High-res Land Use Data to inform CAST-21

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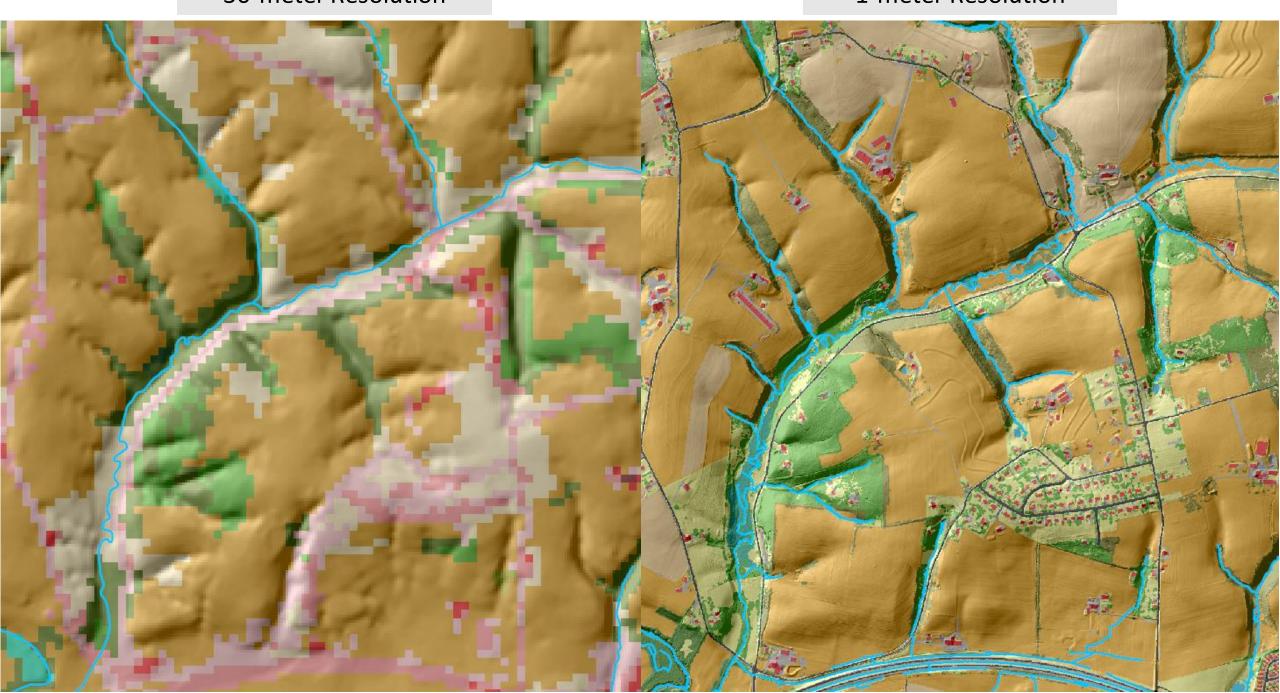4 University of Maryland, Baltimore County, Baltimore, MD 21250

Water Quality Goal Implementation Team Meeting
April 26, 2021

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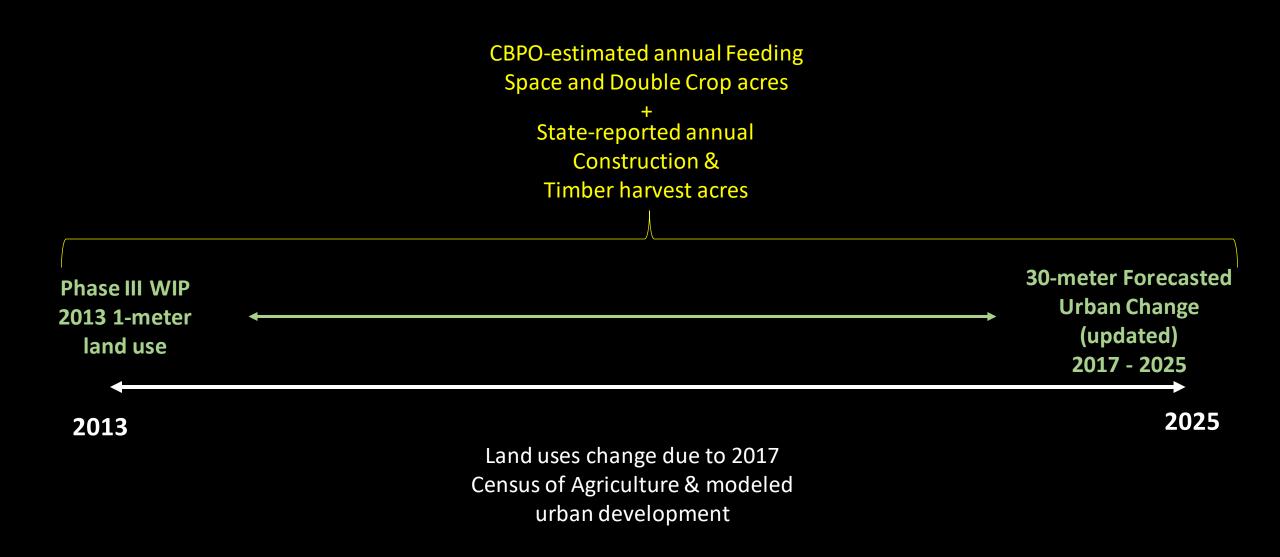U.S. Geological Survey

Disclaimer

"This information is preliminary or provisional and is subject to revision. It is being provided to meet the need for timely best science. The information has not received final approval by the U.S. Geological Survey (USGS) and is provided on the condition that neither the USGS nor the U.S. Government shall be held liable for any damages resulting from the authorized or unauthorized use of the information."

≋USGS

30-meter Resolution

1-meter Resolution

2013/14 Land Use in CAST (all versions)

2013/14 High-res land use (13 classes)

+

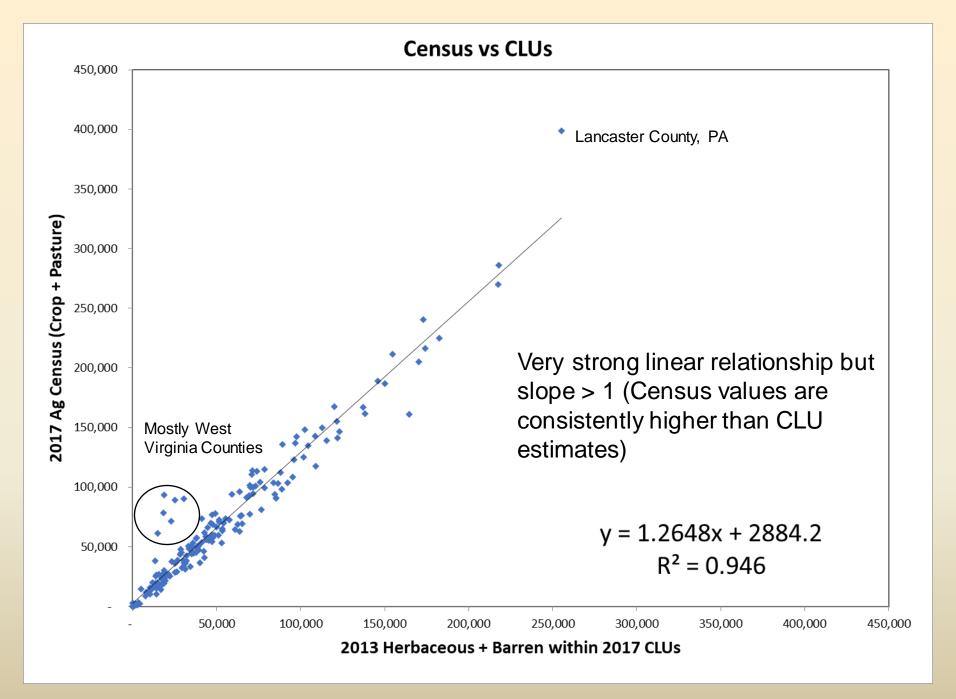CBPO-estimated annual Feeding Space and Double Crop acres

