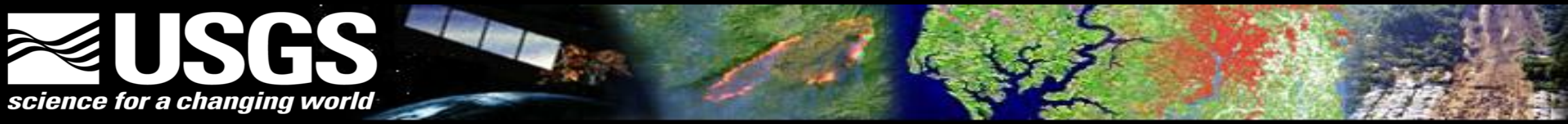

Final CAST-21 Land Use and Lessons Learned

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Water Quality Goal Implementation Team Meeting
September 1, 2021

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

Problem: Potential for Double Counting of Forest Harvest

1. **Impervious Roads**
   - 2.1 Impervious
     - 2.1.1 Roads

2. **Impervious**
   - 2.1 Impervio
     - 2.1.2
     - 2.1.3
   - 4.2 Solar fie
     - 4.2.1 Impervious

But CAST subtracts reported and estimated harvested forest acres from forest.

3. **Tree Canopy Over Impervious**
   - 2.1 Impervious
     - 2.1.4 Tree Canopy over Impervious

4. **Turf Grass**
   - 2.2 Pervious, Developed
     - 2.2.1 Turf Grass

5. **Tree Canopy over Turf Grass**
   - 2.2 Pervious. Developed
     - 2.2.4 Tree Canopy over Turf Grass

6. **Forest**
   - 3.1 Forest (>= 1 acre, 240-ft width)
   - 3.2 Tree Canopy in Agriculture

7. **Wetlands, Floodplain**
   - 5.2 Riverine, Wetlands

8. **Wetlands, Other**
   - 5.3 Terrene/Isolated, Wetlands

9. **Water**
   - 1.1 Lentic
     - 1.1.1 Estuary (tidal)
     - 1.1.2 Lakes & Ponds
   - 1.2 Lotic
     - 1.2.1 Streams
     - 1.2.2 Ditches

10. **Cropland**
    - 4.1 Agriculture
      - 4.1.1 Cropland
      - 4.1.3 Orchard/vineyard

11. **Pasture**
    - 4.1 Agriculture
      - 4.1.2 Pasture

12. **Mixed Open**
    - 2.2 Pervious, Developed
      - 2.2.2 Bare Developed
      - 2.2.3 Suspended Succession
    - 3.3 Harvested Forest (<= 3 years)
    - 3.4 Natural Succession (> 3 years)
    - 4.2 Solar fields
      - 4.2.2 Pervious
    - 4.3 Extractive (active mines)
    - 5.4 Bare shore, Water Margins

For 2013-2017 land use change, mapped forest clearings logically roll up to mixed open.

Generalized Land Use Changes: 2013 – 2017

CAST-19 (pre-BMP) vs CAST-21 (pre-BMP)

	CAST 2019				
	2013-2017	DEV	NAT	AG	MO
2013 to 2017	Delaware	1,431	(7,534)	14,724	(8,621)
	District of Columbia	64	(64)	-	(0)
	Maryland	18,027	(2,077)	(9,693)	(6,257)
	New York	28,305	132,912	(163,996)	2,779
	Pennsylvania	36,453	49,781	(81,583)	(4,650)
	Virginia	31,407	(65,551)	46,699	(12,555)
	West Virginia	1,099	(17,751)	20,116	(3,464)
	Total	116,785	89,716	(173,733)	(32,769)

CAST 2021				
2013-2017	DEV	NAT	AG	MO
Delaware	11,180	(4,473)	(2,567)	(4,140)
District of Columbia	78	(34)	-	(44)
Maryland	24,974	(11,361)	(8,068)	(5,545)
New York	7,621	(6,154)	(3,103)	1,636
Pennsylvania	34,619	(75,060)	(6,278)	50,720
Virginia	38,974	(242,427)	(1,920)	205,374
West Virginia	4,108	(11,677)	(386)	7,955
Total	121,555	(355,187)	(22,324)	255,956

CAST 2021				
2013-2017	DEV	NAT	AG	MO
Delaware	11,181	(3,348)	(2,567)	(5,265)
District of Columbia	78	(25)	-	(53)
Maryland	24,987	(4,442)	(8,215)	(12,329)
New York	7,623	(3,411)	(3,104)	(1,108)
Pennsylvania	34,651	(40,163)	(6,326)	11,838
Virginia	39,990	(62,172)	(2,282)	25,464
West Virginia	4,108	(5,893)	(387)	2,172
Total	121,616	(119,454)	(22,881)	20,719

APPROVED

DEV = Developed (impervious surfaces and turf grass); NAT = Natural (forest, wetlands, and water), AG = Agriculture (cropland and pasture), MO = Mixed Open (natural and suspended succession, bare developed)

