Objective 1: Land Cover and Land Use Updates

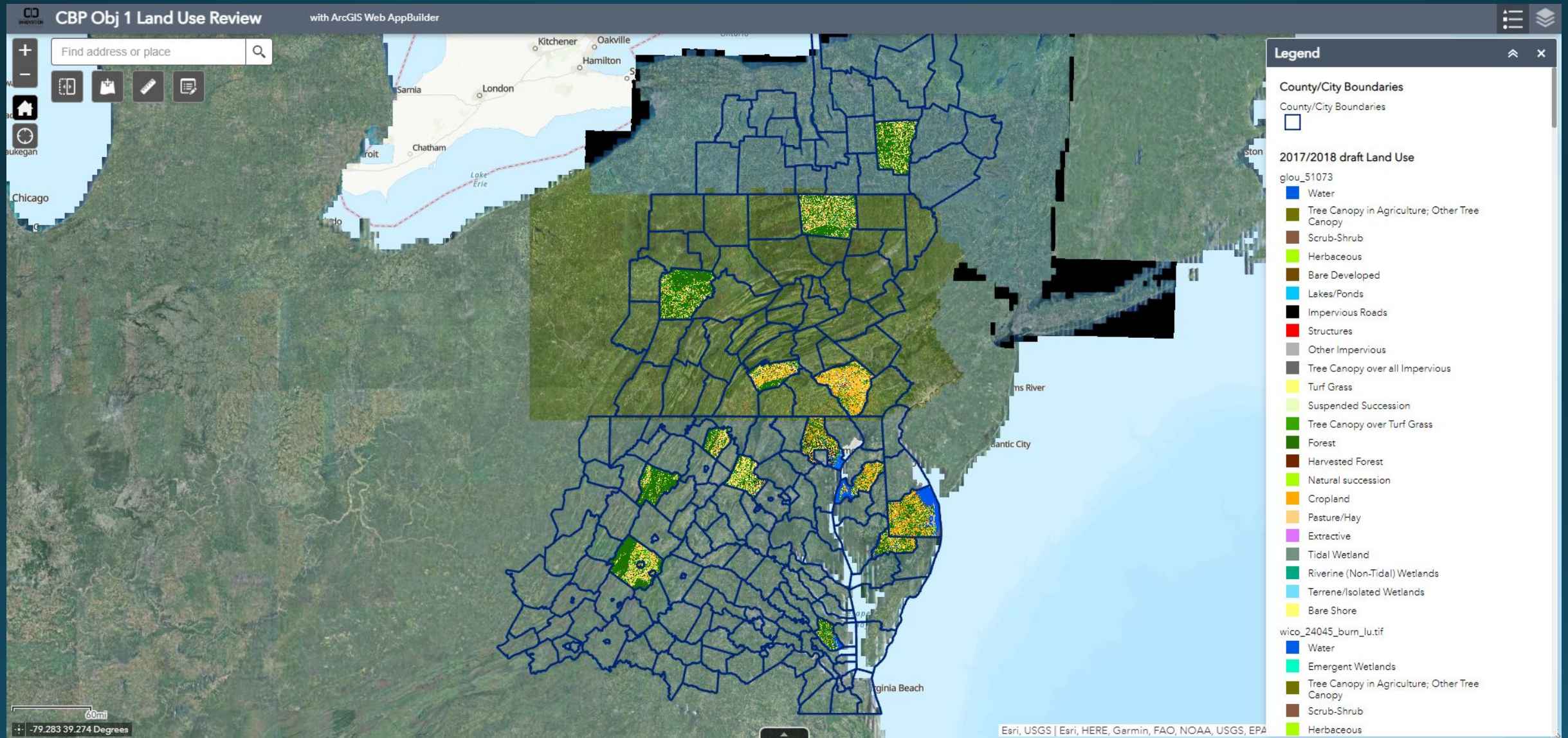
March 31, 2021: LUWG

Rachel Soobitsky
rsoobitsky@chesapeakeconservancy.org
Jacob Czawlytko
jczawlytko@chesapeakeconservancy.org

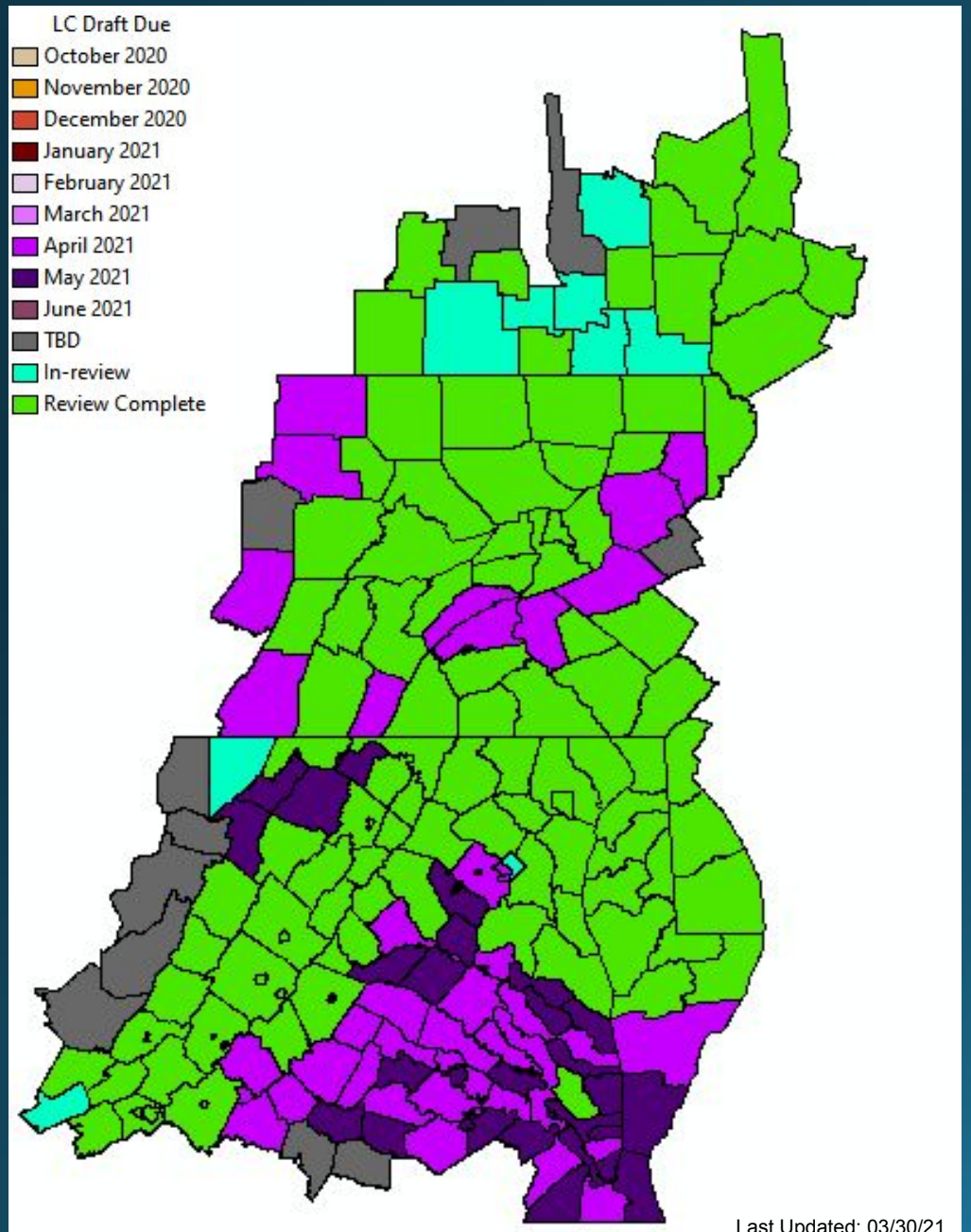
14 Counties Draft LU are Live!!

https://tinyurl.com/DraftLandUse20172018

Username: LU_Reviewer
Password: LU_Reviewer2021



Land Cover Production Schedule



Last Updated: 03/30/21

Localities Currently In-Review:

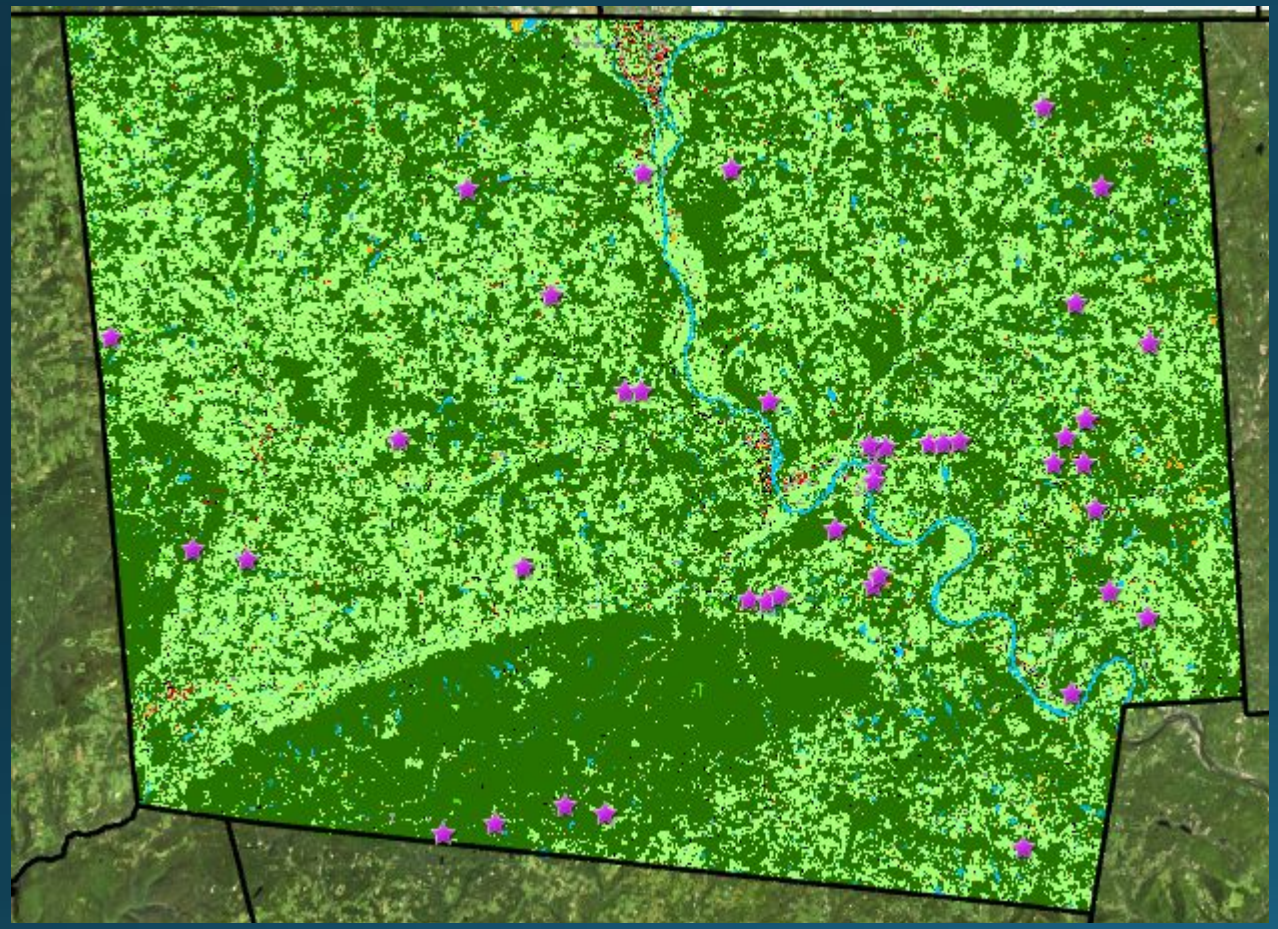
- Washington D.C.
- Garrett, MD
- Broome, NY
- Onondaga, NY
- Tioga, NY
- Schuyler, NY
- Cortland, NY
- Steuben, NY
- Giles, VA

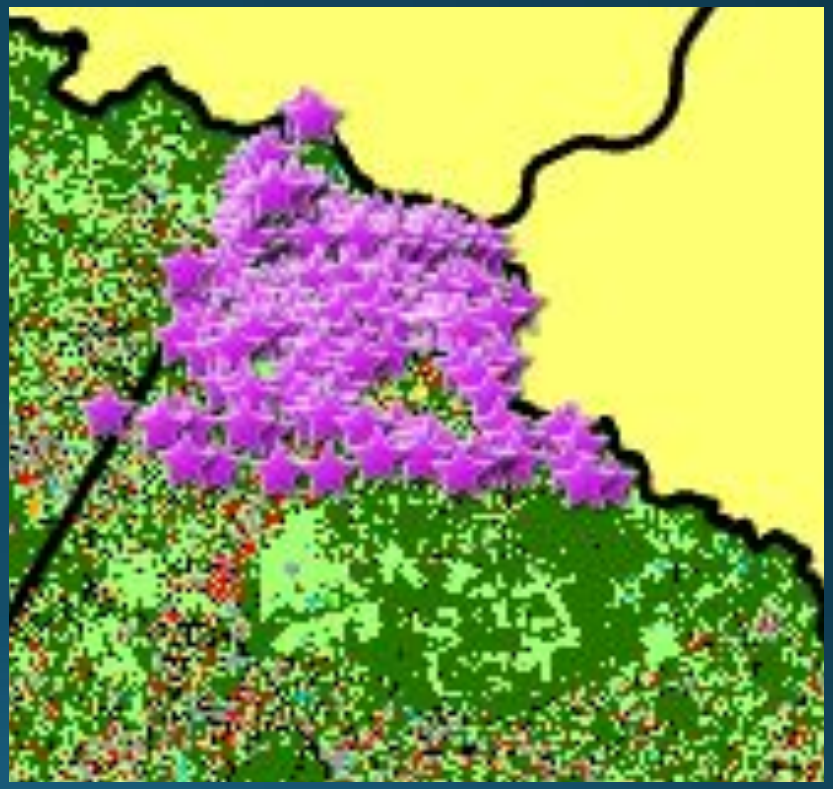
Upcoming Localities to Review:

- Dauphin, PA
- Elk, PA
- Fulton, PA
- Indiana, PA
- Juniata, PA
- Lackawanna, PA
- Luzerne, PA
- McKean, PA
- Perry, PA
- Schuylkill, PA
- Somerset, PA
- Accomack, VA
- Alexandria, VA
- Amelia, VA
- Amherst, VA
- Appomattox, VA
- Arlington, VA
- Buckingham, VA
- Campbell, VA
- Caroline, VA
- Charles City, VA
- Chesapeake, VA
- Chesterfield, VA

Versioning of the LC/LU Products

- To incorporate all local feedback, we are creating 2 versions of the datasets
- June 2021 – CBP internal deadline for CAST 21
  - V1 2017/18 LC and LU, and 2013/14 – 2017/18 LC and LU change
  - V2 2013/14 LC and LU
- December 2021- published version (winter 2021/22)
  - V2 2017/18 LC and LU, and 2013/14 – 2017/18 LC and LU change
  - V3 2013/14 LC and LU
  - Wetlands incorporated into LC Baywide





V1 of 2017/18 LC and LU: June 2021

- What will be fixed in LC product:
  - Tile line/seam line errors
  - Systematic errors and large mistakes
  - Impervious - barren errors
  - Larger building errors
  - Multiple building errors in one location
  - Large water errors
  - False impervious that you find in new neighborhoods

Incorporated into CAST 21

Systematic Errors Documented

Providing upcoming localities this list of Systematic Errors found in previous counties, plus screenshots of examples:

- Missed buildings due to misclassification as impervious surface, or due to many areas not updated to match new 2017 NAIP Imagery.
- Over-classification of impervious surface in suburban areas.
- Misclassification of barren in rural areas, when it should have been low vegetation or impervious.
- Under-reporting of shrubland.
- Improper delineation of water bodies.
- Water misclassified as low vegetation or impervious often leading to errors like disconnected streams.
- Tree canopy and impervious surface shadows get misclassified as water.
- Few areas that were in development and are packed dirt, have been classified as impervious.
- Forest misclassified as low vegetation, when it should be tree canopy or shrubland.
- Systemic inconsistency in the classification of gravel/dirt roads and driveways. Some places they are classed impervious roads and associated tree canopy over impervious roads. Other places they are classed barren or impervious surfaces. Some places roads are clearly visible but are missed and classed as tree canopy or low vegetation. Other places clearly visible road is properly classed but then abruptly and inaccurately stops.
- Inconsistencies in linear features -streams, rights of way, transmission lines.