+

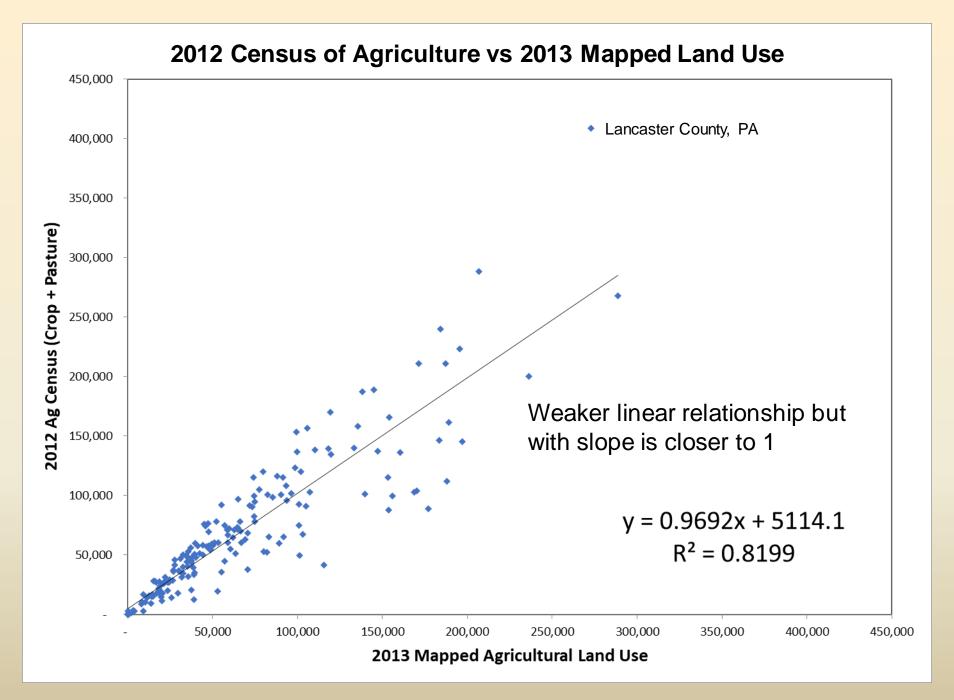State-reported annual Construction & Timber harvest acres

+

2012 Census of Agriculture

True-up*
(mass balance all land uses based on their relative errors)

=
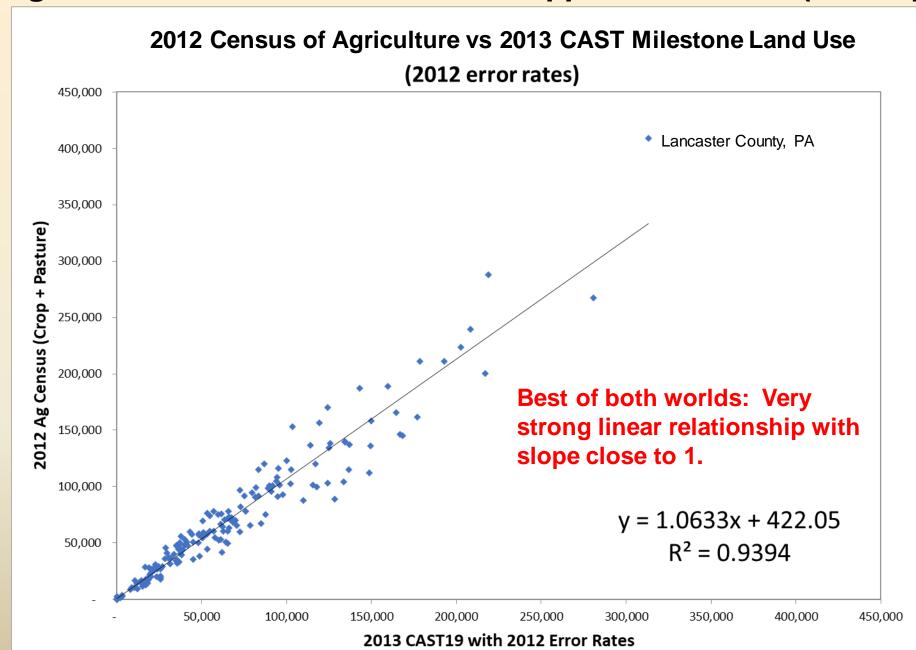
2013 Conditions for CAST-17, CAST-19, CAST-21, etc.

*CBP "true-up" methodology reconciles and balances the errors in the Census of Agriculture and mapped land uses.

Census vs CLUs

2012 Census of Agriculture vs 2013 Mapped Land Use

Lancaster County, PA

Weaker linear relationship but with slope is closer to 1

$y = 0.9692x + 5114.1$
$R^2 = 0.8199$

2012 Ag Census (Crop + Pasture)

2013 Mapped Agricultural Land Use

USGS

Balancing the Errors in the Census and Mapped Land Uses (True-up Method)

2012 Census of Agriculture vs 2013 CAST Milestone Land Use

(2012 error rates)

◆ Lancaster County, PA

y-axis: 2012 Ag Census (Crop + Pasture)

x-axis: 2013 CAST19 with 2012 Error Rates

Best of both worlds: Very strong linear relationship with slope close to 1.

$$y = 1.0633x + 422.05$$
$$R^2 = 0.9394$$

USGS

CAST-21

CBPO-estimated annual Feeding
Space and Double Crop acres
+
State-reported annual
Construction &
Timber harvest acres

Phase III WIP
2013 1-meter
land use

1-meter Land Use
Change from
2013/14 to
2017/18

30-meter Forecasted
Urban Change
(updated)
2017 - 2025

2013

2017

2025

Land uses change as
observed in aerial imagery

Land uses change due to modeled
urban development

CBP 2017 Land Use Classification (25 classes, version 1)

1. Water (3)
1.1 Lentic
- 1.1.1 Estuary (tidal)
- 1.1.2 Lakes & Ponds

1.2 Lotic
- 1.2.1 Streams

2. Developed (8)
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

2.2 Pervious
- 2.2.1 Turf Grass
- 2.2.2 Bare Developed
- 2.2.3 Suspended Succession (rights-of-way)
- 2.2.4 Tree Canopy over Turf Grass

