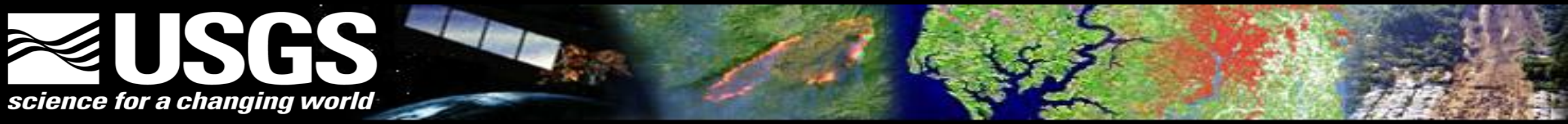

Forest Clearing and Timber Harvest Data in CAST

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2 Chesapeake Conservancy, Annapolis, MD 21403
3 University of Vermont Spatial Analysis Laboratory, Burlington, VT 05405
4 University of Maryland, Baltimore County, Baltimore, MD 21250

Forestry Workgroup Meeting
August 4, 2021

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

Agriculture Workgroup Conferen | heart emoji keyboard shortcut - | CBP Obj 1 Land Use Review | Geomorphometry for Streams an

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CBP Obj 1 Land Use Review

with ArcGIS Web AppBuilder

Original 2013

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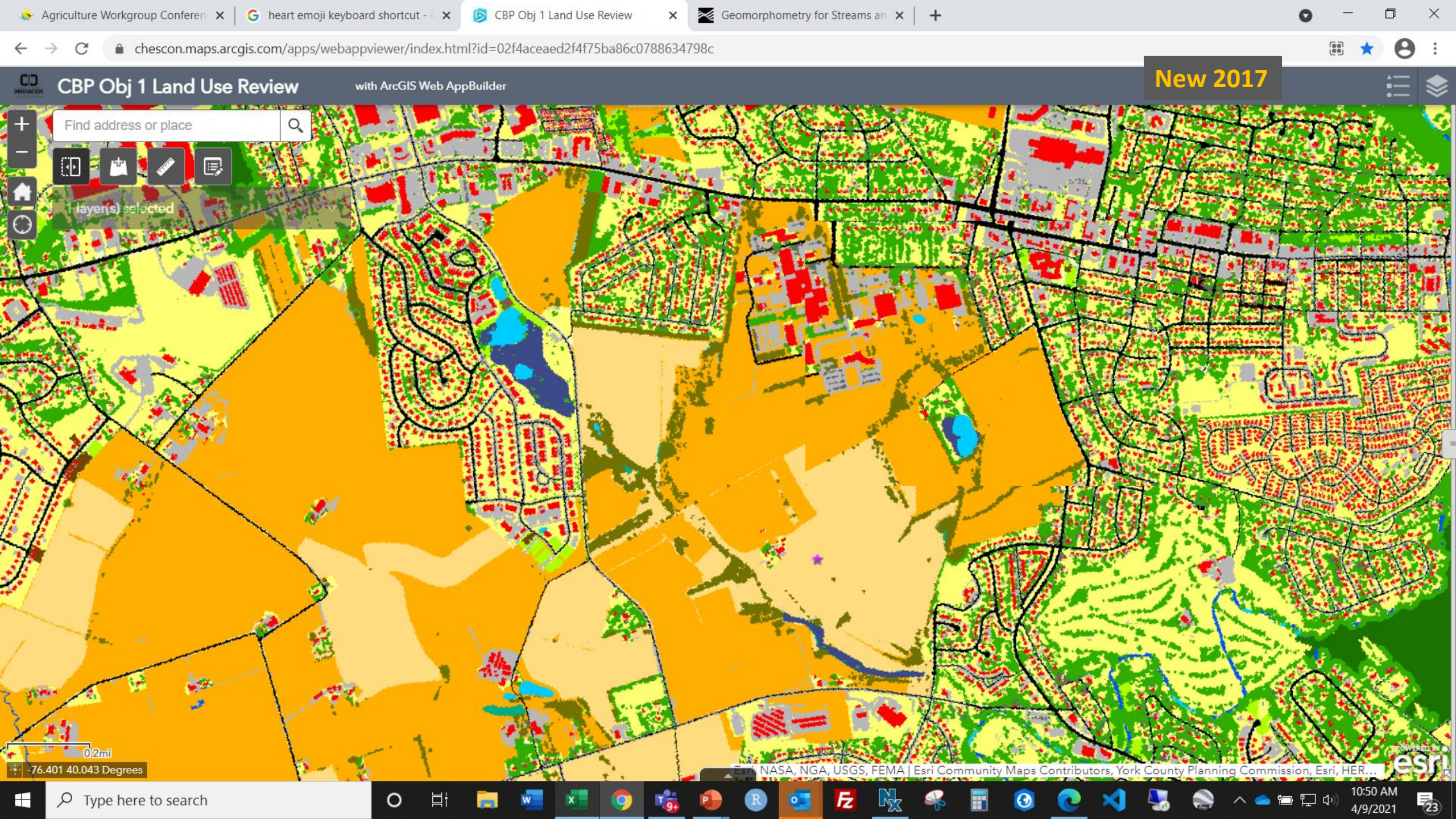
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NASA, NGA, USGS, FEMA | Esri Community Maps Contributors, York County Planning Commission, Esri, HER...
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10:50 AM
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CBP Full Land Use/Cover Classification (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 Tree Canopy in Agriculture
- 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

Phase 6 Land Use/Cover Classes

1. Impervious Roads
- 2.1 Impervious
  - 2.1.1 Roads

2. Impervious Non-Roads
- 2.1 Impervious
  - 2.1.2 Structures
  - 2.1.3 Other Impervious
- 4.2 Solar fields
  - 4.2.1 Impervious

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. Wetlands, Tidal
- 5.1 Tidal, Wetlands

10. 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

11. Cropland
- 4.1 Agriculture
  - 4.1.1 Cropland
  - 4.1.3 Orchard/vineyard

12. Pasture
- 4.1 Agriculture
  - 4.1.2 Pasture

13. Water
- 1.1 Lentic
  - 1.1.1 Estuary (tidal)
  - 1.1.2 Lakes & Ponds
- 1.2 Lotic
  - 1.2.1 Streams

Change among these classes is irrelevant to CAST!