V2 of LC and LU: December 2021

- What will be fixed in LC product:
  - Wetlands incorporation bay wide
  - Other edits captured by local review (and by UVM's QAQC team)
  - Parking lots wrongly classified as roads
- This will be the final, published data!!
  - We will allow certain projects to acquire draft or V1 data prior to the final V2 data release- with caveat that this data is not final and make sure they understand the differences between versions.

Recent Developments

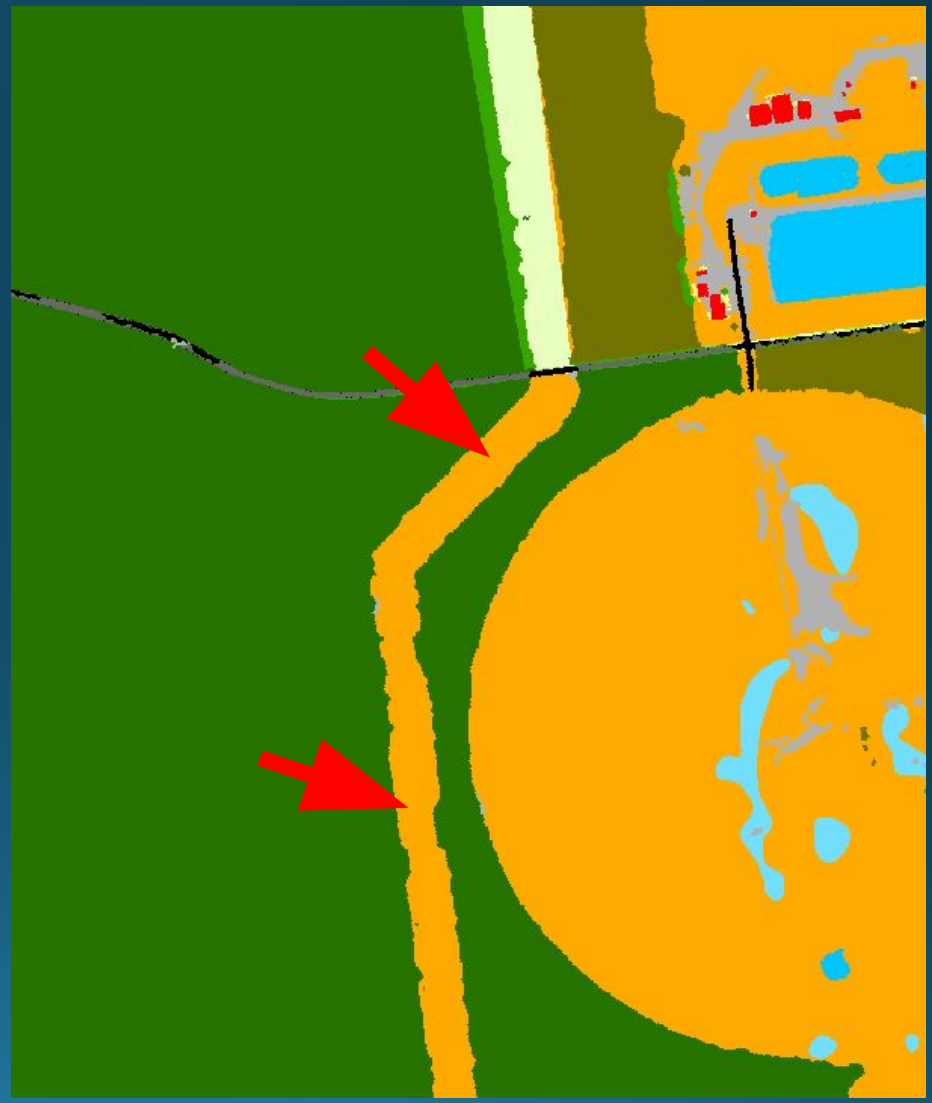
- **Completed land use for 14 test counties** 🎉
- Spatial analysis optimized to manageable run times
- Developed rasterization “burn in” code
- Integrated more classes:
  - Terrene Non-Tidal Wetlands
  - Riverine Non-Tidal Wetlands
  - Tidal Wetlands
  - TC in Agriculture
  - TC over Turf Grass
  - Forest

Remaining Development

- New data (T2V1) from UVM
- Address incoming LUWG feedback
- Correct known issues
- Further spatial analysis optimization
- Streamline data preparation
- Develop more error handling
- Build out existing cloud infrastructure for more robust batching
  - Automate: VM creation, execute code, transfer outputs to central data repository, detailed reporting (runtimes, parameters, errors) to central tracking.
- Update and share model diagram

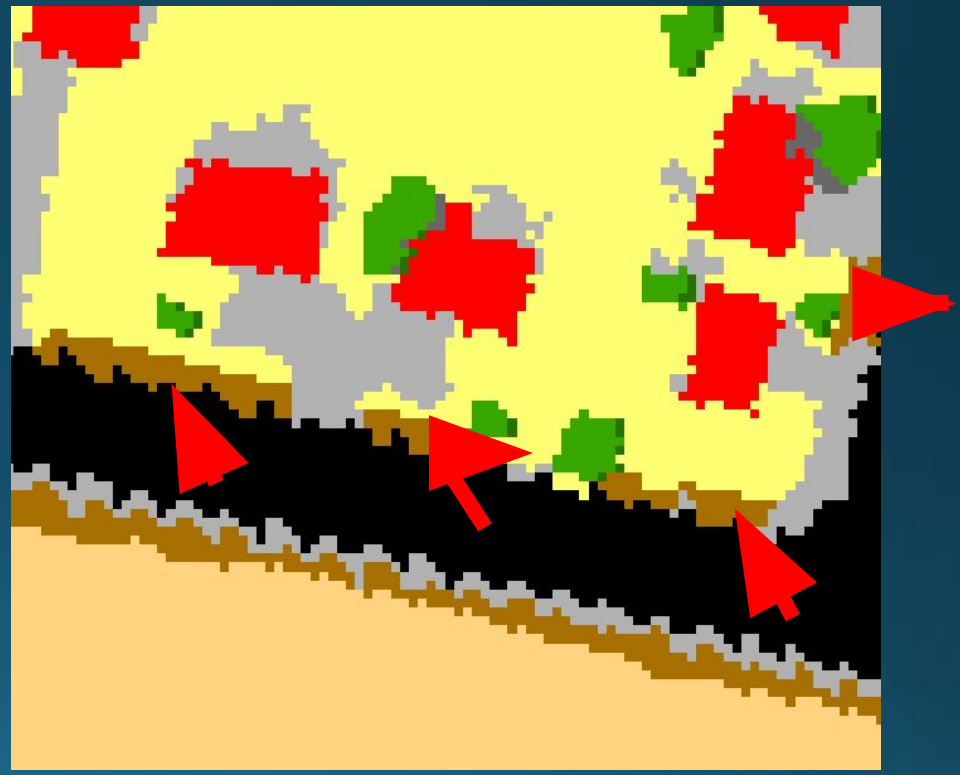
Known Issues & Potential Corrections

- **Omission of Suspended Succession under Transmission Lines**
  - **Source**: Transmission lines are classified after ag and turf “gap filling” methods leading to omission
  - **Fix**: re-order transmission line classification and ag/turf “gap filling”
- **Suspended Succession in small parcels**
  - Source: Area thresholds and inconsistencies in parcel data topology
  - Fix: apply adjacency analysis to exclude these areas
- **Commission of TC in Ag + TC over Turf Grass**
  - **Source**: TC regions are bisected by parcel boundaries affecting area and geometric thresholds
  - **Fix**: Separate TC in Agriculture



Known Issues & Potential Corrections

- **Omission of Suspended Succession under Transmission Lines**
  - **Source**: Transmission lines are classified after ag and turf “gap filling” methods leading to omission
  - **Fix**: re-order transmission line classification and ag/turf “gap filling”
- **Suspended Succession in small parcels**
  - Source: Area thresholds and inconsistencies in parcel data topology
  - Fix: apply adjacency analysis to exclude these areas
- **Commission of TC in Ag + TC over Turf Grass**
  - **Source**: TC regions are bisected by parcel boundaries affecting area and geometric thresholds
  - **Fix**: Separate TC in Agriculture