How the land use was adjusted… Isle of Wight County, VA example

T1-T2 LU	IR	INR	TCI	TG	TCT	FORE	WLF	WLO	WLT	MO	CRP	PAS	WAT	Loss
IR	-	-	3	-	0	8	0	0	-	-	-	-	-	11
INR	2	-	8	93	1	10	7	0	0	45	15	3	0	184
TCI	0	2	-	2	-	-	0	-	-	13	1	0	-	18
TG	1	9	-	-	25	1	0	-	-	2	1	-	-	39
TCT	0	11	-	9	-	0	-	-	-	46	1	0	-	67
FORE	5	46	0	79	99	-	-	-	-	6,309	251	54	0	6,842
WLF	-	0	-	0	-	-	-	-	-	-	-	-	-	0
WLO	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WLT	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MO	13	48	-	194	8	2,595	-	-	-	-	26	13	6	2,904
CRP	0	11	-	2	1	141	-	-	-	195	-	0	23	373
PAS	-	2	-	1	0	3	-	-	-	3	-	-	-	9
WAT	-	-	-	-	0	2	0	-	0	-	-	-	-	3
Gain	21	129	12	380	134	2,760	7	0	0	6,611	294	71	29	10,450

From 2013-2017, 6309 acres (blue) of forest was cleared to mixed open while 2595 acres (green) of mixed open grew back to forest. Net change = 3714 acres of mapped mixed open might be timber harvest.

Of the 2904 acres (yellow) of mixed open in 2013 that were converted to something else in 2017, 9% (263 acres in pink) were converted to development. Therefore, 9% of the 3714 acres (334 acres) may become developed in the future and should not be considered potential timber harvest acres.

Therefore, move 3380 acres (3714 – 334) from mixed open to forest and continue to subtract reported/estimated timber harvest from mapped forest in CAST-21.

Lessons Learned (the good, bad, and ugly)