3. Forest (4)
3.1 Forest (>= 1 acre, 240-ft width)
3.2 Tree Canopy in Agriculture
3.3 Harvested Forest (<= 3 years)
3.4 Natural Succession (> 3 years)

4. Production (6)
4.1 Agriculture
- 4.1.1 Cropland
- 4.1.2 Pasture
- 4.1.3 Orchard/vineyard

4.2 Solar fields
- 4.2.1 Impervious
- 4.2.2 Pervious

4.3 Extractive (active mines)

5. Wetlands and Water Margins (4)
5.1 Tidal
5.2 Riverine (Non-tidal)
5.3 Terrene/Isolated (Non-tidal)
5.4 Bare shore

Land Cover Change in Loudoun County 2014 - 2018

2018

	Overall Change	**2.85%**										
2014		Water	Wetlands	Tree Canopy	Shrub-scrub	Low Vegetation	Barren	Structures	Other Impervious	Roads	TC over Structures	TC over Other Imp	TC over Roads	Total Change
	Water	2,534	-	2	-	-	-	-	-	-	-	-	-	2
	Wetlands	-	10	0	-	-	-	-	-	-	-	-	-	0
	Tree Canopy	-	-	141,233	-	2,009	483	278	762	104	-	-	-	3,634
	Shrub-scrub	-	-	264	2,968	-	43	13	31	4	-	-	-	355
	Low Vegetation	-	-	524	-	140,686	1,117	556	836	217	-	-	-	3,250
	Barren	-	-	0	-	1,122	1,207	8	-	8	-	-	-	1,138
	Structures	-	-	7	-	1	0	6,604	5	0	23	-	-	36
	Other Impervious	-	-	19	-	217	26	215	14,847	138	-	59	-	674
	Roads	-	-	14	-	1	-	-	3	11,545	-	-	35	53
	TC over Structures	-	-	-	-	2	0	0	0	-	198	-	-	2
	TC over Other Imp	-	-	-	-	21	2	62	5	2	-	1,306	-	92
	TC over Roads	-	-	-	-	16	0	1	1	1	-	-	1,421	18
	Total Change	-	-	830	-	3,389	1,670	1,133	1,642	474	23	59	35	9,255

Land Cover Change in the 14 Prototype Counties 2013/14 – 2017/18

FIPS	County	State	Nat to Dev	Nat to LVB	LVB to NAT	LVB to Dev	Pct_Change
10005	Sussex	DE	1,046	6,105	1,066	3,069	2.01%
24005	Baltimore	MD	28	326	812	1,400	0.97%
24035	Queen Anne's	MD	87	387	661	499	0.68%
24045	Wicomico	MD	141	2,052	3,464	404	2.69%
36017	Chenango	NY	37	523	883	148	0.35%
42015	Bradford	PA	211	1,525	508	450	0.61%
42033	Clearfield	PA	350	4,940	897	461	1.33%
42041	Cumberland	PA	392	2,077	572	1,913	1.74%
42071	Lancaster	PA	395	1,105	607	2,253	0.91%
51015	Augusta	VA	184	2,068	675	440	0.67%
51073	Gloucester	VA	58	4,011	814	53	3.71%
51107	Loudoun	VA	1,191	2,534	524	1,625	2.85%
54003	Berkeley	WV	131	810	228	613	1.24%
54031	Hardy	WV	42	1,605	269	115	0.58%
Totals			4,295	30,067	11,981	13,441	

Nat = Natural = water, wetlands, tree canopy, and shrub-scrub

Dev = Structures, Other Impervious, Roads, and Tree Canopy over all forms of Impervious

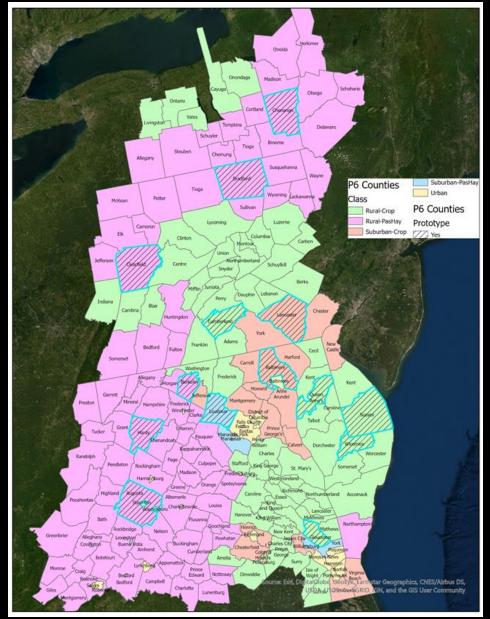LVB = low vegetation and barren lands

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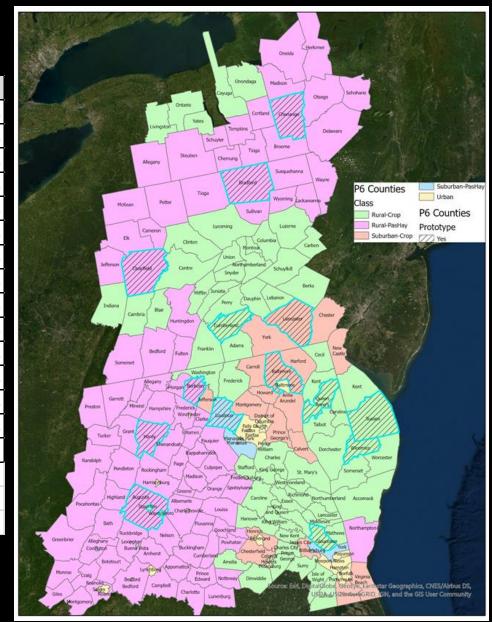
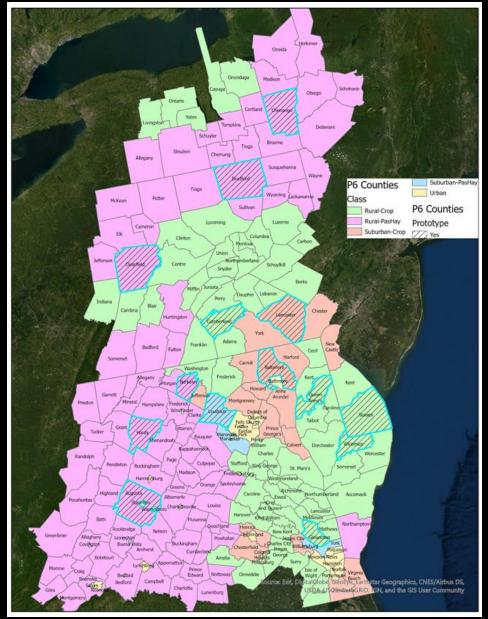LVB = low vegetation and barren lands