Suspended is recolored to brown in this example for clarity

Known Issues & Potential Corrections

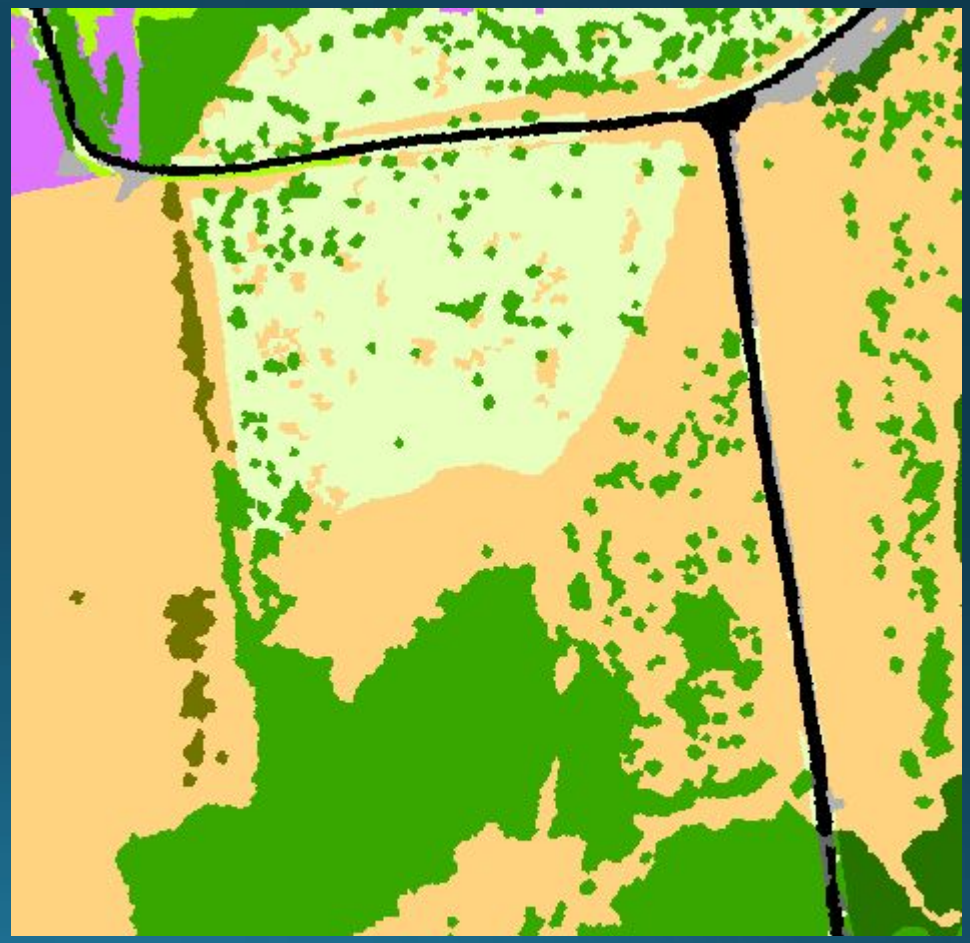
- **Omission of Suspended Succession under Transmission Lines**
  - **Source**: Transmission lines are classified after ag and turf “gap filling” methods leading to omission
  - **Fix**: re-order transmission line classification and ag/turf “gap filling”
- **Suspended Succession in small parcels**
  - Source: Area thresholds and inconsistencies in parcel data topology
  - Fix: apply adjacency analysis to exclude these areas
- **Commission of TC in Ag + TC over Turf Grass**
  - **Source**: TC regions are bisected by parcel boundaries affecting area and geometric thresholds
  - **Fix**: Separate TC in Agriculture

Known Issues & Potential Corrections

- **Incomplete coverage in Open Water areas**
  - **Source**: Draft land cover data
  - **Fix**: UVM will include full coverage in V1 LC
- **Commission of Agriculture and multiple LU classes in fields and Omission of Natural Succession**
  - **Source**: Conflicting ancillary data - CDL vs NLCD vs local data vs HERE
  - **Fix**: Inclusion of segmentation geometry analysis, tightening of CDL+NCLD coverage thresholds
- **Single pixels with differing classification from adjacent similar LC**
  - **Source**: differing LC and segmentation versions and the combination of parcel and segmentation boundaries
  - **Fix**: Matching LC and segmentation in V1 data, “attach” single pixels to parent segment in data prep

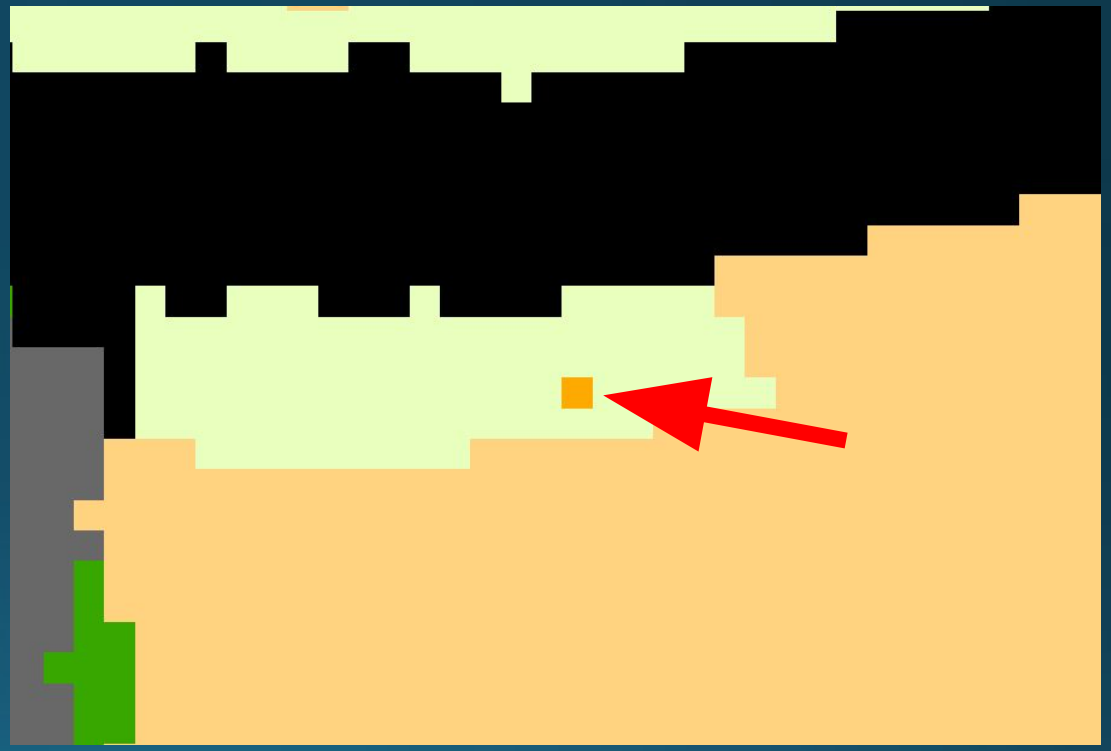
Known Issues & Potential Corrections

- **Incomplete coverage in Open Water areas**
  - **Source**: Draft land cover data
  - **Fix**: UVM will include full coverage in V1 LC
- **Commission of Agriculture and multiple LU classes in fields and Omission of Natural Succession**
  - **Source**: Conflicting ancillary data - CDL vs NLCD vs local data vs HERE
  - **Fix**: Inclusion of segmentation geometry analysis, tightening of CDL+NCLD coverage thresholds
- **Single pixels with differing classification from adjacent similar LC**
  - **Source**: differing LC and segmentation versions and the combination of parcel and segmentation boundaries
  - **Fix**: Matching LC and segmentation in V1 data, “attach” single pixels to parent segment in data prep