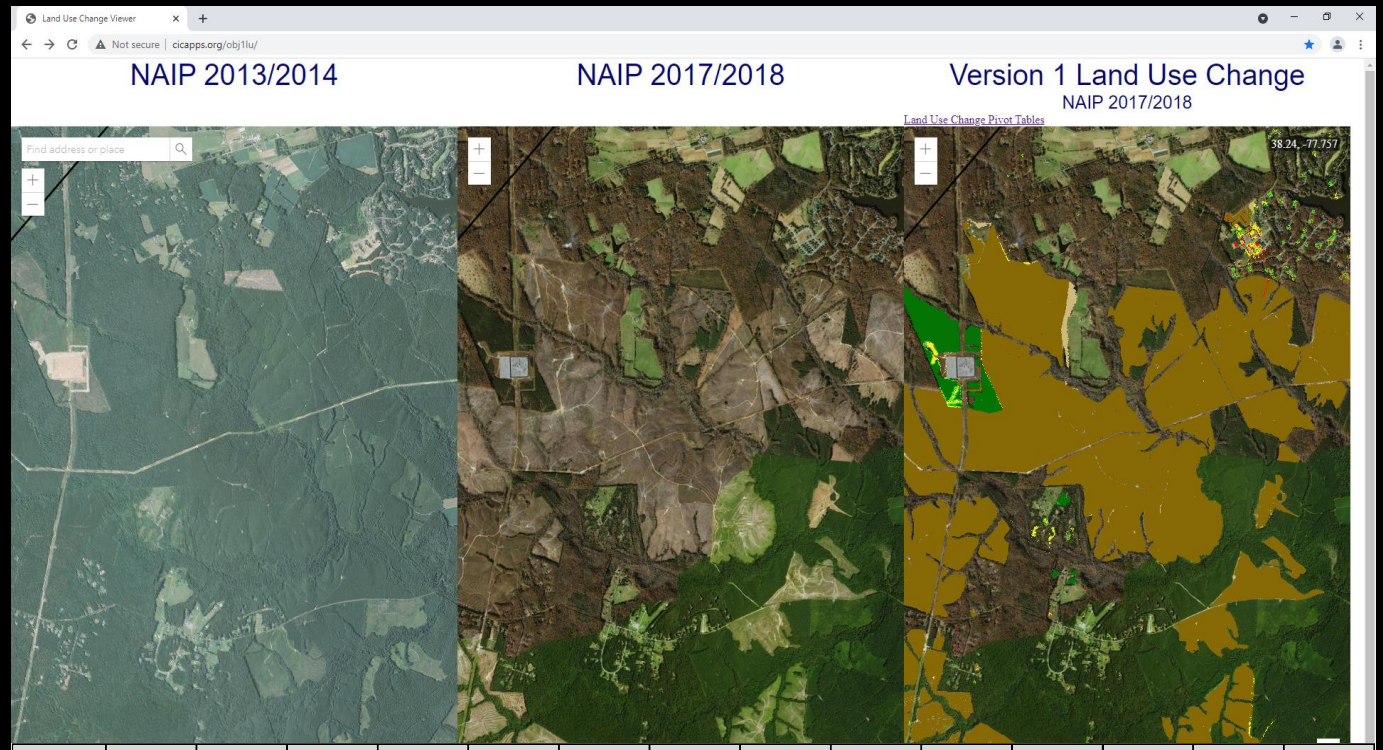
Benefits of High-resolution Land Use Data for CAST

1. Transparent

2. Verifiable

3. Logical

http://cicapps.org/obj1lu/



T1-T2 LU	IR	INR	TCI	TG	TCT	FORE	WLF	WLO	WLT	MO	CRP	PAS	WAT	Loss
IR	-	-	12	-	0	0	-	-	-	-	-	-	-	12
INR	3	-	28	24	0	1	0	-	-	8	1	4	0	70
TCI	0	17	-	6	-	-	-	-	-	5	0	0	-	28
TG	10	42	-	-	86	2	-	-	-	54	-	0	-	194
TCT	0	57	-	40	-	1	-	-	-	64	1	1	-	164
FORE	24	160	1	625	310	-	-	-	-	10,985	16	78	1	12,202
WLF	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WLO	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WLT	-	-	-	-	-	-	-	-	-	-	-	-	-	-
MO	34	270	0	440	14	1,126	-	-	-	-	0	7	19	1,910
CRP	3	3	-	3	-	1	-	-	-	19	-	18	0	47
PAS	5	29	-	22	2	130	-	-	-	27	7	-	10	232
WAT	-	-	-	-	0	1	0	-	-	1	-	3	-	5
Gain	80	577	41	1,160	412	1,262	0	-	-	11,165	24	111	31	14,863
TotGain	80	577	41	1,160	412	1,262	0	-	-	11,165	24	111	31	
TotLoss	12	70	28	194	164	12,202	-	-	-	1,910	47	232	5	
Net	68	508	13	967	248	(10,940)	0	-	-	9,255	(23)	(121)	26	

One-meter Resolution Land Use Products for Chesapeake Bay Counties

Land Use: 60+ classes

2017/2018 Land Use and 2013/14 – 2017/18 Land Use Change
- Version 1 (internal for use in CAST) Complete!
- Version 2 (public) will be released in February 2022

2021/22 Land Use and 2013/14 – 2017/18 – 2021/22 Land Use Change
- Version 1 (internal for CAST-23) will be completed July 2023
- Version 2 (public) will be released in February 2024

Hydrography: 2-D raster (discontinuous), 1-D polyline (continuous)

Features: streams, rills/gullies, agricultural ditches, roadside ditches, floodplains (from FACET), floodplain depressions, detention features, headwater wetlands, other.

Attributes: width, bank height, flow permanence, stream order, drainage area

Planned public release date: June 2024 (draft products will be available in 2022-23)

Generalized Land Use Changes: 2013 – 2017

CAST-21 (pre-BMP) vs CAST-19 (pre-BMP) vs CBLCM (urban growth)

Change: 2013 - 2017	CAST-21				CAST-19				CBLCM			
Land Use	**DEV**	**NAT**	**AG**	**MO**	**DEV**	**NAT**	**AG**	**MO**	**DEV**	**NAT**	**AG**	**MO**
Gains	121,510	4,772	3,960	279,934	116,785	237,171	172,142	25,095	86,947	-	-	2,952
Losses	-	(359,949)	(26,491)	(23,736)	(0)	(147,455)	(345,875)	(57,864)	-	(42,512)	(47,387)	-
Net Change	**121,510**	**(355,177)**	**(22,531)**	**256,198**	**116,785**	**89,716**	**(173,733)**	**(32,769)**	**86,947**	**(42,512)**	**(47,387)**	**2,952**

