Classification (62 planned for 2021/22, 54 classes mapped for 2017/18)

## 1. Water (11)

### 1.1 Estuarine / Marine

### 1.2 Lentic (fresh)

#### 1.2.1. Lakes and reservoirs

#### 1.2.2 Riverine ponds

#### 1.2.3 Terrene ponds

### 1.3 Lotic (fresh)

#### 1.3.1 Channels

##### 1.3.1.1 Open Channel

##### 1.3.1.2 Tree Canopy over Channel

##### 1.3.1.3 Culverted

#### 1.3.2. Ditches

##### 1.3.2.1 Open Ditch

##### 1.3.2.2 Tree Canopy over Ditch

##### 1.3.2.3 Culverted

## 2. Developed (12)

### 2.1 Impervious

#### 2.1.1 Roads

#### 2.1.2 Structures

#### 2.1.3 Other Impervious

#### 2.1.4 Tree Canopy (TC) over Impervious

##### 2.1.4.1 TC over Roads

##### 2.1.4.2 TC over Structures

##### 2.1.4.3 TC over Other Impervious

### 2.2 Pervious

#### 2.2.1 Turf Grass

#### 2.2.2 Transitional- barren

### 2.2.3 Suspended Succession

#### 2.2.3.1 Barren

#### 2.2.3.2 Herbaceous

#### 2.2.3.3 Scrub-shrub

### 2.2.4 Tree Canopy over Turf Grass

## 3. Forested (7)

### 3.1 Forest (>= 1 acre, 240-ft width)

### 3.2 Other Tree Canopy

### 3.3 Harvested Forest (<= 3 years)

#### 3.3.1 Barren

#### 3.3.2 Herbaceous

### 3.4 Natural Succession (> 3 years)

#### 3.4.1 Barren

#### 3.4.2 Herbaceous

#### 3.4.3 Scrub-shrub

## 4. Production (17)

### 4.1 Agriculture

#### 4.1.1 Cropland

##### 4.1.1.1 Barren

##### 4.1.1.2 Herbaceous

#### 4.1.2 Pasture/Hay

##### 4.1.2.1 Barren

##### 4.1.2.2 Herbaceous

##### 4.1.2.3 Scrub-shrub

#### 4.1.3 Orchard/vineyard

##### 4.1.3.1 Barren

##### 4.1.3.2 Herbaceous

##### 4.1.3.3 Scrub-shrub

### 4.1.4 Animal Operations

#### 4.1.4.1 Impervious

#### 4.1.4.2 Barren

#### 4.1.4.3 Herbaceous

### 4.2 Solar fields

#### 4.2.1 Impervious

#### 4.2.2 Pervious

##### 4.2.2.1 Barren

##### 4.2.2.2 Herbaceous

##### 4.2.2.3 Scrub-shrub

### 4.3 Extractive (active mines)

#### 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

#### 5.1.4 Other Tree Canopy

#### 5.1.5 Forest

### 5.2 Riverine (Non-tidal)

#### 5.2.1. Barren

#### 5.2.2 Herbaceous

#### 5.2.3 Scrub-shrub

#### 5.2.4 Other Tree Canopy

#### 5.2.5 Forest

### 5.3 Terrene/Isolated (Non-tidal)

#### 5.3.1 Barren

#### 5.3.2 Herbaceous

#### 5.3.3 Scrub-shrub

#### 5.3.4 Other Tree Canopy

#### 5.3.5 Forest

### 5.4 Bare shore

Note: Yellow and blue classes mapped for 2017/18. Grey classes will be added to all years with the production of the 2021/22 LULC.

# Proposed Generalized Land Use Classes

## 1. Impervious Roads

- 2.1 Impervious
  - 2.1.1 Roads

## 2. Impervious Structures

- 2.1 Impervious
  - 2.1.2 Structures

## 3. Impervious, Other

- 2.1 Impervious
  - 2.1.3 Other Impervious
- 4.2 Solar fields
  - 4.2.1 Impervious

## 4. Tree Canopy Over Impervious

- 2.1 Impervious
  - 2.1.4 Tree Canopy over Impervious

## 5. Turf Grass

- 2.2 Pervious, Developed
  - 2.2.1 Turf Grass

## 6. Tree Canopy over Turf Grass

- 2.2 Pervious, Developed
  - 2.2.4 Tree Canopy over Turf Grass

## 7. Pervious Developed, Other

- 2.2 Pervious, Developed
  - 2.2.2 Transitional- barren
  - 2.2.3 Suspended Succession
- 4.2 Solar fields
  - 4.2.2 Pervious