Review Process, Timing, Feedback, and Corrections

Data dissemination portals: land change viewer, land cover/use viewer

Classification Scheme

Data format

Data documentation

Land Use Change Viewer

Not secure | cicapps.org/obj1lu/

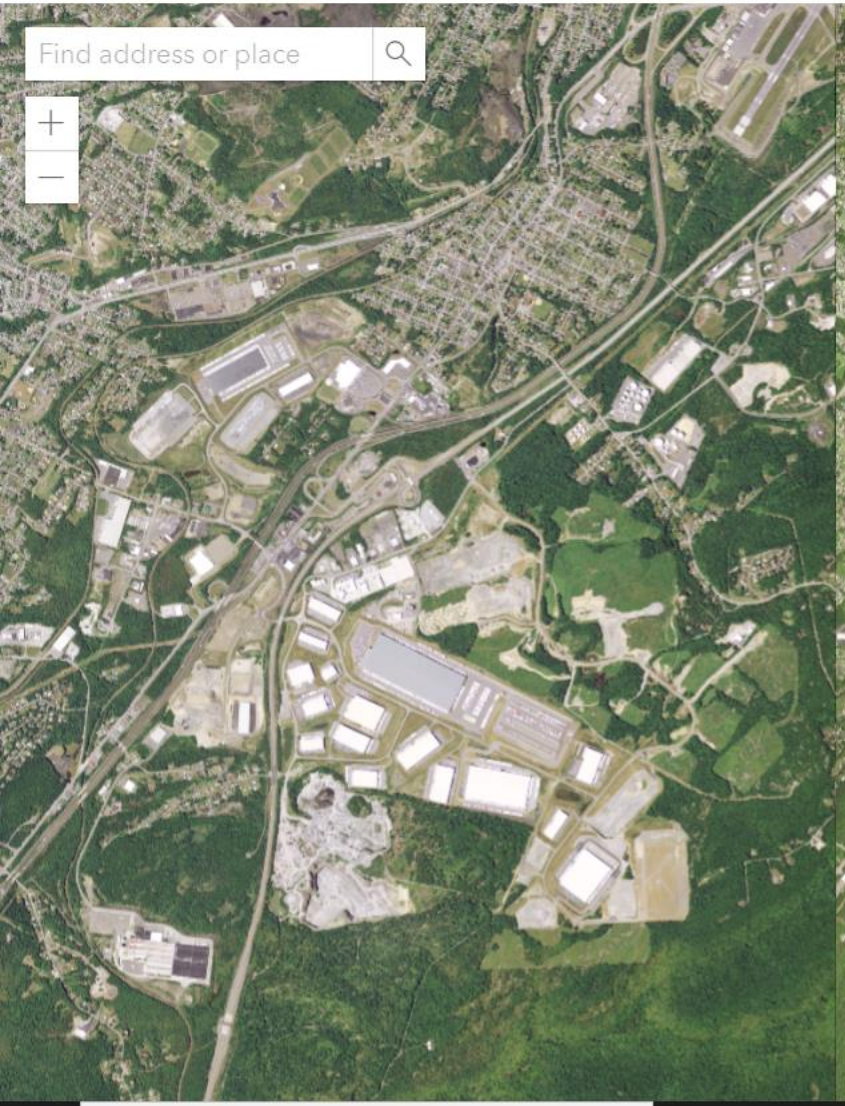
NAIP 2013/2014

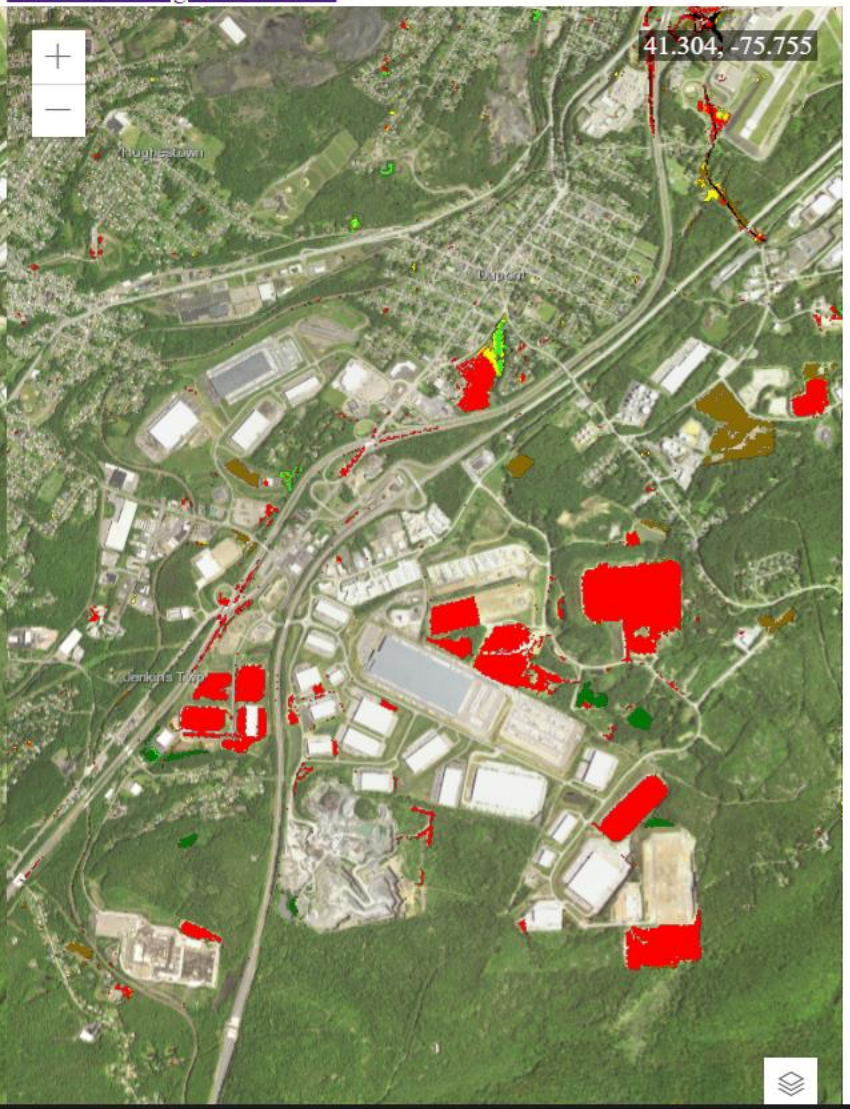
NAIP 2017/2018

Version 1 Land Use Change

NAIP 2017/2018

Land Use Change Pivot Tables





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CBP Full Land Use/Cover Classification (60 classes, final version)

1. Water (9)

- 1.1 Lentic
  - 1.1.1 Estuary (tidal)
  - 1.1.2 Lakes & Ponds
- 1.2 Lotic
  - 1.2.1 Channels
    - 1.2.1.1 Open Channel
    - 1.2.1.2 Tree Canopy over Channel
    - 1.2.1.3 Culverted
  - 1.2.2.Ditches
    - 1.2.2.1 Open Ditch
    - 1.2.2.2 Tree Canopy over Ditch
    - 1.2.2.3 Culverted
- 1.3 Other Water

2. Developed (12)

- 2.1 Impervious
  - 2.1.1 Roads
  - 2.1.2 Structures
  - 2.1.3 Other Impervious (Parking lots, driveways)
  - 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 Bare Developed
  - 2.2.3 Suspended Succession (rights-of-way)
    - 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. Forest (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 (16)

- 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
  - 4.1.4 Animal Operations (TBD)
    - 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 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 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 Tree Canopy
  - 5.3.5 Forest
- 5.4 Bare shore

Lessons Learned LULC Process

- **More time for locality feedback collection and incorporation**
  - Can be tricky based on NAIP release and data production speed from UVM

- **Streamline process for rule development with LUWG**
  - Preparing class rules for vetting by LUWG at monthly meetings took time away from developing model architecture
  - Possible Solutions:
    - Start process sooner with more staff on deck
    - Discuss all classes and ancillary datasets at the beginning, show draft outputs when ready and then edit from there

- **Address coding and cloud implementation issues earlier in the process**
  - Possible solutions:
    - Pull in more staff members sooner on tasks such as this
    - Limit feedback on class rules/additional ancillary datasets/errors past a certain date
    - Coordinate closer with UVM to make sure data outputs work smoothly with LU model


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