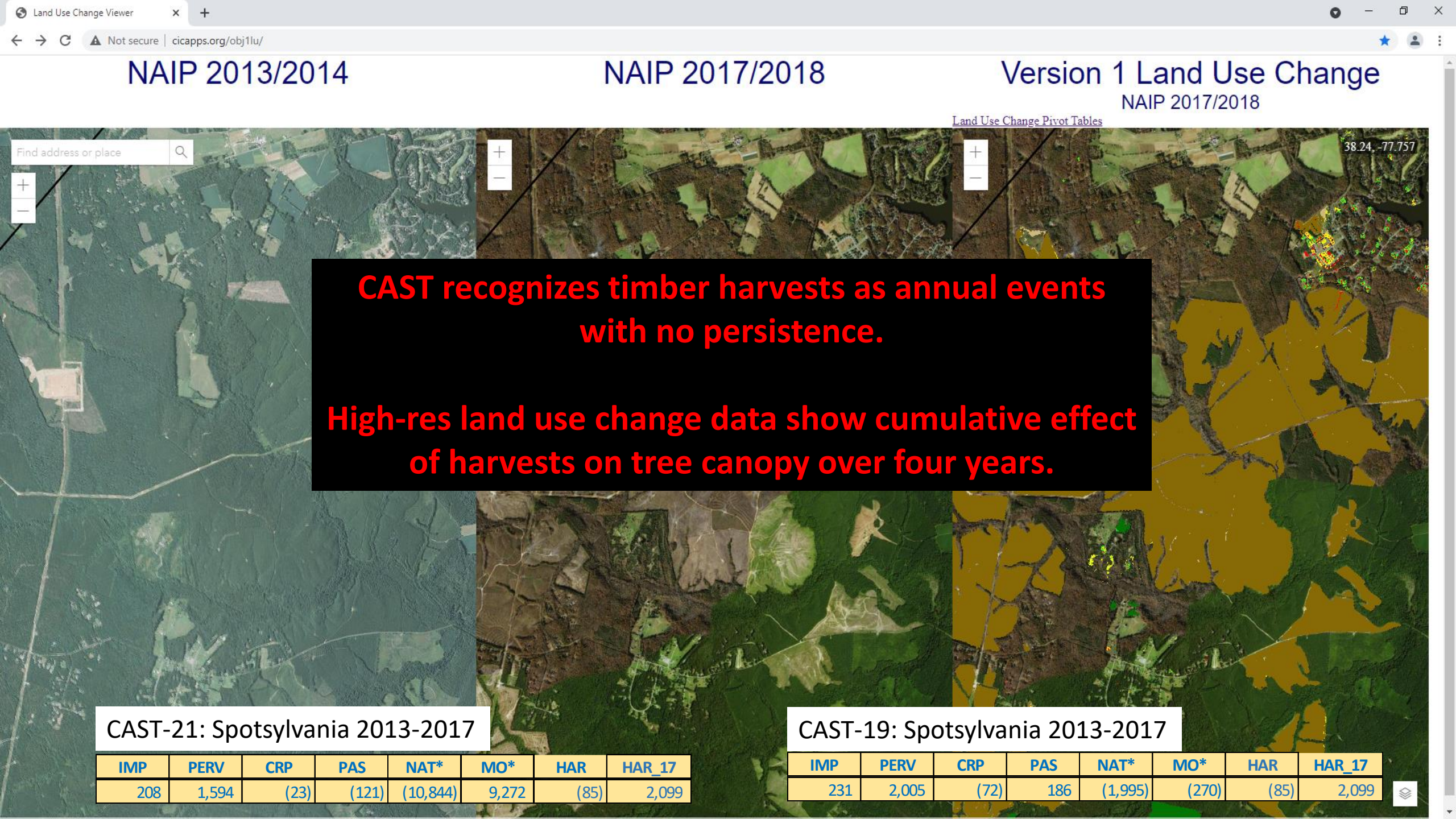
Why the differences:

CAST-21 relies on direct measures of land cover change from aerial imagery interpreted as changes in land use based on rules and ancillary data.

CAST-19 reconciles modeled urban development (from the CBLCM) with surveyed changes in cropland and pasture (from the Census of Agriculture. The reconciliation process, aka “true up”, results in non-transparent and unverifiable changes in all land uses, some of which are illogical.

CBLCM simulates future changes in impervious surfaces and turf grass associated with residential and commercial development driven by state projections of population and employment.

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)



CAST-21: Spotsylvania 2013-2017

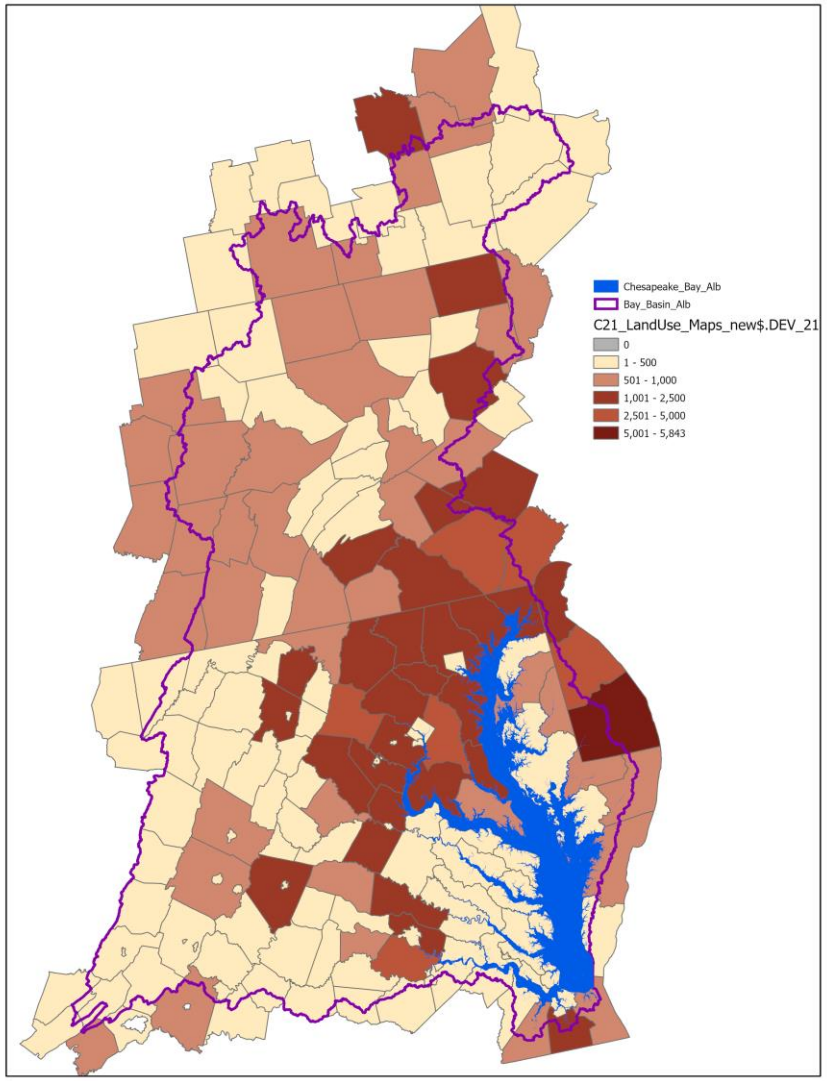
IMP	PERV	CRP	PAS	NAT*	MO*	HAR	HAR_17
208	1,594	(23)	(121)	(10,844)	9,272	(85)	2,099