## 8. Forest

- 3.1 Forest ( $\geq 1$  acre, 240-ft width)
- 5.1 Tidal
  - 5.1.5 Forest ( $\geq 1$  acre, 240-ft width)
- 5.2 Riverine (Non-tidal)
  - 5.2.5 Forest ( $\geq 1$  acre, 240-ft width)
- 5.3 Terrene/Isolated (Non-tidal)
  - 5.3.5 Forest ( $\geq 1$  acre, 240-ft width)

## 9. Tree Canopy, Other

- 3.2 Other Tree Canopy
- 5.1 Tidal
  - 5.1.4 Other Tree Canopy
- 5.2 Riverine (Non-tidal)
  - 5.2.4 Other Tree Canopy
- 5.3 Terrene/Isolated (Non-tidal)
  - 5.3.4 Other Tree Canopy

## 10. Harvested Forest

- 3.3 Harvested Forest ( $\leq 3$  years)

## 11. Natural Succession

- 3.4 Natural Succession ( $> 3$  years)
- 5.4 Bare shore, Water Margins

## 12. Wetlands, Tidal non-forested

- 5.1 Tidal Wetlands
  - 5.1.1 Barren
  - 5.1.2 Herbaceous
  - 5.1.3 Scrub-shrub

## 13. Wetlands, Riverine non-forested

- 5.2 Riverine Wetlands (Non-tidal)
  - 5.1.1 Barren
  - 5.1.2 Herbaceous
  - 5.1.3 Scrub-shrub

## 14. Wetlands, Terrene non-forested

- 5.3 Terrene/Isolated Wetlands (Non-tidal)
  - 5.1.1 Barren
  - 5.1.2 Herbaceous
  - 5.1.3 Scrub-shrub

## 15. Extractive

- 4.3 Extractive (active mines)
  - 4.3.1 Barren
  - 4.3.2 Impervious

## 16. Cropland

- 4.1 Agriculture
  - 4.1.1 Cropland
  - 4.1.3 Orchard/vineyard

## 17. Pasture/Hay

- 4.1 Agriculture
  - 4.1.2 Pasture/Hay

## 18. Water

- 1.1 Estuarine/Marine
- 1.2 Lentic
- 1.3 Lotic

- **Goal:** accurately monitor land use change every 3-5 years)
- Land Cover Change contains 80 classes of observed change across the Bay Watershed
  - 12 class x 12 class = 132 potential change classes
- Land Cover change is the key driver to locate land use change
- Land Use change exists where land cover did not change
  - Example: A forest patch that became fragmented

# Land Cover/Land Use Change

# Land Cover Change

2013/14 NAIP



2017/18 NAIP



2013/14 - 2017/18 LC Change\*



\* data shown is preliminary results and may differ from the final released data

# Land Use Change

2013/14 NAIP



2017/18 NAIP



2013/14 - 2017/18 LU Change\*



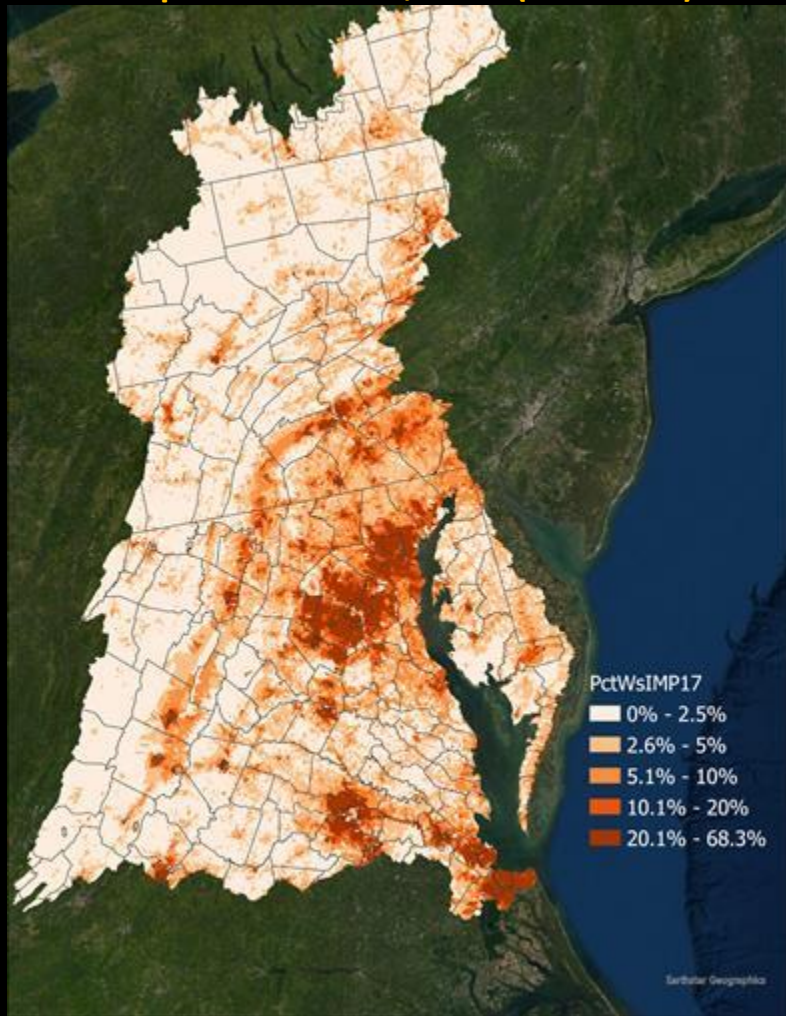
\* data shown is preliminary results and may differ from the final released data