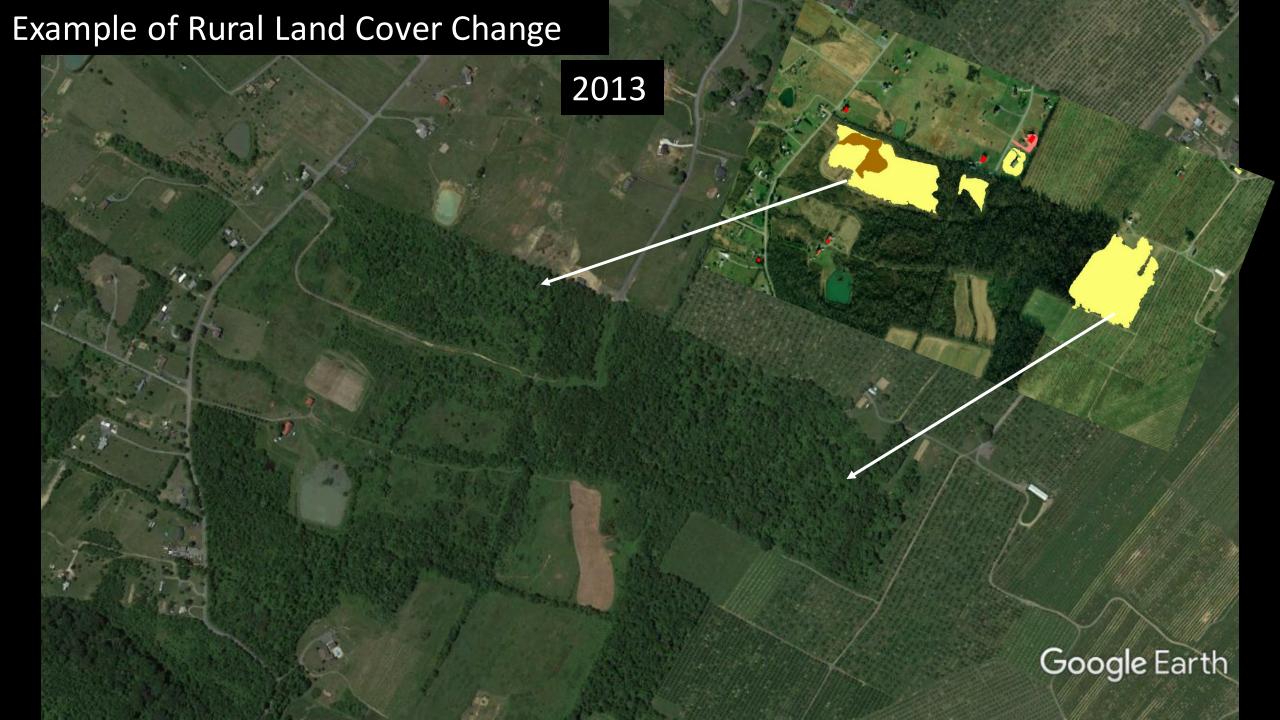# Land Cover Change in the 14 Prototype Counties 2013/14 – 2017/18

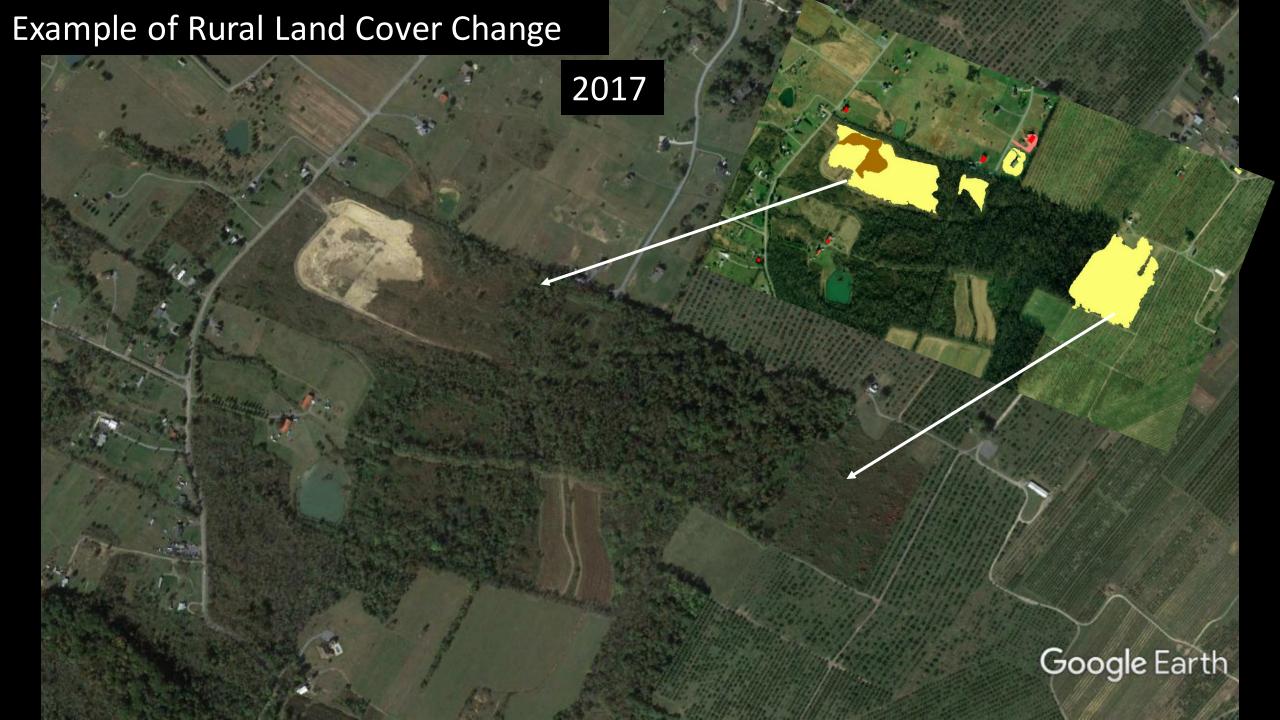| FIPS	County	State	Nat to Dev	Nat to LVB	LVB to NAT	LVB to Dev	Pct_Change
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Example of Rural Land Cover Change