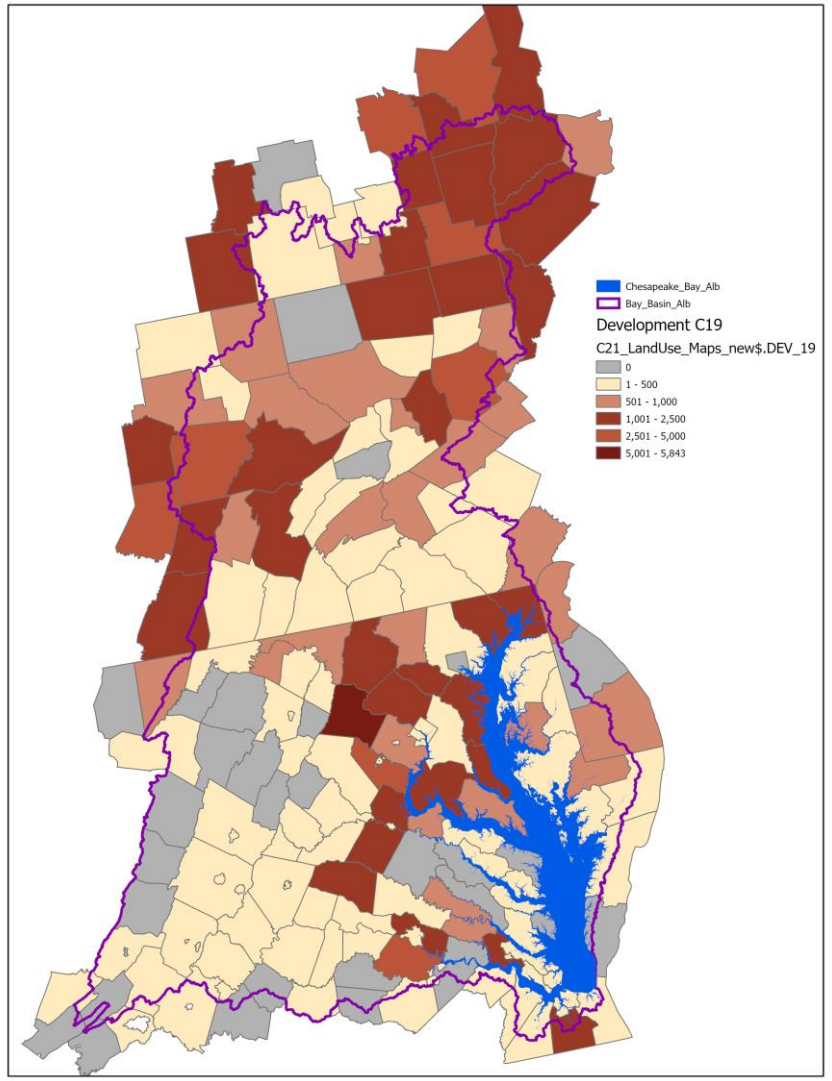
CAST-19: Spotsylvania 2013-2017

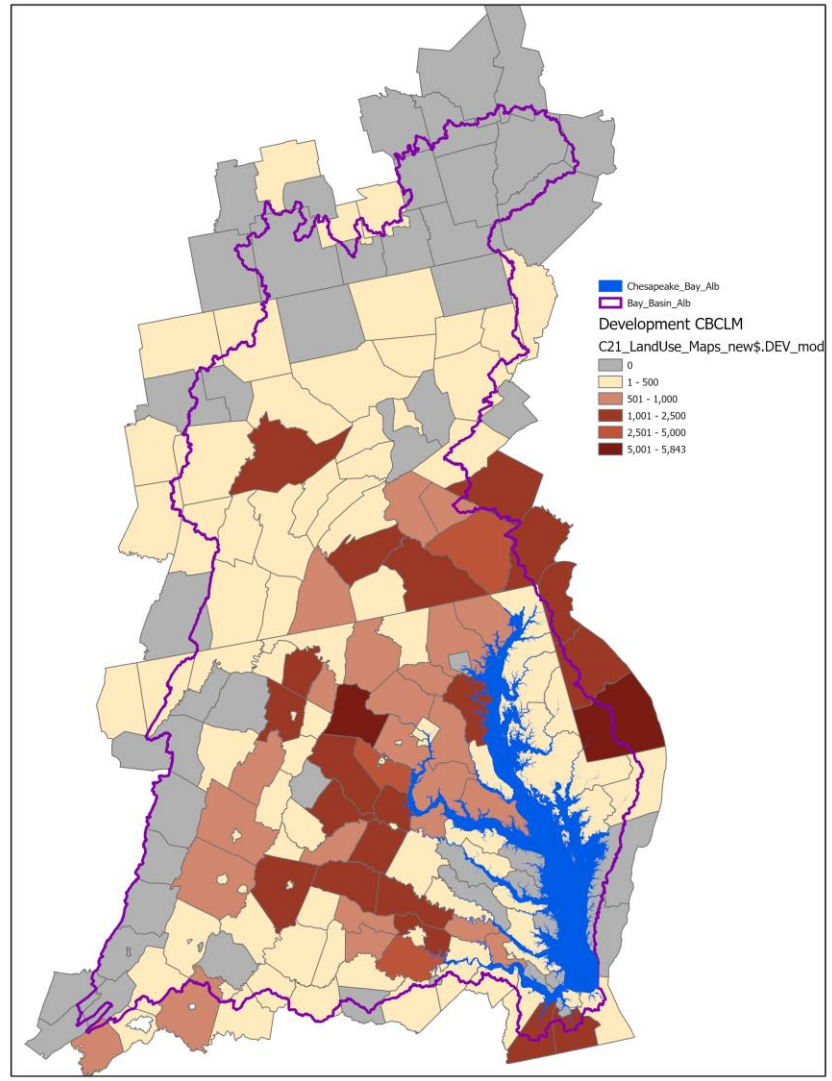
IMP	PERV	CRP	PAS	NAT*	MO*	HAR	HAR_17
231	2,005	(72)	186	(1,995)	(270)	(85)	2,099

Generalized Development Changes: 2013 – 2017

CAST-21 (pre-BMP) vs CAST-19 (pre-BMP) vs CBLCM (urban growth)