# Land Use Change Matrices (by county, state\*, and watershed)

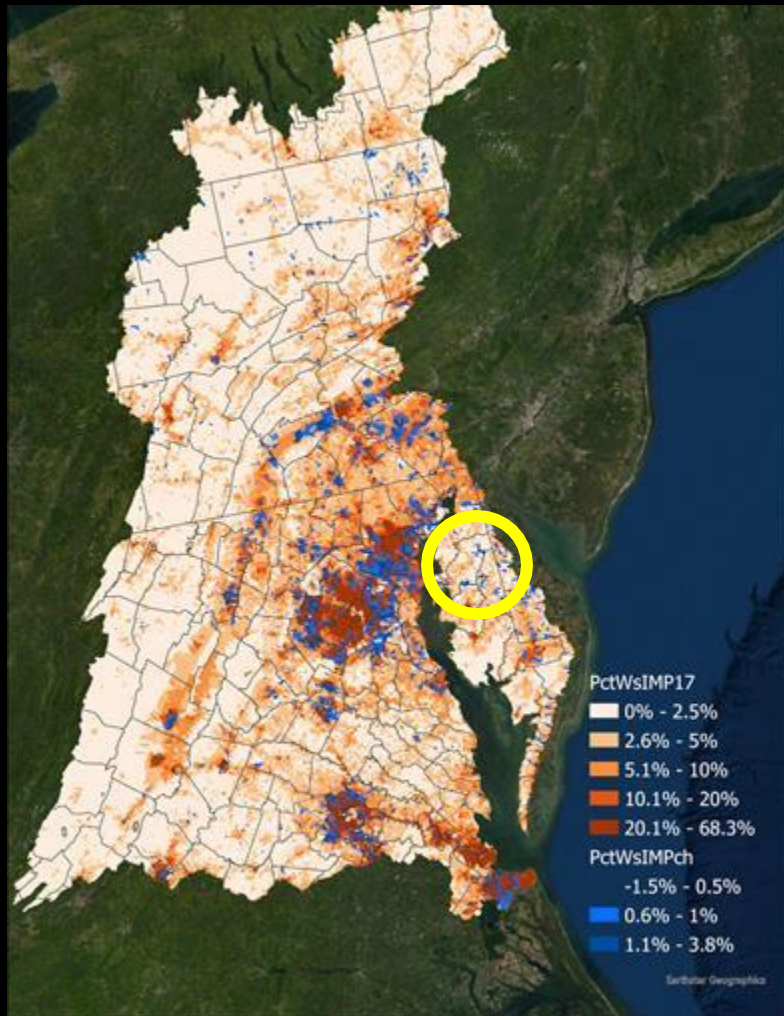
2013/14-2017/18	ROAD	IMPS	IMPO	TCIS	TURF	TCTG	PDEV	FORE	TCOT	NATS	HARF	TDLW	RIVW	TERW	CROP	PAST	EXTR	WATR	Decrease
ROAD	-	10	50	1,143	6	47		217				-	3	-	1	2		-	1,479
IMPS	20	-	25	1,400	1,500	133		58				4	41	12	210	412		5	3,820
IMPO	578	300	-	1,300	3,400	400		186				-	11	1	330	712		7	7,225
TCIS	114	507	790	-	2,000	13		6				2	17	3	57	91		-	3,600
TURF	250	3,450	2,720	-	-	11,210		344							45	69		13	18,101
TCTG	104	2,800	3,640	-	11,367	-		98							516	472		14	19,011
PDEV							-												-
FORE	1,152	5,700	11,600	17	10,660	15,779		-			299,732				20,609	22,054		143	387,446
TCOT									-		5,700								5,700
NATS		150	780	1	28,503	1,037		57,500		-					943	1,788		748	91,450
HARF					2			72,000			-								72,002
TDLW					2							-							2
RIVW					-								-						-
TERW														-					-
CROP	61	1,000	3,400	-	302			3,263							-	151		104	8,281
PAST	51	1,500	3,800	-	451			4,591							178	-		63	10,634
EXTR																	-		-
WATR	1	31	82	-	2			192										-	308
<b>Increase</b>	2,331	15,448	26,887	3,861	58,195	28,619	-	138,455	-	-	305,432	6	72	16	22,889	25,751	-	1,097	629,059
<b>Totals</b>																			
<b>TotGain</b>	2,331	15,448	26,887	3,861	58,195	28,619	-	138,455	-	-	305,432	6	72	16	22,889	25,751	-	1,097	
<b>TotLoss</b>	1,479	3,820	7,225	3,600	18,101	19,011	-	387,446	5,700	91,450	72,002	2	-	-	8,281	10,634	-	308	
<b>Net</b>	852	11,628	19,662	261	40,094	9,608	-	(248,991)	(5,700)	(91,450)	233,430	4	72	16	14,608	15,117	-	789	