2013

Google Earth

Example of Rural Land Cover Change

2017

Google Earth

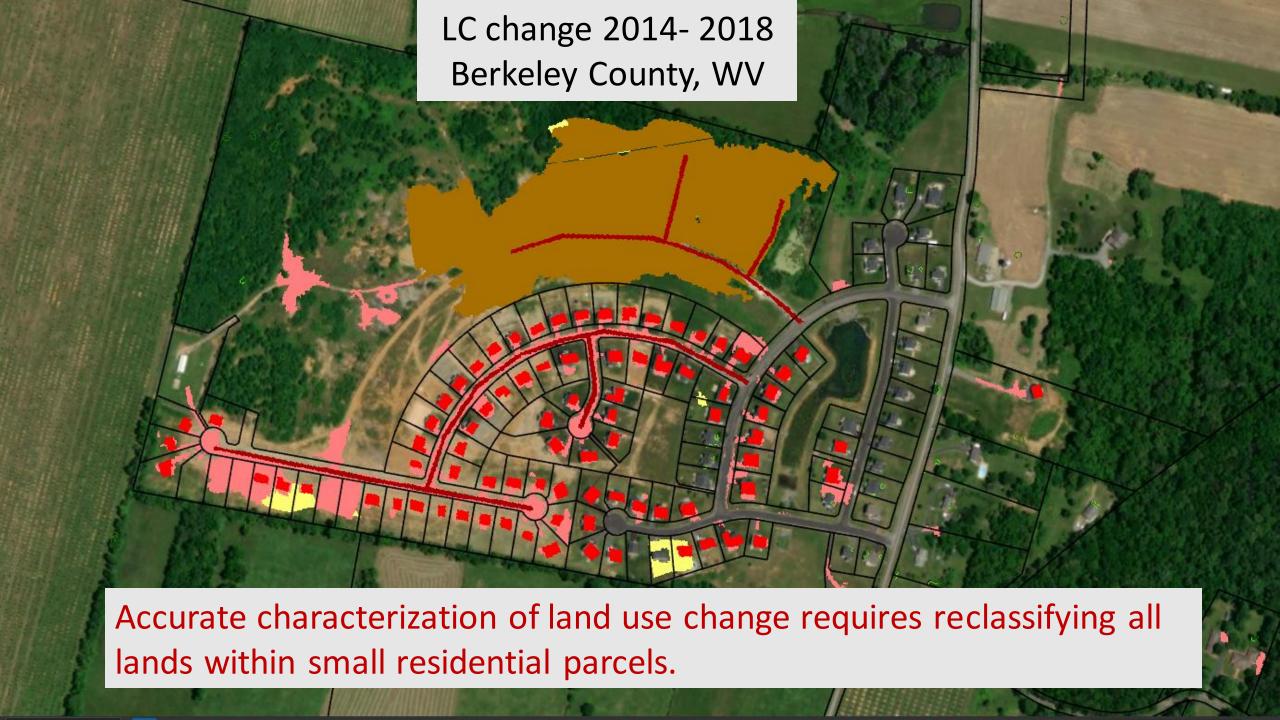Natural Succession Herbaceous to Forest (Context Based):

2013 NAIP

Natural Succession Herbaceous to Forest (Context Based):

2018 NAIP

Natural Succession Herbaceous to Forest (Context Based):

NAIP 2018 and 2018 LU Change

Legend:
- Water to Lakes & Ponds
- Water to Forest
- Roads to TC over Roads
- Road to Forest
- Other Impervious to Structures
- Other Impervious to Other Impervious
- Other Impervious to TC over Turf
- Other Impervious to Forest
- TC over Roads to Roads
- TC over Roads to Other Impervious
- TC over Roads to Suspended Sucession Herbaceous
- TC over Other Impervious to Roads
- Turf Grass to TC over Turf Grass
- Natural Sucession Herbaceous to Suspended Sucession Herbaceous
- Natural Sucession Herbaceous to Forest

LC change 2014- 2018
Berkeley County, WV

Accurate characterization of land use change requires reclassifying all lands within small residential parcels.

Timeline for 2013 - 2017 Land Use Change Review for CAST-21
April – June 2021

Apr 26: WQGIT presented with information on the 2013-2017 land use change product, how it can be incorporated into CAST, and an overview of the decision that will be requested of the WQGIT during their May 24 call.

May 5: LUWG discusses 2013-2017 land use change data, methodology, and how these data are incorporated into CAST.

May 5 – May 17:

Sector workgroups (AGWG, USWG, FWG) review 2013-2017 land use change in the 14 prototype counties. Data will be available to review online through a web application built by the Chesapeake Conservancy's Conservation Innovation Center's (CIC).

May 20: AGWG meets to discuss comments on the land use change data. LUWG meets to review comments from sector workgroups on the land use change data and makes recommendation to the WQGIT on the quality of the data.

May 24: WQGIT decision: approval of method for using 2013 – 2017 land use change data in CAST as implemented in the 14 prototype counties.

Jun 30: CIC completes the 2013-2017 land use change dataset for all Bay watershed counties using corrected land cover data from UVM to fix all systematic errors.

Review of 2017 High-res Land Use:

Are the 2017 land use data more accurate than the existing 2013 land use data?

Is the mapped agricultural footprint accurate?
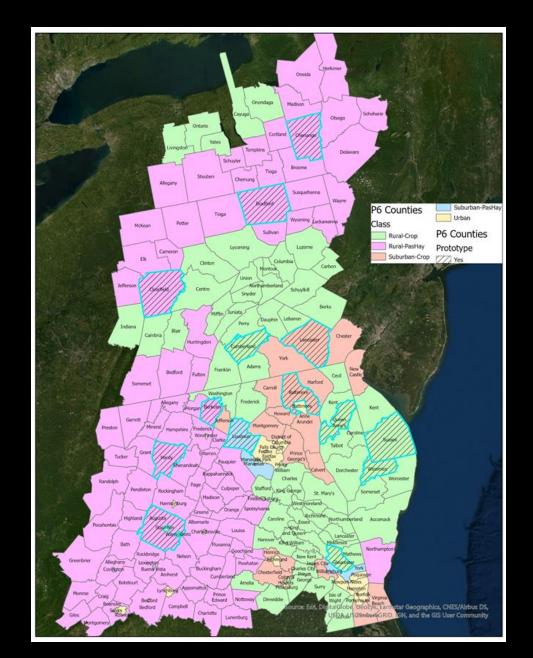(differentiated from timber harvest, turf grass, suspended succession, and natural succession)