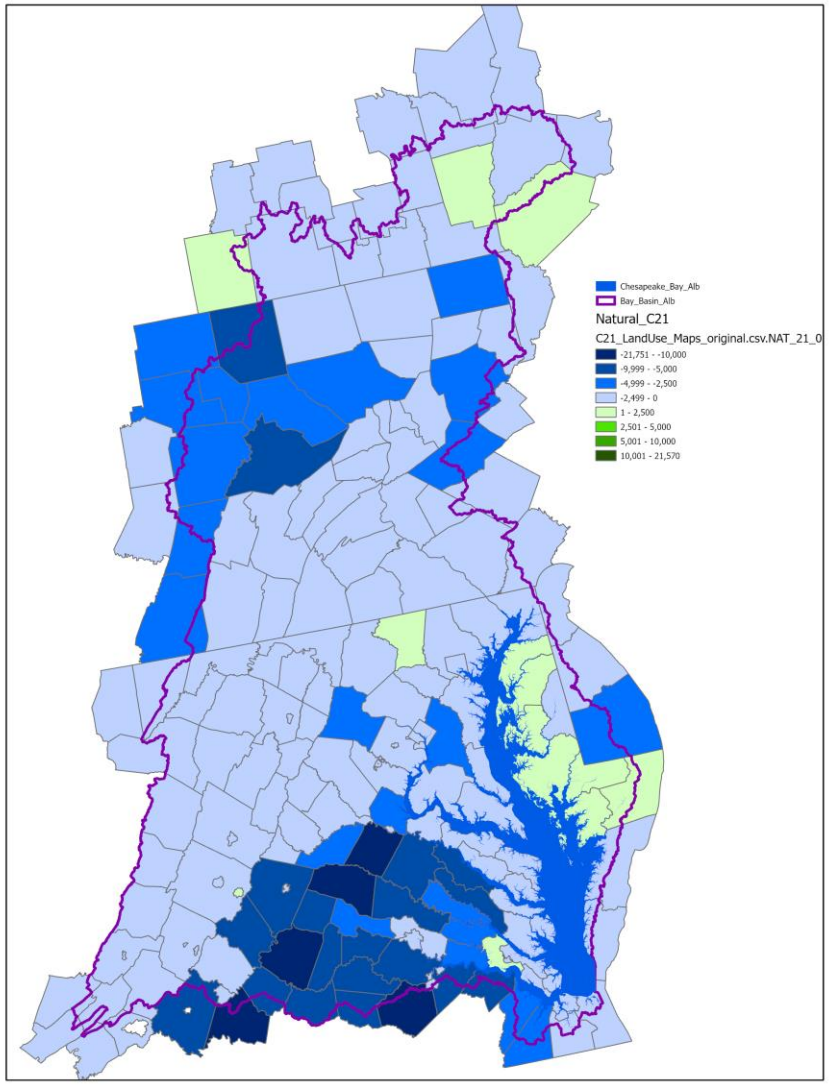


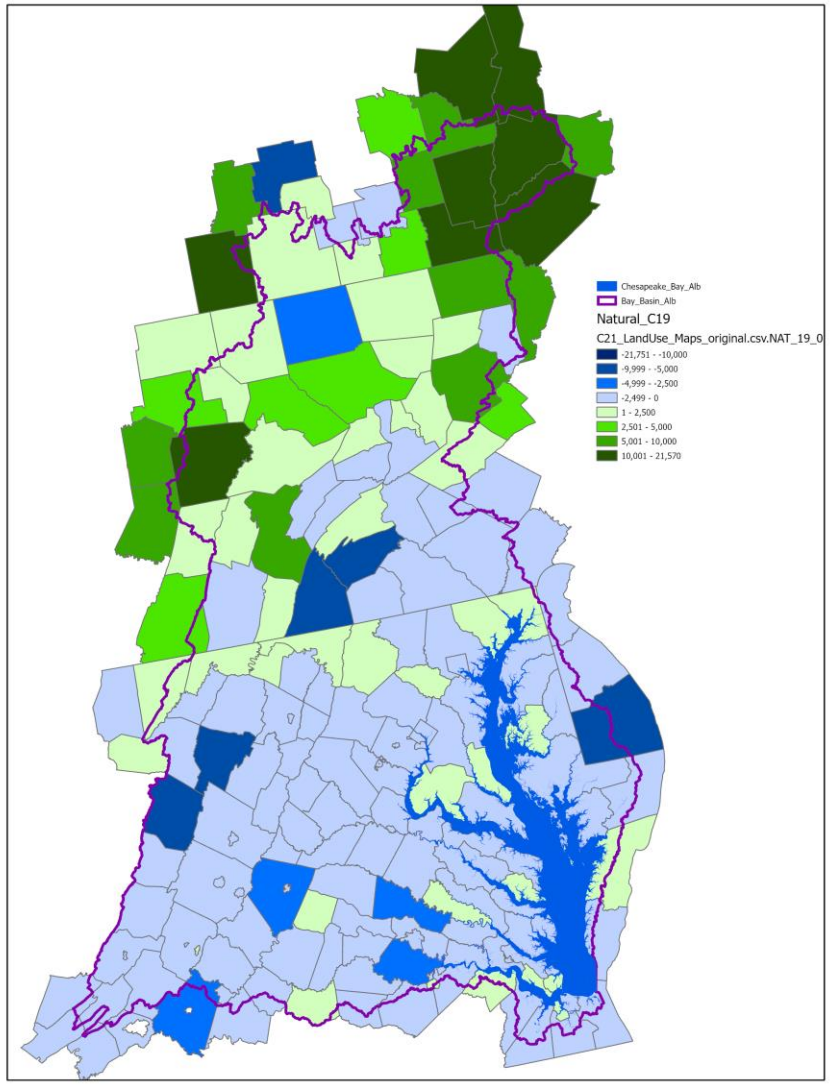


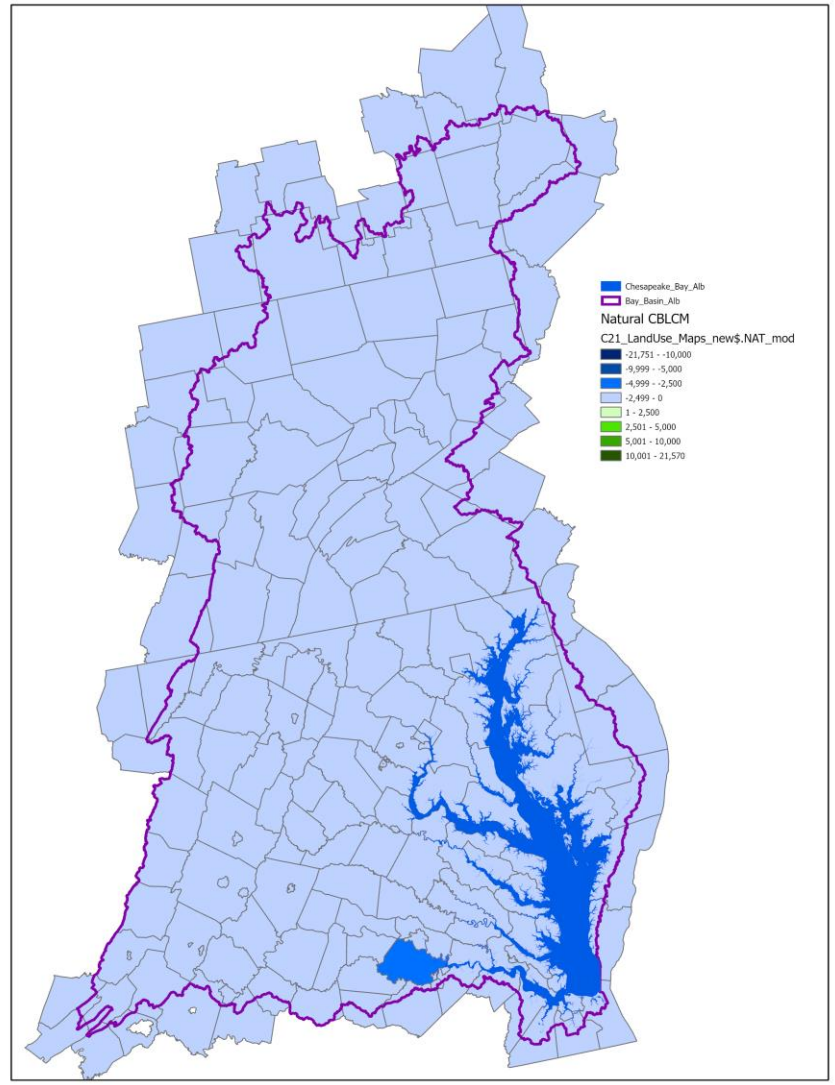


Generalized Natural Changes: 2013 – 2017

CAST-21 (pre-BMP) vs CAST-19 (pre-BMP) vs CBLCM (urban growth)