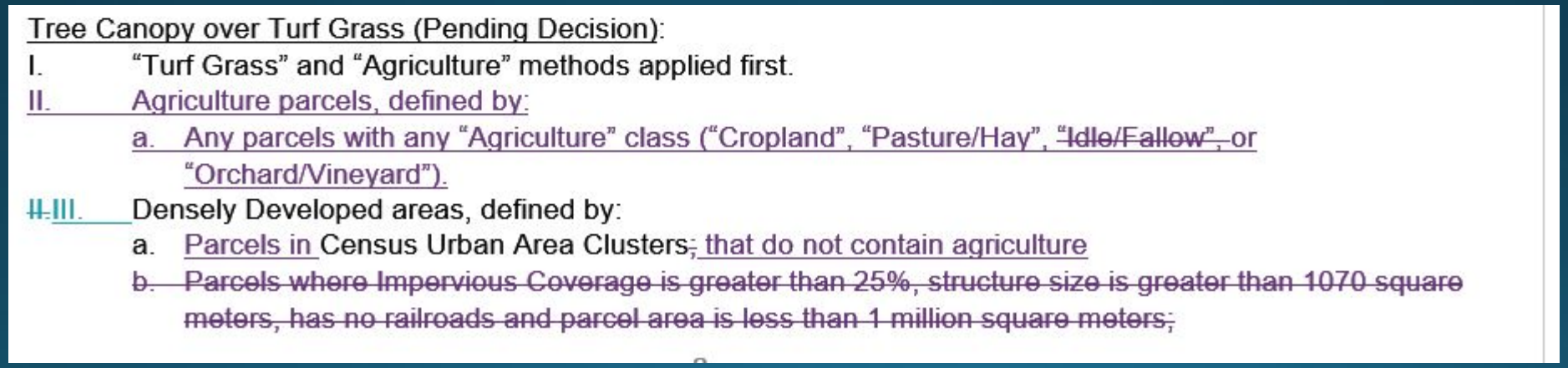
Known Issues & Potential Corrections

- **Incomplete coverage in Open Water areas**
  - **Source**: Draft land cover data
  - **Fix**: UVM will include full coverage in V1 LC
- **Commission of Agriculture and multiple LU classes in fields and Omission of Natural Succession**
  - **Source**: Conflicting ancillary data - CDL vs NLCD vs local data vs HERE
  - **Fix**: Inclusion of segmentation geometry analysis, tightening of CDL+NCLD coverage thresholds
- **Single pixels with differing classification from adjacent similar LC**
  - **Source**: differing LC and segmentation versions and the combination of parcel and segmentation boundaries
  - **Fix**: Matching LC and segmentation in V1 data, “attach” single pixels to parent segment in data prep



New Format of LU Classification Documents

- New 3/30/21 LU Classification Document
- Track changes version from the 3/30/21 document with the 1/08/21 document
- To see examples of each class, LUWG will be able to use LU Viewer, instead of the PDF previously sent



Tree Canopy over Turf Grass (Pending Decision):

I. "Turf Grass" and "Agriculture" methods applied first.

II. Agriculture parcels, defined by:

a. Any parcels with any "Agriculture" class ("Cropland", "Pasture/Hay", ~~"Idle/Fallow",~~ or "Orchard/Vineyard").

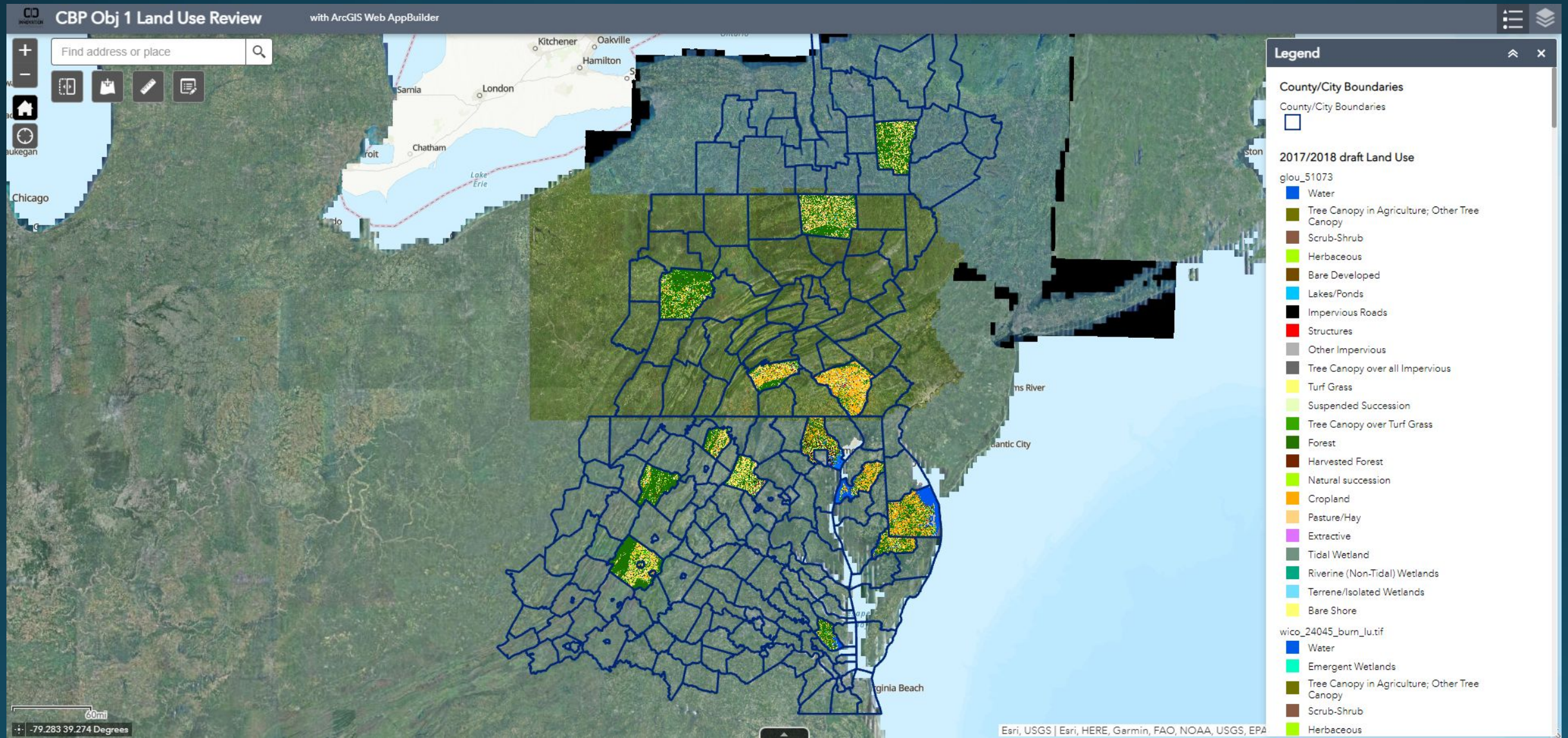
~~II.~~ III. Densely Developed areas, defined by:

a. Parcels in Census Urban Area Clusters~~;~~ that do not contain agriculture

~~b. Parcels where Impervious Coverage is greater than 25%, structure size is greater than 1070 square meters, has no railroads and parcel area is less than 1 million square meters;~~

https://tinyurl.com/DraftLandUse20172018

Username: LU_Reviewer
Password: LU_Reviewer2021



Chesapeake Bay Program Land Use Classification (64 classes)

1. Water (8)

- 1.1 Lentic
  - 1.1.1 Estuary (tidal)
  - 1.1.2 Lakes & Ponds
- 1.2 Lotic
  - 1.2.1 Streams
    - 1.2.1.1 Open Channel
    - 1.2.1.2 TC over Channel
    - 1.2.1.3 Culverted/ Buried Channel
  - 1.2.2.Ditches
    - 1.2.2.1 Open Ditch
    - 1.2.2.2 TC over Ditch
    - 1.2.2.3 Culverted/ Buried Ditch

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 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 TC over Turf Grass

3. Forest (7)

- 3.1 Forest (>= 1 acre, 240-ft width)
- 3.2 TC 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 Idle/Fallow
    - 4.1.4.1 Barren
    - 4.1.4.2 Herbaceous
    - 4.1.4.3 Scrub-shrub
- 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 (21)

- 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 Headwater
    - 5.2.1.1 Barren
    - 5.2.1.2 Herbaceous
    - 5.2.1.3 Scrub-shrub
    - 5.2.1.4 Tree Canopy
    - 5.2.1.5 Forest
  - 5.2.2 Floodplain
    - 5.2.2.1 Barren
    - 5.2.2.2 Herbaceous
    - 5.2.2.3 Scrub-shrub
    - 5.2.2.4 Tree Canopy
    - 5.2.2.5 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

Chesapeake Bay Program Land Use Classification (64 classes)

1. Water (8)
- 1.1 Lentic
- 1.1.1 Estuary (tidal)
- 1.1.2 Lakes & Ponds
- 1.2 Lotic
- 1.2.1 Streams
  - 1.2.1.1 Open Channel
  - 1.2.1.2 TC over Channel
  - 1.2.1.3 Culverted/ Buried Channel
- 1.2.2.Ditches
  - 1.2.2.1 Open Ditch
  - 1.2.2.2 TC over Ditch
  - 1.2.2.3 Culverted/ Buried Ditch