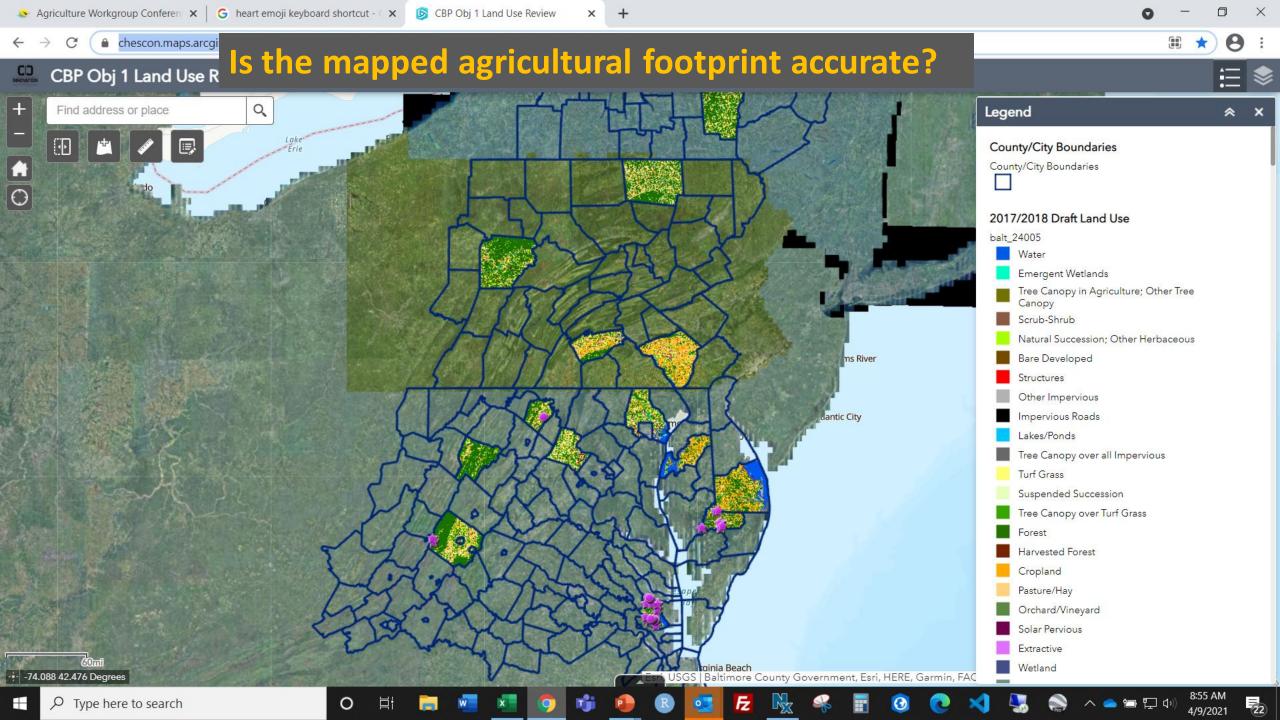Is the general spatial distribution of cropland and pasture/hay within a county, correct?
(the spatial distribution is used to allocate crop, hay, and pasture types reported in the Census of Agriculture from the County-scale to Land-River Segments)