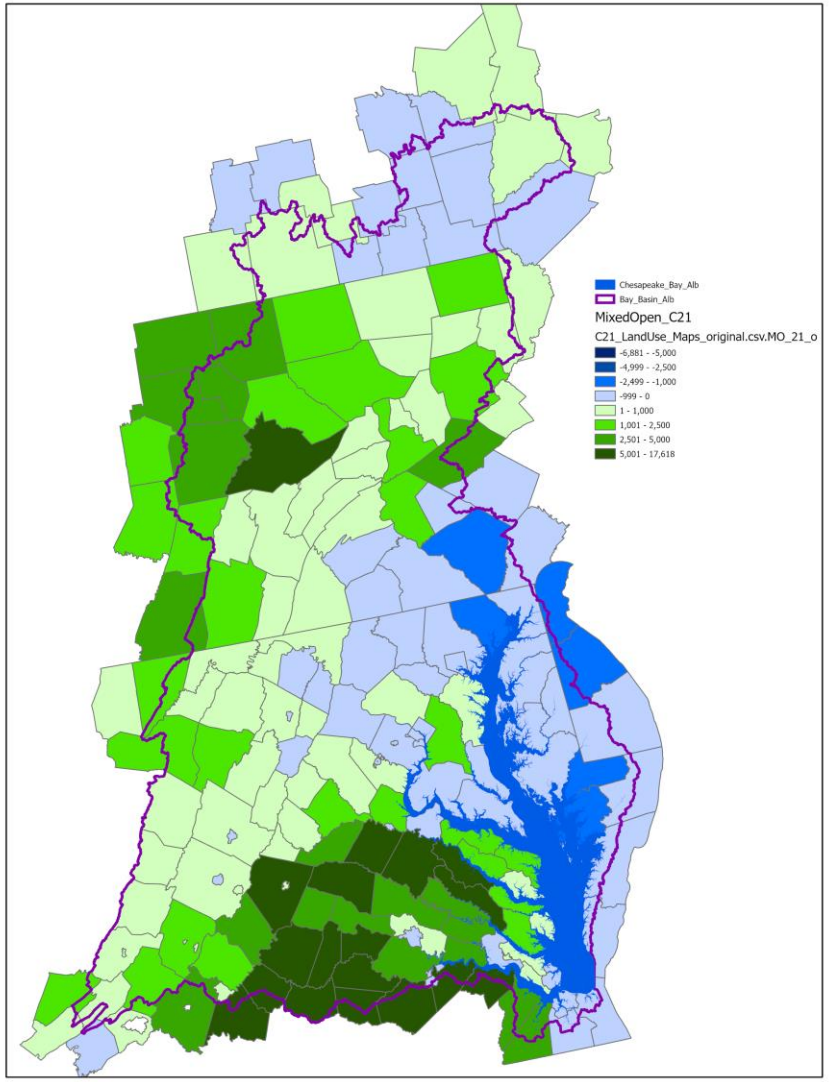


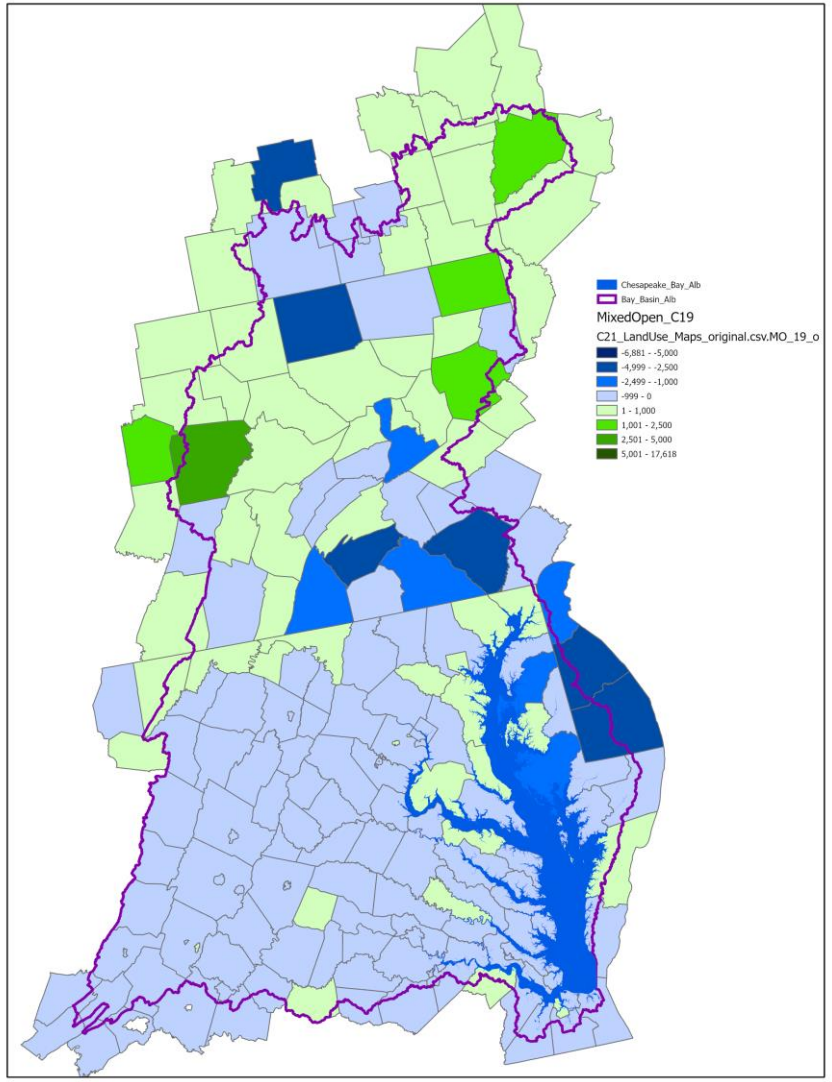


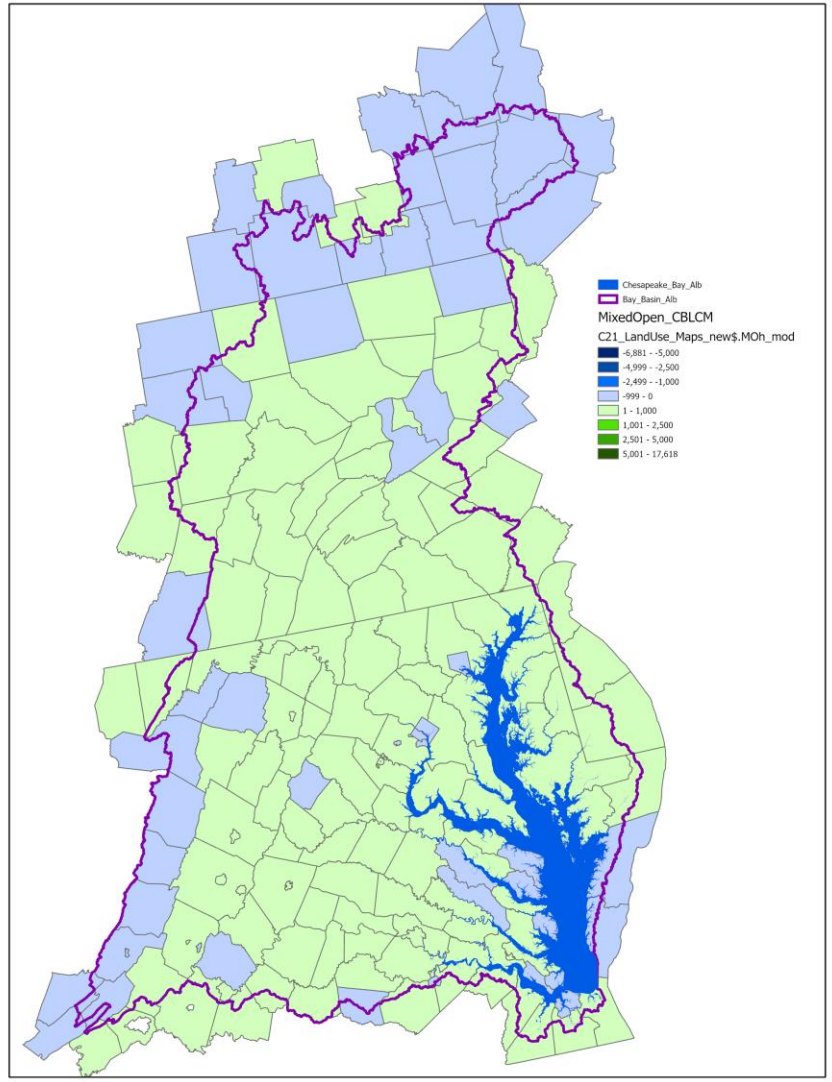


Generalized Mixed Open Changes: 2013 – 2017

CAST-21 (pre-BMP) vs CAST-19 (pre-BMP) vs CBLCM (urban growth)