Wetlands Workgroup
Stream Health Workgroup

2. Developed (13)
- 2.1 Impervious
  - 2.1.1 Roads
  - 2.1.2 Structures
  - 2.1.3 Other Impervious (Parking lots, driveways)
- 2.2 Pervious
  - 2.2.1 Turf Grass
  - 2.2.2 Bare Developed
  - 2.2.3 Managed Grass (rights-of-way)
    - 2.2.3.1 Barren
    - 2.2.3.2 Herbaceous
    - 2.2.3.3 Scrub-shrub
- 2.3 Tree Canopy (TC)
  - 2.3.1 TC over Roads
  - 2.3.2 TC over Structures
  - 2.3.3 TC over Other Impervious
  - 2.3.4 TC over Turf Grass
  - 2.3.5 TC in Agriculture

Land Use Workgroup
Urban Stormwater Workgroup

3. Forest (6)
- 3.1 Forest (>= 1 acre, 240-ft width)
- 3.2 Harvested Forest (<= 3 years)
- 3.2.1 Barren
- 3.2.2 Herbaceous
- 3.3 Natural Succession (> 3 years)
  - 3.3.1 Barren
  - 3.3.2 Herbaceous
  - 3.3.3 Scrub-shrub

Forestry Workgroup

4. Production (13)
- 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 Idle/Fallow
  - 4.1.4.1 Barren
  - 4.1.4.2 Herbaceous
  - 4.1.4.3 Scrub-shrub
- 4.2 Solar fields
- 4.2.1 Barren
- 4.2.2 Herbaceous
- 4.2.3 Scrub-shrub
- 4.2.4 Impervious

Agriculture Workgroup
Federal Facilities Workgroup

Land Use Workgroup
Urban Stormwater Workgroup

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

Land Use Workgroup

5. Wetlands and Water Margins (21)
- 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 Non-tidal
- 5.2.1 Riverine
  - 5.2.1.1 Barren
  - 5.2.1.2 Herbaceous
  - 5.2.1.3 Scrub-shrub
  - 5.2.1.4 Tree Canopy
  - 5.2.1.5 Forest
- 5.2.2 Headwater
  - 5.2.2.1 Barren
  - 5.2.2.2 Herbaceous
  - 5.2.2.3 Scrub-shrub
  - 5.2.2.4 Tree Canopy
  - 5.2.2.5 Forest
- 5.2.3 Terrene / Isolated
  - 5.2.3.1 Barren
  - 5.2.3.2 Herbaceous
  - 5.2.3.3 Scrub-shrub
  - 5.2.3.4 Tree Canopy
  - 5.2.3.5 Forest
- 5.3 Bare shore

Wetlands Workgroup

New High-Resolution Land Use Classes

Water
- **Lentic**
  - Estuary (tidal)
  - Lakes and Ponds
- **Lotic**
  - Streams
    - Open Channel
    - TC over Channel
    - Culverted/Buried Channel
  - Ditches
    - Open Ditch
    - TC over Ditch
    - Culverted/Buried Ditch

Forest
- **Forest**
- **TC in Agriculture**
- **Harvested Forest**
- **Natural Succession**

Developed
- **Impervious**
  - Roads
  - Structures
  - Other Impervious (Parking Lots, Driveways, Railroads, etc.)
  - TC over Impervious
- **Pervious**
  - Turf Grass
  - Bare Developed
  - Suspended Succession
  - TC over Turf Grass

Wetlands and Water Margins
- **Tidal**
- **Riverine (Non-tidal)**
- **Terrene/Isolated (Non-tidal)**
- **Bare Shore**

Production
- **Agriculture**
  - Cropland
  - Pasture/Hay
  - Orchard/Vineyard
  - Idle/Fallow
- **Extractive**
- **Solar Fields**
  - Impervious
  - Pervious

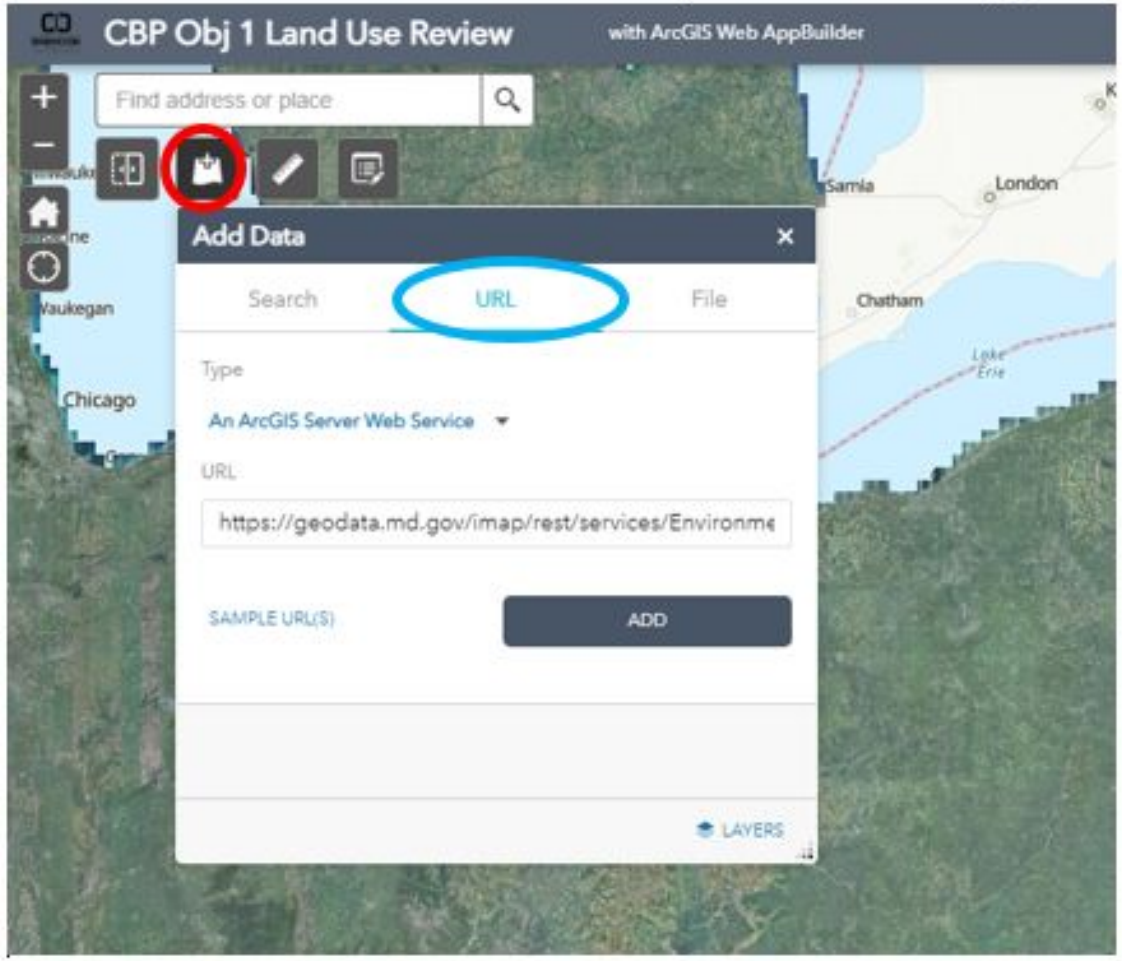
Land Use Viewer

- Do not: Comment on isolated errors or an error that looks like a misclassification of the NAIP imagery. This means it is an issue tracing back to the Land Cover, and these comments should have been made in the Land Cover Review application. UVM is doing a QAQC of the land cover.
  - For example, if the Land Use is showing Tree Canopy over Turf, where there appears to be no Tree Canopy in the NAIP imagery. This is a misclassification stemming from the Land Cover (which is still in draft form)
- Do: Comment on specific systematic errors that could be fixed by rule or definition tweaking. Systematic errors are frequent misclassifications.
  - For example, if the land cover classifies the landscape as “herbaceous”, the land use model then needs to filter it into a type of “herbaceous” land. It could fall into many categories, such as; cropland, pasture, turf grass, etc. If you notice a ton of residential yards being misclassified as cropland, that is something to make note of.