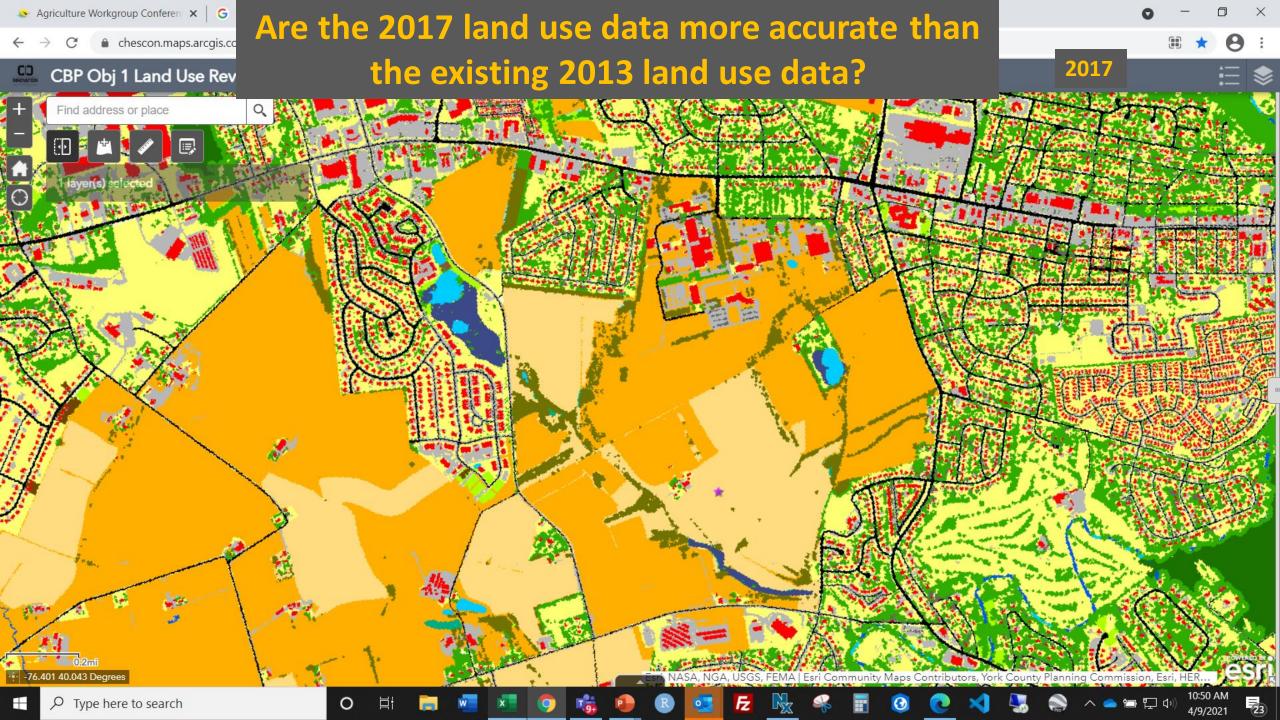
At the field/parcel scale, are cropland, pasture/hay, and turf grass classes generally accurate? If not, where are there systematic errors?
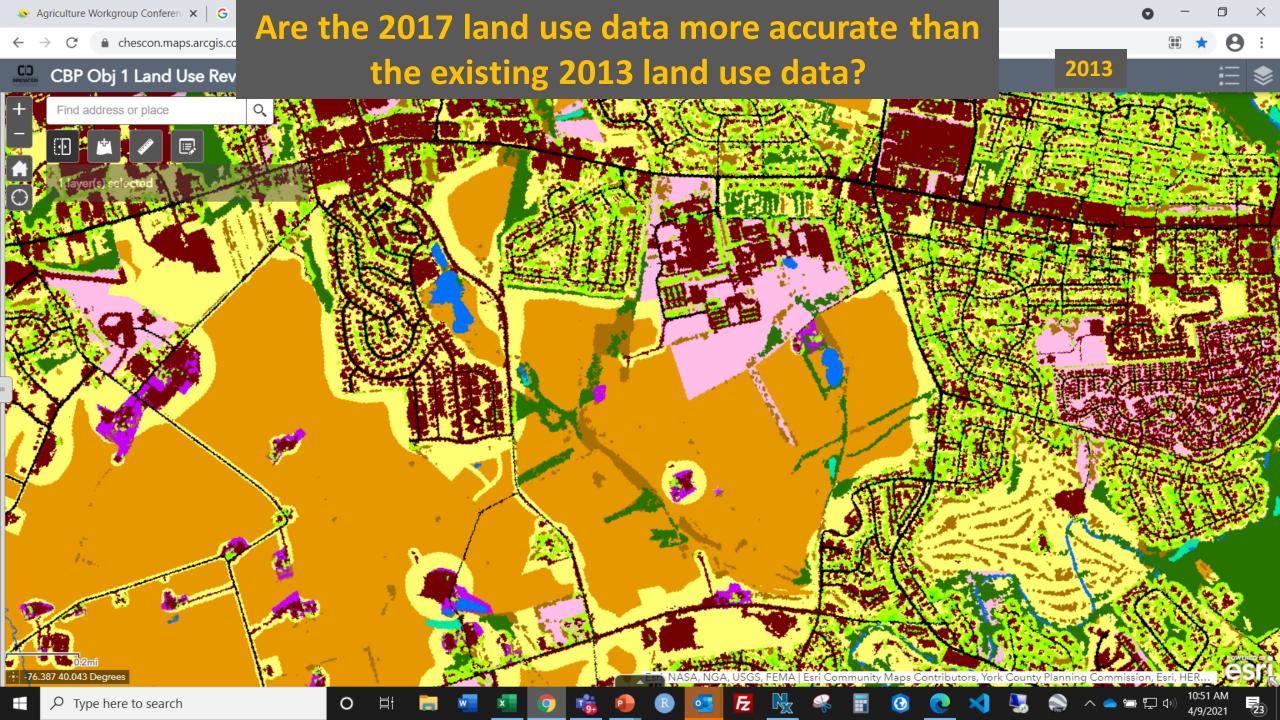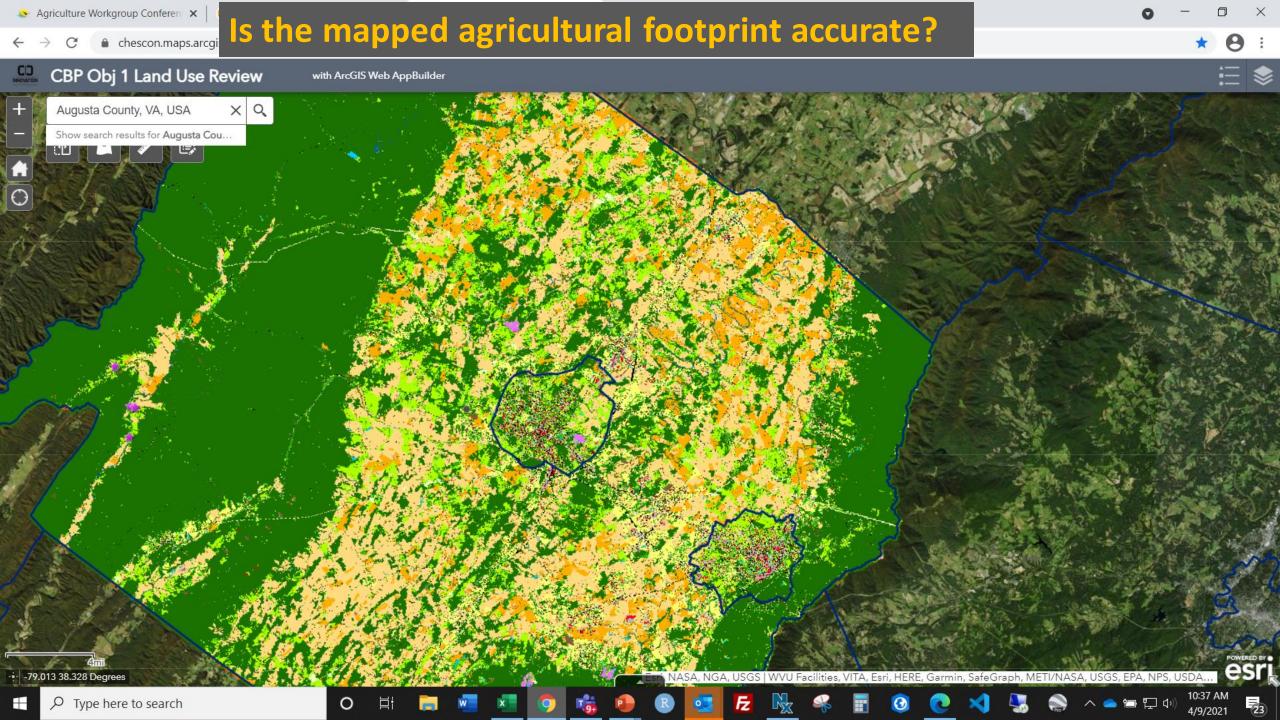
Is the mapped agricultural footprint accurate?