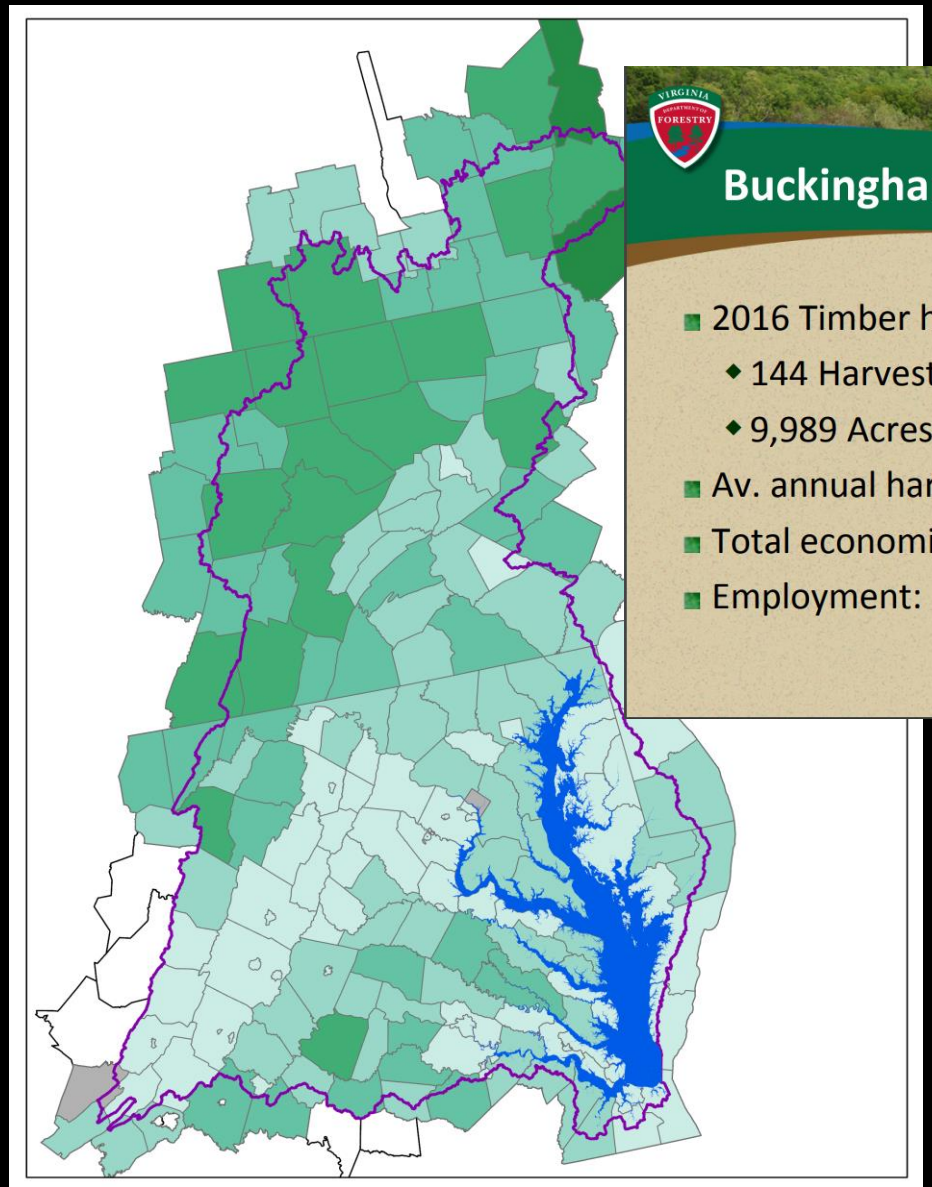




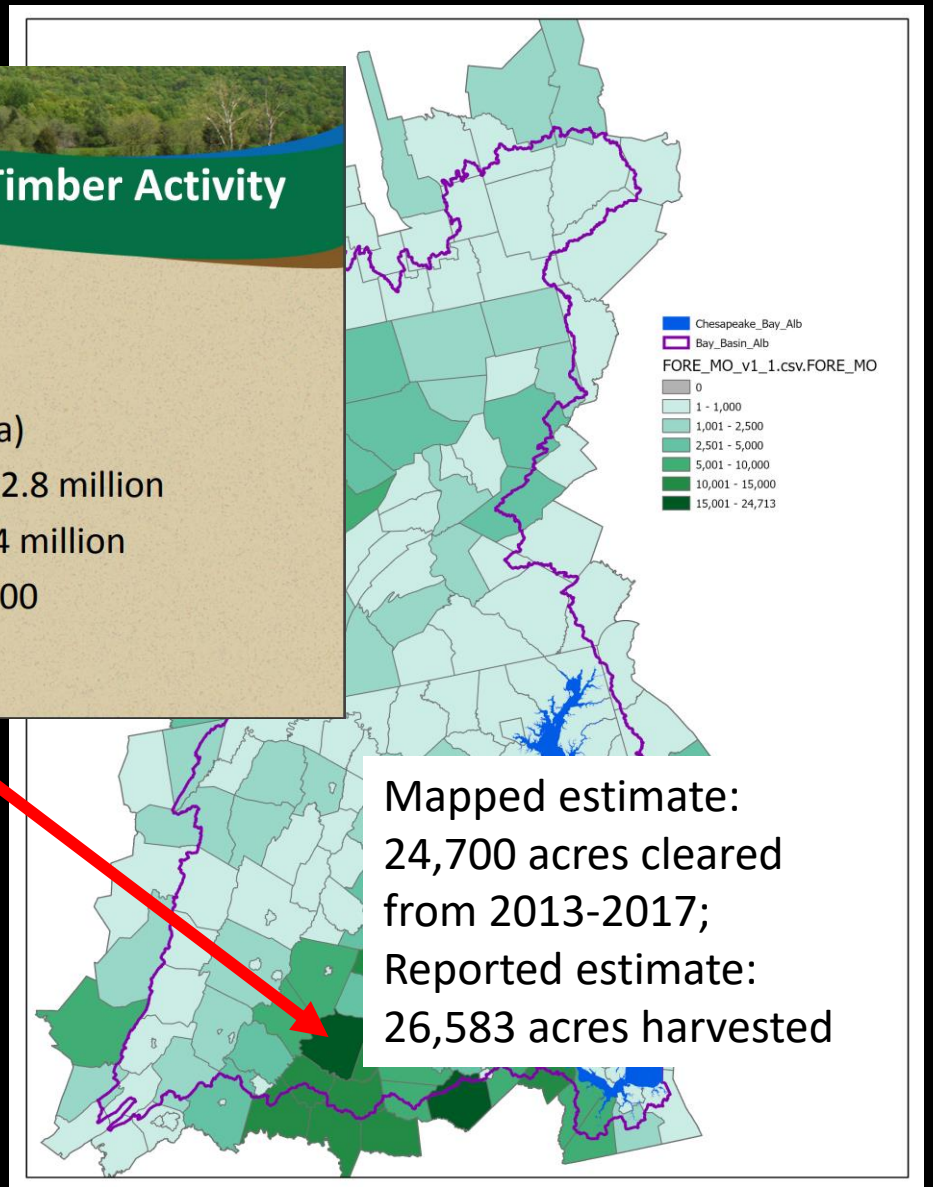


Harvested Forest (2017) vs Forest Clearings (2013 – 2017)