\* data shown is an example and does not reflect any of the mentioned geographies

Impervious Cover, 2017 (accum. %)



Impervious Cover Change, 2013-17 (accum. %)







NAIP 2013/2014



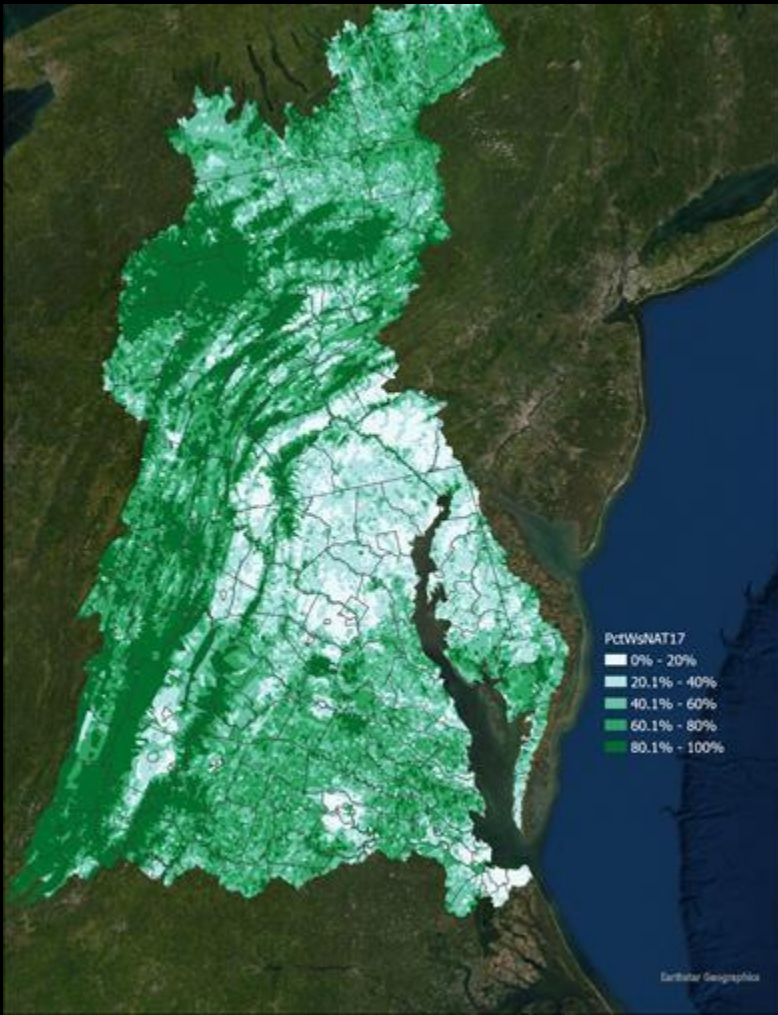
NAIP 2017/2018



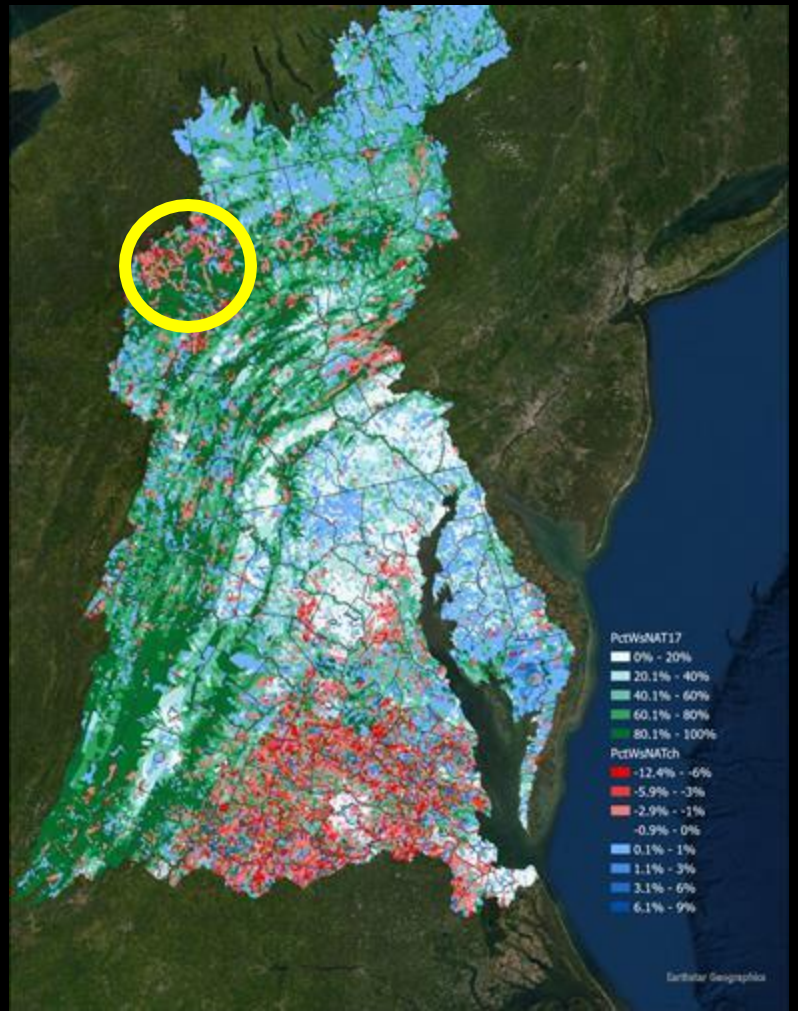
Version 1 Land Use Change



Tree Cover and Wetlands, 2017 (accum. %)