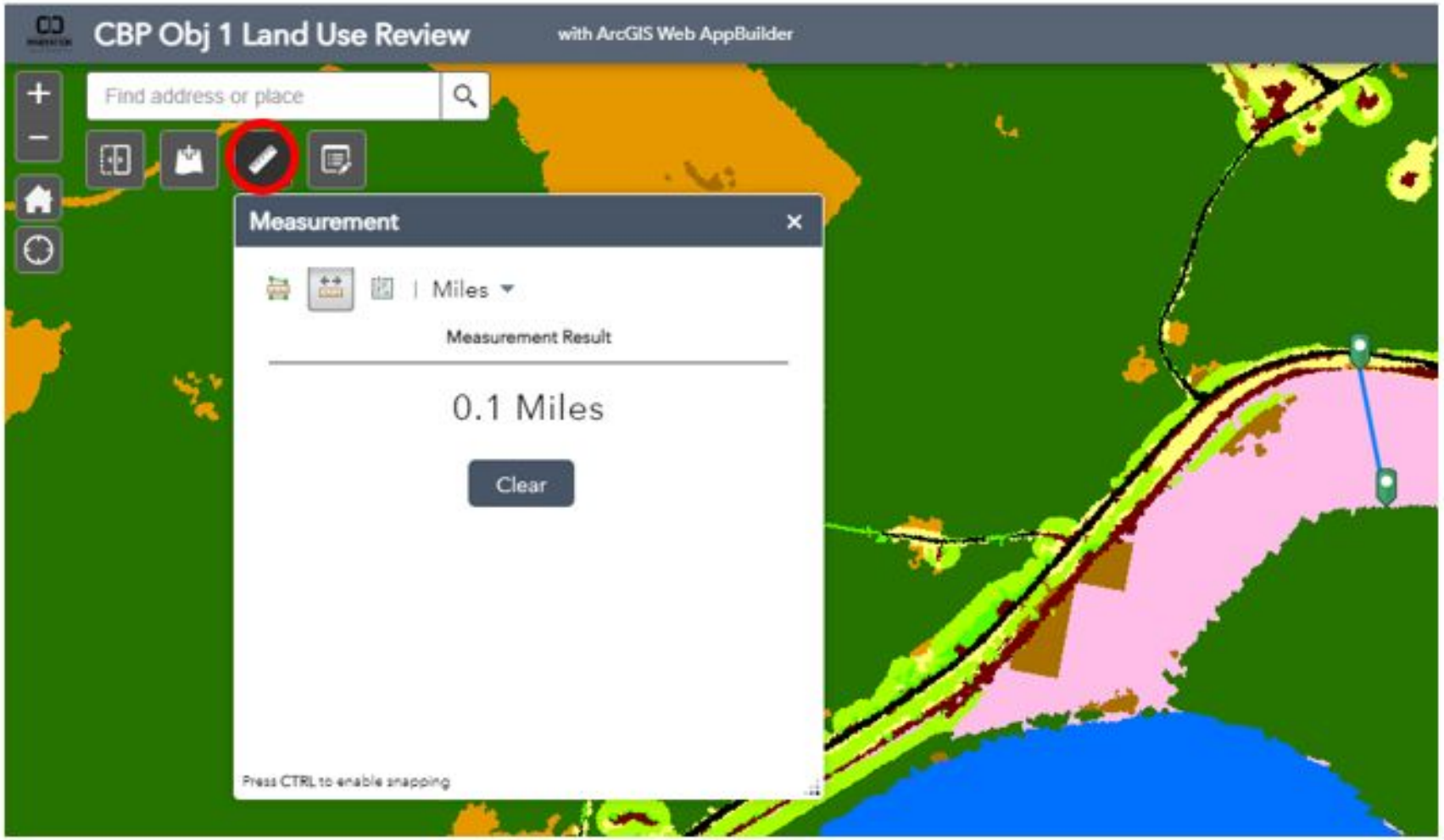
1. To use the swipe tool, click the "swipe" widget in the top left corner. In the drop-down menu, choose which layers you want to swipe between. Click and drag the swipe bar to compare layers.
   Recommended to swipe between the 2013/2014 LU and the new 2017/2018 classification scheme, or between the new 2017/2018 Classification scheme and the 2017/2018 NAIP.

To swipe between 2017/2018 Classification scheme and the 2017/2018 NAIP, check of both the 2013/2014 Land Use and the 2017/2018 draft Land Use in the swipe dropdown options.

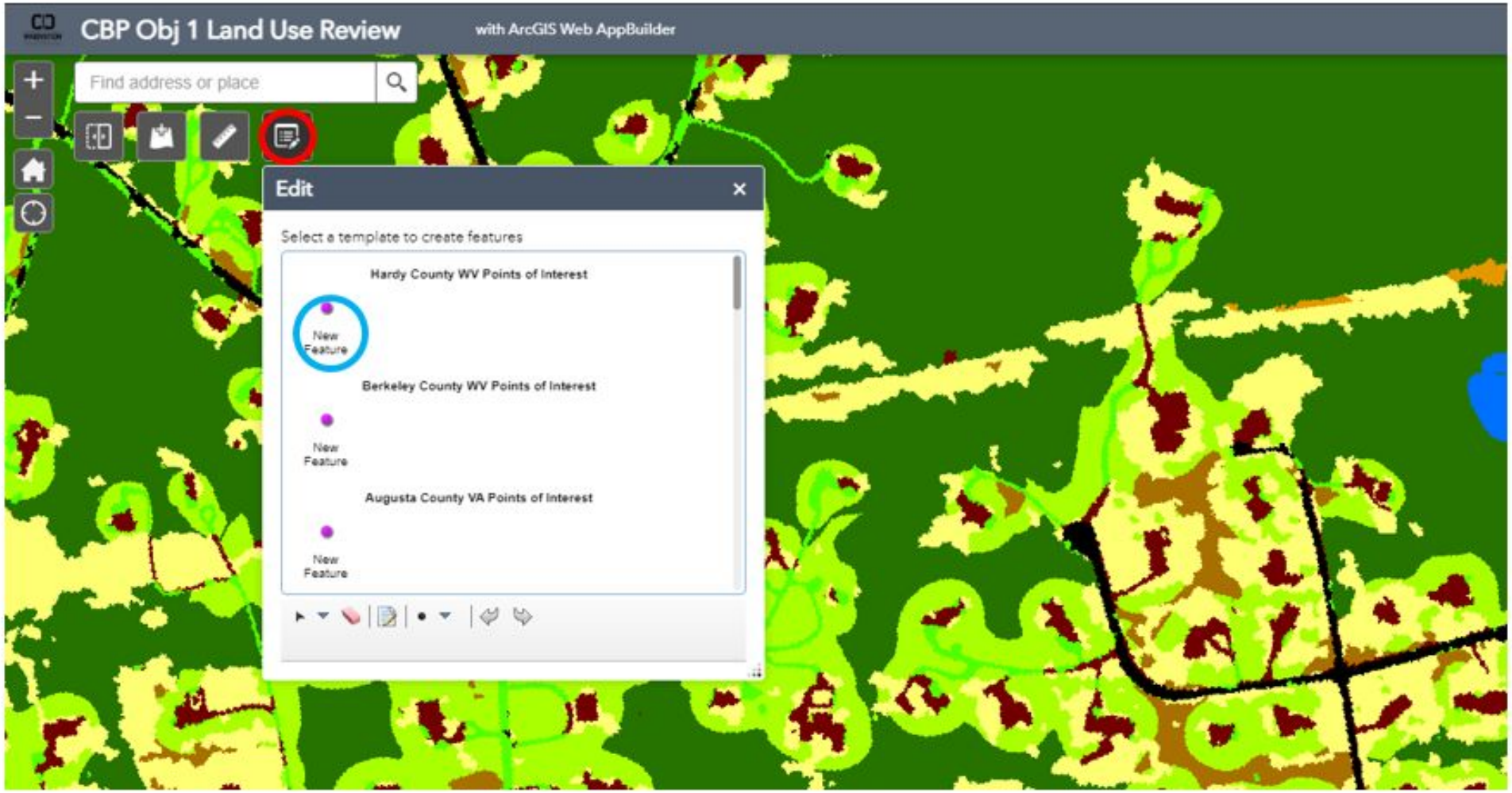
2. To add your own data to the web application, click the “add data” widget in the top left corner (second from the left). The most useful part of this tool is the “URL” tab. Here, you can post a link to an online data layer, and add it to the map. These datasets will only be added on your screen and will be removed when you exit the application and start fresh.