Reported (VA & WV) and Calculated (1.5x) Harvest Forest (2017)



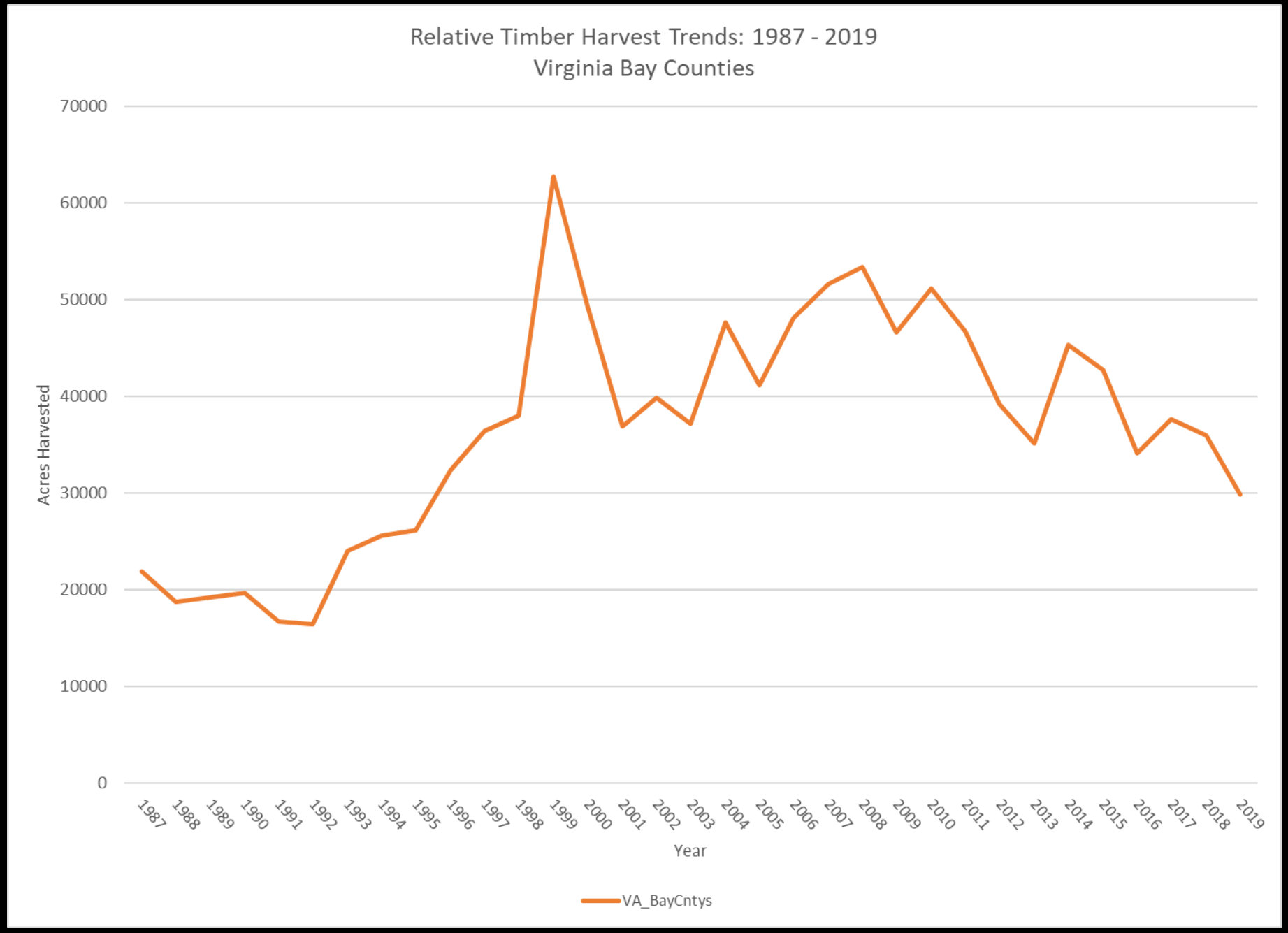
Mapped Forest Clearings (2013-2017)



Buckingham County Timber Activity

- 2016 Timber harvests
  - 144 Harvest Sites
  - 9,989 Acres (#2 in Virginia)
- Av. annual harvest value: $12.8 million
- Total economic impact: $64 million
- Employment: >500

Mapped estimate:
24,700 acres cleared
from 2013-2017;
Reported estimate:
26,583 acres harvested


Relative Timber Harvest Trends: 1987 - 2019
Virginia Bay Counties
70000
60000
50000
40000
30000
20000
10000
0
Acres Harvested
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
Year
VA_BayCntys

Forest Clearing and Timber Harvest Data in CAST

The 2013-2017 high-resolution land use change data map transitions from forest to mixed open land uses which are mostly lands undergoing managed or natural succession, i.e., timber harvests. Timber harvests are the greatest changes in land use visible across the Bay watershed and remain visible as forest clearings for 3-5 years.

For the period 2013-2017, only Virginia and West Virginia report annual acres harvested. In all other states, 1.5% of the forest in each county is assumed to be harvested annually and loading at 7x forest for TN and 3x forest for TP.

Mapped timber harvest acres from 2013-2017 have a very weak correlation with calculated (1.5x) timber harvest acres ($R^2 = 0.27$) and with reported harvest acres in WV, but they strongly correlate ($R^2 = 0.80$) with reported timber harvest acres from 2014-2017 in Virginia.

Reported timber harvest acres may include selective cuts which are not mapped but may exclude harvests on private and federal lands which are mapped. No timber harvests on federal lands are reported in CAST.

Recommendations

- Form a Timber Harvest Task Force (expiring in 18-months) to improve reporting, understanding, and modeling of timber harvest activities throughout the Bay watershed; or

- Identify key personnel in each state that USGS can consult with to improve the representation of timber harvest data in Chesapeake Bay models.

Benefits:

- Document current practices, trends, and future potential;
- Improve representation of timber harvest activities in Chesapeake Bay models (CAST-23, the Chesapeake Bay Land Change Model, and Phase 7);
- Improve the representation of all forest clearing activities in Chesapeake Bay models;
- Inform biological carbon sequestration modeling and investment initiatives.


USGS
science for a changing world