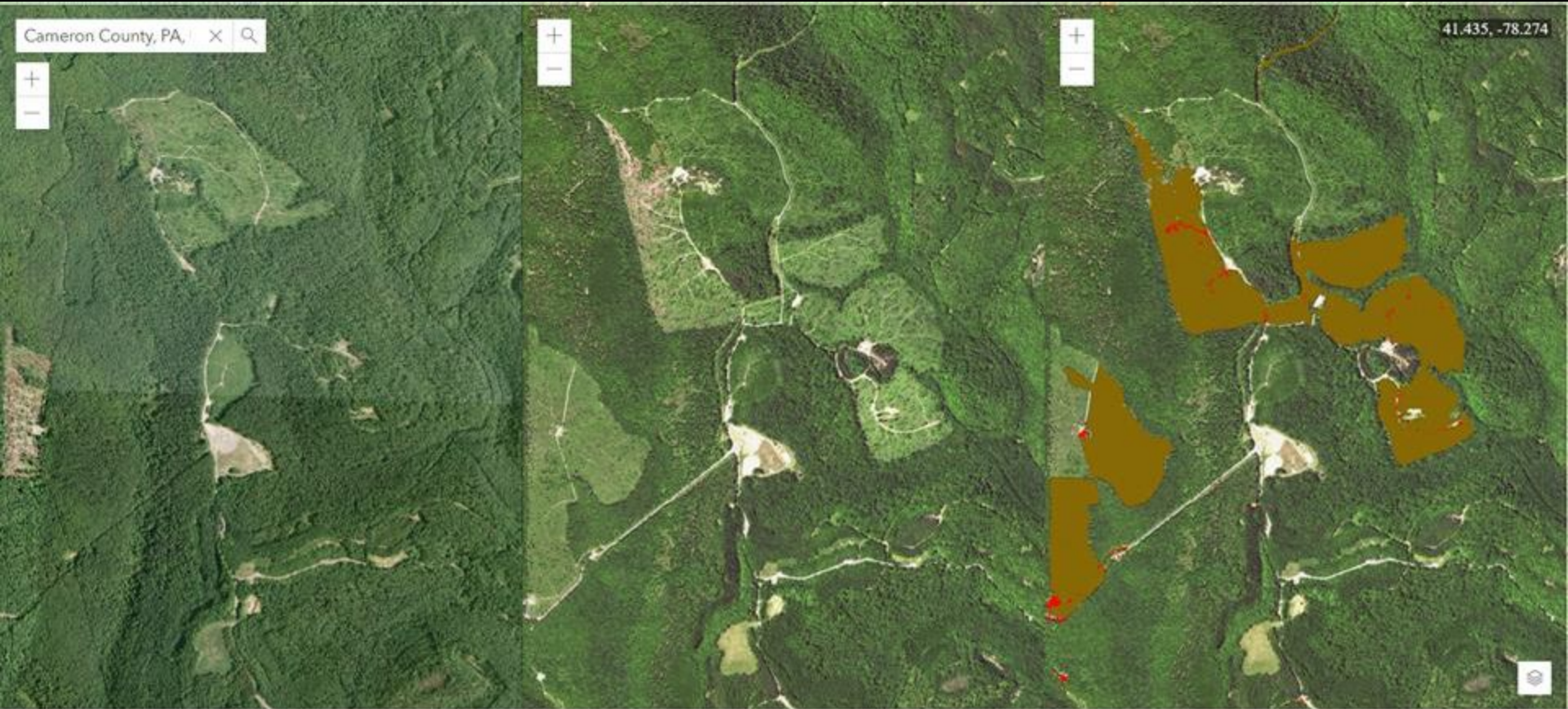
Tree Cover and Wetland Change, 2013-17 (accum. %)



2013

2017

Land Use Change, 2013-17



# Caveats

- Data will be retrospectively revised with future data releases
  - Streams, ditches, and animal operations will be added in 2021/22 data planned for release in 2024
  - Digital surface models (elevation of objects) will be added to workflow
  - Methods and ancillary data will be further refined
  - All updates will be applied to 2013/14 and 2017/18 LULC data to ensure accurate change
- A longer temporal record is needed to interpret certain types of LULC change
  - Pre-2013/14 land use data are needed to distinguish forest and farmland conversion to development
  - Post-2017/18 land use are needed to verify the end state of transitional land uses (e.g., natural succession, suspended succession)
- Potential to confuse transitional and temporary change with permanent change
  - Timber harvest is the largest change in the Bay watershed but signifies only a temporary change in tree cover, not a loss.
  - Changes from forest to tree canopy over turf grass represent a contextual change, not a loss of tree cover.
- Periods of change vary by state: 5 years for MD and DE; 4 years for DC, NY, PA, VA, and WV.

# Applications

- Identifying Best Management Practices (BMP) opportunities and where they may be most effective
  - riparian forest buffers
  - tree planting in densely developed areas