3. To measure anything in the map, use the "measure" widget in the top left corner (third from the left). You can measure distance or area with this tool, in a variety of units. Click once on the map to start measuring, click again to create vertices, and double click to stop measuring.

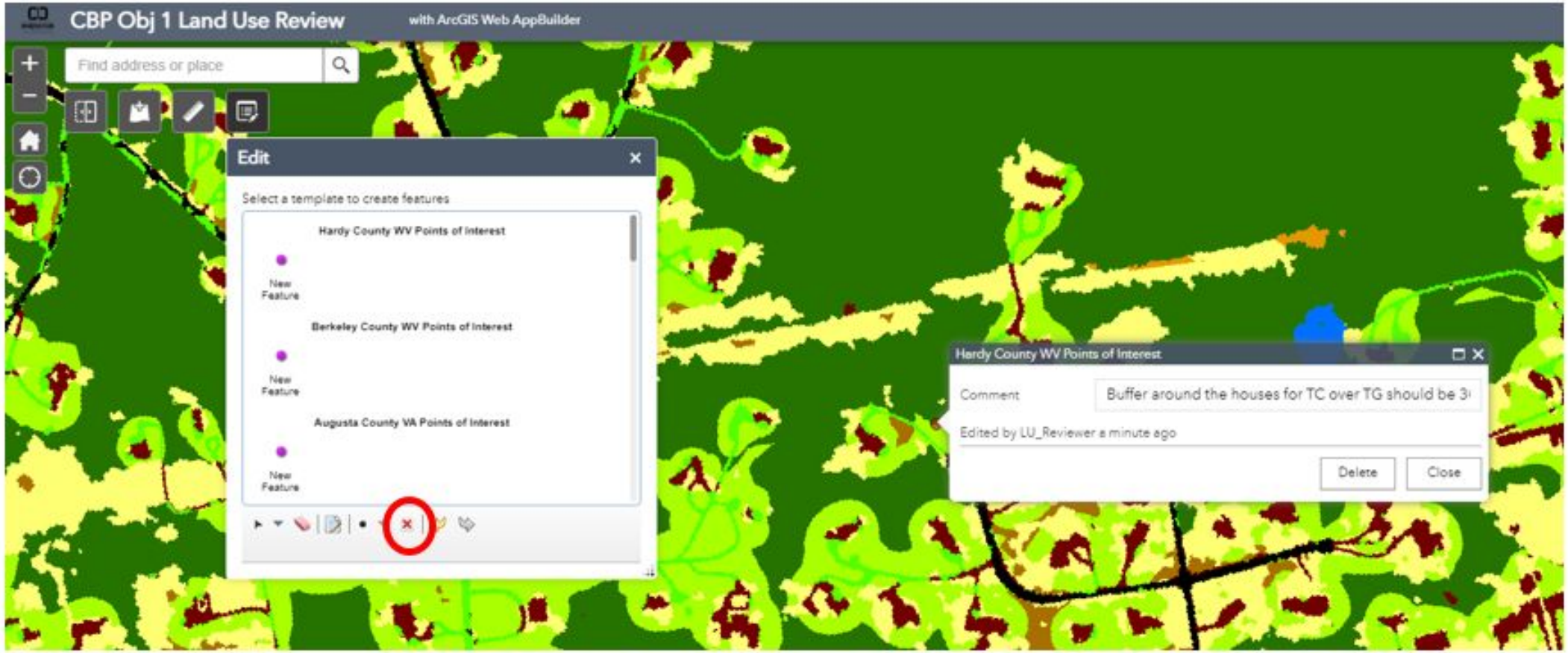


4. To add a point with a comment regarding the Land Use and the classification scheme, use the "edit" widget. Scroll to select the workgroup or county you are representing, and click on "New Feature" underneath. This example will use "Hardy County WV Points of Interest".

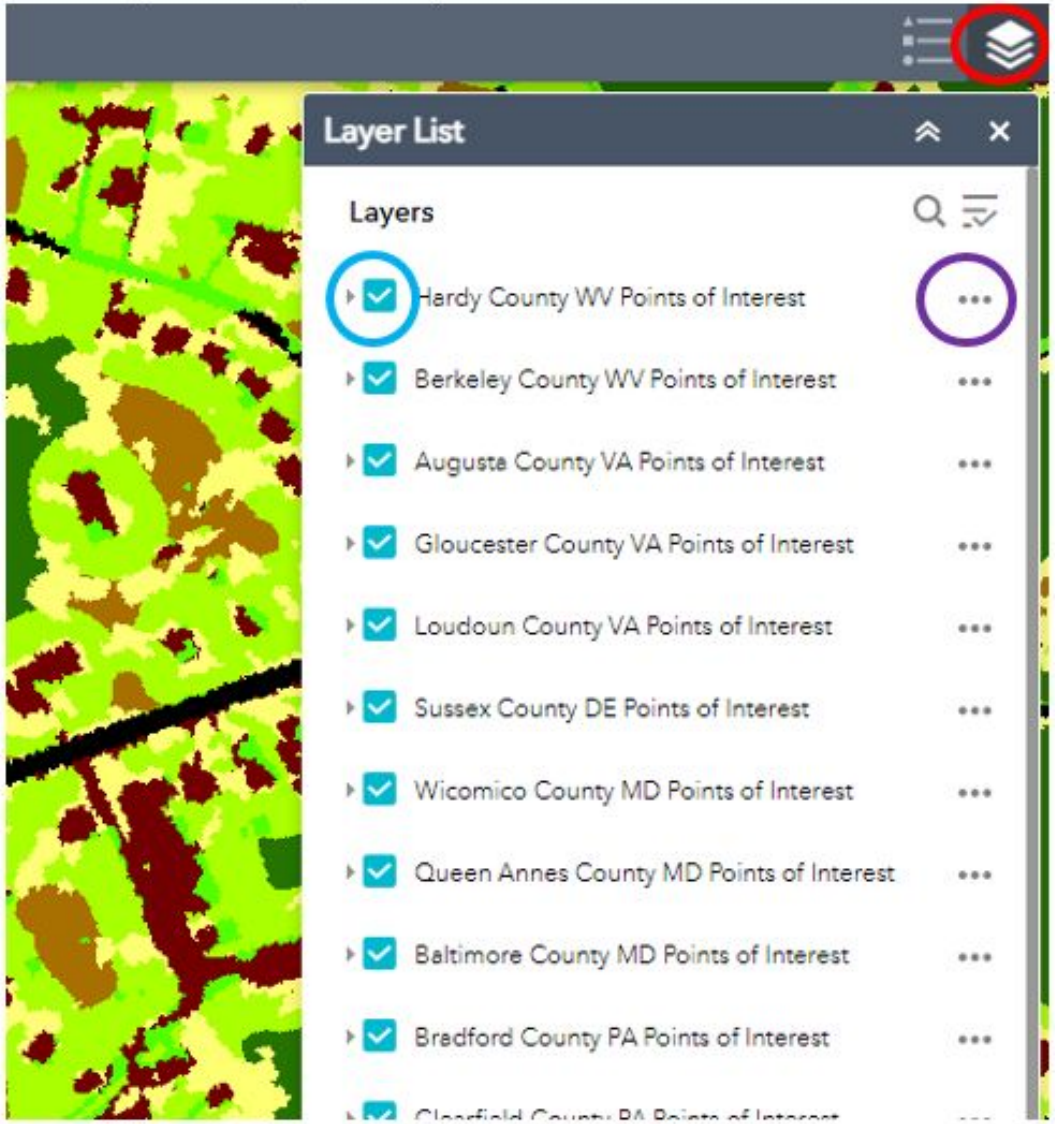


5. Click anywhere on the map to add a point, and add text in the text box to describe why you are adding a point. Click “close” to save. Click “delete” to remove the point and comment.

6. After you've clicked close and the comment saves, you can still delete the point and comment. Back in the "edit" widget, click the point you want to delete, and click the "x" in the edit widget or the "delete" button on the pop-up.



7. To toggle on and off layers, go to the "layer list" on the top right of the web application. Turn on and off layers by clicking the check box next to each layer. Click the ellipses next to the layer to change transparency.



Questions?

rsoobitsky@chesapeakeconservancy.org

jczawlytko@chesapeakeconservancy.org