FIPS	CNTY_NAME	Census AG_17	Map AG_13	Map AG_17
10005	SUSSEX	245,523	206,810	234,831
24005	BALTIMORE	60,469	60,416	60,696
24035	QUEEN ANNES	137,939	105,568	118,952
24045	WICOMICO	67,242	58,956	59,732
36017	CHENANGO	94,664	170,330	109,915
42015	BRADFORD	214,089	236,327	231,889
42033	CLEARFIELD	36,661	115,343	104,169
42041	CUMBERLAND	152,928	110,131	116,748
42071	LANCASTER	347,906	272,655	304,277
51015	AUGUSTA	234,308	171,437	145,181
51073	GLOUCESTER	15,195	14,036	13,027
51107	LOUDOUN	92,937	90,317	55,791
54003	BERKELEY	51,763	44,175	32,009
54031	HARDY	87,069	45,008	37,251

Are the 2017 land use data more accurate than the existing 2013 land use data?

2017

Are the 2017 land use data more accurate than the existing 2013 land use data?

2013

Is the mapped agricultural footprint accurate?

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Is the general spatial distribution of cropland and pasture/hay within a county, correct?

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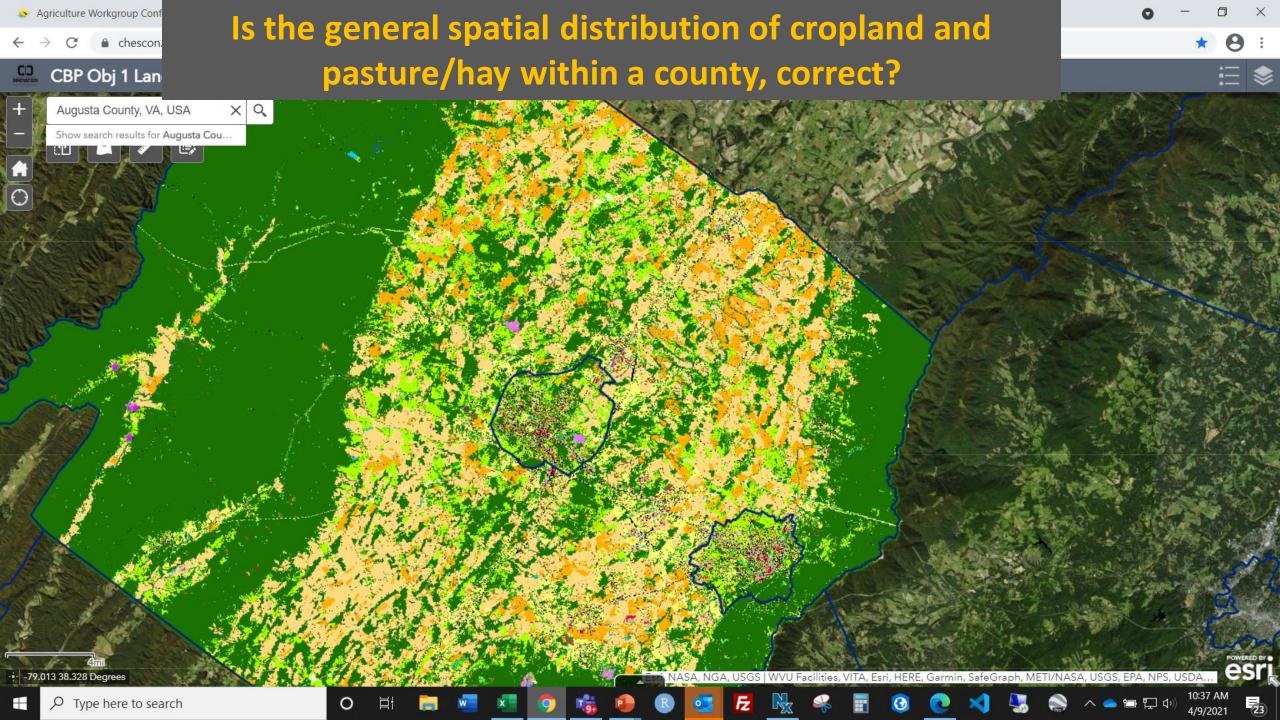At the field scale, are cropland and pasture/hay fields mostly classified correctly?
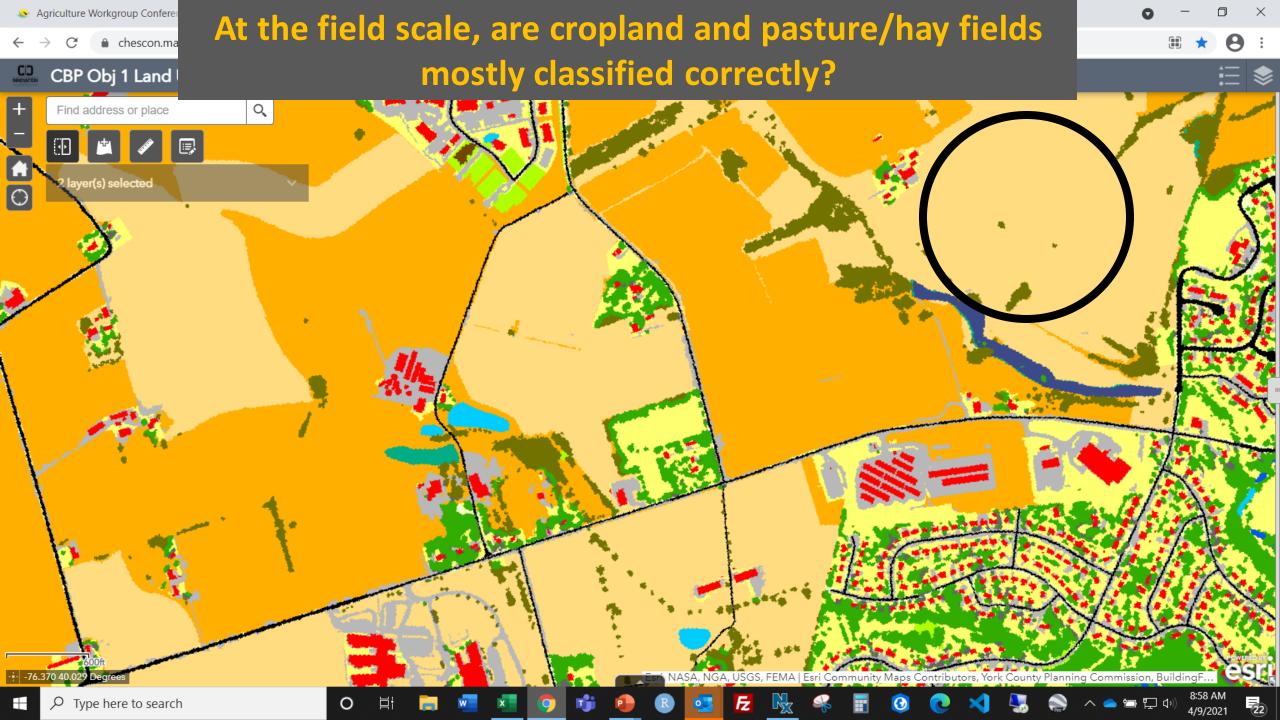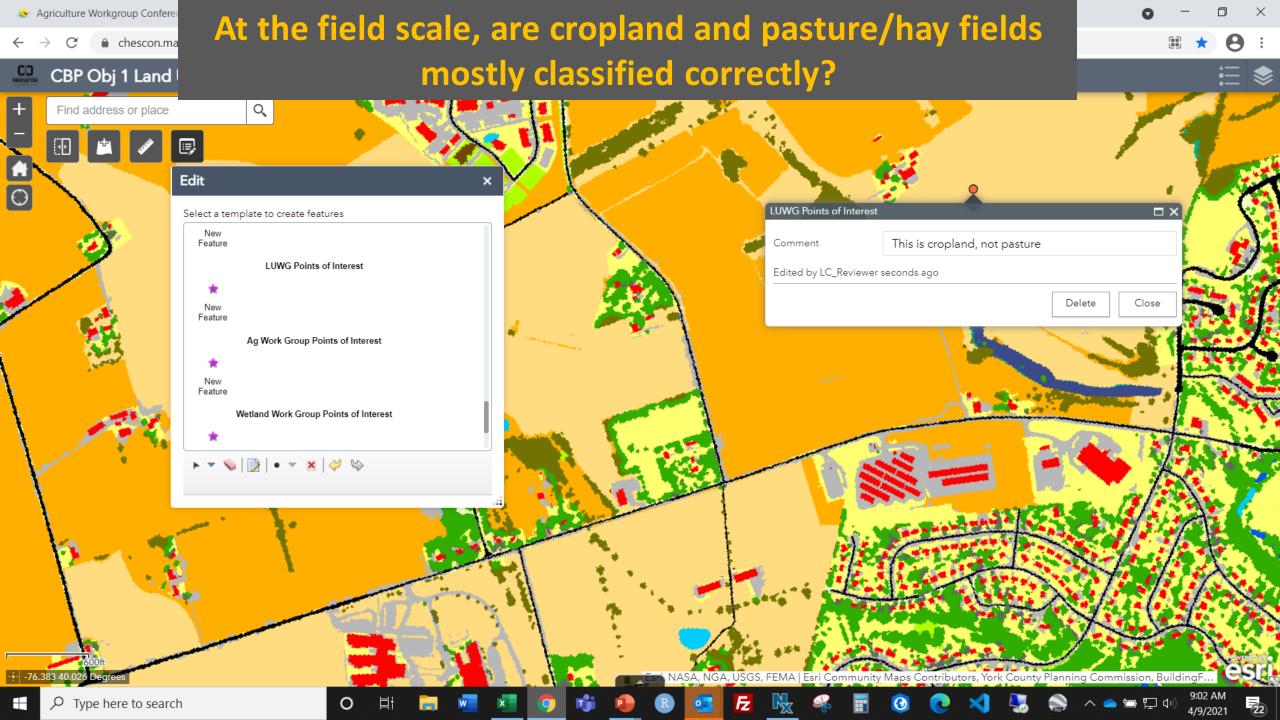
Timeline for 2017 Land Cover and Land Use Review/Refinement
April 2021 – February 2022

Apr – Jun 2021: Sector workgroups (AGWG, FWG, USWG, LUWG) review the draft 2017 Land Use. Local government review of 2017 land cover continues for some counties. UVM corrects systematic and large area land cover errors in all counties.

Jul – Nov 2021:

University of Vermont (UVM) corrects all land cover errors from local and expert review (e.g., over-classification of water, confusion between water and impervious) and produces land cover for counties adjacent to the Bay watershed. UVM maps emergent tidal wetland land cover in Virginia and potential non-tidal wetlands in all jurisdictions outside PA (PA was done in 2016). Conservation Innovation Center (CIC) continually evaluates and refines land use model code. Sector workgroups continue to review draft versions of the land use dataset.

Dec 2021 – Jan 2022:

CIC re-runs 2017 land use on revised land cover and produces comparable 2013 land use for all 206 counties.

Feb 2022: LUWG recommends approval of the 2013 and 2017 land use data for the Land Use Methods and Metrics Outcome.

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