  - stream restoration
- Targeting land conservation
- Identifying potential healthy and vulnerable watersheds
- Informing land use planning decisions
- Assessing net change in forest buffers, tree canopy and imperviousness
- Assessing extent of shaded streams
- Assessing stream geomorphic conditions and impairments
- Assessing land use conditions in areas of future marsh migration
- Others?

- LC, LULC, and LULC Change data will be available in raster format for download at the county scale via web viewers.
- Tabular summaries of class area (detailed and general classification scheme) and change matrices will also be made available for download.
- Documentation on methodology, interpretation guides, and high-level interpretations will also be provided.

# Upcoming Data Release (April 2022)



Labeeb Ahmed, U.S. Geological Survey  
Peter Claggett, U.S. Geological Survey  
Jacob Czawlytko, Chesapeake Conservancy  
Sean MacFaden, UVM SAL  
Patrick McCabe, Chesapeake Conservancy  
Sarah McDonald, U.S. Geological Survey  
Emily Mills, Chesapeake Conservancy  
Jarlath O'Neil Dunne, UVM SAL  
Rachel Soobitsky, Chesapeake Conservancy  
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# Questions? Feedback?

Interested in being notified when the data is released? Email Katie.



# Post Webinar Survey

Please take the time to fill out the survey below

<https://www.surveymonkey.com/r/MBB9NCV>